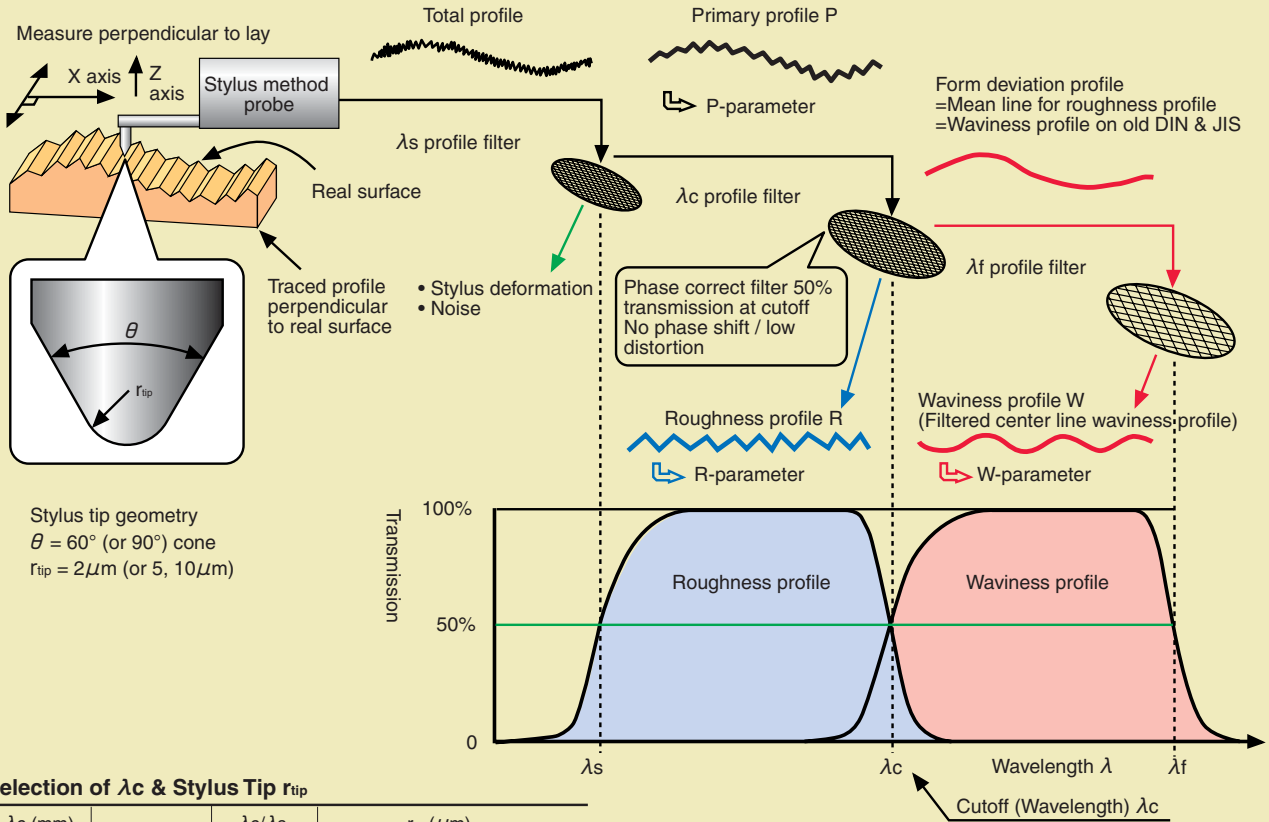


# Definition of Surface texture and Stylus instrument

## Profile by Stylus and phase correct filter

ISO4287: '97 and ISO3274: '96



### Selection of λc & Stylus Tip r<sub>tip</sub>

λc (mm)		λc/λs	r <sub>tip</sub> (μm)
0.08	2.5	30	2
0.25		100	
0.8	8	300	2 (5 at RZ > 3μm)
2.5			5 or 2
8			10, 5 or 2

## Evaluation procedure of roughness

ISO4288: '96

- View the surface and decide whether profile is periodic or non-periodic.
- When the tolerance limit is specified, use the table shown on the left for condition.
- When the tolerance limit is not specified.
  - Estimate roughness and measure it in corresponding condition in the table.
  - Change condition according with above result and measure it again.
  - Repeat "3.2" if the result does not reached the condition.
  - When the result reaches the condition, it will be the final value. Check it in shorter sampling length at non-periodic and change it if it meets.
- Compare the result toward tolerance limit in accordance with following rule,

### Upper limit - the 16% rule (Default)

Measure on the most critical surface. If not more than 16% of all value based on sampling length are exceed the limit, surface is acceptable.

- The first value does not exceed 70% of the limit.
- The first three values do not exceed the limit.
- Not more than one of the first six value exceed the limit.
- Not more than two of the first twelve value exceed the limit.

or when  $\mu + \sigma$  does not exceed the limit, the result is acceptable.

### Lower limit - the 16% rule (shown as L)

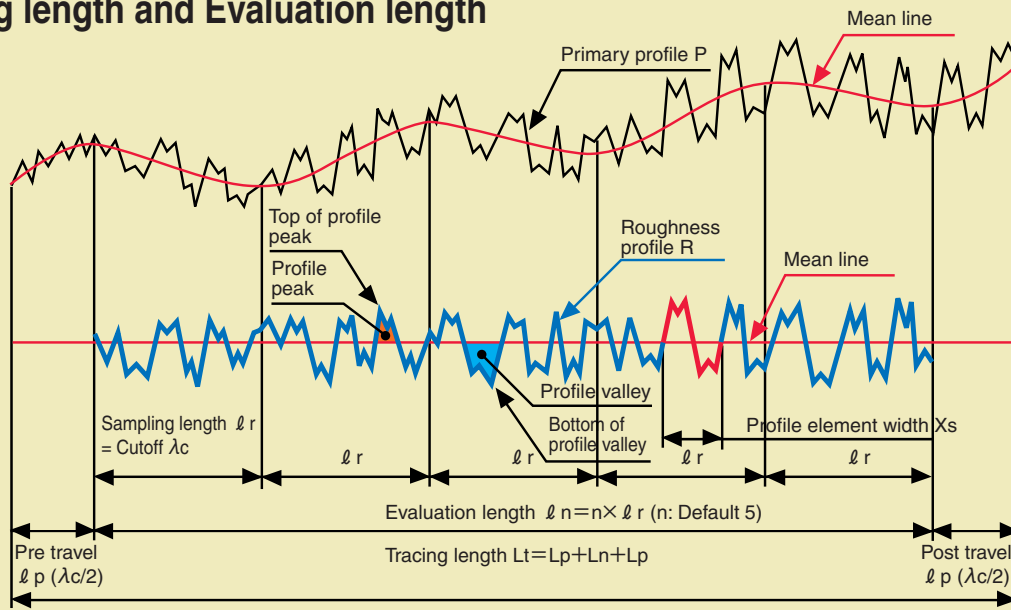
Measure the surface that can be expected the lowest roughness. If not more than 16% of all sampling length are less than the limit, or when  $\mu - \sigma$  is not less than the limit, the result is acceptable.

