BRITISH STANDARD

BS 2593:1974

Specification for

Rotary drill rods and tungsten carbide tipped rotary drill bits

Co-operating organizations

The Mining and Quarrying Requisites Industry Standards Committee, under whose supervision this British Standard was prepared, consists of representatives from the following Government department and scientific and industrial organizations:

Association of Mining Electrical and Mechanical Engineers
British Electrical and Allied Manufacturers' Association
British Steel Industry*
Council of Underground Machinery Manufacturers*
Department of Trade and Industry
Engineering Equipment Users' Association
Institute of Quarrying
Institution of Mechanical Engineers
Institution of Mining Engineers
Mechanical Handling Engineers' Association
National Coal Board*

The industrial organizations marked with an asterisk in the above list, together with the following, were directly represented on the committee entrusted with the preparation of this British Standard:

British Compressed Air Society
British Quarrying and Slag Federation
Ministry of Defence — Army Department
National Union of Mineworkers

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Foreword

This British Standard, prepared under the authority of the Mining and Quarrying Requisites Industry Standards Committee, was designed primarily to satisfy the relevant needs of the coal industry, and it incorporates essential basic requirements for the degree of quality and interchangeability demanded by the user.

Originally published in 1955 and revised in 1964, the standard continues to cover the fundamental aspects of the original standard and, in addition, takes cognizance of current trends of developing experience, both in manufacture and performance. The relevant properties of materials are now specified for rods, bits and tips; also included are pilot and reamer bits, together with two other types of bit.

The shanks of the specified drill rods are designed to fit the chuck shown in BS 1090 *"Flameproof hand-held electric drilling machines primarily for use in mines"*.

In this revision the metric dimensions on which the relevant ISO work was based have in general been adopted; however, in order to provide ready cross-reference at this juncture, the equivalent imperial dimensions have been included and it should be noted that these lie within the limits of the metric dimensions.

A British Standard does not purport to include all the necessary provisions of a contract. Users of British Standards are responsible for their correct application.

Compliance with a British Standard does not of itself confer immunity from legal obligations.

Summary of pages

This document comprises a front cover, an inside front cover, pages i and ii, pages 1 to 10, an inside back cover and a back cover.

This standard has been updated (see copyright date) and may have had amendments incorporated. This will be indicated in the amendment table on the inside front cover.

Section 1. General

1 Scope

This British Standard specifies requirements for rotary drill rods and tungsten carbide tipped rotary drill bits. These tools are principally for drilling in coal and other minerals, but are applicable to other materials having appropriate drilling characteristics.

2 References

The titles of the British Standards referred to in this standard are listed on the inside back cover.

Section 2. Rotary drill rods

3 Form, dimensions and tolerances

The form, dimensions and tolerances of the rods shall be in accordance with Table 1 or Table 2, except that for rods of 54 mm diameter or larger, the winged portion adjacent to the shank shall be reduced in diameter to 48 mm maximum for a minimum distance of 13 mm to facilitate the maximum possible engagement of the chuck (see Table 2).

Although the drill rods illustrated are shown as the hollow type, solid rods which do not have the centre hole shall be deemed to comply with this standard, provided that all other relevant requirements stated herein are met.

The rods shall be supplied in a straight condition so that, when laid upon a flat surface and rotated, no point on the line of contact is more than 6 mm above the surface for lengths up to 2 m and pro rata for lengths over 2 m. The eccentricity between shank and rod shall not exceed 0.8 mm.

4 Material

Rods shall be supplied from steel having a hardness within the range 220–330HB (when tested in accordance with BS 240-1) and which has the following chemical composition:

Element	Per cent	
	Min.	Max.
Carbon	0.65	0.75
Silicon	0.10	0.25
Manganese	—	0.40
Sulphur	—	0.05
Phosphorus	—	0.05

The manufacturer shall provide a specification of the material if so requested by the purchaser.

