MECH2400 MECHANICAL DESIGN 1 LECTURE NOTES

Shane Leviton

Contents

MECH2400 MECHANICAL DESIGN 1 LECTURE NOTES

Introduction:

Paul Briozzo

1. Need for use of standard drawings in communication and definition of parts and assemblies to AS1100
2. Use of CAD
3. Creativity
4. Design process
5. Methods to analyse design
6. Appreciation and analysis of standard components
7. Understanding of power transmission elements

Lecture 1. Tuesday, 26 July 2016

Assessments:

Assignment A 5% week 2 Friday

Quiz 1 15% week 5 Friday

Assignment B (group_ 15% week 6 Friday

Assignment c (group) 20% week 10 Friday

Quiz 2 15 week 13

Assignment D 15 week 13

Design portfolios 1.5% Tuesday week 3,6,9,12

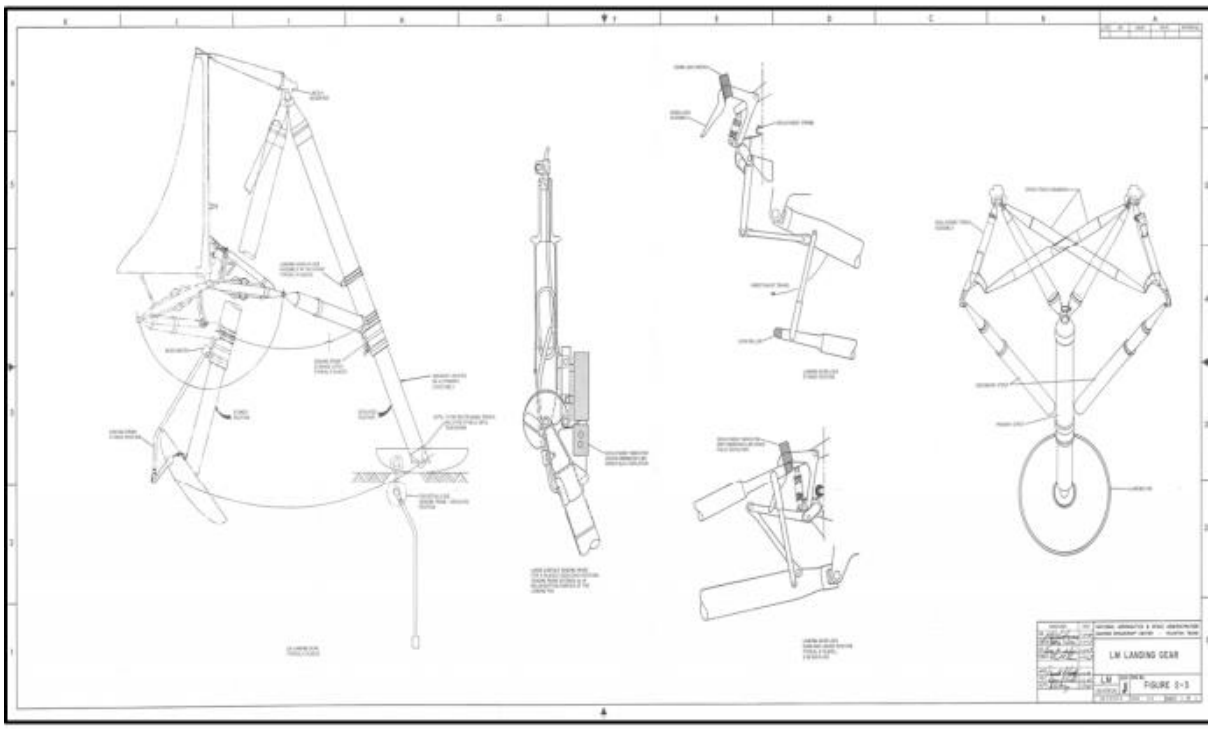
Engineering Drawing

An engineering drawing is a technical drawing which clearly defines and communitcates a design to other people.

- To allow design to devlop from thought to design
- Communication
- Convert designs into layout drawings whih show link up to existing infrastructure
- Include sketch for proposals
- Manufacturing

