BRITISH STANDARD

BS 3821-2:
1974

Specification for

Hardmetal dies and associated hardmetal tools —

Part 2: As-sintered pellets and finished dies for drawing round wire

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British Non-ferrous Metals Federations — High Conductivity Copper Group
British Hard Metal Association
British Independent Steel Producers' Association
Institute of Iron and Steel Wire Manufacturers
Individual experts

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Contents

Foreword

First published as BS 3821:1964 this Part of this British Standard has been revised to include dimensions of as-sintered pellets, and other Parts added to extend the range of the standard.

Prepared under the authority of the Mechanical Engineering Industry Standards Committee, full cognizance has been taken of ISO Recommendation R 524 "*Hard metal wire drawing dies. Interchangeability dimensions of pellets and cases*". Account has also been taken of ISO work which relates to dimensions of as-sintered pellets and note taken of ISO/R 1684 "*Wire, bar and tube drawing dies — Designation — Marking — Dimension*", which is an extension of ISO/R 524.

The manufacture of hardmetal wire drawing dies involves highly specialized techniques and development. For this reason, every care has been taken to establish a British Standard containing requirements calculated to ensure the first rate quality and performance of the finished dies, which will not impede the research and development of new techniques in a healthy and progressive industry.

The standard does not lay down the requirements for hardmetal grades. This information is applicable to all types of hardmetal dies and associated hardmetal tools, and therefore a separate standard, BS 4276 "*Hard metal for wire, bar and tube drawing dies*", has been published relating exclusively to grading and quality of hardmetal for dies, including wire drawing dies.

Part 1 of this British Standard specifies designation and marking of as-sintered pellets and finished dies, and Part 3 of the standard specifies as-sintered pellets and finished dies for drawing round bar.

The standard has been produced with the fullest co-operation of die users and manufacturers, and the manufacturers of wire drawing machinery.

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 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 the dimensions of as-sintered pellets and finished hardmetal dies and certain quality aspects of finished dies for drawing ferrous and non-ferrous round wire. The dies are intended to produce wire up to 12 mm diameter from steel and 13 mm diameter from non-ferrous material.

NOTE The titles of the British Standards 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 wire 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 wire 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 wire which it will produce

1.2.7
measured size

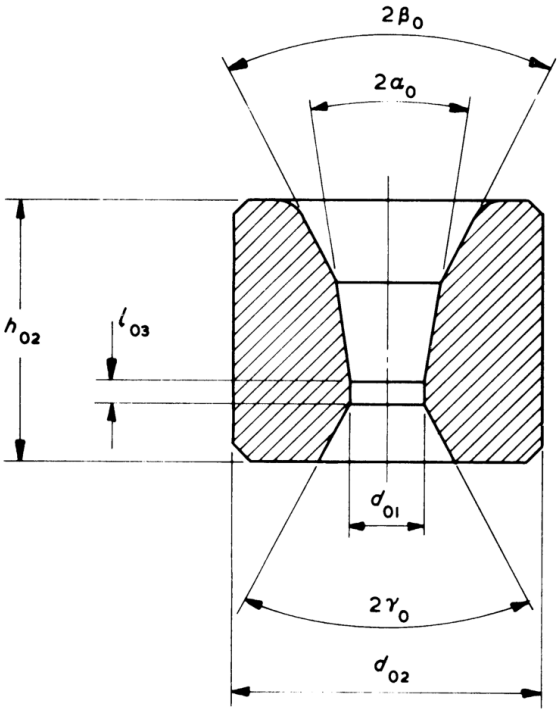
the actual measured value of the bearing diameter

1.2.8
designating size

the size of the die expressed as pellet diameter (d_2) × case diameter (d_3) (see Table 5)

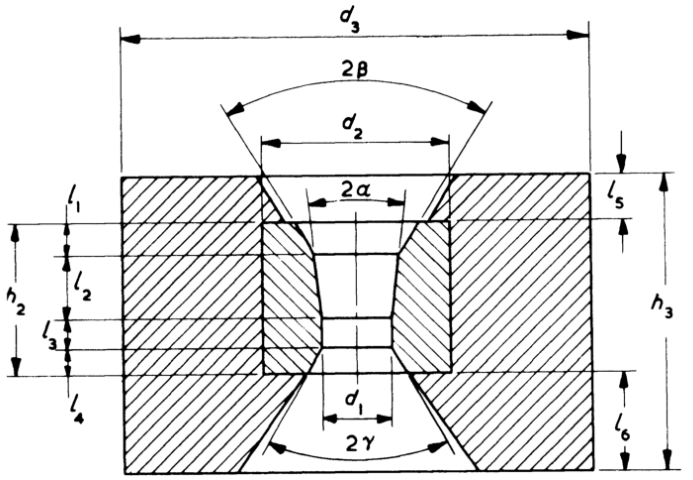
1.3 Symbols

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 wire.