5 Rod diameters and lengths

The preferred dimensions for the diameters, sections and lengths of rods shall be as follows:

All dimensions are in millimetres

Nominal rod diameter	Rod lengths	
	Diamond section	Turbine section
32	610, 915, 1 370, 1 524, 1 830	—
40	610, 915, 1 220, 1 370, 1 830, 2 435	610, 915, 1 220, 1 524, 1 830, 2 435
48	3 050	610, 915, 1 370, 1 524, 1 830
54	—	610, 915, 1 370, 1 524, 1 830
60	—	610, 915, 1 370, 1 524, 1 830
67	—	610, 915, 1 370, 1 524, 1 830, 2 130, 2 435

The foregoing are the standard preferred sizes, but where agreed between the purchaser and the supplier, rods of other lengths, provided they satisfy all other relevant requirements specified in this standard, shall be deemed to comply with this standard.

6 Workmanship

The drill rods shall have a fine grain structure, be resistant to impact, and be free from undue surface decarburization, cracks and other defects.

7 Marking

7.1 Identification marking. Each rod shall be indelibly marked with the manufacturer's registered trade name or trademark.

7.2 British Standard marking. Rods may be marked with the number of this standard, i.e. BS 2593.

NOTE The mark BS 2593 on or in relation to a product is a claim by the manufacturer that it complies with the requirements of the standard.

8 Packaging

The rods shall be given rust resistant protection and be prepared in bundles each normally not exceeding 255 kg (5 cwt) in weight, using a seamless strapping or other efficient method.

9 Requirements for ordering

The purchaser shall state the following in his enquiry or order.

a) The number of this British Standard, i.e. BS 2593.

b) Diameter of rod.

c) Length of rod.

d) Section of rod, i.e. turbine or diamond.

e) Solid or hollow rod.

Section 3. Tungsten carbide tipped rotary drill bits

10 Form, dimensions and tolerances

10.1 Bit body. The form, dimensions and tolerances of the bits shall conform to those shown in Table 3 and Table 4, and the design shall be such that it allows an unrestricted flow of cuttings away from the bit when fitted into the rod.

The tolerance on the bit and reamer diameter shall be + 0.8, – 0 mm.

10.2 Tungsten carbide tips. The form, dimensions and tolerances of the tips shall conform to the requirements shown in Table 5.

11 Material

11.1 Bodies. Bit and reamer bodies shall be produced by any suitable method, from one or other of the relevant grades of steels detailed in Part 1, 2 or 3 of BS 970 as appropriate; in the specified condition these components shall have tensile strength of not less than 700 N/mm^2.

The choice of material supplied shall be at the option of the manufacturer who shall provide a specification if so requested by the purchaser.

The hardness shall be not less than 201 HB and the hardness test, complying with the requirements of BS 240-1, shall be carried out on the driving flats or shank of the bit.

11.2 Tungsten carbide tips. Tips shall consist of tungsten carbide sintered with cobalt and shall normally be supplied to one or other of the following hardness ranges:

Carbide grade	Vickers hardness No. (HV)	
	min.	max.
Hard	1 450	1 550
Medium	1 350	1 450
Tough	1 250	1 350

Where an extra tough grade is required, the minimum hardness may be reduced to 1 150 HV.

The hardness test shall be carried out on the surface of the tip after removing 0.25 mm to 0.38 mm. The finish of the surface shall be fine enough to give a distinct impression for accurate measurement. The test shall be carried out with a Vickers hardness testing machine, or with any equivalent machine which uses a diamond indenter in the form of a square pyramid having an angle between opposite faces of 136°; the load shall be at least 295 N. To allow for variations in hardness measurements between different test centres, a range of 25 points HV above or below the specified hardness ranges will be permitted, provided that any grade supplied by a given manufacturer does not have a range of hardness greater than 100 points HV.

Tips shall be free from an undue amount of porosity, uncombined carbon and cobalt segregation. Tips shall also be free from eta-phase.

The total impurities shall not exceed 1 % and the individual impurities shall not exceed the following:

Iron	0.5 %
Titanium or other carbides (excluding tungsten carbide)	0.25 %

The surfaces of the tips shall be free from pitting.

12 Brazing

The tips shall be firmly brazed to the bit body, in accordance with the requirements of BS 1723.

