

इंटरनेट

मानक

Disclosure to Promote the Right To Information

Whereas the Parliament of India has set out to provide a practical regime of right to information for citizens to secure access to information under the control of public authorities, in order to promote transparency and accountability in the working of every public authority, and whereas the attached publication of the Bureau of Indian Standards is of particular interest to the public, particularly disadvantaged communities and those engaged in the pursuit of education and knowledge, the attached public safety standard is made available to promote the timely dissemination of this information in an accurate manner to the public.

“जानने का अधिकार, जीने का अधिकार”

Mazdoor Kisan Shakti Sangathan

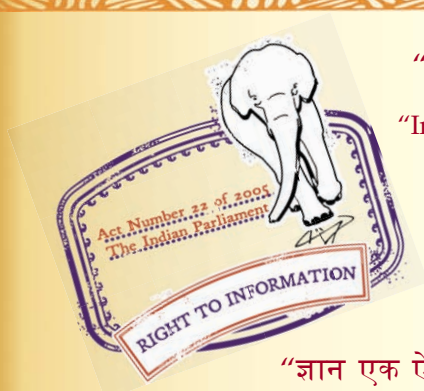
“The Right to Information, The Right to Live”

“पुराने को छोड़ नये के तरफ”

Jawaharlal Nehru

“Step Out From the Old to the New”

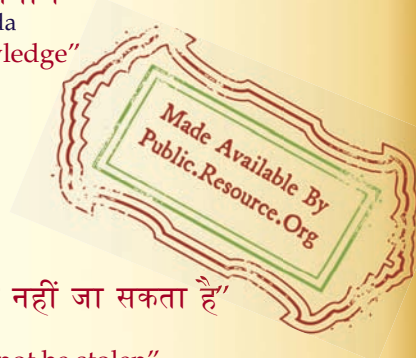
IS 10990-1 (1991): Technical drawings - Simplified representation of pipelines, Part 1: General rules and orthogonal representation [PGD 24: Drawings]



“ज्ञान से एक नये भारत का निर्माण”

Satyanarayan Gangaram Pitroda

“Invent a New India Using Knowledge”



“ज्ञान एक ऐसा खजाना है जो कभी चुराया नहीं जा सकता है”

Bhartrhari—Nitiśatakam

“Knowledge is such a treasure which cannot be stolen”

BLANK PAGE



IS 10990 (Part 1) : 1991
ISO 6412-1 : 1989

Indian Standard (Reaffirmed 2003)

TECHNICAL DRAWINGS — SIMPLIFIED REPRESENTATION OF PIPELINES

PART 1 GENERAL RULES AND ORTHOGONAL REPRESENTATION

(First Revision)

UDC 744 : 621.644

© BIS 1991

BUREAU OF INDIAN STANDARDS
MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG
NEW DELHI 110002

October 1991

Price Group 6

Indian Standard

TECHNICAL DRAWINGS — SIMPLIFIED REPRESENTATION OF PIPELINES

PART 1 GENERAL RULES AND ORTHOGONAL REPRESENTATION

(First Revision)

NATIONAL FOREWORD

This Indian Standard which is identical with ISO 6412-1 : 1989 'Technical drawings — Simplified representation of pipelines — Part 1 : General rules and orthogonal representation' issued by the International Organization for Standardization (ISO), was adopted by the Bureau of Indian Standards on the recommendations of the Drawing Sectional Committee (LMD 02) and approved by the Light Mechanical Engineering Division Council.

The original version of this standard IS 10990 : 1984 'Code of practice for industrial piping diagrams' was based on standards of other developed countries. ISO has published ISO 6412-1 : 1989 'Technical drawings — Simplified representation of pipelines — Part 1 : General rules and orthogonal representation' and ISO 6412-2 : 1989 'Technical drawings — Simplified representation of pipelines — Part 2 : Isometric projection'. Harmonization of the standard has been made by the adoption of ISO 6412-1 : 1989 and ISO 6412-2 : 1989, in two parts of IS 10990.