d_{01}	diameter of bearing
d_{02}	diameter of pellet
h_{02}	height of pellet
l_{03}	length of bearing
$2\alpha_0$	drawing angle
$2\beta_0$	angle of entry cone
$2\gamma_0$	exit angle

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



d_1	diameter of bearing
l_1	height of entry angle
l_2	height of drawing angle
l_3	length of bearing
l_6	height between exit faces of pellet and case
2α	drawing angle

Figure 2 — Symbols for finished dies for drawing round wire

2 Pellet

2.1 Hardmetal grades

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

2.2 Forms, dimensions and tolerances

The as-sintered pellet shall conform to the dimensions given in Table 1, according to type as shown in Figure 3.

Tolerances on the dimensions of as-sintered pellets shall be in accordance with Table 2, Table 3 and Table 4.

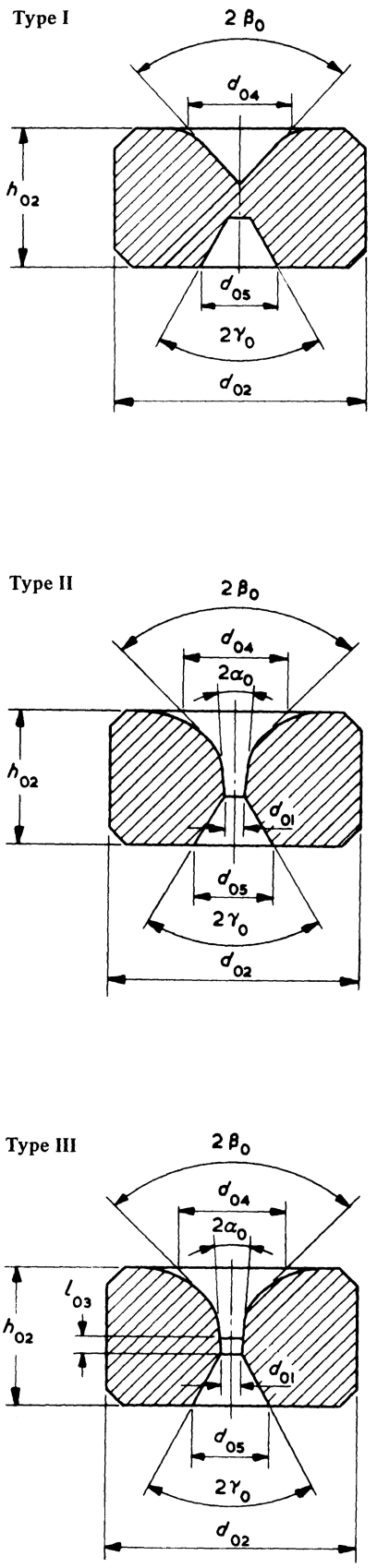


Figure 3 — Types of pellet

Table 1 — Dimensions of as-sintered pellets

Type	d_{02}	h_{02}	$2\alpha_0 \pm 1°$	$2\beta_0 \pm 2°$	$2\gamma_0 \pm 4°$	d_{01}	d_{04}	d_{05}
	mm	mm	degrees	degrees	degrees	mm	mm	mm
I	8	4	—	90	90	—	4.2	2.2
II	8	4	10	90	90	0.1	3.6	2.2
II	8	4	10	90	90	0.3	3.6	2.2
I	10	8	—	90	90	—	7.6	6.2
II	10	8	10	90	90	0.1	5.5	3.5
II	10	8	10	90	90	0.3	6.0	3.5
II	10	8	12	90	90	0.6	6.0	4.0
II	10	8	12	90	90	1.0	6.0	4.0
II	10	8	12	90	90	1.5	6.0	4.5
II	12	10	10	90	90	0.2	7.0	4.5
II	12	10	12	90	90	0.6	7.0	4.5
II	12	10	12	90	90	1.0	7.0	5.0
II	12	10	12	90	90	1.4	7.0	5.0
II	12	10	12	90	90	1.8	8.0	5.0
II	14	12	10	60	75	0.2	7.0	5.0
II	14	12	12	60	75	0.6	7.0	5.0
II	14	12	12	60	75	1.0	7.0	5.0
II	14	12	12	60	75	1.4	7.0	5.0
II	14	12	12	60	75	1.8	8.0	5.5
II	14	12	14	60	75	2.4	8.0	6.0
II	16	13	10	60	75	0.3	8.0	5.0
II	16	13	12	60	75	0.6	8.0	5.0
II	16	13	12	60	75	1.0	8.5	5.0
II	16	13	12	60	75	1.4	9.0	5.5
II	16	13	12	60	75	1.8	9.0	6.0
II	16	13	14	60	75	2.2	9.5	6.5
II	16	13	14	60	75	2.6	9.5	6.5
II	16	13	14	60	75	3.0	9.5	7.0
II	20	17	12	60	60	1.0	8.5	6.0
II	20	17	12	60	60	1.6	8.5	6.5
II	20	17	14	60	60	2.2	10.0	6.5
II	20	17	14	60	60	2.8	10.0	7.0
II	20	17	14	60	60	3.4	11.0	8.0
III	20	17	16	60	60	4.0	12.0	8.5
III	20	17	16	60	60	4.6	12.5	9.0
II	25	20	12	60	60	2.0	11.5	7.0
II	25	20	14	60	60	2.7	12.0	7.5
II	25	20	14	60	60	3.4	13.0	8.0
III	25	20	16	60	60	4.1	13.5	8.5
III	25	20	16	60	60	4.8	14.0	9.0
III	25	20	16	60	60	5.5	14.5	10.0
III	25	20	16	60	60	6.5	15.5	11.0
II	30	24	14	60	60	3.0	15.0	9.0
II	30	24	14	60	60	3.7	16.0	9.0
III	30	24	16	60	60	4.5	17.0	10.0
III	30	24	16	60	60	5.5	18.0	10.0
III	30	24	16	60	60	6.5	18.0	12.0
III	30	24	16	60	60	8.0	19.0	13.5
III	30	24	16	60	60	9.5	20.0	16.0

