Chapter 7

Dimensioning

TOPICS

- Introduction

- Dimensioning components

- Dimensioning object' s features

- Placement of dimensions.

Introduction

ENGINEERING DESIGN

PROCESS	RESULT	TRANSFERRED INFORMATION
Design a part	Sketches of ideas	
Create drawings	**Multiview Drawing**	Shape
	Dimensioning	1. Size, Location 2. Non-graphic information
Manufacture		

DEFINITION

Dimensioning is the process of specifying part' s information by using of **figures**, **symbols** and **notes**.

This information are such as:

1. **Sizes and locations of features**

2. **Material's type**

3. **Number required**

This course

4. **Kind of surface finish**

5. **Manufacturing process**

6. **Size and geometric tolerances**

DIMENSIONING SYSTEM

1. Metric system : ISO and JIS standards

Examples 32, 32.5, 32.55, 0.5 *(not .5)* etc.

This course

2. Decimal-inch system

Examples 0.25 *(not .25)*, 5.375 etc.

3. Fractional-inch system

Examples $\frac{1}{4}$, $5\frac{3}{8}$ etc.

Dimensioning Components

DIMENSIONING COMPONENTS

- Extension lines
- Dimension lines
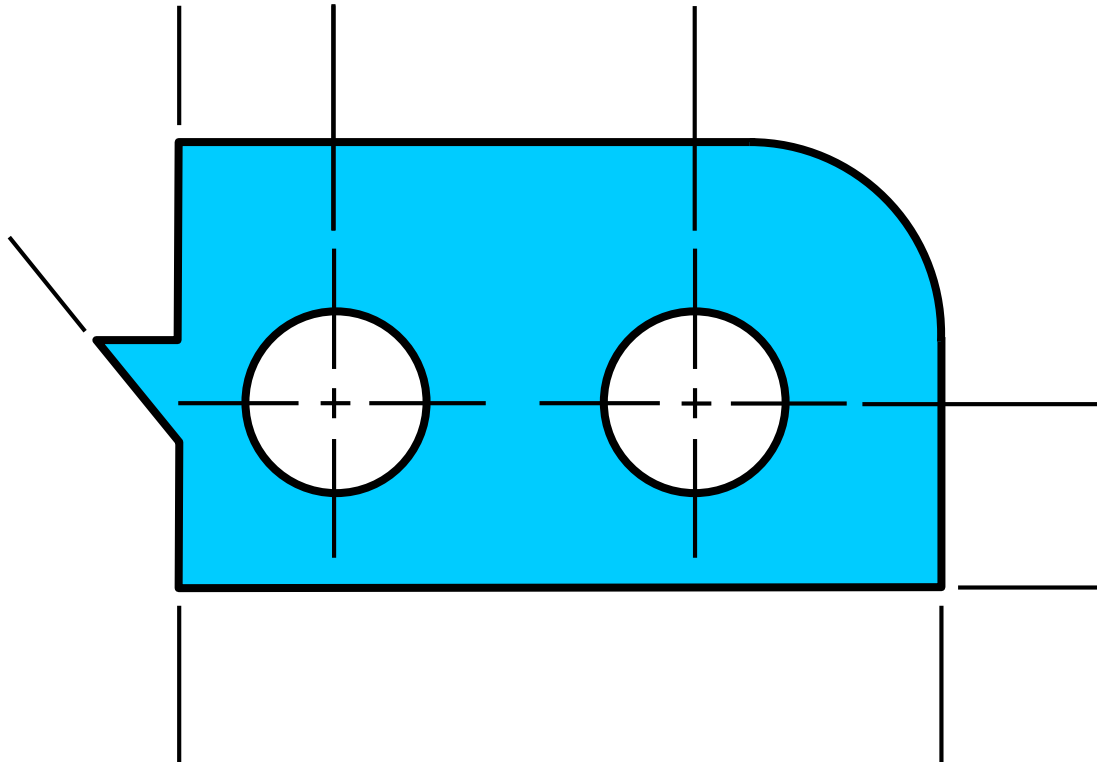 *(with arrowheads)*
- Leader lines

→ Drawn with **4H** pencil

- Dimension figures
- Notes :
  - *local note*
  - *general note*

→ Lettered with **2H** pencil.

EXTENSION LINES

indicate the location on the object's features that are dimensioned.

DIMENSION LINES

indicate the direction and extent of a dimension, and inscribe *dimension figures*.
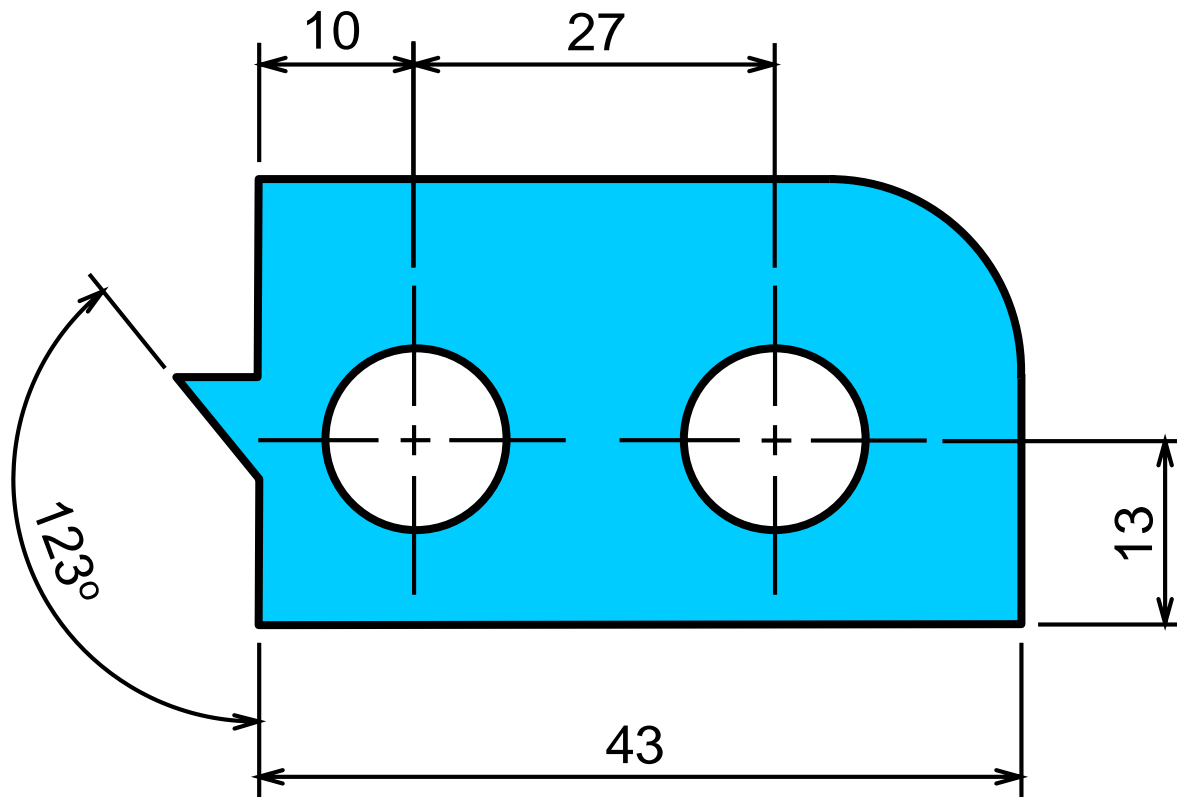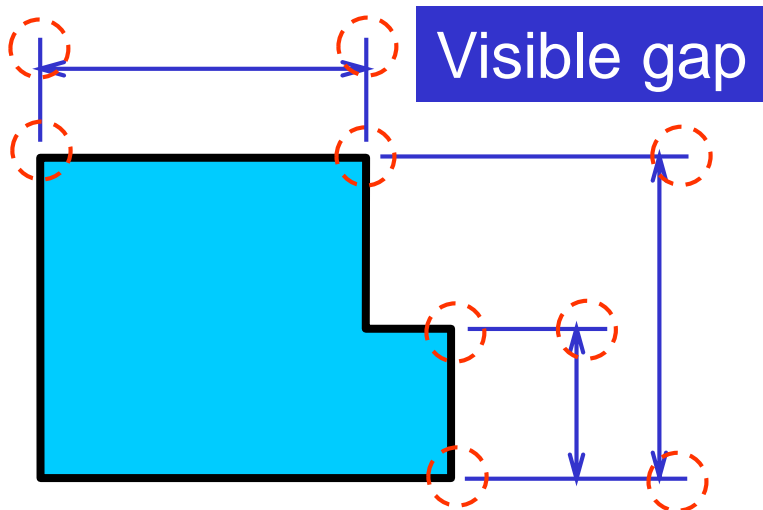
LEADER LINES

indicate details of the feature with a *local* note.
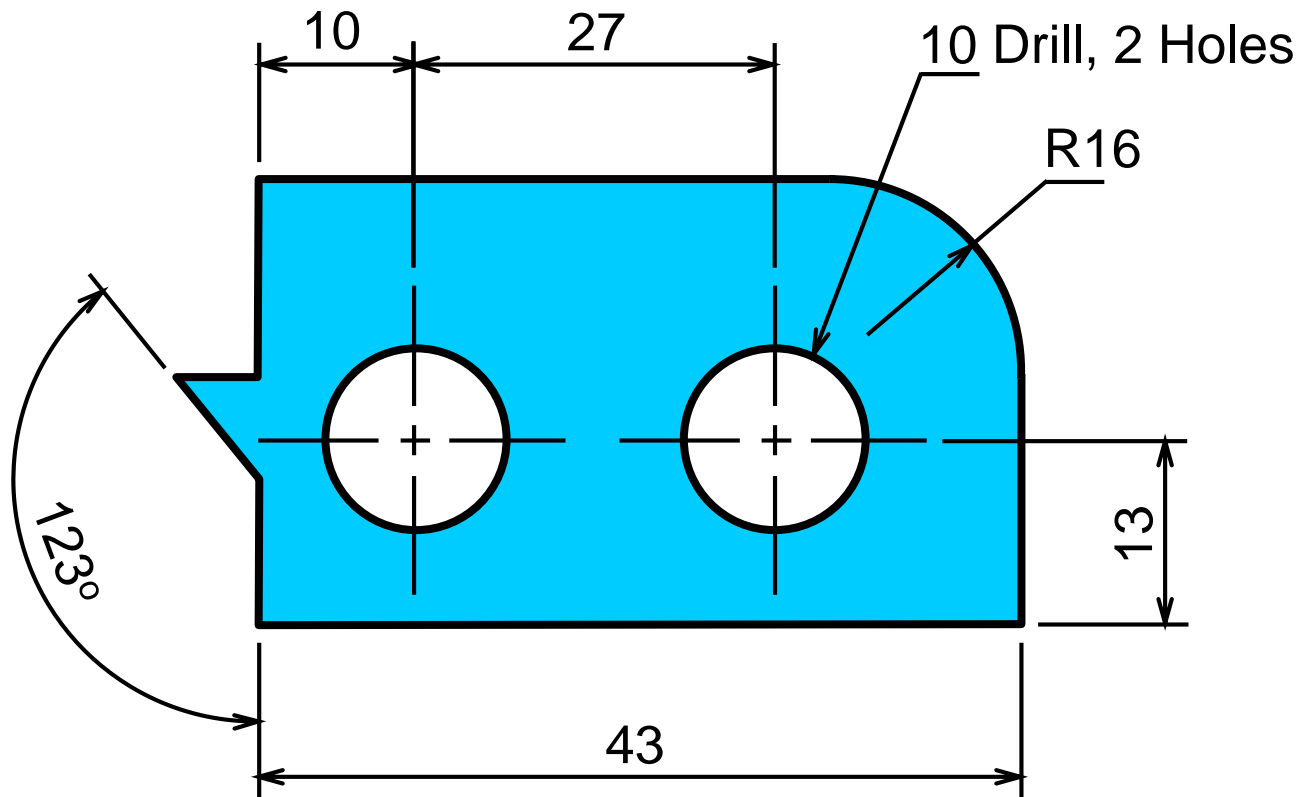
Recommended Practices

EXTENSION LINES

- Leave a **visible gap** (≈ 1 mm) from a view and start drawing an extension line.

- Extend the lines beyond the (last) dimension line 1-2 mm.

Visible gap
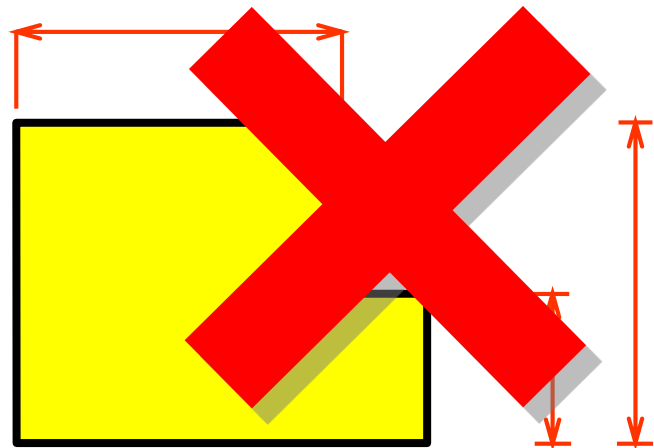
COMMON MISTAKE

EXTENSION LINES

Do not break the lines as they cross object lines.

Continuous
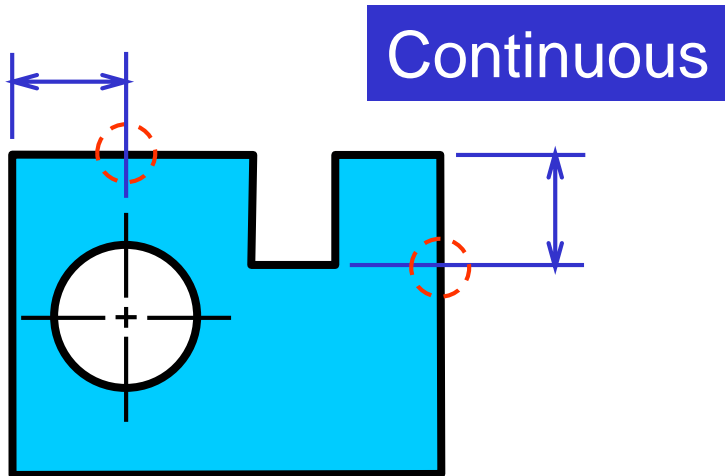
COMMON MISTAKE
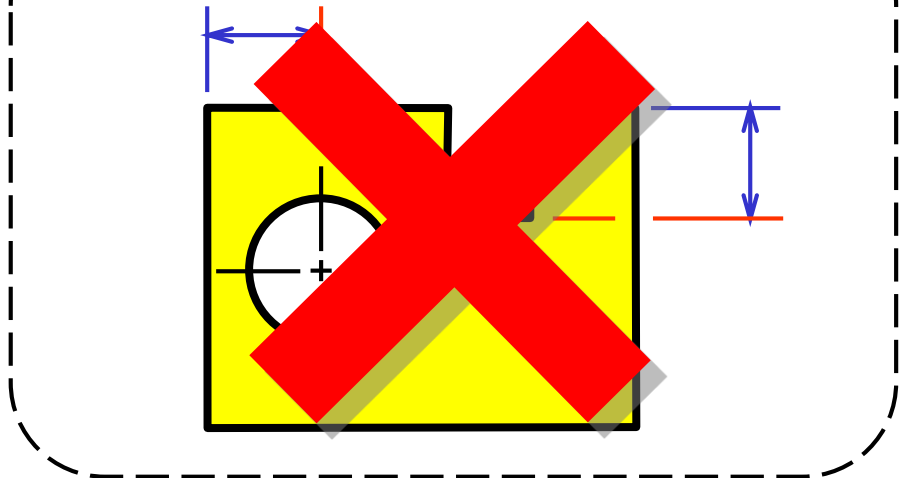
DIMENSION LINES

■ Dimension lines should **not** be spaced too close to each other and to the view.

Leave a space at least 2 times of a letter height.

Leave a space at least 1 time of a letter height.

35   16   11   34
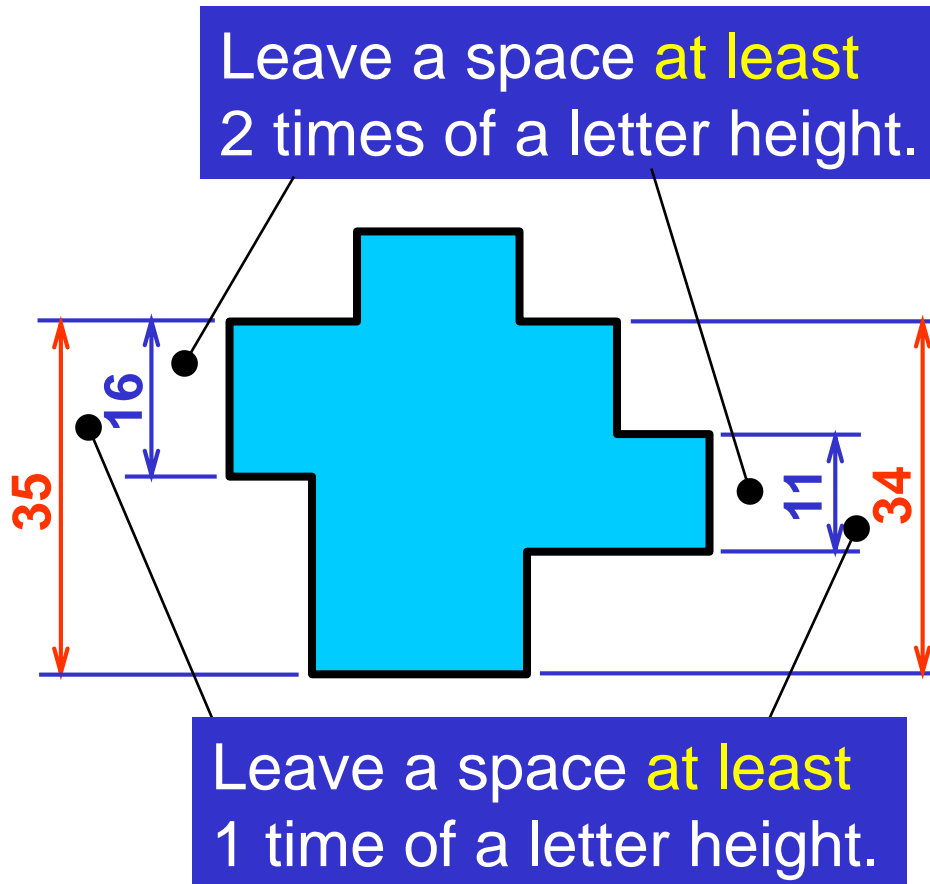
DIMENSION FIGURES

■ The height of figures is suggested to be 2.5~3 mm.

