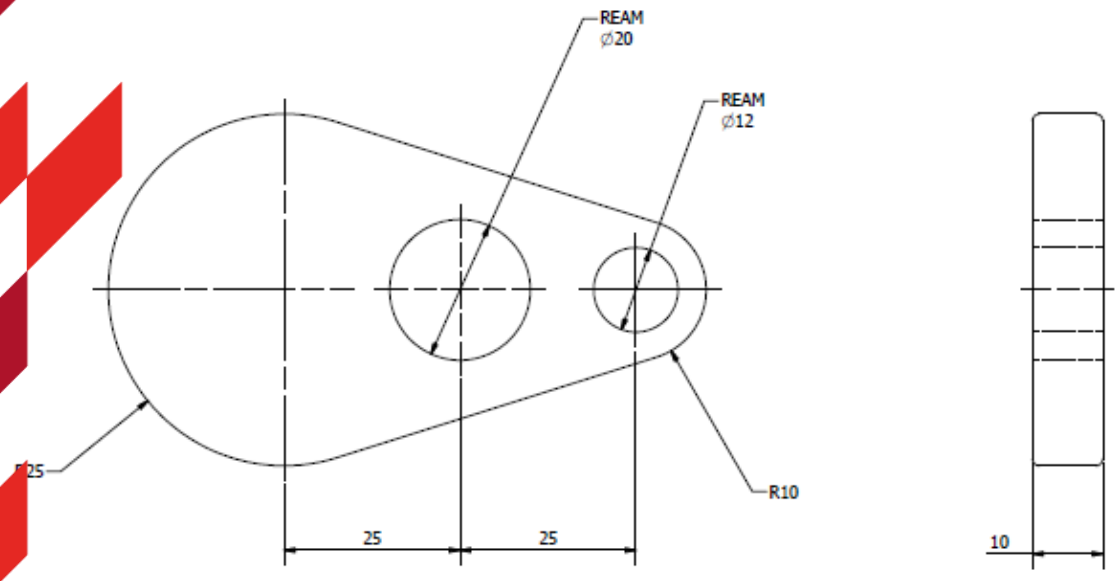
MECH2003,
Mechanical Engineering Design
Manufacturing Drawing and AS1100



MECH2003: Mechanical Design

Introduction to Manufacturing Drawings

Who has used machines such as lathes or Mills in a Mechanical Workshop?

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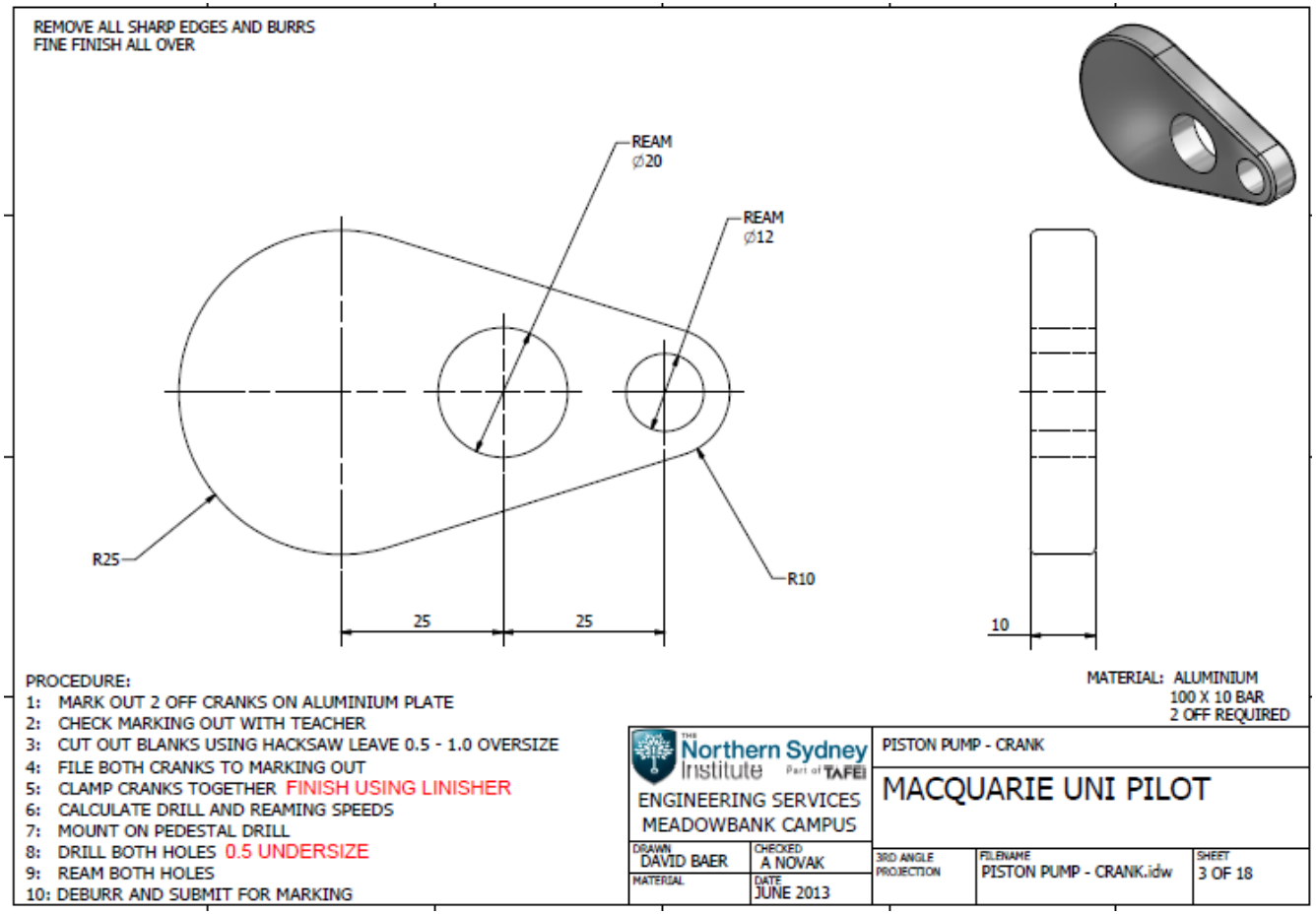
Introduction to Manufacturing Drawings

Those who have would be very familiar with these…



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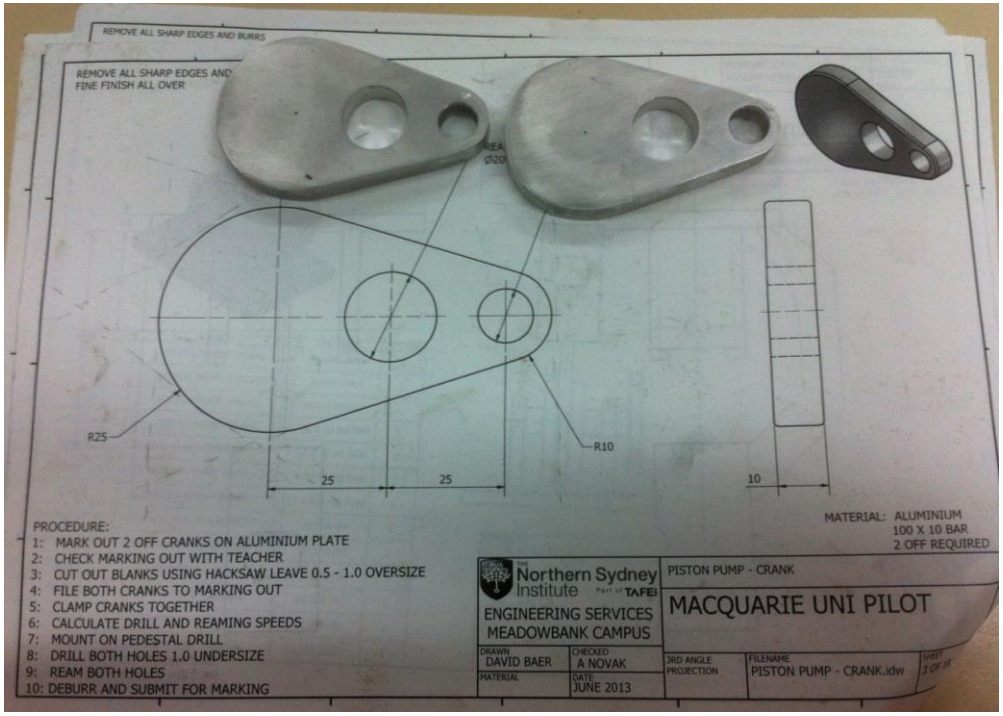
Introduction to Manufacturing Drawings

Drawings are a critical requirement that allow a design to be communicated. This may be the designer to a supervisor or an engineer to a tool smith.



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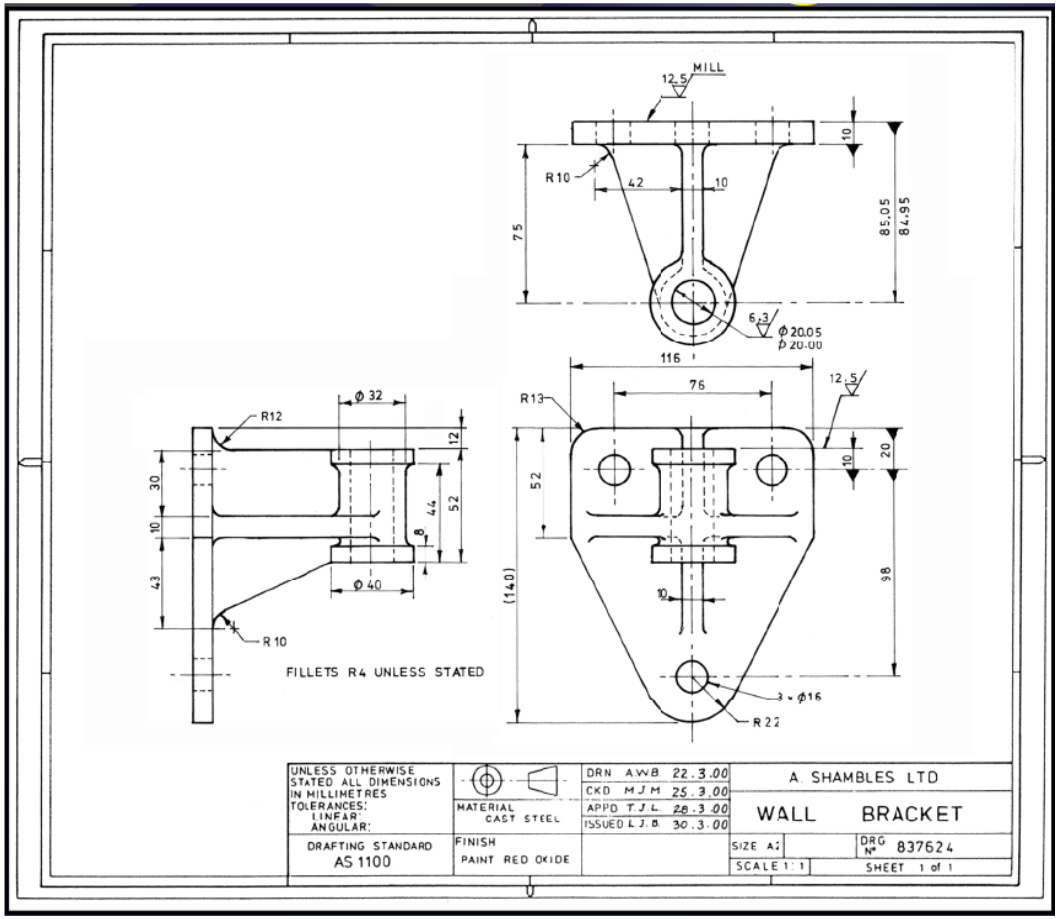
Introduction to Manufacturing Drawings

Drawings consist of many individual features to communicate or describe a component.



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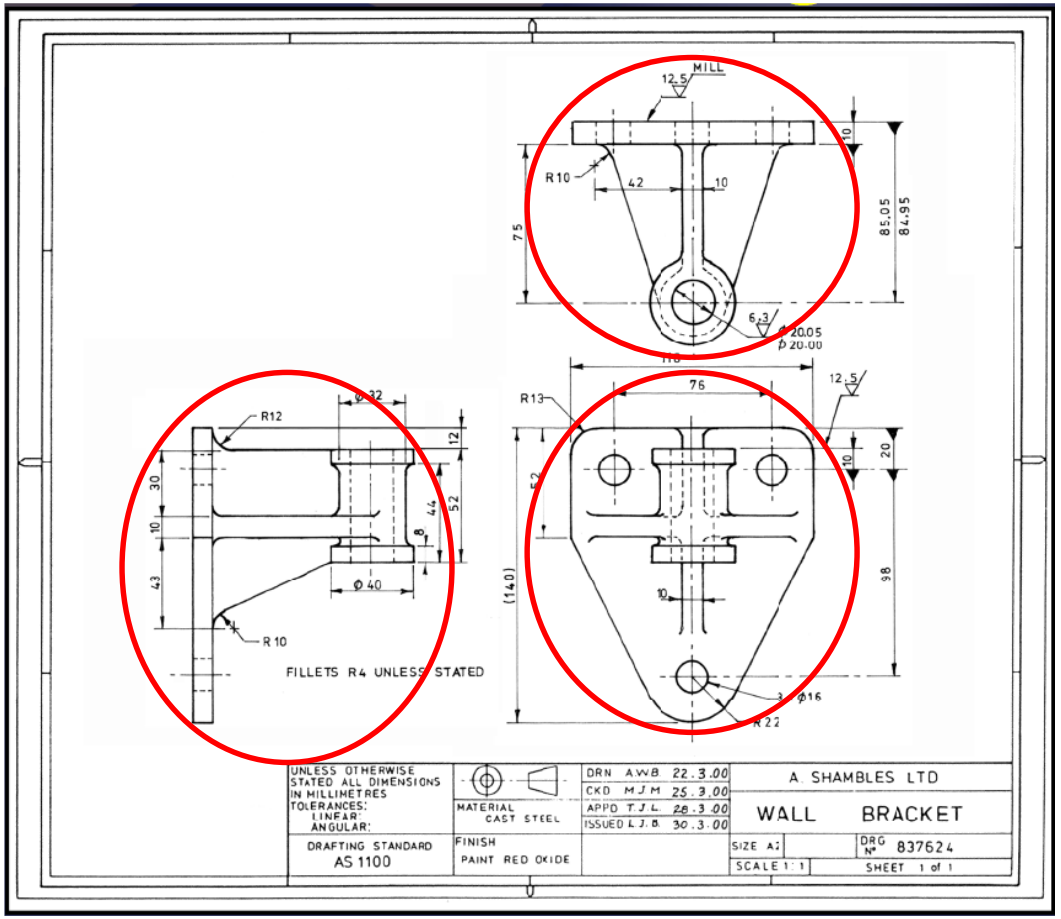
Introduction to Manufacturing Drawings

Drawings consist of many individual features to communicate or describe a component.



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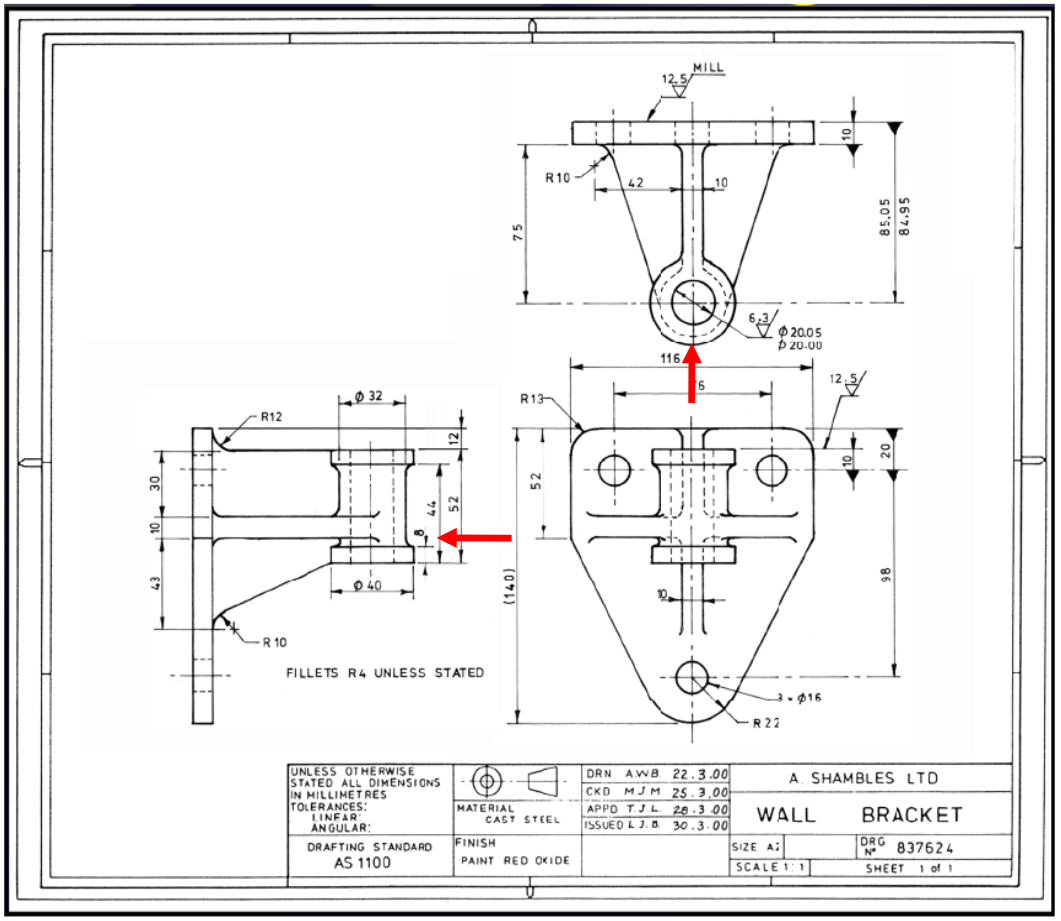
Introduction to Manufacturing Drawings

The views in this drawing are **projections** of each other.



