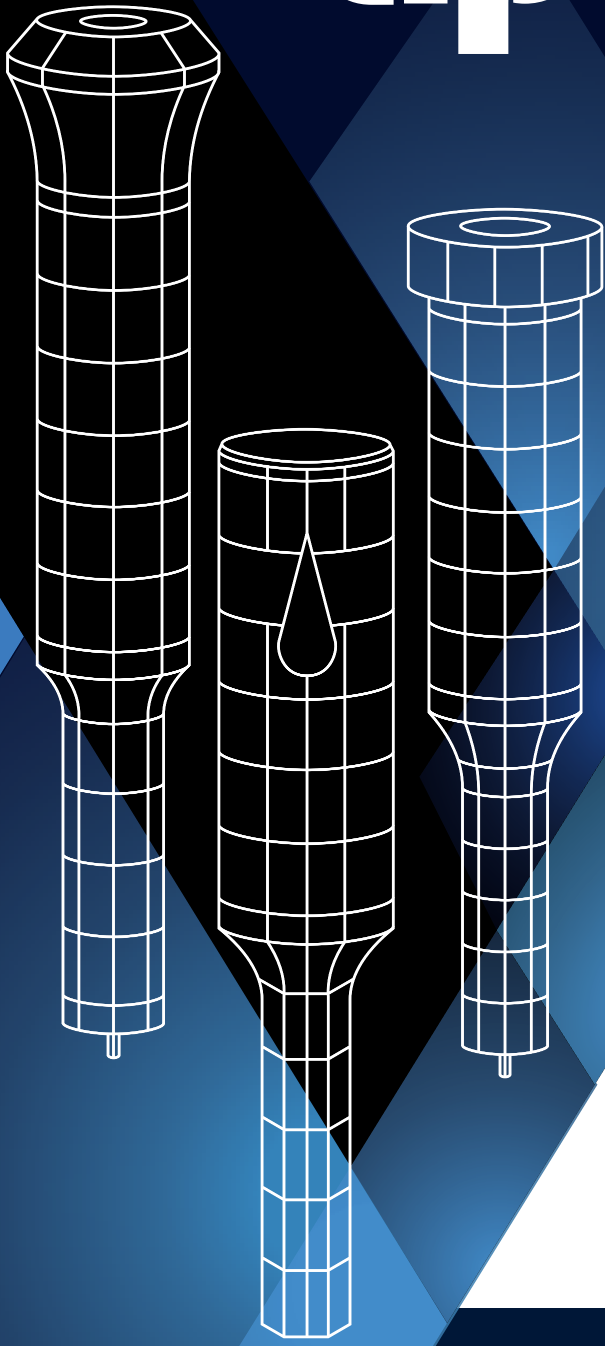
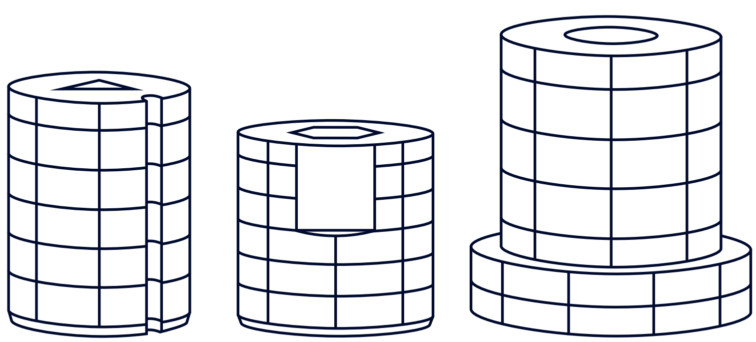


INCH



CATALOG · INCH

PUNCHES & DIE BUTTONS

www.tipcopunch.com

Special Punches

Die Buttons

Precision Tooling

Threadform Tooling

Die Springs

tipco»

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 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.

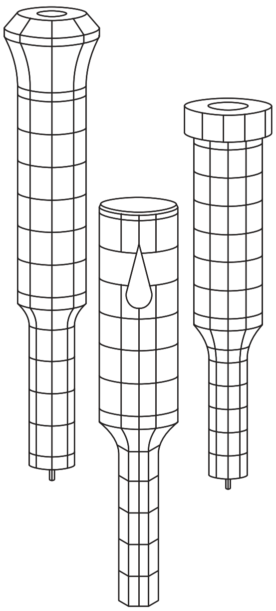
Tipco is also committed to supplying superior complementary products, including best-in-class die springs, marking stamps, automated tapping systems, tool and die accessories, and more.

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.

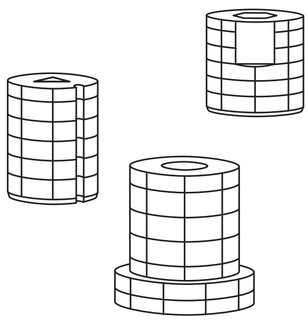
In addition, Tipco is continually working on meeting and exceeding statutory and regulatory standards. For example, Tipco's North American operations are ISO 9001 compliant.

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



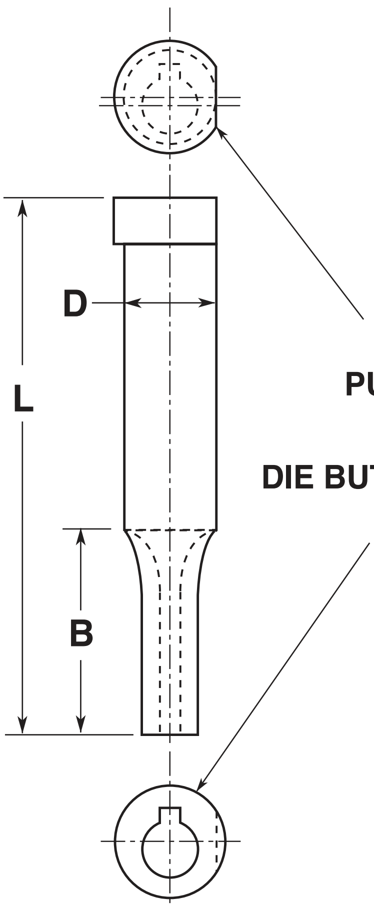
INDEX

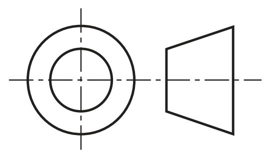
INDEX



ORDER EXAMPLE

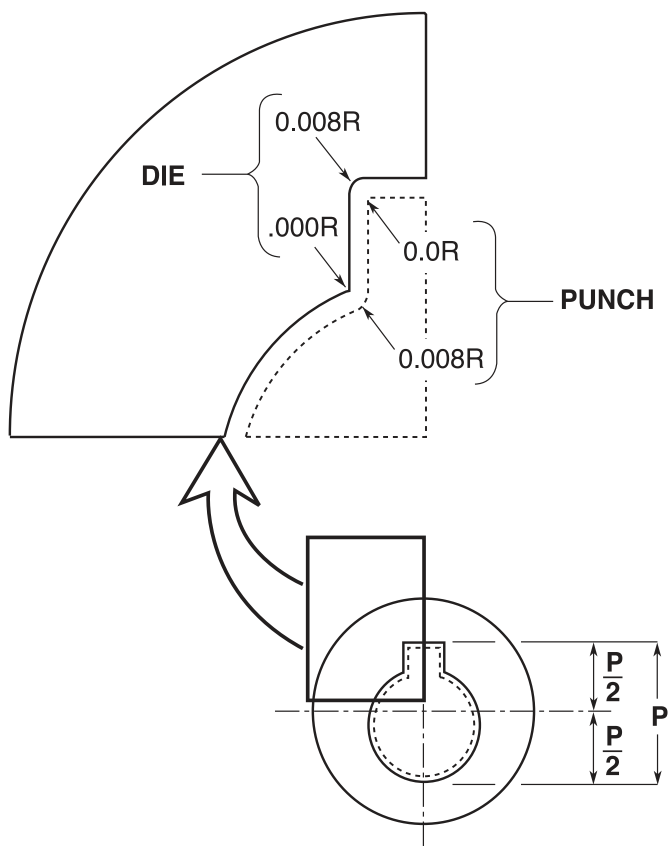
When ordering specify Punch or Die Button.





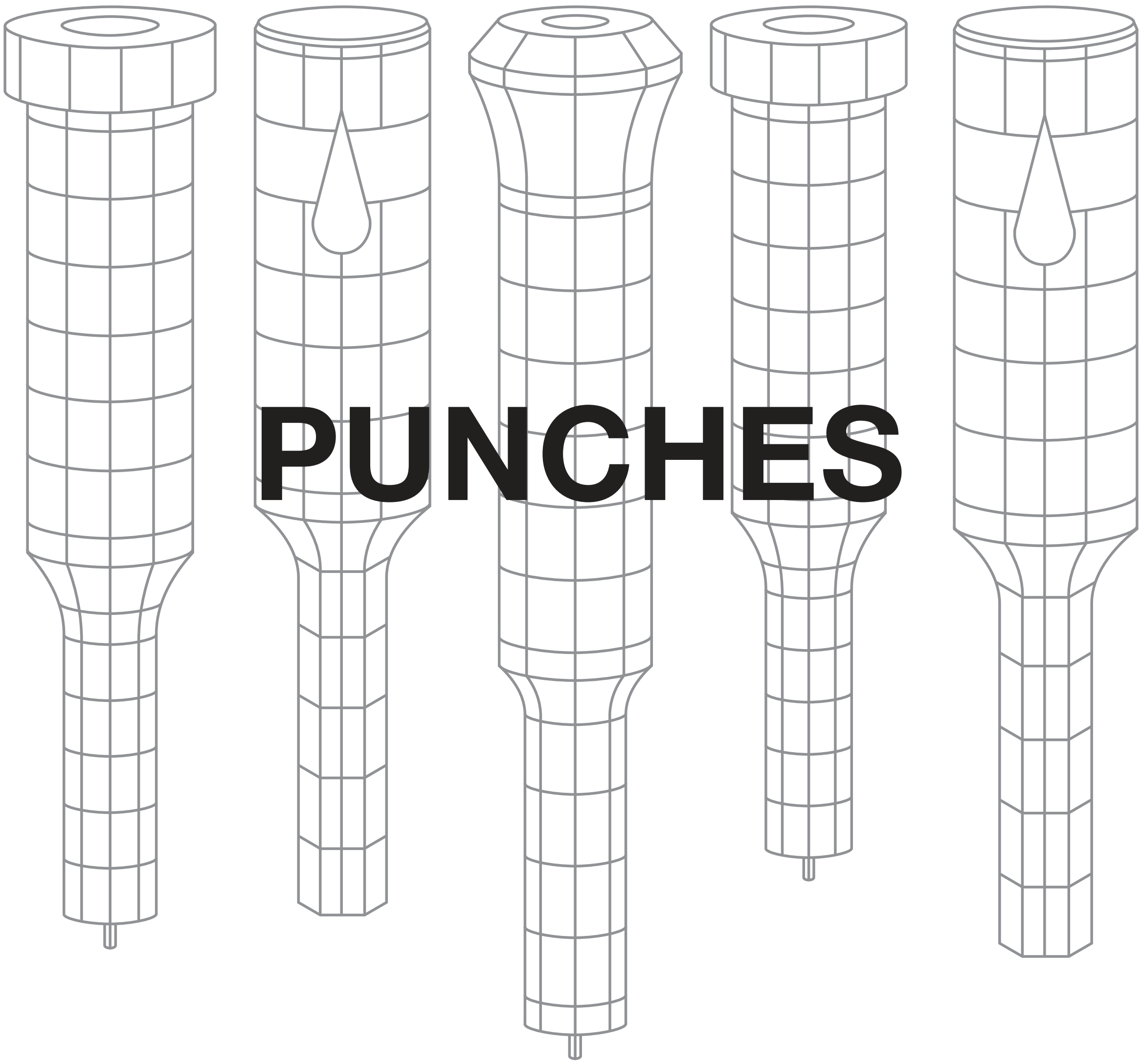
PROJECTION

PUNCH:	TPQ26	37 X 250	P.150	W.060	B.62	SF 0˚
DIE BUTTON:	TPQ26	50 X 100	P.154	W.064	SF3 0˚	

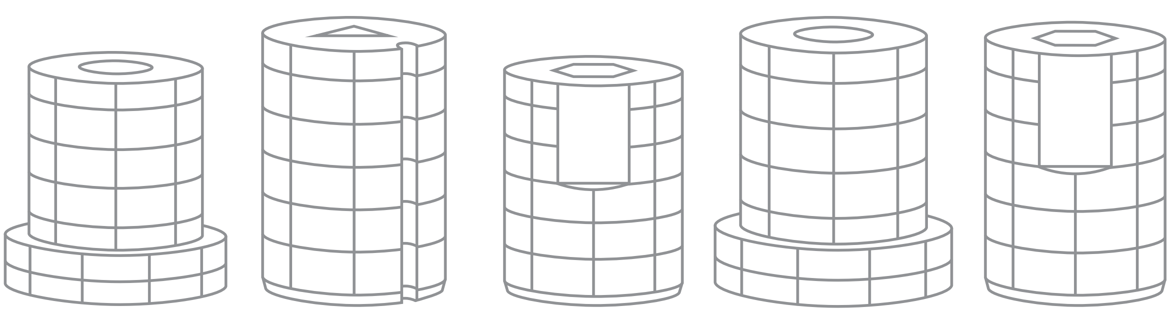


All shapes are central on Punch and Die Button.

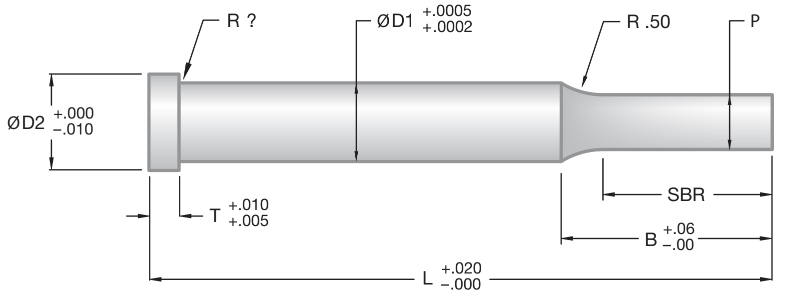
Dimensions are INCH.



PUNCHES



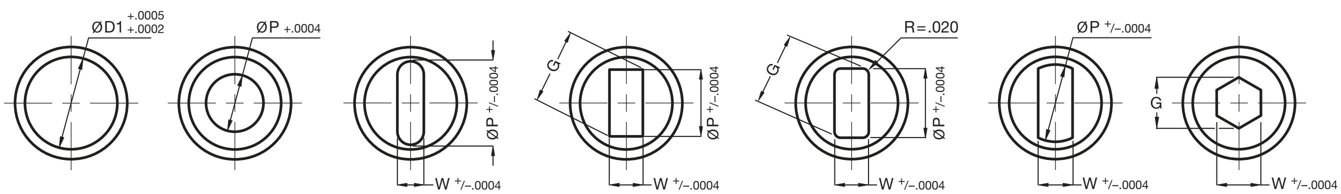
TP Head Type



3D CONFIGURATOR	
3Dfindit	

Material	Hardness
M2	60-62

TPB	TPC	TPO	TPR	TPL	TPF	TPH



For qualified shapes see page 38.

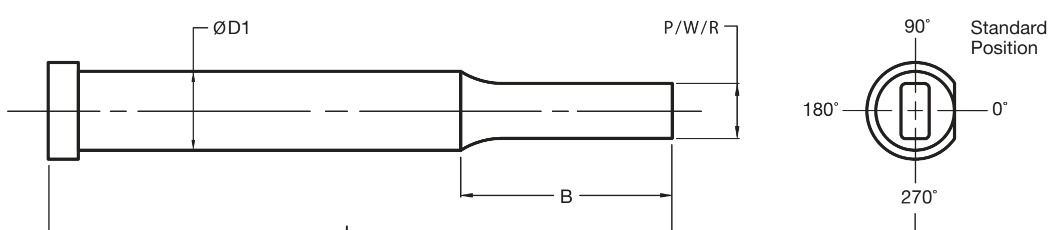
$G = \sqrt{W^2 + P^2}$ $G = \sqrt{(W-2R)^2 + (P-2R)^2} + 2R$ $G = W \times 0.045$

CAT # CODE	BODY Ø D1	HEAD Ø D2	T	B	ROUND RANGE P	SHAPE MIN W	SHAPE MAX G	LENGTHS L
18	.1875	.312	.125	.43	.062 – .187	.062	.187	Available Lengths: 1.50 inches to 8.00 inches Standard Lengths (page 39)
25	.250	.375	.125	.50	.093 – .249	.093	.249	
31	.3125	.437	.125	.56	.125 – .312	.125	.312	
37	.375	.500	.188	.62	.187 – .374	.187	.374	
50	.500	.625	.188	.81	.250 – .499	.187	.499	
62	.625	.750	.250	.94	.375 – .624	.250	.624	
75	.750	.875	.250	1.06	.500 – .749	.312	.749	
100	1.000	1.125	.250	1.25	.687 – .999	.375	.999	

Standard Alterations (Page 40).
Locating Methods (Page 41).

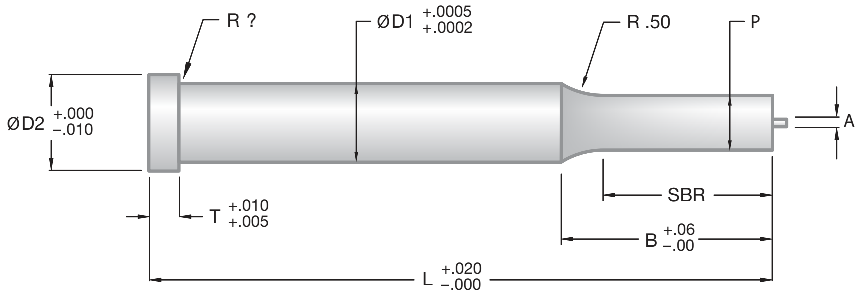
Alterations from standard dimensions available on request.

ORDER EXAMPLE



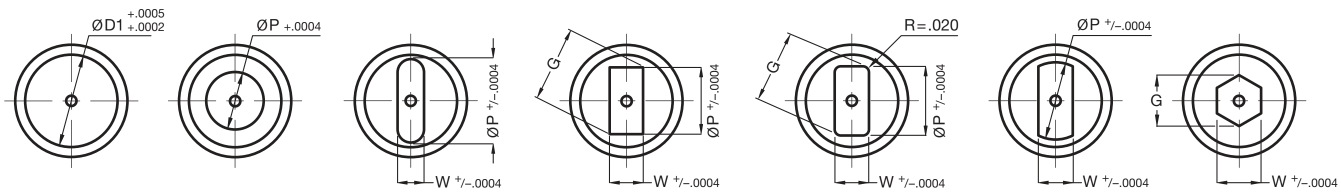
CODE	QTY	Material	Type	D1 x L	P / W / R	B	Locating Method		Alterations	Coating
50	10	M2	TP	.500 x 3.50	.250 / .200 / .039	.81	SF	0˚	Roof Top Shear	TIN

TE Head Type Ejector



3D CONFIGURATOR	
3Dfindit	
Material	**Hardness**
M2	60-62

TEB	TEC	TEO	TER	TEL	TEF	TEH



For qualified shapes see page 38.

