INTERNATIONAL STANDARD

ISO 6412-2

Second edition
2017-12

Technical product documentation — Simplified representation of pipelines —

Part 2: Isometric projection

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

Partie 2: Projection isométrique

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Foreword

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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).

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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 6412-2:1989), which has been technically revised.

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

— the normative references were updated;

— the document underwent editorial reision.

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

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Introduction

For drawings for tender, manufacturing drawings and erection drawings in pipeline construction as well as in machine construction and the construction industry, isometric projection has been introduced to a great extent, since the drawing work can be cut down and the presentation made clearer.

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 ISO 6412-1.

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Technical product documentation — Simplified representation of pipelines —

Part 2: Isometric projection

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1 Scope

This document specifies supplementary rules, in addition to the general rules given in ISO 6412-1, applicable to isometric representation. Isometric representation is used where it is necessary to show the essential features clearly in three dimensions.

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 128-20, *Technical drawings — General principles of presentation*

ISO 129-1, *Technical drawings — Indication of dimensions and tolerances — Part 1: General principles*

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 6412-1, *Technical drawings — Simplified representation of pipelines — Part 1: General rules and orthogonal representation*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 6412-1 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

4 Coordinates

As far as it is necessary to use Cartesian coordinates, for instance for calculations or numerical control of machine tools, the coordinate axes shall comply with Figure 1.

In all cases, the coordinates of individual pipes or pipe assemblies shall comply with those adopted for the complete installation and shall be indicated on the drawing or in an associated document.

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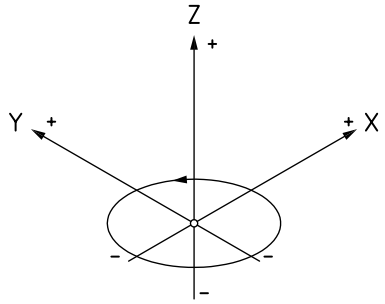

Figure 1

5 Line conventions

See ISO 6412-1:2017, 4.4.2.

6 Deviations from the direction of coordinate axes

6.1 General

Pipes, or parts of pipes, running parallel to the coordinate axes, shall be drawn parallel to the relevant axis without any further indication.

Deviations from the directions of the coordinate axes shall be indicated by means of auxiliary hatched projection planes as shown in Figure 2.

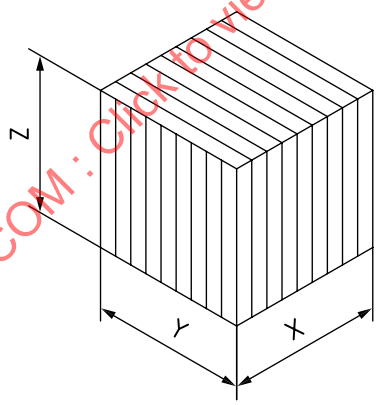

Figure 2

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6.2 Pipes in a vertical plane

Pipes, or parts of pipes, situated in a vertical plane, shall be indicated by showing their projections on a horizontal plane [see Figure 3 a)].

6.3 Pipes in a horizontal plane

Pipes, or parts of pipes, situated in a horizontal plane, shall be indicated by showing their projections on a vertical plane [see Figure 3 b)].

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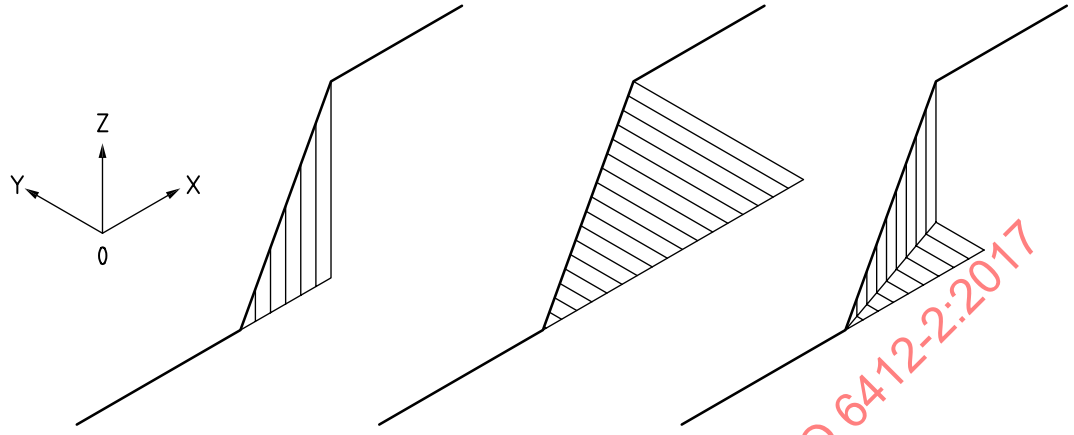
6.4 Pipes not parallel to any coordinate plane

