

Rotary core drilling equipment —

Part 3: Specification for System A — Metric units

Committees responsible for this British Standard

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- British Coal Corporation
- Drilling and Prospecting International Limited
- English Drilling Equipment Co. Limited
- Institution of Civil Engineers
- Institution of Mining and Metallurgy
- Natural Environment Research Council (Institute of Geological Science)

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Contents

	Page
Committees responsible	Inside front cover
National foreword	iv
1 Scope	1
2 Normative references	1
3 Designation	1
4 Materials	1
5 Dimensions and tolerances	1
Figure 1 — System of dimensional identification letters	3
Figure 2 — Drill rod and coupling	7
Figure 3 — “W” design drill rod — Drill rod tube	8
Figure 4 — “W” design drill rod — Drill-rod coupling	9
Figure 5 — General relation of casing to core bit	10
Figure 6 — Casing	10
Figure 7 — Nesting of casing	11
Figure 8 — “W” design flush-jointed casing — Casing	12
Figure 9 — “W” design flush-jointed casing — Casing drive shoe	14
Figure 10 — “W” design flush-jointed casing — Casing shoe	15
Figure 11 — “W” design flush-jointed casing — Casing bit	16
Figure 12 — “W” design flush-jointed casing — Casing reaming shell	17
Figure 13 — “X” design flush-coupled casing — Casing tube	18
Figure 14 — “X” design flush-coupled casing — Casing shoe	19
Figure 15 — “X” design flush-coupled casing — Casing bit	20
Figure 16 — “X” design flush-coupled casing — Reaming shell	21
Figure 17 — “X” design flush-coupled casing — Casing coupling	22
Figure 18 — “WF” design double-tube core barrel — Swivel type — Assembly for sizes HWF, PWF, SWF, UWF and ZWF	23
Figure 19 — “WF” design double-tube core barrel — Short core bit	24
Figure 20 — “WF” design double-tube core barrel — Long core bit	25
Figure 21 — “WF” design double-tube core barrel — Core-lifter case	26
Figure 22 — “WF” design double-tube core barrel — Core lifter	27
Figure 23 — “WF” design double-tube core barrel — Reaming shell	28
Figure 24 — “WF” design double-tube core barrel — Outer tube	30
Figure 25 — “WF” design double-tube core barrel — Inner tube	31
Figure 26 — “WF” design double-tube core barrel — Head	32
Figure 27 — “WG” design single-tube core barrel — Assembly	33
Figure 28 — “WG” design core barrel — Single- and double-tube type — Bevel wall core bit	34
Figure 29 — “WG” design core barrel — Single- and double-tube type — Core lifter	35
Figure 30 — “WG” design single-tube core barrel — Reaming shell	35
Figure 31 — “WG” design single-tube core barrel — Tube	37
Figure 32 — “WG” design double-tube core barrel — Assembly — Rigid and swivel types	38
Figure 33 — “WG” design double-tube core barrel — Reaming shell	39
Figure 34 — “WG” design double-tube core barrel — Outer tube	41
Figure 35 — “WG” design double-tube core barrel — Inner tube	42
Figure 36 — “WG” design double-tube core barrel — Head	43
Figure 37 — “WM” design double-tube core barrel — Assembly — Swivel type	45

	Page
Figure 38 — “WM” design double-tube core barrel — Core bit	46
Figure 39 — “WM” design double-tube core barrel — Core lifter case	47
Figure 40 — “WM” design double-tube core barrel — Core lifter	48
Figure 41 — “WM” design double-tube core barrel — Reaming shell	49
Figure 42 — “WM” design double-tube core barrel — Outer tube	50
Figure 43 — “WM” design double-tube core barrel — Inner tube	51
Figure 44 — “WM” design double-tube core barrel — Head	52
Figure 45 — “WT” design single-tube core barrel — Assembly — Sizes BWT, NWT and HWT	54
Figure 46 — “WT” design single-tube core barrel — Reaming shell	55
Figure 47 — “WT” design single-tube core barrel — Tube	57
Figure 48 — “WT” design double-tube core barrel — Assembly — Rigid and swivel types BWT, NWT and HWT	58
Figure 49 — “WT” design core barrel — Single and double type — Bevel wall core bit	59
Figure 50 — “WT” design core barrel — Single and double type — Core lifter	60
Figure 51 — “WT” design double-tube core barrel — Reaming shell	61
Figure 52 — “WT” design double-tube core barrel — Outer tube	63
Figure 53 — “WT” design double-tube core barrel — Inner tube	64
Figure 54 — “WT” design double-tube core barrel — Head	65
Figure 55 — “WT” design double-tube core barrel — Assembly — Rigid type RWT, EWT and AWT	67
Figure 56 — “WT” design double-tube core barrel — Bevel wall core bit	68
Figure 57 — “WT” design double-tube core barrel — Straight wall core bit	69
Figure 58 — “WT” design double-tube core barrel — Core lifter	70
Figure 59 — “WT” design double-tube core barrel — Reaming shell	71
Figure 60 — “WT” design double-tube core barrel — Outer tube	73
Figure 61 — “WT” design double-tube core barrel — Inner tube	74
Figure 62 — “WT” design double-tube core barrel — Head — Sizes RWT, EWT and AWT	75
Table 1 — Identification symbols	2
Table 2 — Mechanical properties	2
Table 3 — System of dimensional identification letters	4
Table 4 — Nomenclature and basic dimensions for drill rods and casings and their related diamond set items	5
Table 5 — Nomenclature and basic dimensions for core barrels and their related diamond set items	6
Tables 6 to 8 — “W” design drill rod and coupling	7
Table 9 — Casing and casing coupling (where used) — Main dimensions	14
Tables 10 to 14 — “W” design flush-jointed casing	13
Tables 15 to 19 — “X” design flush-coupled casing	18
Tables 20 to 27 — “WF” design double-tube core barrel	24
Tables 28 to 31 — “WG” design single-tube core barrel	34
Tables 32 to 35 — “WG” design double-tube core barrel	40
Tables 36 to 42 — “WM” design double-tube core barrel	46

	Page
Tables 43 and 44 — “WT” design single-tube core barrel (BWT, NWT, HWT)	56
Tables 45 and 46 — “WT” design single- and double-tube core barrel (BWT, NWT, HWT)	59
Tables 47 to 50 — “WT” design double-tube core barrel (BWT, NWT, HWT)	62
Tables 51 to 57 — “WT” design double-tube core barrel (RWT, EWT, AWT)	68
List of references	Inside back cover

National foreword

This Part of BS 4019 has been prepared under the direction of the General Mechanical Engineering Standards Policy Committee. It is identical with ISO 3551-1:1992 *Rotary core diamond drilling equipment — System A — Part 1: Metric units*, which was prepared by Technical Committee ISO/TC82/SC6 Diamond core drilling equipment, of the International Organization for Standardization (ISO) and in the development of which the United Kingdom played an active part.

To a large extent this Part of BS 4019 has been based on BS 4019-1:1974, which first was issued in 1966 and subsequently revised and converted into SI units by the UK in 1974 in cooperation with Canada and the USA and supported by Australia and South Africa and based on a proposal to ISO for an International Standard. This Part of BS 4019, together with BS 4019-4:1993, supersedes BS 4019-1:1974 which is withdrawn.

In this Part of BS 4019 all dimensions have been converted into SI units from the original inch units and the purpose of this Part is to provide, on an international basis, the dimensional interchangeability in essential rotary core drilling fittings. These fittings are designed specifically for drilling with water as the circulating medium and are not necessarily suitable for use with air or mud as the circulating media. It is proposed to produce other Parts of this standard to cover equipment for use with air flush and wire-line, but it is not intended to publish British Standards on System B or System C.

BS 4019 comprises the following Parts:

- *Part 3: Specification for system A — Metric units;*
- *Part 4: Specification for system A — Inch units.*

NOTE The title of the ISO standard is *Rotary core diamond drilling equipment*. However, the use of other cutting materials is permitted (see note to clause 1).

Cross-references

International Standard	Corresponding British Standard
ISO 263:1973	BS 1580 <i>Specification for unified screw threads</i> Parts 1 and 2:1962 <i>Diameters $\frac{1}{4}$ in and larger</i> (Technically equivalent)

The Technical Committee has reviewed the provisions of ISO 5864 and API 7, to which normative reference is made in the text, and has decided that they are acceptable for use in conjunction with this standard.

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 to iv, pages 1 to 76, 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.

1 Scope

This part of ISO 3551 establishes the nomenclature and lays down the leading dimensions to ensure interchangeability within the limits of System A of the following equipment:

- a) drill rods and couplings;
- b) casings, casing couplings, casing bits, casing shoes, drive shoes and casing reaming shells;
- c) core barrels, core bits, core lifters and reaming shells.

It specifies the characteristics of a range of equipment for drilling holes having diameters from 30 mm to 200 mm and yielding cores having diameters from 18,5 mm to 165 mm.

NOTE The title of this part of ISO 3551 specifies diamond core drilling, but it is also possible to use other cutting materials.

2 Normative references

The following standards contain provisions which, through reference in this text, constitute provisions of this part of ISO 3551. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this part of ISO 3551 are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below. Members of IEC and ISO maintain registers of currently valid International Standards.

ISO 263:1973, *ISO inch screw threads — General plan and selection for screws, bolts and nuts — Diameter range 0.06 to 6 in.*

ISO 5864:1978, *ISO inch screw threads — Allowances and tolerances.*

BS 1580:1962, *Specification for Unified screw threads — Parts 1 and 2: Diameters 1/4 in and larger.*

API 7, *Rotary shouldered connection, internal flush type (IF).*

3 Designation

Items manufactured in accordance with this part of ISO 3551 shall be designated by its number followed by the symbols as listed in Table 1.

4 Materials

Materials used in the manufacture of the equipment specified in this part of ISO 3551 shall have the mechanical properties specified in Table 2, though for special purposes other materials may be used by agreement between manufacturer and purchaser.

The method by which the mechanical properties of tubes are obtained is left to the manufacturer.

5 Dimensions and tolerances

5.1 Dimensions

All dimensions and tolerances shall be in accordance with Table 4 to Table 57. All dimensions given in this part of ISO 3551, unless otherwise stated, are in millimetres (see Introduction).

NOTE 1 In System A, maximum and minimum values are included for all dimensions.

NOTE 2 All these items have a right-hand thread. Where a left-hand thread is necessary, it is stipulated for each individual case in the footnotes to the figure or to the corresponding table.

NOTE 3 Radius (or chamfer) of the thread profile crest and radius in thread root corners are to be chosen by the manufacturers (determined by national standards of manufacturers' countries).