■ Place the numbers at about 1 mm *above dimension line* and *between extension lines*.

COMMON MISTAKE

34

11

34

11
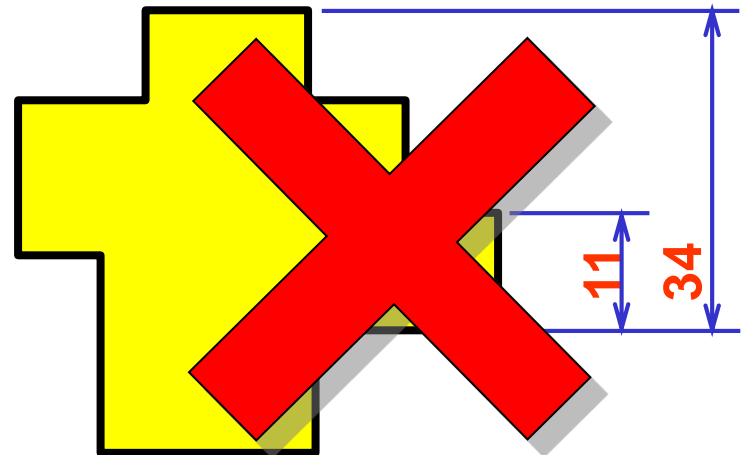
DIMENSION FIGURES

When there is **not** enough space for figure or arrows, put it **outside** either of the extension lines.

Not enough space for *figures*
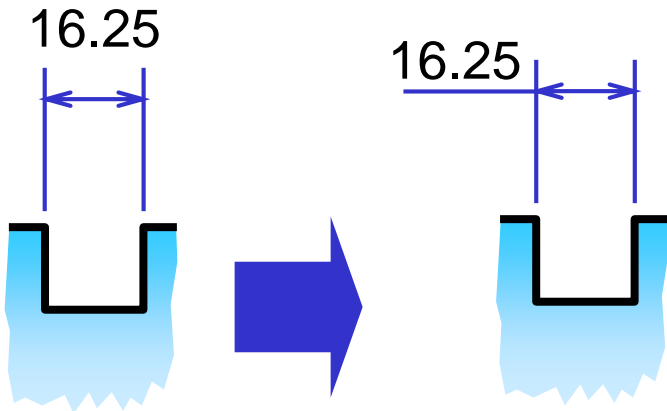
Not enough space for *arrows*

16.25

16.25

1

1

1

or
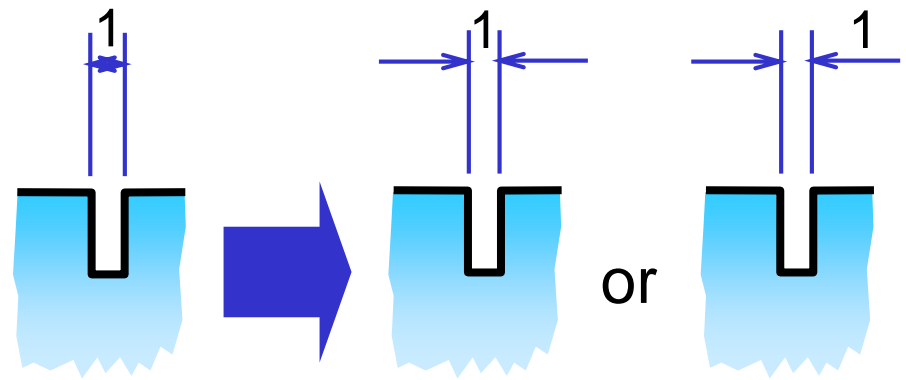
DIMENSION FIGURES : UNITS

The JIS and ISO standards adopt the unit of

■ **Length** dimension in **millimeters without** specifying a unit symbol "mm".

■ **Angular** dimension in **degree** with a symbol "°" place behind the figures (and if necessary **minutes** and **seconds** may be used together).

DIMENSION FIGURES : ORIENTATION

1. Aligned method

The dimension figures are placed so that they are readable from the **bottom** and **right side** of the drawing.

2. Unidirectional method

The dimension figures are placed so that they can be read from the **bottom** of the drawing.

Do not use both system on the same drawing or on the same series of drawing (JIS Z8317)

EXAMPLE : Dimension of *length* using *aligned* method.
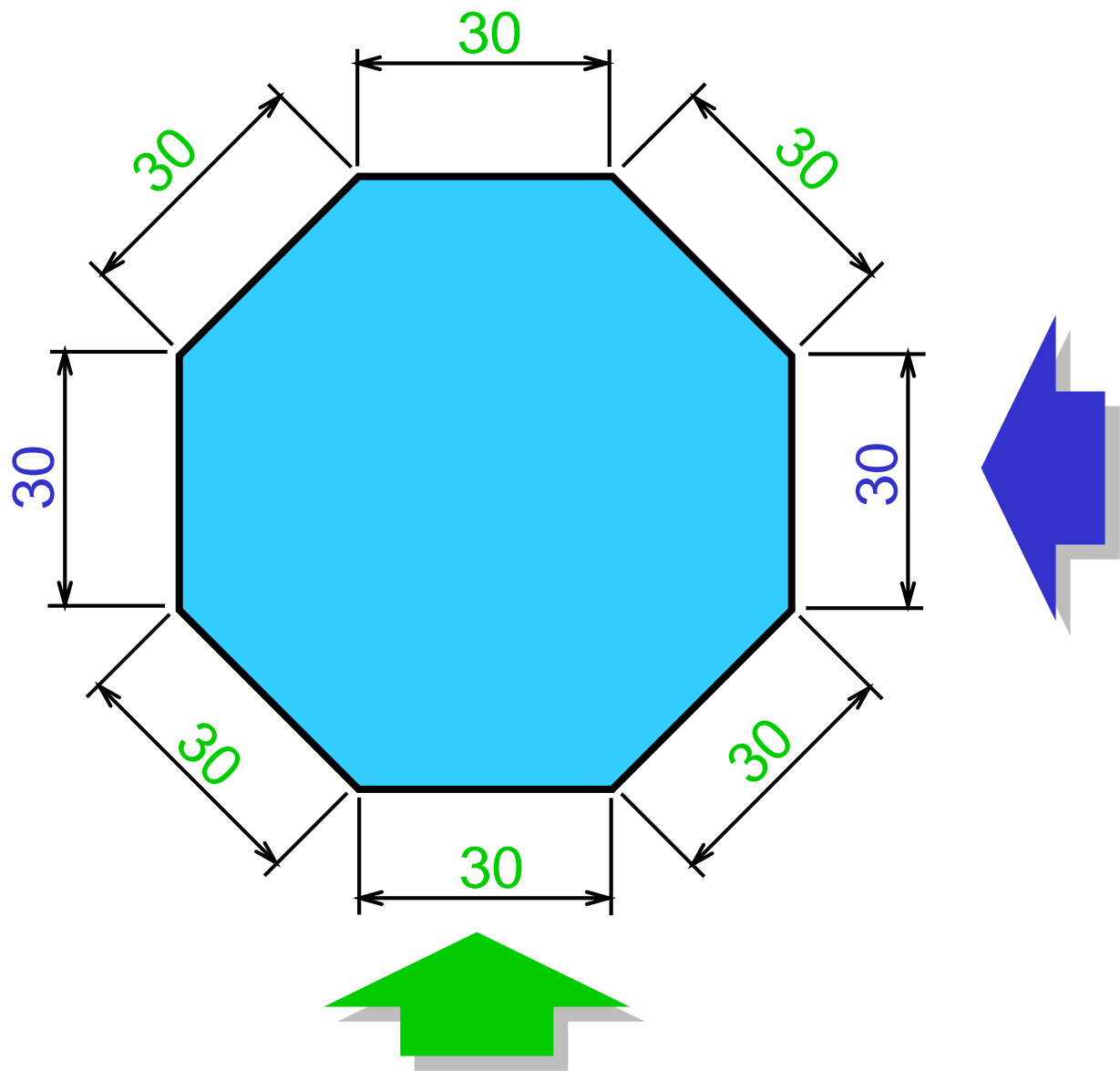
EXAMPLE : Dimension of *length* using *unidirectional* method.
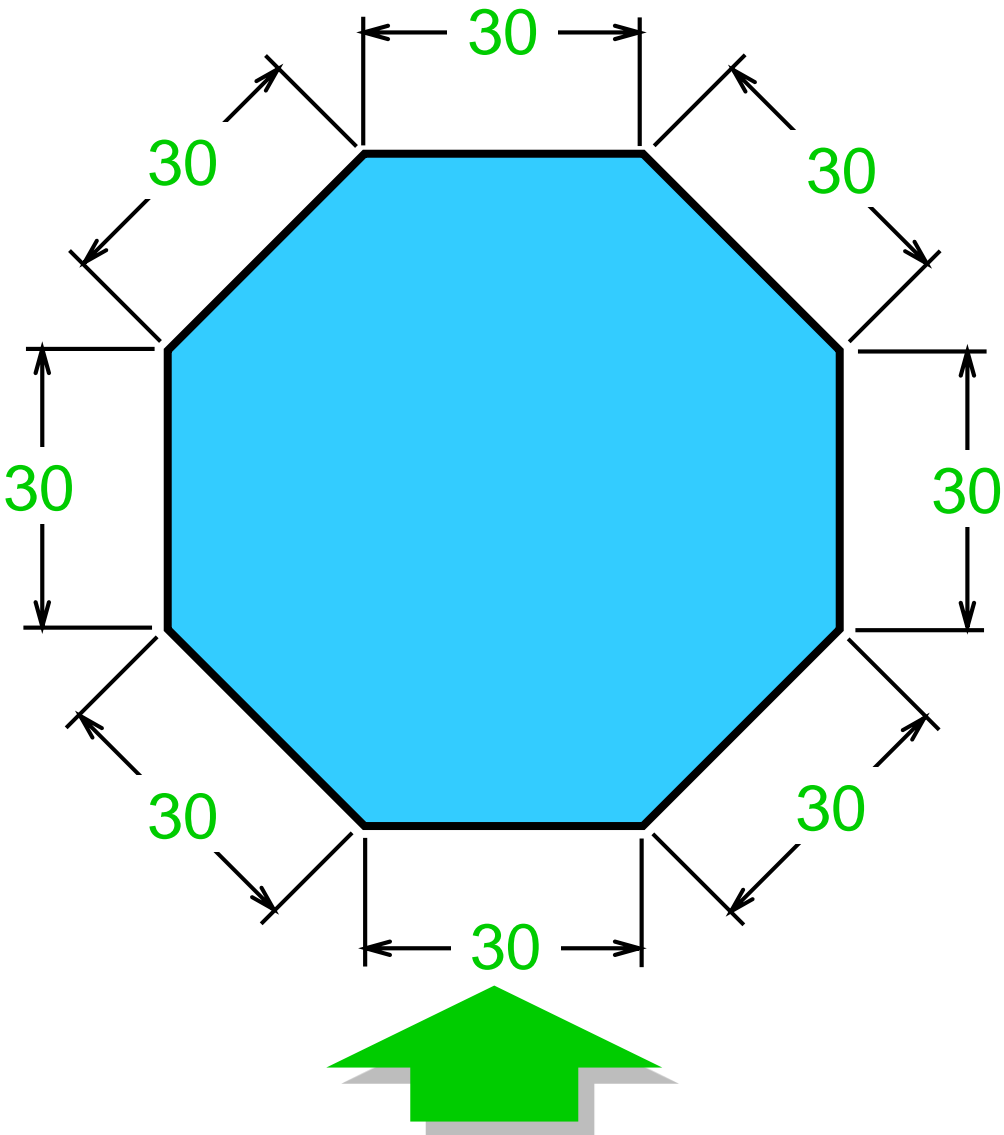
EXAMPLE : Dimension of *angle* using *aligned* method.
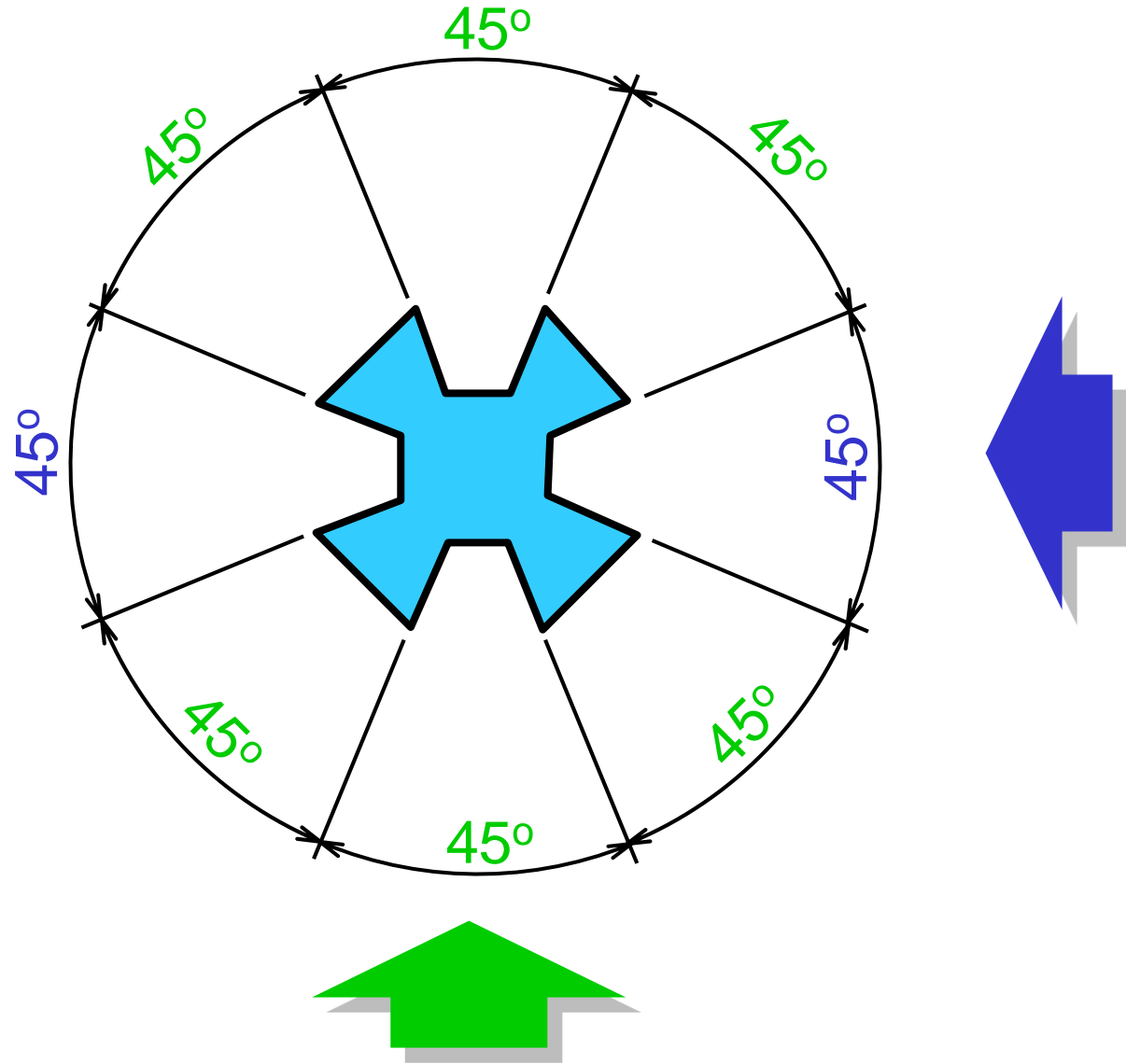
EXAMPLE : Dimension of *angle* using *unidirectional* method.
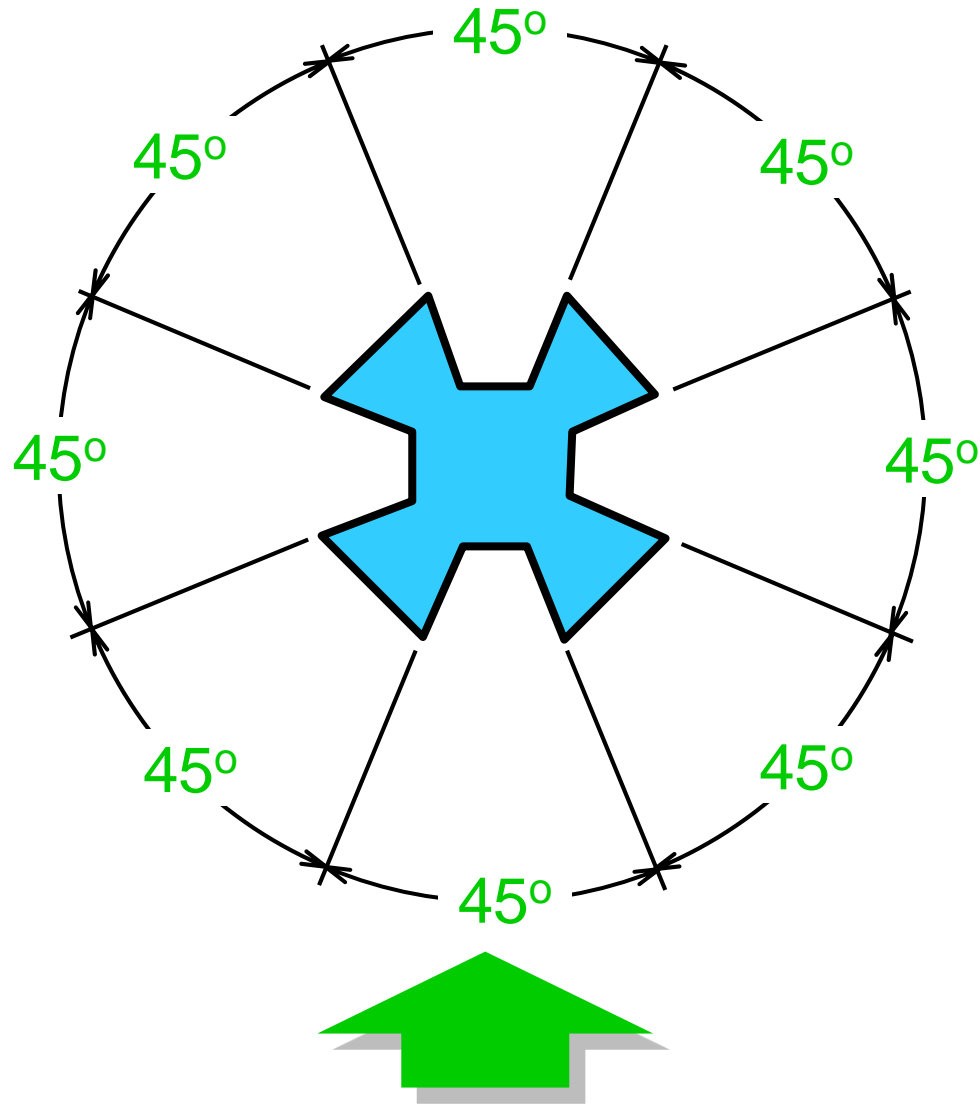
LOCAL NOTES

- Place the notes **near** to the feature which they apply, and should be placed outside the view.

