

5. DIMENSIONING [IS 11669 : 1986 and SP 46 : 2003]

Indicating the sizes of the *features* (In Fig. 5, Circle is a feature; C.L. means Center Line or Axis) of the object and other details essential for its construction and function on a drawing by the use of lines, numerals, symbols, notes, etc., is called *Dimensioning*.

5.1 ELEMENTS OF DIMENSIONING

1. DIMENSION LINE (D.L.)

See Fig. 5. Dimension Line (D.L.) is a *continuous narrow line*, drawn parallel to the edge or surface whose measurement should be shown. It should be placed *outside* the view. Sometimes it may be placed *inside* the view, if the drawing becomes very clear by doing so.

Dimension line is placed at least 6 to 10 mm away from the outline of the drawing. It is terminated by arrowheads at its ends.

2. EXTENSION LINE (E.L.) or PROJECTION LINE (P.L.)

See Fig. 5. Extension Line (E.L.) or Projection Line (P.L.) is a *continuous narrow line* drawn perpendicular to the outline to be dimensioned and without leaving a gap from the outline. It is drawn extending slightly beyond the dimension line by about 2 mm.

3. LEADER LINE (L.L.)

See Fig. 5. Leader Line (L.L.) is a *continuous narrow line*, connecting a dimensional value or a NOTE [NOTE gives information relating to a feature, e.g., $\varnothing 15$ in Fig. 5] with the corresponding *feature* on the drawing. It is drawn at 30° or 45° or 60° to the horizontal or to the line it touches. When pointing to a circle or an arc, leader line is drawn radially.

If the leader line ends on the outline of a drawing, it shall have an arrowhead [Fig. 6(i)].

If it ends within the outline of the drawing, it shall have a dot at the end [Fig. 6(ii)].

4. ARROWHEADS

See Fig. 7. An arrowhead is placed at each end of a dimension line. The arrowhead may be open, closed or closed and filled in. *Open type arrowhead is preferable for fast execution.*

In a drawing, only one style of arrowhead termination should be used.

Shape of the arrowhead

See Fig. 8. Length l of an arrowhead is about three times the width w . The size of the arrowheads should be proportionate to the size of the drawing.

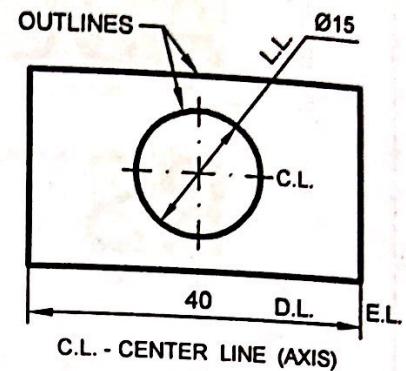


FIG. 5

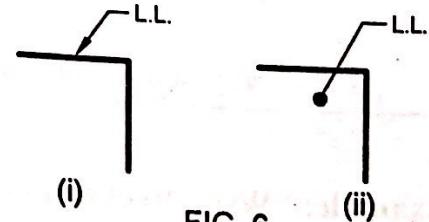


FIG. 6

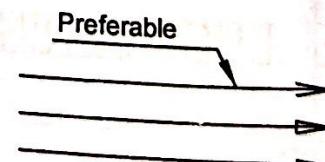


FIG. 7

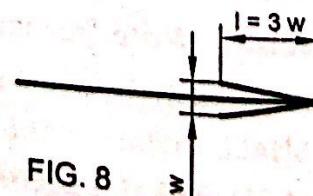


FIG. 8

See Fig. 9. Place the dimensional value parallel to and at the middle of Dimension Line. When the length of the dimension line is not sufficient, place arrowheads outside the Extension Line (e.g., dimensional value 5) or place the dimensional value (e.g., 3) above the extended portion of the dimension line beyond the arrowhead.

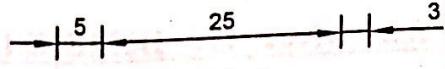


FIG. 9

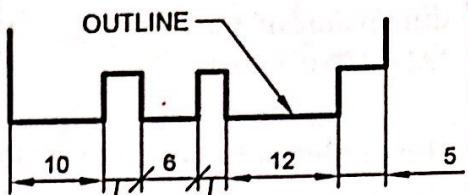


FIG. 10

5.2 METHODS OF DIMENSIONING

Method I: Aligned Method

- See Fig. 11. Dimensional value is placed above the dimension line without breaking it. It is placed parallel to and at the middle of the dimension line without touching it.

