INTERNATIONAL STANDARD ISO 1302

INTERNATIONAL ORGANIZATION FOR STANDARDIZATION • МЕЖДУНАРОДНАЯ ОРГАНИЗАЦИЯ ПО СТАНДАРТИЗАЦИИ • ORGANISATION INTERNATIONALE DE NORMALISATION

Technical drawings — Method of indicating surface texture on drawings

Dessins techniques — Indication des états de surface sur les dessins

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FOREWORD

ISO (the International Organization for Standardization) is a worldwide federation of national standards institutes (ISO member bodies). The work of developing International Standards is carried out through ISO technical committees. Every member body interested in a subject for which a technical committee has been set up has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work.

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 1302 was developed by Technical Committee ISO/TC 10, *Technical drawings*. The first edition (ISO 1302-1974) had been approved by the member bodies of the following countries :

Australia
Austria
Belgium
Brazil
Canada
Czechoslovakia
Denmark
Egypt, Arab Rep. of
Finland
Germany
Greece
Hungary
India
Iran
Israel
Italy
Japan
Korea, Rep. of
Netherlands
New Zealand
Norway
Poland
Portugal
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Spain
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United Kingdom
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The member bodies of the following countries expressed disapproval of the Recommendation on technical grounds :

France
U.S.A.

This second edition, which supersedes ISO 1302-1974, incorporates draft Addendum 1, which features at present as annex B, and which was circulated to the member bodies in October 1976. This draft addendum has been approved by the member bodies of the following countries :

Australia
Belgium
Chile
Denmark
Finland
India
Italy
Korea, Rep. of
Mexico
Netherlands
New Zealand
Poland
Romania
South Africa, Rep. of
Spain
Sweden
Switzerland
Turkey
United Kingdom
U.S.A.
U.S.S.R.

The member bodies of the following countries expressed disapproval of the document on technical grounds :

Canada
France
Germany
Japan

Printed in Switzerland

CONTENTS

Technical drawings — Method of indicating surface texture on drawings

1 SCOPE AND FIELD OF APPLICATION

This International Standard specifies the symbols and additional indications of surface texture to be indicated on technical drawings.

NOTE — For uniformity all figures in this International Standard are in first angle projection (method E). It should be understood that the third angle projection (method A) could equally well have been used without prejudice to the principles established.

2 REFERENCES

ISO/R 129, *Engineering drawing — Dimensioning.*

ISO/R 468, *Surface roughness.*

3 SYMBOLS USED FOR INDICATION OF SURFACE TEXTURE

3.1 The basic symbol consists of two legs of unequal length inclined at approximately 60° to the line representing the considered surface, as shown in figure 1.

This symbol alone has no meaning except as in sub-clauses 5.4 and 5.6.

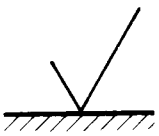


FIGURE 1

3.2 If the removal of material by machining is required, a bar is added to the basic symbol, as shown in figure 2.

FIGURE 2

3.3 If the removal of material is not permitted, a circle is added to the basic symbol, as shown in figure 3.

FIGURE 3

3.4 The symbol in figure 3 may also be used in a drawing relating to a production process to indicate that a surface is to be left in the state resulting from a preceding manufacturing process, whether this state was achieved by removal of material or otherwise.

In this case none of the indications given in clause 4 are added to the symbol.

3.5 When special surface characteristics have to be indicated (see 4.2) a line is added to the longer arm of any of the above symbols, as shown in figure 4.

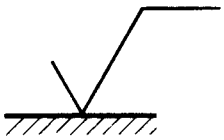


FIGURE 4

4 INDICATIONS ADDED TO THE SYMBOLS

4.1 Indication of surface roughness

4.1.1 The value or values defining the principal criterion of roughness (see 4.1.5) are added to the symbols given in figures 1, 2 and 3, as shown in figures 5, 6 and 7.

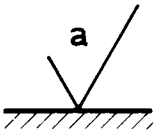


FIGURE 5

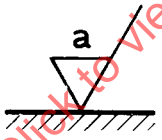


FIGURE 6

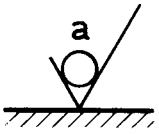


FIGURE 7

4.1.2 A surface texture specified

- as in figure 5 may be obtained by any production method;
- as in figure 6 must be obtained by removal of material by machining;
- as in figure 7 must be obtained without removal of material.