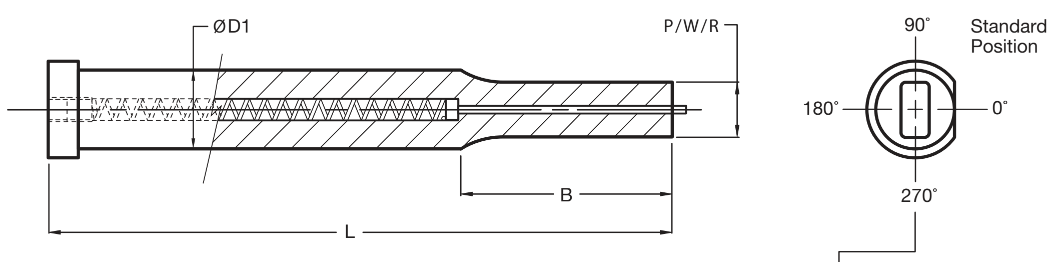
$G = \sqrt{W^2 + P^2}$ $G = \sqrt{(W - 2R)^2 + (P - 2R)^2} + 2R$ $G = W \times 0.045$

CAT # CODE	BODY Ø D1	HEAD Ø D2	T	A	B	ROUND RANGE P	SHAPE MIN W	SHAPE MAX G	LENGTHS L
18	.1875	.312	.125	.025	.43	.062 – .187	.062	.187	**Available Lengths: 1.50 inches to 8.00 inches**
25	.250	.375	.125	.032	.50	.093 – .249	.093	.249	
31	.3125	.437	.125	.047	.56	.125 – .312	.125	.312	
37	.375	.500	.188	.063	.62	.187 – .374	.187	.374	
50	.500	.625	.188	.063	.81	.225 – .499	.250	.499	**Standard Lengths (page 39)**
62	.625	.750	.250	.063	.94	.310 – .624	.282	.624	
75	.750	.875	.250	.063	1.06	.390 – .749	.312	.749	
100	1.000	1.125	.250	.063	1.25	.485 – .999	.375	.999	

Standard Alterations (Page 40).
Locating Methods (Page 41).

Alterations from standard dimensions available on request.

ORDER EXAMPLE

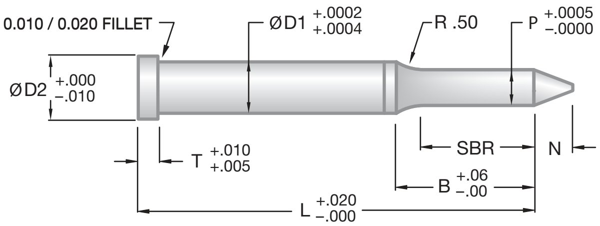


CODE	QTY	Material	Type	D1 x L	P / W / R	B	Locating Method	Alterations	Coating
50	10	M2	TE	.500 x 3.50	.250 / .200 / .039	.81	SF 0˚	Roof Top Shear	TIN

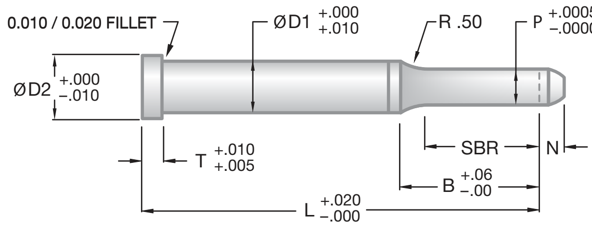
TPA/TPN Head Type Pilots

3D CONFIGURATOR

Material	Hardness
M2	60-62



TPA



TPN

TPA

CAT# CODE	BODYØ D1	HEADØ D2	T	B	B (OPTIONAL)	* N / MIN. P	ROUND RANGE P	LENGTHS L
37	.375	.500	.188	.620	1.00 / 1.25	.375 / .210	.186 – .3745	**Available Lengths: 1.50 inches to 8.00 inches**
50	.500	.625	.188	.810	1.00 / 1.25	.500 / .300	.224 – .500	
62	.625	.750	.250	.940	1.00 / 1.25	.625 / .390	.309 – .625	
75	.750	.875	.250	1.060	1.00 / 1.25	.750 / .480	.389 – .750	**Standard Lengths (page 39)**
100	1.000	1.125	.250	1.250	1.00 / 1.25	1.000 / .660	.749 – 1.000	

*** N = 1.2 x P when "P" is below minimum.**

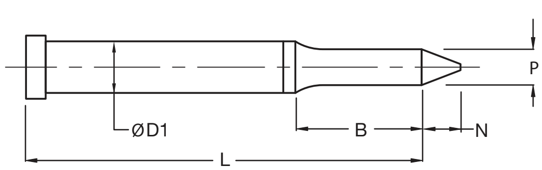
TPN

CAT# CODE	BODYØ D1	HEADØ D2	T	B (SPECIFY)	POINT LEAD	ROUND RANGE P	LENGTHS L
18	.188	.312	.125	.75 / 1.00 / 1.25	.037 – .077 : 1/16	.062 – .187	**Available Lengths: 1.50 inches to 8.00 inches**
25	.250	.375	.125	.75 / 1.00 / 1.25	.078 – .171 : 1/8	.062 – .249	
31	.313	.437	.125	.75 / 1.00 / 1.25	.172 – .129 : 3/16	.093 – .312	
37	.375	.500	.188	.75 / 1.00 / 1.25	.296 – .405 : 1/4	.125 – .374	
50	.500	.625	.188	.75 / 1.00 / 1.25	.515 – .639 : 3/8	.187 – .499	**Standard Lengths (page 39)**
62	.625	.750	.250	.75 / 1.00 / 1.25	.640 – .936 : 7/16	.375 – .624	
75	.750	.875	.250	.75 / 1.00 / 1.25	.937 – .999 : 1/2	.500 – .749	
100	1.000	1.125	.250	.75 / 1.00 / 1.25	1.00 : 9/16	.687 – .999	

Standard Alterations (Page 40). **Locating Devices (Page 41).** **Qualified Shapes (Page 38).** Alterations from standard dimensions available on request.

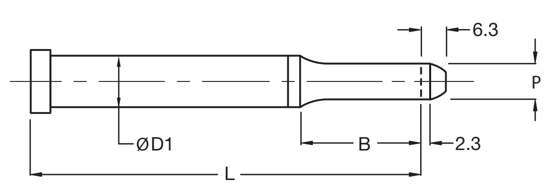
ORDER EXAMPLE

TPA



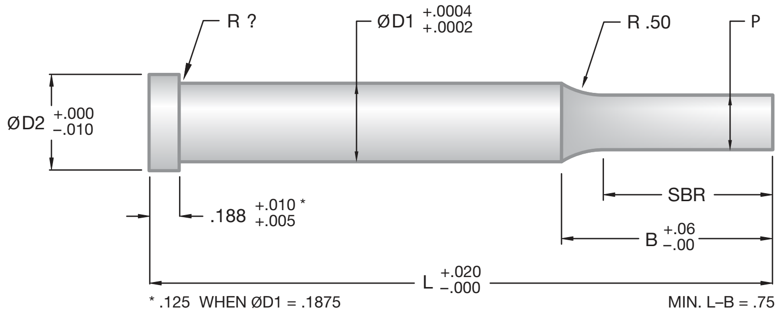
CODE	QTY	Material	Type	L	P	B
50	10	M2	TPA	2	.250	.125

TPN



CODE	QTY	Material	Type	L	P	B
50	10	M2	TPN	2	.250	.125

FP Flexible Head Type



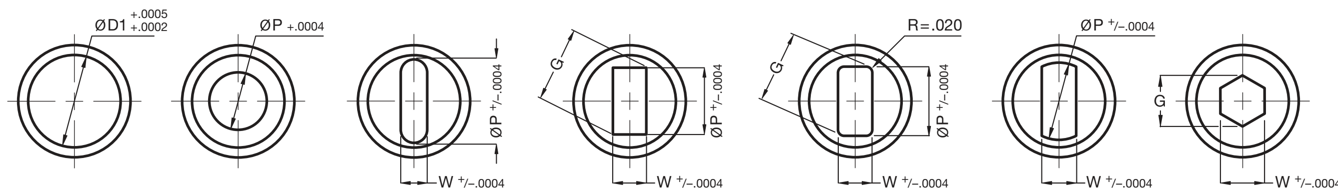
3D CONFIGURATOR

3Dfindit powered by CADENAS

Material	Hardness
M2	60-62

Also available in PM M4

FPB	FPC	FPO	FPR	FPL	FPF	FPH



For qualified shapes see page 38.

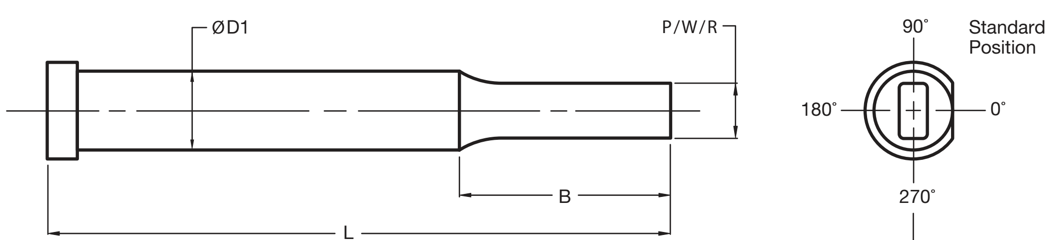
$G = \sqrt{W^2 + P^2}$ $G = \sqrt{(W-2R)^2 + (P-2R)^2} + 2R$ $G = W \times 0.045$

CAT # CODE	BODY Ø D1	HEAD Ø D2	(SPECIFY) B	ROUND RANGE P	SHAPE MIN W	SHAPE MAX G	LENGTHS L
18	.1875	.312	.75 / 1.00	.062 – .187	.062	.187	**Available Lengths: 1.50 inches to 8.00 inches**
25	.250	.375	.75 / 1.00 / 1.25	.093 – .249	.093	.249	
31	.3125	.437	.75 / 1.00 / 1.25	.125 – .312	.125	.312	
37	.375	.500	.75 / 1.00 / 1.25	.187 – .374	.187	.374	
43	.4375	.562	.75 / 1.00 / 1.25	.187 – .437	.187	.437	
50	.500	.625	.75 / 1.00 / 1.25	.225 – .499	.250	.499	**Standard Lengths (page 39)**
62	.625	.750	.75 / 1.00 / 1.25	.310 – .624	.282	.624	
75	.750	.875	.75 / 1.00 / 1.25	.390 – .749	.312	.749	
100	1.000	1.125	.75 / 1.00 / 1.25	.485 – .999	.375	.999	

Standard Alterations (Page 40).
Locating Methods (Page 41).

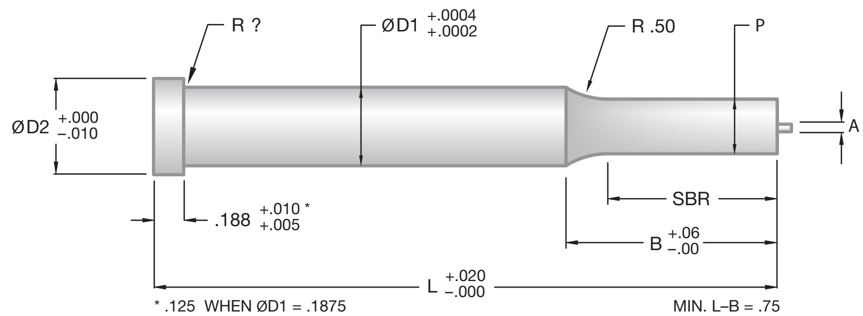
Alterations from standard dimensions available on request.

ORDER EXAMPLE



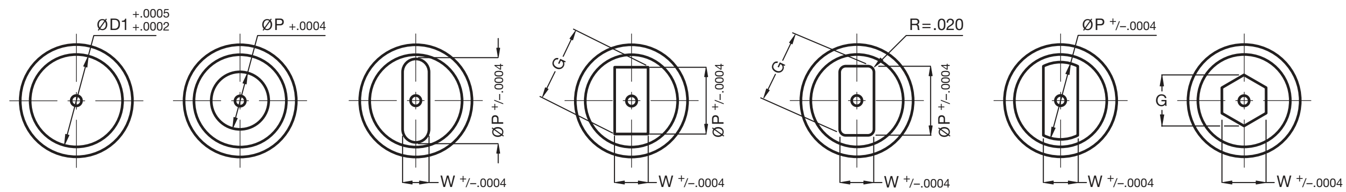
CODE	QTY	Material	Type	D1 x L	P / W / R	B	Locating Method	Alterations	Coating
50	10	M2	FP	.500 x 3.50	.250 / .200 / .039	.81	SF 0˚	Roof Top Shear	TIN

FE Flexible Head Type Ejector



3D CONFIGURATOR	
3Dfindit	
Material	**Hardness**
M2	60-62

FEB	FEC	FEO	FER	FEL	FEF	FEH



For qualified shapes see page 38.

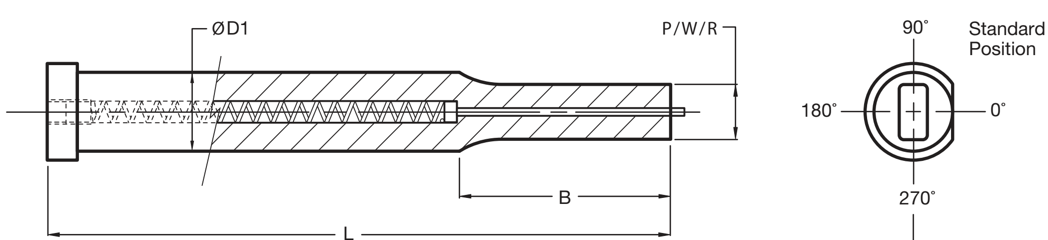
$G = \sqrt{W^2 + P^2}$ $G = \sqrt{(W - 2R)^2 + (P - 2R)^2} + 2R$ $G = W \times 0.045$

CAT # CODE	BODY Ø D1	HEAD Ø D2	A	(SPECIFY) B	ROUND RANGE P	SHAPE MIN W	SHAPE MAX G	LENGTHS L
18	.1875	.312	.125	.75 / 1.00	.062 – .187	.062	.187	**Available Lengths: 1.50 inches to 8.00 inches**
25	.250	.375	.125	.75 / 1.00 / 1.25	.093 – .249	.093	.249	
31	.3125	.437	.125	.75 / 1.00 / 1.25	.125 – .312	.125	.312	
37	.375	.500	.188	.75 / 1.00 / 1.25	.187 – .374	.187	.374	
43	.4375	.562	.188	.75 / 1.00 / 1.25	.187 – .437	.187	.437	
50	.500	.625	.188	.75 / 1.00 / 1.25	.225 – .499	.250	.499	**Standard Lengths (page 39)**
62	.625	.750	.250	.75 / 1.00 / 1.25	.310 – .624	.282	.624	
75	.750	.875	.250	.75 / 1.00 / 1.25	.390 – .749	.312	.749	
100	1.000	1.125	.250	.75 / 1.00 / 1.25	.485 – .999	.375	.999	

Standard Alterations (Page 40).
Locating Methods (Page 41).

Alterations from standard dimensions available on request.

ORDER EXAMPLE

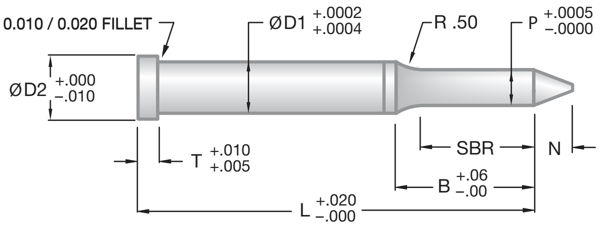


CODE	QTY	Material	Type	D1 x L	P / W / R	B	Locating Method	Alterations	Coating
50	10	M2	FE	.500 x 3.50	.250 / .200 / .039	.81	SF 0˚	Roof Top Shear	TIN

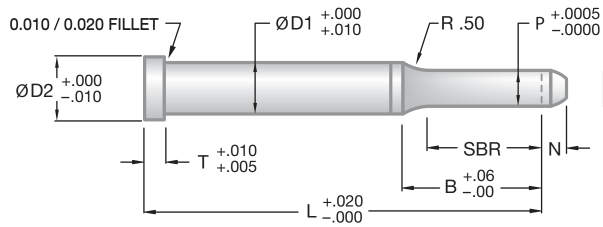
FPA/FPN Flexible Head Type Pilot

3D CONFIGURATOR

Material	Hardness
M2	60-62



FPA



FPN

FPA

CAT# CODE	BODYØ D1	HEAD Ø D2	T	B (SPECIFY)	* N / MIN. P	ROUND RANGE P	SHAPE MIN W	SHAPE MAX G	LENGTHS L
37	.375	.500	.188	.75 / 1.00 / 1.25	.375 / .210	.186 – .3745	.125	.374	**Available Lengths: 1.50 inches to 8.00 inches** **Standard Lengths (page 39)**
43	.435	.562	.188	.75 / 1.00 / 1.25	.4375 / .250	.186 – .500	.187	.437	
50	.500	.625	.188	.75 / 1.00 / 1.25	.500 / .300	.224 – .500	.187	.499	
62	.625	.750	.250	.75 / 1.00 / 1.25	.625 / .390	.375 – .625	.375	.624	
75	.750	.875	.250	.75 / 1.00 / 1.25	.750 / .480	.309 – .750	.500	.749	
100	1.000	1.125	.250	.75 / 1.00 / 1.25	1.000 / .660	.389 – 1.000	.687	.999	

*** N = 1.2 x P when “P” is below minimum.**

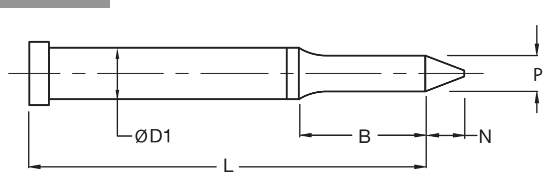
FPN

CAT# CODE	BODYØ D1	HEADØ D2	T	B (SPECIFY)	POINT LEAD	ROUND RANGE P	SHAPE MIN W	SHAPE MAX G	LENGTHS L
18	.188	.312	.125	.75 / 1.00 / 1.25	.037 – .077 : 1/16	.062 – .187	.062	.187	**Available Lengths: 1.50 inches to 8.00 inches** **Standard Lengths (page 39)**
25	.250	.375	.125	.75 / 1.00 / 1.25	.078 – .171 : 1/8	.062 – .249	.062	.249	
31	.313	.437	.125	.75 / 1.00 / 1.25	.172 – .129 : 3/16	.093 – .312	.093	.312	
37	.375	.500	.188	.75 / 1.00 / 1.25	.296 – .405 : 1/4	.125 – .374	.125	.374	
43	.438	.562	.188	.75 / 1.00 / 1.25	.406 – .514 : 5/16				
50	.500	.625	.188	.75 / 1.00 / 1.25	.515 – .639 : 3/8	.187 – .499	.187	.499	
62	.625	.750	.250	.75 / 1.00 / 1.25	.640 – .936 : 7/16	.375 – .624	.375	.624	
75	.750	.875	.250	.75 / 1.00 / 1.25	.937 – .999 : 1/2	.500 – .749	..500	.749	
100	1.000	1.125	.250	.75 / 1.00 / 1.25	1.00 : 9/16	.687 – .999	.687	.999	

Standard Alterations (Page 40). **Locating Devices (Page 41).** **Qualified Shapes (Page 38).** Alterations from standard dimensions available on request.

