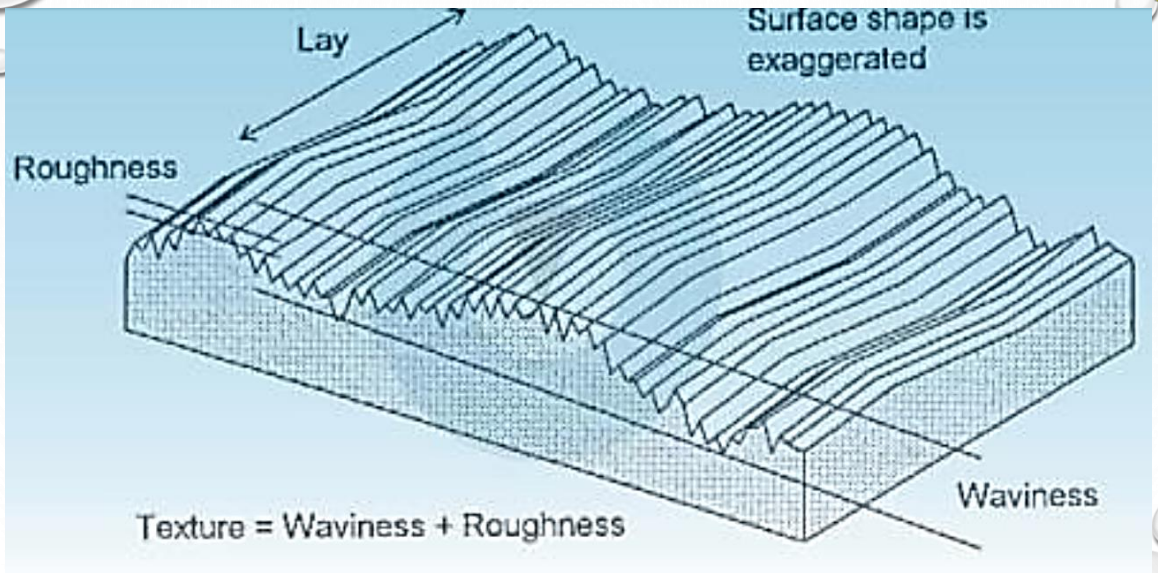
SURFACE TEXTURE/MACHINING SYMBOLS

Surface Texture

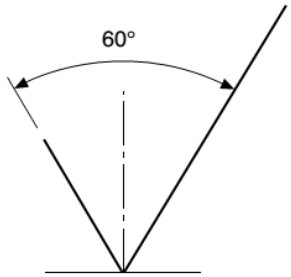
- The nature of the surface of components has a bearing on their function, wear and cost of manufacturing.
- All surfaces need not have the same finishing.
- The desired natures of components' different surfaces are specified with the Surface texture symbol.
- The term Surface Texture comprises
  - Surface Roughness - the finest irregularities of a surface.
  - Surface Waviness - more widely spaced deviations of a surface from its nominal shape.
- Surface Texture specification standards include the ASME Y14.36M and ISO 1302.

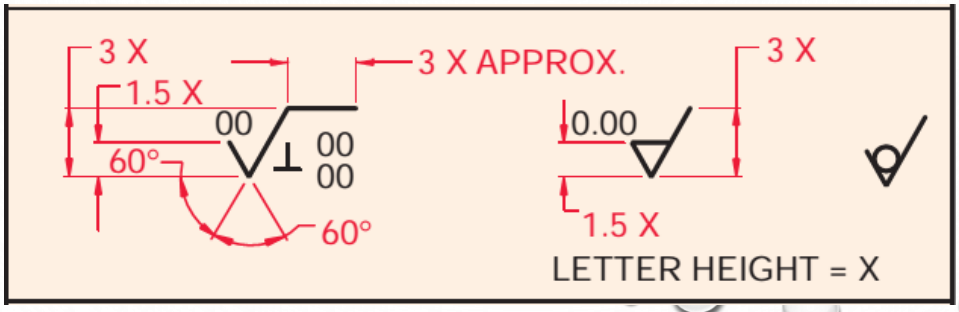
SURFACE TEXTURE/MACHINING SYMBOLS

Surface Texture



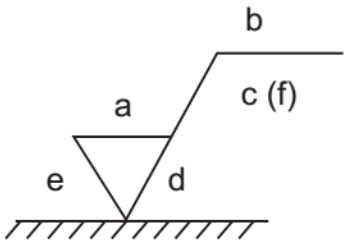
SURFACE TEXTURE/MACHINING SYMBOLS
Surface Texture Symbol





ASME

SURFACE TEXTURE/MACHINING SYMBOLS
Surface Texture Symbol



a Roughness Average value, *Ra* in micrometers or microinches

or

Roughness grade number ranging from N1 to N12

b Production method, treatment or coating

or

waviness height and spacing, separated by a dash (a common ANSI practice)

c Sampling length

d Direction of Lay

e Machining allowance

f Other Roughness values – these include Root Mean Square (RMS) Roughness, Roughness Height, Maximum Roughness Depth etc etc etc.

SURFACE TEXTURE/MACHINING SYMBOLS

Surface Texture Symbols

SURFACE TEXTURE SYMBOLS AND CONSTRUCTION	
Symbol	Meaning
	Basic surface texture symbol. Surface may be produced by any method, except when the bar or circle is specified.
	Material removal by machining is required. The horizontal bar indicates that material removal by machining is required to produce the surface and that material must be provided for that purpose.