5.2 Conformity

In those industries where drilling depths are measured in metres, the rod and casing lengths shall be 3 m, 1,5 m or 0,75 m; but when drilling in conformity with American Diamond Core Drill Manufacturers Association (DCDMA) and Canadian Diamond Drilling Association (CDDA) standards, the lengths of rods and casings may be 120 in, 60 in or 30 in.

5.3 Eccentricity

The eccentricity is defined as the distance between the centres of the outside and inside diameters and shall not exceed 10 % of the nominal wall thickness Q . The eccentricity is calculated according to the formula

$$\frac{Q_{\max} - Q_{\min}}{2 Q_{\text{nom}}} \times 100$$

where $Q_{\max}$ and $Q_{\min}$ are values of the wall thickness measured in the same section.

5.4 Straightness

When measured over the whole length of the tube by rolling against a straightedge, the maximum deviation shall not be greater than 1 in 1 200.

Table 1 — Identification symbols

Drill rods (see Table 4, Table 6, Table 7 and Table 8)	RW	EW	AW	BW	NW	HW	—	—	—	—
Casing — flush coupled (see Table 4, Table 9 and Table 15 to Table 19)	RX	EX	AX	BX	NX	HX	PX	SX	UX	ZX
Casing — flush jointed (see Table 4 and Table 9 to Table 14)	RW	EW	AW	BW	NW	HW	PW	SW	UW	ZW
“WF” design, face discharge core barrel (see Figure 6)	—	—	—	—	—	HWF	PWF	SWF	UWF	ZWF
“WG” design, internal discharge core barrel (see Figure 7 and Figure 8)	—	EWG	AWG	BWG	NWG	HWG	—	—	—	—
“WM” design, internal discharge core barrel ^a (see Figure 9)	—	EWM	AWM	BWM	NWM	—	—	—	—	—
“WT” design, thin wall, internal discharge core barrel (see Figure 10, Figure 11 and Figure 12)	RWT	EWT	AWT	BWT	NWT	HWT	—	—	—	—

^a These may be used with face discharge bits.

Table 2 — Mechanical properties

Component	Tensile strength, R_m , min.	Yield stress, R_e , min.	Percentage elongation after fracture A , min. %
	N/mm ² (MPa)	N/mm ² (MPa)	
Parallel wall rods	620	525	12
Upset or forged ends of rods	500	310	18
Casing and casing coupling sizes R to H	620	525	12
Casing and casing coupling sizes P to Z	500	310	18
Drill-rod couplings and adaptors	700	495	15
All other components	Not specified		

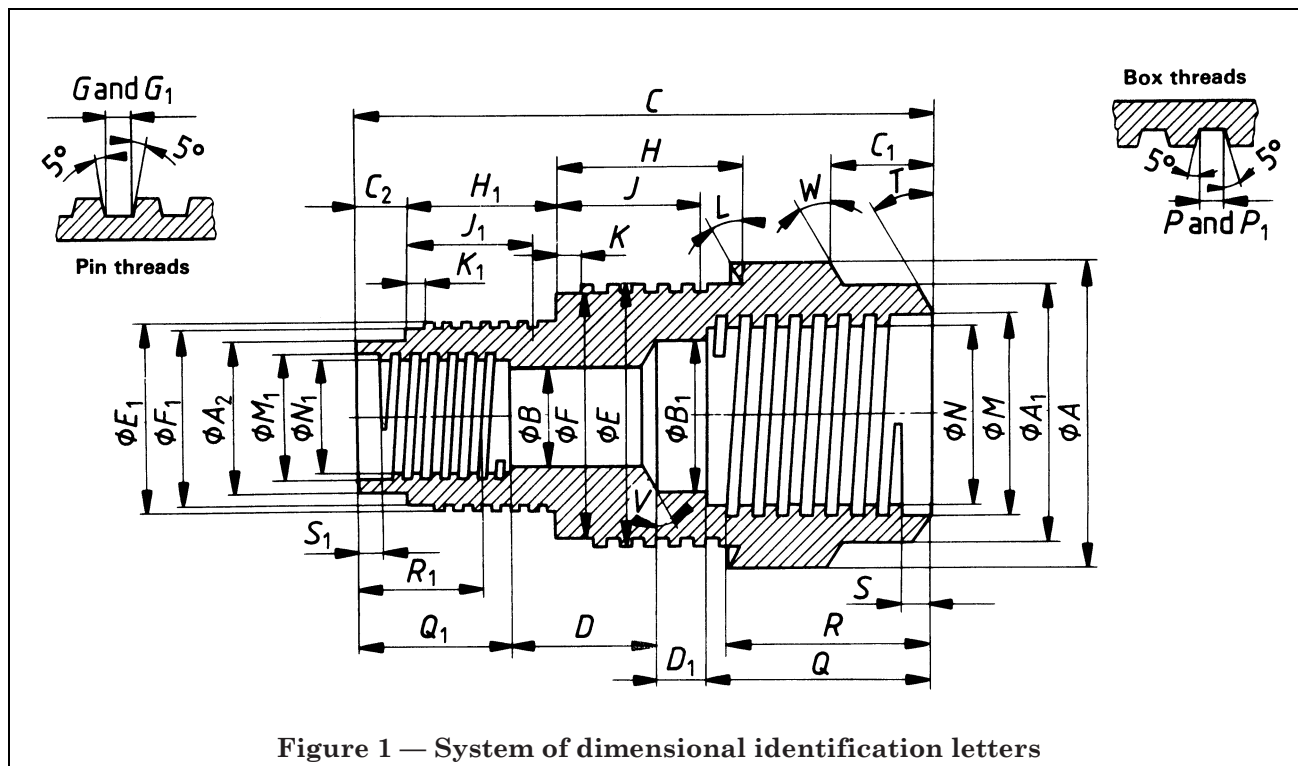


Table 3 — System of dimensional identification letters

<i>A, A₁, etc.</i>	Outside diameters — <i>A</i> being largest; <i>A₁, A₂</i> etc. progressively smaller
<i>B, B₁, etc.</i>	Inside diameters — <i>B</i> being smallest; <i>B₁, B₂</i> , etc. progressively larger
<i>C, C₁, etc.</i>	External lengths — <i>C</i> being longest; <i>C₁, C₂</i> , etc. progressively shorter
<i>D, D₁, etc.</i>	Internal lengths — <i>D</i> being longest; <i>D₁, D₂</i> , etc. progressively shorter
<i>E, E₁, etc.</i>	Major diameter of pin threads — <i>E</i> being largest; <i>E₁, E₂</i> , etc. smaller
<i>F, F₁, etc.</i>	Minor diameter of pin threads <i>F</i> being largest; <i>F₁, F₂</i> , etc. smaller
Thread pitch (Threads per inch)	Pin threads
<i>G, G₁, etc.</i>	Width at root of pin thread
<i>H, H₁, etc.</i>	Length of outside diameter machined for external threading
<i>J, J₁, etc.</i>	Minimum thread length for pin threads
<i>K, K₁, etc.</i>	Length of relief at the starting-point of pin threads
<i>L, L₁, etc.</i>	Angle of bevel for pin thread shoulder
<i>M, M₁, etc.</i>	Major diameter of box threads — <i>M</i> being largest; <i>M₁, M₂</i> , etc. smaller
<i>N, N₁, etc.</i>	Minor diameter of box threads — <i>N</i> being largest; <i>N₁, N₂</i> , etc. smaller
Thread pitch (Threads per inch)	Box threads
<i>P, P₁, etc.</i>	Width at root of box threads
<i>Q, Q₁, etc.</i>	Length of inside diameter machined for internal threading
<i>R, R₁, etc.</i>	Minimum thread length for box threads
<i>S, S₁, etc.</i>	Length of counterbore at the starting-point of box threads
<i>T, T₁, etc.</i>	Angle of bevel for box thread shoulder
<i>U, U₁, etc.</i>	Included angles — internal and external
<i>V, V₁, etc.</i>	Internal angles — not pertaining to threaded connections
<i>W, W₁, etc.</i>	External angles — not pertaining to threaded connections
<i>X</i>	Diamond set dimensions — external diameter
<i>Y</i>	Diamond set dimensions — internal diameter
NOTE The following common abbreviations are sometimes used in tables in the English version for the sake of simplicity: O.D. = outside diameter I.D. = inside diameter.	

Table 4 — Nomenclature and basic dimensions for drill rods and casings and their related diamond set items

