
International Standard



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Technical drawings — Geometrical tolerancing — Datums and datum-systems for geometrical tolerances

Dessins techniques — Tolérancement géométrique — Références spécifiées et systèmes de références spécifiées pour tolérances géométriques

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Foreword

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Draft International Standards adopted by the technical committees are circulated to the member bodies for approval before their acceptance as International Standards by the ISO Council.

International Standard ISO 5459 was developed by Technical Committee ISO/TC 10, *Technical drawings*, and was circulated to the member bodies in February 1978.

It has been approved by the member bodies of the following countries :

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Technical drawings — Geometrical tolerancing — Datums and datum-systems for geometrical tolerances

0 Introduction

For uniformity all figures in this International Standard are in first angle projection.

It should be understood that the third angle projection could equally well have been used without prejudice to the principles established.

For the definitive presentation (proportions and dimensions) of symbols for geometrical tolerancing, see ISO 7083.

1 Scope and field of application

This International Standard describes datum and datum-systems for geometrical tolerancing, their definitions, practical embodiments and their indications on technical drawings in the field of mechanical engineering.

2 References

ISO 128, *Technical drawings — General principles of presentation*.¹⁾

ISO 129, *Engineering drawings — Dimensioning*.²⁾

ISO 1101, *Technical drawings — Geometrical tolerancing — Tolerances of form, orientation, location and run-out — Generalities, definitions, symbols, indications on drawings*.³⁾

ISO 2692, *Technical drawings — Geometrical tolerancing — Maximum material principle*.⁴⁾

ISO 7083, *Technical drawings — Symbols for geometrical tolerancing — Proportions and dimensions*.⁵⁾

3 Definitions

3.1 datum : A theoretically exact geometric reference (such as axes, planes, straight lines, etc.) to which toleranced features are related. Datums may be based on one or more datum features of a part.

3.2 datum-system : A group of two or more separate datums used as a combined reference for a toleranced feature.

3.3 datum feature : A real feature of a part (such as an edge, a surface, or a hole, etc.), which is used to establish the location of a datum.

NOTE — As datum features are subject to manufacturing errors and variations, it may be necessary where appropriate to specify tolerances of form to them.

3.4 datum target : A point, line or limited area on the work-piece to be used for contact with the manufacturing and inspection equipment, to define the required datums in order to satisfy the functional requirements.

3.5 simulated datum feature : A real surface of adequately precise form (such as a surface plate, a bearing, or a mandrel, etc.) contacting the datum feature(s) and used to establish the datum(s).

NOTE — Simulated datum features are used as the practical embodiment of the datums during manufacture and inspection.

1) At present at the stage of draft. (Revision of ISO/R 128-1959.)

2) At present at the stage of draft. (Revision of ISO/R 129-1959.)

3) At present at the stage of draft. (Revision of ISO/R 1101/1-1969.)

4) At present at the stage of draft. (Revision of ISO/R 1101/2-1974.)

5) At present at the stage of draft.

4 Establishing datums

Features indicated as datums have inherent inaccuracies resulting from the production process. These may take the form of convex, concave or conical deviations. The following methods are examples for establishing datums.

4.1 Datum being a straight line or a plane

The datum feature shall be arranged in such a way that the maximum distance between it and the simulated datum feature has the least possible value. Should the datum feature not be stable with the contacting surface, suitable supports should be placed between them at a practical distance apart. For lines, use two supports (see figure 1) and for flat surfaces, use three supports.