In the adopted standard certain terminology and conventions are not identical with those used in Indian Standards; attention is especially drawn to the following:

- a) Comma (,) has been used as a decimal marker while in Indian Standards the current practice is to use a point (.) as the decimal marker.
- b) Wherever the words International Standard appear referring to this standard, they should be read as Indian Standard.

CROSS REFERENCES

<i>International Standard</i>	<i>Corresponding Indian Standard</i>	<i>Degree of Equivalence</i>
ISO 128 : 1982	IS 10714 : 1983 General principles of presentation on technical drawings	Identical
ISO 129 : 1985	IS 11669 : 1986 General principles of dimensioning on technical drawings	Identical
ISO 406 : 1987	IS 11667 : 1991 Technical drawings — Linear and angular tolerancing — Indication on drawings	Identical
ISO 1219 : 1976	IS 7513 : 1974 Graphical symbols for fluid power systems	Identical
ISO 3091 - 1 : 1974	IS 9609 (Part 1) : 1983 Lettering on technical drawings : Part 1 English characters	Identical
ISO 5261 : 1981	IS 10720 : 1983 Technical drawings for structural metal works	Identical
ISO 5455 : 1979	IS 10713 : 1983 Scales for use in technical drawings	Identical

IS 10990 (Part 1) : 1991
ISO 6412- 1 : 1980

<i>International Standard</i>	<i>Corresponding Indian Standard</i>	<i>Degree of Equivalence</i>
ISO 6428 : 1982	IS 10164 : 1985 Requirements to execute technical drawings for micro-copying (<i>first revision</i>)	Identical
ISO 7573 : 1983	IS 11666 : 1985 Technical drawings — Item lists	Identical

The concerned technical committee has reviewed the provisions of ISO 3461 - 2. ISO 3545, ISO 4067 - 1 referred in this adopted standard and has decided that they are acceptable for use in conjunction with this standard.

This Indian Standard (IS : 10990) is issued in two part, other part deals with : General rules and orthogonal representation.

Technical drawings — Simplified representation of pipelines —

Part 1 : General rules and orthogonal representation

1 Scope

This part of ISO 6412 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 shall be used whenever pipes or pipelines have to be represented in a simplified manner.

For the purposes of this part of ISO 6412, the figures illustrate the text only and should not be considered as design examples.

NOTE — This part of ISO 6412 might also be of some use for the representation of similar installations, such as ventilation or air-conditioning systems; in such cases, the term "duct", etc. should be substituted for the term "pipe".

2 Normative references

The following standards contain provisions which, through reference in this text, constitute provisions of this part of ISO 6412. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this part of ISO 6412 are encouraged to investigate the possibility of applying the most recent editions of the standards listed below. Members of IEC and ISO maintain registers of currently valid International Standards.

ISO 128 : 1982, *Technical drawings — General principles of presentation*.

ISO 129 : 1985, *Technical drawings — Dimensioning — General principles, definitions, methods of execution and special indications*.

ISO 406 : 1987, *Technical drawings — Tolerancing of linear and angular dimensions*.

ISO 1219 : 1976, *Fluid power systems and components — Graphic symbols*.

ISO 3098-1 : 1974, *Technical drawings — Lettering — Part 1: Currently used characters*.

ISO 3461-2 : 1987, *General principles for the creation of graphical symbols — Part 2: Graphical symbols for use in technical product documentation*.

ISO 3545 : 1981, *Steel tubes and tubular shaped accessories with circular cross-section — Symbols to be used in specifications*.

ISO 4067-1 : 1984, *Technical drawings — Installations — Part 1 : Graphical symbols for plumbing, heating, ventilation and ducting*.

ISO 5261 : 1981, *Technical drawings for structural metal work*.

ISO 5455 : 1979, *Technical drawings — Scales*.

ISO 6428 : 1982, *Technical drawings — Requirements for microcopying*.

ISO 7573 : 1983, *Technical drawings — Item lists*.

3 Definitions

For the purposes of ISO 6412, the following definitions apply.

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

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 part of ISO 6412.

4.1 Representation of pipes, etc.

The flow line representing a pipe, etc. (irrespective of its diameter), shall be a single continuous thick line (type A, see table 1 and ISO 128), coinciding with the central line of the pipe (see ISO 4067:1).

