INTERNATIONAL STANDARD

ISO 10899

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High-speed steel two-flute twist drills — Technical specifications

Forets hélicoïdaux à deux lèvres en acier rapide — Spécifications techniques

Reference number
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Contents

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established 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. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

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 10899 was prepared by Technical Committee ISO/TC 29, *Small tools*, Subcommittee SC 2, *Drills, reamers, milling cutters and milling machine accessories.*

Annex A forms an integral part of this International Standard. Annexes B and C are for information only.

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High-speed steel two-flute twist drills — Technical specifications

1 Scope

This International Standard specifies the technical requirements for two-flute twist drills made of high speed steel with either cylindrical or Morse taper shanks. It is applicable to drills irrespective of the manufacturing process, except the roll-forged drills. These requirements may also form the basis for the specification of special purpose twist drills as agreed between the buyer and supplier. This International Standard is not applicable to woodworking or do-it-yourself drills.

2 Normative references

The following standards contain provisions which, through reference in this text, constitute provisions of this International Standard. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this International Standard 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 286-2:1988, *ISO system of limits and fits — Part 2: Tables of standard tolerance grades and limit deviations for holes and shafts.*

ISO 296:1991, *Machine tools — Self-holding tapers for tool shanks.*

ISO 1101:—[1], *Technical drawings — Geometrical tolerancing — Tolerances of form, orientation, location and run-out — Generalities, definitions, symbols, indications on drawings.*

ISO 2768-1:1989, *General tolerances — Part 1: Tolerances for linear and angular dimensions without individual tolerance indications.*

ISO 5419:1982, *Twist drills — Terms, definitions and types.*

ISO 6507-1:—[2], *Metallic materials — Vickers hardness test — Part 1: Test method.*

ISO 11054:1993, *Cutting tools — Designation of high-speed steel groups.*

3 Definitions

For the purposes of this International Standard, the definitions given in ISO 5419 apply.

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1) To be published. (Revision of ISO 1101:1983)

2) To be published. (Revision of ISO 6507-1:1982, ISO 6507-2:1983, ISO 6507-3:1989, ISO 409-1:1982, ISO 409-2:1983 and ISO/DIS 409-3)

4 General features of design

Both right-hand and left-hand cutting drills are in conformity with this International Standard, but unless otherwise ordered, a right hand cutting drill shall be supplied.

5 Dimensions

5.1 Drill diameter [3.30][3)]

5.1.1 General

The drill diameter is measured across the lands at the outer corners of the drill. The diameter and tolerance on this diameter shall be as specified in the relevant dimensional standard (see annex C).

5.1.2 Back taper [3.32]

The drill diameter d usually decreases from the outer corner [3.25] towards the shank. The difference in diameter, Δd is measured across the lands [3.14] between the flute ends [3.9] over the flute length, l_1 [3.8]. A back taper, $(\Delta d)/l_1$ of 0,02 % to 0,08 % is permitted, except for drills with a diameter $d < 6$ mm which may be parallel.

The total back taper ΔD shall not exceed 0,25 mm.

5.2 Cylindrical shank [3.2.2]

The tolerance on shank diameter shall be h11 (see ISO 286-2); tolerance f11 is allowed for drills with back taper.

The tolerance on cylindricity shall be 0,02 mm on the shank length corresponding to the holding surface of the collet.

5.3 Taper shank [3.2.1]

Taper shank drills shall be provided with Morse taper shanks with tang in accordance with ISO 296, but with a cone tolerance of AT 7, see annex A.

5.4 Radial runout

The maximum radial runout, measured on the land at the outer corner [3.25] of the drill, shall be limited to the tolerance calculated by the formulae given in 5.4.1.

5.4.1 Radial runout tolerance formula

Radial runout tolerances are calculated using the following formula:

$$\text{Runout} = 0{,}03 + 0{,}01\ l/d \text{ for } d \geqslant 2$$

where

d is the drill diameter, in millimetres;

l is the overall drill length, in millimetres.

NOTE — This International Standard does not state runout tolerance for drills $d < 2$ mm, as such a tolerance would be impracticable.

3) Numbers in square brackets after a term is the defining clause in ISO 5419.

