Surface Measurement

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Surface Measurement

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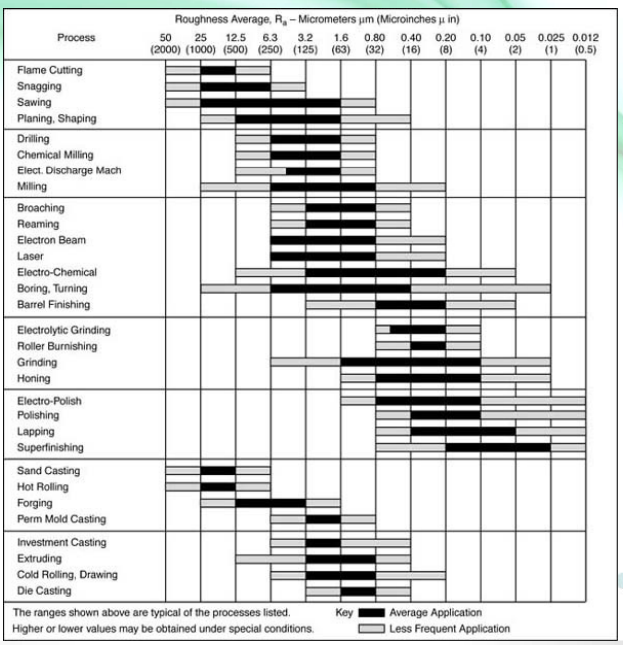
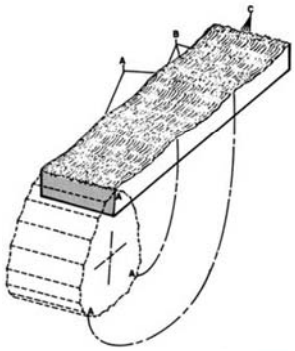
Overview

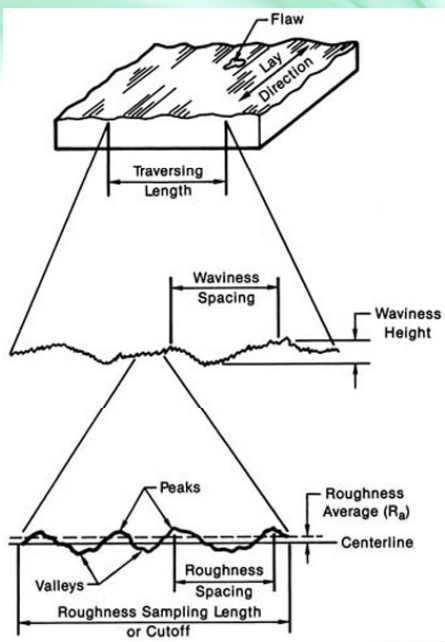


Background

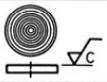
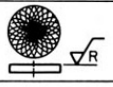
Surface metrology, or surface topology, refers to the **geometry and texture of surfaces**. The condition of a surface is defined by its characteristics: surface texture (finish), roundness (a function of geometry), material, hardness, and surface metallurgy. In the United States, ANSI B46.1 (discussed later) creates a practical standard for the geometry and texture only: it does not apply to other surface characteristics.



