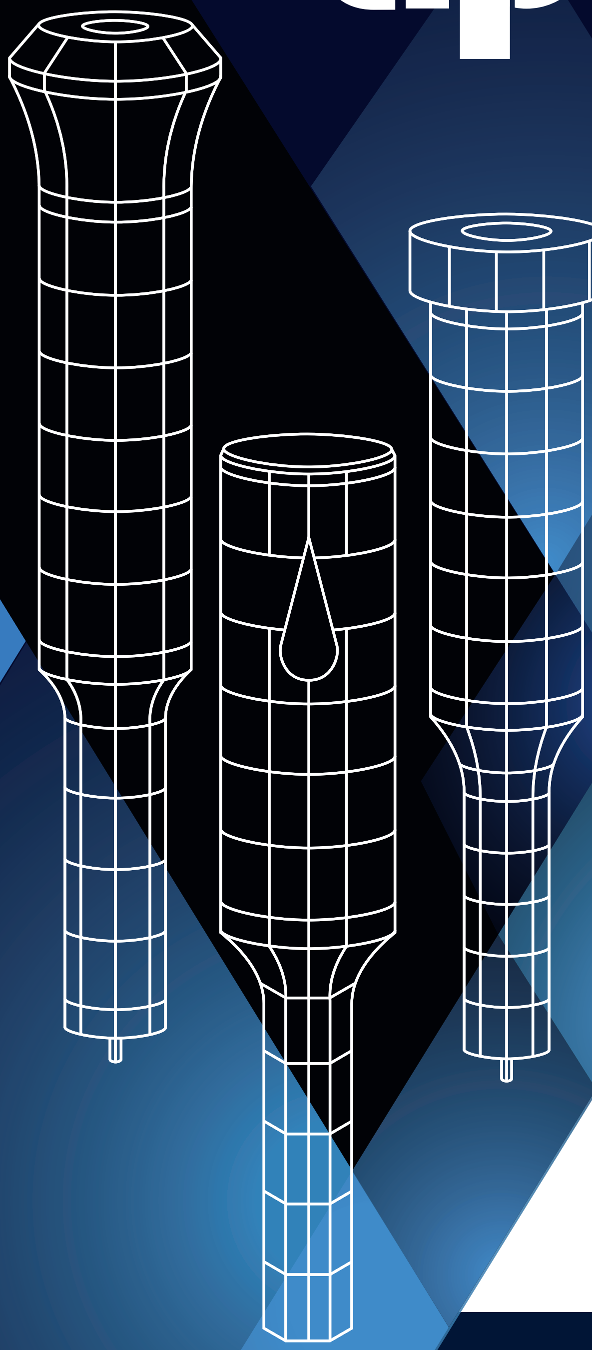
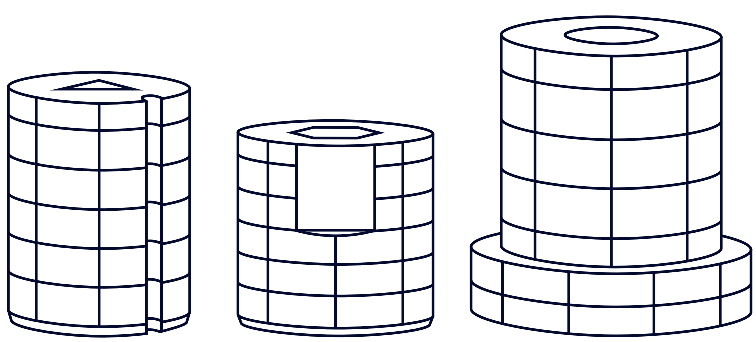
tipco





CATALOG

PUNCHES AND DIES

Special Punches

Die Buttons

Precision Tooling

Threadform Tooling

Die Springs

Punches

Founded in 1959, Tipco has been providing companies with high-quality and innovative precision tooling products for over 60 years. Tipco started with one manufacturing facility in Toronto, Ontario, Canada; however, our company now has manufacturing facilities in the United States, Canada, Italy, and United Kingdom.

Tipco manufactures precision tooling products for a diverse range of industries, including the metal stamping and plastic molding sectors. Our customers include automotive, appliance, building, infrastructure, furniture, and pharmaceutical manufacturers and suppliers.

Tipco is committed to operational and customer service excellence. Our commitment extends to manufacturing superior products, providing invaluable customer support and service, and exceeding industry standards. Tipco's commitments to our various stakeholders include:

- Eliminating external defects and customer complaints;
- Providing on-time delivery of products;
- Hiring and promoting well-trained, knowledgeable staff;
- Providing a safe working environment;
- Providing efficient and productive facilities with state-of-the-art equipment; and,
- Adopting and implementing up-to-date information technology to ensure the precise and timely flow of information.

From a manufacturing perspective, Tipco is committed to producing best-in-class tooling products. To achieve our company's manufacturing objectives, Tipco is continually investing in new and innovative machinery, equipment, technologies, and processes.

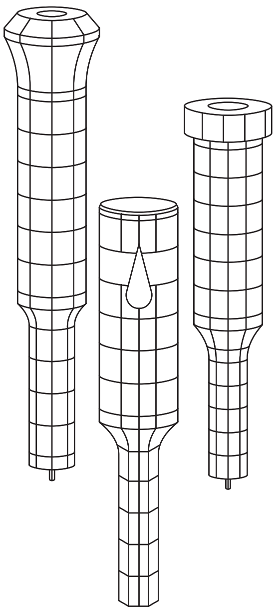
Tipco is also committed to supplying superior complementary products, including best-in-class die springs, marking stamps, automated tapping systems, tool and die accessories, and more.

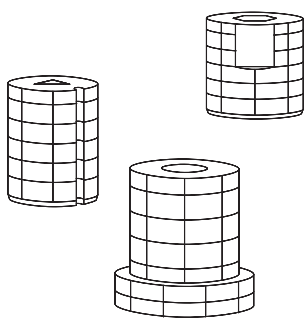
Customer support and satisfaction is integral to our business. Tipco is continually focusing on adding and creating value for our customers. For customers, our company's value-add and value-creation capabilities include extensive design, machining, and application experience.

Tipco's knowledge and expertise includes working with customers to: review and analyze customer tooling requirements; design customer-specific tooling specifications; and, resolve external failure mechanisms. To optimize tooling performance, Tipco also works closely with customers to review and analyze material selection, heat treat requirements, and product coatings.

In addition, Tipco is continually working on meeting and exceeding statutory and regulatory standards. For example, Tipco's North American operations are ISO 9001 compliant.

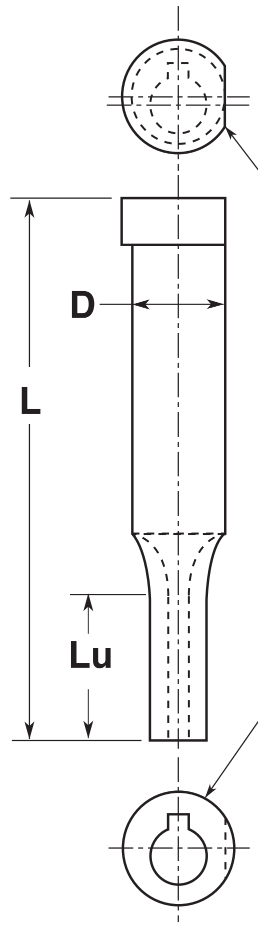
For more information, please visit our website at www.tipcopunch.com.

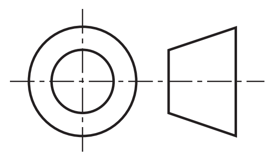




EXAMPLE

When ordering specify Punch or Die Type.





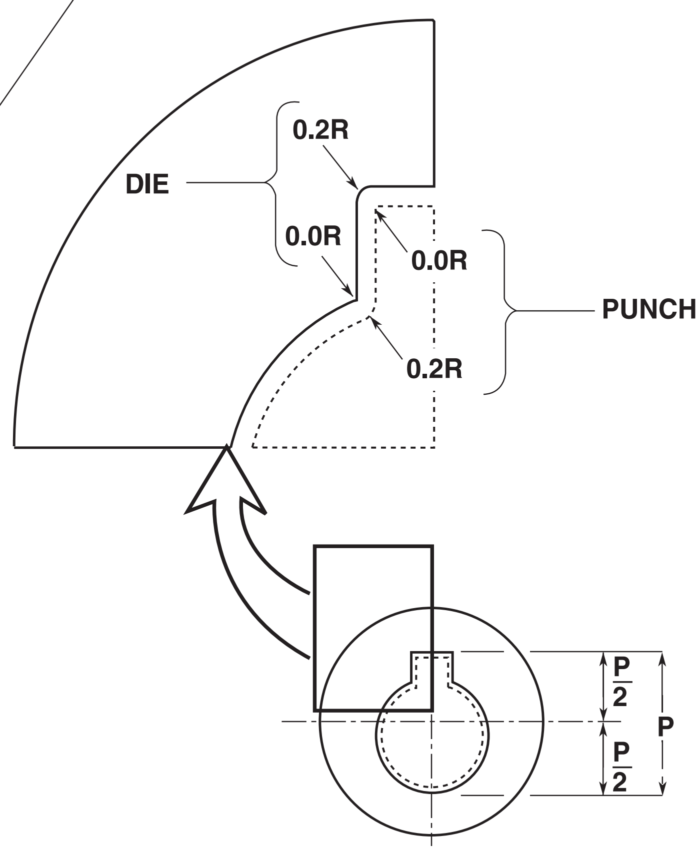
PROJECTION

PUNCH

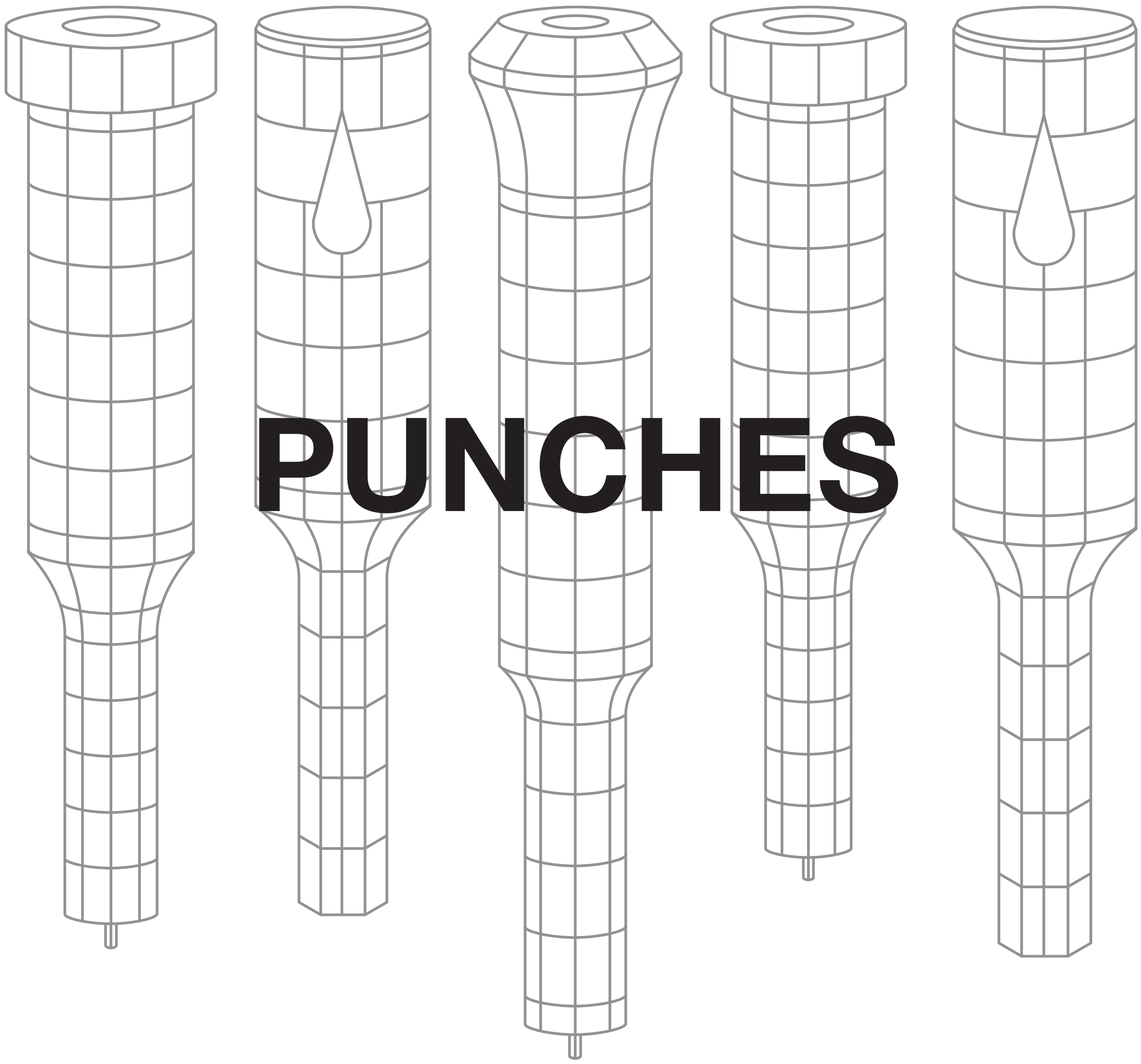
MFQ 16 X 80 Q26 A3.O W8.5 P13.0 Lu25 SF 0°

MFDQ 20 X 25 Q26 A3.3 W8.8 P13.3 SF3 0°

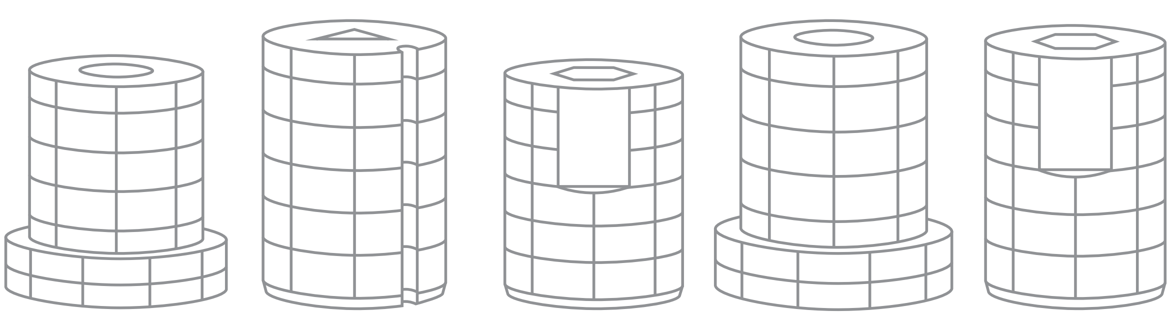
DIE



All shapes are central on Punch and Die body.

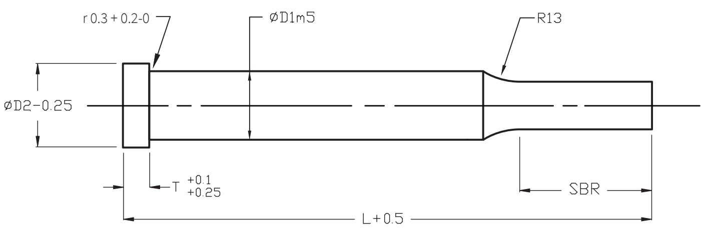


PUNCHES



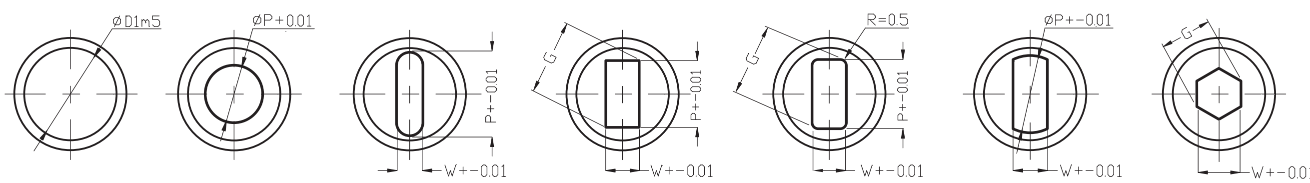
FRACTIONS	DECIMAL	MM
1/64	.0156	0.396
1/32	.0312	0.793
3/64	.0468	1.190
1/16	.0625	1.587
5/64	.0781	1.984
3/32	.0937	2.381
7/64	.1093	2.778
1/8	.1250	3.175
9/64	.1406	3.571
5/32	.1562	3.968
11/64	.1718	4.365
3/16	.1875	4.762
13/64	.2031	5.159
7/32	.2187	5.556
15/64	.2343	5.593
1/4	.2500	6.350
17/64	.2656	6.746
9/32	.2812	7.143
19/64	.2968	7.540
5/16	.3125	7.937
21/64	.3281	8.334
11/32	.3437	8.731
23/64	.3593	9.128
3/8	.3750	9.525
25/64	.3906	9.921
13/32	.4062	10.318
27/64	.4218	10.715
7/16	.4375	11.112
29/64	.4531	11.509
15/32	.4687	11.906
31/64	.4843	12.303
1/2	.5000	12.700

FRACTIONS	DECIMAL	MM
33/64	.5156	13.096
17/32	.5312	13.493
35/64	.5468	13.890
9/16	.5625	14.287
37/64	.5781	14.684
19/32	.5937	15.081
39/64	.6093	15.478
5/8	.6250	15.875
41/64	.6406	16.271
21/32	.6562	16.668
43/64	.6718	17.065
11/16	.6875	17.462
45/64	.7031	17.859
23/32	.7187	18.256
47/64	.7343	18.653
3/4	.7500	19.050
49/64	.7656	19.446
25/32	.7812	19.843
51/64	.7968	20.240
13/16	.8125	20.637
53/64	.8281	21.034
27/32	.8437	21.431
55/64	.8593	21.828
7/8	.8750	22.225
57/64	.8906	22.621
29/32	.9062	23.018
59/64	.9218	23.415
15/16	.9375	23.812
61/64	.9531	24.209
31/32	.9687	24.606
63/64	.9843	25.003
1	1.000	25.400



Material	Hardness HRC
HSS - M2	60-62
PS (on request)	62-64

MTB MTC MTO MTR MTL MTF MTH



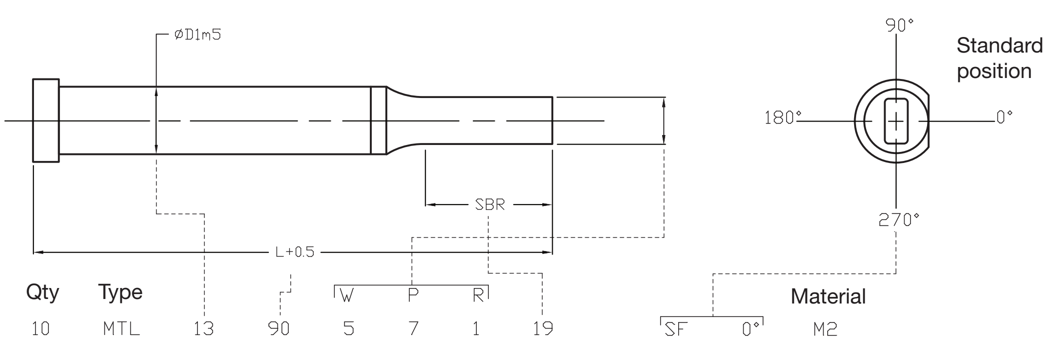
G= $\sqrt{W^2 + P^2}$ G= $\sqrt{(W - 2R)^2 + (P - 2R)^2} + 2R$ G= W x 1.1547

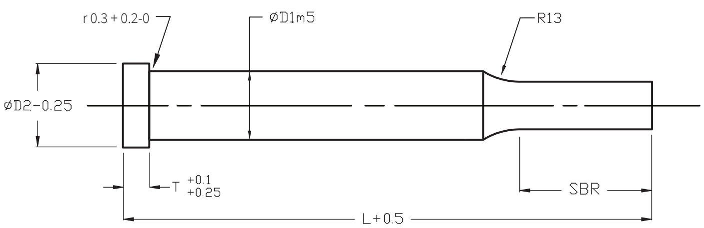
For qualified shapes see page 46.

				ROUND	SHAPE		L						
D1	D2	T	Lu	RANGE P	MIN W	G/P MAX	50	56	63	71	80	90	100
5.0	8.0	5	7/13/19	1.5 - 4.99	1.5	4.99	X	X	X	X	X	X	
6.0	9.0	5	13/19	1.5 - 5.99	1.5	5.99	X	X	X	X	X	X	X
8.0	11.0	5	13/19/25	2.5 - 7.99	2.5	7.99	X	X	X	X	X	X	X
10.0	13.0	5	13/19/25	4.0 - 9.99	3.5	9.99	X	X	X	X	X	X	X
13.0	16.0	5	13/19/25	5.0 - 12.99	4.5	12.99	X	X	X	X	X	X	X
16.0	19.0	5	13/19/25	8.0 - 15.99	6.0	15.99		X	X	X	X	X	X
20.0	23.0	5	13/19/25	12.0 - 19.99	8.0	19.99		X	X	X	X	X	X
25.0	28.0	5	13/19/25	16.0 - 24.99	10.0	24.99		X	X	X	X	X	X
32.0	35.0	5	13/19/25	20.0 - 31.99	10.0	31.99			X	X	X	X	X

Longer lengths (L) available upon request.
For extended range shank diameters see the following page.
For standard alterations see pages 47 and 48.
For locating devices see page 49.

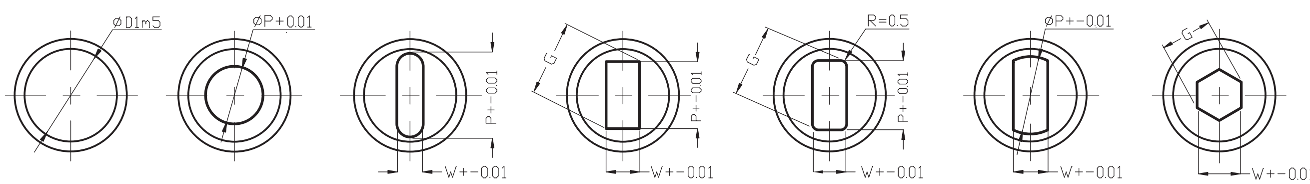
Order Example:





Material	Hardness HRC
HSS - M2	60-62
PS (on request)	62-64

MTB	MTC	MTO	MTR	MTL	MTF	MTH



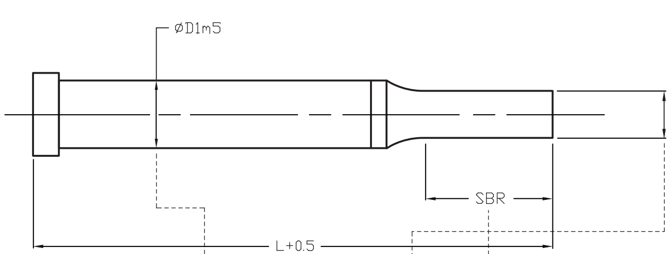
$G = \sqrt{W^2 + P^2}$ $G = \sqrt{(W - 2R)^2 + (P - 2R)^2} + 2R$ $G = W \times 1.1547$

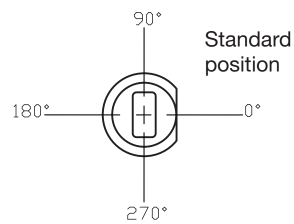
For qualified shapes see page 46.

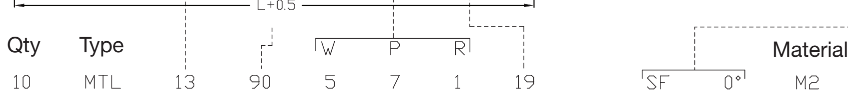
D1	D2	T	Lu	ROUND RANGE P	SHAPE MIN W	SHAPE G/P MAX	L 71	L 80	L 90	L 100	L 125	L 150
40.0	43.0	5	25/30	20.0 - 39.99	8.0	39.99	X	X	X	X	X	X
45.0	48.0	5	25/30	25.0 - 44.99	9.0	44.99	X	X	X	X	X	X
50.0	53.0	5	25/30	30.0 - 49.99	10.0	49.99	X	X	X	X	X	X
56.0	59.0	5	25/30	35.0 - 55.99	11.0	55.99	X	X	X	X	X	X
63.0	66.0	5	25/30	40.0 - 62.99	12.0	62.99	X	X	X	X	X	X

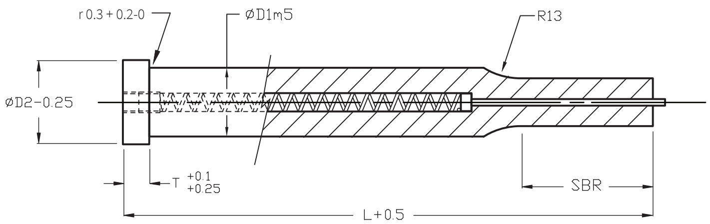
Longer lengths (L) available upon request.
For standard alterations see pages 47 and 48.
For locating devices see page 49.