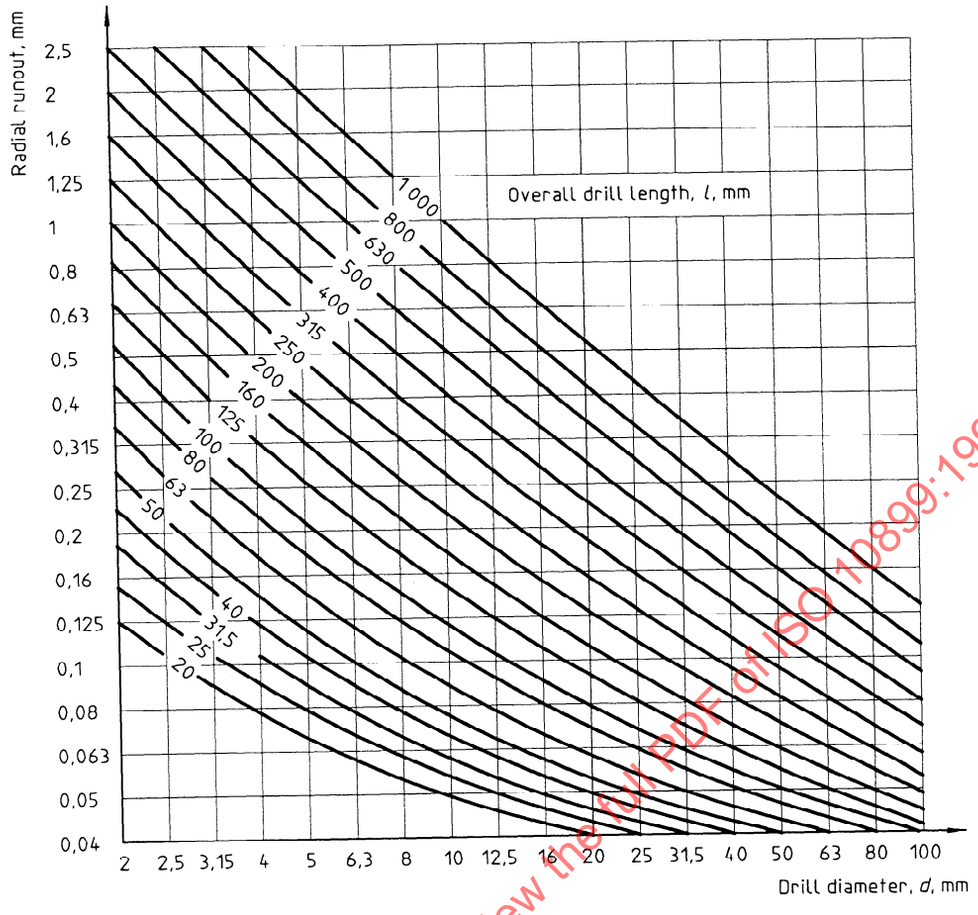

Figure 1 — Radial runout tolerance — Information example

5.4.2 Test measuring method

Testing shall take place at the land level by rotating the drill through 180°, and taking the reading on the dial gauge. The deviation shall be expressed as the difference in measurements.

The point of measurement at the drill end shall be as close as possible to the outer corner.

5.5 Lengths

Drill overall and flute lengths shall be as specified in the relevant dimensional standard (see annex C). The tolerance on overall length and flute length shall be the "very coarse" class as given in ISO 2768-1.

In special cases, e.g. if rapid delivery of twist drills with intermediate diameters is required, the total length, the flute length and other dimensions can, by agreement, be made to correspond to the next larger or next smaller twist drill diameter range.

5.6 Web thickness [3.13]

The web thickness measured at the point of the drill shall not be so small that it lie below the line shown in figure 2. The web may increase in thickness towards the shank. The minimum web thickness based on general purpose design may not be applicable for special purpose drills.