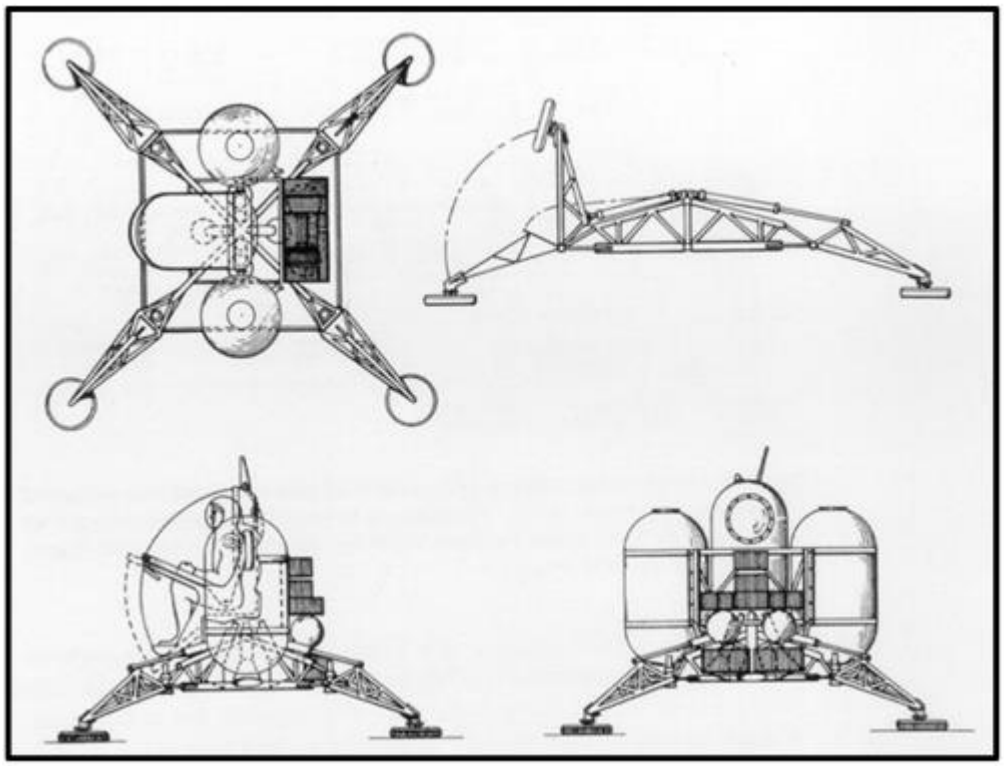
Layout drawings

- Can show different positions



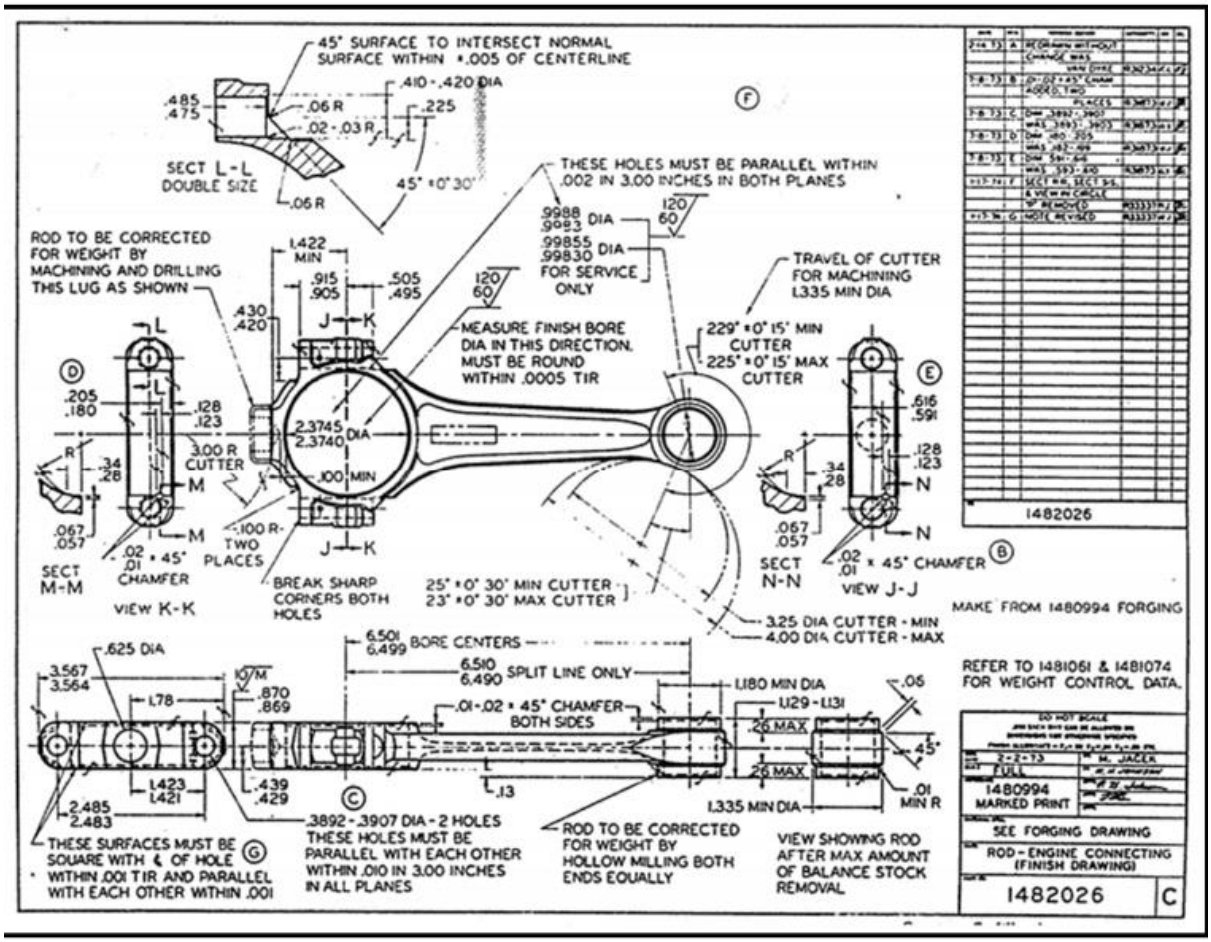
Proposal drawings

- Just above first sketch. No dimensions



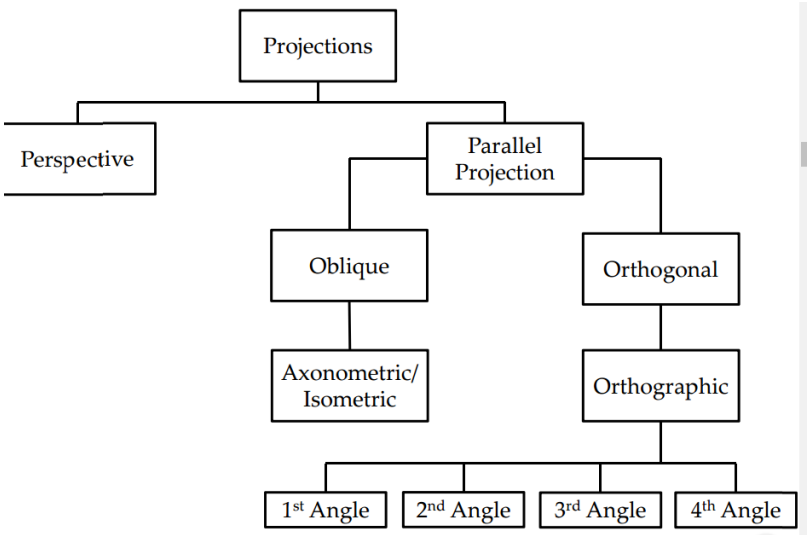
Engineering drawings

- dimensions



Graphical projections

- we will mostly use orthogonal, orthographic, isometric



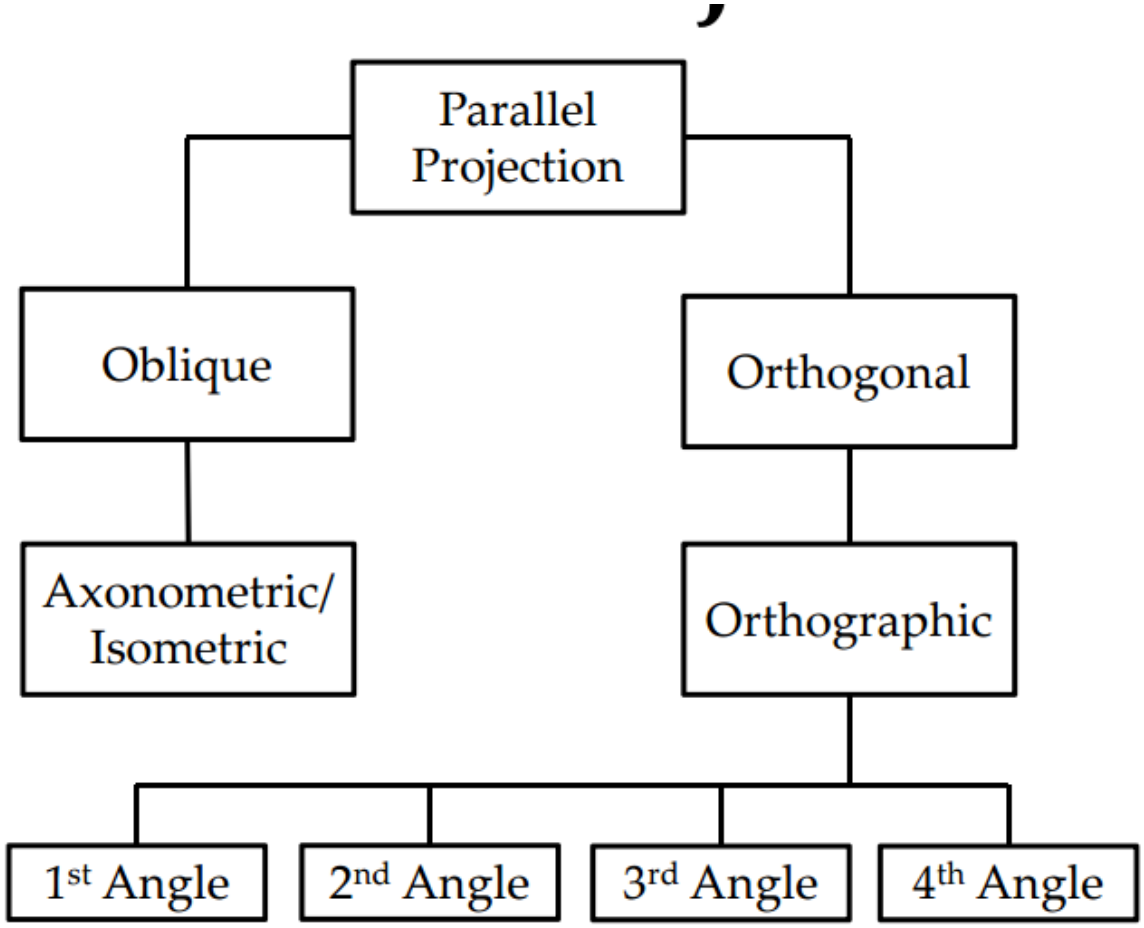
Method of projections

- select view from best position
- observe overall structure
- note parallism, proportional, alignment

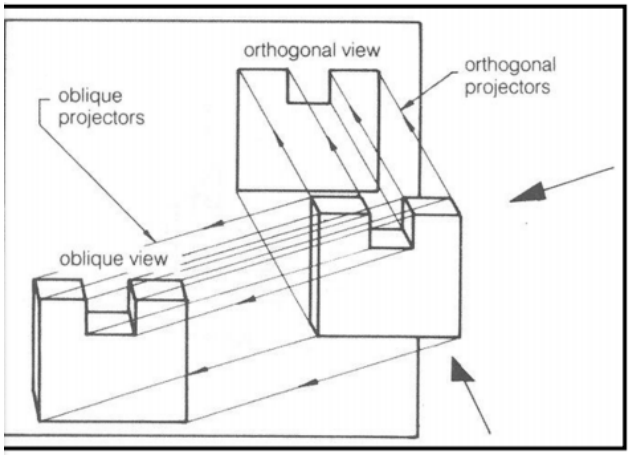