### Max value - the max rule (when "max" suffix is added)

The value is acceptable when none of value in entire surface is over the limit.

## Sampling length and Evaluation length

ISO4287: '97



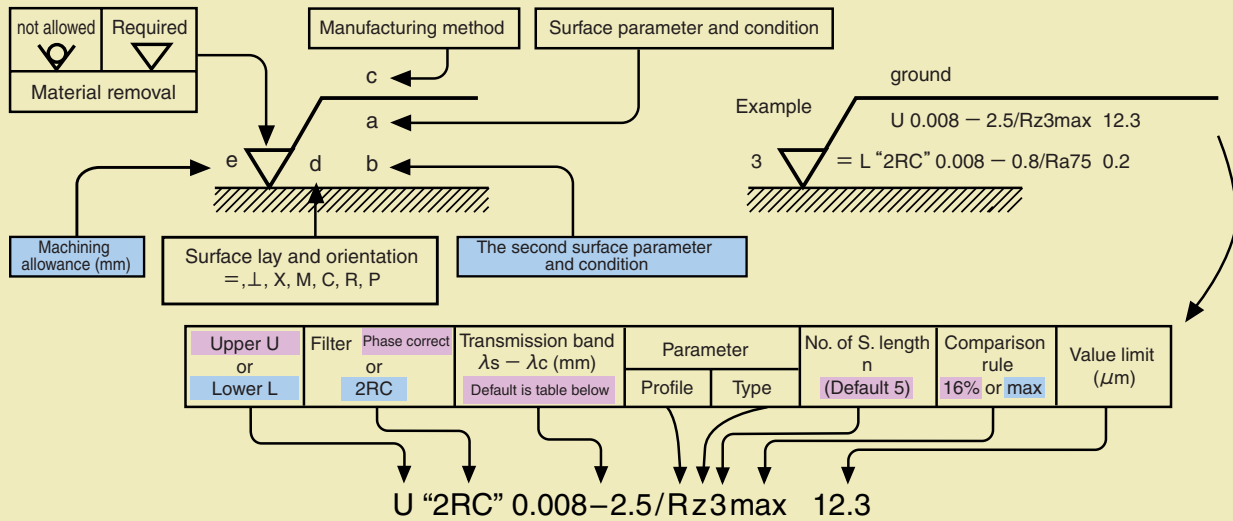
## Indication of surface texture

ISO 1302: '02

Note.:

Default item (red) is not indicated.

Additional item (blue) is indicated if necessary.



### Measuring condition: R-parameter

ISO4288: '96

Non-periodic profile				Periodic profile or RSm		Measuring Condition	
Ra, Rq, Rsk, Rku or RΔq		Rz, Rv, Rp, Rc, or Rt		RSm (mm)		Sampling length: $\lambda_r = \text{CutOff } \lambda_c$ (mm)	Evaluation length $\lambda_n$ (mm) = $5 \times \lambda_r$
Over>	Less≤	Over>	Less≤	Over>	Less≤		
0.006	0.02	0.025	0.1	0.013	0.04	0.08	0.4
0.02	0.1	0.1	0.5	0.04	0.13	0.25	1.25
0.1	2	0.5	10	0.13	0.4	0.8	4
2	10	10	50	0.4	1.3	2.5	12.5
10	80	50	200	1.3	4	8	40

### Measuring condition : P-parameter

ISO4288: '96

Stylus radius	$\lambda_s$	$\lambda_c$	No. of $\lambda_p = n$	S. length $\lambda_p$	E. length $\lambda_n$
2 μm	2.5 μm	-	1	Length of feature (Plane, Line)	Length of feature
5 μm	8 μm				
10 μm	25 μm				

