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Technical drawings — Projection methods —

Part 4: Central projection

*Dessins techniques — Méthodes de projection —
Partie 4: Projection centrale*

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Reference number
ISO 5456-4:1996(E)

Foreword

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Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

International Standard ISO 5456-4 was prepared by Technical Committee ISO/TC 10, *Technical drawings, product definition and related documentation*, Subcommittee SC 1, *Basic conventions*.

ISO 5456 consists of the following parts, under the general title *Technical drawings — Projection methods*:

- Part 1: *Synopsis*
- Part 2: *Orthographic representations*
- Part 3: *Axonometric representations*
- Part 4: *Central projection*

Annexes A and B of this part of ISO 5456 are for information only.

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Introduction

Central projection (perspective) is a realistic pictorial representation obtained by projecting the object to be represented from a point at finite distance (projection centre) on a single projection plane (normally the drawing surface). Central projection provides excellent visual appearance of the object (monocular vision) and is often used in architectural drawings.

Technical drawings — Projection methods —

Part 4: Central projection

1 Scope

This part of ISO 5456 specifies basic rules for the development and application of central projection in technical drawings.

2 Normative reference

The following standard contains provisions which, through reference in this text, constitute provisions of this part of ISO 5456. At the time of publication, the edition indicated was valid. All standards are subject to revision, and parties to agreements based on this part of ISO 5456 are encouraged to investigate the possibility of applying the most recent edition of the standard indicated below. Members of IEC and ISO maintain registers of currently valid International Standards.

ISO 10209-2:1993, *Technical product documentation — Vocabulary — Part 2: Terms relating to projection methods*.

3 Definitions

For the purposes of this part of ISO 5456, the definitions given in ISO 10209-2 and the following definitions apply.

3.1 alignment line: Line parallel to a given line passing through the projection centre. Its intersection with the projection plane gives the vanishing point of all lines parallel to the given line.

3.2 height of projection: Vertical distance of the projection centre from the basic plane.

3.3 horizontal distance: Distance between the projection centre and the projection plane.

3.4 projection angle: Angle formed by the projection plane and the horizon plane.

3.5 scale point: Vanishing point of the horizontal direction orthogonal to that bisecting the angle formed by the horizon line and the alignment line of the given horizontal line, and allowing the true length of the projection of the given line to be determined.

3.6 station of observation: Orthogonal projection of the projection centre onto the basic plane.

4 Symbols

Letter symbols for terms used in central projection are given in table 1 and illustrated in figures 1 and 2, as well as in the figures mentioned in table 1.

Table 1 — Letter symbols

No.	Term	Letter symbol	Figure
1) ¹⁾	Projection plane	T	1
1) ¹⁾	Basic plane	G	1
1) ¹⁾	Basic line	X	1
3.4	Projection angle	β	5
1) ¹⁾	Horizon plane	HT	1
1) ¹⁾	Horizon line	h	1
3.1	Alignment line	VI	4
1) ¹⁾	Main point	C	1
1) ¹⁾	Vanishing point	V	4
1) ¹⁾	Main projector	pL	1
1) ¹⁾	Projection centre	O	1
3.2	Height of projection	H	1
3.3	Horizontal distance	d	1
1) ¹⁾	Vision cone	K	2
1) ¹⁾	Circle of vision	Ks	3
1) ¹⁾	Vision angle	α	2
1) ¹⁾	Projector	PI	3
1) ¹⁾	Distance point	DP	13
3.5	Scale point	MP	14
3.6	Station of observation	Sp	1
1) Terms already defined in ISO 10209-2.			

5 Central projection methods

The mode of the central projection depends on the position of the object to be represented with respect to the projection plane.

For possible positions and applicable projection methods, see 5.1 to 5.4.

5.1 One-point method

A one-point projection method is a central projection of an object having its principal face parallel to the projection plane (special position). All parallel outlines and edges of the object which are parallel to the projection plane retain their direction in this represen-

tation (horizontal lines remain horizontal and vertical lines remain vertical). All lines perpendicular to the projection plane converge at the vanishing point, V, coinciding with the main point, C, (see figure 3 and 7.2.1 and 7.3).

