

## Fundamentals of Drafting - Orthographic Projection with Sectional Views

### Objectives:



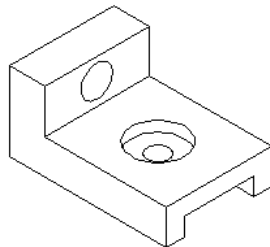
1. To extend the principle of orthographic projection for sectional views.
2. To illustrate the principle of sectioning.
3. To be aware of the basic conventions for sections and representing areas on sections outlined in BS ISO 128-40 and BS ISO 128-50.
4. To draw sectional views in orthographic projection.

### Principle of sectioning

An object is imaged to be cut along a cutting plane. The cut portion nearer to the observer is removed. This exposes the interior detail which can then be shown as visible outlines instead of hidden lines. The resulting view is called a **sectional view** or a **section**.

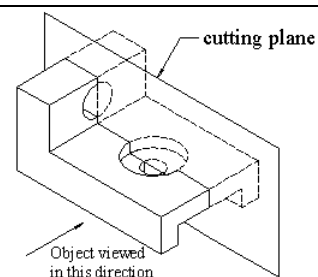
Example:

The object

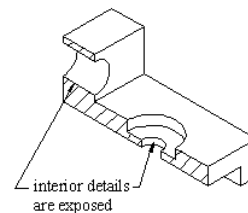


Illustrating the principle

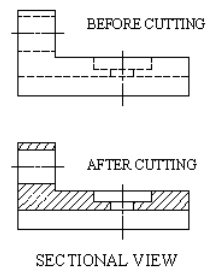
i) the cutting plane



ii) removing the portion between the observer and the cutting plane



iii) the resulting sectional view



### General speaking,

- i) **a section** an element slice which shows only what appears on the cutting plane
- ii) **a sectional view** the resulting view at a cutting plane which includes all visible outlines situated beyond that selected cutting plane when seen in the direction of viewing
- iii) **drawing practice** sectional views are commonly referred to as sections and these two terms are used indiscriminately

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### Use of sectional views

Objects with more complicated interior detail are usually drawn in sections in orthographic projection. Sectional views are usually drawn to

- i) clarify interior construction
- ii) illustrate internal features
- iii) eliminate the use of hidden lines
- iv) facilitate dimensioning of internal features
- v) show the shape of cross-section
- vi) show the relative position of individual component in an assembly

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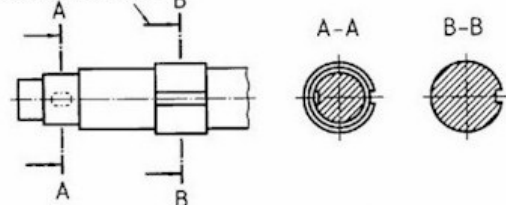
### Cutting plane

**Definition** An imaginary plane along which the object is cut and it is assumed that the parts between the observer and the plane are to be removed.

#### Indication

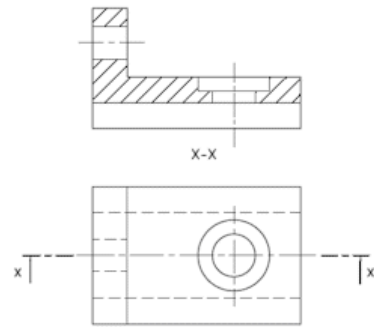
Type: long-dash dotted line (wide)  
Line width: 0.7 mm

position of cutting plane

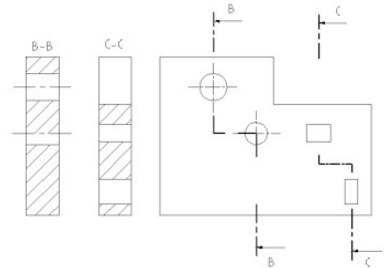


- i) Each section shall be given clear identification with twice the same capital letter, once at each of the reference arrows indicating the direction of viewing for the relevant section, at the end of the cutting line. This identification should be positioned for reading from the bottom of the drawing.

- ii) The position of the **cutting plane** shall be indicated by means of a long-dashed dotted wide line (cutting line). A straight cutting plane will be drawn to a suitable length for legibility.



