BRITISH STANDARD

BS 3821-3:
1974

Specification for

Hardmetal dies and associated hardmetal tools —

Part 3: As-sintered pellets and finished dies for drawing round bar

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British Hard Metal Association
British Independent Steel Producers' Association
Institute of Iron and Steel Wire Manufacturers
Individual experts

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Contents

Foreword

Prepared under the authority of the Mechanical Engineering Industry Standards Committee, this Part of this British Standard takes into account the requirements of ISO Recommendation 1684, "*Wire, bar and tube drawing dies. Designation-Marking-Dimension*" which deals with finished dies, and dimensions of as-sintered pellets.

Part 1 of this British Standard specifies designation and marking of as-sintered pellets and finished dies and Part 2 of the standard specifies as-sintered pellets and finished dies for drawing round wire. Part 2 of this standard revises and extends the scope of the 1964 edition of BS 3821.

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Summary of pages

This document comprises a front cover, an inside front cover, pages i and ii, pages 1 to 8, 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 General

1.1 Scope

This Part of this British Standard specifies as-sintered pellets and finished dies for drawing round bar from steel in the range 9 mm to 61 mm diameter and from non-ferrous metal within the range 9 mm to 72 mm diameter.

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

1.2 Definitions

For the purposes of this British Standard the following definitions apply:

1.2.1

hardmetal

sintered material characterized by high strength and wear resistance, with hard substances, e.g. carbides, of refractory metal, as the main component and with a metallic binder phase

1.2.2

pellet

that component of a bar drawing die which is made from hardmetal. Prior to finishing it is usually termed the "as-sintered pellet" or "rough pellet"

1.2.3

case

that component of a bar drawing die into which the pellet is positively fixed

1.2.4

bore

the bore of the pellet including the entry, drawing, bearing and exit portions

1.2.5

finished die

the assembly of the case and the pellet after all operations have been completed

1.2.6

nominal size

the nominal size of the die: equal to the nominal size of the bar which it will produce

1.2.7

measured size

the actual measured value of the bearing diameter

1.2.8

designating size

the size of the die expressed as pellet diameter (d_2) × case diameter (d_3) (See Table 4 and Table 5.)

1.3 Symbols

For the purposes of this British Standard the symbols shown in Figure 1 and Figure 2 relate to the dimensions of as-sintered pellets and finished dies, respectively, for drawing round bar.

2 As-sintered pellet

2.1 Hardmetal grades

Pellets for bar drawing dies shall be manufactured in grades of hardmetal selected from BS 4276.

2.2 Forms and dimensions

The as-sintered pellet shall conform to the requirements of Table 1, Table 2 and Table 3 with respect to dimensions, tolerances and machining allowances (and See Figure 1).

As-sintered pellets for drawing dies shall be identified as follows:

Bar drawing dies for steel Reference letter C

Bar drawing dies for non-ferrous metal Reference letter D

3 Case

3.1 Material

The case shall be manufactured from material selected in accordance with the following: from steel complying with the requirements of BS 970-1, 080M40[1)] or from steels equivalent or superior in mechanical properties.

3.2 Forms and dimensions

The case shall conform to the requirements given in Table 4 or Table 5 as applicable (and see Figure 2, Figure 3 and Figure 4).