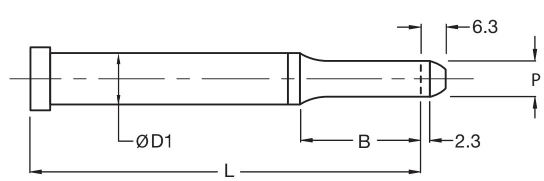
ORDER EXAMPLE

FPA



CODE	QTY	Material	Type	L	P	B
50	10	M2	FPA	2.00	.250	.125

FPN



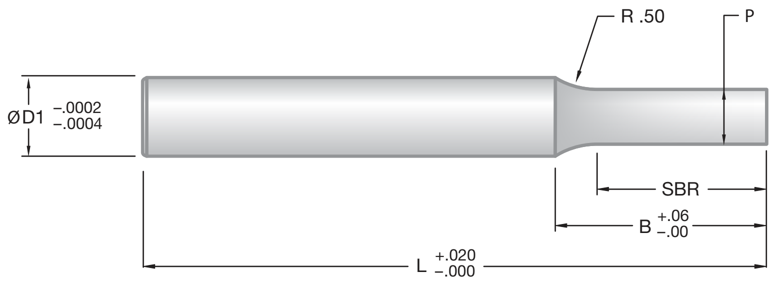
CODE	QTY	Material	Type	L	P	B
50	10	M2	FPN	2.00	.250	.125

HL Headless

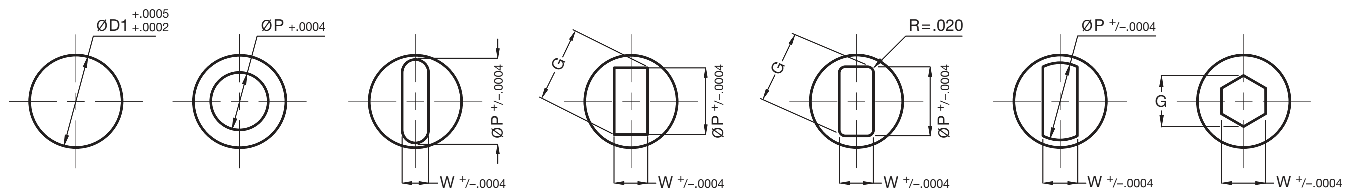
3D CONFIGURATOR

3Dfindit powered by CADENAS

Material	Hardness
M2	60-62



HLB	HLC	HLO	HLR	HLL	HLF	HLH



For qualified shapes see page 38.

$G = \sqrt{W^2 + P^2}$ $\quad$ $G = \sqrt{(W - 2R)^2 + (P - 2R)^2} + 2R$ $\quad$ $G = W \times 0.045$

CAT # CODE	BODYØ D1	B	ROUND RANGE P	SHAPE MIN W	SHAPE MAX G	LENGTHS L
25	.250	.50	.093 – .249	.093	.249	
37	.375	.62	.187 – .374	.187	.374	
50	.500	.75	.250 – .499	.187	.499	
62	.625	.87	.375 – .624	.250	.624	
75	.750	.93	.500 – .749	.312	.749	
87	.875	.93	.500 – .749	.312	.749	
100	1.000	.93	.687 – .999	.375	.999	
125	1.250	.93	1.000 – 1.249	.500	1.249	

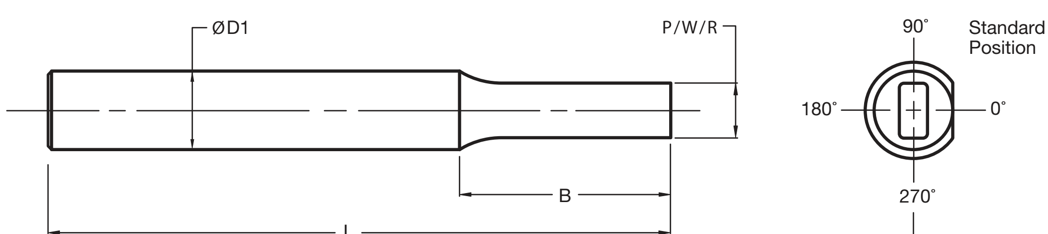
Available Lengths:
1.50 inches
to
8.00 inches

Standard Lengths
(page 39)

Standard Alterations (Page 40).
Locating Methods (Page 41).

Alterations from standard dimensions available on request.

ORDER EXAMPLE



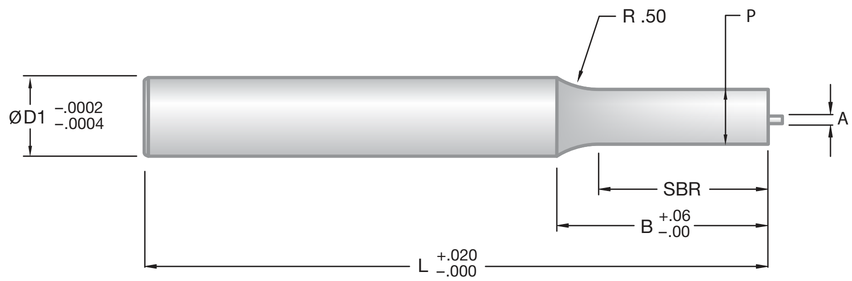
CODE	QTY	Material	Type	D1 x L	P / W / R	B	Locating Method	Alterations	Coating
50	10	M2	HL	.500 x 3.50	.250 / .200 / .039	.81	SF 0˚	Roof Top Shear	TIN

HLE Headless Ejector

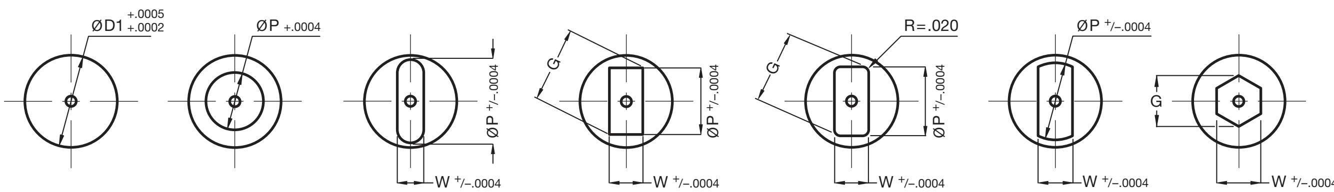
3D CONFIGURATOR

3Dfindit

Material	Hardness
M2	60-62



HLEB	HLEC	HLEO	HLER	HLEL	HLEF	HLEH



For qualified shapes see page 38.

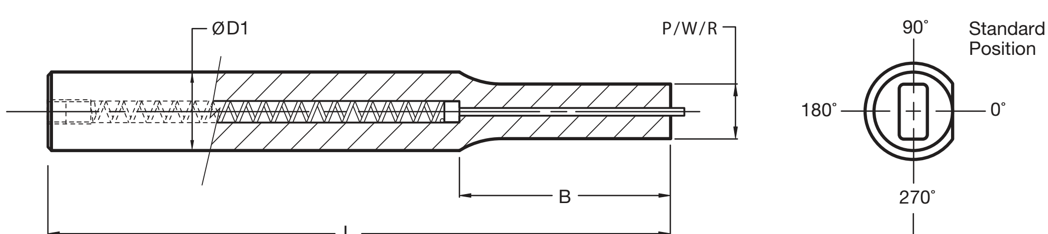
$G = \sqrt{W^2 + P^2}$ $G = \sqrt{(W - 2R)^2 + (P - 2R)^2} + 2R$ $G = W \times 0.045$

CAT # CODE	BODY Ø D1	A	B	ROUND RANGE P	SHAPE MIN W	SHAPE MAX G	LENGTHS L
25	.250	.032	.50	.093 – .249	.093	.249	Available Lengths: 1.50 inches to 8.00 inches Standard Lengths (page 39)
37	.375	.047	.62	.187 – .374	.187	.374	
50	.500	.063	.75	.250 – .499	.187	.499	
62	.625	.063	.87	.375 – .624	.250	.624	
75	.750	.093	.93	.500 – .749	.312	.749	
87	.875	.093	.93	.500 – .749	.312	.749	
100	1.000	.093	.93	.687 – .999	.375	.999	
125	1.250	.093	.93	1.000 – 1.249	.500	1.249	

Standard Alterations (Page 40).
Locating Methods (Page 41).

Alterations from standard dimensions available on request.

ORDER EXAMPLE



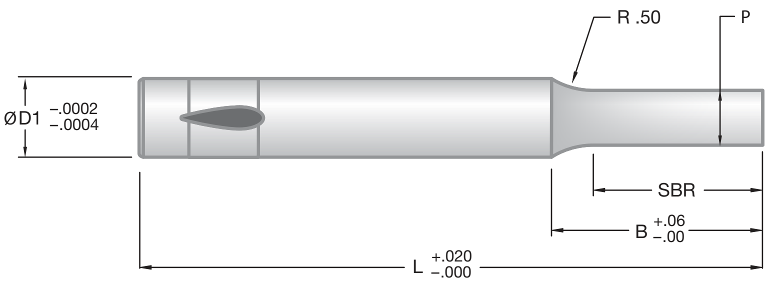
CODE	QTY	Material	Type	D1 x L	P / W / R	B	Locating Method	Alterations	Coating
50	10	M2	HLE	.500 x 3.50	.250 / .200 / .039	.81	SF 0˚	Roof Top Shear	TIN

BL Light Duty Ball Lock

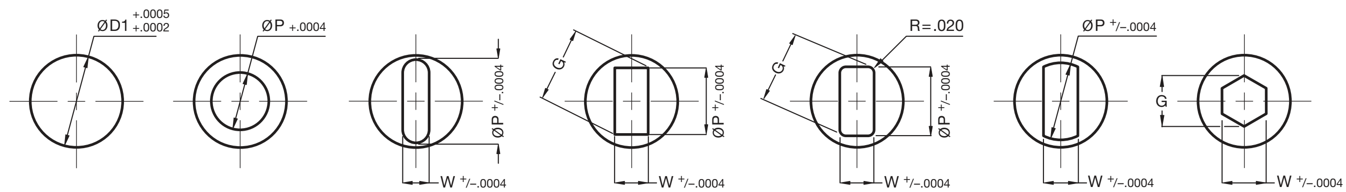
3D CONFIGURATOR

3Dfindit

Material	Hardness
M2	60-62



BLB	BLC	BLO	BLR	BLL	BLF	BLH



For qualified shapes see page 38.

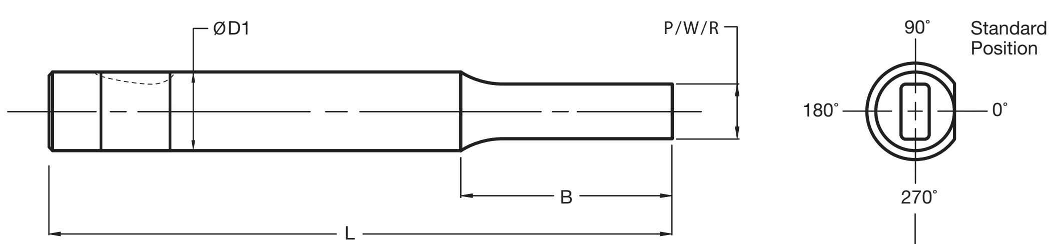
$G = \sqrt{W^2 + P^2}$ $G = \sqrt{(W-2R)^2 + (P-2R)^2} + 2R$ $G = W \times 0.045$

CAT # CODE	BODY Ø D1	B	OPTIONAL B	ROUND RANGE P	SHAPE MIN W	SHAPE MAX G	LENGTH L
25	.250	.50	.75 / 1.00 / 1.25	.060 – .249	.062	.249	Available Lengths: 1.50 inches to 8.00 inches Standard Lengths (page 39)
37	.375	.62	.75 / 1.00 / 1.25	.125 – .374	.125	.374	
50	.500	.75	.75 / 1.00 / 1.25	.187 – .499	.187	.499	
62	.625	.87	.75 / 1.00 / 1.25	.312 – .624	.250	.624	
75	.750	.93	.75 / 1.00 / 1.25	.437 – .749	.312	.749	
87	.875	.93	.75 / 1.00 / 1.25	.625 – .874	.375	.874	
100	1.000	.93	.75 / 1.00 / 1.25	.750 – .999	.437	.999	
125	1.250	.93	.75 / 1.00 / 1.25	1.000 – 1.249	.500	1.249	

Standard Alterations (Page 40).
Locating Methods (Page 41).

Alterations from standard dimensions available on request.

ORDER EXAMPLE

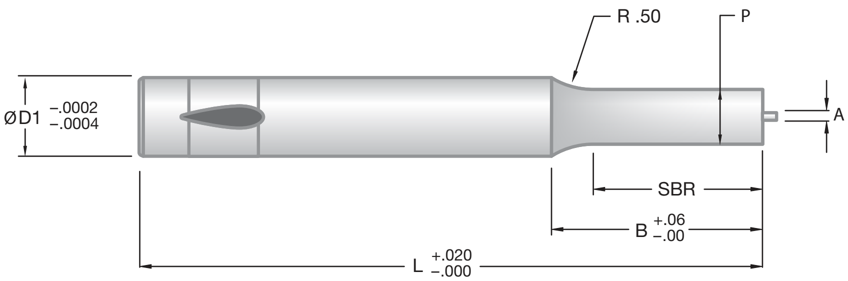


CODE	QTY	Material	Type	D1 x L	P / W / R	B	Locating Method	Alterations	Coating
50	10	M2	BL	.500 x 3.50	.250 / .200 / .039	.81	SF 0°	Roof Top Shear	TIN

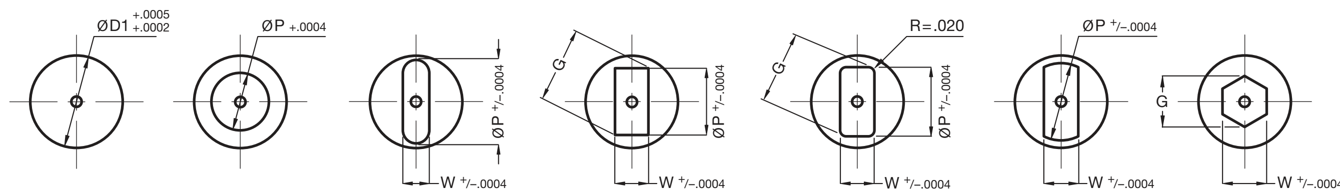
BLE Light Duty Ball Lock Ejector

3D CONFIGURATOR
3Dfindit powered by CADENAS

Material	Hardness
M2	60-62



BHEB	BHEC	BHEO	BHER	BHEL	BHEF	BHEH



For qualified shapes see page 38.

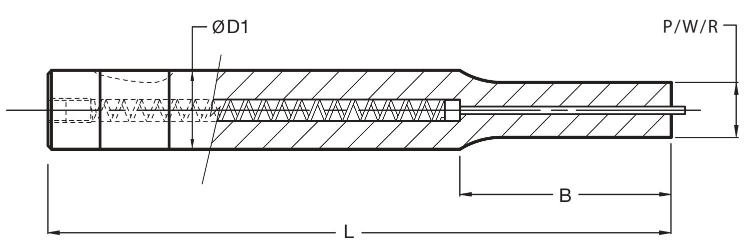
$G = \sqrt{W^2 + P^2}$ $G = \sqrt{(W - 2R)^2 + (P - 2R)^2} + 2R$ $G = W \times 0.045$

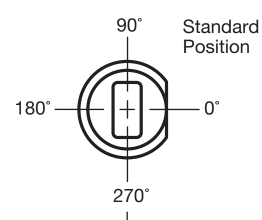
CAT # CODE	BODYØ D1	A	B	OPTIONAL B	ROUND RANGE P	SHAPE MIN W	SHAPE MAX G	LENGTH L
25	.250	.032	.50	.75 / 1.00 / 1.25	.070 – .249	.070	.249	**Available Lengths: 1.50 inches to 8.00 inches**
37	.375	.047	.62	.75 / 1.00 / 1.25	.125 – .374	.125	.374	
50	.500	.063	.75	.75 / 1.00 / 1.25	.187 – .499	.187	.499	
62	.625	.063	.87	.75 / 1.00 / 1.25	.312 – .624	.250	.624	
75	.750	.093	.93	.75 / 1.00 / 1.25	.437 – .749	.312	.749	
87	.875	.093	.93	.75 / 1.00 / 1.25	.625 – .874	.375	.874	**Standard Lengths (page 39)**
100	1.000	.093	.93	.75 / 1.00 / 1.25	.750 – .999	.437	.999	
125	1.250	.093	.93	.75 / 1.00 / 1.25	1.000 – 1.249	.500	1.249	

Standard Alterations (Page 40).
Locating Methods (Page 41).

Alterations from standard dimensions available on request.