- iii) If the **cutting plane** changes its direction, the cutting line should only be drawn at the ends of the cutting plane, where the cutting plane changes direction.



- iv) The cutting line may be drawn to its full length if necessary for its legibility.

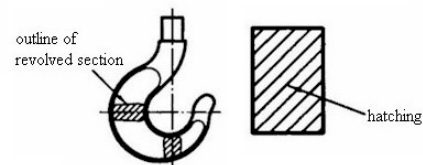
### Hatching

Hatching or **section lines** are drawn on the cut surface produced by a cutting plane to distinguish from an outside view.

#### General rules

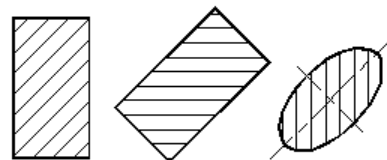
**Type of line** narrow continuous line

Type: continuous (narrow)  
 Line width: 0.35 mm



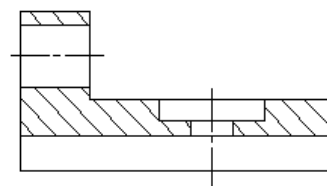
#### Indication

- i) drawn equally spaced at a well defined angle, usually 45 degrees to the principal outlines, to avoid clashing with outlines

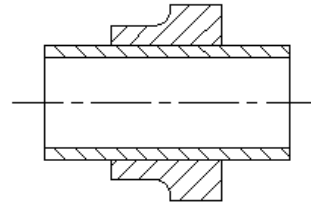


- ii) spacing should be proportional to the size of the hatched area, preferably not less than 4 mm

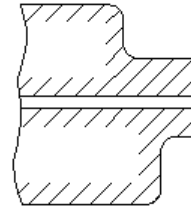
- iii) separated areas of a section of the same component should be hatched in the same manner



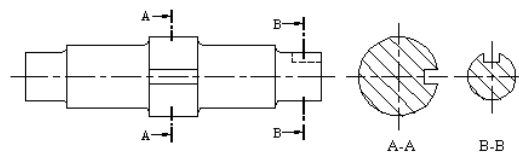
- iv) hatching of adjacent components should be drawn with different directions or spacing



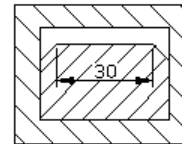
- v) hatching of a large area may be limited to a zone following the contour of the hatched area



- vi) hatching of sections of the same component in different planes should be identical



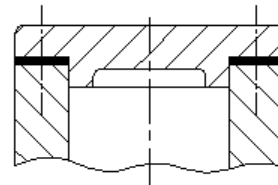
- vii) hatching should be interrupted for unavoidable dimensions, letters, etc. on a hatched area



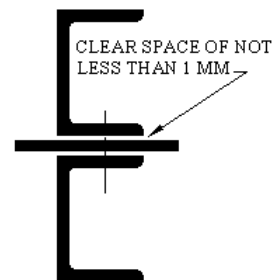
### Hatching on thin material

#### Indication

- i) thin material, such as sheet metal parts, gaskets, etc. in section may be shown filled in, in preference to showing the material thickness out of scale and hatched



- ii) allow a clear space of not less than 1 mm between adjacent thin details.

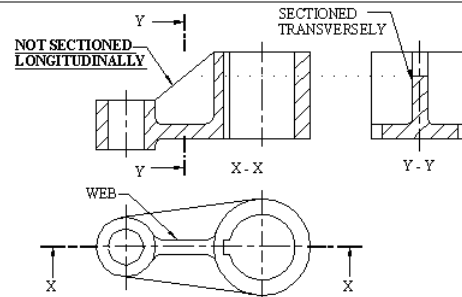


Exceptions to principle of sectioning

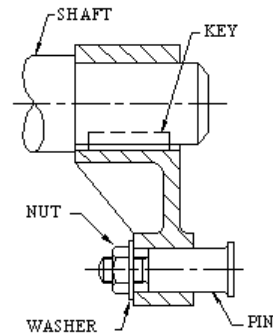
**General rules** Whenever hatching would result in a misleading effect, it should be omitted.