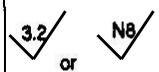
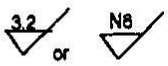
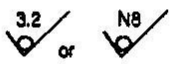
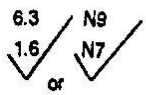
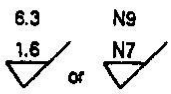
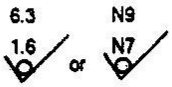
SURFACE TEXTURE/MACHINING SYMBOLS

Surface Texture Symbols

Symbol	Meaning
3.5 	Material removal allowance. The number indicates the amount of stock to be removed by machining in millimeters (or inches). Tolerances may be added to the basic value shown or in a general note.
	Material removal prohibited. The circle in the vee indicates that the surface must be produced by processes such as casting, forging, hot finishing, cold finishing, die casting, powder metallurgy, or injection molding, without subsequent removal of material.
	Surface texture symbol. This is used when any surface characteristics are specified above the horizontal line or to the right of the symbol. Surface may be produced by any method, except when the bar or circle is specified.

SURFACE TEXTURE/MACHINING SYMBOLS

Surface Texture Symbols

Symbol		
Removal of Material by		
an appropriate method	*machining*	*prohibited*
		
		

SURFACE TEXTURE/MACHINING SYMBOLS

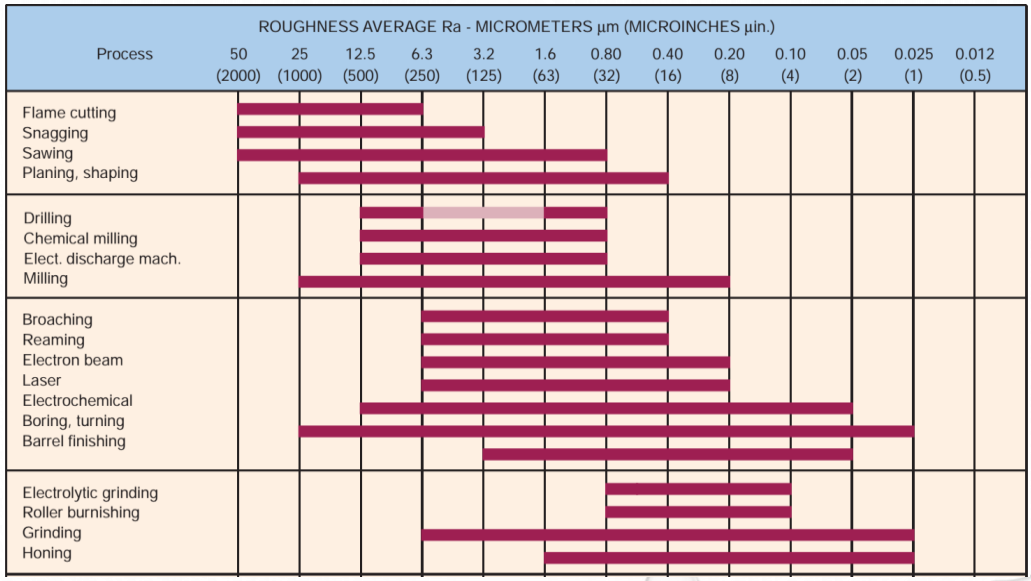
Surface Texture Grades

Roughness values Ra	Roughness values Ra	Roughness
micrometers	microinches	Grade Numbers
50	2000	N12
25	1000	N11
12.5	500	N10
6.3	250	N9
3.2	125	N8
1.6	63	N7
0.8	32	N6
0.4	16	N5
0.2	8	N4
0.1	4	N3
0.05	2	N2
0.025	1	N1

Source: http://www.finishing.com/75/60.shtml

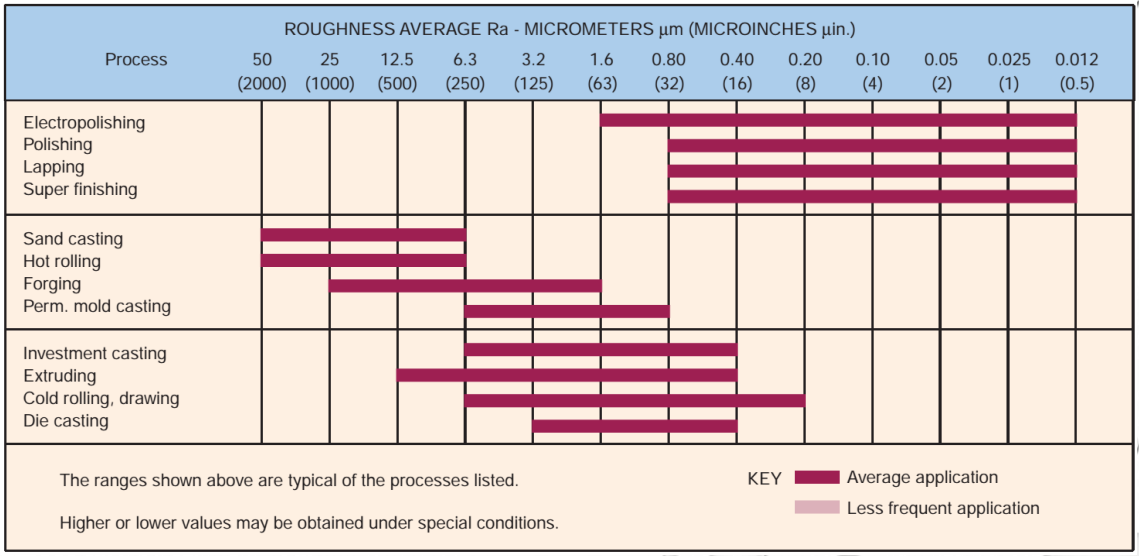
SURFACE TEXTURE/MACHINING SYMBOLS

Surface Roughness Averages



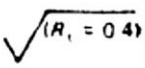
SURFACE TEXTURE/MACHINING SYMBOLS

Surface Roughness Averages (Con't)



