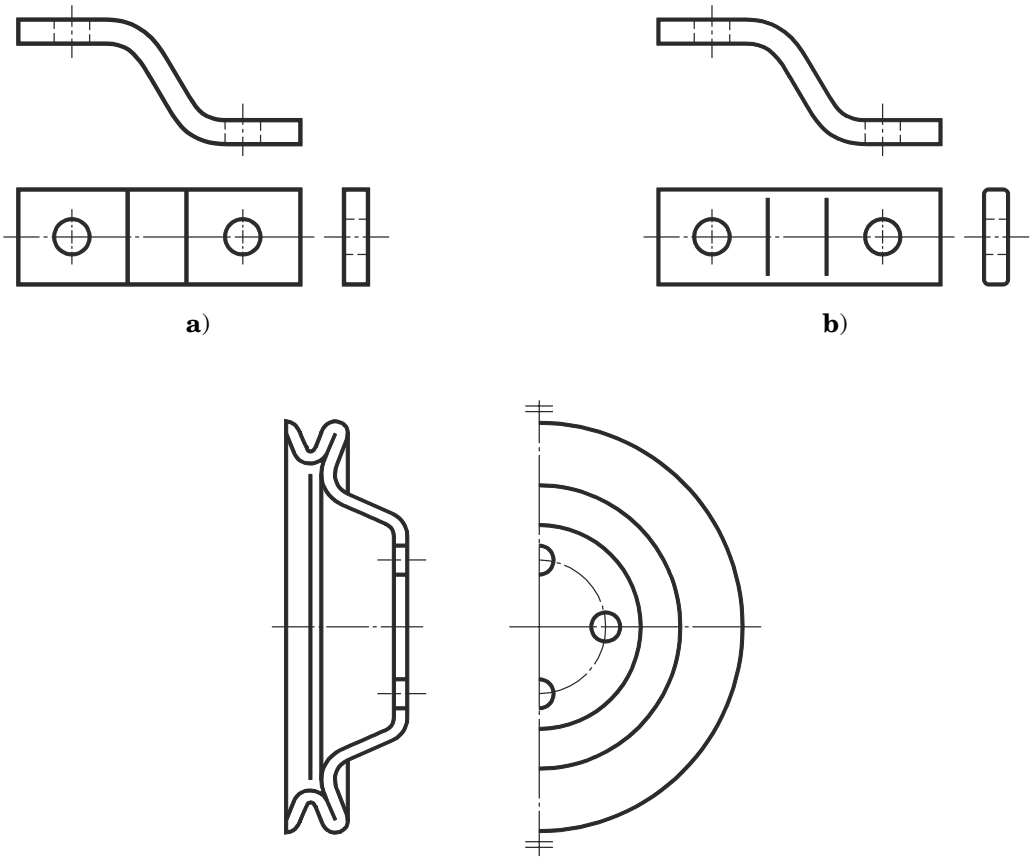


Figure 74 Examples of intersecting part

b) The line of intersecting part of curved surfaces or curved surface with plane (intersecting line) shall be represented by straight line [see Figures 75 a), b), c), d), e) and f)] or by arcs similar to the correct projection [see Figures 75 g), h) and i)].