Dimensional values are marked so that they can be read either from the bottom or from the right hand side of the drawing.

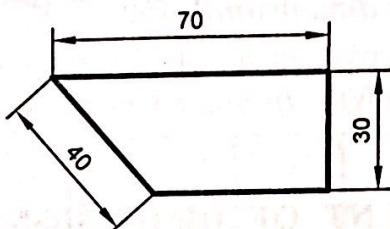


FIG. 11

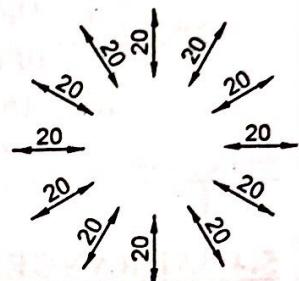


FIG. 12

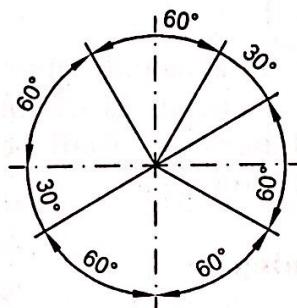


FIG. 13

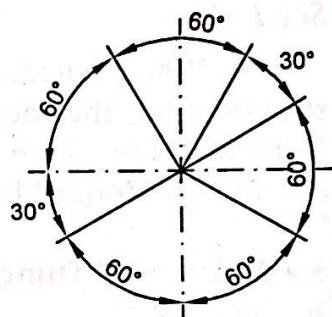


FIG. 14

- Fig. 12 shows the method of placing dimensional values at different positions on the dimension lines.

Angular dimensions

Angular dimensions are oriented either as in Fig. 13 or Fig. 14 and Fig. 15.

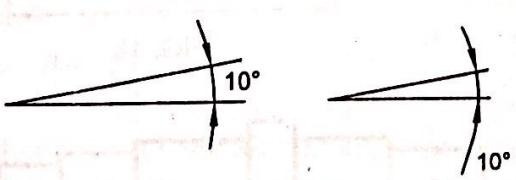


FIG. 15

Method II: Unidirectional Method: Fig. 16

- Dimensional values are indicated so that they may be read from the bottom of the drawing. Non-horizontal dimension lines are interrupted near the middle and the dimensional values are inserted. This method is used on large drawings of automobiles, aircrafts, etc., where it may not be convenient to read the dimensions from right side.

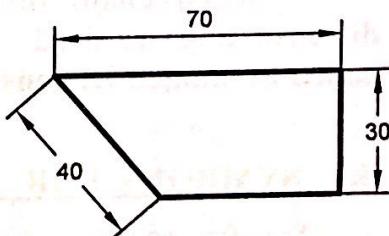


FIG. 16

Note: Method I is preferable. Only one method should be used on a drawing.

5.3 UNIT OF DIMENSIONING

All dimensions in one particular drawing should be expressed in *one unit only*. B.I.S. recommended unit is *millimeter*. Abbreviation **mm** for millimeter need not be shown on each dimension of the drawing. *Example:* A dimension **25** means **25 mm**. A foot note stating '**ALL DIMENSIONS IN mm**' is written in a prominent place near Title Block.

If any other unit like **m** or **cm** is used, even then only the value is written as dimension. But, a foot-note like '**ALL DIMENSIONS IN cm**' is inserted in a prominent place near Title Block.

- Note:**
- If the dimension is less than 1, a zero is placed before the decimal point.*
Example: 0.5 and not .5
 - Decimal point in a dimension should be written in line with the bottom line of the dimension value.* *Example: 0.5 and not 0·5*
 - Abbreviation for millimeters is not mms, but mm only. (s denotes seconds).* *In other words, s is not added for the plural of any units.*

5.4 ARRANGEMENT OF DIMENSIONS

5.4.1 Chain Dimensioning

See Fig. 17.

When successive dimensions are arranged in a straight line, the method is known as *Chain Dimensioning*. Note that the chain of dimensions shall be arranged in a *continuous straight line* as shown.

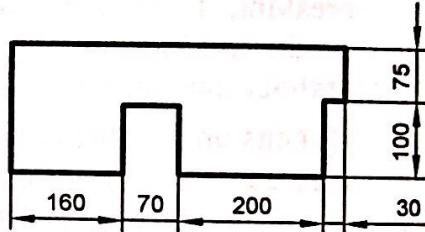


FIG. 17

5.4.2 Parallel Dimensioning

See Fig. 18.