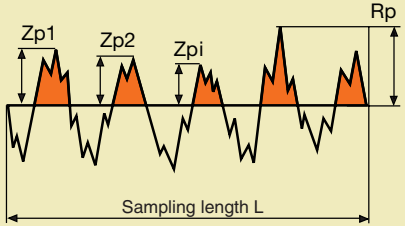
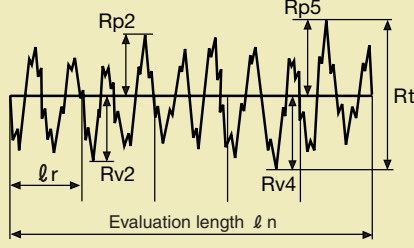
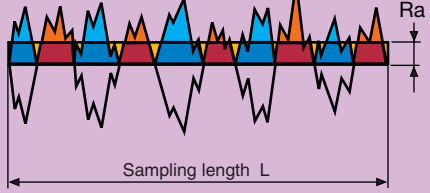
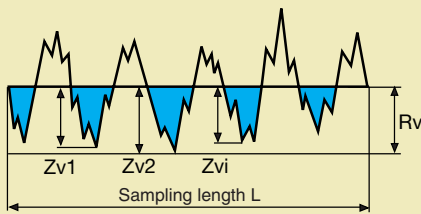
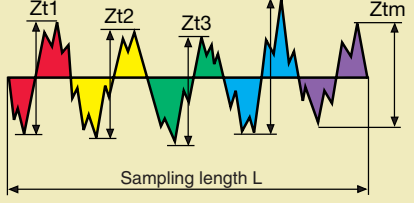
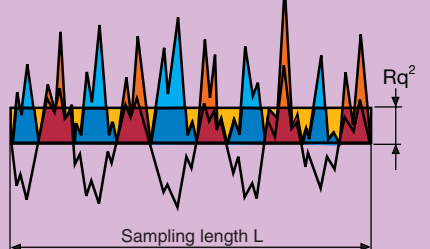
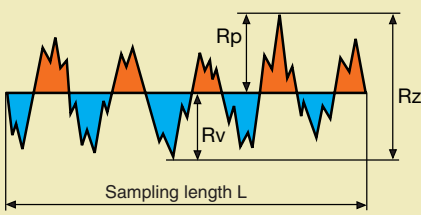
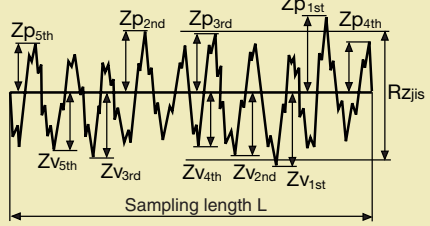
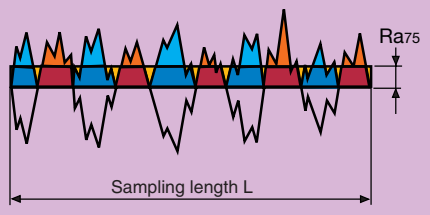
### Measuring condition: W-parameter

ISO1302: '02

$\lambda_c$	$\lambda_f$	No. of $\lambda_w = m$	S. length $\lambda_w$	E. length $\lambda_n$
$\lambda_c$ (for roughness)	$n\lambda_c$ (n: specified)	m: specified	$\lambda_f$	$m\lambda_f$

# Explanation of Surface Characteristics • Standards >>>

## Basic surface texture parameters and curves

Amplitude parameters (peak and valley)		Amplitude average parameters	
<p><b>Rp</b> <b>Pp</b> <b>Wp</b> } Maximum profile peak height</p> <p>The largest profile peak height <math>Z_p</math> within a sampling length.</p> <p><math>R_p, P_p, W_p = \max(Z(x))</math></p> 	<p><b>Rt</b> <b>Pt</b> <b>Wt</b> } Total height of profile (<math>P_t = R_{max}</math> at JIS'82)</p> <p>Sum of height of the largest profile peak height <math>R_p</math> and the largest profile valley <math>R_v</math> within an evaluation length.</p> <p><math>R_t, P_t, W_t = \max(R_{pi}) + \max(R_{vi})</math></p> 	<p><b>Ra</b> <b>Pa</b> <b>Wa</b> } Arithmetical mean deviation</p> <p>Arithmetic mean of the absolute ordinate values <math>Z(x)</math> within a sampling length.</p> <p><math>R_a, P_a, W_a = \frac{1}{L} \int_0^L  Z(x)  dx</math></p> 	
<p><b>Rv</b> <b>Pv</b> <b>Wv</b> } Maximum profile valley depth</p> <p>The largest profile valley depth <math>Z_p</math> within a sampling length.</p> <p><math>R_v, P_v, W_v = \min(Z(x))</math></p> 	<p><b>Rc</b> <b>Pc</b> <b>Wc</b> } Mean height of profile elements</p> <p>Mean value of the profile element heights <math>Z_t</math> within a sampling length.</p> <p><math>R_c, P_c, W_c = \frac{1}{m} \sum_{i=1}^m Z_{ti}</math></p>  <p>Profile element: Profile peak &amp; the adjacent valley</p>	<p><b>Rq</b> <b>Pq</b> <b>Wq</b> } Root mean square deviation</p> <p>Root mean square value of the ordinate values <math>Z(x)</math> within a sampling length.</p> <p><math>R_q, P_q, W_q = \sqrt{\frac{1}{L} \int_0^L Z^2(x) dx}</math></p> 	
<p><b>Rz</b> <b>Pz</b> <b>Wz</b> } Maximum height of profile (<math>R_z = R_y</math> at ISO4287 '84)</p> <p>Sum of height of the largest profile peak height <math>R_p</math> and the largest profile valley <math>R_v</math> within a sampling length.</p> <p><math>R_z = R_p + R_v</math></p>  <p>Different from <math>R_z</math> at old ISO, ANSI &amp; JIS</p>	<p><b>Rzjis</b> Ten point height of roughness profile (<math>R_z</math> at JIS'94)</p> <p>Sum of mean value of largest peak to the fifth largest peak and mean value of largest valley to the fifth largest valley within a sampling length.</p> <p><math>R_{zjis} = \frac{1}{5} \sum_{j=1}^5 (Z_{pj} + Z_{vj})</math></p>  <p>Annex of JIS only and confirm to JIS'94 Different from <math>R_z</math> at JIS'82</p>	<p><b>Ra75</b> Center line average (Old <math>R_a</math>, AA, CLA)</p> <p>Arithmetic mean of the absolute ordinate value <math>Z(x)</math> in a sampling length of roughness profile with 2RC filter of 75% transmission.</p> <p><math>R_{a75} = \frac{1}{\ell_n} \int_0^{\ell_n}  Z(x)  dx</math></p>  <p>Annex of JIS only Same as <math>R_a</math> at old ISO, ANSI &amp; DIN</p>	

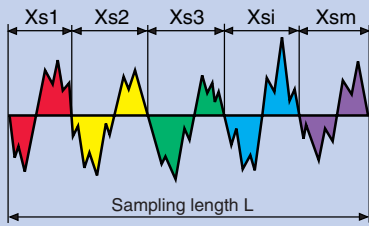
Surface Texture • Contour Measuring Instruments

### Spacing parameters

**RS<sub>m</sub>**  
**PS<sub>m</sub>**  
**WS<sub>m</sub>** } Mean width of the profile elements  
(RS<sub>m</sub> = S<sub>m</sub> at ISO4287 '84)

Mean value of the profile element width X<sub>s</sub> within a sampling length.