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 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).

4.2 Scale

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

4.3 Lines

4.3.1 Thickness of lines

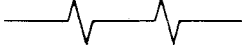
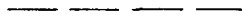
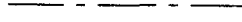
In general, only one thickness of line shall be used. However, in cases where more than one line thickness has to be used, the line thicknesses shall be chosen from ISO 128; the relative proportions of line thicknesses **a:b:c** shall be $2:\sqrt{2}:1$. Different line thicknesses shall then be used as follows (see also 4.3.2):

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

4.3.2 Types of line

The types and thicknesses of line shown in table 1 shall be used.

Table 1

Line type in accordance with with ISO 128	Description	Application
A 	Continuous thick	A1 Flow lines and connected parts
B 	Continuous thin	B1 Hatching B2 Dimensioning B3 Leader lines B4 Isometric grid lines
C 	Continuous thin freehand	C1 "D1" Limits of partial or interrupted views and sections
D 	Continuous thin with zigzags	
E 	Dashed thick	E1 Flow lines specified on other drawing
F 	Dashed thin	F1 Floor F2 Walls F3 Ceilings F4 Holes (hole punchings)
G 	Chain thin	G1 Centrelines
EJ 	Extra thick chain line ¹⁾	EJ1 Contract boundary
K 	Chain thin double-dashed	K1 Outlines of adjacent parts K2 Parts situated in front of the cutting plane
1) Four times the thickness of line type G.		

4.3.3 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.

4.4 Lettering

Lettering shall be in accordance with ISO 3098-1; 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 (see ISO 3461-2).

4.5 Dimensioning

4.5.1 In general, dimensioning shall be in accordance with ISO 129. Nominal dimensions may be indicated in accordance with ISO 3545 using the short designation "DN" (see figure 1).

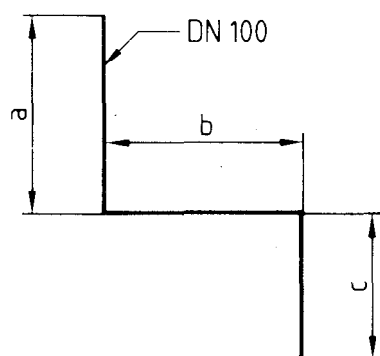


Figure 1

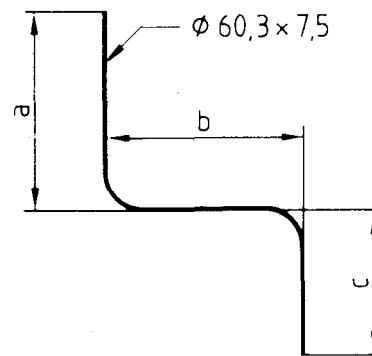


Figure 2

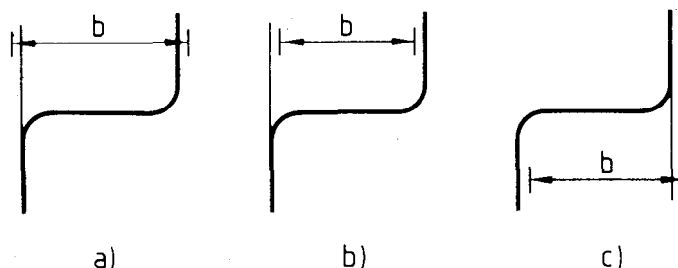


Figure 3

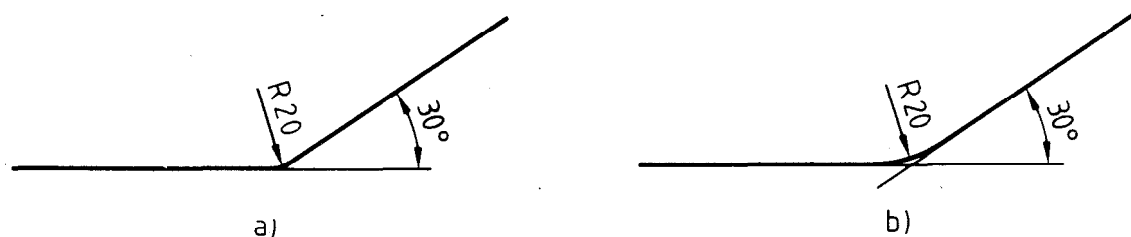


Figure 4

The outer diameter (d) and the wall thickness (t) of pipes may be indicated in accordance with ISO 5261 (see figure 2). If necessary, an item 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.