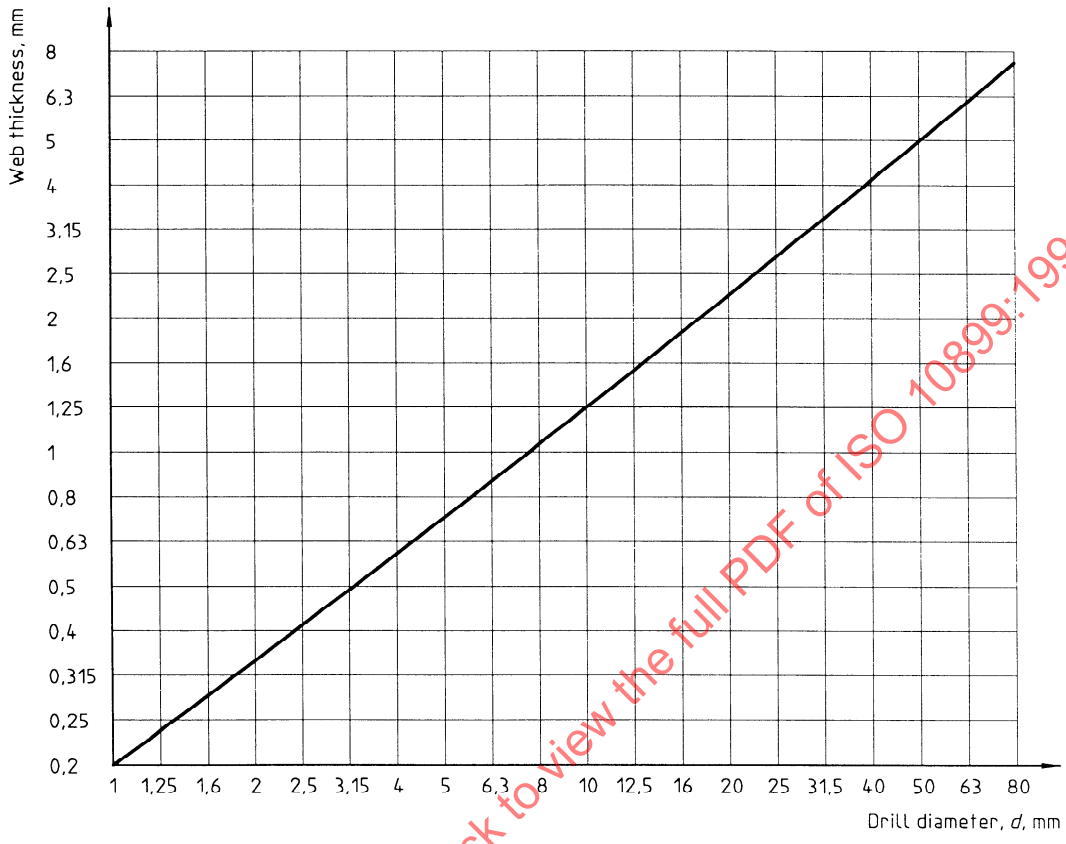

Figure 2 — Minimum web thickness

5.7 Web symmetry

The tolerance on the web symmetry, t, about the drill axis in a plane perpendicular to that axis, as shown in figure 3 and according to ISO 1101, shall not be greater than that given in figure 4. The measurement shall be taken at the point or behind any thinning of the web (see annex B).