- Always read **horizontally**.
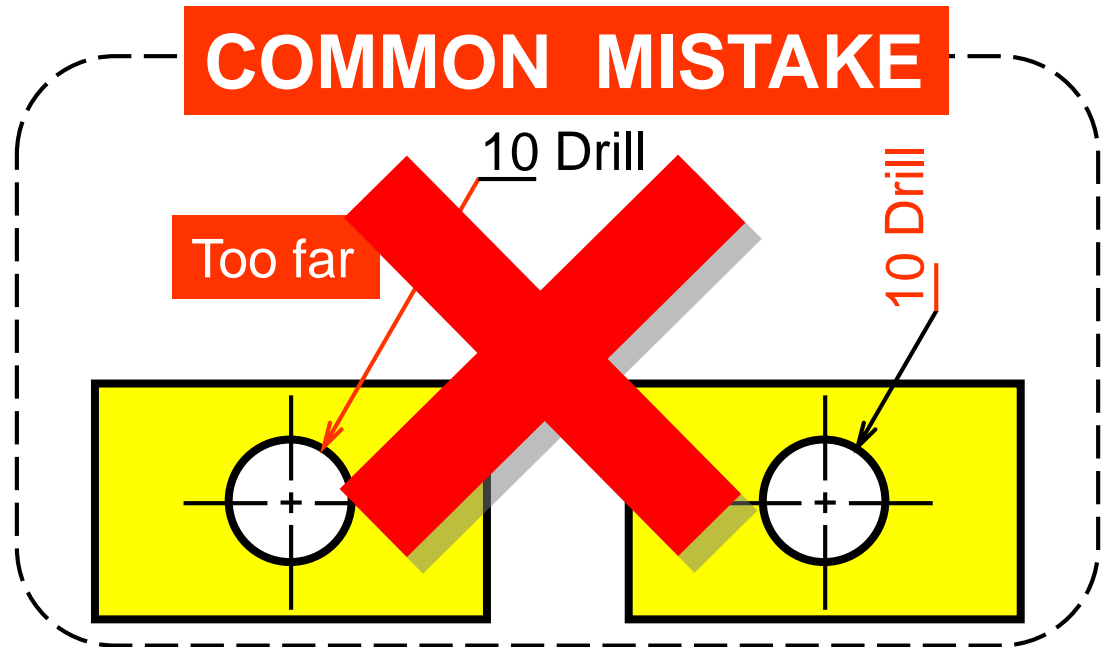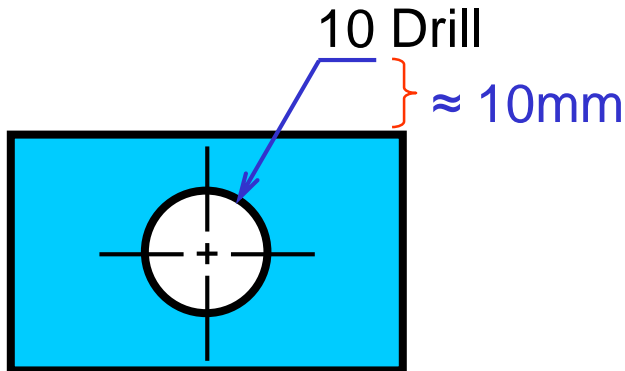
Dimensioning Practices

THE BASIC CONCEPT

Dimensioning is accomplished by adding *size* and *location* information *necessary to manufacture* the object.

This information have to be

- Clear
- Complete
- Facilitate the
  - manufacturing method
  - measurement method

EXAMPLE

Designed
part
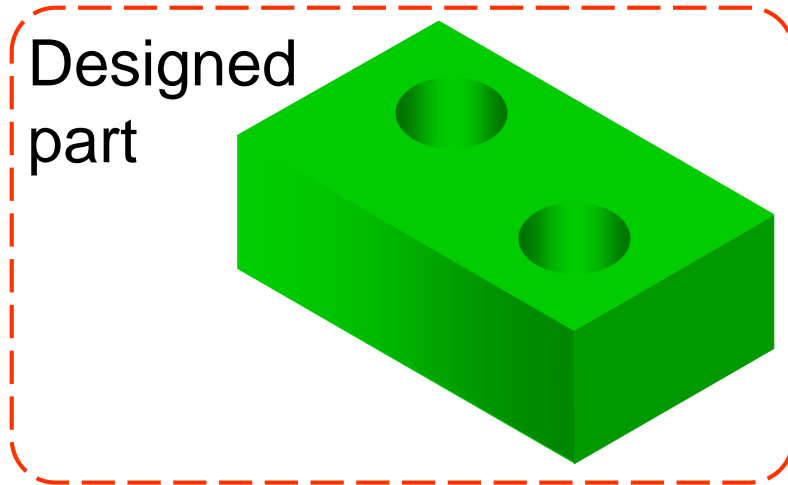
To manufacture this part
we need to know…

1. **Width**, **depth** and
   thickness of the part.

2. **Diameter** and **depth**
   of the hole.

3. **Location** of the holes.
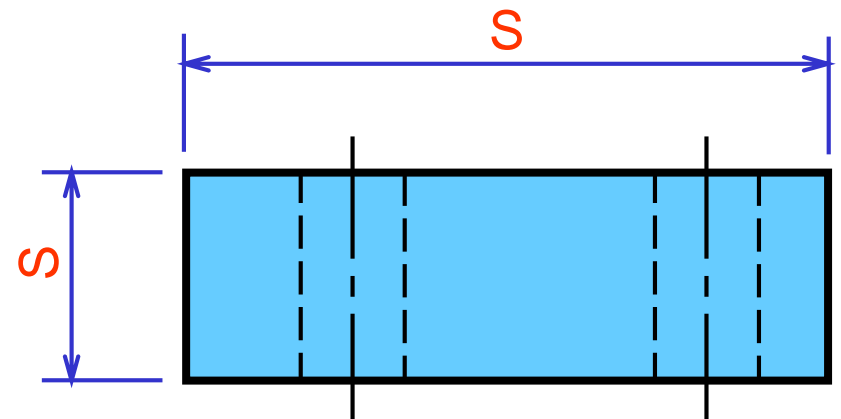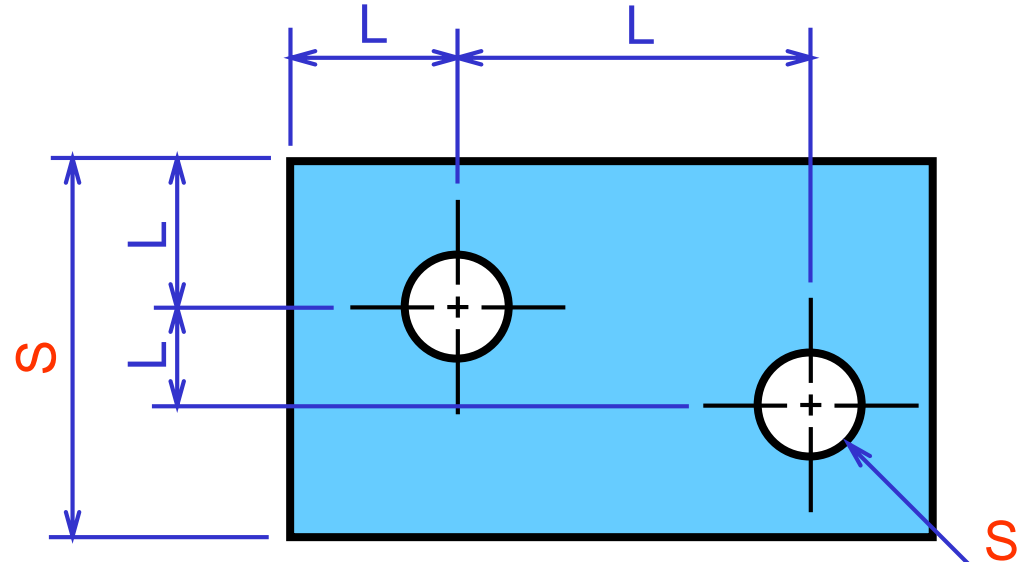
"S" denotes size dimension.

"L" denotes location dimension.

ANGLE

To dimension an angle use **circular dimension line** having the center at the vertex of the angle.
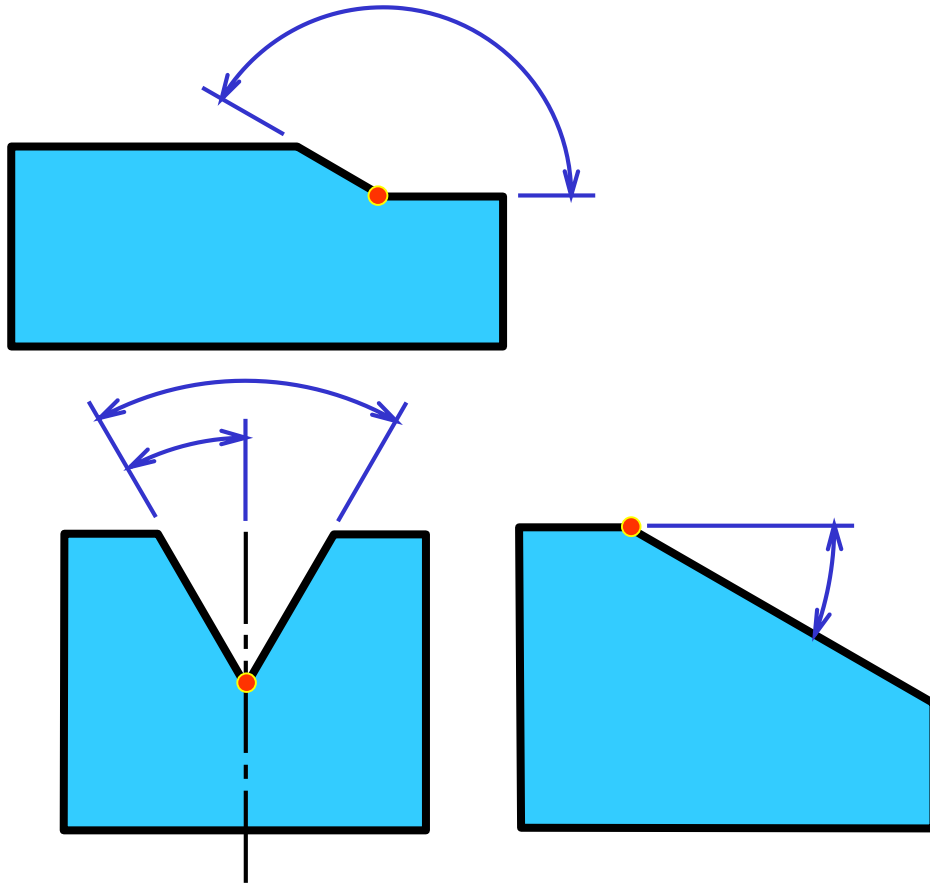
COMMON MISTAKE
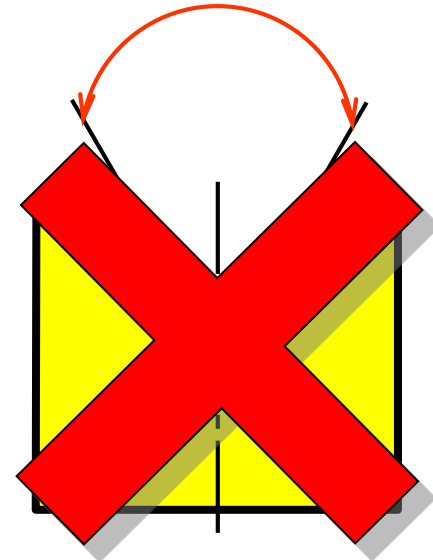
ARC

- Arcs are dimensioned by giving the **radius**, in the views in which their true shapes appear.

- The letter "R" is **always** lettered before the figures to emphasize that this dimension is radius of an arc.

R 200

or

R 200
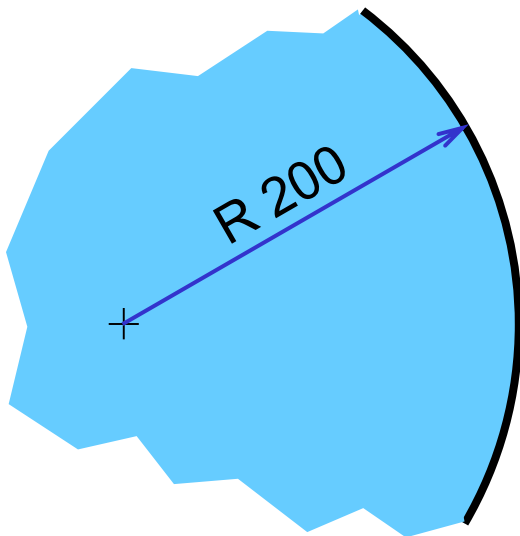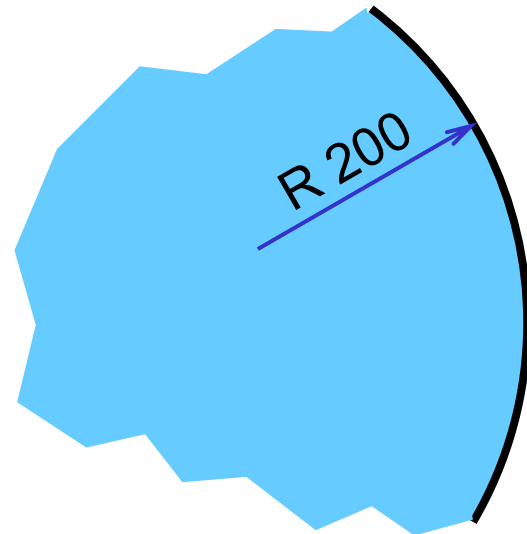
ARC

The dimension figure and the arrowhead **should be inside** the arc, where there is sufficient space.

Sufficient space for both.
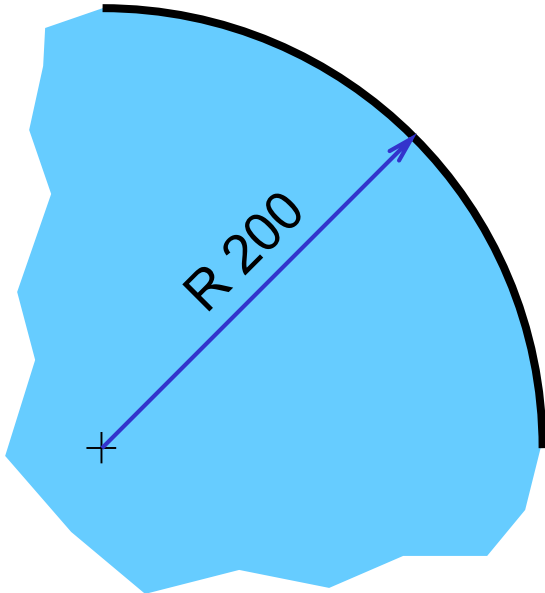
Sufficient space for arrowhead only.

Move figure outside
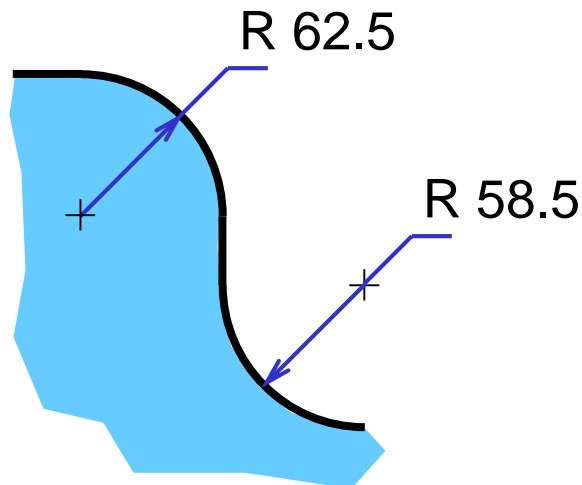
Insufficient space for both.

Move both figure and arrow outside

R 200

R 62.5

R 58.5

R 6.5
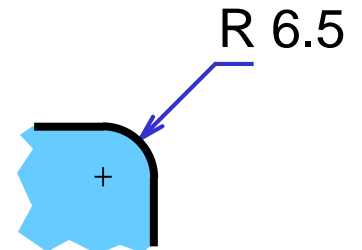
ARC

■ Leader line **must** be **radial** and **inclined** with an angle between 30 ~ 60 degs to the horizontal.

