
**Technical product documentation —
Simplified representation of
pipelines —**

Part 1:
**General rules and orthogonal
representation**

*Documentation technique de produits — Représentation simplifiée
des tuyaux et lignes de tuyauteries —*

Partie 1: Règles générales et représentation orthogonale

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Contents

	Page
Foreword	iv
Introduction	v
1 Scope	1
2 Normative references	1
3 Terms and definitions	2
4 General principles	2
4.1 Overview.....	2
4.2 Representation of pipes.....	2
4.3 Scale.....	2
4.4 Lines.....	2
4.4.1 Line thickness.....	2
4.4.2 Types of line.....	3
4.4.3 Spacing of lines.....	3
4.5 Lettering.....	3
4.6 Dimensioning.....	4
4.7 Tolerances.....	5
5 Crossings and connections	5
6 Representation of equipment	6
6.1 General.....	6
6.2 Fittings.....	6
6.3 Supports and hangers.....	7
6.4 Additional provisions.....	8
6.5 Adjoining apparatus.....	8
6.6 Direction of flow.....	8
6.7 Flanges.....	8
7 Examples	9
Bibliography	11

Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation on the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT) see the following URL: www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 10, *Technical drawings*, Subcommittee SC 10, *Process plant documentation*.

This second edition cancels and replaces the first edition (ISO 6412-1:1989), which has been technically revised.

The main changes compared to the previous edition are as follows:

- the normative references were updated;
- the document went under editorial revision.

A list of all parts in the ISO 6412 series can be found on the ISO website.

Introduction

Depending on the information it is intended to convey and the form of representation required, a distinction is made between graphical representation by means of orthogonal and that by means of isometric representation.

This document deals with general rules used for both representations (orthogonal and isometric). Rules applicable only to isometric representation are given in ISO 6412-2.

For the purposes of this document, all dimensions and tolerances on the drawings have been stencilled in upright lettering. It should be understood that these indications could just as well be written in free-hand or inclined (italic) lettering without altering the meaning of the indications.

For the presentation of lettering (proportions and dimensions), see [4.4](#).

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Technical product documentation — Simplified representation of pipelines —

Part 1: General rules and orthogonal representation

1 Scope

This document specifies rules and conventions for the execution of simplified drawings for the representation of all kinds of pipes and pipelines made of all sorts of materials, (rigid and flexible).

It is used whenever it is necessary to represent pipes or pipelines in a simplified manner.

For the purposes of this document, the figures illustrate the text only and should not be considered as design examples.

NOTE This document can also be used for the representation of similar installations, such as ventilation or air-conditioning systems; in such cases, the term "duct", etc. is substituted for the term "pipe".

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 128 (all parts), *Technical drawings — General principles of presentation*

ISO 129-1, *Technical product documentation (TPD) — Presentation of dimensions and tolerances — Part 1: General principles*

ISO 1219-1, *Fluid power systems and components — Graphical symbols and circuit diagrams — Part 1: Graphical symbols for conventional use and data-processing applications*

ISO 3098-2, *Technical drawings — Lettering — Part 2: Latin alphabet, numerals and marks*

ISO 3545-1, *Steel tubes and fittings — Symbols for use in specifications — Part 1: Tubes and tubular accessories with circular cross-section*

ISO 5261, *Technical drawings — Simplified representation of bars and profile sections*

ISO 5455, *Technical drawings — Scales*

ISO 6412-2, *Technical product documentation — Simplified representation of pipelines — Part 2: Isometric projection*

ISO 6428, *Technical drawings — Requirements for microcopying*

ISO 7573, *Technical product documentation — Parts lists*

ISO 14617-2, *Graphical symbols for diagrams — Part 2: Symbols having general application*

ISO 14617-3, *Graphical symbols for diagrams — Part 3: Connections and related devices*

ISO 81714-1, *Design of graphical symbols for use in the technical documentation of products — Part 1: Basic rules*

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- IEC Electropedia: available at <http://www.electropedia.org/>
- ISO Online browsing platform: available at <https://www.iso.org/obp>

3.1 orthogonal representation

projection method in which the projectors are at right angles to the projection plane

3.2 isometric representation

projection method in which each of the three coordinate axes is inclined at the same angle to the projection plane

3.3 flow line

representation of the flow path of the inlet or outlet streams or of material, energy or energy carriers

4 General principles

4.1 Overview

In this clause, all general principles are specified which are common to the methods of projection and to the pictorial representations, as recommended in this document.