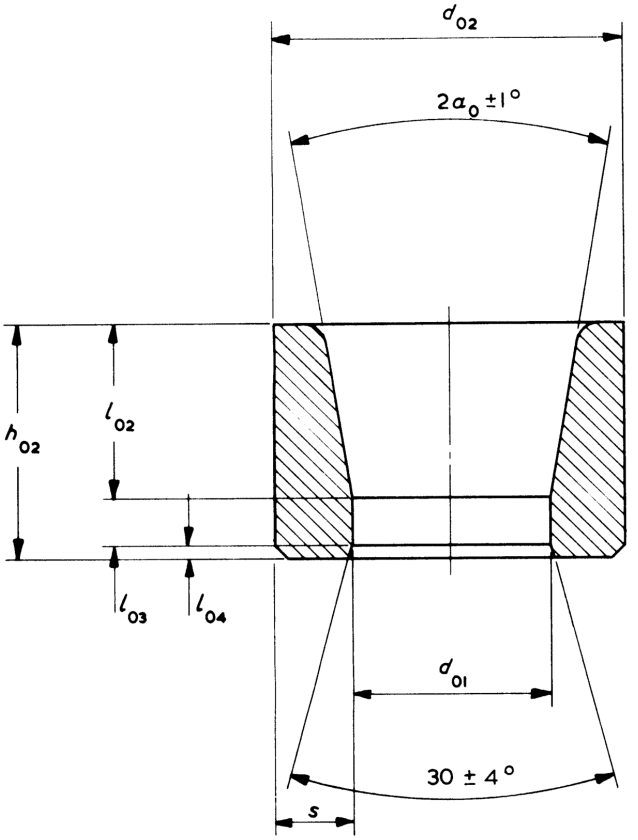
The case may be of straight (code letter Z) or tapered (code letter K) form. When a tapered form is required, an included angle of $2\varepsilon = 10°$ shall be provided, in which event d_3 is the diameter of the larger end of the taper.

4 Finished die

4.1 General requirement

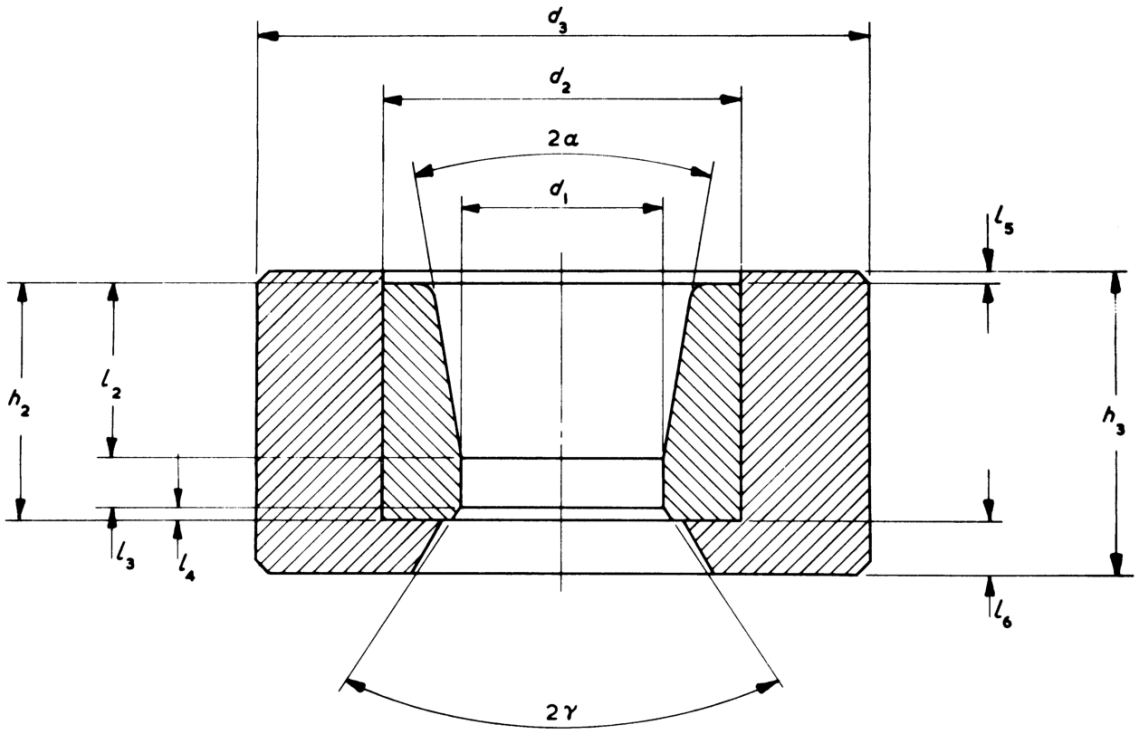
The finished die, consisting of hardmetal pellet and case, shall comply with the requirements specified in **4.2** and **4.3**.