5.2 Two-point method

A two-point projection method is a central projection of an object having its vertical outlines and edges parallel to the projection plane (particular position). All horizontal lines of a representation converge at multiple vanishing points $V_1, V_2, V_3, \dots$, on the horizon line (see figure 4 and 7.2.2 and 7.4).

5.3 Three-point method

A three-point projection method is a central projection of an object having no outlines or edges parallel to the projection plane (any position). If the projection plane is inclined towards the projection centre, i.e. $\beta > 90^\circ$, the vanishing point for vertical lines is situated below the horizon line (see figure 5 and 7.5.1 and 7.5.2).

5.4 Coordinate method

Representation by the coordinate method is based on simple proportions.

The coordinates, related to the main projector of all relevant points of the object to be represented, are taken by the graphic method from the basic plane and elevation. From these point coordinates, the image coordinates are obtained by a calculation method and entered to scale. The image points are connected to each other to provide a clear representation of the object (see figure 6).

6 Principle

6.1 Location and position of the projection plane

The image size of an object can be varied by parallel shifting of the projection plane. If the object is placed in front of the projection plane, the representation will be enlarged. The object behind the projection plane will result in a smaller image. Figure 7 shows the change in image size depending on the position of the object with respect to the projection plane.

Figure 8 shows the change in image size depending on the method of representation with vertical or inclined projection planes. β is the included angle between the projection plane and the basic plane near the projection centre.