Parallel Dimensioning is the placement of a number of single dimension lines parallel to one another from a common origin. It is used where a number of dimensions have a common origin.

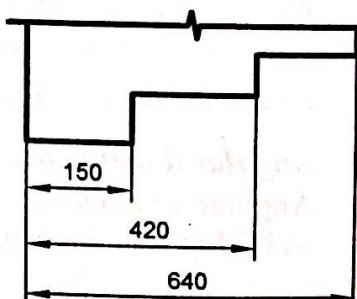


FIG. 18

5.4.3 Combined Dimensioning

See Fig. 19.

When chain dimensioning and parallel dimensioning are used in a single drawing, it is called *Combined Dimensioning*.

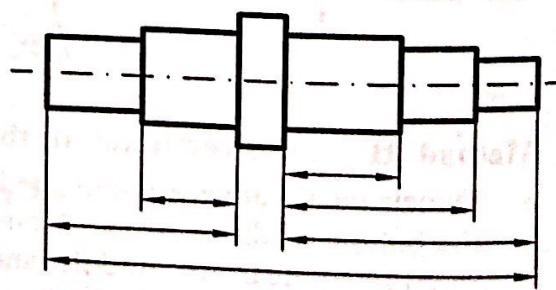


FIG. 19

5.5 SYMBOLS FOR SHAPE INDICATION

Symbol for shape indication shall precede the dimension value. Symbols used are:

Ø – Diameter; **R** – Radius; **□** – Square; **SØ** – Spherical Diameter; **SR** – Spherical Radius.

5.5.1 Circle

See Fig. 20. A circle is dimensioned using the symbol \emptyset , by any one of the ways shown. \emptyset precedes the dimension value.

Always mark the diameter of a circle and not its radius.

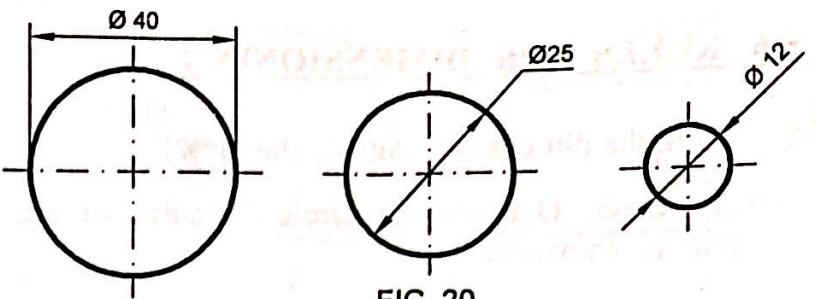


FIG. 20

5.5.2 Cylindrical Diameter

See Fig. 21. Cylindrical Diameter uses symbol \emptyset as shown.

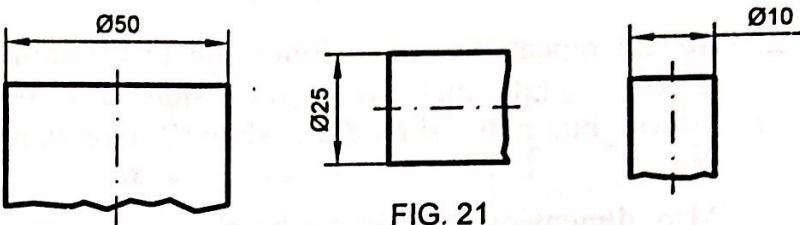


FIG. 21

5.5.3 Arc Radius

See Fig. 22. An arc is dimensioned by its Radius R by any one of the ways shown. Only one arrowhead with its point on the arc end of the dimension line is used.

Dimension line of a radius should pass through the center of the arc. Mark the center with a small cross.