$$RS_m, PS_m, WS_m = \frac{1}{m} \sum_{i=1}^m X_{si}$$

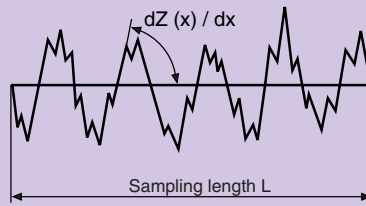


### Hybrid parameters

**RΔq**  
**PΔq**  
**WΔq** } Root mean square slope

Root mean square value of the ordinate slopes dZ/dX within a sampling length.

$$\left. \begin{matrix} R\Delta q \\ P\Delta q \\ W\Delta q \end{matrix} \right\} = \sqrt{\frac{1}{L} \int_0^L \left( \frac{d}{dx} Z(x) \right)^2 dx}$$

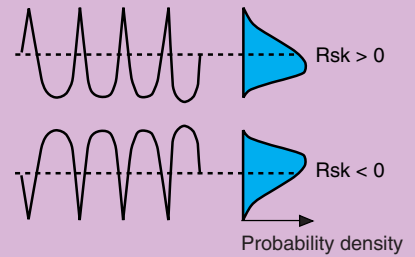


### Height characteristic average parameters

**Rsk**  
**Psk**  
**Wsk** } Skewness

Quotient of mean cube value of the ordinate values Z(x) and cube P<sub>q</sub>, R<sub>q</sub>, W<sub>q</sub> respectively, within a sampling length.

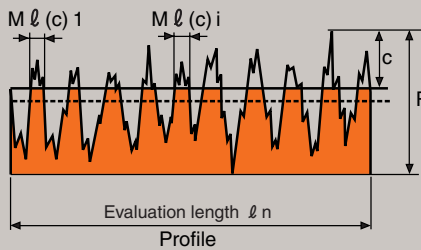
$$Rsk = \frac{1}{Rq^3} \left[ \frac{1}{\ell_r} \int_0^{\ell_r} Z^3(x) dx \right]$$



### Parameter from bearing ratio curve and profile height amplitude curve

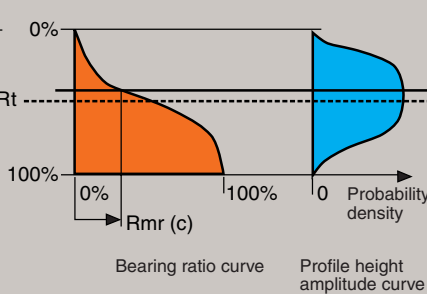
Material ratio curve of the profile  
(Abbott Firestone curve)

Curve representing the material ratio of the profile as a functional of level c.



Profile height amplitude curve

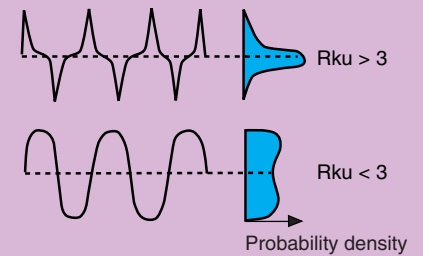
Sample probability density function of ordinate Z(x) within an evaluation length.



**Rku**  
**Pku**  
**Wku** } Kurtosis of profile

Quotient of mean quartic of the ordinate values Z(x) and 4th power of P<sub>q</sub>, R<sub>q</sub>, W<sub>q</sub> respectively, within a sampling length.

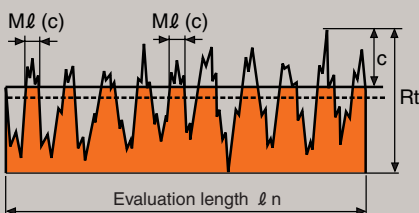
$$Rku = \frac{1}{Rq^4} \left[ \frac{1}{\ell_r} \int_0^{\ell_r} Z^4(x) dx \right]$$



**Rmr(c)**  
**Pmr(c)**  
**Wmr(c)** } Material ratio of profile  
(Rmr(c) = ex-tp)

Ratio of the material length of the profile elements Mℓ(c) at a given level c to the evaluation length.

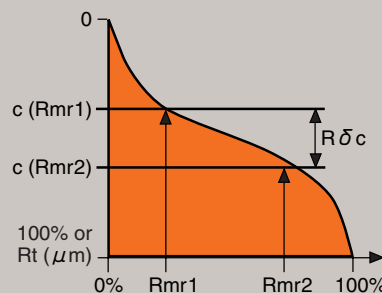
$$Rmr(c) = \frac{100}{\ell_n} \sum_{i=1}^m M\ell(c)_i (\%)$$



**Rδc**  
**Pδc**  
**Wδc** } Profile section height difference

Vertical distance between two section levels of given material ratio.

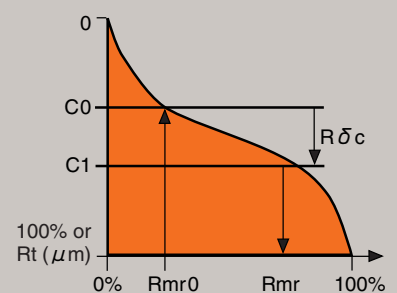
$$R\delta c = c(Rmr1) - c(Rmr2); Rmr1 < Rmr2$$



**Rmr**  
**Pmr**  
**Wmr** } Relative material ratio

Material ratio determined at a profile section level Rδc, related to a reference c<sub>0</sub>.

$$Rmr = Rmr(c_1) \\ C_1 = C_0 - R\delta c, C_0 = C(Rmr_0)$$



# Explanation of Surface Characteristics · Standards >>>

## Expanded surface texture parameters and curves

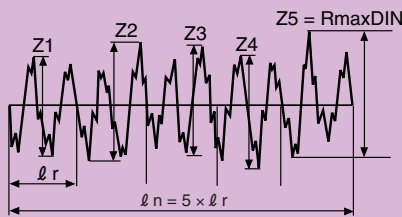
Confirm to ISO4287: '96, ISO12085: '96 & ISO13565-1: '96 / -2: '96 / -3: '98

### Traditional local parameters

**RmaxDIN** Maximum peak to valley height  
**RzDIN** Average peak to valley height

Zi is the maximum Peak to valley height of a sampling length  $\ell r$ .  
 RmaxDIN is the maximum Zi of 5 adjoining sampling length  $\ell r$  in an evaluation length  $\ell n$ .  
 RzDIN is arithmetic mean of 5 Zi.

$$RzDIN = \frac{1}{n} \sum_{i=1}^n Zi$$



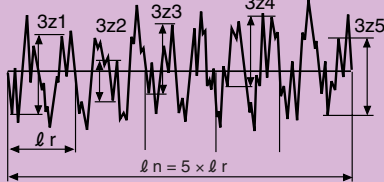
German old standard DIN4768/1: '90

### R3z Base roughness depth

3Zi is the height of the 3rd height peak from the 3rd depth valley in a sampling length  $\ell r$ .