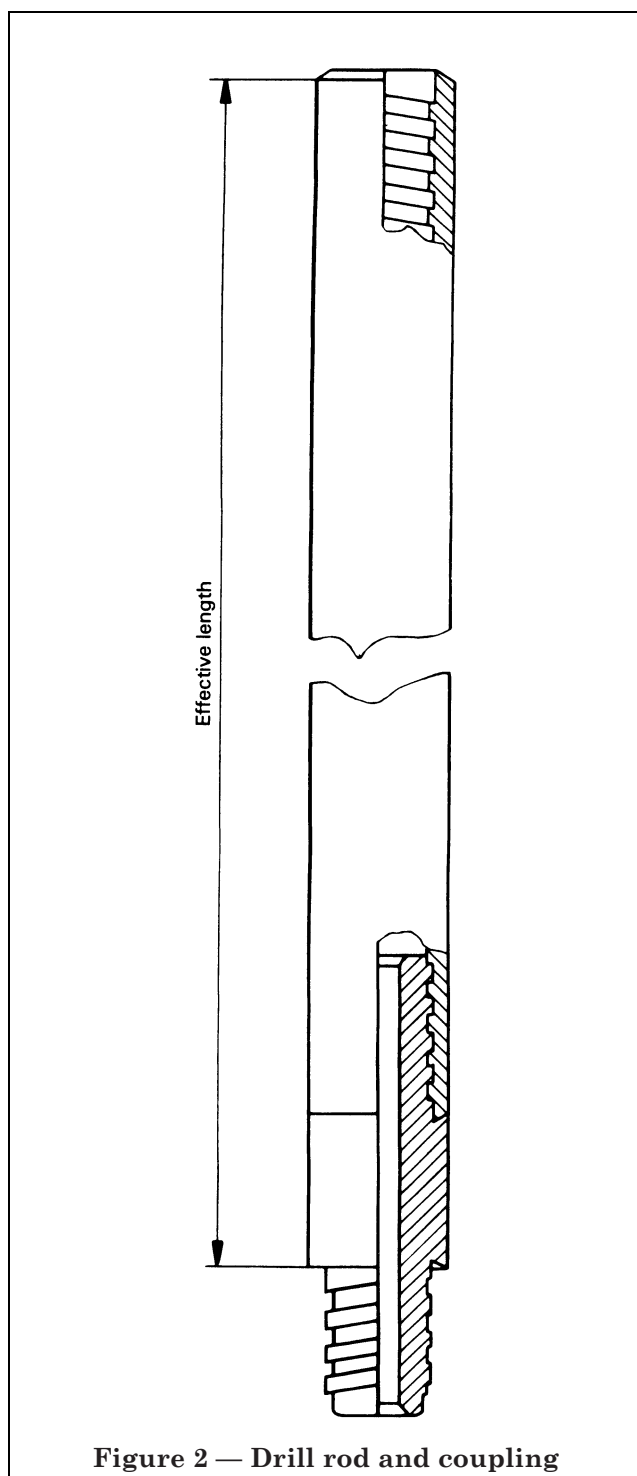
Drill rod	Rod tube	Rod coupling	Casing flush coupling	Casing tube	Casing coupling	Casing flush jointed	Casing		Casing reaming shell	Casing bit		Casing shoe	
	O.D.	I.D.		O.D.	I.D.		O.D.	I.D.	Set O.D.	Set O.D.	Set I.D.	Set O.D.	Set I.D.
RW	27,89 27,76	10,57 10,19	RX	36,63 36,50	30,48 30,23	RW	36,63 36,50	30,48 30,23	not required	37,85 37,59	25,53 25,27	37,85 37,59	30,18 30,05
EW	35,05 34,93	11,35 10,97	EX	46,28 46,02	38,35 38,10	EW	46,28 46,02	38,35 38,10	48,13 47,88	47,75 47,50	35,81 35,56	47,75 47,50	38,02 37,90
AW	43,89 43,64	16,13 15,75	AX	57,40 57,15	48,67 48,41	AW	57,40 57,15	48,67 48,41	60,07 59,82	59,69 59,44	45,34 45,09	59,69 59,44	48,31 48,18
BW	54,23 53,98	19,30 18,92	BX	73,28 73,03	60,58 60,33	BW	73,28 73,03	60,58 60,33	75,82 75,56	75,44 75,18	56,39 56,13	75,44 75,18	60,25 60,12
NW	66,93 66,68	35,18 34,80	NX	89,28 88,90	76,58 76,20	NW	89,28 88,90	76,58 76,20	92,33 92,08	91,95 91,69	72,26 72,01	91,95 91,69	76,12 75,87
HW	89,28 88,90	60,71 60,32	HX	114,68 114,30	100,38 100,00	HW	114,68 114,30	101,60 101,22	not required	117,65 117,27	96,06 95,81	117,65 117,27	99,82 99,57
			PX	140,74 138,66	127,38 123,57	PW	140,74 138,66	127,38 123,57	not required	143,76 143,26	117,86 117,48	143,76 143,26	123,44 123,06
			SX	169,55 167,00	152,45 147,70	SW	169,55 167,00	155,55 151,21	not required	172,72 172,21	143,26 142,88	172,72 172,21	146,94 146,56
			UX	195,12 192,23	179,20 176,20	UW	195,12 192,23	180,54 175,79	not required	198,50 197,74	171,83 171,32	198,50 197,74	175,64 175,13
			ZX	220,73 217,42	205,94 201,60	ZW	220,73 217,42	208,46 203,00	not required	224,16 223,39	197,23 196,72	224,16 223,39	201,04 200,53

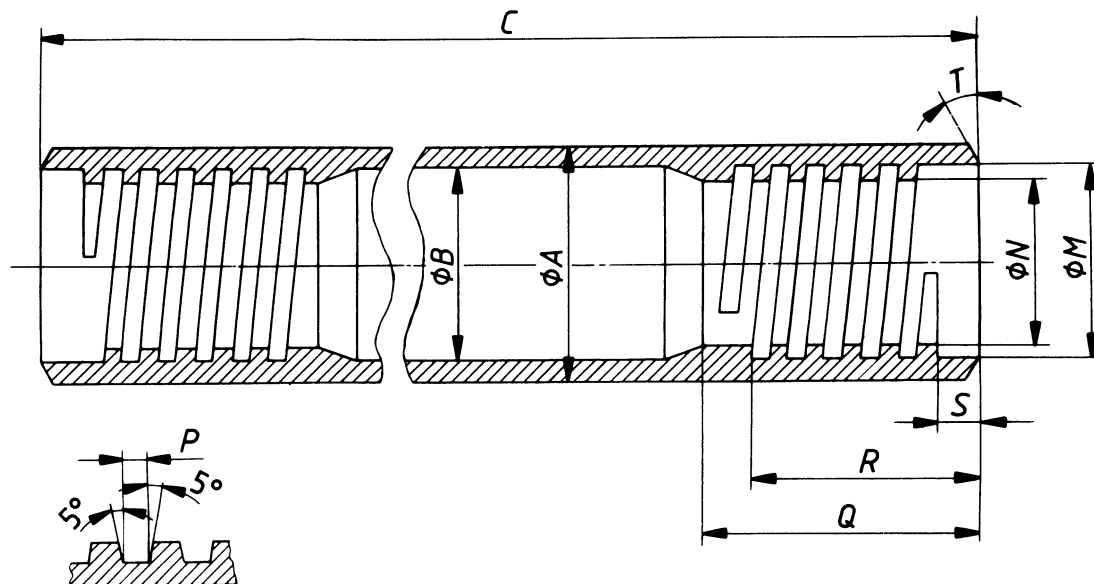
Table 5 — Nomenclature and basic dimensions for core barrels and their related diamond set items

Core barrel designs				Coring bits		Reaming shells	Kerf width mm	Kerf area cm ²	Core area cm ²	Hole area cm ²	Core-to-hole ratio %	Nominal core size	Nominal hole size
WF	WG	WM	WT	Set I.D.	Set O.D.	Set O.D.							
			RWT	18,80 18,54	29,59 29,34	29,97 29,72	5,59	4,25	2,74	6,99	39,1	18,5	30
	EWG	EWM		21,59 21,34	37,46 37,21	37,85 37,59	8,13	7,55	3,62	11,17	32,4	21,5	38
			EWT	23,11 22,86	37,46 37,21	37,85 37,59	7,37	7,03	4,15	11,17	37,1	23	38
	AWG	AWM		30,23 29,97	47,75 47,50	48,13 47,88	8,94	10,99	7,12	18,1	39,3	30	48
			AWT	32,66 32,41	47,75 47,50	48,13 47,88	7,72	9,79	8,32	18,1	45,9	32,5	48
	BWG	BWM		42,16 41,91	59,69 59,44	60,07 59,82	8,94	14,34	13,88	28,22	49,1	42	60
			BWT	44,58 44,32	59,69 59,44	60,07 59,82	7,75	12,7	15,52	28,22	55	44,5	60
	NWG	NWM		54,86 54,61	75,44 75,18	75,82 75,56	10,46	21,46	23,53	44,99	52,2	54,5	76
			NWT	58,88 58,62	75,44 75,18	75,82 75,56	8,46	17,88	27,11	44,99	60	58,5	76
HWF	HWG			76,33 76,07	98,98 98,60	99,36 99,11	11,51	31,74	45,61	77,34	59	76	99
			HWT	81,08 80,82	98,98 98,60	99,36 99,11	9,14	25,88	51,46	77,34	66,5	81	99
PWF				92,33 91,95	120,27 119,76	120,78 120,40	14,22	47,53	66,68	114,21	58,4	92	121
SWF				112,95 112,57	145,67 145,16	146,18 145,80	16,61	67,52	99,86	167,39	59,7	112,5	146
UWF				140,08 139,57	174,12 173,36	174,75 174,24	17,32	85,59	153,56	239,15	64,2	140	175
ZWF				165,48 164,97	199,52 198,76	200,15 199,64	17,32	99,43	214,41	313,84	68,3	165	200

Table 6 — Drill rod and coupling — Main dimensions

Identification symbol	Rod O.D.	Coupling I.D.	Effective lengths (see Figure 2)
RW	27,8	10,4	3 000, 1 500 or 750
EW	35	11,2	
AW	43,8	15,9	
BW	54,1	19,1	
NW	66,8	35	
HW	89,1	60,5	
NOTE 1 Thread may be left-hand if required.			
NOTE 2 For detailed dimensions, see Table 7 and Table 8.			





NOTE Dimensions shown apply to both ends. Not complete without coupling — see Figure 2 and Figure 4.

Figure 3 — “W” design drill rod — Drill rod tube (see Table 7)

Table 7 — “W” design drill rod — Drill rod tube

Dimension		RW	EW	AW	BW	NW	HW
A	max.	27,89	35,05	43,89	54,23	66,93	89,28
	min.	27,76	34,93	43,64	53,98	66,68	88,90
B ^a	max.	18,26	25,4	34,14	44,45	57,15	77,77
C	max.	2 972,57	2 967,23	2 968,12	2 956,44	2 955,93	2 943,61
	min.	2 971,04	2 965,71	2 966,60	2 954,92	2 954,41	2 942,09
M	max.	21,67	27,13	35,05	42,93	56,49	77,06
	min.	21,62	27,08	35,00	42,88	56,44	77,01
N	max.	18,95	23,95	31,88	38,94	51,71	72,24
	min.	18,90	23,90	31,83	38,89	51,66	72,19
Thread pitch (Threads per inch)		6,35 (4)	8,466 (3)	8,466 (3)	8,466 (3)	8,466 (3)	8,466 (3)
P	max.	3,18	4,22	4,22	4,22	4,22	4,22
	min.	3,10	4,11	4,11	4,11	4,11	4,11
Q	min.	39,67	44,45	53,98	63,5	76,2	90,47
R	min.	36,5	39,67	47,63	57,15	69,85	82,55
S	max.	6,6	8,18	9,78	9,78	9,78	9,78
	min.	6,1	7,67	9,27	9,27	9,27	9,27
T		30°	30°	30°	30°	30°	30°

^a The dimension B is a maximum and can apply either to upset end rods or parallel wall rods for the RW size only. For all other sizes, this dimension refers to upset end rods only.

