SHORT DESCRIPTION

This Specification deals with Measuring instruction for scratch detection on grinded shafts at sealing area.

APPROVAL

	CDS ID	Signature	Date
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Document Status: approved

AREAS AFFECTED

	y	n	Remarks
Manufacturing Engineering	X		
Production	X		
Quality	X		
Purchasing			
STA			

RECORD OF REVISION

Release date	Release Number	Description Revision	Pages affected	Author	Approval
dd.mm.yyyy	Release number	Description	page	CDS ID	CDS ID
23.05.2014	Revision 0	Initial Release	all	skuenzel	dlorenz2

Inhalt

Document Status: approved

1 OBJECTIVE AND SCOPE

This document serves a guideline for the detection of scratches on grinded sealing areas

Based on the current available measuring equipment scratches cannot be detected regarding our measurement standards (capability and repeatability)

The following instructions were developed during a leakage issue and indicates the taken actions for **dry clutch transmission input shaft sealing areas**.

2 TERMS AND DEFINITIONS

- P_t $2xL_{scr}$ distance from peak to valley $P\text{-}V_{scr}$ (see page 4)
- Ra arithmetic mean roughness value from the amounts of all profile values
- Rpm average value of the five highest peaks above the median in five consecutive sample lengths taken over the assessment length of the profile
- Rsk skewness (positive means more peaks, negative means more valleys)
- Rpc peak count per 10 mm
- Lead tendency for shaft to pump oil

3 MEASUREMENT ASSUMPTION AGREEMENT

3.1 Measurement Agreement

- During measurement process for rejected parts, plants will measure according control plan

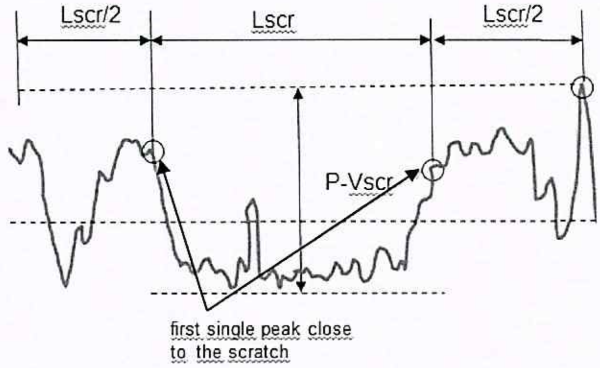
3.2 Surface Finish Specification

Specification	Lower Limit	Upper Limit
Ra	*0.19*	0.61
Rpm	0.63	2.2
Rsk	>-1.75	
Rpc (bandwidth of 0.25µm)	>150	
Lead Input shaft inner diameter	-0.05°	+0.05°
Lead Input shaft outer diameter	0.05° air to oil direction only	

3.3 Definition of scratch width

At implementation with updated quality strategy parts are required to be inspected for scratches. The depth is not measureable by the requested evaluation methods (P_t , W_t) due to the curvature effects; current equipment cannot eliminate form and waviness aspects (REFRENCE PAGE 6)

$P_{t\ flattened}$ measurement (evaluation to be done manually if needed) deliver the best results with our equipment based on P_t (2x L_{scr})



If measuring area is close to scratch for the relevant scratch section:

$$P_{t\ flattened} \approx R_t \approx P\text{-}V_{scr}$$

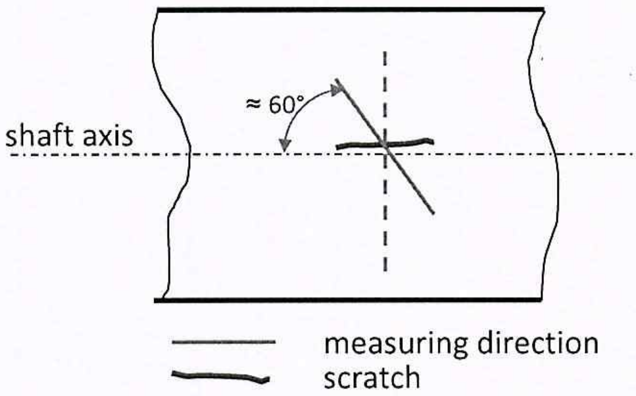
3.4 Definition of Measurement methods and surface defect (scratches)