Table 2 — Tolerance on diameter of pellet, d_{02}

d_{02}		Tolerance
From	Up to and including	
mm	mm	mm
8	16	+ 0.6 + 0.2
20	30	+ 0.7 + 0.2

Table 3 — Tolerance on height of pellet, h_{02}

h_{02}		Tolerance
From	Up to and including	
mm	mm	mm
4	10	± 0.2
12	17	± 0.3
20	24	± 0.4

Table 4 — Tolerance on diameter of bearing of pellet, d_{01}

d_{01}		Tolerance
From	Up to and including	
mm	mm	mm
	0.3	+ 0 – 0.075
0.3	0.5	+ 0 – 0.10
0.5	2.0	+ 0 – 0.15
2.0	4.0	+ 0 – 0.20
4.0	6.0	+ 0 – 0.25
6.0	10.0	+ 0 – 0.30

3 Case

3.1 Material

The case shall be manufactured from material selected in accordance with the following:

1) Up to 28 mm external diameter; from steel complying with the requirements of BS 970-1, 070M20[1)], or from steels equivalent or superior in mechanical properties, or from brass complying with the requirements of BS 249.

2) Over 28 mm external diameter; from steel complying with the requirements of BS 970-1, 070M20[1)] or from steels equivalent or superior in mechanical properties.

[1)] Steel 070M20 was previously designated En 3A in the superseded En series.

3.2 Forms and dimensions

The case shall conform to the dimensions given in Table 5, according to form as shown in Figure 4.

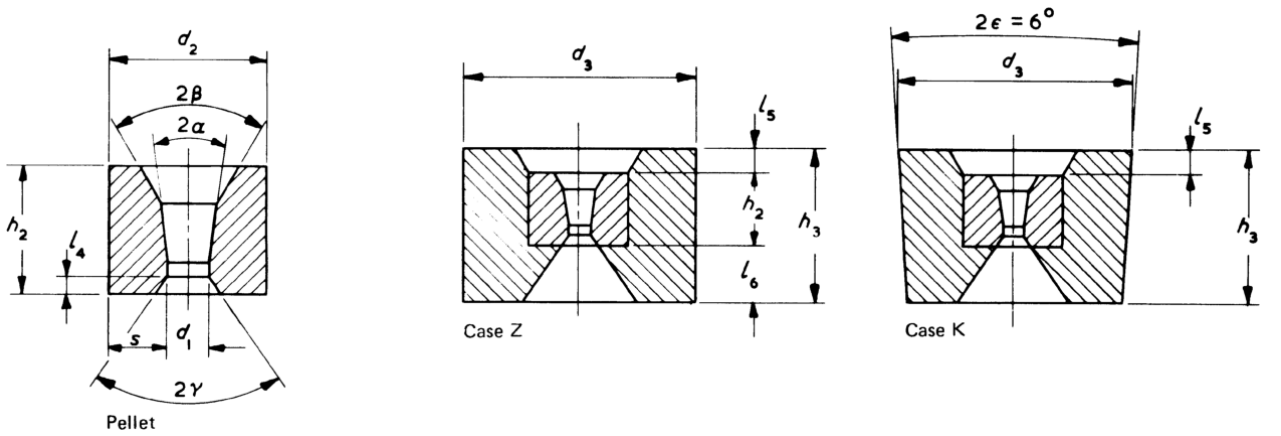


Figure 4 — Pellet and assembled dies

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 $2\varepsilon = 6°$ shall be provided, in which event d_3 is the diameter of the larger and of the taper (see Figure 4).