4.1.3 When only one value is specified it represents the maximum permissible value of surface roughness.

4.1.4 If it is necessary to impose maximum and minimum limits of the principal criterion of surface roughness, both values shall be shown as in figure 8, with the maximum limit (a_1) above the minimum limit (a_2).

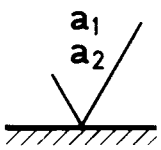


FIGURE 8

4.1.5 The principal criterion of roughness, R_a, may be indicated by the corresponding roughness grade number shown in table 1.

This is to avoid misinterpretation of numerical values, which may be indicated in different units (micrometre or microinch).

TABLE 1

Roughness values R_a		Roughness grade numbers
μm	μin	
50	2 000	N 12
25	1 000	N 11
12,5	500	N 10
6,3	250	N 9
3,2	125	N 8
1,6	63	N 7
0,8	32	N 6
0,4	16	N 5
0,2	8	N 4
0,1	4	N 3
0,05	2	N 2
0,025	1	N 1

4.2 Indication of special surface texture characteristics

4.2.1 In certain circumstances, for functional reasons, it may be necessary to specify additional special requirements concerning surface texture.

4.2.2 If it is required that the final surface texture be produced by one particular production method, this method shall be indicated in plain language on an extension of the longer arm of the symbol given in figure 4, as shown in figure 9.

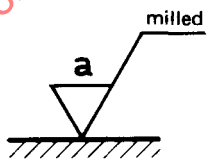


FIGURE 9

4.2.3 Also on this extension line shall be given any indications relating to treatment or coatings.

Unless otherwise stated, the numerical value of the roughness applies to the surface texture after treatment or coating.

If it is necessary to define surface texture both before and after treatment, this shall be explained in a suitable note or in accordance with figure 10.

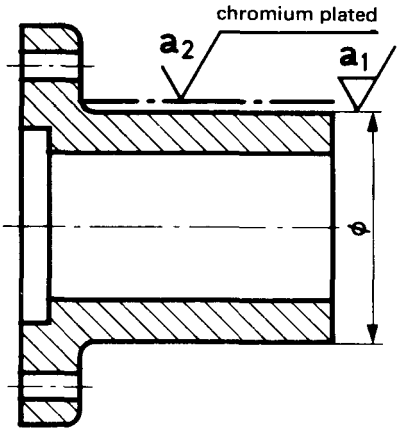


FIGURE 10

4.2.4 If it is necessary to indicate the sampling length, it shall be selected from the series given in ISO/R 468 and be stated adjacent to the symbol, as shown in figure 11.

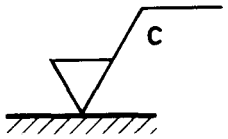


FIGURE 11

4.2.5 If it is necessary to control the direction of lay, it is specified by a symbol (see 4.3) added to the surface texture symbol as shown in figure 12.

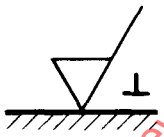


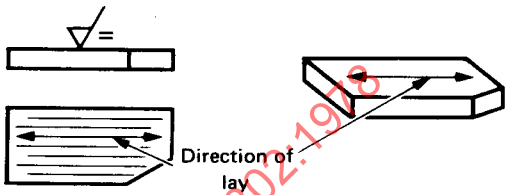
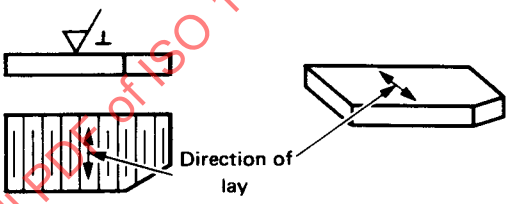
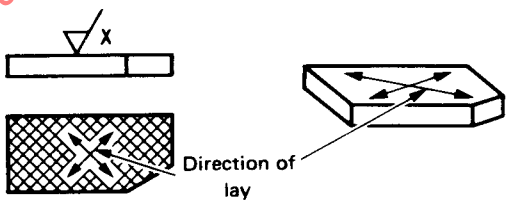
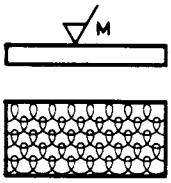
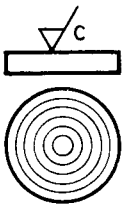
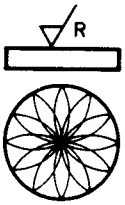
FIGURE 12

NOTE – The direction of lay is the direction of the predominant surface pattern, ordinarily determined by the production method employed.