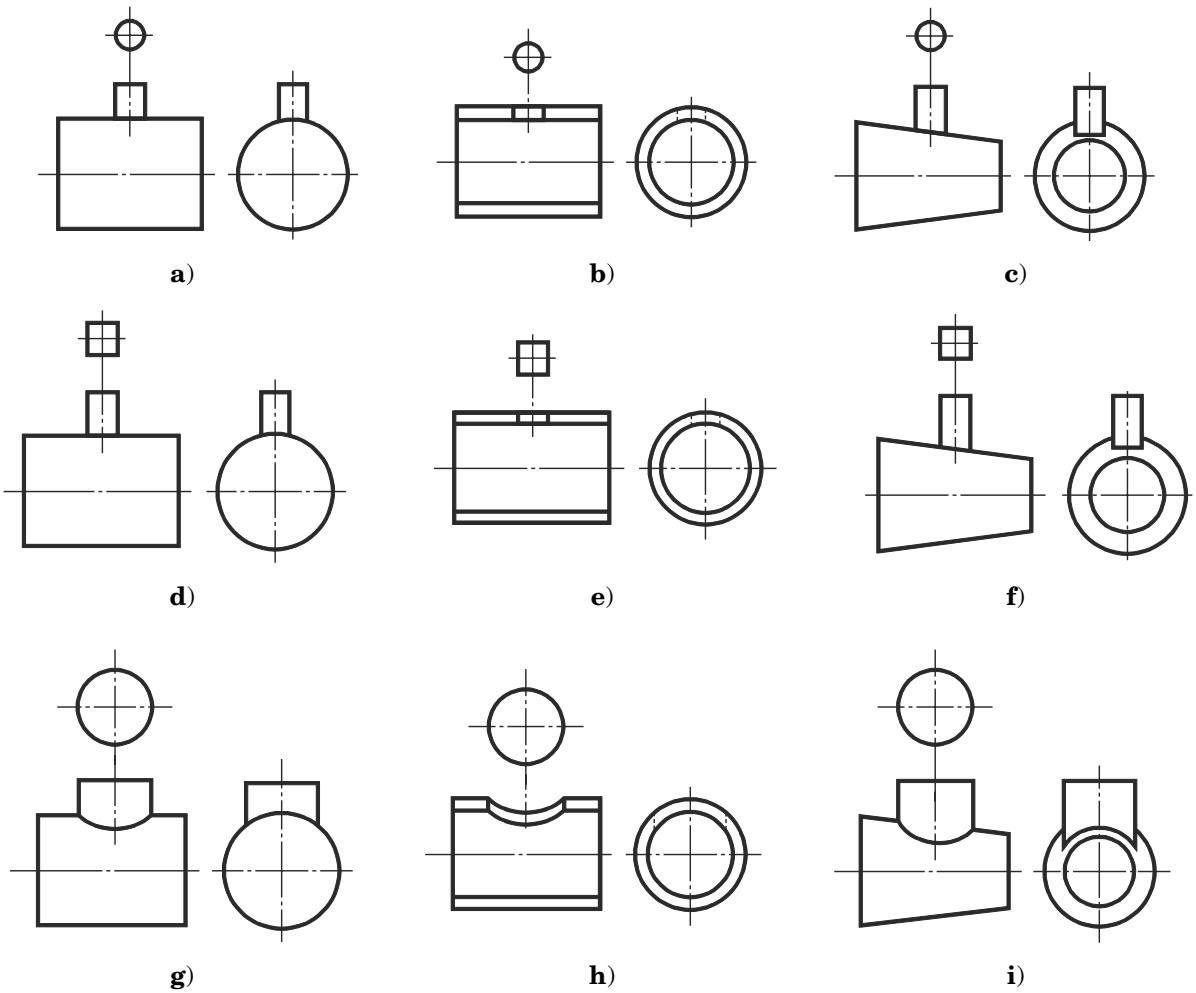


Figure 75 Examples of simplified representation of intersecting parts

c) The line representing the edge of two curved surfaces or one curved surface and one flat surface that are tangent to each other may be indicated with a thin continuous line, provided it is not used in combination with an intersecting line (see Figure 76).