60°

30°

R62.5

COMMON MISTAKE

R62.5

R62.5

R62.5
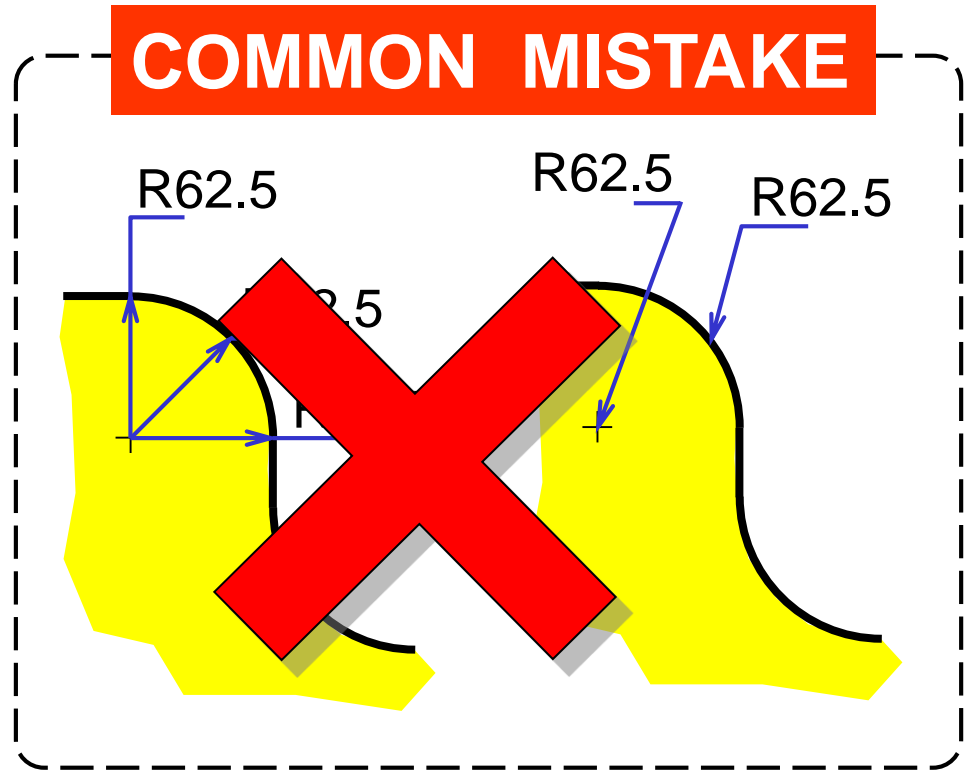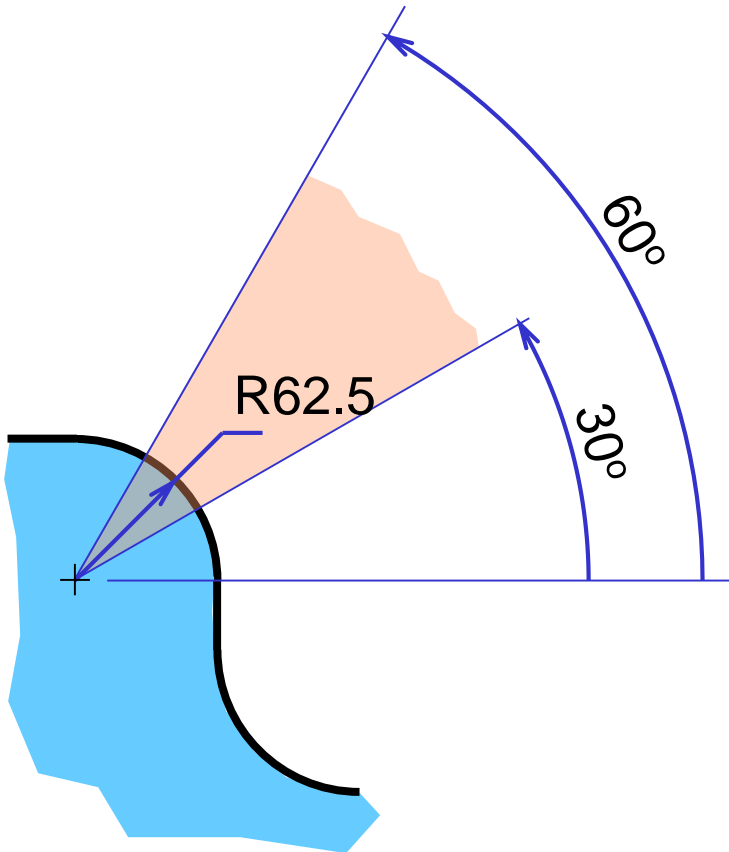
ARC

■ Use the **foreshortened radial dimension line**, when arc' s center locates outside the sheet or interfere with other views.

Method 2
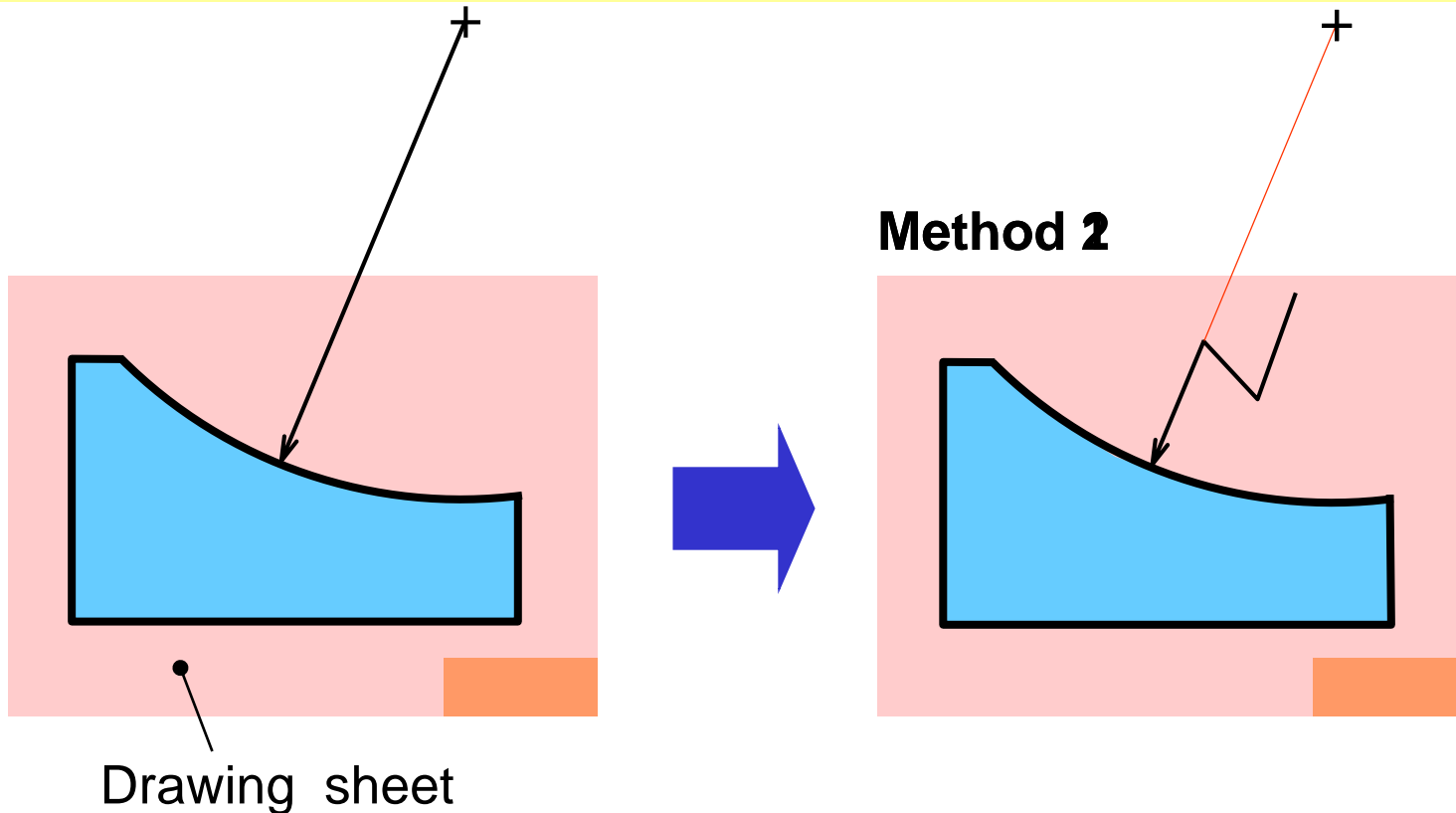
Drawing sheet

FILLETS AND ROUNDS

- Give the radius of a typical fillet only by using a *local* note.

- If all fillets and rounds are uniform in size, dimension may be omitted, but it is necessary to add the note " All fillets and round are Rxx. "

R6.5

NOTE:
All fillets and round are R6.5

Drawing sheet

R12

NOTE:
All fillets and round are R6.5
unless otherwise specified.
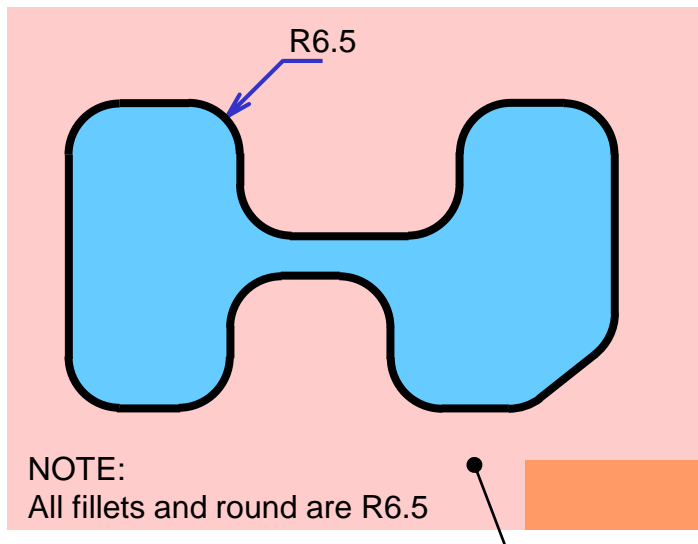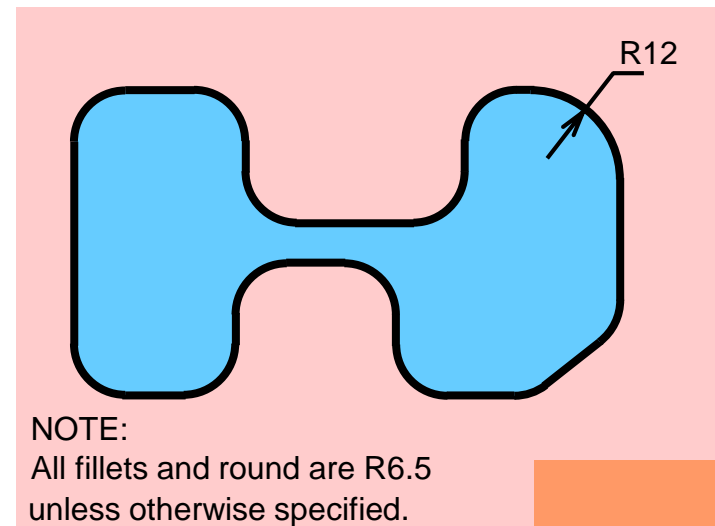
CURVE

The curve constructed from two or more arcs, requires the dimensions of **radii** and **center's location**.

Tangent point
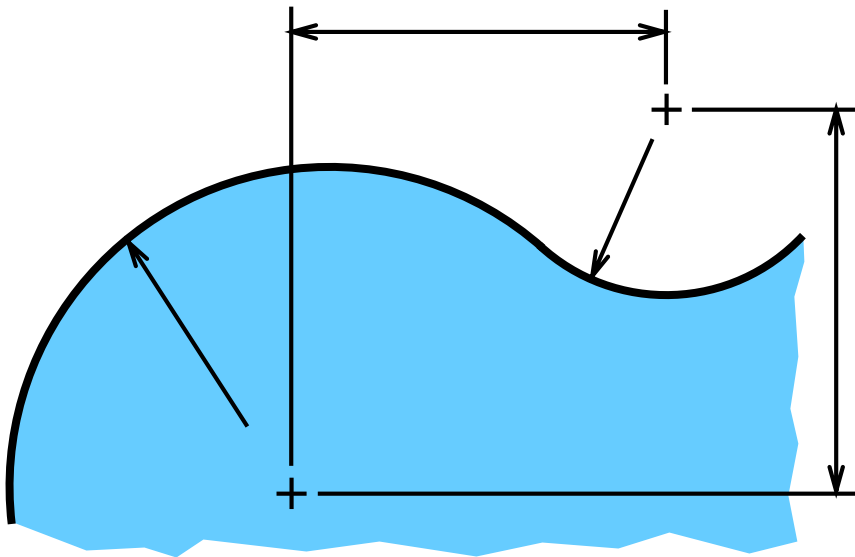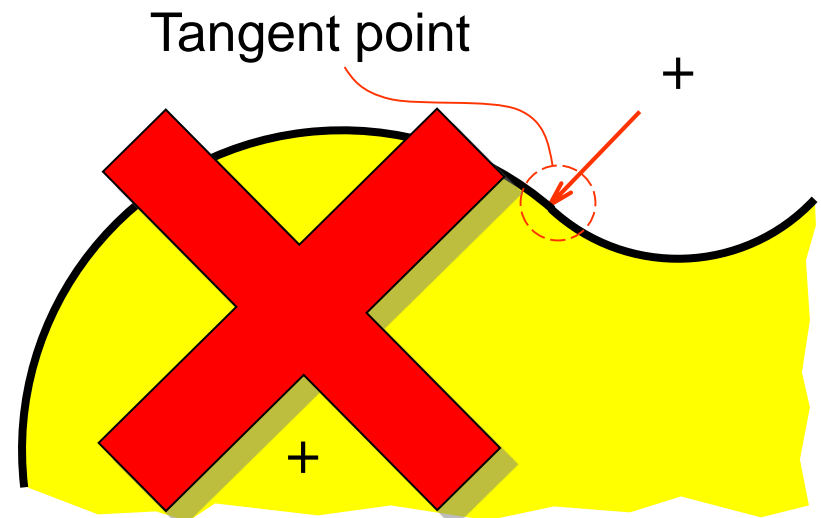
CYLINDER

■ Size dimensions are **diameter** and **length**.

■ Location dimension **must** be located from its center lines and **should be** given in circular view.

Measurement method
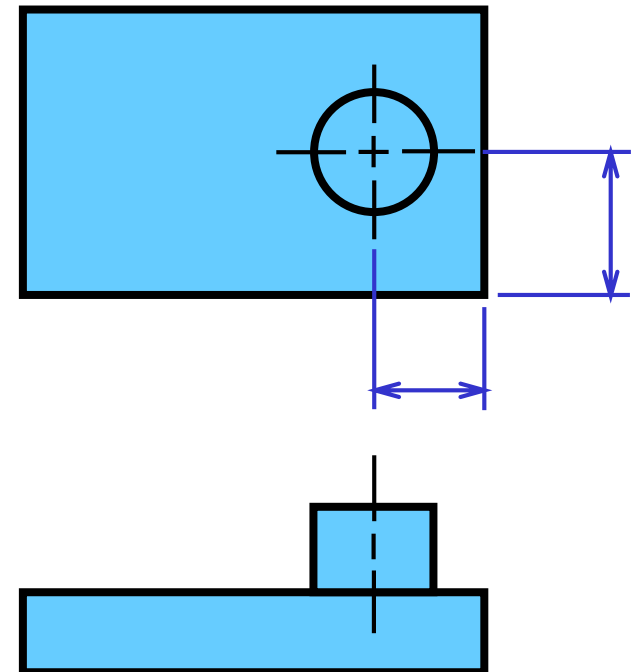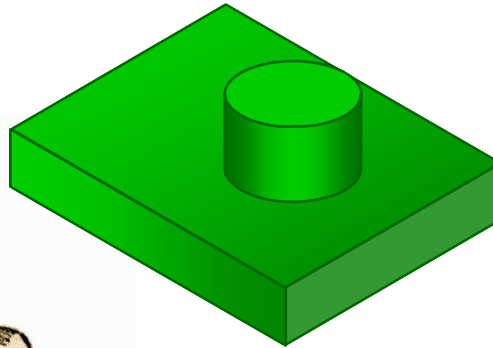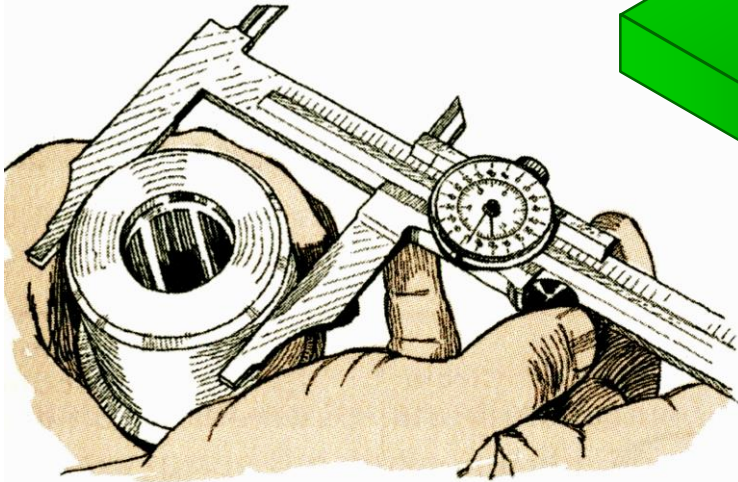
CYLINDER