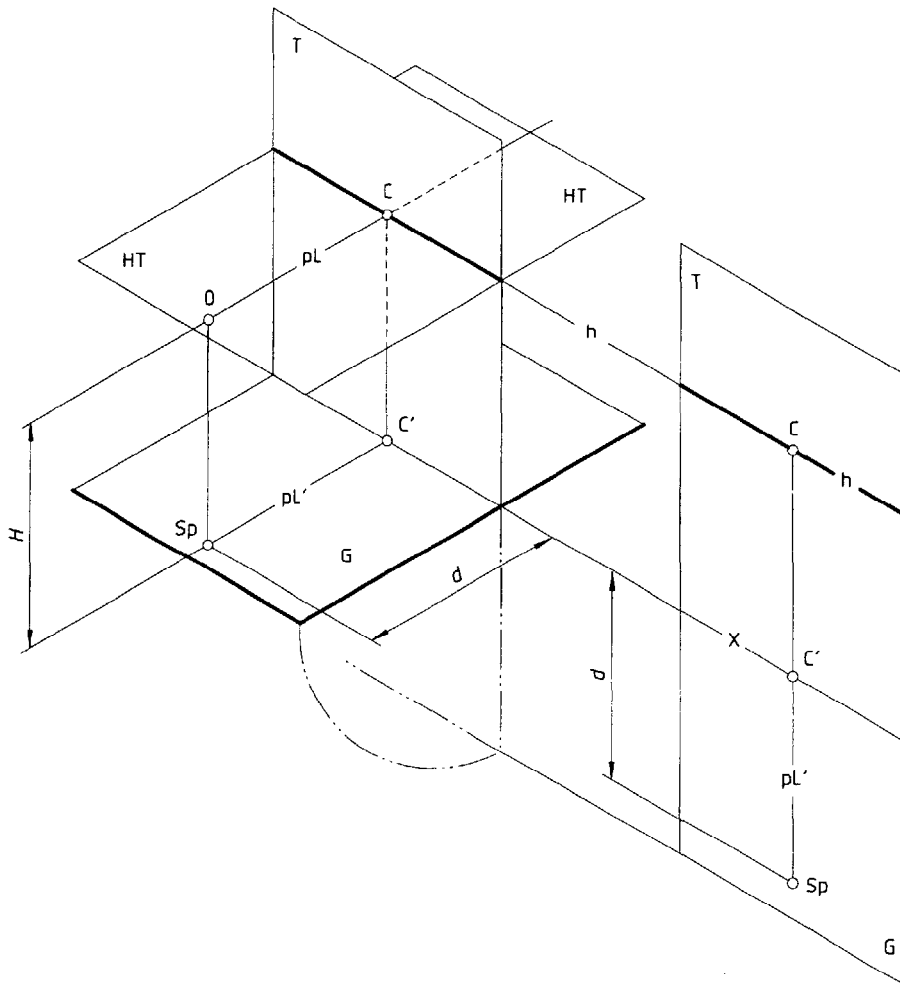


Figure 1 — Projection model of the central projection

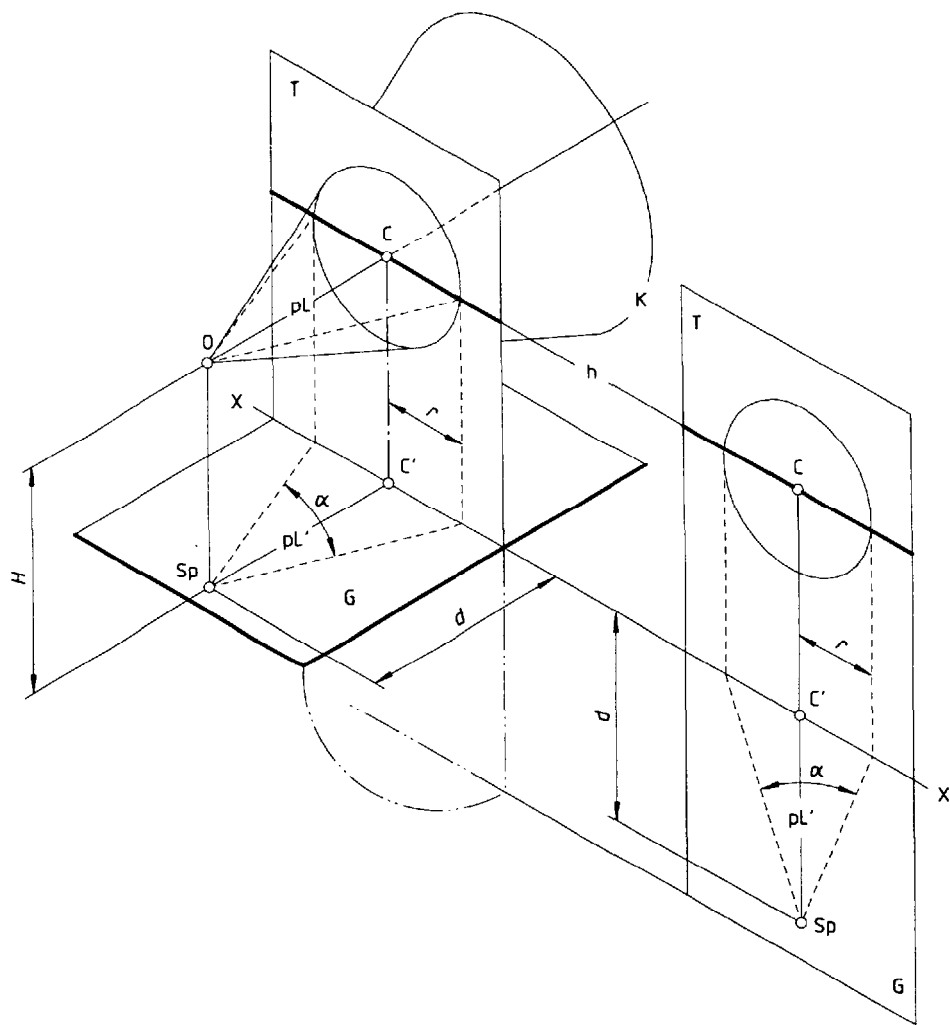


Figure 2 — Vision cone and vision angle in the projection model of the central projection