Pipes, or parts of pipes, not running parallel to any coordinate plane, shall be indicated by showing both their projections on a horizontal and on a vertical plane [see Figure 3 c)].



a) b) c)

Figure 3

6.5 Auxiliary projection planes

It is recommended that the right angles of the triangles limiting the auxiliary projection planes be indicated.

Auxiliary projection planes may be emphasized by hatchings, parallel to the X- or Y-axis for horizontal auxiliary planes, and vertical for all other auxiliary planes.

If such hatching is not convenient it may be omitted, but in that case the rectangle (see Figure 4) or the rectangular prism (see Figure 5), of which a diagonal coincides with the pipe, shall be shown, using continuous narrow lines (type 01, ISO 128-20).

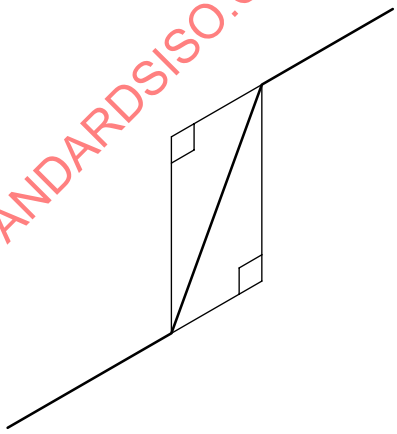


Figure 4

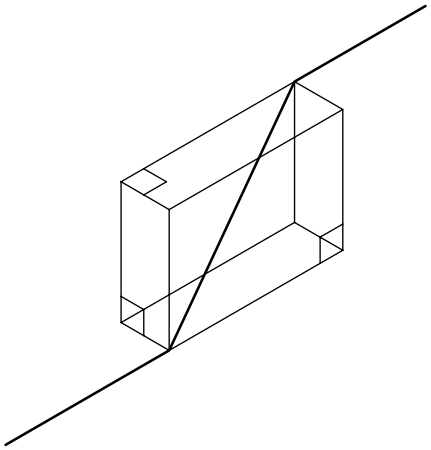


Figure 5

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7 Dimensioning and special rules

7.1 General

Drawings shall be dimensioned in accordance with ISO 129-1. There are, however, special rules for isometric projection for pipelines which are specified in 7.2 to 7.10.

7.2 Diameters and wall thickness

The outer diameter (d) and the wall thickness (t) of pipes shall be indicated in accordance with ISO 5261 (see Figure 6). Nominal dimensions may be indicated in accordance with ISO 3545-1 using the short designation "DN" (see ISO 6412-1:2017, Figure 1).

7.3 Longitudinal and angular dimensions

Longitudinal and angular dimensions shall be indicated in accordance with ISO 129-1; the length shall start from the outer faces of the pipe ends, flanges, or centre of the joint, whenever appropriate.

7.4 Pipes with bends

Pipes with bends shall be dimensioned from central line to central line or from the central line to the end of the pipe (see Figure 6).

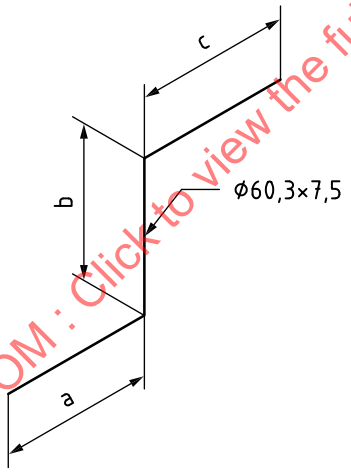

Figure 6

7.5 Radii and angles of bends

Radii and angles of bends may be indicated as shown in Figure 7.

The functional angle shall be indicated.

Bends may be simplified by extending the straight length of the flow line to the vertex. However, the actual bends in the pipes may be shown for the sake of clarity. In this case, if projections of bends would otherwise have been elliptical, these projections may be simplified by drafting circular arcs.