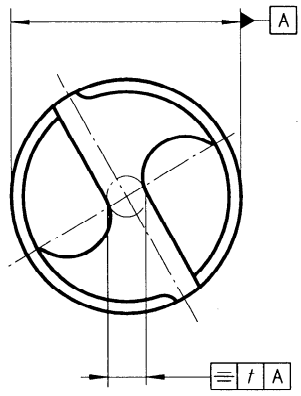

Figure 3 — Tolerance on web symmetry — Specification

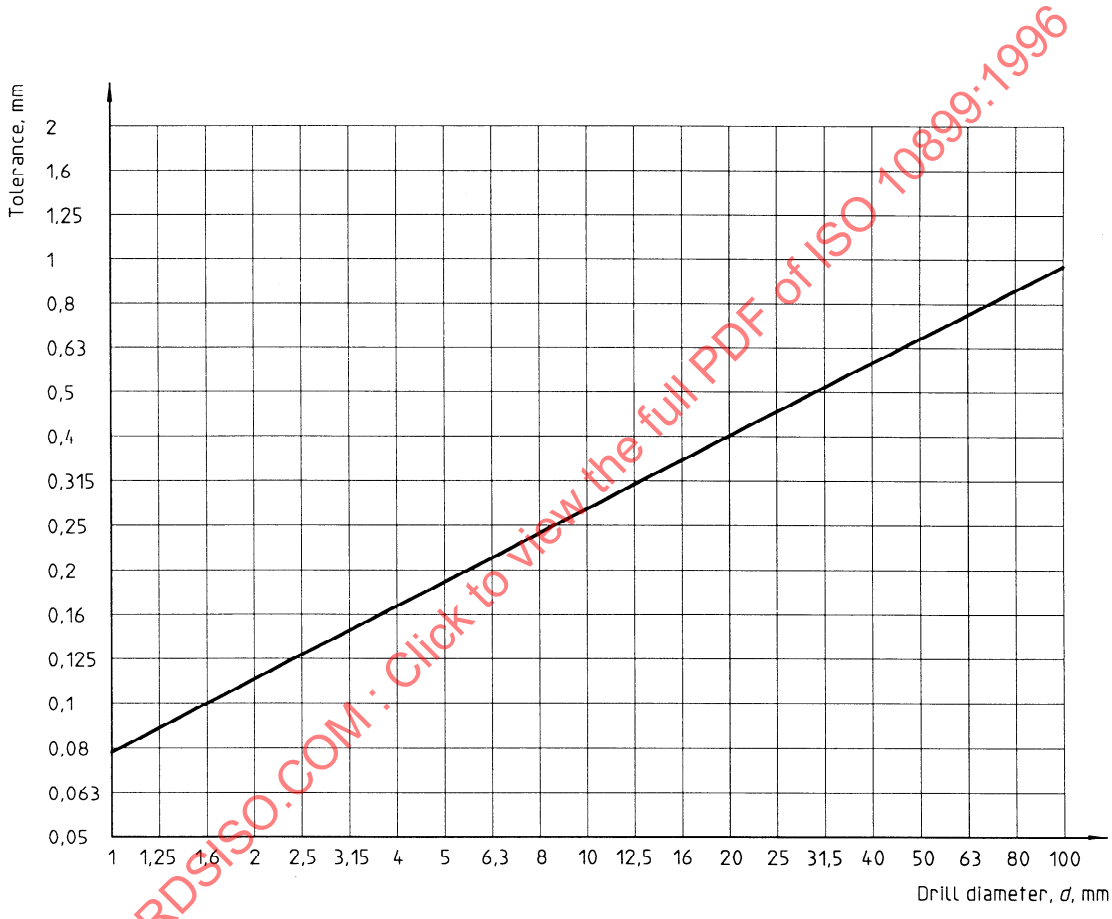

Figure 4 — Tolerance on web symmetry — Limits of the tolerance

5.8 Land width [3.15]

The land width as measured at right angles to the drill helix near the outer corner should have a value such as those given in figure 5. The difference in land widths of a single drill should not exceed a third of the tolerance given in figure 5.