4.3 Symbols for the direction of lay

The series of symbols shown in table 2 specifies the common directions of lay.

TABLE 2

Symbol	Interpretation
=	Parallel to the plane of projection of the view in which the symbol is used 
⊥	Perpendicular to the plane of projection of the view in which the symbol is used 
X	Crossed in two slant directions relative to the plane of projection of the view in which the symbol is used 
M	Multi-directional 
C	Approximately circular relative to the centre of the surface to which the symbol is applied 
R	Approximately radial relative to the centre of the surface to which the symbol is applied 

NOTE – Should it be necessary to specify a direction of lay not clearly defined by these symbols then this must be achieved by a suitable note on the drawing.

4.4 Indication of machining allowance

Where it is necessary to specify the value of the machining allowance, this shall be indicated on the left of the symbol as shown in figure 13. This value shall be expressed in millimetres or inches, according to the general system used for dimensioning the drawing.

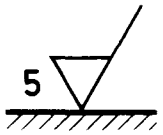


FIGURE 13

4.5 Position of the specifications of surface texture in the symbol

The specifications of surface texture shall be placed relative to the symbol as shown in figure 14.

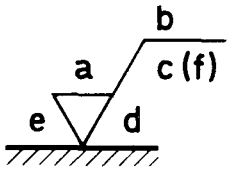


FIGURE 14

a = Roughness value R_a in micrometres or microinches

or

Roughness grade number N1 to N12

b = Production method, treatment or coating

c = Sampling length

d = Direction of lay

e = Machining allowance

f = Other roughness values (in brackets)

5 INDICATIONS ON DRAWINGS

5.1 In conformity with ISO/R 129, the symbol, as well as the inscriptions, shall be orientated so they may be read from the bottom or the right-hand side of the drawing (see figure 15).

If it is not practicable to adopt this general rule, the symbol may be drawn in any position, but only provided that it does not carry any indications of special surface texture characteristics or of machining allowances (as given in 4.2 to 4.4). Nevertheless, in such cases the inscription defining the value of the principal criterion of roughness (if present) must always be written in conformity with the general rule (see figure 16).

If necessary, the symbol may be connected to the surface by a leader line terminating in an arrow.

The symbol or the arrow shall point from outside the material of the piece, either to the line representing the surface, or to an extension of it (see figure 15).

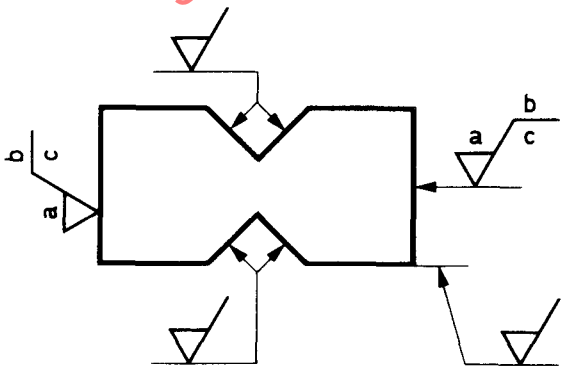


FIGURE 15

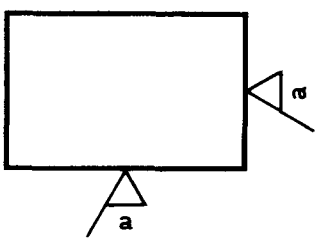


FIGURE 16

5.2 In accordance with the general principles of dimensioning, the symbol is only used once for a given surface and, if possible, on the view which carries the dimension defining the size or position of the surface (see figure 17).

