UDC 744 , 43

Ref. No.: ISO/R 129 - 1959 (E)

ISO

INTERNATIONAL ORGANIZATION FOR STANDARDIZATION

ISO RECOMMENDATION
R 129

ENGINEERING DRAWING
DIMENSIONING

1st EDITION
September 1959

Printed in Switzerland

Also issued in French and Russian. Copies to be obtained through the national standards organizations.

TC

BRIEF HISTORY

The ISO Recommendation R 129, *Engineering Drawing - Dimensioning*, was drawn up by Technical Committee ISO/TC 10, *Drawings (General Principles)*, the Secretariat of which is held by the Association Suisse de Normalisation (SNV).

During its first meeting, held in Zurich, in September 1951, the Technical Committee decided to use as the basis for its work the ISA Bulletin No. 32, drawn up by the former International Federation of the National Standardizing Associations (ISA). The development of the various drafts was entrusted to Sub-Committee SC 1, *Preliminary work*, comprising Austria, Belgium, France, Italy, Netherlands, Sweden, Switzerland, United Kingdom and, since 1952, Germany.

After six meetings spaced over the years 1952, 1953 and 1954, the Sub-Committee submitted to the plenary Technical Committee three proposals relative to the dimensioning of engineering drawings, namely: 1) General principles, 2) Method of execution, and 3) Arrangement of dimensions. At its second meeting, held in Stockholm, in June 1955, the Technical Committee adopted these three proposals as Draft ISO Recommendations.

On 31 December 1956, these three Draft ISO Recommendations were distributed to all the ISO Member Bodies and were approved, subject to a certain number of modifications, by the following 19 (out of a total of 38) Member Bodies:

Australia	Germany	Norway
Austria	*Greece	Pakistan
*Brazil	Italy	Spain
Canada	Japan	Switzerland
Denmark	Mexico	Turkey
Finland	Netherlands	U.S.S.R.
France		

The Draft covering general principles was, furthermore, approved by the Member Bodies of Bulgaria, Romania and the Union of South Africa. The Draft dealing with the method of execution was, furthermore, approved by the Member Body of Israel. The Draft concerning the arrangement of dimensions was, furthermore, approved by the Member Bodies of Belgium, Bulgaria, Israel and Portugal.

No Member Body opposed the approval of the Drafts.

These three Draft ISO Recommendations were then submitted, by correspondence, to the ISO Council, which decided, in September 1959, to accept them as ISO RECOMMENDATIONS.

In line with a suggestion made by a Member of the Editing Committee, it was decided to group into a single ISO Recommendation the subject-matter of the three Draft ISO Recommendations.

The simplest possible figures have been chosen to illustrate the text. Some figures are so clear that they need no comment. The explanatory texts allow these principles to be adopted to those more complicated situations which arise in practice.

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* These Member Bodies stated that they had no objection to the Drafts being approved.

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ENGINEERING DRAWING

DIMENSIONING

INTRODUCTORY NOTE

For uniformity all the dimensions in this ISO Recommendation are given in metric units only and the figures are in European (First angle) projection. It should be understood that inch units and/or American (Third angle) projection could equally well have been used without prejudice to the principles established.

1. GENERAL PRINCIPLES

1.1 Definitions

The following definitions apply to the terms used in the ISO Recommendations relating to engineering drawings.

1.1.1 *End product drawing.* An end product drawing provides a complete description of the product in the condition in which it is to be used, those requirements essential to the function of the product being expressed directly on the drawing. The product may be a piece ready for assembly or service, or a piece for further processing (e.g. the product of a foundry or forge).

1.1.2 *Feature.* A feature is an individual characteristic of a piece, such as a cylindrical surface, shoulder, screw thread, slot, flat surface, profile or the like.

1.1.3 *Functional feature.* A functional feature is a feature which plays an essential part in the performance or serviceability of the piece to which it belongs. It may be a location feature, e.g. a spigot which serves to locate a component in an assembly, or a working surface, e.g. the bore of a bearing.

1.1.4 *Functional dimension.* A functional dimension is a dimension which is essential to the function of a product (Fig. 1).