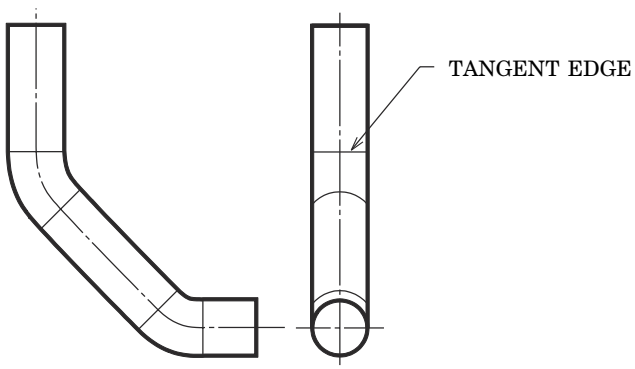
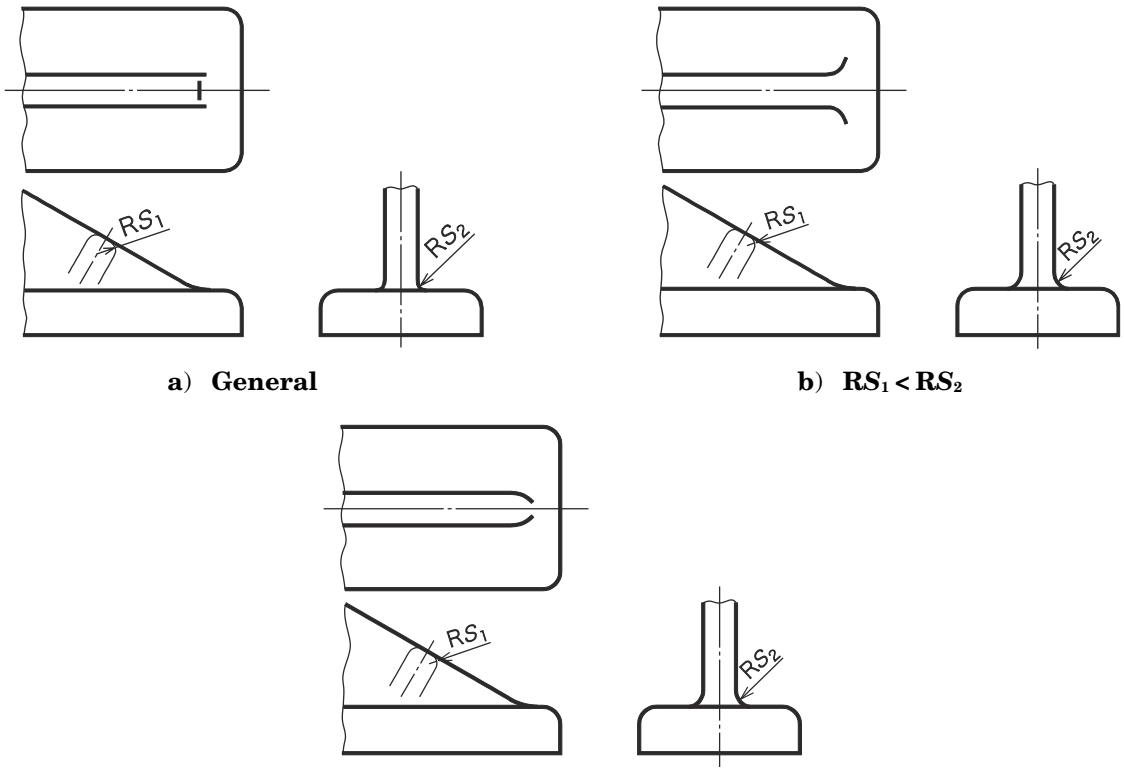


Figure 76 Example of representation of tangent edge

d) The ends of lines expressing the rib or the like shall be straight [see Figure 77 a)].

In the case where the radii of relating roundness are significantly different, the ends may be stopped by curving inward or outward [see Figures 77 b) and c)].



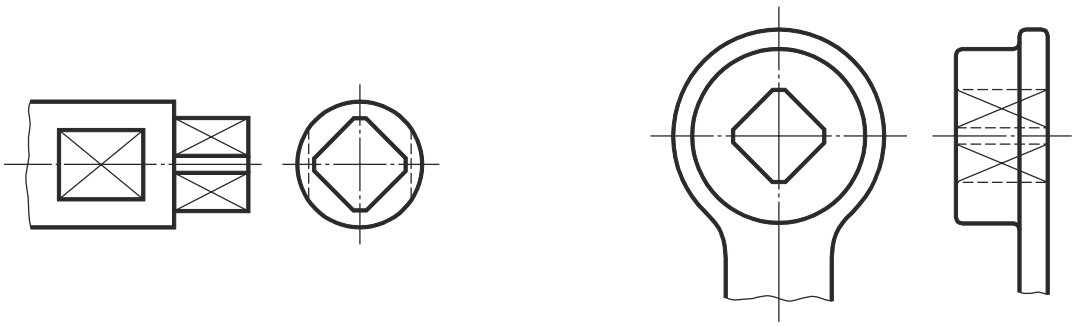
a) General **b) $RS_1 < RS_2$**

c) $RS_1 > RS_2$

Figure 77 Examples of simplified representation of intersecting part of rib

10.4.2 Representation of plane part

In the case where it is required to indicate that a certain part in the view is a plane, the part shall be represented by thin continuous diagonal lines (see Figure 78).



a) **b)**

Figure 78 Examples of representation of plane parts

10.4.3 Representation of development

In the case where the developed shape of object made by bending a plate or of object constituted of surfaces is required to be indicated, it shall be indicated by development. In this case, it is preferable to inscribe “DEVELOPMENT” either above or below the development consistently (see Figure 79).