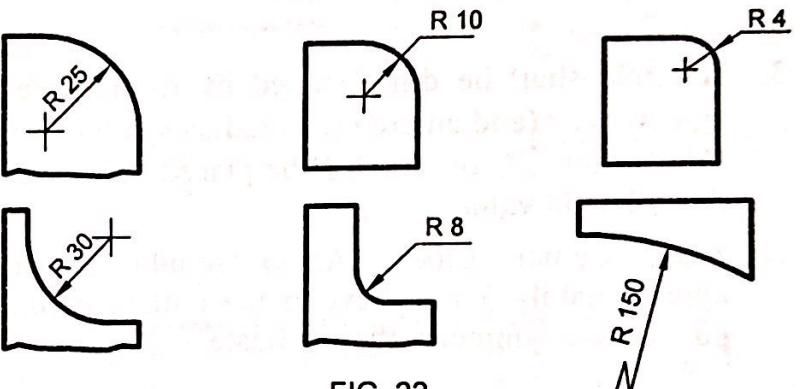


FIG. 22

- Note:**
- (i) Dimensions of small radii are shown preferably outside the view, due to want of space inside the view. Examples: R10 and R4
 - (ii) When the arc center falls outside the limits of space available, dimension line of radius is broken or interrupted according to whether or not it is necessary to locate the center. e.g., R150

5.5.4 Sphere

See Fig. 23.

Use symbol $S\emptyset$ to represent Spherical Diameter and SR for Spherical Radius. The symbols $S\emptyset$ and SR should precede the dimensional value.

Here, S stands for Sphere and R stands for Radius.

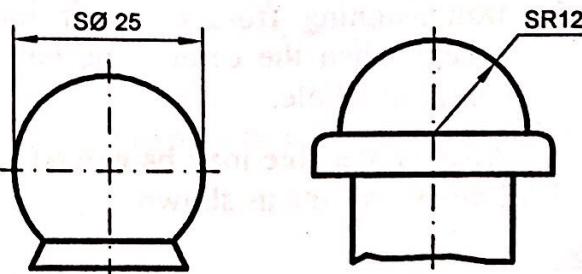


FIG. 23

5.5.5 Square

See Fig. 24.

Symbol \square is used to represent a square and it should precede the dimensional value. Square ends may also be indicated by diagonals drawn as thin lines.

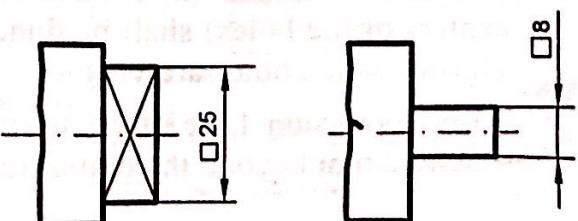


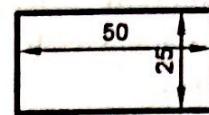
FIG. 24

5.6 RULES FOR DIMENSIONING

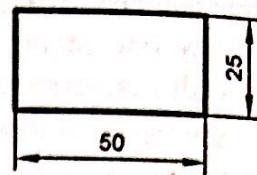
1. Mark the dimensions outside the view.

(However, Diameter of circle / Radius of arc may be shown inside.)

INCORRECT

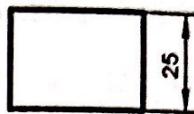
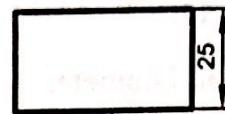


CORRECT



2. Do not repeat the same dimension in different views. Note that every dimension must be shown, but none should be shown more than once.

Also, dimensions should not be placed very near to the parts being dimensioned.

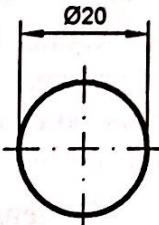
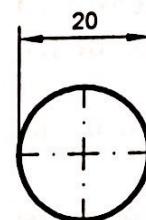


FRONT VIEW

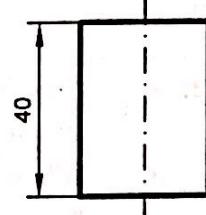
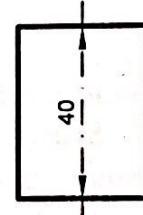
SIDE VIEW

3. A circle shall be dimensioned by its diameter symbol \varnothing (and an arc by its radius symbol R). Convention \varnothing or R shall be placed before the dimensional value.

Also, Center Lines (Axes) should extend approximately 3 mm beyond the outline of the part whose symmetry they indicate.

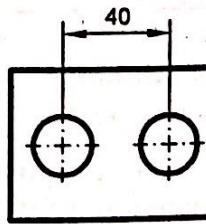


4. Center line (axis) itself shall not be used as a dimension line with arrowheads at its ends.



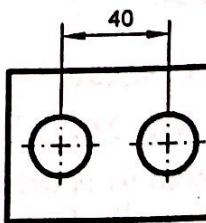
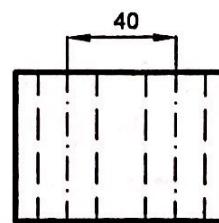
5. Dimensioning from a center line is incorrect, except when the center line passes through the center of a hole.

