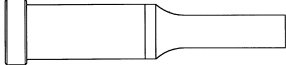

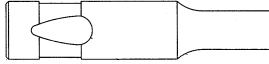

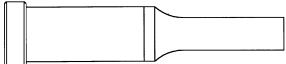

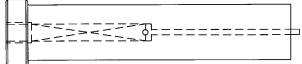
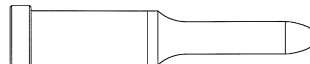





Metric Series

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Basic Series Punches

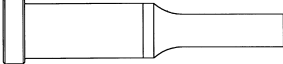

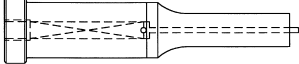





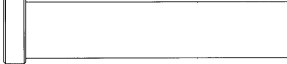

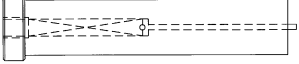

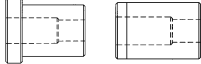

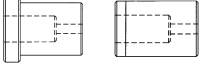
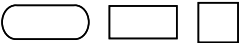
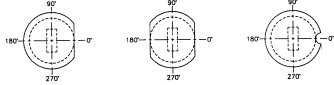
This section of the catalog features Danly IEM's Basic Series Punches in standard shapes. Designed and manufactured for longer production runs, Danly IEM punches meet or exceed ANSI standards. Each component is made of quality heat treated tool steel. Basic Metric punches are available in M2 high speed steel, triple-tempered for long runs where abrasion resistance is required. Other materials are available as specials.



Punches, Die Buttons and Components

- Full Line of Standard Shapes Plus Custom Products
- Ready Availability, Fast Service
- Technical Assistance
- Meets or Exceeds ANSI Standards
- High Strength Tool Steels
- Assured Interchangeability
- Consistent Craftsmanship

Basic Series

	Page No.		
Perforating Punches	6		
Perforating Ejector Punches	7		
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"A" Type Pilot Punches	9		
Blank Punches	10		
Ejector Blank Punches	10		
Press Fit Die Buttons-Round	11		
Press Fit Die Buttons-Shapes	12, 13		
Locking Devices	14		
Basic Series Ordering Information	15		

Standard Point Length

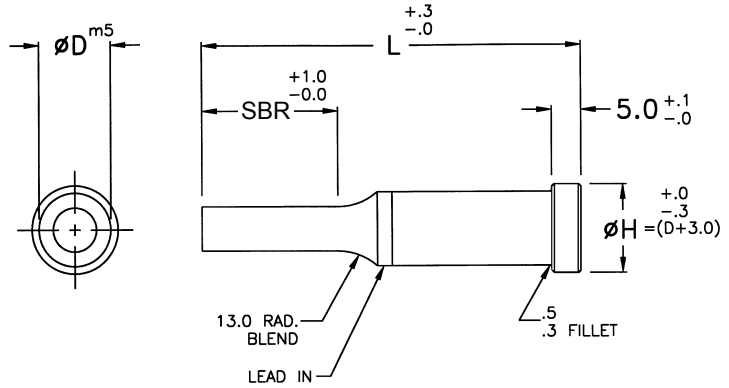
Material: M2—High Speed Steel
Hardness: Point and Shank Rc 60-63; Head Rc 40-55
Concentricity: Point to Shank (P:D)
ROUND: .013 T.I.R. (Max.)
SHAPES: .025 T.I.R. (Max.)

How to order:

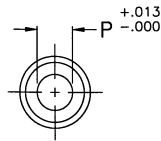
Please specify: Quantity, Catalog Number, Overall Length, Point Dimensions, Material and, if desired, Standard or Custom Locking Device.*

See ordering examples.

NOTE: Other materials are available as specials.



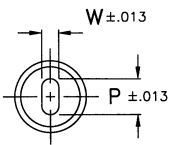
MCP (ROUND)



Cat. No.	Shank Dia.	Range of Point Diameter	
	D	P Min	P Max
MCP5	5	1.60	4.99
MCP6	6	1.60	5.99
MCP8	8	2.50	7.99
MCP10	10	3.20	9.99
MCP13	13	5.00	12.99
MCP16	16	8.00	15.99
MCP20	20	10.00	19.99
MCP25	25	12.00	24.99

EXAMPLE: 6 MCP13 L 63 P 12.0 M2

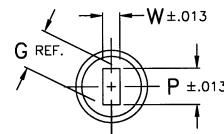
MOP (OBLONG)



Cat. No.	Shank Dia.	Range of Point Dimensions	
	D	P Max	W Min
MOP5	5	4.99	1.60
MOP6	6	5.99	1.60
MOP8	8	7.99	2.50
MOP10	10	9.99	3.20
MOP13	13	12.99	4.50
MOP16	16	15.99	6.00
MOP20	20	19.99	8.00
MOP25	25	24.99	9.00

EXAMPLE: 4 MOP16 L 70 P 14.0 W 9.0 M2 SKF

MRP (RECTANGLE, INCLUDES SQUARE)



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

Cat. No.	Shank Dia.	Range of Point Dimensions	
	D	G Max	W Min
MRP5	5	5.00	1.60
MRP6	6	6.00	1.60
MRP8	8	8.00	2.50
MRP10	10	10.00	3.20
MRP13	13	13.00	4.50
MRP16	16	16.00	6.00
MRP20	20	20.00	8.00
MRP25	25	25.00	9.00

EXAMPLE: 7 MRP13 L 63 P 9.5 W 6.2 M2

The specified P&W Dims. must not result in a shape diagonal greater than G MAX. listed in chart

Shank Dia.	Overall Lengths L										Straight Before Radius SBR	Head Dim. H
	D	40	50	56	60	63	70	71	80	90		
5	40	50	56	60	63	70	71	80			13	8
6	40	50	56	60	63	70	71	80	90	100	13	9
8		50	56	60	63	70	71	80	90	100	19	11
10		50	56	60	63	70	71	80	90	100	19	13
13		50	56	60	63	70	71	80	90	100	19	16
16		50	56	60	63	70	71	80	90	100	19	19
20			56	60	63	70	71	80	90	100	19	23
25			56	60	63	70	71	80	90	100	19	28

*See page 14 for Locking Device ordering information

Standard Point Length

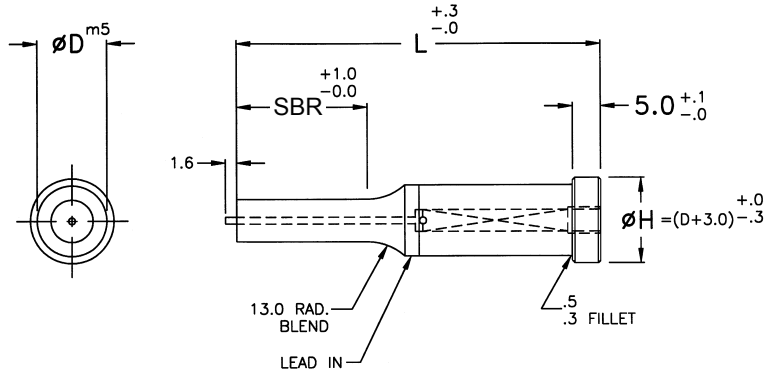
Material: M2—High Speed Steel
Hardness: Point and Shank Rc 60-63; Head Rc 40-55
Concentricity: Point to Shank (P:D)
ROUND: .013 T.I.R. (Max.)
SHAPES: .025 T.I.R. (Max.)

How to order:

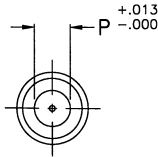
Please specify: Quantity, Catalog Number, Overall Length, Point Dimensions, Material and, if desired, Standard or Custom Locking Device.*

See ordering examples.

NOTE: Other materials are available as specials.



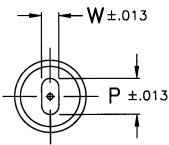
MCK (ROUND)



Cat. No.	Shank Dia. D	Range of Point Diameter	
		P Min	P Max
MCK5	5	1.60	4.99
MCK6	6	2.40	5.99
MCK8	8	3.20	7.99
MCK10	10	4.50	9.99
MCK13	13	6.00	12.99
MCK16	16	8.00	15.99
MCK20	20	10.00	19.99
MCK25	25	12.00	24.99

EXAMPLE: 6 MCK13 L 63 P 12.0 M2

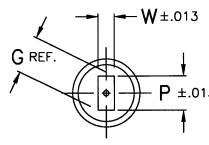
MOK (OBLONG)



Cat. No.	Shank Dia. D	Range of Point Dimensions	
		P Max	W Min
MOK5	5	4.99	1.60
MOK6	6	5.99	2.40
MOK8	8	7.99	3.20
MOK10	10	9.99	4.50
MOK13	13	12.99	6.00
MOK16	16	15.99	7.20
MOK20	20	19.99	8.00
MOK25	25	24.99	9.00

EXAMPLE: 4 MOK16 L 70 P 14.0 W 9.0 M2 SKF

MRK (RECTANGLE, INCLUDES SQUARE)



$$G = -P^2 + W^2$$

Cat. No.	Shank Dia. D	Range of Point Dimensions	
		G Max	W Min
MRK5	5	5.00	1.60
MRK6	6	6.00	1.60
MRK8	8	8.00	2.50
MRK10	10	10.00	3.20
MRK13	13	13.00	4.50
MRK16	16	16.00	6.00
MRK20	20	20.00	8.00
MRK25	25	25.00	9.00

EXAMPLE: 7 MRK13 L 63 P 9.5 W 6.2 M2

The specified P&W Dims. must not result in a shape diagonal greater than G MAX. listed in chart

Shank Dia. D	Overall Lengths L										Straight Before Radius SBR	Head Dim. H	Eject. Grp. Cat No.
	40	50	56	60	63	70	71	80	90	100			
5	40	50	56	60	63	70	71	80			13	8	MKP2
6	40	50	56	60	63	70	71	80	90	100	13	9	MKP3
8		50	56	60	63	70	71	80	90	100	19	11	MKP4
10		50	56	60	63	70	71	80	90	100	19	13	MKP6
13		50	56	60	63	70	71	80	90	100	19	16	MKP6
16		50	56	60	63	70	71	80	90	100	19	19	MKP9
20			56	60	63	70	71	80	90	100	19	23	MKP9
25			56	60	63	70	71	80	90	100	19	28	MKP9

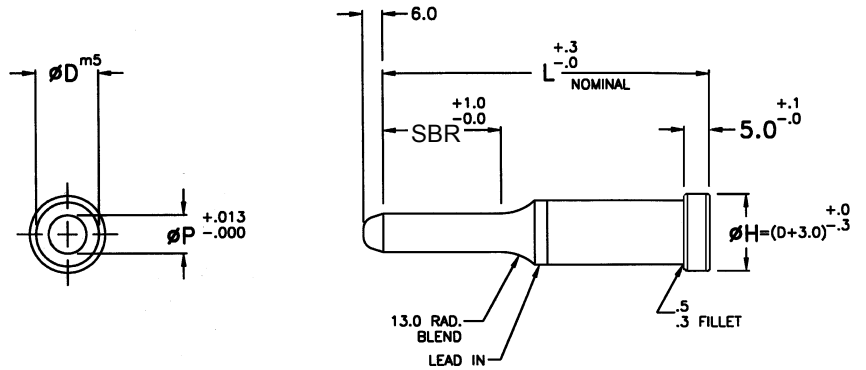
*See page 14 for Locking Device ordering information

NOTE: Refer to page 45 for ejector data

Standard Point Length

Material: M2—High Speed Steel
Hardness: Point and Shank Rc 60-63; Head Rc 40-55
Concentricity: Point to Shank (P:D) .013 T.I.R. (Max.)

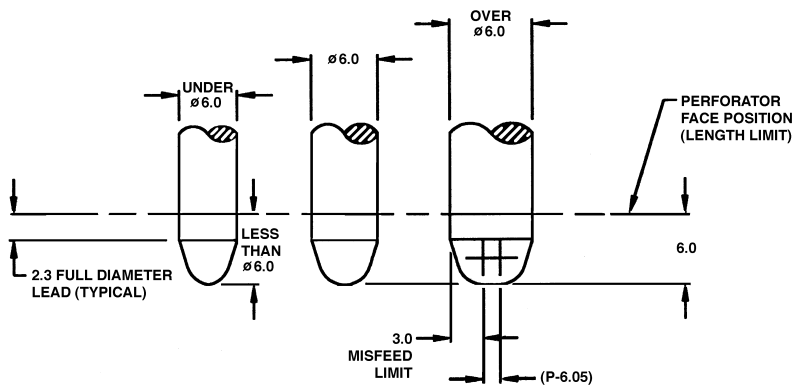
How to order:
Please specify: Quantity, Catalog Number, Nominal Length, Point Diameter and Material.
See ordering examples.
NOTE: Other materials are available as specials.



MPP

Cat. No.	Shank Dia.	Range of Point Dia.		Straight Before Radius
	D	P Min	P Max	SBR
MPP5	5	1.55	5.00	15
MPP6	6	1.55	6.00	15
MPP8	8	2.45	8.00	21
MPP10	10	3.15	10.00	21
MPP13	13	4.95	13.00	21
MPP16	16	7.95	16.00	21
MPP20	20	9.95	20.00	21
MPP25	25	11.95	25.00	21

EXAMPLE: 6 MPP10 L 72 P 6.5 M2



Shank Dia.	Nominal Lengths L										Head Dim. H
	42	52	58	62	65	72	73	82	92	102	
D	42	52	58	62	65	72	73	82			H
5	42	52	58	62	65	72	73	82			8
6	42	52	58	62	65	72	73	82	92	102	9
8		52	58	62	65	72	73	82	92	102	11
10		52	58	62	65	72	73	82	92	102	13
13		52	58	62	65	72	73	82	92	102	16
16		52	58	62	65	72	73	82	92	102	19
20			58	62	65	72	73	82	92	102	23
25			58	62	65	72	73	82	92	102	28

“A” Type

Material: M2—High Speed Steel

Hardness: Point and Shank Rc 60-63; Head Rc 40-55

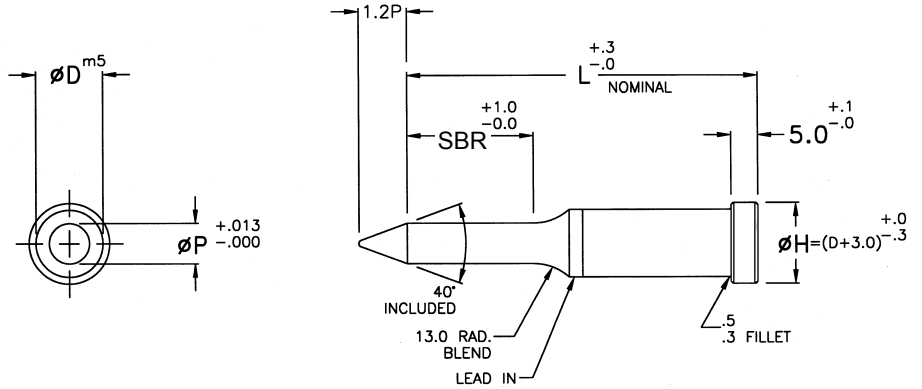
Concentricity: Point to Shank (P:D) .013 T.I.R. (Max.)

How to order:

Please specify: Quantity, Catalog Number, Nominal Length, Point Diameter and Material.

See ordering examples.

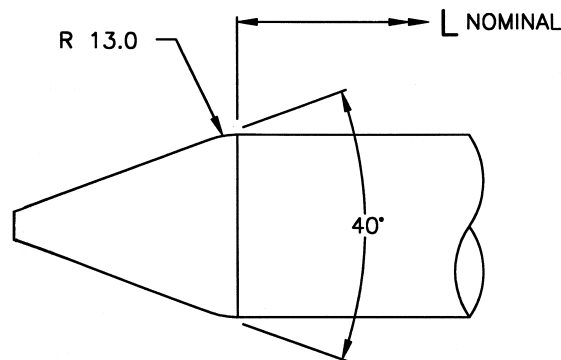
NOTE: Other materials are available as specials.