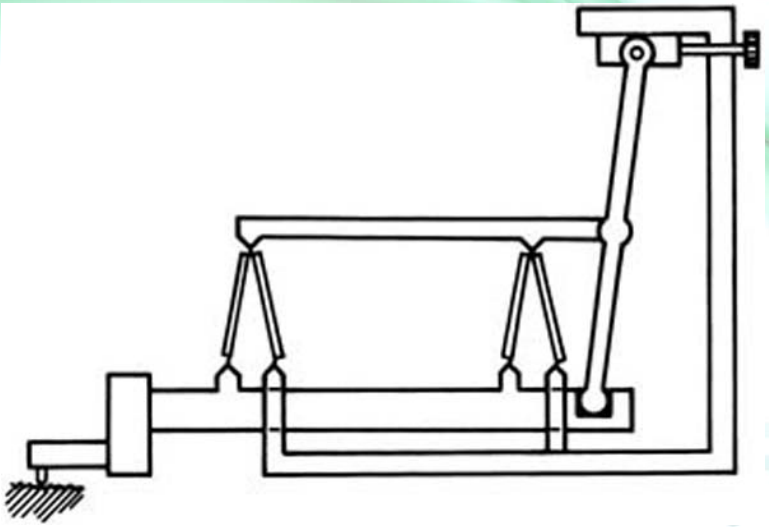
Background



Background

Lay Symbol	Meaning	Example Showing Direction of Tool Marks
=	Lay approximately parallel to the line representing the surface to which the symbol is applied.	
⊥	Lay approximately perpendicular to the line representing the surface to which the symbol is applied.	
X	Lay angular in both directions to line representing the surface to which the symbol is applied.	
M	Lay multidirectional.	
C	Lay approximately circular relative to the center of the surface to which the symbol is applied.	
R	Lay approximately radial relative to the center of the surface to which the symbol is applied.	
P^3	Lay particulate, non-directional, or protuberant.	

Surface Evaluation, Stylus Method



Surface Evaluation, Stylus Method

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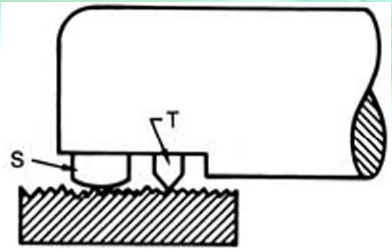
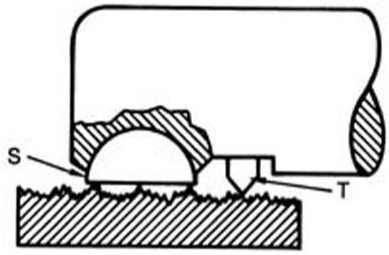
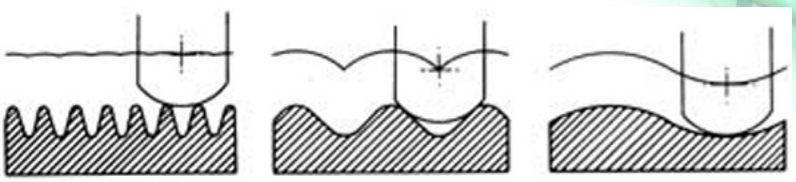