Also, center line may be extended to serve as an Extension Line as shown.



6. Location of holes (i.e., distance between the centers of the holes) shall be dimensioned in the view in which holes are visible.

Also, Extension Line starts from the view and extend 2 mm beyond the dimension line.



7. Dimensions shall be given to visible lines and not to hidden (invisible) lines.

Also, dimension value should be placed little (approximately 2 mm) above the dimension line and not on the dimension line.

8. Taper on diameter shall be dimensioned as shown.

$$Example: \text{ Taper} = \frac{D - d}{L} = \frac{1}{10}$$

9. If dimensioning inside a hatched portion of a drawing is unavoidable, the hatching lines should not cut the dimensional text.

- 10. Repeated Features:** Repeated features of the same size are marked to avoid repeating the same dimensional value.

Notes should always be written horizontally. *Leader line* shall be inclined at an angle of 30° , 45° or 60° to the horizontal as shown.

- 11. Overall Dimensioning:** Overall dimension shall be placed outside the intermediate dimensions. i.e., smaller dimensions shall be placed nearer the view and the larger farther away so that extension lines do not cross dimension lines. (Extension lines may cross each other or the outlines of the drawing, such as the case of leader lines.)

When an overall dimension is shown, one of the intermediate dimensions should not be marked. See Fig. 25.

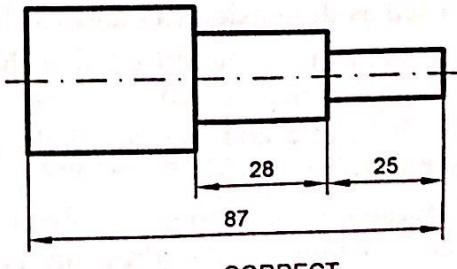
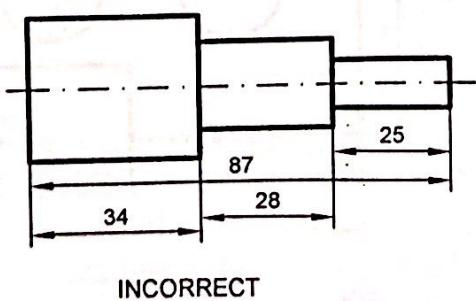


FIG. 25

5.7 PROBLEMS ON DIMENSIONING

Problem 1: (Fig. 26) Read the dimensioned drawing of GASKET shown. Redraw the figure in full size. Dimension it as per BIS Code.

The following mistakes of dimensioning are noted in Fig. 26(i).

1. Most of the dimensions are placed inside the drawing. Place them outside the drawing.
2. Some of the dimension lines are crossing each other. It is not permitted.
3. Diameter of the circle is wrongly given as 300.
4. Axis of the circle is not shown correctly.

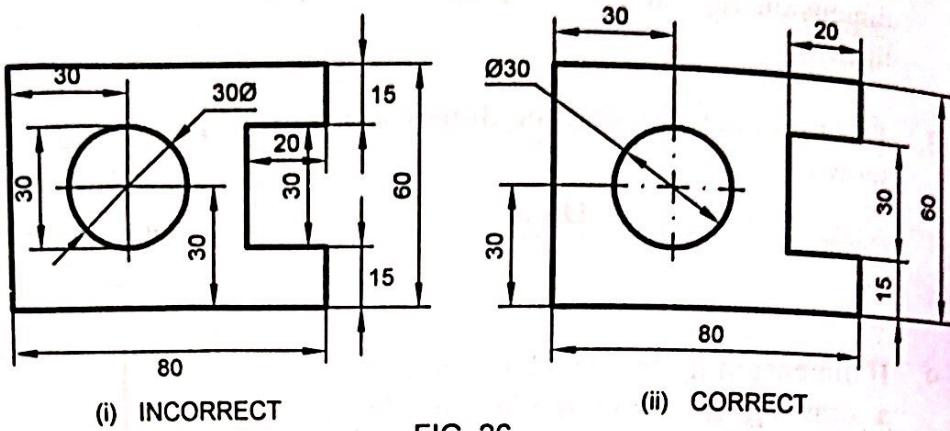


FIG. 26

Problem 2: (Fig. 27) Redraw the LOCK PLATE. Mark the dimensions as per BIS.