4.2 Representation of pipes

The flow line representing a pipe (irrespective of its diameter), shall be a single continuous thick line (type A, see [Table 1](#)), coinciding with the central line of the pipe.

Bends may be simplified by extending the straight length of the flow line to the vertex (see [Figure 1](#)). However, bends may be shown for the sake of clarity in the form illustrated in [Figure 2](#). In this case, if projections of bends would otherwise have been elliptical, these projections may be simplified by drawing circular arcs (see [Figure 3](#)).

4.3 Scale

If the drawing is to scale, this shall be indicated in accordance with ISO 5455.

4.4 Lines

4.4.1 Line thickness

In general, only one thickness of line shall be used. However, in cases where more than one line thickness needs to be used, the line thicknesses shall be chosen from ISO 128-20; the relative proportions of line thicknesses **a:b:c** shall be $2 : \sqrt{2} : 1$. Different line thicknesses shall then be used as follows (see also [4.4.2](#)):

- line thickness **a**: main flow lines;
- line thickness **b**: secondary flow lines, lettering;
- line thickness **c**: leader lines, dimension lines, etc.

4.4.2 Types of line

The types and thicknesses of line shown in [Table 1](#) shall be used.

Table 1

Number of the basic type in accordance with ISO 128-20		Line type in accordance with ISO 128-20	Description	Application
01	01.2	A  b	Continuous wide line	A1 Flow lines and connected parts
	01.1	B  a	Continuous narrow line	B1 Hatching B2 Dimensioning B3 Leader lines B4 Isometric grid lines
	01.1	C  a	Continuous narrow free-hand line	C1/D1 Limits of partial or interrupted views and sections
	01.1	D  a	Continuous narrow line with zigzags	
02	02.2	E  b	Dashed wide line	E1 Flow lines specified on other drawing
	02.1	F  a	Dashed narrow line	F1 Floor F2 Walls F3 Ceilings F4 Holes (hole punchings)
04	04.1	G  a	Long dashed dotted narrow line	G1 Centrelines
	04.3	EJ  c	Long dashed dotted extra-wide line ^a	EJ1 Contract boundary
09	09.1	K  a	Long dashed double-short dashed narrow line	K1 Outlines of adjacent parts K2 Parts situated in front of the cutting plane

^a Four times the thickness of line type G.

4.4.3 Spacing of lines

In accordance with ISO 6428, the space between parallel lines (including hatching) shall not be less than twice the thickness of the heaviest of these lines, with a minimum spacing of 0,7 mm.

The minimum spacing between adjacent flow lines and between flow lines and other lines should be 10 mm.

4.5 Lettering

Lettering shall be in accordance with ISO 3098-2; lettering type B vertical is preferred. The line thickness of the lettering shall be the same as the line thickness of those tpd-symbols to which the lettering is close or associated in accordance with ISO 81714-1.

4.6 Dimensioning

4.6.1 In general, dimensioning shall be in accordance with ISO 129-1. Nominal dimensions may be indicated in accordance with ISO 3545-1 using the short designation “DN” (see Figure 1).

The outer diameter (d) and the wall thickness (t) of pipes may be indicated in accordance with ISO 5261 (see Figure 2). If necessary, a parts list (see ISO 7573) giving additional information on the pipes, including the associated equipment, may be added to the drawing. Lengths shall start from the outer faces of the pipe ends, flanges, or centre of the joint, whenever appropriate.