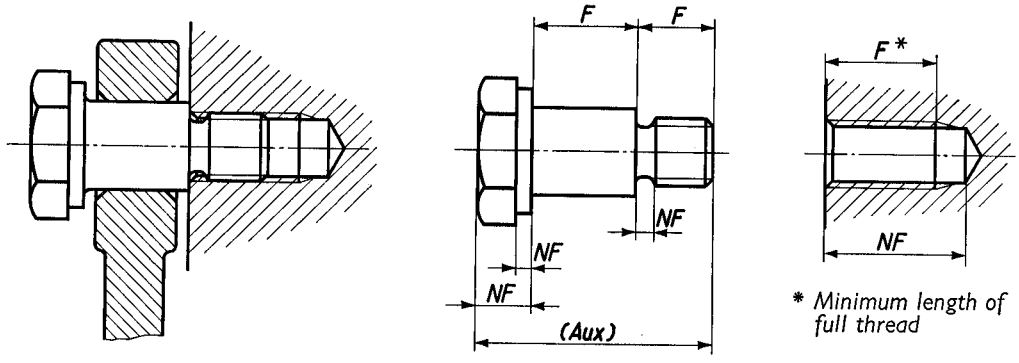

Fig. 1

F = a functional dimension
NF = a non-functional dimension
Aux = an auxiliary dimension given without tolerance, for information only.

1.2 Principles

1.2.1 All the dimensions and tolerances, etc., necessary to provide for the correct functioning of the part should be expressed directly on the drawing together with any other information necessary to describe the part completely in its finished form, without forgetting the manufacturing and inspection requirements.

No single dimension should be given more than once on the drawing, except where unavoidable.

It should not be necessary to deduce a functional dimension from other dimensions or to scale the drawing.

Dimensions should be placed on the view which shows the relevant features most clearly.

All dimensions on a drawing should be given in the same unit, for instance, in millimetres, otherwise the unit should be indicated after the dimensions.

1.2.2 No more dimensions should be given than are necessary to describe the end product, nor should any feature be located by more than one toleranced dimension in any one direction.

Exception may however be made in the following circumstances:

(*a*) In special cases, where it is necessary to give dimensions which apply at intermediate stages of manufacture, e.g. for the size of a feature before carburizing and finishing to size.

(*b*) Where it is desirable to add auxiliary dimensions which, although not essential for the complete definition of the end product, provide useful information which may avoid the need for calculation by workmen and others. Such auxiliary dimensions are not toleranced, and where general tolerances apply, these auxiliary dimensions should be enclosed in brackets (Fig. 1) to show that they are not subject to these tolerances and do not control the acceptability of the part in any way.

1.2.3 The functional dimensions should be expressed directly on the drawing (Fig. 1 and 2). To do otherwise (Fig. 3) necessitates a redistribution of the tolerances, with the general result that tighter tolerances are required to maintain the functional requirements. This does not preclude the dimensioning of holes centre to centre, although the functional dimension may be edge to edge.

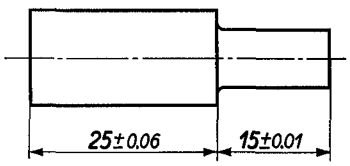

Fig. 2

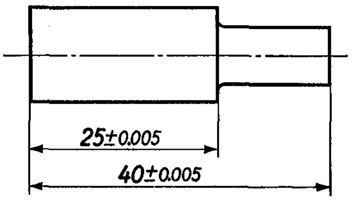

Fig. 3

Tolerances have had to be reduced to ensure that function is safeguarded.

1.2.4 The non-functional dimensions should be placed in the manner most convenient to the producer or inspector.

1.2.5 Tolerances should be specified for all requirements affecting functioning or interchangeability unless ordinary or established workshop practice guarantees the required standard of accuracy. Tolerances should also be used where unusually wide variations are permissible.

Where it is necessary to limit the overall variation of a series of dimensions to an amount less than the sum of the individual tolerances, a note should be used to call special attention to the requirement.

1.2.6 Standard sizes should be used wherever practicable, e.g. for drilled or reamed holes, screw threads, etc. and for work which would be satisfactory with the sizes and surface finish of standard stock such as bright bar, extruded sections, etc.

1.2.7 Production processes or inspection methods should not be specified unless they are essential to ensure satisfactory functioning or interchangeability. This does not apply to process drawings, nor does it preclude the quoting of drill sizes.