3.4.1 Measuring conditions:

Measuring device:	Skidless roughness measuring device
Filter, cutoff:	λc = 0,25 mm
calculation length ln:	ln = 5 * λc =1.25 mm
measuring length lt:	ln + 2 * λc = 1,75 mm
or	ln + 2 * λc/2 = 1,5 mm

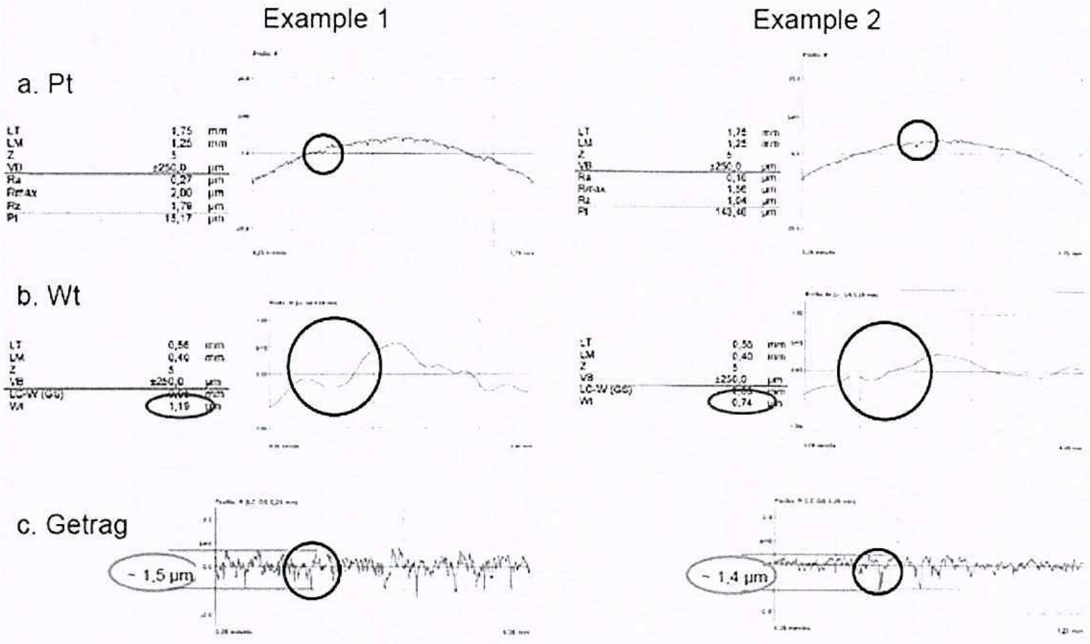
3.4.2 Measuring direction:

- The main direction of scratches is close to the axis of shaft
- In the circumferential measurement, perpendicular to the scatch, the full roughness is not measurable.
- Measuring to be done in an angle of approx. 60° to the axis direction
  Normal to the defect.
- Not more than 60° to the axis
- In this case we detect the Roughness and the P-V scratch.

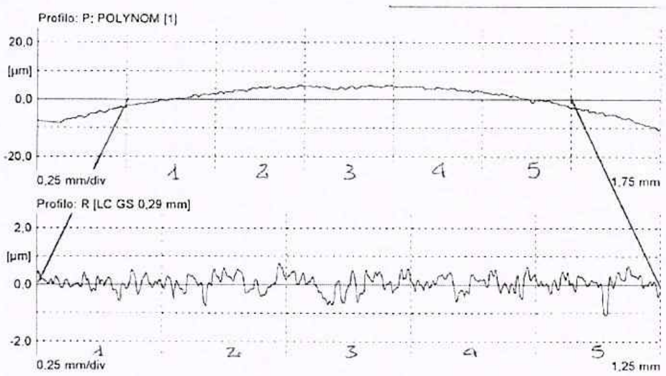


4 BACKUP INFORMATION OF MEASURING PRINCIPLE

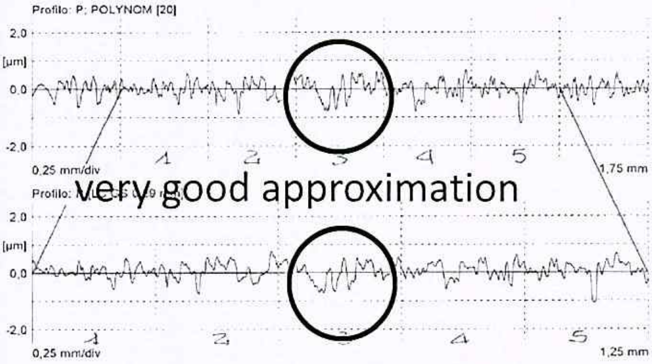
4.1 Deviation between different measurement specifications – Pt vs. Wt vs. $Pt_{flattened}$