Order Example:



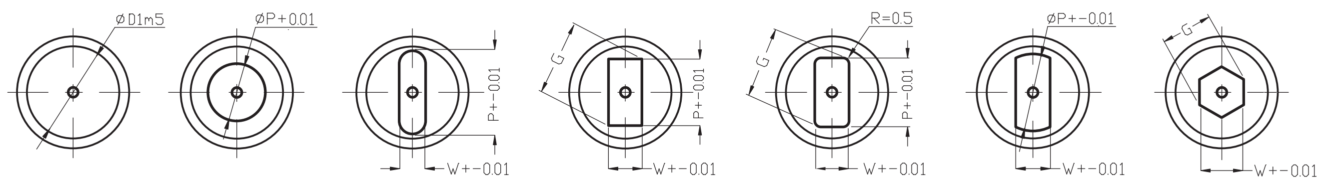






Material	Hardness HRC
HSS - M2	60-62
PS (on request)	62-64

MEB	MTEC	MTEO	MER	MEL	MEF	MEH



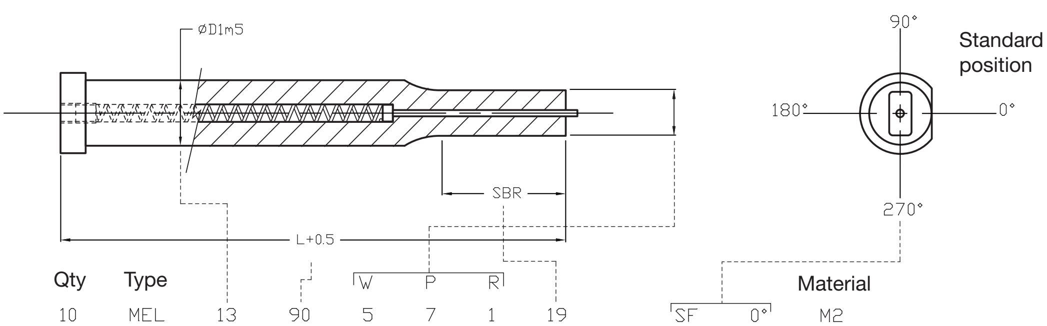
$G = \sqrt{W^2 + P^2}$ $G = \sqrt{(W - 2R)^2 + (P - 2R)^2} + 2R$ $G = W \times 1.1547$

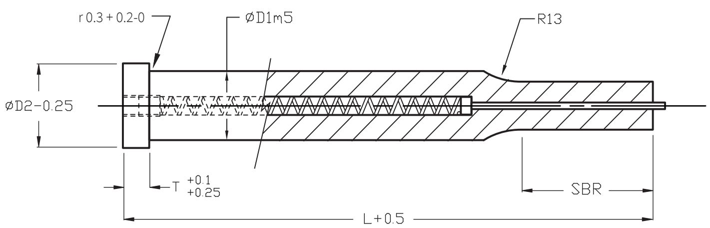
For qualified shapes see page 46.

D1	D2	T	Lu	ROUND RANGE P	SHAPE MIN W	SHAPE G/P MAX	L 50	56	63	71	80	90	100	125	150
5.0	8.0	5	7/13/19	1.5 - 4.99	1.5	4.99	X	X	X	X	X	X		X	X
6.0	9.0	5	13/19	1.5 - 5.99	1.5	5.99	X	X	X	X	X	X	X	X	X
8.0	11.0	5	13/19/25	2.5 - 7.99	2.5	7.99	X	X	X	X	X	X	X	X	X
10.0	13.0	5	13/19/25	4.0 - 9.99	3.5	9.99	X	X	X	X	X	X	X	X	X
13.0	16.0	5	13/19/25	5.0 - 12.99	4.5	12.99	X	X	X	X	X	X	X	X	X
16.0	19.0	5	13/19/25	8.0 - 15.99	6.0	15.99		X	X	X	X	X	X	X	X
20.0	23.0	5	13/19/25	12.0 - 19.99	8.0	19.99		X	X	X	X	X	X	X	X
25.0	28.0	5	13/19/25	16.5 - 24.99	10.0	24.99		X	X	X	X	X	X	X	X
32.0	35.0	5	13/19/25	20.0 - 31.99	10.0	31.99		X	X	X	X	X	X	X	X

Longer lengths (L) available upon request.
For extended range shank diameters see the following page.
For standard alterations see pages 47 and 48.
For locating devices see page 49.

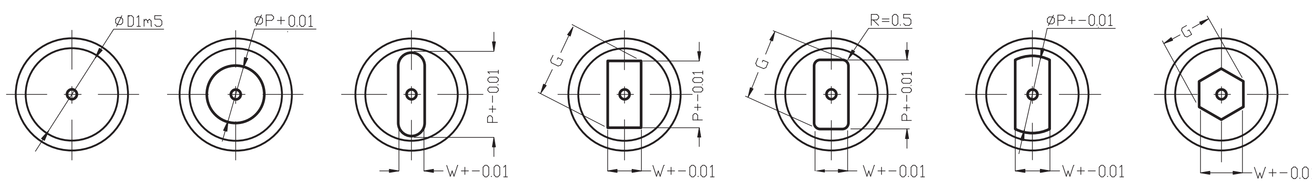
Order Example:





Material	Hardness HRC
HSS - M2	60-62
PS (on request)	62-64

MEB	MTEC	MTEO	MER	MEL	MEF	MEH



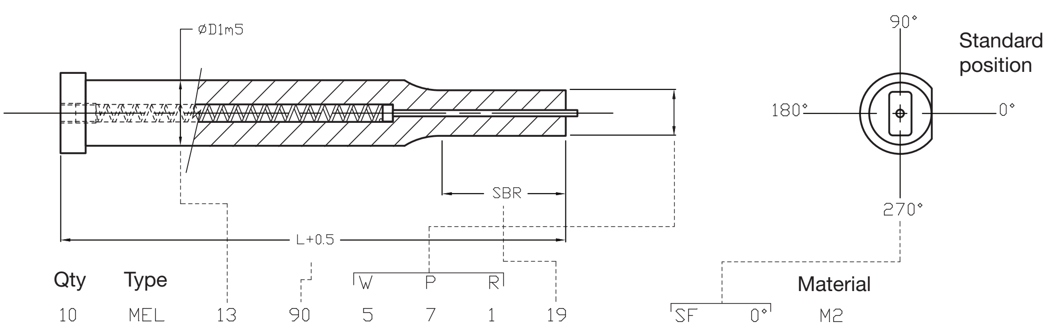
G= $\sqrt{W^2 + P^2}$ G= $\sqrt{(W - 2R)^2 + (P - 2R)^2} + 2R$ G= W x 1.1547

For qualified shapes see page 46.

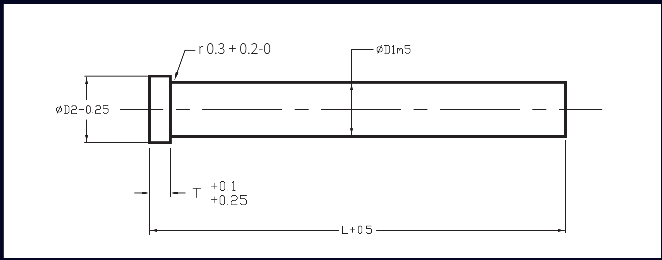
D1	D2	T	Lu	ROUND RANGE P	SHAPE MIN W	SHAPE G/P MAX	L 71	L 80	L 90	L 100	L 125	L 150
40.0	43.0	5	25/30	20.0 - 39.99	8.0	33.99	X	X	X	X	X	X
45.0	48.0	5	25/30	25.0 - 44.99	9.0	44.99	X	X	X	X	X	X
50.0	53.0	5	25/30	30.0 - 49.99	10.0	49.99	X	X	X	X	X	X
56.0	59.0	5	25/30	35.0 - 55.99	11.0	55.99	X	X	X	X	X	X
63.0	66.0	5	25/30	40.0 - 62.99	12.0	62.99	X	X	X	X	X	X

Longer lengths (L) available upon request.
For standard alterations see pages 47 and 48.
For locating devices see page 49.

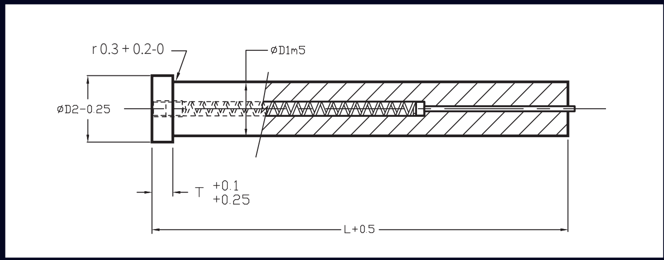
Order Example:



MTX



MEX



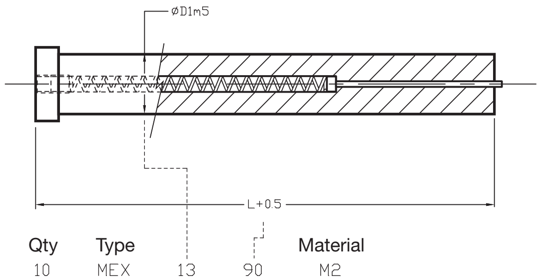
RANGE D1	D2	T	L						
			50	58	63	71	80	90	100
4.01 - 5.0*	8.0	5	X	X	X	X	X	X	
5.01 - 6.0*	9.0	5	X	X	X	X	X	X	X
6.01 - 8.0*	11.0	5	X	X	X	X	X	X	X
8.01 - 10.0*	13.0	5	X	X	X	X	X	X	X
10.01 - 13.0*	16.0	5	X	X	X	X	X	X	X
13.01 - 16.0*	19.0	5		X	X	X	X	X	X
16.01 - 20.0*	23.0	5		X	X	X	X	X	X
20.01 - 25.0*	28.0	5		X	X	X	X	X	X
25.01 - 32.0*	35.0	5		X	X	X	X	X	X

* MTX only

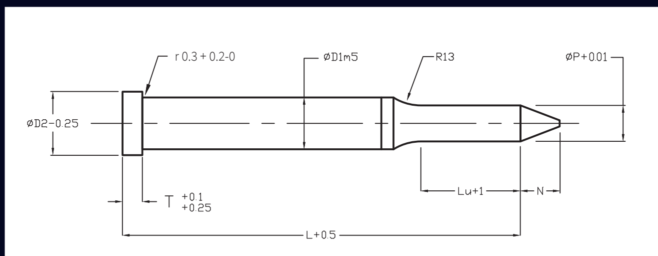
Longer lengths (L) available upon request.
For standard alterations see pages 47 and 48.
For locating devices see page 49.

Material	Hardness HRC
HSS - M2	60-62
PS (on request)	62-64

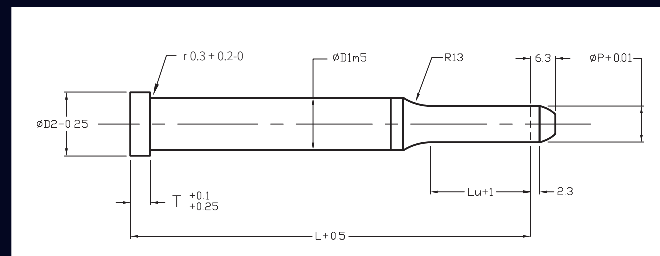
Order Example:



MTA



MTP



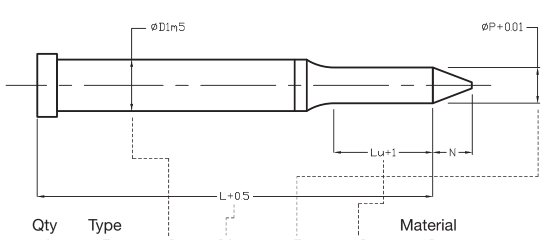
MTA												
						L						
D1	D2	T	Lu	N	RANGE P	63	71	80	90	100	125	150
10.0	13.0	5	13/19/25	10.0	4.9 - 9.99	X	X	X	X	X	X	X
13.0	16.0	5	13/19/25	12.0	5.9 - 12.99	X	X	X	X	X	X	X
16.0	19.0	5	13/19/25	17.0	9.9 - 15.99	X	X	X	X	X	X	X
20.0	23.0	5	13/19/25	22.0	12.9 - 19.99	X	X	X	X	X	X	X
25.0	28.0	5	13/19/25	25.0	16.9 - 24.99	X	X	X	X	X	X	X
32.0	35.0	5	13/19/25	25.0	19.9 - 31.99	X	X	X	X	X	X	X

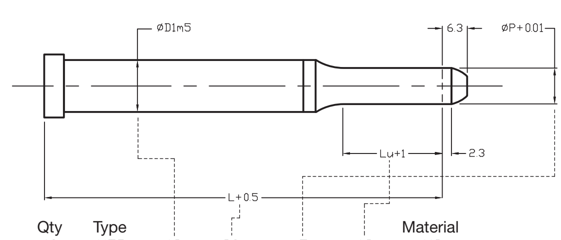
MTP													
					L								
D1	D2	T	Lu	RANGE P	50	56	63	71	80	90	100	125	150
5.0	8.0	5	13	1.0 - 4.99	X	X	X	X	X	X	X	X	X
6.0	9.0	5	13/19	1.9 - 5.99	X	X	X	X	X	X	X	X	X
8.0	11.0	5	13/19/25	2.4 - 7.99	X	X	X	X	X	X	X	X	X
10.0	13.0	5	13/19/25	3.9 - 9.99	X	X	X	X	X	X	X	X	X
13.0	16.0	5	13/19/25	4.9 - 12.99	X	X	X	X	X	X	X	X	X
16.0	19.0	5	13/19/25	7.9 - 15.99	X	X	X	X	X	X	X	X	X
20.0	23.0	5	13/19/25	11.9 - 19.99	X	X	X	X	X	X	X	X	X
25.0	28.0	5	13/19/25	14.9 - 24.99		X	X	X	X	X	X	X	X
32.0	35.0	5	13/19/25	19.9 - 31.99		X	X	X	X	X	X	X	X

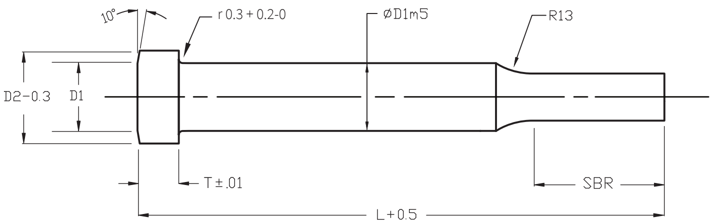
For standard alterations see pages 47 and 48.
For locating devices see page 49.

Material	Hardness HRC
HSS - M2	60-62
PS (on request)	62-64

Order Example:

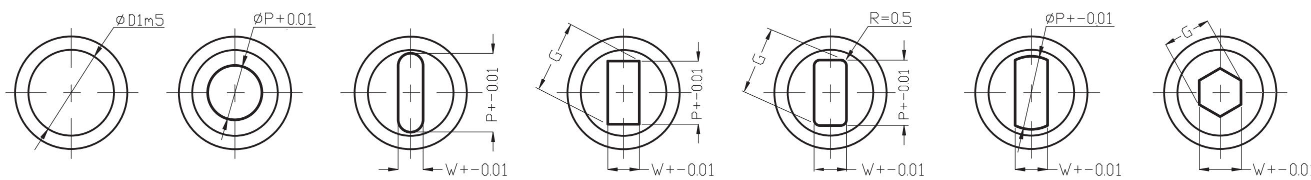






Material	Hardness HRC
PM M4	60-62
Head Draw	40-52

MTUB	MTUC	MTUO	MTUR	MTUL	MTUF	MTUH



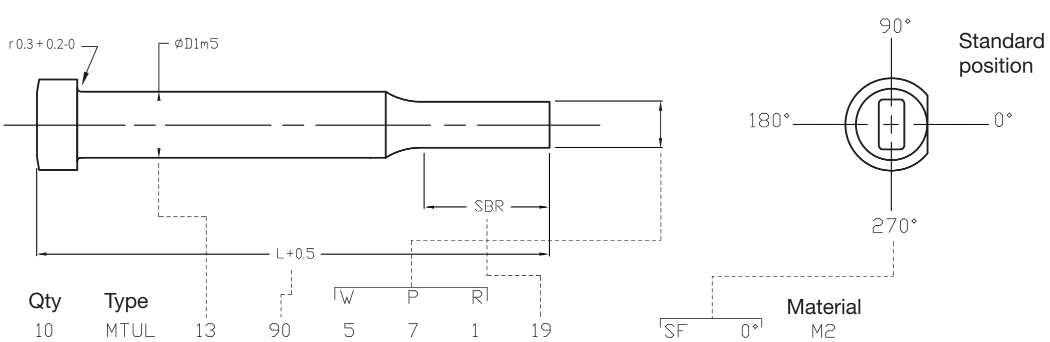
G= $\sqrt{W^2 + P^2}$ G= $\sqrt{(W - 2R)^2 + (P - 2R)^2} + 2R$ G= W x 1.1547

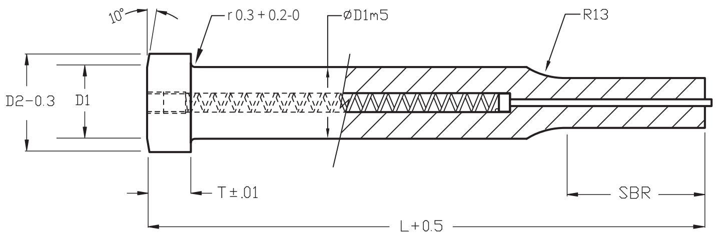
For qualified shapes see page 46.

				ROUND	SHAPE		L		
D1	D2	T	Lu	RANGE P	MIN W	MAX G/P	80	90	100
8.0	13.0	8	13/19/25	3.0 - 7.99	3.0	7.99	X	X	X
10.0	15.0	8	13/19/25	3.0 - 9.99	3.0	9.99	X	X	X
13.0	18.0	8	13/19/25	6.0 - 12.99	3.0	12.99	X	X	X
16.0	21.0	8	13/19/25	8.0 - 15.99	4.0	15.99	X	X	X
20.0	25.0	8	13/19/25	12.0 - 19.99	5.0	19.99	X	X	X
25.0	30.0	8	13/19/25	16.0 - 24.99	6.0	24.99	X	X	X

For standard alterations see pages 47 and 48.
For locating devices see page 49.

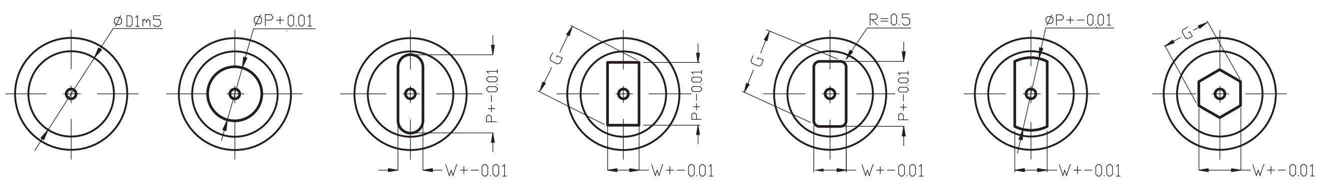
Order Example:





Material	Hardness HRC
PM M4	60-62
Head Draw	40-52

MUEB	MUEC	MUEO	MUER	MUEL	MUEF	MUEH



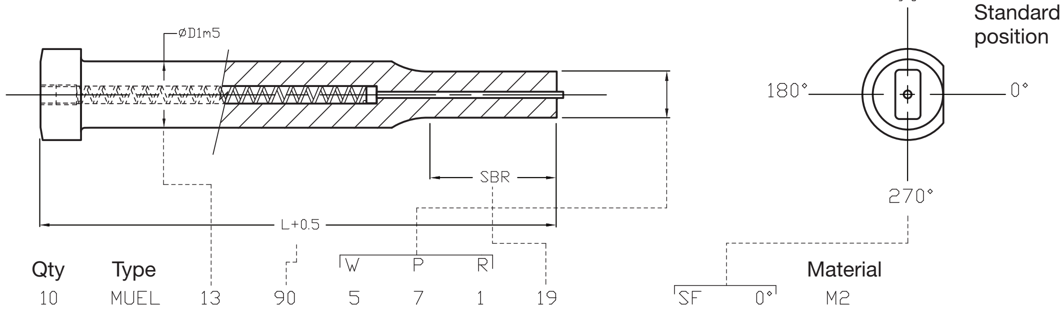
G= $\sqrt{W^2 + P^2}$ G= $\sqrt{(W - 2R)^2 + (P - 2R)^2} + 2R$ G= W x 1.1547

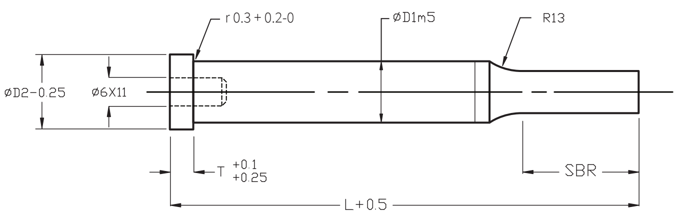
For qualified shapes see page 46.

D1	D2	T	Lu	ROUND RANGE P	SHAPE MIN W	SHAPE MAX G/P	L 80	L 90	L 100
8.0	13.0	8	13/19/25	3.0 - 7.99	3.0	7.99	X	X	X
10.0	15.0	8	13/19/25	3.0 - 9.99	3.0	9.99	X	X	X
13.0	18.0	8	13/19/25	6.0 - 12.99	3.0	12.99	X	X	X
16.0	21.0	8	13/19/25	8.0 - 15.99	4.0	15.99	X	X	X
20.0	25.0	8	13/19/25	12.0 - 19.99	5.0	19.99	X	X	X
25.0	30.0	8	13/19/25	16.0 - 24.99	6.0	24.99	X	X	X

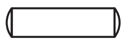
For standard alterations see pages 47 and 48.
For locating devices see page 49.

Order Example:

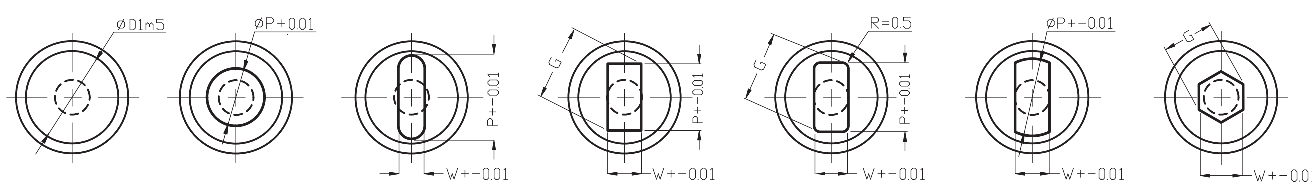




Material	Hardness HRC
HSS - M2	60-62


Ø6X24 Pin included

MCB	MCC	MCO	MCR	MCL	MCF	MCH



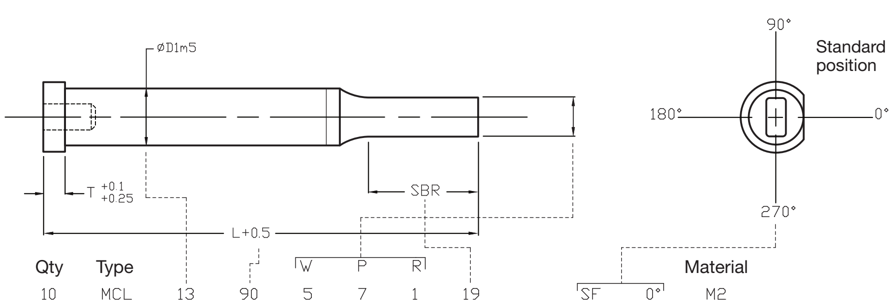
G= $\sqrt{W^2 + P^2}$ G= $\sqrt{(W - 2R)^2 + (P - 2R)^2} + 2R$ G= W x 1.1547

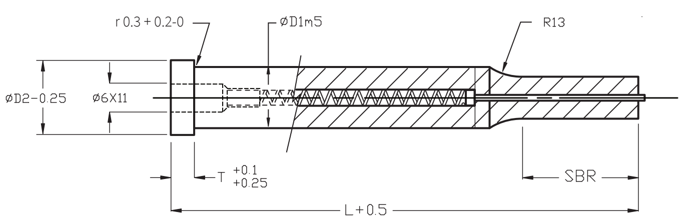
For qualified shapes see page 46.