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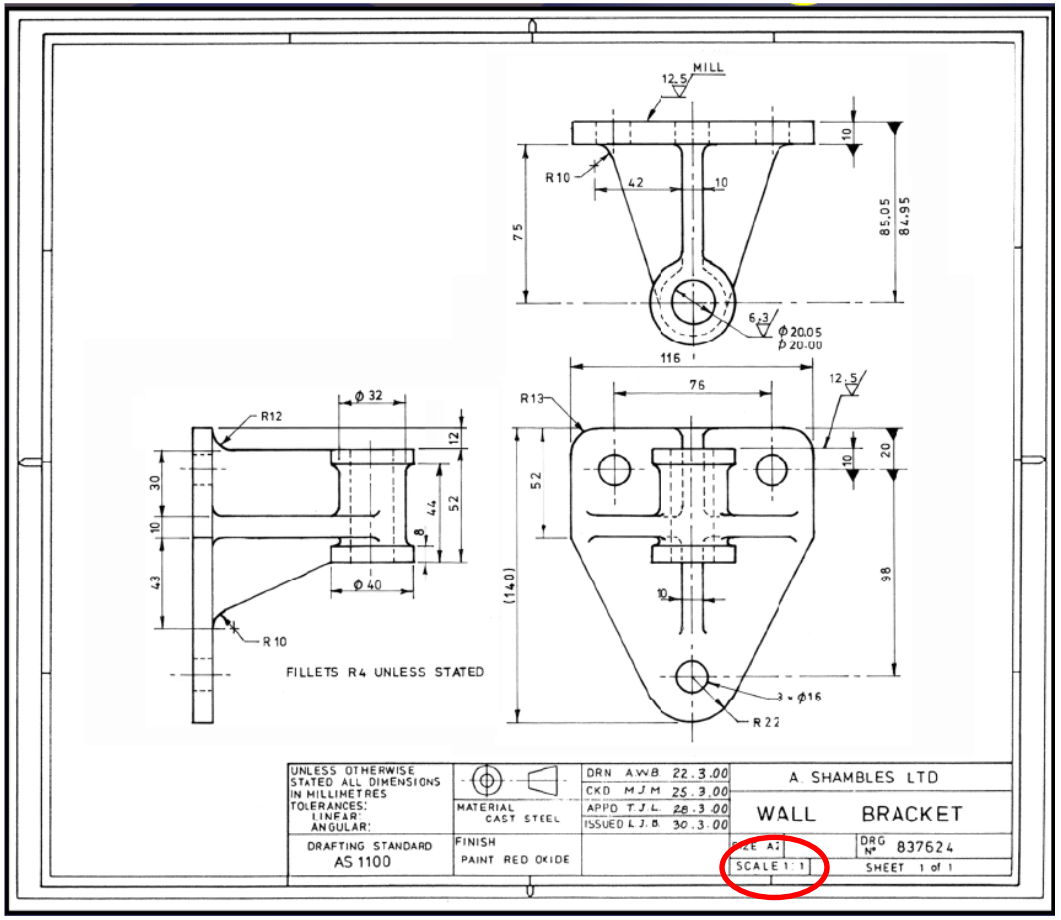
Introduction to Manufacturing Drawings

A **scale** is used to provide the reader with an appreciation of the overall size of the component.



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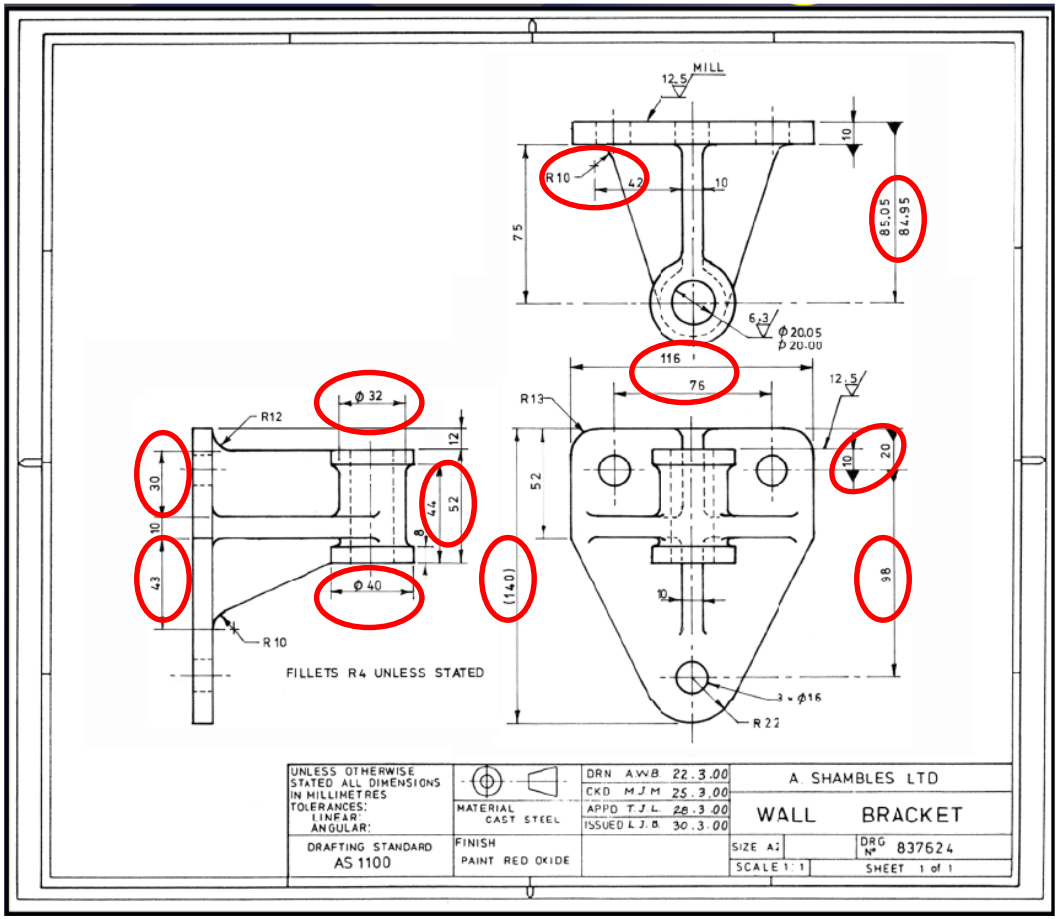
Introduction to Manufacturing Drawings

Adequate **dimensions** are included to convey the size of all the features. Critical dimensions will also include **tolerances**.



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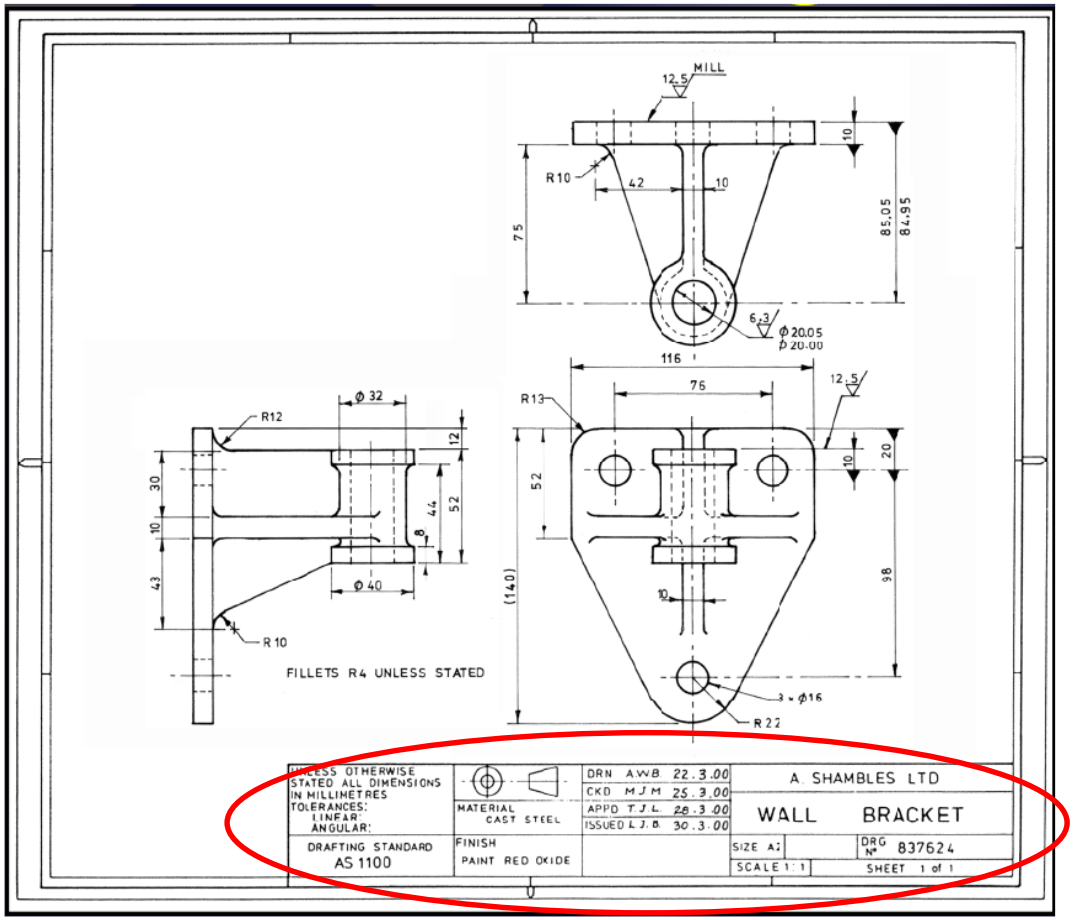
Introduction to Manufacturing Drawings

A **titleblock** is included that conveys additional information.



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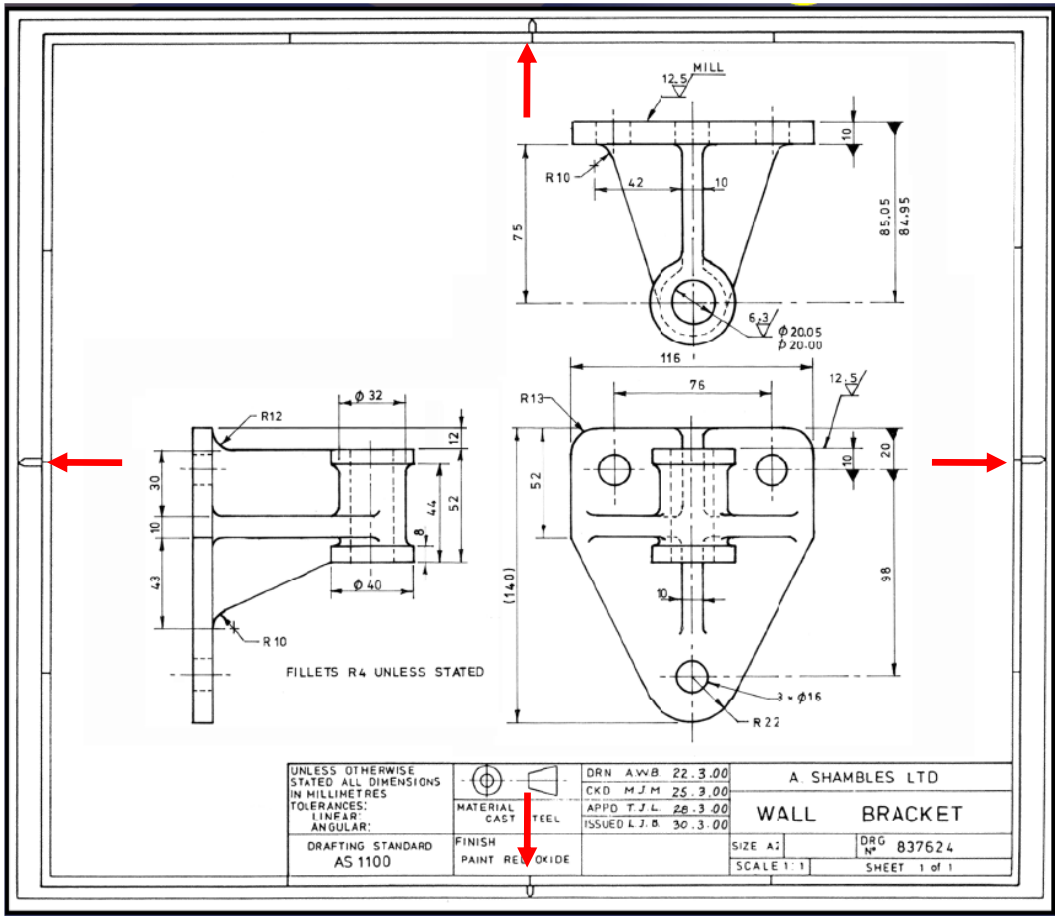
Introduction to Manufacturing Drawings

A **border** that should contain a referencing system.



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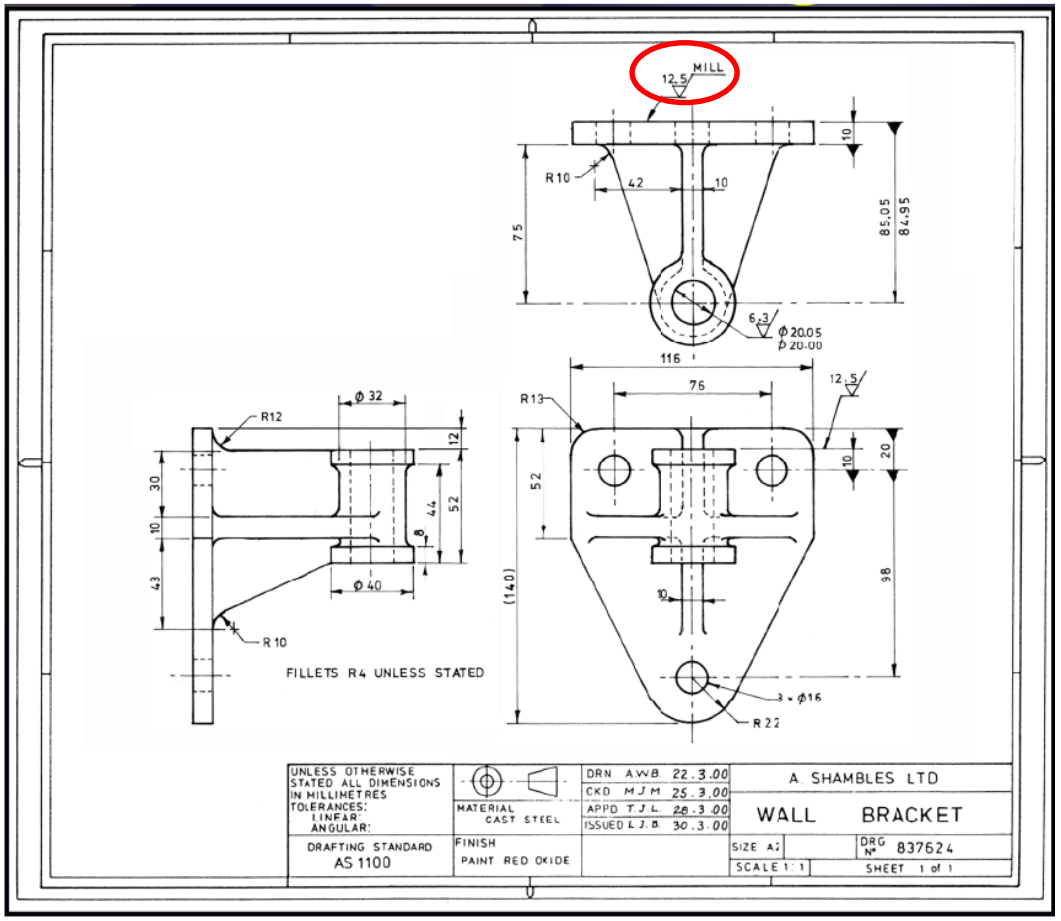
Introduction to Manufacturing Drawings

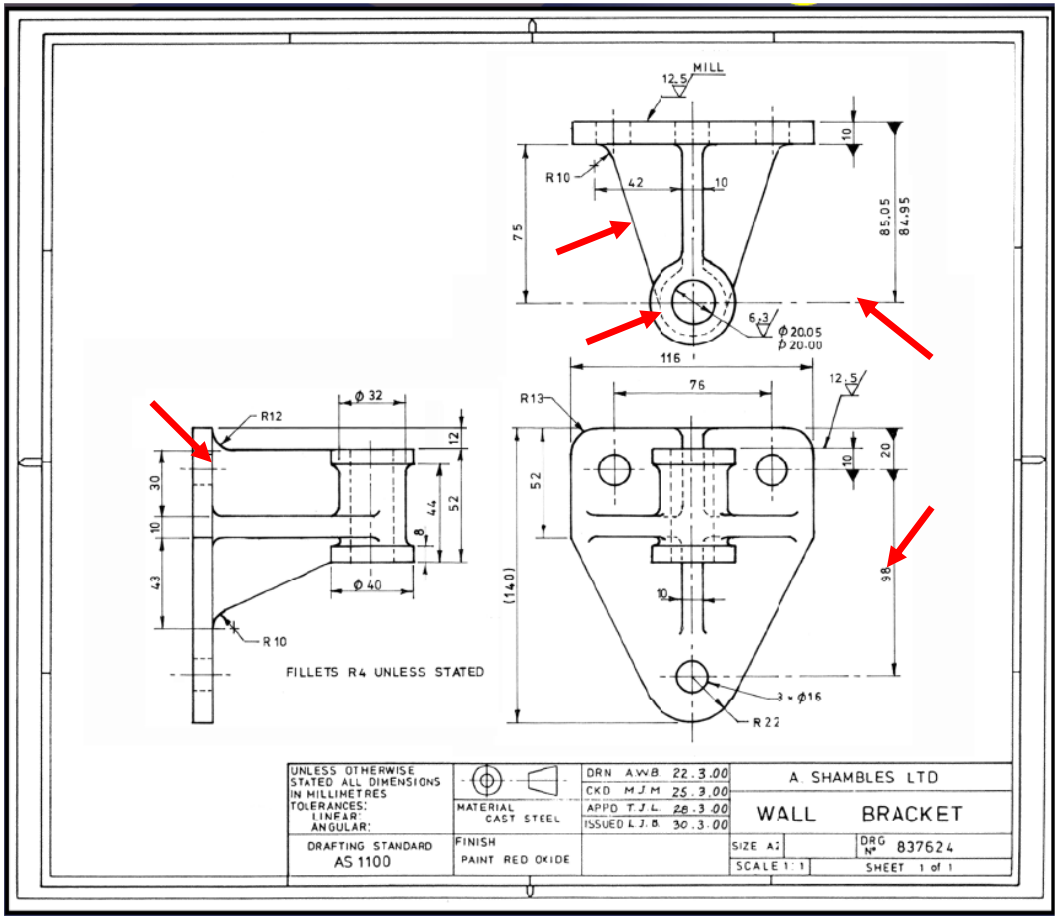
Where required, the surface finish and machining method is specified.



MECH2003: Mechanical Design

Introduction to Manufacturing Drawings

And a variety of **line weights** and **styles** are used to indicate different features.



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Introduction to Manufacturing Drawings

All these features for a manufacturing drawing are dictated by the Australian Standard AS1100.

This lecture intends to introduce you to the requirements of this standard so that you may produce manufacturing drawings that can be read by all professional engineers.

You can find the AS1100 document by using the “multisearch” facility on the library’s website and searching for the Australian Standards database. Then search for AS1100.