R3z is arithmetic mean of 3Zi's of 5 sampling lengths in an evaluation length  $\ell n$ .

$$R3z = \frac{1}{n} \sum_{i=1}^n 3zi$$

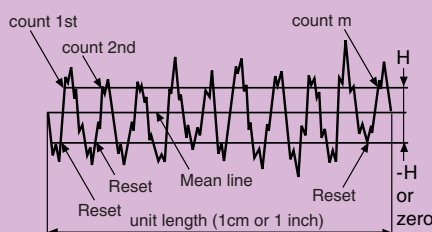


**Pc** Peak density /cm: ASME B46.1: '95

**PPI** Peaks per inch: SAEJ911

**HSC** High spot count

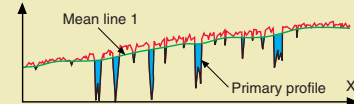
Pc is the number of peaks counted when a profile intersects a lower boundary line -H and an upper line +H per unit length 1 cm.  
 PPI shows Pc in 1 inch (25.4mm) unit length.  
 HSC shows the number of peaks when the lower boundary level is equal to zero.



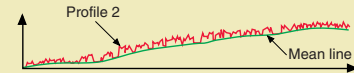
### Parameters of surfaces having stratified functional properties ISO13565's

#### Filtering process of ISO13565-1: '96

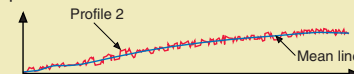
Calculate mean line 1 from a primary profile with phase correct filter.



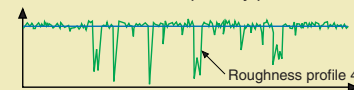
Calculate profile 2 with cutting valley lower than mean line 1.



Calculate mean line 3 from profile 2 with phase correct filter.



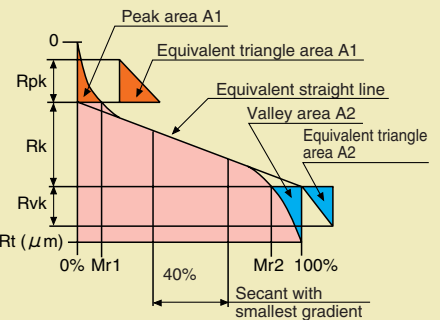
Calculate roughness profile 4 by taking mean line 3 off from a primary profile.



#### Measuring conditions of ISO13565-1

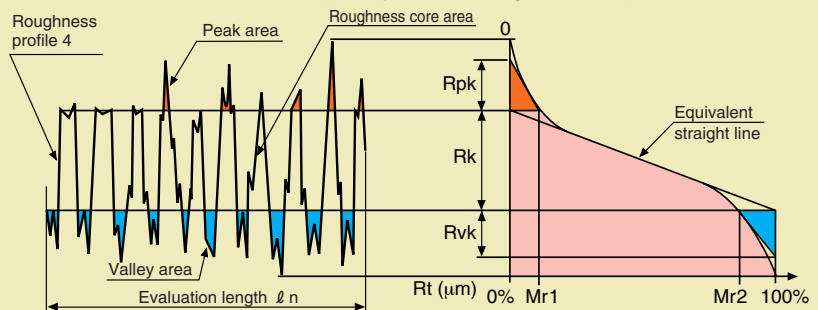
Cutoff value $\lambda c$	Evaluation length $\ell n$
0.8 mm	4 mm
2.5 mm	12.5 mm

40% length secant of smallest gradient separate the material ratio curve into core area & projected areas.  
 Calculate Rpk & Rvk with equivalent triangles of projected areas.



#### Height characterization using the linear material ratio curve ISO13565-2: '96

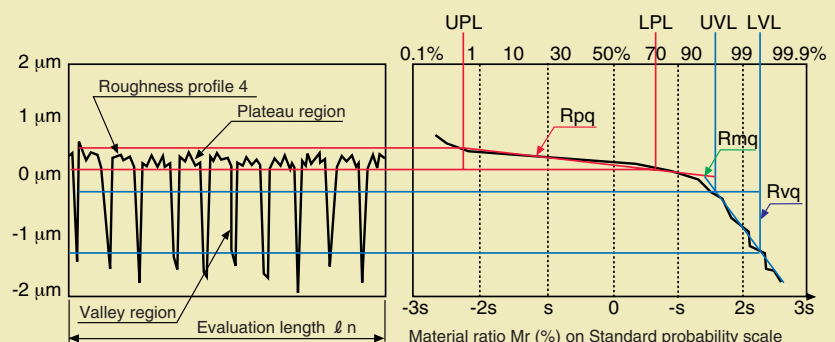
- Rk** core roughness depth : Depth of the roughness core profile
- Rpk** reduced peak height : Average height of protruding peaks above roughness core profile.
- Rvk** reduced valley depths : Average depth of valleys projecting through roughness core profile.
- Mr1** material portion 1 : Level in %, determined for the intersection line which separates the protruding peaks from the roughness core profile.
- Mr2** material portion 2 : Level in %, determined for the intersection line which separates the deep valleys from the roughness core profile.



#### Height characterization using the material probability curve of ISO13565-3

Draw a material ratio curve on normal probability paper from the roughness profile 4 (primary profile) of an evaluation length.  
 Separate the material probability curve to 2 area, upper plateau area and lower valley area.

