

Australian/New Zealand Standard

Drills and reamers

Part 1: Specification for twist drills

AS/NZS 2438.1:1994

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Drills and reamers

Part 1: Specification for twist drills

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PREFACE

This Standard was prepared by the Joint Standards Australia/Standards New Zealand Committee ME/10 on Small Tools to supersede NZS/BS 328.1:1986, *Drills and reamers, Part 1: Specification for twist drills*, and AS 2438—1981, *Twist drills (general purpose)*. This Standard is identical with and has been reproduced from BS 328.1:1993, *Drills and reamers, Part 1: Specification for twist drills*.

With the exception of the imperial size extra long drills the dimensions of drill diameters, lengths and tolerances given in this Standard are in accordance with the following International Standards:

ISO

235:1980 *Parallel shank jobber and stub series drills and Morse taper shank drills*

494:1975 *Parallel shank twist drills—Long series*

3291:1975 *Extra long Morse taper shank twist drills*

3292:1975 *Extra long parallel shank twist drills*

The flute lengths, overall lengths and design parameters specified in this Standard have been arrived at after full discussions at international level.

In addition to tabulating the preferred sizes in which metric drills and imperial drills will normally be available, comprehensive general tables are given for each type of drill so that preferred shank, flute and overall dimensions can be determined for drills with non-listed diameters.

For the purpose of this Joint Australian/New Zealand Standard, references to other publications should be replaced by references to Australian or New Zealand Standards as follows:

*References to other publications**Australian/New Zealand Standards*

BS

AS

240 Method for Brinell hardness test and for verification of Brinell hardness testing machines

1816 Metallic material—Brinell hardness test

1660 Machine tapers

—

1660.1 Part 1: Specification for shanks and sockets with self-holding tapers (Morse and metric 5%)

4490 Methods for micrographic determination of the grain size of steel

—

4500 ISO limits and fits

1654 Limits and fits for engineering (metric units)

NZS/ISO

4500.1 Part 1: General tolerances and deviations

286 ISO system of limits and fits
Part 1: Bases of tolerances, deviations and fits

Section 1.1: Specification for bases of tolerances, deviation and fits
Section 1.2: Tables of commonly used tolerance and grades and limits deviations for holes and shafts

Part 2: Tables of standard tolerance grades and limit deviations for holes and shafts

ISO

AS

4957 Tool steels

1239 Steel—Schedule of tool steel compositions

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STANDARDS AUSTRALIA/STANDARDS NEW ZEALAND

Australian/New Zealand Standard

Drills and reamers

Part 1: Specification for twist drills

1 Scope

This Part of BS 328 specifies requirements for the dimensions, design, materials, hardness values and performance for twist drills made of high-speed steel with either parallel or Morse taper shanks.

A method of test for the drills specified is given in annex A.

NOTE. The requirements in this standard may also form the basis for the specification of special purpose twist drills as agreed between the buyer and supplier.

This British Standard is not applicable to woodworking or do-it-yourself (D.I.Y) drills. Its use is for drills manufactured for general engineering applications.

2 References

2.1 Normative references

This part of BS 328 incorporates, by reference, provisions from specific editions of other publications.

These normative references are cited at the appropriate points in the text and the publications are listed on page 37. Subsequent amendments to, or revisions of, any of these publications apply to this Part of BS 328 only when incorporated in it by updating or revision.

2.2 Informative references

This Part of BS 328 refers to other publications that provide information or guidance. Editions of these publications current at the time of issue of this standard are listed on the inside back cover, but reference should be made to the latest editions.

3 Definitions

For the purposes of this Part of BS 328 the following definitions apply.

3.1 Types of twist drill

3.1.1 parallel shank jobber series twist drill

A drill having two helical flutes and a parallel shank of approximately the same diameter as the cutting end.

3.1.2 parallel shank stub series twist drill

A shortened form of parallel shank jobber series twist drill, the reduction in length being in the flute length.