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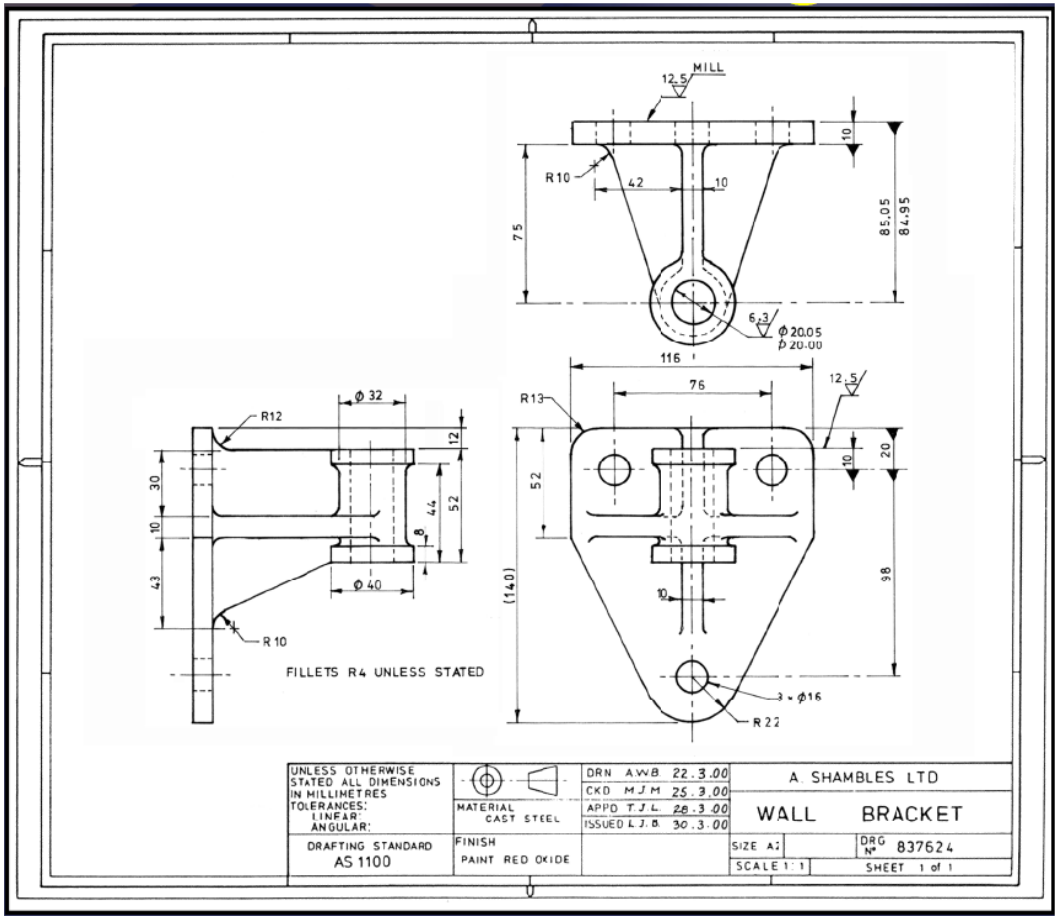
Introduction to Manufacturing Drawings

This type of drawing used is a third angle projection orthogonal drawing, the most common manufacturing drawing.



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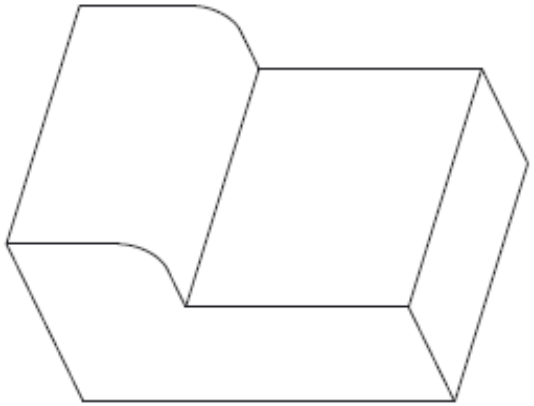
Third Angle Orthogonal Drawings

What is an **orthogonal** drawing?



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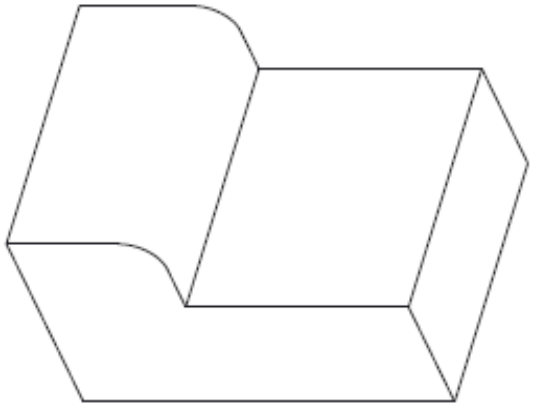
Third Angle Orthogonal Drawings

Imagine having this component…



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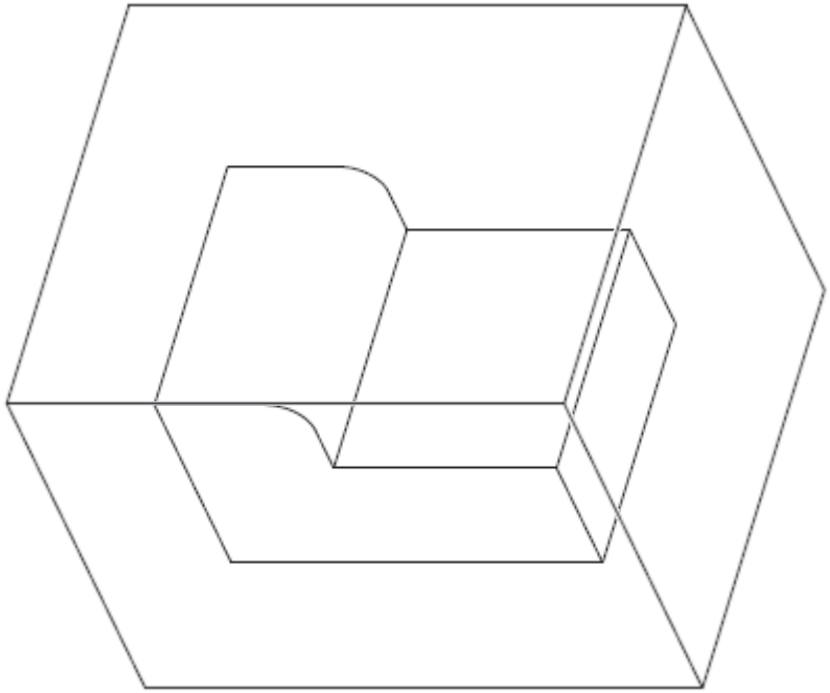
Third Angle Orthogonal Drawings

Imagine having this component which we place a glass box around.



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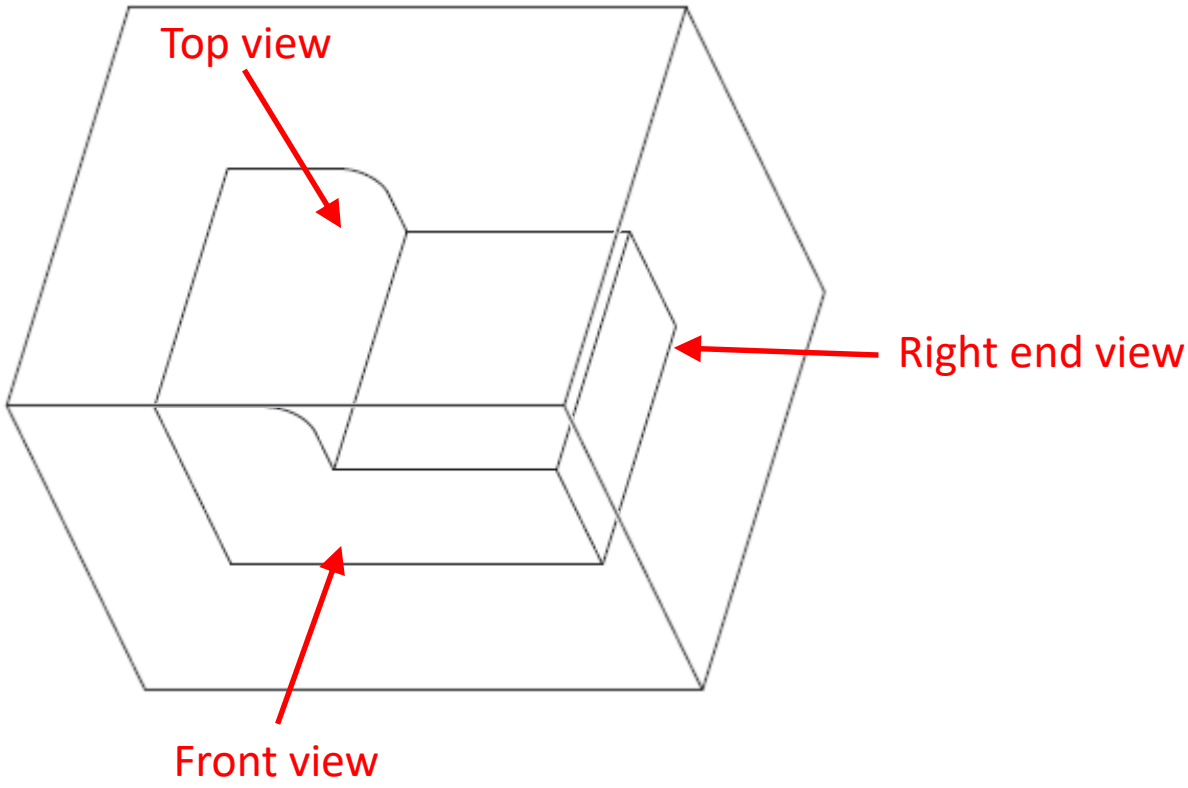
Third Angle Orthogonal Drawings

An orthogonal drawing displays what would be visible if we were viewing the object normal to each face of the glass box.



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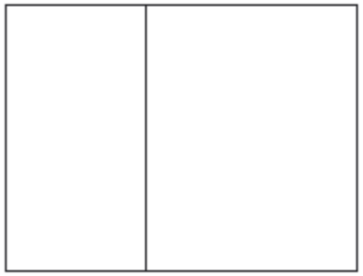
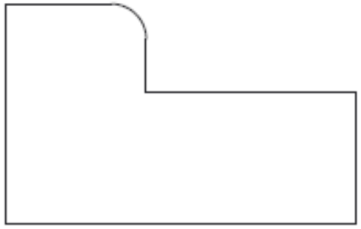
Third Angle Orthogonal Drawings

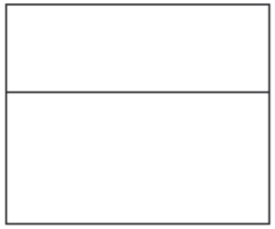
The views are then arranged around the drawing sheet in a specific order as dictated by the **third angle projection** convention.



TOP VIEW



FRONT VIEW



RIGHT END VIEW

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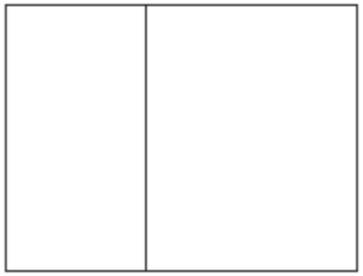
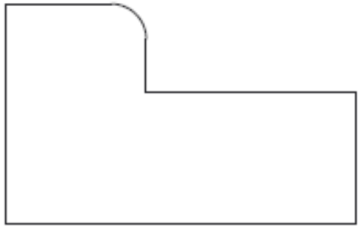
Third Angle Orthogonal Drawings

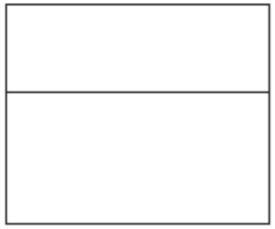
Third angle projection dictates the placement of the projected views. The top view is positioned above the front view while the right end is on the right.



TOP VIEW



FRONT VIEW



RIGHT END VIEW

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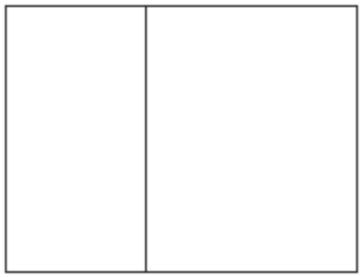
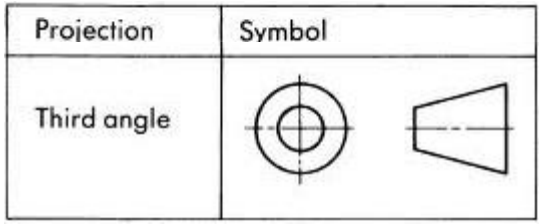
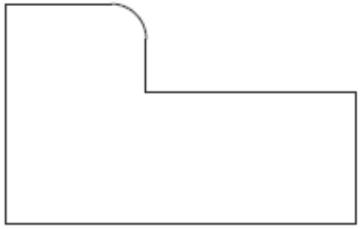
Third Angle Orthogonal Drawings

The symbol shown here indicates that a drawing utilises **third angle projection**, but you should be aware of this by the orientations of the views.

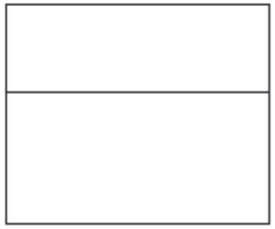


TOP VIEW





FRONT VIEW



RIGHT END VIEW

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Third Angle Orthogonal Drawings

Why do we use third angle convention?

Required by the Australian Standard for mechanical and manufacturing design, AS1100.

AS1100 not only dictates the view orientation, but also the line styles that should be used, the dimensioning and what details should also be included as part of the drawings.

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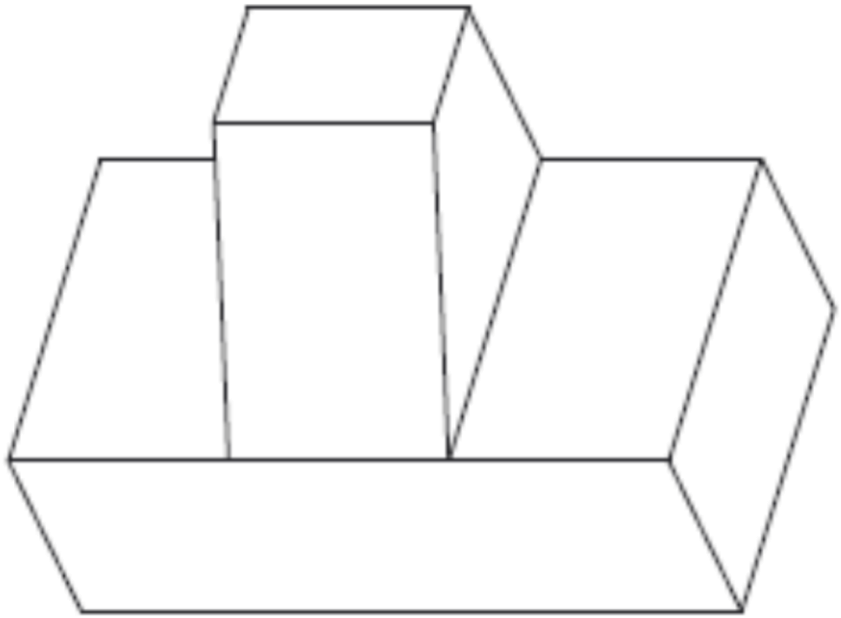
Third Angle Orthogonal Drawings

Example 1: For the following component…



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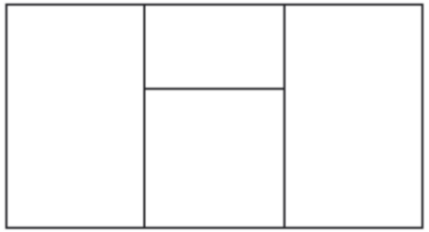
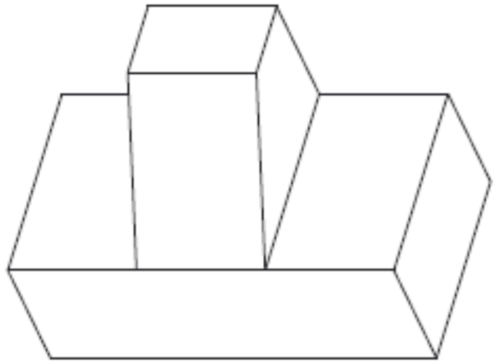
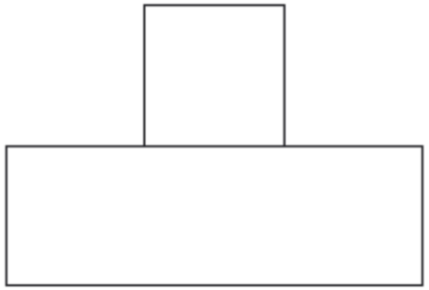
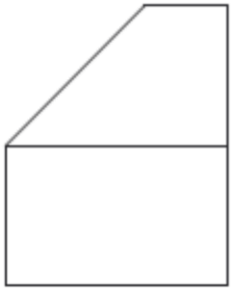
Third Angle Orthogonal Drawings

Example 1: Is the following drawing drawn as a first angle projection or a third angle projection?





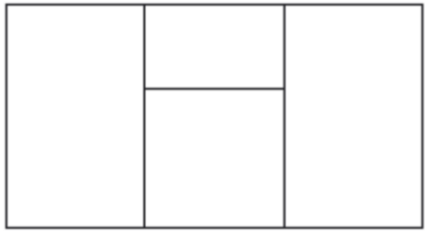




MECH2003: Mechanical Design

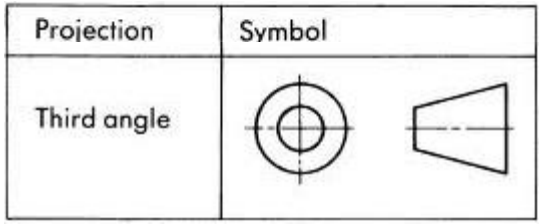
Third Angle Orthogonal Drawings

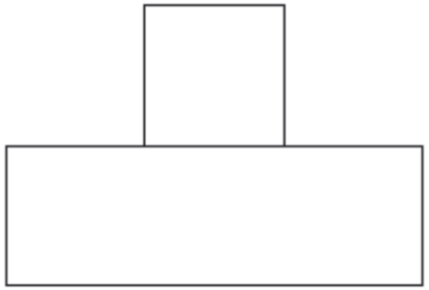
Example 1: Is the following drawing drawn as a first angle projection or a third angle projection?



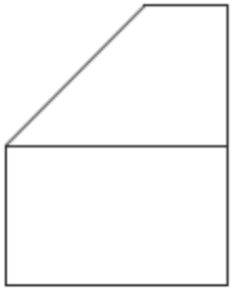
TOP VIEW

ANSWER:





FRONT VIEW



RIGHT END VIEW

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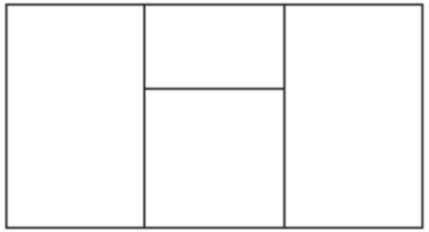
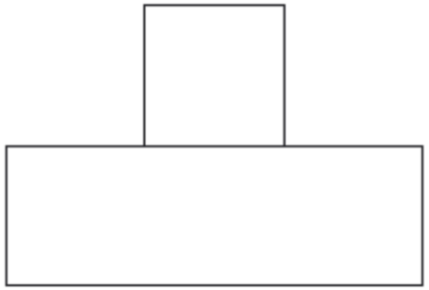
Third Angle Orthogonal Drawings

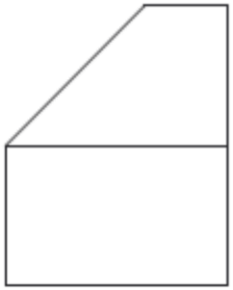
Most common views are front, top and right hand side.