13 Bit and reamer sizes

13.1 Dimensions. The dimensions of the bits and reamers shall conform to the details given in Table 3 and Table 4.

13.2 Diameter of one piece bits. The following diameters of one piece bits shall be regarded as standard:

	mm
Measurements across the wings	35
	43
	46
	52
	57
	60

13.3 Diameter of pilot and reamer bits. The following diameters of pilot and reamer bits shall be regarded as standard:

Pilot	**Reamer**
mm	mm
64	35
71	43
75	43

14 Marking

14.1 Identification marking. Each bit shall be indelibly marked with the manufacturer's registered trade name or trademark.

14.2 British Standard marking. Bits may be marked with the number of this standard, i.e. BS 2593.

NOTE The mark BS 2593 on or in relation to the product is a claim by the manufacturer that it complies with the requirements of the standard.

15 Packaging

The bits shall be protected against damage and corrosion before use.

16 Requirements for ordering

The purchaser shall state the following in his enquiry or order.

a) The number of this British Standard, i.e. BS 2593.

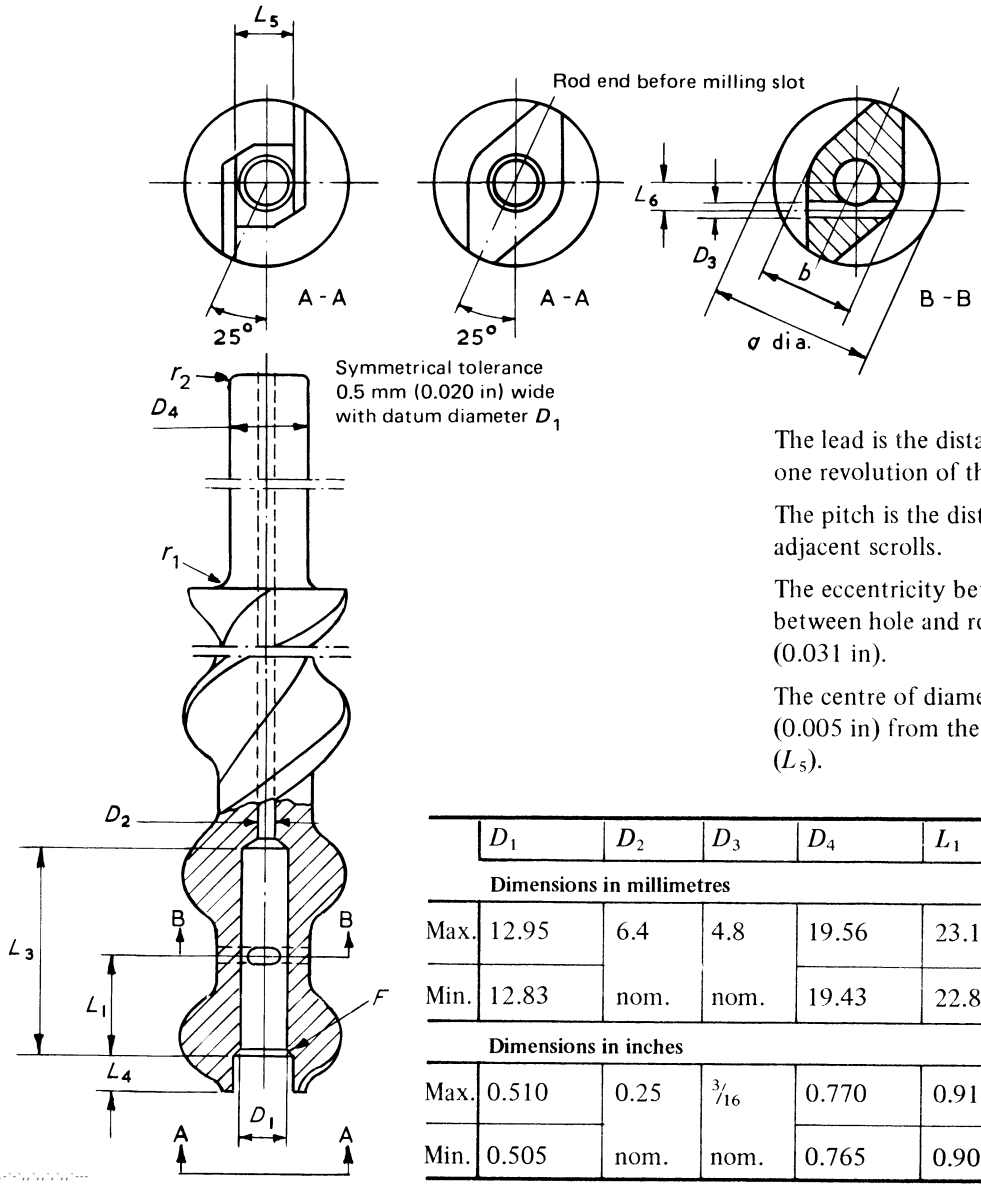
b) The design of the bit, i.e. ordinary, pilot, reamer, or pilot and reamer assembly.