MPPA

Cat. No.	Shank Dia.	Range of Point Dia.		Straight Before Radius
	D	P Min	P Max	SBR
MPPA10	10	4.85	10.00	21
MPPA13	13	6.30	13.00	21
MPPA16	16	9.95	16.00	21
MPPA20	20	13.60	20.00	21
MPPA25	25	17.25	25.00	21

EXAMPLE: 6 MPPA20 L 102 P 18.0 M2



Shank Dia.	Nominal Lengths L												Head Dim.	
	D	52	58	62	65	72	73	82	92	102	112	127		142
10					65	72	73	82	92	102	112			13
13					65	72	73	82	92	102	112	127		16
16						72	73	82	92	102	112	127	142	19
20						72	73	82	92	102	112	127	142	23
25						72	73	82	92	102	112	127	142	28

Head Type

Material: M2—High Speed Steel
Hardness: Shank Rc 60-63; Head Rc 40-55

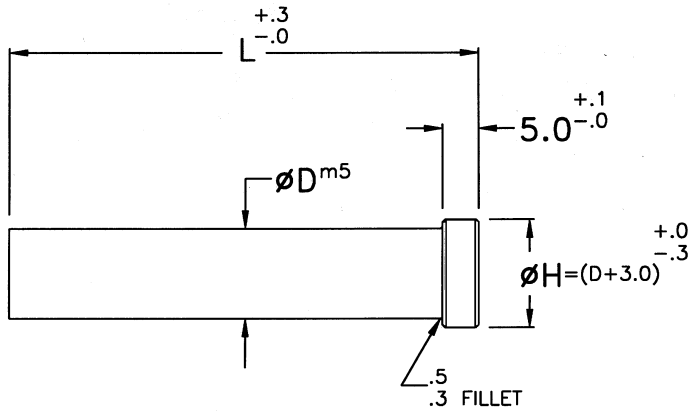
How to order:

Please specify: Quantity, Catalog Number, Overall Length and Material.

See ordering examples.

NOTE: Other materials available as specials.

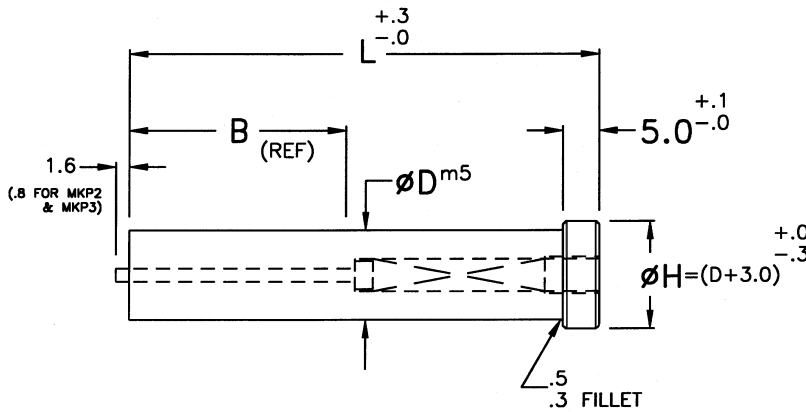
MBP (BLANK)



Cat. No.	Shank Dia.
	D
MBP5	5
MBP6	6
MBP8	8
MBP10	10
MBP13	13
MBP16	16
MBP20	20
MBP25	25

EXAMPLE: 8 MBP6 L 63 M2

MBK (EJECTOR BLANK)



Cat. No.	Shank Dia.	Ejector Grp.
	D	Cat. No.
MBK5	5	MKP2
MBK6	6	MKP3
MBK8	8	MKP4
MBK10	10	MKP6
MBK13	13	MKP9
MBK16	16	MKP9
MBK20	20	MKP9
MBK25	25	MKP9

EXAMPLE: 5 MBK8 L 71 M2

Shank Dia.	Overall Lengths L										Head Dim. H
	40	50	56	60	63	70	71	80	90	100	
D											H
5	40	50	56	60	63	70	71	80			8
6	40	50	56	60	63	70	71	80	90	100	9
8		50	56	60	63	70	71	80	90	100	11
10		50	56	60	63	70	71	80	90	100	13
13		50	56	60	63	70	71	80	90	100	16
16		50	56	60	63	70	71	80	90	100	19
20			56	60	63	70	71	80	90	100	23
25			56	60	63	70	71	80	90	100	28

NOTE: Refer to page 45 for ejector data

Round

Material: A2—High Speed Steel

Hardness: Rc 60-63

Concentricity: Hole to Body (P:D) .013 T.I.R. (Max.)

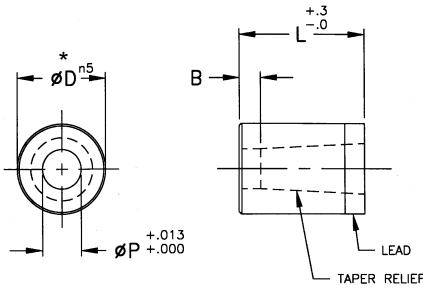
How to order:

Please specify: Quantity, Catalog Number, Overall Length, Die Hole Dia. and Material.

See ordering examples.

NOTE: Other materials are available as specials.

MCD (HEADLESS)



* Note: n5 10-25mm Dia.
j6 32-100mm Dia.

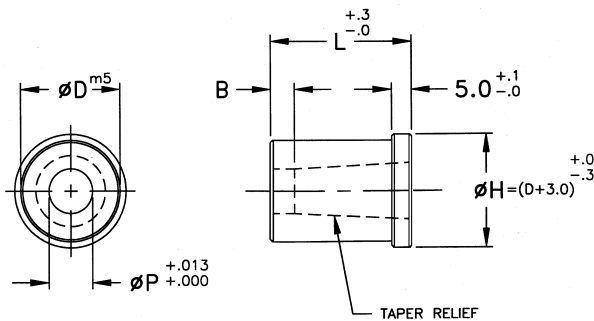
Cat. No.	Body Dia.	Range of Hole Dia.		Land	Overall Lengths L						
		P Min	P Max		B	20	22	25	28	30	32
MCD10	10	1.50	5.00	4.0	20	22	25	28	30	32	35
MCD13	13	1.50	7.20	5.0	20	22	25	28	30	32	35
MCD16	16	5.00	8.80	5.0	20	22	25	28	30	32	35
MCD20	20	7.00	11.00	5.0	20	22	25	28	30	32	35
MCD25	25	11.00	16.50	6.0	20	22	25	28	30	32	35
MCD32	32	13.00	20.00	6.0	20	22	25	28	30	32	35
MCD40	40	16.00	26.00	8.0	20	22	25	28	30	32	35

EXAMPLE: 8 MCD13 L 25 P 5.0 A2

MCH (HEADED)

Cat. No.	Body Dia.	Range of Hole Dia.		Land	Overall Lengths L							Head Dia.
		P Min	P Max		B	20	22	25	28	30	32	
MCH10	10	1.50	5.00	4.0	20	22	25	28	30	32	35	13
MCH13	13	1.50	7.20	5.0	20	22	25	28	30	32	35	16
MCH16	16	5.00	8.80	5.0	20	22	25	28	30	32	35	19
MCH20	20	7.00	11.00	5.0	20	22	25	28	30	32	35	23
MCH25	25	11.00	16.50	6.0	20	22	25	28	30	32	35	28
MCH32	32	13.00	20.00	6.0	20	22	25	28	30	32	35	35
MCH40	40	16.00	26.00	8.0	20	22	25	28	30	32	35	43

EXAMPLE: 5 MCH20 L 28 P 9.0 A2



P Min	P Max	R Max	B
1.50	5.00	5.8	4.0
1.50	7.20	8.0	5.0
5.00	8.80	9.5	5.0
7.00	11.00	12.0	5.0
11.00	16.50	17.5	6.0
13.00	20.00	21.0	6.0
16.00	26.00	27.0	8.0

Shapes

Material: A2—High Speed Steel
Hardness: Rc 60-63
Concentricity: Hole to Body .025 T.I.R. (Max.)

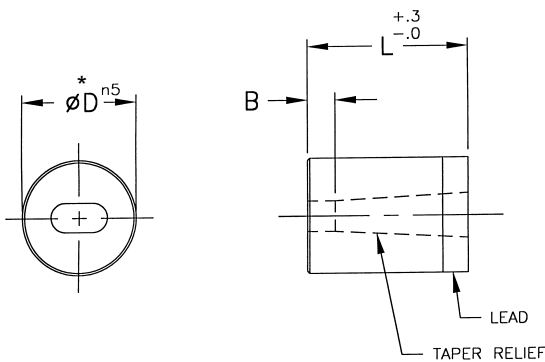
How to order

Please specify: Quantity, Catalog Number, Overall Length, Die Hole Dims., Material and, if desired, Standard or Custom Locking Device.*

See ordering examples.

NOTE: Other materials available as specials.

MOD (OBLONG), MRD (RECTANGLE, INCLUDES SQUARE) HEADLESS



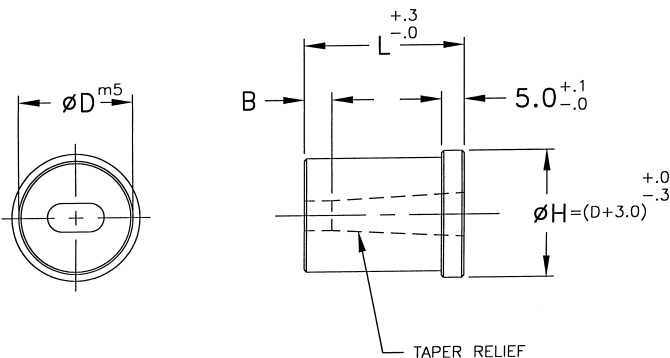
* Note: n5 through 25 Dia.
j6 above 25 Dia.

Catalog Number	Body Dia.	Overall Lengths L						
		D	20	22	25	28	30	32
MOD10	10	20	22	25	28	30	32	35
MOD13	13	20	22	25	28	30	32	35
MOD16	16	20	22	25	28	30	32	35
MOD20	20	20	22	25	28	30	32	35
MOD25	25	20	22	25	28	30	32	35
MOD32	32	20	22	25	28	30	32	35
MOD40	40	20	22	25	28	30	32	35

EXAMPLE: 6 MOD13 L 28 P 7.0 W 3.0 A2 SKF

*See page 14 for Locking Device ordering information

MOH (OBLONG), MRH (RECTANGLE, INCLUDES SQUARE) HEADED



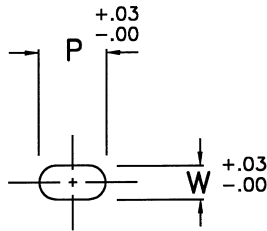
Catalog Number	Body Dia.	Overall Lengths L							Head Dia. H
		D	20	22	25	28	30	32	
MOH10	10	20	22	25	28	30	32	35	13
MOH13	13	20	22	25	28	30	32	35	16
MOH16	16	20	22	25	28	30	32	35	19
MOH20	20	20	22	25	28	30	32	35	23
MOH25	25	20	22	25	28	30	32	35	28
MOH32	32	20	22	25	28	30	32	35	35
MOH40	40	20	22	25	28	30	32	35	43

EXAMPLE: 5 MOH16 L 28 P 7.2 W 3.0 A2 SKF

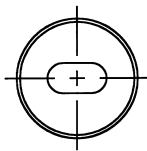
*See page 14 for Locking Device ordering information

Hole Size Information

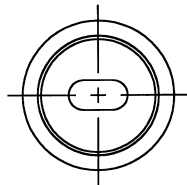
MOD, MOH (OBLONG)



OD

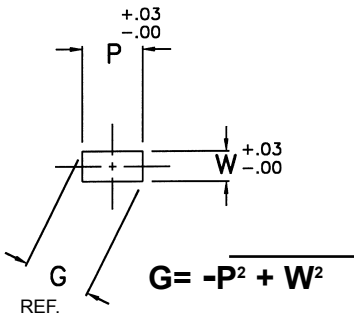


OH

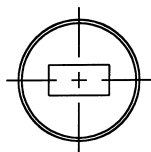


Body Dia.	Range of Hole Sizes		Land Length
	P Max	W Min	B
10	5.00	1.20	4.0
13	7.20	2.00	5.0
16	8.80	2.40	5.0
20	11.00	3.20	5.0
25	16.50	4.80	6.0
32	20.00	5.50	6.0
40	26.00	6.40	8.0

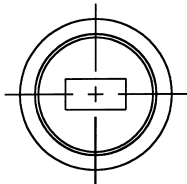
MRD, MRH (RECTANGLE, INCLUDES SQUARE)



RD



RH



Body Dia.	Range of Hole Sizes		Land Length
	P Max	W Min	B
10	5.00	1.20	4.0
13	7.20	2.00	5.0
16	8.80	2.40	5.0
20	11.00	3.20	5.0
25	16.50	4.80	6.0
32	20.00	5.50	6.0
40	26.00	6.40	8.0

The specified P&W Dims. Must not result in a shape diagonal greater than G MAX. listed in chart

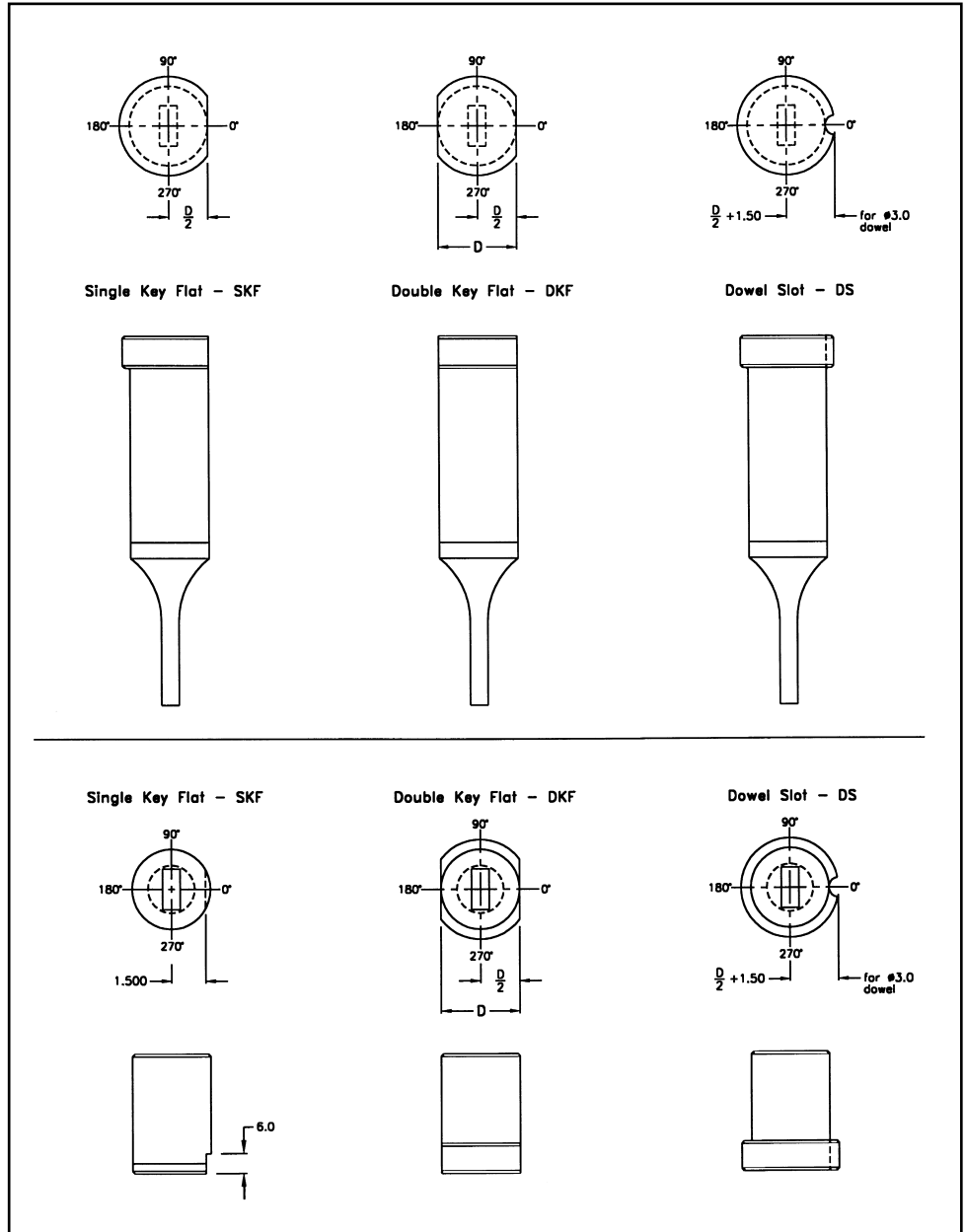
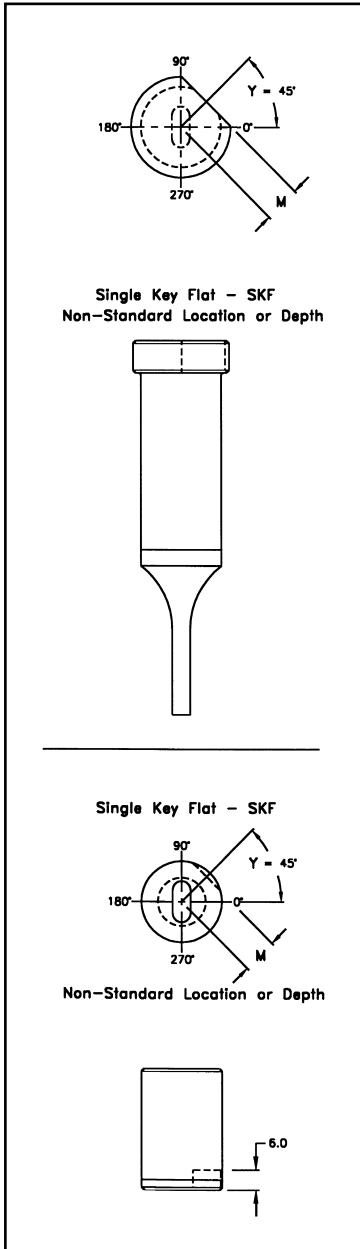
Custom and Standard Locations

Custom

Shape orientation, key flat and dowel slot depth to be specified by customer.