3.1.3 parallel shank long series twist drill

A lengthened form of the parallel shank jobber series twist drill, the increase in length being in the flute length.

3.1.4 parallel shank extra long series twist drill

A lengthened form of the parallel shank jobber series twist drill, longer than the long series, the increase in length being in the flute length.

3.1.5 Morse taper shank twist drill

A drill having two helical flutes and a standard Morse taper shank.

3.1.6 Morse taper shank extra long twist drill

A lengthened form of the Morse taper shank twist drill, the increase in length being in the flute length.

3.2 Other terms

3.2.1 axis

The longitudinal centreline.

NOTE. See figure 1.

3.2.2 back taper (longitudinal clearance)

The reduction in diameter per unit length of drill from the point towards the shank.

3.2.3 body

The portion of a drill extending from the extreme cutting end to the commencement of the shank.

NOTE. See figure 1.

3.2.4 body clearance

The portion of the body surface reduced in diameter to provide diametral clearance.

NOTE. See figure 1.

3.2.5 body clearance diameter

The diameter over that surface of the drill body situated behind the lands.

NOTE. See figure 2.

3.2.6 chisel edge

The edge formed by the intersection of the flanks.

NOTE. See figure 2.

3.2.7 chisel edge angle

The obtuse angle included by the chisel edge and a line from either outer corner to the corresponding end

of the chisel edge, the angle being measured in a plane perpendicular to the drill axis.

NOTE. See figure 2.

3.2.8 chisel edge corner

A corner formed by the intersection of a lip and the chisel edge.

NOTE. See figure 2.

3.2.9 depth of body clearance

The amount of diametral reduction per side to provide body clearance.

NOTE. See figure 2.

3.2.10 diameter, d

The measurement across the cylindrical lands at the outer corners of a drill.

NOTE. See figure 2.

3.2.11 face

The portion of the flute surface, adjacent to the lip, on which the chip impinges as it is cut from the work.

NOTE. See figure 2.

3.2.12 flank

One of the surfaces on a drill point that extends behind a lip to the following flute.

NOTE. See figure 2.

3.2.13 flutes

The grooves in the body of a drill that provide lips, permit the removal of chips and allow cutting fluid to reach the lips.

NOTE. See figure 1.

3.2.14 flute length, l

The axial length from the extreme end of the point to the termination of the flutes at the shank end of the body.

NOTE. See figure 1.

3.2.15 heel

The edge formed by the intersection of the flute surface and the body clearance.

NOTE. See figure 2.

3.2.16 helix angle

The angle between the leading edge of a land and the drill axis.

NOTE. See figure 3.

3.2.17 lands

The cylindrically ground surfaces on the leading edges of the drill flutes.

NOTE. See figure 1.

3.2.18 land width

The width of the land measured at right angles to the flute helix.

NOTE. See figure 2.

3.2.19 lead of helix

The distance measured parallel to the drill axis between corresponding points on the leading edge of a flute in one complete turn of the flute.

NOTE. See figure 1.

3.2.20 left-hand cutting drill

A drill that rotates in a clockwise direction when viewed on the point end of the drill.

3.2.21 lip (cutting edge)

The edge formed by the intersection of a flank and a face.

NOTE. See figure 2.

3.2.22 lip clearance angle

The angle formed by a flank and a plane at right angles to the drill axis, normally measured at the periphery of the drill.

NOTE. See figure 2.