4.5.2 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 figures 3a), 3b) and 3c), respectively.

4.5.3 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.

4.5.4 Levels refer generally to the centre of the pipe and should be indicated in accordance with ISO 129 (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 4.5.2 [see figures 3 and 8a)].

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

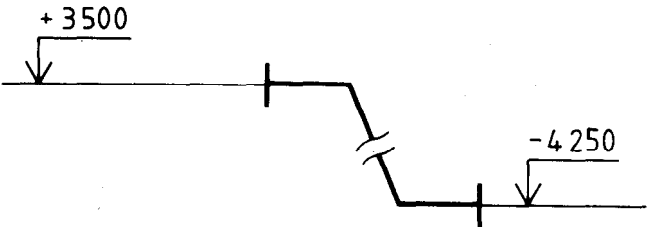


Figure 5

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

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

It may 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).

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

4.6 Tolerances

Tolerances shall be indicated in accordance with ISO 406.

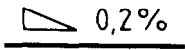


Figure 6

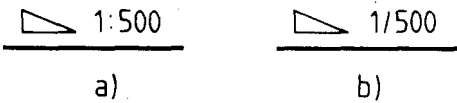


Figure 7

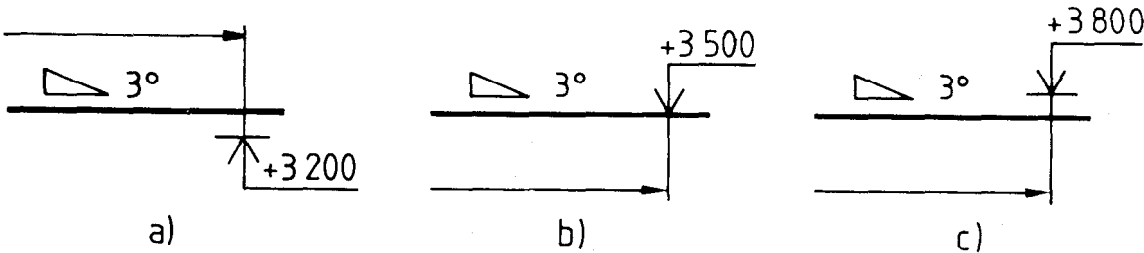


Figure 8

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 4067-1); if, however, 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 10). The width of each interruption shall not be less than five times the thickness of the continuous line (see figure 11).

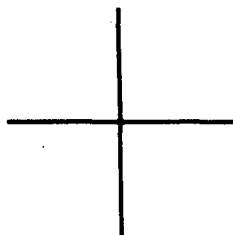


Figure 9

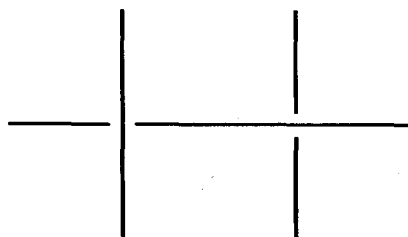


Figure 10

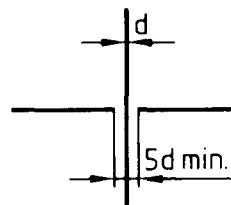


Figure 11

5.2 Permanent junctions (whether made by welding or other processes) shall be marked by a prominent dot in accordance with ISO 1219 (see figure 12). The diameter of the dot shall be five times the thickness of the line.

5.3 Detachable connections should be represented in accordance with ISO 4067-1¹⁾.

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 (see ISO 3461-2).

The graphical symbols used shall be in accordance with the International Standards given in clause 2 and in annex A.