STANDARD

Shape orientation is established by the polar positions shown below, at 0°. Standard Key Flat and Dowel Slot Depth is as shown.



How to order Custom Location:

Specify: Type, Angle(Y), and Depth(M)

EXAMPLE: MOK 37 L 2.25 P .313 W .188 M2

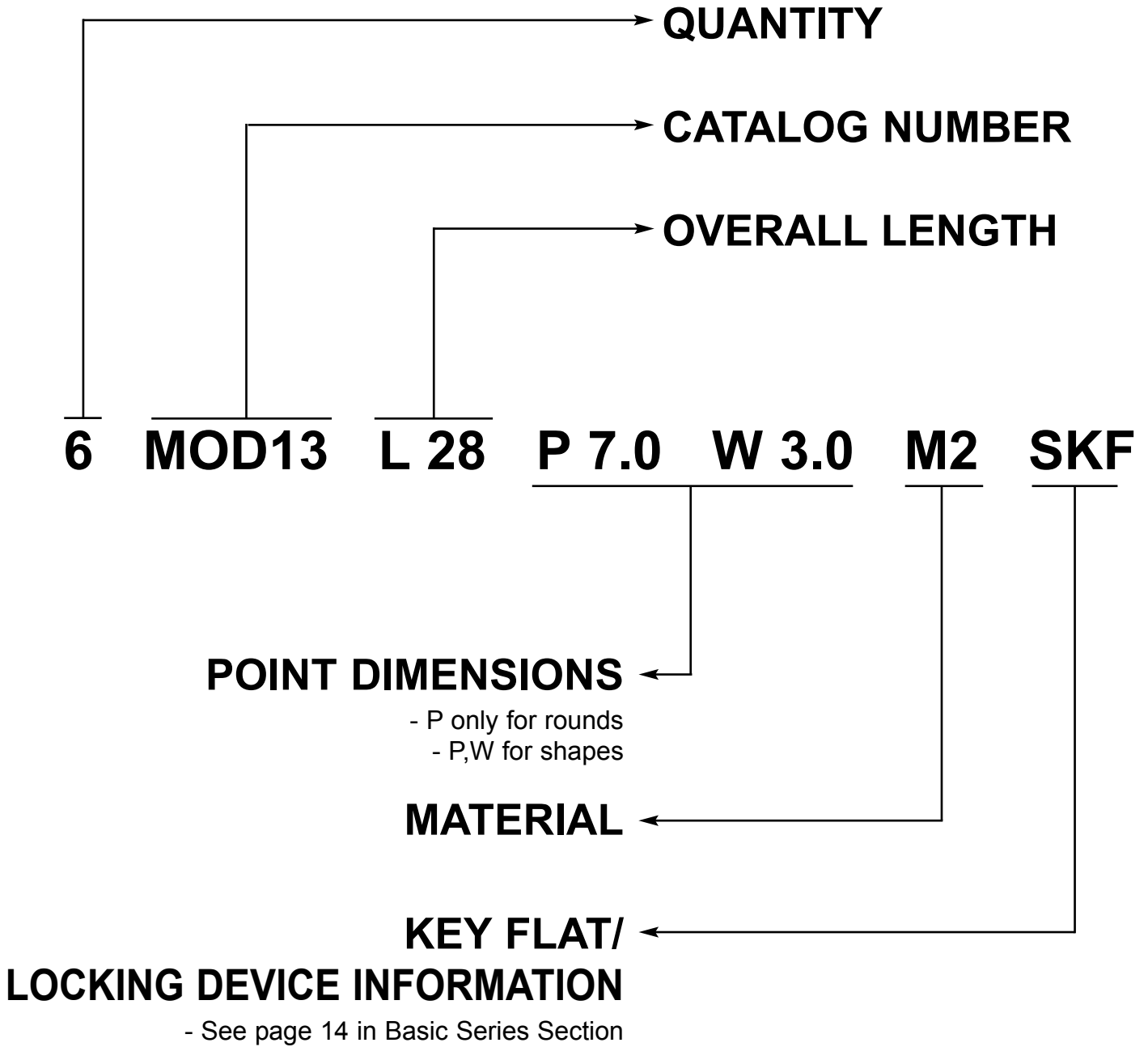
SKF Y 45° M .156

How to order Standard Location:

Specify: Type

EXAMPLE: MOK 37 L 2.25 P .313 W .188 M2 **SKF**

Basic Series Punches and Dies



Ball Lock Series Punches

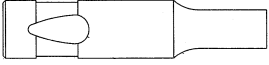

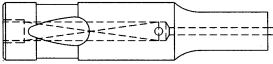



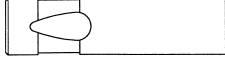

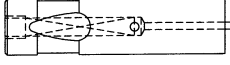

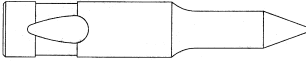





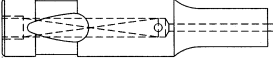

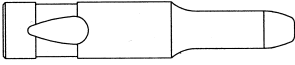

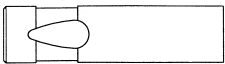

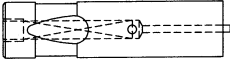

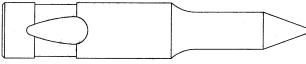

In this section we feature Danly IEM's Ball Lock Series Punches, Die Buttons, and Retainers. The Ball Lock System was developed by Richard Brothers, a subsidiary of Danly IEM. Designed and manufactured for longer production runs, Danly IEM Ball Lock punches meet or exceed ANSI standards. Each component is made of quality heat treated tool steel. Ball Lock Metric punches are available in M2 high speed steel, triple-tempered for long runs where abrasion resistance is required. Other materials are available as specials.



Punches, Die Buttons and Components

- Full Line of Standard Shapes Plus Custom Products
- Ready Availability, Fast Service
- Technical Assistance
- Meets or Exceeds ANSI Standards
- High Strength Tool Steels
- Assured Interchangeability
- Consistent Craftsmanship

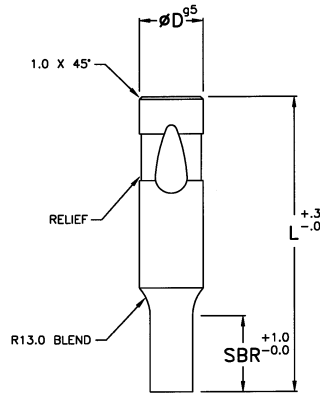
Ball Lock Series

	Page No.		
Light Duty			
Perforating Punches	18		
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Pilot Punches	20		
Blank Punches	20		
Ejector Blank Punches	20		
“A” Type Pilots	21		
Die Buttons	22		
Heavy Duty			
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Ejector Perforating Punches	24		
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Blank Punches	25		
Ejector Blank Punches	25		
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Ball Lock Accessories	27		
Terminology	28		
Ball Lock Series Ordering Information	29		

Light Duty

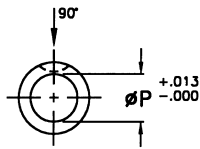
Material: M2—High Speed Steel
Hardness: Point and Shank Rc 60-63
Concentricity: Point to Shank (P:D)
ROUND: .0013 T.I.R.(Max.)
SHAPES: .0025 T.I.R.(Max.)

How to order:
Please specify: Quantity, Catalog Number, Overall Length, Point Dimensions, and Material.
See ordering examples.
NOTE: Other materials are available as specials.



Standard ball seat location shown ↓). Ball seat location other than standard must be specified.

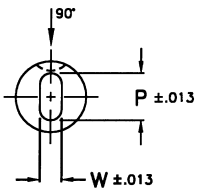
MLBCP (ROUND)



Cat. No.	Shank Dia.	Range of Point Diameter	
	D	P Min	P Max
MLBCP6	6	2.10	5.97
MLBCP10	10	2.10	9.97
MLBCP13	13	5.00	12.97
MLBCP16	16	8.00	15.97
MLBCP20	20	12.00	19.97
MLBCP25	25	16.00	24.97

EXAMPLE: 6 MLBCP10 L 63 P 6.0 M2

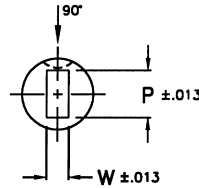
MLBOP (OBLONG)



Cat. No.	Shank Dia.	Range of Point Dimensions	
	D	P Max	W Min
MLBOP6	6	5.97	2.10
MLBOP10	10	9.97	2.10
MLBOP13	13	12.97	4.50
MLBOP16	16	15.97	6.00
MLBOP20	20	19.97	8.00
MLBOP25	25	24.97	10.00

EXAMPLE: 8 MLBOP16 L 80 P 13.0 W 8.0 M2

MLBRP (RECTANGLE, INCLUDES SQUARE)



Cat. No.	Shank Dia.	Range of Point Dimensions	
	D	G Max	W Min
MLBRP6	6	5.97	2.10
MLBRP10	10	9.97	2.10
MLBRP13	13	12.97	4.50
MLBRP16	16	15.97	6.00
MLBRP20	20	19.97	8.00
MLBRP25	25	24.97	10.00

$$G = -P^2 + W^2$$

EXAMPLE: 4 MLBRP13 L 63 P 11.5 W 7.0 M2

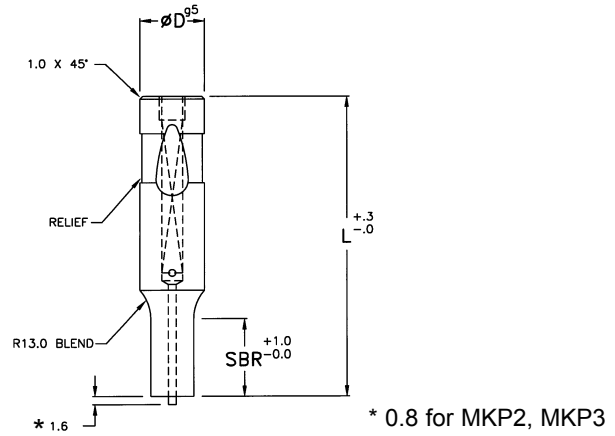
The specified P&W Dims. must not result in a shape diagonal greater than G MAX. listed in chart

Shank Dia.	Overall Lengths L					Straight Before Radius
	D	63	71	80	90	
6	63	71	80	90	100	13
10	63	71	80	90	100	19
13	63	71	80	90	100	19
16	63	71	80	90	100	19
20	63	71	80	90	100	19
25	63	71	80	90	100	19

Light Duty

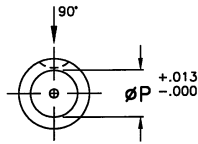
Material: M2—High Speed Steel
Hardness: Point and Shank Rc 60-63
Concentricity: Point to Shank (P:D)
ROUND: .013 T.I.R.(Max.)
SHAPES: .025 T.I.R.(Max.)

How to order:
Please specify: Quantity, Catalog Number, Overall Length, Point Dimensions, and Material.
See ordering examples.
NOTE: Other materials available as specials.



Standard ball seat location shown (). Ball seat location other than standard must be specified.

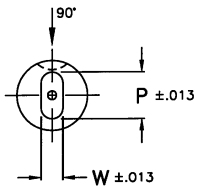
MLBCK (ROUND)



Cat. No.	Shank Dia.	Range of Point Diameter	
		D	P Min
MLBCK6	6	2.10	5.97
MLBCK10	10	2.10	9.97
MLBCK13	13	5.00	12.97
MLBCK16	16	8.00	15.97
MLBCK20	20	12.00	19.97
MLBCK25	25	16.00	24.97

EXAMPLE: 6 MLBCK10 L 63 P 6.0 M2

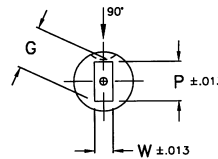
MLBOK (OBLONG)



Cat. No.	Shank Dia.	Range of Point Dimensions	
		P Max	W Min
MLBOK6	6	5.97	2.10
MLBOK10	10	9.97	2.10
MLBOK13	13	12.97	4.50
MLBOK16	16	15.97	6.00
MLBOK20	20	19.97	8.00
MLBOK25	25	24.97	10.00

EXAMPLE: 8 MLBOK16 L 80 P 13.0 W 8.0 M2

MLBRK (RECTANGLE, INCLUDES SQUARE)



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

Cat. No.	Shank Dia.	Range of Point Dimensions	
		G Max	W Min
MLBRK6	6	5.97	2.10
MLBRK10	10	9.97	2.10
MLBRK13	13	12.97	4.50
MLBRK16	16	15.97	6.00
MLBRK20	20	19.97	8.00
MLBRK25	25	24.97	10.00

EXAMPLE: 4 MLBRK 13 L 63 P 11.5 7.0 M2

The specified P&W Dims. must not result in a shape diagonal greater than G MAX. listed in chart

Shank Dia.	Overall Lengths L					Straight Before Radius	Ejector Group
	D	63	71	80	90		
6	63	71	80	90	100	13	MKP3
10	63	71	80	90	100	19	MKP4
13	63	71	80	90	100	19	MKP6
16	63	71	80	90	100	19	MKP6
20	63	71	80	90	100	19	MKP9
25	63	71	80	90	100	19	MKP9

Ejector Components and Design Data shown on page 45.

Light Duty

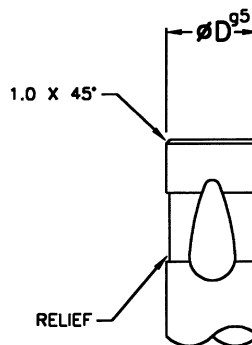
Material: M2—High Speed Steel
Hardness: Rc 60-63
Concentricity: Point to Shank (P:D) Pilot
ROUND: .013 T.I.R.(Max.)

How to order:

Please specify: Quantity, Catalog Number, Overall Length, (point dia. & nominal length for Pilots) and Material.

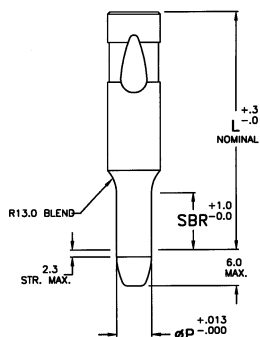
See ordering examples.

NOTE: Other materials available as specials.



Standard ball seat location shown ↓). Ball seat location other than standard must be specified.

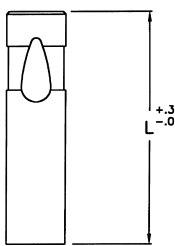
MLBPP (PILOT)



Cat. No.	Shank Dia.	Range of Point Diameter		Straight Before Radius
	D	P Min	P Max	SBR
MLBPP6	6	2.05	6.00	15
MLBPP10	10	2.05	10.00	21
MLBPP13	13	4.95	13.00	21
MLBPP16	16	7.95	16.00	21
MLBPP20	20	11.95	20.00	21
MLBPP25	25	15.95	25.00	21

EXAMPLE: 6 MLBPP20 L 102 P 14.0 M2

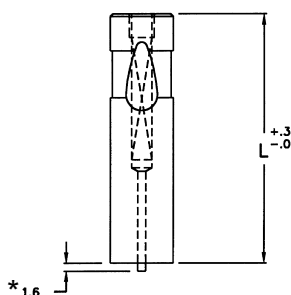
MLBBP (BLANK)



Cat. No.	Shank Dia.
	D
MLBBP6	6
MLBBP10	10
MLBBP13	13
MLBBP16	16
MLBBP20	20
MLBBP25	25

EXAMPLE: 10 MLBBP13 L 71 M2

MLBBK (EJECTOR BLANK)



Cat. No.	Shank Dia.	Ejector Group
	D	Cat. No.
MLBBK6	6	MKP3
MLBBK10	10	MKP4
MLBBK13	13	MKP6
MLBBK16	16	MKP6
MLBBK20	20	MKP9
MLBBK25	25	MKP9

EXAMPLE: 8 MLBBK 13 L 90 M2

* 0.8 for MKP3

Shank Dia.	Overall Lengths (Blanks) Nominal Lengths (Points)				
	63	71	80	90	100
D					
6	63	71	80	90	100
10	63	71	80	90	100
13	63	71	80	90	100
16	63	71	80	90	100
20	63	71	80	90	100
25	63	71	80	90	100

Ejector Components and Design Data shown on page 45.