rules of projection

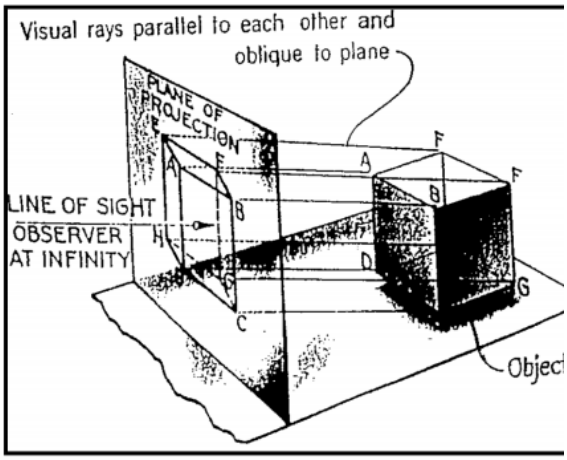
- object viewed from ∞
- parallel lines remain parallel
- proportions remain unchanged
- circles are ellipses with major axis perpendicular to polar axis
- transformations of 90° angles

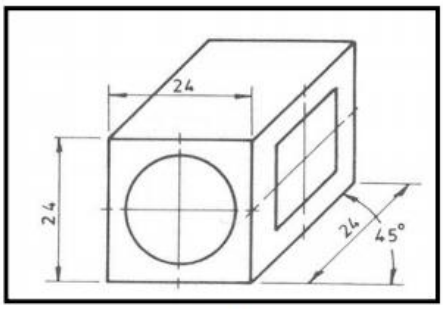
Parallel projections



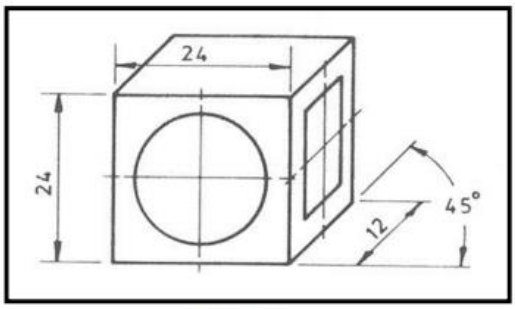
Oblique







Cavalier

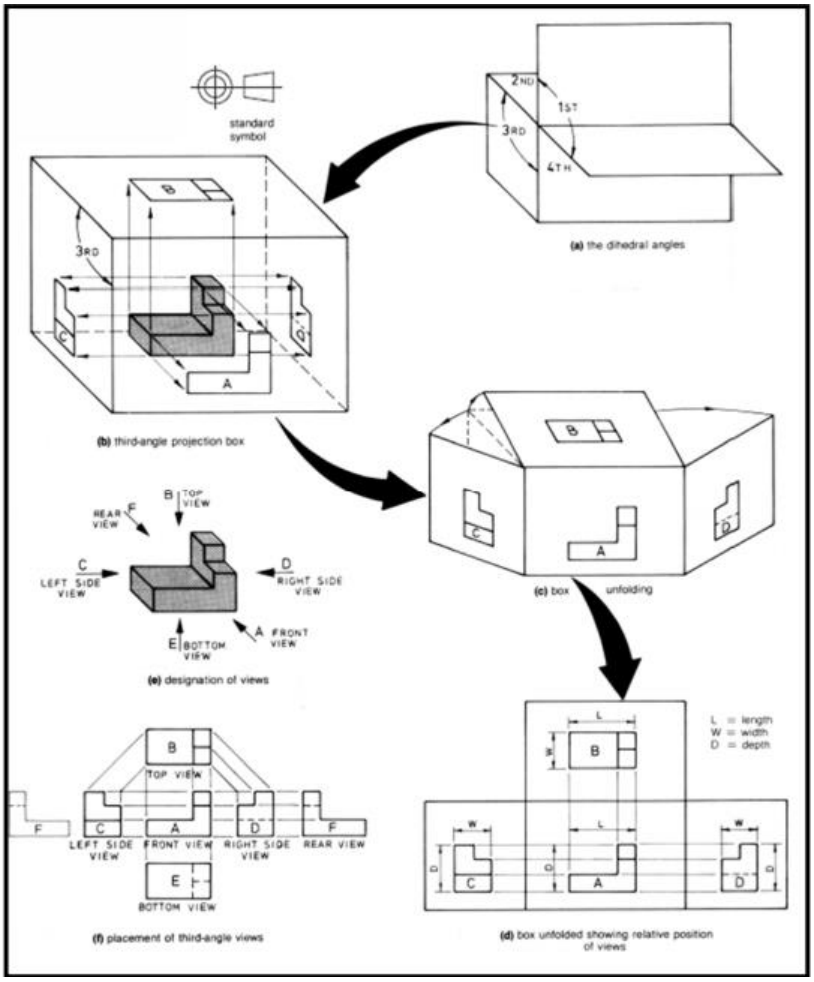


Cabinet

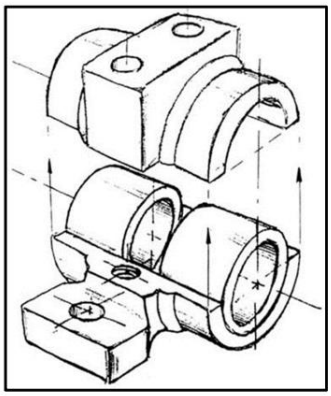
Cabinet is preferred

3rd angle projections (what we're going to use most)