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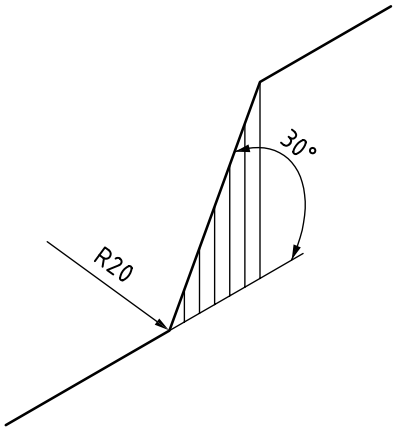

Figure 7

7.6 Levels

Levels shall be indicated in accordance with ISO 129-1 and ISO 6412-1 as shown in Figure 8.

The horizontal part of the leader line shall follow the direction of the associated flow line.

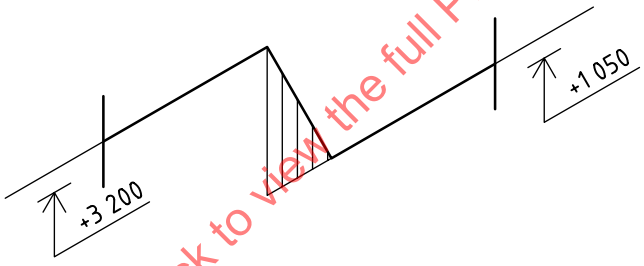

Figure 8

7.7 Direction of slope

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, without changing the isometric direction of the flow line.

The amount of slope shall be indicated in accordance with the method shown in Figure 9 and in ISO 6412-1.

It can, however, be useful to specify the slope be referring to a datum level (see Figure 9).

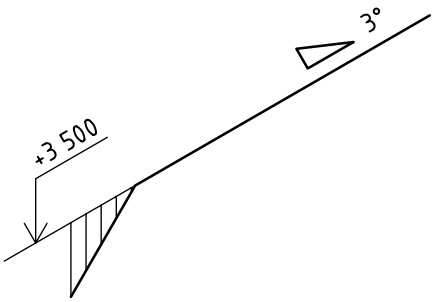

Figure 9

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7.8 Positions of ends of pipes

If necessary, the positions of the ends of the piping may be specified by indicating the coordinates referring to the centres of the end faces.

In the case of adjacent drawings, a reference should be given. For example, “continued on drawing x”.

7.9 Redundant dimensioning

If necessary, the auxiliary hatched projection planes can be dimensioned (see Figure 10).

If it is necessary for manufacturing and/or technical reasons to indicate double dimensioning, one of the dimensions should be indicated in parentheses.

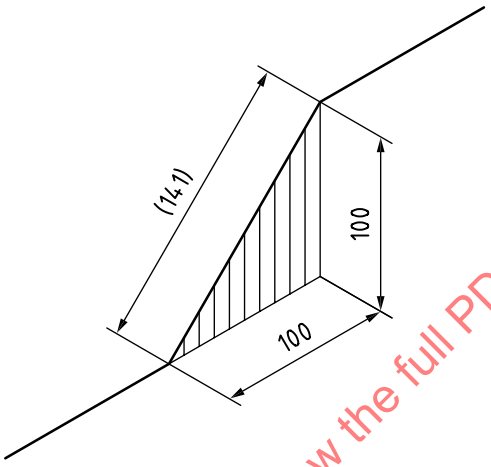

Figure 10

7.10 Dimensioning for pipe-bending machines

The dimensioning is defined on the basis of a reference system (point of origin) (see Figure 23).

8 Graphical symbols

8.1 General

Graphical symbols for pipeline systems shall be in accordance with ISO 3545-1, ISO 5261, ISO 6412-1, and the other International Standards given in Clause 2 and the Bibliography and shall be drawn using the isometric projection method (see Figure 11).

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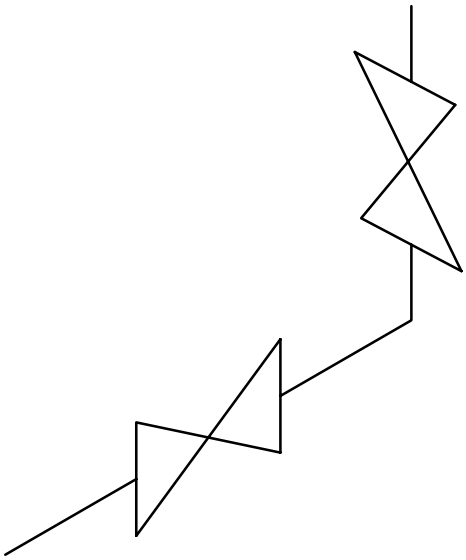

Figure 11

8.2 Examples of graphical symbols drawn with the isometric projection method

8.2.1 Valves

See examples in Figures 12 and 13.