SURFACE TEXTURE/MACHINING SYMBOLS

Surface Texture Grades

Symbol	Meaning
	Production method: milled.
	Sampling length: 2.5 mm
	Direction of lay: perpendicular to the plane of projection of the view.
	Machining allowance: 2 mm
	Indication (in brackets) of a criterion of roughness other than that used for R_a for example $R_t = 0.4\ \mu m$

SURFACE TEXTURE/MACHINING SYMBOLS

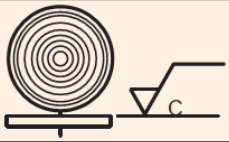
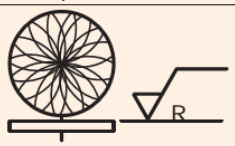
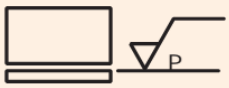
Direction of Lay

Lay is the direction of the predominant surface pattern ordinarily determined by the production method used

LAY SYMBOLS		
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.	

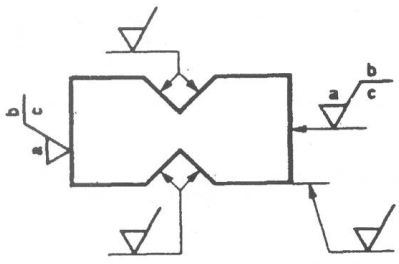
SURFACE TEXTURE/MACHINING SYMBOLS

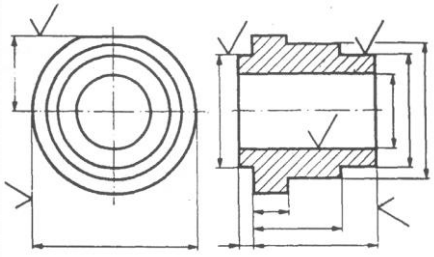
Direction of Lay

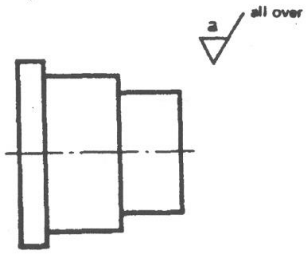
Lay symbol	Meaning	Example showing direction of tool marks
M	Lay multidirectional.	
C	Lay approximately circular relative to the center of the surface to which the symbol is applied.	
R	Lay approximately radial relative to the center of the surface to which the symbol is applied.	
P	Lay particulate, nondirectional, or protuberant.	

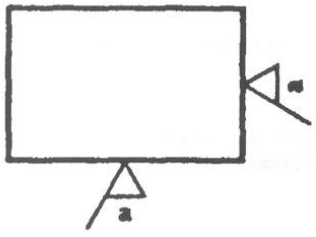
SURFACE TEXTURE/MACHINING SYMBOLS

Surface Texture Symbols on Drawings



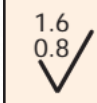
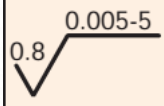
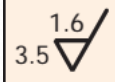






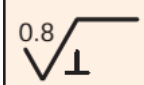
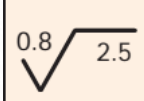
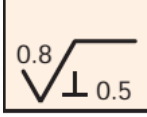
SURFACE TEXTURE/MACHINING SYMBOLS

Surface Texture Symbols on Drawings

APPLICATION OF SURFACE TEXTURE VALUES TO SYMBOL	
	Roughness average rating is placed at the left of the long leg. The specification of only one rating shall indicate the maximum value, and any lesser value shall be acceptable. Specify in micrometers (microinch).
	The specification of maximum and minimum roughness average values indicates permissible range of roughness. Specify in micrometers (microinch).
	Maximum waviness height rating is the first rating placed above the horizontal extension. Any lesser rating shall be acceptable. Specify in millimeters (inch). Maximum waviness spacing rating is the second rating placed above the horizontal extension and to the right of the waviness height rating. Any lesser rating shall be acceptable. Specify in millimeters (inch).
	Material removal by machining is required to produce the surface. The basic amount of stock provided for material removal is specified at the left of the short leg of the symbol. Specify in millimeters (inch).

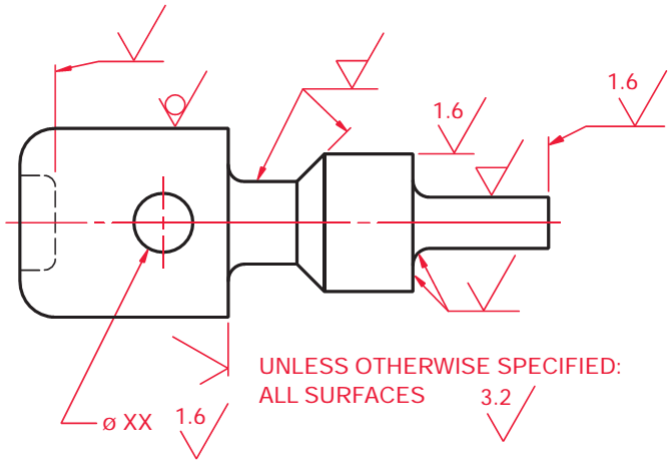
SURFACE TEXTURE/MACHINING SYMBOLS

Surface Texture Symbols on Drawings

	Removal of material is prohibited.
	Lay designation is indicated by the lay symbol placed at the right of the long leg.
	Roughness sampling length or cutoff rating is placed below the horizontal extension. When no value is shown, 0.80 mm (0.030 inch) applies. Specify in millimeters (inch).
	Where required, maximum roughness spacing shall be placed at the right of the lay symbol. Any lesser rating shall be acceptable. Specify in millimeters (inch).