6.2 Fittings

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

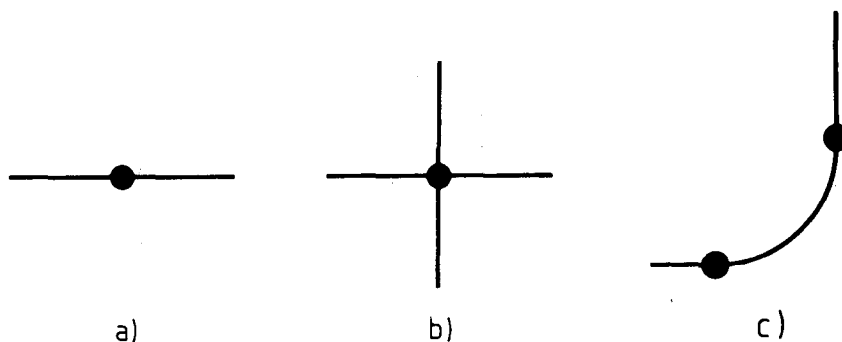


Figure 12

1) It is envisaged to enlarge ISO 4067 to include all other graphical symbols used for piping systems.

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.

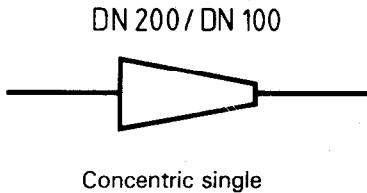


Figure 13

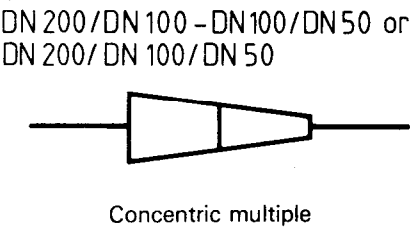


Figure 14

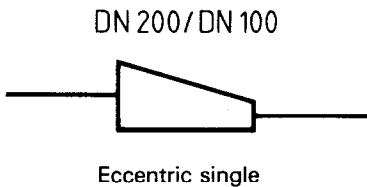


Figure 15

6.3 Supports and hangers

Supports and hangers shall be represented by their appropriate symbols in accordance with figures 16 to 19.

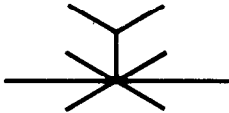
The representation of repeated accessories may be simplified shown in figure 20.

NOTE — Figures 16 to 19 refer to hangers only. It should be understood that in the case of supports, the same symbols should be used, but in the reverse position.



General

Figure 16



Fixed

Figure 17



Guided

Figure 18



Sliding

Figure 19

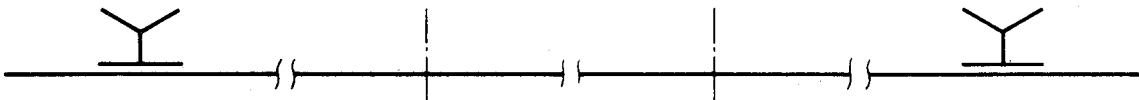


Figure 20

If necessary, an alphanumerical 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).

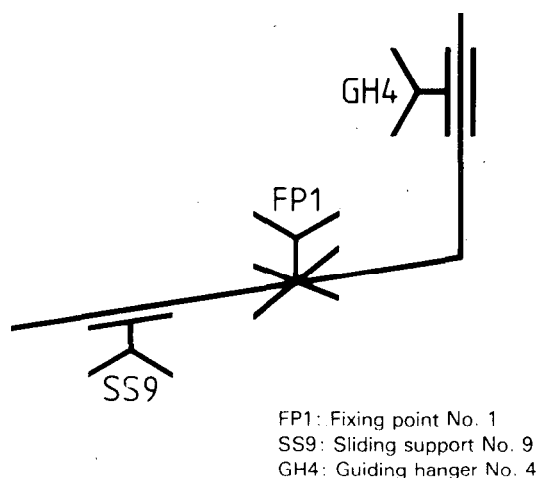


Figure 21

6.4 Additional provisions

Additional provisions such as insulation, coating, stream tracer lines, etc. may be specified in writing¹⁾.