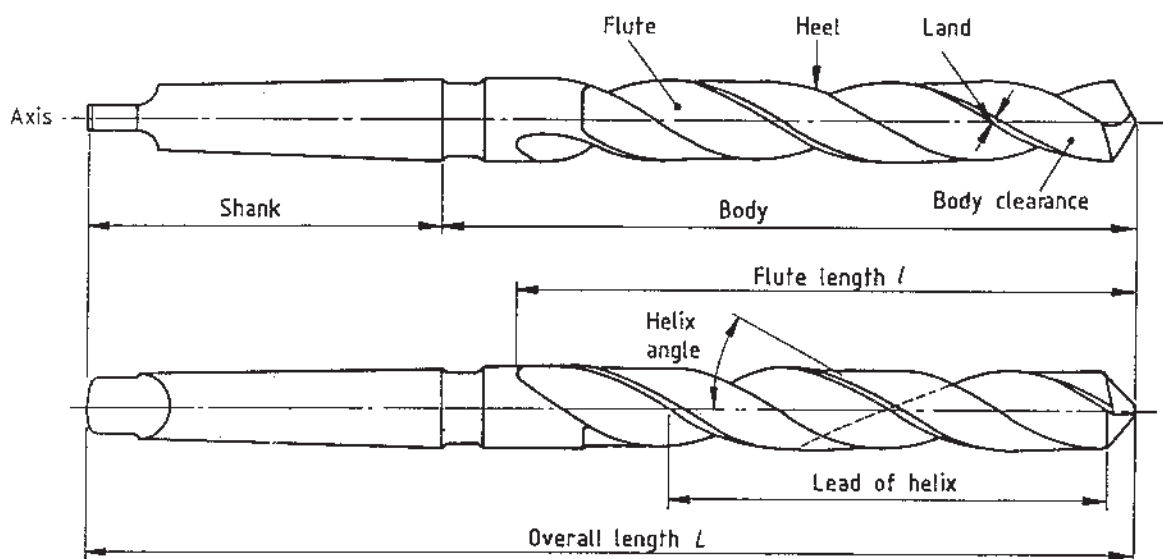


Figure 1. Twist drill terms. General features

3.2.23 lip length

The minimum distance between the outer corner and the chisel edge corner of a lip.

NOTE. See figure 2.

3.2.24 outer corner

A corner formed by the intersection of a lip and the leading edge of a land.

NOTE. See figure 2.

3.2.25 overall length, L

The length over the extreme ends of the point and the shank.

NOTE. See figure 1.

3.2.26 point

The sharpened end of a drill, consisting of all that part of the drill that is shaped to produce lips, faces, flanks and a chisel edge.

NOTE. See figure 2.

3.2.27 point angle

The included angle of the cone formed by the lips.

NOTE. See figure 2.

3.2.28 quick helix angle

A helix angle that is larger in angular value (i.e. in number of degrees) than the normal helix angle, thereby shortening the lead of helix.

NOTE. See figure 4.

3.2.29 rake angle

The angle between a face and a line parallel to the drill axis.

NOTE 1. At the periphery of the drill the rake angle is equivalent to the helix angle.

NOTE 2. See figure 2.

3.2.30 relative lip height

The distance between two planes, perpendicular to the drill axis, each of which passes through an outer corner of the drill.

NOTE. See figure 2.

3.2.31 right-hand cutting drill

A drill that rotates in a counter-clockwise direction when viewed on the point end of the drill.

3.2.32 shank

The portion of a drill by which it is held and driven.

NOTE. See figure 1.

3.2.33 slow helix angle

A helix angle that is smaller in angular value (i.e. in number of degrees) than the normal helix angle, thereby lengthening the lead of helix.

NOTE. See figure 5.

3.2.34 web

The central portion of a drill situated between the roots of the flutes and extending from the point towards the shank.

NOTE 1. The point end of the web forms the chisel edge.

NOTE 2. See figure 2.