SURFACE TEXTURE/MACHINING SYMBOLS

Surface Texture Symbols on Drawings



PRODUCTION/WORKING DRAWINGS

- Production or working drawings are specialized engineering drawings that provide the information required to make the part or assembly of the final design.
- They are a complete set of standardized drawings specifying the manufacture and assembly of a product based on its design.
- They rely on orthographic projection and other techniques to communicate design information for production.
- The complexity of the design determines the number and types of drawings.

PRODUCTION/WORKING DRAWINGS

- A complete set of working drawings for an assembly includes the following:
  - Detail drawings.
  - An assembly (and subassembly drawings).

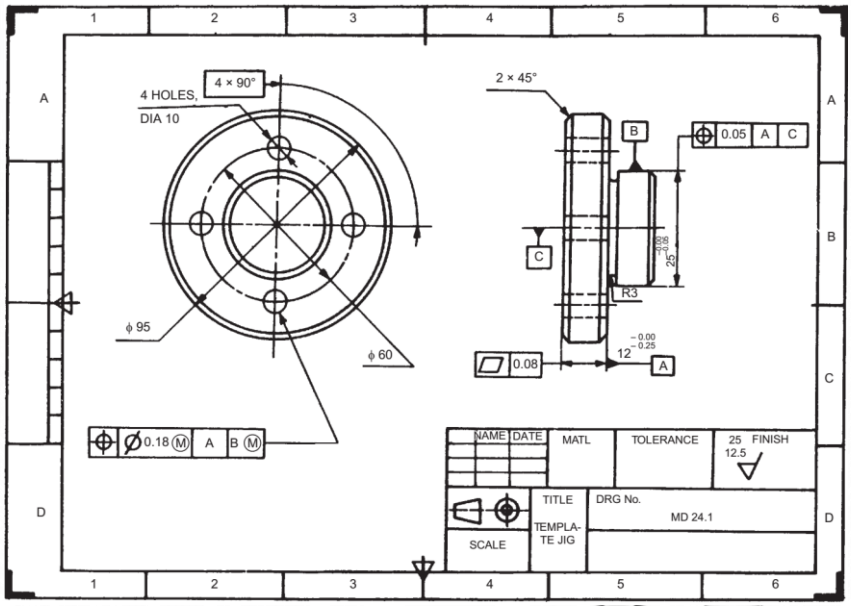
PRODUCTION/WORKING DRAWINGS

Detail drawings

- These are drawings of each nonstandard part.
- Drawings for different parts are normally on different sheets, each sheet . with a Title block.
- Drawings include such information as dimensions and notes that relates to material, finish, weight, or standard tolerances