■ Diameter **should be** given in a longitudinal view with the symbol "ϕ" placed before the figures.
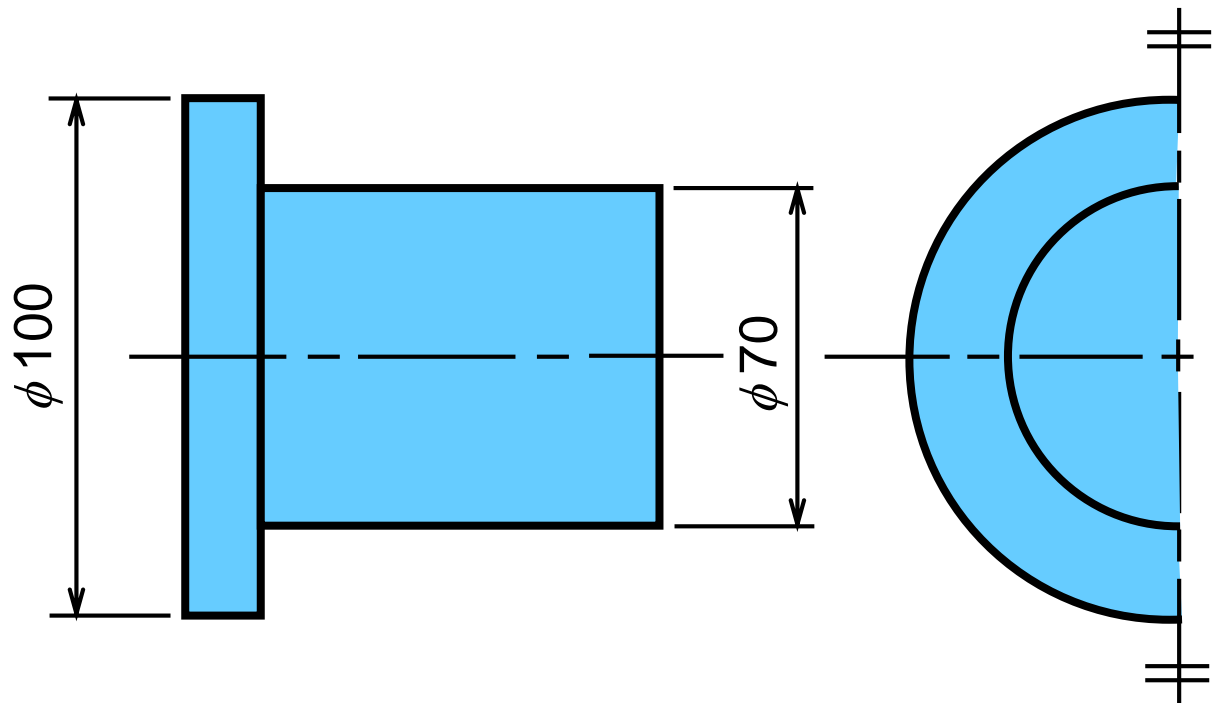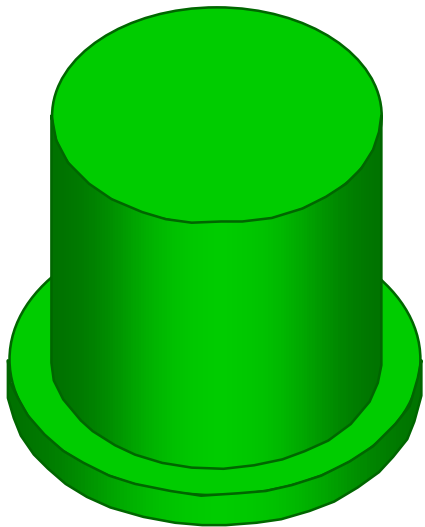
HOLES

- Size dimensions are **diameter** and **depth**.

- Location dimension **must** be located from its center lines and should be given in circular view.

Measurement method
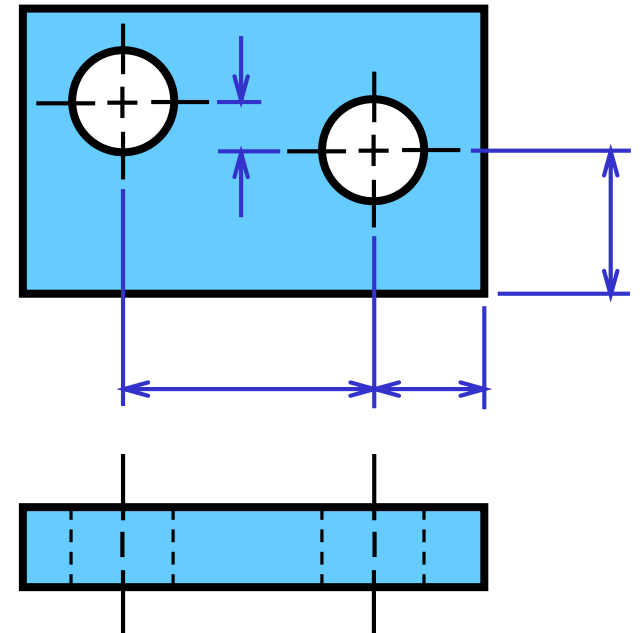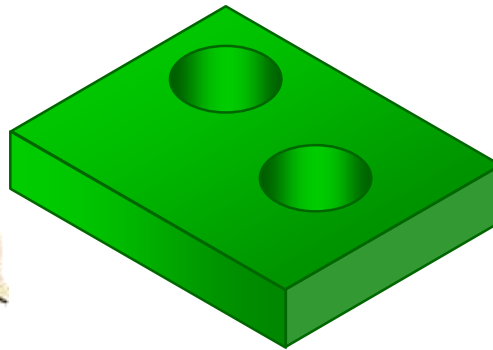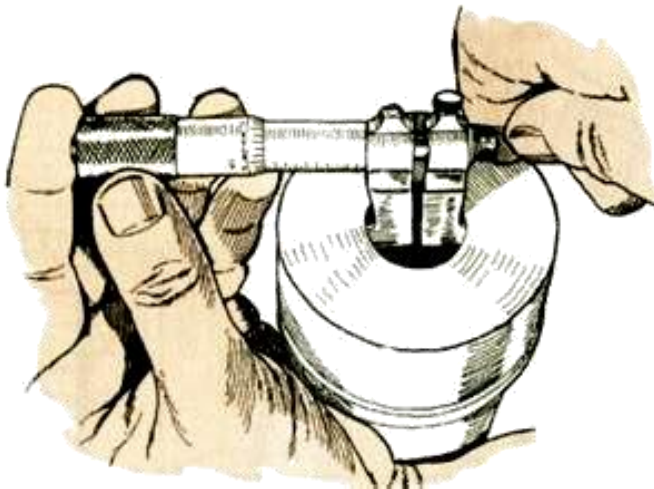
HOLES : SMALL SIZE

■ Use leader line and local note to specify **diameter** and **hole's depth** in the circular view.

1) Through thickness hole
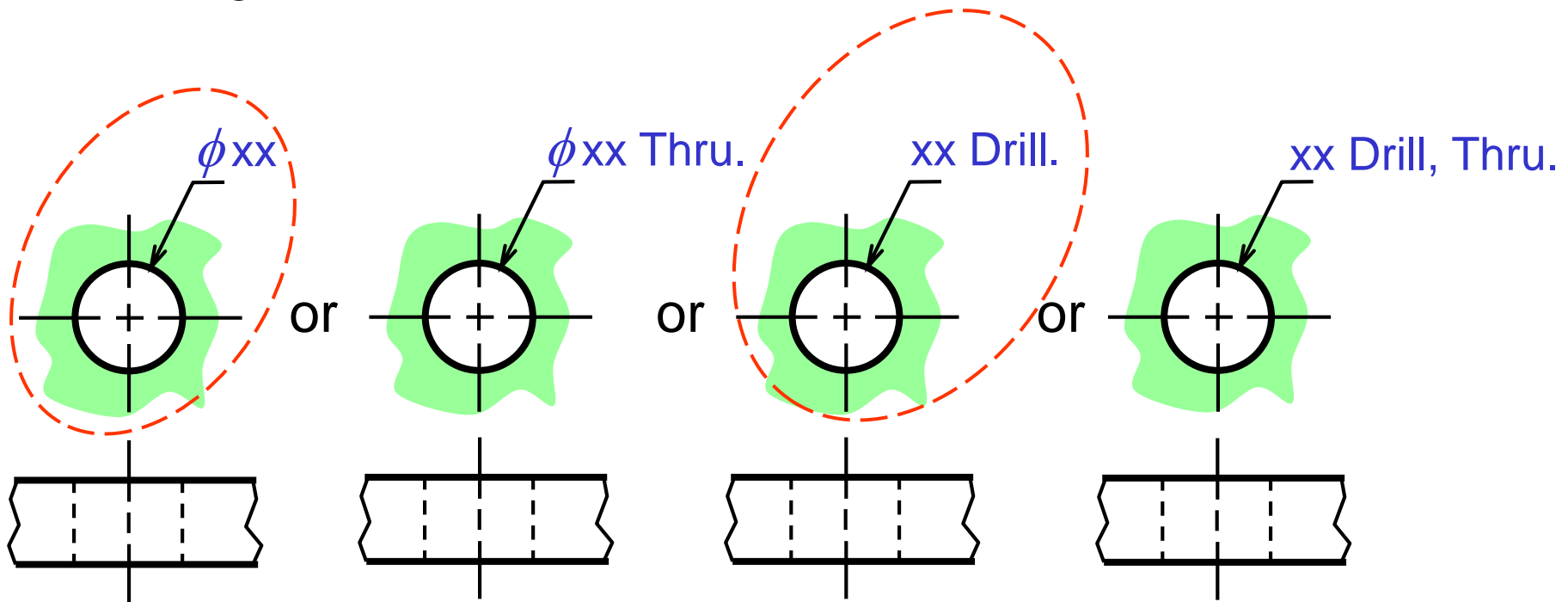
ϕxx   or ϕxx Thru.   or   xx Drill.   or   xx Drill, Thru.

HOLES : SMALL SIZE

■ Use leader line and local note to specify **diameter** and **hole's depth** in the circular view.

2) Blind hole

ϕxx, yy Deep

xx Drill, yy Deep

or

Hole's depth
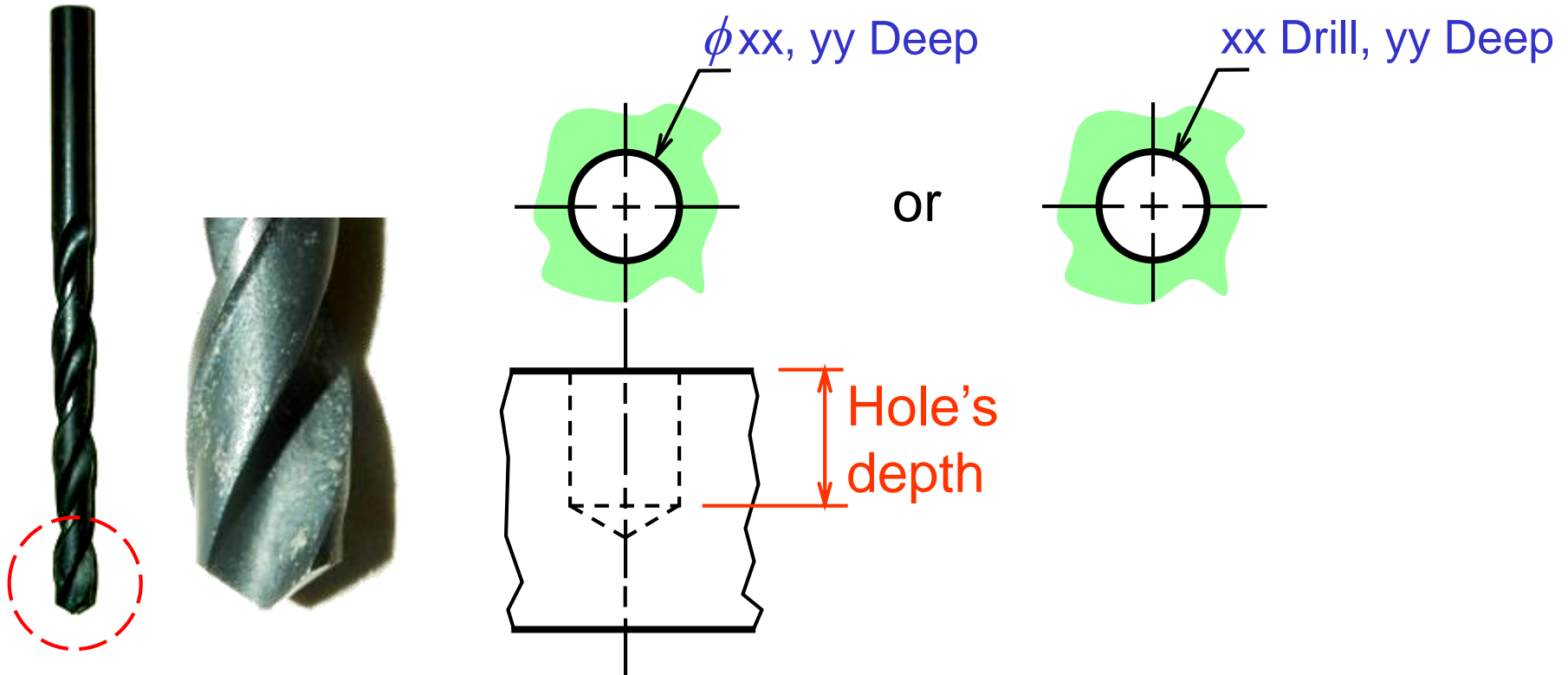
HOLES : LARGE SIZE

Use extension and
dimension lines
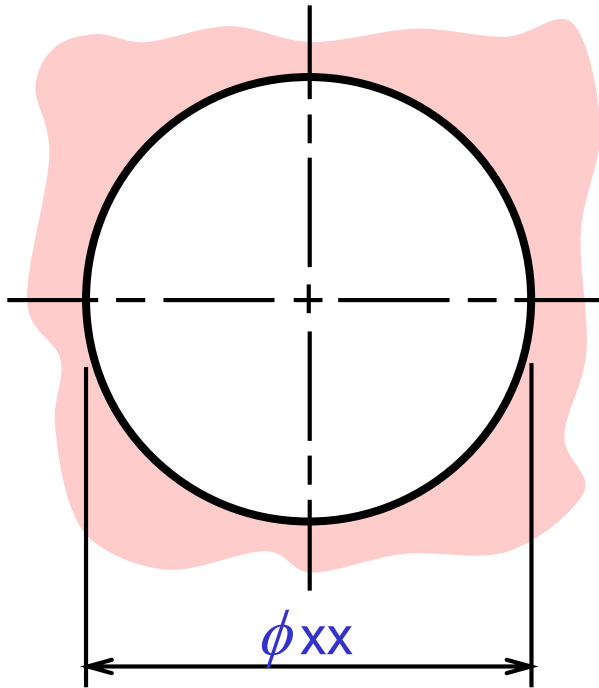
Use diametral
dimension line

Use leader line
and note

ϕ xx

HOLES

ϕxx   Rxx ϕxx ϕxx

ϕxx ϕxx
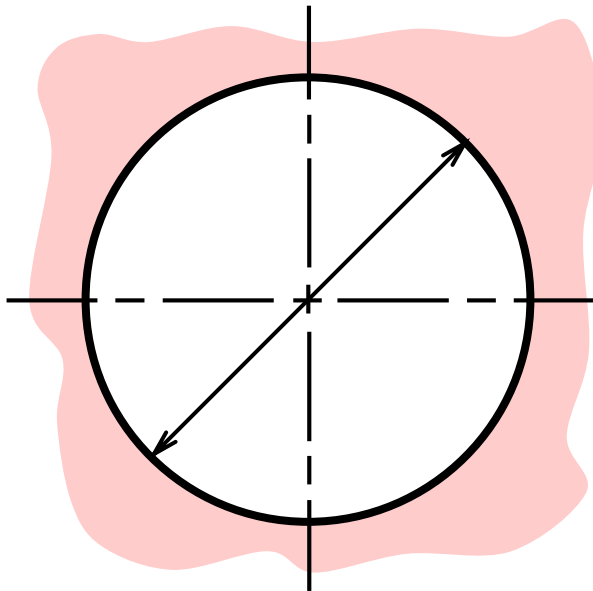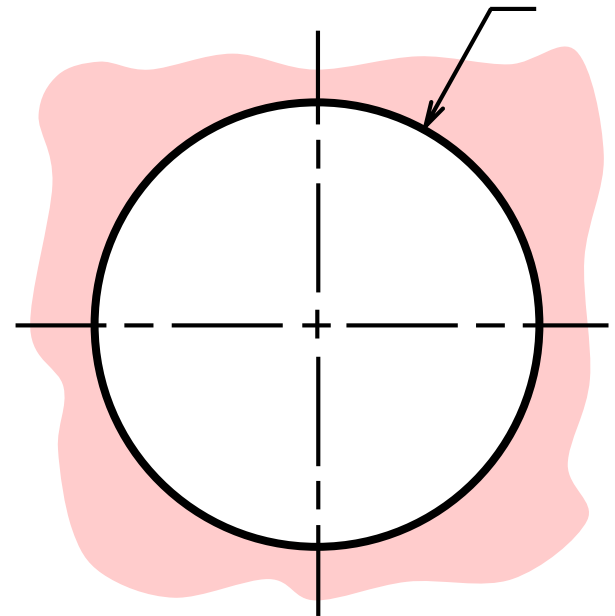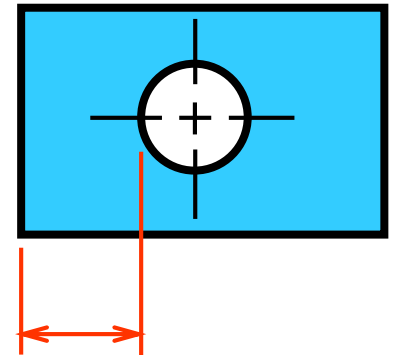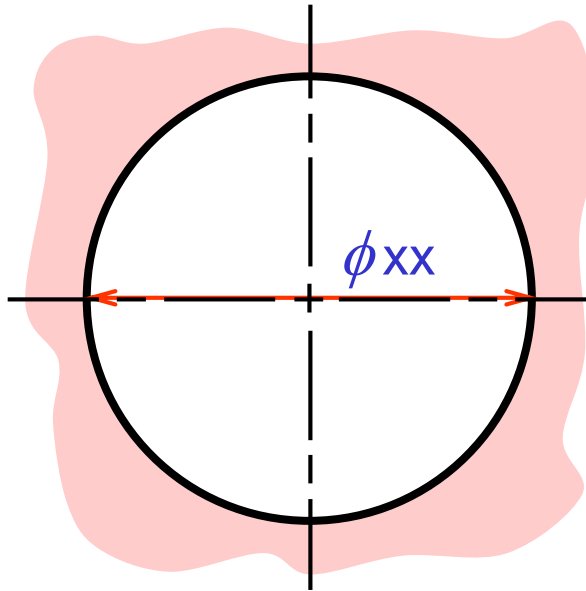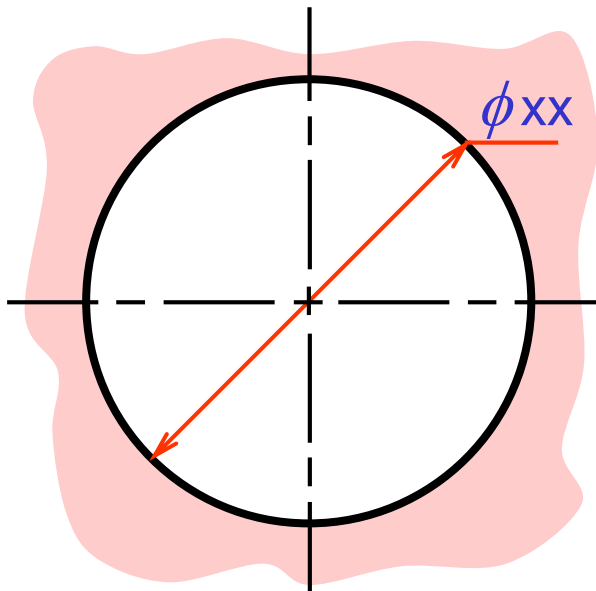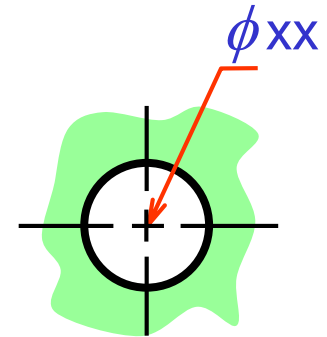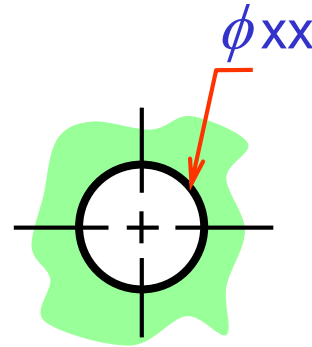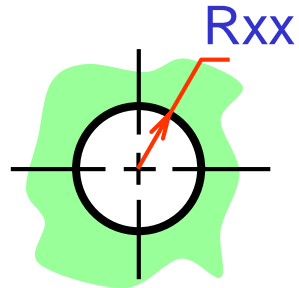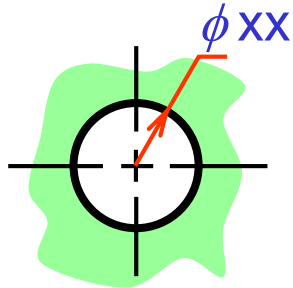
CHAMFER