**Details** Features and parts in longitudinal section

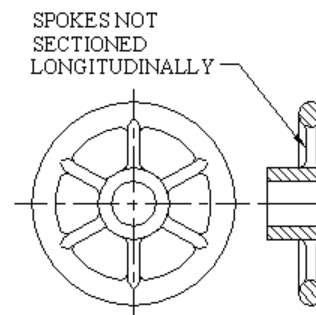
**not sectioned** i) ribs and webs



ii) fasteners and shafts



iii) spokes of wheels and the like

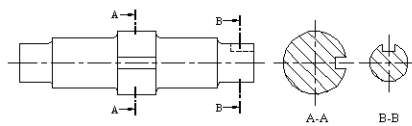


- Special notes**
- i) Fasteners and shafts may include nuts, bolts, screws, studs, rivets, solid shafts and small solid cylindrical parts, keys, cotters, split and taper pins, and ball and roller bearings.
  - ii) These items are not sectioned because they are more easily recognised by their outside views than by a section.
  - iii) When these items are cut transversely, resulting in a circular sectional view, they are hatched in the normal way.

### Types of sections

Type	Features
<u>Full section</u>	<ul style="list-style-type: none"> <li>i) the cutting plane passes completely through the object</li> <li>ii) all visible edges behind the plane must be shown</li> <li>iii) hidden detail lines are not shown on the view unless they are needed to describe the object completely</li> </ul>
<u>Half section</u>	<ul style="list-style-type: none"> <li>i) applicable to symmetrical objects, with one half drawn in section and the other half as an outside view</li> <li>ii) the halves of a half section are separated by a centre line</li> <li>iii) unless required for dimensioning, hidden detail can be omitted from the unsectioned half of the view</li> </ul>
<u>Local section</u>	<ul style="list-style-type: none"> <li>i) a part of a view in section to show the internal details of an object</li> <li>ii) the local break is shown by a continuous thin irregular line</li> </ul>
<u>Revolved section</u>	<ul style="list-style-type: none"> <li>i) the section is drawn on the outside view and used to show the shape of a symmetrical cross section, the cutting plane being revolved in position</li> <li>ii) the outline of a revolved section is a thin line and any outlines of the main view which are covered by the revolved section are not shown</li> </ul>
<u>Removed section</u>	<ul style="list-style-type: none"> <li>i) similar to revolved section but removed to another part of the drawing</li> <li>ii) the outline of a removed section is the normal thick line</li> <li>iii) the view is not subject to the rules of orthographic projection regarding to the position of the view</li> </ul>

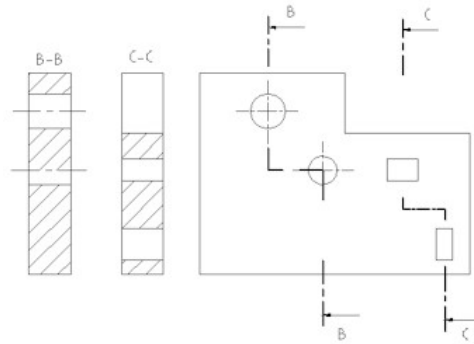
Successive removed sections



i) similar to removed section, but the sections should be arranged in sequence as may be convenient for the layout and understanding of the drawing

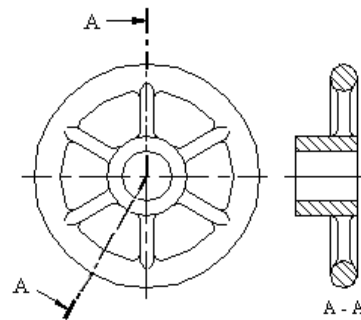
Other sections

i) section in parallel planes



(also known as off-set section)