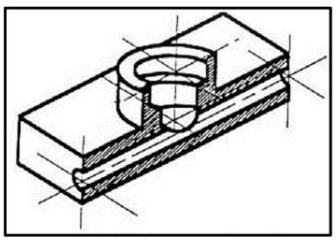
- have to state in 3rd angle; either with words or with this symbol
-



Free hand pictorial sketches



"Design Handbook: Engineering Drawing and Sketching"
MIT Open Courseware

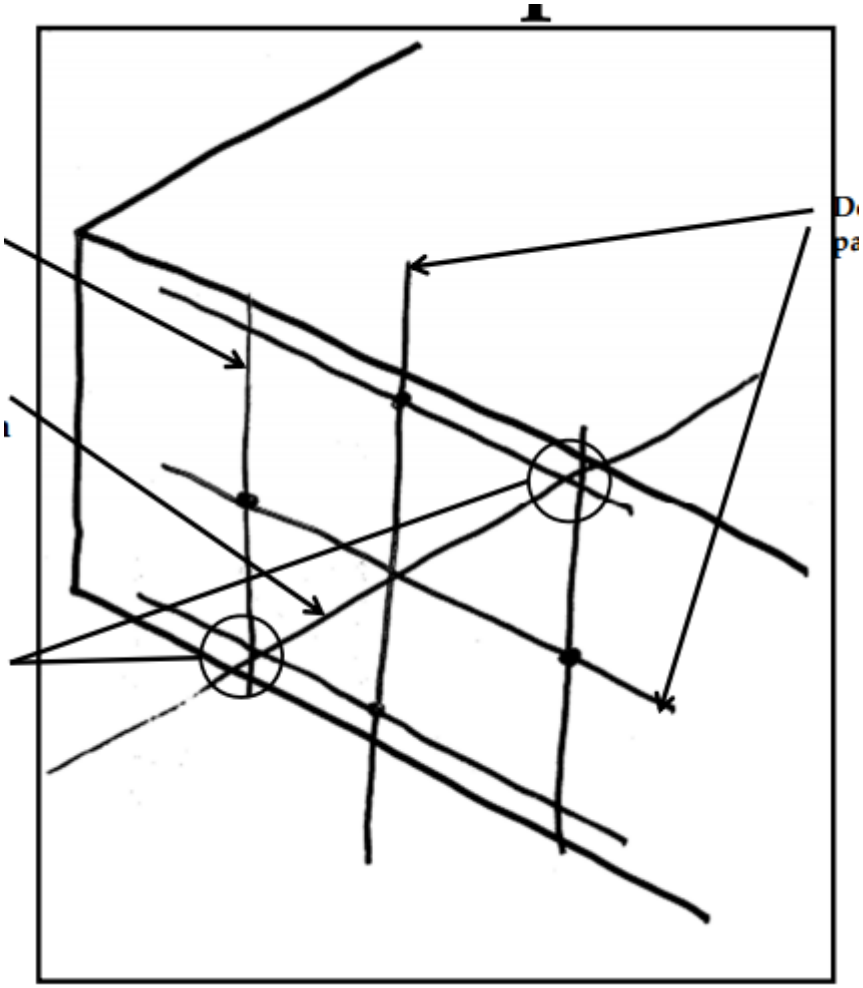


"Design Handbook: Engineering Drawing and Sketching"
MIT Open Courseware

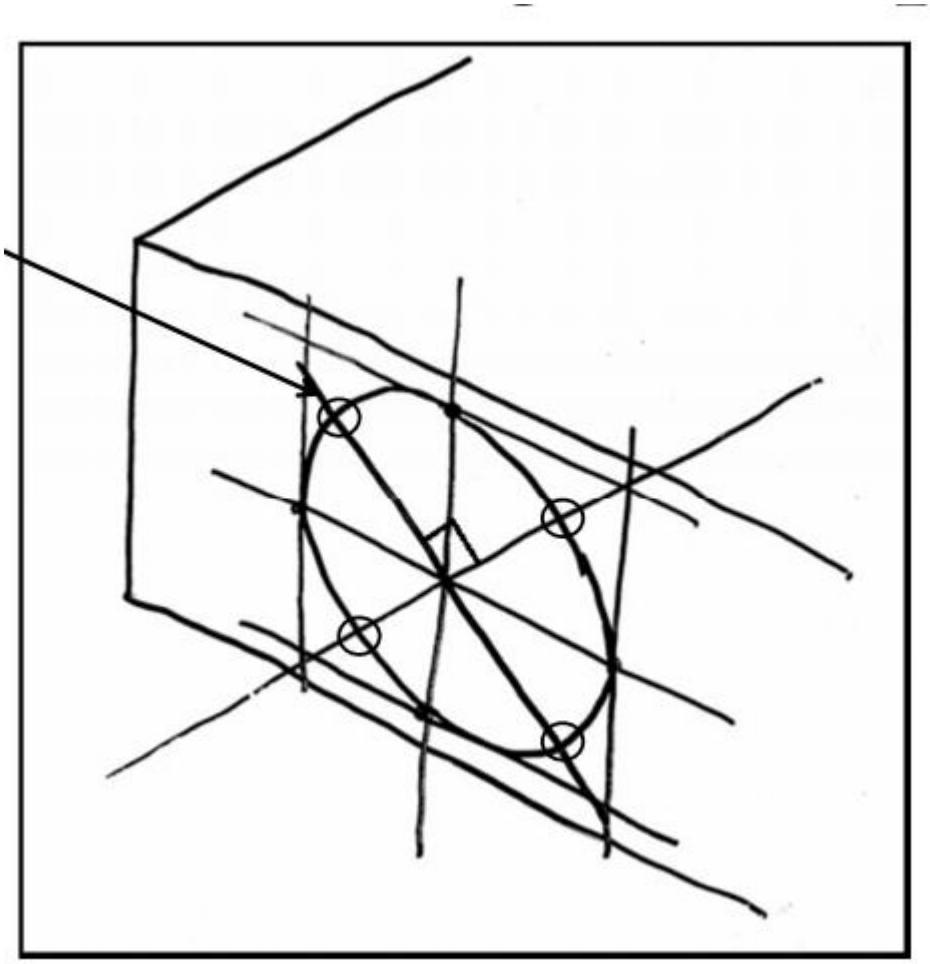
- Better than photos sometimes as: focus/hidden features/shadows/scratches/lack of parallel lines/ reflections

