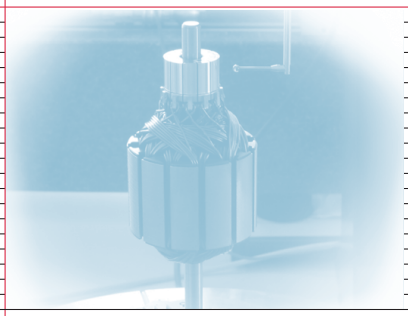
MAHR I MARFORM



ELECTRIC MOTOR APPLICATION

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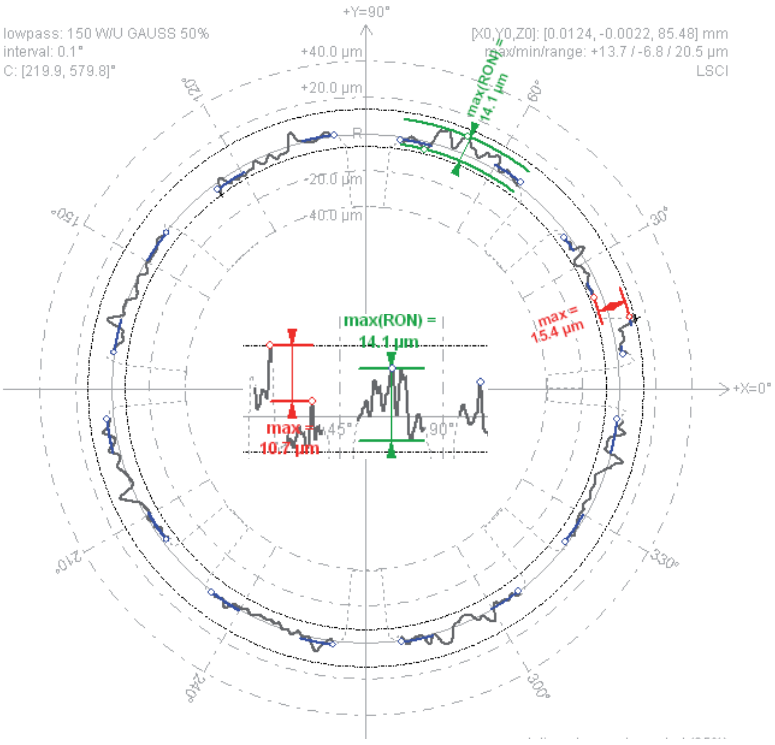
Mahr

EXACTLY

Application: Commutator Analysis with MarForm



Option: Software package for analysis of segment gap on commutators

Segment gap refers to the difference in height between the various segment segments on a commutator. This segment gap is a contributory factor in the wear of carbon brushes and brush fires in electric motors.

Using this software package it is possible to use MarWin analysis software with roundness measurements obtained from MarForm measuring machines in order to investigate and assess segment gaps.

Four calculation methods are provided for the evaluation of two neighboring segments (maximum segment gap):

1. **Segment gap: center of segment**
   Difference in the radii measured at the respective centers of two neighboring segments.
   The centers can optionally be expanded to ranges by entering their size as a percentage of the segment width; all radii are then averaged over this range.
2. **Segment gap: max./min. radius**
   Difference between the respective maximum and minimum radii of two neighboring segments
3. **Segment gap: difference between. max. radii**
   Difference between the respective maximum radii of two neighboring segments
4. **Segment gap: end of segment–start of segment**
   Difference between radii of two neighboring segments, measured at the end of one segment and the start of the next.
   The end and start points can optionally be expanded to ranges by entering their size as a percentage of the segment width; all radii are then averaged over this range.

The results evaluated are the values of the individual segment gaps and their mean values. The form deviations of the commutator are also recorded (individual roundnesses, corresponding mean value, overall roundness), as is the radial run-out.