A. Skid



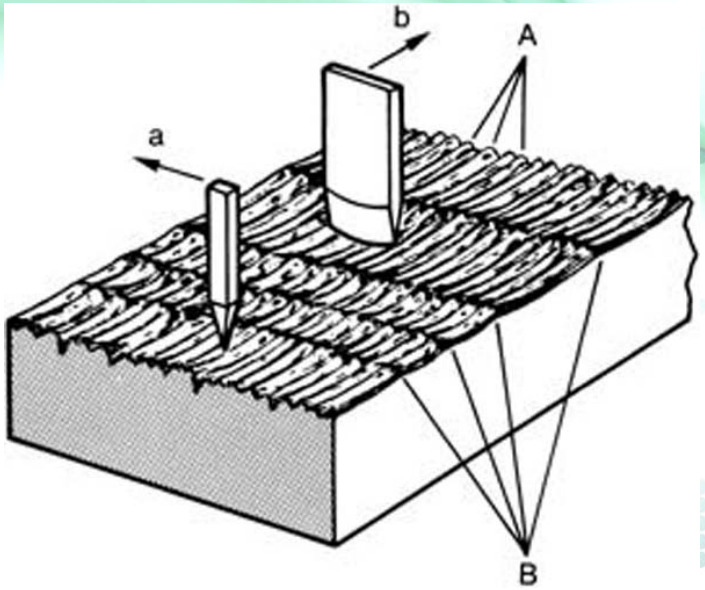
B. Shoe

Surface Evaluation, Stylus Method



A B C

Surface Evaluation, Stylus Method



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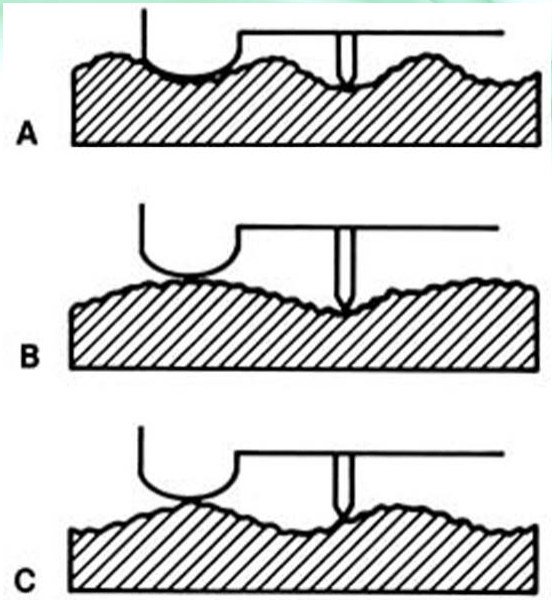

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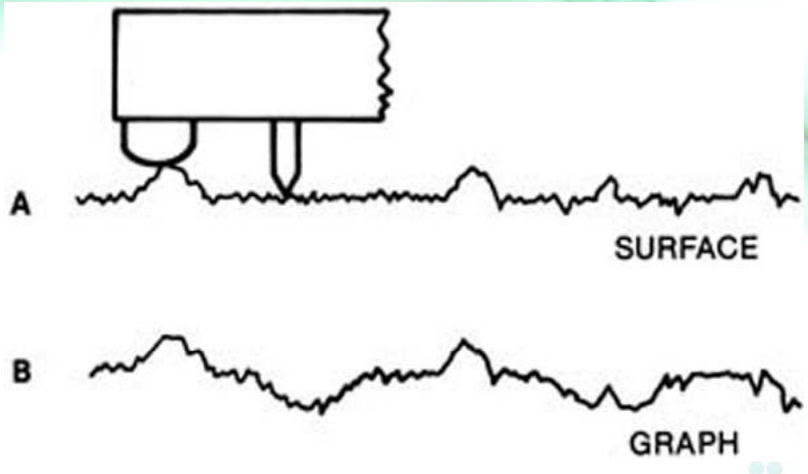


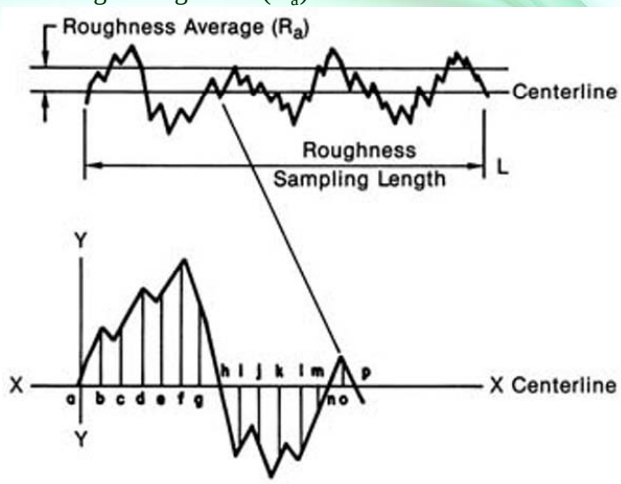
Numerical Values for Assessment

A surface texture standard, like all standards, ensures that various observers, using various instruments under a wide range of conditions all produce nearly the same values. They can never be exactly the same; but they must be close enough to result in a device that can be affordably manufactured and maintained. A standard attempts to identify all the variables and give them limits in relationship to the uses they will have. These variables, included in ANSI B46.1 include:

1. Identification of surface characteristics
2. Establishment of nonambiguous terminology
3. Tracer head characteristics
    - Stylus form, force, support
    - Skid form, support
4. Traversing length
5. Instrument characteristics
    - Response time
    - Cutoff lengths
    - Attenuation rate
    - Display of readings
6. Specimens
    - Precision for calibration
    - Roughness comparison