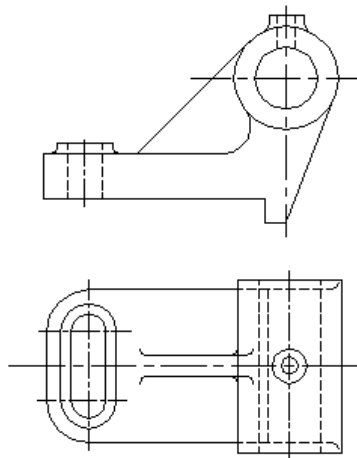
ii) section in intersecting planes



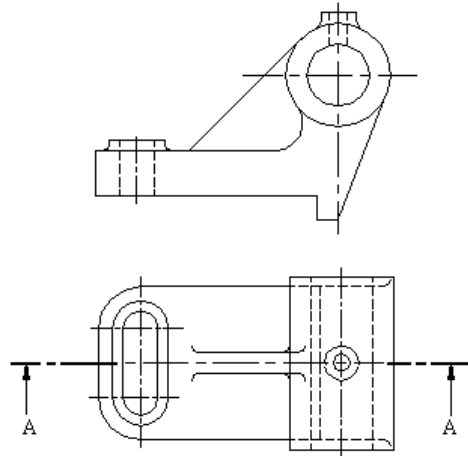
(also known as aligned section)

**Worked example**

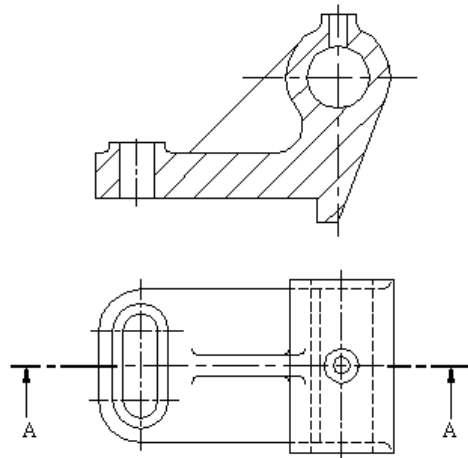
A bracket drawn in First Angle Projection



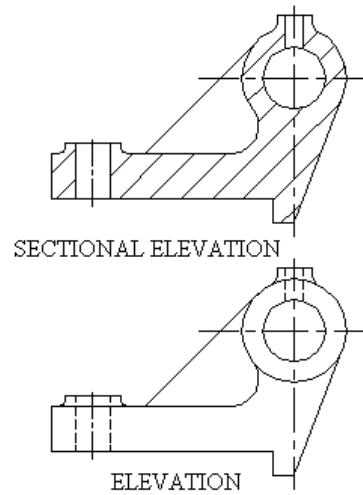
Defining a cutting plane



The sectional elevation on AA



Comparing the elevation before and after sectioning



- Points to note:**
- web not sectioned
  - bosses after sectioning
  - omitted details

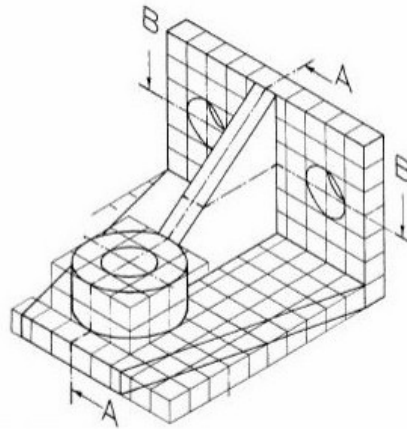


### Drawing practice

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#### Question No. 1 (Referring to Figure 5.40)

Draw full size in First Angle Projection the following views of the bracket shown in the figure below (extracted from Figure 5.40):



- (a) a sectional front view on AA
- (b) a sectional plan view on BB
- (c) an end view, positioned on the left of view (a)

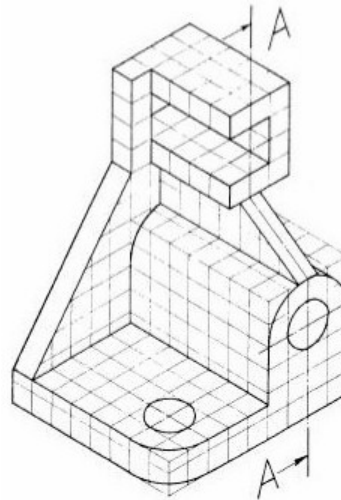
Ensure the correct positioning of all views.

Each construction square represents a 10 mm measurement.