Valve actuators may only be shown if it is necessary to define their positions or the kind of actuators (spindle, piston, etc.).

If shown, an actuator with a position parallel to one of the coordinate axes need not be dimensioned. Deviations from such positions shall be indicated (see Figure 13).

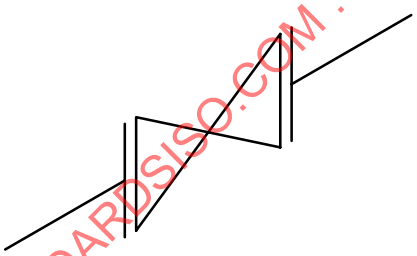

Figure 12

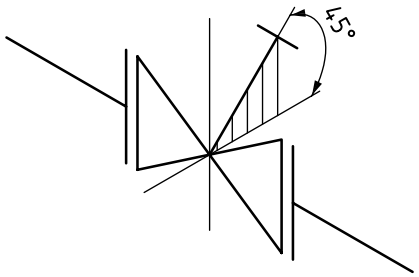

Figure 13

8.2.2 Transition pieces (cones)

The relevant nominal sizes shall be indicated above the graphical symbols (see Figure 14).

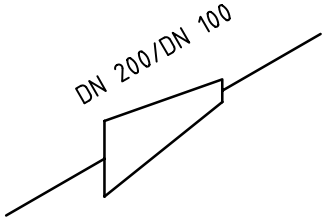

Figure 14

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8.2.3 Supports and hangers

See examples in Figures 15 and 16. See also ISO 6412-1:2017, 6.3.

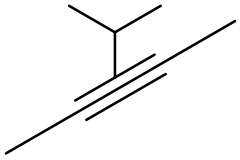

Figure 15

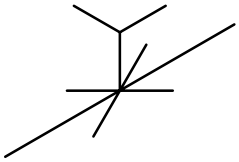

Figure 16

8.2.4 Crossings

Crossings shall be shown in accordance with ISO 6412-1:2017, 5.1.

If it is absolutely necessary to indicate that one pipe has to pass behind the other, the flow line representing the hidden pipe shall be interrupted (see Figure 17). The width of each interruption shall not be less than five times the thickness of the continuous line.

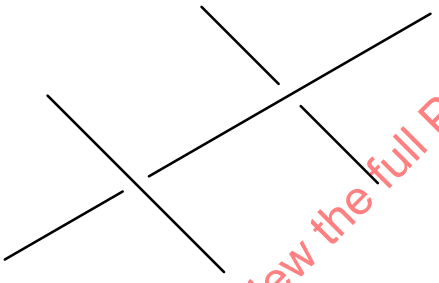

Figure 17

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8.2.5 Permanent junctions

See examples of a weld in Figure 18 and of a site weld in Figure 19.

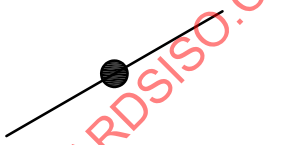

Figure 18

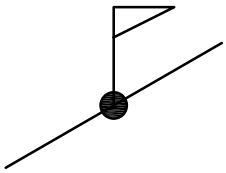

Figure 19

8.2.6 General connections

If the kind, or type, of connection is not specified, a general symbol shall be used.

See example in Figure 20.

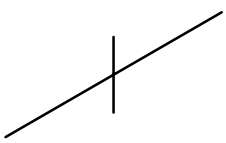

Figure 20

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8.2.7 Flanges

See examples in Figures 21 and 22.

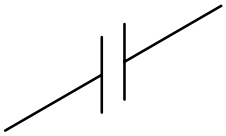

Figure 21

Figure 22

9 Examples

Examples of isometric projection are given in Figures 23 and 24.