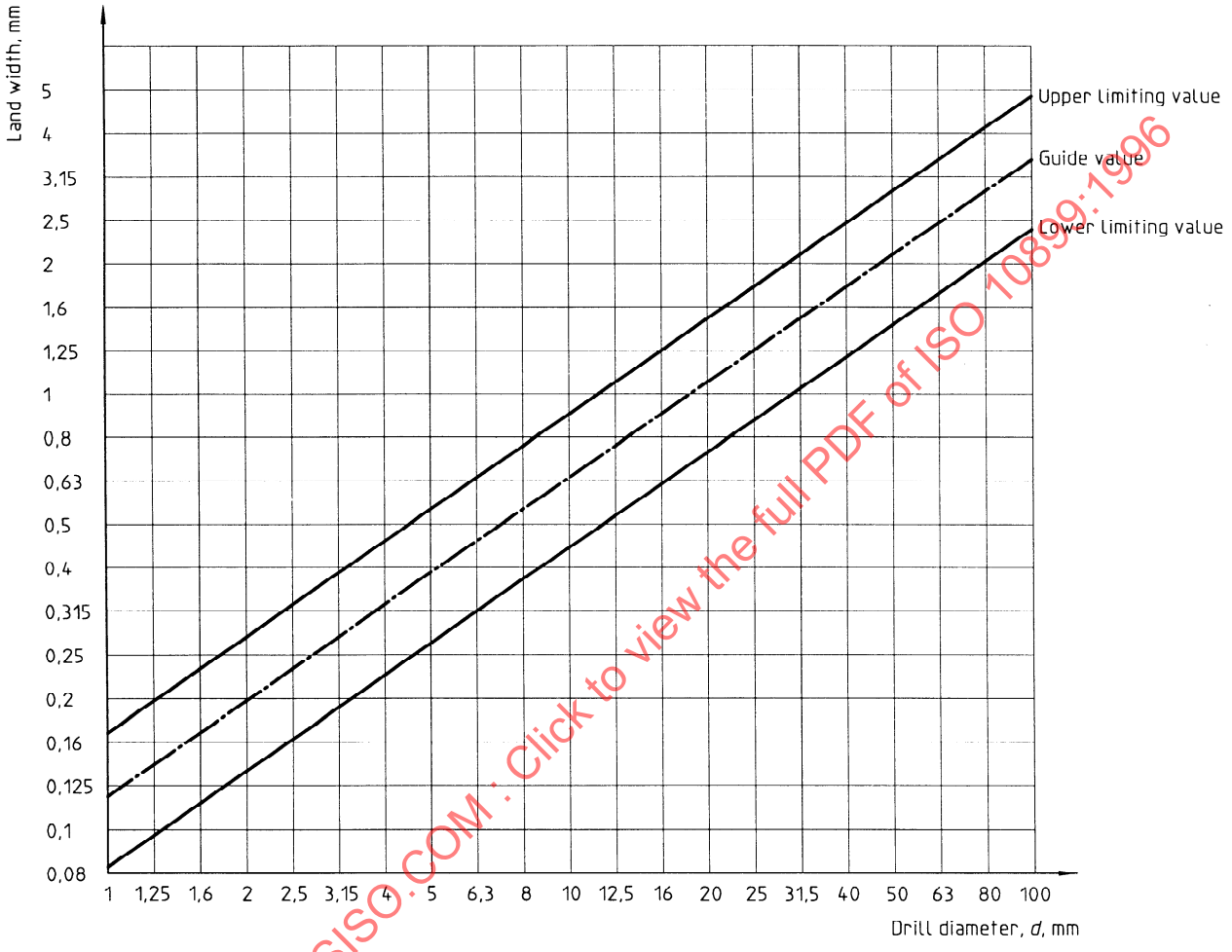

Figure 5 — Land width

5.9 Relative lip heights

The maximum permissible difference in height of the two major cutting edges (lips) [3.23] of a drill measured at the outer corners shall be limited to a value below the line shown in figure 6.