D1	D2	T	Lu	ROUND	SHAPE		L					
				RANGE P	MIN W	MAX G/P	71	80	90	100	125	150
10.0	13.0	5	13/19/25	4.0 - 9.99	3.5	9.99	X	X	X	X	X	X
13.0	16.0	5	13/19/25	5.0 - 12.99	4.5	12.99	X	X	X	X	X	X
16.0	19.0	5	13/19/25	8.0 - 15.99	6.0	15.99	X	X	X	X	X	X
20.0	23.0	5	13/19/25	12.0 - 19.99	8.0	19.99	X	X	X	X	X	X
25.0	28.0	5	13/19/25	16.5 - 24.99	10.0	24.99	X	X	X	X	X	X
32.0	35.0	5	13/19/25	20.0 - 31.99	10.0	31.99	X	X	X	X	X	X

For standard alterations see pages 47 and 48.
For locating devices see page 49.

Order Example:

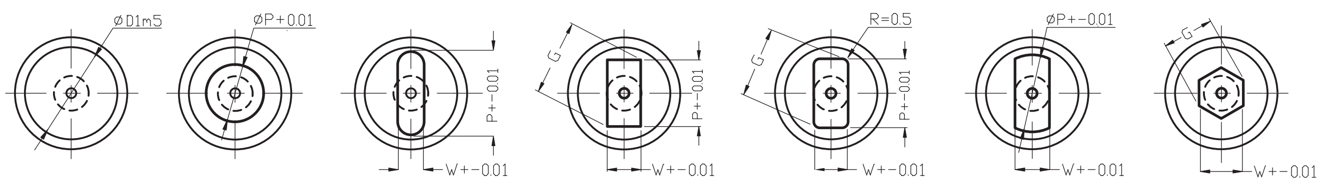




Ø6X24 Pin included

Material	Hardness HRC
HSS - M2	60-62

MCEB MCEC MCEO MCER MCEL MCEF MCEH



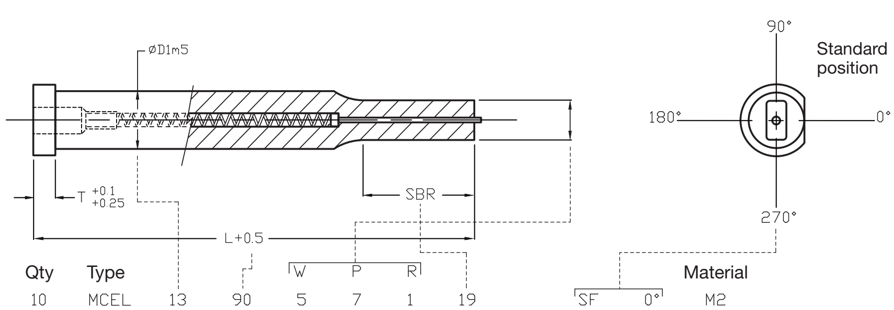
$G = \sqrt{W^2 + P^2}$ $G = \sqrt{(W - 2R)^2 + (P - 2R)^2} + 2R$ $G = W \times 1.1547$

For qualified shapes see page 46.

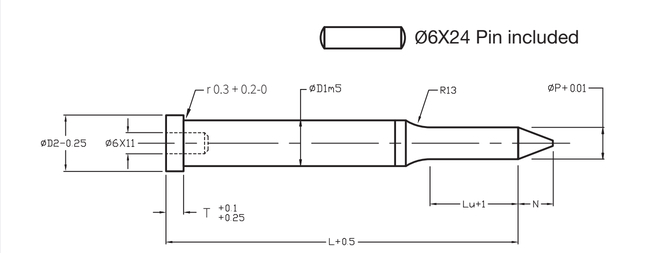
D1	D2	T	Lu	ROUND RANGE P	SHAPE MIN W	 G/P MAX	L 71	 80	 90	 100	 110	 120	 130
10.0	13.0	5	13/19/25	4.0 - 9.99	3.5	9.99	X	X	X	X	X	X	X
13.0	16.0	5	13/19/25	5.0 - 12.99	4.5	12.99	X	X	X	X	X	X	X
16.0	19.0	5	13/19/25	8.0 - 15.99	6.0	15.99	X	X	X	X	X	X	X
20.0	23.0	5	13/19/25	12.0 - 19.99	8.0	19.99	X	X	X	X	X	X	X
25.0	28.0	5	13/19/25	16.5 - 24.99	10.0	24.99	X	X	X	X	X	X	X
32.0	35.0	5	13/19/25	20.0 - 31.99	10.0	31.99	X	X	X	X	X	X	X

Longer lengths (L) available upon request.
For standard alterations see pages 47 and 48.
For locating devices see page 49.

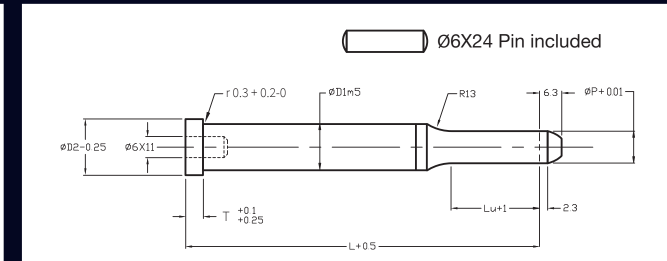
Order Example:



MCA



MCP



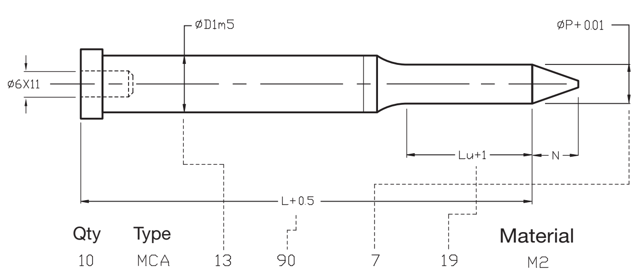
MCA												
						L						
D1	D2	T	Lu	N	RANGE P	63	71	80	90	100	125	150
10.0	13.0	5	13/19/25	10.0	4.9 - 9.99	X	X	X	X	X	X	X
13.0	16.0	5	13/19/25	12.0	5.9 - 12.99	X	X	X	X	X	X	X
16.0	19.0	5	13/19/25	17.0	9.9 - 15.99	X	X	X	X	X	X	X
20.0	23.0	5	13/19/25	22.0	12.9 - 19.99	X	X	X	X	X	X	X
25.0	28.0	5	13/19/25	25.0	16.9 - 24.99	X	X	X	X	X	X	X
32.0	35.0	5	13/19/25	25.0	19.9 - 31.99	X	X	X	X	X	X	X

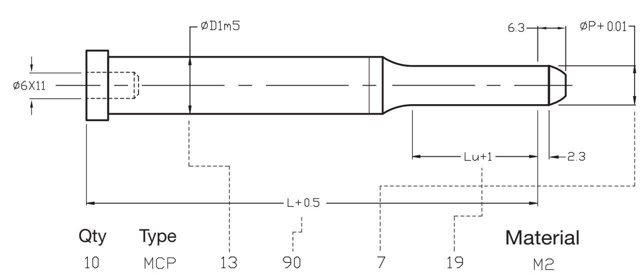
MCP													
					L								
D1	D2	T	Lu	RANGE P	50	56	63	71	80	90	100	125	150
10.0	13.0	5	13/19/25	3.9 - 9.99	X	X	X	X	X	X	X	X	X
13.0	16.0	5	13/19/25	4.9 - 12.99	X	X	X	X	X	X	X	X	X
16.0	19.0	5	13/19/25	7.9 - 15.99	X	X	X	X	X	X	X	X	X
20.0	23.0	5	13/19/25	11.9 - 19.99	X	X	X	X	X	X	X	X	X
25.0	28.0	5	13/19/25	14.9 - 24.99		X	X	X	X	X	X	X	X
32.0	35.0	5	13/19/25	19.9 - 31.99		X	X	X	X	X	X	X	X

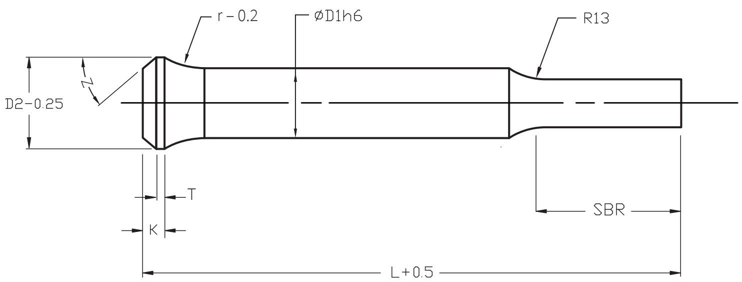
For standard alterations see pages 47 and 48.
For locating devices see page 49.

Material	Hardness HRC
HSS - M2	60-62
PS (on request)	62-64

Order Example:

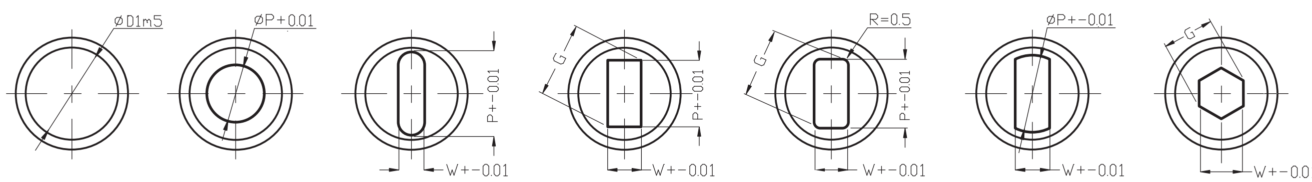






Material	Hardness HRC
HSS - M2	60-62
PS (on request)	62-64

MBNB MBNC MBNO MBNR MBNL MBNF MBNH



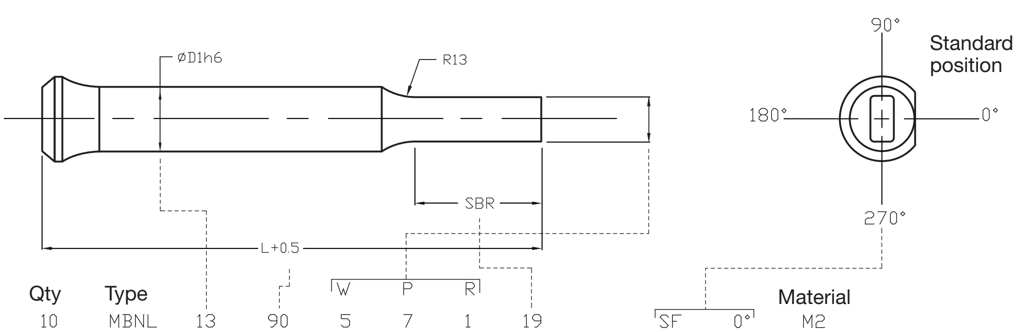
$G=\sqrt{W^2 + P^2}$ $G=\sqrt{(W - 2R)^2 + (P - 2R)^2} + 2R$ $G= W \times 1.1547$

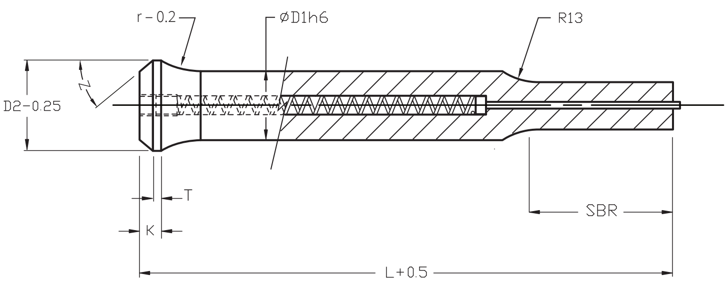
For qualified shapes see page 46.

D1	D2	T	Lu	k	r	z	ROUND	SHAPE		L				
							RANGE P	MIN W	MAX G/P	80	90	100	120	150
5.0	7.0	1.5	13/19	4.0	10.0	15.0	1.5 - 4.99	1.5	4.99	X	X	X	X	X
6.0	9.0	1.5	13/19	4.0	10.0	15.0	1.5 - 5.99	1.5	5.99	X	X	X	X	X
8.0	11.0	1.5	13/19	4.0	12.0	15.0	2.5 - 7.99	2.5	7.99	X	X	X	X	X
10.0	14.0	1.5	13/19/25	4.0	15.0	15.0	4.0 - 9.99	3.5	9.99	X	X	X	X	X
13.0	17.0	1.5	13/19/25	4.0	15.0	15.0	5.0 - 12.99	4.5	12.99	X	X	X	X	X
16.0	20.0	1.5	13/19/25	4.0	15.0	15.0	8.0 - 15.99	6.0	15.99	X	X	X	X	X
20.0	25.0	1.5	13/19/25	4.0	15.0	15.0	12.0 - 19.99	8.0	19.99	X	X	X	X	X
25.0	30.0	1.5	13/19/25	4.0	15.0	15.0	16.0 - 24.99	10.0	24.99	X	X	X	X	X

Longer lengths (L) available upon request.
For standard alterations see pages 47 and 48.
For locating devices see page 49.

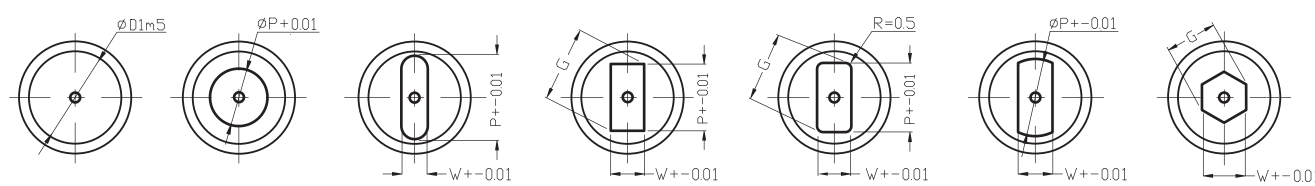
Order Example:





Material	Hardness HRC
HSS - M2	60-62
PS (on request)	62-64

MBNEB	MBNEC	MBNEO	MBNER	MBNEL	MBNEF	MBNEH



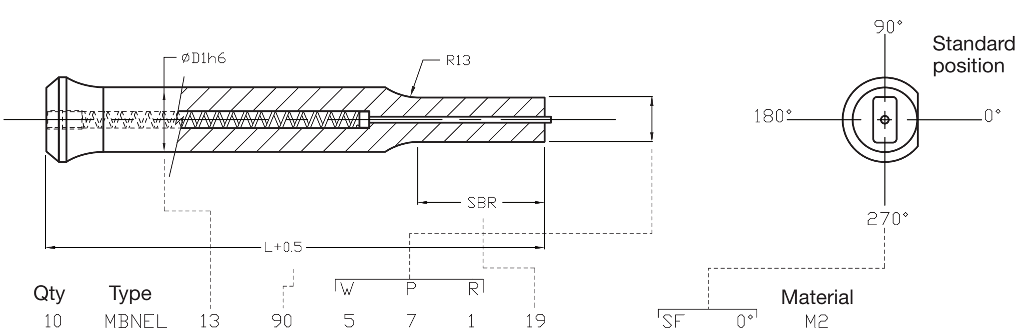
$G = \sqrt{W^2 + P^2}$ $G = \sqrt{(W - 2R)^2 + (P - 2R)^2} + 2R$ $G = W \times 1.1547$

For qualified shapes see page 46.

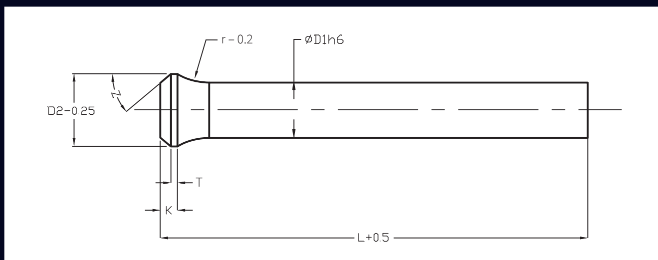
D1	D2	T	Lu	k	r	z	ROUND RANGE P	SHAPE MIN W	SHAPE MAX G/P	L 80	L 90	L 100	L 120	L 150
6.0	9.0	1.5	13/19	4.0	10.0	15.0	1.5 - 5.99	1.5	5.99	X	X	X	X	X
8.0	11.0	1.5	13/19	4.0	10.0	15.0	2.5 - 7.99	2.5	7.99	X	X	X	X	X
10.0	14.0	1.5	13/19/25	4.0	12.0	15.0	4.0 - 9.99	3.5	9.99	X	X	X	X	X
13.0	17.0	1.5	13/19/25	4.0	15.0	15.0	5.0 - 12.99	4.5	12.99	X	X	X	X	X
16.0	20.0	1.5	13/19/25	4.0	15.0	15.0	8.0 - 15.99	6.0	15.99	X	X	X	X	X
20.0	25.0	1.5	13/19/25	4.0	15.0	15.0	12.0 - 19.99	8.0	19.99	X	X	X	X	X
25.0	30.0	1.5	13/19/25	4.0	15.0	15.0	16.0 - 24.99	10.0	24.99	X	X	X	X	X

For standard alterations see pages 47 and 48.
For locating devices see page 49.

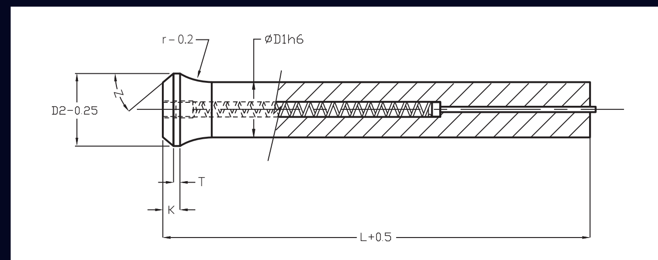
Order Example:



MBNX



MBNEX



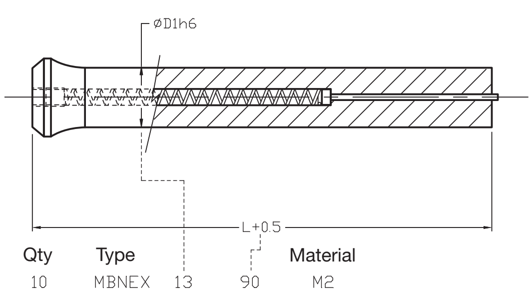
RANGE D1	D2	T	k	r	L						
					63	71	80	90	100	120	150
5.0 - 5.4*	7.0	1.5	4.0	10.0	X	X	X	X	X	X	X
5.5 - 5.9*	8.0	1.5	4.0	10.0	X	X	X	X	X	X	X
6.0 - 6.4	9.0	1.5	4.0	10.0	X	X	X	X	X	X	X
6.5 - 7.4	10.0	1.5	4.0	12.0	X	X	X	X	X	X	X
7.5 - 8.4	11.0	1.5	4.0	12.0	X	X	X	X	X	X	X
8.5 - 9.4	13.0	1.5	4.0	15.0	X	X	X	X	X	X	X
9.5 - 10.4	14.0	1.5	4.0	15.0	X	X	X	X	X	X	X
10.5 - 11.4	15.0	1.5	4.0	15.0	X	X	X	X	X	X	X
11.5 - 12.4	16.0	1.5	4.0	15.0	X	X	X	X	X	X	X
12.5 - 13.4	17.0	1.5	4.0	15.0	X	X	X	X	X	X	X
13.5 - 14.4	18.0	1.5	4.0	15.0	X	X	X	X	X	X	X
14.5 - 15.4	19.0	1.5	4.0	15.0	X	X	X	X	X	X	X
15.5 - 16.4	20.0	1.5	4.0	15.0	X	X	X	X	X	X	X
16.5 - 17.4	21.0	1.5	4.0	15.0	X	X	X	X	X	X	X
17.5 - 18.4	22.0	1.5	4.0	15.0	X	X	X	X	X	X	X
18.5 - 19.4	23.0	1.5	4.0	15.0	X	X	X	X	X	X	X
19.5 - 20.0	25.0	1.5	4.0	15.0	X	X	X	X	X	X	X

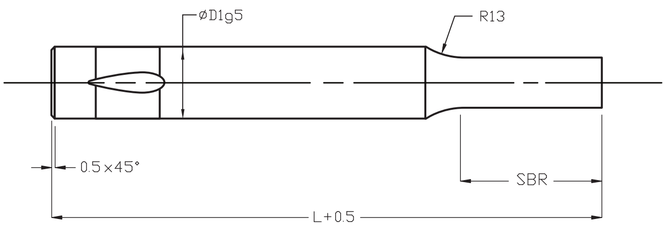
* MBNX only

Longer lengths (L) available upon request.
For standard alterations see pages 47 and 48.
For locating devices see page 49.

Material	Hardness HRC
HSS - M2	60-62
PS (on request)	62-64

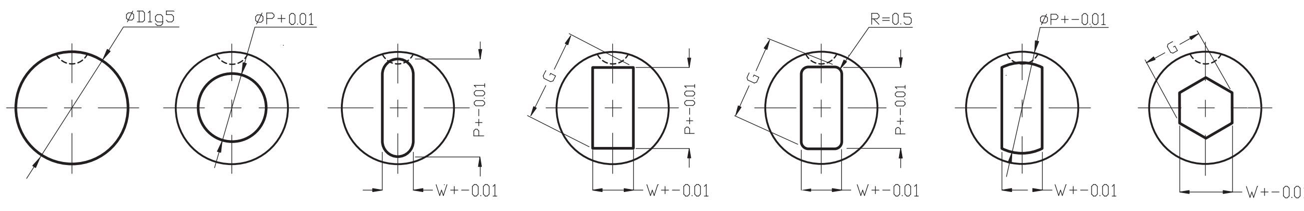
Order Example:





Material	Hardness HRC
HSS - M2	60-62

MBLB	MBLC	MBLO	MBLR	MBLL	MBLF	MBLH



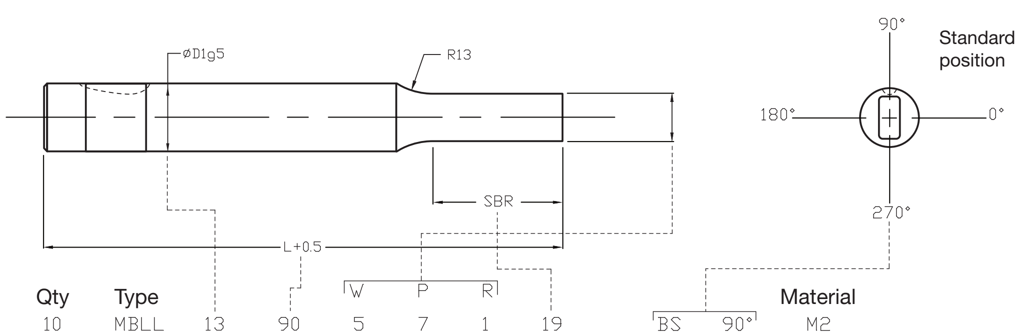
$G = \sqrt{W^2 + P^2}$ $G = \sqrt{(W - 2R)^2 + (P - 2R)^2} + 2R$ $G = W \times 1.1547$

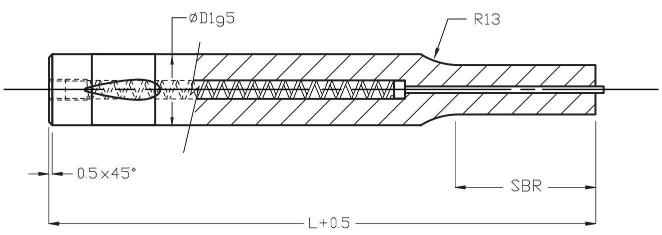
For qualified shapes see page 46.

D1	Lu	ROUND RANGE P	SHAPE MIN W	SHAPE MAX G/P	L 56	L 63	L 71	L 80	L 90	L 100	L 125	L 150
6.0	13/19	2.5 - 5.98	2.0	5.98	X	X	X	X	X	X	X	X
10.0	13/19	3.5 - 9.98	3.2	9.98	X	X	X	X	X	X	X	X
13.0	13/19	5.0 - 12.98	4.5	12.98	X	X	X	X	X	X	X	X
16.0	19/25	8.5 - 15.98	6.0	15.98	X	X	X	X	X	X	X	X
20.0	19/25	12.5 - 19.98	8.0	19.98	X	X	X	X	X	X	X	X
25.0	19/25	16.0 - 24.98	10.0	24.98		X	X	X	X	X	X	X
32.0	19/25	20.0 - 31.98	16.0	31.98		X	X	X	X	X	X	X
38.0	19/25	25 - 37.98	18.0	37.98			X	X	X	X	X	X

For standard alterations see pages 47 and 48.