ORDER EXAMPLE





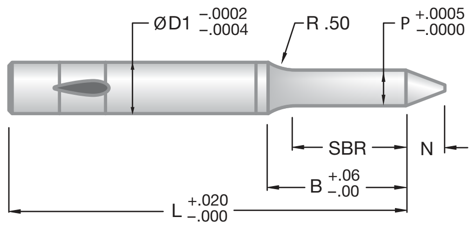
CODE	QTY	Material	Type	D1 x L	P / W / R	B	Locating Method	Alterations	Coating
50	10	M2	BLE	.500 x 3.50	.250 / .200 / .039	.81	SF 0˚	Roof Top Shear	TIN

BLA Light Duty Ball Lock Pilot

3D CONFIGURATOR

3Dfindit powered by CADENAS

Material	Hardness
M2	60-62



BLA, BHA

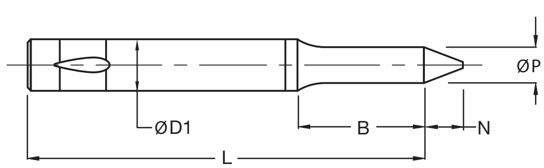
CAT# CODE	BODYØ D1	B (SPECIFY)	* N / MIN. P	ROUND RANGE P	LENGTHS L
37	.375	.75 / 1.00 / 1.25	.375 / .210	.186 – .374	**Available Lengths:** **1.50 inches** **to** **8.00 inches** **Standard Lengths** **(page 39)**
50	.500	.75 / 1.00 / 1.25	.500 / .300	.249 – .499	
62	.625	.75 / 1.00 / 1.25	.625 / .390	.311 – .624	
75	.750	.75 / 1.00 / 1.25	.750 / .480	.436 – .749	
87	.875	.75 /1.00 / 1.25	.875 / .570	.624 – .875	
100	1.000	.75 /1.00 / 1.25	1.000 / .660	.749 – .999	
125	1.250	.75 /1.00 / 1.25	1.250 / .840	.999 – 1.240	

*** N = 1.2 x P when "P" is below minimum.**

Standard Alterations (Page 40).
Locating Methods (Page 41).
Qualified Shapes (Page 38).

Alterations from standard dimensions available on request.

ORDER EXAMPLE



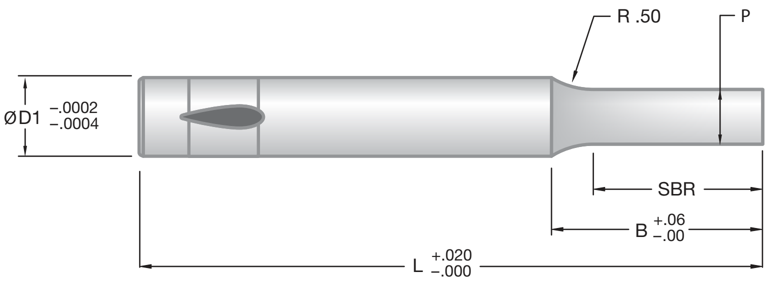
CODE	QTY	Material	Type	L	P	B
50	10	M2	BLA	2.00	.250	.125

BH Heavy Duty Ball Lock

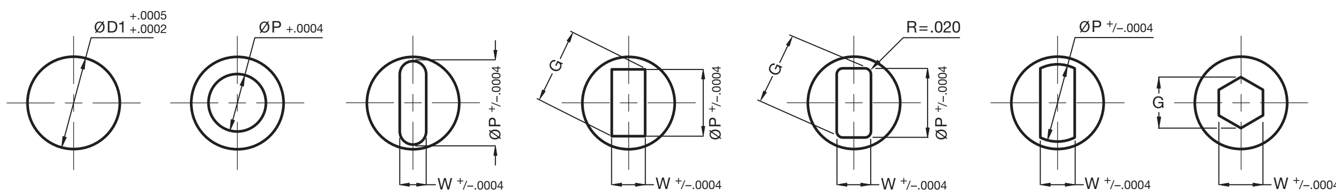
3D CONFIGURATOR

3Dfindit powered by CADENAS

Material	Hardness
M2	60-62



BHB	BHC	BHO	BHR	BHL	BHF	BHH



For qualified shapes see page 38.

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

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

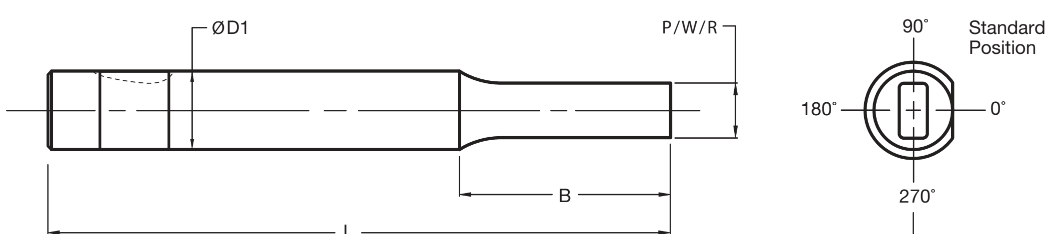
$G = W \times 0.045$

CAT # CODE	BODY Ø D1	B	OPTIONAL B	ROUND RANGE P	SHAPE MIN W	SHAPE MAX G	LENGTH L
37	.375	.62	.75 / 1.00 / 1.25	.125 – .374	.125	.374	Available Lengths: 1.50 inches to 8.00 inches
50	.500	.81	.75 / 1.00 / 1.25	.187 – .499	.187	.499	
62	.625	.94	.75 / 1.00 / 1.25	.312 – .624	.250	.624	
75	.750	1.06	.75 / 1.00 / 1.25	.437 – .749	.312	.749	
87	.875	1.18	.75 / 1.00 / 1.25	.625 – .874	.375	.874	Standard Lengths (page 39)
100	1.000	1.25	.75 / 1.00 / 1.25	.750 – .999	.437	.999	
125	1.250	1.44	.75 / 1.00 / 1.25	1.000 – 1.249	.500	1.249	

Standard Alterations (Page 40).
Locating Methods (Page 41).

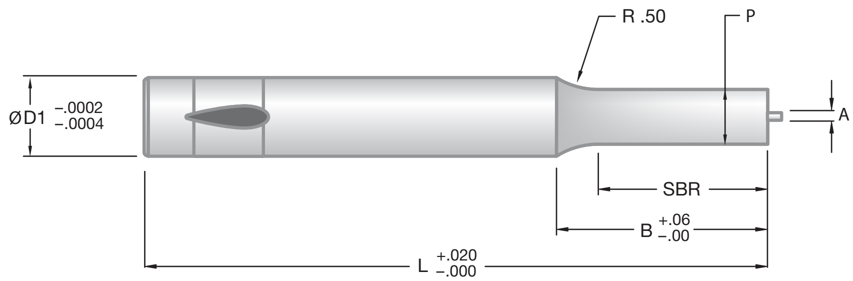
Alterations from standard dimensions available on request.

ORDER EXAMPLE



CODE	QTY	Material	Type	D1 x L	P / W / R	B	Locating Method	Alterations	Coating
50	10	M2	BH	.500 x 3.50	.250 / .200 / .039	.81	SF 0˚	Roof Top Shear	TIN

BHE Heavy Duty Ball Lock Ejector

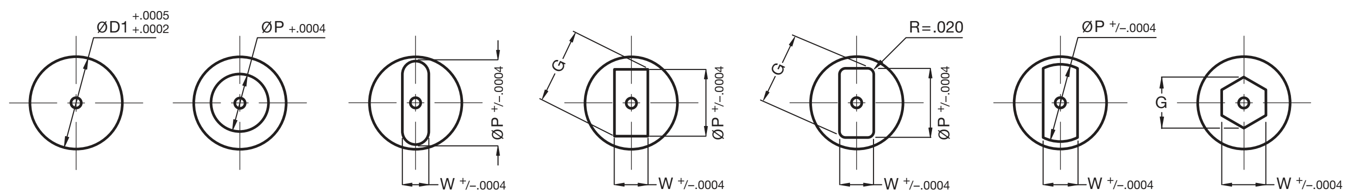


3D CONFIGURATOR

3Dfindit powered by CADENAS

Material	Hardness
M2	60-62

BHEB	BHEC	BHEO	BHER	BHEL	BHEF	BHEH



For qualified shapes see page 38.

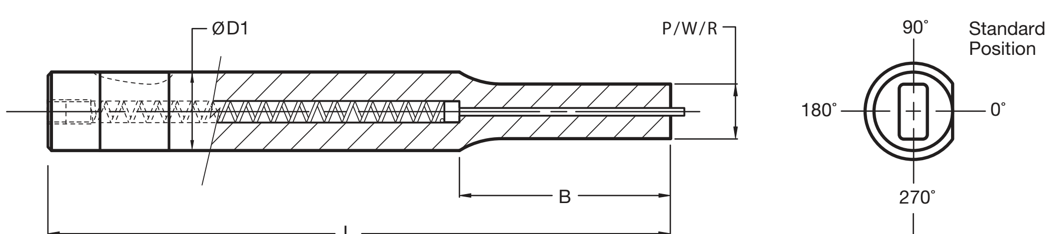
$G = \sqrt{W^2 + P^2}$ $G = \sqrt{(W - 2R)^2 + (P - 2R)^2} + 2R$ $G = W \times 0.045$

CAT # CODE	BODYØ D1	A	B	OPTIONAL B	ROUND RANGE P	SHAPE MIN W	SHAPE MAX G	LENGTH L
37	.375	.047	.62	.75 / 1.00 / 1.25	.125 – .374	.125	.374	**Available Lengths: 1.50 inches to 8.00 inches**
50	.500	.063	.81	.75 / 1.00 / 1.25	.187 – .499	.187	.499	
62	.625	.063	.94	.75 / 1.00 / 1.25	.312 – .624	.250	.624	
75	.750	.093	1.06	.75 / 1.00 / 1.25	.437 – .749	.312	.749	
87	.875	.093	1.18	.75 / 1.00 / 1.25	.625 – .874	.375	.874	**Standard Lengths (page 39)**
100	1.000	.093	1.25	.75 / 1.00 / 1.25	.750 – .999	.437	.999	
125	1.250	.093	1.44	.75 / 1.00 / 1.25	1.000 – 1.249	.500	1.249	

Standard Alterations (Page 40).
Locating Methods (Page 41).

Alterations from standard dimensions available on request.

ORDER EXAMPLE



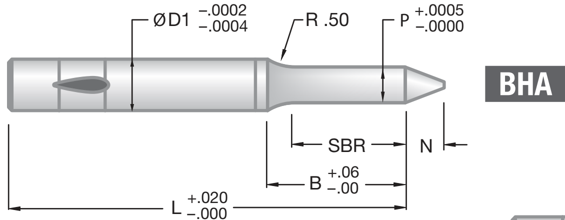
CODE	QTY	Material	Type	D1 x L	P / W / R	B	Locating Method	Alterations	Coating
50	10	M2	BHE	.500 x 3.50	.250 / .200 / .039	.81	SF 0°	Roof Top Shear	TIN

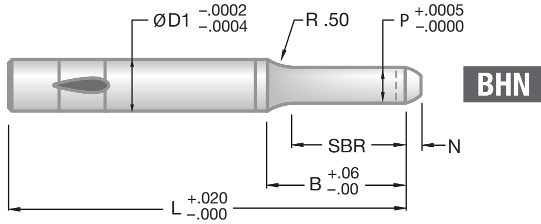
BHA, BHN Heavy Duty Ball Lock Pilot

3D CONFIGURATOR

3Dfindit powered by CADENAS

Material	Hardness
M2	60-62





BLA, BHA

CAT# CODE	BODYØ D1	B (SPECIFY)	* N / MIN. P	ROUND RANGE P	LENGTHS L
37	.375	.75 / 1.00 / 1.25	.375 / .210	.186 – .374	**Available Lengths: 1.50 inches to 8.00 inches** **Standard Lengths (page 39)**
50	.500	.75 / 1.00 / 1.25	.500 / .300	.249 – .499	
62	.625	.75 / 1.00 / 1.25	.625 / .390	.311 – .624	
75	.750	.75 / 1.00 / 1.25	.750 / .480	.436 – .749	
87	.875	.75 /1.00 / 1.25	.875 / .570	.624 – .875	
100	1.000	.75 /1.00 / 1.25	1.000 / .660	.749 – .999	
125	1.250	.75 /1.00 / 1.25	1.250 / .840	.999 – 1.240	

*** N = 1.2 x P when “P” is below minimum.**

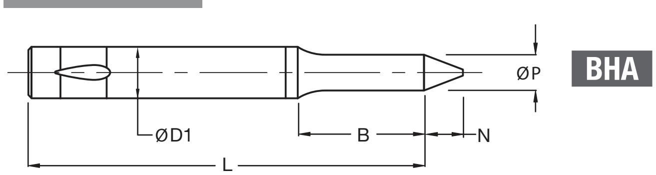
BHN

CAT# CODE	BODYØ D1	B	B (OPTIONAL)	POINT LEAD	ROUND RANGE P	LENGTHS L
37	.375	.620	.75 / 1.00 / 1.25	.296 -.405 : 1/4	.124 – .375	**Available Lengths: 1.50 inches to 8.00 inches** **Standard Lengths (page 39)**
50	.500	.810	.75 / 1.00 / 1.25	.515 -.639 : 3/8	.186 – .500	
62	.625	.940	.75 / 1.00 / 1.25	.640 -.936 : 7/16	.311 – .625	
75	.750	1.060	.75 / 1.00 / 1.25	.937 -.999 : 1/2	.436 – .750	
87	.875	1.180	.75 /1.00 / 1.25	?	.624 – .875	
100	1.000	1.250	.75 / 1.00 / 1.25	1.00 : 9/16	.749 – 1.000	
125	1.250	1.430	.75 /1.00 / 1.25	?	.999 – 1.250	

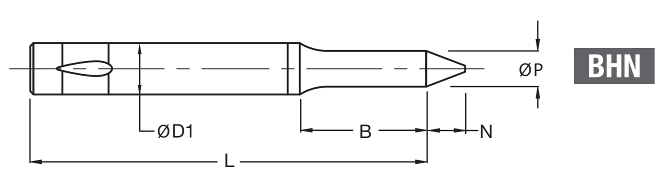
Standard Alterations (Page 40).
Locating Methods (Page 41).
Qualified Shapes (Page 38).

Alterations from standard dimensions available on request.

ORDER EXAMPLE



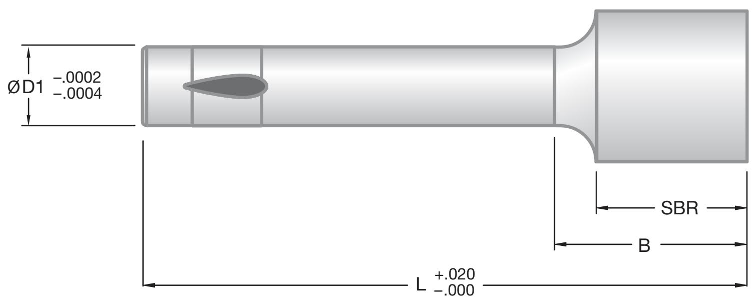
CODE	QTY	Material	Type	L	P	B
50	10	M2	BHA	2.00	.250	.125



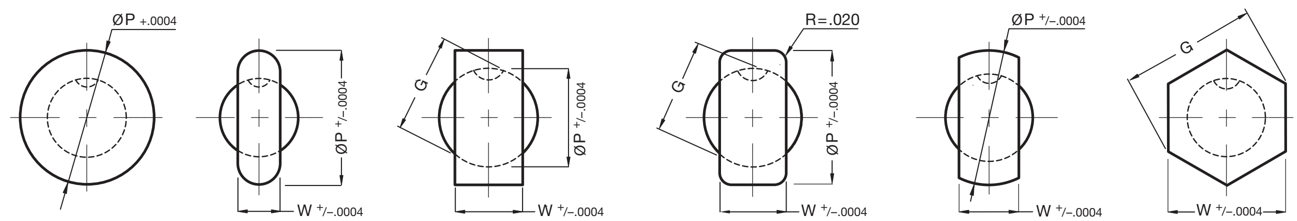
CODE	QTY	Material	Type	L	P	B
50	10	M2	BHN	2.00	.250	.125

BLK Light Duty Ball Lock Knob Style

3D CONFIGURATOR	
3Dfindit powered by CADENAS	
Material	**Hardness**
M2	60-62



BLKC	BLKO	BLKR	BLKL	BLKF	BLKH



For qualified shapes see page 38.

$G = W^2 + P^2$

$G = (W - 2R)^2 + (P - 2R)^2 + 2R$

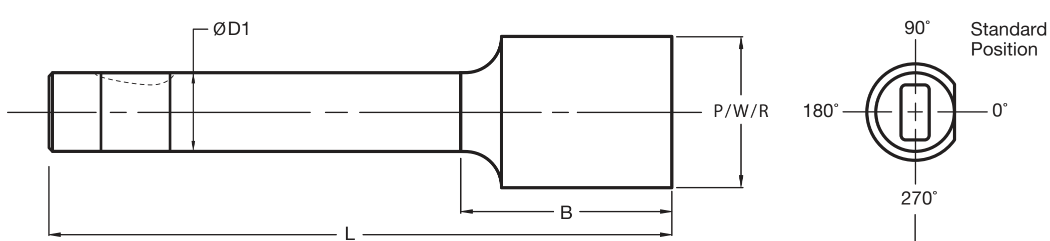
$G = W \times 0.045$

CAT # CODE	D1	B	ROUND RANGE P	SHAPE MIN W	SHAPE MAX G	LENGTHS (L)
.50	.500	.75	.501 – 1.250	.188	1.250	**Available Lengths: 1.50 inches to 8.00 inches**
.62	.625	.88	.626 – 1.500	.250	1.500	
.75	.750	.93	.751 – 1.500	.312	1.500	
.87	.875	.93	.876 – 1.750	.375	1.750	
1.00	1.000	1.13	1.001 – 1.750	.437	1.750	**Standard Lengths (page 39)**
1.25	1.250	1.13	1.251 – 2.500	.500	2.500	

Standard Alterations (Page 40).
Locating Methods (Page 41).

Alterations from standard dimensions available on request.