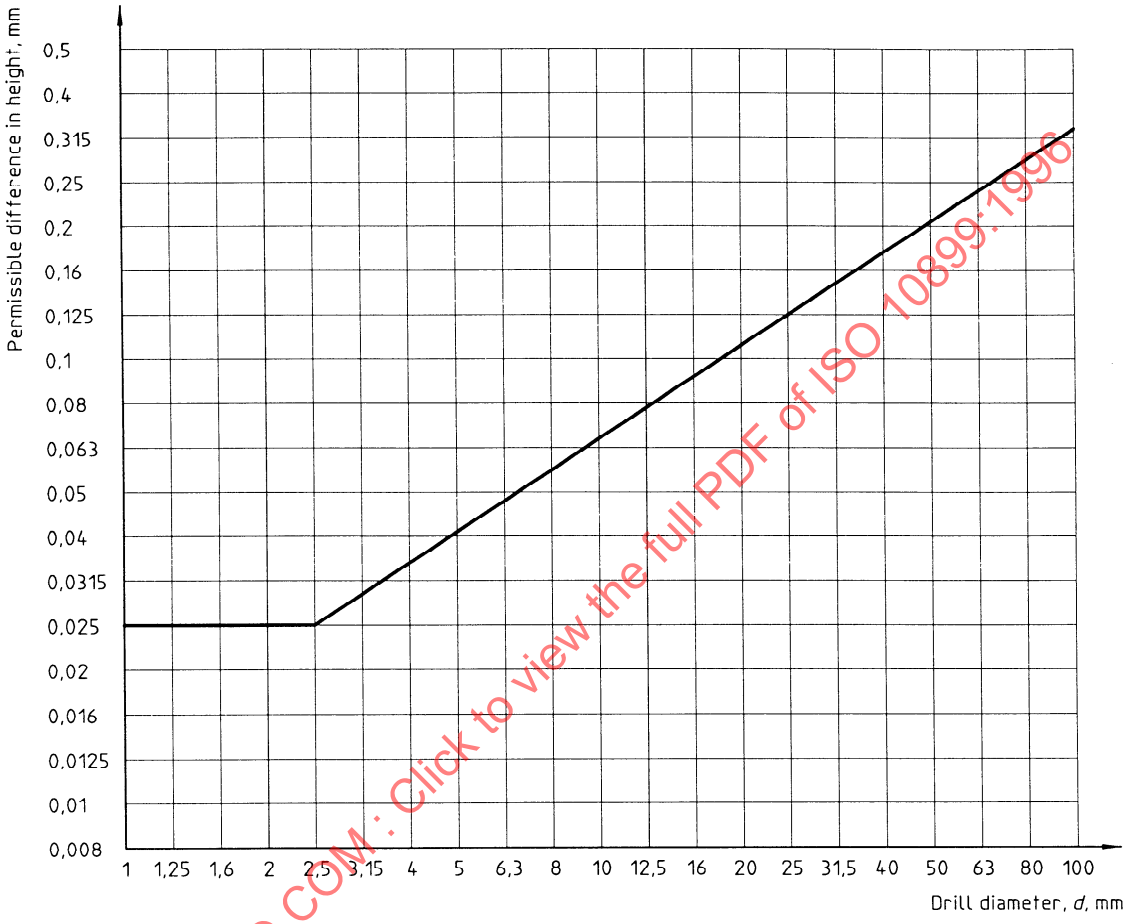

Figure 6 — Permissible difference in height of major cutting edges

5.10 Flute spacing

The maximum difference in pitch between the two major cutting edges (lips) of a drill measured as close as possible to the outer corners shall not exceed the values given by the line shown in figure 7.

