〔TECHNICAL DATA〕

# SURFACE ROUGHNESS

EXCERPT FROM JIS B 0601 (1994)
AND JIS B 0031 (1994)

## Categories of surface roughness

Definitions and indications for surface roughness parameters (for industrial products) are specified. They are arithmetical mean roughness (Ra), maximum height (Ry), ten-point mean roughness (Rz), mean spacing of profile irregularities (Sm), mean spacing of local peaks of theprofile (S) and profile bearing length ratio (tp). Surface roughness is given as the arithmetical mean value for a randomly sampled area.

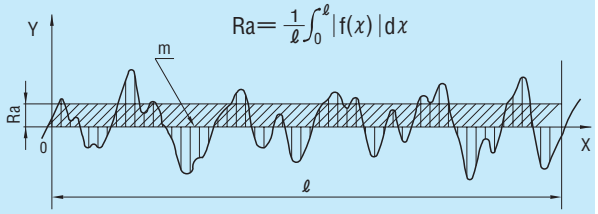
〔Mean center line roughness ($Ra_{75}$) is defined in the annexes of JIS B 0031 and JIS B 0601.〕

### Typical ways for obtaining surface roughness

**Arithmetical mean roughness (Ra)**

A section of standard length is sampled from the mean line on the roughness chart. The mean line is laid on a Cartesian coordinate system where in the mean line runs in the direction of the x-axis and magnification is the y-axis. The value obtained with the formula on the right is expressed in micrometer ($\mu$m) when y=f ($\chi$).

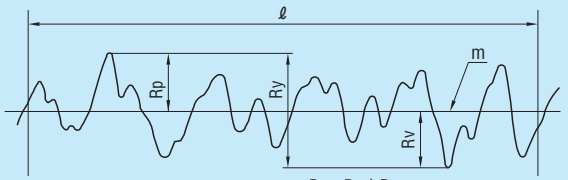
$$Ra = \frac{1}{\ell}\int_0^{\ell} |f(x)|\,dx$$




**Maximum peak (Ry)**

A section of standard length is sampled from the mean line on the roughness chart. The distance between the peaks and valleys of the sampled line is measured in the y direction. The value is expressed in micrometer ($\mu$m).

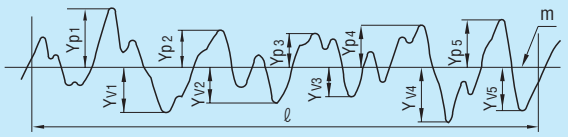
Note: To obtain Ry, sample only the standard length. The part, where peaks and valleys are wide enough to be interpreted as scratches, should be avoided.




Ry=Rp+Rv

**Ten-point mean roughness (Rz)**

A section of standard length is sampled from the mean line on the roughness chart. The distance between the peaks and valleys of the sampled line is measured in the y direction. Then, the average peak is obtained among 5 tallest peaks (Yp), as is the average valley between 5 lowest valleys (Yv). The sum of these two values is expressed in micrometer ($\mu$m).




$$Rz = \frac{|Yp_1 + Yp_2 + Yp_3 + Yp_4 + Yp_5| + |Yv_1 + Yv_2 + Yv_3 + Yv_4 + Yv_5|}{5}$$

Yp1、Yp2、Yp3、Yp4、Yp5: Tallest 5 peaks within sample

Yv1、Yv2、Yv3、Yv4、Yv5: Lowest 5 peaks within sample

### Reference: Relationship between arithmetical mean roughness (Ra) and conventional symbols

| Arithmetical mean roughness Ra | | | Max. height Ry | Ten-point mean roughness Rz | Standard length of Ry・Rz ℓ(mm) | Triangular indication |
|---|---|---|---|---|---|---|
| Preferred number series | Cut-off value c (mm) | Indication of surface texture on drawings | Preferred number series | | | |
| 0.012 a | 0.08 | 0.012 ~ 0.2 | 0.05 s | 0.05 z | 0.08 | ▽▽▽▽ |
| 0.025 a | 0.25 | | 0.1 s | 0.1 z | | |
| 0.05 a | | | 0.2 s | 0.2 z | 0.25 | |
| 0.1 a | 0.8 | | 0.4 s | 0.4 z | | |
| 0.2 a | | | 0.8 s | 0.8 z | 0.8 | |
| 0.4 a | | 0.4 ~ 1.6 | 1.6 s | 1.6 z | | ▽▽▽ |
| 0.8 a | | | 3.2 s | 3.2 z | | |
| 1.6 a | | | 6.3 s | 6.3 z | | |
| 3.2 a | 2.5 | 3.2 ~ 6.3 | 12.5 s | 12.5 z | 2.5 | ▽▽ |
| 6.3 a | | | 25 s | 25 z | | |
| 12.5 a | 8 | 12.5 ~ 25 | 50 s | 50 z | | ▽ |
| 25 a | | | 100 s | 100 z | 8 | |
| 50 a | | 50 ~ 100 | 200 s | 200 z | | ~ |
| 100 a | — | | 400 s | 400 z | — | |