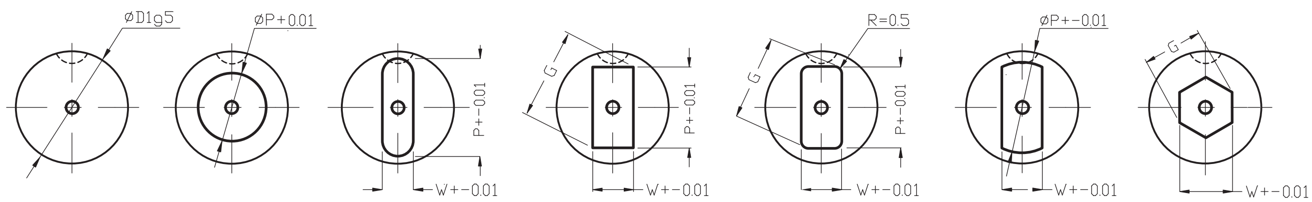
Order Example:





Material	Hardness HRC
HSS - M2	60-62

MBLEB MBLEC MBLEO MBLER MBLEL MBLEF MBLEH



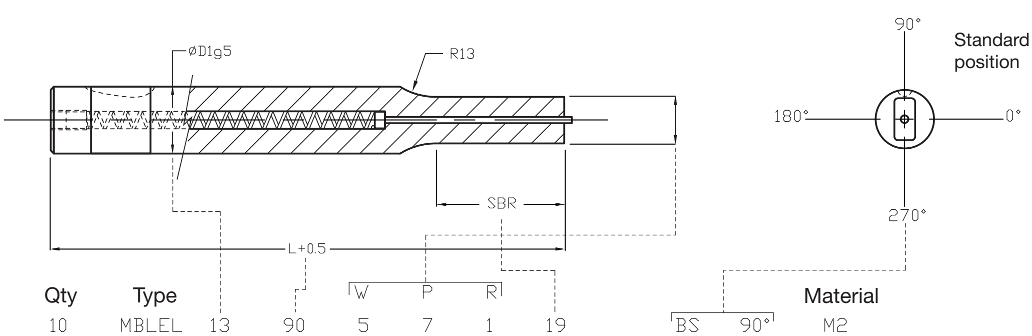
$G = \sqrt{W^2 + P^2}$ $G = \sqrt{(W - 2R)^2 + (P - 2R)^2} + 2R$ $G = W \times 1.1547$

For qualified shapes see page 46.

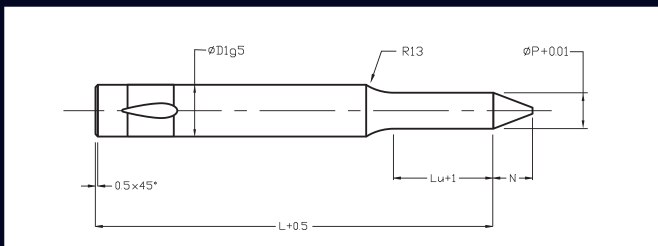
		ROUND	SHAPE		L							
D1	Lu	RANGE P	MIN W	MAX G/P	56	63	71	80	90	100	125	150
6.0	13/19	2.5 - 5.98	2.0	5.98	X	X	X	X	X	X	X	X
10.0	13/19	3.5 - 9.98	3.2	9.98	X	X	X	X	X	X	X	X
13.0	13/19	5.0 - 12.98	4.5	12.98	X	X	X	X	X	X	X	X
16.0	19/25	8.5 - 15.98	6.0	15.98	X	X	X	X	X	X	X	X
20.0	19/25	12.5 - 19.98	8.0	19.98	X	X	X	X	X	X	X	X
25.0	19/25	16.0 - 24.98	10.0	24.98		X	X	X	X	X	X	X
32.0	19/25	20.0 - 31.98	16.0	31.98		X	X	X	X	X	X	X
38.0	19/25	25 - 37.98	18.0	37.98			X	X	X	X	X	X

For standard alterations see pages 47 and 48.

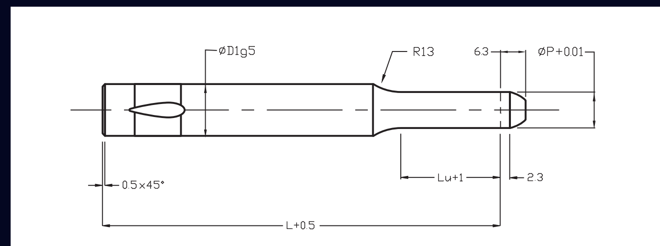
Order Example:



MBLA



MBLP



MBLA

D1	Lu	N	RANGE P	L: 63	71	80	90	100	120	150
10.0	13/19/25	10.0	4.9 - 9.99	X	X	X	X	X	X	X
13.0	13/19/25	12.0	5.9 - 12.99	X	X	X	X	X	X	X
16.0	13/19/25	17.0	9.9 - 15.99	X	X	X	X	X	X	X
20.0	13/19/25	22.0	12.9 - 19.99	X	X	X	X	X	X	X
25.0	13/19/25	25.0	16.9 - 24.99		X	X	X	X	X	X
32.0	13/19/25	25.0	19.9 - 31.99		X	X	X	X	X	X
38.0	13/19/25	30.0	24.9 - 37.99		X	X	X	X	X	X

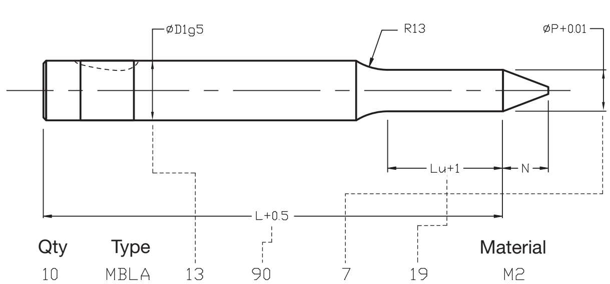
MBLP

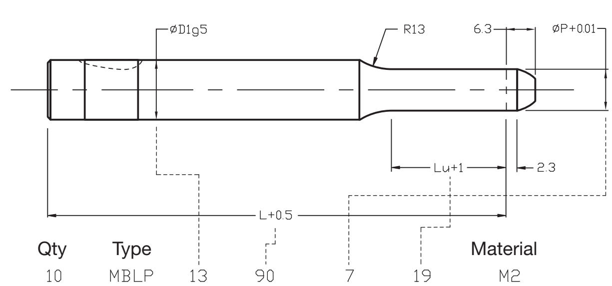
D1	Lu	RANGE P	L: 56	63	71	80	90	100	120	150
6.0	13/19	1.9 - 5.99	X	X	X	X	X		X	X
10.0	13/19/25	3.9 - 9.99	X	X	X	X	X	X	X	X
13.0	13/19/25	4.9 - 12.99	X	X	X	X	X	X	X	X
16.0	13/19/25	7.9 - 15.99	X	X	X	X	X	X	X	X
20.0	13/19/25	11.9 - 19.99	X	X	X	X	X	X	X	X
25.0	13/19/25	14.9 - 24.99		X	X	X	X	X	X	X
32.0	13/19/25	19.9 - 31.99		X	X	X	X	X	X	X
38.0	13/19/25	24.9 - 37.99		X	X	X	X	X	X	X

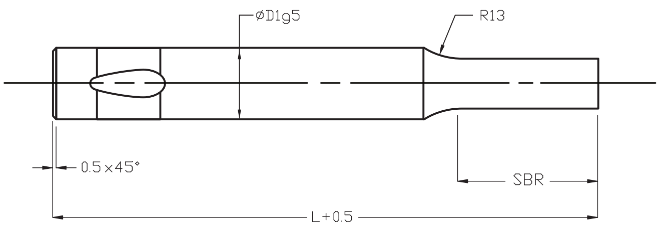
Longer lengths (L) available upon request.
For standard alterations see pages 47 and 48.

Material	Hardness HRC
HSS - M2	60-62

Order Example:

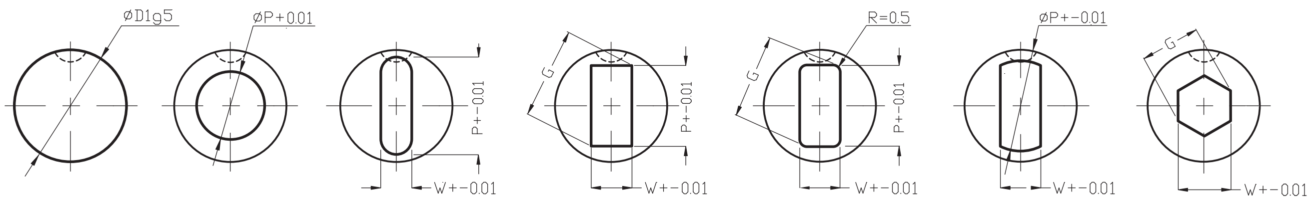






Material	Hardness HRC
HSS - M2	60-62

MBHB MBHC MBHO MBHR MBHL MBHF MBHH



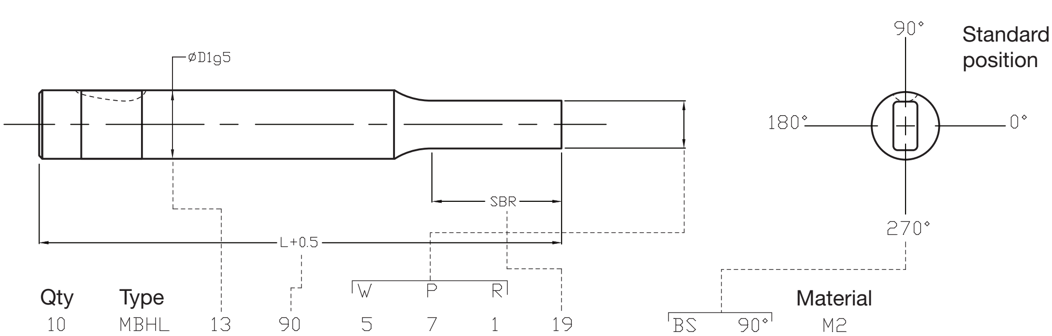
G= $\sqrt{W^2 + P^2}$ G= $\sqrt{(W - 2R)^2 + (P - 2R)^2} + 2R$ G= W x 1.1547

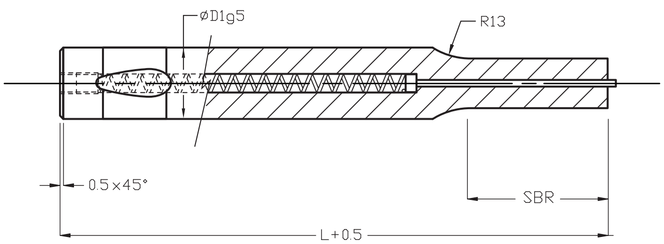
For qualified shapes see page 46.

		ROUND	SHAPE		L						
D1	Lu	RANGE P	MIN W	MAX G/P	63	71	80	90	100	125	150
10.0	13/19	2.5 - 9.98	2.5	9.98	X	X	X	X	X	X	X
13.0	13/19	5.0 - 12.98	4.5	12.98	X	X	X	X	X	X	X
16.0	19/25	8.0 - 15.98	6.0	15.98	X	X	X	X	X	X	X
20.0	19/25	12.0 - 19.98	8.0	19.98	X	X	X	X	X	X	X
25.0	19/25	16.0 - 24.98	10.0	24.98	X	X	X	X	X	X	X
32.0	19/25	24.0 - 31.98	12.0	31.98		X	X	X	X	X	X
40.0	19/25	30.0 - 39.98	18.0	39.98			X	X	X	X	X

Longer lengths (L) available upon request.
For standard alterations see pages 47 and 48.

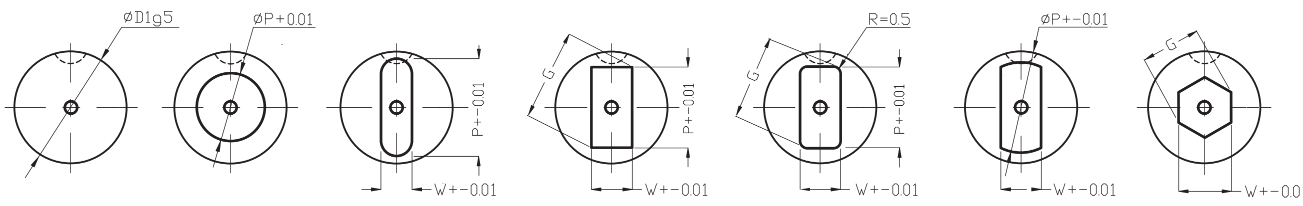
Order Example:





Material	Hardness HRC
HSS - M2	60-62

MBHEB MBHEC MBHEO MBHER MBHEL MBHEF MBHEH



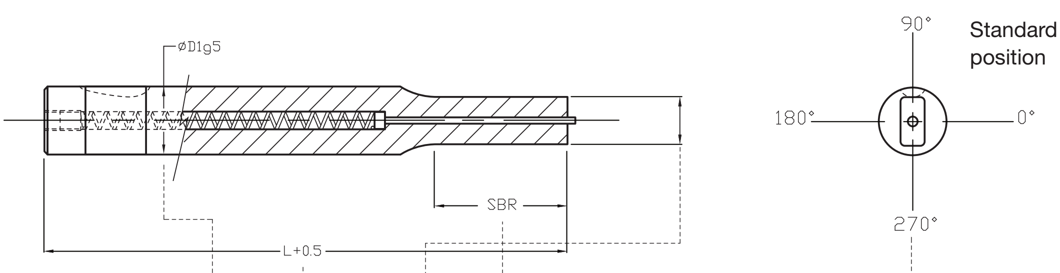
$G = \sqrt{W^2 + P^2}$ $G = \sqrt{(W - 2R)^2 + (P - 2R)^2} + 2R$ G= W x 1.1547

For qualified shapes see page 46.

		ROUND	SHAPE		L						
D1	Lu	RANGE P	MIN W	MAX G/P	63	71	80	90	100	125	150
10.0	13/19	2.5 - 9.98	2.5	9.98	X	X	X	X	X	X	X
13.0	13/19	5.0 - 12.98	4.5	12.98	X	X	X	X	X	X	X
16.0	19/25	8.0 - 15.98	6.0	15.98	X	X	X	X	X	X	X
20.0	19/25	12.0 - 19.98	8.0	19.98	X	X	X	X	X	X	X
25.0	19/25	16.0 - 24.98	10.0	24.98	X	X	X	X	X	X	X
32.0	19/25	24.0 - 31.98	12.0	31.98		X	X	X	X	X	X
40.0	19/25	30.0 - 39.98	18.0	39.98			X	X	X	X	X

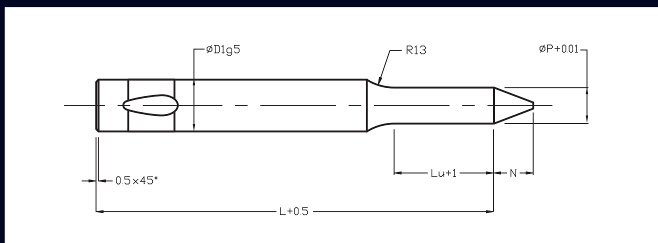
Longer lengths (L) available upon request.
For standard alterations see pages 47 and 48.

Order Example:

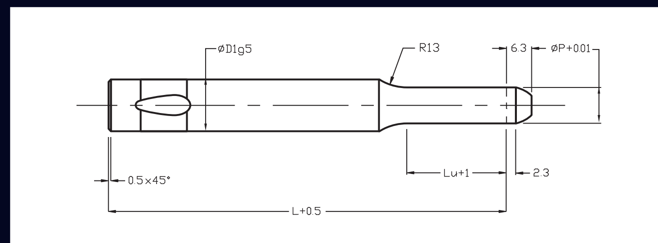


Qty	Type			W	P	R				Material
10	MBHEL	13	90	5	7	1	19	BS	90°	M2

MBHA



MBHP



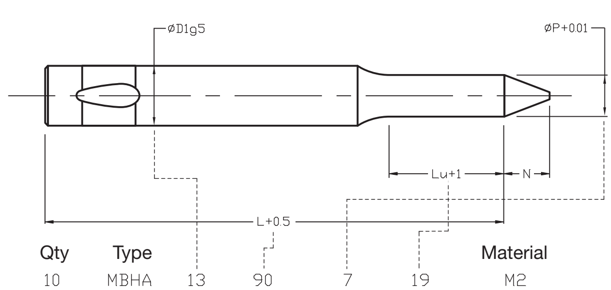
MBHA										
				L						
D1	Lu	N	RANGE P	63	71	80	90	100	120	150
10.0	13/19/25	10.0	4.9 - 9.99	X	X	X	X	X	X	X
13.0	13/19/25	12.0	5.9 - 12.99	X	X	X	X	X	X	X
16.0	13/19/25	17.0	9.9 - 15.99	X	X	X	X	X	X	X
20.0	13/19/25	22.0	12.9 - 19.99	X	X	X	X	X	X	X
25.0	13/19/25	25.0	16.9 - 24.99		X	X	X	X	X	X
32.0	13/19/25	25.0	19.9 - 31.99		X	X	X	X	X	X
40.0	13/19/25	30.0	24.9 - 39.99		X	X	X	X	X	X

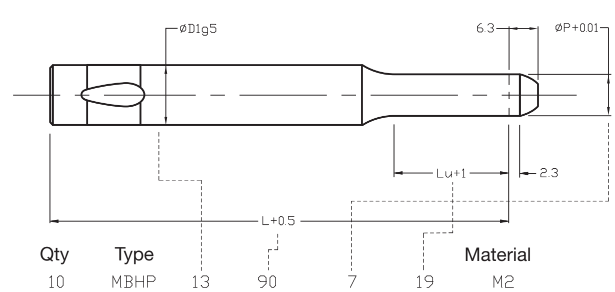
MBHP										
			L							
D1	Lu	RANGE P	56	63	71	80	90	100	120	150
10.0	13/19/25	3.9 - 9.99	X	X	X	X	X	X	X	X
13.0	13/19/25	4.9 - 12.99	X	X	X	X	X	X	X	X
16.0	13/19/25	7.9 - 15.99	X	X	X	X	X	X	X	X
20.0	13/19/25	11.9 - 19.99	X	X	X	X	X	X	X	X
25.0	13/19/25	14.9 - 24.99		X	X	X	X	X	X	X
32.0	13/19/25	19.9 - 31.99		X	X	X	X	X	X	X
40.0	13/19/25	24.9 - 39.99		X	X	X	X	X	X	X

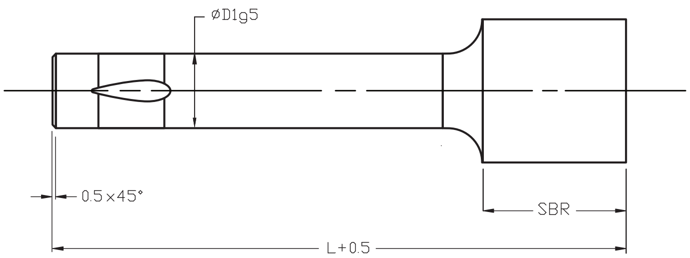
Longer lengths (L) available upon request.
For standard alterations see pages 47 and 48.

Material	Hardness HRC
HSS - M2	60-62

Order Example:

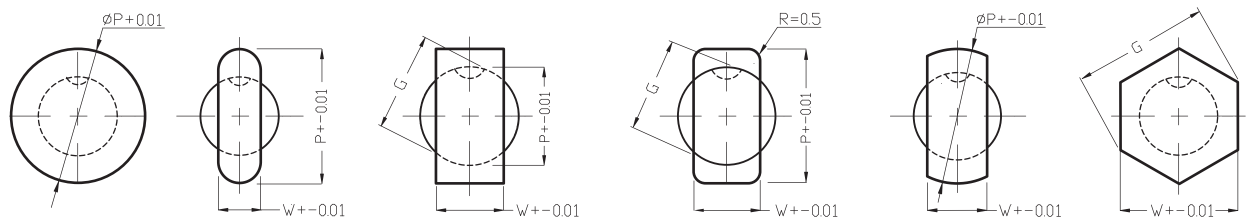






Material	Hardness HRC
HSS - M2	60-62

MBLKC MBLKO MBLKR MBLKL MBLKF MBLKH



$G=\sqrt{W^2+P^2}$

$G=\sqrt{(W-2R)^2+(P-2R)^2}+2R$

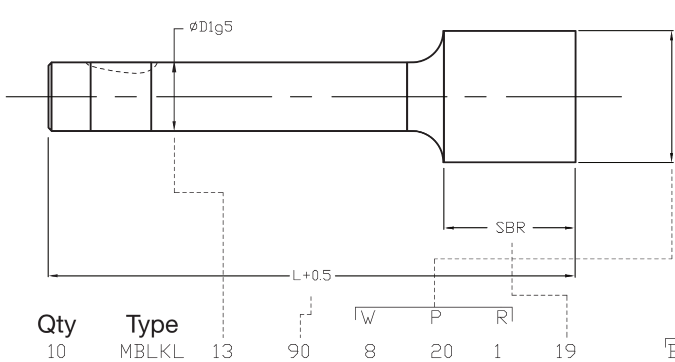
G= W x 1.1547

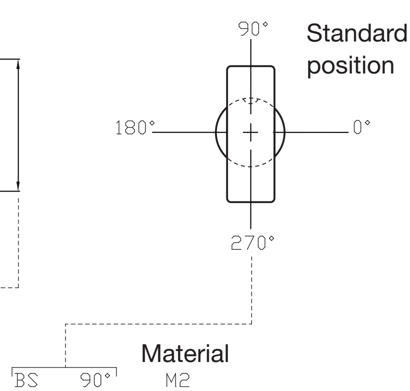
For qualified shapes see page 46.

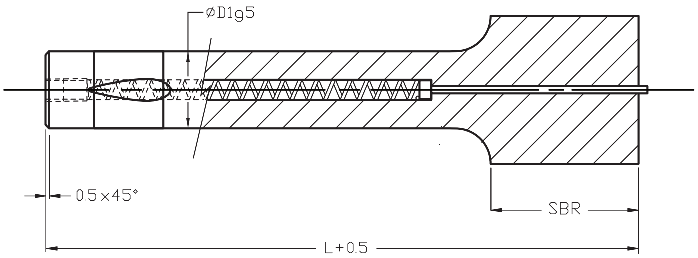
D1	Lu	ROUND RANGE P	SHAPE MIN W	 MAX G/P	L 80	 90	 100
10.0	13/19/25	10.01 - 30.0	4.0	30.0	X	X	X
13.0	13/19/25	13.01 - 32.0	5.0	32.0	X	X	X
16.0	13/19/25	16.01 - 38.0	6.5	38.0	X	X	X
20.0	13/19/25	20.01 - 40.0	8.0	40.0	X	X	X
25.0	13/19/25	25.01 - 44.0	10.0	44.0	X	X	X
32.0	13/19/25	32.01 - 50.0	11.5	50.0	X	X	X
38.0	13/19/25	38.01 - 56.0	14.0	56.0	X	X	X

For standard alterations see pages 47 and 48.

Order Example:

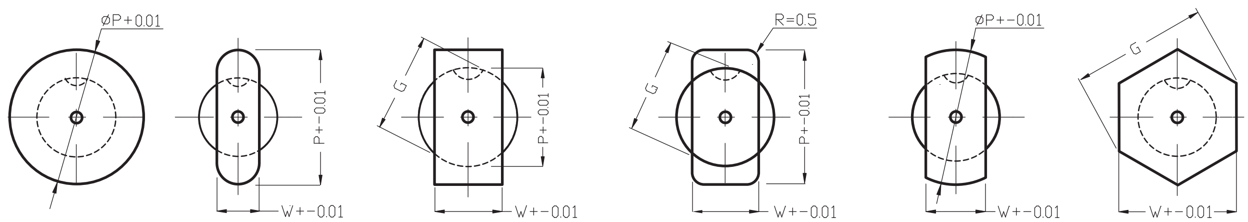






Material	Hardness HRC
HSS - M2	60-62

MBLEKC MBLEKO MBLEKR MBLEKL MBLEKF MBLEKH



G= $\sqrt{W^2 + P^2}$

G= $\sqrt{(W - 2R)^2 + (P - 2R)^2} + 2R$

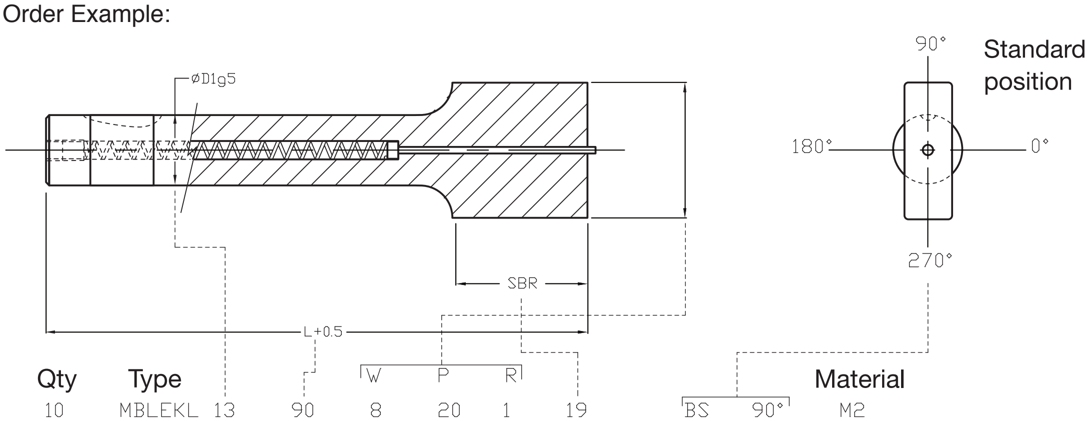
G= W x 1.1547

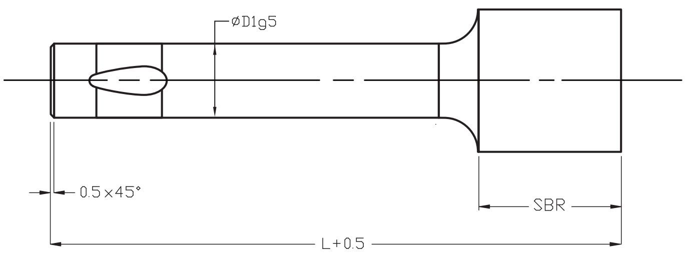
For qualified shapes see page 46.