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 chain thin double-dashed lines (type K; see table 1 and ISO 128) as shown in figure 22.

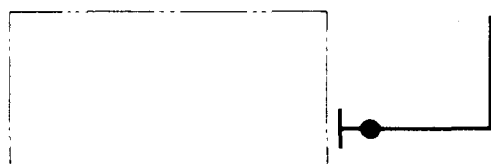


Figure 22

6.6 Direction of flow

The direction of flow shall be indicated by an arrowhead (see ISO 4067-1) 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,
- by a stroke for the side view,

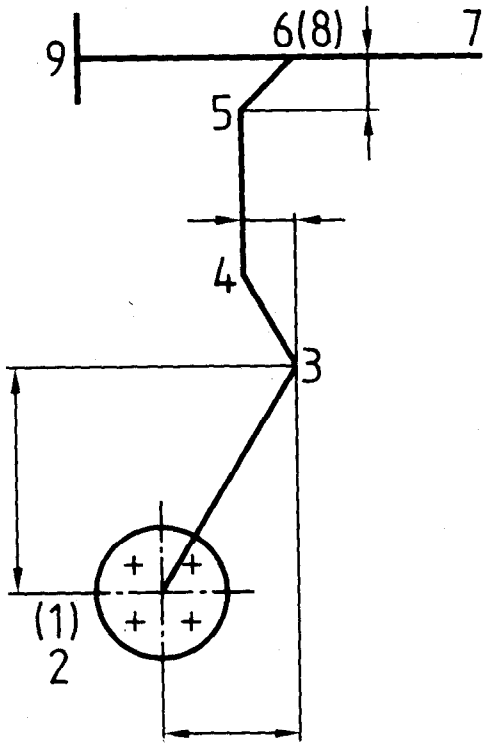
using lines of the same thickness as used for the representation of the pipes (see figures 22 and 25). A simplified representation of the flange holes may be shown by the appropriate number of crosses at their centrelines.

7 Examples

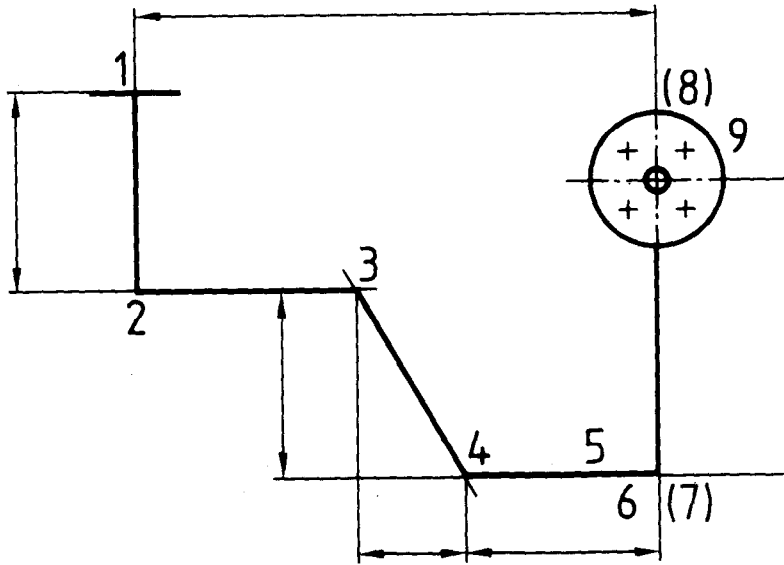
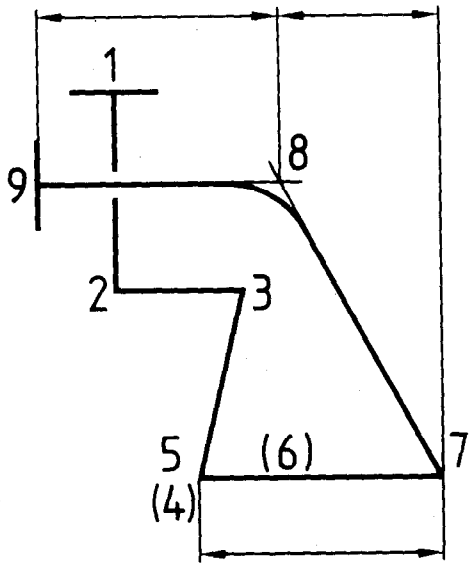
An example of orthogonal projection is given in figure 25.