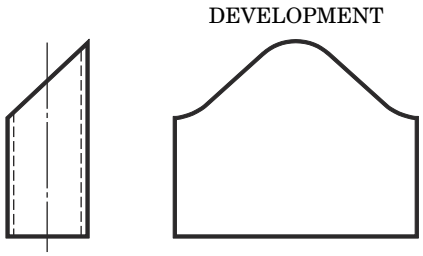
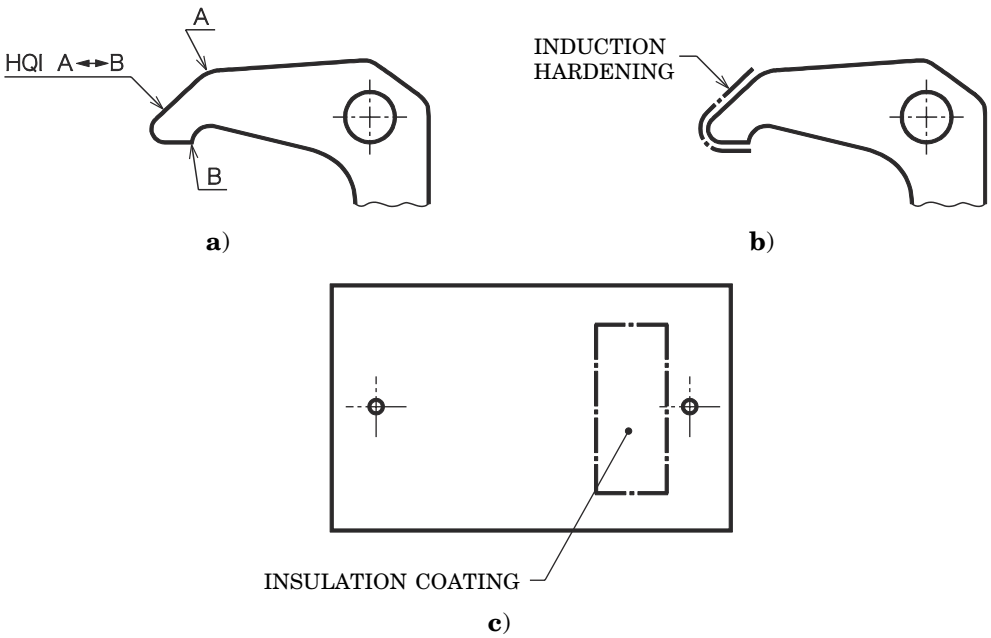


Figure 79 Example of representation of development

10.4.4 Limitation of working and treatment range

In the case where special processing is applied to a part of surface of the object, the range may be indicated by "between" symbol "◂▸" or thick long dashed short dashed line drawn in parallel to visible outline and slightly apart from it [see Figures 80 a) and b)]. Further, in the case where it is required to indicate a specific range or region in the view, enclose the range with thick long dashed short dashed line [see Figure 80 c)].

In these cases, indicate the necessary items concerning special processing.



Note [a] "INDUCTION HARDENING" may be abbreviated as "HQI" (see **JIS B 0122**).

Figure 80 Examples of presentation of limited range

10.4.5 Indication of worked parts

The worked parts shall be indicated as follows.

a) In the case where it is required to represent the weld portion of welded part for reference, the indication shall be as follows.

1) In the case of indicating the overlapping relation of welded materials, it shall be in accordance with the example of Figure 81.

2) In the case of indicating the overlapping relation of welded materials, as well as the type and size of the weld, the designation shall be made using weld symbols

as shown in the example of Figure 82 a), and in the case of not requiring any weld dimensions as in assembly view, the designation shall be made by blackening the weld location as shown in the example of Figure 82 b).