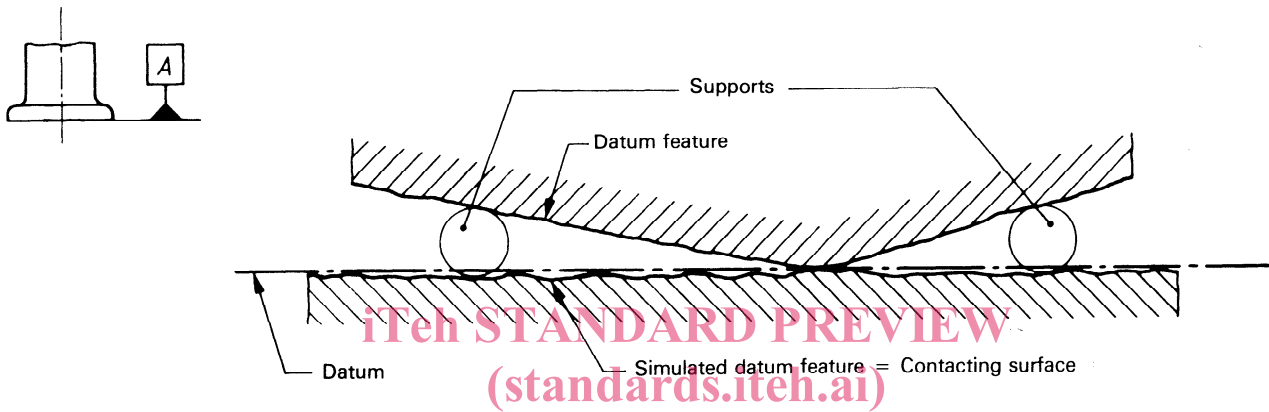


Figure 1:1981

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4.2 Datum being the axis of a cylinder

The datum is the axis of the largest inscribed cylinder of a hole or the smallest circumscribed cylinder of a shaft, so located that any possible movement of the cylinder in any direction is equalised (see figure 2).

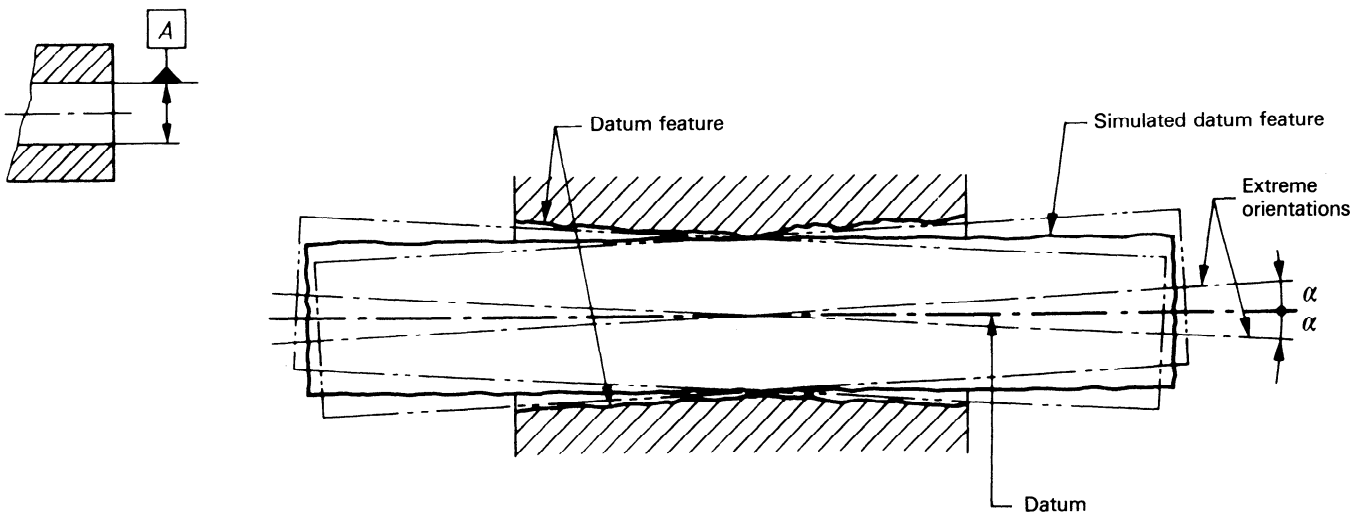
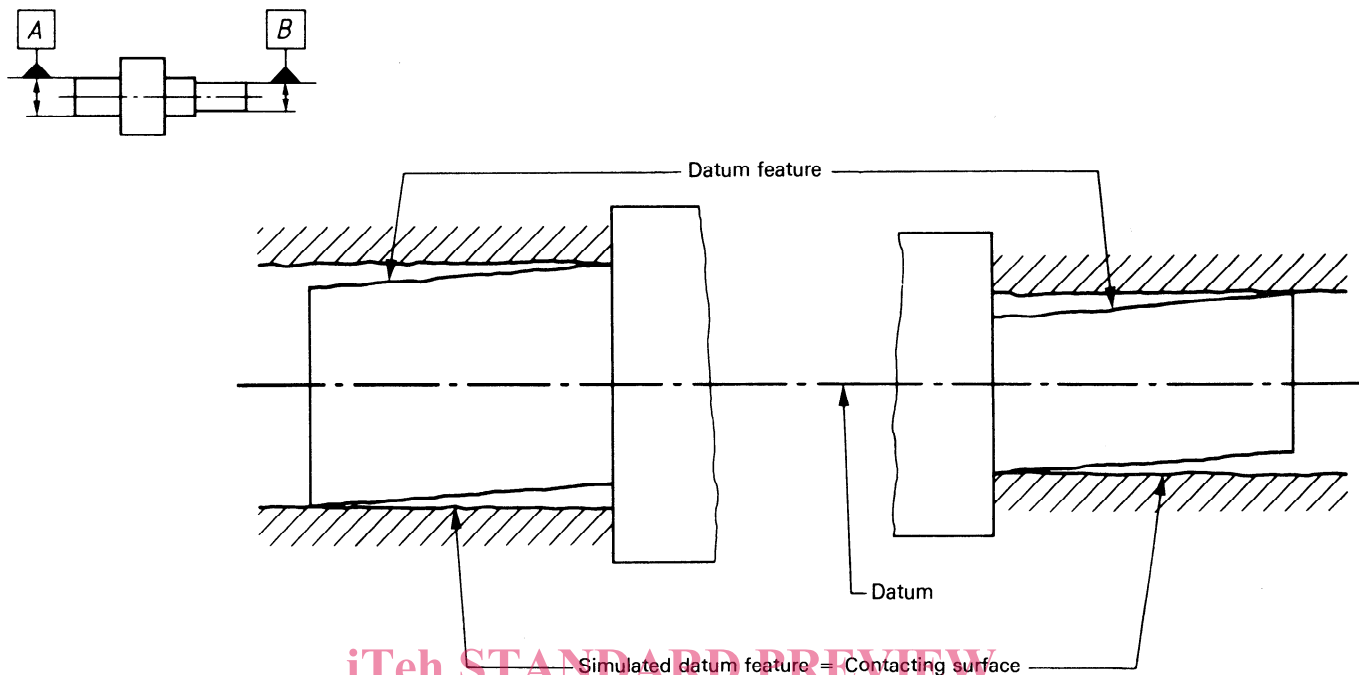