1. Many dimensions are placed inside the drawing. Mark them outside the drawing.
2. Dimension (50) line is crossing the dimension (45) line. Also, dimension (45) line and dimension (30) line cross each other. Also, dimension (50) and dimension (35) line cross each other. Dimension lines should not cross other dimension lines.
3. Dimensional value (50) should be placed in the middle of the dimension line.
4. Center lines of both the holes should be drawn. Distance between center lines should be marked.
5. Diameters of the holes are not shown properly. Follow the convention of *Repeated Features* for the two holes using leader line and Note (2 x Ø 20 or 2 HOLES Ø 20) written horizontally.
6. Extensions of outlines of the drawing are wrongly used as dimension (35 and 15) lines.
7. Dimension (15) line between outside the circles and also the dimension (10) line between the outline of the circle and outline of the drawing are not permissible.
8. Overall measurements should be given. But, only overall width of the drawing is shown. Mark the overall length too.

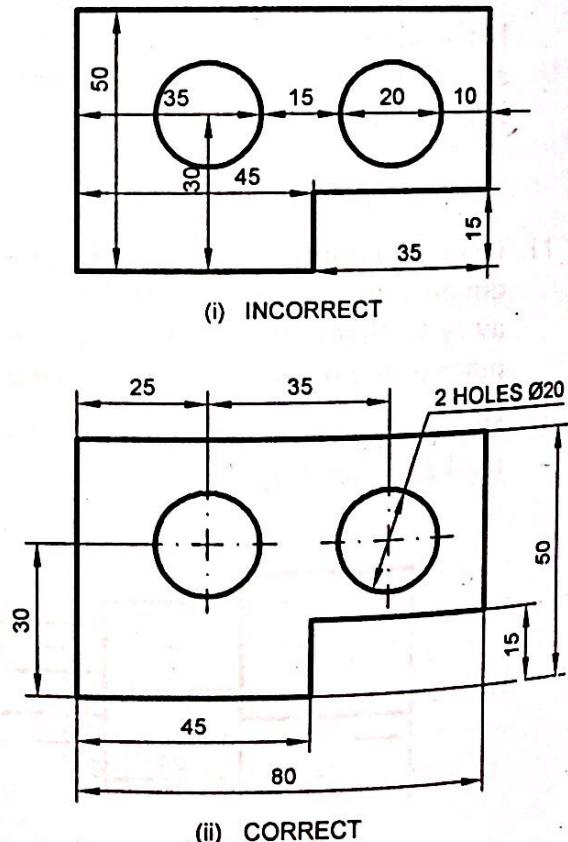


FIG. 27 LOCK PLATE

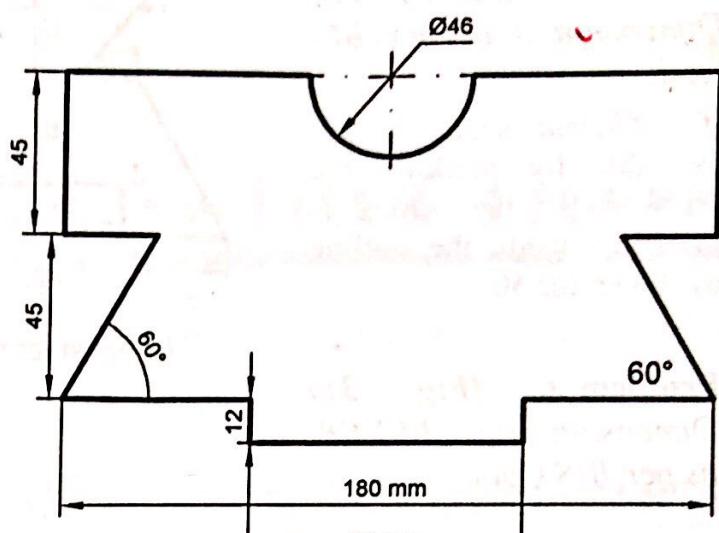
Problem 3: (Fig. 28) Redraw the TEMPLATE to half size. Dimension it as per BIS code.

Note: Draw the figure to Half Size (Scale 1 : 2). Mark actual dimensions on the drawing.