c) The diameter of the component or assembly.

d) Grade of carbide, or application.

e) Rake of the bit.

Table 1 — Diamond section rotary drill rods



Bit diameter	Size of rod		Pitch
	a	b	
Dimensions (nom.) in millimetres			
35	32	22	43
43	40		
Dimensions (nom.) in inches			
$1\frac{3}{8}$	$1\frac{1}{4}$	$\frac{7}{8}$	$1\frac{11}{16}$
$1\frac{11}{16}$	$1\frac{9}{16}$		1.7

The lead is the distance which any one scroll advances in one revolution of the rod.

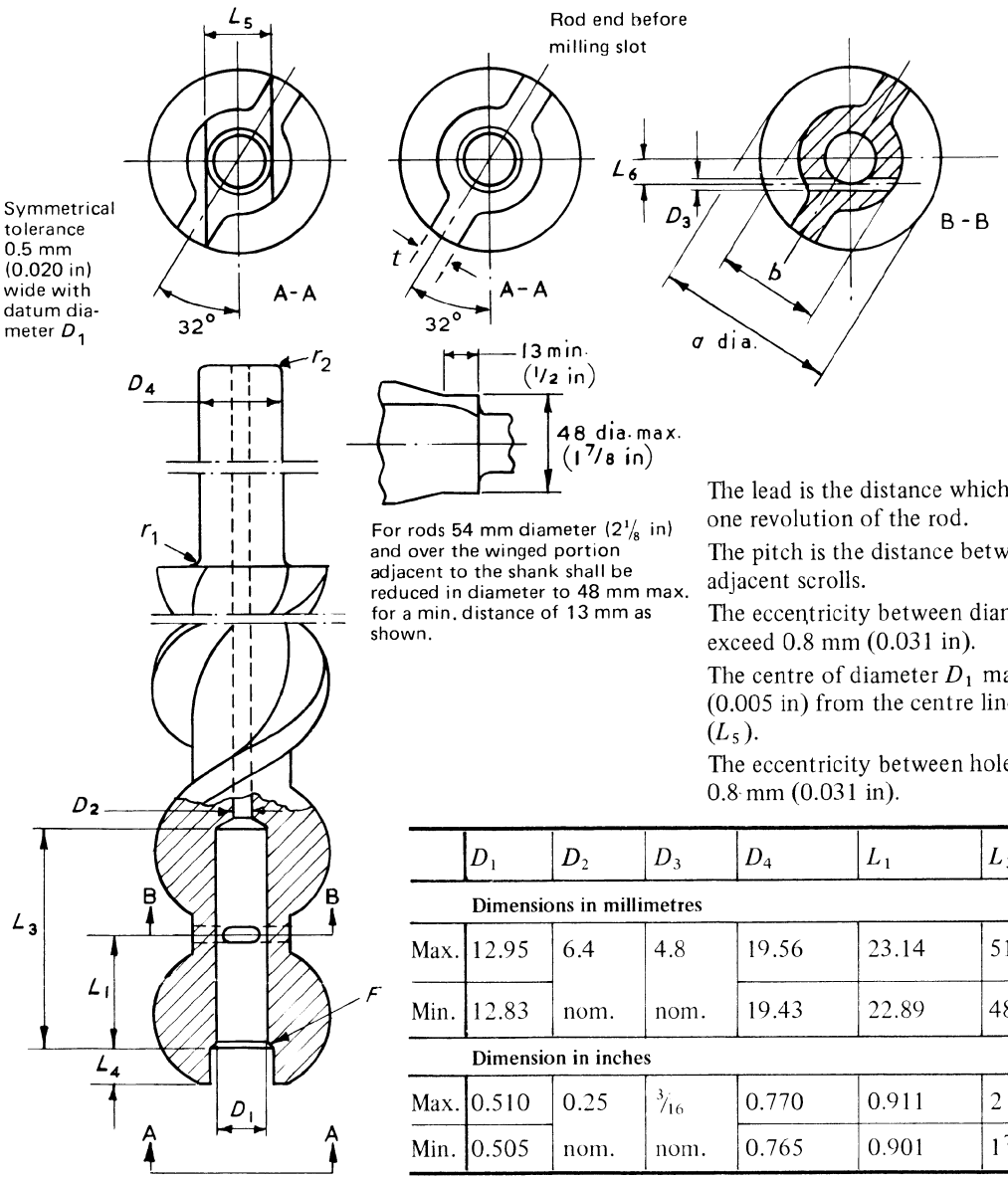
The pitch is the distance between the centres of two adjacent scrolls.