	Example1	Example 2
Pt	na	na
Wt	1,19	0,74
Getrag	1,5	1,4



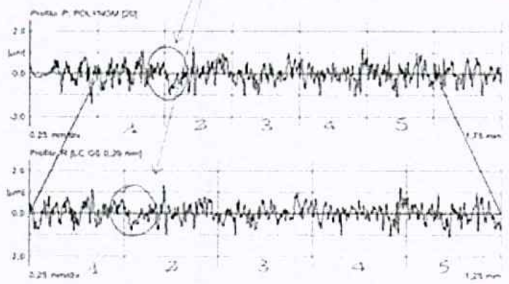
Pt flattened compared with R profile



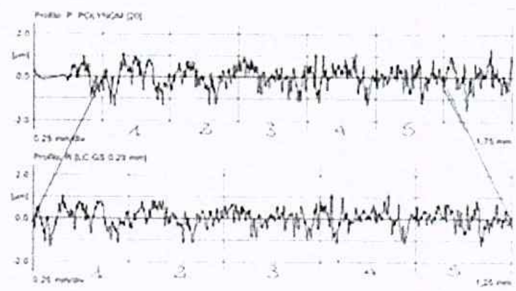
Proposed compromise to accommodate high volume process : Measure P_t in this way keeping the limit of 2µm.

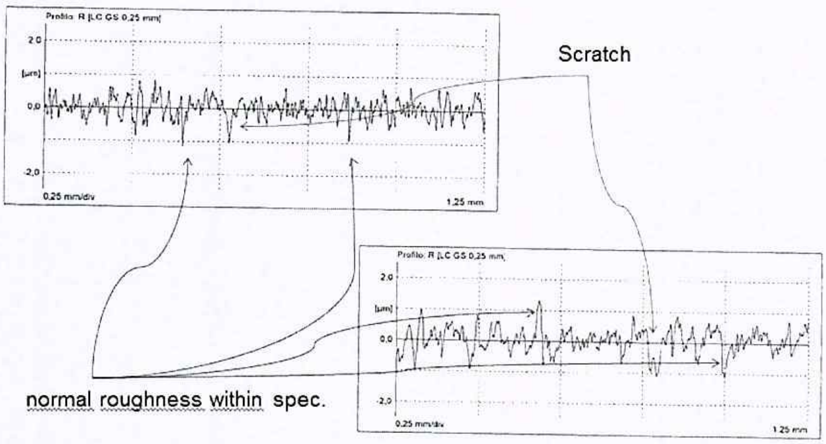
4.1.1 Examples

example of a scratch whose depth is smaller than the normal defects due to just grinding operation.



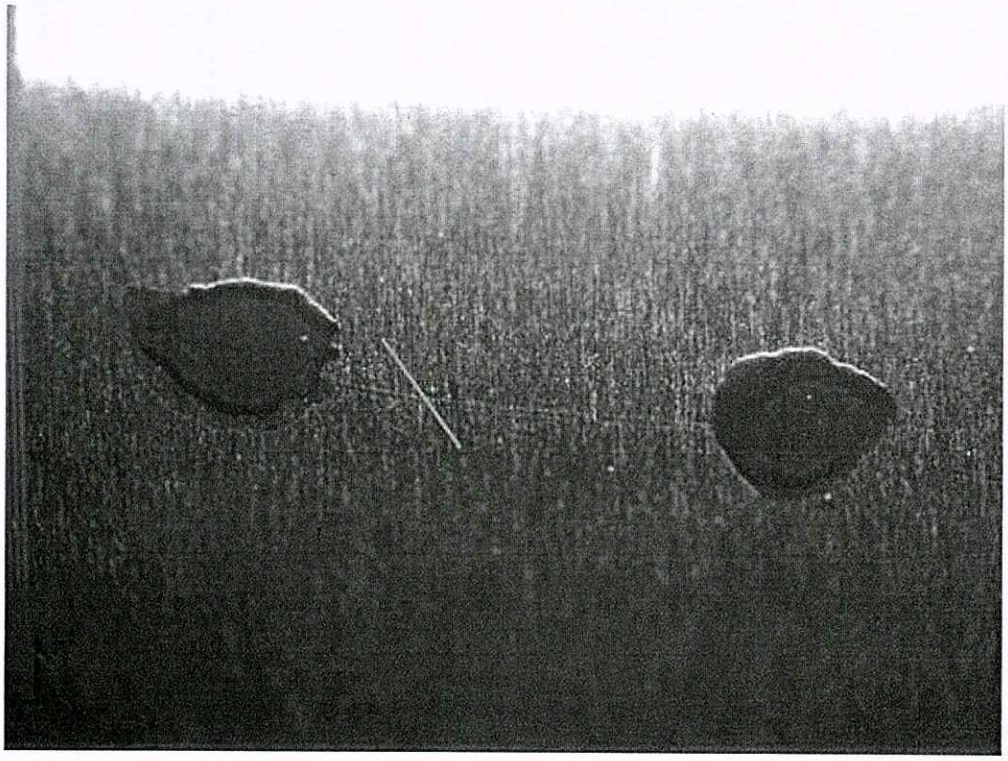
example of a scratch free area whose standard ground defects are deeper than 2 µm.