TOP VIEW



FRONT VIEW



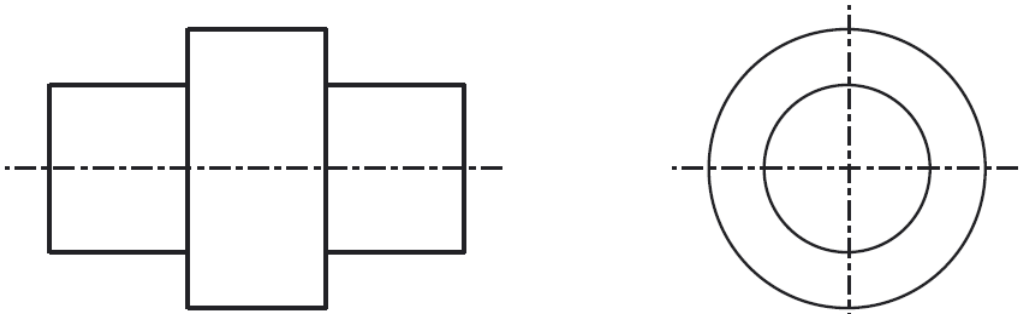
RIGHT END VIEW

MECH2003: Mechanical Design

Alternative Views

It is not vital to all ways use three views for every orthogonal drawing.

Does anybody recognise this component?



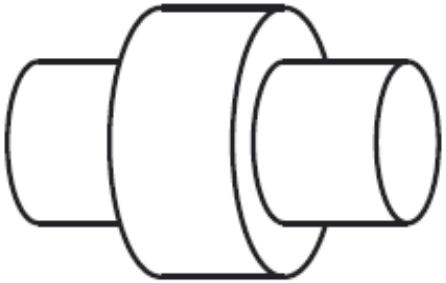
FRONT VIEW

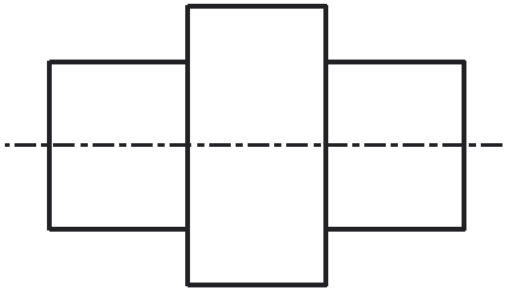
RIGHT END VIEW

MECH2003: Mechanical Design

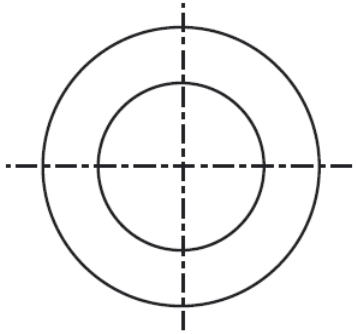
Alternative Views

Only two views are required to model the “big end” from the piston pump that those in the mechanical workshop manufactured.





FRONT VIEW



RIGHT END VIEW

MECH2003: Mechanical Design

Alternative Views

Sometimes, the standard orthogonal views used are not sufficient.

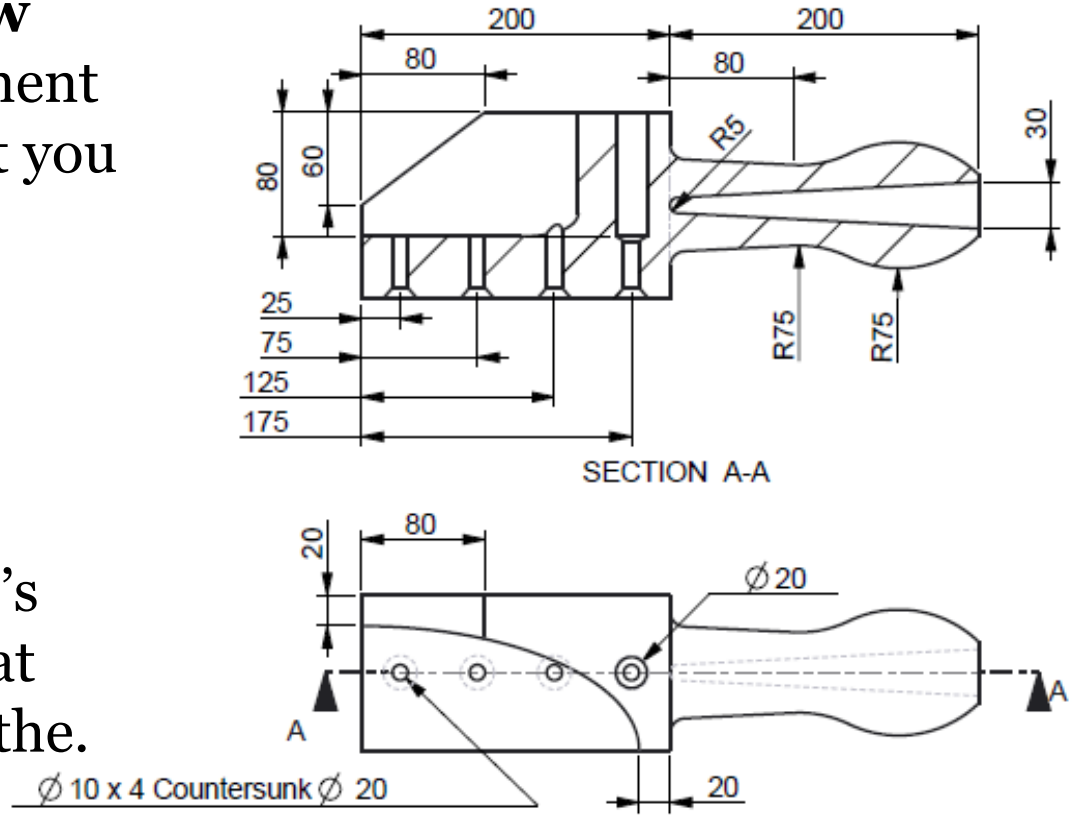
During these circumstances, it may be necessary to use alternative style views that provide additional information. These may include, cross section views, detailed views, isometric or perspective views…

MECH2003: Mechanical Design

Alternative Views

A **cross section view** cuts away at a component or an assembly so that you can see the geometry through that cut.

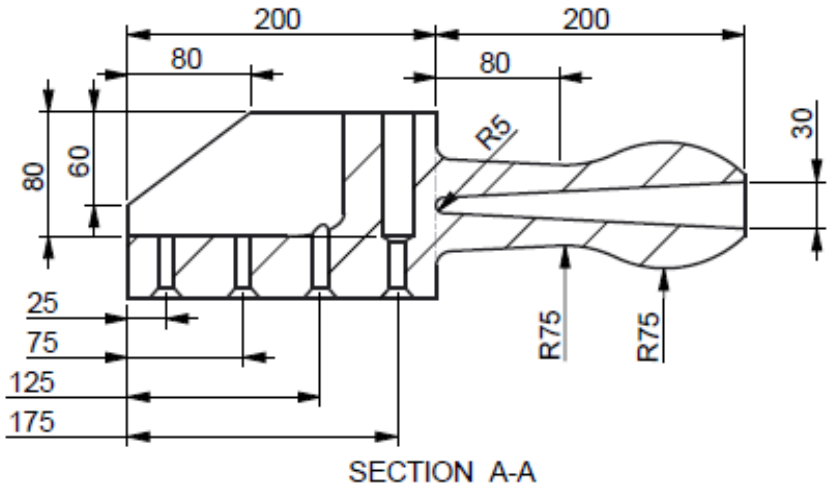
These are particularly valuable when demonstrating a shaft's details or anything that may be turned on a lathe.



MECH2003: Mechanical Design

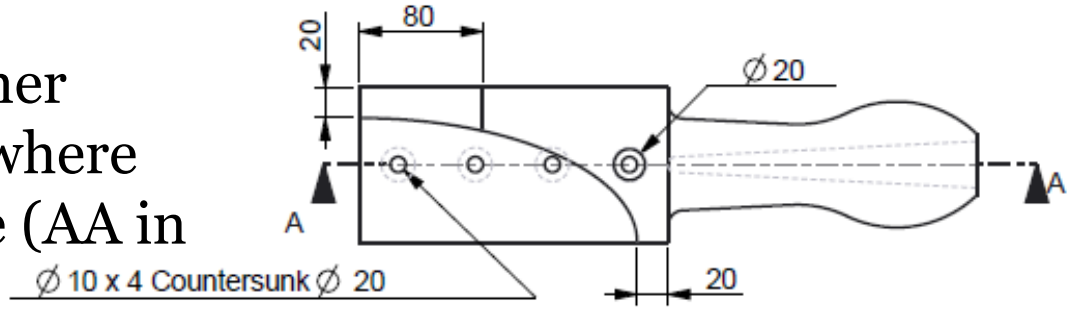
Alternative Views

Cross hatching is used to indicate where a component has been cut. In assemblies, this cross hatching should be different for each individual component.



SECTION A-A

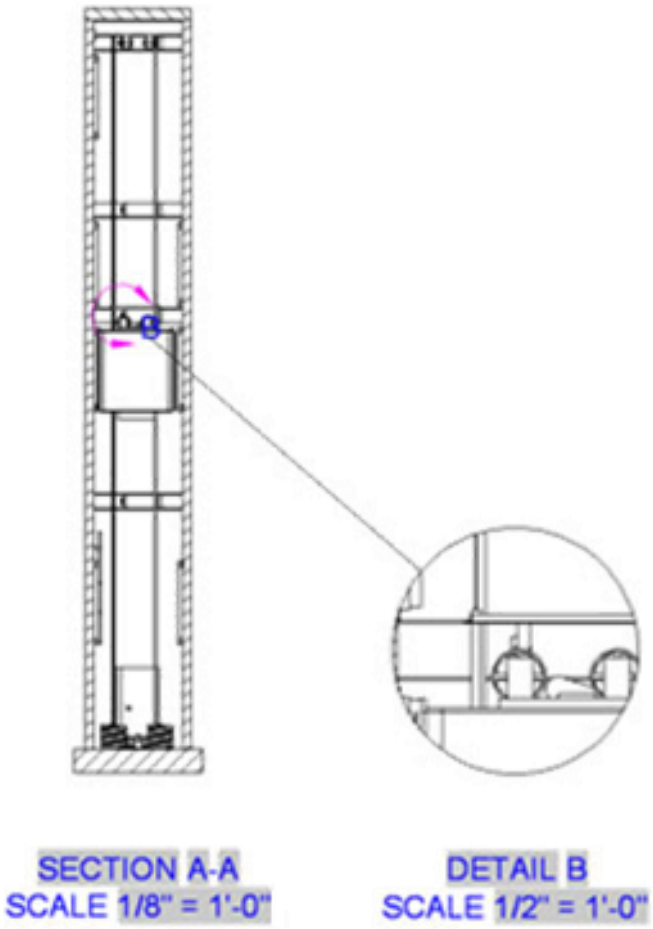
These views are accompanied by another view which indicates where the cut has been made (AA in this example).



MECH2003: Mechanical Design

Alternative Views

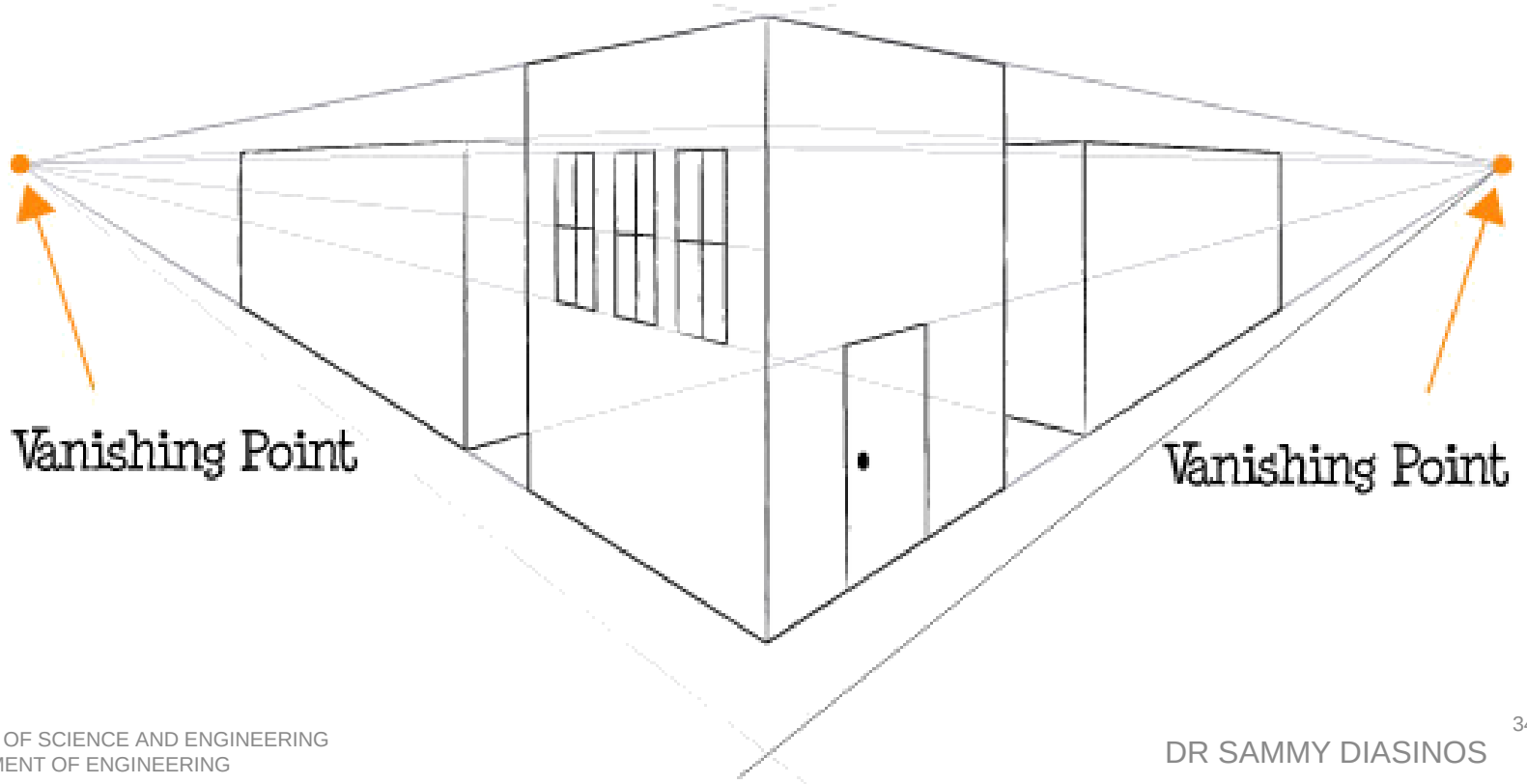
Detailed views provide additional information on a specific region of greater complexity while also providing an indication of the location of this feature in the overall component. These are useful in assembly and individual component drawings.



MECH2003: Mechanical Design

Alternative Views

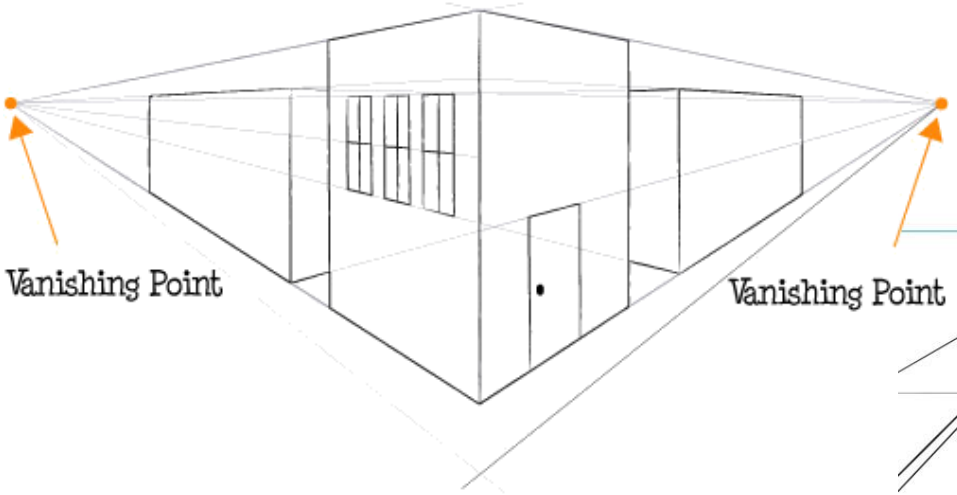
Perspective views provide a realistic three dimensional view which provides a feeling of depth due to the use of vanishing points. They are more commonly found in architecture.



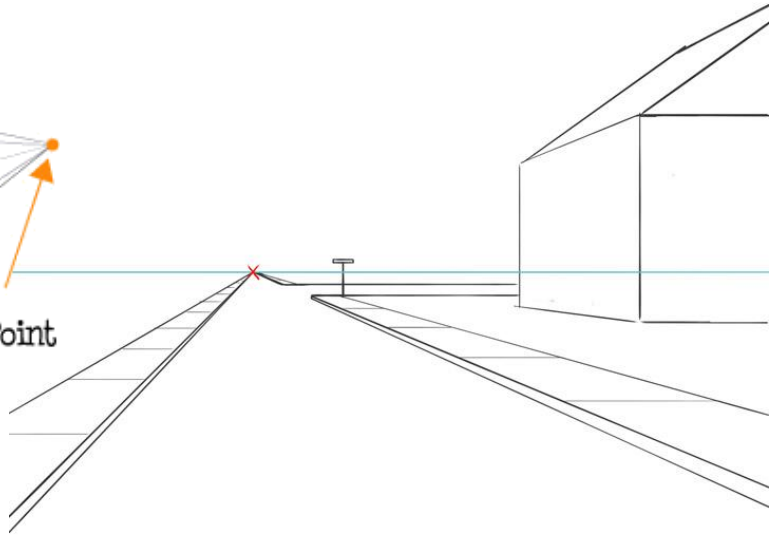
MECH2003: Mechanical Design

Alternative Views

They can be either twin vanishing points or single vanishing point depending on the number of points that the lines converge too.