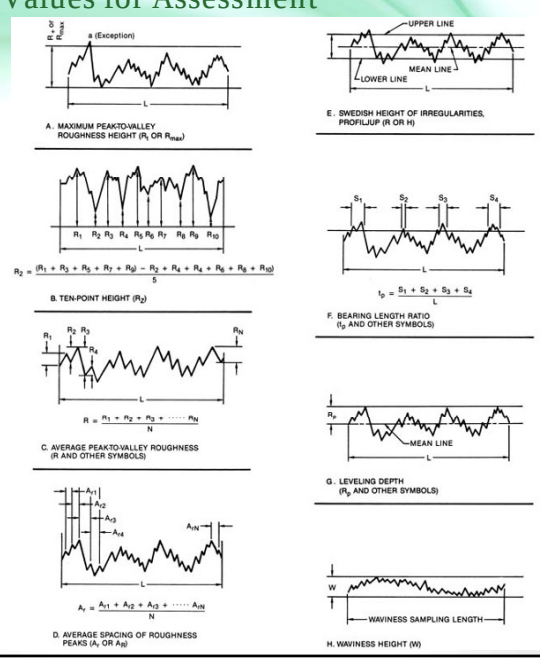
Numerical Values for Assessment

Arithmetic Average Roughness (R_a)



$$R_a = \frac{y_a + y_b + y_c \cdots\cdots + y_n}{n}$$

Numerical Values for Assessment



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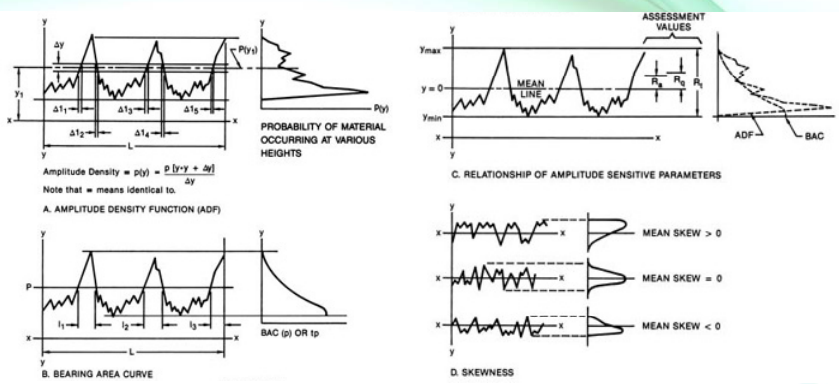
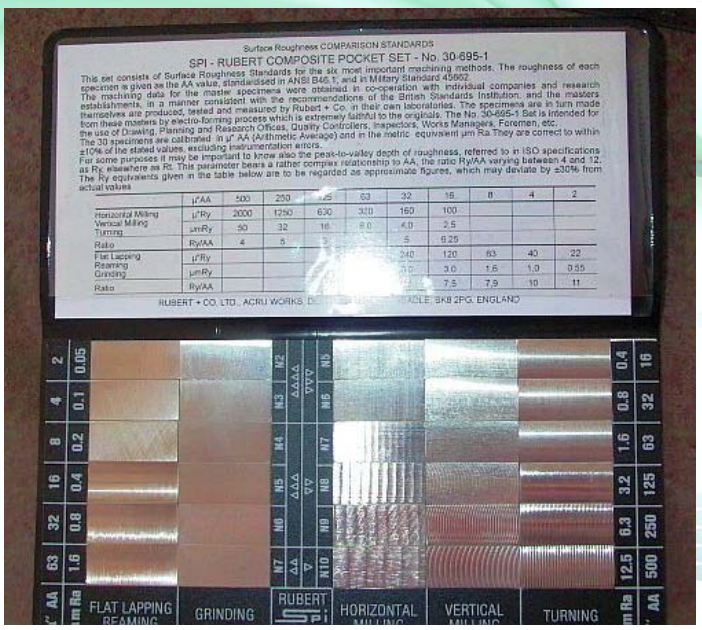


Surface Texture Specimens



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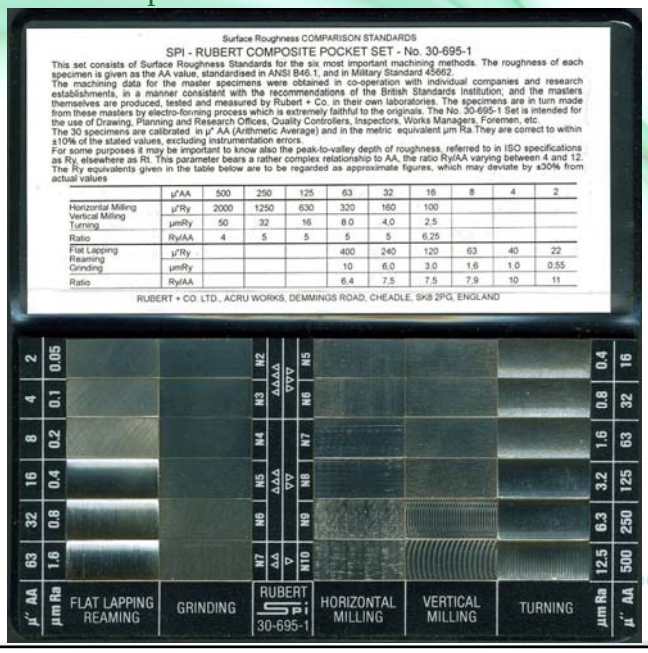