Light Duty

Material: M2—High Speed Steel

Hardness: Point and Shank Rc 60-63

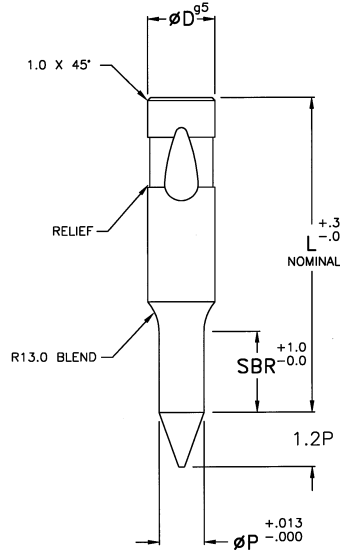
Concentricity: Point to Shank (P:D) .013 T.I.R. (Max.)

How to order:

Please specify: Quantity, Catalog Number, Nominal Length Point Diameter & Material.

See ordering examples.

NOTE: Other materials available as specials.

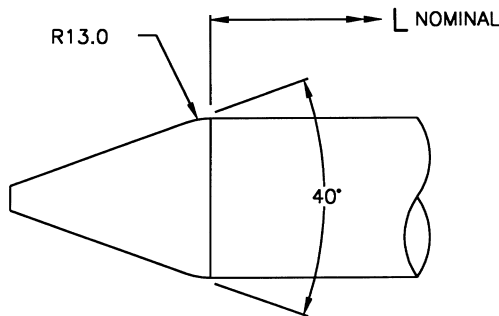


Standard ball seat location shown (). Ball seat location other than standard must be specified.

MLBPA

Cat. No.	Shank Dia. D	Range of Point Dia.		Straight Before Radius SBR
		P Min	P Max	
MLBPA10	10	5.00	10.00	19
MLBPA13	13	9.00	13.00	19
MLBPA16	16	12.00	16.00	25
MLBPA20	20	15.00	20.00	25
MLBPA25	25	19.00	25.00	25

EXAMPLE: 6 MLBPA13 L 100 P 11.5 M2

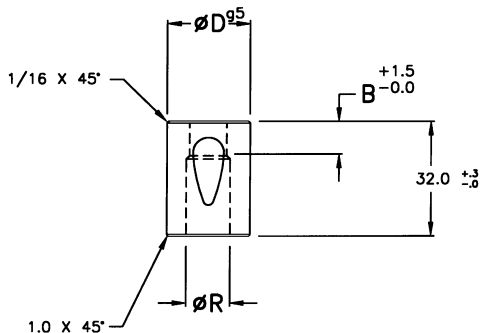


Shank Dia. D	Nominal Lengths L							
	71	80	90	100	110	125	140	150
10	71	80	90	100	110			
13	71	80	90	100	110	125	140	
16	71	80	90	100	110	125	140	150
20	71	80	90	100	110	125	140	150
25	71	80	90	100	110	125	140	150

Light Duty

Material: A2—High Speed Steel
Hardness: Hole and Body Rc 60-63
Concentricity: Hole to Body (P:D)
ROUND: .013 T.I.R.(Max.)
SHAPES: .025 T.I.R.(Max.)

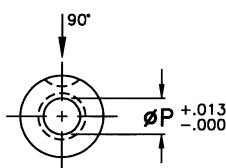
How to order:
Please specify: Quantity, Catalog Number, Hole Dimensions, and Material.
See ordering examples.
NOTE: Other materials available as specials.



For rectangular die holes: The Specified "P" and "W" dim. must not result in a shape diagonal greater than the "G" max listed in the chart.

Standard ball seat position (). Ball seat location other than standard must be specified.

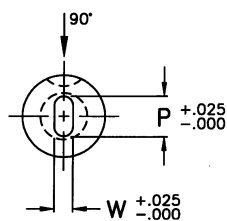
MLBCD (ROUND)



Catalog Number	Body Dia.	Die Hole Range		Relief Hole	Land Min.
		P Min	P Max		
MLBCD13	13	1.50	5.00	5.8	4.0
MLBCD16	16	3.20	7.20	8.0	5.0
MLBCD20	20	4.00	11.00	11.9	5.0
MLBCD25	25	8.00	15.00	16.0	6.0
MLBCD32	32	11.00	19.00	20.0	6.0
MLBCD38	38	16.50	26.00	27.0	8.0

Example: 5 MLBCD13 P 4.0 A2

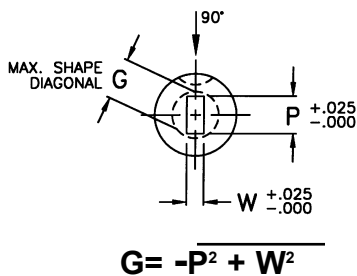
MLBOD (OBLONG)



Catalog Number	Body Dia.	Die Hole Range		Relief Hole	Land Min.
		P Max	W Min		
MLBOD13	13	5.00	1.20	5.8	4.0
MLBOD16	16	7.20	2.00	8.0	5.0
MLBOD20	20	11.00	2.40	11.9	5.0
MLBOD25	25	15.00	4.00	16.0	6.0
MLBOD32	32	19.00	4.80	20.0	6.0
MLBOD38	38	26.00	6.40	27.0	8.0

Example: 2 MLBOD16 P 6.5 W 3.0 A2

MLBRD (RECTANGLE, INCLUDES SQUARE)



Catalog Number	Body Dia.	Die Hole Range		Relief Hole	Land Min.
		G Max	W Min		
MLBRD13	13	5.00	1.20	5.8	4.0
MLBRD16	16	7.20	2.00	8.0	5.0
MLBRD20	20	11.00	2.40	11.9	5.0
MLBRD25	25	15.00	4.00	16.0	6.0
MLBRD32	32	19.00	4.80	20.0	6.0
MLBRD38	38	26.00	6.40	27.0	8.0

Example: 4 MLBRD20 P 8.0 W 4.0 A2

Heavy Duty

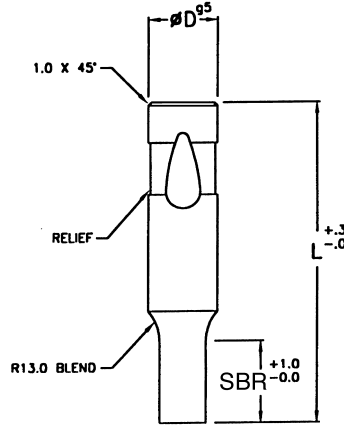
Material: M2—High Speed Steel
Hardness: Point and Shank Rc 60-63
Concentricity: Point to Shank (P:D)
ROUND: .013 T.I.R.(Max.)
SHAPES: .025 T.I.R.(Max.)

How to order:

Please specify: Quantity, Catalog Number, Overall Length, Point Dimensions, and Material.

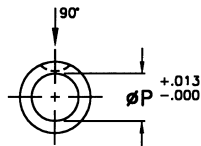
See ordering examples.

NOTE: Other materials available as specials.



Standard ball seat location shown ). Ball seat location other than standard must be specified.

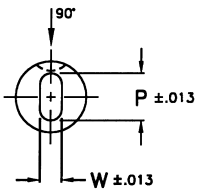
MHBCP (ROUND)



Cat. No.	Shank Dia.	Range of Point Dia.	
	D	P Min	P Max
MHBCP10	10	2.10	9.97
MHBCP13	13	5.00	12.97
MHBCP16	16	8.00	15.97
MHBCP20	20	12.00	19.97
MHBCP25	25	16.00	24.97
MHBCP32	32	24.00	31.97

Example: 6 MHBCP10 L 63 P 6.0 M2

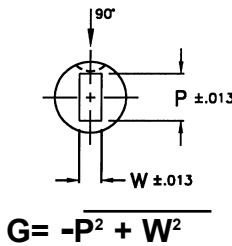
MHBOP (OBLONG)



Cat. No.	Shank Dia.	Range of Point Dimensions	
	D	P Max	W Min
MHBOP10	10	9.97	2.10
MHBOP13	13	12.97	4.50
MHBOP16	16	15.97	6.00
MHBOP20	20	19.97	8.00
MHBOP25	25	24.97	10.00
MHBOP32	32	31.97	12.50

Example: 8 MHBOP16 L 80 P 13.0 W 8.0 M2

MHBRP (RECTANGLE, INCLUDES SQUARE)



Cat. No.	Shank Dia.	Range of Point Dimensions	
	D	G Max	W Min
MHBRP10	10	9.97	2.10
MHBRP13	13	12.97	4.50
MHBRP16	16	15.97	6.00
MHBRP20	20	19.97	8.00
MHBRP25	25	24.97	10.00
MHBRP32	32	31.97	12.50

Example: 6 HBRP50 L 3.50 P .313 W .187 M2

The specified P&W Dims. must not result in a shape diagonal greater than G MAX. listed in chart

Shank Dia.	Overall Lengths L								Straight Before Radius
	D	63	71	80	90	100	110	125	
10	63	71	80	90	100	110	125	19	
13	63	71	80	90	100	110	125	19	
16	63	71	80	90	100	110	125	19	
20	63	71	80	90	100	110	125	19	
25		71	80	90	100	110	125	19	
32		71	80	90	100	110	125	19	

Heavy Duty

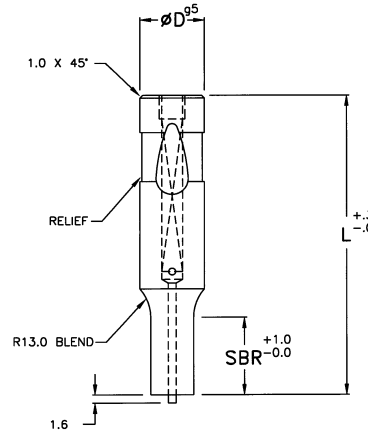
Material: M2—High Speed Steel
Hardness: Point and Shank Rc 60-63
Concentricity: Point to Shank (P:D)
ROUND: .013 T.I.R.(Max.)
SHAPES: .025 T.I.R.(Max.)

How to order:

Please specify: Quantity, Catalog Number, Overall Length, Point Dimensions, and Material.

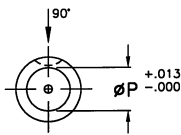
See ordering examples.

NOTE: Other materials available as specials.



Standard ball seat location shown). Ball seat location other than standard must be specified.

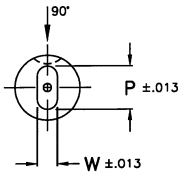
MHBCK (ROUND)



Cat. No.	Shank Dia.	Range of Point Diameter	
	D	P Min	P Max
MHBCK10	10	2.10	9.97
MHBCK13	13	5.00	12.97
MHBCK16	16	8.00	15.97
MHBCK20	20	12.00	19.97
MHBCK25	25	16.00	24.97
MHBCK32	32	24.00	31.97

Example: 6 MHBCK10 L 63 P 6.0 M2

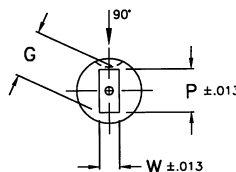
MHBOK (OBLONG)



Cat. No.	Shank Dia.	Range of Point Dimensions	
	D	P Max	W Min
MHBOK10	10	9.97	2.10
MHBOK13	13	12.97	4.50
MHBOK16	16	15.97	6.00
MHBOK20	20	19.97	8.00
MHBOK25	25	24.97	10.00
MHBOK32	32	31.97	12.50

Example: 8 MHBOK16 L 80 P 13.0 W 8.0 M2

MHBRK (RECTANGLE, INCLUDES SQUARE)



$$G = -P^2 + W^2$$

Cat. No.	Shank Dia.	Range of Point Dimensions	
	D	G Max	W Min
MHBRK10	10	9.97	2.10
MHBRK13	13	12.97	4.50
MHBRK16	16	15.97	6.00
MHBRK20	20	19.97	8.00
MHBRK25	25	24.97	10.00
MHBRK32	32	31.97	12.50

Example: 4 MHBRK13 L 63 P 11.5 W 7.0 M2

The specified P&W Dims. must not result in a shape diagonal greater than G MAX. listed in chart

Shank Dia.	Overall Lengths L								Straight Before Radius	Ejector Group
	D	63	71	80	90	100	110	125		
10	63	71	80	90	100	110	125	19	MKP4	
13	63	71	80	90	100	110	125	19	MKP6	
16	63	71	80	90	100	110	125	19	MKP6	
20	63	71	80	90	100	110	125	19	MKP9	
25		71	80	90	100	110	125	19	MKP9	
32		71	80	90	100	110	125	19	MKP9	

Ejector Components and Design Data shown on page 45.

Heavy Duty

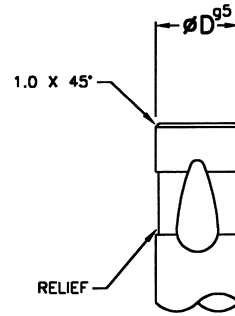
Material: M2—High Speed Steel
Hardness: Rc 60-63
Concentricity: Point to Shank (P:D) Pilot
 .013 T.I.R.(Max.)

How to order:

Please specify: Quantity, Catalog Number, Overall Length, (point dia. & nominal lengths for Pilots) and Material.

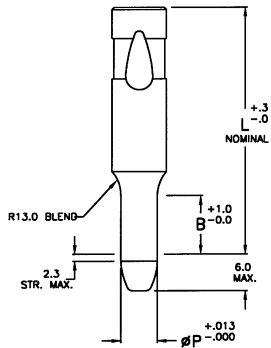
See ordering examples.

NOTE: Other materials available as specials.



Standard ball seat location shown (). Ball seat location other than standard must be specified.

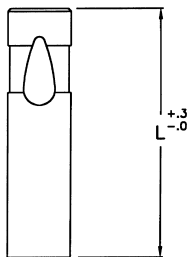
MHBPP (PILOT)



Cat. No.	Shank Dia. D	Range of Point Diameter		Straight Before Radius SBR
		P Min	P Max	
MHBPP10	10	2.05	10.00	21
MHBPP13	13	4.95	13.00	21
MHBPP16	16	7.95	16.00	21
MHBPP20	20	11.95	20.00	21
MHBPP25	25	15.95	25.00	21
MHBPP32	32	23.95	32.00	21

Example: 6 MHBPP20 L 102 P 14.0 M2

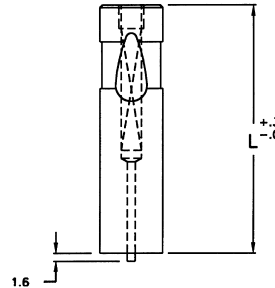
MHBBP (BLANK)



Cat. No.	Shank Dia. D
MHBBP10	10
MHBBP13	13
MHBBP16	16
MHBBP20	20
MHBBP25	25
MHBBP32	32

Example: 10 MHBBP 13 L 71 M2

MHBBK (EJECTOR BLANK)



Cat. No.	Shank Dia. D	Ejector Group
		Cat. No.
MHBBK10	10	MKP4
MHBBK13	13	MKP6
MHBBK16	16	MKP6
MHBBK20	20	MKP9
MHBBK25	25	MKP9
MHBBK32	32	MKP9

Example: 8 MHBBK13 L 90 M2

Shank Dia. D	Overall Lengths					
	63	71	80	90	100	125
10	63	71	80	90		
13	63	71	80	90	100	125
16	63	71	80	90	100	125
20	63	71	80	90	100	125
25		71	80	90	100	125
32		71	80	90	100	125

Ejector Components and Design Data shown on page 45.

Heavy Duty

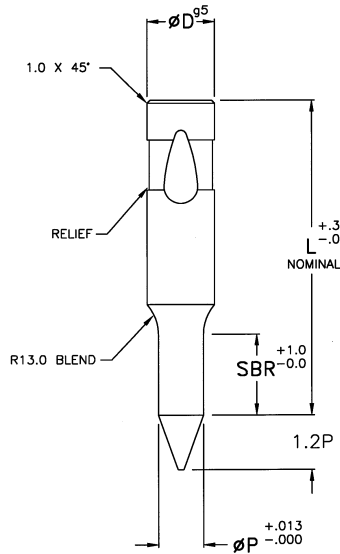
Material: M2—High Speed Steel
Hardness: Point and Shank Rc 60-63
Concentricity: Point to Shank (P:D) .013 T.I.R. (Max.)

How to order:

Please specify: Quantity, Catalog Number, Nominal Length, Point Diameter, and Material.

See ordering examples.

NOTE: Other materials available as specials.