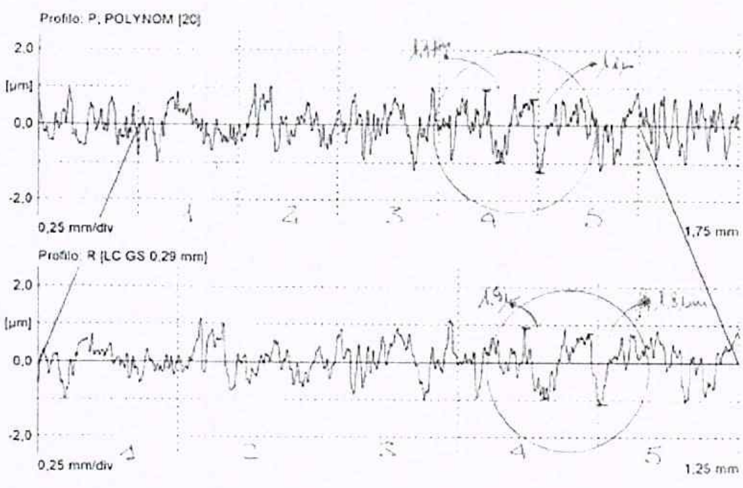
4.1.2 Measuring examples Pt flattened vs. R