The eccentricity between diameter D_1 and rod, and between hole and rod, should not exceed 0.8 mm (0.031 in).

The centre of diameter D_1 may deviate max. 0.13 mm (0.005 in) from the centre line between the driving flats (L_5).

	D_1	D_2	D_3	D_4	L_1	L_3	L_4	L_5	L_6	F	r_1	r_2
Dimensions in millimetres												
Max.	12.95	6.4	4.8	19.56	23.14	51	8.73	14.29	6.7	0.8 (nom.) × 45°	2.4 nom.	0.8 nom.
Min.	12.83	nom.	nom.	19.43	22.89	48	8.33	14.16	6.3			
Dimensions in inches												
Max.	0.510	0.25	$\frac{3}{16}$	0.770	0.911	2	$\frac{11}{32}$	0.5625	0.264	0.03 (nom.) × 45°	$\frac{3}{32}$ nom.	$\frac{1}{32}$ nom.
Min.	0.505	nom.	nom.	0.765	0.901	$1\frac{7}{8}$	$\frac{21}{64}$	0.5575	0.248			

Table 2 — Turbine section rotary drill rods



Bit diameter	Size of rod		Pitch
	a	b	
Dimensions (nom.) in millimetres			
43	40	22	43
46			
52	48		64
57	54		67
60			
64	60		76
71	67	25	86
75			
Dimensions (nom.) in inches			
$1\frac{11}{16}$	$1\frac{9}{16}$	$\frac{7}{8}$	1.7
$1\frac{13}{16}$			
$2\frac{1}{16}$	$1\frac{7}{8}$		$2\frac{1}{2}$
$2\frac{1}{4}$	$2\frac{1}{8}$		$2\frac{5}{8}$
$2\frac{3}{8}$			
$2\frac{1}{2}$	$2\frac{3}{8}$		3
$2\frac{13}{16}$	$2\frac{5}{8}$	1	$3\frac{3}{8}$
$2\frac{15}{16}$			

The lead is the distance which any one scroll advances in one revolution of the rod.

The pitch is the distance between the centres of two adjacent scrolls.

The eccentricity between diameter D_1 and rod should not exceed 0.8 mm (0.031 in).