Twin Vanishing Point

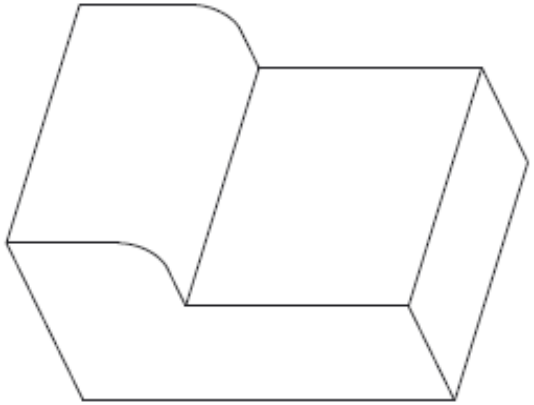


Single Vanishing Point

MECH2003: Mechanical Design

Alternative Views

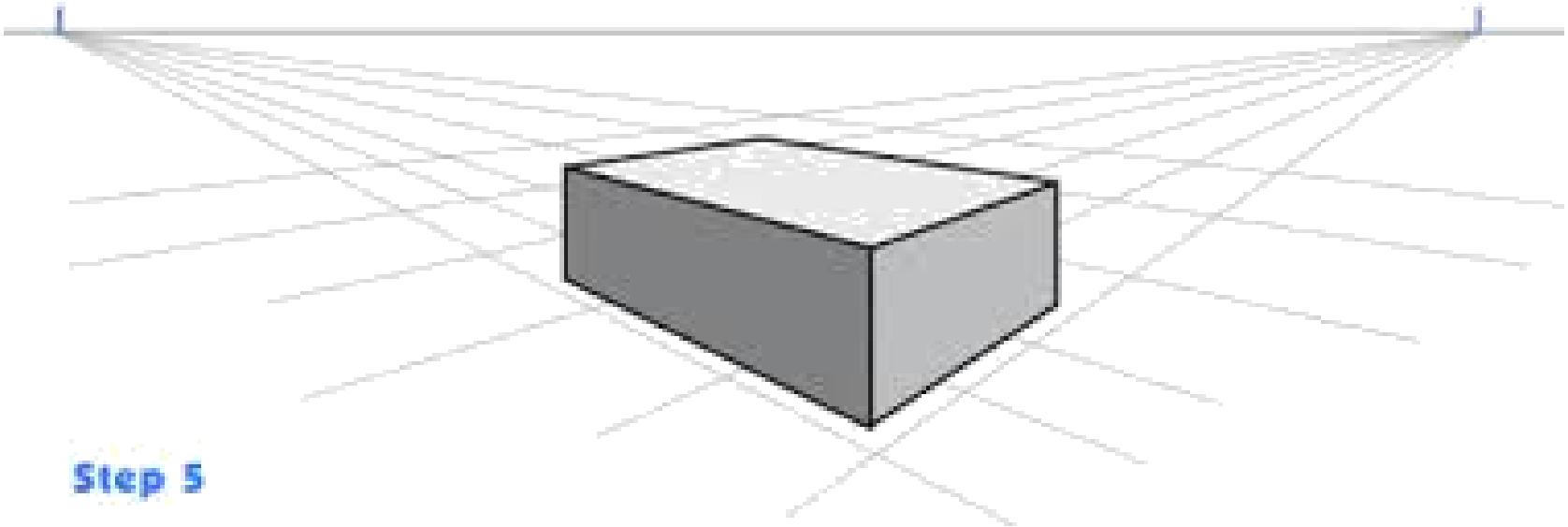
Isometric views also provide a three dimensional view without the use of vanishing points. They are often added to a manufacturing drawing to aid the understanding of the component being depicted in the orthogonal views.



MECH2003: Mechanical Design

Alternative Views

Example 2: describe the type of view below:



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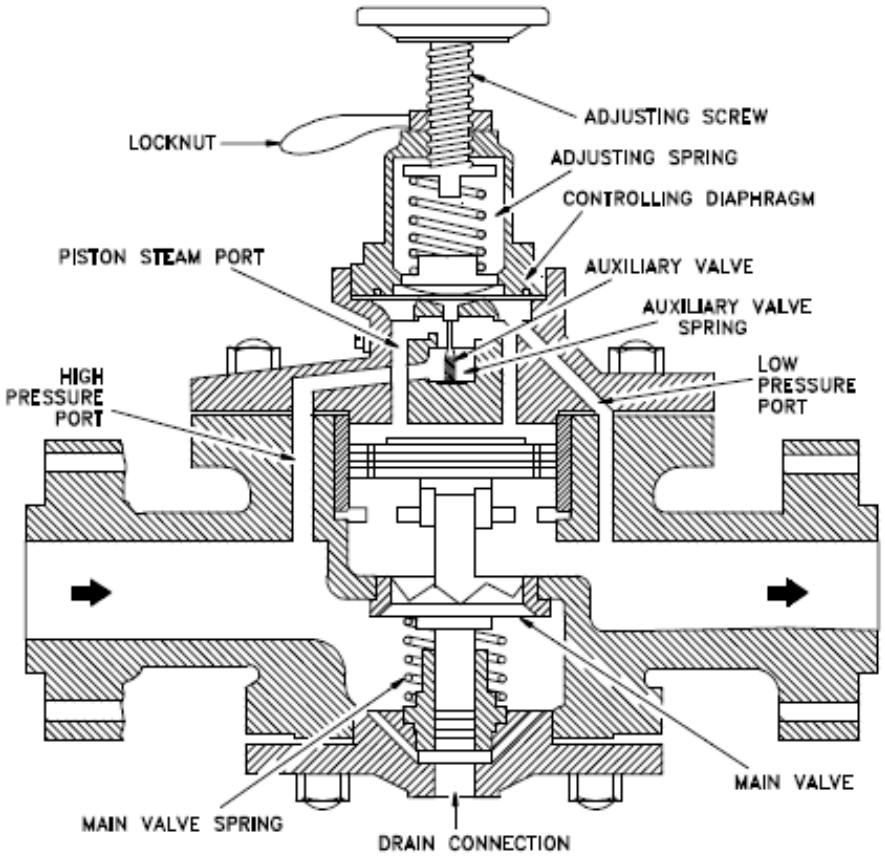
Alternative Views

Example 3: describe the type of view below:



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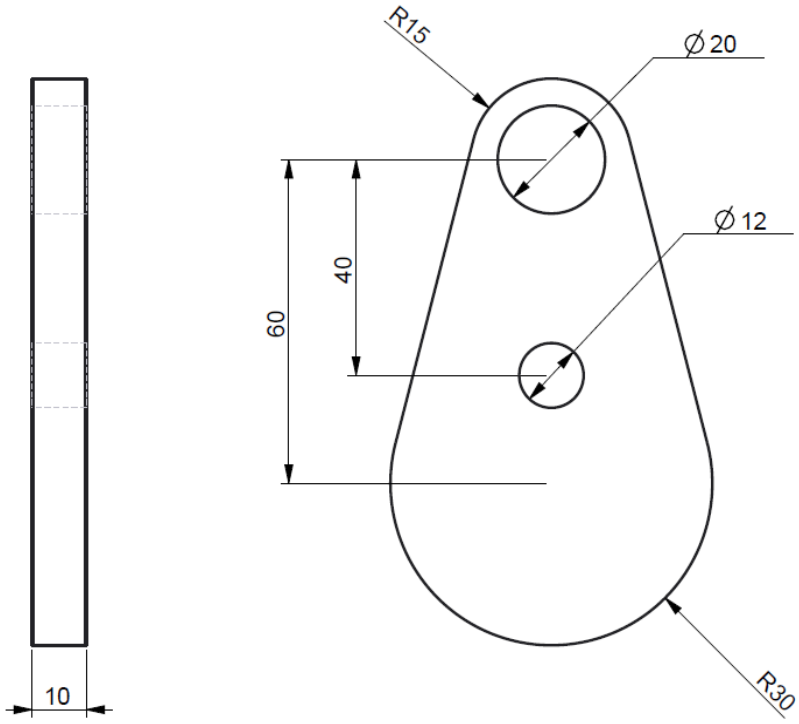
Alternative Views

Example 4: Describe the type of view shown below:



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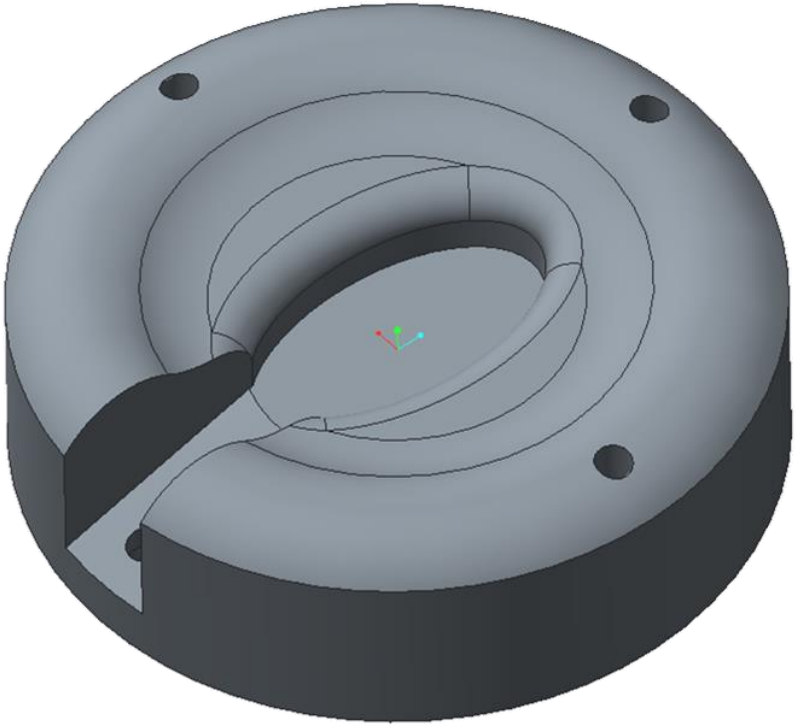
Alternative Views

Example 5: Describe the type of view shown below:



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What do different types of lines mean?

Different types of lines are used to depict different details in a drawing. These may be:

- Visible edge
- Hidden edge
- Tangents or
- Centre lines
- Dimensions

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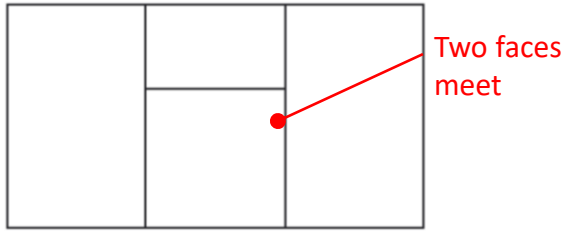
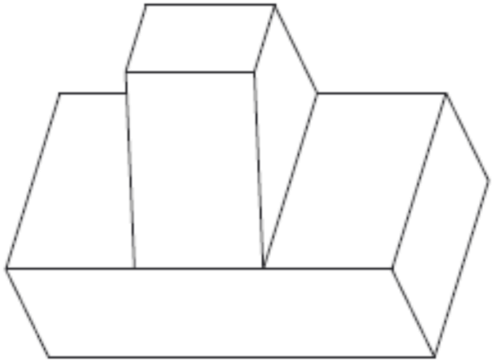
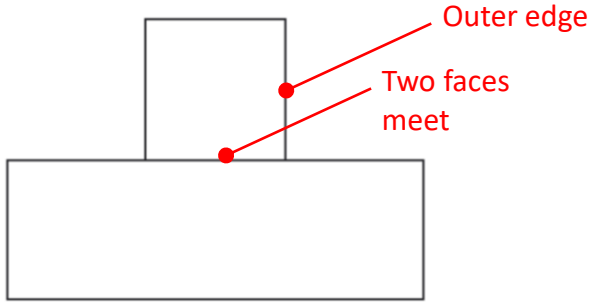
What do different types of lines mean?

Visible edges are where two faces meet that can be seen from the orientation being viewed, or the outline of a component. Should use a heavy solid line.

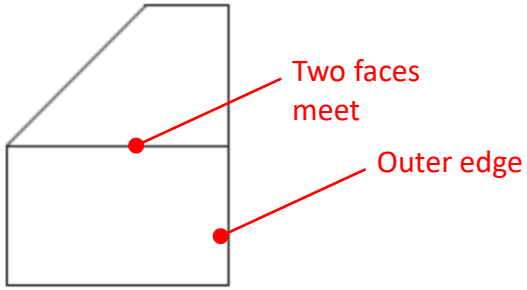


TOP VIEW





FRONT VIEW



RIGHT END VIEW

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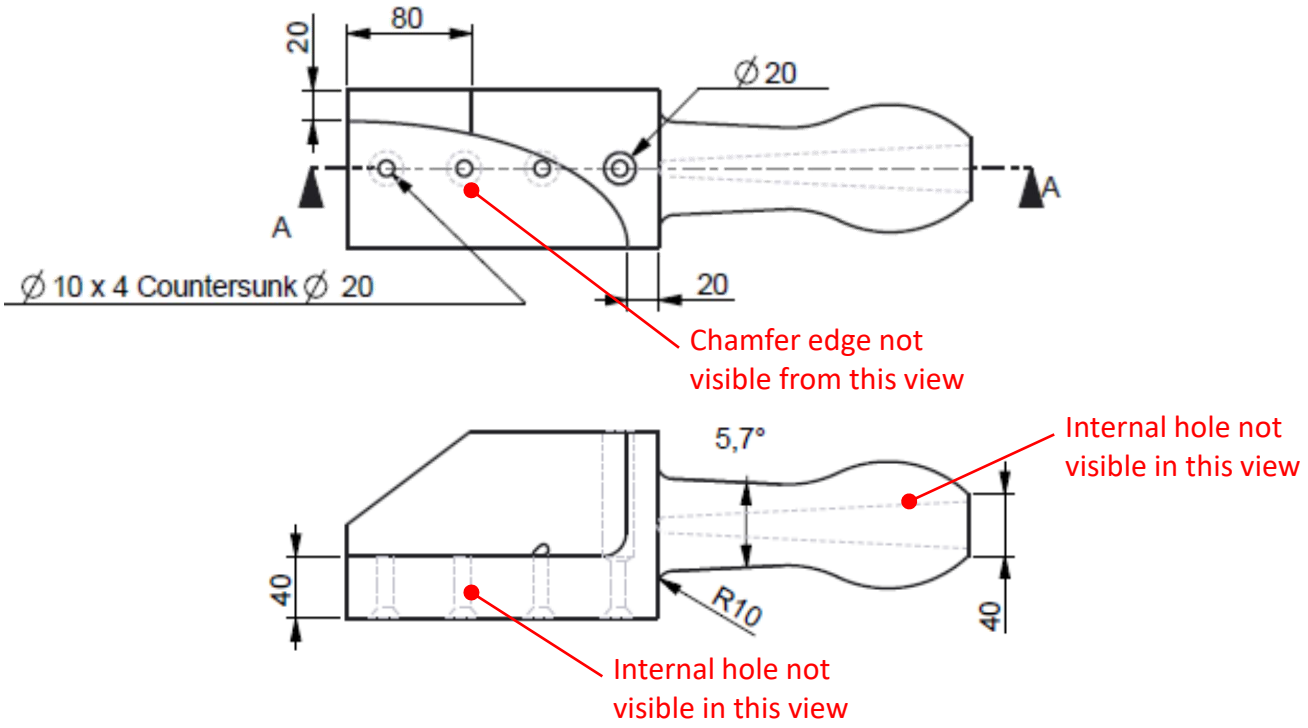
What do different types of lines mean?

Hidden edges are where two faces meet that or the outline of a feature that both can not be seen from the orientation being viewed. Should use a heavy dashed line.



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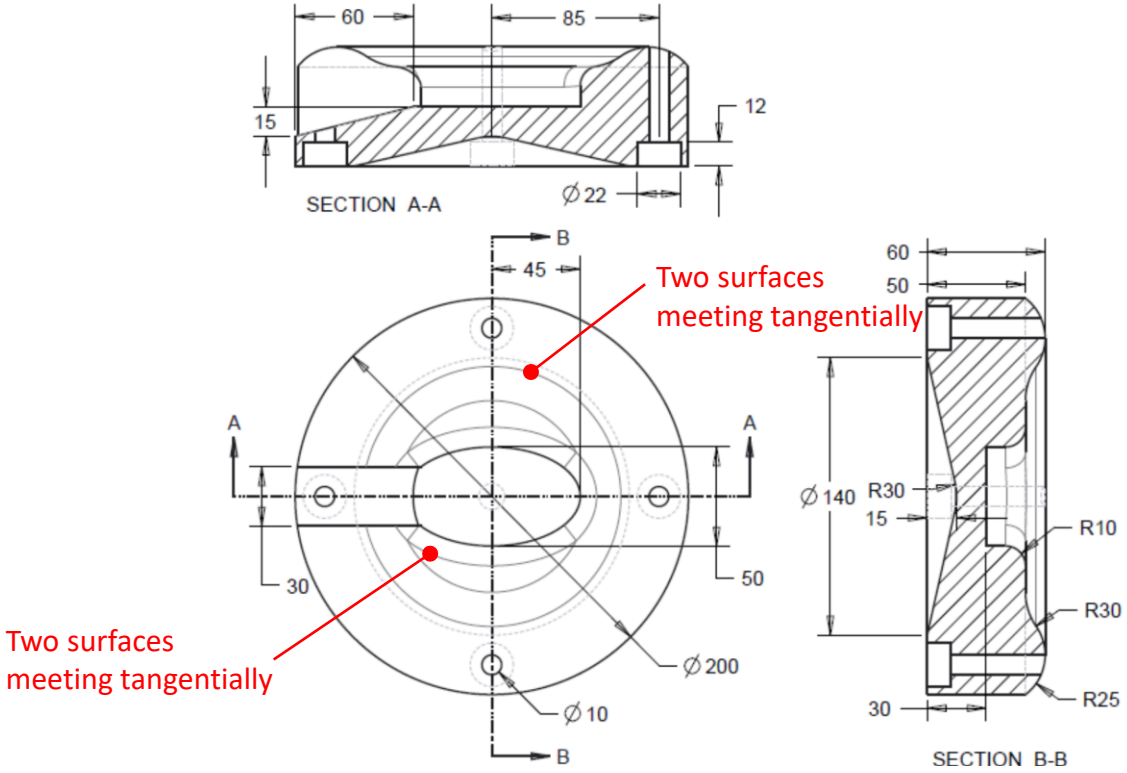
What do different types of lines mean?

Tangents are where two faces meet without forming an edge. Should use a light solid line if required, better not to show at all.



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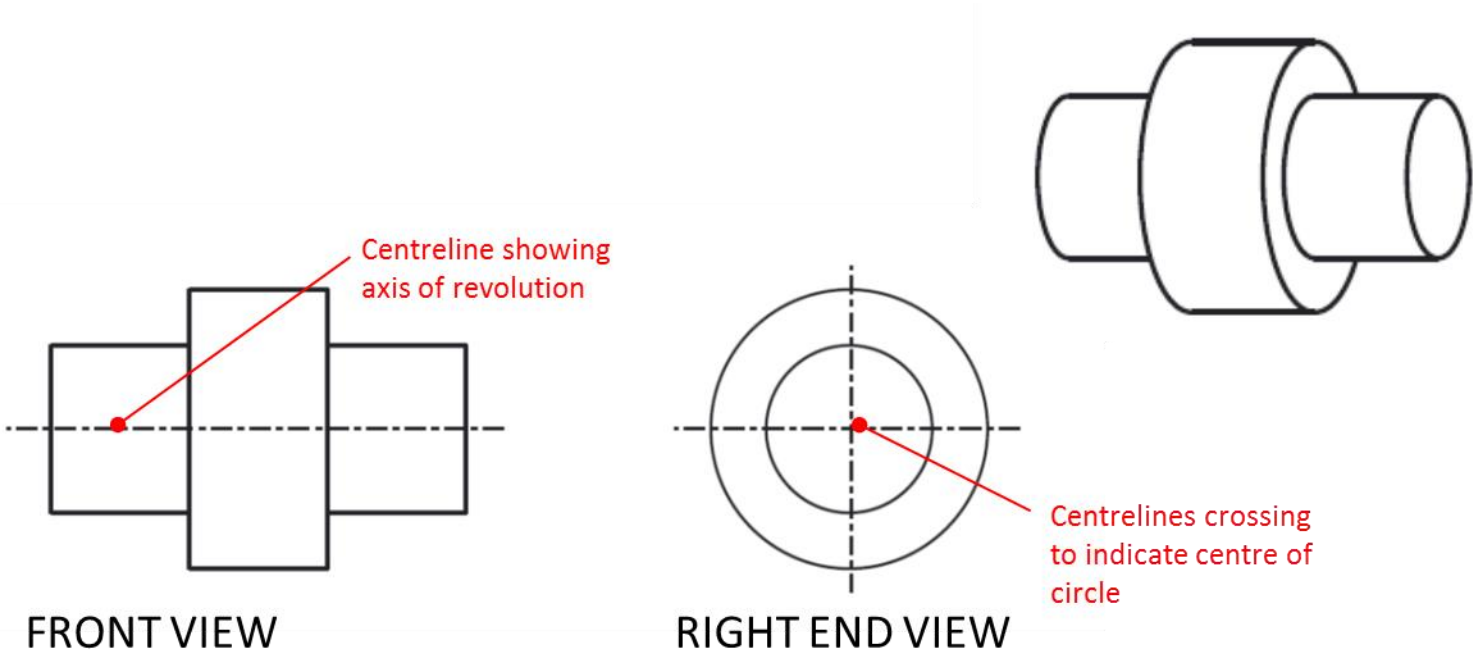
What do different types of lines mean?