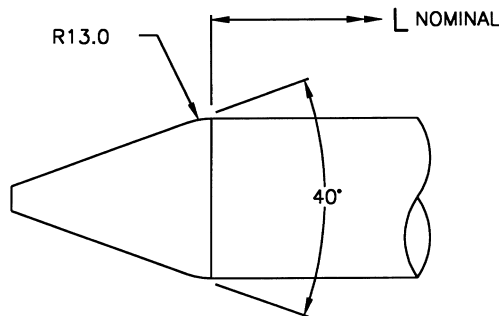


Standard ball seat location shown ↓). Ball seat location other than standard must be specified.

MHBPA

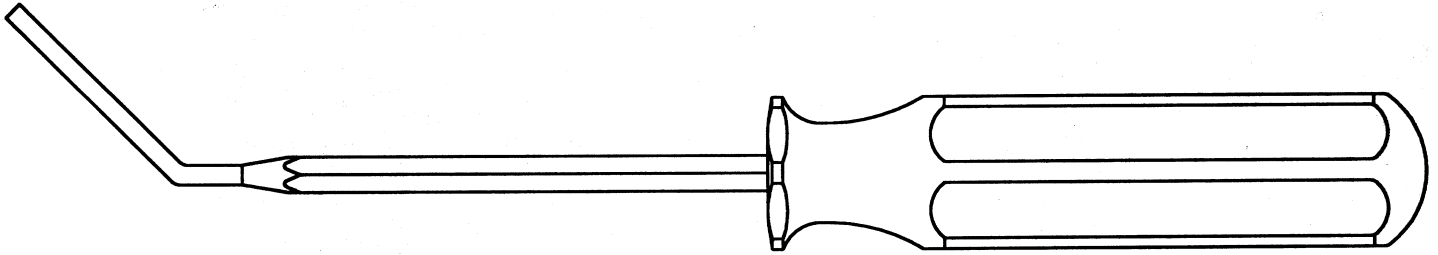
Cat. No.	Shank Dia. D	Range of Point Dia.		Straight Before Radius SBR
		P Min	P Max	
MHBPA10	10	5.00	10.00	19
MHBPA13	13	9.00	13.00	19
MHBPA16	16	12.00	16.00	25
MHBPA20	20	15.00	20.00	25
MHBPA25	25	19.00	25.00	25
MHBPA32	32	24.00	32.00	25

EXAMPLE: 6 MHBPA13 L 100 P 11.5 M2



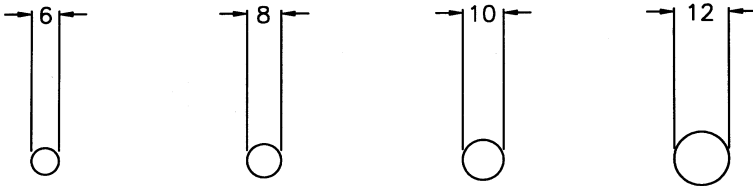
Shank Dia. D	Nominal Lengths L						
	80	90	100	110	125	140	150
10	80	90	100	110			
13	80	90	100	110	125	140	
16	80	90	100	110	125	140	150
20	80	90	100	110	125	140	150
25	80	90	100	110	125	140	150
32	80	90	100	110	125	140	150

Ball Release Tool



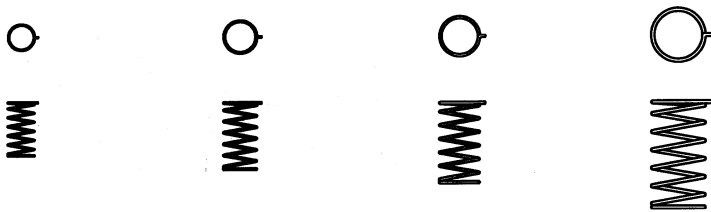
Catalog No. BLT - 1

Retainer Balls



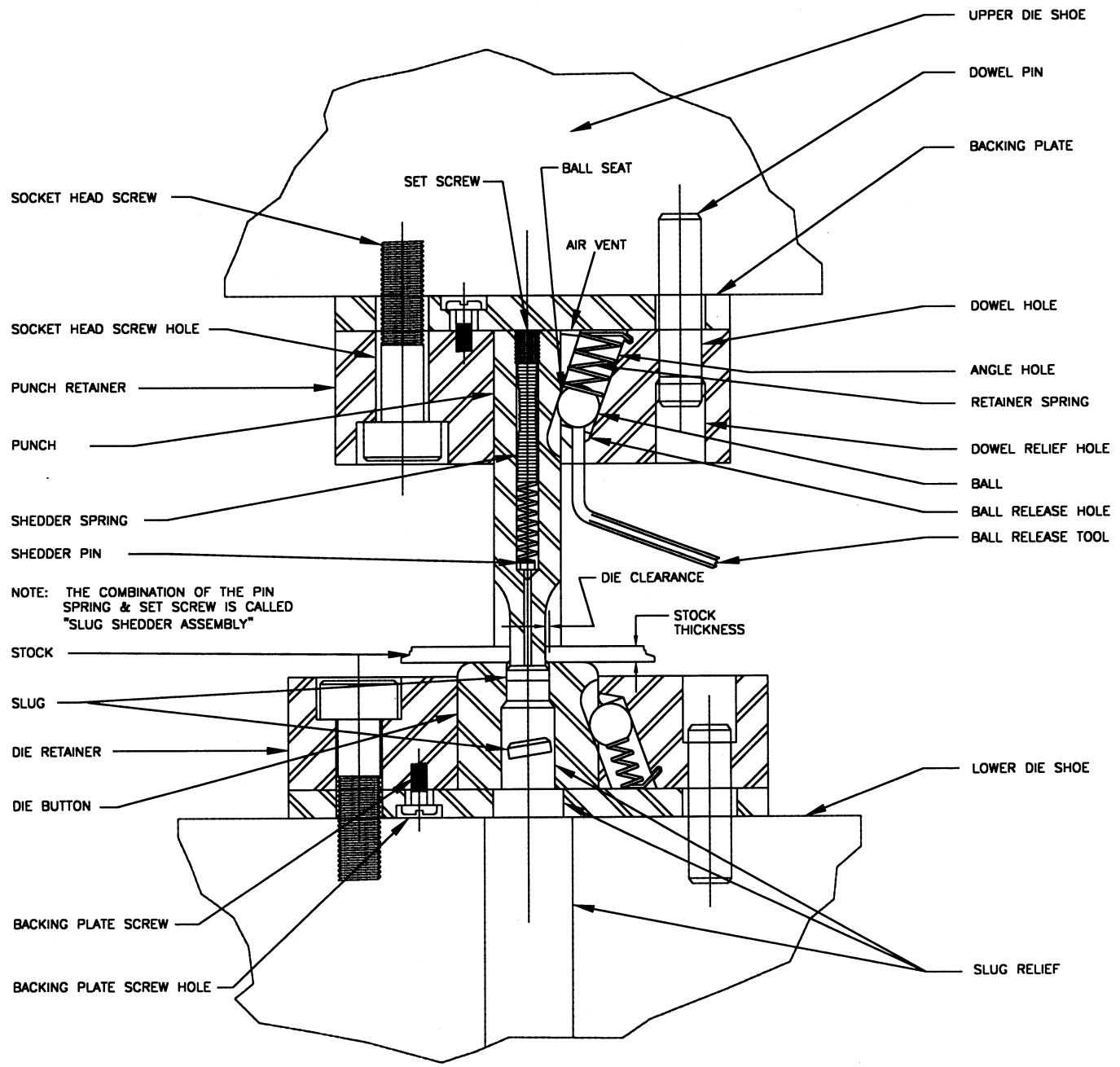
Catalog Number	Ball Dia.	For Use With Retainers
MRBLD6	6	MLBR6
MRBLD8	8	MLBR: 10, 13, 16, 20, 25
MRBHD10	10	MHBR10
MRBHD12	12	MHBR: 13, 16, 20,25, 32

Retainer Springs

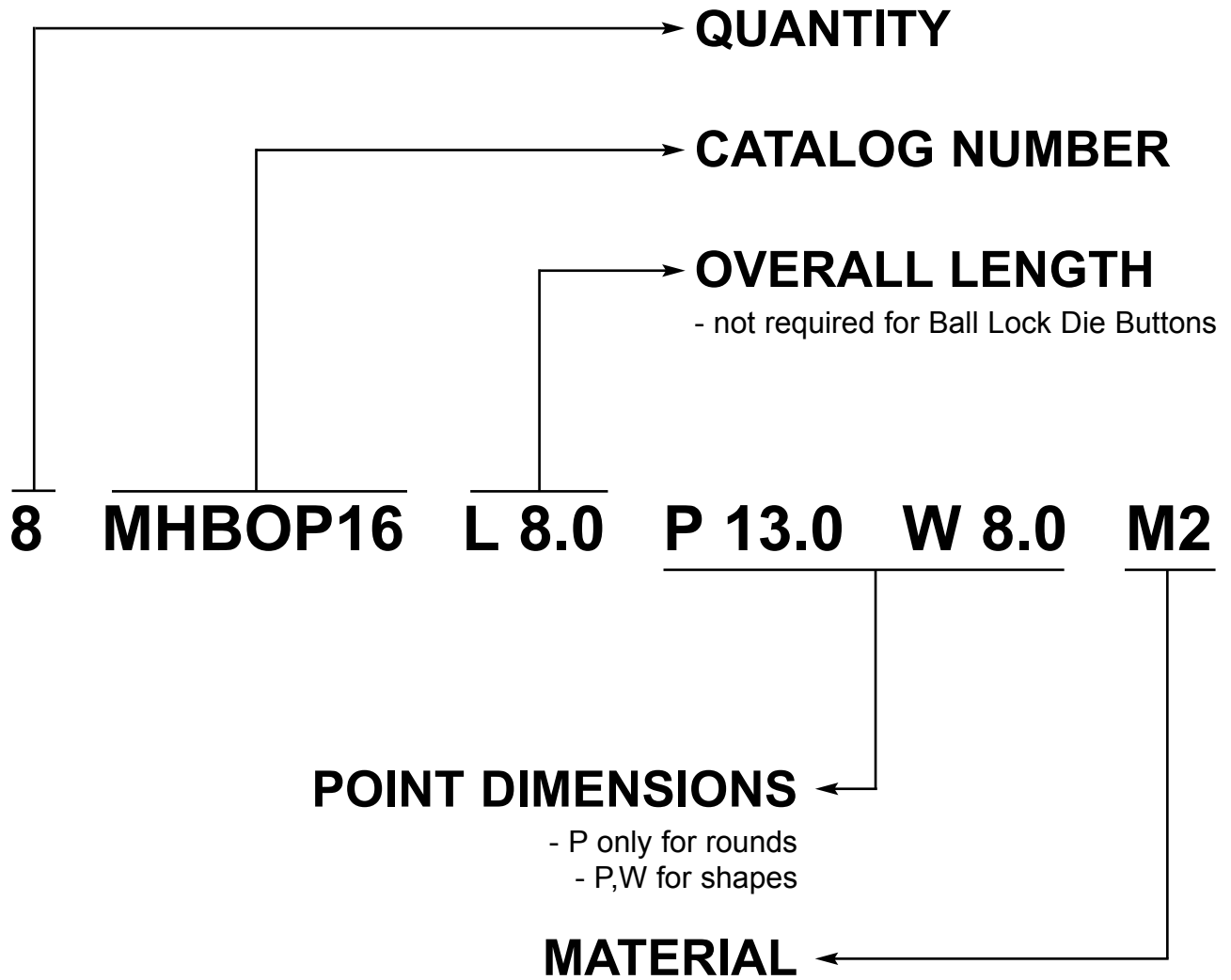


Catalog Number	Tail Springs	For Use With Retainers
MLRS6	6	MLBR6
MLRS8	8	MLBR: 10, 13, 16, 20, 25
MHRS10	10	MHBR10
MHRS12	12	MHBR: 13, 16, 20,25, 32

Terminology



Ball Lock Series Punches and Dies



Variable Precision Series Punches

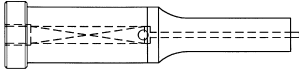

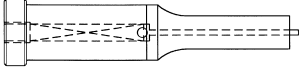
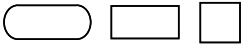
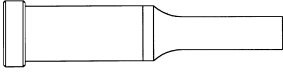

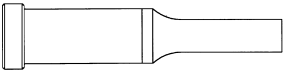

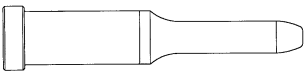

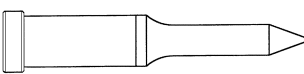





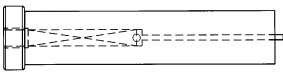

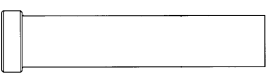

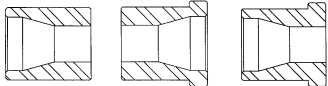

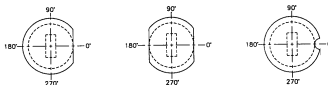
In this section we feature Danly IEM's Variable Precision Series Punches in all popular point lengths, precision manufactured to exacting design tolerances. Variable point lengths allow greater design flexibility to ensure proper punch to die alignment for long, accurate production runs. Variable Metric punches are available in M2 high speed steel, triple-tempered for long runs where abrasion resistance is required. Other materials including PM4 are available as specials.



Punches, Die Buttons and Components

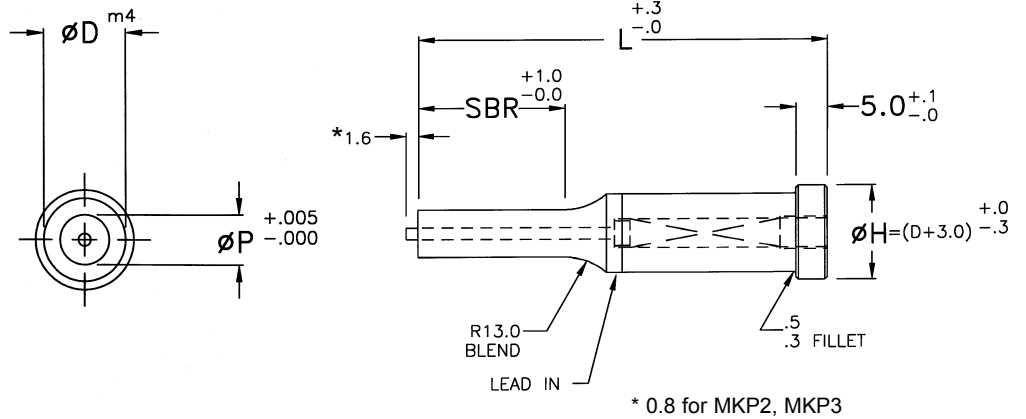
- Full Line of Standard Shapes Plus Custom Products
- Ready Availability, Fast Service
- Technical Assistance
- Meets or Exceeds ANSI Standards
- High Strength Tool Steels
- Assured Interchangeability
- Consistent Craftsmanship

Variable Precision Series

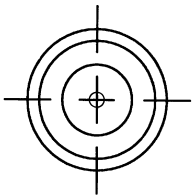
	Page No.		
Perforating Ejector Punches Round.	32		
Perforating Ejector Punches Shapes.	33		
Perforating Punches Round	34		
Perforating Punches Shapes.	35		
Pilot Punches	36		
“A” Type Pilot Punches	37		
Press Fit Die Buttons-Round.	38		
Press Fit Die Buttons-Shapes.	39		
Ejector Punch Blanks	40		
Punch Blanks	41		
Stripper Guides.	42		
Locking Devices	43		
Variable Series Ordering Information.	44		

Round

Material: M2—High Speed Steel
Hardness: M2: Rc 60-63; Head: Rc 40-55
Concentricity: Point to Shank (P:D) .008 T.I.R. (Max.)
How to order:
Please specify: Quantity, Catalog Number, Length Code, Point Diameter and Material.
See ordering examples.
 Shaded Areas represent standard products.
 Others available upon request.
NOTE: Other materials available as specials.