ORDER EXAMPLE



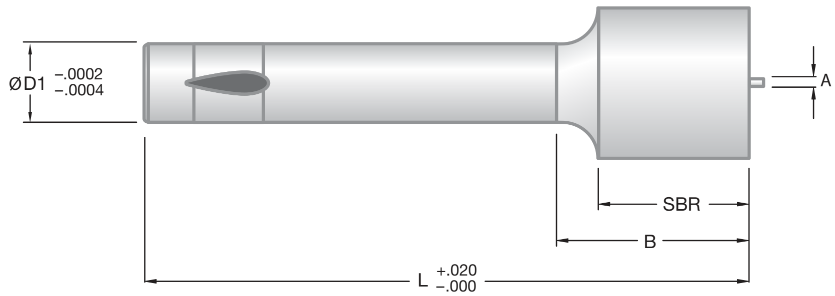
CODE	QTY	Material	Type	D1 x L	P / W / R	B	Locating Method	Alterations	Coating
50	10	M2	BLK	.500 x 3.50	.250 / .200 / .039	.81	SF 0˚	Roof Top Shear	TIN

BLEK Light Duty Ball Lock Knob Style Ejector

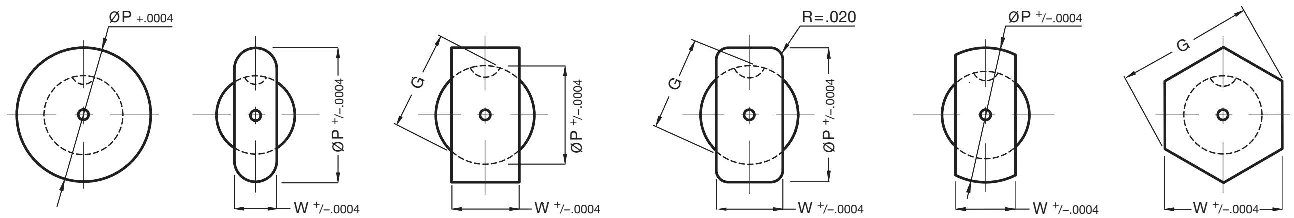
3D CONFIGURATOR

3Dfindit powered by CADENAS

Material	Hardness
M2	60-62



BLEKC	BLEKO	BLEKR	BLEKL	BLEKF	BLEKH



For qualified shapes see page 38.

$G = W^2 + P^2$

$G = (W - 2R)^2 + (P - 2R)^2 + 2R$

$G = W \times 0.045$

CAT # CODE	D1	A	B	ROUND RANGE P	SHAPE MIN W	SHAPE MAX G
.50	.500	.063	.75	.501 – 1.250	.188	1.250
.62	.625	.063	.88	.626 – 1.500	.250	1.500
.75	.750	.093	.93	.751 – 1.500	.312	1.500
.87	.875	.093	.93	.876 – 1.750	.375	1.750
1.00	1.000	.093	1.13	1.001 – 1.750	.437	1.750
1.25	1.250	.093	1.13	1.251 – 2.500	.500	2.500

LENGTHS (L)

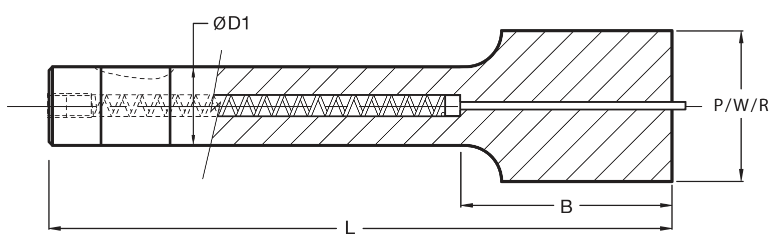
Available Lengths:
1.50 inches
to
8.00 inches

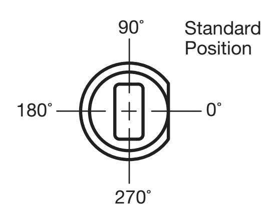
Standard Lengths
(page 39)

Standard Alterations (Page 40).
Locating Methods (Page 41).

Alterations from standard dimensions available on request.

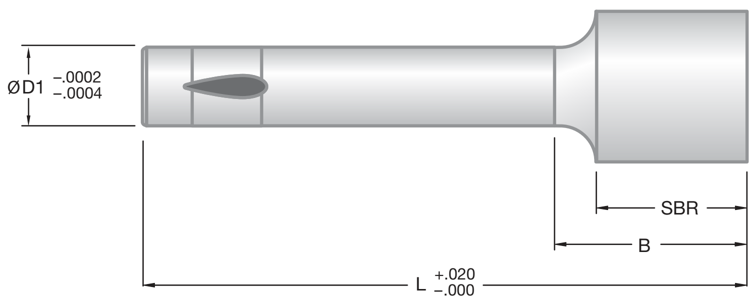
ORDER EXAMPLE





CODE	QTY	Material	Type	D1 x L	P / W / R	B	Locating Method	Alterations	Coating
50	10	M2	BLEK	.500 x 3.50	.250 / .200 / .039	.81	SF 0°	Roof Top Shear	TIN

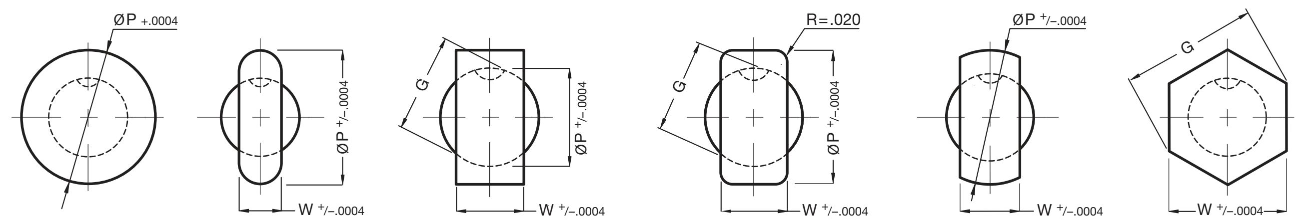
BHK Heavy Duty Ball Lock Knob Style



3D CONFIGURATOR

Material	Hardness
M2	60-62

BHKC	BHKO	BHKR	BHKL	BHKF	BHKH



For qualified shapes see page 38.

$G = W^2 + P^2$

$G = (W - 2R)^2 + (P - 2R)^2 + 2R$

$G = W \times 0.045$

CAT # CODE	D1	B	ROUND RANGE P	SHAPE MIN W	SHAPE MAX G	LENGTHS (L)
.50	.500	.75	.501 – 1.250	.188	1.250	
.62	.625	.88	.626 – 1.500	.250	1.500	
.75	.750	.93	.751 – 1.500	.312	1.500	
.87	.875	.93	.876 – 1.750	.375	1.750	
1.00	1.000	1.13	1.001 – 1.750	.437	1.750	
1.25	1.250	1.13	1.251 – 2.500	.500	2.500	

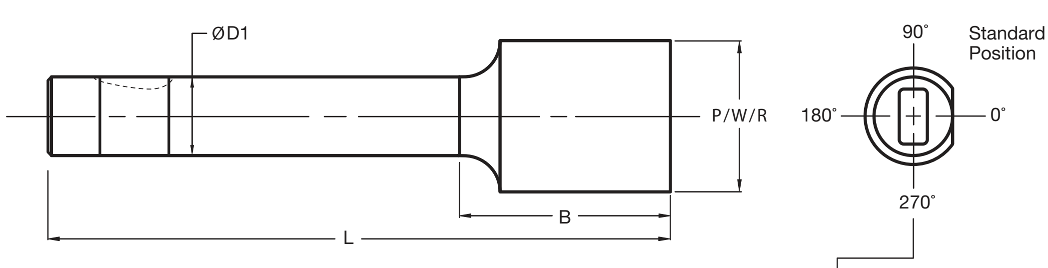
Available Lengths:
1.50 inches
to
8.00 inches

Standard Lengths
(page 39)

Standard Alterations (Page 40).
Locating Methods (Page 41).

Alterations from standard dimensions available on request.

ORDER EXAMPLE



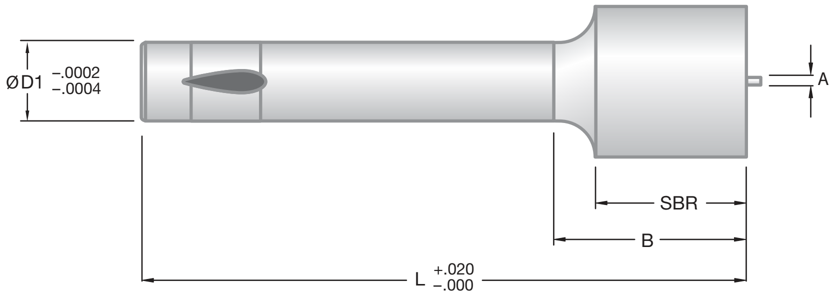
CODE	QTY	Material	Type	D1 x L	P / W / R	B	Locating Method	Alterations	Coating
50	10	M2	BHK	.500 x 3.50	.250 / .200 / .039	.81	SF 0˚	Roof Top Shear	TIN

BHEK Heavy Duty Ball Lock Knob Style Ejector

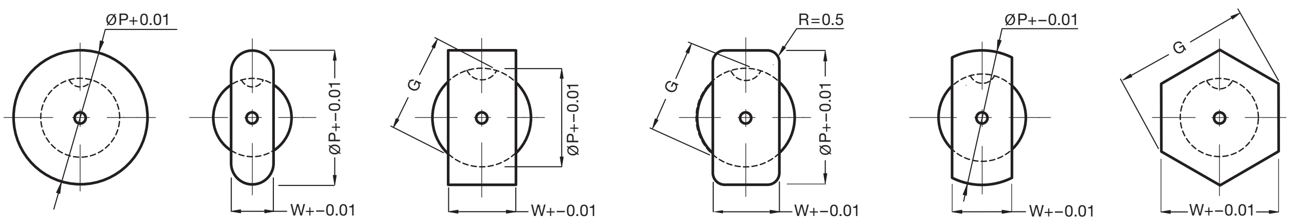
3D CONFIGURATOR

3Dfindit powered by CADENAS

Material	Hardness
M2	60-62



BHEKC	BHEKO	BHEKR	BHEKL	BHEKF	BHEKH



For qualified shapes see page 38.

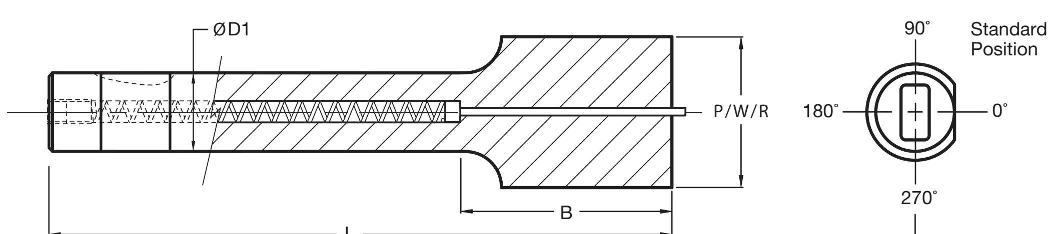
$G = W^2 + P^2$ $G = (W - 2R)^2 + (P - 2R)^2 + 2R$ $G = W \times 1.1547$

CAT # CODE	D1	A	B	ROUND RANGE P	SHAPE MIN W	SHAPE MAX G	LENGTHS (L)
.50	.500	.063	.75	.501 – 1.250	.188	1.250	**Available Lengths:** **1.50 inches** **to** **8.00 inches** **Standard Lengths** **(page 39)**
.62	.625	.063	.88	.626 – 1.500	.250	1.500	
.75	.750	.093	.93	.751 – 1.500	.312	1.500	
.87	.875	.093	.93	.876 – 1.750	.375	1.750	
1.00	1.000	.093	1.13	1.001 – 1.750	.437	1.750	
1.25	1.250	.093	1.13	1.251 – 2.500	.500	2.500	

Standard Alterations (Page 40).
Locating Devices (Page 41).

Alterations from standard dimensions available on request.

ORDER EXAMPLE

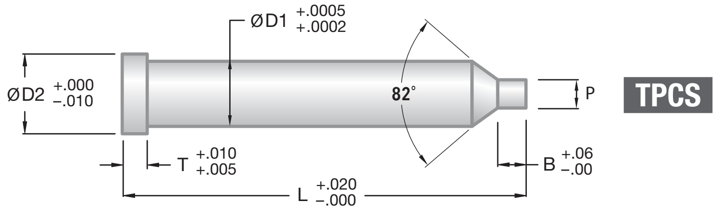


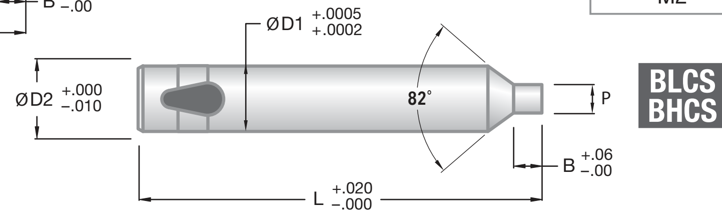
CODE	QTY	Material	Type	D1 x L	P / W / R	B	Locating Method	Alterations	Coating
50	10	M2	BHEK	.500 x 3.50	.250 / .200 / .039	.81	SF 0˚	Roof Top Shear	TIN

TPCS, BLCS, BHCS Counter Sink

3D CONFIGURATOR

Material	Hardness
M2	60-62





TPCS Counter Sink

CAT # CODE	BODYØ D1	HEADØ D2	T	B	ROUND RANGE P	LENGTHS (L)
25	.250	.37	.125	.125	.055 – .125	**Available Lengths: 1.50 inches to 8.00 inches** **Standard Lengths (page 39)**
31	.3125	.43	.125	.125	.078 – .140	
37	.375	.50	.188	.156	.090 – .187	
50	.500	.62	.188	.188	.140 – .250	
62	.625	.75	.250	.188	.203 – .281	
75	.750	.87	.250	.250	.265 – .359	

BLCS
Light Duty Ball Lock Counter Sink

CAT # CODE	BODYØ D1	B	ROUND RANGE P	LENGTHS (L)
25	.250	.125	.055 – .125	**Available Lengths: 1.50 inches to 8.00 inches** **Standard Lengths (page 39)**
37	.375	.156	.090 – .187	
50	.500	.188	.140 – .250	
62	.625	.188	.203 – .281	
75	.750	.250	.265 – .359	

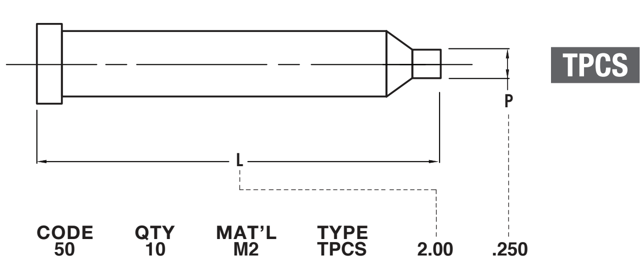
BHCS
Heavy Duty Ball Lock Counter Sink

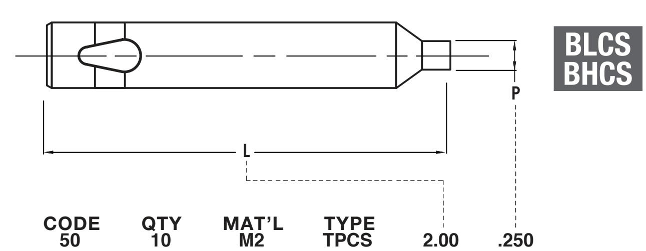
CAT # CODE	BODYØ D1	B	ROUND RANGE P	LENGTHS (L)
37	.375	.156	.090 – .187	**Available Lengths: 1.50 inches to 8.00 inches** **Standard Lengths (page 39)**
50	.500	.188	.140 – .250	
62	.625	.188	.203 – .281	
75	.750	.250	.265 – .359	

Standard Alterations (Page 40).
Locating Devices (Page 41).
Qualified Shapes (Page 38).

Alterations from standard dimensions available on request.

ORDER EXAMPLE

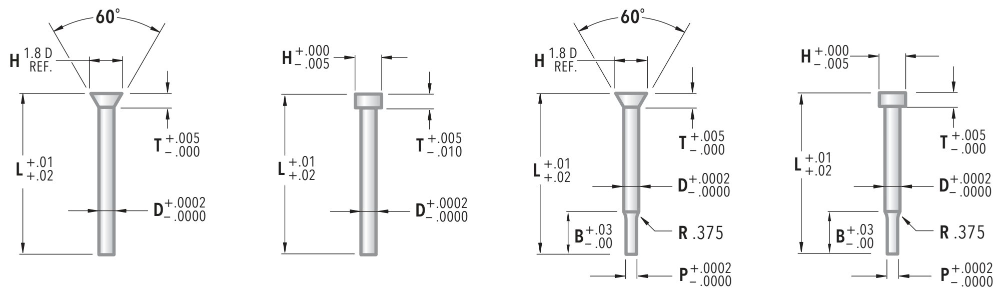




CS Close Space Punches

3D CONFIGURATOR

Material	Hardness
M2	60-62



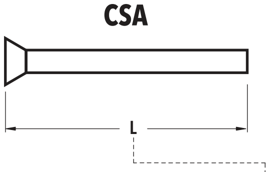
CSA CSB CSAP CSBP

CSA and CSB			
CODE	D	H	T
	.010 — .014	1/32	1/16
	.015 — .019	1/32	1/16
	.020 — .029	1/32	1/16
	.030 — .036	1/32	1/16
	.037 — .046	1/32	1/16
	.047 — .055	1/32	1/16
06	.0625	1/8	1/8
	.056 — .064	1/32	3/32
	.065 — .078	1/32	3/32
	.079 — .087	1/32	3/32
09	.0938	5/32	1/8
	.088 — .099	1/32	3/32
	.100 — .120	1/32	3/32
12	.125	3/16	1/8
	.121 — .131	1/32	3/32
	.132 — .147	1/32	3/32
15	.1562	7/32	1/8
	.148 — .163	1/32	3/32
	.164 — .179	1/32	3/32
18	.1875	1/4	1/8
	.180 — .194	1/32	3/32
	.195 — .210	1/32	3/32
21	.2188	9/32	1/8
	.211 — .225	1/32	3/32
	.226 — .241	1/32	3/32
	.242 — .249	1/32	3/32
25	.250	5/16	1/8

CSAP and CSBP						
CODE	D	H	T	B	MIN.P	MAX. P
	.010 — .014	1/32	1/16			
	.015 — .019	1/32	1/16			
	.020 — .029	1/32	1/16			
	.030 — .036	1/32	1/16			
	.037 — .046	1/32	1/16			
	.047 — .055	1/32	1/16			
06	.0625	1/8	1/8	.187	.031	.0624
	.056 — .064	1/32	3/32			
	.065 — .078	1/32	3/32			
	.079 — .087	1/32	3/32			
09	.0938	5/32	1/8	.250	.062	.0937
	.088 — .099	1/32	3/32			
	.100 — .120	1/32	3/32			
12	.125	3/16	1/8	.312	.093	.1249
	.121 — .131	1/32	3/32			
	.132 — .147	1/32	3/32			
15	.1562	7/32	1/8	.375	.125	.1561
	.148 — .163	1/32	3/32			
	.164 — .179	1/32	3/32			
18	.1875	1/4	1/8	.438	.156	.1874
	.180 — .194	1/32	3/32			
	.195 — .210	1/32	3/32			
21	.2188	9/32	1/8	.500	.182	.2187
	.211 — .225	1/32	3/32			
	.226 — .241	1/32	3/32			
	.242 — .249	1/32	3/32			
25	.250	5/16	1/8	.438	.218	.2499

