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ISO RECOMMENDATION

R 468

SURFACE ROUGHNESS

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BRIEF HISTORY

The ISO Recommendation R 468, *Surface Roughness*, was drawn up by Technical Committee ISO/TC 57, *Surface Finish*, the Secretariat of which is held by the Gosudarstvennyj Komitet Standartov, Mer i Izmeritel'nyh Priborov pri Sovete Ministrov SSSR (GOST).

Work on this question by the Technical Committee began in 1954 and led, in 1957, to the adoption of a Draft ISO Recommendation.

This first Draft ISO Recommendation (No. 221) was circulated to all the ISO Member Bodies for enquiry in September 1958. As the results of this consultation were not considered satisfactory, the Technical Committee presented a second Draft ISO Recommendation, which was circulated to all the Member Bodies in April 1962 and which was approved by the following Member Bodies:

Austria	Greece	Poland
Belgium	Hungary	Republic of South Africa
Brazil	India	Romania
Bulgaria	Israël	Switzerland
Burma	Italy	U.S.A.
Czechoslovakia	Mexico	U.S.S.R.
Denmark	New Zealand	Yugoslavia

Eight Member Bodies opposed the approval of the Draft:

Canada	Japan	U.A.R.
France	Netherlands	United Kingdom
Germany	Sweden	

The second Draft ISO Recommendation was then submitted by correspondence to the ISO Council, which decided, in February 1966, to accept it as an ISO RECOMMENDATION.

ISO Recommendation R 468 February 1966

SURFACE ROUGHNESS

INTRODUCTION

The purpose of this ISO Recommendation is:

— to define the basic terms relating to surface roughness (section 1);

— to give a method of quantitatively evaluating the roughness of the effective profile of a surface in accordance with the mean line system M (section 2).

Definitions and parameters in other reference systems, in particular the envelope line system E*, will be the subject of further sections to be published subsequently in the form of addenda to the present ISO Recommendation.

1. GENERAL TERMS

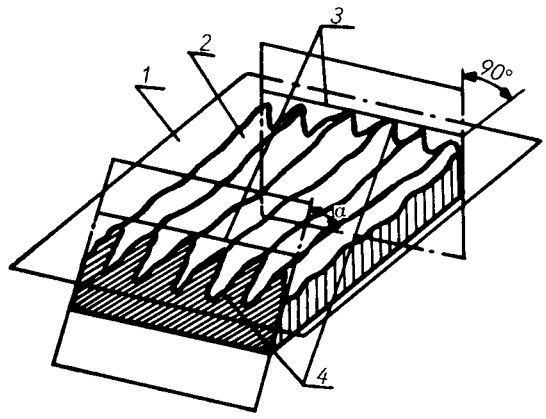
1.1 *Real surface.* The surface limiting the body, separating it from the surrounding space.

1.2 *Geometrical surface.* The surface determined by the design or by the process of manufacture, neglecting errors of form and surface roughness (see Fig. 1).

NOTE. — The terms "ideal geometrical surface", "design form" and "nominal surface" are used in certain national standards with the sense of "geometrical surface", as defined above.

1.3 *Effective surface.* The close representation of a real surface obtained by instrumental means (see Fig. 1).

NOTE. — The term "measured surface" is used in certain national standards with the sense of "effective surface", as defined above.



1. *Geometrical surface*
2. *Effective surface*
3. *Geometrical profile*
4. *Effective profile*

FIG. 1

* The difference between the M and E systems lies in reference being made to two distinct lines for measuring the ordinates characterizing the roughness of each point of the surface profile, the criteria of roughness being defined with reference to the mean line in the M system and with reference to the envelope line in the E system.

1.4 *Real profile.* The contour that results from the intersection of the real surface by a plane conventionally defined with respect to the geometrical surface.

1.5 *Geometrical profile.* The contour that results from the intersection of the geometrical surface by a plane conventionally defined with respect to this surface (see Fig. 1).

NOTE. — The terms "ideal geometrical profile", "design profile" and "nominal profile" are used in certain national standards with the sense of "geometrical profile", as defined above.

1.6 *Effective profile.* The contour that results from the intersection of the effective surface by a plane conventionally defined with respect to the geometrical surface (see Fig. 1).

NOTE. — The term "measured profile" is used in certain national standards with the sense of "effective profile", as defined above.

1.7 *Reference line.* A line chosen by convention to serve for the quantitative evaluation of the roughness of the effective profile.

1.8 *Irregularities.* The peaks and valleys of a real surface.

1.9 *Surface roughness.* All those irregularities of the surface which are conventionally defined within a section of the area where deviations of form and waviness are eliminated.

1.10 *Traversing length.* The length of the effective profile necessary for the evaluation of the surface roughness parameters for the surface inspected.

NOTE. — The traversing length may include one or more sampling lengths (see clause 2.2).

2. TERMS AND PARAMETERS RELATING TO THE M SYSTEM *(mean line)*

2.1 *Spacing of the irregularities.* The mean distance between the more prominent irregularities of the effective profile.

2.2 *Sampling length l.* The length of the effective profile selected for the evaluation of the surface roughness, without taking into account other types of irregularities (see Fig. 2).