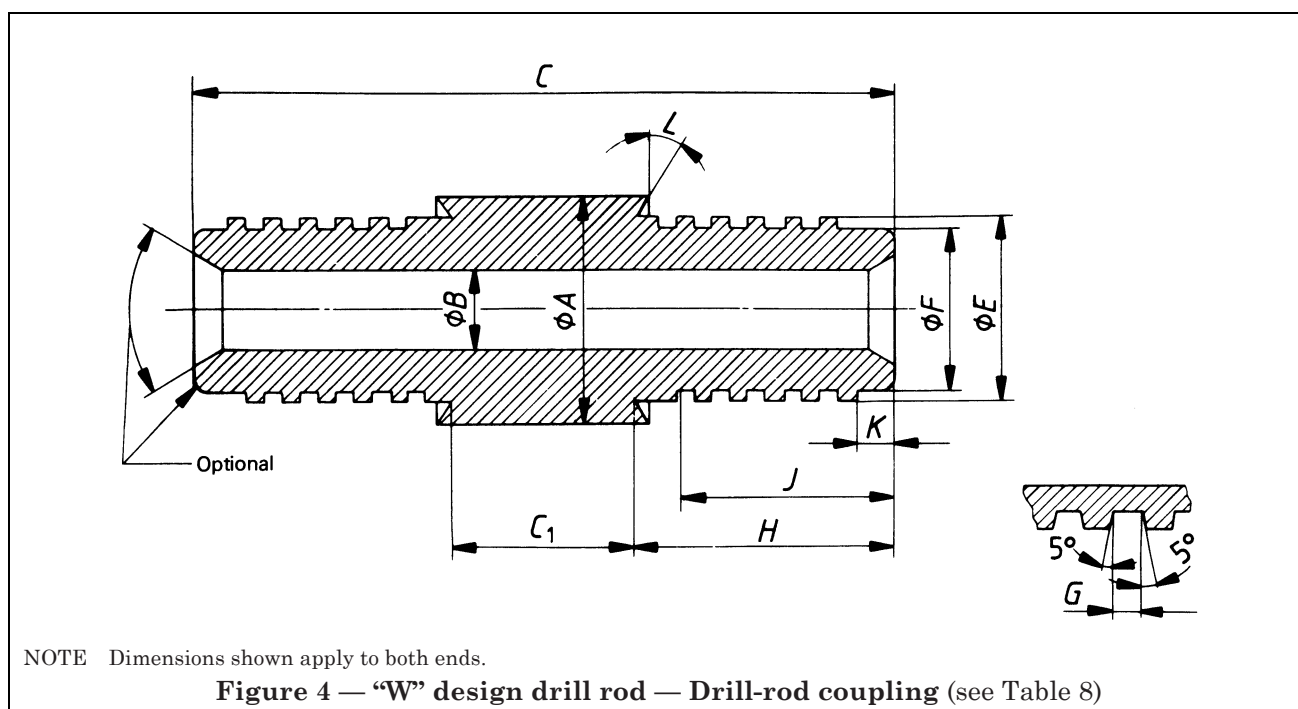


Table 8 — “W” design drill rod — Drill-rod coupling

Dimension		RW	EW	AW	BW	NW	HW
A	max.	27,89	35,05	43,89	54,23	66,93	89,28
	min.	27,69	34,85	43,54	53,87	66,55	88,77
B	max.	10,57	11,35	16,13	19,30	35,18	60,71
	min.	10,19	10,97	15,75	18,92	34,80	60,32
C	ref.	95,25	117,48	133,35	165,1	190,5	228,6
C ₁	max.	28,45	33,78	32,89	44,58	45,08	57,4
	min.	27,94	33,27	32,39	44,07	44,58	56,9
E	max.	21,56	26,97	34,90	42,77	56,34	76,91
	min.	21,51	26,92	34,85	42,72	56,29	76,86
F	max.	18,85	23,80	31,72	38,79	51,56	72,09
	min.	18,72	23,67	31,60	38,66	51,44	71,96
Thread pitch (Threads per inch)		6,35 (4)	8,466 (3)	8,466 (3)	8,466 (3)	8,466 (3)	8,466 (3)
G	max.	3,18	4,22	4,22	4,22	4,22	4,22
	min.	3,10	4,11	4,11	4,11	4,11	4,11
H	max.	33,78	42,21	50,65	60,63	73,08	84,43
	min.	33,27	41,71	50,14	60,12	72,57	83,92
J	min.	28,58	36,5	44,45	53,98	66,68	79,38
K	max.	1,83	5,0	6,6	8,18	9,78	9,78
	min.	1,32	4,5	6,1	7,67	9,27	9,27
L		30°	30°	30°	30°	30°	30°

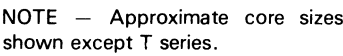


Figure 5 — General relation of casing to core bit

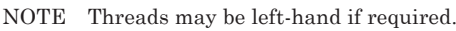


Figure 6 — Casing (see Table 9)

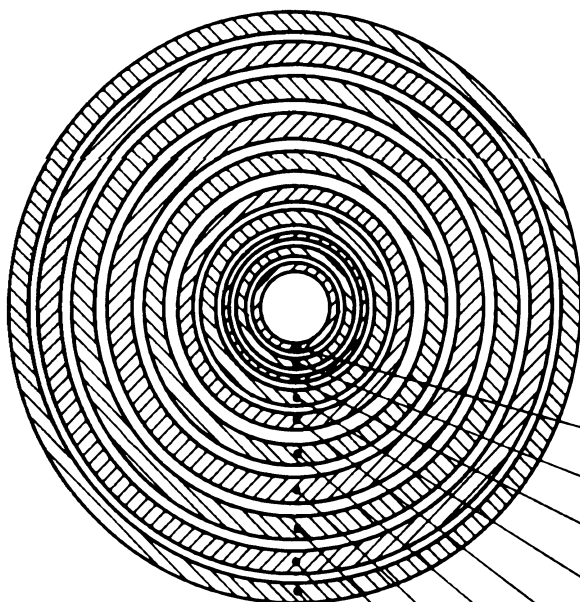


Table 9 — Casing and casing coupling (where used) — Main dimensions

Identification symbol	Outside diameter max.	Inside diameter min.	Effective lengths (see figure 6)
RX RW	36,63	30,23	3 000, 1 500 or 750
EX EW	46,28	38,1	
AX AW	57,4	48,41	
BX BW	73,28	60,33	
NX NW	89,28	76,2	
HX HW	114,68	100	
PX PW	140,74	123,57	
SX SW	169,55	147,7	
UX UW	195,12	176,2	
ZX ZW	220,73	201,6	

Figure 7 — Nesting of casing (see Table 9)