■ Use leader line and note to indicate **linear distance** and **angle** of the chamfer.
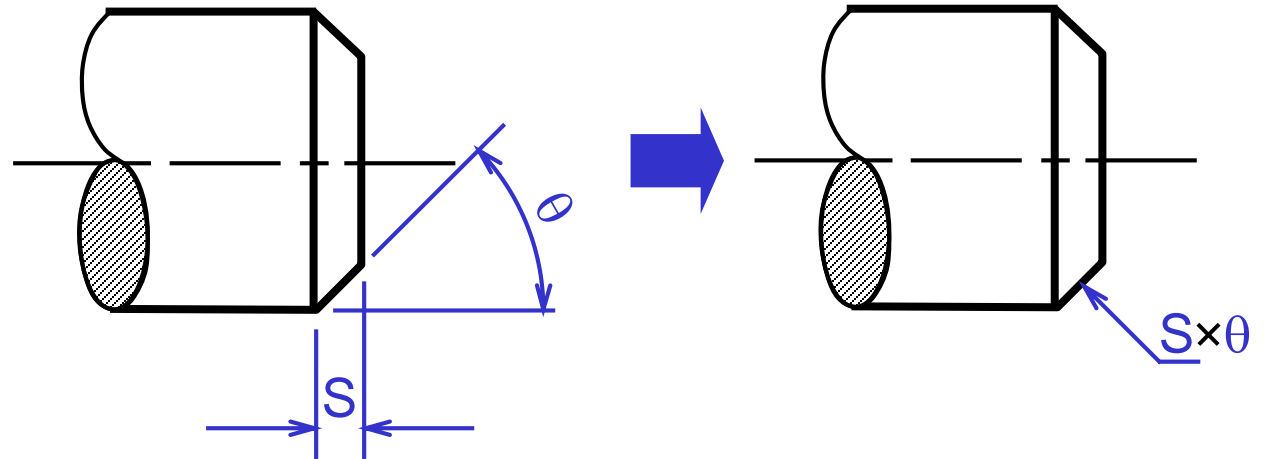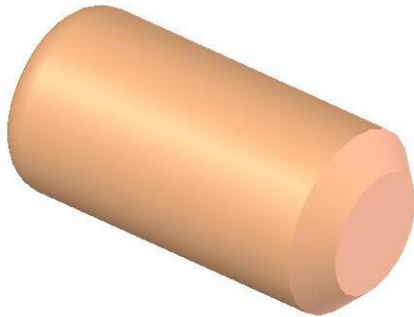
For a 45° chamfer

$S \times \theta$

or

CS
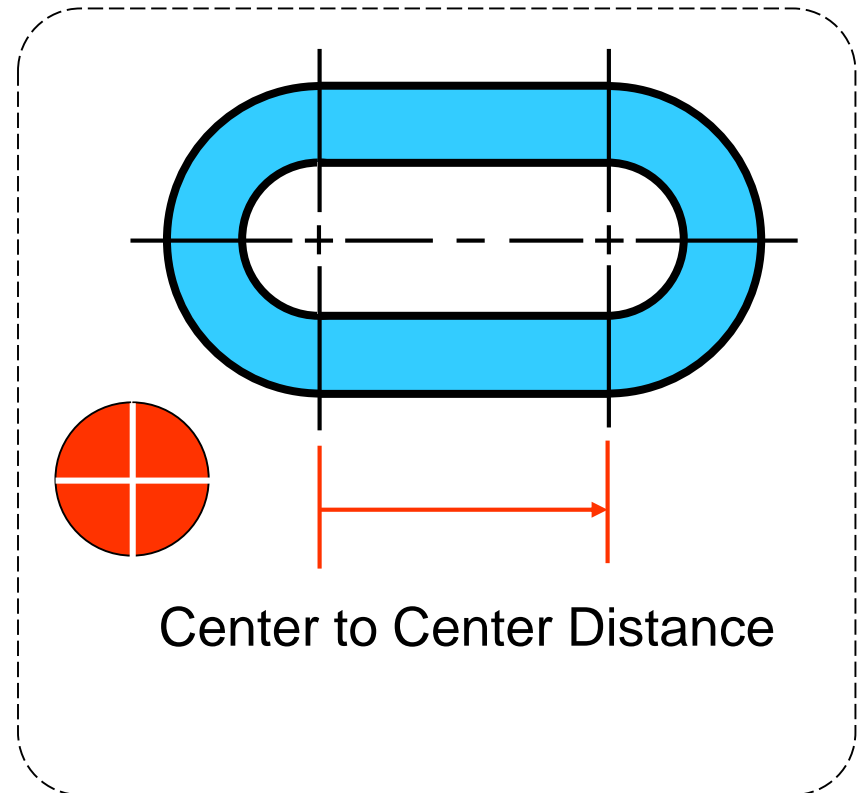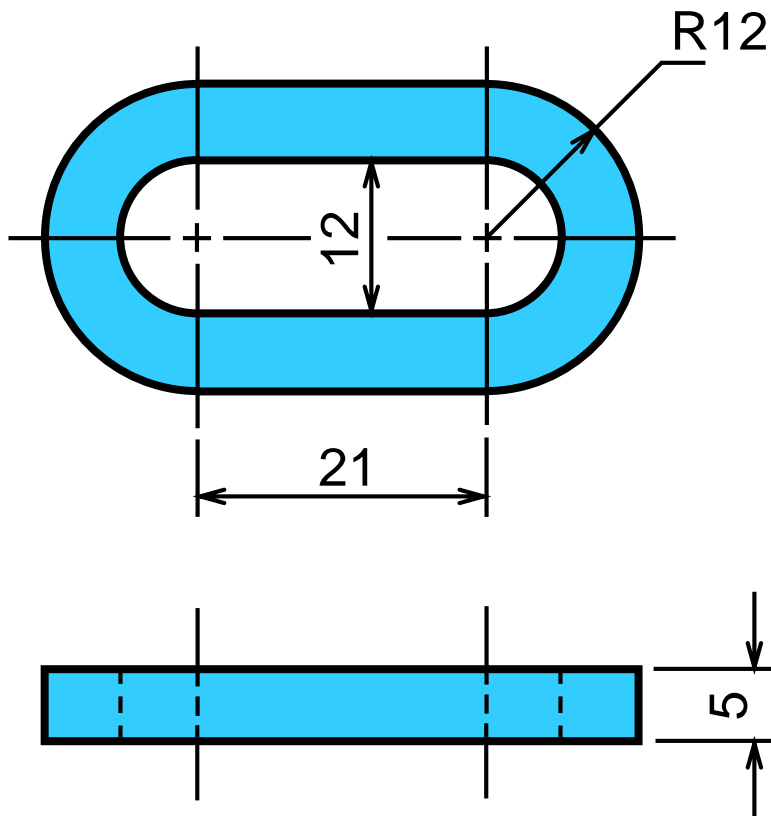
$S \times S$

ROUNDED-END SHAPES

■ Dimensioned according to the manufacturing method used.

ϕ12

R12

21

5

Center to Center Distance

ROUNDED-END SHAPES

Dimensioned according to the manufacturing method used.

R12

12

21

5

Center to Center Distance
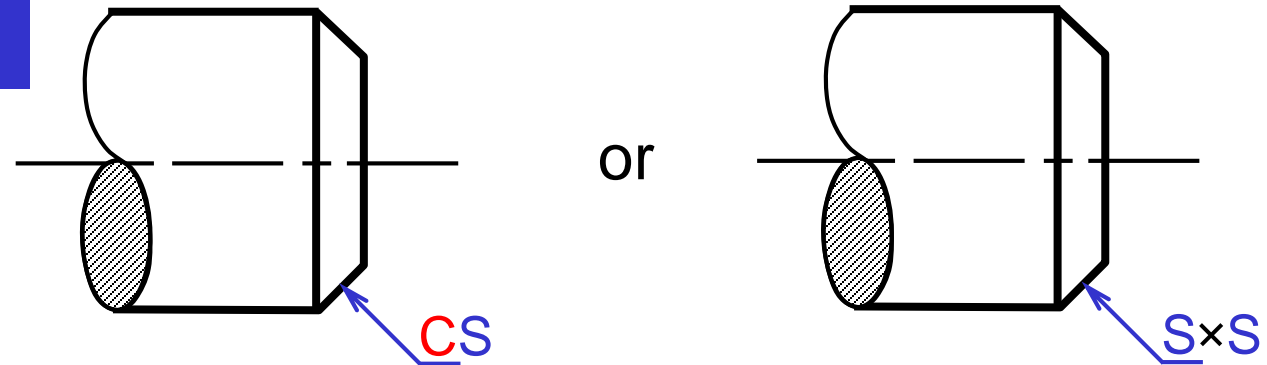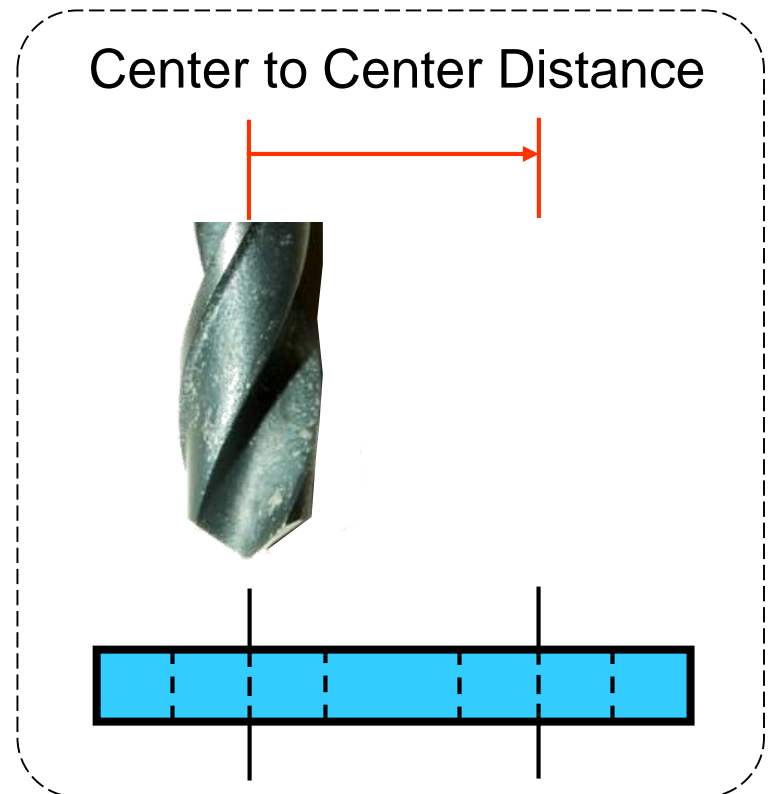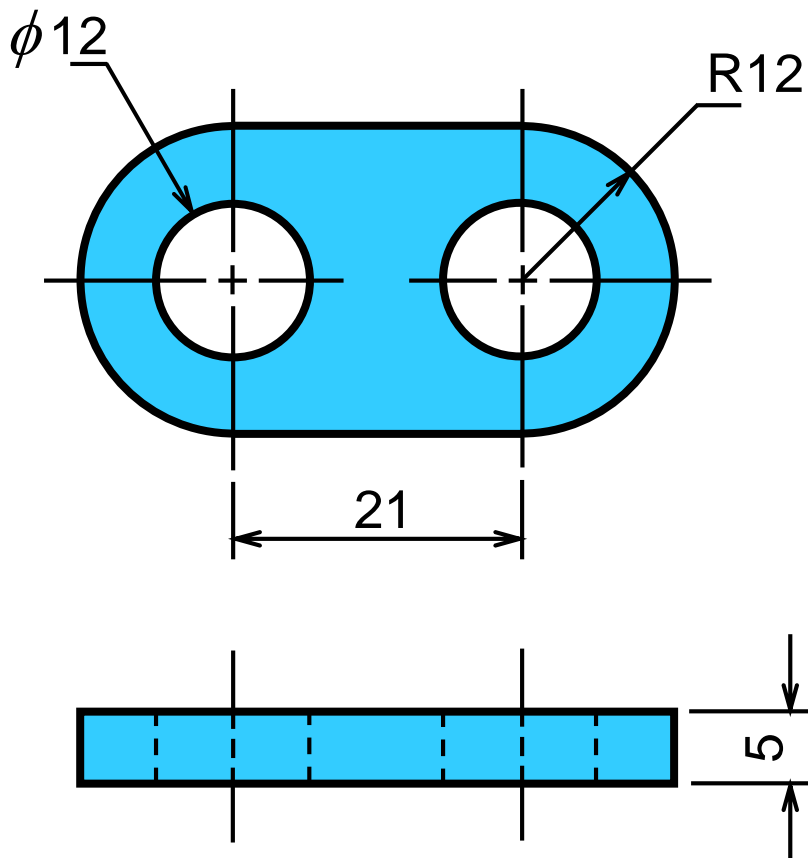
ROUNDED-END SHAPES

Dimensioned according to the manufacturing method used.