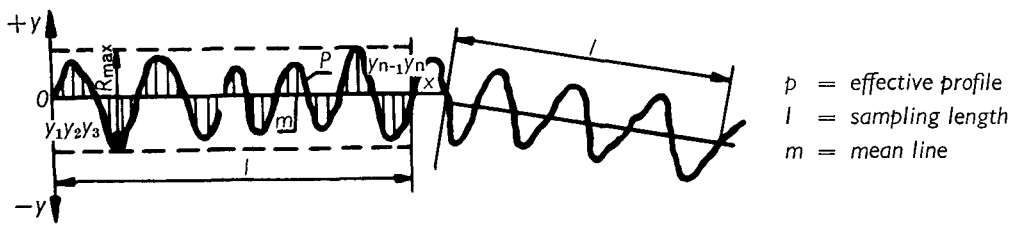


FIG. 2

2.3 *Mean line "m" of the profile.* A line having the form of the geometrical profile and dividing the effective profile so that, within the sampling length, the sum of the squares of distances (Y_1, Y_2 ... Y_n) between effective profile points and the mean line is a minimum.

NOTE. — The particular case of the mean line of the profile *m* is the central line, having the same form as the geometrical profile and located parallel to the general direction of the profile within the sampling length, so that the sums of the areas contained between this line and the effective profile, at both sides of this line, are equal.

2.4 *Arithmetical mean deviation R_a from the mean line of the profile.* The average value of the ordinates (Y_1, Y_2 ... Y_n) from the effective profile to its mean line (see Fig. 2).

The ordinates are summed without considering their algebraic sign:

$$R_a = \frac{1}{l} \int_o^l |y| \, dx$$

approximately

$$R_a = \frac{\sum_1^n |Y|}{n}$$

2.5 *Ten point height R_z of irregularities.* The average distance between the five highest peaks and the five deepest valleys within the sampling length measured from a line parallel to the mean line and not crossing the profile (see Fig. 3).

$$R_z = \frac{(R_1 + R_3 + \ldots R_9) - (R_2 + R_4 + \ldots R_{10})}{5}$$

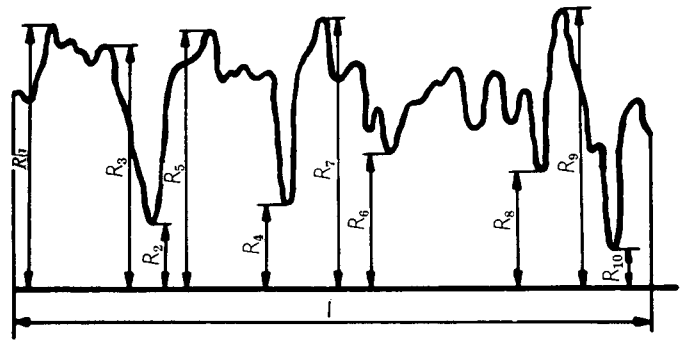


FIG. 3

2.6 *Maximum height R_{max} of irregularities.* The distance between two lines parallel to the mean line and touching the profile at the highest and lowest points, respectively, within the sampling length (see Fig. 2).

2.7 *Numerical values for R_a and R_z.* The series of numerical values for R_a and R_z forming a geometrical progression with a common ratio of 1.25 (preferred number series R 10*) are given in Tables 1 and 2 below.

TABLE 1. — **Arithmetical mean deviation R_a**

microns	micro inches	microns	micro inches	microns	micro inches	microns	micro inches
0.008	0.32						
0.010	0.40						
0.012	0.50	0.125	5.0	1.25	50	12.5	500
0.016	0.63	0.160	6.3	1.60	63	16.0	630
0.020	0.80	0.20	8.0	2.0	80	20	800
0.025	1.00	0.25	10.0	2.5	100	25	1000
0.032	1.25	0.32	12.5	3.2	125	32	1250
0.040	1.60	0.40	16.0	4.0	160	40	1600
0.050	2.0	0.50	20	5.0	200	50	2000
0.063	2.5	0.63	25	6.3	250	63	2500
0.080	3.2	0.80	32	8.0	320	80	3200
0.100	4.0	1.00	40	10.0	400	100	4000

TABLE 2. — **Ten point height of irregularities R_z**

microns	micro inches	microns	micro inches	microns	micro inches	microns	micro inches	microns	micro inches
		0.125	5.0	1.25	50	12.5	500	125	5000
		0.160	6.3	1.60	63	16.0	630	160	6300
		0.20	8.0	2.0	80	20	800	200	8000
		0.25	10.0	2.5	100	25	1000	250	10 000
		0.32	12.5	3.2	125	32	1250	320	12 500
0.040	1.60	0.40	16.0	4.0	160	40	1600	400	16 000
0.050	2.0	0.50	20	5.0	200	50	2000	—	—
0.063	2.5	0.63	25	6.3	250	63	2500		
0.080	3.2	0.80	32	8.0	320	80	3200		
0.100	4.0	1.00	40	10.0	400	100	4000		

NOTES

1. All the numerical values of surface roughness refer to the section normal to the geometrical surface.
2. The numerical value of roughness limits only the highest value of roughness. When it is necessary to limit the maximum and minimum values of roughness, two limit values should be given.
3. Roughness control by means of measuring instruments should be effected in the direction which gives the greatest value of R_a or R_z, unless some other direction is specified.
4. In national standards, series having the common progression ratios of either 2 (preferred number series R 10/3*) or 1.6 (preferred number series R 5*) may be used.

* See ISO Recommendation R 3, *Preferred Numbers — Series of Preferred Numbers.*

2.8 *Numerical values for l.* For measuring roughness, the series of numerical values of the sampling length *l* is given in Table 3 below:

TABLE 3. — **Sampling length** *l*

millimetres	inches	millimetres	inches	millimetres	inches
0.08	0.003	0.80	0.03	8.00	0.30
0.25	0.01	2.50	0.10	25.0	1.00

2.9 *Correspondence.* Correspondence between the numerical values of the sampling length (see Table 3) and the numerical values of roughness (see Tables 1 and 2) or with the types of machining may be specified in national standards.