The analysis package is available with version V4 and above of **EasyForm, AdvancedForm,** and **ProfessionalForm.**
Order no.: 9967225

Application: Commutator Analysis with MarForm

Convenient input screen

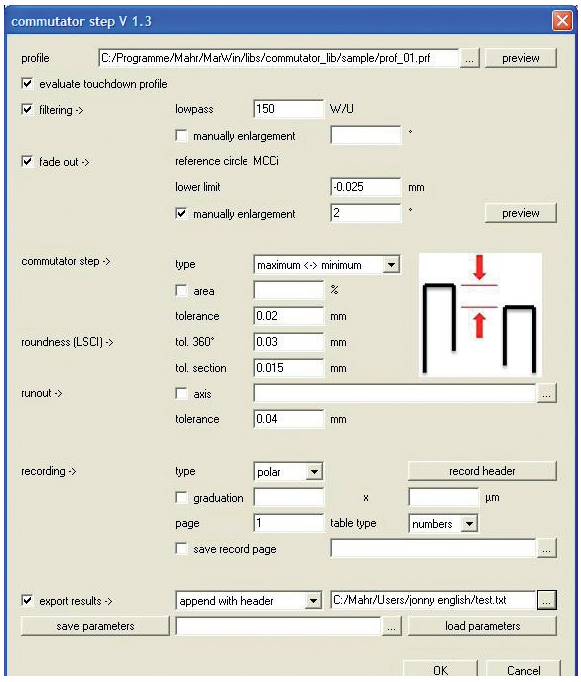
Simple parameterization:
A drop-down list in the dialog box is used to select one of the segment gap calculation methods given above.

The size of the averaging range can also be defined here if possible/necessary. Size is specified as a percentage of the width of the segments in question.

User-defined tolerances can be specified for the calculation methods of the individual segment gaps, the single roundness deviations of each segment, the overall roundness deviations, and the radial run-out deviations.

If these are defined, then the attribute values will be shown in the results table with a colored indicator to show whether they are within tolerance.

For the radial run-out deviation, both the C-axis of the form measuring machine and a predefined datum element axis can be selected.



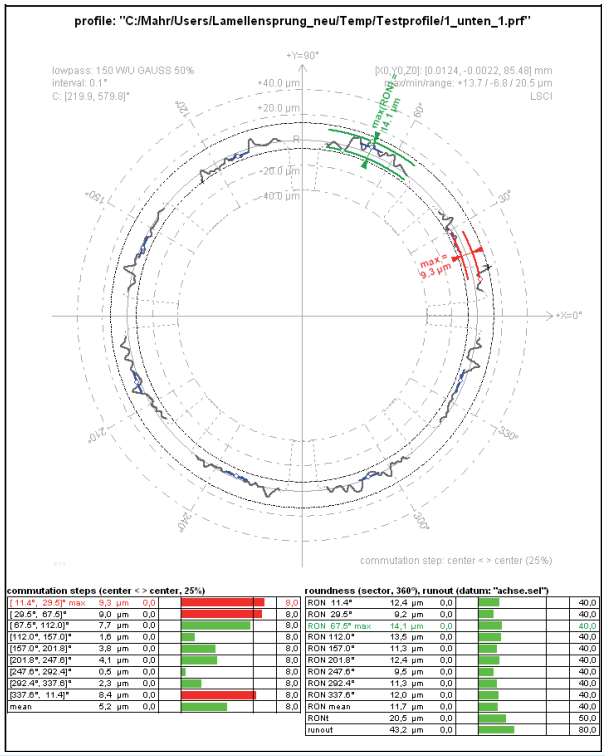
Evaluation: segment gap, center of segment

Analysis method: segment gap, center of segment

Difference in radii measured at the centers of the two neighboring segments in question.