ROUNDED-END SHAPES
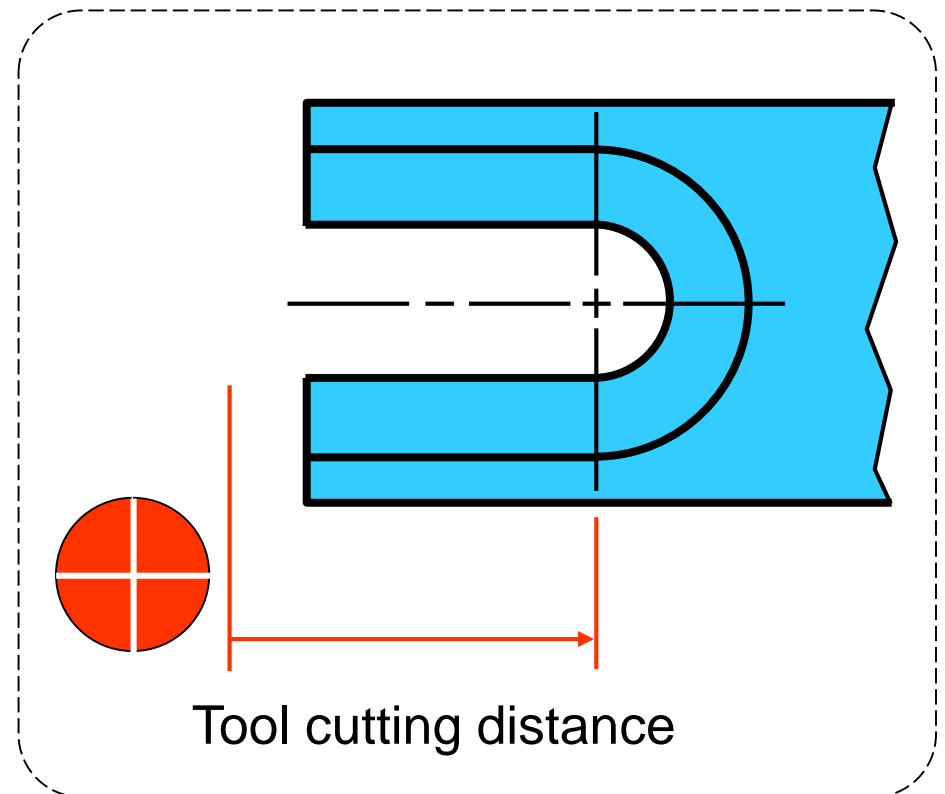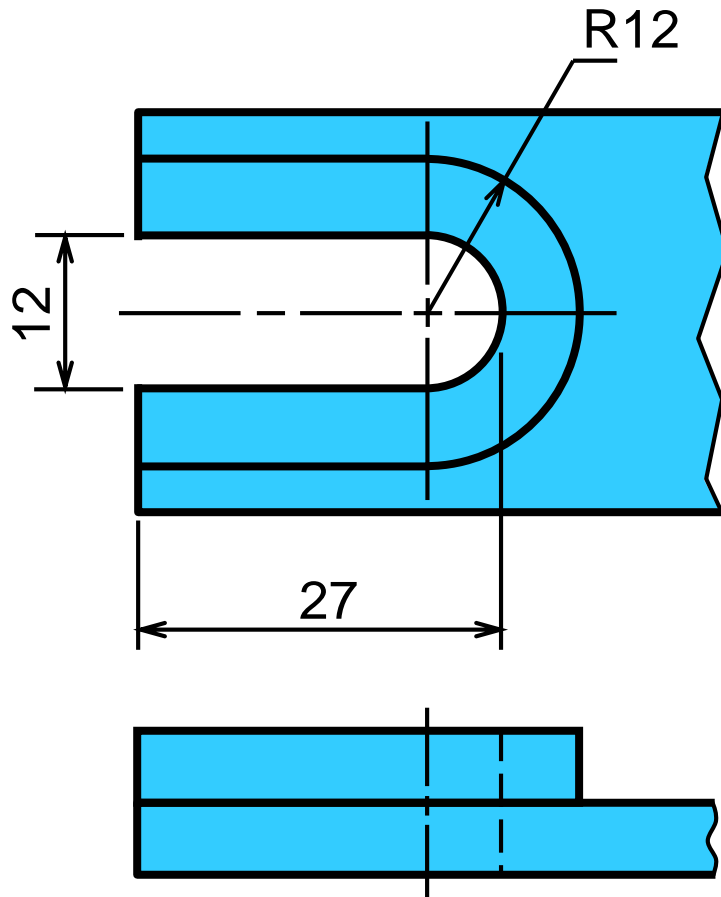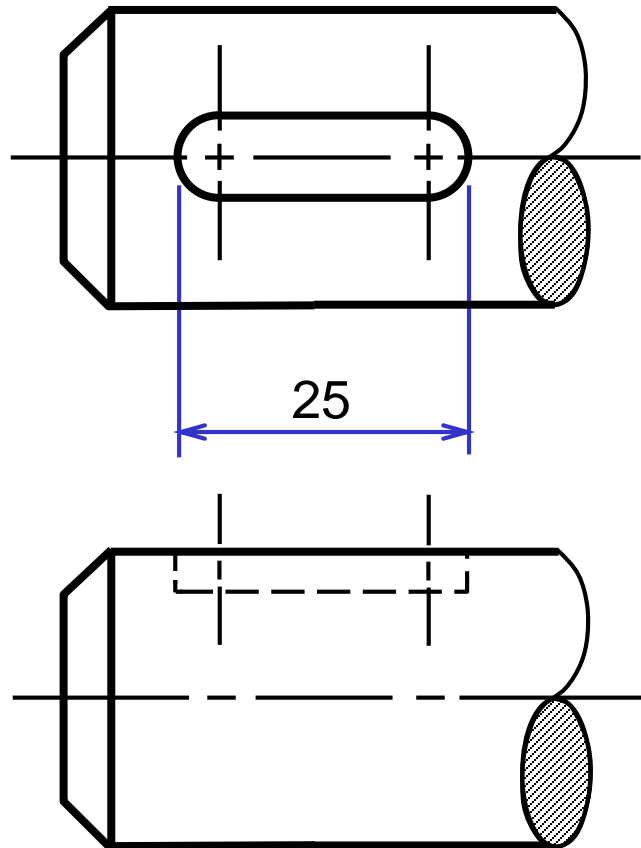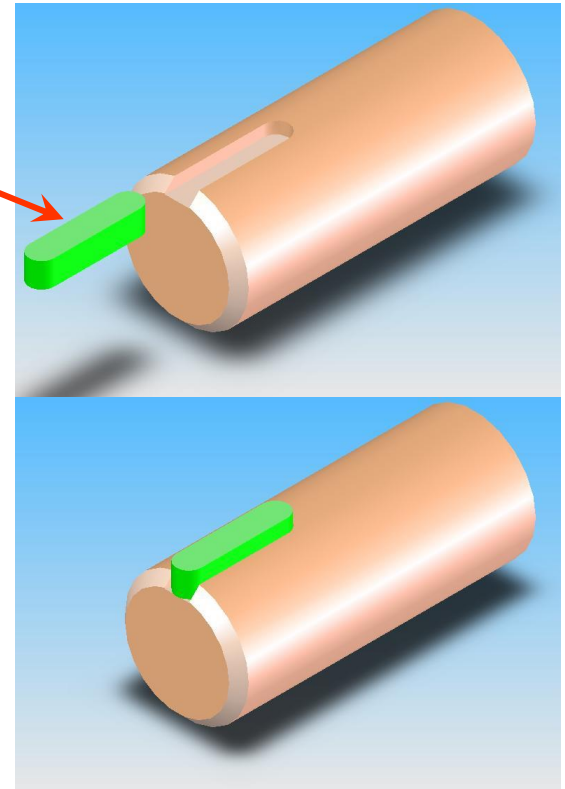
Dimensioned according to the manufacturing method used.

R12

12

27

Tool cutting distance

ROUNDED-END SHAPES

■ Dimensioned according to the **standard sizes** of another part to be assembled or manufacturing method used.

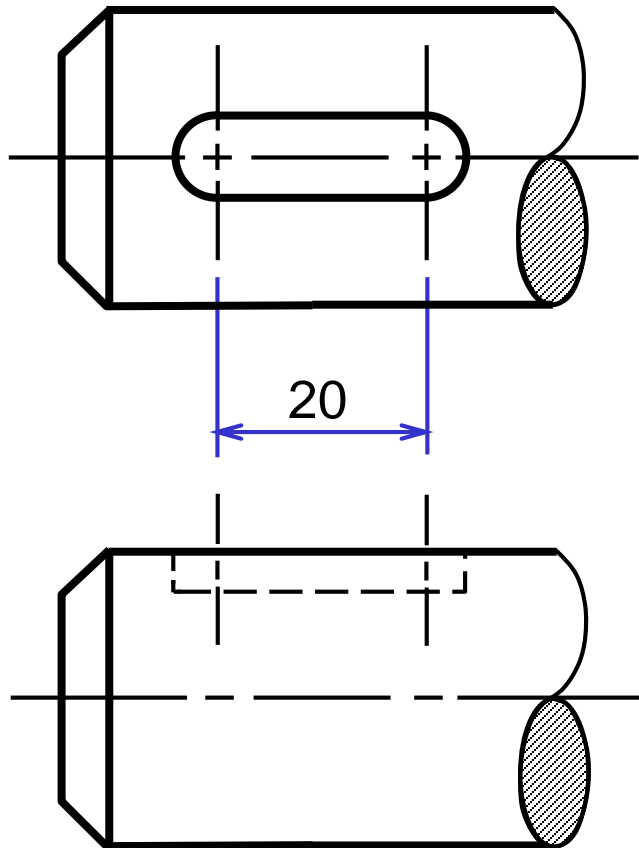25

Key
(standard part)

ROUNDED-END SHAPES

■ Dimensioned according to the **standard sizes** of another part to be assembled or manufacturing method used.
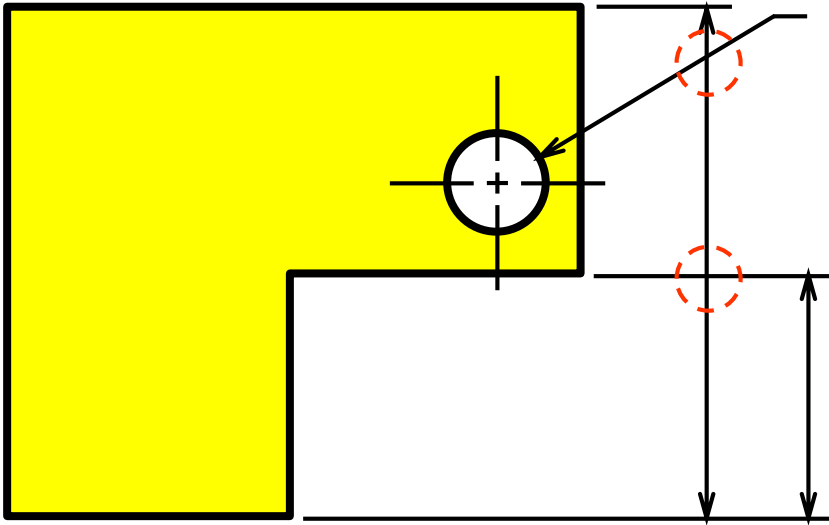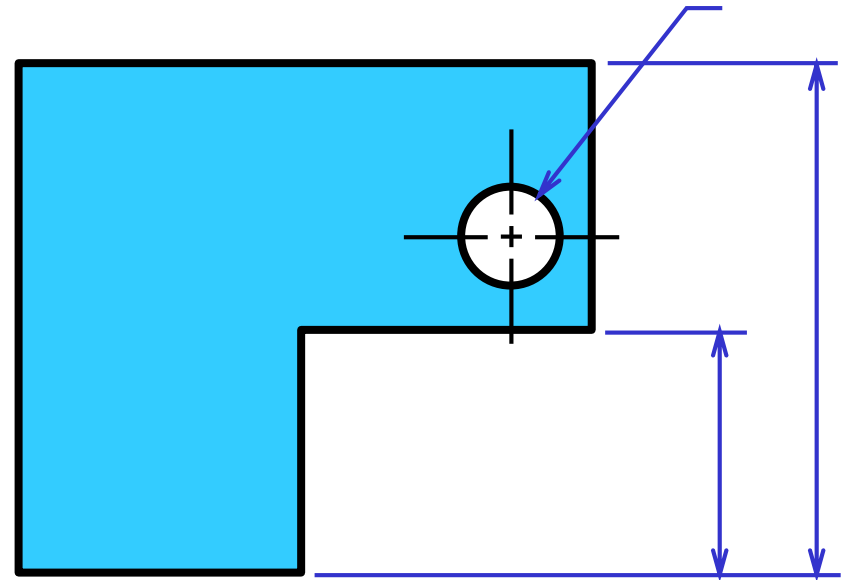
Placement of Dimensions

RECOMMENDED PRACTICE

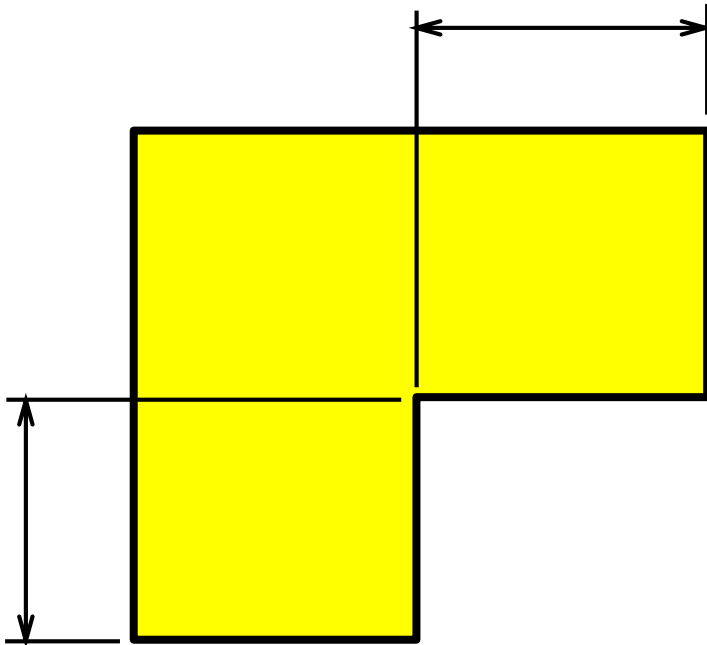1. Extension lines, leader lines **should not** cross dimension lines.
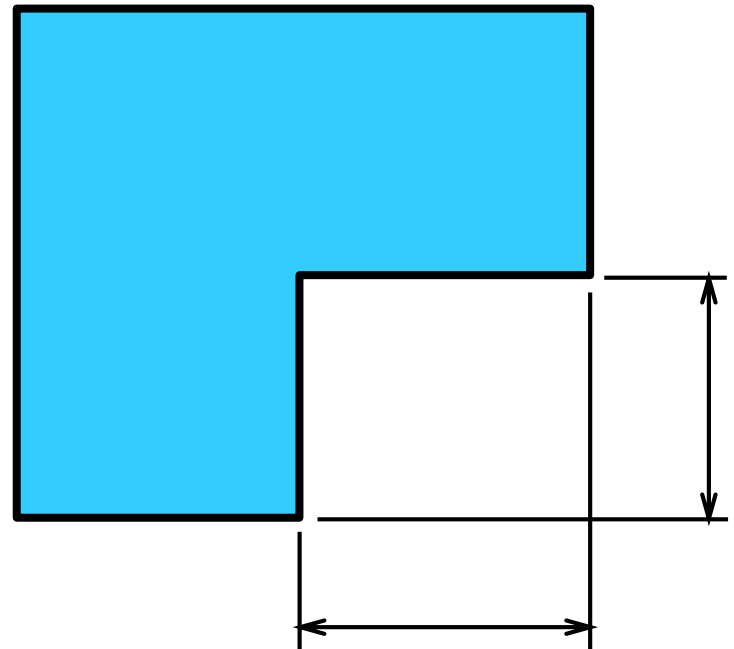
POOR

GOOD

RECOMMENDED PRACTICE

2. Extension lines **should be** drawn from the nearest points to be dimensioned.
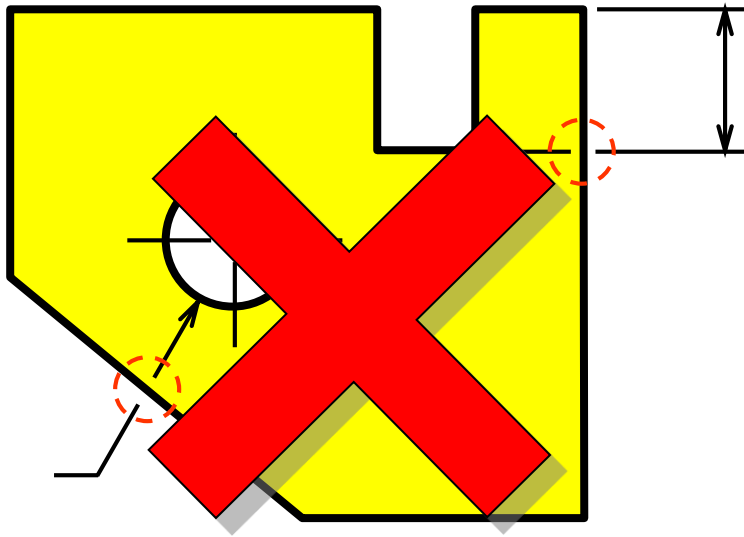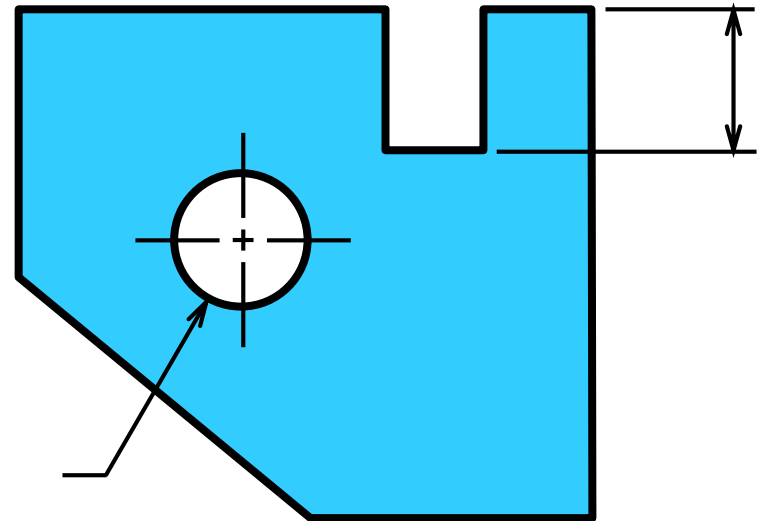
POOR

GOOD

RECOMMENDED PRACTICE

3. *Extension lines of internal feature* **can** *cross visible lines* **without** *leaving a gap at the intersection point.*
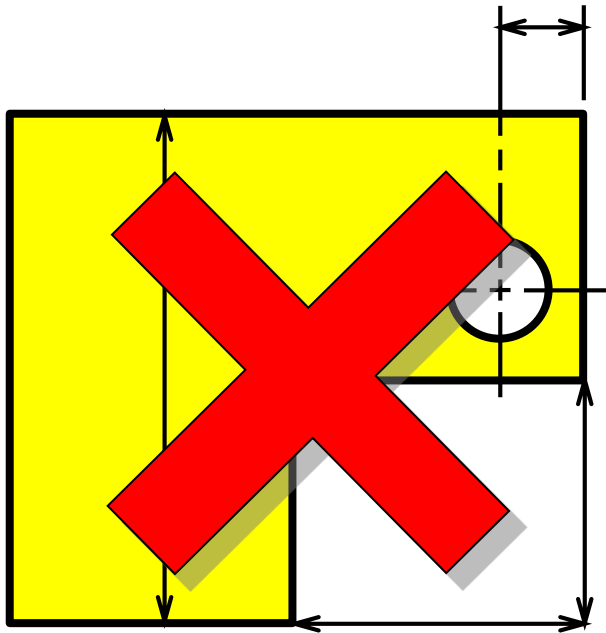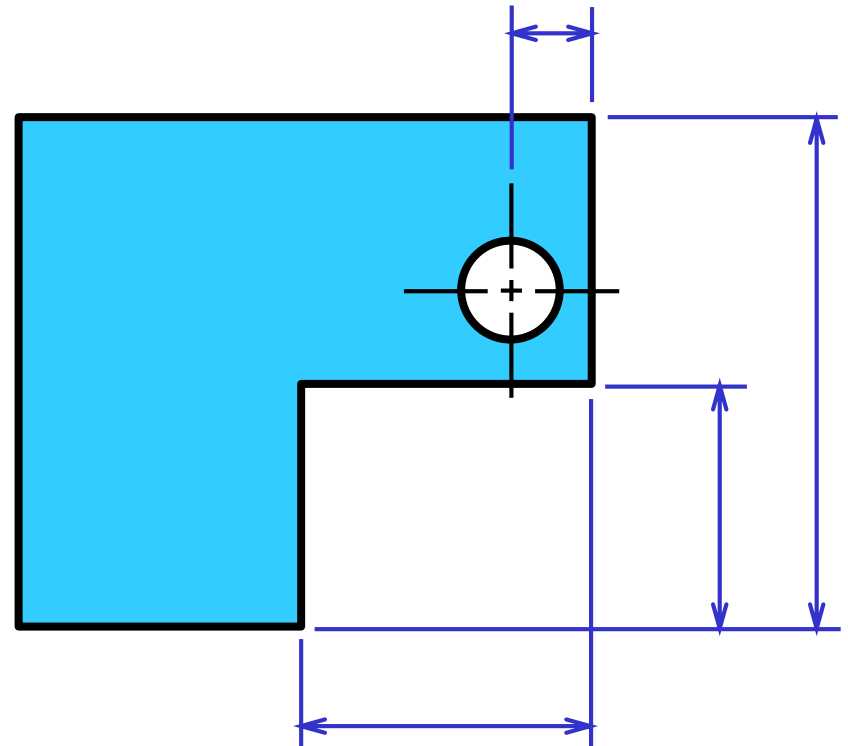
WRONG