- Rpq (Ppq)** parameter: slope of a linear regression performed through the plateau region.
- Rvq (Pvq)** parameter: slope of a linear regression performed through the valley region.
- Rmq (Pmq)** parameter: relative material ratio at the plateau to valley intersection.



## Motif parameters of ISO12085: '96

### Motif

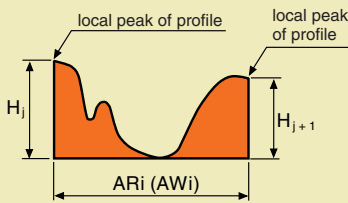
A portion of the primary profile between the highest points of two local peaks of the profile, which are not necessarily adjacent.

### Motif depths $H_j$ & $H_{j+1}$

Depth measured perpendicular to the general direction of the primary profile.

### Motif length $AR_i$ or $AW_i$

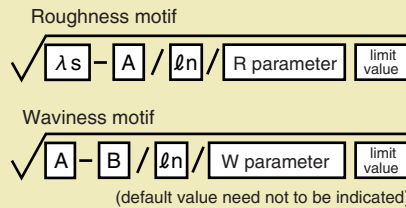
Length measured parallel to the general direction of the profile.



### Measuring condition

Default A=0.5mm, B=2.5mm, $\ell n=16$ mm			
A (mm)	B (mm)	$\ell n$ (mm)	$\lambda s$ ( $\mu\text{m}$ )
0.02	0.1	0.64	2.5
0.1	0.5	3.2	2.5
<b>0.5</b>	<b>2.5</b>	<b>16</b>	<b>8</b>
2.5	12.5	80	25

### Indication of ISO1302: '02



**Roughness motif:** Motif derived by using the ideal operator with limit value A.

**Limit value A:** Maximum length of roughness motif to separate waviness motif.

**Upper envelope line of the primary profile (Waviness profile):** Straight lines joining the highest points of peaks of the primary profile, after conventional discrimination of peaks.

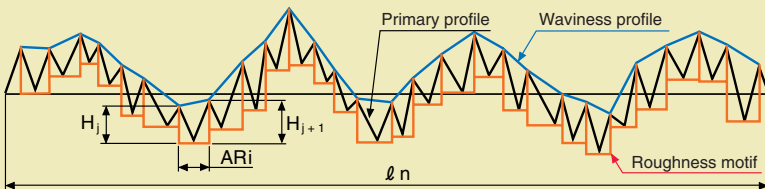
**AR:** Mean spacing of roughness motifs: The arithmetical mean value of the lengths  $AR_i$  of roughness motifs, within the evaluation length, i.e.

$$AR = \frac{1}{n} \sum_{i=1}^n AR_i \quad (n: \text{Total number of roughness motifs})$$

**R:** Mean depth of roughness motifs: The arithmetical mean value of the depths  $H_j$  of roughness motifs, within the evaluation length, i.e.

$$R = \frac{1}{m} \sum_{j=1}^m H_j \quad m = 2n$$

**Rx:** Maximum depth of roughness motifs: The maximum value of the depths  $H_j$  of roughness motifs, within the evaluation length.



**Waviness motif:** Motif derived on upper envelope line by using ideal operator with limit value B

**Limit value B:** Maximum length of waviness motif

**AW:** Mean spacing of waviness motifs: The arithmetical mean value of the lengths  $AW_i$  of waviness motifs, within the evaluation length, i.e.

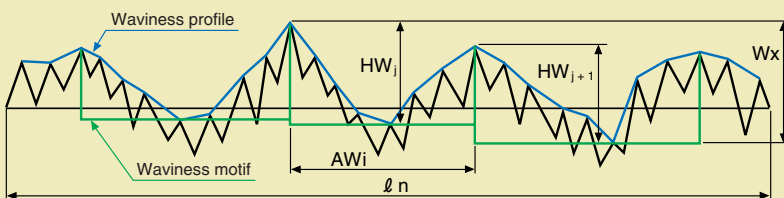
$$AW = \frac{1}{n} \sum_{i=1}^n AW_i \quad (n: \text{Total number of waviness motifs})$$

**W:** mean depth of waviness motifs: The arithmetical mean value of the depths  $HW_j$  of waviness motifs, within the evaluation length, i.e.

$$W = \frac{1}{m} \sum_{j=1}^m HW_j \quad m = 2n$$

**Wx:** Maximum depth of waviness: The largest depth  $HW_j$ , within the evaluation length.

**Wte:** Total depth of waviness: Distance between the highest point and the lowest point of waviness profile.

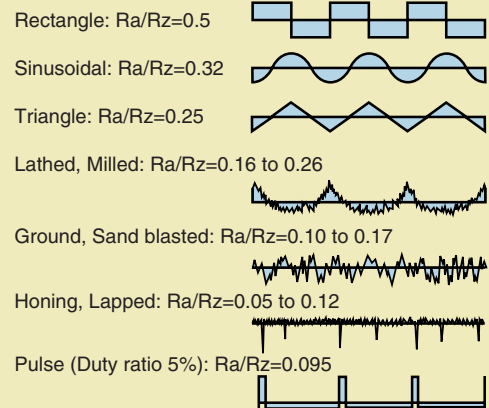


## Hint of surface texture measurement

### Roughness parameter conversion

The parameter ratio  $Ra/Rz$  ( $R_{max}, R_y$ )=0.25 is applicable only to triangle profile.

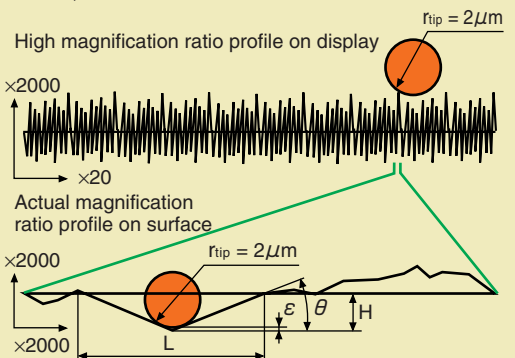
Actual profiles have different parameter ratios according to the form of profile.



### Display aspect ratio & Stylus fall depth in valley

Roughness profile usually displayed as much magnified height deviations than wavelength. Displayed valley looks sharp but actually wide. Stylus can contact to bottom of valley.