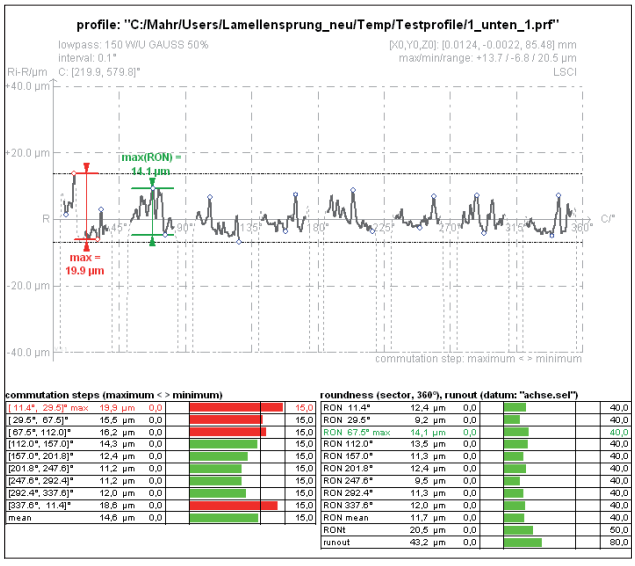
The centers can optionally be expanded to ranges by entering their size as a percentage of the segment width. All radii are then averaged over this range.

The graph can be displayed polar-centered or linear aligned, and can therefore be unwound.



Application: Commutator Analysis with MarForm

Analysis method: segment gap at max./min. radius

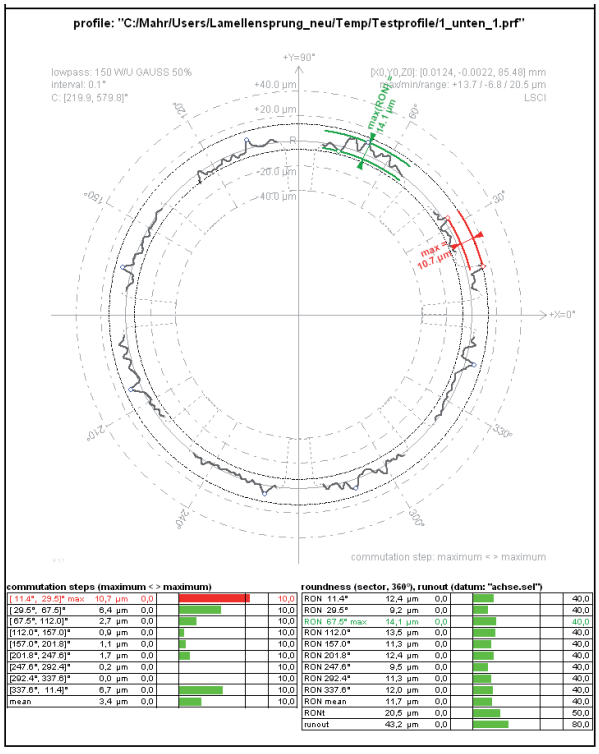


Analysis method: segment gap at max./min. radius

Difference between the respective maximum and minimum radii of two neighboring segments.

The graph can be displayed polar-centered or linearaligned, and can therefore be unwound.

Analysis: segment gap as difference between max. radii



Analysis method: segment gap as difference between max. radii

Difference between the respective maximum radii of two neighboring segments.

The graph can be displayed polar-centered or linearaligned, and can therefore be unwound.

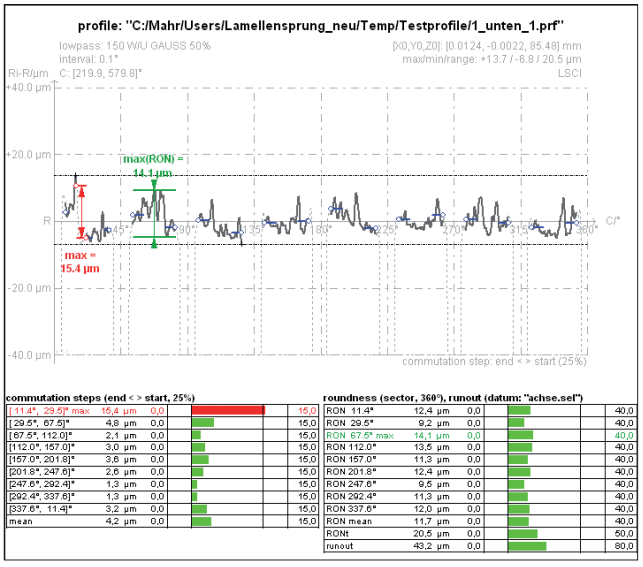
Application: Commutator Analysis with MarForm

Analysis: segment gap from end of segment–start of segment

Analysis method: segment gap, end of segment–start of segment

- Difference between radii of two neighboring segments, measured at the end of one segment and the start of the next.
- The end and start points can optionally be expanded to ranges by entering their size as a percentage of the segment width.
- all radii are then averaged over this range.