Table 5 — Dimensions of pellets and cases

Designation size	Pellet									Case					
	d_2	h_2	Steel (reference letter A) d_1 min.	Steel (reference letter A) d_1 max.	Steel (reference letter A) s[a] min.	Non-ferrous (reference letter B) d_1 min.	Non-ferrous (reference letter B) d_1 max.	Non-ferrous (reference letter B) s[a] min.	l_4 max.	2β	2γ	d_3 ± 0.25	h_3 ± 0.13	l_s	l_6[b]
	mm	mm	mm	mm	mm	mm	mm	mm	mm	deg.	deg.	mm	mm	mm	mm
8/28	8	4	0.1	1	3.5	0.1	1.5	3.25	1				12		5
10/28	10	8	0.2	2	4	0.2	2.5	3.75	2	90	90	28	16	3	
12/28	12	10	0.3	3	4.5	0.3	3.5	4.25	2.5				20		7
14/28	14	12	0.4	4	5	0.4	4.5	4.75	3			28[c]	22	3	7
14/43										60	75	43			
16/43	16	13	0.5	5	5.5	0.5	6	5	3.5			43	25	4	8
20/43	20	17	1.5	6.5	6.75	1.5	8	6	4.5			43	32		
25/53	25	20	2.5	9	8	2.5	10.5	7.25	5	60	60	53	35	5	10
25/75												75[c]			
30/75	30	24	3.5	12	9	3.5	13	8.5	6			75	40	6	

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 wire having a tensile strength up to 900 MPa in the drawn condition and for drawing wires of non-ferrous metal having a tensile strength up to 600 MPa in the drawn condition.

NOTE 3 The diameter of bearing d_1 required by the user should be chosen within the limits $d_{1\max}$ and $d_{1\min}$. The tolerance of bearing should be specified by the user.

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

[b] For information only

[c] The value 28 instead of 43 is generally suitable for drawing wires of lower tensile strength, e.g. copper.
The value 75 instead of 53 is generally suitable for drawing wires of higher tensile strength, e.g. steel.

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**.

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 and the base of the pellet.

4.3 Accuracy

4.3.1 Diameter of bearing. The diameter of bearing shall be accurate within the appropriate tolerance as given in Table 6.

Table 6 — Tolerance on diameter of bearing of finished die

Diameter of bearing	Tolerance	
	upper limit	lower limit
mm		µm
Up to 0.381	nominal size	5
Over 0.381 up to and including 2.54	nominal size	7.5
Over 2.54 up to and including 15.5	nominal size	10

4.3.2 Roundness of bearing. When assessed in accordance with BS 3730, departures from ideal roundness shall not exceed the values given in Table 7. Bearing diameters too small to be evaluated by direct instrumental means shall be assessed by checking the roundness or the wire drawn through the die.

Table 7 — Maximum tolerable departure from roundness of diameter of bearing

Diameter of bearing	Maximum tolerable departure from roundness
mm	µm
Up to 0.381	1.2
Over 0.381 up to and including 2.54	2.5
Over 2.54 up to and including 15.5	5

4.3.3 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.

Bores too small to permit direct instrumental evaluation shall be assessed using plastics replica techniques similar to those outlined in BS 1134.

Bores too small to permit evaluation by plastics replica techniques (of the order of 0.762 mm and smaller) shall be assessed by examination for detrimental surface irregularities only, using a watchmaker's eyeglass of × 10 magnification.

4.3.4 Concentricity. The external diameter of case and pellet shall be concentric with the bearing diameter within 0.25 mm total indicator reading.

4.3.5 Squareness of faces. The front and back faces shall be true one with the other and shall be square relative to the axis of the bore within 1°.

4.3.6 Drawing angles. The following shall be regarded as preferred drawing angles:

10°, 12°, 14° and 16°

4.3.7 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.

Appendix A Information to be given when purchasing hardmetal as-sintered pellets and hardmetal dies

When placing an order for as-sintered hardmetal pellets and hardmetal dies for drawing round metal the information which should be given 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 type, as given in Table 1 and shown in Figure 3.
2) The outside diameter, d_{02}.
3) The diameter of bearing, d_{01}.

Publications referred to

This standard makes reference to the following British Standards:
BS 249, *Leaded brass (58 per cent copper, 3 per cent lead) rods and sections (other than forging stock).*
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 3730, *Methods for the assessment of departures from roundness.*
BS 4276, *Hard metal for wire, bar and tube drawing dies.*

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