

# Chapter 5

## Surface Texture

### SUMMARY

The internationally adopted system of measuring surface texture is to use the roughness average parameter designated  $R_a$  (Table 5-1).

**TABLE 5-1 ROUGHNESS NUMBERS (ISO 1302)**

Nominal value of $R_a$	micrometers:	50	25	12.5	6.3	3.2	1.6	0.8	0.4	0.2	0.1	0.05	0.025
	microinches:	2000	1000	500	250	125	63	32	16	8	4	2	1
ISO Roughness number:		N12	N11	N10	N9	N8	N7	N6	N5	N4	N3	N2	N1

In order to choose the optimum roughness average level, consider tolerance required as shown in Chapter 6 and Table 5-3. Cost or machining time increases with finer surfaces as shown in Fig. 5-3.

### SURFACE TEXTURE VS. PRODUCTION COSTS

A typical relationship of surface texture and production time (cost) is shown in Fig. 5-3. The chart, Fig. 5-3, shows a series of curves displaying production time in relation to  $R_a$  values for the range of common machining processes, and is based on research carried out on machine tools from 1 to 10 years old. The chart, however, is not intended to be used for making comparisons between different processes.

Results obtained from common production processes in terms of  $R_a$  values (micrometers) are shown in Table 5-4.

### SYMBOLS USED FOR INDICATION OF SURFACE TEXTURE

The basic surface texture symbol, as in Fig. 5-1A, consists of two legs of unequal length inclined at approximately 60 deg. to the line representing the considered surface. Machining of the surface is optional. A horizontal bar, as in Fig. 5-1B, indicates that removal of material by machining is required. A circle, as in Fig. 5-1C, indicates that removal of material by machining is not permitted, and Fig. 5-1D indicates the position of the surface-texture specifications (listed below) in the symbol.

a = roughness value  $R_a$  (CLA) or in grade numbers N1 through N12 (see Table 5-1). Maximum ( $a_1$ ) and minimum ( $a_2$ ) surface roughness limits (if required) are shown here.

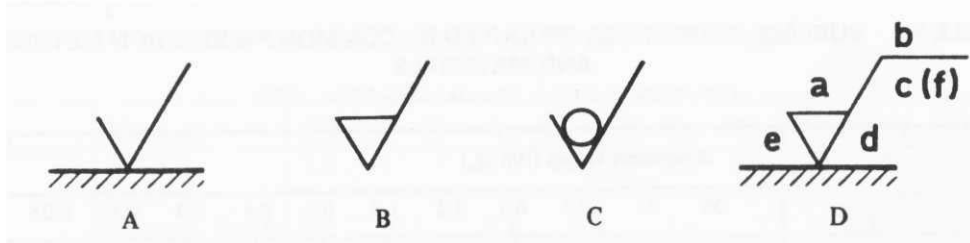
b = production method, treatment or coating

c = sampling length (see Table 5-7)

d = direction of lay (see Table 5-8)

e = machining allowance

f = other roughness values (in brackets, as in Fig. 5-1D).



**FIG. 5-1 SURFACE TEXTURE SYMBOLS (ISO 1302)**

- A. Machining of surface is optional;    C. Machining of surface is not permitted; and  
 B. Machining of surface is required;    D. Position of specifications in the symbol (ISO 1302).

NOTE: The symbols in "D" deviate slightly from the ANSI B46.1 standard.

### Use of the N Series of Roughness Numbers<sup>1</sup>

Instead of the micrometer values, roughness numbers, N1 to N12, maybe quoted on drawings. The use of the "N" series of roughness numbers is recommended to avoid possible misinterpretation on drawings that are apt to be internationally exchanged.

<sup>1</sup>The roughness numbers in the N Series are not recognized by ANSI B46.