Sketching circles/ellipses

- Define a bounding box
- Minor axis goes through intersection of two axis and is parallel to edge of box
- Minor axis does not go through box corners
- Define two axis midway parallel to each side of box



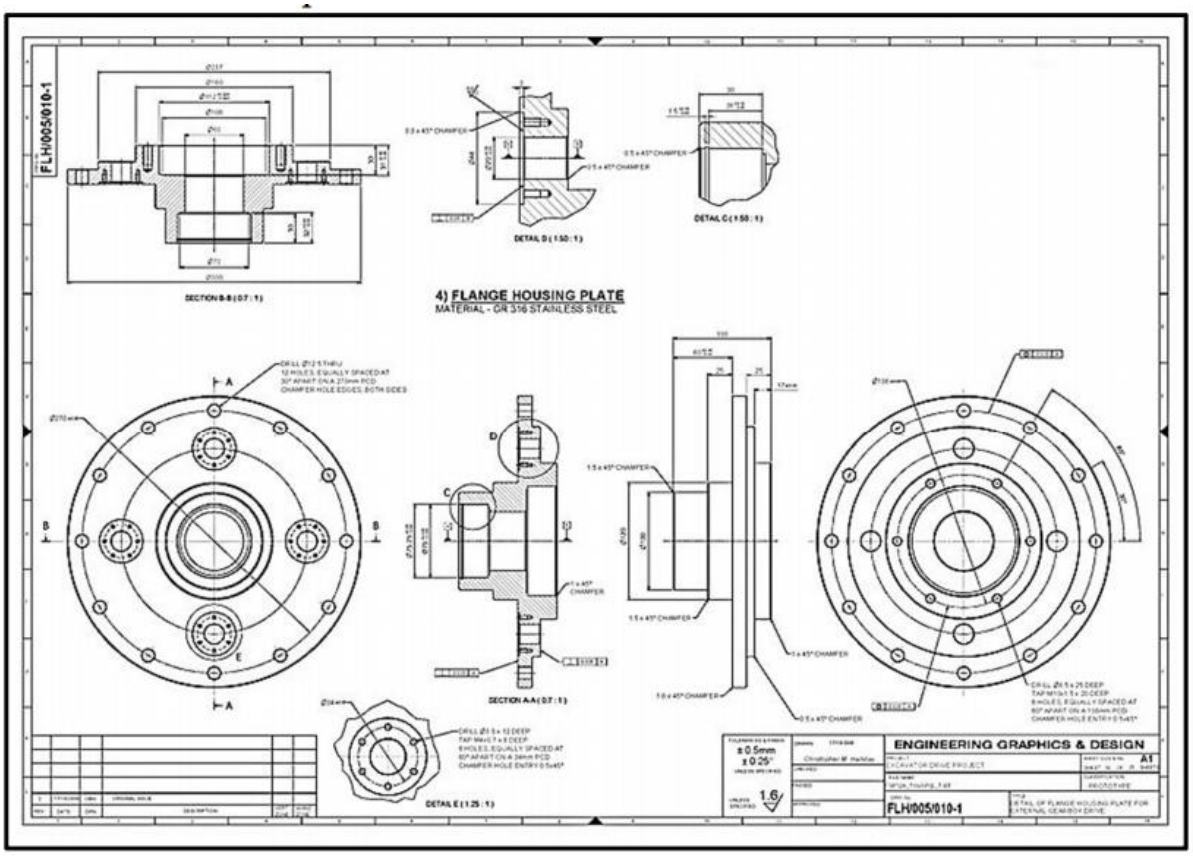
- Define major axis of ellipse going through the 6 interseciton points at $90°$ to minor axis
- Sketch ellipse noting minor/major axis define outer limits of ellipse
- Ellipse curves do not necessarily blend at interseciotion points



Lecture 2. Thursday, 28 July 2016

Detail Drawings:

- Detail drawins contain the key points to enable the manufacture or description of a single component that defines or communicates part or complete design to other interested parties

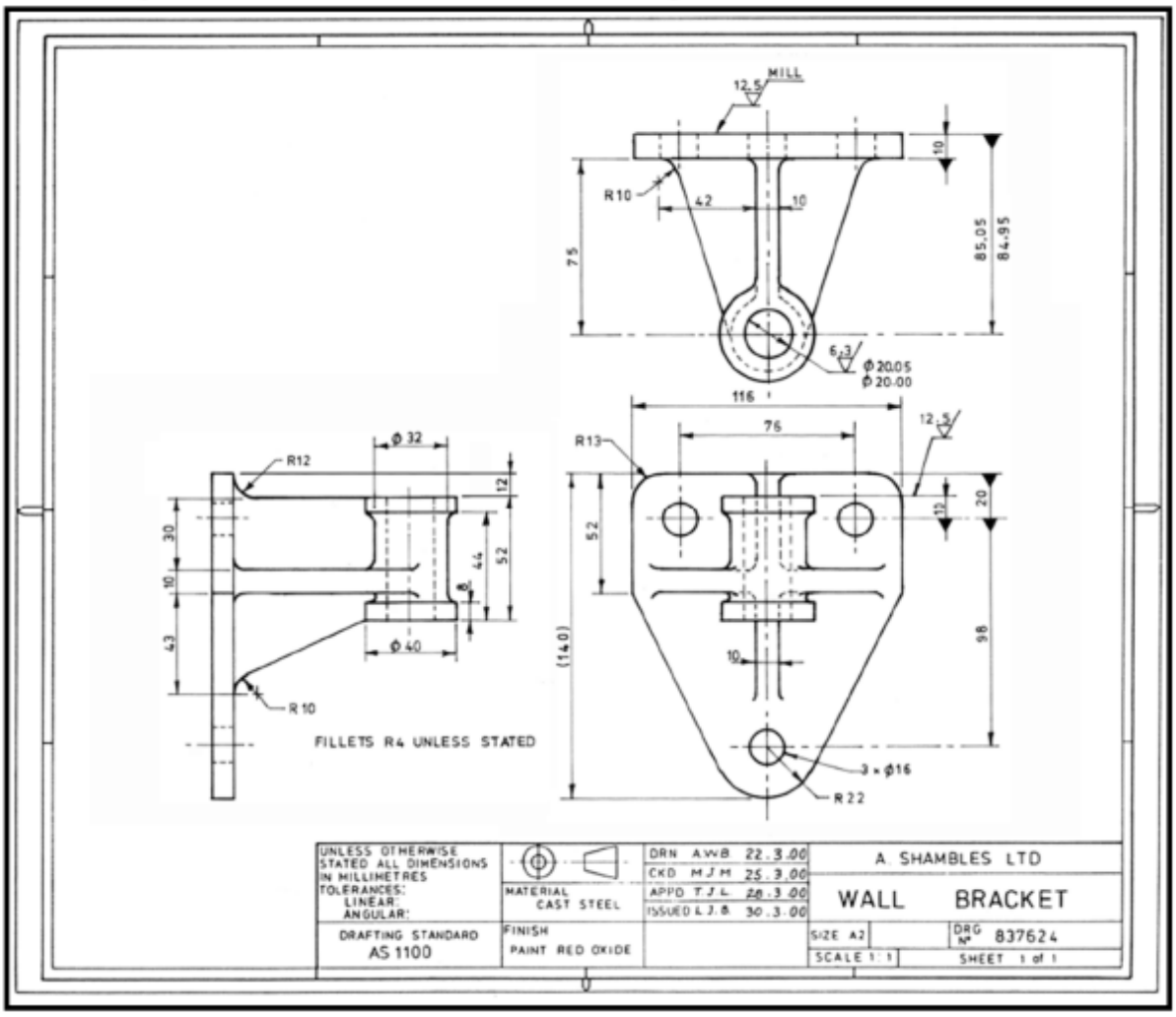


Details drawins must provide sufficient information to enable the manufacture of a part