		ROUND	SHAPE		L		
D1	Lu	RANGE P	MIN W	MAX G/P	80	90	100
10.0	13/19/25	10.01 - 30.0	4.0	30.0	X	X	X
13.0	13/19/25	13.01 - 32.0	5.0	32.0	X	X	X
16.0	13/19/25	16.01 - 38.0	6.5	38.0	X	X	X
20.0	13/19/25	20.01 - 40.0	8.0	40.0	X	X	X
25.0	13/19/25	25.01 - 44.0	10.0	44.0	X	X	X
32.0	13/19/25	32.01 - 50.0	11.5	50.0	X	X	X
38.0	13/19/25	38.01 - 56.0	14.0	56.0	X	X	X

For standard alterations see pages 47 and 48.

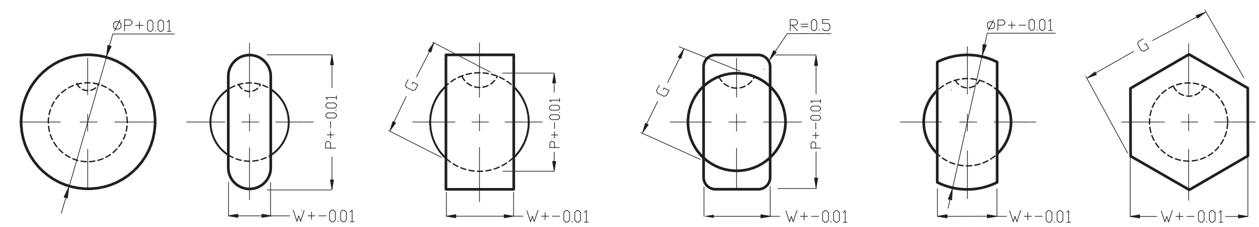
Order Example:





Material	Hardness HRC
HSS - M2	60-62

MBHKC MBHKO MBHKR MBHKL MBHKF MBHKH



MBHKR: $G = \sqrt{W^2 + P^2}$

MBHKL: $G = \sqrt{(W - 2R)^2 + (P - 2R)^2} + 2R$

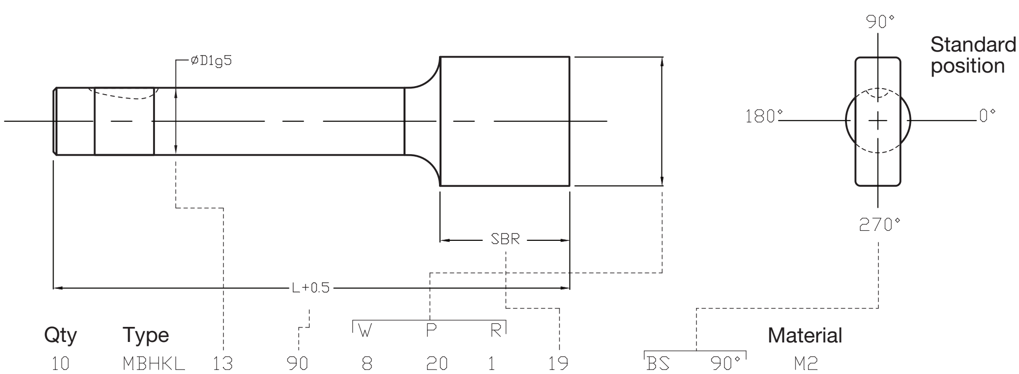
MBHKH: $G = W \times 1.1547$

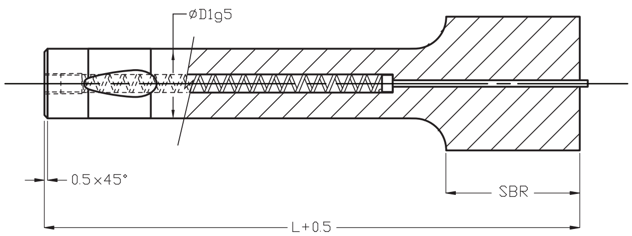
For qualified shapes see page 46.

		ROUND	SHAPE		L		
D1	Lu	RANGE P	MIN W	MAX G/P	80	90	100
10.0	13/19/25	10.01 - 30.0	4.0	30.0	X	X	X
13.0	13/19/25	13.01 - 32.0	5.0	32.0	X	X	X
16.0	13/19/25	16.01 - 38.0	6.5	38.0	X	X	X
20.0	19/25/30	20.01 - 40.0	8.0	40.0	X	X	X
25.0	19/25/30	25.01 - 44.0	10.0	44.0	X	X	X
32.0	19/25/30	32.01 - 50.0	11.5	50.0	X	X	X
40.0	19/25/30	40.01 - 56.0	14.0	56.0	X	X	X

Longer lengths (L) available upon request.
For standard alterations see pages 47 and 48.

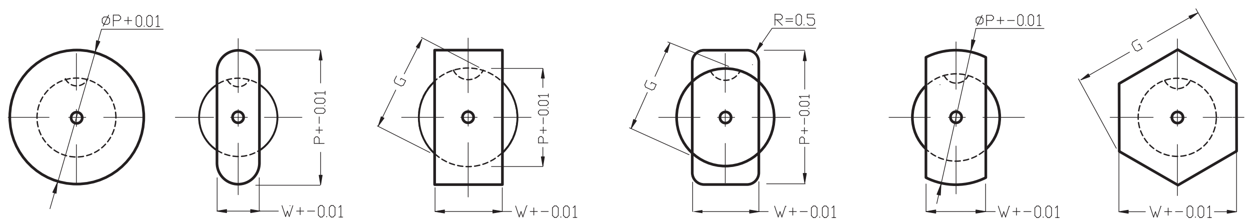
Order Example:





Material	Hardness HRC
HSS - M2	60-62

MBHEKC	MBHEKO	MBHEKR	MBHEKL	MBHEKF	MBHEKH



G= $\sqrt{W^2 + P^2}$

G= $\sqrt{(W - 2R)^2 + (P - 2R)^2} + 2R$

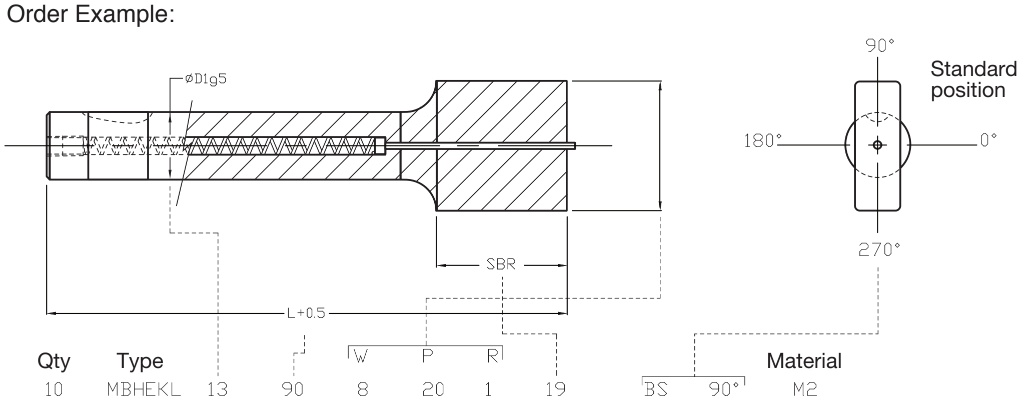
G= W x 1.1547

For qualified shapes see page 46.

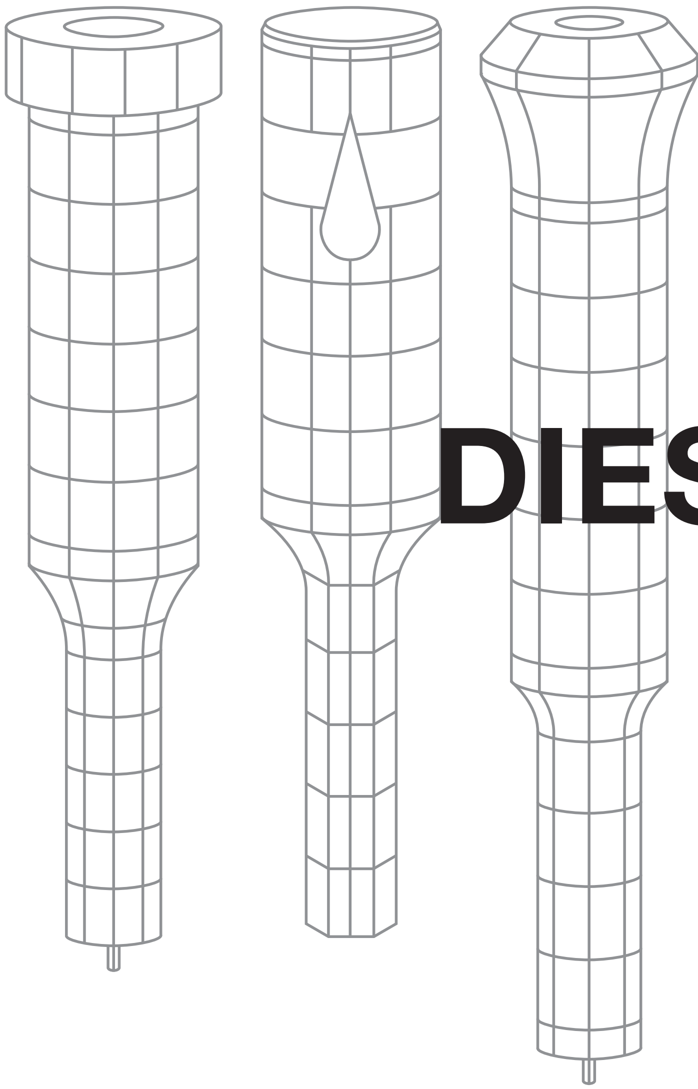
		ROUND	SHAPE		L		
D1	Lu	RANGE P	MIN W	MAX G/P	80	90	100
10.0	13/19/25	10.01 - 30.0	4.0	30.0	X	X	X
13.0	13/19/25	13.01 - 32.0	5.0	32.0	X	X	X
16.0	13/19/25	16.01 - 38.0	6.5	38.0	X	X	X
20.0	19/25/30	20.01 - 40.0	8.0	40.0	X	X	X
25.0	19/25/30	25.01 - 44.0	10.0	44.0	X	X	X
32.0	19/25/30	32.01 - 50.0	11.5	50.0	X	X	X
40.0	19/25/30	40.01 - 56.0	14.0	56.0	X	X	X

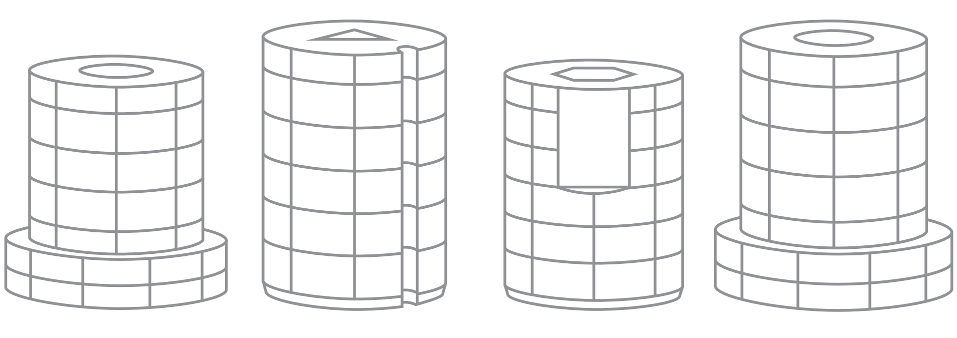
Longer lengths (L) available upon request.
For standard alterations see pages 47 and 48.

Order Example:



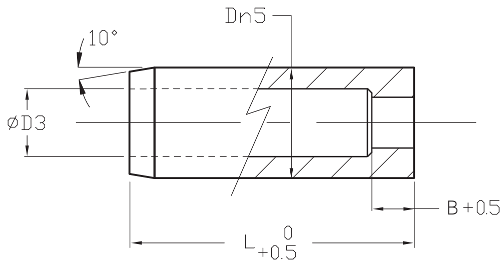
DIES





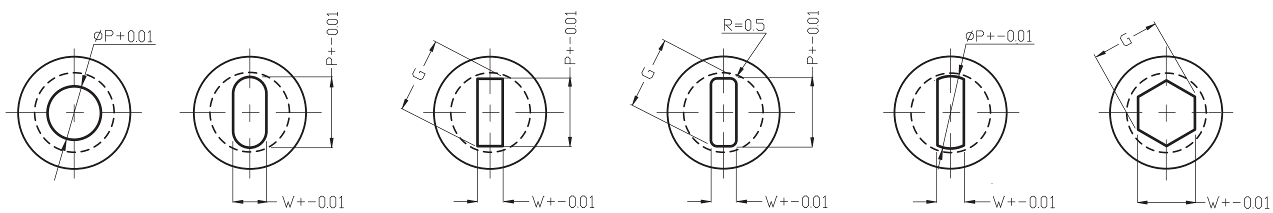
FRACTIONS	DECIMAL	MM
1/64	.0156	0.396
1/32	.0312	0.793
3/64	.0468	1.190
1/16	.0625	1.587
5/64	.0781	1.984
3/32	.0937	2.381
7/64	.1093	2.778
1/8	.1250	3.175
9/64	.1406	3.571
5/32	.1562	3.968
11/64	.1718	4.365
3/16	.1875	4.762
13/64	.2031	5.159
7/32	.2187	5.556
15/64	.2343	5.593
1/4	.2500	6.350
17/64	.2656	6.746
9/32	.2812	7.143
19/64	.2968	7.540
5/16	.3125	7.937
21/64	.3281	8.334
11/32	.3437	8.731
23/64	.3593	9.128
3/8	.3750	9.525
25/64	.3906	9.921
13/32	.4062	10.318
27/64	.4218	10.715
7/16	.4375	11.112
29/64	.4531	11.509
15/32	.4687	11.906
31/64	.4843	12.303
1/2	.5000	12.700

FRACTIONS	DECIMAL	MM
33/64	.5156	13.096
17/32	.5312	13.493
35/64	.5468	13.890
9/16	.5625	14.287
37/64	.5781	14.684
19/32	.5937	15.081
39/64	.6093	15.478
5/8	.6250	15.875
41/64	.6406	16.271
21/32	.6562	16.668
43/64	.6718	17.065
11/16	.6875	17.462
45/64	.7031	17.859
23/32	.7187	18.256
47/64	.7343	18.653
3/4	.7500	19.050
49/64	.7656	19.446
25/32	.7812	19.843
51/64	.7968	20.240
13/16	.8125	20.637
53/64	.8281	21.034
27/32	.8437	21.431
55/64	.8593	21.828
7/8	.8750	22.225
57/64	.8906	22.621
29/32	.9062	23.018
59/64	.9218	23.415
15/16	.9375	23.812
61/64	.9531	24.209
31/32	.9687	24.606
63/64	.9843	25.003
1	1.000	25.400



Material	Hardness HRC
HSS - M2	60-62
PS (on request)	62-64

MTDC	MDO	MDR	MDL	MDF	MDH



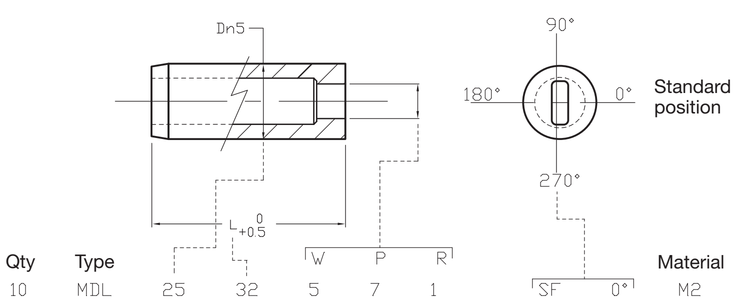
$G = \sqrt{W^2 + P^2}$ $G = \sqrt{(W - 2R)^2 + (P - 2R)^2} + 2R$ $G = W \times 1.1547$

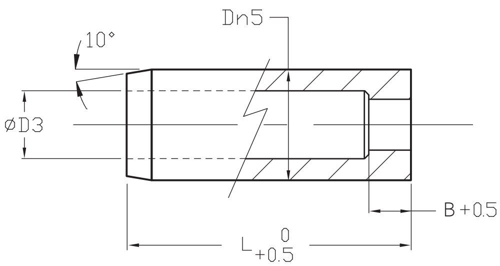
For qualified shapes see page 44.

D1	B	MAX D3	ROUND	SHAPE		L						
			RANGE P	MIN W	MAX G/P	16	20	25	30	32	35	40
5.0	2	2.8	1.0 - 2.4	1.2	2.4	X	X	X	X	X		X
6.0	3	3.5	1.6 - 3.0	1.5	3.0	X	X	X	X	X		X
8.0	4	4.0	2.0 - 3.5	1.5	3.5	X	X	X	X	X		X
10.0	4	5.8	3.0 - 5.0	2.0	5.0	X	X	X	X	X	X	X
13.0	5	8.0	4.0 - 7.2	3.0	7.2		X	X	X	X	X	X
16.0	5	9.5	6.0 - 8.8	4.0	8.8		X	X	X	X	X	X
20.0	8	12.0	7.5 - 11.3	6.0	11.3		X	X	X	X	X	X
22.0	8	15.0	9.0 - 14.3	8.0	14.3		X	X	X	X	X	X
25.0	8	17.3	11.0 - 16.6	8.0	16.6		X	X	X	X	X	X
32.0	8	20.7	15.0 - 20.0	8.0	20.0		X	X	X	X	X	X
38.0	8	27.7	18.0 - 27.0	10.0	27.0		X	X	X	X	X	X
40.0	8	27.7	18.0 - 27.0	10.0	27.0		X	X	X	X	X	X

For extended range shank diameters see the following page.
For standard alterations see pages 47 and 48.
For locating devices see page 49.

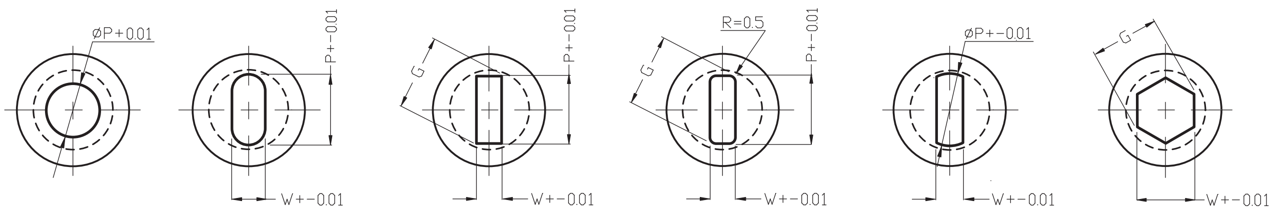
Order Example:





Material	Hardness HRC
HSS - M2	60-62
PS (on request)	62-64

MTDC	MDO	MDR	MDL	MDF	MDH



G= $\sqrt{W^2 + P^2}$

G= $\sqrt{(W - 2R)^2 + (P - 2R)^2} + 2R$

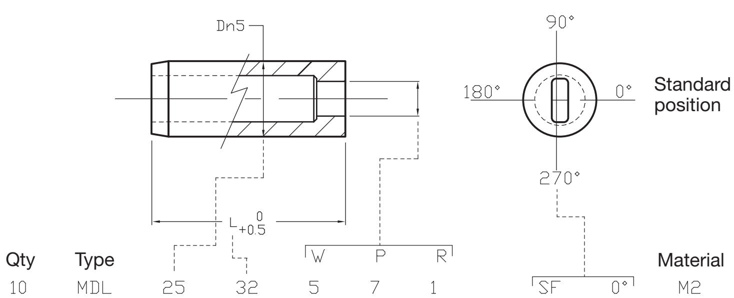
G= W x 1.1547

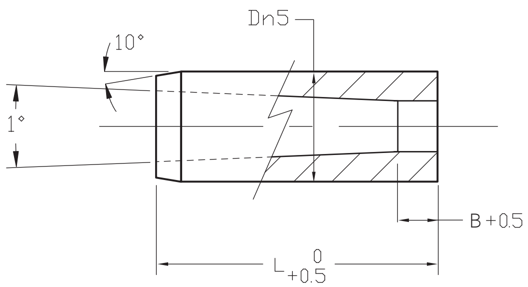
For qualified shapes see page 44.

			ROUND	SHAPE		L						
D1	B	MAX D3	RANGE P	MIN W	MAX G/P	20	25	30	32	35	40	45
45.0	8	36.0	19.05 - 35.6	5.0	35.6	X	X	X	X	X	X	X
50.0	8	41.0	22.2 - 40.6	7.0	40.6	X	X	X	X	X	X	X
56.0	8	46.0	25.4 - 45.6	8.0	45.6	X	X	X	X	X	X	X
63.0	8	51.0	28.55 - 50.5	9.0	50.5	X	X	X	X	X	X	X
71.0	8	57.0	31.75 - 56.5	11.0	56.5	X	X	X	X	X	X	X
76.0	8	61.0	34.90 - 60.5	13.0	60.5	X	X	X	X	X	X	X
85.0	8	67.0	42.50 - 66.5	15.0	66.5	X	X	X	X	X	X	X
90.0	8	71.0	44.5 - 70.5	20.0	70.5	X	X	X	X	X	X	X
100.0	8	79.0	49.5 - 78.5	25.0	78.5	X	X	X	X	X	X	X

For standard alterations see pages 47 and 48.
For locating devices see page 49.

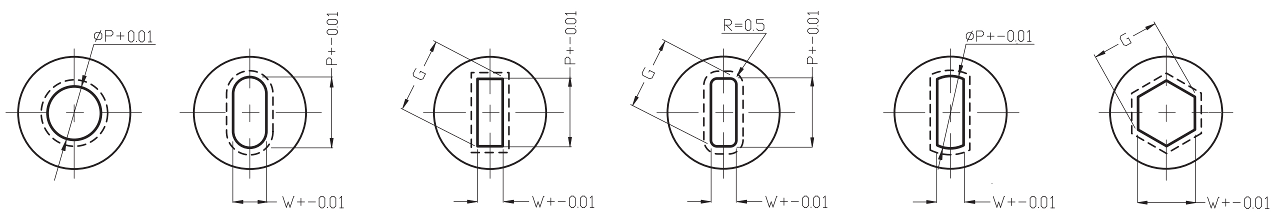
Order Example:





Material	Hardness HRC
HSS - M2	60-62
PS (on request)	62-64

MFDC	MFDO	MFDR	MFDL	MFDF	MFDH



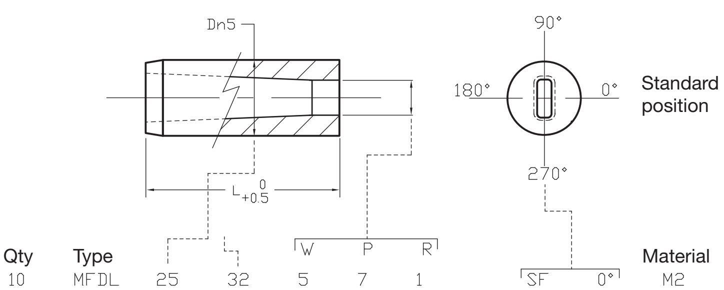
$G = \sqrt{W^2 + P^2}$ $G = \sqrt{(W - 2R)^2 + (P - 2R)^2} + 2R$ $G = W \times 1.1547$

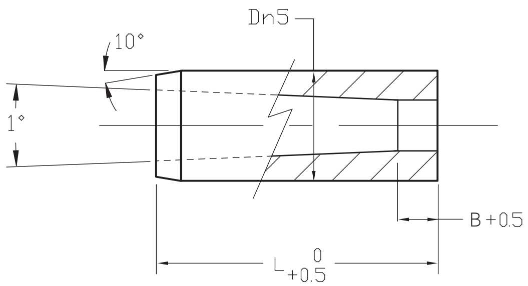
For qualified shapes see page 44.