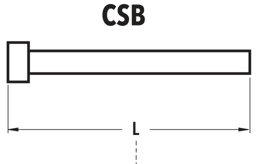
ORDER EXAMPLE

CSA



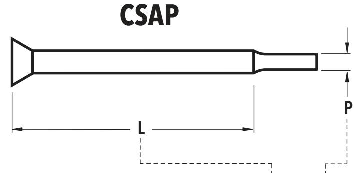
QTY	MAT'L	TYPE	CODE	
10	M2	CSA	06	0

CSB



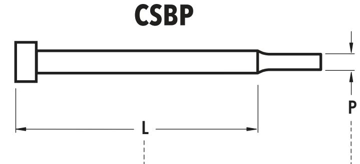
QTY	MAT'L	TYPE	CODE	
10	M2	CSB	06	0

CSAP



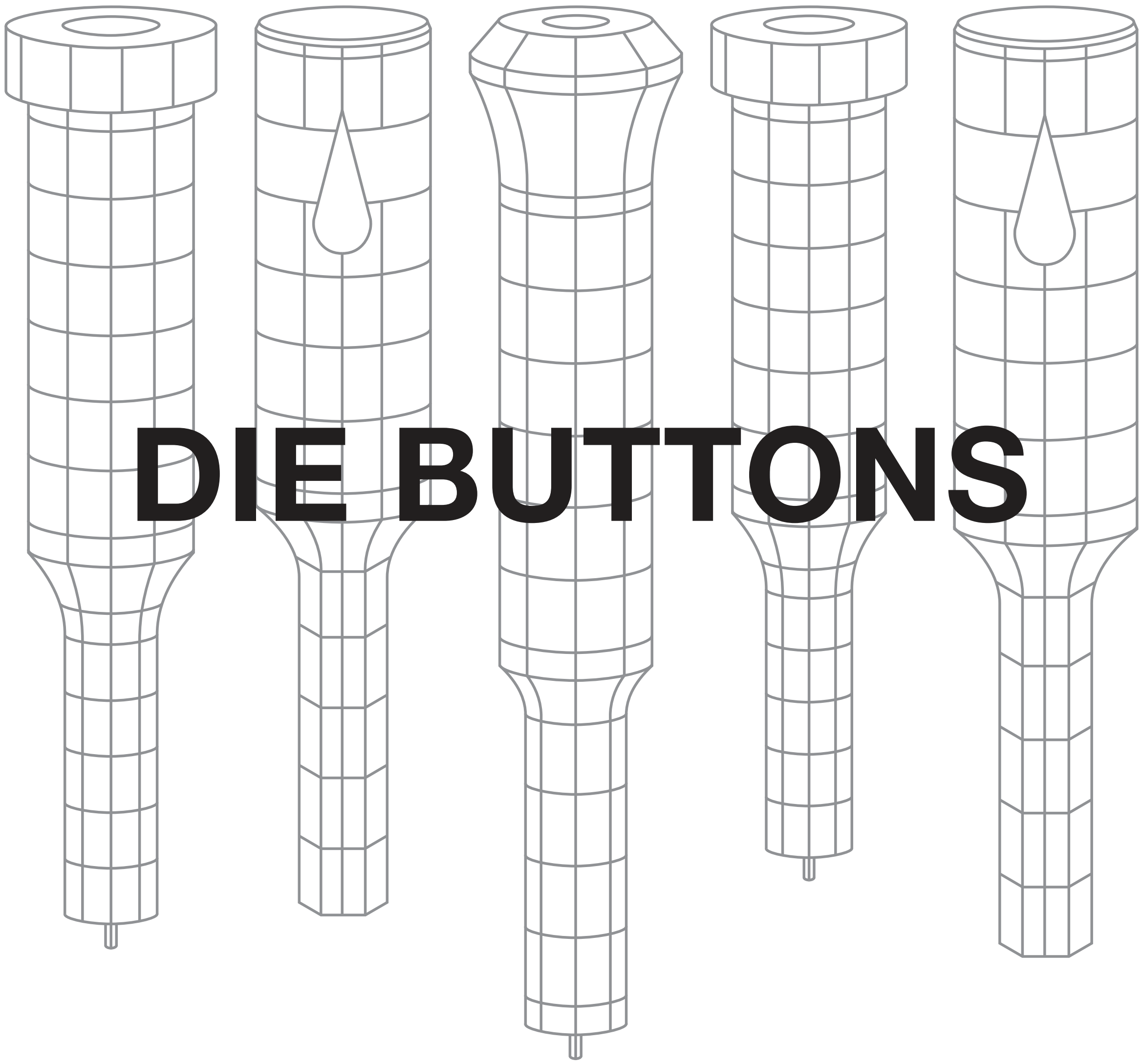
QTY	MAT'L	TYPE	CODE		
10	M2	CSAP	12	0	0

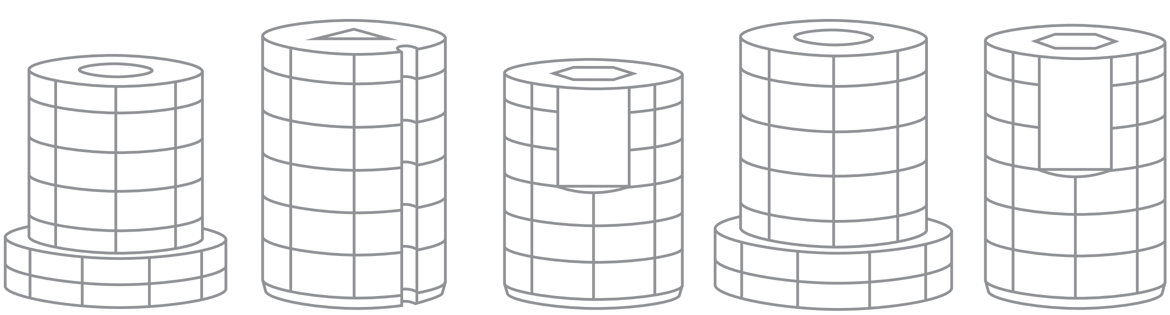
CSBP



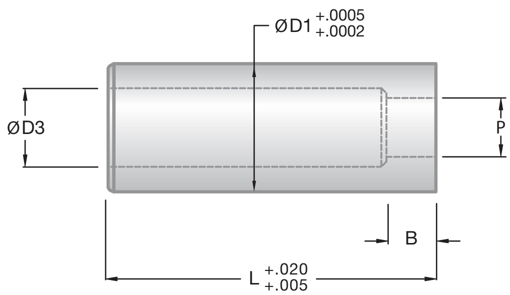
QTY	MAT'L	TYPE	CODE		
10	M2	CSBP	12	0	0

DIE BUTTONS





TD Stepped Relief

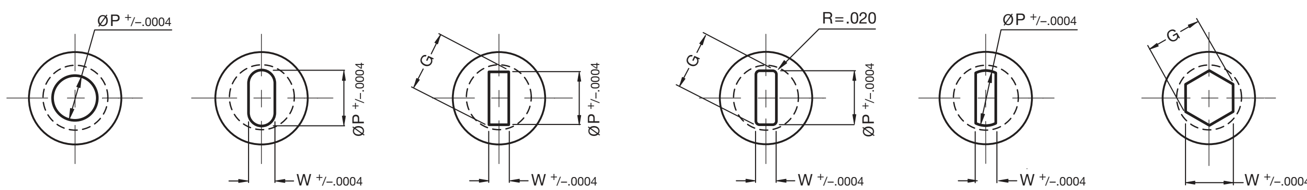


3D CONFIGURATOR

3Dfindit powered by CADENAS

Material	Hardness
M2	60-62

TDC	TDO	TDR	TDL	TDF	TDH



For qualified shapes see page 43.

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

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

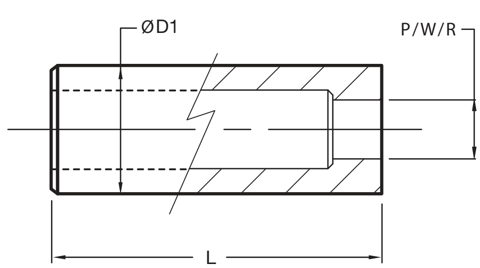
$G = W \times 0.045$

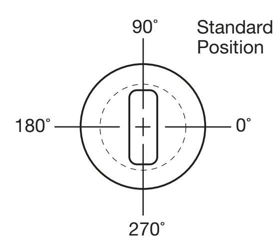
CODE	BODYØ D1	B	MAXØ D3	ROUND RANGE P	SHAPE MIN W	SHAPE MAX G	LENGTHS L
25	.250	.156	.156	.064 – .135			**Available Lengths: 0.75 inches to 2.00 inches** **Standard Lengths (page 39)**
37	.375	.156	.288	.064 – .195	.062	.195	
50	.500	.188	.312	.064 – .285	.062	.285	
62	.625	.188	.375	.136 – .365	.095	.356	
75	.750	.188	.468	.136 – .435	.118	.435	
87	.875	.250	.578	.276 – .545	.127	.545	
100	1.000	.250	.687	.356 – .675	.158	.675	
125	1.250	.312	.812	.500 – .800	.189	.800	
150	1.500	.312	1.062	.616 – 1.050	.252	1.050	

Standard Alterations page 40.
Locating Devices page 42.

Alterations from standard dimensions available on request.

ORDER EXAMPLE



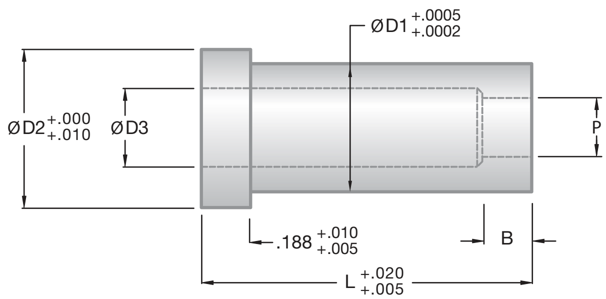


CODE	QTY	Material	Type	D1 x L	P / W / R	Locating Method
50	10	M2	TDL	.500 x 3.50	.250 / .200 / .039	SF* 0°

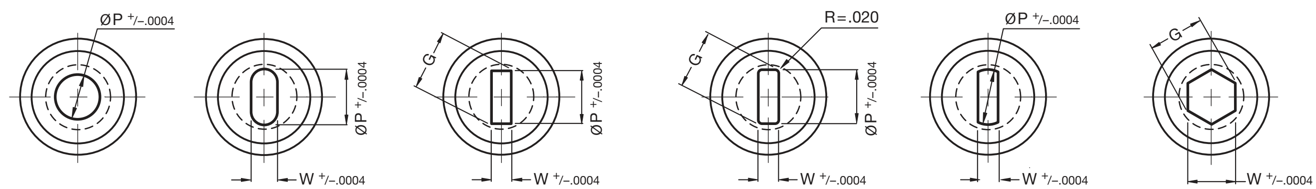
TH Head Type Stepped Relief

3D CONFIGURATOR

Material	Hardness
M2	60-62



THC	THO	THR	THL	THF	THH



For qualified shapes see page 43.

$G = \sqrt{W^2 + P^2}$ $G = \sqrt{(W - 2R)^2 + (P - 2R)^2} + 2R$ $G = W \times 0.045$

CODE	BODYØ D1	HEADØ D2	MAXØ D3	B	ROUND RANGE P	SHAPE MIN W	SHAPE MAX G
25	.250	.375	.156	.156	.064 – .135		
37	.375	.500	.228	.156	.064 – .195	.062	.195
50	.500	.625	.312	.188	.064 – .285	.062	.285
62	.625	.750	.375	.188	.136 – .365	.095	.356
75	.750	.875	.468	.188	.136 – .435	.118	.435
87	.875	1.000	.578	.250	.276 – .545	.127	.545
100	1.000	1.125	.687	.250	.356 – .675	.158	.675
125	1.250	1.375	.812	.312	.500 – .800	.189	.800
150	1.500	1.625	1.062	.312	.616 – 1.050	.252	1.050

LENGTHS L

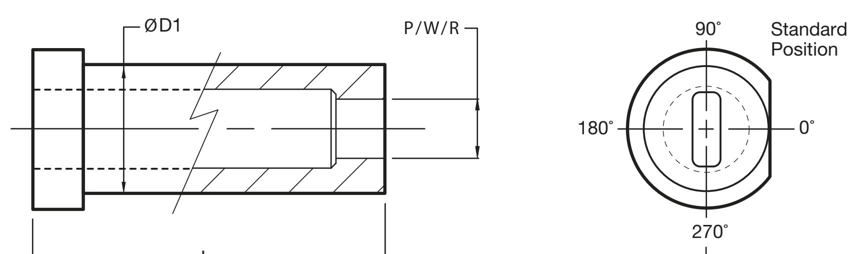
Available Lengths:
0.75 inches
to
2.00 inches

Standard Lengths
(page 39)

Standard Alterations page 40.
Locating Devices page 42.

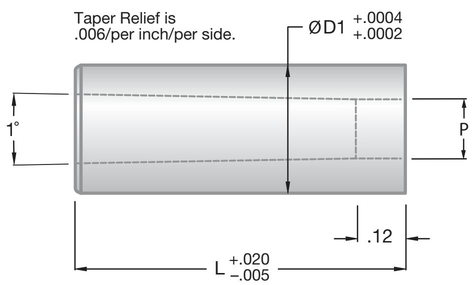
Alterations from standard dimensions available on request.

ORDER EXAMPLE



CODE	QTY	Material	Type	D1 x L	P / W / R	Locating Method
50	10	M2	THL	.500 x 3.50	.250 / .200 / .039	SF* 0˚

FD Flexible Tapered Relief

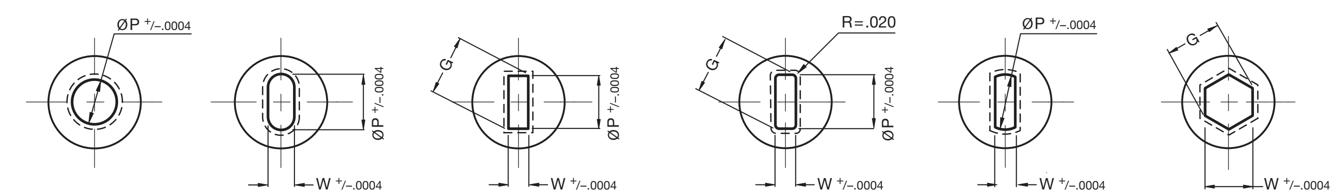


3D CONFIGURATOR

3Dfindit powered by CADENAS

Material	Hardness
M2	60-62

FDC	FDO	FDR	FDL	FDF	FDH



For qualified shapes see page 43.

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

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

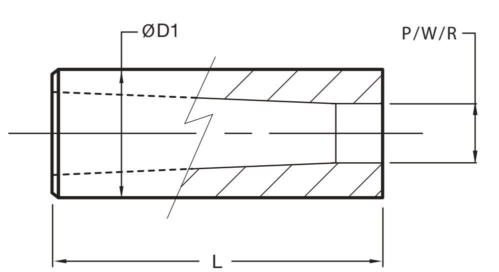
$G = W \times 0.045$

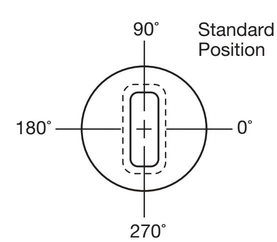
CODE	BODYØ D1	ROUND RANGE P	SHAPE MIN W	SHAPE MAX G	LENGTHS L
25	.250	.062 – .170	.062	.170	**Available Lengths: 0.75 inches to 2.00 inches**
31	.3125	.062 – .212	.062	.212	
37	.375	.075 – .255	.062	.255	**Standard Lengths (page 39)**
43	.4375	.130 – .297	.075	.297	
50	.500	.150 – .344	.075	.344	
62	.625	.188 – .425	.075	.425	
75	.750	.225 – .510	.075	.510	
87	.875	.300 – .595	.075	.595	
100	1.000	.400 – .680	.075	.680	
125	1.250	.500 – .850	.075	.850	
150	1.500	.600 – 1.050	.075	1.050	

Standard Alterations page 40.
Locating Devices page 42.

Alterations from standard dimensions available on request.

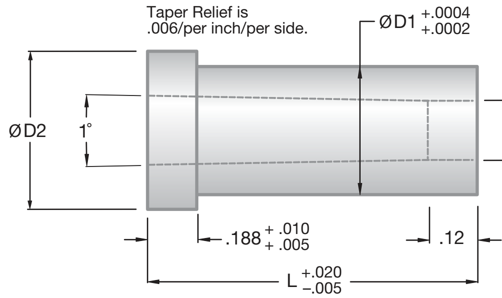
ORDER EXAMPLE





CODE	QTY	Material	Type	D1 x L	P / W / R	Locating Method
50	10	M2	FDL	.500 x 3.50	.250 / .200 / .039	SF* 0°

FH Flexible Head Type Tapered Relief

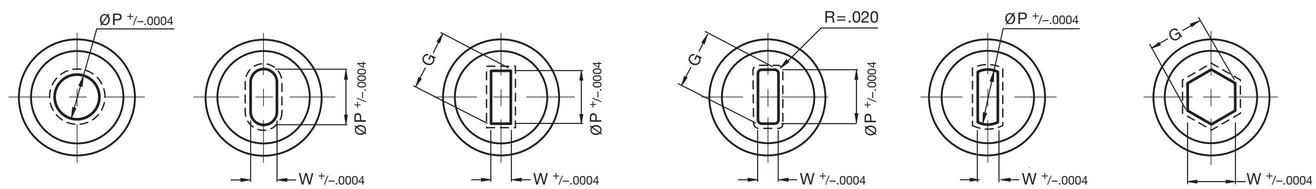


3D CONFIGURATOR

3Dfindit powered by CADENAS

Material	Hardness
M2	60-62

FHC	FHO	FHR	FHL	FHF	FHH



For qualified shapes see page 43.