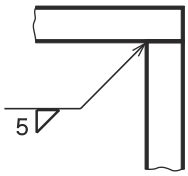
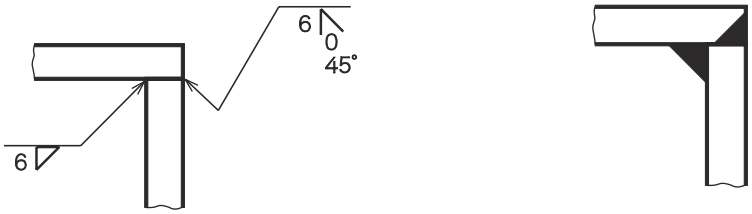


Figure 81 Example of representation of welded materials



a) **b**)

Figure 82 Examples of representation of weld

b) The example of weld construction for increasing the strength of thin-plate is shown in Figure 83.

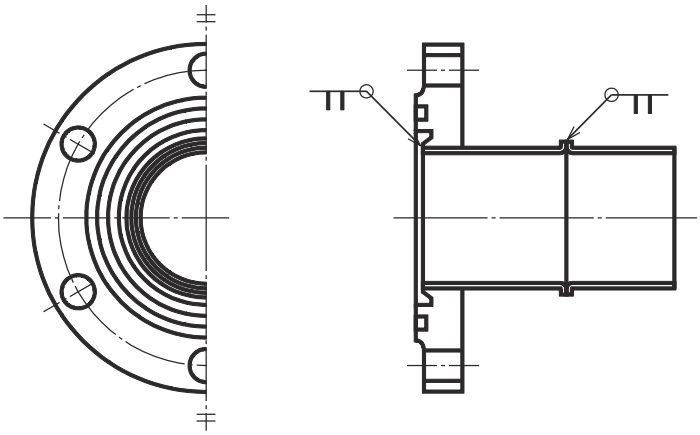
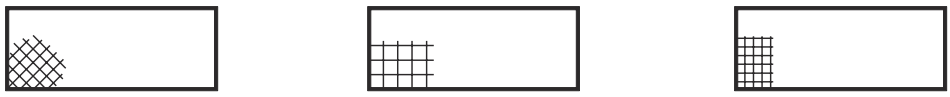


Figure 83 Example of representation of weld construction

c) In views of knurled part, metal wire net, checkered steel plate, etc., their features may be expressed as graphic patterns on a part of the outline, in which case, the following examples should be referred to (Figures 84, 85 and 86).

a) **b**)

Figure 84 Examples of representation of knurled part



a) **b**) **c**)

Figure 85 Examples of representation of metal wire net

Figure 86 Example of representation of checkered steel plate

Further, in the case where it is specially required to indicate non-metallic materials, the representation shall, as a rule, be as shown in Figure 87 or in the relevant standard. In this case also the name of material shall be inscribed separately with letters in the part drawing. In the case of indicating the appearance and also the section, representation should be in accordance with the following.

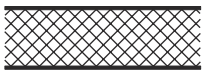
Material	Representation
Glass	
Heat insulating sound absorbing material	
Wood	
Concrete	
Liquid	

Figure 87 Example of representation of non-metallic materials

d) Where it is required to provide representation of the shape of object before or after processing in the view, the following shall apply.

1) In the case where the shape before processing or rough piece dimensions is to be indicated, the representation shall be by thin long dashed double-short dashed line [see a) of Example 9 in Figure 6].

2) In the case where the shape after processing, for example, the shape after assembly, is to be expressed, the representation shall be by thin long dashed double-short dashed line [see b) of Example 9 in Figure 6].

e) In the case where it is required to indicate for reference the shape of tools, jigs, etc. or the size of tool to be used for processing, the representation should be by thin long dashed double-short dashed line (see Example 8 in Figure 6).

10.4.6 Other special methods of representation

Other special methods of representation shall be as follows.

a) In the case where it is required to indicate the part on the viewer's side of the cutting plane, the representation should be by thin long dashed double-short dashed line (see Example 11 in Figure 6).

b) In the case where it is required to indicate for reference the parts adjacent to the adjacent object to be expressed, the representation should use thin long dashed double-short dashed line.

The view of the object to be expressed shall not be drawn with hidden outline even though it is hidden by the adjacent part (see Example 7 in Figure 6). The adjacent parts in the sectional view shall not be hatched.