NOTE — Other examples are given in ISO 3511-3 and ISO 3753.

¹⁾ It is envisaged to enlarge ISO 4067 to include all other graphical symbols used for piping systems.



Reference number	Coordinates of the end points		
1	$x_1 = -8$	$y_1 = +72$	$z_1 = +50$
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 isometric representation illustrated in ISO 6412-2 : 1989, figure 23. Reference numbers for points hidden behind other points are shown in brackets.

Figure 25

Annex A (informative)

Bibliography

ISO 841 : 1974, *Numerical control of machines — Axis and motion nomenclature.*

ISO 1101 : 1983, *Technical drawings — Geometrical tolerancing — Tolerancing of form, orientation, location and run-out — Generalities, definitions, symbols, indications on drawings.*

ISO 1503 : 1977, *Geometrical orientation and directions of movements.*

ISO 3511-1 : 1977, *Process measurement control functions and instrumentation — Symbolic representation — Part 1: Basic requirements.*

ISO 3511-2 : 1984, *Process measurement control functions and instrumentation — Symbolic representation — Part 2: Extension of basic requirements.*

ISO 3511-3 : 1984, *Process measurement control functions and instrumentation — Symbolic representation — Part 3: Detailed symbols for instrument interconnection diagrams.*

ISO 3511-4 : 1985, *Process measurement control functions and instrumentation — Symbolic representation — Part 4: Basic symbols for process computer, interface and shared display/control functions.*

ISO 3753 : 1977, *Vacuum technology — Graphical symbols*

ISO 4067-6 : 1985, *Technical drawings — Installations — Part 6: Graphical symbols for water supply and drainage systems in the ground.*

Bureau of Indian Standards

BIS is a statutory institution established under the *Bureau of Indian Standard Act, 1986* to promote harmonious development of the activities of standardization, marking and quality certification of goods and attending to connected matters in the country.

Copyright

BIS has the copyright of all its publications. No part of these publications may be reproduced in any form without the prior permission in writing of BIS. This does not preclude the free use, in the course of implementing the standard, of necessary details, such as symbols and sizes, type of grade designations. Enquiries relating to copyright be addressed to the Director (Publications), BIS.

Revision of Indian Standards

Indian Standards are reviewed periodically and revised, when necessary and amendments, if any, are issued from time to time. Users of Indian Standards should ascertain that they are in possession of the latest amendments or edition. Comments on this Indian Standard may be sent in BIS giving the following reference :

Doc : No. LMD 02 (0079)

Amendments Issued Since Publication

Amend No.	Date of Issue	Text Affected

BUREAU OF INDIAN STANDARDS

Headquarters :

Manak Bhavan, 9 Bahadur Shah Zafar Marg, New Delhi 110002
Telephone : 331 01 31, 331 13 75

Telegrams : Manaksanstha
(Common to all Offices)

Regional Offices :

	Telephone
Central : Manak Bhavan, 9 Bahadur Shah Zafar Marg NEW DELHI 110001	{ 331 01 31 331 13 75
Eastern : I/14, C.I.T. Scheme VII M, V.I.P. Road, Maniktola, CALCUTTA 700054	37 86 62
Northern : SCO 445-446, Sector 35-C, CHANDIGARH 160036	53 38 43
Southern : C.I.T. Campus, IV Cross Road, MADRAS 600113	41 29 16
Western : Manakalaya, E9 MIDC, Marol, Andheri (East) BOMBAY 400093	6 32 92 95
Branches : AHMADABAD. BANGALORE. BHOPAL. BHUBANESHWAR. COIMBATORE. FARIDABAD. GHAZIABAD. GUWAHATI. HYDERABAD. JAIPUR. KANPUR. PATNA. THIRUVANANTHAPURAM.	