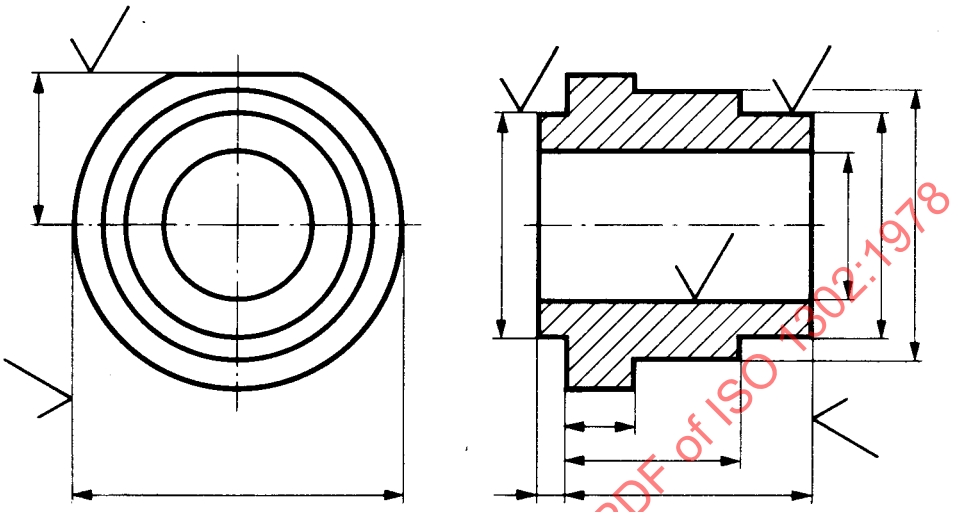


FIGURE 17

5.3 If the same texture is required on all the surfaces of a part, it is specified

- either by a note near a view of the part (figure 18), near the title block, or in the space devoted to general notes;
- or following the part number on the drawing (figure 19).

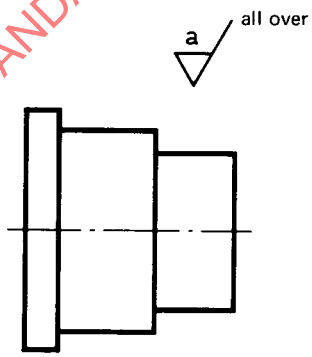


FIGURE 18

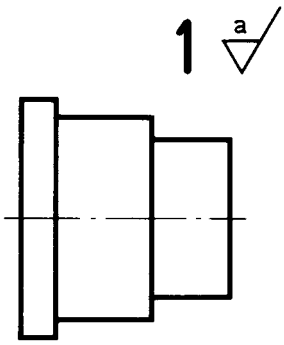


FIGURE 19

5.4 If the same surface texture is required on the majority of the surfaces of a part, it is specified as in 5.3 with the addition of

- the notation "except where otherwise stated" (figure 20);
- or a basic symbol (in brackets) without any other indication (figure 21);
- or the symbol or symbols (in brackets) of the special surface texture or textures (figure 22).

The symbols for the surface textures which are exceptions to the general symbol are indicated on the corresponding surfaces.

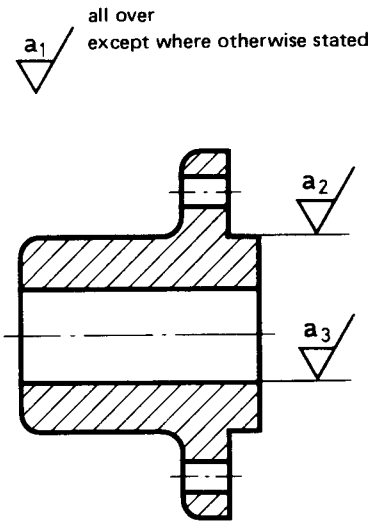


FIGURE 20

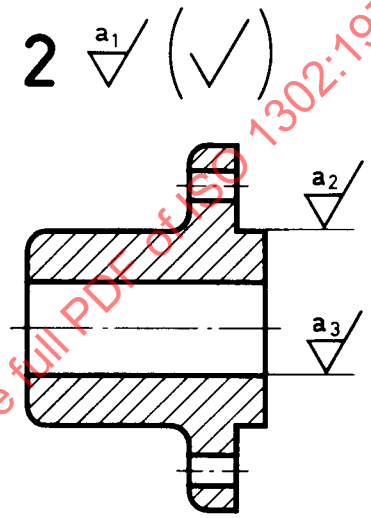


FIGURE 21

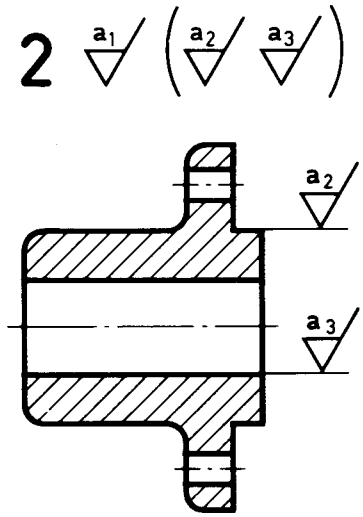


FIGURE 22

5.5 To avoid the necessity of repeating a complicated specification a number of times, or where space is limited, a simplified specification may be used on the surface, provided that its meaning is explained near the drawing of the part, near the title block or in the space devoted to general notes (see figure 23).