[1)] Steel 080M40 was previously designated En 8 in the superseded En series.



d_{01}	diameter of bearing
d_{02}	diameter of pellet
h_{02}	height of pellet
l_{02}	length of drawing angle
l_{03}	length of bearing
l_{04}	length of exit angle
$2\alpha_0$	drawing angle
S	wall thickness of the pellet

Figure 1 — Symbols for as-sintered pellets for drawing round bar



d_1	diameter of bearing	l_3	length of bearing
d_2	diameter of pellet	l_4	length of exit angle
d_3	diameter of case	l_5	length of entry opening of the case
h_2	height of pellet	l_6	length of exit angle of case
h_3	height of case	2α	drawing angle
l_2	length of drawing angle	2γ	exit angle

Figure 2 — Symbols for finished dies for drawing round bar

Table 1 — Dimensions and tolerances of as-sintered pellets

d_{02}	Tolerance on d_{02}	h_{02}	Tolerance on h_{02}	l_{04}	Maximum and minimum values of d_{01}[a] such that for finished dies one obtains:			
					for steel bar (reference letter C)		for non-ferrous bar (reference letter D)	
					$d_{1\,min}$	$d_{1\,max}$	$d_{1\,min}$	$d_{1\,max}$
mm		mm	mm	mm	mm	mm	mm	mm
25	+ 0.7 mm	20		5.0	—	—	9	12
30	+ 0.2 mm				9	13	11	14
35		24		5.5	12	16	13	18
40					15	19	17	21
45		25	± 0.4	6.0	18	22	20	25
50					21	25	24	28
55					24	28	27	32
60		27		6.5	27	31	30	36
65					29	34	34	40
70	± 1 %				32	37	38	44
75		30		7.5	35	41	42	48
80					39	45	46	52
85					43	49	50	56
90		33	± 0.5	8.0	47	53	54	60
95					—	—	58	64
100		35		8.5	51	61	62	68
105					—	—	65	72

[a] d_{01} shall be determined when ordering, taking account of the minimum machining allowance: $d_{01} = d_1$ – machining allowance (see Table 3).

Table 2 — Tolerance on diameter of bearing of pellet, d_{01}

d_{01}		Tolerance on d_{01}[a]
From	Up to but not including	
mm	mm	mm
9	12	+0 –0.3
12	16	+0 –0.35
16	20	+0 –0.4
20	25	+0 –0.45
25	32	+0 –0.5
32	40	+0 –0.6
40	50	+0 –0.75
50	63	+0 –0.9
63	72	+0 –1.1

[a] The tolerance on d_{01} applies to the greatest measured value of d_{01}

Table 3 — Machining allowance on diameter of bearing of pellet, d_{01}

d_{02}	d_{01} machining allowance
mm	mm
25 to 80	+0 –0.5
85 to 100	+0 –0.6
105 to 150	+0 –0.8

4.2 Assembly

The pellet shall be positively and permanently fixed in its correct position in the case. The method of fixing shall be such as to ensure adequate support to the peripheral face of the base of the pellet.

4.3 Accuracy

4.3.1 Roundness of bearing. Up to and including 15.5 mm diameter the maximum tolerable departure is 5 µm.

For diameters greater than 15.50 mm the maximum tolerable departure is 10 µm.

4.3.2 Finish. All surfaces of the pellet bore shall be free from scratch marks and surface irregularities other than those naturally inherent in the finishing process. When assessed in accordance with BS 1134 the roughness value shall be not greater than 0.1 μm R_a.

4.3.3 Concentricity. The external diameters of case and pellet shall be concentric with the bearing diameter within 0.25 mm total indicator reading up to and including 150 mm case diameter and 0.5 mm for sizes larger than 150 mm.

4.3.4 Squareness of back face. The back face shall be square relative to the axis of the bore within 1°.

4.3.5 Tolerance on drawing angle. The drawing angle 2α shall be accurate within ± 0° 30′.

4.4 Marking

The finished dies shall be permanently and indelibly marked as specified in Part 1 of this standard.