D1	MAX D3	ROUND	SHAPE		L						
		RANGE P	MIN W	MAX G/P	16	20	25	30	32	35	40
5.0	2.8	1.0 - 2.4	1.2	2.4	X	X	X	X	X		X
6.0	3.5	1.6 - 3.0	1.5	3.0	X	X	X	X	X		X
8.0	4.0	2.0 - 3.5	1.5	3.5	X	X	X	X	X		X
10.0	5.8	3.0 - 5.0	2.0	5.0	X	X	X	X	X	X	X
13.0	8.0	4.0 - 7.2	3.0	7.2		X	X	X	X	X	X
16.0	9.5	6.0 - 8.8	4.0	8.8		X	X	X	X	X	X
20.0	12.0	7.5 - 11.3	6.0	11.3		X	X	X	X	X	X
22.0	15.0	9.0 - 14.3	8.0	14.3		X	X	X	X	X	X
25.0	17.3	11.0 - 16.6	8.0	16.6		X	X	X	X	X	X
32.0	20.7	15.0 - 20.0	8.0	20.0		X	X	X	X	X	X
38.0	27.7	18.0 - 27.0	10.0	27.0		X	X	X	X	X	X
40.0	27.7	18.0 - 27.0	10.0	27.0		X	X	X	X	X	X

For extended range shank diameters see the following page.
For standard alterations see pages 47 and 48.
For locating devices see page 49.

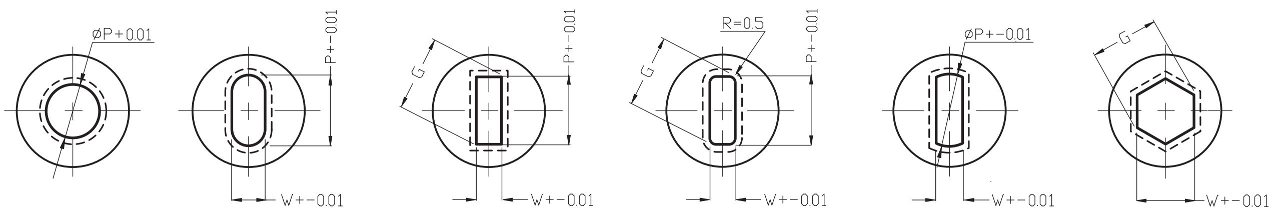
Order Example:





Material	Hardness HRC
HSS - M2	60-62
PS (on request)	62-64

MFDC **MFDO** **MFDR** **MFDL** **MFDF** **MFDH**



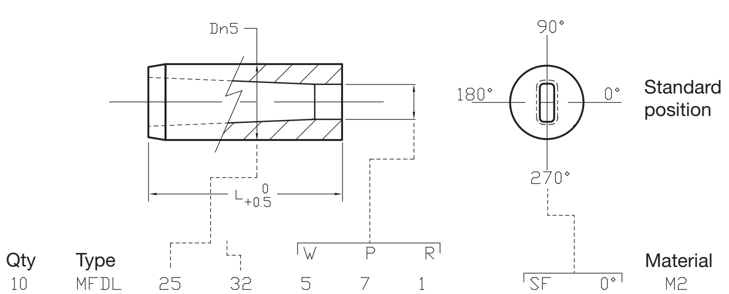
$G=\sqrt{W^2+P^2}$ $G=\sqrt{(W-2R)^2+(P-2R)^2}+2R$ G= W x 1.1547

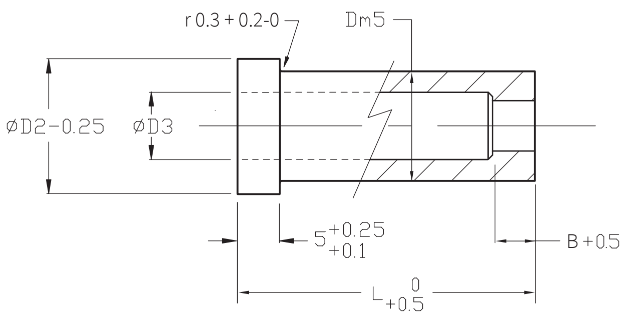
For qualified shapes see page 44.

D1	MAX D3	ROUND	SHAPE		L					
		RANGE P	MIN W	MAX G/P	20	25	30	32	35	40
45.0	36.0	19.05 - 35.6	5.0	35.6	X	X	X	X	X	X
50.0	41.0	22.2 - 40.6	7.0	40.6	X	X	X	X	X	X
56.0	46.0	25.4 - 45.6	8.0	45.6	X	X	X	X	X	X
63.0	51.0	28.55 - 50.5	9.0	50.5	X	X	X	X	X	X
71.0	57.0	31.75 - 56.5	11.0	56.5	X	X	X	X	X	X
76.0	61.0	34.90 - 60.5	13.0	60.5	X	X	X	X	X	X
85.0	67.0	42.50 - 66.5	15.0	66.5	X	X	X	X	X	X
90.0	71.0	44.5 - 70.5	20.0	70.5	X	X	X	X	X	X
100.0	79.0	49.5 - 78.5	25.0	78.5	X	X	X	X	X	X

For standard alterations see pages 47 and 48.
For locating devices see page 49.

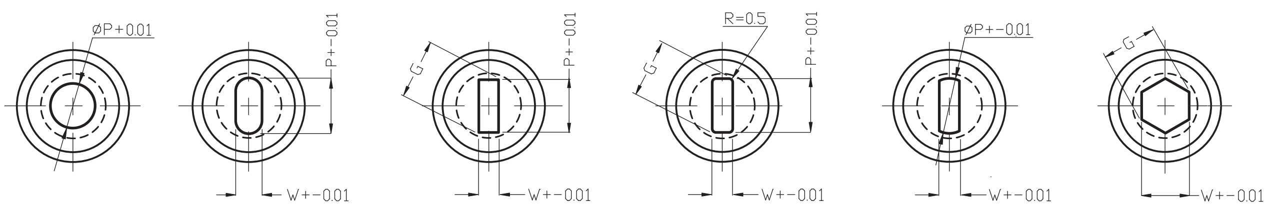
Order Example:





Material	Hardness HRC
HSS - M2	60-62
PS (on request)	62-64

MTHC	MHO	MHR	MHL	MHF	MHH



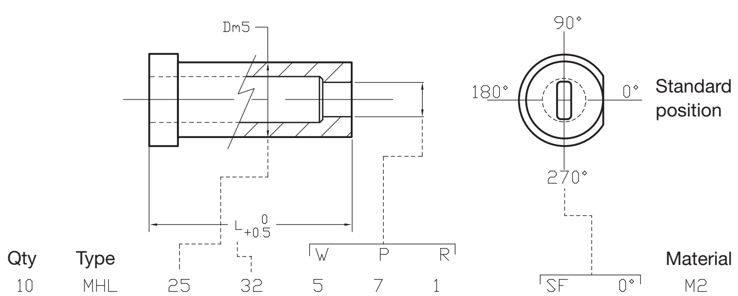
G= $\sqrt{W^2 + P^2}$ G= $\sqrt{(W - 2R)^2 + (P - 2R)^2} + 2R$ G= W x 1.1547

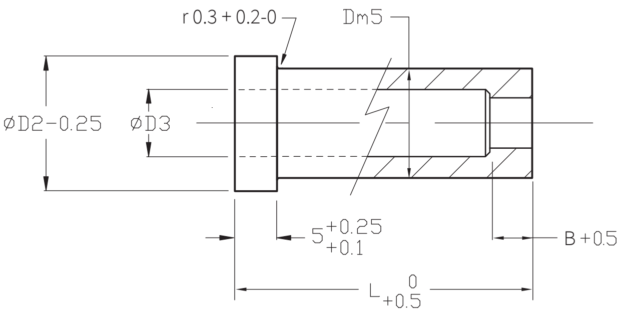
For qualified shapes see page 44.

				ROUND	SHAPE		L					
D1	B	D2	MAX D3	RANGE P	MIN W	MAX G/P	20	25	30	32	35	40
5.0	2	8.0	2.8	1.0 - 2.4	1.2	2.4	X	X	X	X		X
6.0	3	9.0	3.5	1.6 - 3.0	1.5	3.0	X	X	X	X		X
8.0	4	11.0	4.0	2.0 - 3.5	1.5	3.5	X	X	X	X	X	X
10.0	4	13.0	5.8	3.0 - 5.0	2.0	5.0	X	X	X	X	X	X
13.0	5	16.0	8.0	4.0 - 7.2	3.0	7.2	X	X	X	X	X	X
16.0	5	19.0	9.5	6.0 - 8.8	4.0	8.8	X	X	X	X	X	X
20.0	8	23.0	12.0	7.5 - 11.3	6.0	11.3	X	X	X	X	X	X
22.0	8	25.0	15.0	9.0 - 14.3	8.0	14.3	X	X	X	X	X	X
25.0	8	28.0	17.3	11.0 - 16.6	8.0	16.6	X	X	X	X	X	X
32.0	8	35.0	20.7	15.0 - 20.0	8.0	20.0	X	X	X	X	X	X
38.0	8	41.0	27.7	18.0 - 27.0	10.0	27.0	X	X	X	X	X	X
40.0	8	43.0	27.7	18.0 - 27.0	10.0	27.0	X	X	X	X	X	X

For extended range shank diameters see the following page.
For standard alterations see pages 47 and 48.
For locating devices see page 49.

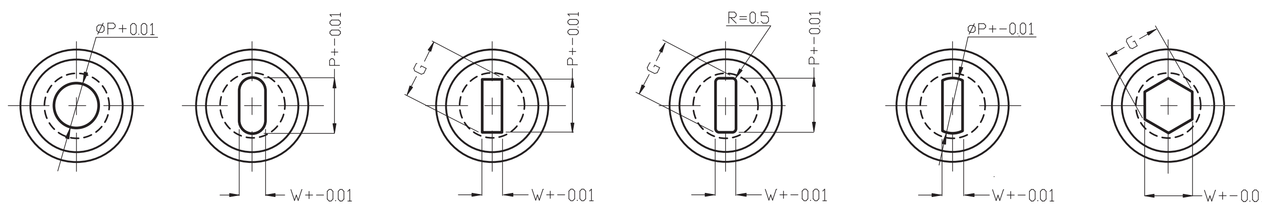
Order Example:





Material	Hardness HRC
HSS - M2	60-62
PS (on request)	62-64

MTHC MHO MHR MHL MHF MHH



G= $\sqrt{W^2 + P^2}$

G= $\sqrt{(W - 2R)^2 + (P - 2R)^2} + 2R$

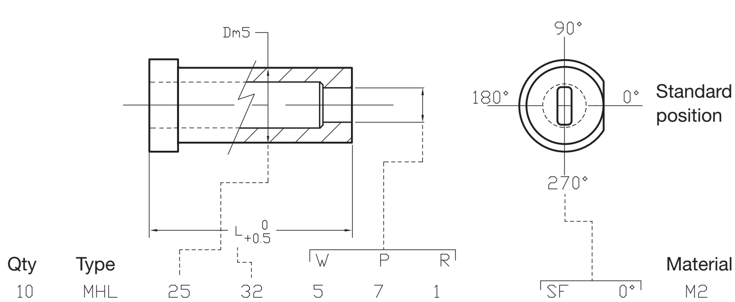
G= W x 1.1547

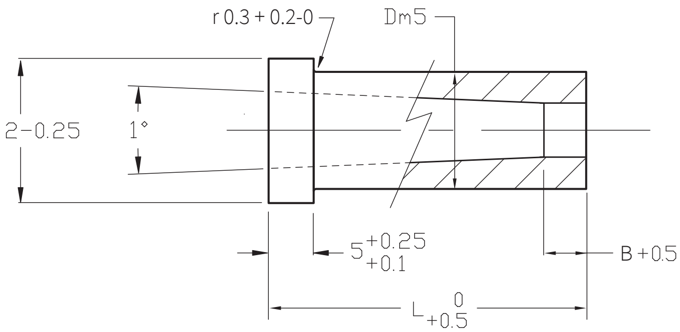
For qualified shapes see page 44.

D1	D2	MAX D3	ROUND RANGE P	SHAPE MIN W	SHAPE MAX G/P	L 20	L 25	L 30	L 32	L 35	L 40	L 45
45.0	48.0	36.0	19.05 - 35.6	5.0	35.6	X	X	X	X	X	X	X
50.0	53.0	41.0	22.2 - 40.6	7.0	40.6	X	X	X	X	X	X	X
56.0	59.0	46.0	25.4 - 45.6	8.0	45.6	X	X	X	X	X	X	X
63.0	66.0	51.0	28.55 - 50.5	9.0	50.5	X	X	X	X	X	X	X
71.0	74.0	57.0	31.75 - 56.5	11.0	56.5	X	X	X	X	X	X	X
76.0	79.0	61.0	34.90 - 60.5	13.0	60.5	X	X	X	X	X	X	X
85.0	88.0	67.0	42.50 - 66.5	15.0	66.5	X	X	X	X	X	X	X
90.0	93.0	71.0	44.5 - 70.5	20.0	70.5	X	X	X	X	X	X	X
100.0	103.0	79.0	49.5 - 78.5	25.0	78.5	X	X	X	X	X	X	X

For standard alterations see pages 47 and 48.
For locating devices see page 49.

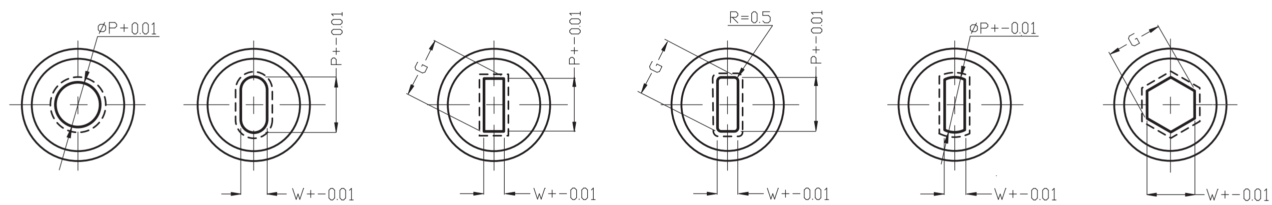
Order Example:





Material	Hardness HRC
HSS - M2	60-62
PS (on request)	62-64

MFHC MFHO MFHR MFHL MFHF MFHH



MFHR: $G = \sqrt{W^2 + P^2}$

MFHL: $G = \sqrt{(W - 2R)^2 + (P - 2R)^2} + 2R$

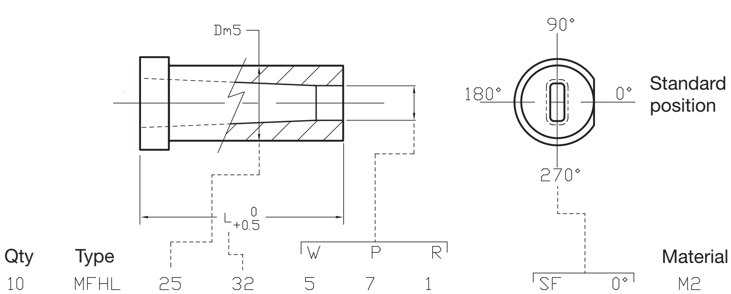
MFHH: $G = W \times 1.1547$

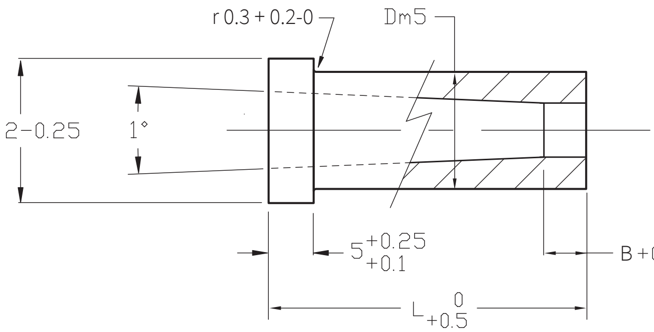
For qualified shapes see page 44.

D1	D2	ROUND RANGE P	SHAPE MIN W	SHAPE MAX G/P	L 16	20	25	30	32	35	40
5.0	8.0	1.0 - 2.4	1.2	2.4	X	X	X	X	X		X
6.0	9.0	1.6 - 3.0	1.5	3.0	X	X	X	X	X		X
8.0	11.0	2.0 - 3.5	1.5	3.5	X	X	X	X	X		X
10.0	13.0	3.0 - 5.0	2.0	5.0	X	X	X	X	X	X	X
13.0	16.0	4.0 - 7.2	3.0	7.2		X	X	X	X	X	X
16.0	19.0	6.0 - 8.8	4.0	8.8		X	X	X	X	X	X
20.0	23.0	7.5 - 11.3	6.0	11.3		X	X	X	X	X	X
22.0	25.0	9.0 - 14.3	8.0	14.3		X	X	X	X	X	X
25.0	28.0	11.0 - 16.6	8.0	16.6		X	X	X	X	X	X
32.0	35.0	15.0 - 20.0	8.0	20.0		X	X	X	X	X	X
38.0	41.0	18.0 - 27.0	10.0	27.0		X	X	X	X	X	X
40.0	43.0	18.0 - 27.0	10.0	27.0		X	X	X	X	X	X

For extended range shank diameters see the following page.
For standard alterations see pages 47 and 48.
For locating devices see page 49.

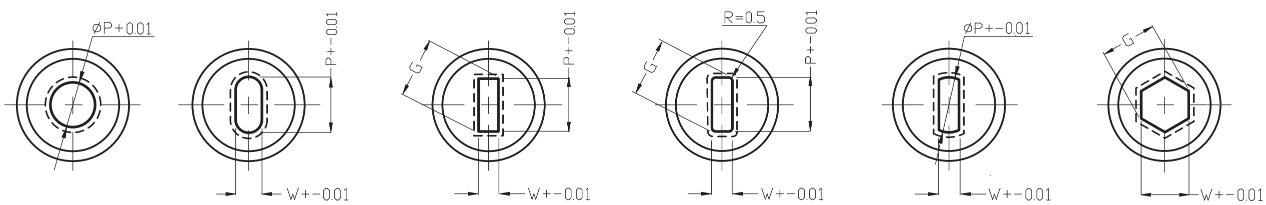
Order Example:





Material	Hardness HRC
HSS - M2	60-62
PS (on request)	62-64

MFHC **MFHO** **MFHR** **MFHL** **MFHF** **MFHH**



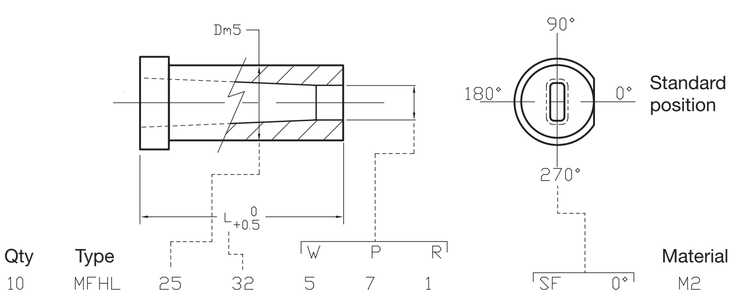
G= $\sqrt{W^2 + P^2}$ G= $\sqrt{(W - 2R)^2 + (P - 2R)^2} + 2R$ G= W x 1.1547

For qualified shapes see page 44.

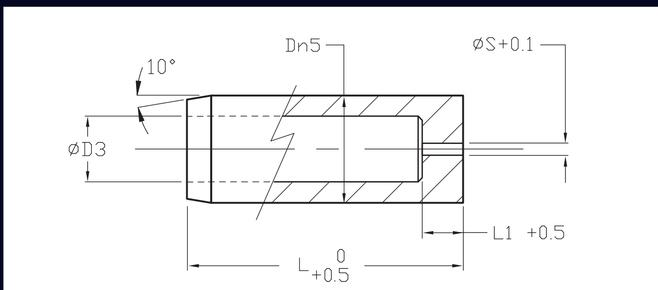
			ROUND	SHAPE		L						
D1	D2	MAX D3	RANGE P	MIN W	MAX G/P	20	25	30	32	35	40	45
45.0	48.0	36.0	19.05 - 35.6	5.0	35.6	X	X	X	X	X	X	X
50.0	53.0	41.0	22.2 - 40.6	7.0	40.6	X	X	X	X	X	X	X
56.0	59.0	46.0	25.4 - 45.6	8.0	45.6	X	X	X	X	X	X	X
63.0	66.0	51.0	28.55 - 50.5	9.0	50.5	X	X	X	X	X	X	X
71.0	74.0	57.0	31.75 - 56.5	11.0	56.5	X	X	X	X	X	X	X
76.0	79.0	61.0	34.90 - 60.5	13.0	60.5	X	X	X	X	X	X	X
85.0	88.0	67.0	42.50 - 66.5	15.0	66.5	X	X	X	X	X	X	X
90.0	93.0	71.0	44.5 - 70.5	20.0	70.5	X	X	X	X	X	X	X
100.0	103.0	79.0	49.5 - 78.5	25.0	78.5	X	X	X	X	X	X	X

For standard alterations see pages 47 and 48.
For locating devices see page 49.

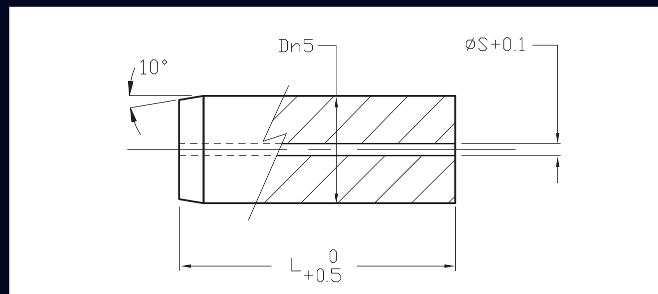
Order Example:



MDW



MFDW



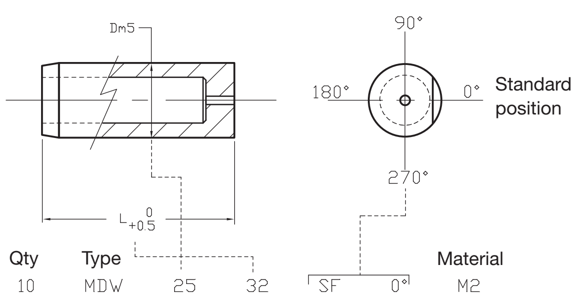
D1	B*	D3*	S	L							
				16	20	25	30	32	35	40	45
5.0	2	2.8	1.0	X	X	X	X	X	X		
6.0	3	3.5	1.0	X	X	X	X	X	X		
8.0	4	4.0	1.0	X	X	X	X	X	X		
10.0	4	5.8	1.5	X	X	X	X	X	X		
13.0	5	8.0	1.5		X	X	X	X	X		
16.0	5	9.5	1.5		X	X	X	X	X		
20.0	8	12.0	1.5		X	X	X	X	X		
22.0	8	15.0	1.5		X	X	X	X	X		
25.0	8	17.3	1.5		X	X	X	X	X		
32.0	8	20.7	1.5		X	X	X	X	X		
38.0	8	27.7	1.5		X	X	X	X	X		
40.0	8	27.7	1.5		X	X	X	X	X		
45.0	8	36.0	1.5		X	X	X	X	X	X	X
50.0	8	41.0	1.5		X	X	X	X	X	X	X
56.0	8	46.0	1.5		X	X	X	X	X	X	X
63.0	8	51.0	1.5		X	X	X	X	X	X	X
71.0	8	57.0	1.5		X	X	X	X	X	X	X
76.0	8	61.0	1.5		X	X	X	X	X	X	X
85.0	8	67.0	1.5		X	X	X	X	X	X	X
90.0	8	71.0	1.5		X	X	X	X	X	X	X
100.0	8	79.0	1.5		X	X	X	X	X	X	X

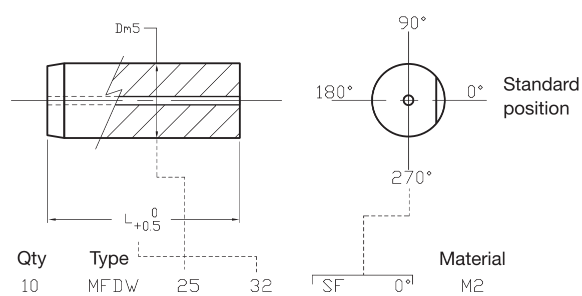
* MDW only

For standard alterations see pages 47 and 48.
For locating devices see page 49.