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

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

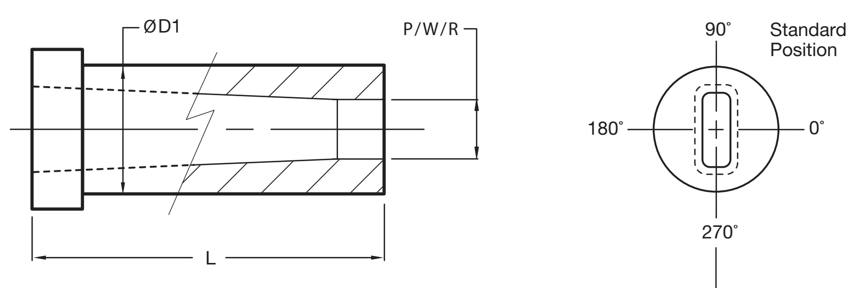
$G = W \times 0.045$

CODE	BODYØ D1	HEADØ D2	ROUND RANGE P	SHAPE MIN W	SHAPE MAX G	LENGTHS L
25	.250	.375	.062 – .170	.062	.170	**Available Lengths: 0.75 inches to 2.00 inches**
31	.3125	.437	.062 – .212	.062	.212	
37	.375	.500	.075 – .255	.062	.255	**Standard Lengths (page 39)**
43	.4375	.562	.130 – .297	.075	.297	
50	.500	.625	.150 – .344	.075	.344	
62	.625	.750	.188 – .425	.075	.425	
75	.750	.875	.225 – .510	.075	.510	
87	.875	1.000	.300 – .595	.075	.595	
100	1.000	1.125	.400 – .680	.075	.680	
125	1.250	1.375	.500 – .850	.075	.850	
150	1.500	1.625	.600 – 1.050	.075	1.050	

Standard Alterations page 40.
Locating Devices page 42.

Alterations from standard dimensions available on request.

ORDER EXAMPLE



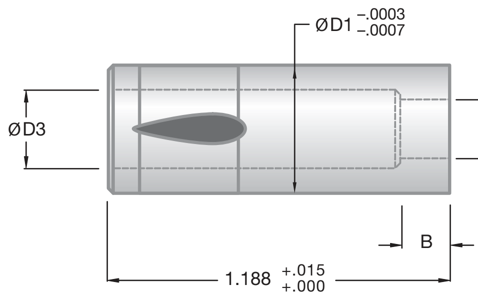
CODE	QTY	Material	Type	D1 x L	P / W / R	Locating Method
50	10	M2	FHL	.500 x 3.50	.250 / .200 / .039	SF* 0°

BLD Light Duty Ball Lock

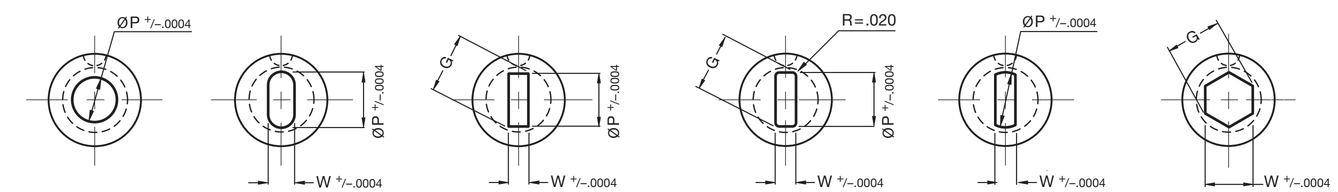
3D CONFIGURATOR

3Dfindit powered by CADENAS

Material	Hardness
M2	60-62



BLDC	BLDO	BLDR	BLDL	BLDF	BLDH



For qualified shapes see page 43.

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

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

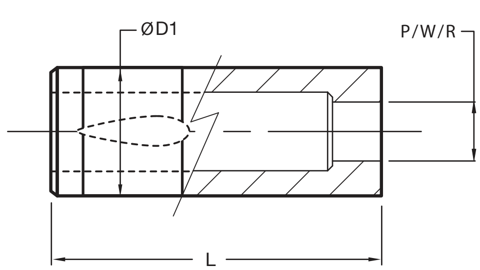
$G = W \times 0.045$

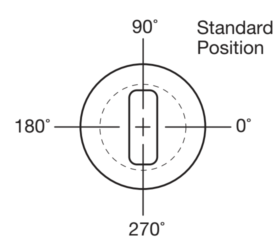
CODE	BODYØ D1	B	MAXØ D3	ROUND RANGE P	SHAPE MIN W	SHAPE MAX G	LENGTHS L
50	.500	.156	.228	.064 – .195	.062	.195	Available Lengths: 0.75 inches to 2.00 inches Standard Lengths (page 39)
62	.625	.188	.312	.126 – .285	.095	.285	
75	.750	.188	.375	.196 – .345	.125	.345	
87	.875	.250	.468	.286 – .435	.125	.435	
100	1.000	.250	.578	.346 – .545	.158	.545	
125	1.250	.250	.687	.436 – .655	.189	.655	
150	1.500	.312	.812	.546 – .780	.220	.780	
175	1.750	.312	1.062	.656 – 1.035	.312	1.035	

Standard Alterations page 40.
Locating Devices page 42.

Alterations from standard dimensions available on request.

ORDER EXAMPLE





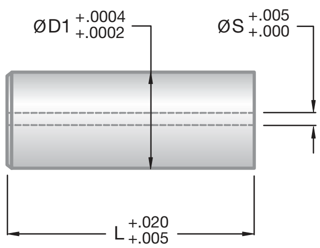
CODE	QTY	Material	Type	D1 x L	P / W / R	Locating Method
50	10	M2	BLDL	.500 x 3.50	.250 / .200 / .039	SF* 0°

FDW, FHW Wire EDM Blanks

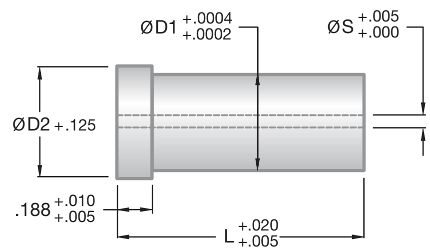
3D CONFIGURATOR

Material	Hardness
M2	60-62

FDW



FHW



FDW

CODE	BODYØ D1	WIRE START HOLE S*	LENGTHS L
25	.2500	0.047	**Available Lengths: 0.75 inches to 2.00 inches** **Standard Lengths (page 39)**
31	.3125	0.047	
37	.3750	0.047	
43	.4375	0.047	
50	.5000	0.047	
62	.6250	0.062	
75	.7500	0.062	
100	1.0000	0.062	
125	1.2500	0.062	

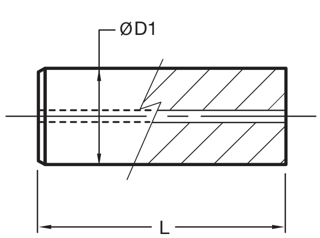
FHW

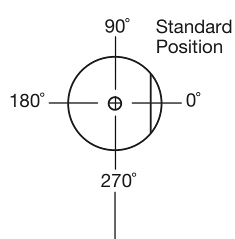
CODE	BODYØ D1	HEAD Ø D2	WIRE START HOLE S*	LENGTHS L
25	.2500	.375	0.047	**Available Lengths: 0.75 inches to 2.00 inches** **Standard Lengths (page 39)**
31	.3125	.437	0.047	
37	.3750	.500	0.047	
43	.4375	.562	0.047	
50	.5000	.625	0.047	
62	.6250	.750	0.062	
75	.7500	.875	0.062	
100	1.0000	1.125	0.062	
125	1.2500	1.375	0.062	

Standard Alterations page 40.
Locating Devices page 42.

ORDER EXAMPLE

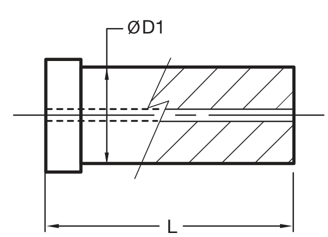
FDW

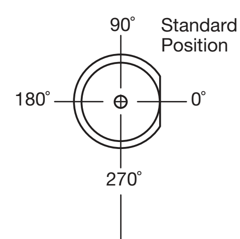




QTY	Material	Type	D1 x L	Locating Method
10	M2	FDW	.500 x 3.50	SF 0°

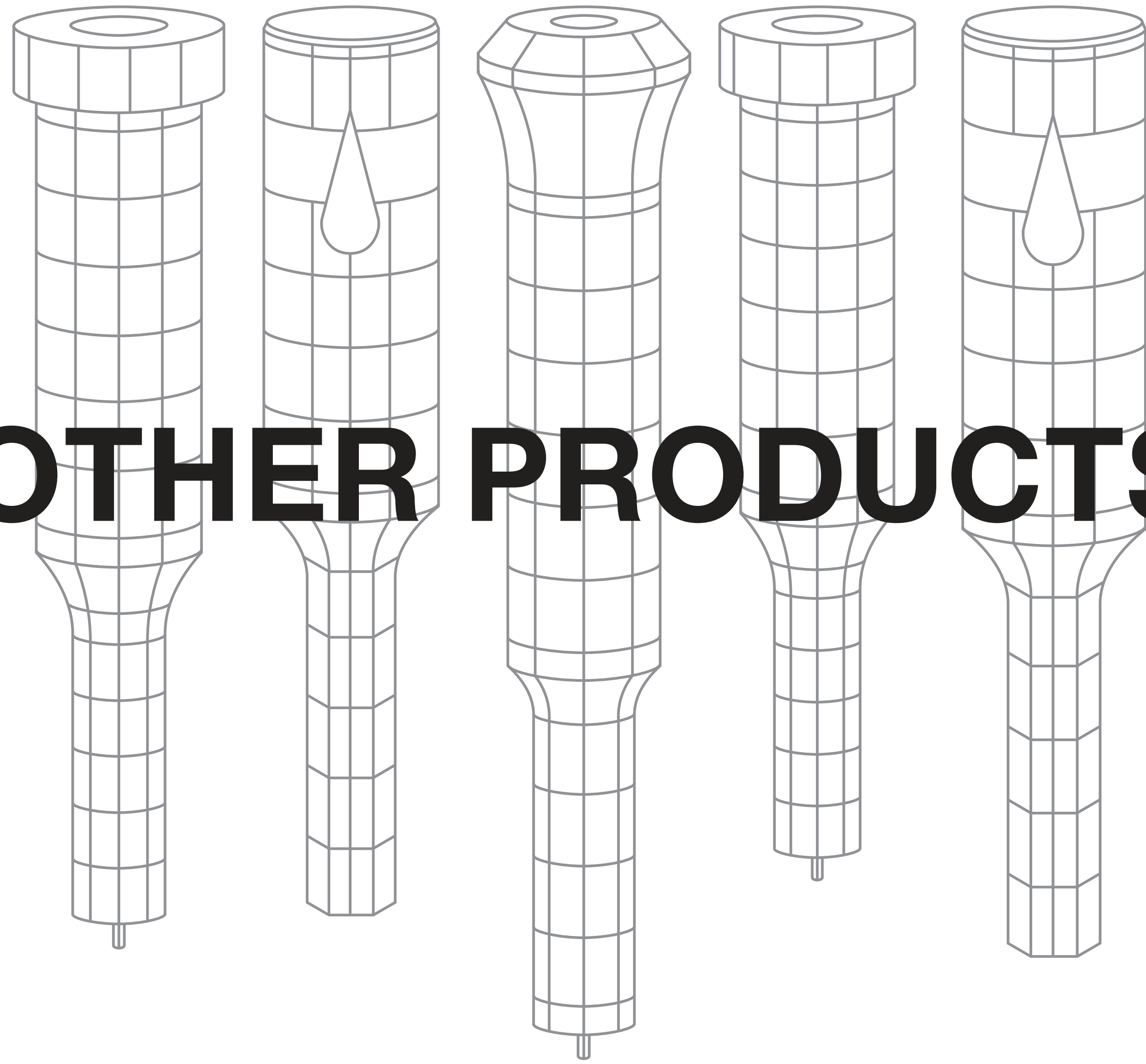
FHW

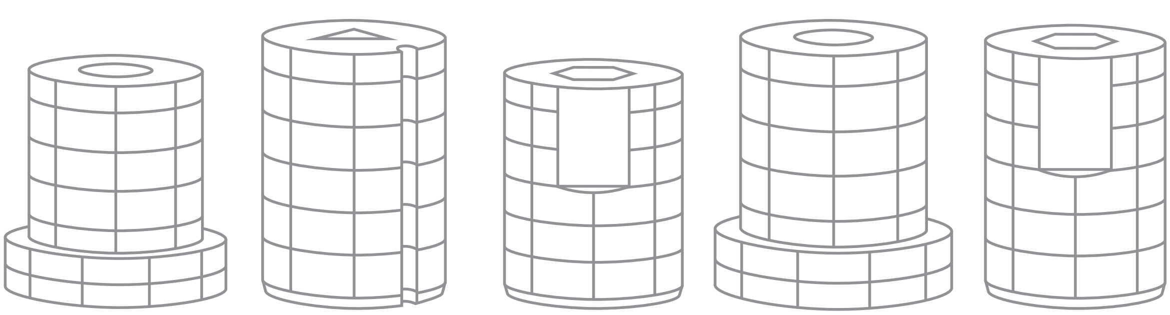




QTY	Material	Type	D1 x L	Locating Method
10	M2	FHW	.500 x 3.50	SF 0°

OTHER PRODUCTS



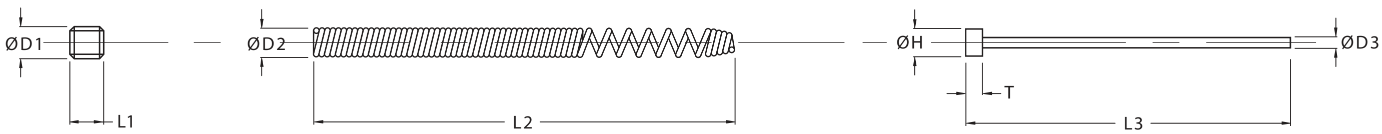


Ejector Components

3D CONFIGURATOR

3Dfindit

Material	Hardness
M2	60-62



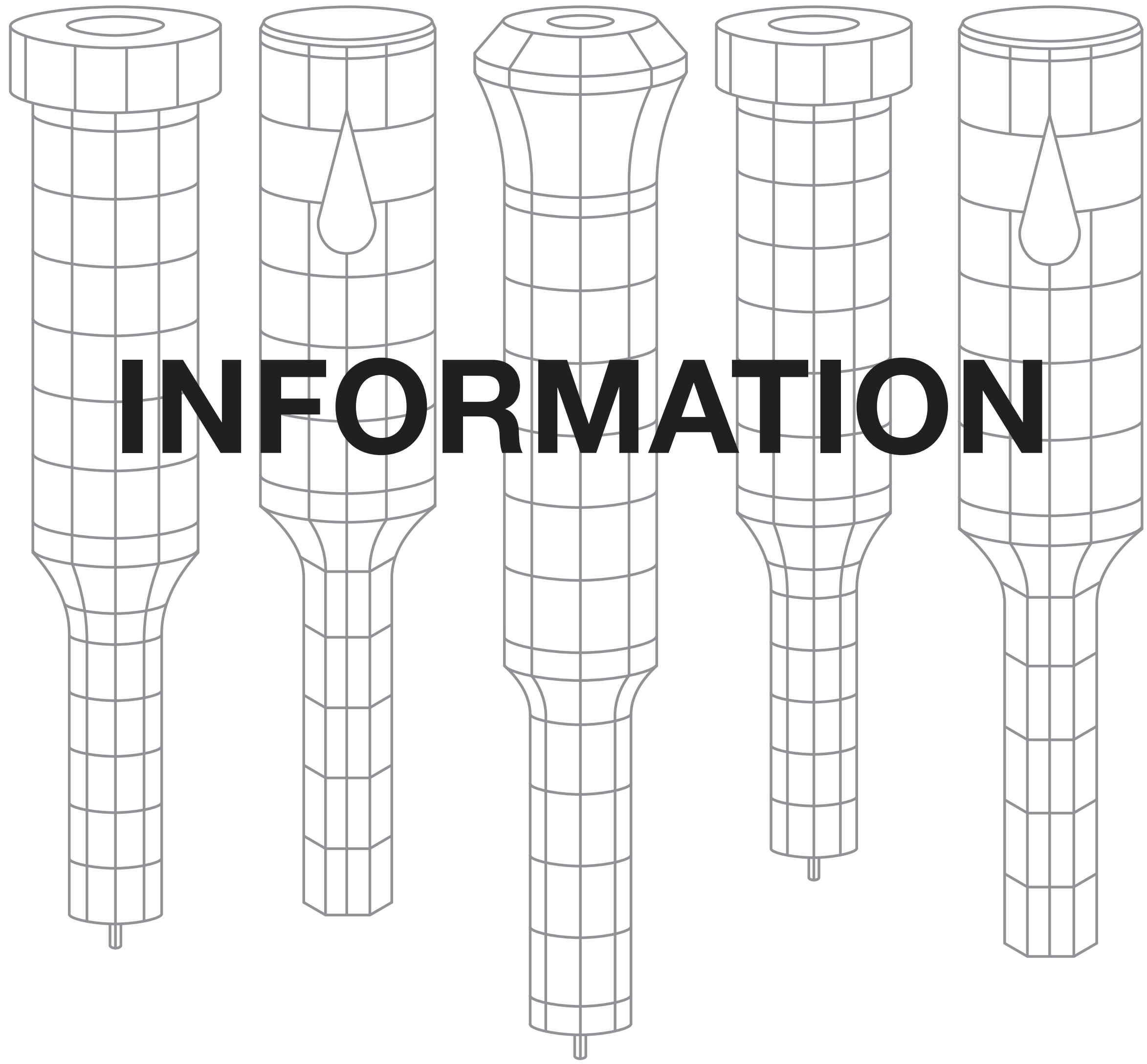
SET SCREW **SPRING** **PIN**

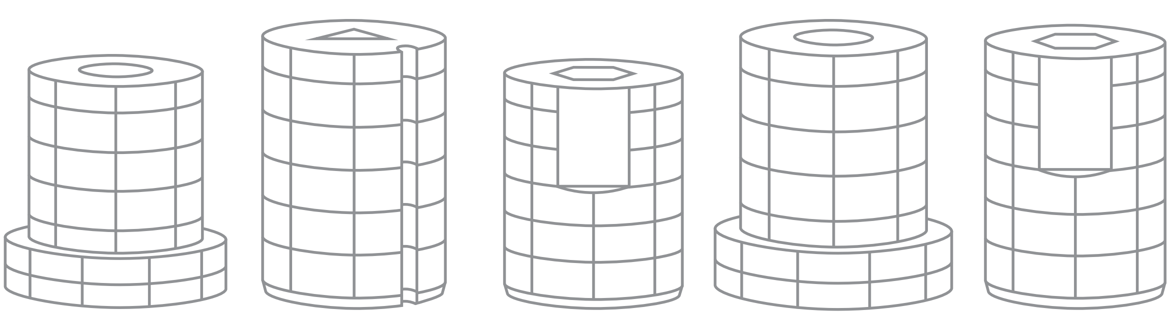
CODE	SET SCREW		SPRING		PIN			
	ØD1	L1	ØD2	L2	ØD3	L3	ØH	T
25	3–48	.188	.082	2.38	.022	.048	.031	1.11
32	5–40	.188	.104	2.38	.027	.073	.047	1.38
47	5–40	.188	.130	2.65	.041	.094	.062	2.00
63	10–32	.188	.165	3.00	.058	.120	.062	2.00
93	1/4–28	.188	.198	3.00	.089	.156	.094	2.25
125	5/16–24	.250	.270	2.56	.120	.188	.094	2.22