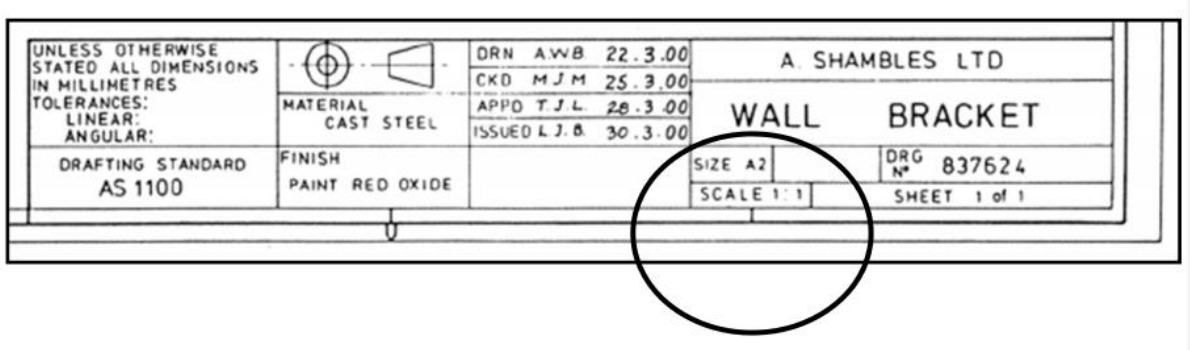
- Enough orthogonal views
- Dimensions (evenly distributed, structured and not dublicated)
- Scale stated
- Erd angle projection
- Drafting standard (AS1100) (Australian standard)
- Name
- Drawing number
- Dimensional units
- Tolerances for manufacturing
- Surface texture
- Treatments
- Reference to assembly drawing
- Material
- Drafter (who drew it), checker (who checked), approver (who approved) and dates
- Zones (where in drawing refereeing to)
- Revision
- Sheet size
- Company
- Sheet reference

Orthogonal views:

Wall Bracket drawing shows three regular views. Could have been done with two regular views and a sectional view replacing the end elevation.