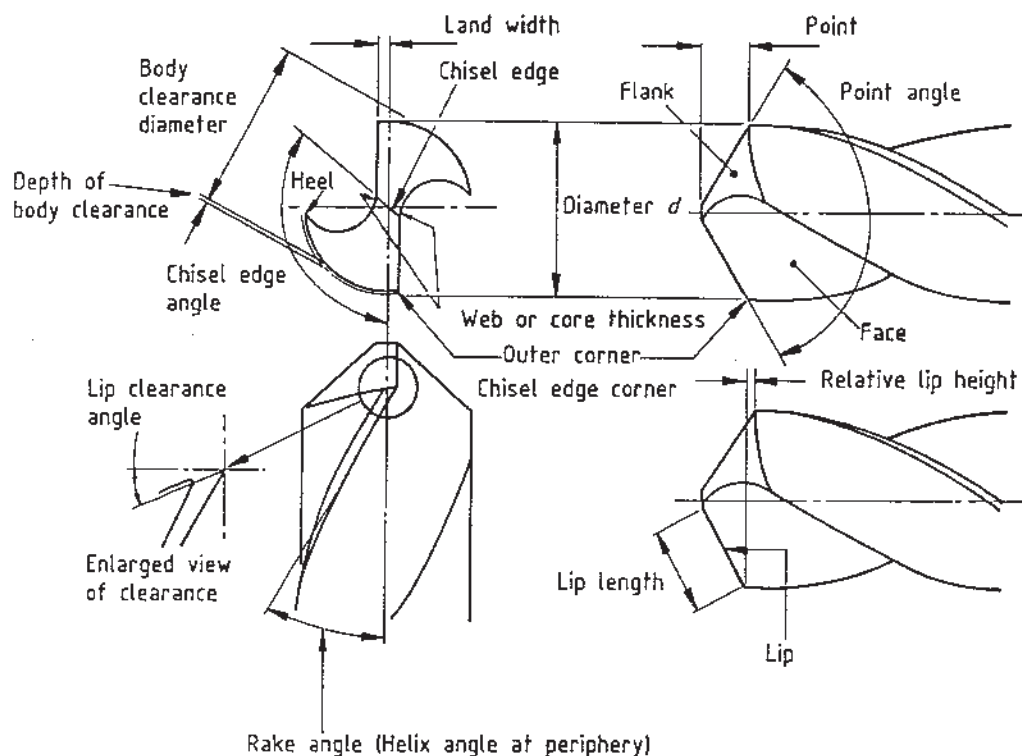
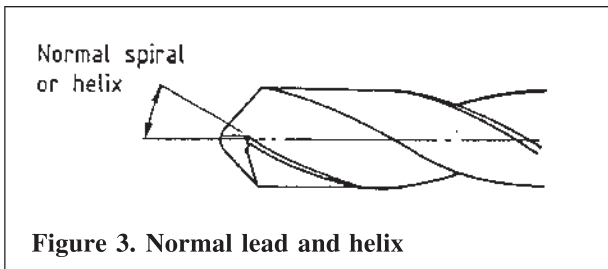


Figure 2. Twist drill terms. Point geometry



3.2.35 web taper

The increase in the web thickness from the point of the drill to the shank end of the flutes.

3.2.36 web thickness

The minimum dimensions of the web measured at the point end of the drill.

NOTE. See figure 2.

4 Dimensions

4.1 Preferred sizes of drills shall conform to the dimensions, and Morse taper shanks where applicable, given in tables 1, 2, 3, 4, 5 or 6.

4.2 Non-preferred sizes shall conform to the dimensions, and Morse taper shanks where applicable, given in tables 7, 8, 9 or 10.

4.3 Shanks shall be either parallel without driving tenon or of Morse taper shank with tang.

5 Features of design

NOTE. The helix angle is left to the manufacturer's discretion.

5.1 General

Twist drills shall be supplied sharpened and ready for use. The flutes shall be designed so that the cutting lips are equal.

Both right-hand and left-hand cutting drills may conform to this standard, but unless otherwise ordered, a right-hand cutting drill shall be supplied.

5.2 Cutting diameter

The tolerance on the cutting diameter, d , of a drill, as measured across the lands at the outer corners, shall be as shown in table 11 (i.e. h8 as specified in BS 4500: Section 1.1: 1990 and Section 1.2: 1990).