The graph can be displayed polar-centered or linearaligned, and can therefore be unwound.



Comprehensive results table

Comprehensive results table

The results table lists the characteristic values from the analysis. The following are documented:

Segment gaps

- Values of segment gaps with tolerance exploitation display (optional)
- Corresponding angle positions
- Colored indicator for maximum value
- Mean of all segment gaps

Form deviations

- Values of roundness deviations with tolerance exploitation display (optional)
- Corresponding angle positions
- Colored indicator for maximum value
- Mean of all individual roundnesses
- Overall roundness deviation, RONt

Form and position deviations

- Radial run-out deviation referenced to datum axis (workpiece axis) or C-axis of the formtester

commutation steps (maximum < > maximum)

[11.4°, 29.5]° max	10,7 µm	0,0		10,0
[29.5°, 67.5]°	6,4 µm	0,0		10,0
[67.5°, 112.0]°	2,7 µm	0,0		10,0
[112.0°, 157.0]°	0,9 µm	0,0		10,0
[157.0°, 201.8]°	1,1 µm	0,0		10,0
[201.8°, 247.6]°	1,7 µm	0,0		10,0
[247.6°, 292.4]°	0,2 µm	0,0		10,0
[292.4°, 337.6]°	0,0 µm	0,0		10,0
[337.6°, 11.4]°	6,7 µm	0,0		10,0
mean	3,4 µm	0,0		10,0

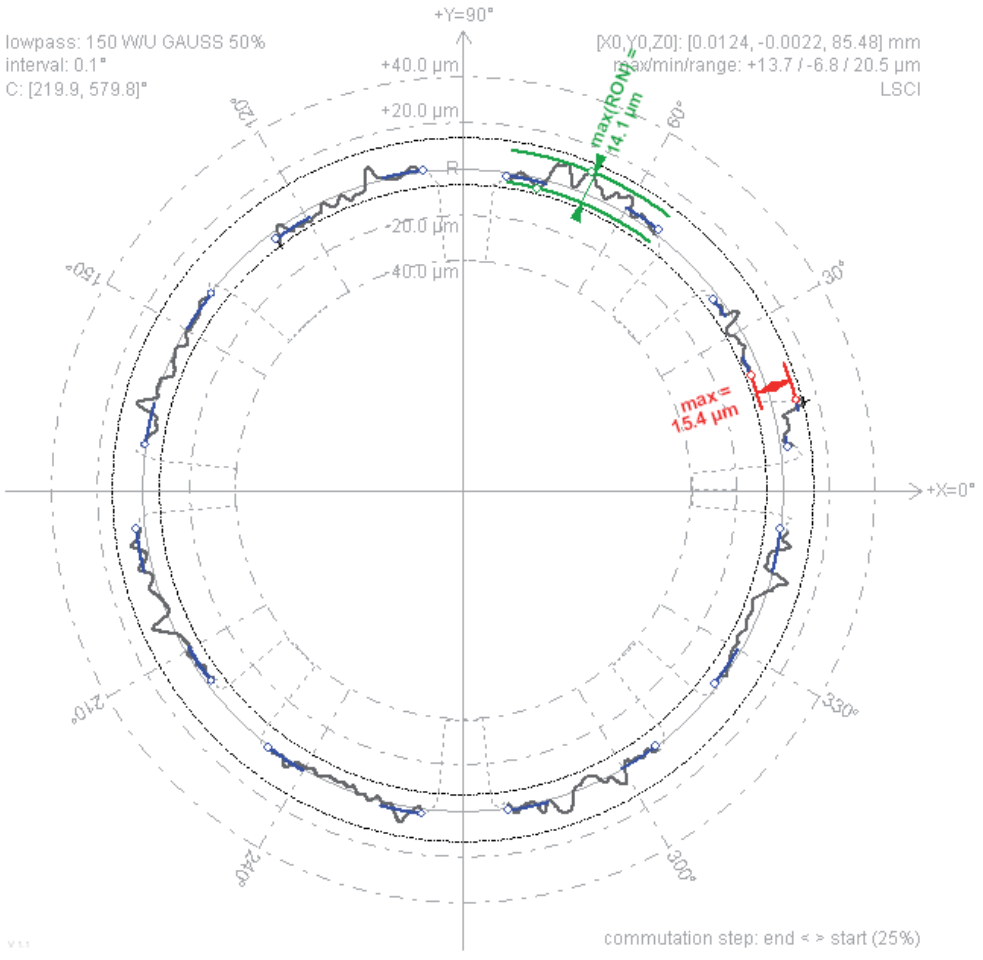
roundness (sector, 360°), runout (datum: "achse.sel")