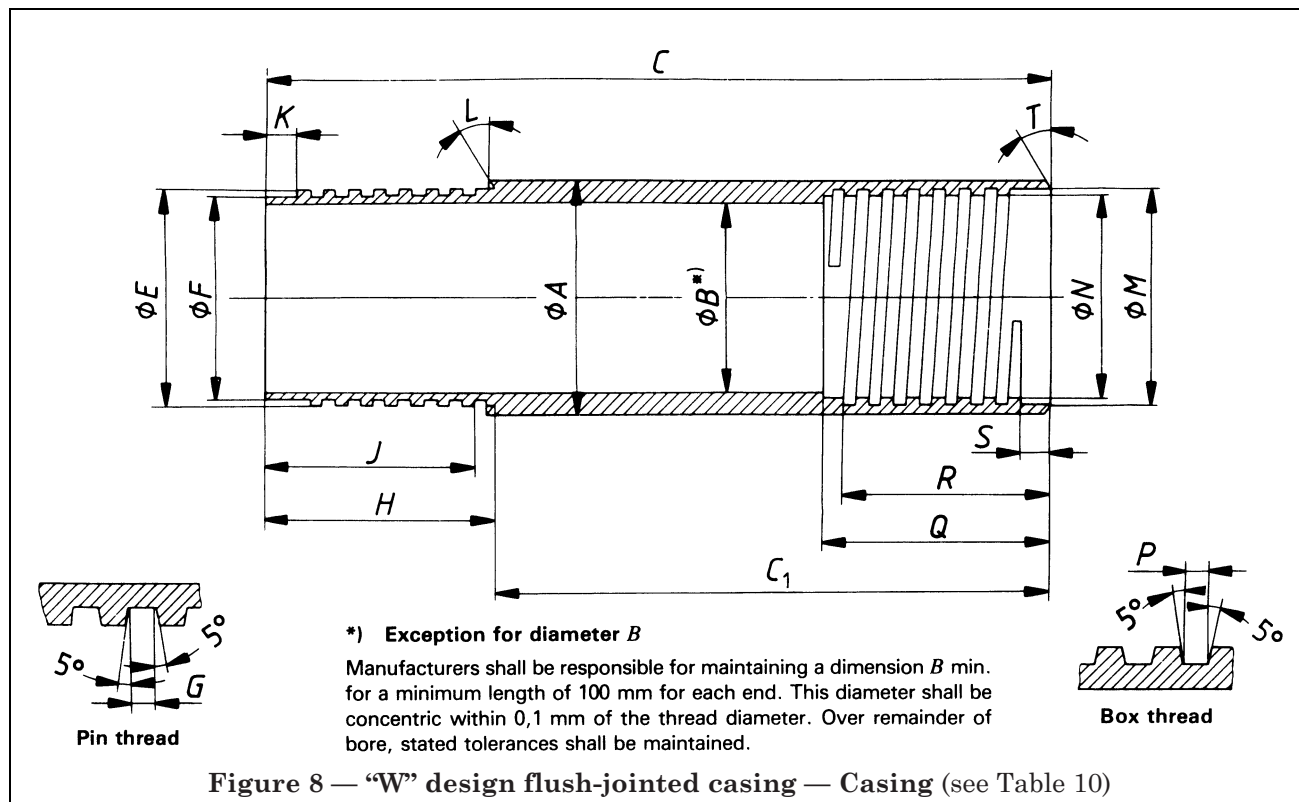


Table 10 — “W” design flush-jointed casing — Casing

Dimension		RW	EW	AW	BW	NW	HW	PW	SW	UW	ZW
<i>A</i>	max. min.	36,63 36,50	46,28 46,02	57,40 57,15	73,28 73,03	89,28 88,90	114,68 114,30	140,74 138,66	169,55 167,00	195,12 192,23	220,73 217,42
<i>B^a</i>	max. min.	30,48 30,23	38,35 38,10	48,67 48,41	60,58 60,33	76,58 76,20	101,60 101,22	127,38 123,57	155,55 151,21	180,54 175,79	208,46 203,00
<i>C</i>	max. (ref.) min. (ref.)	3 045,52 3 043,23	3 051,87 3 049,58	3 058,22 3 055,93	3 064,57 3 062,28	3 070,92 3 068,63	3 077,27 3 074,98	3 083,62 3 081,33	3 089,97 3 087,68	3 096,32 3 094,03	3 102,67 3 100,38
<i>C₁</i>	max. min.	3 001,19 2 998,78	3 001,19 2 998,78	3 001,19 2 998,78	3 001,19 2 998,78	3 001,19 2 998,78	3 001,19 2 998,78	3 001,19 2 998,78	3 001,19 2 998,78	3 001,19 2 998,78	3 001,19 2 998,78
<i>E</i>	max. min.	34,19 34,11	43,38 43,31	54,1 54,0	68,00 67,89	84,0 83,9	109,14 109,02	134,59 134,47	162,84 162,71	188,26 188,11	214,81 214,66
<i>F</i>	max. min.	32,61 32,56	41,07 41,02	51,79 51,71	65,68 65,61	81,69 81,61	106,86 106,76	131,55 131,45	159,79 159,69	184,43 184,30	210,97 210,85
Thread pitch (Threads per inch)		5,08 (5)	6,35 (4)	6,35 (4)	6,35 (4)	6,35 (4)	6,35 (4)	8,466 (3)	8,466 (3)	12,7 (2)	12,7 (2)
<i>G</i>	max. min.	2,64 2,54	3,25 3,15	3,25 3,15	3,25 3,15	3,25 3,15	3,25 3,15	4,29 4,19	4,29 4,19	6,4 6,3	6,4 6,3
<i>H</i>	max. min.	44,45 44,32	50,80 50,67	57,15 57,02	63,50 63,37	69,85 69,72	76,20 76,07	82,55 82,42	88,90 88,77	95,25 95,12	101,60 101,47
<i>J</i>	min.	41,28	47,62	53,98	60,33	66,68	73,02	79,38	85,73	92,08	98,43
<i>K</i>	max. min.	6,6 6,1	7,62 7,11	7,62 7,11	7,62 7,11	7,62 7,11	7,62 7,11	9,14 8,64	9,14 8,64	11,18 10,67	11,18 10,67
<i>L</i>		15°	15°	15°	15°	15°	15°	15°	15°	15°	15°
<i>M</i>	max. min.	34,34 34,26	43,54 43,46	54,31 54,20	68,2 68,1	84,2 84,1	109,42 109,30	134,87 134,75	163,12 162,99	188,62 188,47	215,16 215,01
<i>N</i>	max. min.	32,72 32,66	41,17 41,12	51,94 51,87	65,84 65,76	81,84 81,76	107,06 106,96	131,75 131,65	159,99 159,89	184,68 184,56	211,23 211,10
Thread pitch (Threads per inch)		5,08 (5)	6,35 (4)	6,35 (4)	6,35 (4)	6,35 (4)	6,35 (4)	8,466 (3)	8,466 (3)	12,7 (2)	12,7 (2)
<i>P</i>	max. min.	2,64 2,54	3,25 3,15	3,25 3,15	3,25 3,15	3,25 3,15	3,25 3,15	4,29 4,19	4,29 4,19	6,4 6,3	6,4 6,3
<i>Q</i>	max. min.	44,58 44,45	50,93 50,80	57,28 57,15	63,63 63,50	69,98 69,85	76,33 76,20	82,68 82,55	89,03 88,90	95,38 95,25	101,73 101,60
<i>R</i>	min.	41,28	47,63	53,98	60,33	66,68	73,03	79,38	85,73	92,08	98,43
<i>S</i>	max. min.	6,6 6,1	7,62 7,11	7,62 7,11	7,62 7,11	7,62 7,11	7,62 7,11	9,14 8,64	9,14 8,64	11,18 10,67	11,18 10,67
<i>T</i>		15°	15°	15°	15°	15°	15°	15°	15°	15°	15°

^a See note in Figure 8.

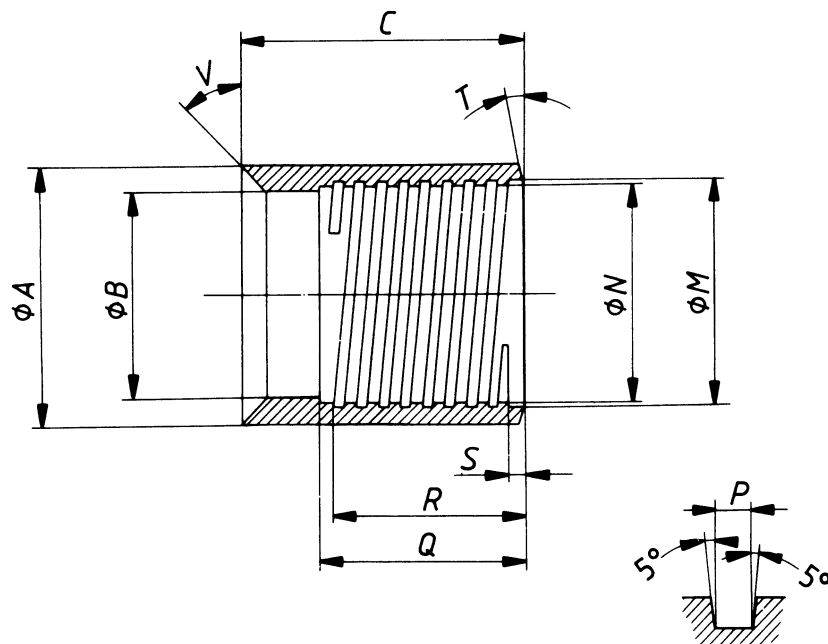


Figure 9 — “W” design flush-jointed casing — Casing drive shoe (see Table 11)

Table 11 — “W” design flush-jointed casing — Casing drive shoe

Dimension		RW	EW	AW	BW	NW	HW	PW	SW	UW	ZW
A	max.	37,47	47,75	59,56	75,31	92,66	118,06	144,02	172,59	197,99	223,14
	min.	37,21	47,50	58,73	74,63	91,90	117,30	142,49	171,07	196,47	221,36
B	max.	30,23	38,10	48,38	60,33	76,20	101,22	123,57	151,21	175,79	203,00
	min.	30,10	37,97	48,26	60,20	75,95	100,84	123,06	150,44	175,03	202,23
C	min.	95,25	101,6	107,95	114,3	120,65	165,1	171,45	177,8	184,15	190,5
M	max.	34,34	43,54	54,31	68,2	84,2	109,42	134,87	163,12	188,62	215,16
	min.	34,26	43,46	54,20	68,1	84,1	109,30	134,75	162,99	188,47	215,01
N	max.	32,72	41,17	51,94	65,84	81,84	107,06	131,75	159,99	184,68	211,23
	min.	32,66	41,12	51,87	65,76	81,76	106,96	131,65	159,89	184,56	211,10
Thread pitch (Threads per inch)		5,08 (5)	6,35 (4)	6,35 (4)	6,35 (4)	6,35 (4)	6,35 (4)	8,466 (3)	8,466 (3)	12,7 (2)	12,7 (2)
P	max.	2,64	3,25	3,25	3,25	3,25	3,25	4,29	4,29	6,4	6,4
	min.	2,54	3,15	3,15	3,15	3,15	3,15	4,19	4,19	6,3	6,3
Q	max.	44,58	50,93	57,28	63,63	69,98	76,33	82,68	89,03	95,38	101,73
	min.	44,45	50,80	57,15	63,50	69,85	76,20	82,55	88,90	95,25	101,60
R	min.	41,28	47,63	53,98	60,33	66,68	73,03	79,38	85,73	92,08	98,43
S	max.	6,6	7,62	7,62	7,62	7,62	7,62	9,14	9,14	11,18	11,18
	min.	6,1	7,11	7,11	7,11	7,11	7,11	8,64	8,64	10,67	10,67
T		15°	15°	15°	15°	15°	15°	15°	15°	15°	15°
V		Optional									

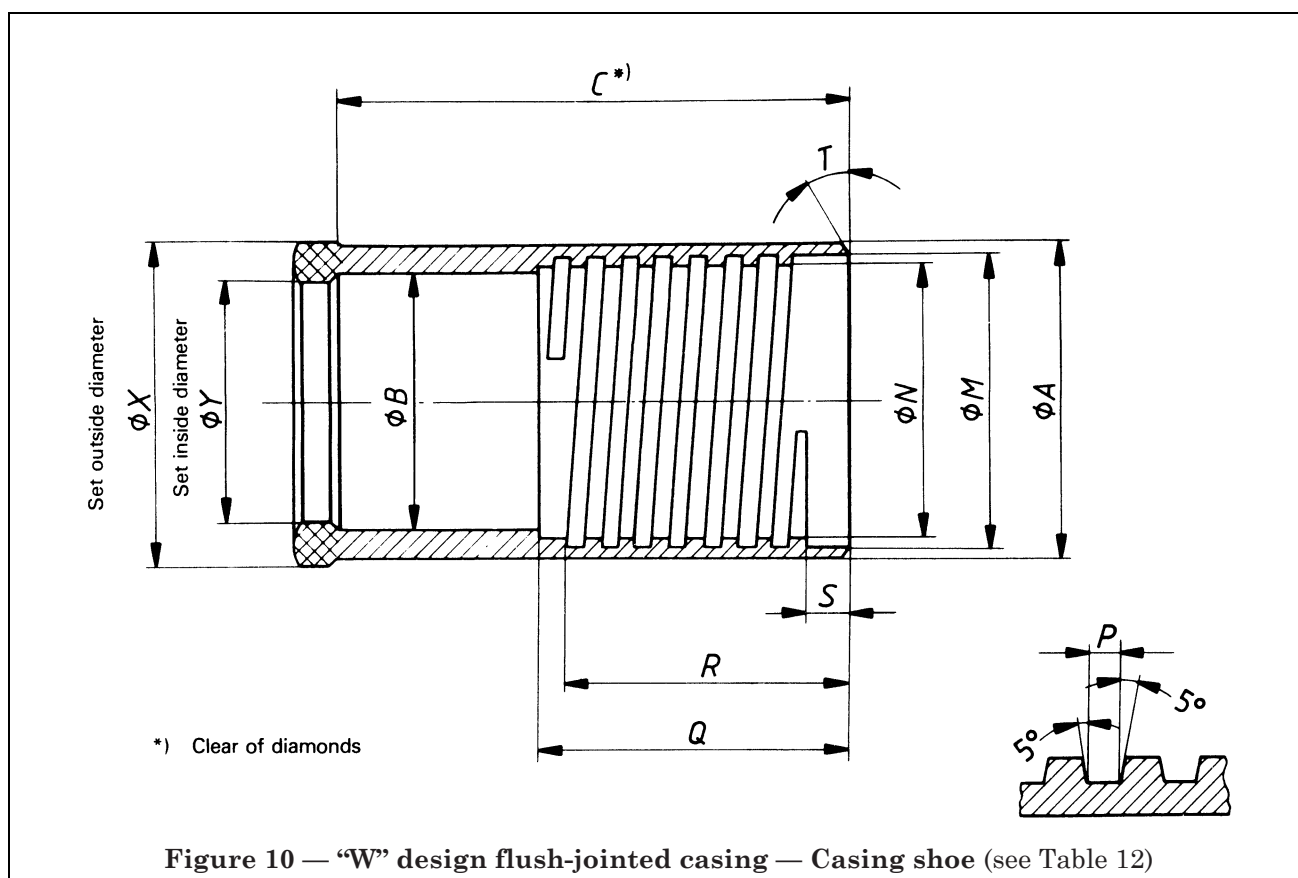


Figure 10 — “W” design flush-jointed casing — Casing shoe (see Table 12)