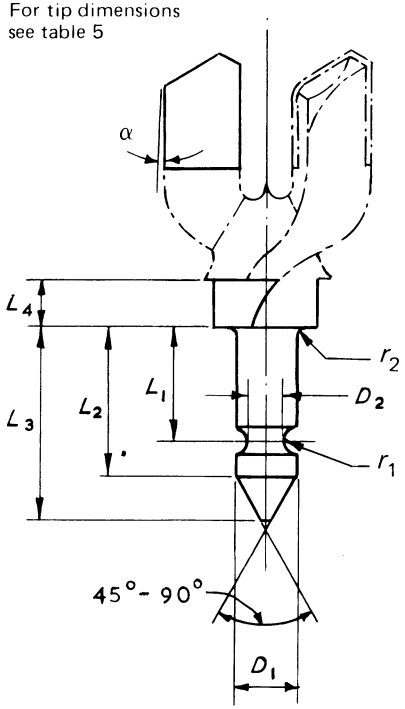
The centre of diameter D_1 may deviate max. 0.13 mm (0.005 in) from the centre line between the driving flats (L_5).

The eccentricity between hole and rod should not exceed 0.8 mm (0.031 in).

	D_1	D_2	D_3	D_4	L_1	L_3	L_4	L_5	L_6	F	r_1	r_2	t
Dimensions in millimetres													
Max.	12.95	6.4	4.8	19.56	23.14	51	8.73	14.29	6.7	0.8 nom. × 45°	2.4	0.8	5.61
Min.	12.83	nom.	nom.	19.43	22.89	48	8.33	14.16	6.3		nom.	nom.	5.52
Dimension in inches													
Max.	0.510	0.25	$\frac{3}{16}$	0.770	0.911	2	$\frac{11}{32}$	0.5625	0.264	0.03 × 45°	$\frac{3}{32}$	$\frac{1}{32}$	0.2209
Min.	0.505	nom.	nom.	0.765	0.901	$1\frac{7}{8}$	$\frac{21}{64}$	0.5575	0.248		nom.	nom.	0.2175

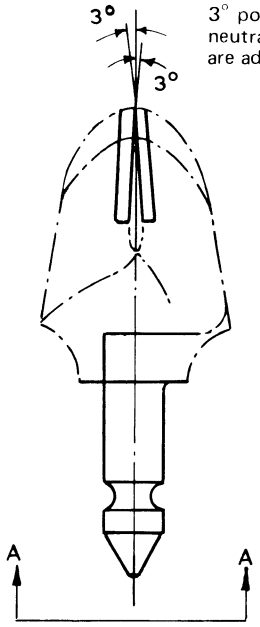
Table 3 — One-piece bit details (up to 60 mm)

For tip dimensions see table 5

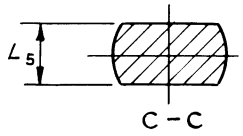


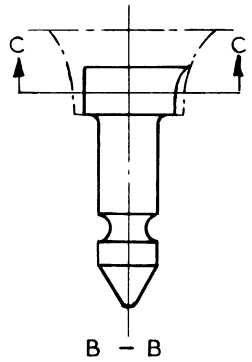
The eccentricity between shank and cutting wings shall not exceed 0.8 mm ($^1/_{32}$ in).

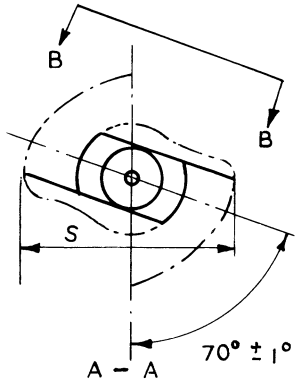
The centre of diameter D_1 may deviate max. 0.13 mm (0.005 in) from the centre line between the driving flats (L_5).



3° positive rake shown, but neutral and 4° negative rakes are admissible.