11 Dimensioning

11.1 General matters

General matters shall be as follows.

a) Dimensions that are considered essential in light of the function, production, assembly, etc. of the object to be expressed shall be inscribed clearly in the drawing.

b) Dimensions that are necessary and sufficient to express the size, figure and position of the object most clearly shall be indicated.

c) Dimensions shall be indicated with dimension figures by using dimension line, projection line, symbol for dimensioning, etc.

d) Dimensions shall be indicated collectively in the principal view, as far as possible.

e) Unless otherwise indicated, the dimensions given shall be the finished dimensions of the object expressed in the view of the drawing.

NOTE Drawings of cast parts represent final-machined view, as-cast view, pre-machined view, etc. which may be inscribed with finished dimensions, as-cast dimensions and pre-machining dimensions, respectively.

f) The dimensions shall be inscribed as thoroughly as possible so that no calculation is necessary.

g) In the case where there is a feature to be a reference when machining or assembly is performed, the dimensions based on the referenced feature shall be inscribed (see Figure 88).

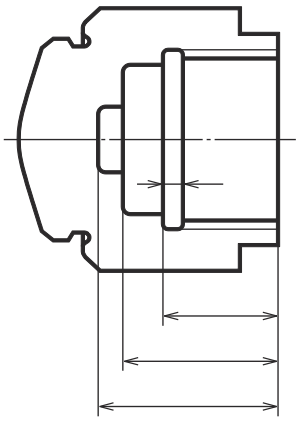


Figure 88 Example of representation of dimensions based on reference

h) Where possible, dimensions shall be arranged according to respective processes (see Figure 89).

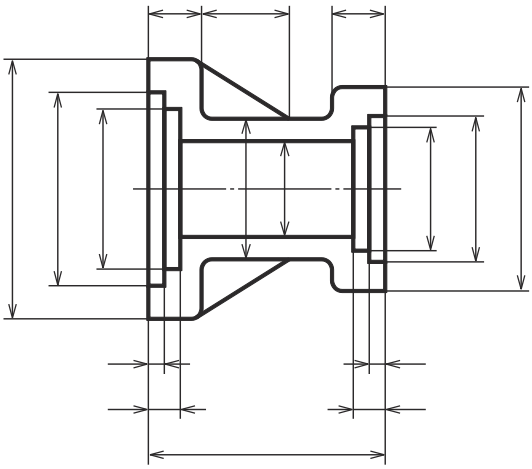


Figure 89 Example of representation of dimensions arranged according to each process

i) Where possible, the interrelated dimensions should be inscribed collectively in one place (see Figure 90).

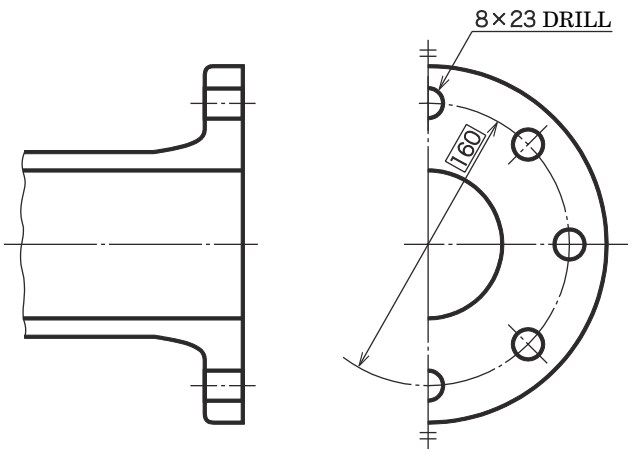
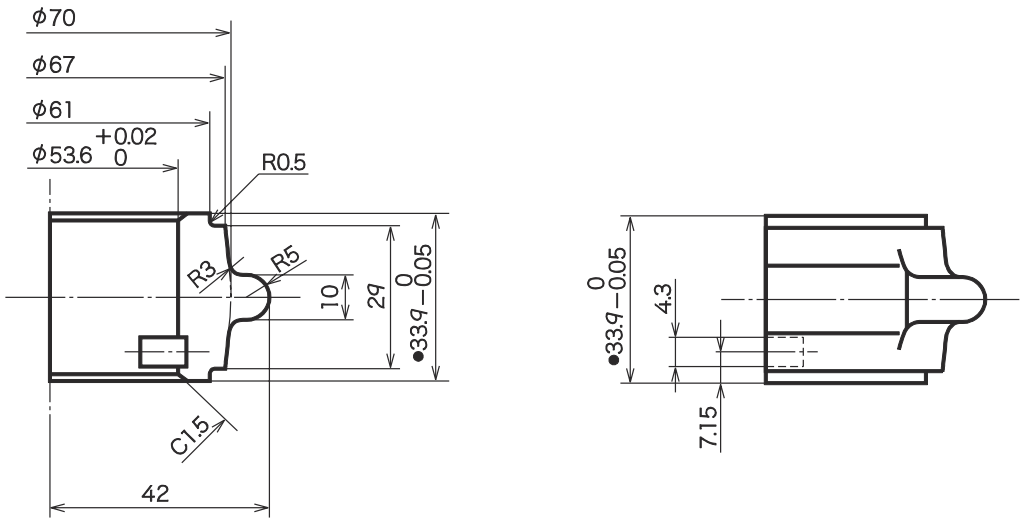