Centerlines are lines that show the center of a hole or arc and the axis of a revolution . Should use light chain.



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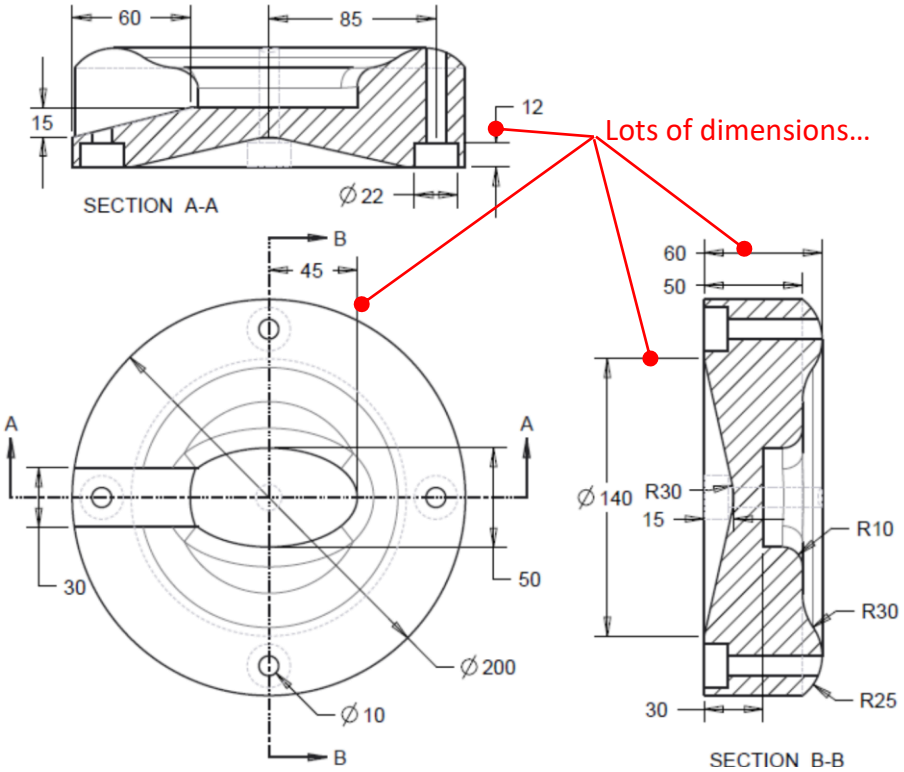
What do different types of lines mean?

Dimensions are lines and arrows used to describe the magnitude of a particular feature. Should use light solid lines and arrows.



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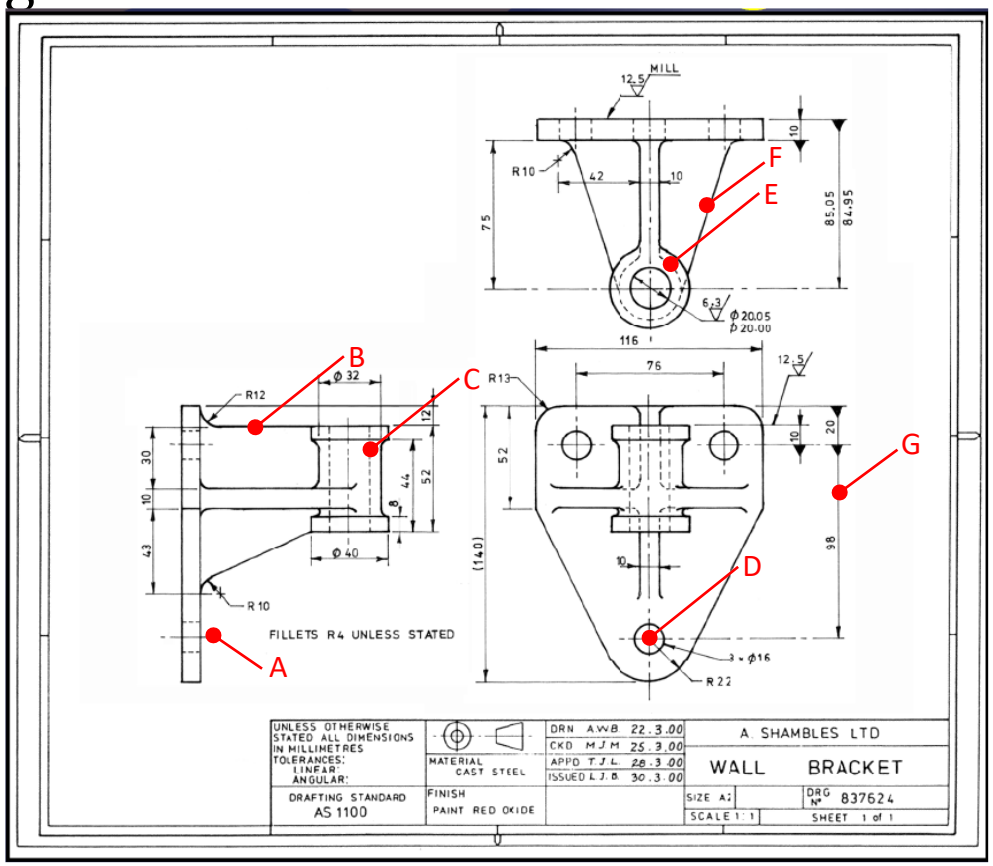
What do different types of lines mean?

Example 6: For each of the labels, determine what type of line is being shown.



Answers:

A) ?
B) ?
C) ?
D) ?
E) ?
F) ?
G) ?

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MACQUARIE University

Applying Dimensions

Different types of dimensions which include:

- Linear dimensions
- Angular dimensions
- Diameter and radii
- Tolerances

Care must be taken that critical dimensions are referenced appropriately and tolerances are applied.

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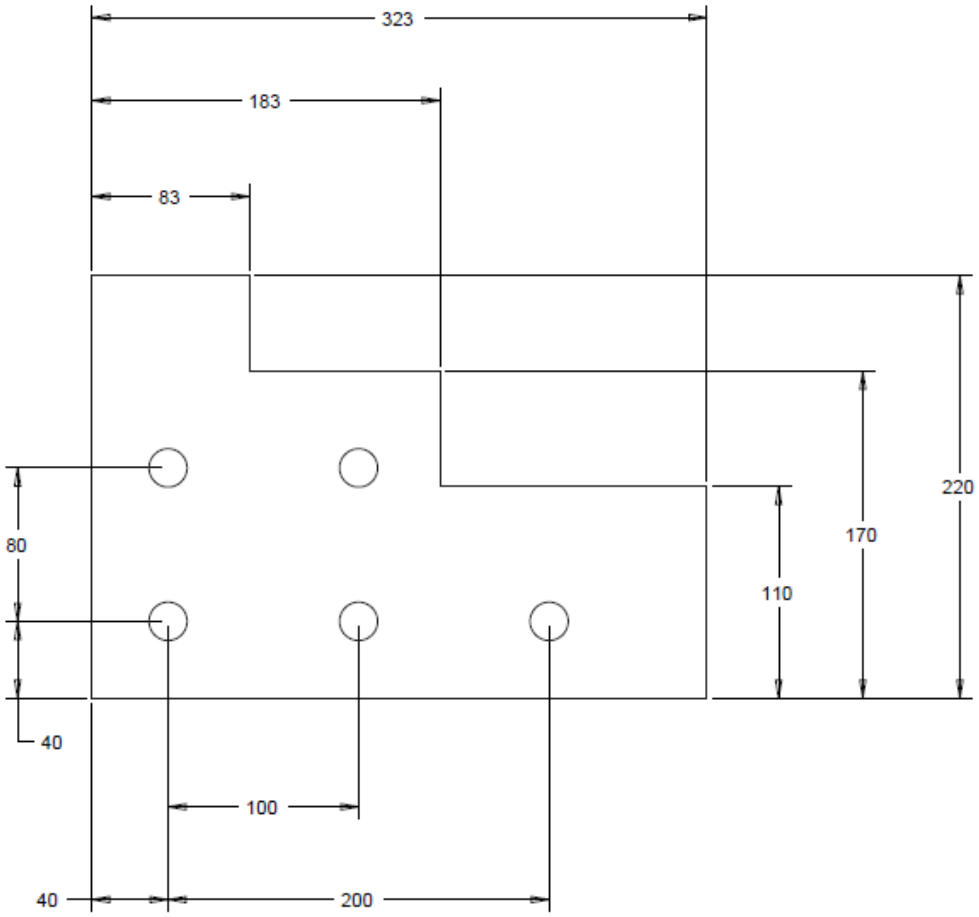
Applying Dimensions

Linear dimensions should be dimensioned to indicate the critical values. They should not overlap the part or dimension to hidden lines. Must also use a common reference where possible.



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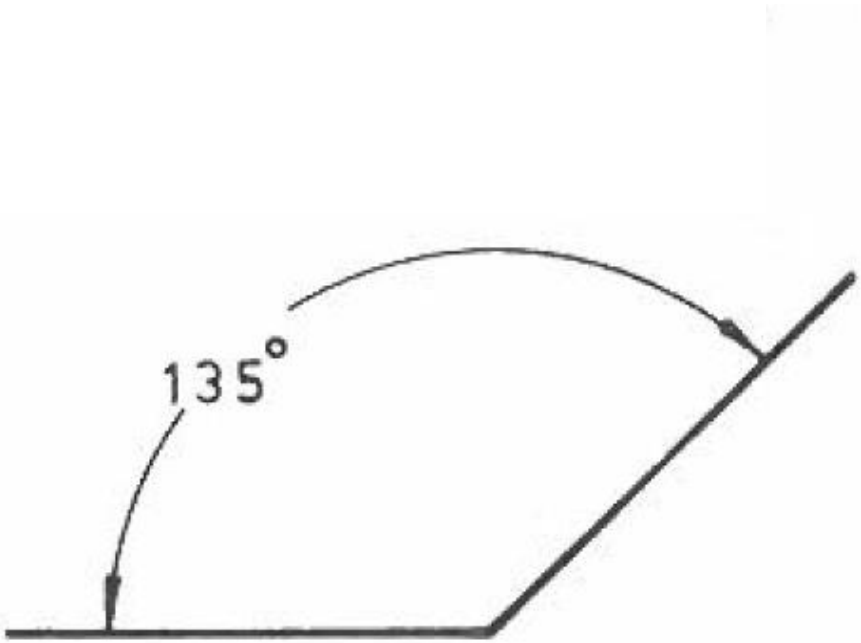
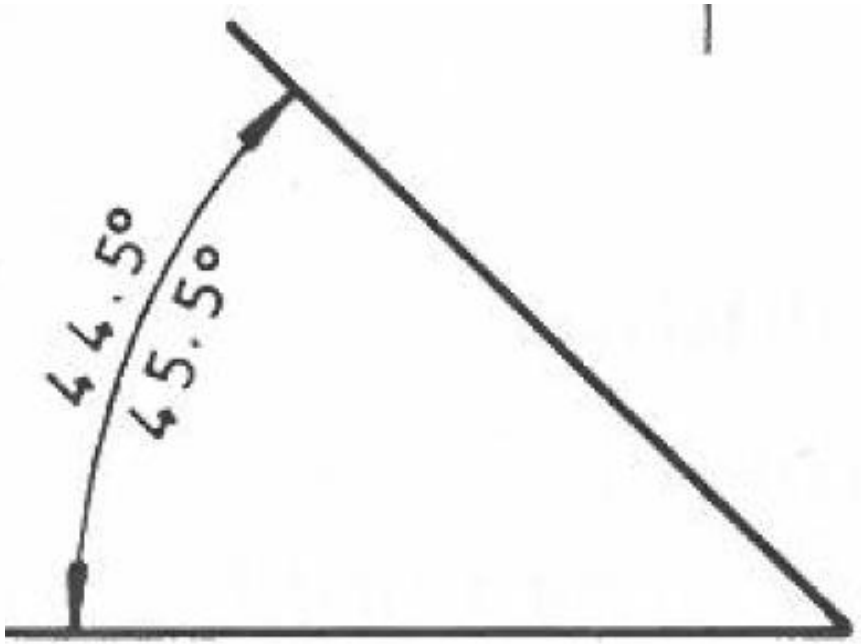
Applying Dimensions

Angular dimensions should be stated in degrees, minutes and seconds, the value should be adjacent to an arced arrow.





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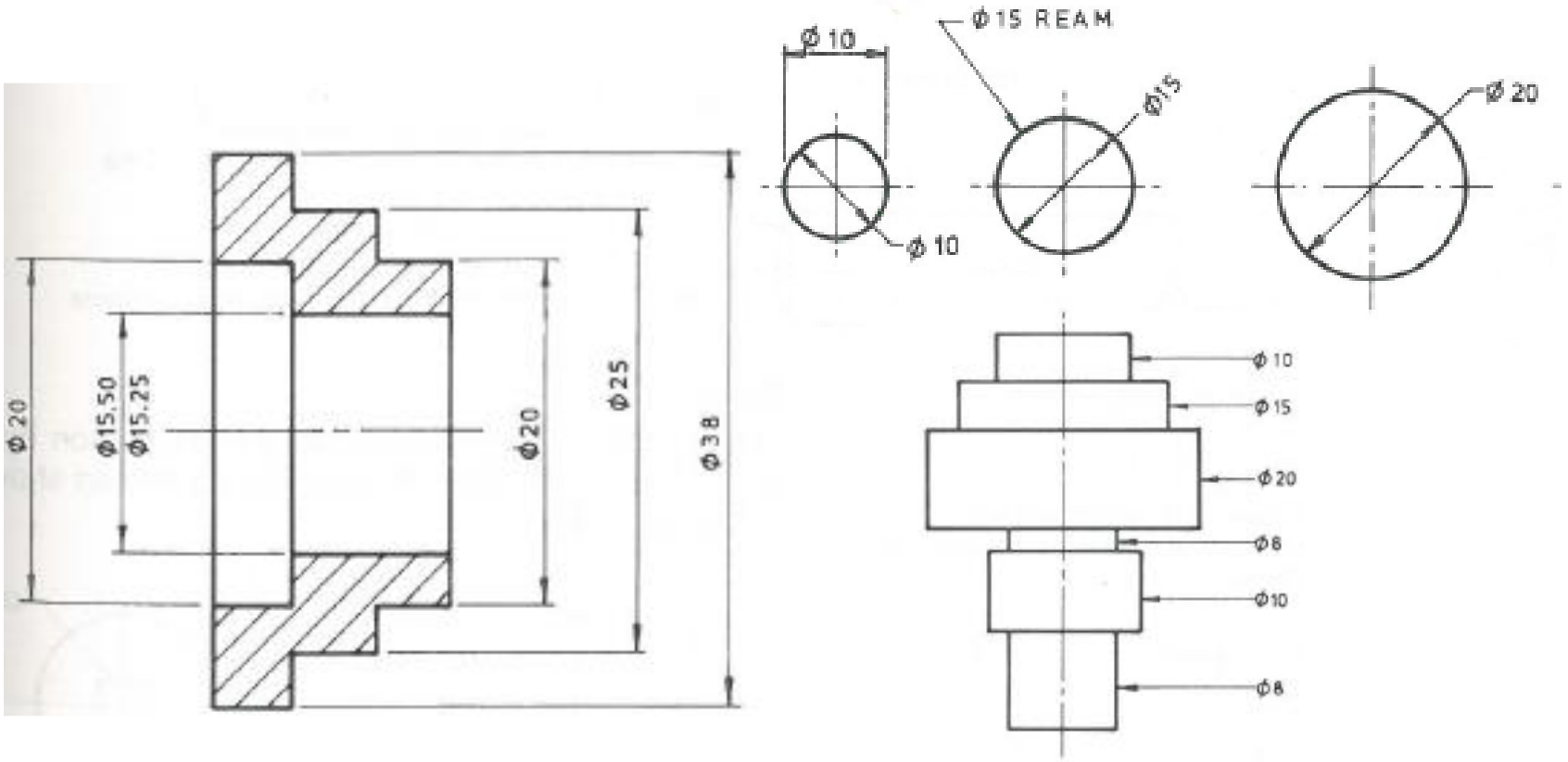
Applying Dimensions

Diameters should be used to dimensions a hole or cylinder. The value should have the diameter symbol (Ø) as a prefix.



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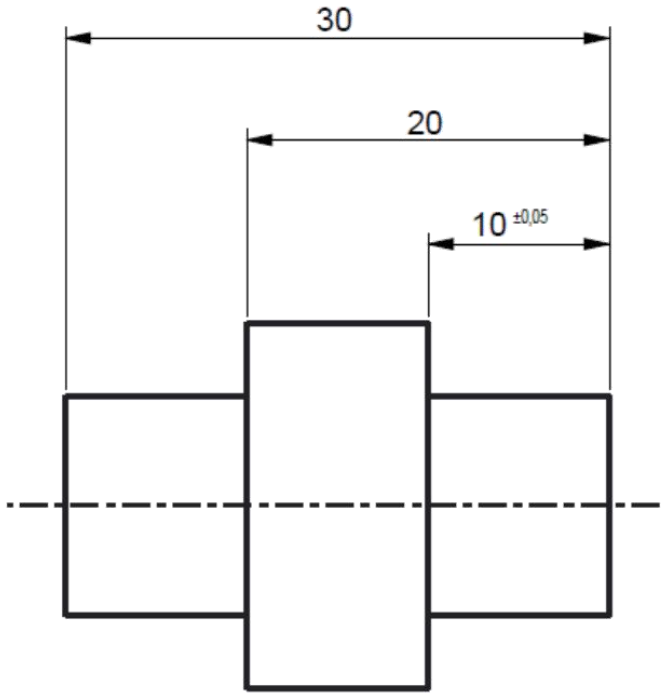
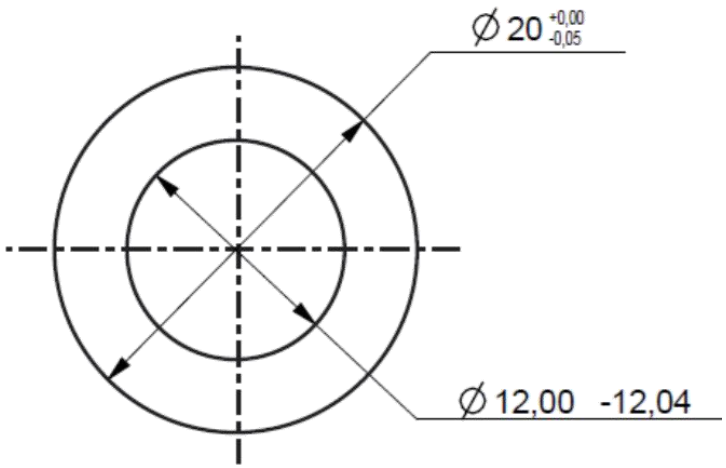
Applying Dimensions

Tolerances should be used to indicate the largest deviation acceptable only when specifically required.