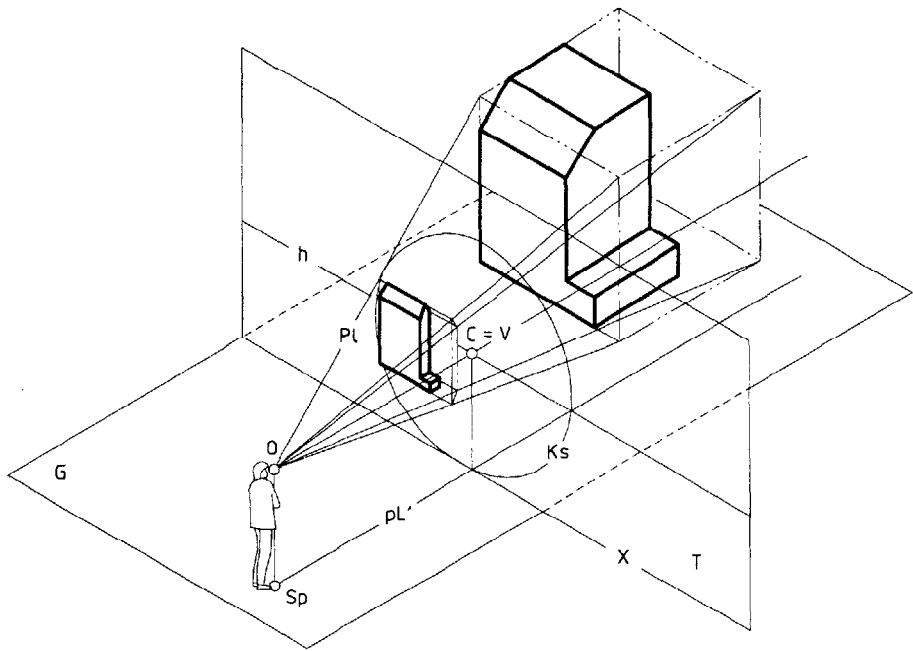


Figure 3 — Projection model with vertical projection plane and an object in a special position with respect to the projection plane

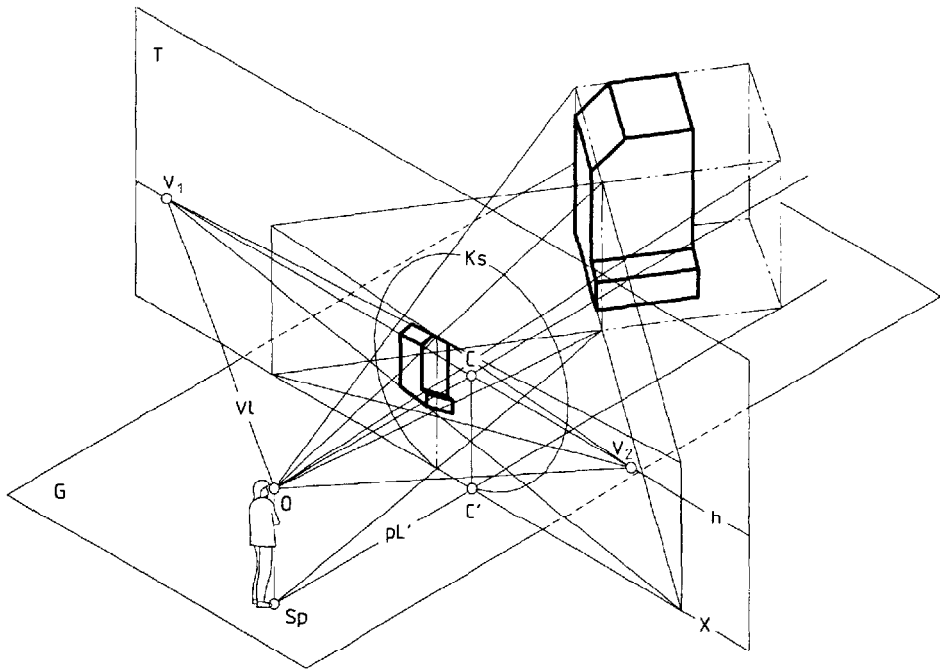


Figure 4 — Projection model with vertical projection plane and an object in a particular position with respect to the projection plane