Figure 90 Example of representation of interrelated dimensions

j) Duplicated inscription of dimensions shall be avoided. However, it is permitted in the multi-sheet drawing, where duplicated inscription of dimensions facilitate understanding of the drawings [this can be done, for example, by marking black dots before dimension figures that are duplicate (see Figure 91) and by giving a note on the symbol to explain that it indicates duplicated dimension].



NOTE ●: duplicated dimension

Figure 91 Example of representation of duplicated dimensions in multi-sheet drawing

k) The dimension of a segment of a circular arc shall be expressed with the radius when the angle of the circular arc is up to 180° [see Figure 92 a)] and with the diameter when it exceeds 180° [see Figure 92 b)]. Even when the angle of the circular arc is within 180°, however, the diameter shall be inscribed if it is of particular significance in terms of function or machining (see Figure 93).

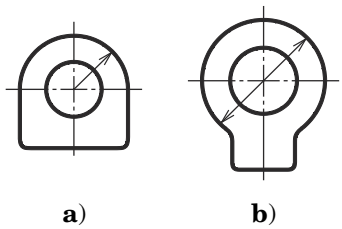


Figure 92 Examples of representation of radius or diameter

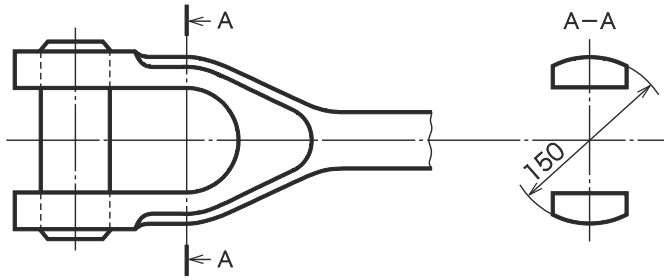


Figure 93 Example of representation of diameter

l) For dimensions that are significant in terms of functions (including interchangeability), the tolerances or limits of size (see **JIS B 0401-1**) shall be indicated in accordance with **JIS Z 8318**, except for the theoretically correct dimensions and reference dimensions.

In addition, when the dimensional tolerance or limits of size is not designated, the general dimension tolerance individually specified shall be applied. In this case,

the number of the standard and class symbol or numerical value applied shall be indicated collectively within or adjacent to the title block.

m) Among dimensions, theoretically correct dimensions shall be indicated within rectangular frames, and reference dimensions, in parentheses.

Reference dimensions shall not be targeted for verification.

11.2 Projection lines

The projection lines shall be as follows.

a) The dimension line shall, as a rule, be inscribed by using projection lines and dimension figures shall be indicated thereon (see Figure 94). However, in the case where the drawing becomes confusing if the projection lines are drawn, this does not have to be applied (see Figure 95).