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#### Question No. 2 (Referring to Figure 5.41)

Draw full size in Third Angle Projection the following views of the bracket shown in the figure below (extracted from Figure 5.41):



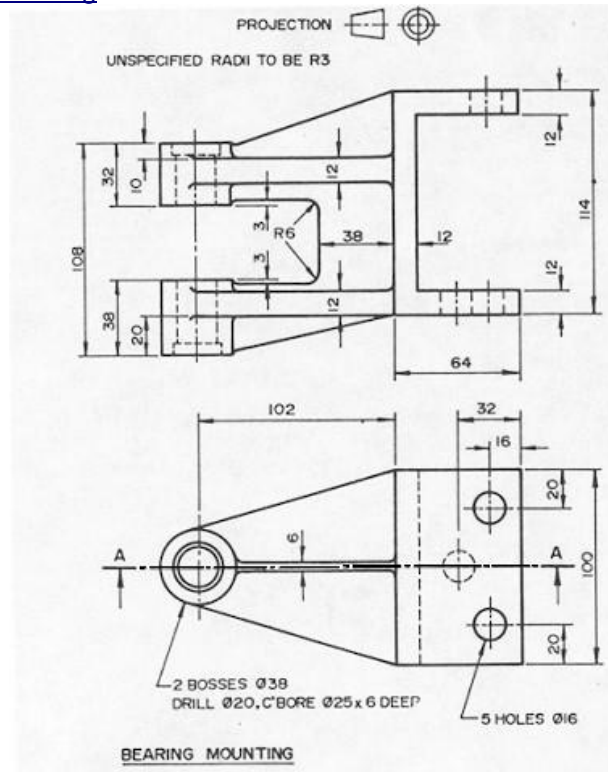
- (a) a sectional front view on AA
- (b) an end view, positioned on the right of view (a)
- (c) a plan

Ensure the correct positioning of all views.

Each construction square represents a 10 mm measurement.

### Assignment 3

#### No. 1 Bearing Mounting

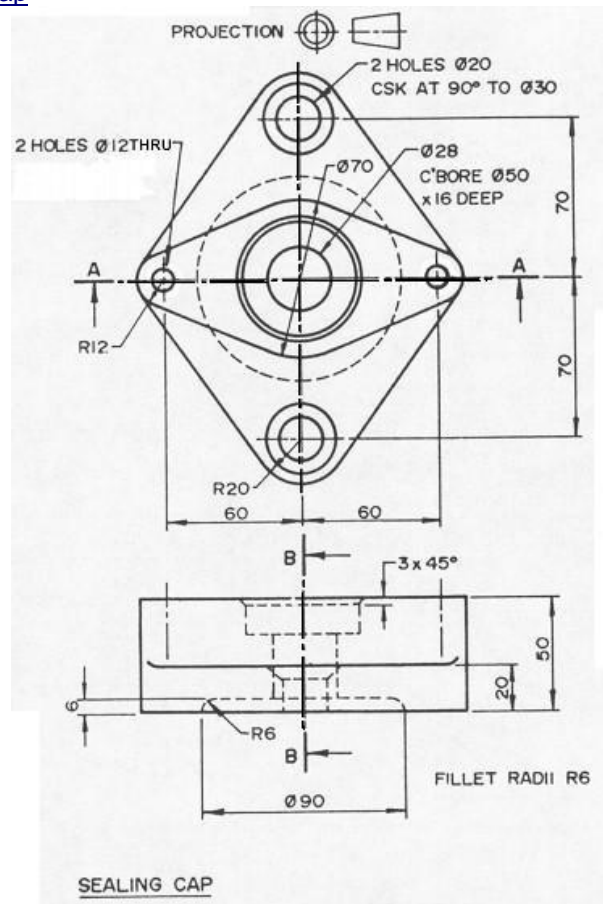


Draw the following views of the bearing mounting full size in First Angle Projection:

- the given plan view
- a sectional front elevation on AA
- an end view, drawn on the right of the front elevation

No. 2

Sealing Cap



A front elevation and plan of this component are given in the figure. Draw the following views full size in Third Angle Projection:

- the given plan view
- a half sectional front elevation on AA
- a half sectional end view on BB

You may download the assignment sheet from the "ACTION MENU".