5.3 Back taper

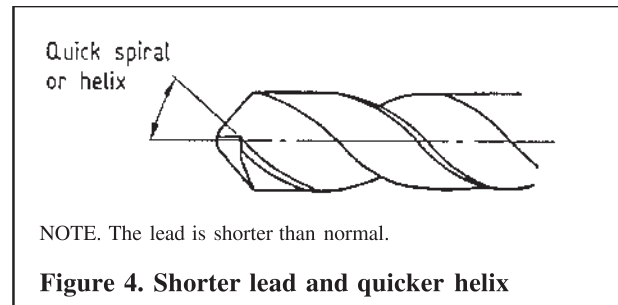
The drill diameter shall decrease by between 0.0002 mm and 0.0008 mm per millimetre linear distance from the outer corner towards the shank.

The total back taper shall not exceed 0.25 mm.

NOTE. Below 6.0 mm diameter, back taper is not a requirement but may be provided.

5.4 Parallel shank

The tolerance on the shank shall be h11 (as specified in BS 4500: Section 1.1: 1990 and Section 1.2: 1990) for shank diameters less than 6.0 mm.



For shank diameters 6.0 mm and above, the tolerance shall be f11 (as specified in BS 4500: Section 1.1: 1990 and Section 1.2: 1990).

The tolerance on cylindricity shall be 0.02 mm on the shank length corresponding to the holding surface of the collet.

5.5 Taper shank

Taper shank drills shall be provided with Morse taper shanks with tang conforming to BS 1660: Part 1: 1992.

5.6 Lengths

Drill overall and flute lengths shall be as given in tables 1 to 10. The flute lengths of Morse taper shank extra long twist drills shall be as given in table 12.

The tolerance on overall length and flute length shall be as given in table 13.

5.7 Web thickness

The web thickness measured at the point of the drill shall be sufficiently large to lie above the graphical line in figure 6.

NOTE 1. The web may increase in thickness towards the shank.

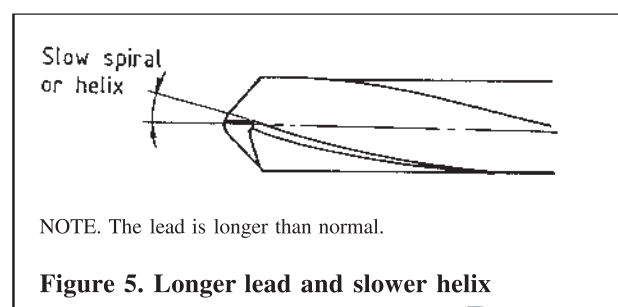
NOTE 2. The minimum web thickness based on general purpose design may not be applicable for special purpose drills.

5.8 Web centrality

The tolerance on the centrality of the web about the drill axis in a plane perpendicular to that axis shall not be greater than the values given by the graphical line in figure 7.

5.9 Flute divide

The maximum difference in pitch between the two major cutting edges (lips) of a drill measured at the outer corners shall not be greater than the values given by the graphical line in figure 8.