Figure 2

4.3 Datum being the common axis or common median plane

In the example shown in figure 3, the datum is the common axis formed by the two smallest circumscribed coaxial cylinders.



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Figure 3

4.4 Datums being the axis of a cylinder and perpendicular to a plane

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The datum "A" is the plane represented by the contacting flat surface.

The datum "B" is the axis of the largest inscribed cylinder, perpendicular to the datum "A".

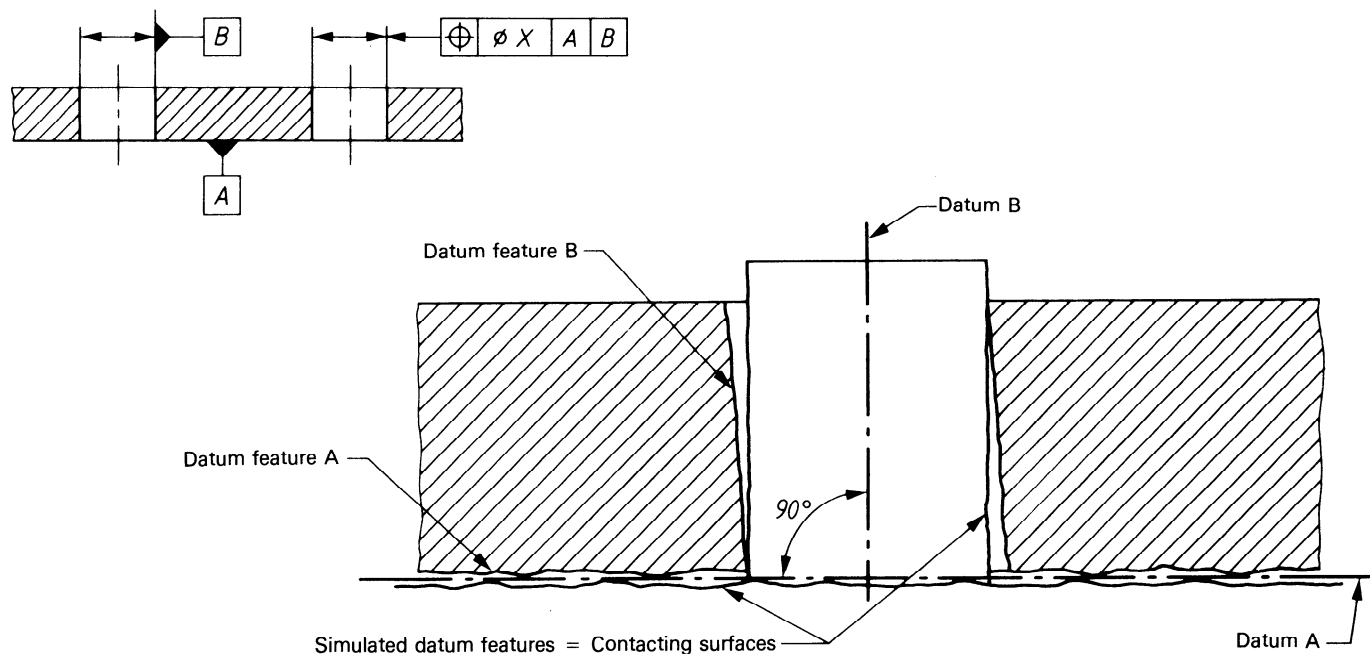


Figure 4

NOTE — In the above example the datum "A" is considered to be primary and the datum "B", secondary (see 6.2.3).

5 Application of datums

Datums and datum-systems are used as the base for establishing the geometric relationship of related features. The quality of relevant datum features and simulated datum features must be adequate for functional requirements.