MCKV_(ROUND)



Shank Dia.	Cat. No.	Straight Before Radius	Point Range		Overall Length											Ejector Group	
			P Min	P Max	40.0	45.0	50.0	56.0	60.0	63.0	70.0	71.0	80.0	90.0	100.0		Cat. No.
5	MCKV5	8.0	1.60	4.99													MKP2
6	MCKV6		2.40	5.99													
5	MCKV5	13.0	1.60	4.99													MKP2
6	MCKV6		2.40	5.99													MKP3
8	MCKV8		3.20	7.99													MKP4
10	MCKV10		4.50	9.99													MKP6
13	MCKV13		6.00	12.99													MKP6
16	MCKV16		8.00	15.99													MKP9
20	MCKV20		9.50	19.99													MKP9
25	MCKV25	12.00	24.99													MKP9	
5	MCKV5	19.0	1.60	4.99													MKP2
6	MCKV6		2.40	5.99													MKP3
8	MCKV8		3.20	7.99													MKP4
10	MCKV10		4.50	9.99													MKP6
13	MCKV13		6.00	12.99													MKP6
16	MCKV16		8.00	15.99													MKP9
20	MCKV20		9.50	19.99													MKP9
25	MCKV25	12.00	24.99													MKP9	
6	MCKV6	25.0	2.40	5.99													MKP3
8	MCKV8		3.20	7.99													MKP4
10	MCKV10		4.50	9.99													MKP6
13	MCKV13		6.00	12.99													MKP6
16	MCKV16		8.00	15.99													MKP9
20	MCKV20		9.50	19.99													MKP9
25	MCKV25		12.00	24.99													MKP9

Example: 6 MCKV 13 L 60.0 SBR 19.0 M2

NOTE: Refer to page 45 for ejector data

Oblong and Rectangle

Material: M2—High Speed Steel

Hardness: M2: Rc 60-63; Head: Rc 40-55

Concentricity: Point to Shank (P:D) .008 T.I.R. (Max.)

How to order:

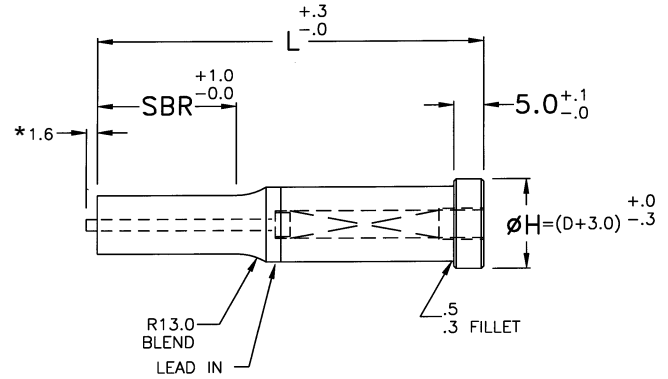
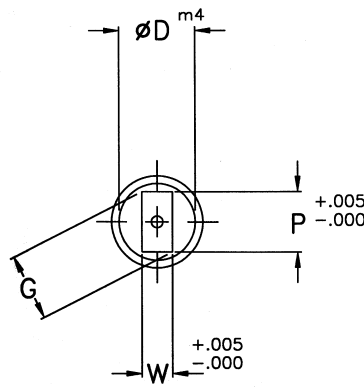
Please specify: Quantity, Catalog Number, Length Code, Point Dimensions, Material, and if desired, Standard or Custom Locking Device.

See ordering examples.

Shaded Areas represent standard products.

Others available upon request.

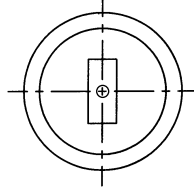
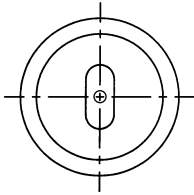
NOTE: Other materials available as specials.



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

MOKV (OBLONG)

MRKV (RECTANGLE, includes square)



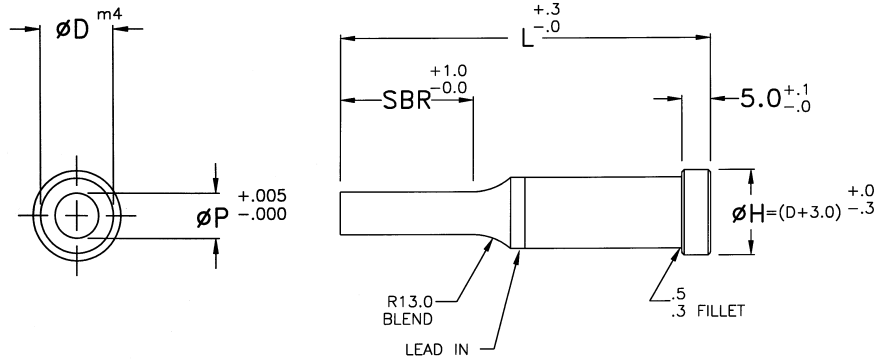
Shank Dia.	Cat. No.	Straight Before Radius	Point Range		Overall Length											Ejector Group
			P/G Max.	W Min.	40.0	45.0	50.0	56.0	60.0	63.0	70.0	71.0	80.0	90.0	100.0	
5	M_KV5	8.0	4.99	1.60												MKP2
6	M_KV6		5.99	2.40												MKP3
5	M_KV5	13.0	4.99	1.60												MKP2
6	M_KV6		5.99	2.40												MKP3
8	M_KV8		7.99	3.20												MKP4
10	M_KV10		9.99	4.50												MKP6
13	M_KV13		12.99	6.00												MKP6
16	M_KV16		15.99	7.20												MKP6
20	M_KV20		19.99	8.00												MKP9
25	M_KV25		24.99	9.00												MKP9
5	M_KV5	19.0	4.99	1.60												MKP2
6	M_KV6		5.99	2.40												MKP3
8	M_KV8		7.99	3.20												MKP4
10	M_KV10		9.99	4.50												MKP6
13	M_KV13		12.99	6.00												MKP6
16	M_KV16		15.99	7.20												MKP6
20	M_KV20		19.99	8.00												MKP9
25	M_KV25		24.99	9.00												MKP9
6	M_KV6	25.0	5.99	2.40												MKP3
8	M_KV8		7.99	3.20												MKP4
10	M_KV10		9.99	4.50												MKP6
13	M_KV13		12.99	6.00												MKP6
16	M_KV16		15.99	7.20												MKP6
20	M_KV20		19.99	8.00												MKP9
25	M_KV25		24.99	9.00												MKP9

Example: 6 MKOV 13 L 60.0 SBR 19.0 P 10.0 W 6.00 M2 SKF

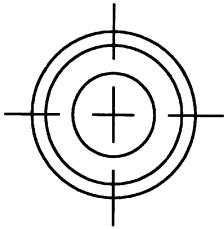
NOTE: Refer to page 45 for ejector data
Refer to page 43 for Locking Device Information.

Round

Material: M2—High Speed Steel
Hardness: M2: Rc 60-63; Head: Rc 40-55
Concentricity: Point to Shank (P:D) .008 T.I.R. (Max.)
How to order:
Please specify: Quantity, Catalog Number, Length Code, Point Diameter and Material.
See ordering examples.
 Shaded Areas represent standard products.
 Others available upon request.
NOTE: Other materials available as specials.



MCPV (Round)



Shank Dia.	Cat. No.	Straight Before Radius	Point Range		Overall Length											
			P Min	P Max	32.0	40.0	45.0	50.0	56.0	60.0	63.0	70.0	71.0	80.0	90.0	100.0
5	MCPV5	8.0	1.20	4.99												
6	MCPV6		1.60	5.99												
8	MCPV8		2.00	7.99												
10	MCPV10		2.50	9.99												
5	MCPV5	13.0	1.60	4.99												
6	MCPV6		1.60	5.99												
8	MCPV8		2.50	7.99												
10	MCPV10		3.20	9.99												
13	MCPV13		5.00	12.99												
16	MCPV16		8.00	15.99												
20	MCPV20	10.00	19.99													
25	MCPV25	12.00	24.99													
5	MCPV5	19.0	1.60	4.99												
6	MCPV6		1.60	5.99												
8	MCPV8		2.50	7.99												
10	MCPV10		3.20	9.99												
13	MCPV13		5.00	12.99												
16	MCPV16		8.00	15.99												
20	MCPV20	10.00	19.99													
25	MCPV25	12.00	24.99													
5	MCPV5	25.0	2.50	4.99												
6	MCPV6		2.50	5.99												
8	MCPV8		2.50	7.99												
10	MCPV10		3.20	9.99												
13	MCPV13		5.00	12.99												
16	MCPV16		8.00	15.99												
20	MCPV20	10.00	19.99													
25	MCPV25	12.00	24.99													

Example: 6 MCPV 13 L 60.0 SBR 19.0 P 12.0 M2

Oblong and Rectangle

Material: M2—High Speed Steel

Hardness: M2: Rc 60-63; Head: Rc 40-55

Concentricity: Point to Shank (P:D) .008 T.I.R. (Max.)

How to order:

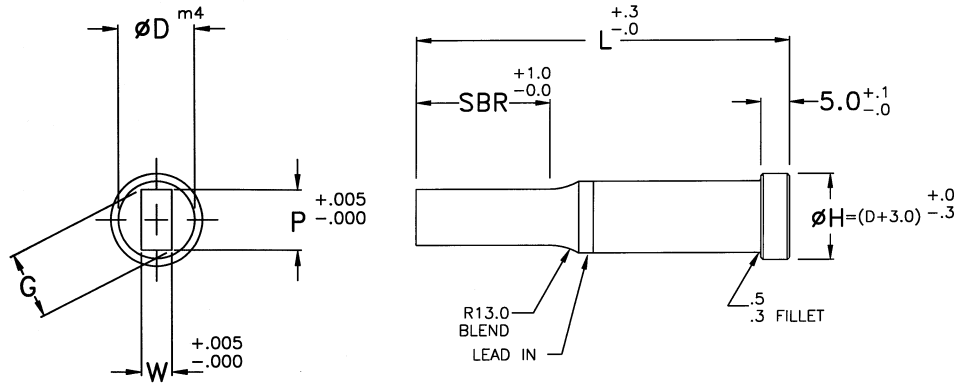
Please specify: Quantity, Catalog Number, Length Code, Point Dimensions, Material, and if desired, Standard or Custom Locking Device.

See ordering examples.

Shaded Areas represent standard products.

Others available upon request.

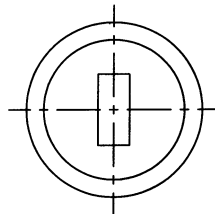
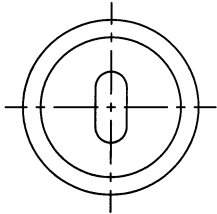
NOTE: Other materials available as specials.



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

MOPV (OBLONG)

MRPV (RECTANGLE, includes square)



Shank Dia.	Cat. No.	Straight Before Radius	Point Range		Overall Length											
			P/G Max	W Min	32.0	40.0	45.0	50.0	56.0	60.0	63.0	70.0	71.0	80.0	90.0	100.0
5	M_PV5	8.0	4.99	1.60												
6	M_PV6		5.99	1.60												
8	M_PV8		7.99	2.00												
10	M_PV10		9.99	3.20												
5	M_PV5	13.0	4.99	1.60												
6	M_PV6		5.99	1.60												
8	M_PV8		7.99	2.50												
10	M_PV10		9.99	3.20												
13	M_PV13		12.99	4.50												
16	M_PV16		15.99	6.00												
20	M_PV20	19.99	8.00													
25	M_PV25	24.99	9.00													
5	M_PV5	19.0	4.99	1.60												
6	M_PV6		5.99	1.60												
8	M_PV8		7.99	2.50												
10	M_PV10		9.99	3.20												
13	M_PV13		12.99	4.50												
16	M_PV16		15.99	6.00												
20	M_PV20	19.99	8.00													
25	M_PV25	24.99	9.00													
5	M_PV5	25.0	4.99	2.50												
6	M_PV6		5.99	2.50												
8	M_PV8		7.99	2.50												
10	M_PV10		9.99	3.20												
13	M_PV13		12.99	4.50												
16	M_PV16		15.99	6.00												
20	M_PV20	19.99	8.00													
25	M_PV25	24.99	9.00													

Example: 6 MOPV 13 L 60.0 SBR 19.0 P 12.0 W 8.0 M2 SKF

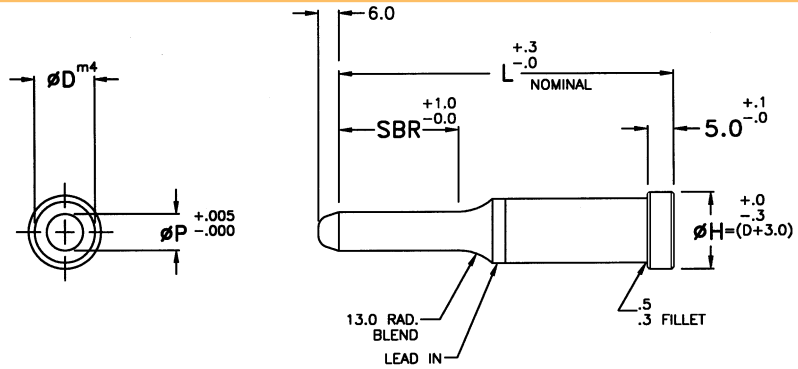
Refer to page 43 for Locking Device Information.

Standard

Material: M2—High Speed Steel
Hardness: M2: Rc 60-63; Head: Rc 40-55
Concentricity: Point to Shank (P:D) .008 T.I.R. (Max.)

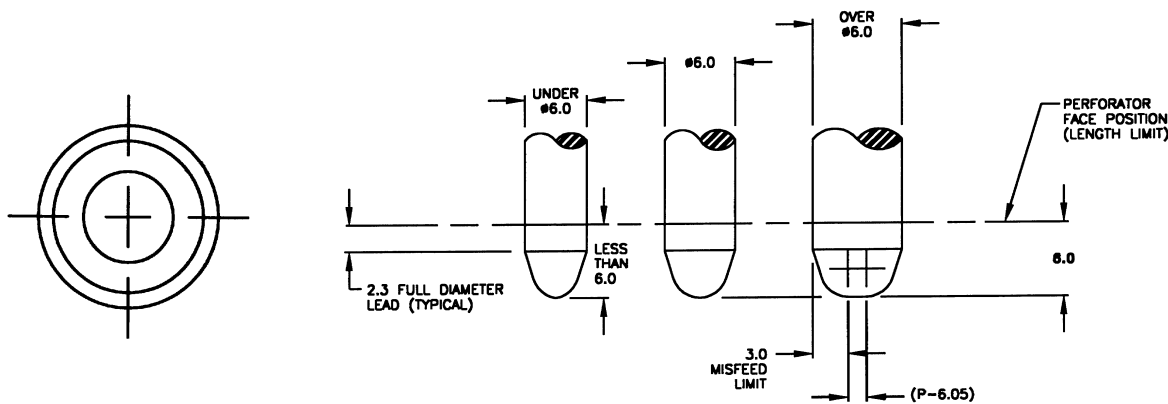
How to order:
Please specify: Quantity, Catalog Number, Length Code, Point Diameter and Material.

See ordering examples.
 Shaded Areas represent standard products.
 Others available upon request.



NOTE: Other materials available as specials.

MPPV



Shank Dia.	Cat. No.	Straight Before Radius	Point Range		Overall Length											
			P Min	P Max	42.0	47.0	52.0	58.0	62.0	65.0	72.0	73.0	82.0	92.0	102.0	
5	MPPV5	10.0	1.55	5.00												
6	MPPV6		1.55	6.00												
8	MPPV8		1.95	8.00												
10	MPPV10		2.35	10.00												
5	MPPV5	15.0	1.55	5.00												
6	MPPV6		1.55	6.00												
8	MPPV8		2.35	8.00												
10	MPPV10		3.15	10.00												
13	MPPV13		4.95	13.00												
16	MPPV16		7.95	16.00												
20	MPPV20	9.95	20.00													
25	MPPV25	11.95	25.00													
5	MPPV5	21.0	1.55	5.00												
6	MPPV6		1.55	6.00												
8	MPPV8		2.35	8.00												
10	MPPV10		3.15	10.00												
13	MPPV13		4.95	13.00												
16	MPPV16		7.95	16.00												
20	MPPV20	9.95	20.00													
25	MPPV25	11.95	25.00													
5	MPPV5	27.0	2.45	5.00												
6	MPPV6		2.45	6.00												
8	MPPV8		2.45	8.00												
10	MPPV10		3.15	10.00												
13	MPPV13		4.95	13.00												
16	MPPV16		7.95	16.00												
20	MPPV20	9.95	20.00													
25	MPPV25	11.95	25.00													

Example: 15 MPPV16 L 65.0 SBR 21.0 P 13.0 M2

“A” - Type

Material: M2—High Speed Steel

Hardness: M2: Rc 60-63; Head: Rc 40-55

Concentricity: Point to Shank (P:D) .008 T.I.R. (Max.)