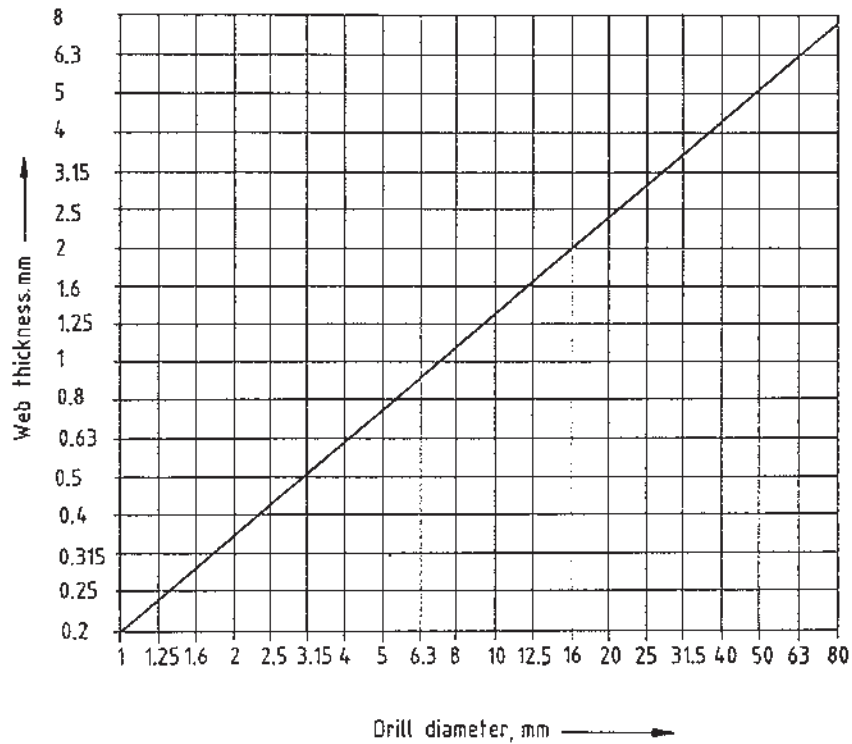


Figure 6. Minimum web thickness

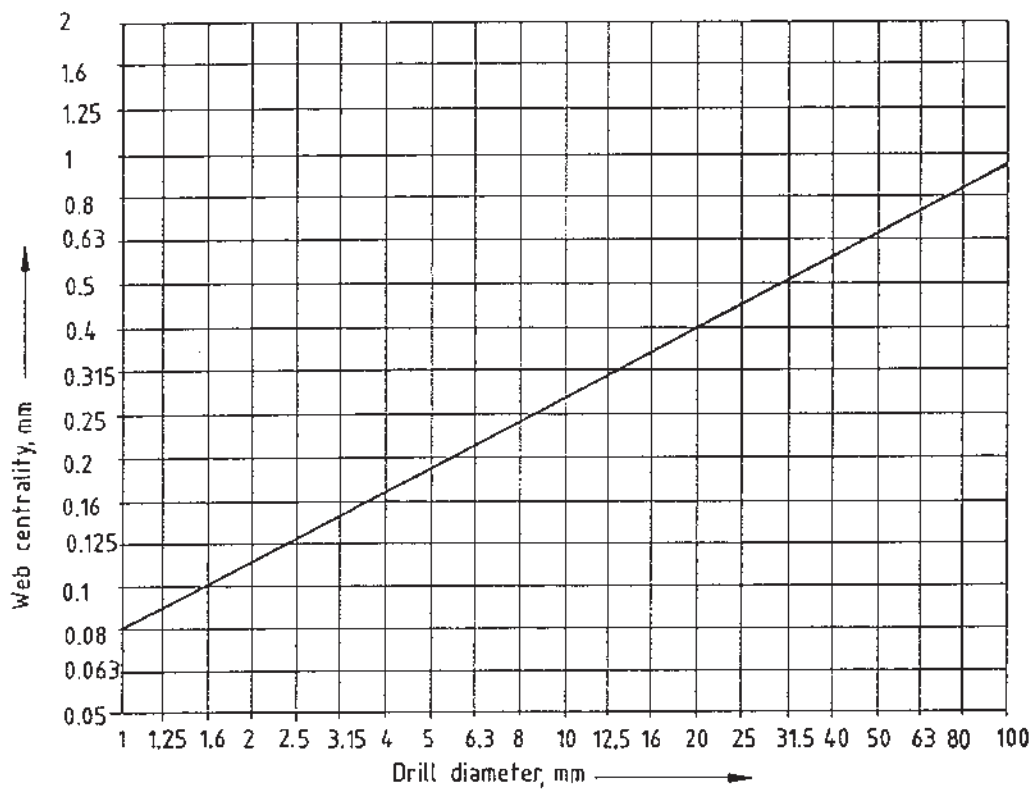


Figure 7. Tolerance on web centrality

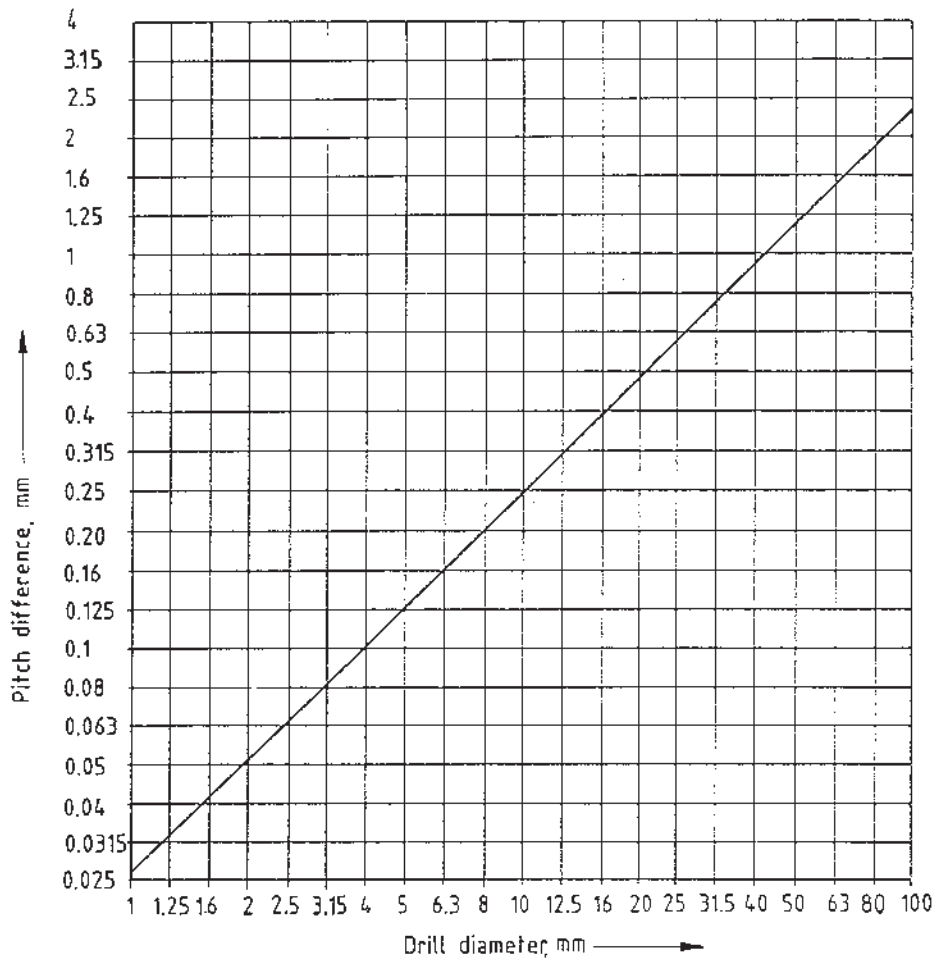


Figure 8. Maximum permissible variation in flute divide

5.10 Land width

The land width measured at right angles to the drill helix near the outer corner shall have the values given in figure 9. The difference in land widths of a drill shall not exceed one-third of the tolerance given by the graphical lines in figure 9.

5.11 Point angle

For general purpose twist drills, the point angle shall be $118^\circ \pm 3^\circ$.

NOTE. The tolerance of $\pm 3^\circ$ also applies to other point angles and is an included angle tolerance.

5.12 Relative lip height

The maximum difference in height between the two major cutting edges (lips) of a drill measured at the outer corners shall be a value below the graphical line in figure 10.

5.13 Radial runout

The maximum radial runout, measured on the land at the outer corner of the drill, shall not exceed the values given in figure 11.

NOTE. For sizes over 2.0 mm the radial runout, r , as shown in figure 11, is calculated using the following formula:

$$r = 0.03 + 0.01 \frac{l}{d}$$

where

l is the overall length;

d is the drill diameter.