CORRECT

RECOMMENDED PRACTICE

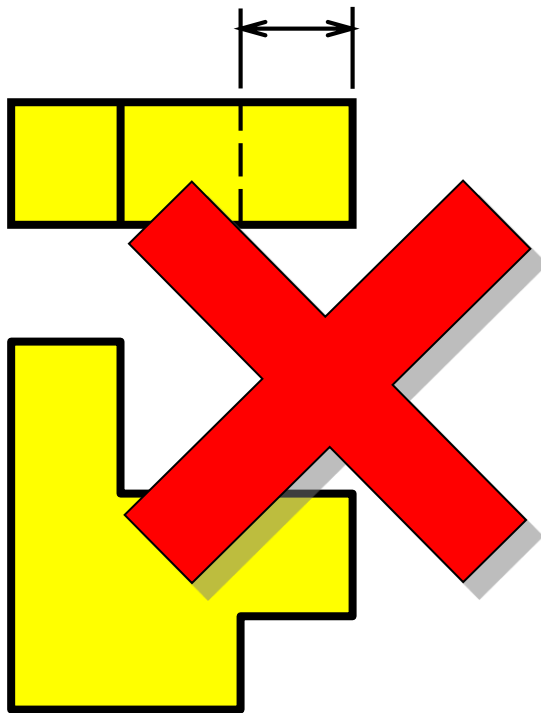*4. **Do not** use object line, center line, and dimension line as an extension lines.*
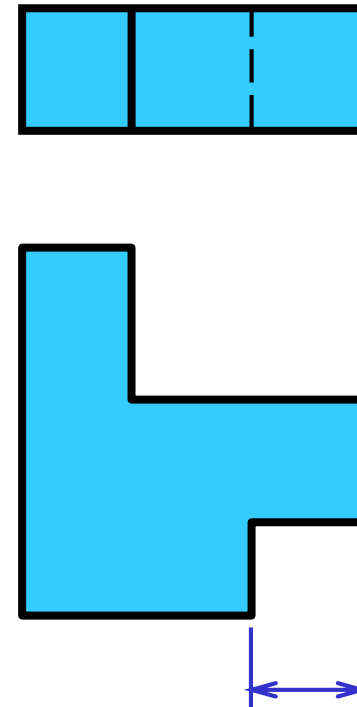
POOR

GOOD

RECOMMENDED PRACTICE

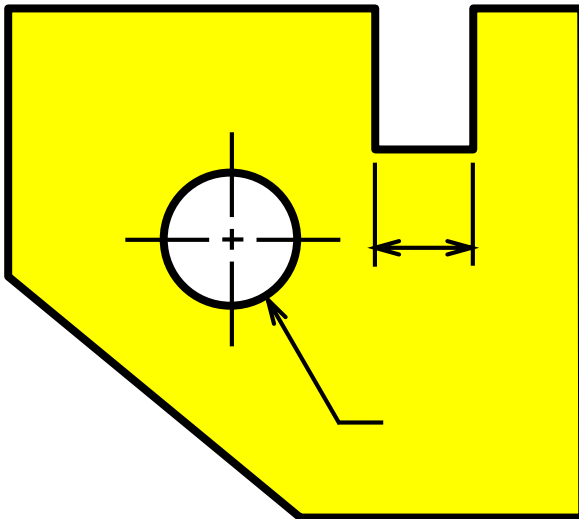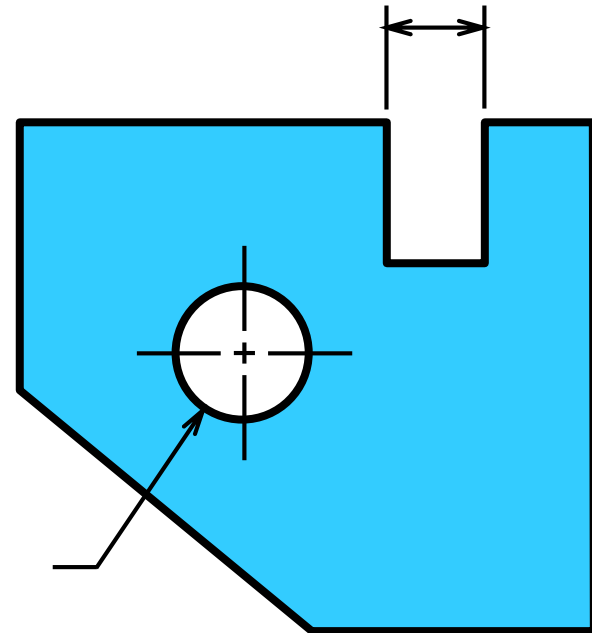5. *Avoid* dimensioning hidden lines.

POOR

GOOD

RECOMMENDED PRACTICE

6. Place dimensions **outside** the view, unless placing them inside improve the clarity.
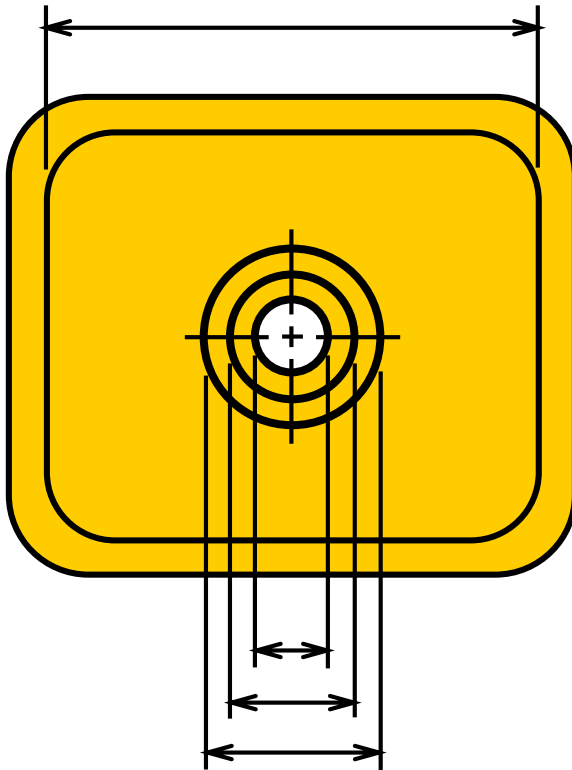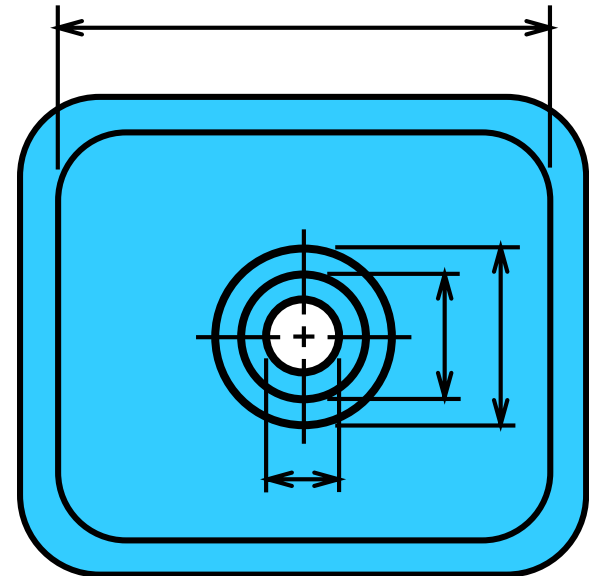
POOR

GOOD

RECOMMENDED PRACTICE

6. Place dimensions **outside** the view, unless placing them inside improve the clarity.
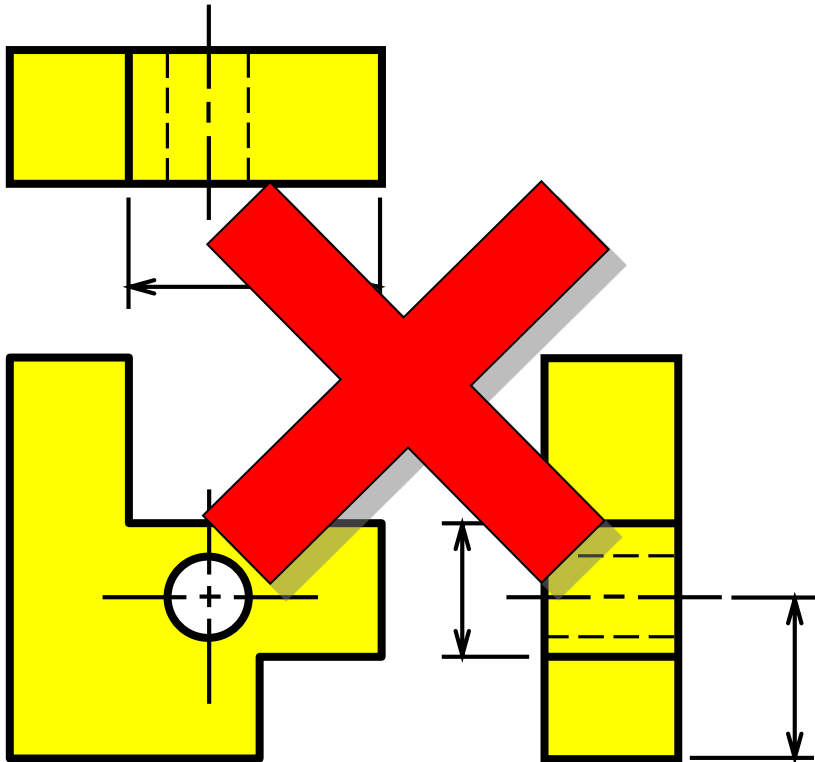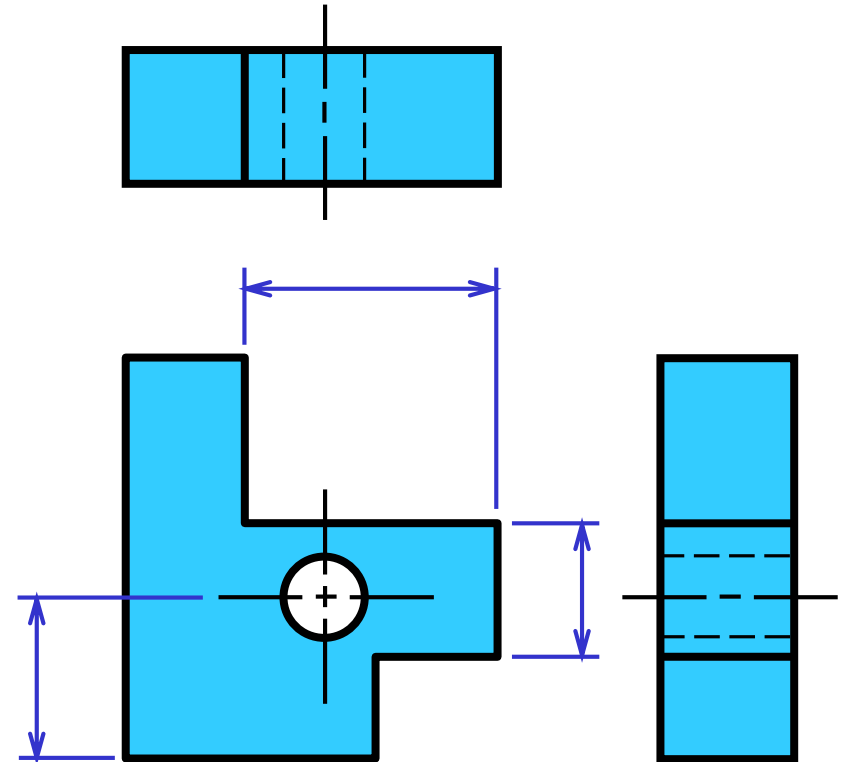
JUST OK !!!　　　　　　**BETTER**

RECOMMENDED PRACTICE

7. *Apply the dimension to the view that clearly show the shape or features of an object.*
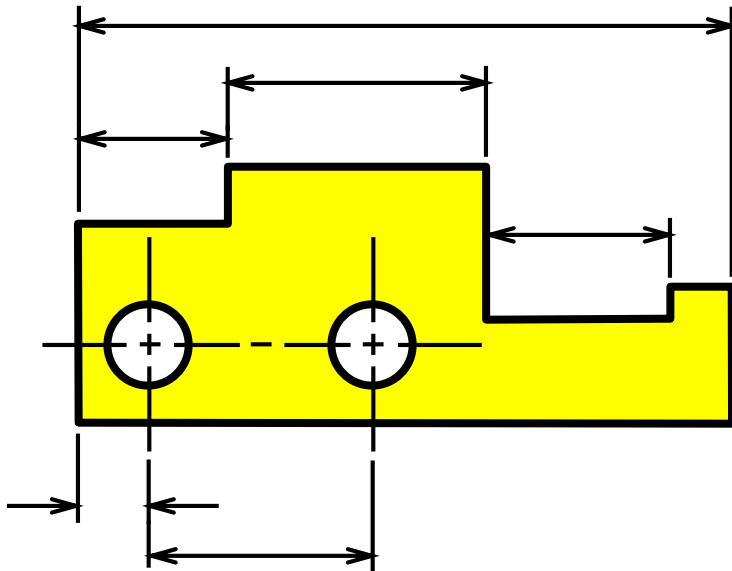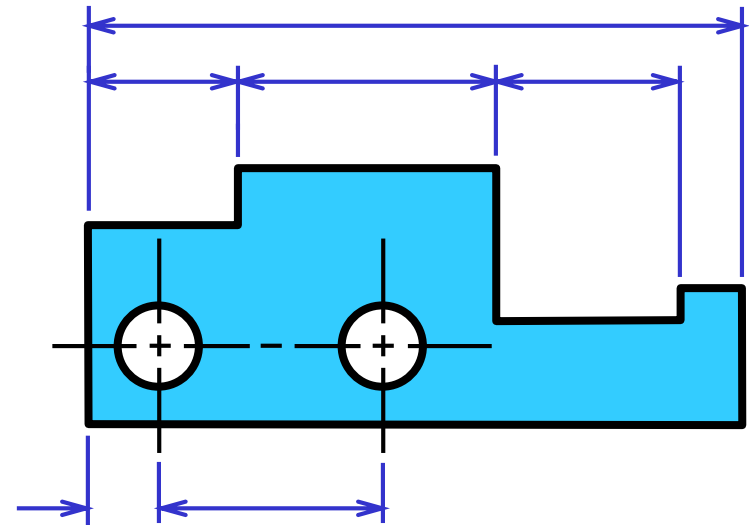
POOR

GOOD

RECOMMENDED PRACTICE

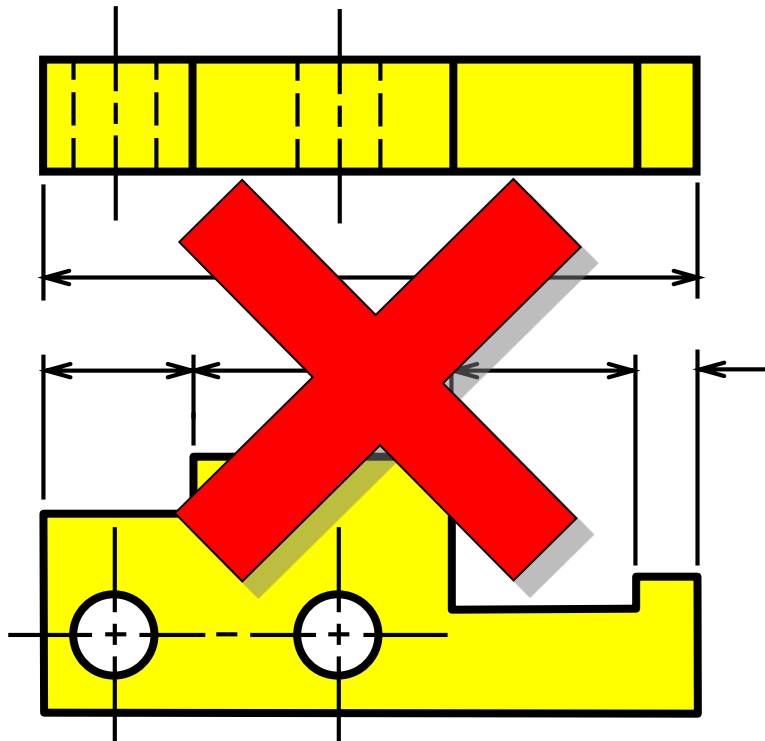8. Dimension lines should be lined up and grouped together as much as possible.

POOR

GOOD

RECOMMENDED PRACTICE

9. *Do not* repeat a dimension.

POOR

GOOD