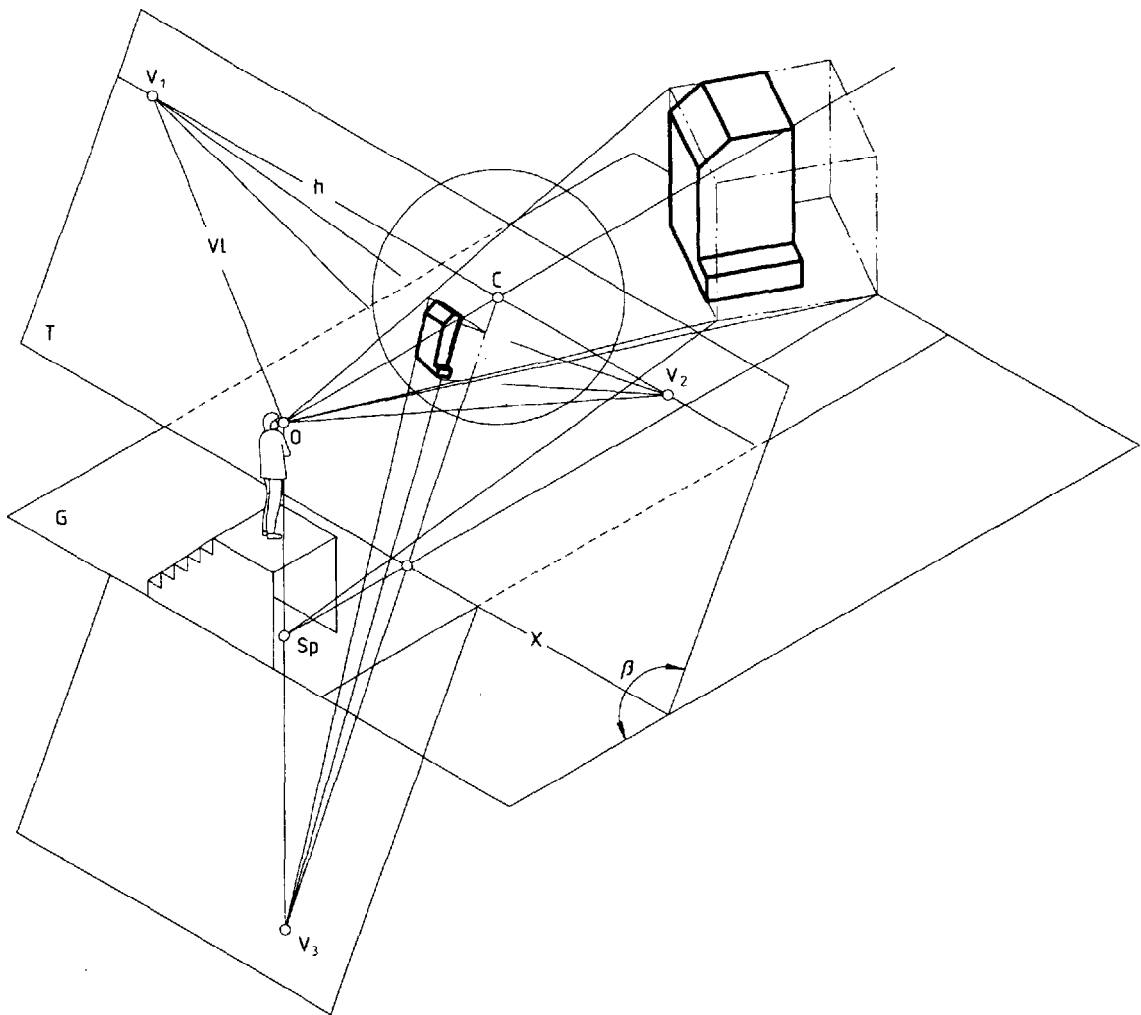


Figure 5 — Projection model with inclined projection plane and an object in any position with respect to the projection plane ($\beta > 90^\circ$)