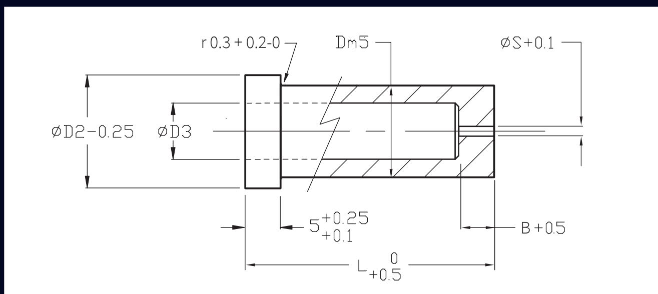
Material	Hardness HRC
HSS - M2	60-62
PS (on request)	62-64

Order Example:

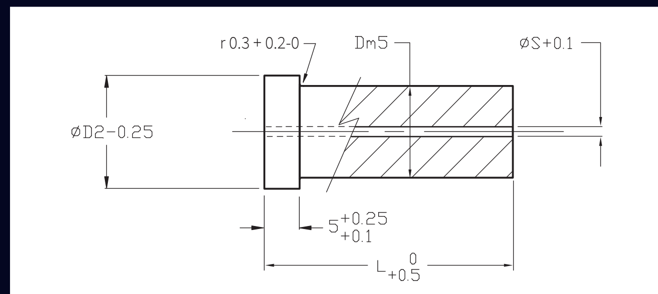




MHW



MFHW



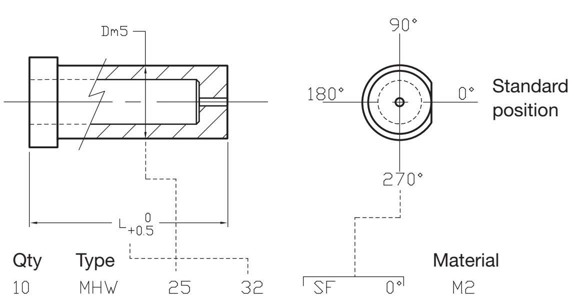
D1	B*	D2	D3*	S	L							
					16	20	25	30	32	35	40	45
5.0	2	8.0	2.8	1.0	X	X	X	X	X			
6.0	3	9.0	3.5	1,0	X	X	X	X	X			
8.0	4	11.0	4.0	1.0	X	X	X	X	X			
10.0	4	13.0	5.8	1.5	X	X	X	X	X	X		
13.0	5	16.0	8.0	1.5		X	X	X	X	X		
16.0	5	19.0	9.5	1.5		X	X	X	X	X		
20.0	8	23.0	12.0	1.5		X	X	X	X	X		
22.0	8	25.0	15.0	1.5		X	X	X	X	X		
25.0	8	28.0	17.3	1.5		X	X	X	X	X		
32.0	8	35.0	20.7	1.5		X	X	X	X	X		
38.0	8	41.0	27.7	1.5		X	X	X	X	X		
40.0	8	43.0	27.7	1.5		X	X	X	X	X		
45.0	8	48.0	36.0	1.5		X	X	X	X	X	X	X
50.0	8	53.0	41.0	1.5		X	X	X	X	X	X	X
56.0	8	59.0	46.0	1.5		X	X	X	X	X	X	X
63.0	8	66.0	51.0	1.5		X	X	X	X	X	X	X
71.0	8	74.0	57.0	1.5		X	X	X	X	X	X	X
76.0	8	79.0	61.0	1.5		X	X	X	X	X	X	X
85.0	8	88.0	67.0	1.5		X	X	X	X	X	X	X
90.0	8	93.0	71.0	1.5		X	X	X	X	X	X	X
100.0	8	103.0	79.0	1.5		X	X	X	X	X	X	X

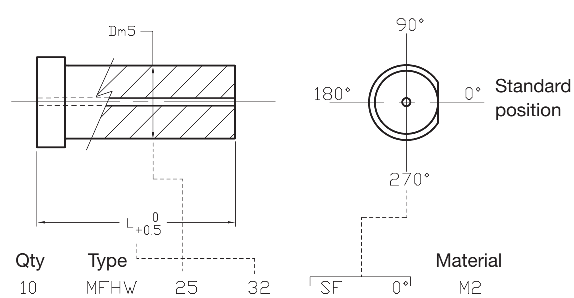
* MHW only

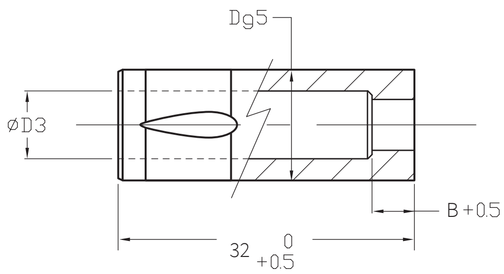
For standard alterations see pages 47 and 48.
For locating devices see page 49.

Material	Hardness HRC
HSS - M2	60-62
PS (on request)	62-64

Order Example:

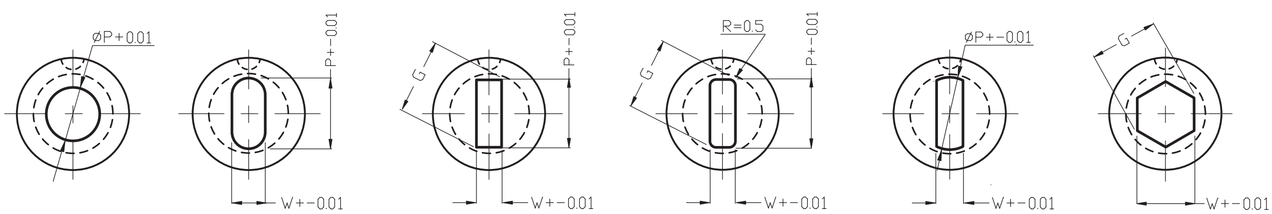






Material	Hardness HRC
HSS - M2	60-62

MBLDC MBLDO MBLDR MBLDL MBLDF MBLDH



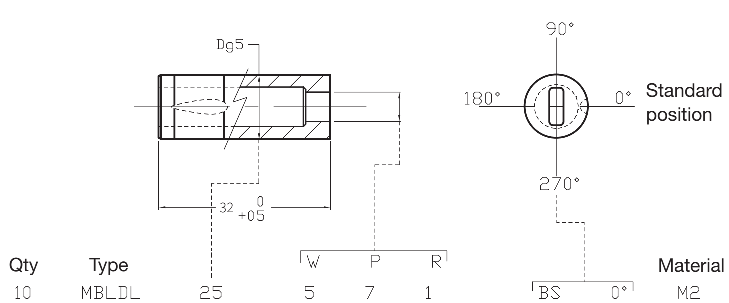
G= $\sqrt{W^2 + P^2}$ G= $\sqrt{(W - 2R)^2 + (P - 2R)^2} + 2R$ G= W x 1.1547

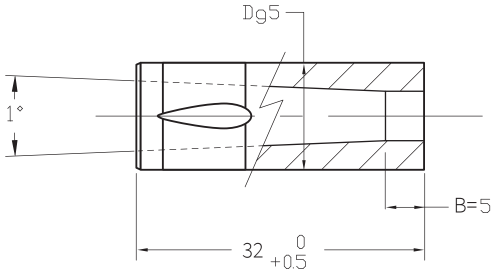
For qualified shapes see page 44.

			ROUND	SHAPE	
D1	B	MAX D3	RANGE P	MIN W	MAX G/P
13.0	4	5.8	1.5 - 5.0	2.0	5.0
16.0	5	8.0	3.0 - 7.2	2.5	7.2
20.0	5	12.0	4.5 - 11.0	4.5	11.0
25.0	6	16.0	8.0 - 15.0	5.0	15.0
32.0	6	20.0	11.0 - 19.0	6.0	19.0
38.0	8	27.0	16.0 - 26.0	8.0	6.0

For standard alterations see pages 47 and 48.

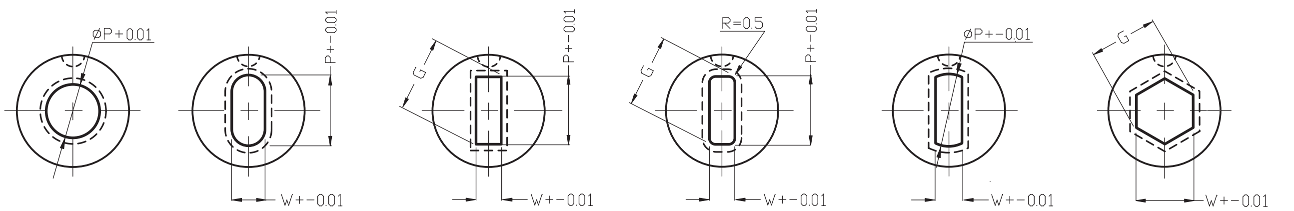
Order Example:





Material	Hardness HRC
HSS - M2	60-62

MFBLDC MFBLDO MFBLDR MFBLDL MFBLDF MFBLDH



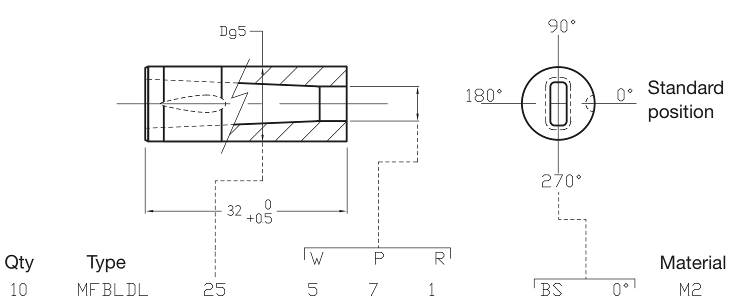
$G = \sqrt{W^2 + P^2}$ $G = \sqrt{(W - 2R)^2 + (P - 2R)^2} + 2R$ $G = W \times 1.1547$

For qualified shapes see page 44.

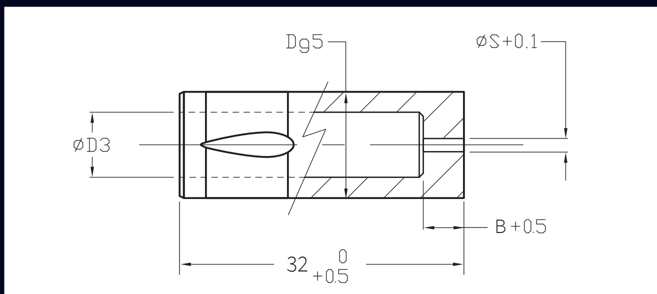
D1	MAX D3	ROUND	SHAPE	
		RANGE P	MIN W	MAX G/P
13.0	5.8	1.5 - 5.0	2.0	5.0
16.0	8.0	3.0 - 7.2	2.5	7.2
20.0	12.0	4.5 - 11.0	4.5	11.0
25.0	16.0	8.0 - 15.0	5.0	15.0
32.0	20.0	11.0 - 19.0	6.0	19.0
38.0	27.0	16.0 - 26.0	8.0	6.0

For standard alterations see pages 47 and 48.

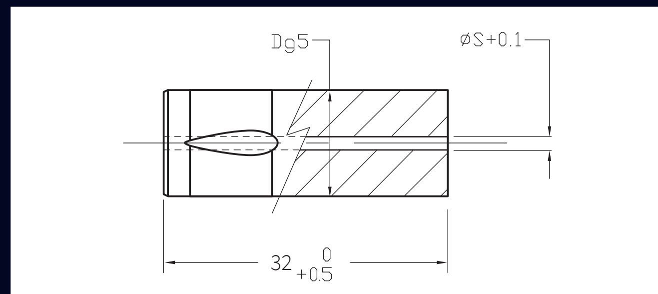
Order Example:



MBLDW



MFBLDW

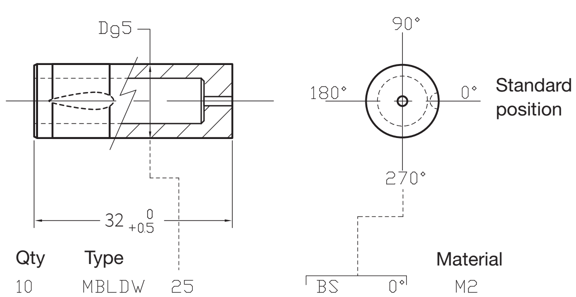


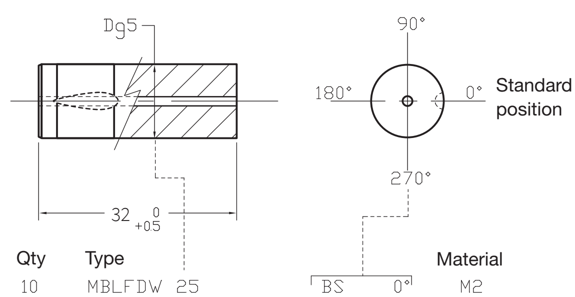
D1	D3*	S
13.0	5.8	1.5
16.0	8.0	1.5
20.0	12.0	1.5
25.0	16.0	1.5
32.0	20.0	1.5
38.0	27.0	1.5

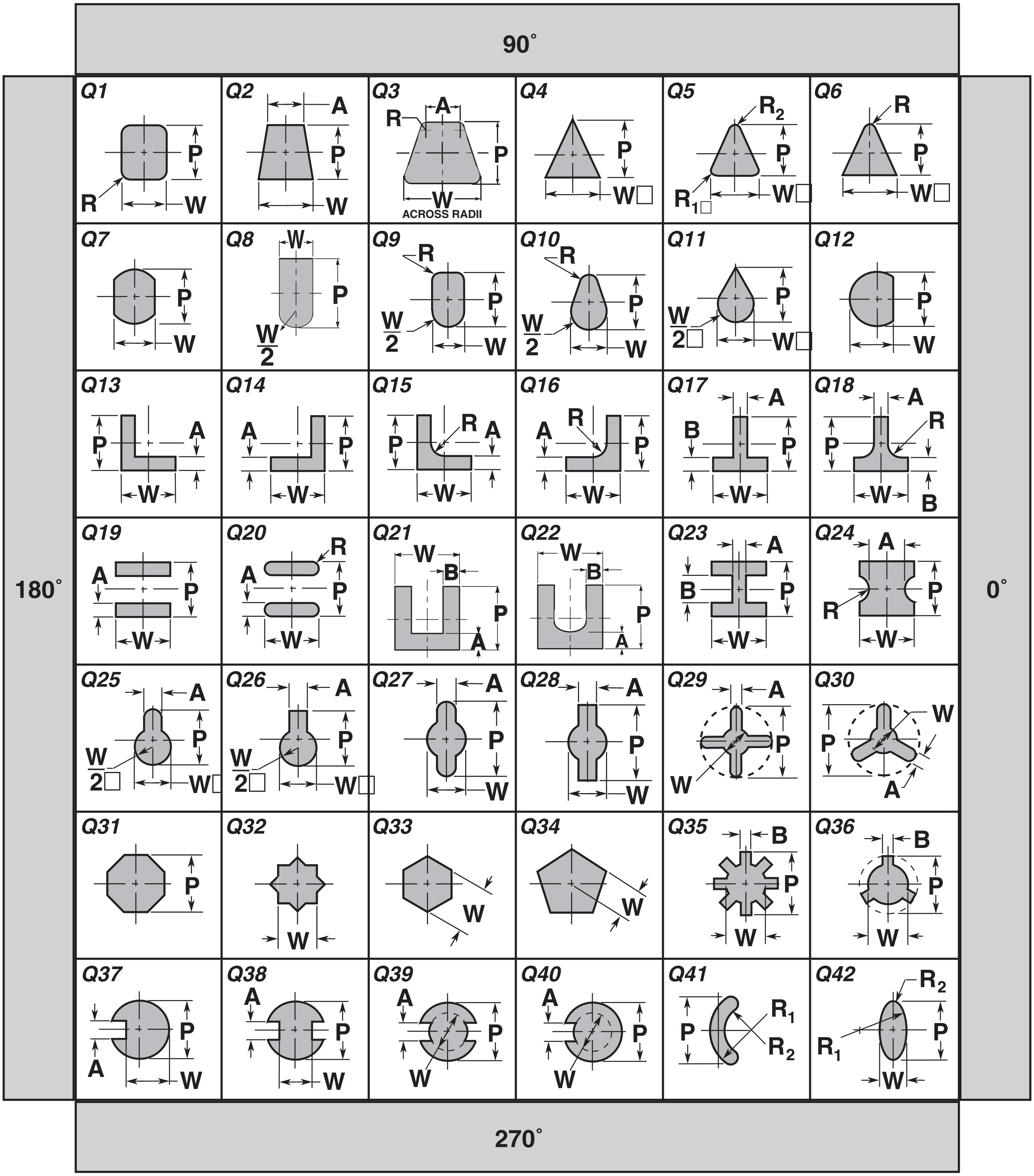
Material	Hardness HRC
HSS - M2	60-62

For standard alterations see pages 47 and 48.

Order Example:







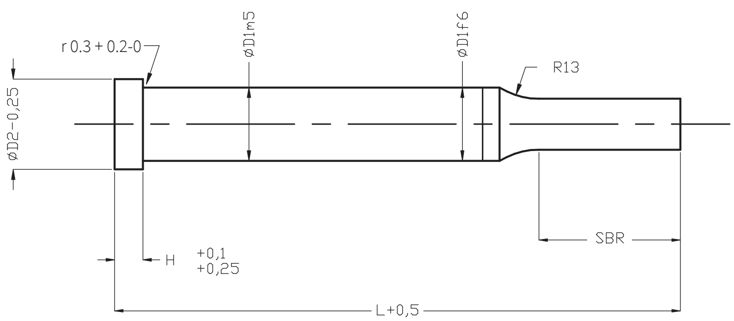
Views are from above shank on punches and cutting edge of die button.

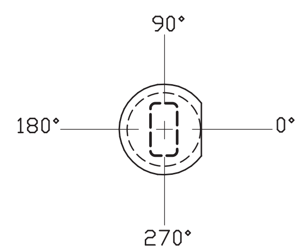
STANDARD ALTERATIONS

To obtain different sizes compared to the standard sizes table, write the size you need directly into the description, adding possible missing codes (for example H and D2 that normally are not in the description) after the Lu code for the punch, or P/P+W for the die.

See below:

1 - PUNCHES

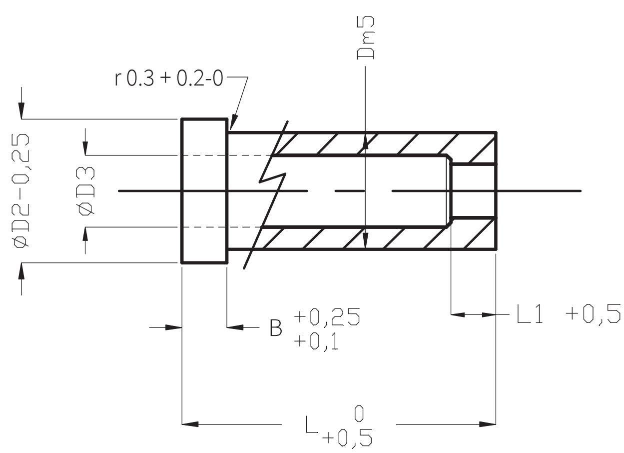


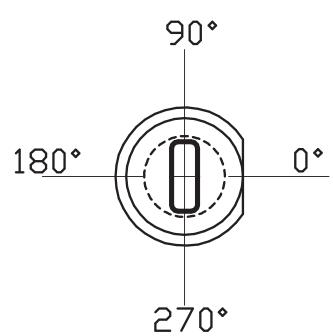


Standard position

Qty	Type	D1	L	W	P	R	Lu	H	D2	Key flat		Material
10	MTL	12	81	5	7	1	17	4	14	SF	0°	M2

2 - DIES

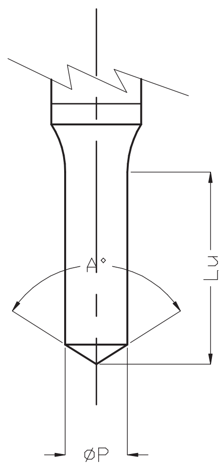




Standard position

Qty	Type	D	L	W	P	R	L1	H	D2	D3	Key flat		Material
10	MHL	27	33	5	7	1	7	4	31	18	SF	0°	M2

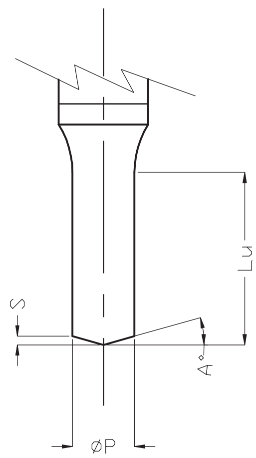
CONICAL POINT



Please add the following line to the order:

CP A=3°

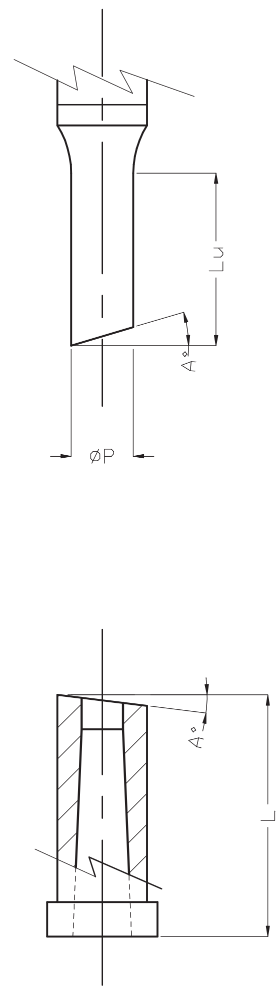
ROOFTOP SHEAR



Please add the following line to the order:

RS A=3° OR RS S=3

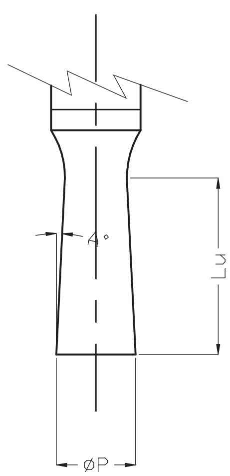
ANGLE SHEAR



Please add the following line to the order:

AS A=3°

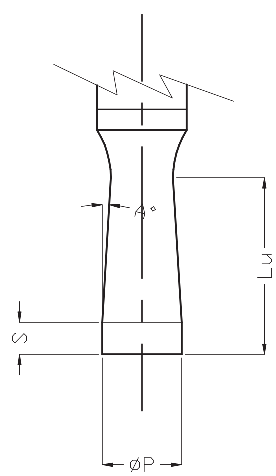
BACK TAPERED



Please add the following line to the order:

BT A=0.5°

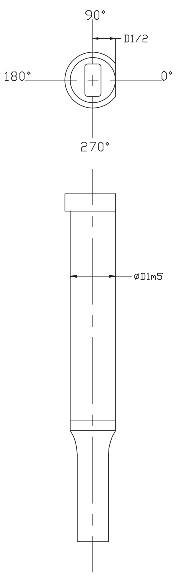
STRAIGHT + BACK TAPERED



Please add the following line to the order:

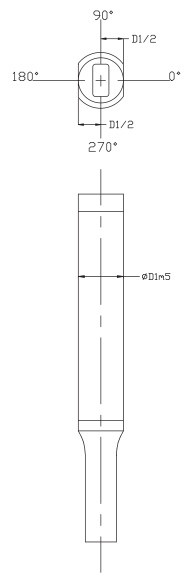
SC S=2 A=0.5°

SF	DF	DS	FL



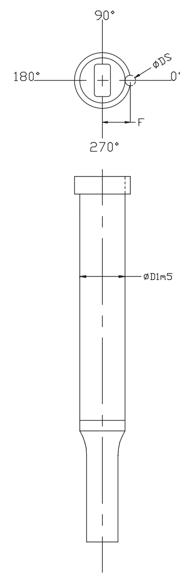
Standard position

Add the following line to the description. Example: SF 145˚



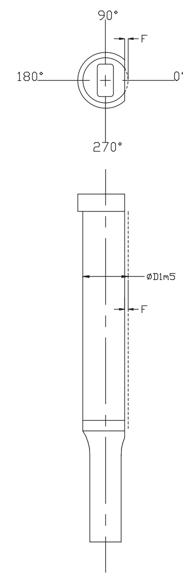
Standard position

Add the following line to the description. Example: DF 145˚



Standard position

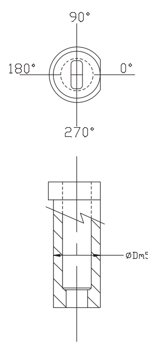
Add the following line to the description.
Example: DS3 F=D1/2+DS/2 145˚
F from punch center to pin center



Standard position

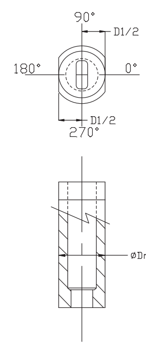
Add the following line to the description.
Example: SF1 F=1 145˚ F = depth

SF	DF	DS	FL



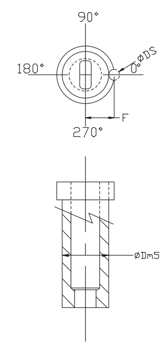
Standard position

Add the following line to the description. Example: SF 145˚



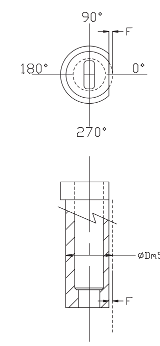
Standard position

Add the following line to the description. Example: DF 145˚



Standard position

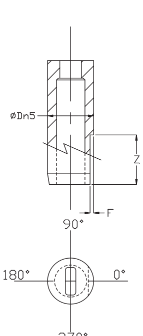
Add the following line to the description.
Example: DS3 F=D1/2+DS/2 145˚
F from die center to pin center



Standard position

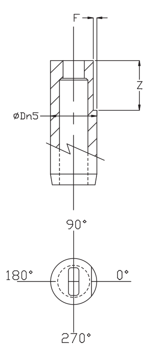
Add the following line to the description.
Example: SF1 F=1 145˚ F = depth

SF3	SF4	DS	FL



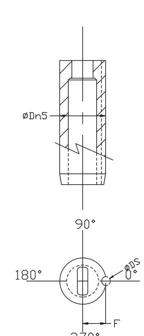
Standard position

Add the following line to the description. Example:
SF3 1X14 145˚ (F=1 Z=14)



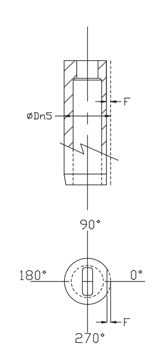
Standard position

Add the following line to the description. Example:
SF4 1X14 145˚ (F=1 Z=14)



Standard position

Add the following line to the description.
Example: DS6 F=9 145˚
F from die center to pin center

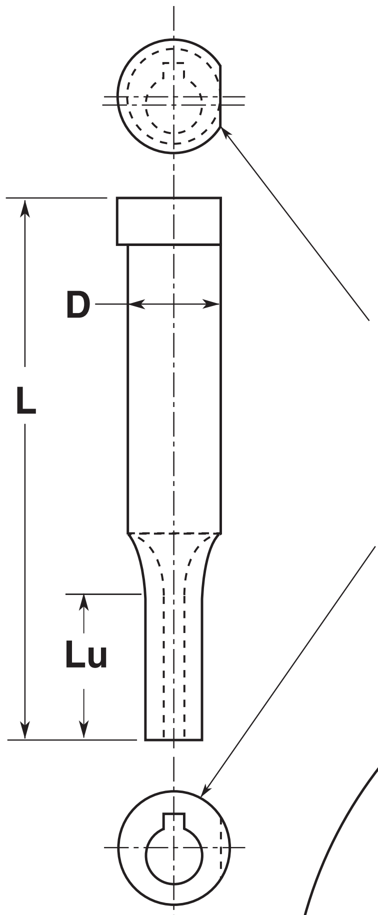


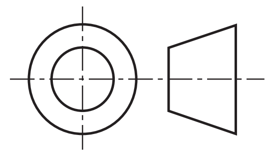
Standard position

Add the following line to the description.
Example: SF1 F=1 145˚ F = depth

EXAMPLE

When ordering specify Punch or Die Type.