How to order:

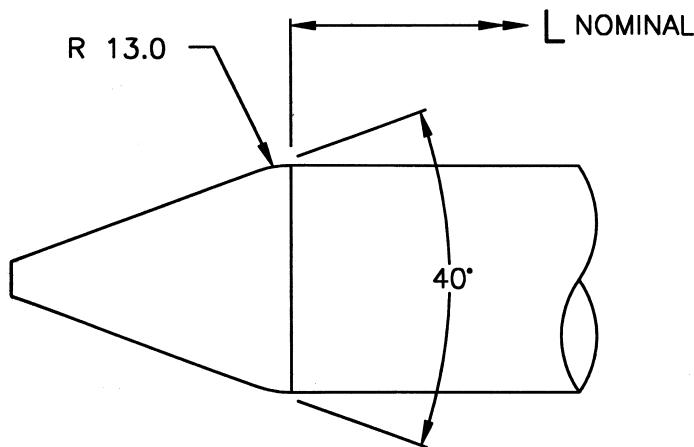
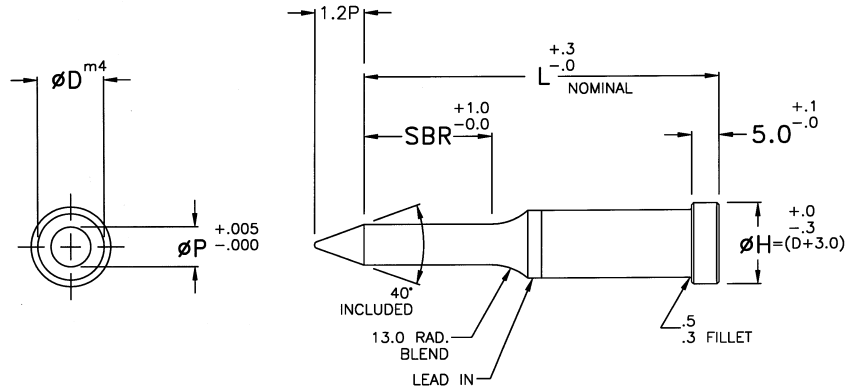
Please specify: Quantity, Catalog Number, Length Code, Point Diameter and Material.

See ordering examples.

Shaded Areas represent standard products.

Others available upon request.

NOTE: Other materials available as specials.



MPPVA

Shank Dia.	Cat. No.	Straight Before Radius	Point Range		Overall Length									
			SBR	P Min	P Max	62.0	65.0	72.0	73.0	82.0	92.0	102.0	112.0	127.0
10	MPPVA10	21.0	4.85	10.00										
13	MPPVA13		6.30	13.00										
16	MPPVA16		9.95	16.00										
20	MPPVA20		13.60	20.00										
25	MPPVA25		17.25	25.00										
10	MPPVA10	27.0	4.85	10.00										
13	MPPVA13		6.30	13.00										
16	MPPVA16		9.95	16.00										
20	MPPVA20		17.25	20.00										
25	MPPVA25		20.85	25.00										

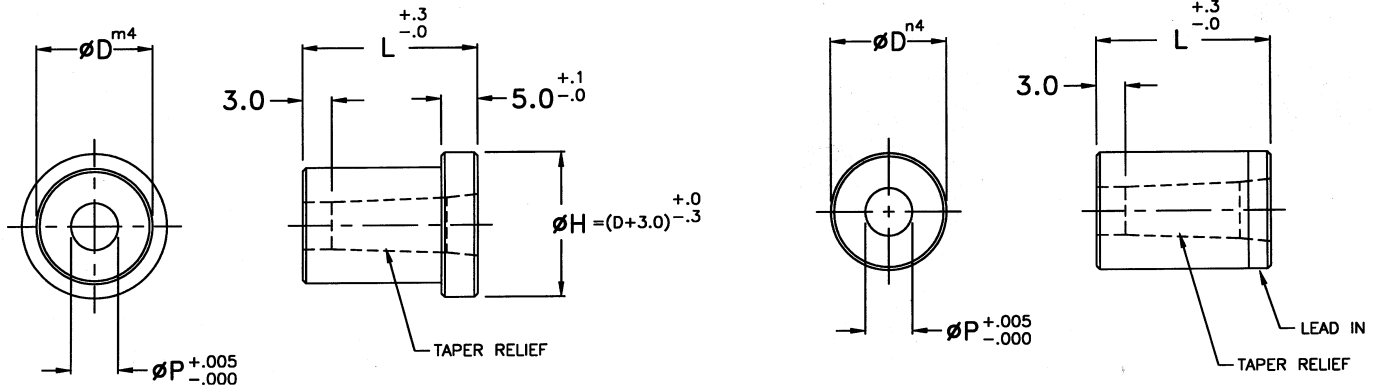
Example: 15 MPPVA 20 L 92.0 SBR 21.0 P 18.0 M2

Round

Material: A2 —5% Chrome
Hardness: Rc 60-63
Concentricity: (P:D) .008 T.I.R. (Max.)

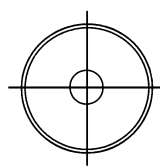
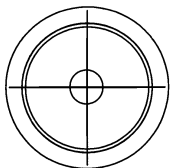
How to order:
Please specify: Quantity, Catalog Number, Length Code, Hole Diameter, and Material.
See ordering examples.

NOTE: Other materials available as specials.
 Shaded Areas represent standard products.
 Others available upon request.



MCHV ROUND (HEADED)

MCDV ROUND (HEADLESS)



Body Dia.	Cat. No.	Cat. No.	Hole Range		Overall Length								
			P Min	P Max	13.0	16.0	20.0	22.0	25.0	28.0	30.0	32.0	35.0
5	MCHV5	MCDV5	1.60	3.20									
6	MCHV6	MCDV6	1.60	3.90									
8	MCHV8	MCDV8	2.40	5.40									
10	MCHV10	MCDV10	3.20	6.80									
13	MCHV13	MCDV13	5.40	8.80									
16	MCHV16	MCDV16	7.40	10.80									
20	MCHV20	MCDV20	9.50	13.60									
25	MCHV25	MCDV25	12.00	17.00									
32	MCHV32	MCDV32	16.00	22.00									
38	MCHV38	MCDV38	18.00	27.00									
40	MCHV40	MCDV40	18.00	27.00									

EXAMPLE: 15 MCHV 20 L 30.0 P 12.0 A2

Oblong and Rectangle

Material: A2 —5% Chrome

Hardness: Rc 60-63

Concentricity: Point to Shank (P:D) .008 T.I.R. (Max.)

Note: Fillets and sharp corners on die buttons will be .18 Max.

How to order:

Please specify: Quantity, Catalog Number, Length Code, Hole Dimensions, Material, and if desired, Standard or Custom Locking Device.

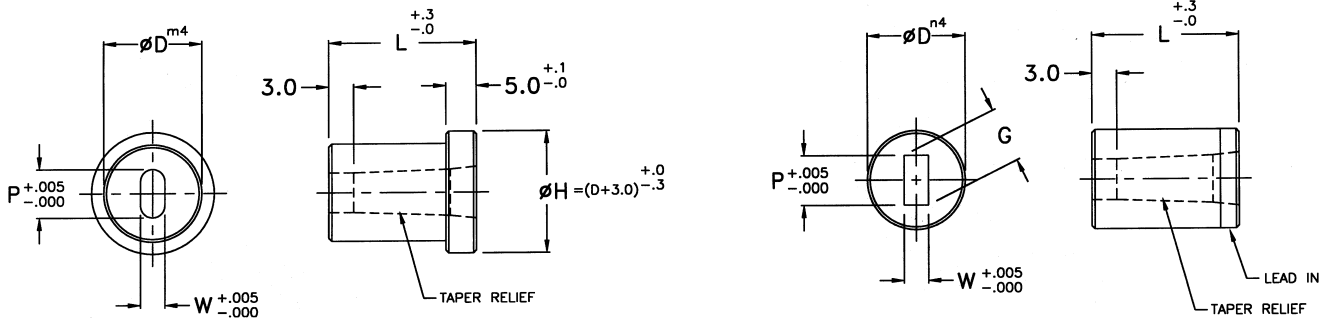
See ordering examples.

NOTE: Other materials available as specials.

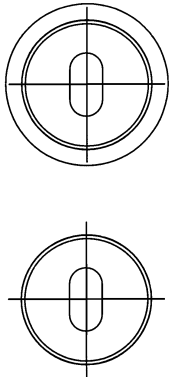
Shaded Areas represent standard products.

Others available upon request.

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



MOHV OBLONG (HEADED), MODV OBLONG (HEADLESS)

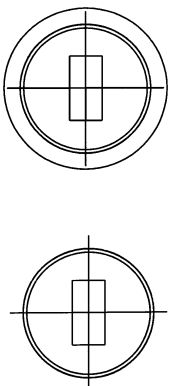


Body Dia.	Cat. No.	Cat. No.	Hole Range		Overall Length								
			W Min	P Max	13.0	16.0	20.0	22.0	25.0	28.0	30.0	32.0	35.0
5	MOHV5	MODV5	1.30	3.20									
6	MOHV6	MODV6	1.30	3.90									
8	MOHV8	MODV8	1.30	5.40									
10	MOHV10	MODV10	1.30	6.80									
13	MOHV13	MODV13	1.90	8.80									
16	MOHV16	MODV16	1.90	10.80									
20	MOHV20	MODV20	1.90	13.60									
25	MOHV25	MODV25	1.90	17.00									
32	MOHV32	MODV32	1.90	22.00									
38	MOHV38	MODV38	1.90	27.00									
40	MOHV40	MODV40	1.90	27.00									

EXAMPLE: 15 MOHV 25 L 25.0 P 15.0 W 5.0 A2 SKF

*Refer to page 43 for Locking Device Information.

MRHV RECTANGLE, INCLUDES SQUARE (HEADED), MRDV RECTANGLE, INCLUDES SQUARE (HEADLESS)



Body Dia.	Catalog Number	Catalog Number	Hole Range		Overall Length								
			W Min	G Max	13.0	16.0	20.0	22.0	25.0	28.0	30.0	32.0	35.0
5	MRHV5	MRDV5	1.30	3.20									
6	MRHV6	MRDV6	1.30	3.90									
8	MRHV8	MRDV8	1.30	5.40									
10	MRHV10	MRDV10	1.30	6.80									
13	MRHV13	MRDV13	1.90	8.80									
16	MRHV16	MRDV16	1.90	10.80									
20	MRHV20	MRDV20	1.90	13.60									
25	MRHV25	MRDV25	1.90	17.00									
32	MRHV32	MRDV32	1.90	22.00									
38	MRHV38	MRDV38	1.90	27.00									
40	MRHV40	MRDV40	1.90	27.00									

EXAMPLE: 12 MRDV L 25.0 P 15.0 W 5.0 A2 SKF

* Refer to page 43 for Locking Device Information.

Blank Punches

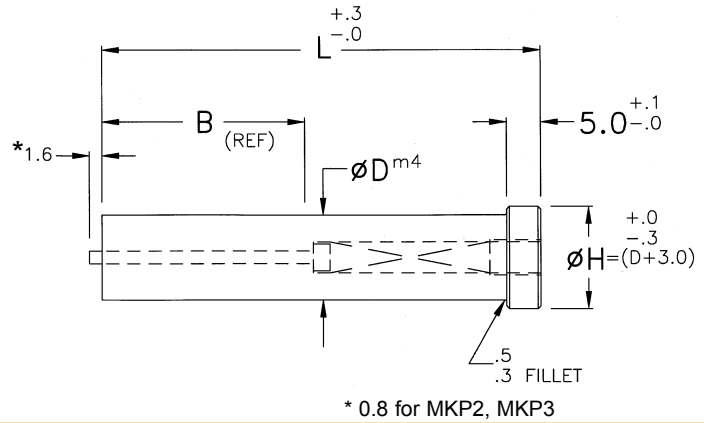
Material: M2—High Speed Steel
Hardness: M2: Rc 60-63; Head: Rc 40-55

How to order:
(MBKV) Please specify: Quantity, Catalog Number, Length Code, Material.

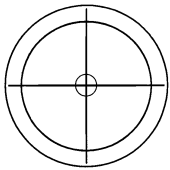
See ordering examples.

NOTE: Other materials available as specials.

Shaded Areas represent standard products.
 Others available upon request.



MBKV (PUNCH BLANK)



Shank Dia.	Cat. No.	Point Length	Overall Length											Ejector Group
			40.0	45.0	50.0	56.0	60.0	63.0	70.0	71.0	80.0	90.0	100.0	
D		B												
5	MBKV5	13.0												MKP2
6	MBKV6													MKP3
8	MBKV8													MKP4
10	MBKV10													MKP6
13	MBKV13													MKP6
16	MBKV16													MKP9
20	MBKV20													MKP9
25	MBKV25												MKP9	
5	MBKV5	25.0												MKP2
6	MBKV6													MKP3
8	MBKV8													MKP4
10	MBKV10													MKP6
13	MBKV13													MKP6
16	MBKV16													MKP9
20	MBKV20													MKP9
25	MBKV25												MKP9	

EXAMPLE: 6 MBKV 13 L 63.0 M2

Blank Punches

Material: M2—High Speed Steel

Hardness: M2: Rc 60-63; Head: Rc 40-55

How to order:

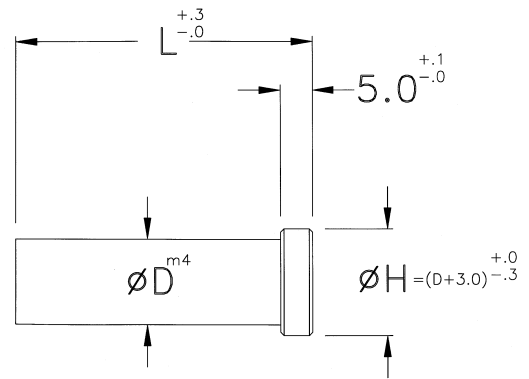
(MBPV) Please specify: Quantity, Catalog Number, Length Code, and Material.

See ordering examples.

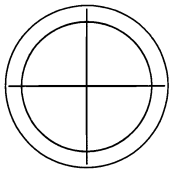
Shaded Areas represent standard products.

Others available upon request.

NOTE: Other materials available as specials.



MBPV (PUNCH BLANK)



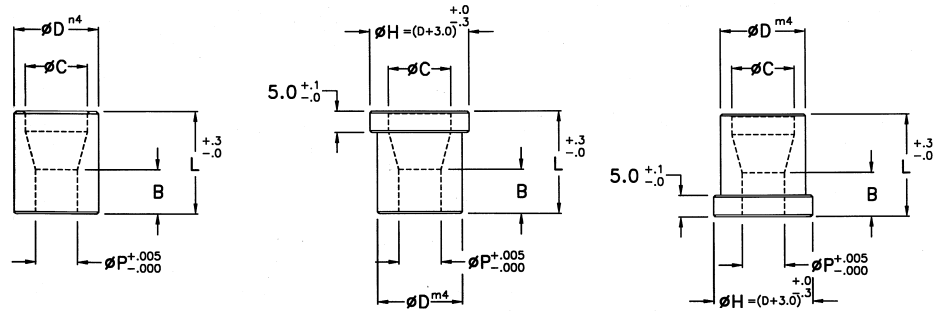
Shank Dia.	Cat. No.	Overall Length											
		32.0	40.0	45.0	50.0	56.0	60.0	63.0	70.0	71.0	80.0	90.0	100.0
5	MBPV5												
6	MBPV6												
8	MBPV8												
10	MBPV10												
13	MBPV13												
16	MBPV16												
20	MBPV20												
25	MBPV25												

EXAMPLE: 6 MBPV 13 L 56.0 M2

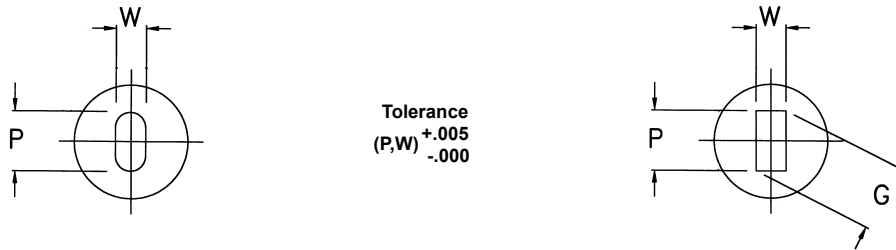
Round, Oblong, Rectangle, Square

Material: A2—5% Chrome
Hardness: Rc 60-63
Concentricity: (P:D) .008 T.I.R. (Max.)

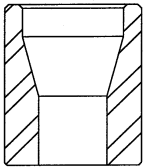
How to order:
Please specify: Quantity, Catalog Number, Length Code, Hole Dimensions, Material, and if desired, Standard or Custom Locking Device.
See ordering examples.
 Shaded Areas represent standard products.
 Others available upon request.