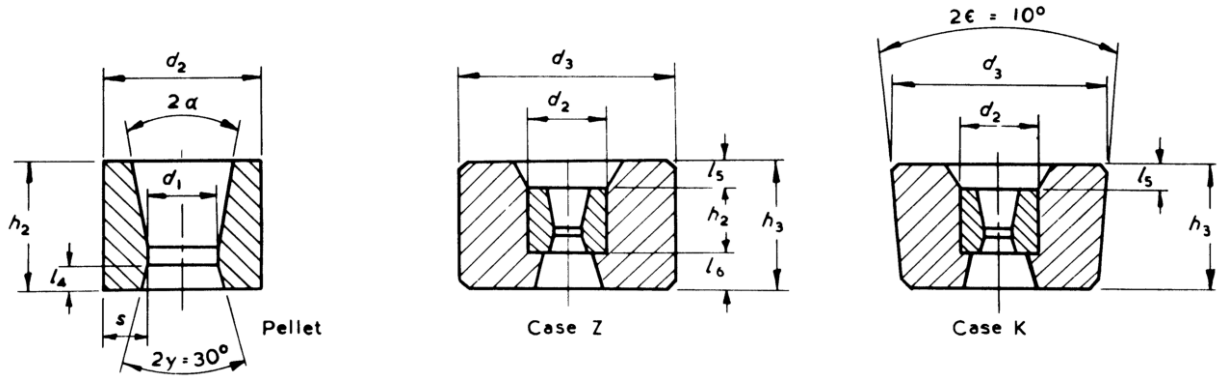


Figure 3 — Bar drawing dies for steel (reference letter C)

Table 4 — Dimensions of bar drawing dies for steel

Designation size	Pellet							Case					
	d_2	h_2	d_1		s[a]	l_4[b]		d_3	h_3	l_5		l_6[c]	
			min.	max.	min.	min.	max.			min.	max.	min.	max.
mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm
30/100	30	24	9	13	8.5	2.4	4.8	100	45	5	9	12	16
35/100	35		12	16	9.5								
40/100	40		15	19	10.5								
45/100	45	25	18	22	11.5	2.5	5.0	100	50	5	9	16	20
50/150	50		21	25	12.5			150					
55/150	55	27	24	28	13.5	2.7	5.4		55			19	23
60/150	60	27	27	31	14.5	2.7	5.4	150	55	5	9	19	23
65/150	65		29	34	15.5								
70/150	70	30	32	37	16.5	3.0	6.0		60			21	25
75/150	75	30	35	41	17.0	3.0	6.0	150	60	5	9	21	25
80/200	80		39	45	17.5			200					
85/200	85	33	43	49	18.0	3.3	6.6		65			23	27
90/200	90	33	47	53	18.5	3.3	6.6	200	65	5	9	23	27
100/200	100	35	51	61	19.5	3.5	7.0					21	25

NOTE 1 $d_{1\,min}$ is the minimum and preferred diameter of bearing at the first application.

NOTE 2 $d_{1\,max}$ is the maximum diameter of bearing which is recommended for drawing steel bars having a tensile strength up to 900 MPa in the drawn condition with a drawing angle 2α up to and including 20°.

NOTE 3 Dies for drawing steel bars with $d_{1\,max}$ exceeding 61 mm are outside the scope of this standard.

NOTE 4 The diameter of bearing d_1 required by the user should be chosen within the limits $d_{1\,max}$ and $d_{1\,min}$ except when the drawing angle 2α exceeds 20°. The tolerance of bearing should be specified by the user.

NOTE 5 For use on multiple draw benches a case diameter d_3 of 125 mm may be supplied for pellet diameters d_2 of 50 mm, 55 mm and 60 mm and a case diameter d_3 of 175 mm for pellet diameters d_2 of 80 mm and 85 mm.

[a] $s_{min} = \frac{d_2 - d_{1\,max}}{2}$

[b] $l_4 = 0.1\ h_2$ up to $0.2\ h_2$

[c] For information only.