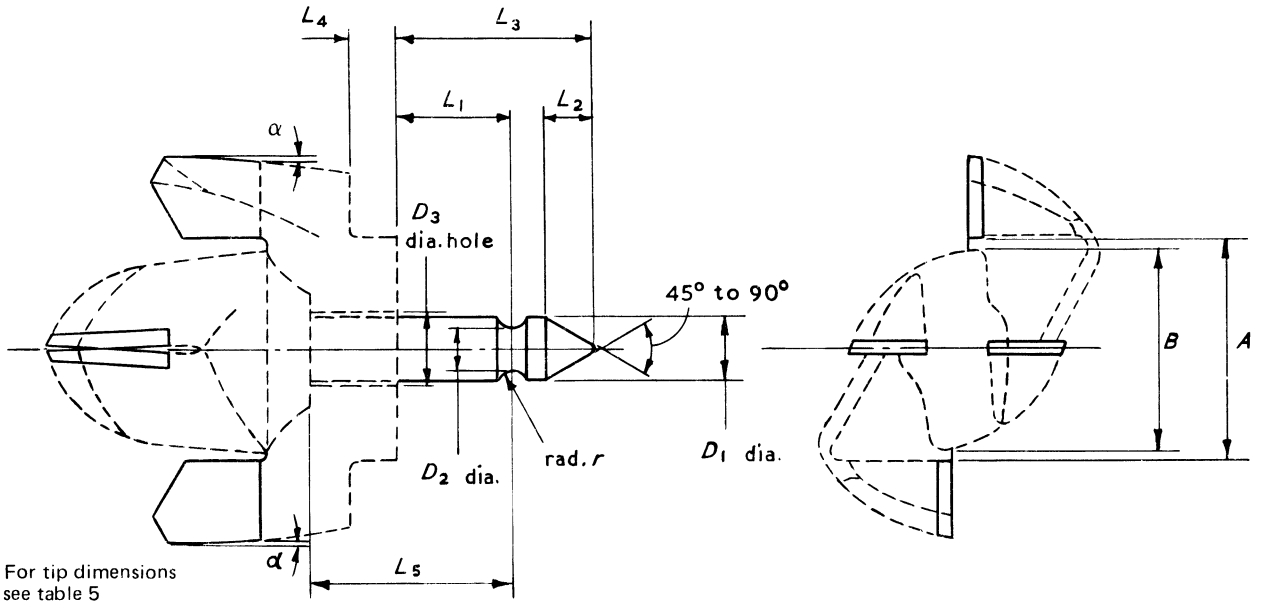


The bits are designed for deep slot fixing only and provide for a free flow of the cuttings away from the bit.

Bit diameter		S	
mm	in	mm	in
35	$1^3/_8$	29	$1^1/_8$
43	$1^{11}/_{16}$	40	$1^9/_{16}$
46	$1^{13}/_{16}$		
52	$2^1/_{16}$	48	$1^7/_8$
57	$2^1/_4$	54	$2^1/_8$
60	$2^3/_8$		

	D_1	D_2	L_1	L_2	L_3	L_4	L_5	r_1	r_2	Angle α
Dimensions in millimetres										
Max.	12.70	8.64	23.14	9.5	39.7	10	13.08	3.30	0.8	2°
Min.	12.57	8.38	22.89	nom.	38.9	9.5	12.83	3.05	–	1°
Dimensions in inches										
Max.	0.500	0.340	0.911	$^3/_8$	$1^1/_{16}$	$^{25}/_{64}$	0.515	0.130	$^1/_{32}$	2°
Min.	0.495	0.330	0.901	nom.	$1^{17}/_{32}$	$^3/_8$	0.505	0.120	–	1°

Table 4 — Pilot and reamer type bit details



For tip dimensions see table 5

Reamer bit diameter	Pilot bit diameter	*A*	*B*
Dimensions in millimetres			
64	35	35	32
71	43	39	36
75	43	45	36
Dimensions in inches			
$2^{1}/_{2}$	$1^{3}/_{8}$	$1^{3}/_{8}$	$1^{1}/_{4}$
$2^{13}/_{16}$	$1^{11}/_{16}$	$1^{9}/_{16}$	$1^{7}/_{16}$
$2^{15}/_{16}$	$1^{11}/_{16}$	$1^{3}/_{4}$	$1^{7}/_{16}$