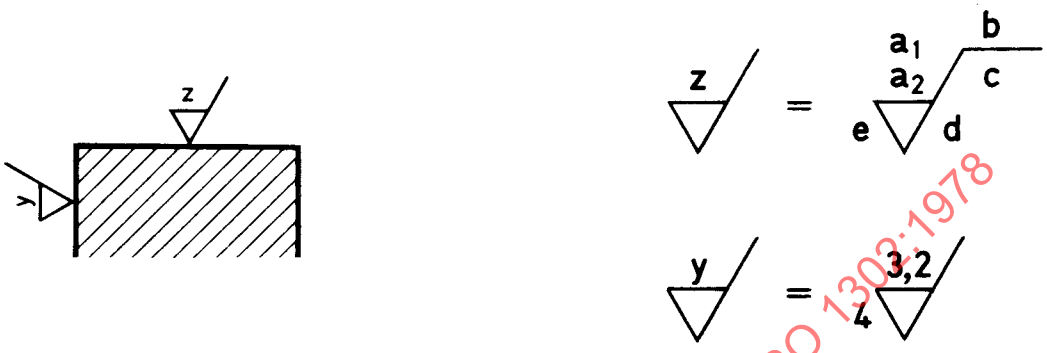


FIGURE 23

5.6 If the same surface texture is required on a large number of surfaces of the part, one of the symbols shown in figure 1, 2 or 3 may be used on the appropriate surfaces and its meaning given on the drawing, for example as shown in figures 24, 25 and 26.

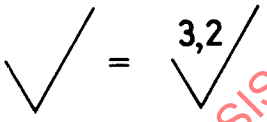


FIGURE 24

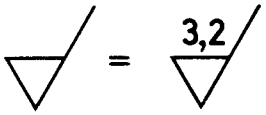


FIGURE 25

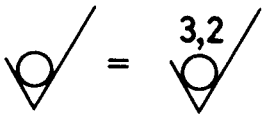


FIGURE 26

6 IMPORTANT NOTES

6.1 Only give indications of the roughness, method of production or machining allowance in so far as this is necessary to ensure fitness for purpose and only for those surfaces which require it.

6.2 The specification of surface texture is unnecessary whenever the ordinary manufacturing processes by themselves ensure an acceptable surface finish.

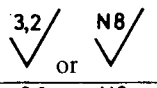
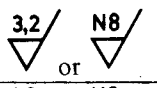
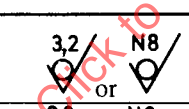
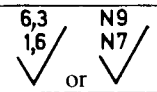
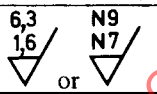
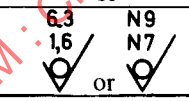
ANNEX A

SYNOPTIC TABLE

A.1 SYMBOLS WITH NO INSCRIPTION

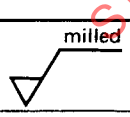
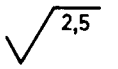
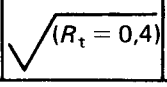
	Symbol	Meaning
A.1.1		Basic symbol. It may only be used alone when its meaning is explained by a note.
A.1.2		A machined surface with no indication of any other detail.
A.1.3		A surface from which the removal of material is prohibited. This symbol may also be used in a drawing relating to a production process to indicate that a surface is to be left in the state resulting from a preceding manufacturing process, whether this state was achieved by removal of material or otherwise.

A.2 SYMBOLS WITH INDICATION OF THE PRINCIPAL CRITERION OF ROUGHNESS, R_a

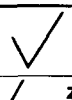
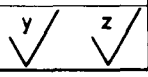
	Symbol			Meaning
	Removal of material by machining is			
	optional	obligatory	prohibited	
A.2.1				A surface with a maximum surface roughness value R_a of 3,2 μm.
A.2.2				A surface with a maximum surface roughness value R_a of 6,3 μm and a minimum of 1,6 μm.

A.3 SYMBOLS WITH ADDITIONAL INDICATIONS

(May be used singly, in combination or combined with an appropriate symbol from A.2 above).

	Symbol	Meaning
A.3.1		Production method : milled.
A.3.2		Sampling length : 2,5 mm.
A.3.3		Direction of lay : perpendicular to the plane of projection of the view.
A.3.4		Machining allowance : 2 mm.
A.3.5		Indication (in brackets) of a criterion of roughness other than that used for R_a, for example R_t = 0,4 μm.