Table 12 — “W” design flush-jointed casing — Casing shoe

Dimension		RW	EW	AW	BW	NW	HW	PW	SW	UW	ZW
A	max.	36,98	46,53	58,34	73,96	90,47	115,93	141,33	169,90	195,30	220,70
	min.	36,88	46,43	58,24	73,86	90,37	115,82	141,17	169,75	195,07	220,47
B	max.	30,73	38,61	48,92	60,83	76,96	100,84	124,08	148,26	177,22	202,62
	min.	30,23	38,10	48,41	60,33	76,20	100,08	123,57	147,50	176,20	201,60
C	min.	82,55	88,9	95,25	107,95	114,3	127	133,35	146,05	152,4	158,75
M	max.	34,34	43,54	54,31	68,2	84,2	109,42	134,87	163,12	188,62	215,16
	min.	34,26	43,46	54,20	68,1	84,1	109,30	134,75	162,99	188,47	215,01
N	max.	32,72	41,17	51,94	65,84	81,84	107,06	131,75	159,99	184,68	211,23
	min.	32,66	41,12	51,87	65,76	81,76	106,96	131,65	159,89	184,56	211,10
Thread pitch (Threads per inch)		5,08 (5)	6,35 (4)	6,35 (4)	6,35 (4)	6,35 (4)	6,35 (4)	8,466 (3)	8,466 (3)	12,7 (2)	12,7 (2)
P	max.	2,64	3,25	3,25	3,25	3,25	3,25	4,29	4,29	6,4	6,4
	min.	2,54	3,15	3,15	3,15	3,15	3,15	4,19	4,19	6,3	6,3
Q	max.	44,58	50,93	57,28	63,63	69,98	76,33	82,68	89,03	95,38	101,73
	min.	44,45	50,80	57,15	63,50	69,85	76,20	82,55	88,90	95,25	101,60
R	min.	41,28	47,63	53,98	60,33	66,68	73,03	79,38	85,73	92,08	98,43
S	max.	6,6	7,62	7,62	7,62	7,62	7,62	9,14	9,14	11,18	11,18
	min.	6,1	7,11	7,11	7,11	7,11	7,11	8,64	8,64	10,67	10,67
T		15°	15°	15°	15°	15°	15°	15°	15°	15°	15°
X	max.	37,85	47,75	59,69	75,44	91,95	117,65	143,76	172,72	198,50	224,16
	min.	37,59	47,50	59,44	75,18	91,69	117,27	143,26	172,21	197,74	223,39
Y	max.	30,18	38,02	48,31	60,25	76,12	99,82	123,44	146,94	175,64	201,04
	min.	30,05	37,90	48,18	60,12	75,87	99,57	123,06	146,56	175,13	200,53

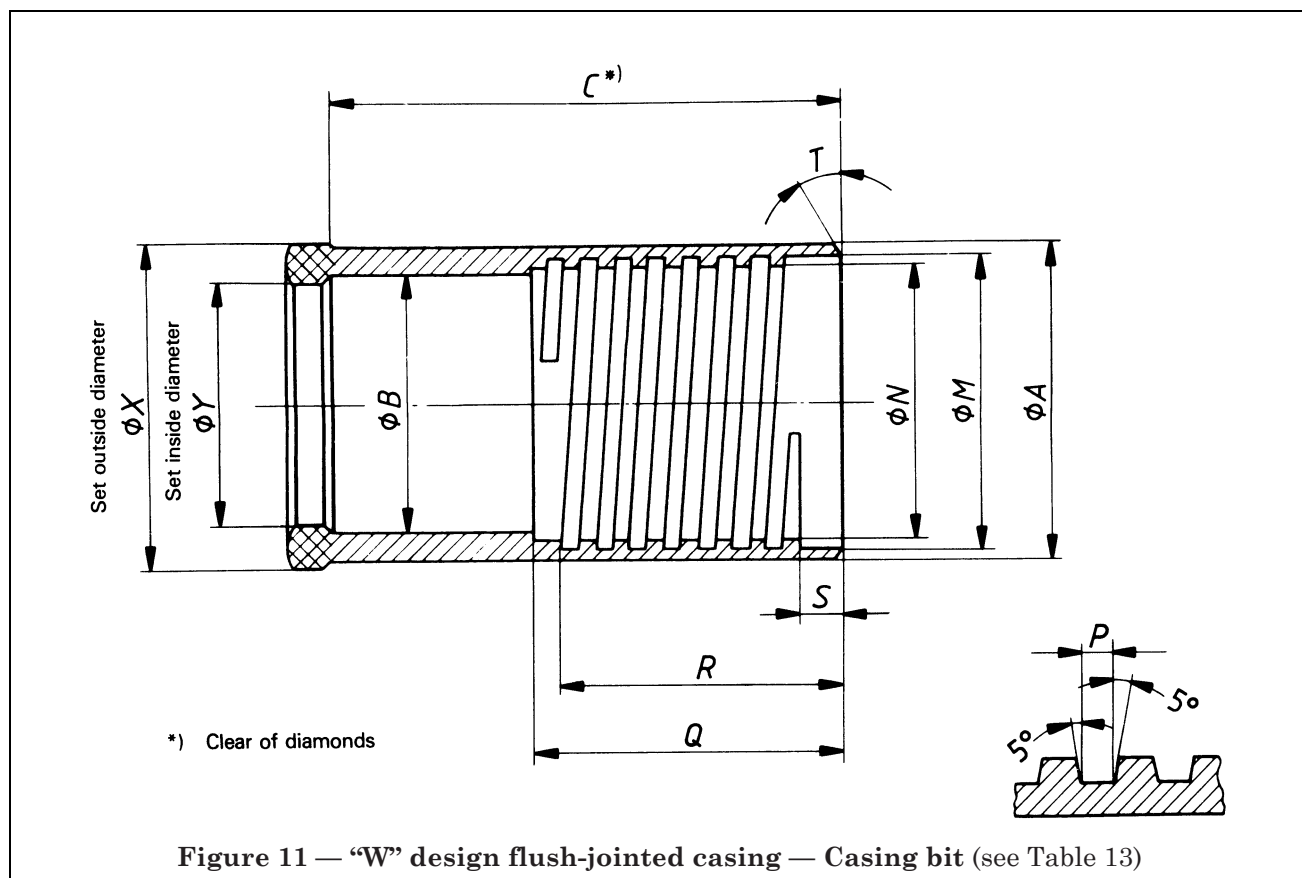


Table 13 — “W” design flush-jointed casing — Casing bit

Dimension		RW	EW	AW	BW	NW	HW	PW	SW	UW	ZW
A	max.	36,98	46,53	58,34	73,96	90,47	115,93	141,33	169,90	195,30	220,70
	min.	36,88	46,43	58,24	73,86	90,37	115,82	141,17	169,75	195,07	220,47
B	max.	26,54	37,21	46,74	57,86	73,74	98,35	120,65	146,05	175,13	200,53
	min.	26,04	36,45	45,97	57,10	72,97	97,33	119,38	144,78	173,61	199,01
C	min.	82,55	88,9	95,25	107,95	114,3	127	133,35	146,05	152,4	158,75
M	max.	34,34	43,54	54,31	68,2	84,2	109,42	134,87	163,12	188,62	215,16
	min.	34,26	43,46	54,20	68,1	84,1	109,30	134,75	162,99	188,47	215,01
N	max.	32,72	41,17	51,94	65,84	81,84	107,06	131,75	159,99	184,68	211,23
	min.	32,66	41,12	51,87	65,76	81,76	106,96	131,65	159,89	184,56	211,10
Thread pitch (Threads per inch)		5,08 (5)	6,35 (4)	6,35 (4)	6,35 (4)	6,35 (4)	6,35 (4)	8,466 (3)	8,466 (3)	12,7 (2)	12,7 (2)
P	max.	2,64	3,25	3,25	3,25	3,25	3,25	4,29	4,29	6,4	6,4
	min.	2,54	3,15	3,15	3,15	3,15	3,15	4,19	4,19	6,3	6,3
Q	max.	44,58	50,93	57,28	63,63	69,98	76,33	82,68	89,03	95,38	101,73
	min.	44,45	50,80	57,15	63,50	69,85	76,20	82,55	88,90	95,25	101,60
R	min.	41,28	47,63	53,98	60,33	66,68	73,03	79,38	85,73	92,08	98,43
S	max.	6,6	7,62	7,62	7,62	7,62	7,62	9,14	9,14	11,18	11,18
	min.	6,1	7,11	7,11	7,11	7,11	7,11	8,64	8,64	10,67	10,67
T		15°	15°	15°	15°	15°	15°	15°	15°	15°	15°
X	max.	37,85	47,75	59,69	75,44	91,95	117,65	143,76	172,72	198,50	224,16
	min.	37,59	47,50	59,44	75,18	91,69	117,27	143,26	172,21	197,74	223,39
Y	max.	25,53	35,81	45,34	56,39	72,26	96,06	117,86	143,26	171,83	197,23
	min.	25,27	35,56	45,09	56,13	72,01	95,81	117,48	142,88	171,32	196,72