The following table shows :

- the indication of datums on technical drawings;
- the datum features;
- how datums are established by means of simulated datum features.

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Table – Examples

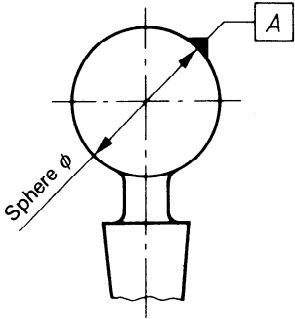
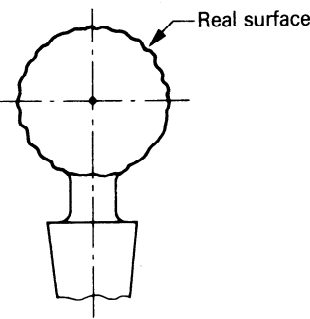
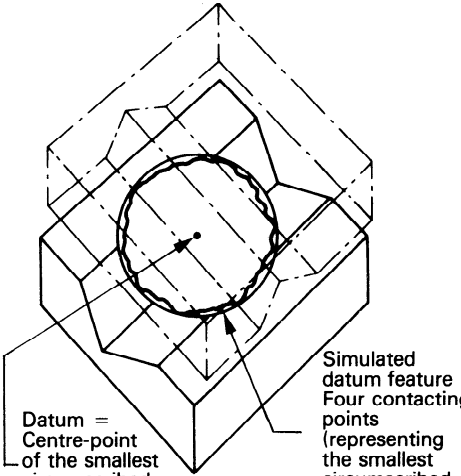
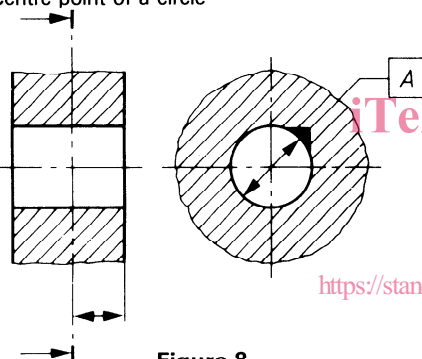
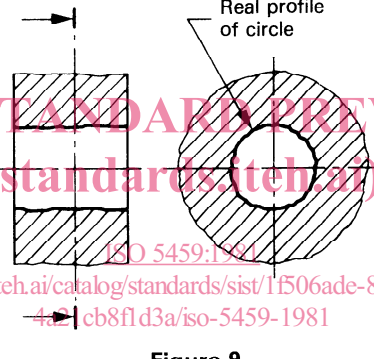
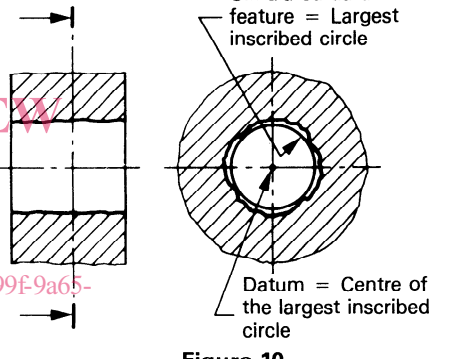
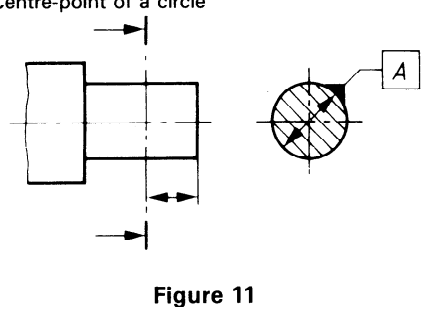
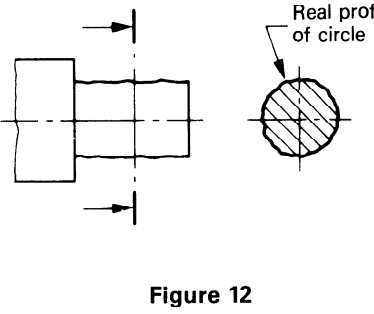
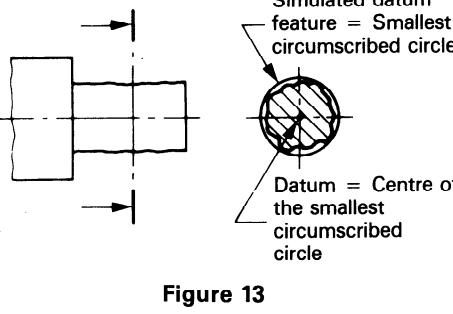
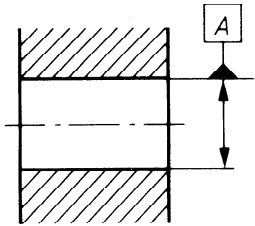
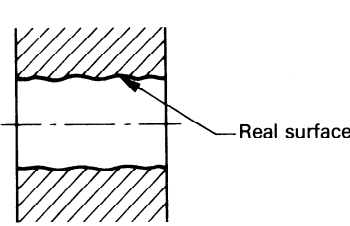
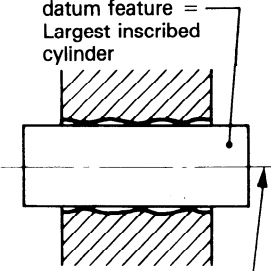
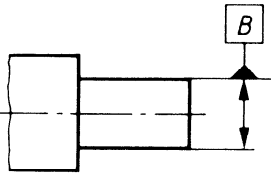
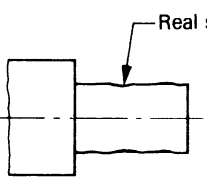
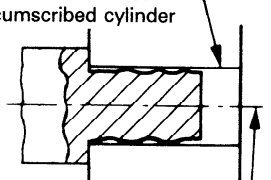
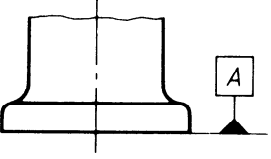