Photo 1



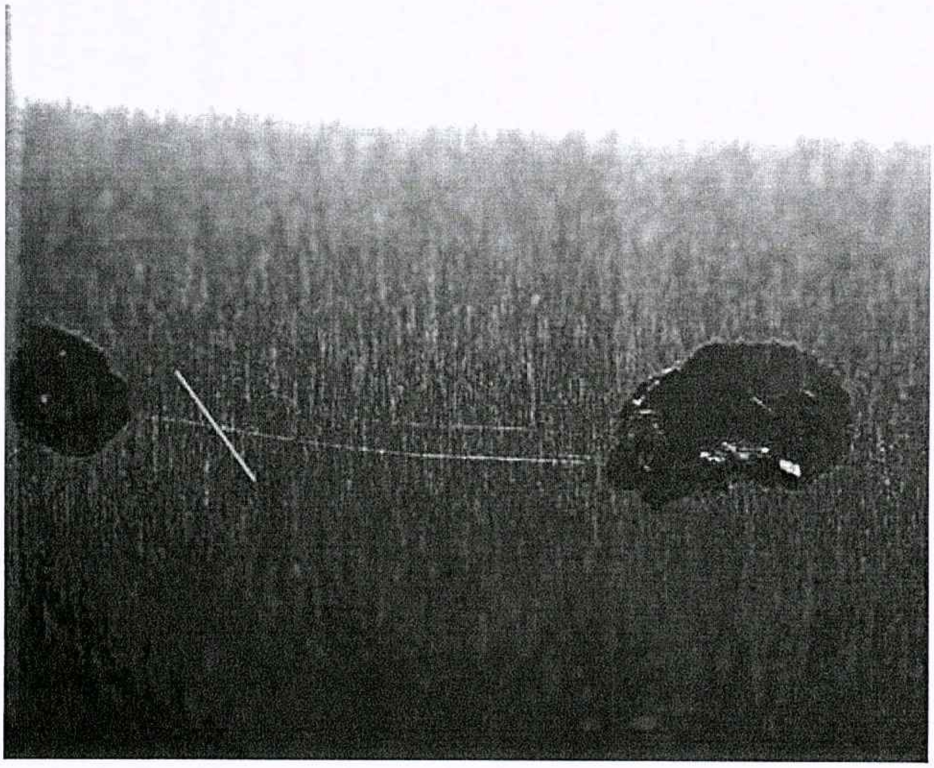
— measuring direction

Measuring Photo_1



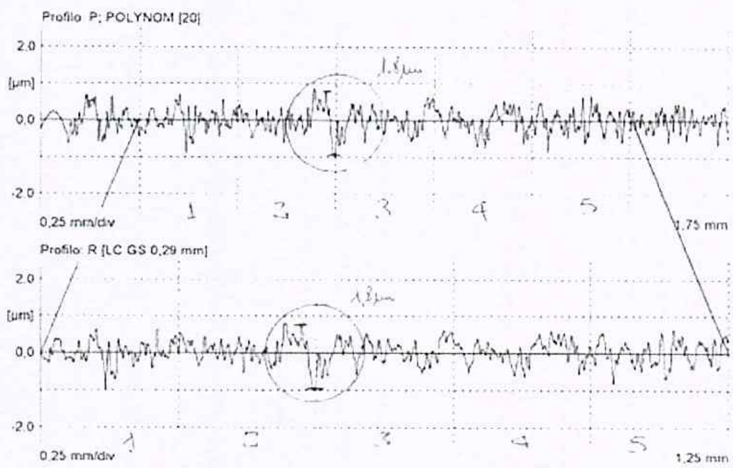
LT	1,75	mm
LM	1,25	mm
Z	5	
VB	±250,0	µm
Ra	0,35	µm
Rmax	2,19	µm
Rz	1,95	µm
Rz1	1,71	µm
Rz2	1,89	µm
Rz3	2,19	µm
Rz4	1,98	µm
Rz5	1,99	µm
Rz sigma	0,17	µm
Rp	0,95	µm
Rp max	1,15	µm
Rp1	0,71	µm
Rp2	1,10	µm
Rp3	1,15	µm
Rp4	0,96	µm
Rp5	0,81	µm
Rp sigma	0,19	µm
Rv	1,01	µm
Rv max	1,17	µm
Rv1	1,00	µm
Rv2	0,79	µm
Rv3	1,05	µm
Rv4	1,02	µm
Rv5	1,17	µm
Rv sigma	0,14	µm
Pt	2,35	µm
Pa	0,36	µm

Photo 2



— measuring direction

Measuring photo_2



LT	1,75	mm
LM	1,25	mm
Z	5	
VB	±250,0	µm
Ra	0,25	µm
Rmax	1,75	µm
Rz	1,50	µm
Rz1	1,64	µm
Rz2	1,75	µm
Rz3	1,42	µm
Rz4	1,23	µm
Rz5	1,48	µm
Rz sigma	0,20	µm
Rp	0,65	µm
Rp max	0,80	µm
Rp1	0,64	µm
Rp2	0,80	µm
Rp3	0,60	µm
Rp4	0,58	µm
Rp5	0,64	µm
Rp sigma	0,09	µm
Rv	0,85	µm
Rv max	1,00	µm
Rv1	1,00	µm
Rv2	0,96	µm
Rv3	0,82	µm
Rv4	0,66	µm
Rv5	0,83	µm
Rv sigma	0,13	µm
Pt	1,94	µm
Pa	0,26	µm