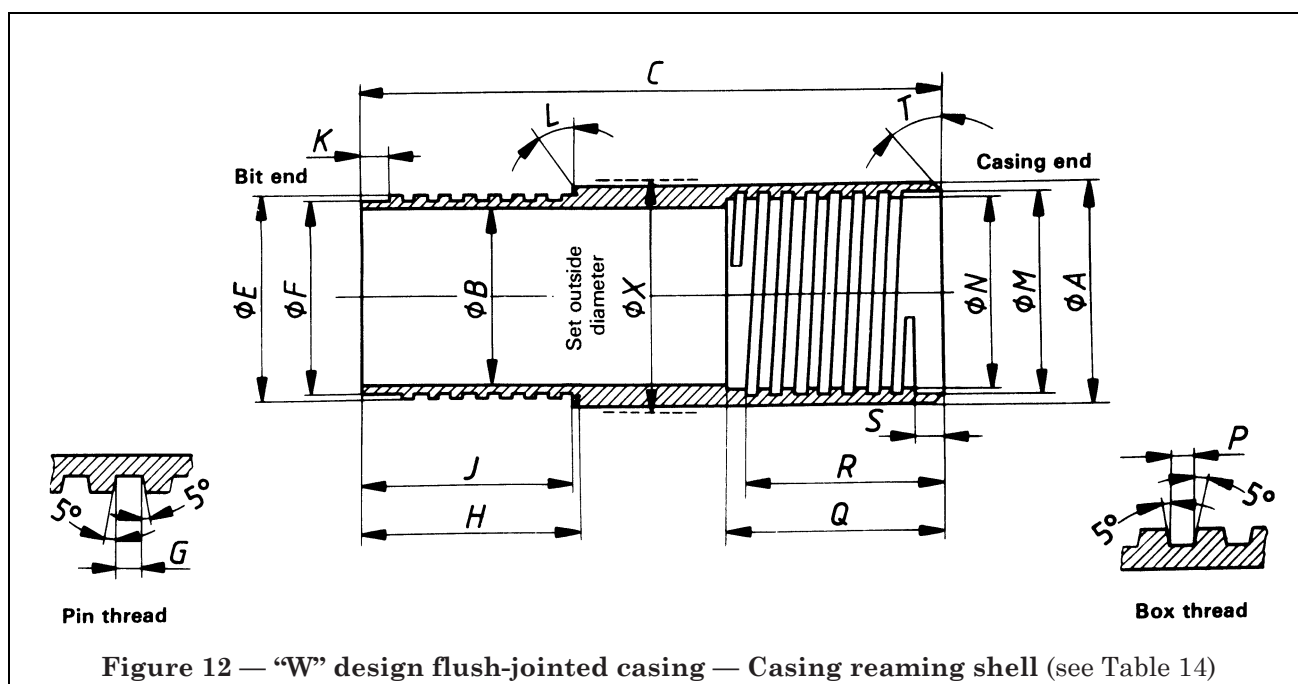
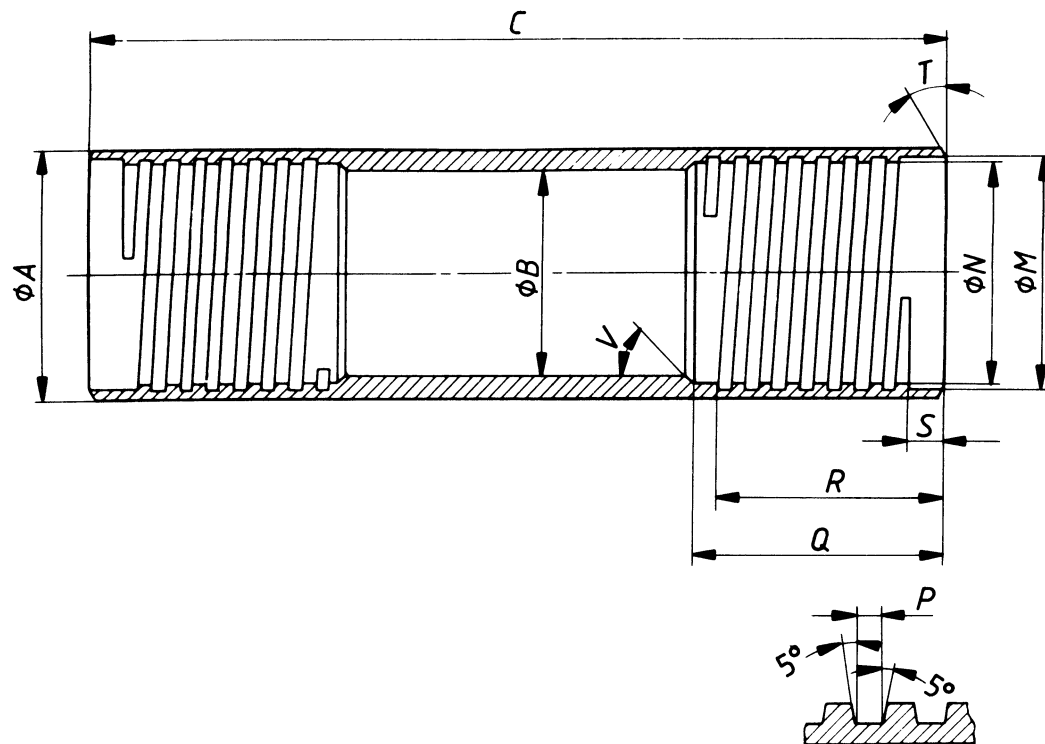


Table 14 — “W” design flush-jointed casing — Casing reaming shell

Dimension		EW	AW	BW	NW
A	max.	46,53	58,34	73,96	90,47
	min.	46,43	58,24	73,86	90,37
B	max.	38,35	48,67	60,58	76,58
	min.	38,10	48,41	60,33	76,20
C	min.	139,7	152,4	171,45	184,15
E	max.	43,38	54,1	68,00	84,0
	min.	43,31	54,0	67,89	83,9
F	max.	41,07	51,79	65,68	81,69
	min.	41,02	51,71	65,61	81,61
Thread pitch (Threads per inch)		6,35 (4)	6,35 (4)	6,35 (4)	6,35 (4)
G	max.	3,25	3,25	3,25	3,25
	min.	3,15	3,15	3,15	3,15
H	max.	50,80	57,15	63,50	69,85
	min.	50,67	57,02	63,37	69,72
J	min.	47,62	53,98	60,32	66,68
K	max.	7,62	7,62	7,62	7,62
	min.	7,11	7,11	7,11	7,11
L		15°	15°	15°	15°
M	max.	43,54	54,31	68,2	84,2
	min.	43,46	54,20	68,1	84,1
N	max.	41,17	51,94	65,84	81,84
	min.	41,12	51,87	65,76	81,76
Thread pitch (Threads per inch)		6,35 (4)	6,35 (4)	6,35 (4)	6,35 (4)
P	max.	3,25	3,25	3,25	3,25
	min.	3,15	3,15	3,15	3,15
Q	max.	50,93	57,28	63,63	69,98
	min.	50,80	57,15	63,50	69,85
R	min.	47,63	53,98	60,33	66,68
S	max.	7,62	7,62	7,62	7,62
	min.	7,11	7,11	7,11	7,11
T		15°	15°	15°	15°
X	max.	48,13	60,07	75,82	92,33
	min.	47,88	59,82	75,56	92,08



NOTE Dimensions shown apply to both ends.

Figure 13 — “X” design flush-coupled casing — Casing tube (see Table 15)

Table 15 — “X” design flush-coupled casing — Casing tube

Dimension		RX	EX	AX	BX	NX	HX	PX	SX	UX	ZX
A	max.	36,63	46,28	57,40	73,28	89,28	114,68	140,74	169,55	195,12	220,73
	min.	36,50	46,02	57,15	73,03	88,90	114,30	138,66	167,00	192,23	217,42
B	max.	30,48	41,28	50,80	65,07	80,95	104,78	130,51	158,80	184,00	208,99
	min.	30,23	41,02	50,55	64,82	80,57	104,39	125,30	151,21	175,79	203,00
C	max.	2 946,76	2 964,19	2 926,54	2 914,81	2 914,81	2 902,72	2 900,94	2 888,19	2 875,74	2 862,48
	min.	2 945,24	2 962,66	2 925,02	2 913,28	2 913,28	2 901,19	2 899,42	2 886,67	2 874,02	2 860,96
M	max.	34,32	43,71	54,05	68,33	84,20	108,48	133,65	162,03	187,76	212,75
	min.	34,26	43,66	54,00	68,28	84,15	108,38	133,53	161,85	187,58	212,57
N	max.	32,79	42,14	52,45	65,94	81,81	106,05	131,24	159,56	184,81	209,80
	min.	32,74	42,09	52,40	65,89	81,76	105,97	131,14	159,46	184,68	209,68
Thread pitch (Threads per inch)		3,175 (8)	3,175 (8)	3,175 (8)	3,175 (8)	3,175 (8)	5,08 (5)	5,08 (5)	5,08 (5)	6,35 (4)	6,35 (4)
P	max.	1,63	1,63	1,63	1,60	1,60	2,59	2,57	2,57	3,18	3,18
	min.	1,55	1,55	1,55	1,52	1,52	2,51	2,46	2,46	3,07	3,07
Q	min.	25,4	50,8	57,15	60,33	66,68	63,5	69,85	76,2	82,55	88,9
R	min.	23,8	47,63	53,98	57,15	63,50	57,15	66,68	73,03	79,38	85,73
S	max.	3,43	6,6	6,6	6,6	6,6	8,13	9,78	9,78	9,78	9,78
	min.	2,95	6,1	6,1	6,1	6,1	7,62	9,27	9,27	9,27	9,27
T		0°	30°	30°	30°	30°	30°	15°	15°	15°	15°
V		—	—	does not apply		—	—	30°	30°	30°	30°