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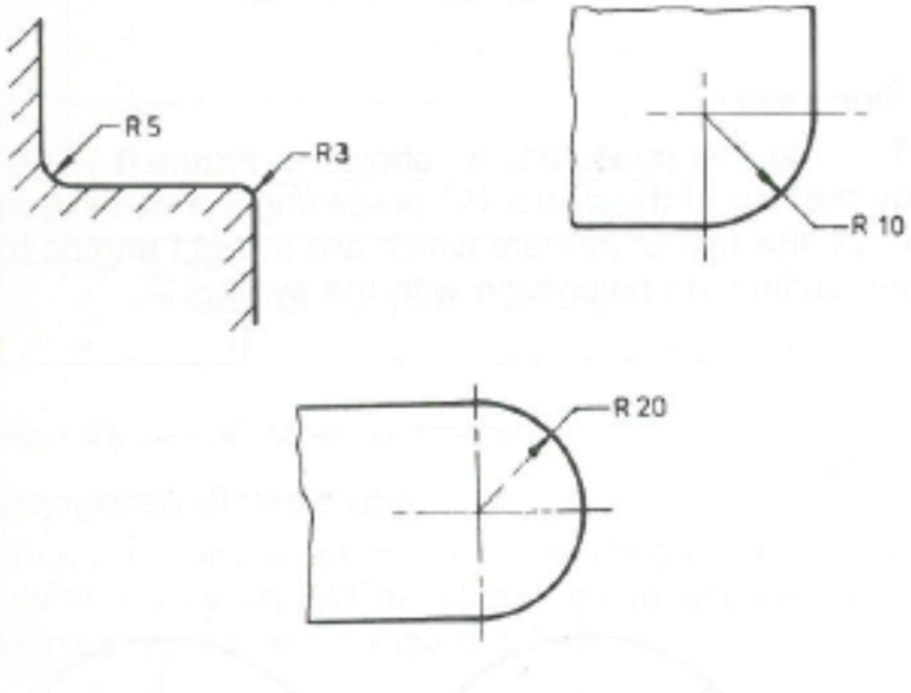
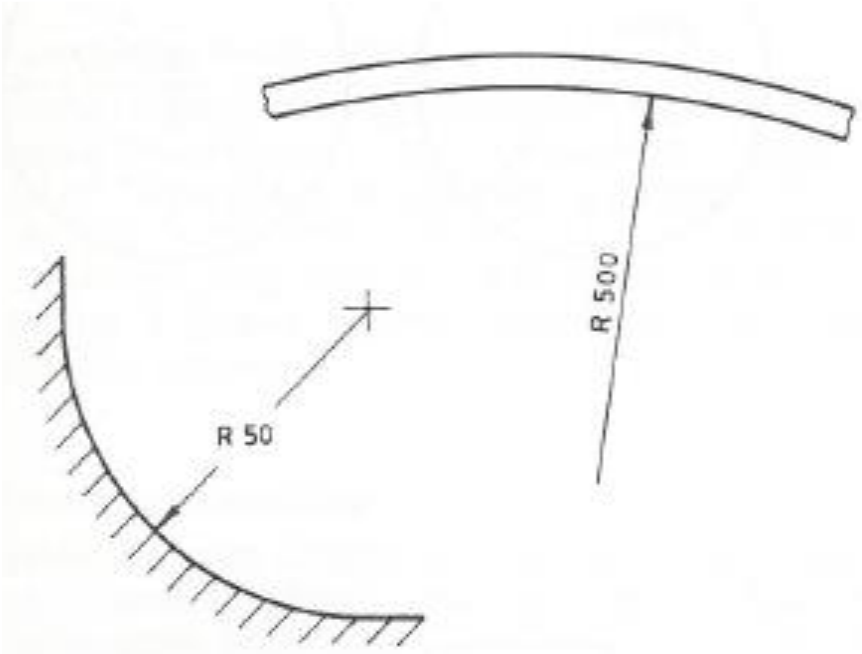
Applying Dimensions

Radii should be used to dimension an arc (not a complete circle like a hole) and should have a capital “R” as a prefix.



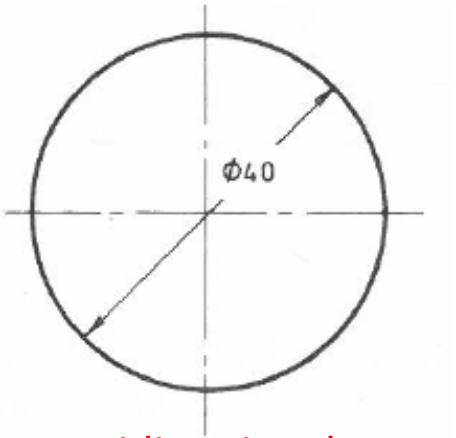


MECH2003: Mechanical Design

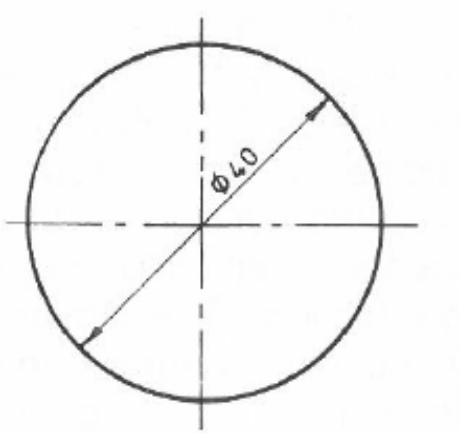
Applying Dimensions

Dimension values should all be written either :

- parallel to the bottom of the page (unidirectional)



Unidirectional



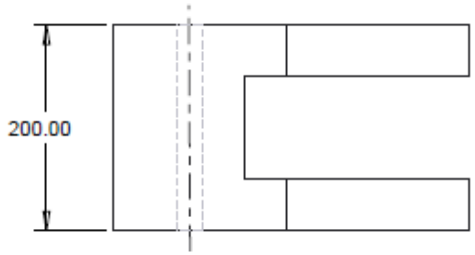
Aligned

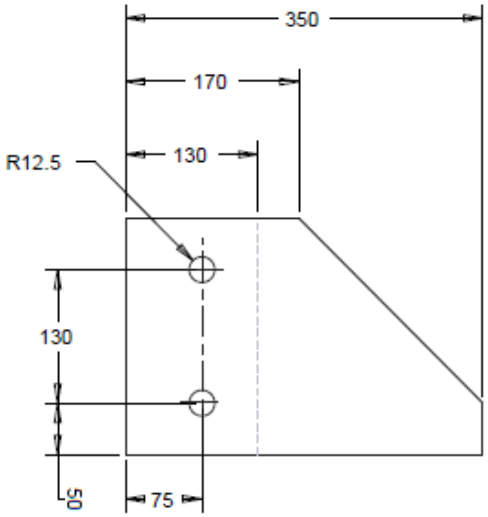
- parallel to each dimension that allows it to be readable from either the bottom or right of the page (aligned)

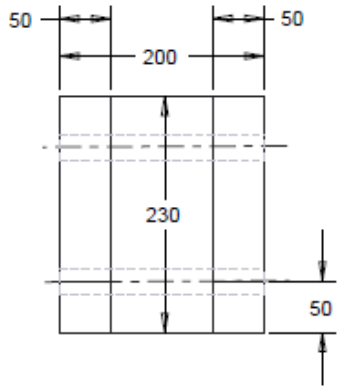
MECH2003: Mechanical Design

Applying Dimensions

Example 7: indicate the errors with the dimensioning.







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Information Contained in Drawing Block

What information should a drawing block contain:

- What standard is the drawing drawn too
- What projection has been used
- Name or title of drawing
- Drawing number and/or revision number
- Name of company or organisation
- Material intended to be used for manufacture
- Names of engineers responsible and date drawn or approved

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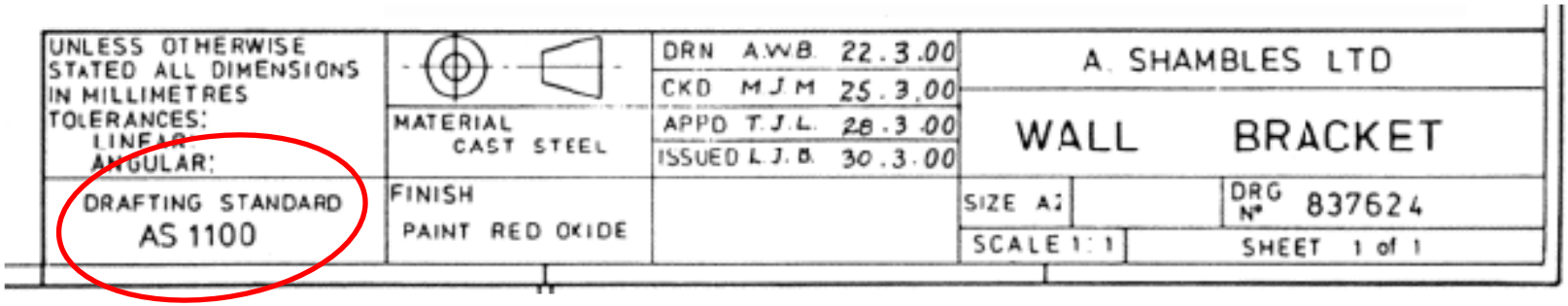
Information Contained in Drawing Block

The standard should all ways be AS1100 for any item engineered or manufactured within Australia.



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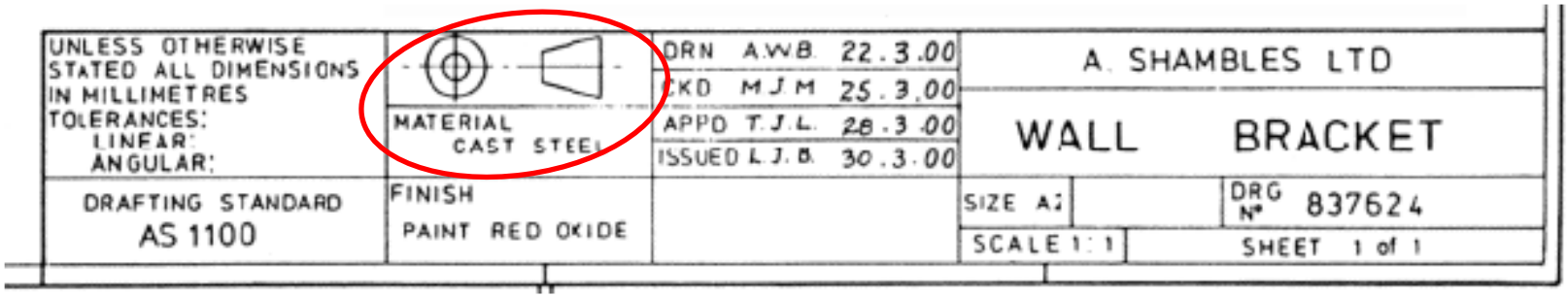
Information Contained in Drawing Block

Therefore the third hand projection symbol should also be visible.



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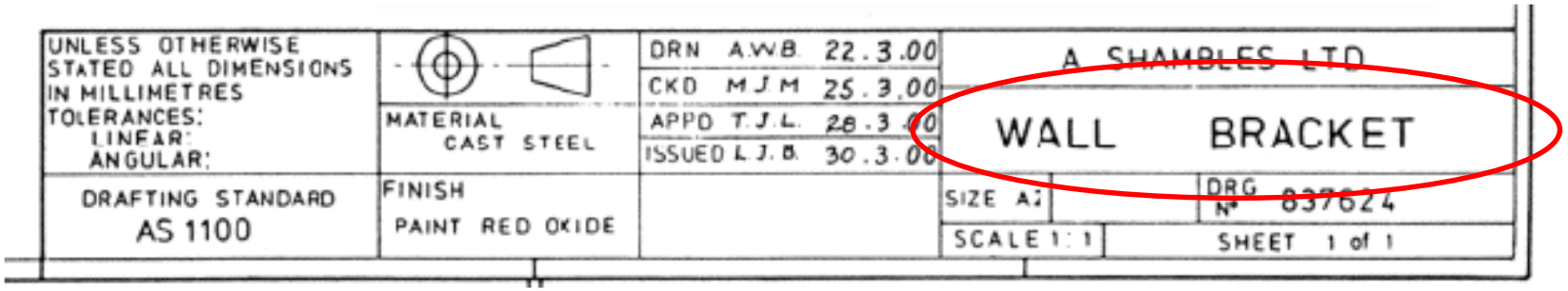
Information Contained in Drawing Block

A name or title that all involved with the project will understand should be included to describe the component.



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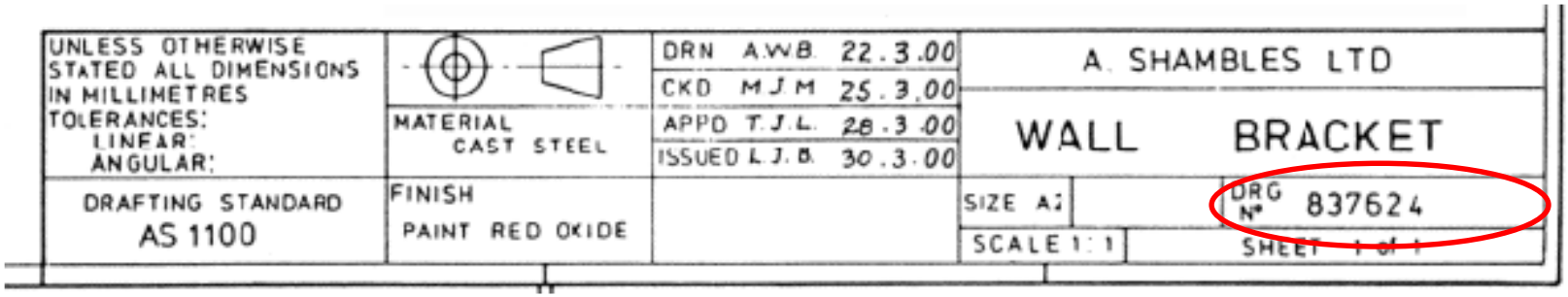
Information Contained in Drawing Block

A drawing number and revision number should be included for easy reference and to be aware of when modifications are made.



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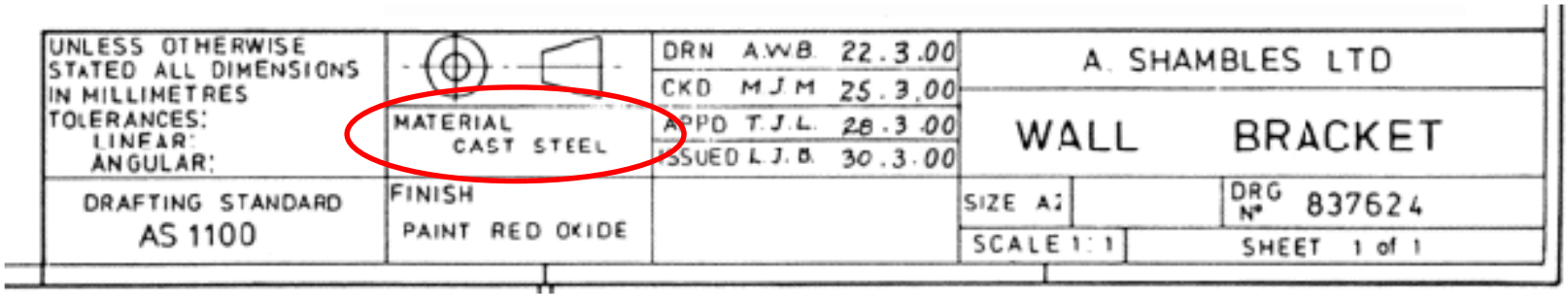
Information Contained in Drawing Block

The material that will be used to manufacture the component should also be provided.



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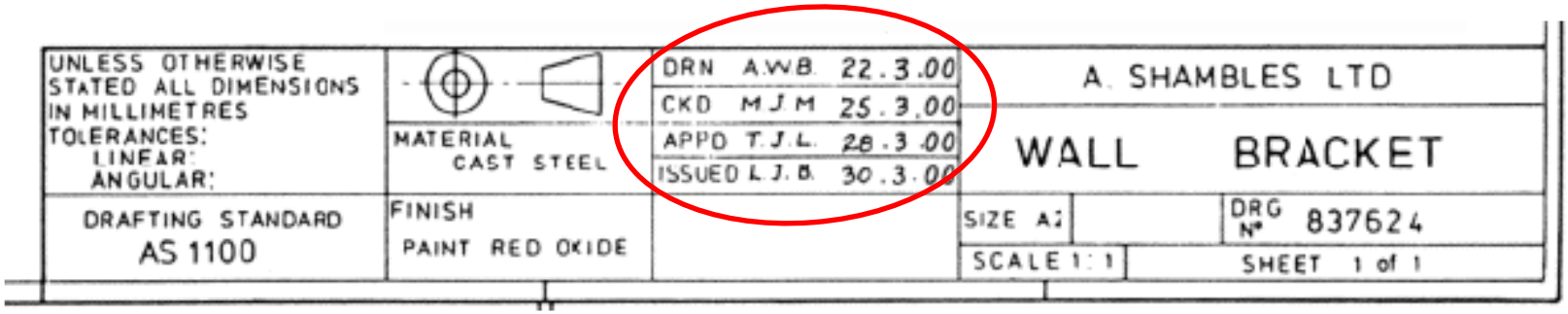
Information Contained in Drawing Block

The name of the engineers that have created and approved the drawing should also be included as well as the date that these steps were completed.