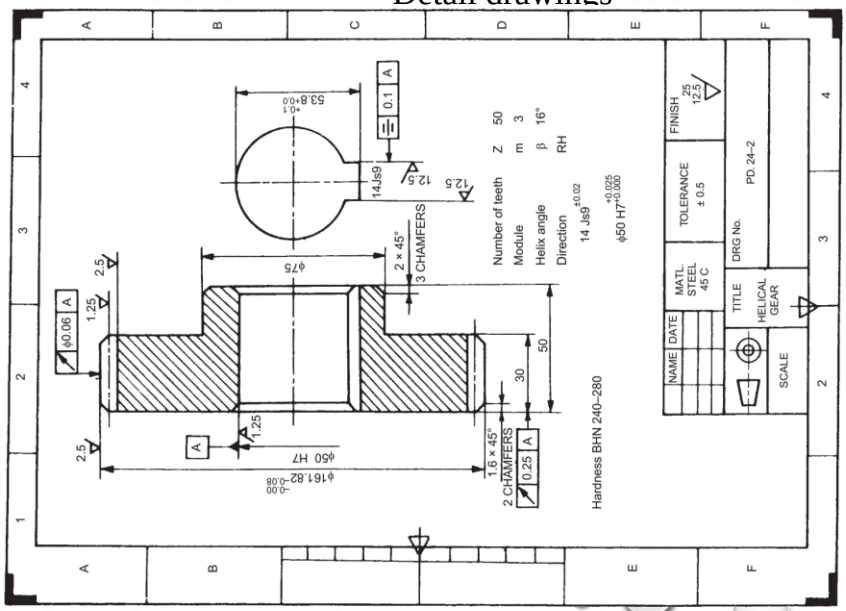
PRODUCTION/WORKING DRAWINGS

Detail drawings



PRODUCTION/WORKING DRAWINGS

Detail drawings



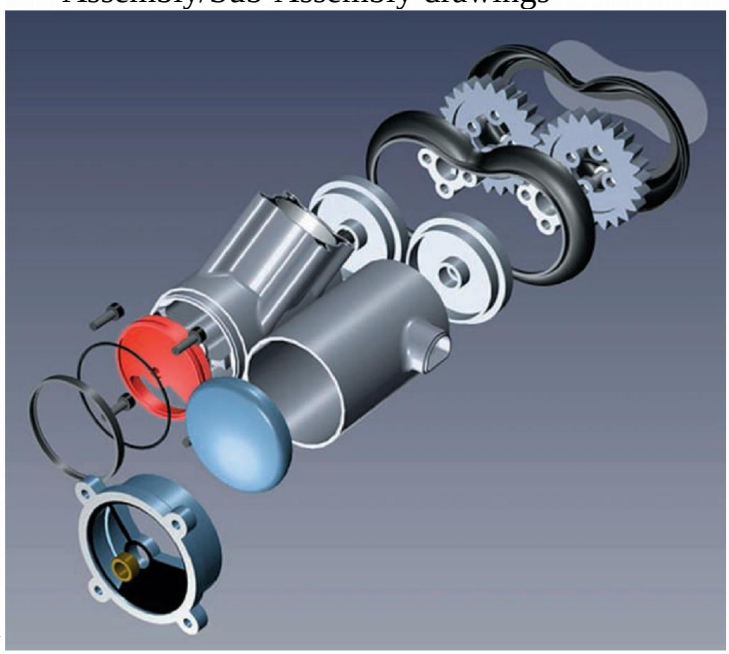
PRODUCTION/WORKING DRAWINGS

Assembly/Sub-Assembly drawings

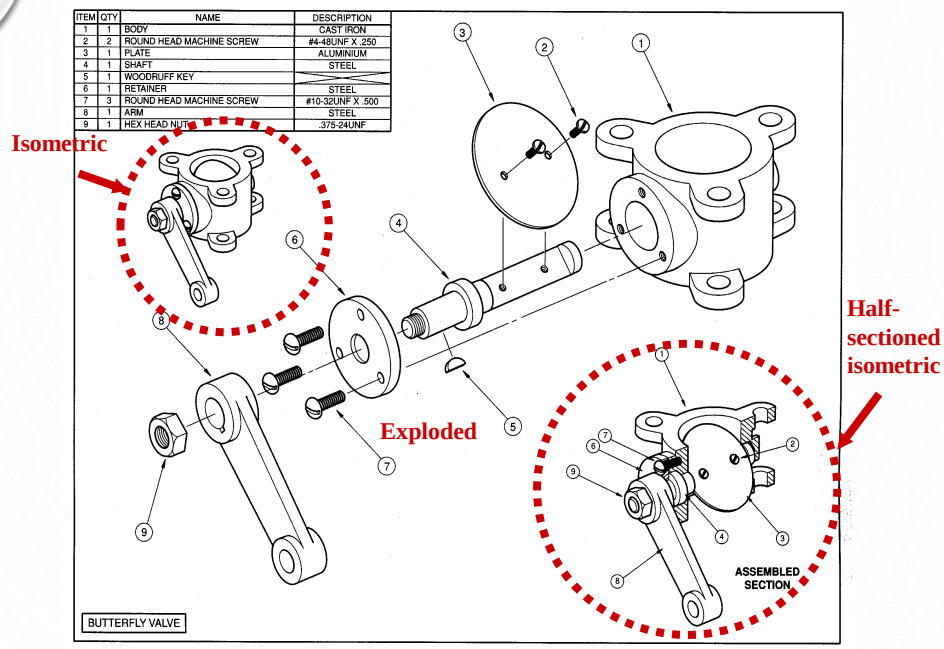
- These shows how parts fit together or are functionally related.
- They show assembled machine or structure, with detail parts in their functional positions, and may be isometric/pictorial or multiview.
- Dimensions refer to relationships among the parts, not to the size of individual objects.
- Includes listing of all parts necessary to make up the total assembly
- Assembly drawings should have a Bill of Materials (BOM) and a Title Block.