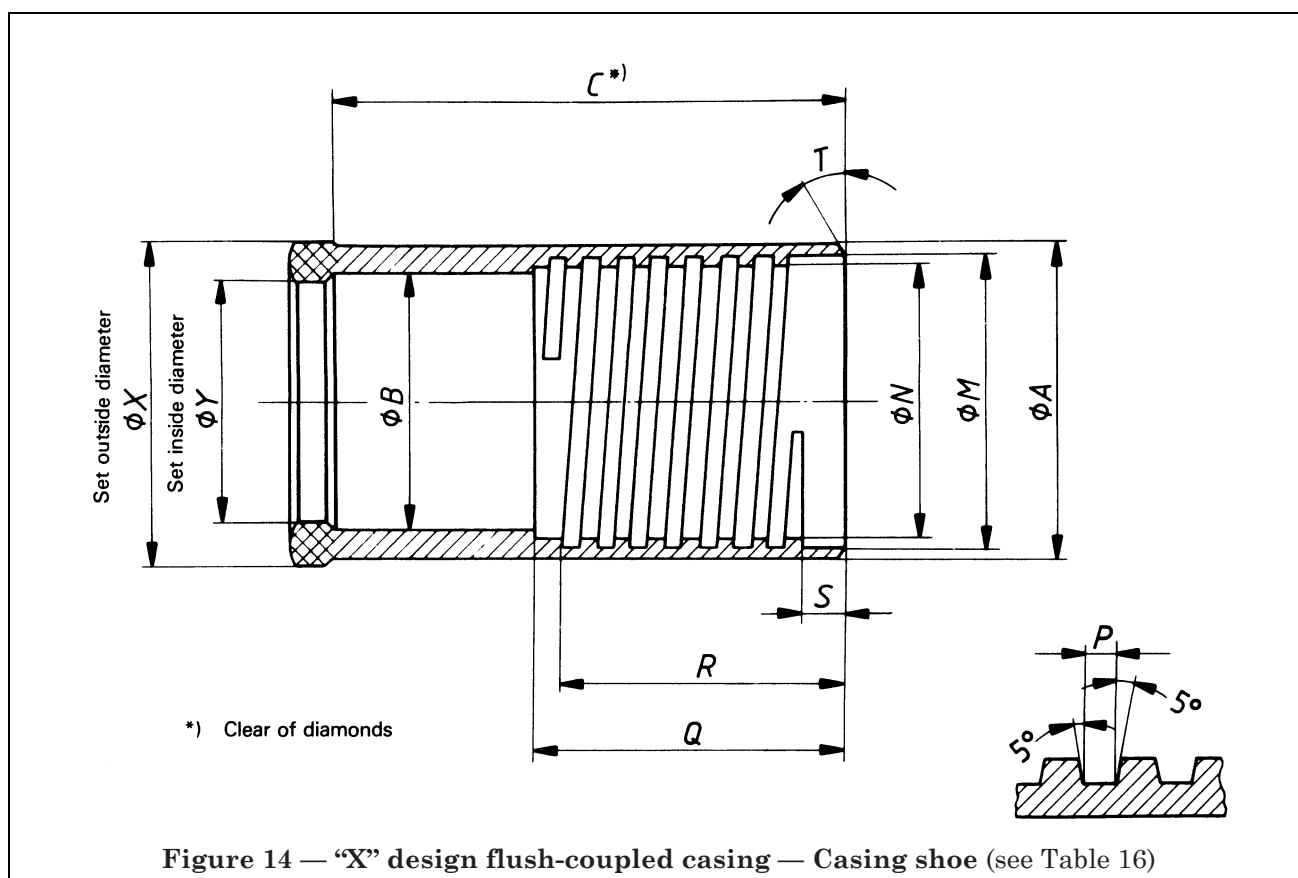


Table 16 — “X” design flush-coupled casing — Casing shoe

Dimension		RX	EX	AX	BX	NX	HX	PX	SX	UX	ZX
A	max.	36,98	46,53	58,34	73,96	90,47	115,93	141,33	169,90	195,30	220,70
	min.	36,88	46,43	58,24	73,86	90,37	115,82	141,17	169,75	195,07	220,47
B	max.	30,73	38,61	48,92	60,83	76,96	100,84	124,08	148,26	177,22	202,62
	min.	30,23	38,10	48,41	60,33	76,20	100,08	123,57	147,50	176,20	201,60
C	min.	63,5	88,9	95,25	104,78	111,13	114,3	133,35	146,05	152,4	158,75
M	max.	34,32	43,71	54,05	68,33	84,20	108,48	133,65	162,03	187,76	212,75
	min.	34,26	43,66	54,00	68,28	84,15	108,38	133,53	161,85	187,58	212,57
N	max.	32,79	42,14	52,45	65,94	81,81	106,05	131,24	159,56	184,81	209,80
	min.	32,74	42,09	52,40	65,89	81,76	105,97	131,14	159,46	184,68	209,68
Thread pitch (Threads per inch)		3,175 (8)	3,175 (8)	3,175 (8)	3,175 (8)	3,175 (8)	5,08 (5)	5,08 (5)	5,08 (5)	6,35 (4)	6,35 (4)
P	max.	1,63	1,63	1,63	1,60	1,60	2,59	2,57	2,57	3,18	3,18
	min.	1,55	1,55	1,55	1,52	1,52	2,51	2,46	2,46	3,07	3,07
Q	min.	25,4	50,8	57,15	60,33	66,68	63,5	69,85	76,2	82,55	88,9
R	min.	23,8	47,63	53,98	57,15	63,5	57,15	66,68	73,03	79,38	85,73
S	max.	3,43	6,6	6,6	6,6	6,6	8,13	9,78	9,78	9,78	9,78
	min.	2,95	6,1	6,1	6,1	6,1	7,62	9,27	9,27	9,27	9,27
T		0°	30°	30°	30°	30°	30°	15°	15°	15°	15°
X	max.	37,85	47,75	59,69	75,44	91,95	117,65	143,76	172,72	198,50	224,16
	min.	37,59	47,50	59,44	75,18	91,69	117,27	143,26	172,21	197,74	223,39
Y	max.	30,18	38,02	48,31	60,25	76,12	99,82	123,44	146,94	175,64	201,04
	min.	30,05	37,90	48,18	60,12	75,87	99,57	123,06	146,56	175,13	200,53

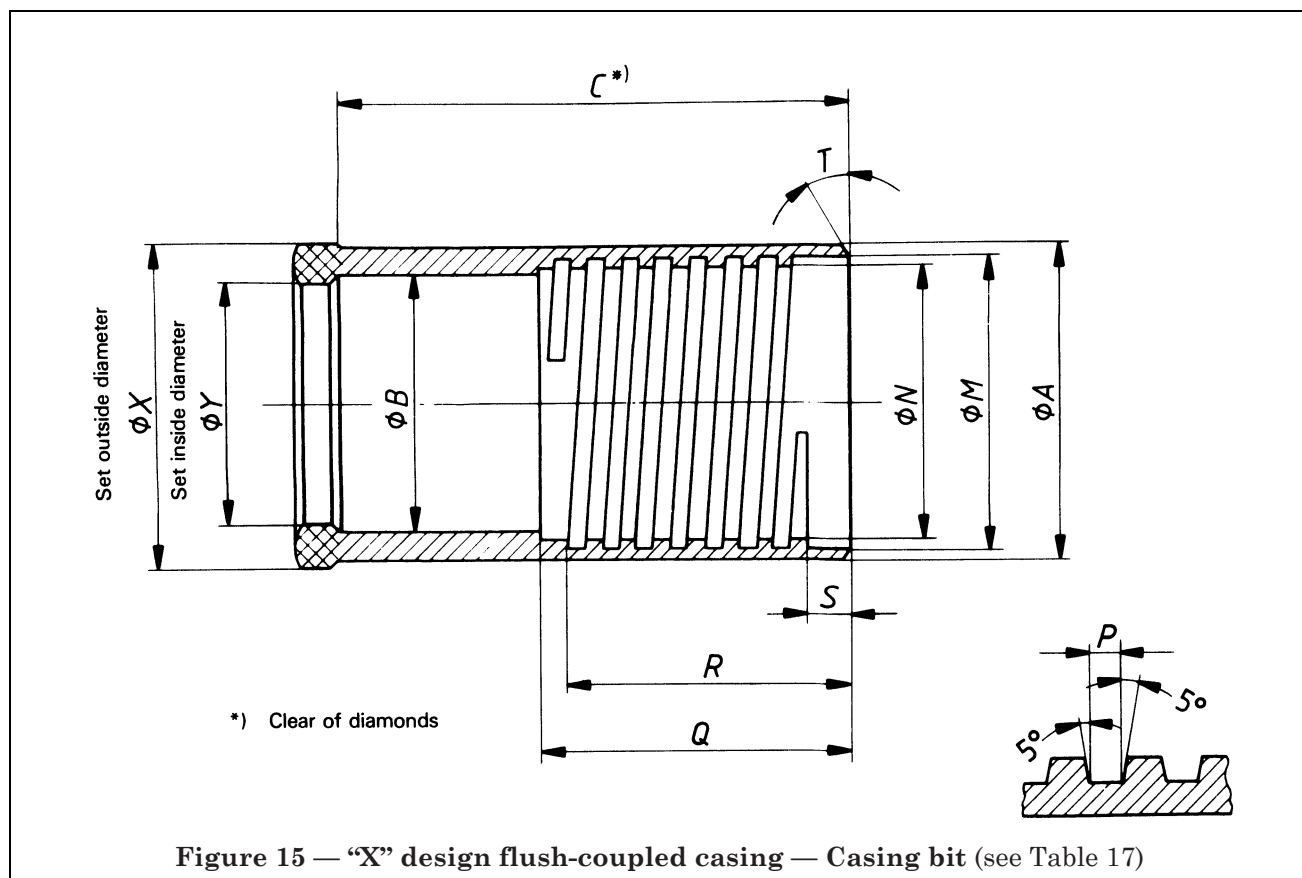


Figure 15 — "X" design flush-coupled casing — Casing bit (see Table 17)

Table 17 — "X" design flush-coupled casing — Casing bit

Dimension		RX	EX	AX	BX	NX	HX	PX	SX	UX	ZX
A	max.	36,98	46,53	58,34	73,96	90,47	115,93	141,33	169,90	195,30	220,70
	min.	36,88	46,43	58,24	73,86	90,37	115,82	141,17	169,75	195,07	220,47
B	max.	26,54	37,21	46,74	57,86	73,74	98,35	120,65	146,05	175,13	200,53
	min.	26,04	36,45	45,97	57,10	72,97	97,33	119,38	144,78	173,61	199,01
C	min.	63,5	88,9	95,25	104,78	111,13	114,3	133,35	146,05	152,4	158,75
M	max.	34,32	43,71	54,05	68,33	84,20	108,48	133,65	162,03	187,76	212,75
	min.	34,26	43,66	54,00	68,28	84,15	108,38	133,53	161,85	187,58	212,57
N	max.	32,79	42,14	52,45	65,94	81,81	106,05	131,24	159,56	184,81	209,80
	min.	32,74	42,09	52,40	65,89	81,76	105,97	131,14	159,46	184,68	209,68
Thread pitch (Threads per inch)		3,175 (8)	3,175 (8)	3,175 (8)	3,175 (8)	3,175 (8)	5,08 (5)	5,08 (5)	5,08 (5)	6,35 (4)	6,35 (4)
P	max.	1,63	1,63	1,63	1,60	1,60	2,59	2,57	2,57	3,18	3,18
	min.	1,55	1,55	1,55	1,52	1,52	2,51	2,46	2,46	3,07	3,07
Q	min.	25,4	50,8	57,15	60,33	66,68	63,5	69,85	76,2	82,55	88,9
R	min.	23,8	47,63	53,98	57,15	63,5	57,15	66,68	73,03	79,38	85,73
S	max.	3,43	6,6	6,6	6,6	6,6	8,13	9,78	9,78	9,78	9,78
	min.	2,95	6,1	6,1	6,1	6,1	7,62	9,27	9,27	9,27	9,27
T		0°	30°	30°	30°	30°	30°	15°	15°	15°	15°
X	max.	37,85	47,75	59,69	75,44	91,95	117,65	143,76	172,72	198,50	224,16
	min.	37,59	47,50	59,44	75,18	91,69	117,27	143,26	172,21	197,74	223,39
Y	max.	25,53	35,81	45,34	56,39	72,26	96,06	117,86	143,26	171,83	197,23
	min.	25,27	35,56	45,09	56,13	72,01	95,81	117,48	142,88	171,32	196,72