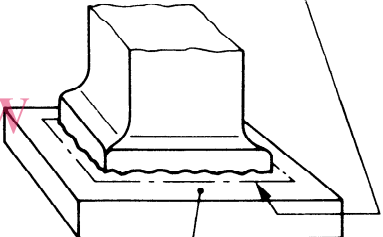
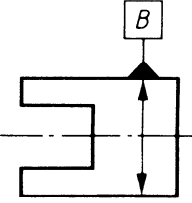
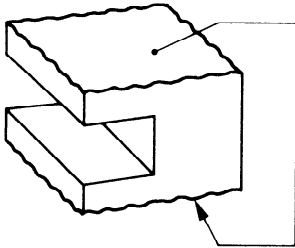
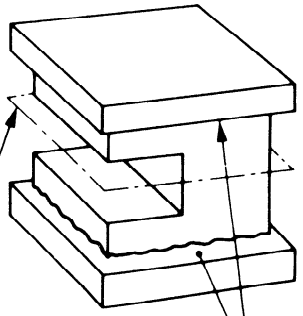
Datums	Datum features	Establishment of datums
<p>Datum - centre-point Centre-point of a sphere</p>  <p>Figure 5</p>	 <p>Real surface</p> <p>Figure 6</p>	 <p>Datum = Centre-point of the smallest circumscribed sphere</p> <p>Simulated datum feature = Four contacting points (representing the smallest circumscribed sphere) on the vee-block</p> <p>Figure 7</p>
<p>Centre-point of a circle</p>  <p>Figure 8</p>	 <p>Real profile of circle</p> <p>Figure 9</p>	 <p>Simulated datum feature = Largest inscribed circle</p> <p>Datum = Centre of the largest inscribed circle</p> <p>Figure 10</p>
<p>Centre-point of a circle</p>  <p>Figure 11</p>	 <p>Real profile of circle</p> <p>Figure 12</p>	 <p>Simulated datum feature = Smallest circumscribed circle</p> <p>Datum = Centre of the smallest circumscribed circle</p> <p>Figure 13</p>
<p>Datum-line Axis of a hole</p>  <p>Figure 14</p>	 <p>Real surface</p> <p>Figure 15</p>	 <p>Simulated datum feature = Largest inscribed cylinder</p> <p>Datum = Axis of the largest inscribed cylinder</p> <p>Figure 16</p>