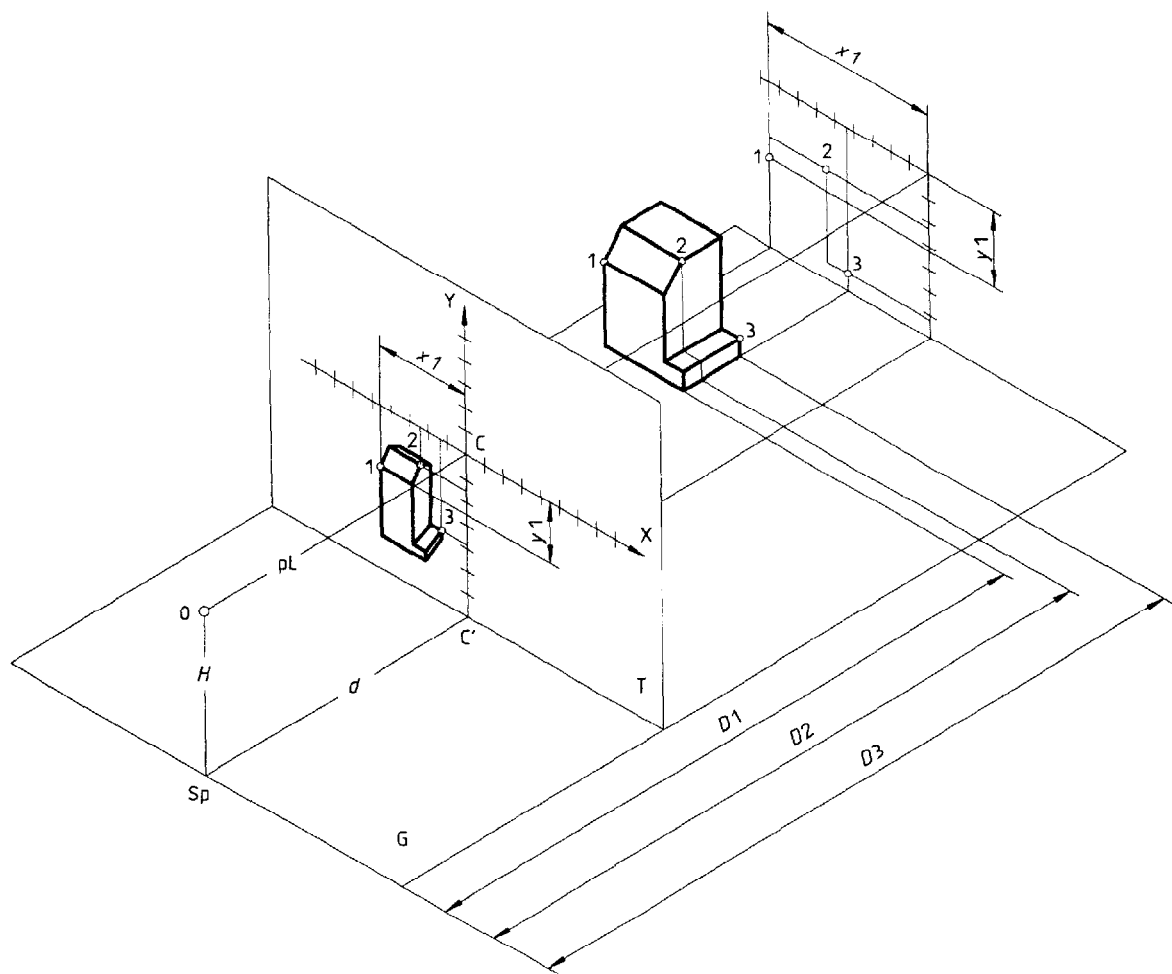


Figure 6 — Projection model with vertical projection plane and an object in special position, showing the lengths used in the mathematical formula for calculation of the perspective image