A.4 SIMPLIFIED SYMBOLS

	Symbol	Meaning
A.4.1		A note indicates the meaning of the symbol.
A.4.2		A note indicates the meaning of the symbols.

NOTE – The surface texture values, production method, sampling length, direction of lay and machining allowance quoted are typical values and are only given as examples.

ANNEX B

PROPORTIONS AND DIMENSIONS OF SYMBOLS

In order to harmonize the sizes of the symbols specified in this International Standard with those of the other inscriptions on the drawing (dimensions, tolerances, etc.) the following rules should be observed.

B.1 GENERAL REQUIREMENTS

B.1.1 The symbols (i.e. the basic symbol and its complements according to figures 1 to 4, and also the symbols for the direction of lay shown in table 2) shall be inscribed with a line thickness (d') equal to 1/10 of the height (h) of the lettering used for the dimensions in the relevant drawing.

B.1.2 The numerals and capital letters (and/or lower case letters) used for the additional specifications of surface texture within the areas a_1, a_2, b, c(f) and e (see figures 14 and 37) shall be inscribed with the same line thickness (d), height (h) and type of lettering as used for the dimensions in the relevant drawing, and in accordance with ISO 3098/I.[1)]

B.1.3 The minimum spacing between adjacent lines shall never be less than twice the thickness of the heaviest line.

It is recommended that this spacing be not less than 0,7 mm.

B.2 PROPORTIONS

B.2.1 The basic symbol and its complements (see clause 3) shall be drawn in accordance with figures 27 to 30.

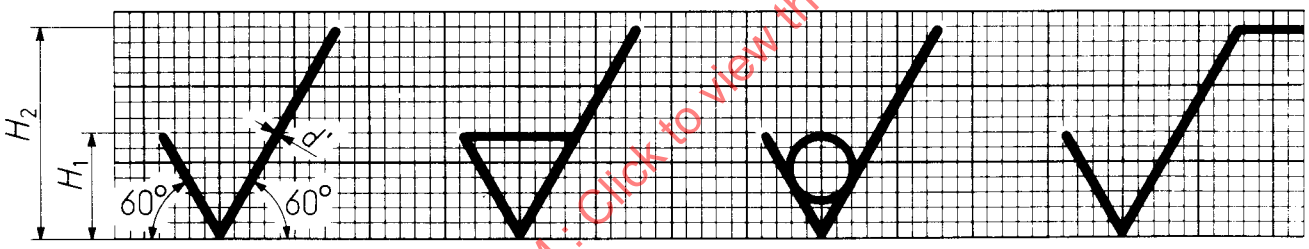


FIGURE 27 FIGURE 28 FIGURE 29 FIGURE 30

For dimensions d', H_1 and H_2, see clause B.3.

The length of the horizontal stroke of the symbol in figure 30 depends upon that of the adjacent indications (see 4.2 and A.3).

B.2.2 The symbols for indicating the direction of lay (see 4.3) shall be drawn as shown in figures 31 to 36.

The shape of the symbols in figures 33 to 36 is the same as that of the corresponding letters in ISO 3098/I (lettering B, vertical).

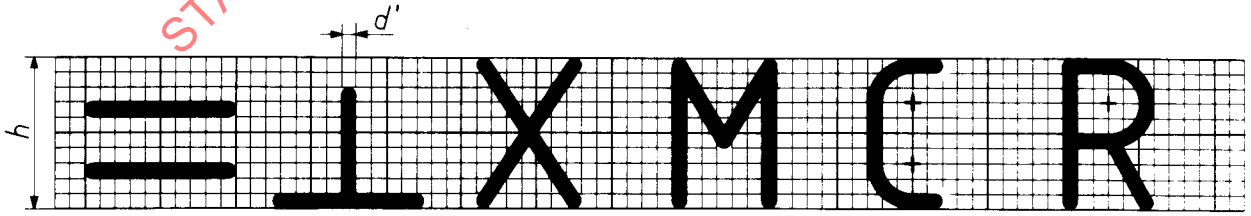


FIGURE 31 FIGURE 32 FIGURE 33 FIGURE 34 FIGURE 35 FIGURE 36

For dimensions d' and h, see clause B.3.

1) Owing to its larger spacing, lettering type A is superior to type B for reproduction and especially for microfilming. For this reason, lettering type A is to be preferred for all lettering.

The difference in line thickness of the lettering (d) and that of the symbols (d') may be used as a means of distinguishing the two kinds of inscriptions more clearly.