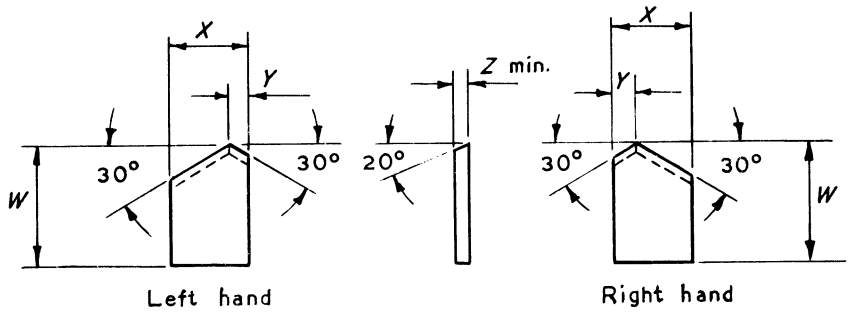
	D_1	D_2	D_3	L_1	L_2	L_3	L_4	L_5	r	Angle α
Dimensions in millimetres										
Max.	12.70	8.64	12.95	23.14	9.5	39.7	10	40.59	3.30	2°
Min.	12.57	8.38	12.83	22.89	nom.	38.9	9.5	40.34	3.05	1°
Dimensions in inches										
Max.	0.500	0.340	0.510	0.911	$^{3}/_{8}$	$1^{9}/_{16}$	$^{25}/_{64}$	1.598	0.130	2°
Min.	0.495	0.330	0.505	0.901	nom.	$1^{17}/_{32}$	$^{3}/_{8}$	1.588	0.120	1°

Table 5 — Carbide tips for standard tungsten carbide tipped rotary drill bits (one-piece, and pilot and reamer patterns)

NOTE The *Y* dimension on tip fitted to the reamer bar of pilot and reamer bits 71 mm and 75 mm diameter may vary between 4 mm and 5.5 mm.

Tip details

Type		*W*	*X*	*Y*	*Z*
		Dimensions in millimetres			
A	Max.	19.05	14.68	4	–
	Min.	18.67	14.30	nom.	3.18
B	Max.	23.80	16.26	4	–
	Min.	23.42	15.88	nom.	3.18
C	Max.	25.40	6.73	6.4	–
	Min.	25.02	6.35	nom.	3.68
D	Max.	25.40	21.82	8	–
	Min.	25.02	21.44	nom.	3.68
		Dimensions in millimetres			
A	Max.	0.750	0.578	$^{5}/_{32}$	–
	Min.	0.735	0.563	nom.	$^{1}/_{8}$
B	Max.	0.937	0.640	$^{5}/_{32}$	–
	Min.	0.922	0.625	nom.	$^{1}/_{8}$
C	Max.	1.000	0.265	¼	–
	Min.	0.985	0.250	nom.	0.145
D	Max.	1.000	0.859	$^{5}/_{16}$	–
	Min.	0.985	0.844	nom.	0.145



	Bit diameter		Type of tip	No. per set	
	mm	in			
One-piece bits	35	$1^{3}/_{8}$	A	*	
	43	$1^{11}/_{16}$	B	*	
	46	$1^{13}/_{16}$	B	*	
	52	$2^{1}/_{16}$	C	*	
	58	2¼	D	*	
	60	$2^{3}/_{8}$	D	*	
				Pilot	**Reamer**
Reamer bits with pilot	64	2½	A	*	2 right hand
	71	$2^{13}/_{16}$	B	*	2 right hand
	75	$2^{15}/_{16}$	B	*	2 right hand

* 1 off each hand

Appendix A Dimensional equivalents

The following are metric/imperial equivalents additional to those covered by Table 1 to Table 5.

mm	in	mm	ft	m	ft
0.25	0.010	610	2	2	6.56
0.38	0.015	915	3		
0.8	$^{1}/_{32}$	1 220	4		
5.5	$^{7}/_{32}$	1 370	4.5		
13 (12.8)	$^{1}/_{2}$	1 524	5		
43	1.7	1 830	6		
		2 130	7		
		2 435	8		
		3 050	10		

Publications referred to

This standard makes reference to the following British Standards:
BS 240, *Method for Brinell hardness test Part 1 Testing of metals.*
BS 970, *Wrought steels in the form of blooms, billets, bars and forgings.*
BS 970-1, *Carbon and carbon manganese steels including free cutting steels.*
BS 970-2, *Direct hardening alloy steels, including alloy steels capable of surface hardening by nitriding.*
BS 970-3, *Steels for case hardening.*
BS 1723, *Brazing.*

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London
W4 4AL