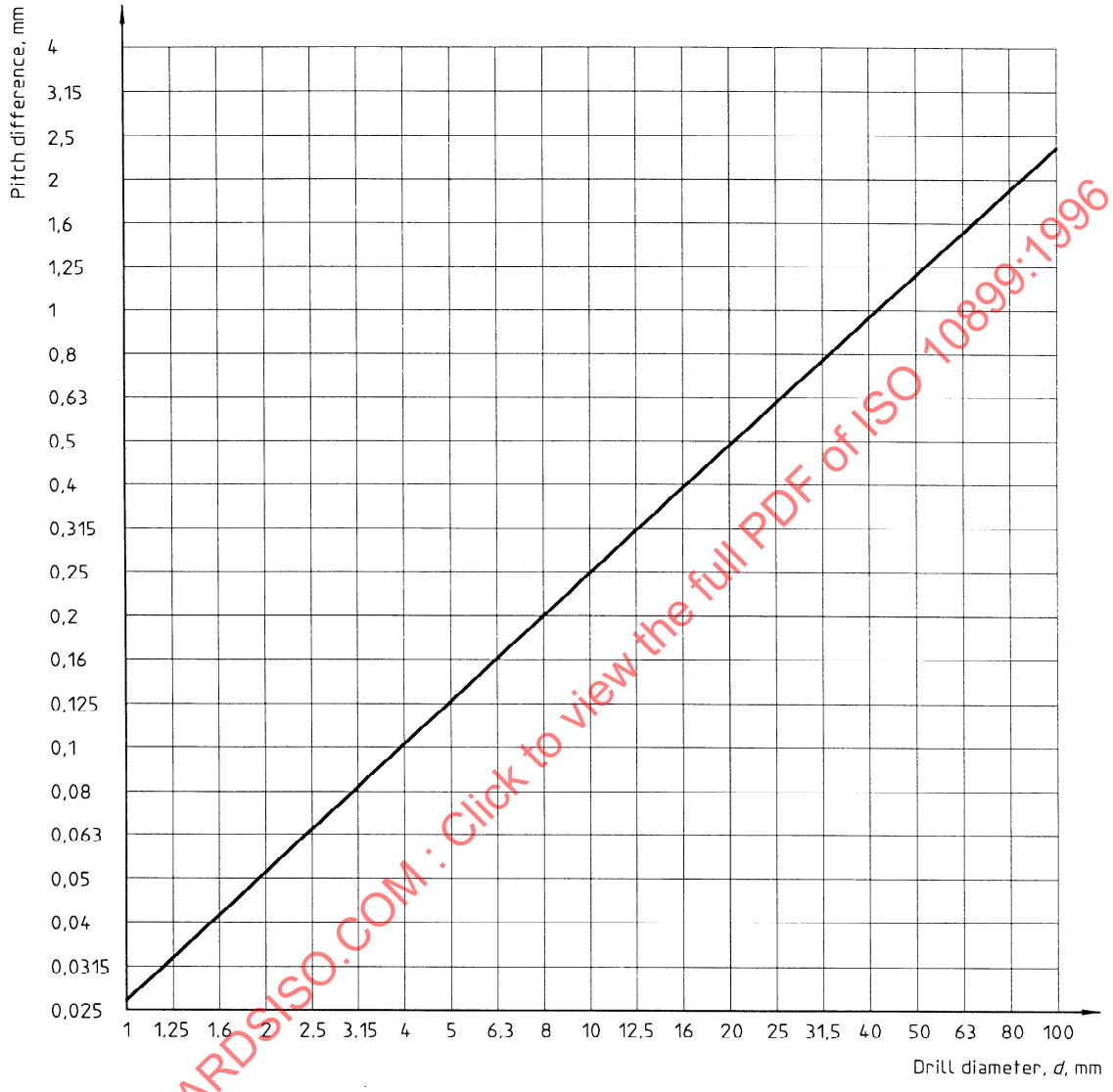

Figure 7 — Maximum permissible variation in flute spacing

5.11 Twist drill angles

5.11.1 Helix angle [3.38]

The helix angle is left to the manufacturer's discretion or shall be as agreed between the distributor and purchaser.

5.11.2 Point angle [3.41]

For general purpose twist drills the point angle should be 118° ± 3°. The tolerance of ± 3° also applies to other point angles.

6 Materials and hardness

6.1 Cutting portion

The material of the cutting portion of the drill over the flute length shall be of high-speed steel and designated according to ISO 11054.

The hardness of the cutting portion of the drill measured on the outside diameter of the land or adjacent relieved land, on the Vickers hardness scales (see ISO 6507-1) shall lie within the following ranges:

HSS code: 780 HV to 900 HV

HSS-E code: 820 HV to 950 HV

The test load shall be selected according to the drill diameter.

For other groups of high-speed steel, the hardness value shall be agreed between the distributor and the purchaser.

6.2 Shank

The material may be as for the cutting portion, or, when the shank is welded on, of steel which ensures the material hardness specified below.

When the twist drill is made entirely of high-speed steel, the Vickers hardness of the shank shall be a minimum of 240 HV. When made with a welded shank, the Vickers hardness of the shank shall be a minimum of 170 HV.

The loads shall be selected according to the drill diameter.

NOTE — The quoted hardness values correspond respectively to annealed high-speed steel or steel used for welded shanks following annealing after the welding process, however the maximum hardness should not exceed that of the cutting portion.

For Morse taper shank twist drills with a nominal diameter $d \geq 10$ mm the knock-out tang shall have a Vickers hardness of at least 220 HV 30.

7 Surface finish

The surface roughness of the drill shall be limited to the values given in table 1.