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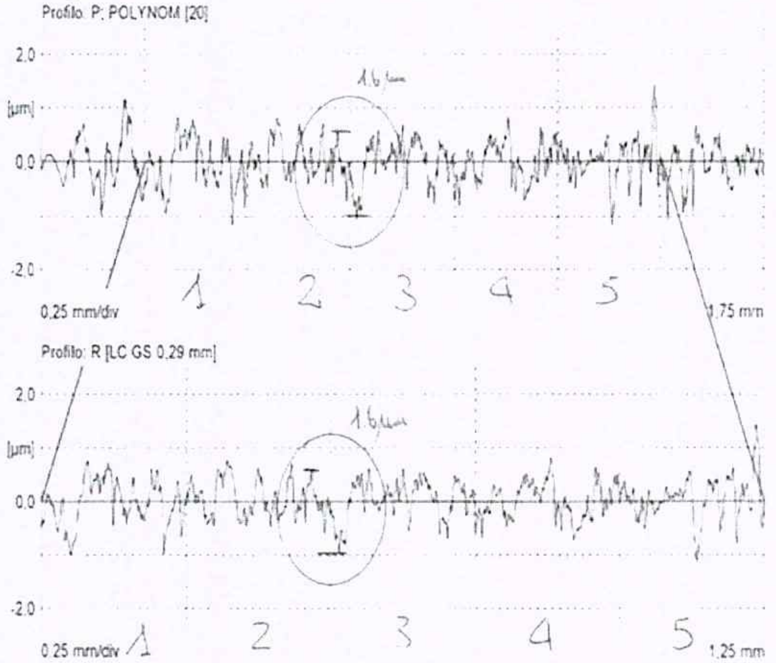
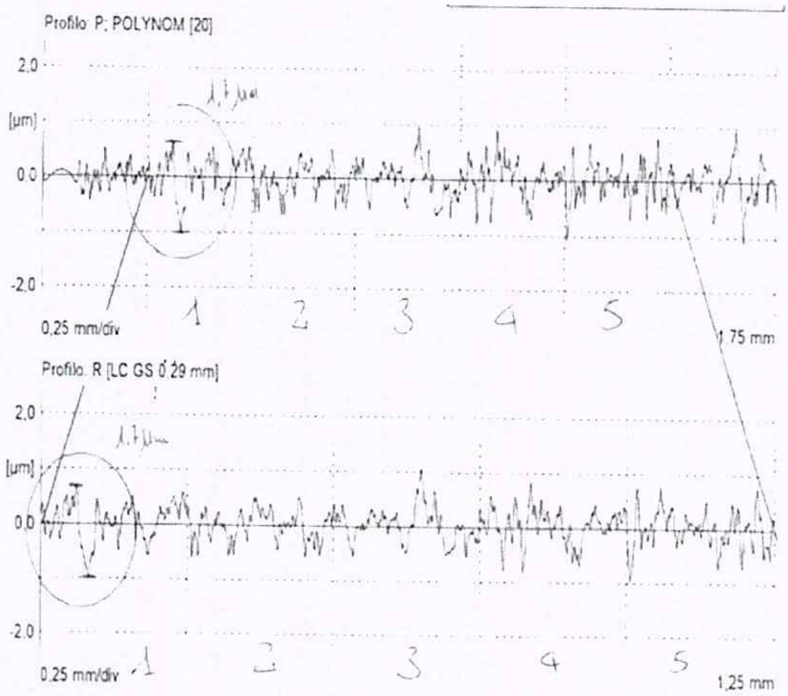
Measuring



LT	1,75	mm
LM	1,25	mm
Z	5	
VB	±250,0	µm
Ra	0,30	µm
Rmax	2,56	µm
Rz	1,74	µm
Rz1	1,74	µm
Rz2	1,35	µm
Rz3	1,54	µm
Rz4	1,52	µm
Rz5	2,56	µm
Rz sigma	0,48	µm
Rp	0,87	µm
Rp max	1,43	µm
Rp1	0,75	µm
Rp2	0,75	µm
Rp3	0,61	µm
Rp4	0,81	µm
Rp5	1,43	µm
Rp sigma	0,32	µm
Rv	0,87	µm
Rv max	1,12	µm
Rv1	0,99	µm
Rv2	0,60	µm
Rv3	0,93	µm
Rv4	0,71	µm
Rv5	1,12	µm
Rv sigma	0,21	µm
Pt	2,64	µm
Pa	0,31	µm

Measuring



LT	1,75	mm
LM	1,25	mm
Z	5	
VB	±250,0	µm
Ra	0,25	µm
Rmax	1,77	µm
Rz	1,59	µm
Rz1	1,70	µm
Rz2	1,16	µm
Rz3	1,61	µm
Rz4	1,71	µm
Rz5	1,77	µm
Rz sigma	0,25	µm
Rp	0,78	µm
Rp max	1,04	µm
Rp1	0,70	µm
Rp2	0,54	µm
Rp3	1,04	µm
Rp4	0,82	µm
Rp5	0,78	µm
Rp sigma	0,18	µm
Rv	0,81	µm
Rv max	1,00	µm
Rv1	1,00	µm
Rv2	0,62	µm
Rv3	0,57	µm
Rv4	0,89	µm
Rv5	0,99	µm
Rv sigma	0,21	µm
Pt	2,10	µm
Pa	0,24	µm