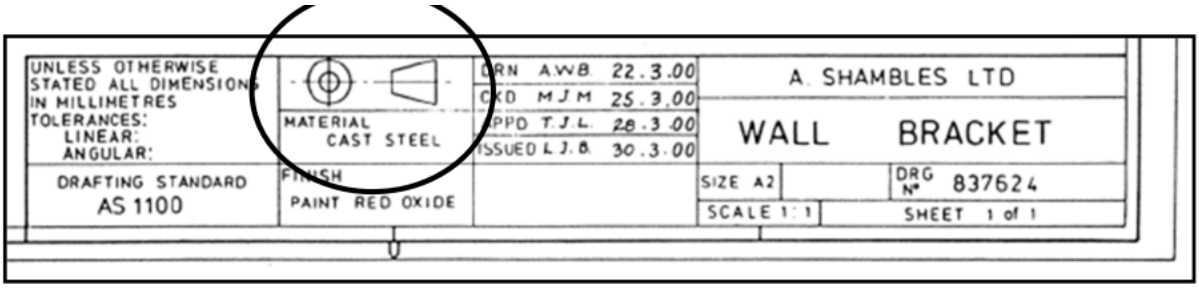
Scale



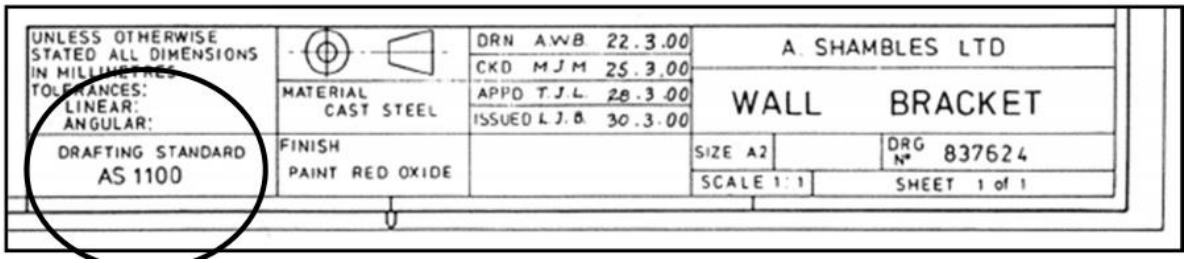
For enlargement: 2:1,5:1,10:1 ect

Reduction: 1:2, 1:2.5, 1:10 ect

Type of projection

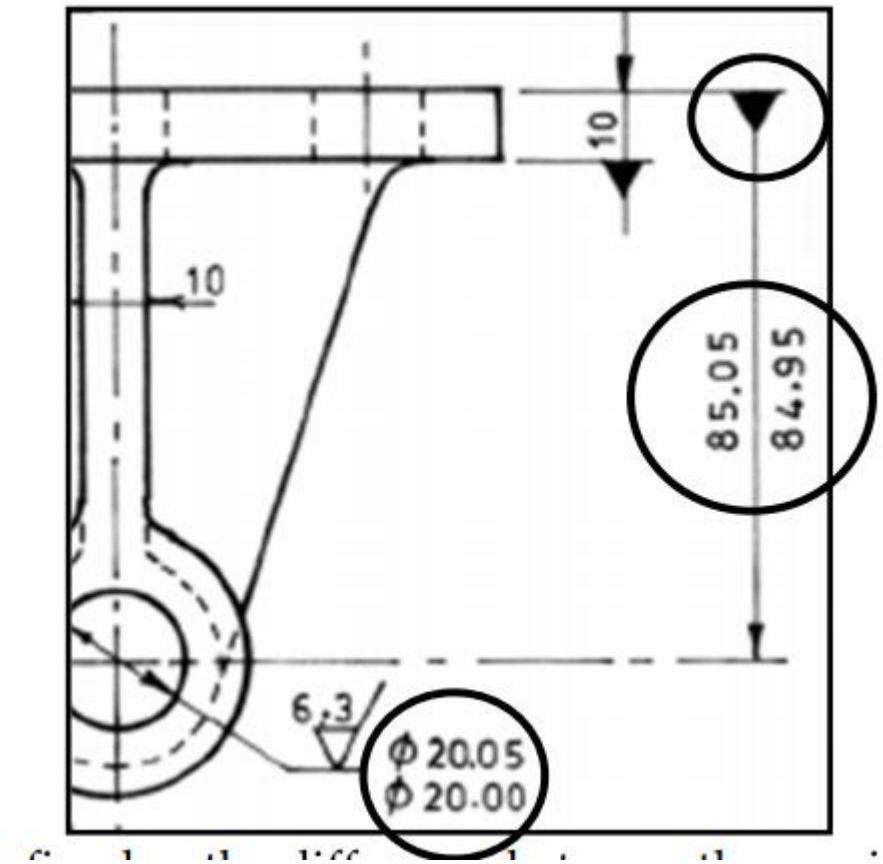


Drafting standards



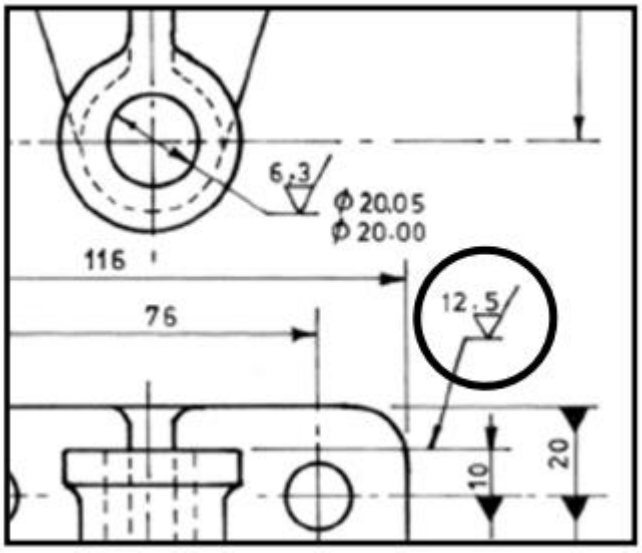
Tolerances:

Tolerance can be defined as the difference between the maximum and minimum limits of size. In this view, two tolerances are shown. One tolerance can be seen from the back of the Wall Bracket to the centre of the hole. The black triangle on the end of the dimension line infers that this is a datum surface. The other tolerance refers to the hole diameter

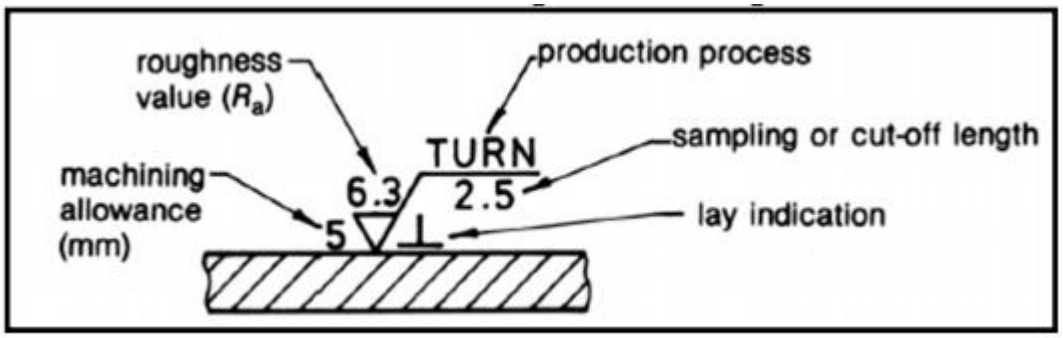


Surface texture/roughness

Symbols which indicate the surface texture of roughness that a component or a particular feature of a component requires must be inserted



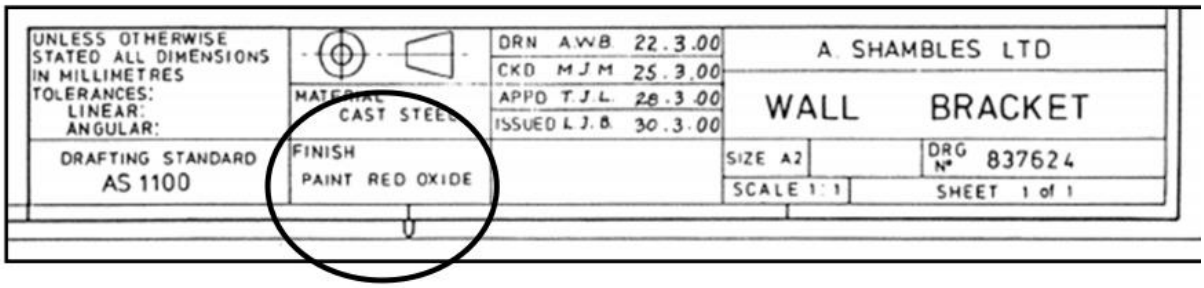
The surface texture symbol should be located so that it can be read from the bottom or right hand side of the drawing



Standard roughness values

R_a VALUE (µm)		PROCESS AND APPLICATION
0.025 or 0.025 and 0.05 or 0.05	very fine quality surface finishes, costly to produce	This very smoothly finished surface is produced by fine honing, lapping, buffing or super-finishing machines. It is costly to produce and seldom required. It has a highly polished appearance, depending on the production process, and is normally used on precision instruments such as gauges, laboratory equipment and finely made tools.
0.1 or 0.1		This is similar to the finer grades of finish and has much the same application. Very refined surfaces have this high degree of finish. It is produced by honing, lapping and buffing methods and is costly to produce.
0.2 or 0.2		This fine surface is produced by honing, lapping and buffing methods. This texture could be specified on precision gauge and instrument work, and on high speed shafts and bearings where lubrication is not dependable.
0.4 or 0.4		This fine quality surface can be produced by precision cylindrical grinding, coarse honing, buffing and lapping methods. It is used on high speed shafts, heavily loaded bearings and other applications where smoothness is desirable for the proper functioning of a part.
0.8 or 0.8	medium quality finishes, used where reasonable surfaces are required	This first-class machine finish can be easily produced on cylindrical, surface and centreless grinders but requires great care on lathes and milling machines. It is satisfactory for bearings and shafts carrying light loads and running at medium to slow speeds. It may be used on parts where stress concentration is present. It is the finest finish that it is economical to produce; below this costs rise rapidly.
1.6 or 1.6		This good machine finish can be maintained on production lathes and milling machines using sharp tools, fine feeds and high cutting speeds. It is used when close fits are required but is unsuitable for fast rotating members. It may be used as a bearing surface when motion is slow and loads are light. This surface can be achieved on extrusions, rolled surfaces, die castings and permanent mould castings in controlled production.
3.2 or 3.2		This medium commercial finish is easily produced on lathes, milling machines and shapers. A finish commonly used in general engineering machining operations, it is economical to produce and of reasonable appearance. It is the roughest finish recommended for parts subjected to slow speeds, light loads, vibration and high stress, but it should not be used for fast rotating shafts. This finish may also be found on die castings, extrusions, permanent mould castings and rolled surfaces.
6.3 or 6.3	rough finishes, used where quality surfaces are unimportant	This coarse production finish is obtained by taking coarse feeds on lathes, millers, shapers, boring and drilling machines. It is acceptable when tool marks have no bearing on performance or quality. This texture can also be found on the surfaces of metal moulded castings, forgings, extruded and rolled surfaces, and can be produced by rough hand filing or disc grinding.
12.5 or 12.5		This surface is produced from heavy cuts and coarse feeds by milling, turning, shaping, boring, disc grinding and snagging. It can also be obtained by sand casting, saw cutting, chipping, rough forging and oxy cutting. This finish is rarely specified and is used only where it is not seen or its appearance is unimportant, e.g. on machinery, jigs and fixtures.
25		This very rough finish is produced by sand casting, torch and saw cutting, chipping and rough forgings. Machining operations are not required as this finish is suitable as found, e.g. on large machinery.