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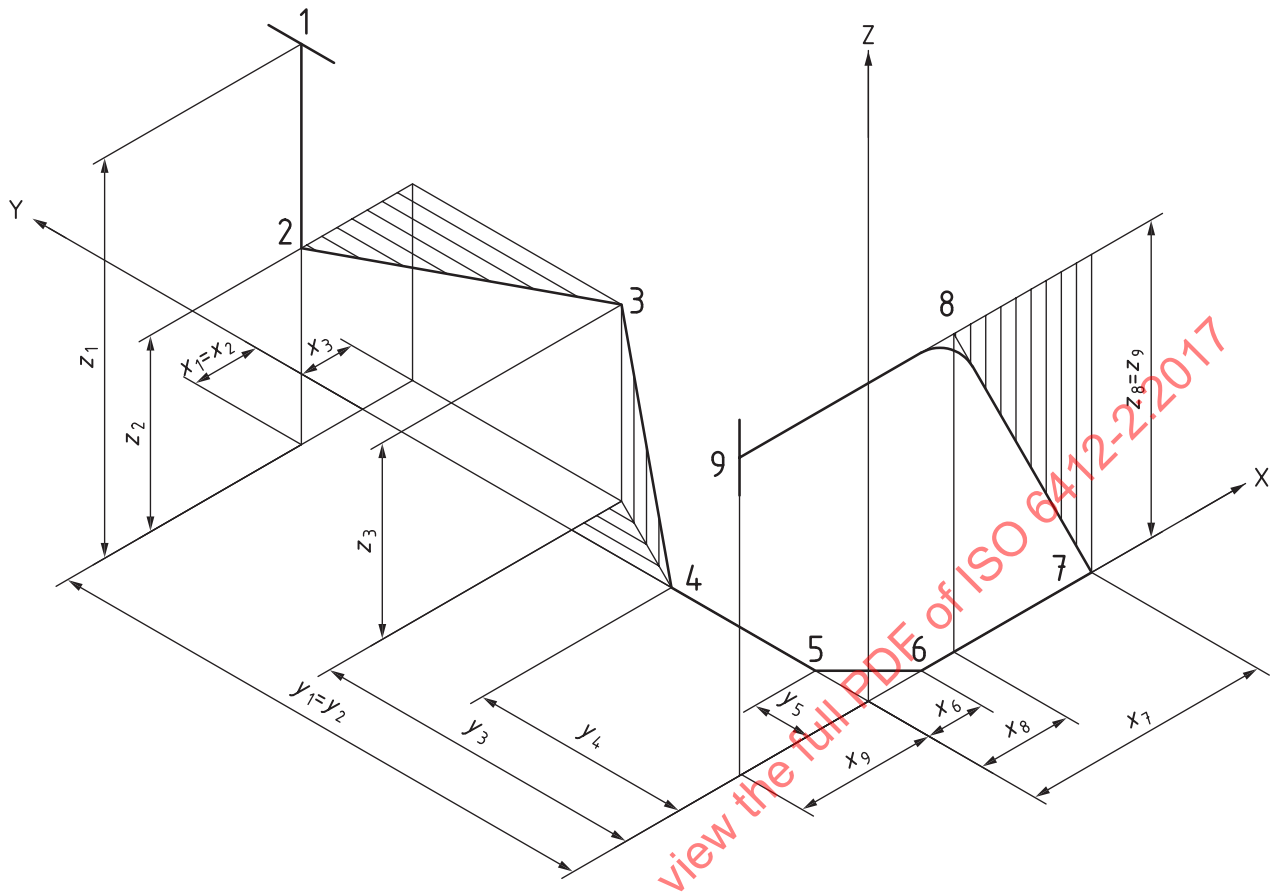

Reference number	Coordinates		
1	$x_1 = -8$	$y_1 = +72$	$z_1 = +50$
2	$x_2 = -8$	$y_2 = +72$	$z_2 = +25$
3	$x_3 = +7$	$y_3 = +42$	$z_3 = +25$
4	$x_4 = 0$	$y_4 = +28$	$z_4 = 0$
5	$x_5 = 0$	$y_5 = +7$	$z_5 = 0$
6	$x_6 = +7$	$y_6 = 0$	$z_6 = 0$
7	$x_7 = +32$	$y_7 = 0$	$z_7 = 0$
8	$x_8 = +10$	$y_8 = 0$	$z_8 = +40$
9	$x_9 = -20$	$y_9 = 0$	$z_9 = +40$

NOTE Points at which the pipe changes direction and connections are indicated by reference numbers. The pipe and the reference numbers are identical to those in the orthogonal representation illustrated in ISO 6412-1:2017, Figure 25.

Figure 23

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