PRODUCTION/WORKING DRAWINGS

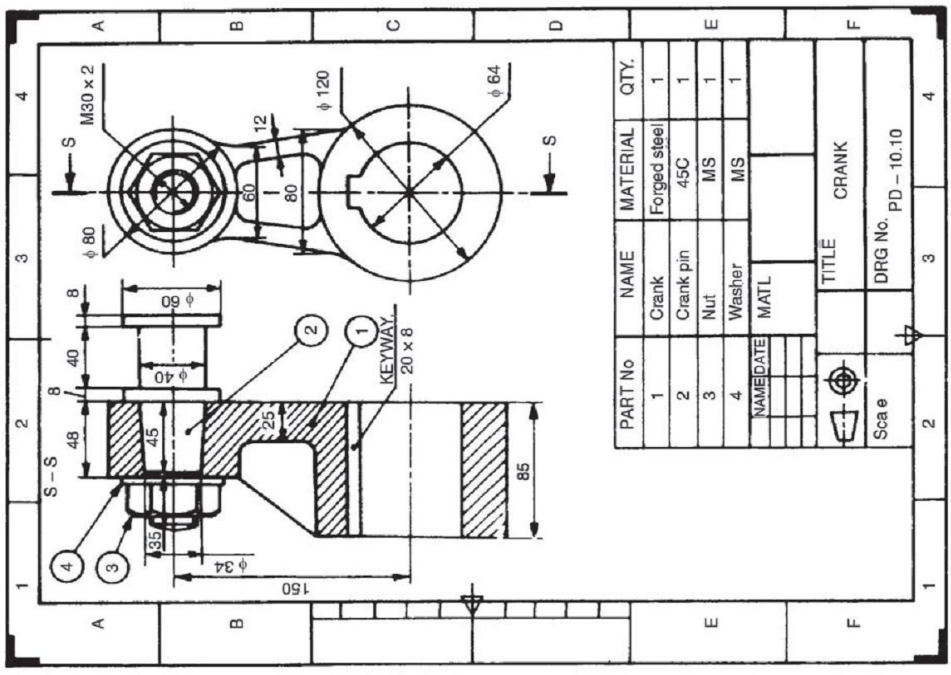
Assembly/Sub-Assembly drawings



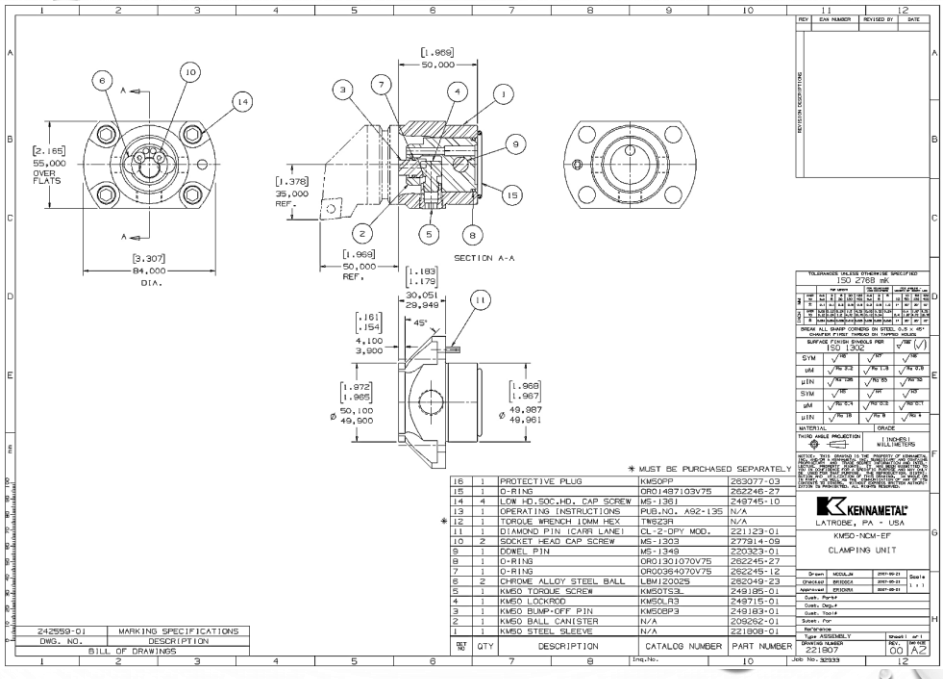
PRODUCTION/WORKING DRAWINGS



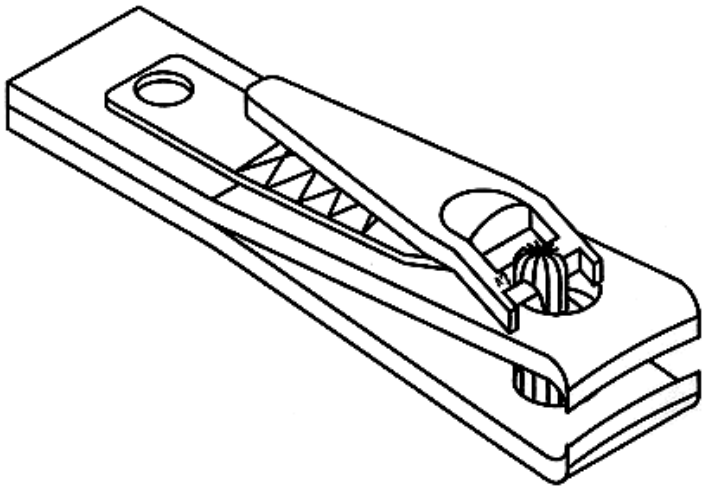
PRODUCTION/WORKING DRAWINGS



PRODUCTION/WORKING DRAWINGS

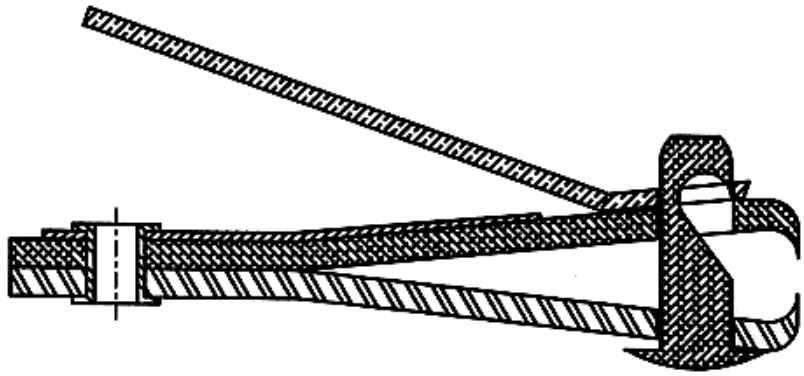


PRODUCTION/WORKING DRAWINGS



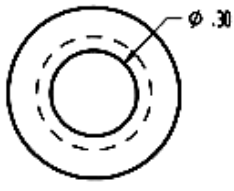
THE OHIO STATE UNIVERSITY ENGINEERING GRAPHICS DEPARTMENT	DUE: 10-30-94	FILE: ISOM	NAME: ROLLS, BURGESS
TITLE: ISOMETRIC VIEW	SECTION: ASF - 10:30 - TEAM 2		CLONDALKIN, IRELAND, MAINE DWG 8 OF 8

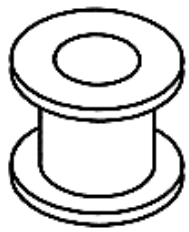
PRODUCTION/WORKING DRAWINGS

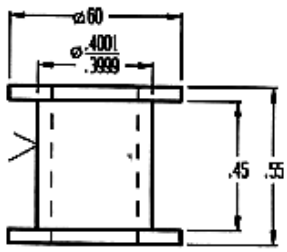


THE OHIO STATE UNIVERSITY ENGINEERING GRAPHICS DEPARTMENT	DATE: 10-30-94	FILE: SECTION	NAME: PUGLIS, BURNSIDES, CLEMENT, IRELAND, WHITE DWG 7 OF 8
TITLE: SECTION VIEW	SECTION: AMF - 10:30 - TEAM 2		