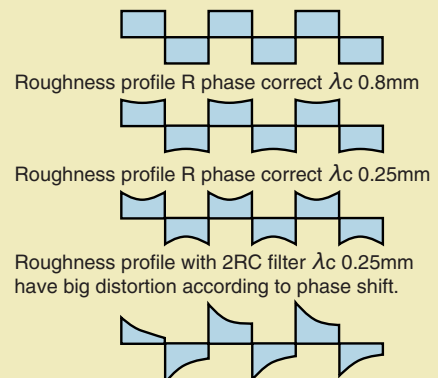
Depth error  $\epsilon$  with stylus unable to contact on triangle valley is;  $\epsilon = r_{tip} (1/\cos\theta - 1)$   
 $\theta < 15^\circ$ , or  $H/L=0.1-0.01$  on machined surface.



### Profile distortion with cutoff

Roughness profile will have bigger profile distortion & smaller amplitude when cutoff  $\lambda c$  is short.

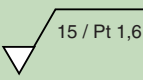
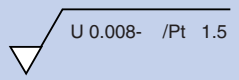
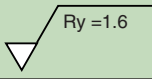
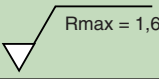
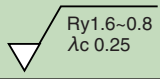
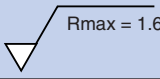
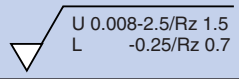
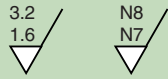
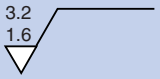
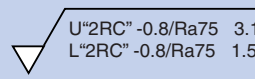
Primary profile P



# Comparison of national standards of surface texture measurement

Specification		ID. of national standard country	JIS B0601-'82 JIS B0031-'82	ANSI B46.1-'85	NF E05-015('84) NF E05-016('78) NF E05-017('72)	ISO468-'82 ISO4287/1-'84 ISO4288-'85 ISO1302-'78
		former Japan	former U.S.A.	former France	former ISO	
Primary profile P	Profile format	Analog signal without filtering	Analog signal with low pass filtering	Analog signal without filtering	Analog signal without filtering	
	Evaluation length	1 sampling length 0.25, 0.8, 2.5, 8, & 25	—	not defined	—	
P profile parameter	Maximum height	R <sub>max</sub> (S indication)	—	P <sub>t</sub>	—	
	Ten point height	R <sub>z</sub> (Z indication)	—	—	—	
	Other P parameters	—	—	P <sub>p</sub> , P <sub>a</sub> , (T <sub>p</sub> ) <sub>c</sub> , R, AR, Kr, W, W <sub>max</sub> , W <sub>t</sub> , AW, Kw	—	
	Motif parameters	—	—	—	—	
	Indication of maximum height < 1.5μm		—	Pt 0.8 - 0.6	—	
Roughness profile R	Unit of height	μm	μm or μin.	μm	μm	
	Unit of length	mm	mm or in.	mm	mm	
	Filter	2RC	2RC	2RC	2RC	
	Long cutoff	λ <sub>c</sub>	λ <sub>B</sub>	λ <sub>c</sub>	λ <sub>c</sub>	
	Short cutoff	—	cutoff value 2.5μm	—	—	
	Sampling length	L=3 × λ <sub>c</sub> or over	L:1.3-5mm @ λ <sub>B</sub> 0.25 L:2.4-8mm @ λ <sub>B</sub> 0.8 L:5-15mm @ λ <sub>B</sub> 2.5	ℓ	ℓ	
	Evaluation length	TL=L=3 × λ <sub>c</sub> or over	—	L = n × ℓ	ℓ n = n × ℓ	
R profile Height parameter	Maximum height	—	Peak-to-Valley Height (R <sub>max</sub> , R <sub>y</sub> )	R <sub>y</sub>	R <sub>y</sub>	
	Maximum peak to valley height	—	—	R <sub>max</sub>	R <sub>y</sub> max	
	Ten point height	—	(R <sub>z</sub> )	R <sub>z</sub>	R <sub>z</sub>	
	Average peak to valley height	—	—	—	R <sub>y</sub> 5	
	Other peak height parameters	—	(R <sub>p</sub> )	R <sub>p</sub>	R <sub>p</sub> , R <sub>p</sub> max, R <sub>p</sub> 5, R <sub>m</sub> , R <sub>c</sub>	
ℓ r & λ <sub>c</sub> for peak height parameter	0.25mm	R <sub>max</sub> , R <sub>z</sub> ≤ 0.8μm	—	not defined	0,1 < R <sub>z</sub> , R <sub>y</sub> ≤ 0,5μm	
	0.8mm	0.8 < R <sub>max</sub> , R <sub>z</sub> ≤ 6.3μm	—	not defined	0,5 < R <sub>z</sub> , R <sub>y</sub> ≤ 10μm	
	2.5mm	6.3 < R <sub>max</sub> , R <sub>z</sub> ≤ 25μm	—	not defined	10 < R <sub>z</sub> , R <sub>y</sub> ≤ 50μm	
Indication of Maximum height in case of R <sub>z</sub> < 1.5μm		—	—	R <sub>mac</sub> 1.6		
R profile averaging parameter	Arithmetic average	R <sub>a</sub> (a indication)	R <sub>a</sub>	R <sub>a</sub>	R <sub>a</sub>	
	root mean square	—	(R <sub>q</sub> )	R <sub>q</sub>	R <sub>q</sub>	
	Skewness, kurtosis	—	(Skewness, Kurtosis)	Sk, Ek	Sk	
ℓ r & λ <sub>c</sub> for R <sub>a</sub> on non-periodic profile	0.25mm	optional	0.0063 < S <sub>m</sub> ≤ 0.05μm	not defined	0,02 < R <sub>a</sub> ≤ 0,1μm	
	0.8mm	R <sub>a</sub> ≤ 12.5μm	0.02 < S <sub>m</sub> ≤ 0.16μm	not defined	0,1 < R <sub>a</sub> ≤ 2μm	
	2.5mm	12.5 < R <sub>a</sub> ≤ 100μm	0.063 < S <sub>m</sub> ≤ 0.5μm	not defined	2 < R <sub>a</sub> ≤ 10μm	
Indication of R <sub>a</sub> in case of 1.5 < R <sub>a</sub> < 3.1μm				R <sub>a</sub> 1.6 - 3.2		
R profile other parameter	Mean spacing	—	Roughness spacing	S <sub>m</sub>	S <sub>m</sub>	
	RMS slope	—	—	Δq	Δq	
	material ratio	—	(tp)	—	tp	
	Other parameters	—	(Peak count P <sub>c</sub> )	S, Δa, λ <sub>a</sub> , λ <sub>q</sub>	S, Δa, λ <sub>a</sub> , λ <sub>q</sub> , Lo, D	
Comparison rule of measured value with tolerance limits	Average	average value of all sampling lengths	average value of all sampling lengths	not defined	—	
	16% rule	—	—	not defined	16% rule default	
	Maximum rule	—	—	not defined	Max rule for parameter with suffix "max"	