※The interdependence for 3 classes is not strictly enforced.

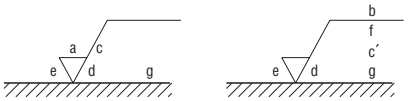
※The evaluation lengths of Ra : Ry and Rz : Five times the cut-off value and standard length respectively.

# TECHNICAL DRAWINGS-METHOD OF INDICATING SURFACE TEXTURE ON DRAWING

EXCERPT FROM JIS Z B0031（1994）

## Positions of respective indicating symbols relative to indicating symbol of surface

Each grain surface position is indicated as shown in Drawing 7 This includes surface roughness, cutoff value or reference length, processing method, symbol of direction of lay, surface waviness, etc.




**Drawing7 Entry position of each indication**

a：Value of Ra

b：Processing method

c：Cutoff value・valuation length

c′：Reference length・valuation length

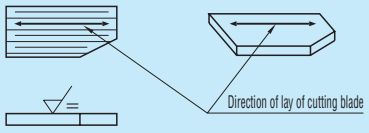
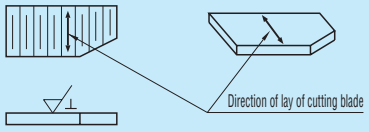
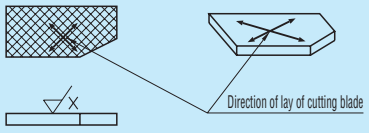
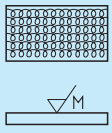
d：Symbol of direction of lay

f：Parameter other than Ra（With tp, parameter/cutoff level）

g：Surface waviness（according to JIS B 0610）

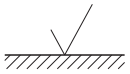
**Note**：Items other than a and f are added as necessary.

**Reference**：The location of lay of e in Drawing7 is given as the finish allowance in ISO 1302.

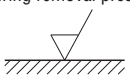
| Symbol | Meaning | Figure |
|---|---|---|
| = | Parallel to the projected surface on which the direction of lay of the cutting blade is indicated.<br>（ex） Shaped surface |  |
| ⊥ | Direction of lay of cutting blade<br>（ex） Shaped surface （when viewed from the side）, machined or cylindrical ground surface. |  |
| X | Intersection of two diagonal lines on the projected surface on which the direction of lay of the cutting blade is indicated.<br>（ex） Honing finished surface |  |
| M | Multidirectional intersection or non-directional point on the projected surface on which the direction of lay of the cutting blade is indicated.<br>（ex） Rapping finished surface, super finished surface, face milled or end milled surface in surfacing feed direction |  |
| C | Concentric circles roughly centered on the same on the surface on which the direction of lay of the cutting blade is indicated.<br>（ex） Facing surface |  |
| R | Radiating shape roughly centered on the same point on the surface on which the direction of lay of the cutting blade is indicated. |  |

## ■Examples Indicating Surface Texture on Drawing

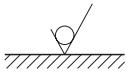
Indicating symbol of surface



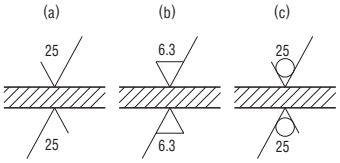
Indicating symbol of surface requiring removal press



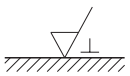
Indicating symbol of surface on which no removal process is permitted



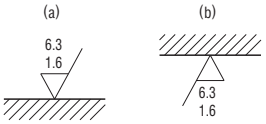
Examples indicating the upper limits of Ra




Examples indicating direction of lay



Examples indicating the upper limit and lower limit of Ra




Examples indicating processing method