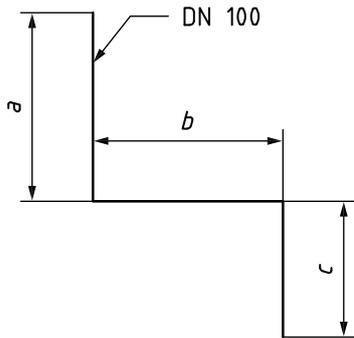


Figure 1

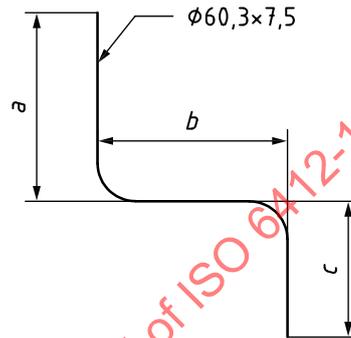


Figure 2

4.6.2 Pipes with bends should be generally dimensioned from central line to central line of the pipelines (see Figures 1 and 2).

If it is necessary to specify the dimension from the outside or inside external protection or surface of the pipe, the dimension may be specified by arrows pointing to short thin strokes parallel to the projection line (see Figure 3).

The dimensions from outer to outer, from inner to inner and from inner to outer vertex are shown in Figure 3 a), Figure 3 b) and Figure 3 c), respectively.

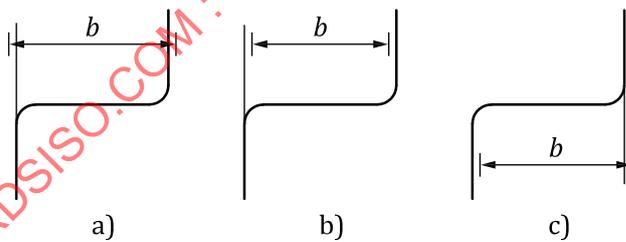


Figure 3

4.6.3 Radii and angles of bends may be indicated as shown in Figure 4.

The functional angle shall be indicated; in general, angles of 90° are not indicated.

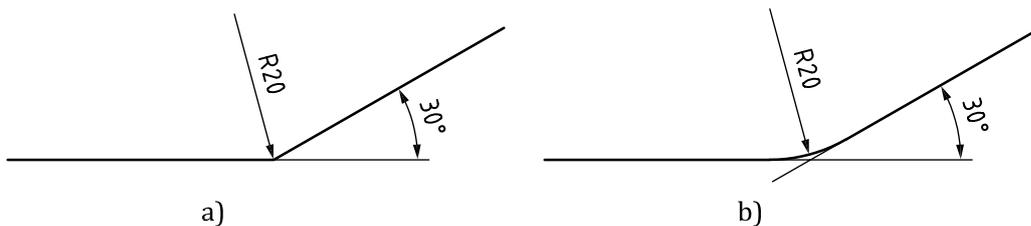


Figure 4

4.6.4 Levels refer generally to the centre of the pipe and should be indicated in accordance with ISO 129-1 (see Figure 5). If, in special cases, it is necessary to specify the level to the bottom of a pipe this shall be indicated by the reference arrow pointing to short thin strokes, as specified in 4.4.2 [see Figure 3 and Figure 8 a)].

A similar rule shall be applied to indicate levels to the top of the pipe [see Figure 8 c)].

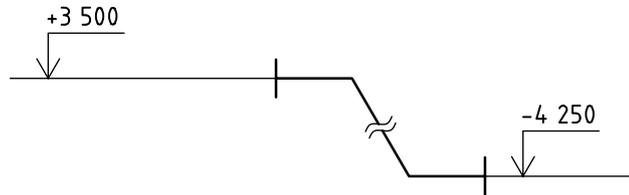


Figure 5

4.6.5 The direction of slope shall be indicated by a right-angled triangle above the flow line, pointing from the higher down to the lower level.

The amount of slope shall be indicated in accordance with the methods shown in Figures 6 to 8.