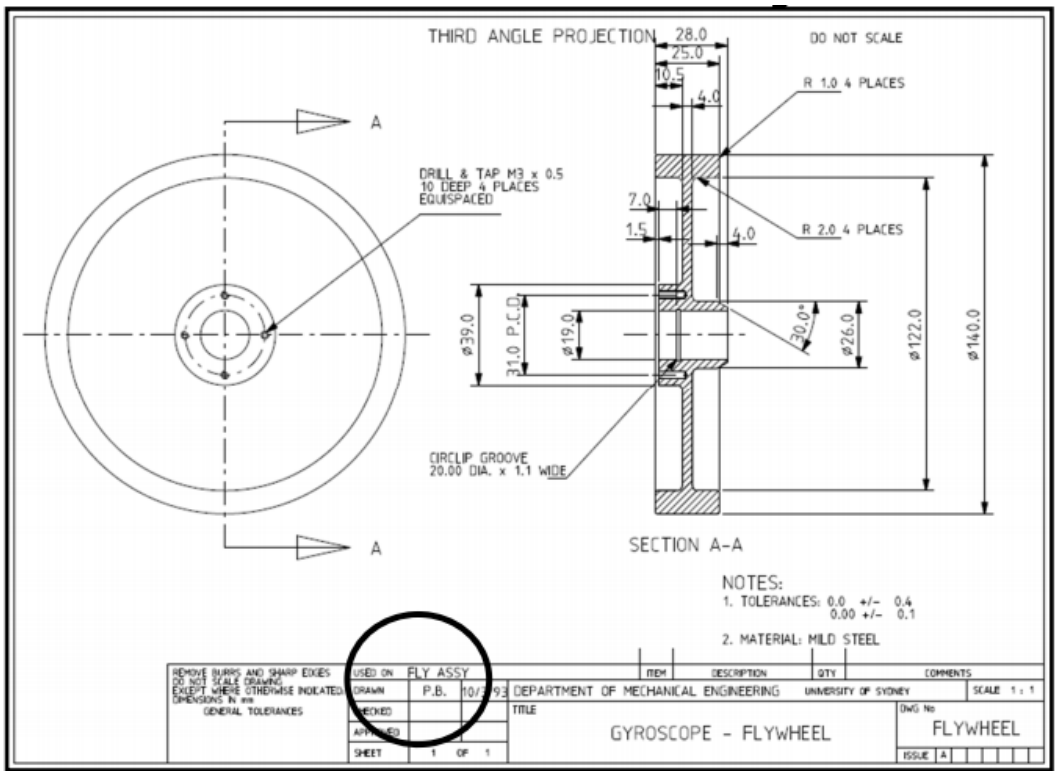
Surface treatments



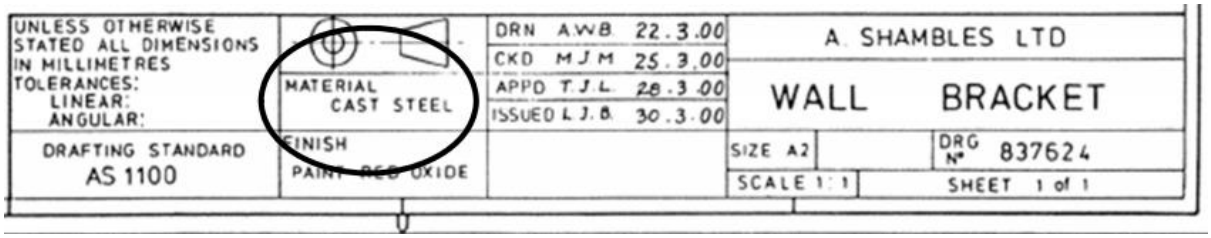
The treatment or coating that the component is finished to is stated in the title block. If the process is a company or military standard that is often followed e.g. the aircraft industry, NASA, The Australian Army, then reference to a standard data sheet is made.

Reference to assembly drawings

Detail drawings seldom describe the intent of an engineering design. An engineering design is usually defined by many individual detail drawings which combine to form an assembly drawing. The name and or drawing number of the assembly drawing in which the detail drawing is "called up" or "used on" is stated in the title block.

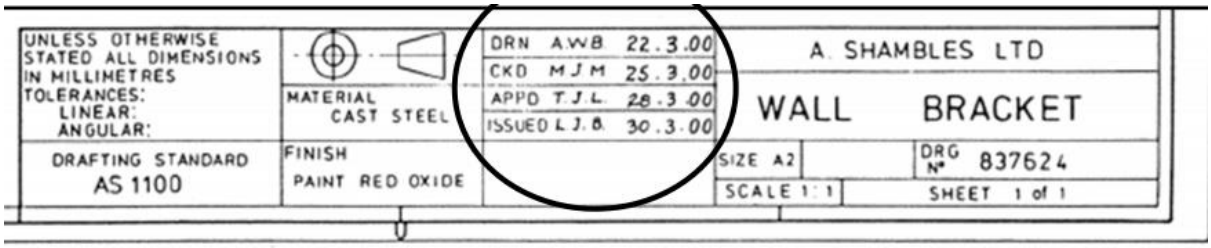


Materials



Engineering designs are highly dependant on the material from which they are manufactured. Clearly this is something that must be stated in the drawing as it vital information that must be passed on to the manufacturer of the part and many other parties. This information is normally stated in the title block. If the information is extensive a separate note located in the drawing or a separate data sheet may be used.

Names and dates: (very important)



Engineering designs are the work of many people within an organisation. The initials or names indicate who was responsible for the various duties. In the above title block, DRN indicate who was responsible for drafting the drawing. The initials CKD indicate who checked the drawing. Usually this task is completed by a highly experienced drafter or the chief drafter in a drawing office. The initials APPD indicate who approved the drawing. This signatory is usually the project engineer who overseas the entire project. The title “ISSUED” is the final approval which would be signed off by a senior or chief engineer

These signatures carry responsibilities and dictate accountability

Zone reference system (not that important anymore)

The numbers and capital letters surrounding a drawing provide a method whereby two people may discuss (perhaps over a telephone call) a particular feature on a drawing. This is most useful on large format sheets such as A0 and A1 sizes.