RON 11.4°	12,4 µm	0,0		40,0
RON 29.5°	9,2 µm	0,0		40,0
RON 67.5° max	14,1 µm	0,0		40,0
RON 112.0°	13,5 µm	0,0		40,0
RON 157.0°	11,3 µm	0,0		40,0
RON 201.8°	12,4 µm	0,0		40,0
RON 247.6°	9,5 µm	0,0		40,0
RON 292.4°	11,3 µm	0,0		40,0
RON 337.6°	12,0 µm	0,0		40,0
RON mean	11,7 µm	0,0		40,0
RONt	20,5 µm	0,0		50,0
runout	43,2 µm	0,0		80,0

Application: Commutator Analysis with MarForm

Mahr	MarWin 4.50-09 SP 4	Mahr GmbH Carl - Mahr - Str. 1 D - 37073 Goettingen	20.01.2012 1 12:10:08 Inspector: Administrator Signature:
Part: Electric motor	Drawing n°: 123 456 789 A	Machining operation: OP 501	
No. 1	Technical Application		
MMQ200 No. 3481			
Comment: Segment gap, roundness and runout evaluation			

profile: "C:/Mahr/Users/Lamellensprung_neu/Temp/Testprofile/1_unten_1.prf"



commutation steps (end < > start, 25%)

[11.4°, 29.5]° max	15,4 µm	0,0		15,0
[29.5°, 67.5]°	4,8 µm	0,0		15,0
[67.5°, 112.0]°	2,1 µm	0,0		15,0
[112.0°, 157.0]°	3,0 µm	0,0		15,0
[157.0°, 201.8]°	3,6 µm	0,0		15,0
[201.8°, 247.6]°	2,6 µm	0,0		15,0
[247.6°, 292.4]°	1,3 µm	0,0		15,0
[292.4°, 337.6]°	1,3 µm	0,0		15,0
[337.6°, 11.4]°	3,2 µm	0,0		15,0
mean	4,2 µm	0,0		15,0