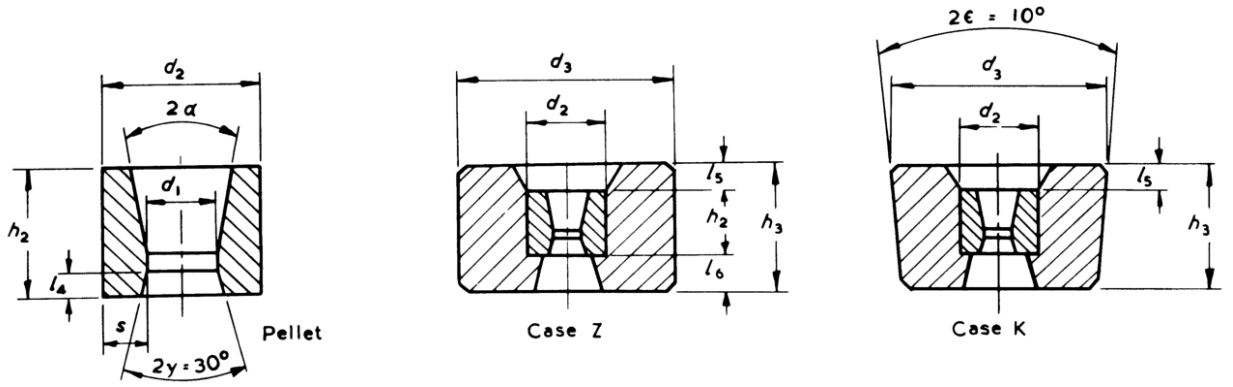


Figure 4 — Bar drawing dies for non-ferrous metal (reference letter D)

Table 5 — Dimensions of bar drawing dies for non-ferrous metal

Designation size	Pellet							Case					
	d_2	h_2	d_1	s[a]		l_4[b]		d_3	h_3	l_5		l_6[c]	
			min.	max.	min.	min.	max.			min.	max.	min.	max.
	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm
25/75	25	20	9	12	6.5	2.0	4.0	75	40	5	9	11	15
30/100	30	24	11	14	8.0	2.4	4.8	100	45			12	16
35/100	35		13	18	8.5								
40/100	40	24	17	21	9.5	2.4	4.8	100	45	5	9	12	16
45/100	45	25	20	25	10.0	2.5	5.0		50			16	20
50/150	50		24	28	11.0			150					
55/150	55	27	27	32	11.5	2.7	5.4	150	55	5	9	19	23
60/150	60		30	36	12.0								
65/150	65		34	40	12.5								
70/150	70	30	38	44	13.0	3.0	6.0	150	60	5	9	21	25
75/150	75		42	48	13.5								
80/200	80		46	52	14.0			200					
85/200	85	33	50	56	14.5	3.3	6.6	200	65	5	9	23	27
90/200	90		54	60	15.0								
95/200	95		58	64	15.5								
100/200	100	35	62	68	16.0	3.5	7.0	200	65	5	9	21	25
105/250	105		65	72	16.5			250					

NOTE 1 d_{1min} is the minimum and preferred diameter of bearing at the first application.

NOTE 2 d_{1max} is the maximum diameter of bearing which is recommended for drawing non-ferrous metal bars having a tensile strength up to 800 MPa in the drawn condition with a drawing angle 2α up to and including 25°.

NOTE 3 Dies for drawing non-ferrous metal bars with d_{1max} exceeding 72 mm are outside the scope of this standard.

NOTE 4 The diameter of bearing d_1 required by the user should be chosen within the limits d_{1max} and d_{1min} except when the drawing angle 2α exceeds 25°. If the drawing angle is considerably smaller than 25°, the dimension d_{1max} can be increased by up to 1 mm. The tolerance of bearing should be specified by the user.

NOTE 5 For use on multiple draw benches a case diameter d_3 of 125 mm may be supplied for pellet diameters d_2 of 50 mm and 55 mm and a case diameter d_3 of 175 mm for pellet diameter d_2 of 80 mm.

[a] $s_{min} = \frac{d_2 - d_1 \text{ max}}{2}$

[b] $l_4 = 0.1\ h_2$ up to $0.2\ h_2$

[c] For information only.

Appendix A Information to be supplied when ordering

Information to be supplied when ordering hardmetal as-sintered pellets and hardmetal dies for drawing round bar shall be in accordance with the designation system specified in Part 1 of this standard.

The following information shall also be given when ordering hardmetal as-sintered pellets.

1) The outside diameter, d_{02}.

2) The diameter of bearing, d_{01}.

Publications referred to

This standard makes reference to the following British Standards:
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 1134, *Method for the assessment of surface texture.*
BS 4276, *Hard metal for wire, bar and tube drawing dies.*

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