MECH2003: Mechanical Design

Information Contained in Drawing Block

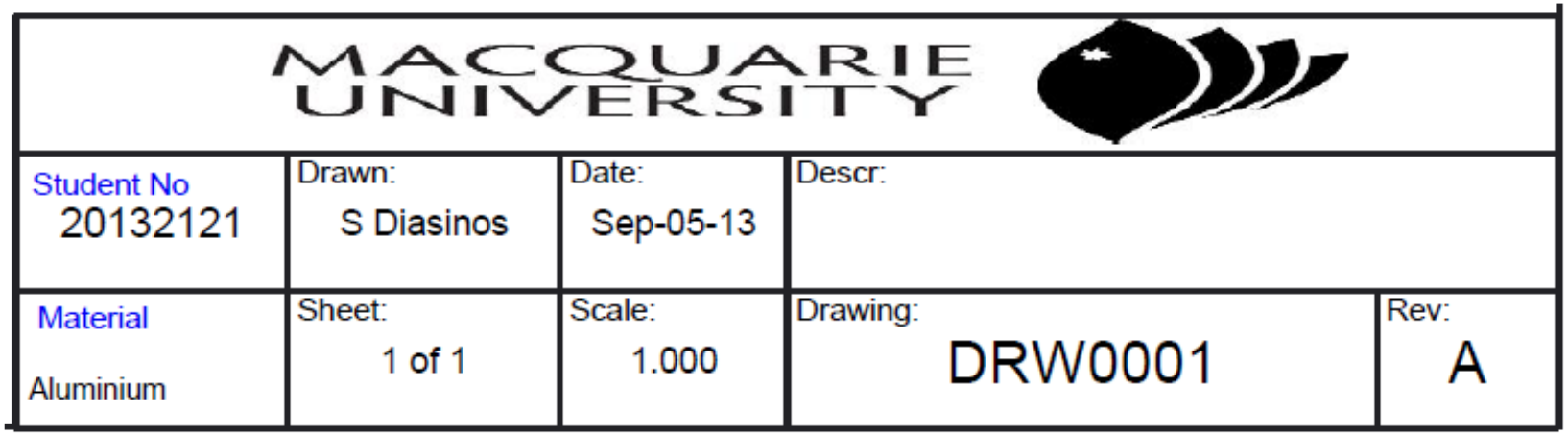
Example 8: currently we are developing a title block to use but it is incomplete. What items are missing from this title block?

MACQUARIE UNIVERSITY				
Student No 20132121	Drawn: S Diasinos	Date: Sep-05-13	Descr:	
Material Aluminium	Sheet: 1 of 1	Scale: 1.000	Drawing: DRW0001	Rev: A

MECH2003: Mechanical Design

Information Contained in Drawing Block

Example 8: currently we are developing a title block to use but it is incomplete. What items are missing from this title block?



Drafting standard
Indication of which projection used
No drawing name/description entered

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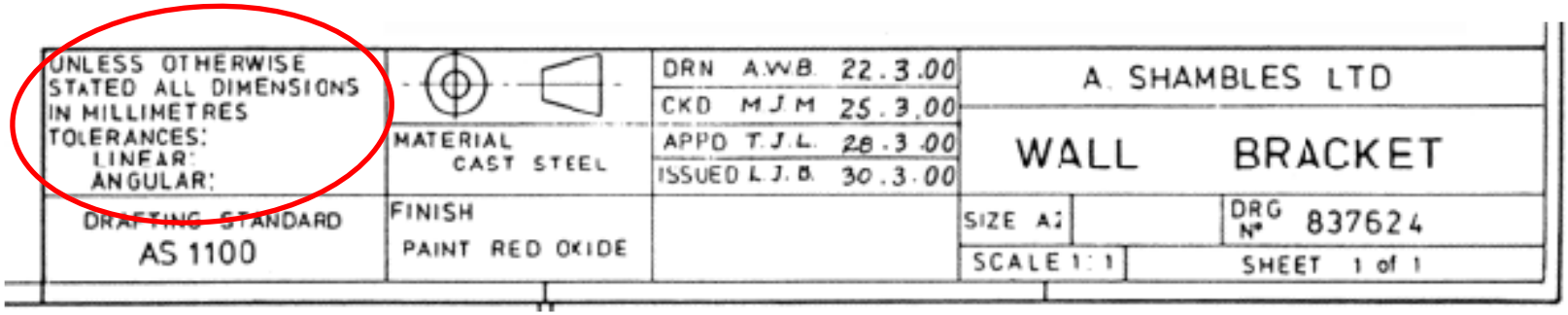
Miscellaneous features of drawings.

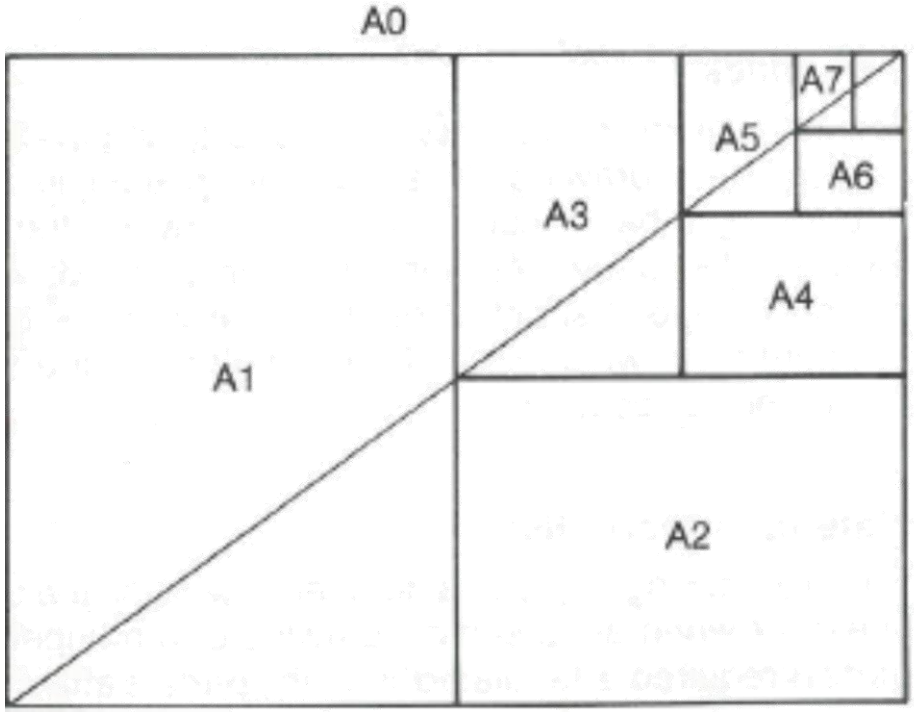
On the drawing it should be indicated what dimensions have been used and a general tolerance should also be provided.



MECH2003: Mechanical Design

Miscellaneous features of drawings.

Sheet size should be selected so that there is adequate space for the necessary views and dimensions to be all aesthetically arranged.



MECH2003: Mechanical Design

Miscellaneous features of drawings.

Similarly the scale should be selected from the following to best utilize the sheet size.

For enlargement: 2:1, 5:1, 10:1, 20:1, 50:1

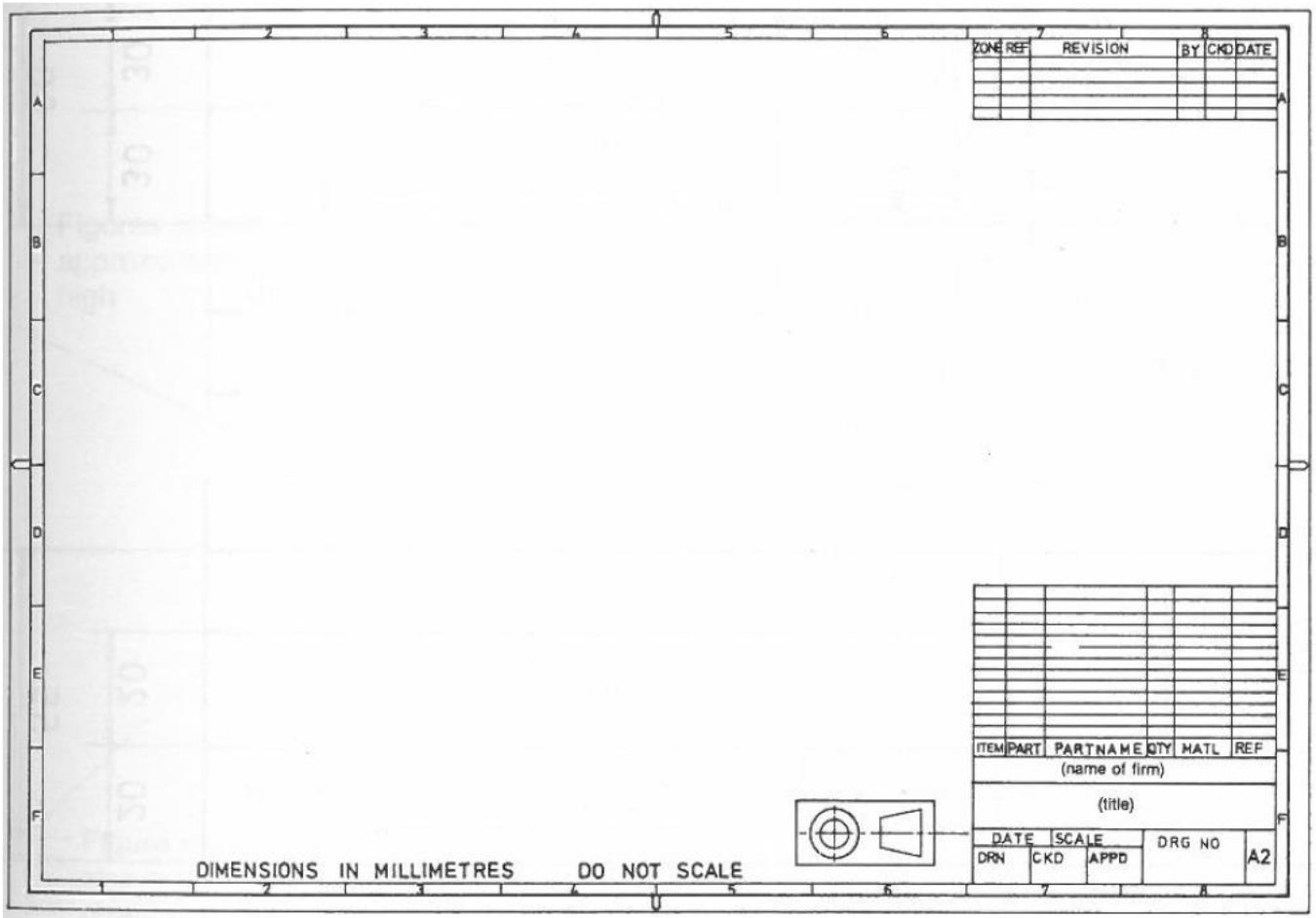
Full size: 1:1

For reduction: 1:2, 1:2.5, 1:5, 1:10, 1:20, 1:50, 1:100, 1:200, 1:500, 1:1000, 1:2000, 1:5000, 1:10000

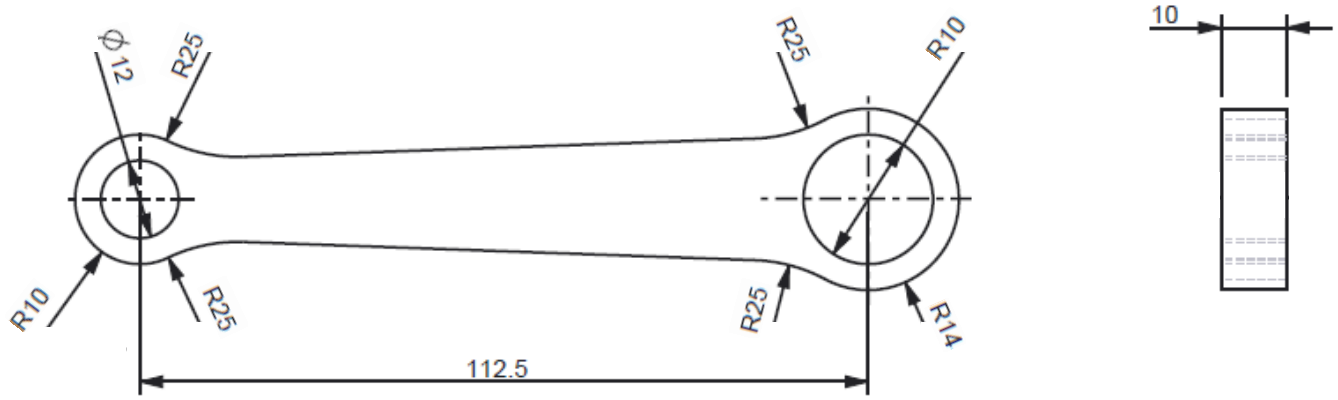
MECH2003: Mechanical Design

Miscellaneous features of drawings.

Zonal reference included within the border.

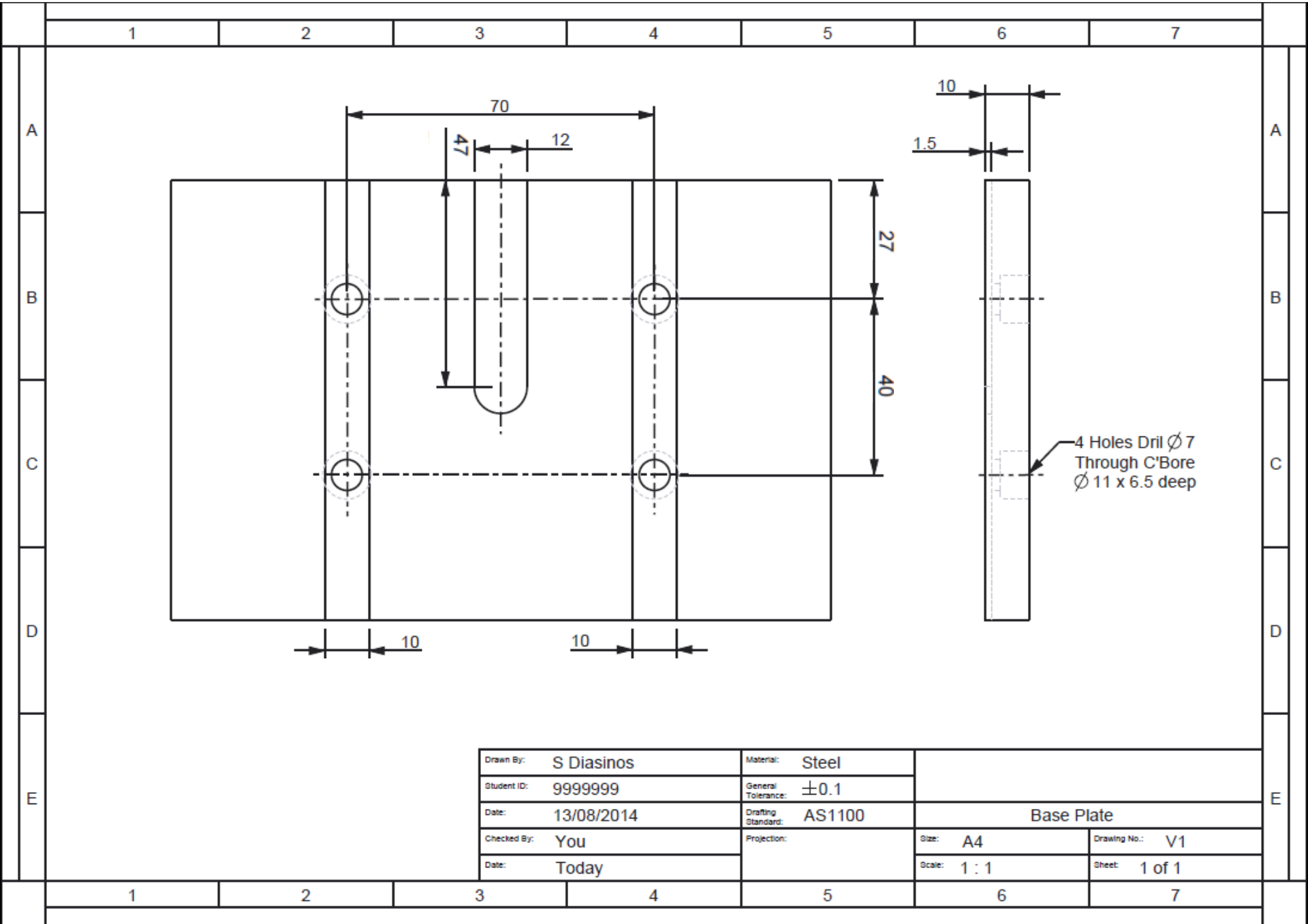


Example 9: with at least 6 errors



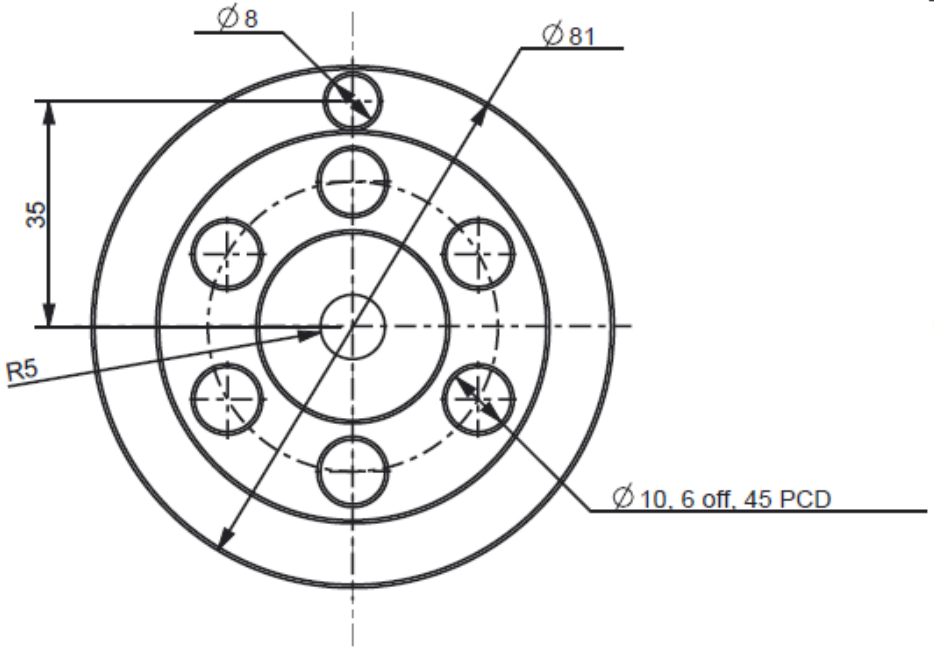
Material:	Aluminium	MACQUARIE UNIVERSITY	
General Tolerance:	±0.1		
Drafting Standard:	AS1100	Conrod	
Projection:		Size: A4	Drawing No.: V1
		Scale: 1 : 1	Sheet: 1 of 1

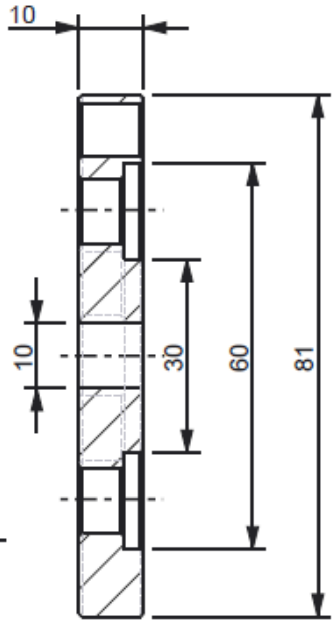
Example 10: with at least 5 errors



Example 11: with at least 6 errors

All edges 0.5 chamfer





SECTION A-A

Drawn By:	S Diasinos	Material:	Cast Iron	MACQUARIE UNIVERSITY	
Student ID:	9999999	General Tolerance:	±0.1		
Date:	13/08/2014	Drafting Standard:	AS1100	Handle	
Checked By:	You	Projection:		Size: A4	Drawing No.: V1
Date:	Today			Scale: 1 : 1	Sheet: 1 of 1