Table 1 — Surface finish

Drill part	Drill diameter	
	$d \leq 15$ mm	$d > 15$ mm
	Surface roughness, Ra µm	
Land	0,8	1,6
Shanke	0,8	0,8

8 Marking

Twist drills with diameters $d \geqslant 4$ mm shall be marked with the:

a) drill diameter d;

b) high-speed steel designation;

c) name or mark of manufacturer or distributor.

Additional marking is at the manufacturer's discretion or agreement. Other or different marking may be by mutual agreement.

Marking shall be permanent and the marks shall not protrude more than 0,03 mm.

In the case of twist drills of diameter $d < 4$ mm, the marking shall be applied to the packaging.

Annex A
(normative)

Cone angle tolerances of AT 7 quality

Cone angle tolerances of AT 7 quality are given in table B.1.

NOTE — Table A.1 reproduces the values for AT 7 tolerances from ISO 1947:1973, "*System of cone tolerances for conical workpieces from C = 1:3 to 1:500 and lengths from 6 to 630 mm*", which has been withdrawn.

Table A.1 — Cone angle tolerances of AT 7 quality

Range of cone length L	AT_α		AT_D [1]
mm	μrad	minutes, seconds	μm
$40 \leqslant L \leqslant 63$	315	1′ 05″	12,5.....20
$63 < L \leqslant 100$	250	52″	16.....25
$100 < L \leqslant 160$	200	41″	20.....32
$160 < L \leqslant 250$	160	33″	25.....40

1) AT_D is calculated from the constant AT_α value within a range of cone lengths.

Annex B
(informative)

Web symmetry measurement

B.1 Definition of web symmetry tolerance

The web symmetry tolerance, t, stated in figure 3 is defined as follows.

The median plane of the web shall be located between two parallel planes t apart, which are symmetrically disposed about the datum axis of the drill. This can lead to a deviation between the median plane of the web and the axis of the drill of $t/2$.

B.2 Measurement method

The measurement method illustrated in figure B.1 complies with the definitions given in B.1.

The twist drill is located in a vee block; at the point or behind any thinning of the web, a zero setting is made on one side of the web; then the twist drill is rotated through 180°; the corresponding reading of the dial gauge, X, shall be smaller or equal to t.

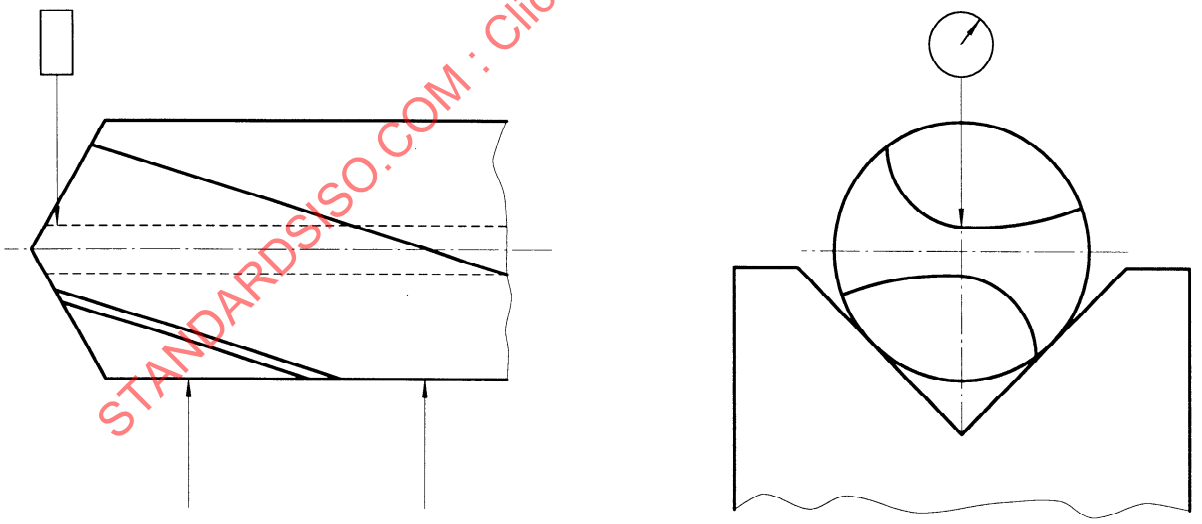

Figure B.1