It can be useful to specify the level of the sloping pipe, either at its higher or at its lower end, or at any convenient point, by referring to a datum level (see Figure 8).

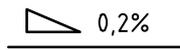
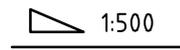
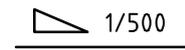


Figure 6

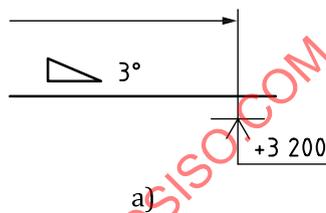


a)

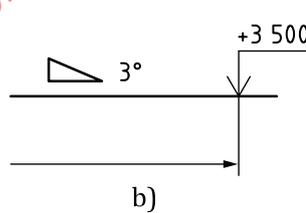


b)

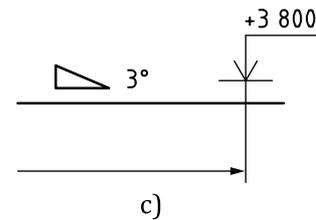
Figure 7



a)



b)



c)

Figure 8

4.6.6 The positions of the ends of the pipe shall be specified by indicating the coordinates referring to the centres of the end faces.

4.7 Tolerances

Tolerances shall be indicated in accordance with ISO 129-1.

5 Crossings and connections

5.1 Crossings without connections shall normally be depicted without interrupting the flow line representing the hidden pipe (see Figure 9; see also ISO 14617-3); if, however, it is absolutely necessary to indicate that one pipe is required to pass behind the other, the flow line representing the hidden pipe

shall be interrupted (see Figure 10). The width of each interruption shall not be less than five times the thickness of the continuous line (see Figure 11).

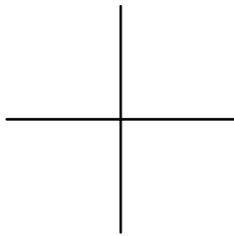


Figure 9

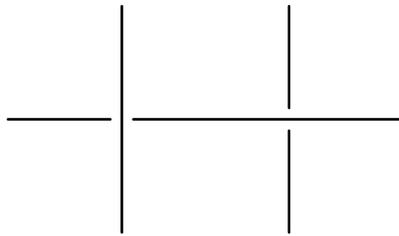


Figure 10

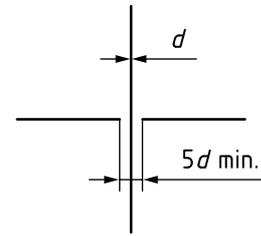


Figure 11

5.2 Permanent junctions (whether made by welding or other processes) shall be marked by a prominent dot (see Figure 12). The diameter of the dot shall be five times the thickness of the line.

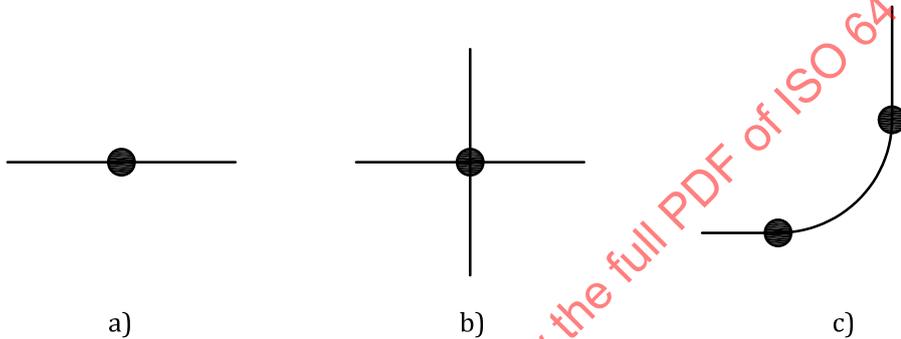


Figure 12

5.3 Detachable connections shall be represented in accordance with ISO 14617-3.

6 Representation of equipment

6.1 General

All items of equipment, machinery, valves, etc. shall be represented by means of graphical symbols with the same line thickness as the flow line.