PRODUCTION/WORKING DRAWINGS





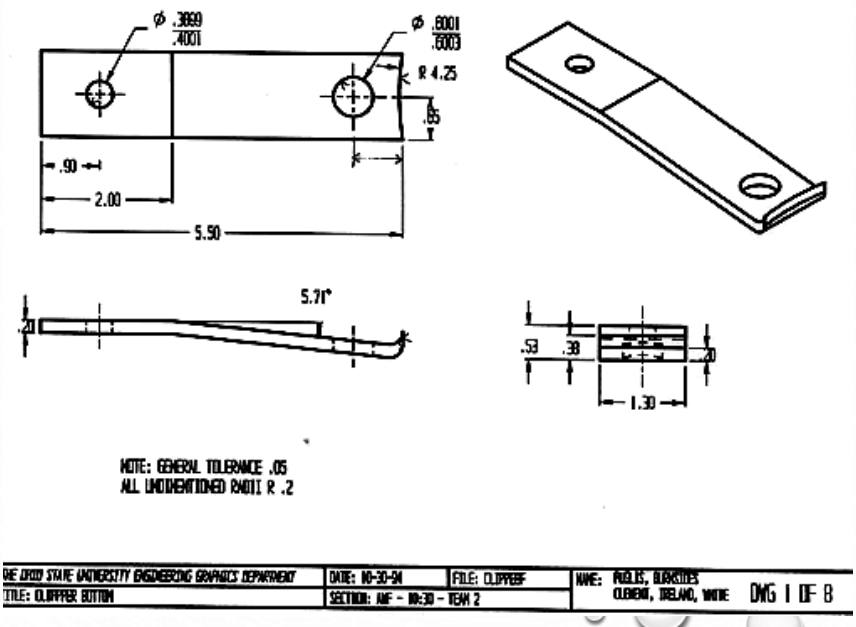


NOTE: GENERAL TOLERANCE .05

Detailed Part Drawing of Rivet

THE OHIO STATE UNIVERSITY ENGINEERING GRAPHICS DEPARTMENT	DATE: 10-18-94	FILE: RIVET	NAME: PUGLIS, BURNSIDES CLEMENT, IRELAND, WHITE DWG 5 OF 8
TITLE: RIVET	SECTION: AMF - 10:30 - TEAM 2		

PRODUCTION/WORKING DRAWINGS



Detailed Part Drawing of Bottom Clipper

Tutorial Assignment on
12/03/15 for Mechanical
13/03/15 for Materials/Metallurgical

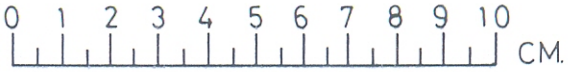
Produce a full size section C-C for the Blow-Down Body below.

Represent with the appropriate symbols on your drawing, an Average Roughness range of between 0.012 and 0.025 micrometers for the inner section of the Body.

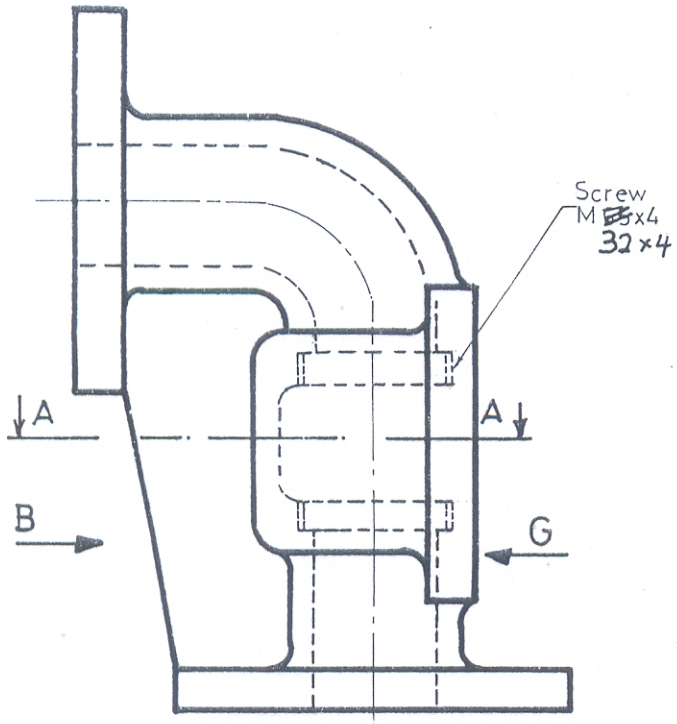
Indicate with the appropriate symbols, a condition of parallelism (within a diametrical tolerance zone of 0.05) for the other M32 hole in the Front View using the first M32 hole as one of your datums.

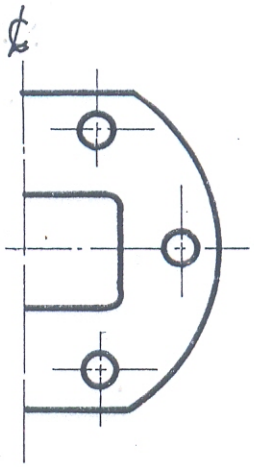
Indicate with the appropriate symbols, a condition of perpendicularity (to a diametrical tolerance zone of 0.04) between the hole with the M32 label and the Face G.