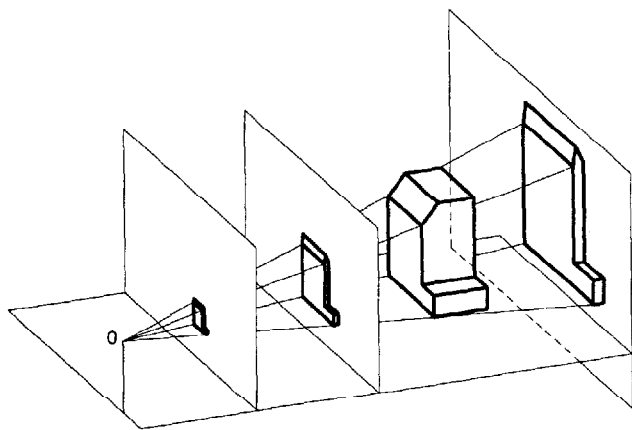
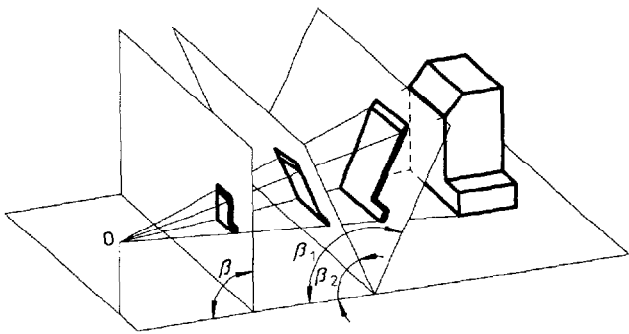


Figure 7 — Location of projection planes



$\beta = 90^\circ, \beta_1 > 90^\circ; \beta_2 < 90^\circ$

Figure 8 — Position of projection planes

6.2 Circle of vision and vision cone

To obtain a fully instructive image of an object without peripheral distortions on the projection plane, the object must be positioned within a vision cone having an aperture angle not greater than 60°.

Heavy peripheral distortions occur on images outside the circle of vision; the image does not appear fully

instructive since length, width and height do not match the object's inherent proportions (see figure 9).

An object can be depicted nearly undistorted if the projectors result in a bundle of rays inclined not more than 30° with respect to the main projector. At this aperture angle the vision cone provides only a small distortion on the projection plane.