	µ"AA	500	250	125	63	32	16	8	4	2
Horizontal Milling Vertical Milling Turning	µ"Ry	2000	1250	630	320	160	100			
	µmRy	50	32	16	8.0	4.0	2.5			
Ratio	Ry/AA	4	5	5	5	5	6.25			
Flat Lapping Reaming Grinding	µ"Ry				400	240	120	63	40	22
	µmRy				10	6.0	3.0	1.6	1.0	0.55
Ratio	Ry/AA				6.4	7.5	7.5	7.9	10	11

Surface Evaluation, Other Methods

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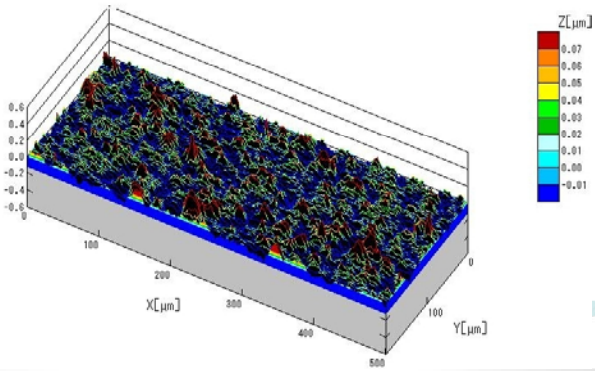

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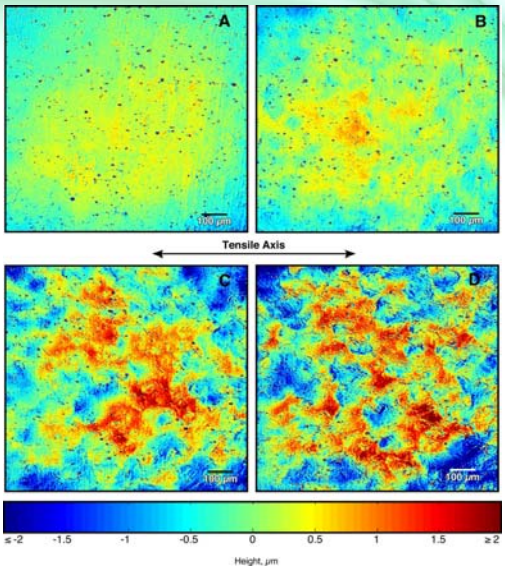

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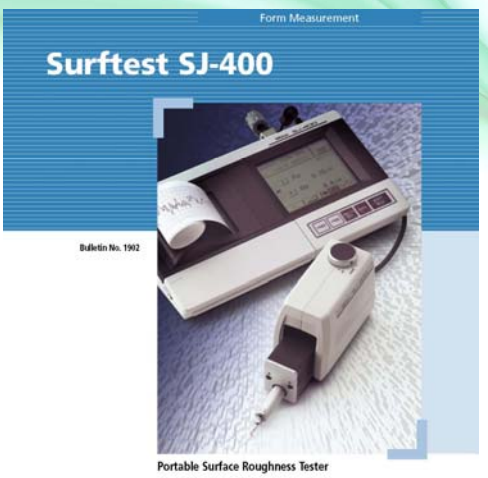
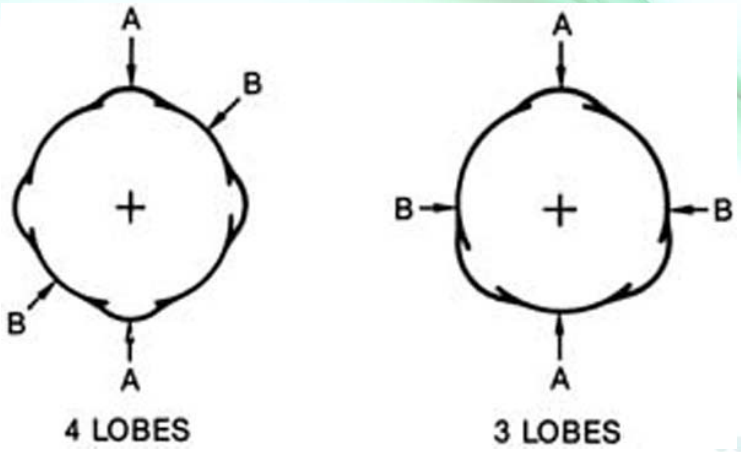