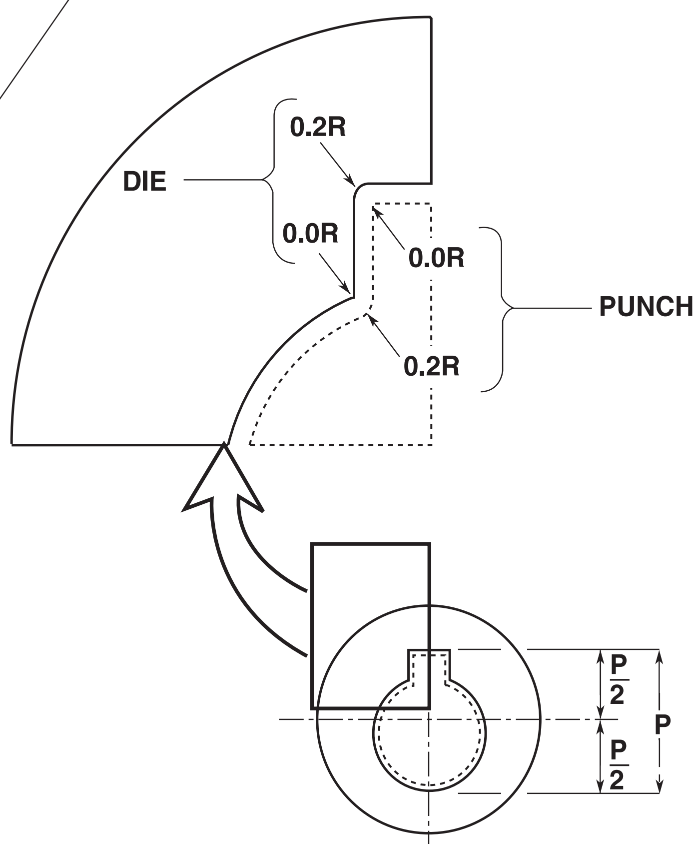
PROJECTION

PUNCH

MFQ 16 X 80 Q26 A3.O W8.5 P13.0 Lu25 SF 0°

MFDQ 20 X 25 Q26 A3.3 W8.8 P13.3 SF3 0°

DIE



All shapes are central on Punch and Die body.

PERFORATING TECHNOLOGY

The perforating punch is an essential yet fragile part of the die assembly.

The success of a perforating punch is largely dependent on two key criteria:

1) Physical inter-changeability; and

2) Structural soundness.

PERFORMANCE CRITERIA

Perforating punch performance is based on two key criteria:

1) Physical inter-changeability; and

2) Structural soundness.

With regard to punch performance, other key characteristics include the following:
strength; load distribution; fatigue-resistance.

Structural soundness is impacted by material and construction details.

FUNCTIONAL REQUIREMENTS

Perforating punch functionality is largely dictated by two factors:

1) The perforating process; and

2) The magnitude of developed loads.

The Perforating Process

The perforating process requires two actions:

1) Perforating; and

2) Stripping.

Each action generates different loading conditions. The two actions must be successfully opposed for optimum component performance.

Under impact, a punch is forced through a work piece resulting in the separation of a slug; afterwards, the slug passes through the mating die cavity. The work piece hole conforms to the size and shape of the punch point. Similarly, the slug conforms to the die cavity.

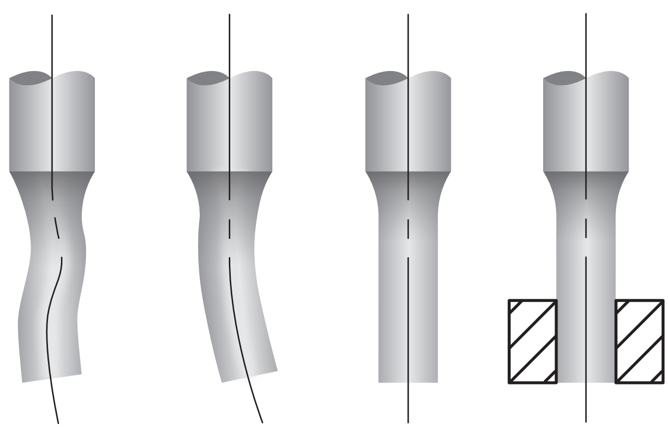
After the hole and slug have been produced, the direction of punch travel is reversed so that it withdraws from the work piece. A stripping mechanism is often used to restrain the work piece during punch withdrawal.

Perforating Loads

Punch durability is largely dependent upon induced stress levels (relative to the ultimate strength of the component material).

Due to the nature of applied loads, breakage generally occurs during the perforating process; whereas, most cutting-edge wear develops during stripping.

For perforating punches, head breakage is a serious concern. Often times, this concern can be mitigated by increasing the shank diameter so that the load is distributed over a larger area, thereby reducing the stress value.



Improved punch durability can sometimes be achieved by a blend radius that reduces stress concentration in critical areas. For example, cutting edge chipping can be reduced or eliminated by stoning a .002” to .004” radius or chamfer on the component. This procedure effectively increases the contact area resulting in a lower stress level.

The perforating process subjects punch components to a variety of forces, including the following: compressive tensile forces; frictional forces; and, deflecting forces.

Frictional force is equal to the stripping load and directly related to the rate at which the component cutting edges erode. Factors impacting the magnitude of frictional force and, consequently, wear rate are expressed in the following formula:
F = uN where F = Force of Friction (lbs.),
u = Coefficient of Friction, and N = Normal Force (lbs.)

Normal Force (N)

If a work piece hole becomes smaller than the perforating punch, it is likely that an interference fit developed during the perforating cycle. The resulting force is known as the "normal force" because its line of action is perpendicular to the direction of the punch travel.

Variables which effect the amount of interference and the magnitude of the normal force include the following:

- Punch-to-die clearance allowances;
- Ratio of hole size to work piece thickness;
- Proximity of the hole to an adjacent part edge;
- Spacing between adjacent holes;
- Type of stripping device utilized;
- Cutting edge condition of the perforating components.

For example, clearance allowances must be predicated on the functional requirements of a work piece hole. Small allowances result in minimum roll-over, long burnished lands, and slight angular breaks in the punched holes. In this instance, punch wear is accelerated and slug-jamming problems may develop. Whereas, large clearances produce more roll-over, shorter burnished lands, and an increase in the break or fracture angle. In this case, the punch wear rate is reduced, but there is a tendency for the slugs to be lifted out of the die cavity. When utilizing larger clearance allowances, slug-ejector punches should be used to prevent slug-pulling.

Punch-to-Die Alignment

Punch-to-die alignment is an expression of the degree of clearance uniformity between corresponding points on the cutting periphery between a punch and die button. The equation is relatively straightforward: better alignment equals more uniform stamping; and, more uniform stamping equals greater production quantities (by a given die assembly). Non-uniform clearances subject a punch to unbalanced loads. Unbalanced loads result in deflection, which ultimately leads to premature component failure. To ensure punch-to-die alignment during the die construction assembly phase, special attention should be given to the following factors:

- Component of concentricity limits;
- Effect of shape deviations on clearance uniformity;
- Axial relationships in multi-hole retainer plates;
- Effect of the retention system on axial relationships;
- Total effect of the combined factors.

Component of Concentricity Limits

The shank of the punch and the body of the die button establish the relative positions of the two components when assembled in their respective retainer plates. Any significant eccentricity of the punch point to its shank or the die hole to its body will contribute to a non-uniform clearance condition. The issue and concern is that misalignment increments may be accumulative (or self-canceling) depending upon the direction and amount of the individual offsets.

Effect of Shape Deviations on Clearance Uniformity

Punch point or die hole shape deviations can cause the clearance per side to range from uniform to non-uniform values. As such, component loading can vary from a balanced condition to an unbalanced one (which produces deflection).

As permissible shape deviations are not usually specified, it is implied that they lie within the dimensional limits of the selected punch point or die hole. Point-to-point clearance variations are a result of the size tolerance and orientation of the mating components at assembly.

For a round punch point or die hole, the actual shape may range from a perfect circle to an ellipse and still lie within the dimensional limits. Relative to an ellipse, the minor axis cannot be smaller than the low limit dimension and the major axis cannot exceed the high limit. In effect, the maximum permissible difference between the two axes is equal to the total tolerance. The point-to-point clearance variation contributed by each component will not be greater than one half of its total size tolerance.

Size tolerances can range from +.0002”/-.0000” to +.0010”/-.0000”. However, these tolerances depend on the following characteristics: shape; component type; and precision level.

Axial Relationships in Multi-hole Retainer Plates

Dimensional control of the spacing between adjacent retention holes is dependent upon the production method. For example, jig-boring or jig-grinding can maintain a specified dimension to ±.0001” tolerance.

When multi-hole retainer plates are required, it is imperative that center distances be closely controlled to minimize axial displacements, especially as the outcome may have a substantial effect on the alignment of the mating components.

Effect of the Retention System on Axial Relationship

The type of retention system effects the axial alignment of the punch or die button to its retainer hole. In a press-fit assembly, a light interference fit develops uniform pressure completely around the component and, as a result, the center lines coincide.

The ball-lock system of retention utilizes the slip-fit concept in conjunction with a spring-loaded ball. Spring pressure forces the component against the opposite side of the hole and maximum axial displacement occurs. The offset is predictable and can be compensated in retainer assemblies.

Total Effect of the Combined Factors

As the mating components are assembled, the various factors combine to add to (or cancel out) one another to eliminate or exacerbate punch-to-die misalignment. Under the most adverse conditions of dimensional and axial relationships, the maximum eccentricity will be equal to the sum of the maximum misalignment increments per side. Conversely, the minimum accumulation of misalignment increments will total zero when conditions are ideal.

The clearance value must be established to satisfy work piece requirements. As such, it can be used to select the appropriate component standard relative to the desired retention system.

THE PERFORATING PUNCH

Retained on the shank and usually unsupported at the point, the punch must possess the following characteristics: tough enough to withstand impact loads; strong enough to cause slug separation in the work piece; and, abrasion-resistant to oppose stripping forces. Finally, it must provide sufficient length to permit a reasonable number of re-sharpenings.

Point Length-to-Point Size Proportions

The most critical relationship is “point length to point size”. The punch point must be shaped and sized to satisfy the work piece hole requirement. The length of point required is equal to the sum of the following:

a) Length of blend radius;

b) Sharpening allowance;

c) Length of stripper lip or straight portion in the support bushing;

d) Work piece Thickness;

e) Penetration into Die Cavity.

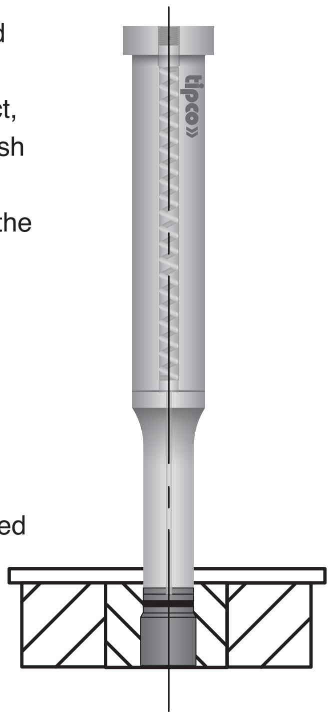
Excessive sharpening allowances increase the unsupported length which can lead to breakage issues.

Point-to-Shank Proportions

Various cross-sectional areas may be used throughout the punch length in order to reduce applied stress levels and improve component performance. Both rigidity and punching load distribution improve as shank diameter increases relative to the punch point size.

The Ejector Punch and its Function

Ejector punch components incorporate a spring-loaded pin that extend beyond the face of the punch. At impact, the pin retracts until it is flush with the punch face. When the slug is separated from the workpiece, the pin exerts a force on the slug to drive it downward or to hold it in position depending upon the punch-to-die clearance allowance. As the punch is withdrawn, the ejector pin functions like a spring-loaded stripper and prevents the slug from rising with the punch. In many instances, a slug-ejector punch is inter-changeable with a solid punch.



The Pilot Punch and its Function

A pilot punch must enter a previously punched-hole, contact the hole edge, move the workpiece to its required position, and hold it in place before other components strike the workpiece. The pilot punch is usually .001” smaller on the diameter than its related perforator and has approximately .090” of full diameter lead beyond the face of the perforators. The end of a pilot punch may range from a bullet-nose to conical shape.

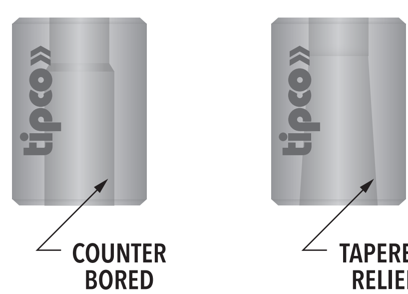
Die Button / Matrix Requirements

The die button provides a hardened cutting edge to facilitate slug separation. The cavity (or hole) accepts the slug and must be long enough to permit a satisfactory number of sharpenings. The die hole shape conforms to the punch point; however, the hole is larger to provide for the necexssary clearance. Below the wear land, the die hole is enlarged to permit unrestricted slug travel.

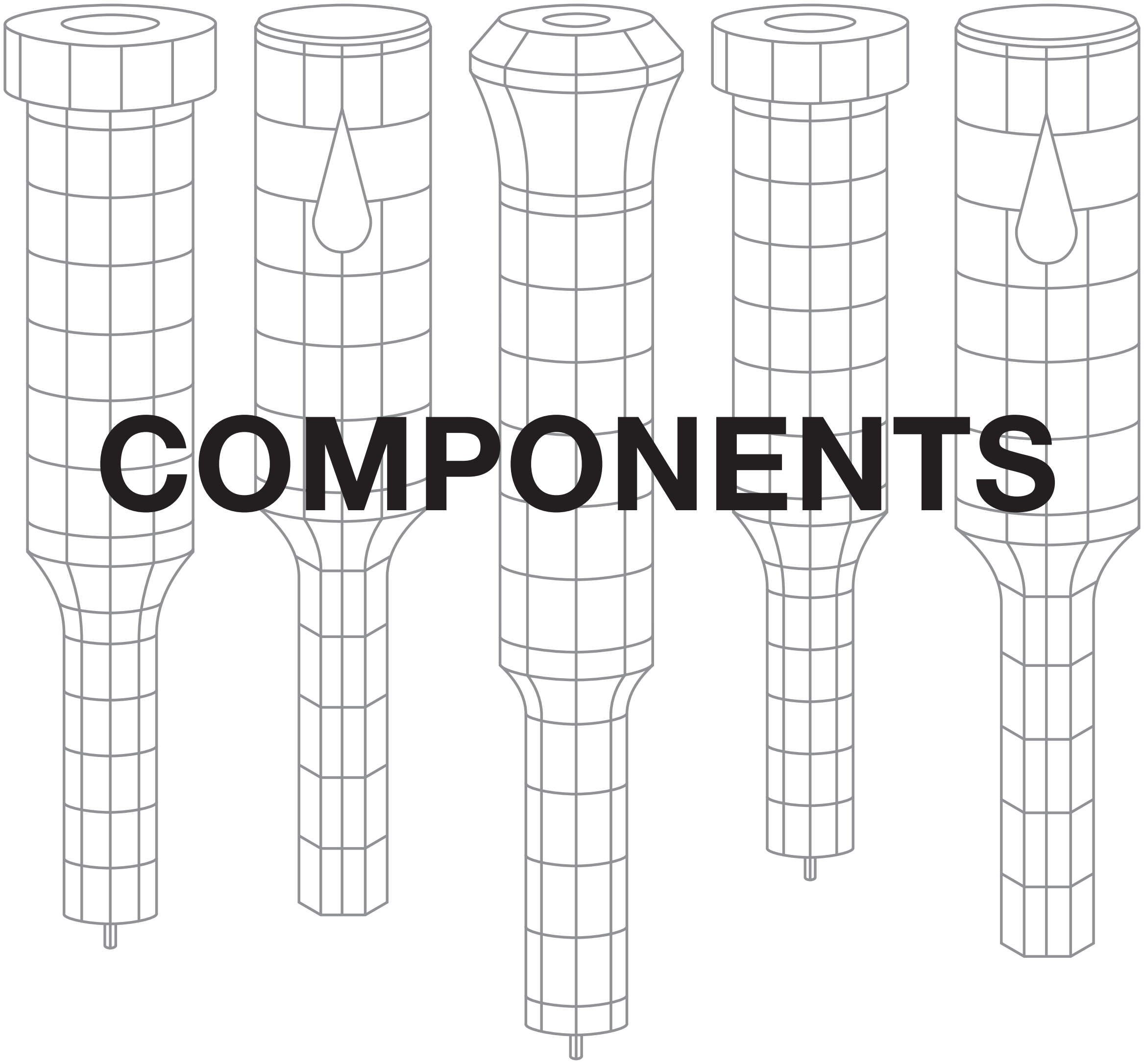
Die button relief holes are divided into two groups:
1) Counter-bore; and,
2) Taper relief.
It is important to note that the selected relief hole type to be used is generally determined by individual preference.

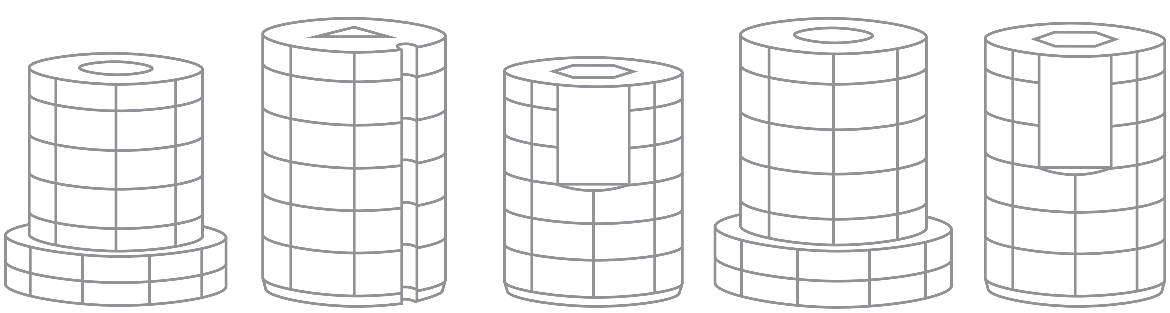
The construction type is referred to as stepped when the hole is larger at the intersection with the bottom of the wear land. The balance of the relief hole may be tapered or straight and may not conform with the shape of the die cavity. No-step construction requires that there be no step at the intersection with the wear land and that the relief hole be tapered to conform with the die cavity shape.

Both construction types are available in headless or headed types. The headless die button must be press- fitted for retention. Headed die buttons may be slip-fitted to avoid distortion of the retainer plate when large numbers must be inserted. The larger bearing surface provided by the head also results in better load distribution.

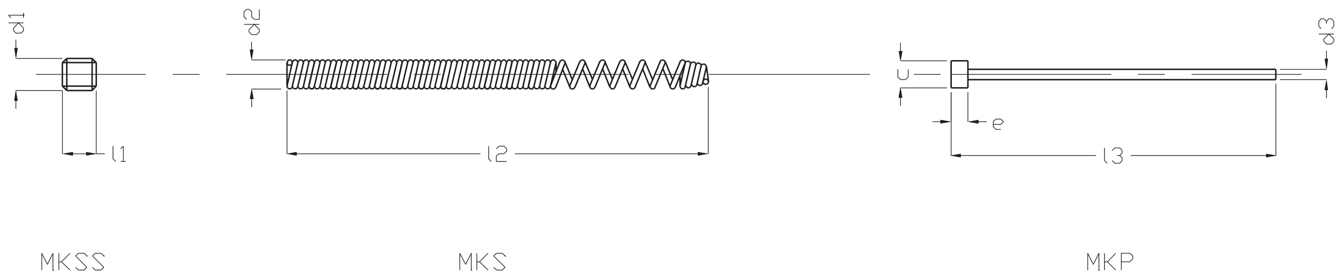


COMPONENTS





KIT MK



D	5	6	8	10	13	16	20	25	32	40
d1	M2.5 x 0.45	M3 x 0.5	M4 x 0.7	M5 x 0.8	M5 x 0.8	M5 x 0.8	M6 x 1.0	M6 x 1.0	M6 x 1.0	M8 x 1.5
l1	5	5	5	5	5	5	6	6	6	8
d2	2.01	2.39	3.30	4.19	4.19	4.19	5.03	5.03	5.03	6.80
l2	50.80	60.45	66.80	76.20	76.20	76.20	76.20	76.20	76.20	64.80
d3	0.51	0.69	1.04	1.47	1.47	1.47	2.26	2.26	2.26	3.05
l3	28.19	50.8	50.8	50.8	50.8	50.8	57.15	57.15	57.15	57.15
c	1.22	1.86	2.39	3.05	3.05	3.05	3.96	3.96	3.96	4.90
e	0.76	1.19	1.58	1.58	1.58	1.58	2.39	2.39	2.39	2.50

Order example KIT, MK D=10 (D = punch diameter)

Single component order example: MKS D=10, MK D=10 (D = punch diameter)

TiN

It is the least expensive and most commonly used.

- Good wear resistance on cutting edges and wear surfaces
- Good lubricity
- Suitable thermal stability for most cold work metalworking applications
- High micro hardness of 2300 Vickers

Note: TiN works best when used with lubricants and is not recommended for uses in stainless steel, nickel, or copper applications.

TiCN

It has the broadest range of application use regarding PVD coatings including stainless steel, nickel and copper.

- Higher hardness and lower coefficient of friction than that of TiN coating resulting in extremely high wear resistance
- Improved lubricity
- Extremely high hardness of 3000 Vickers

Note: Suitable for uses in stainless steel, nickel, or copper applications.

TiAIN

It is ideal for applications where surface heat is generated, which converts the aluminum constituent to aluminum oxide for added protection against shear stress and wear resistance on cutting edges.

- High thermal stability
- Extremely high micro hardness of 3400 Vickers

Note: Suitable for uses in stainless steel, nickel, copper or aluminum applications.

ALCRONA

Performance is enhanced utilizing the thermal stability, low coefficient of friction and ductility advantages.

- Exceptionally low coefficient of friction
- Extraordinary high thermal stability
- Extremely high micro hardness of 3400 Vickers

Balanit® Alcrona is a trademark of Oerlikon Balzers.

DLC

Being a carbon coating, it has extreme wear resistance and very low friction coefficients.

- Exceptionally low coefficient of friction
- Extraordinary high thermal stability

Note: Can be used without lubricants.

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