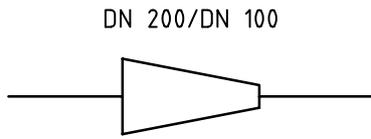
The graphical symbols used shall be in accordance with ISO 1219-1, ISO 3545-1, ISO 5261, ISO 6412-2, ISO 14617-3, ISO 81714-1, and the other International Standards given in [Clause 2](#).

6.2 Fittings

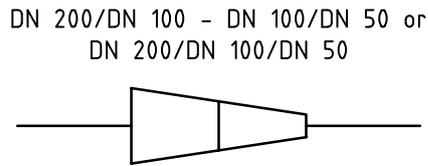
6.2.1 Fittings such as nozzles, tee-pieces and bends, shall be drawn with the same line thickness as the flow line.

6.2.2 Transition pieces for changing the cross-section shall be represented in accordance with Figures 13 to 15.

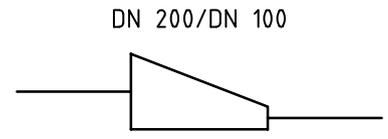
The relevant nominal sizes shall be indicated above the symbols.



Concentric single
Figure 13



Concentric multiple
Figure 14



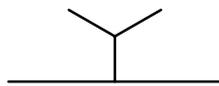
Eccentric single
Figure 15

6.3 Supports and hangers

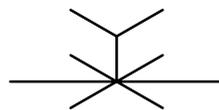
Supports and hangers shall be represented by their appropriate symbols in accordance with [Figures 16 to 19](#).

The representation of repeated accessories may be simplified as shown in [Figure 20](#).

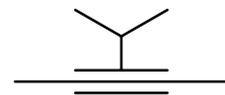
NOTE [Figures 16 to 19](#) refer to hangers only. It is important to understand that in the case of supports, the same symbols are used, but in the reverse position.



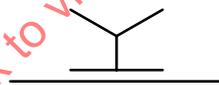
General
Figure 16



Fixed
Figure 17



Guided
Figure 18

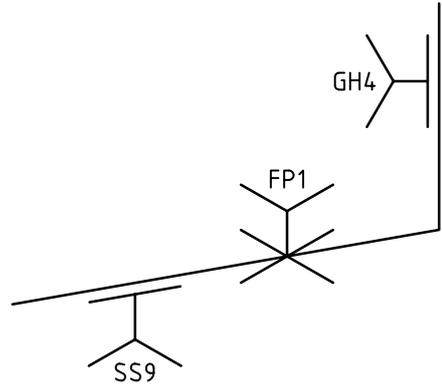


Sliding
Figure 19



Figure 20

If necessary, an alphanumeric code giving more information about the type of supports and hangers, with their numbering, may be added to the symbols shown in [Figures 16 to 19](#). The code giving the numbering shall be given on the drawing or in associated documents (see [Figure 21](#)).



Key

- FP1 fixing point no. 1
- SS9 sliding support no. 9
- GH4 guiding hanger no. 4

Figure 21

6.4 Additional provisions

Additional provisions such as insulation, coating, stream tracer lines, etc. may be specified in writing.

6.5 Adjoining apparatus

If needed, adjoining apparatus, such as tanks, machinery, not belonging to the piping itself, may be represented by their outlines using long dashed double-short dashed narrow lines (type K; see [Table 1](#) and ISO 128-20) as shown in [Figure 22](#).



Figure 22

6.6 Direction of flow

The direction of flow shall be indicated by an arrowhead (see ISO 14617-2) on the flow line or near a graphical symbol representing a valve (see Figures 23 and 24).



Figure 23

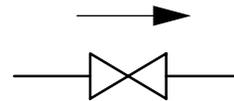


Figure 24

6.7 Flanges

Flanges shall be represented, irrespective of their type and sizes

- by two concentric circles for the front view,
- by one circle for the rear view,