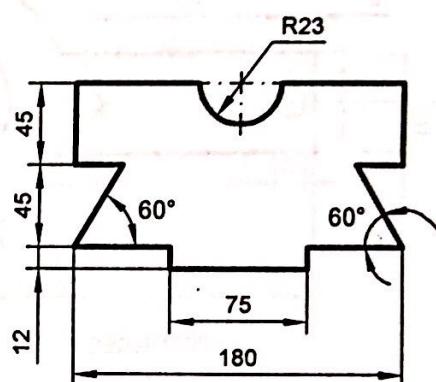
- Dimension (12) is wrongly marked, since the outline of the object is used as Dimension Line.

An outline or a center line should never be used as a Dimension Line. However, a center line may be extended to serve as an Extension Line.

- Series of dimensions (45, 45 and 12) are not in a continuous line, which is not proper. They should be arranged on a continuous line.
- The longer dimension (180) is wrongly placed inside the shorter dimension (75).
- Arc dimension (R23) is wrongly marked as ($\varnothing 46$).
- Angle (60°) is not properly dimensioned in both the places. The same should be placed by either of the two methods.
- Unit of dimension mm is marked for the dimensional values (75 and 180), which is not correct. A foot-note stating 'ALL DIMENSIONS IN mm' is written in a prominent place near the Title Block.

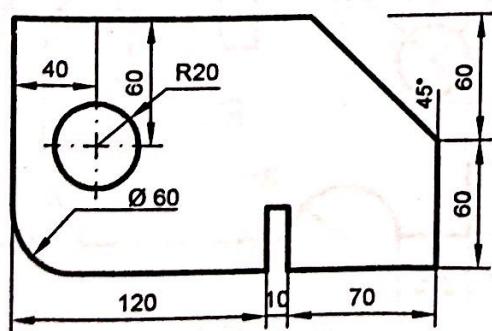


(i) INCORRECT



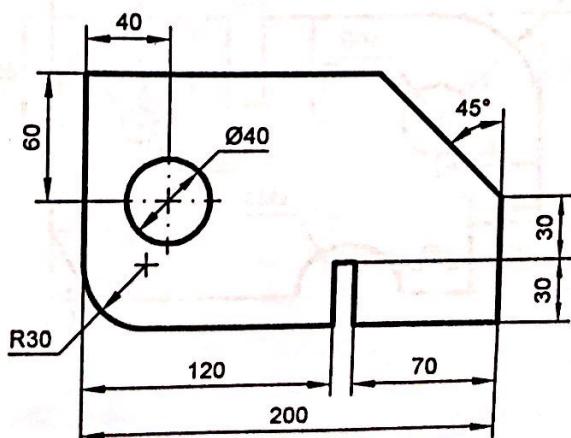
(ii) CORRECT SCALE 1:2

Problem 4: (Fig. 29) Redraw the SLIDING PLATE. Dimension it as per BIS Code.



(i) INCORRECT

FIG. 29 SLIDING PLATE



(ii) CORRECT

Problem 5: (Fig. 30)
Redraw the M.S. PLATE.
Dimension it as per BIS
Code.

If sufficient space is not available for marking the arrowheads, the same is marked outside the outline as shown for 50° .

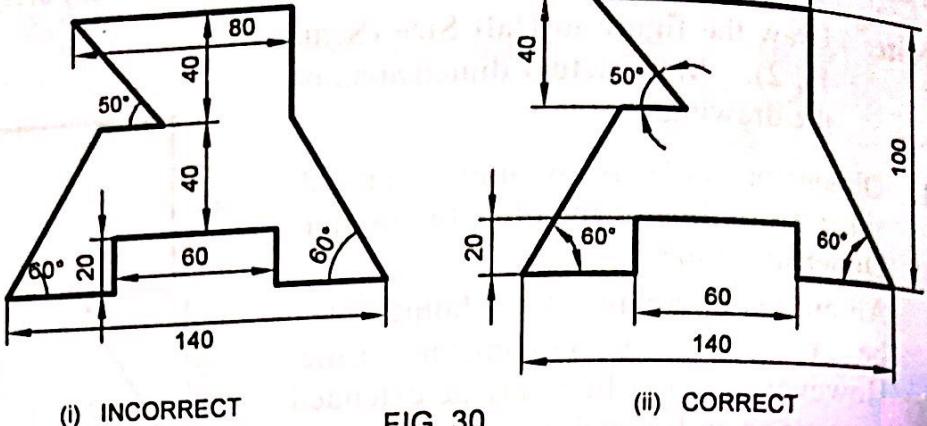


FIG. 30

Problem 6: (Fig. 31)
Dimension the LEVER.
as per BIS Code.