Indicate with the appropriate symbols, a condition of flatness (to a diametrical tolerance zone of 0.04) for face G

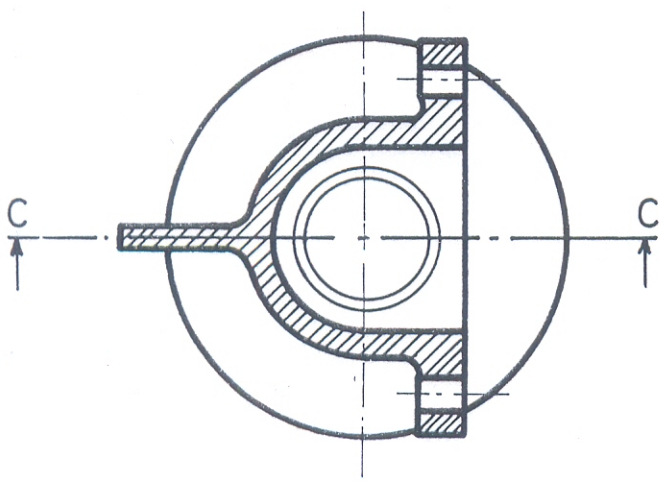


SCALE





HALF OF FACE G.



SECTION A A

NOTES:

1 DIMENSIONS ARE IN MM.

2 FILLET RADII ~~10~~ 3

3 GENERAL CASING THICKNESS 12

BLOW - DOWN BODY

PRODUCTION/WORKING DRAWINGS

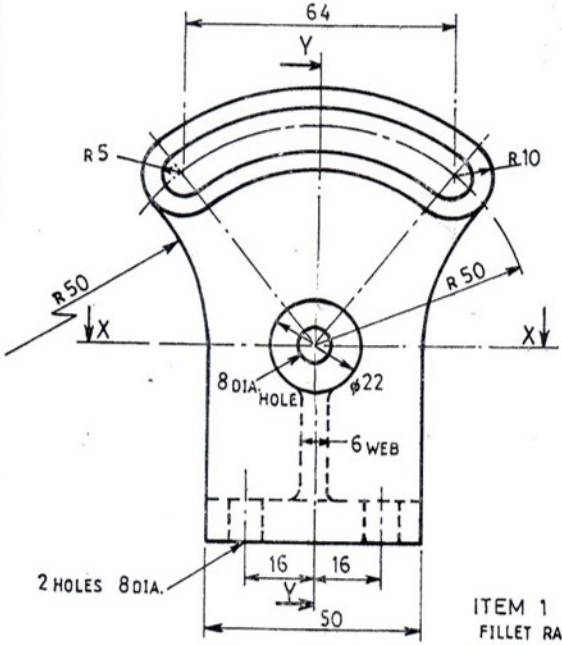
Assignment (due 19/03/2015)

The drawings on the next page comprise the detailed drawings for the parts of a Control Handle.

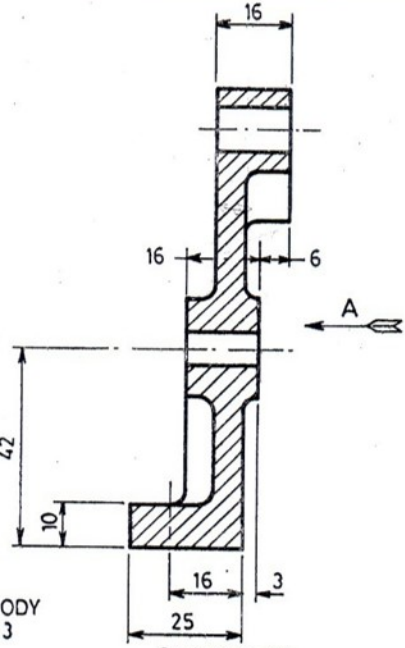
There is a detail drawing each of 5 items;

1. A Body
2. A Handle
3. A Pivot Stud
4. A Collar
5. A Pin

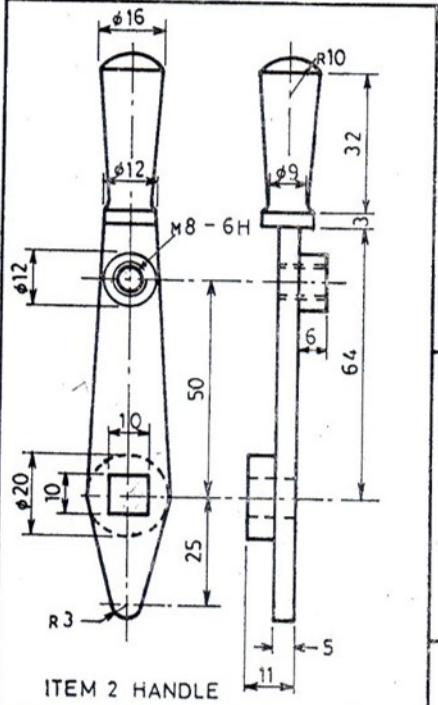
Produce Section Y-Y of the Control Handle assembly.



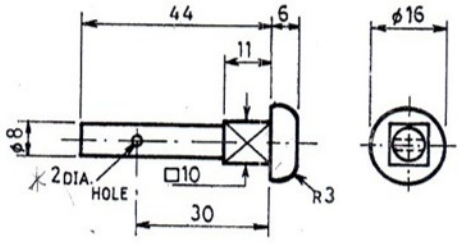
ITEM 1 BODY
FILLET RADII 3



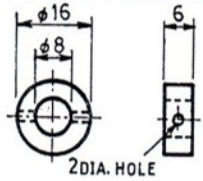
SECTION YY



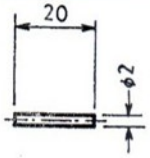
ITEM 2 HANDLE



ITEM 3 PIVOT STUD



ITEM 4 COLLAR



ITEM 5 PIN

CONTROL HANDLE DETAILS

ALL DIMENSIONS IN MM