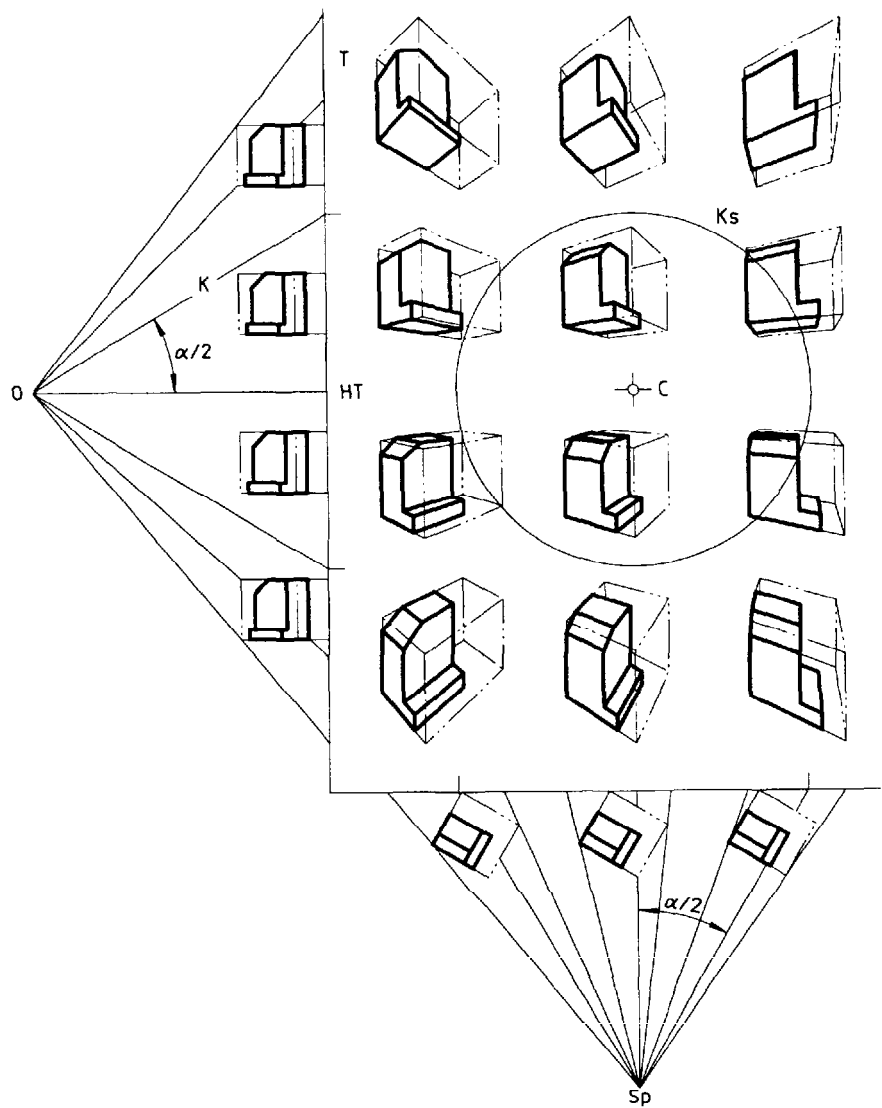


Figure 9 — Object, framed in a cube, within and outside the circle of vision

The main projector should hit the object to be depicted in a part which is visually important, so that the object is contained within the minimum vision cone.

6.3 Distance

Different relative distances influence the image size and its appearance. When the distance between the object and the projection plane is fixed and the projection centre and the object lie on opposite sides of the projection plane, increasing the distance (d) between the projection centre and the projection plane gives enlarged and flattened representations. When the distance (d) is fixed and the object and the projection centre lie on opposite sides of the projection plane, increasing the distance

between the object and the projection plane gives reduced and flattened representations.

7 Principles and methods of depiction

7.1 Piercing method

Using the piercing method, the piercing points of projectors with the projection plane are shown by basic plane and elevation, and may be determined either by drawing or by calculation (see figure 10).

The piercing method allows even complex objects (round shapes, helicoids, etc.) to be easily represented in central projection.

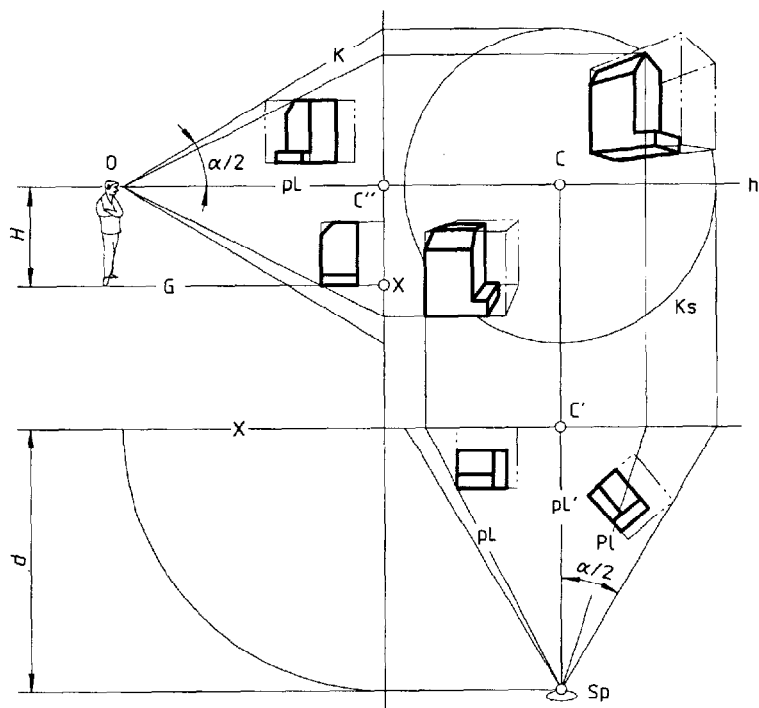


Figure 10 — Projection model turned into the drawing surface with side view