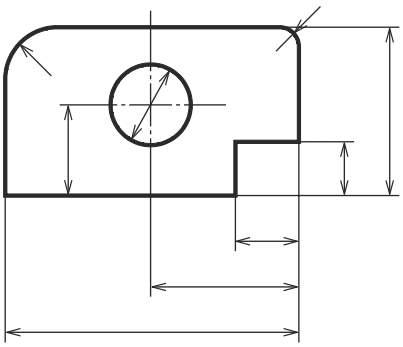


Figure 94 Example of representation using projection lines and dimension lines

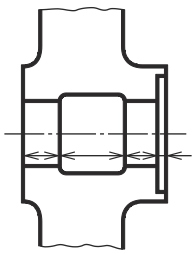


Figure 95 Example of representation not using projection lines

b) The projection lines shall be drawn perpendicularly to the dimension line through the centres of the points or lines which correspond to the ends of the dimensions to be indicated on the view, and extended until exceeding slightly the dimension line (see Figure 94). The projection lines may be slightly apart from the view, but should be consistently so within single-sheet drawing or through all sheets in multi-sheet drawing (see Figure 96).

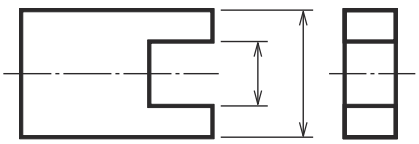


Figure 96 Example of representation using projection lines provided with gap

c) In order to clearly specify the positions of points or lines of which the dimension is to be inscribed, where specially required, projection lines that are parallel to each other may be drawn at a suitable angle to the dimension lines. The angle should be 60° where possible (see Figure 97).

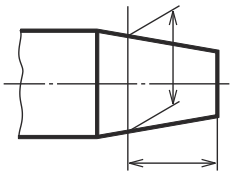
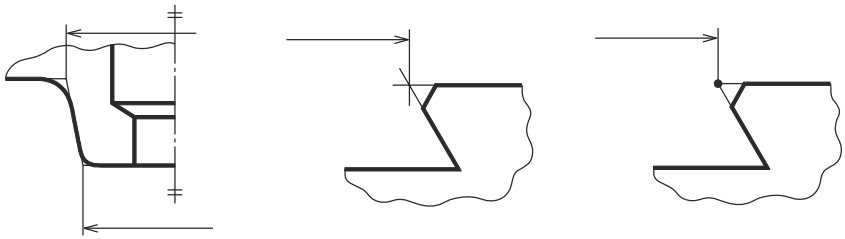


Figure 97 Example of representation using lines clearly indicating the position of dimension

d) When rounding or chamfering is applied between two surfaces intersecting at an angle, in order to indicate the intersecting position of the two surfaces, the profile before rounding or chamfering shall be expressed by thin continuous lines. The projection lines shall be drawn from the intersecting point of these drawn lines [see Figure 98 a)].

Further, in this case, when the intersecting point needs to be indicated clearly, the lines shall be drawn to intersect with each other or black dot shall be attached to the intersecting point [see Figure 98 b) and c)].



a) **b**) **c**)

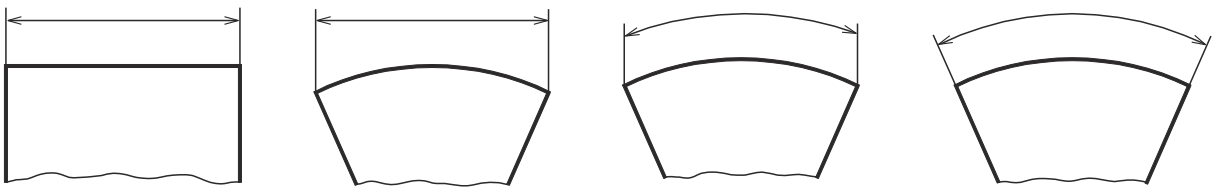
Figure 98 Examples of representation using projection lines drawn from rounded or chamfered parts

11.3 Dimension lines

The dimension lines shall be as follows.

a) The dimension line shall be drawn in parallel to the direction of length to be indicated or of angle to be measured (see Figure 99), with a terminator attached at each end (see Figure 100).

In addition, within one sheet of drawing, except where the specifications of **11.3 g**) **3**) are applied, use of dimension lines shown in Figures 100 a), b), c) and d) shall not be mixed.



a) **Dimension of side length** **b**) **Dimension of chord length** **c**) **Dimension of arc length** **d**) **Angular dimension**

Figure 99 Examples of representation of side length, chord length, arc length, and angular dimensions