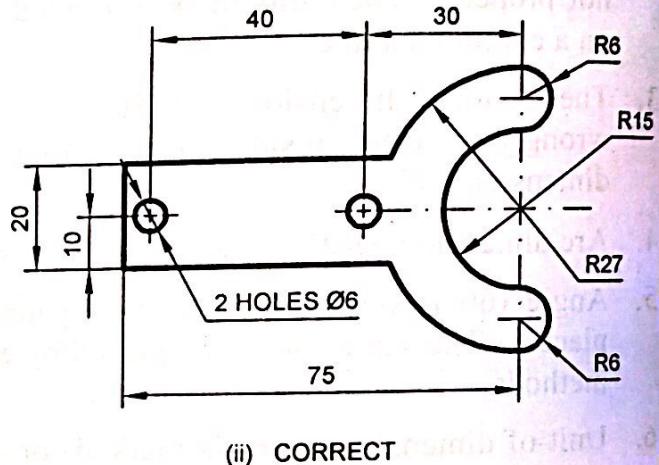
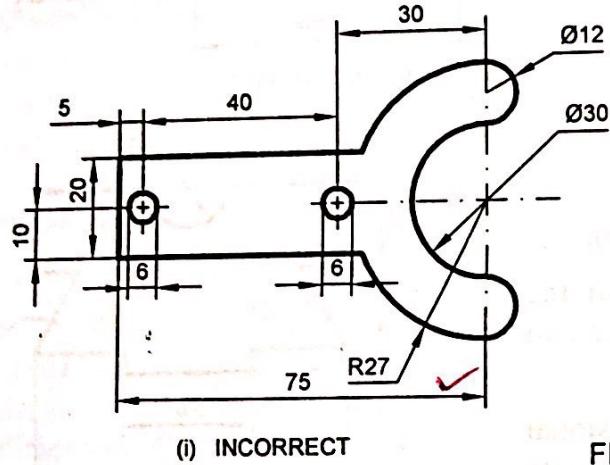


FIG. 31

Problem 7: (Fig. 32) Redraw Fig. 32(i). Dimension it as per BIS Code.

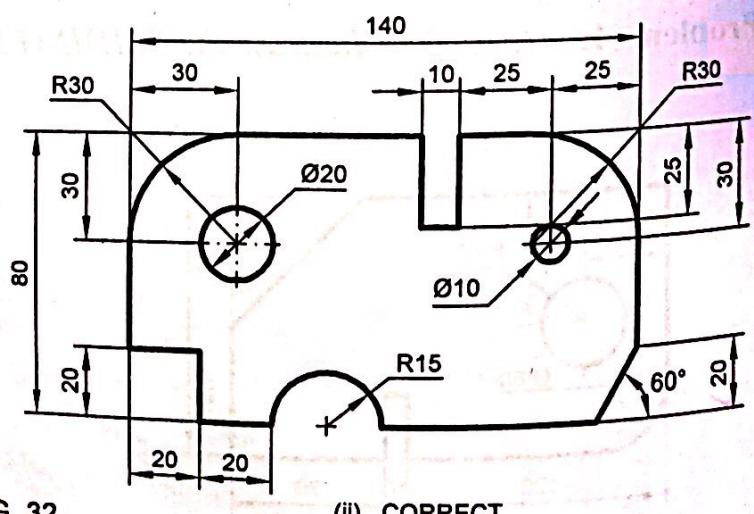
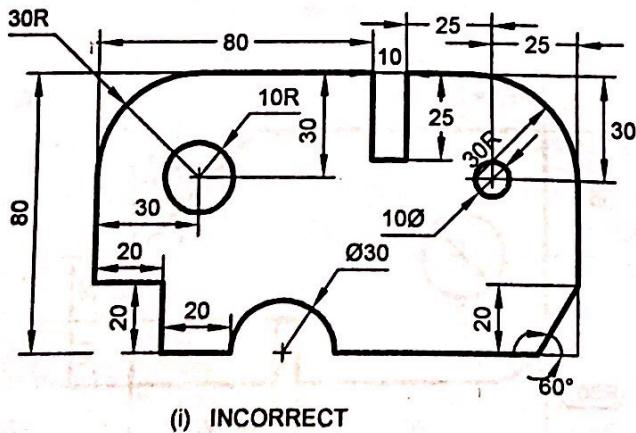


FIG. 32

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