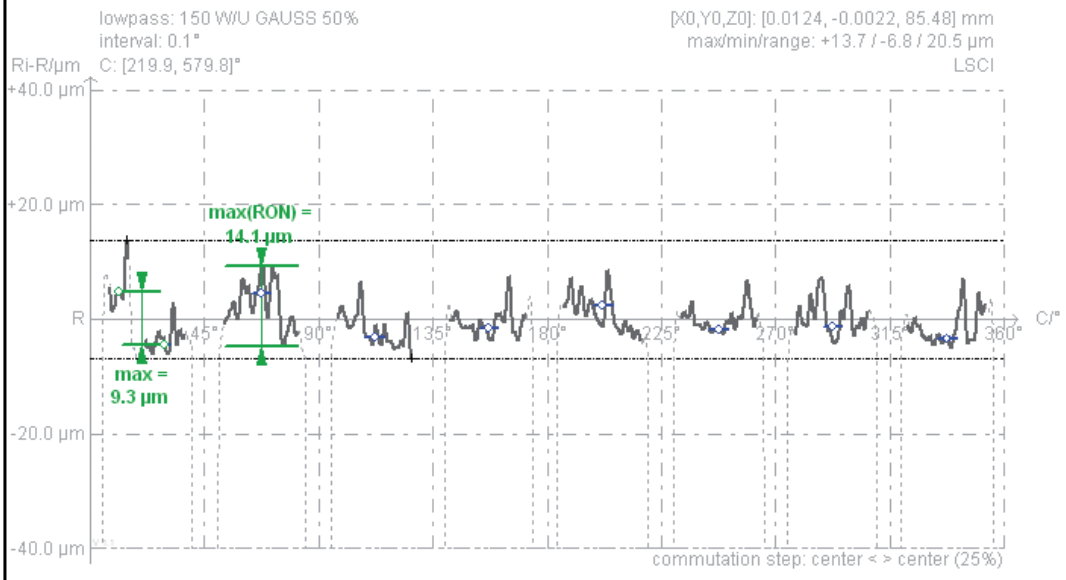
roundness (sector, 360°), runout (datum: "achse.sel")

RON 11.4°	12,4 µm	0,0		40,0
RON 29.5°	9,2 µm	0,0		40,0
RON 67.5° max	14,1 µm	0,0		40,0
RON 112.0°	13,5 µm	0,0		40,0
RON 157.0°	11,3 µm	0,0		40,0
RON 201.8°	12,4 µm	0,0		40,0
RON 247.6°	9,5 µm	0,0		40,0
RON 292.4°	11,3 µm	0,0		40,0
RON 337.6°	12,0 µm	0,0		40,0
RON mean	11,7 µm	0,0		40,0
RONt	20,5 µm	0,0		50,0
runout	43,2 µm	0,0		80,0

Application: Commutator Evaluation with MarForm

Mahr	MarWin 4.50-09 SP 4	Mahr GmbH Carl - Mahr - Str. 1 D - 37073 Goettingen	20.01.2012 1 12:09:40 Inspector: Administrator Signature:
Part: Electric motor	Drawing n°: 123 456 789 A	Machining operation: OP 501	
No. 1	Technical Application		
MMQ200 No. 3481			
Comment: Segment gap, roundness and runout evaluation			

profile: "C:/Mahr/Users/Lamellensprung_neu/Temp/Testprofile/1_unten_1.prf"



commutation steps (center < > center, 25%)

[11.4°, 29.5]° max	9,3 µm	0,0		15,0
[29.5°, 67.5]°	9,0 µm	0,0		15,0
[67.5°, 112.0]°	7,7 µm	0,0		15,0
[112.0°, 157.0]°	1,6 µm	0,0		15,0
[157.0°, 201.8]°	3,8 µm	0,0		15,0
[201.8°, 247.6]°	4,1 µm	0,0		15,0
[247.6°, 292.4]°	0,5 µm	0,0		15,0
[292.4°, 337.6]°	2,3 µm	0,0		15,0
[337.6°, 11.4]°	8,4 µm	0,0		15,0
mean	5,2 µm	0,0		15,0

roundness (sector, 360°), runout (datum: "achse.sel")

RON 11.4°	12,4 µm	0,0		40,0
RON 29.5°	9,2 µm	0,0		40,0
RON 67.5° max	14,1 µm	0,0		40,0
RON 112.0°	13,5 µm	0,0		40,0
RON 157.0°	11,3 µm	0,0		40,0
RON 201.8°	12,4 µm	0,0		40,0
RON 247.6°	9,5 µm	0,0		40,0
RON 292.4°	11,3 µm	0,0		40,0
RON 337.6°	12,0 µm	0,0		40,0
RON mean	11,7 µm	0,0		40,0
RONt	20,5 µm	0,0		50,0
runout	43,2 µm	0,0		80,0

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