Table – Examples (concluded)

Datums	Datum features	Establishment of datums
<p>Axis of a shaft</p>  <p>Figure 17</p>	<p>Real surface</p>  <p>Figure 18</p>	<p>Simulated datum feature = Smallest circumscribed cylinder</p>  <p>Datum = Axis of the smallest circumscribed cylinder</p> <p>Figure 19</p>
<p>Datum-plane</p> <p>Surface of a part</p>  <p>Figure 20</p>	<p>Real surface</p>  <p>Figure 21</p>	<p>Datum = Plane established by the surface plate</p>  <p>Simulated datum feature = Surface of the surface plate</p> <p>Figure 22</p>
<p>Median plane</p> <p>Median plane of the two surfaces of a part</p>  <p>Figure 23</p>	<p>Real surfaces</p>  <p>Figure 24</p>	<p>Simulated datum feature = Contacting flat surfaces</p> <p>Datum = Median plane established by the two contacting flat surfaces</p>  <p>Figure 25</p>

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6 Indication of datums and datum-systems

6.1 Datum symbols

6.1.1 Datum triangle

The datums are indicated by a leader line terminating in a filled or an open triangle (see figure 26).



Figure 26



Figure 27

6.2 Datum and datum-systems specified in the tolerance frame

A datum may be established by one or more features. The following procedures should be used as appropriate.

6.2.1 Datum established by a single feature

Where the datum is established by a single feature, the datum is indicated by a single letter in the third compartment of the tolerance frame.

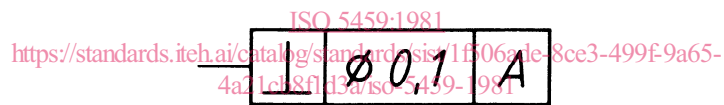


Figure 28

6.2.2 Common datum established by two features

Where the common datum is established by two features, the datum is indicated in the third compartment of the tolerance frame by two letters separated by a hyphen.

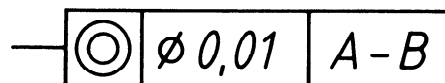


Figure 29

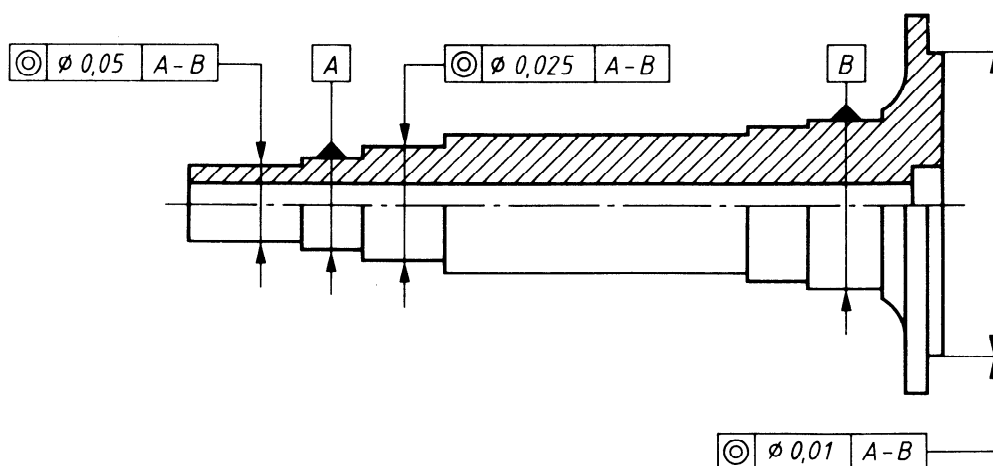


Figure 30