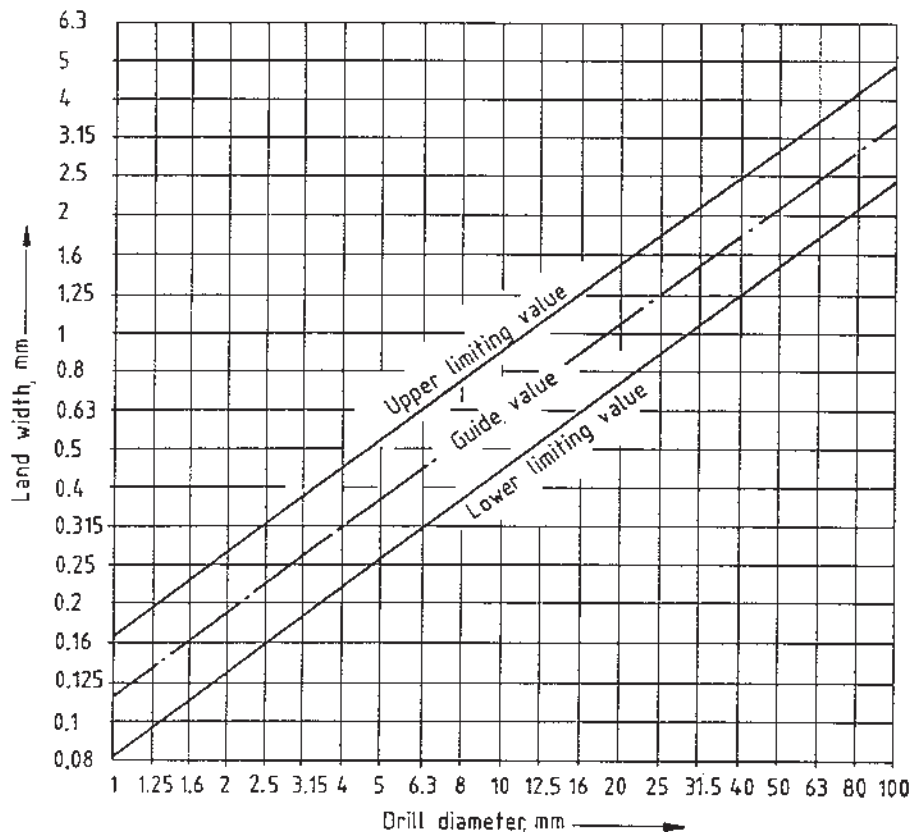


Figure 9. Land width

6 Materials and hardness

6.1 Cutting portion

The material of the cutting portion of the drill over the flute length shall be high-speed steel (HSS) as indicated in table 14.

NOTE. The choice of material of the remainder of the drill is not specified.

The hardness of the cutting portion of the drill measured on the diameter land or adjacent relieved land, shall lie within the following ranges:

HSS material: 780 HV to 900 HV;

high-speed steel with cobalt (HSCo) (HSS-E) material: 820 HV to 950 HV.

The test load (see annex A) shall be selected according to the drill diameter.

6.2 Shank

The material shall be either the same as for the cutting portion, or, when the shank is welded on, of steel which ensures the material hardness specified in this subclause.

When the twist drill is made entirely of high-speed steel, the Vickers hardness of the shank shall be at least 240 HV. A shank which is welded on shall have a Vickers hardness of at least 170 HV.

NOTE. The quoted hardness values correspond respectively to annealed high-speed steel or steel used for welded shanks following annealing after the welding process.

For Morse taper shank twist drills with a nominal diameter of 10.0 mm and above, the knock-out tang shall have a Vickers hardness of at least 220 HV 30.

7 Marking

Twist drills with diameters 3.0 mm and above shall be marked with the following:

- the drill size;
- the high-speed steel designation (see 6.1);
- the name or trade mark of the manufacturer or distributor.

NOTE 1. Any additional marking is discretionary.

NOTE 2. The marking may be punched, etched or electrically inscribed, including the use of lasers.