2. METHOD OF EXECUTION

2.1 Projection lines and dimension lines

2.1.1 Projection lines and dimension lines are drawn as thin continuous lines (Fig. 4).

2.1.2 Projection lines should extend slightly beyond dimension lines (Fig. 4).

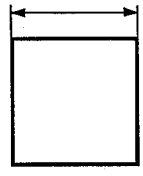

Fig. 4

2.1.3 The construction lines and the intersecting projection lines should extend slightly beyond their point of intersection (Fig. 5).

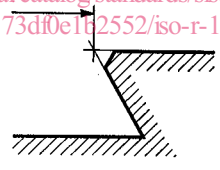

Fig. 5

2.1.4 An axis or a contour line should never be used as a dimension line but may be used as a projection line (Fig. 6).

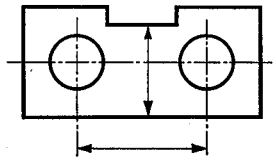

Fig. 6

2.1.5 Projection and dimension lines should not cross other lines unless this is unavoidable (Fig. 7).

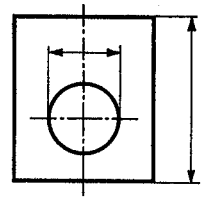

Fig. 7

2.1.6 Projection lines should be drawn in a direction perpendicular to the feature to be dimensioned (Fig. 4, page 7) or, where necessary, they may be drawn obliquely but preferably parallel with each other (Fig. 8).

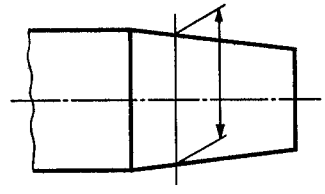

Fig. 8

2.1.7 The dimensioning of chords, arcs and angles should be as shown in Figures 9, 10 and 11 respectively.

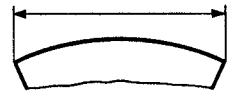

Fig. 9

Fig. 10

Fig. 11

2.1.8 Except where unavoidable, dimension lines should not be placed in the 30° zone shown hatched in Figure 19, page 11.

2.1.9 In partially drawn views and partial sections of symmetrical parts, the portions of the dimension lines shown should be extended slightly beyond the axis of symmetry and the second arrow should be omitted (Fig. 12).

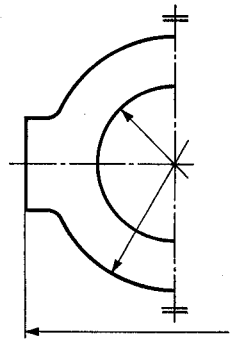

Fig. 12

2.1.10 When the centre of an arc falls outside the limits of the space available, the dimension line of the radius should be broken or interrupted according to whether or not it is necessary to locate the centre (Fig. 13).

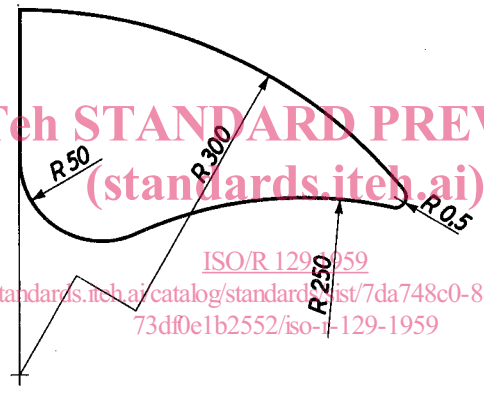

Fig. 13

2.2 Arrows

2.2.1 Each end of a dimension line should be defined by a carefully drawn arrowhead whose two branches should be at an angle sufficiently open to mark clearly the extremities of the dimension line (Fig. 14).

2.2.2 The size of arrowheads should be proportionate to the thickness of the lines of the drawing (Fig. 14).

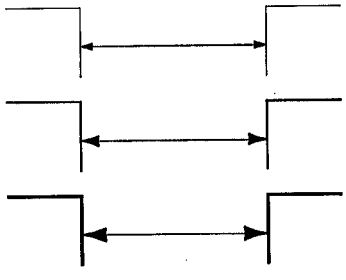

Fig. 14