Surface Texture · Contour Measuring Instruments

BS1134 part 1-'88 BS1134 part 2-'90	DIN4768-'90 DIN4771-'77 DIN4775-'82 DIN4776-'90 DIN4777-'90	JIS B0601-'94 JIS B0031-'94	ASME B46.1-'95	ISO4287:'97 (JIS B0601:'01) ISO4288:'96 (JIS B0633:'01) ISO12085:'96 (JIS B0631:'00) ISO13565's, (JIS B0671's) ISO1302:'02 EU, U.K. & Japan
former U.K.	former Germany	former Japan	U.S.A.	
Analog signal without filtering	Digital data without filtering	Digital data without filtering	Digital data with $\lambda$ s filter	Digital data with $\lambda$ s filter
—	0,5, 1,5, 5, 15 & 50mm	—	—	= 1 sampling length = Length of the measured feature
—	Pt	—	—	Pt, Pz(=Pt)
—	—	—	—	—
—	—	—	—	Pp, Pv, Pc, Pa, Pq, Psk, Pku, PSm, PΔq, Pmr(c), Pδc, Pmr, Ppq, Pvq, Pmq
—	—	—	—	R, AR, Rx, W, AW, Wx, Wte
—		—	—	
$\mu\text{m}$ ( $\mu\text{in}$ )	$\mu\text{m}$	$\mu\text{m}$	$\mu\text{m}$ (or $\mu\text{in}$ .)	$\mu\text{m}$
mm (inch)	mm	mm	mm (or in.)	mm
2RC	Phase correct	Phase correct	Phase correct (or 2RC)	Phase correct
$\lambda_B$	$\lambda_C$	$\lambda_C$	$\lambda_C$	$\lambda_C$
—	—	—	$\lambda_S$	$\lambda_S$
$\ell_r$	$\ell_c$	$\ell_r$	Cutoff length : $\ell$	$\ell_r$
$\ell_e = 5 \times \ell_r$	$5 \times \ell_c$	$\ell_e = 5 \times \ell_r$	$L = 5 \times \ell$	$\ell_e = 5 \times \ell_r$ Calculate for each sampling length $\ell_r$
—	Rt	Maximum height Ry in 1 $\ell_r$	Rt	Maximum height Rz in 1 $\ell_r$ or total height Rt in 1 $\ell_e$
Ry	Maximum two point height Rmax	—	Rmax	Rz max
Rz	—	Ten point height Rz	—	—
—	Ten point height Rz	Maximum height Ry	Rz	Average method Rz
—	—	—	Rp, Rpm, Rv	Rp, Rv, Rc
$0,1 < Rz \leq 0,5\mu\text{m}$	$0,1 < Rz \leq 0,5\mu\text{m}$	$0,1 < Rz, Ry \leq 0,5\mu\text{m}$	$0,02 < Ra \leq 0,1\mu\text{m}$	$0,1 < Rz \leq 0,5\mu\text{m}$
$0,5 < Rz \leq 10\mu\text{m}$	$0,5 < Rz \leq 10\mu\text{m}$	$0,5 < Rz, Ry \leq 10\mu\text{m}$	$0,1 < Ra \leq 2\mu\text{m}$	$0,5 < Rz \leq 10\mu\text{m}$
$10 < Rz \leq 50\mu\text{m}$	$10 < Rz \leq 50\mu\text{m}$	$10 < Rz, Ry \leq 50\mu\text{m}$	$2 < Ra \leq 10\mu\text{m}$	$10 < Rz \leq 50\mu\text{m}$
				
Ra	Ra	Ra	Ra	Ra
—	—	—	Rq	Rq
—	—	—	Rsk, Rku	Rsk, Rku
$0,02 < Ra \leq 0,1\mu\text{m}$	$0,02 < Ra \leq 0,1\mu\text{m}$	$0,02 < Ra \leq 0,1\mu\text{m}$	$0,02 < Ra \leq 0,1\mu\text{m}$	$0,02 < Ra \leq 0,1\mu\text{m}$
$0,1 < Ra \leq 2\mu\text{m}$	$0,1 < Ra \leq 2\mu\text{m}$	$0,1 < Ra \leq 2\mu\text{m}$	$0,1 < Ra \leq 2\mu\text{m}$	$0,1 < Ra \leq 2\mu\text{m}$
$2 < Ra \leq 10\mu\text{m}$	$2 < Ra \leq 10\mu\text{m}$	$2 < Ra \leq 10\mu\text{m}$	$2 < Ra \leq 10\mu\text{m}$	$2 < Ra \leq 10\mu\text{m}$
				
Sm	—	Sm	Sm	RSm
—	—	—	Δq	RΔq
tp	—	tp	tp	Rmr(c)
S	—	S	Htp, Δa, SAE Peak PPI, Peak density Pc	Rδc, Rmr, Rpk, Rvk, Rk, Mr1, Mr2, Rpq, Rvq, Rmq
—	—	average value of all sampling lengths	not defined	average value of all sampling lengths
16% rule	16% rule for Ra, Rz	—	not defined	16% rule default
Max rule for parameter with suffix "max"	Max rule for Rmax	—	not defined	Max rule for parameter with suffix "max"