CODE	PART NUMBER			
	EJECTOR KIT	SET SCREW	SPRING	PIN
25	KIT 025	ESS 025	ES 025	EP 025
32	KIT 032	ESS 032	ES 032	EP 032
47	KIT 047	ESS 047	ES 047	EP 047
63	KIT 063	ESS 063	ES 063	EP 063
93	KIT 093	ESS 093	ES 093	EP 093
125	KIT 125	ESS 125	ES 125	EP 125

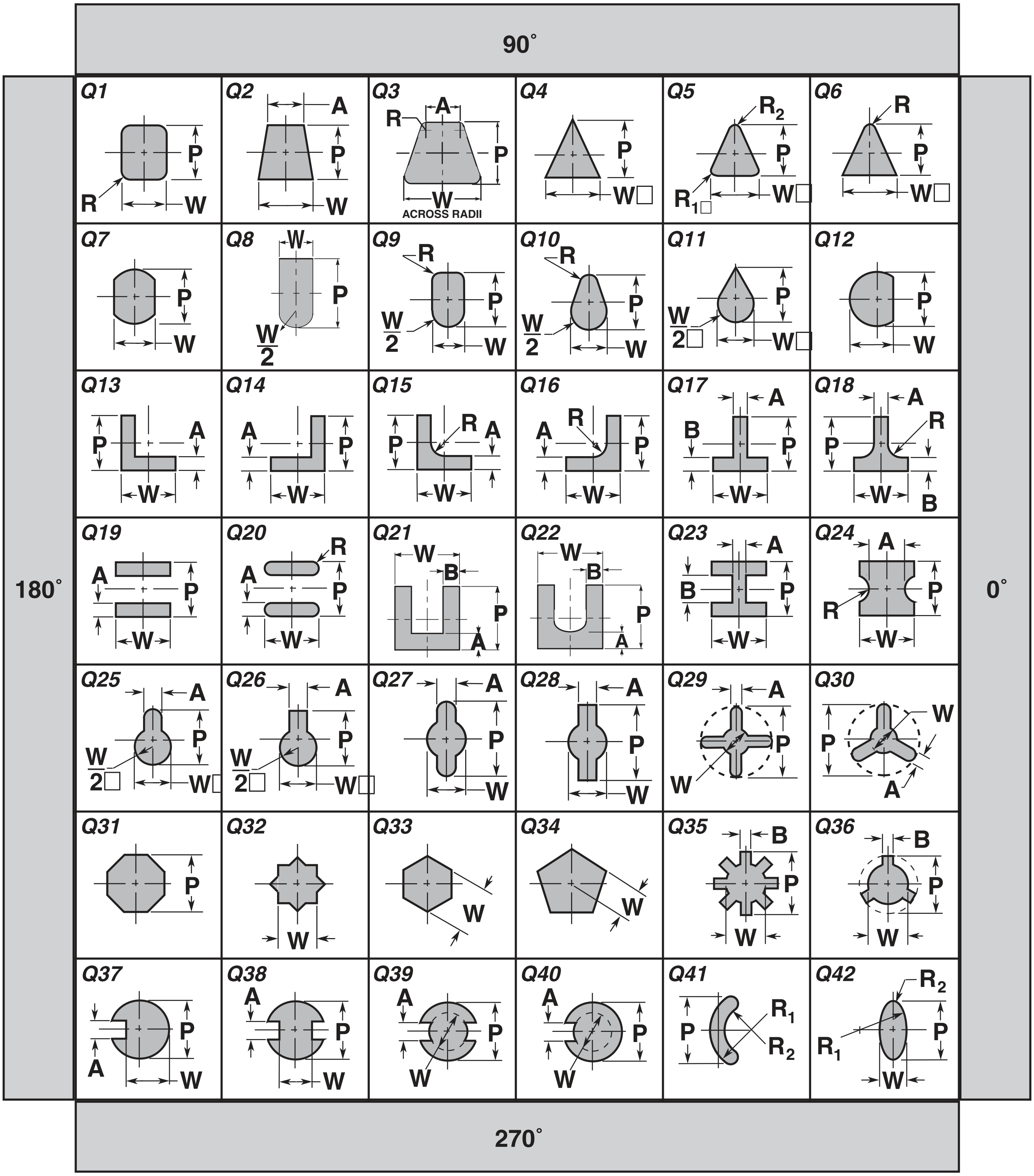
Material: 0-1 TOOL STEEL
Hardness: Rc 60-63

INFORMATION





QUALIFIED SHAPES



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

Standard Lengths (inches)

Punches

	TP	TE	FP	FE	HL	HLE	BL	BLE	BH	BHE
Standard Lengths (inches)	150									
	175	175	175	175						
	200	200	200	200	200	200				
	225	225	225	225	225	225	225	225		
	250	250	250	250	250	250	250	250	250	250
	275	275	275	275	275	275	275	275	275	275
	300	300	300	300	300	300	300	300	300	300
			325	325			325	325	325	325
	350	350	350	350	350	350	350	350	350	350
			375	375			375	375	375	375
	400	400	400	400	400	400	400	400	400	400
									450	450
									500	500

	BLK	BLEK	BHK	BHEK	TPCS	BLCS	BHCS	CSA/CSB	CSAP/CSBP	
Standard Lengths (inches)					150			150	150	
					175			175	175	
					200	200		200	200	
					225	225	225	225	225	
					250	250	250	250	250	
					275	275	275			
	300	300	300	300	300	300	300			
							325			
	350	350	350	350	350	350	350			
							375			
	400	400	400	400	400	400	400			

Punch Pilots

	TPA/TPN	FPA/FPN	BLA	BHA/BHN
Standard Lengths (inches)	?	?	?	?

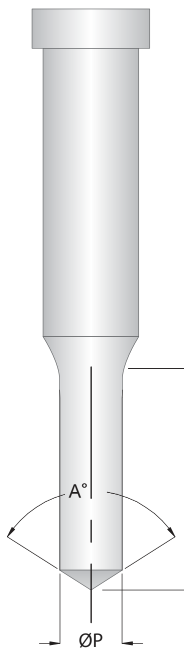
Standard length availability same as parabolic pilot.
Longer lengths available on request.

Die Buttons

	TD	TH	FD	FH
Standard Lengths (inches)	75	75	75	75
	100	100	100	100
	125	125	125	125
	150	150	150	150
	175	175		
	200	200		

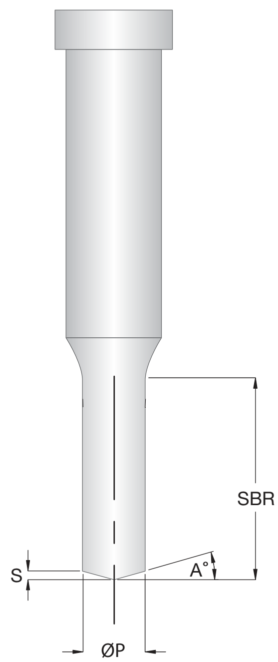
STANDARD ALTERATIONS

CONICAL POINT



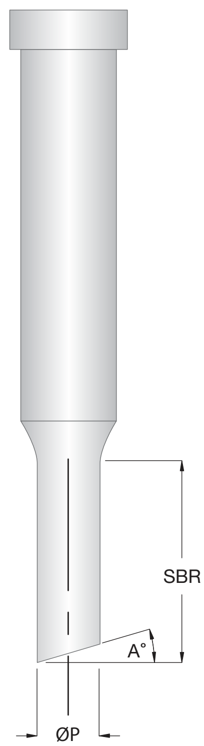
Add the following line to the order description:
Example: CP A = 3˚

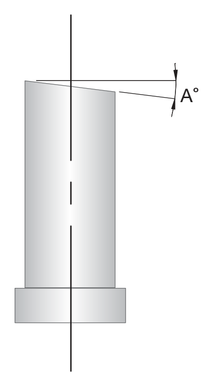
ROOFTOP SHEAR



Add the following line to the order description:
Example: RS A = 3˚ or RS S = 3˚

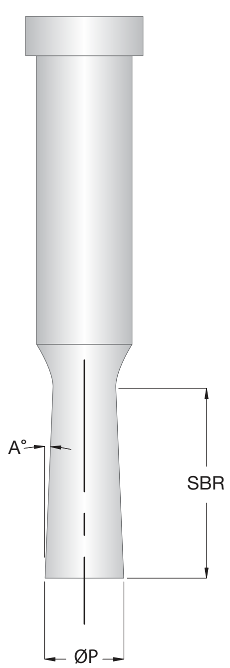
ANGLE SHEAR





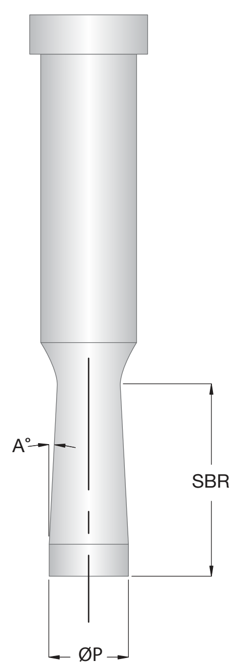
Add the following line to the order description:
Example: AS A = 3˚

BACK TAPERED



Add the following line to the order description:
Example: BT A = 0.5˚

STRAIGHT + BACK TAPERED

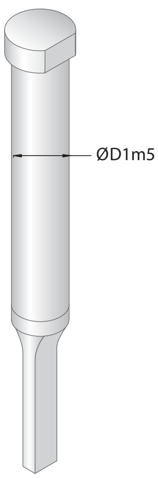


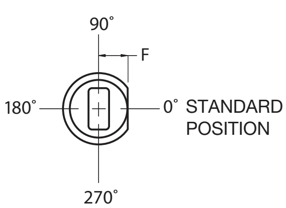
Add the following line to the order description:
Example: SC S = 2 A = 0.5˚

LOCATING METHODS
PUNCHES

SF

SINGLE FLAT





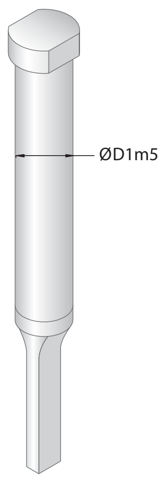
F from punch center to flat.

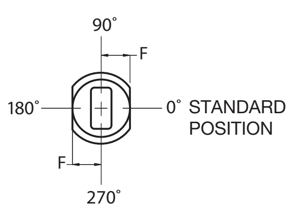
Add the following line
to the description:

Example:
SF 145˚

DF

DOUBLE FLAT





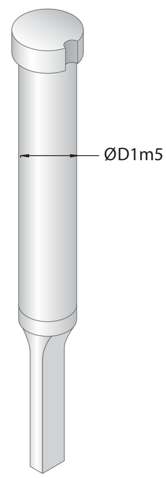
F from punch center to flat.

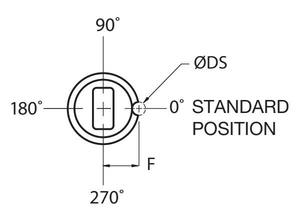
Add the following line
to the description:

Example:
DF 145˚

DS

DOWEL SLOT





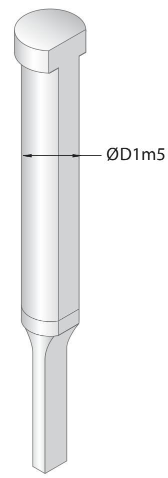
F from punch center to pin center.

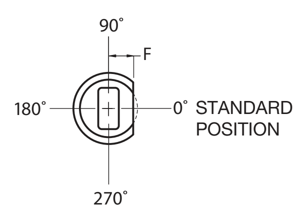
Add the following line
to the description:

Example:
DS 145˚

FL

FULL LENGTH FLAT





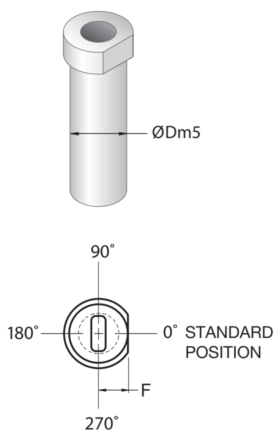
F = depth

Add the following line
to the description:

Example:
FLS 145˚

LOCATING METHODS
DIE BUTTONS

SF

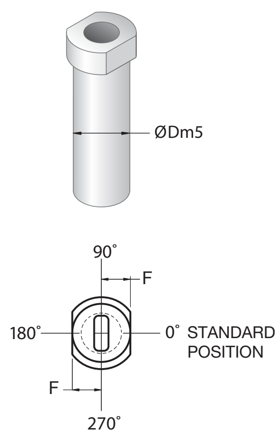


F from punch center to flat.

Add the following line to the description.

Example: SF 145˚

DF

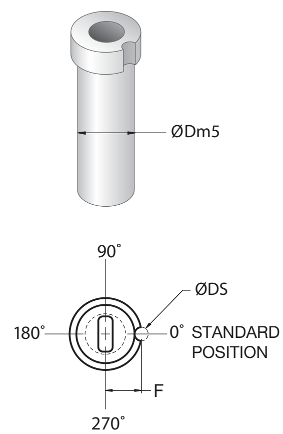


F from punch center to flat.

Add the following line to the description.

Example: DF 145˚

DS

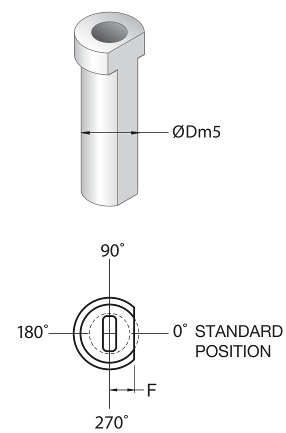


F from die center to pin center.

Add the following line to the description.

Example: DS 145˚

FL

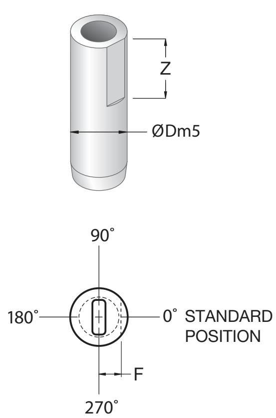


F from punch center to flat.

Add the following line to the description.

Example: SF1 F=1 145˚

SF4 (TOP)



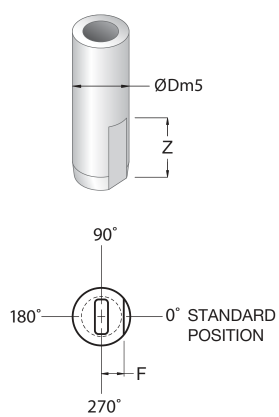
F from punch center to flat.

F = Depth Z = Length

Add the following line to the description.

Example: SF3 1X14 145˚

SF3 (BOTTOM)



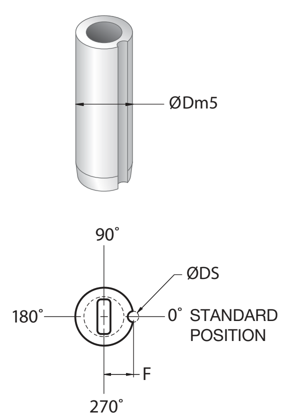
F from punch center to flat.

F = Depth Z = Length

Add the following line to the description.

Example: SF4 1X14 145˚

DS

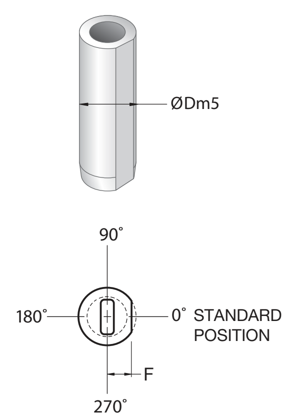


F from die center to pin center

Add the following line to the description.

Example: DS 145˚

FL



F = depth

Add the following line to the description.

Example: SF1 F=1 145˚

PERFORATING TECHNOLOGY

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.

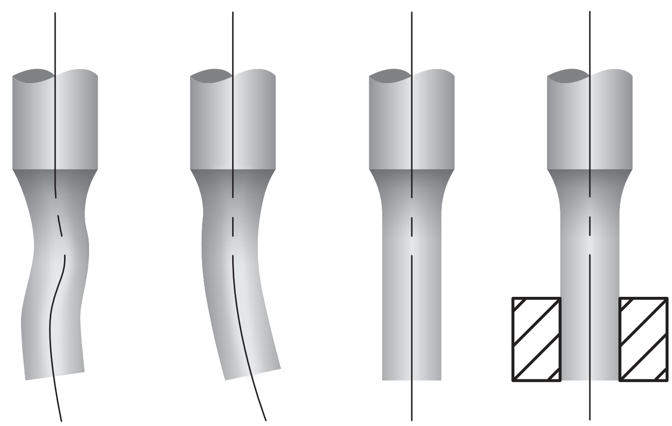
After the hole and slug have been produced, the direction of punch travel is reversed so that it withdraws from the work piece. A stripping mechanism is often used to restrain the work piece during punch withdrawal.

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.

PERFORATING TECHNNOLOGY

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.

PERFORATING TECHNNOLOGY

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.

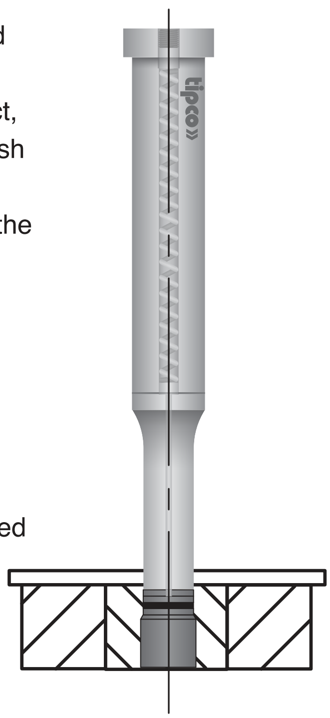
PERFORATING TECHNNOLOGY

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.

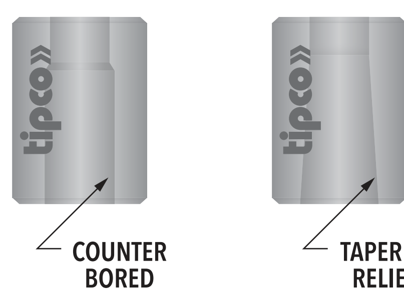
Die Button / Matrix Requirements

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.



COATINGS

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.

TiALN

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.

INCHES/METRIC CONVERSION CHART

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

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