Surface Evaluation, Other Methods

Roundness



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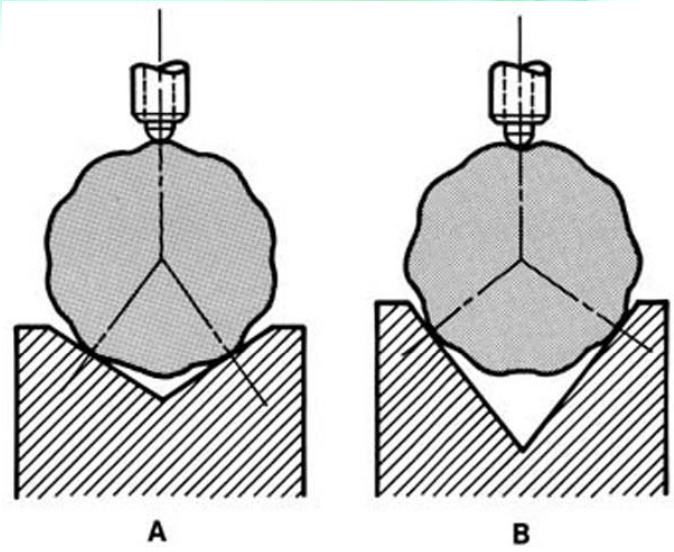

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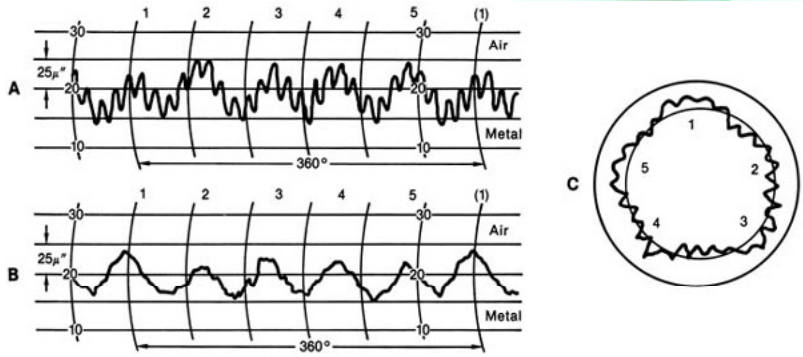

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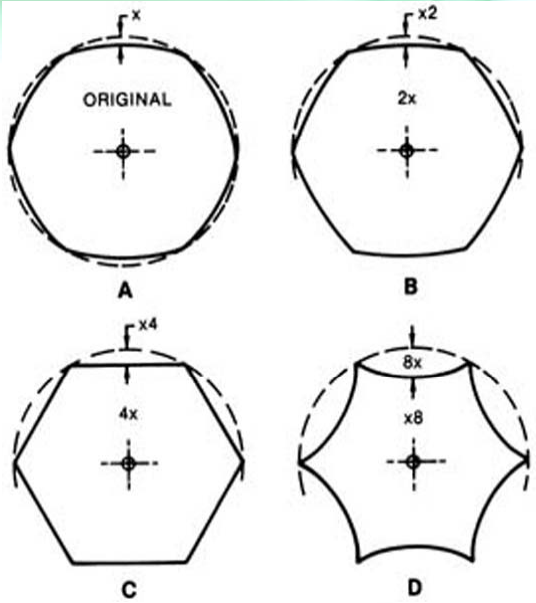

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