Rectangle: $G = -W^2 + P^2$



M_GV (HEADLESS)

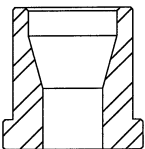


Body Dia.	Catalog Numbers			Hole Range			Overall Length				Lead In Dia.	
	D	Round	Oblong	Rect/Sq.	P Min	P/G Max	W Min	8.0	10.0	13.0	16.0	C
5	MCGV5	MOGV5	MRGV5	1.60	3.20	1.30						3.6
6	MCGV6	MOGV6	MRGV6	1.60	3.90	1.30						4.6
8	MCGV8	MOGV8	MRGV8	2.40	5.40	1.30						6.6
10	MCGV10	MOGV10	MRGV10	3.20	6.80	1.30						8.2
13	MCGV13	MOGV13	MRGV13	5.40	8.80	1.90						11.4
16	MCGV16	MOGV16	MRGV16	7.40	10.80	1.90						-

Example: 6 MCGV 5 L 13.0 P 2.5 A2

*Refer to page 43 for Locking Device Information.

M_UV (HEAD DOWN)

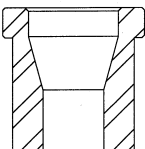


Body Dia.	Catalog Numbers			Hole Range			Overall Length				Lead In Dia.	
	D	Round	Oblong	Rect/Sq.	P Min	P/G Max	W Min	8.0	10.0	13.0	16.0	C
5	MCUV5	MOUV5	MRUV5	1.60	3.20	1.30						3.6
6	MCUV6	MOUV6	MRUV6	1.60	3.90	1.30						4.6
8	MCUV8	MOUV8	MRUV8	2.40	5.40	1.30						6.6
10	MCUV10	MOUV10	MRUV10	3.20	6.80	1.30						8.2
13	MCUV13	MOUV13	MRUV13	5.40	8.80	1.90						11.4
16	MCUV16	MOUV16	MRUV16	7.40	10.80	1.90						-

Example: 6 MOUV 5 L 13.0 P 2.5 W 1.9 A2

*Refer to page 43 for Locking Device Information.

M_TV (HEAD UP)



Body Dia.	Catalog Numbers			Hole Range			Overall Length				Lead In Dia.	
	D	Round	Oblong	Rect/Sq.	P Min	P/G Max	W Min	8.0	10.0	13.0	16.0	C
5	MCTV5	MOTV5	MRTV5	1.60	3.20	1.30						3.6
6	MCTV6	MOTV6	MRTV6	1.60	3.90	1.30						4.6
8	MCTV8	MOTV8	MRTV8	2.40	5.40	1.30						6.6
10	MCTV10	MOTV10	MRTV10	3.20	6.80	1.30						8.2
13	MCTV13	MOTV13	MRTV13	5.40	8.80	1.90						11.4
16	MCTV16	MOTV16	MRTV16	7.40	10.80	1.90						-

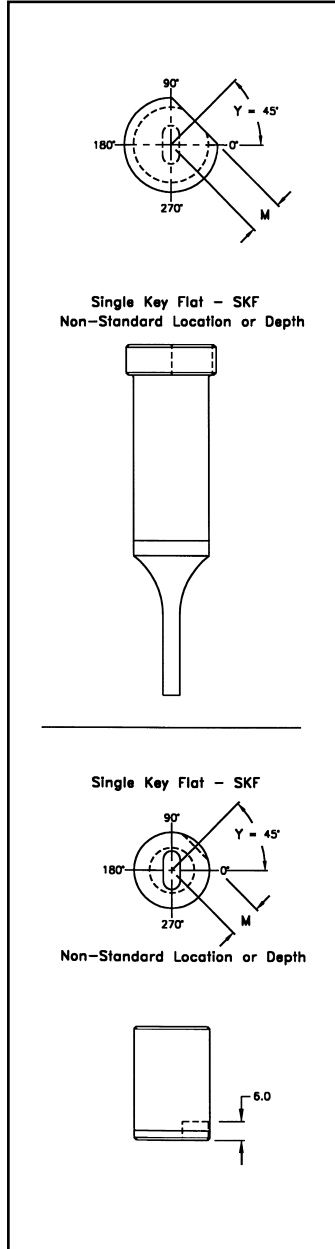
Example: 6 MRTV 5 L 13.0 P 2.5 W 1.9 A2 SKF

*Refer to page 43 for Locking Device Information.

Custom and Standard Locations

Custom

Shape orientation, key flat and dowel slot depth to be specified by customer.



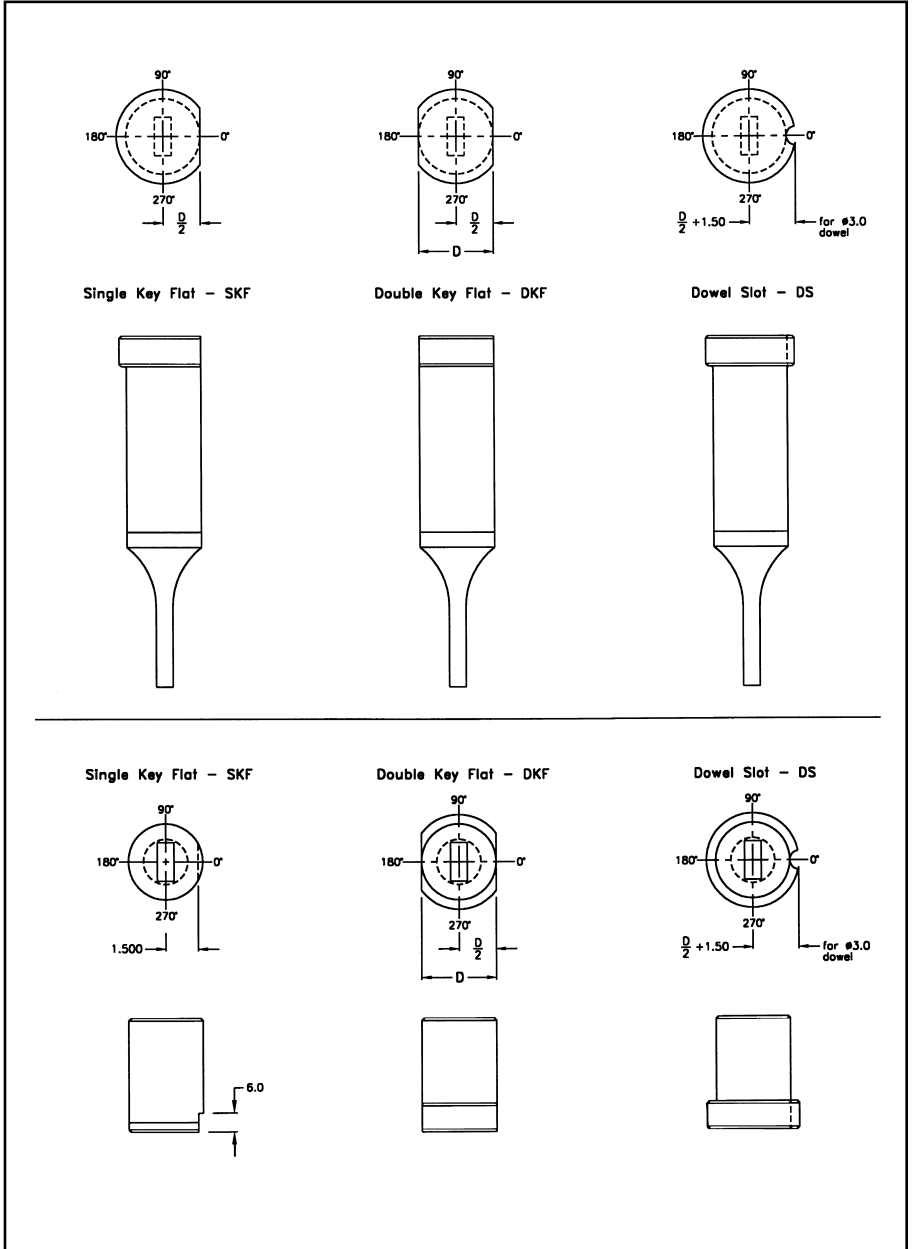
How to order Custom Location:

Specify: Type, Angle(Y), and Depth(M)

EXAMPLE: 4 MOKV 13 L 70.0 SBR 19.0 P 12.0
W 5.0 M2 SKF Y 45° M 3.96

STANDARD

Shape orientation is established by the polar positions shown below, at 0°. Standard Key Flat and Dowel Slot Depth is as shown.

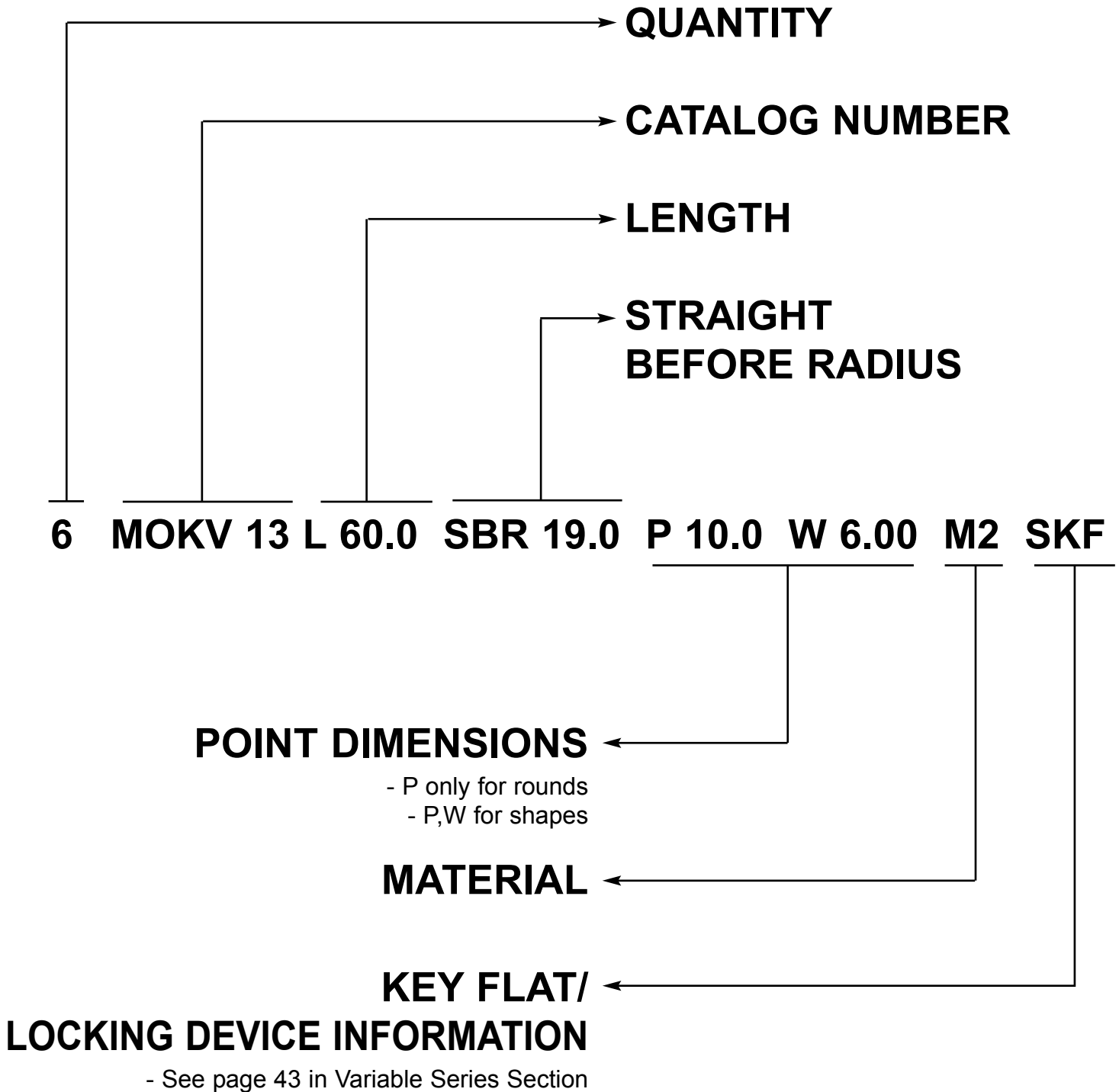


How to order Standard Location:

Specify: Type

EXAMPLE: 4 MOKV 13 L 70.0 SBR 19.0 P 12.0 W 5.0 M2 SKF

Variable Precision Series Punches and Dies



Basic and Ball Lock Series

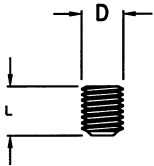
Available in single sets which include pin, spring and set screw; or individual components in minimum quantities of 10 pieces.

Please specify: quantity and catalog number.

Catalog Numbers			
Ejector Group Sets	Set Screws	Spring	Pin
MKP2	MKPW2	MKPS2	MKPP2
MKP3	MKPW3	MKPS3	MKPP3
MKP4	MKPW4	MKPS4	MKPP4
MKP6	MKPW6	MKPS6	MKPP6
MKP9	MKPW9	MKPS9	MKPP9

Ordering Example: 3 KP 3 Ejector Sets.

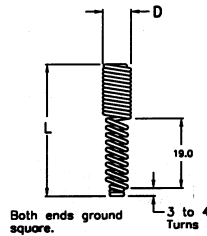
MKPW (SET SCREW)



Available only in min. qty. of 10 units. To order, specify quantity & catalog number. See ordering example.

Catalog Number	D	L
MKPW2	M2.6	5.0
MKPW3	M3	5.0
MKPW4	M4	5.0
MKPW6	M5	5.0
MKPW9	M6	6.0

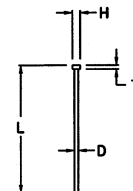
MKPS (SPRING)



Available only in min. qty. of 10 units. To order, specify quantity & catalog number. See ordering example.

Catalog Number	D	L
MKPS2	2.05	60.3
MKPS3	2.40	60.3
MKPS4	3.25	81.0
MKPS6	4.25	76.2
MKPS9	5.00	68.9

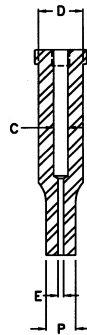
MKPP (PIN)



Available only in min. qty. of 10 units. To order, specify quantity & catalog number. See ordering example.

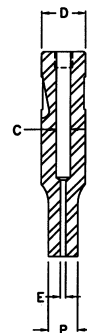
Catalog Number	D	L	H	T
MKPP2	0.38	27.9	1.2	0.8
MKPP3	0.69	35.1	1.9	1.2
MKPP4	1.04	49.3	2.4	1.6
MKPP6	1.47	49.3	3.2	1.6
MKPP9	2.26	55.9	4.0	2.4

MKP (BASIC & VARIABLE PRECISION)



Basic Series Standard Ejector Data			
Ejector Group	Std. Shank Dia.	Point Hole Dia.	Shank Hole Dia.
	D	E	C
MKP2	5.0	0.51	2.18
MKP3	6.0	0.81	2.50
MKP4	8.0	1.17	3.30
MKP6	10.0-13.0	1.60	4.37
MKP9	16.0-25.0	2.39	5.08

MKP (BALL LOCK)



Ball Lock Standard Ejector Data			
Ejector Group	Std. Shank Dia.	Point Hole Dia.	Shank Hole Dia.
	D	E	C
MKP3	6.0	0.81	2.50
MKP4	10.0	1.17	3.30
MKP6	13.0-16.0	1.60	4.37
MKP9	20.0-25.0	2.39	5.08

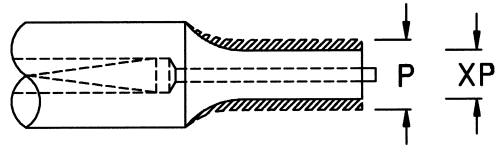
Alterations

The manufacture of components with dimensions outside the ranges listed as standard in the catalog. The limits for each standard dimensions are available on request, and there will be an additional charge for these components.

Punches

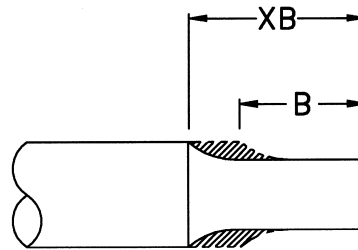
XP, XW

Point Dimensions (round or shapes) smaller than standard.



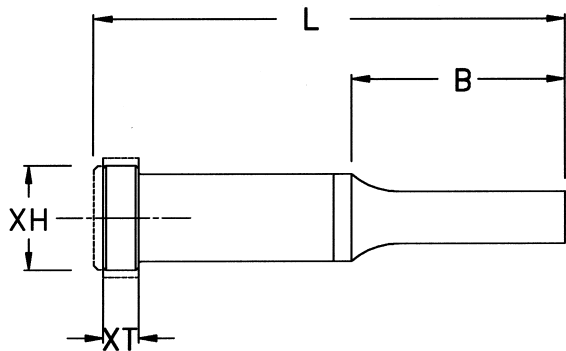
XB

Point longer than standard. Add **R** to code for rounds, **S** for shapes.



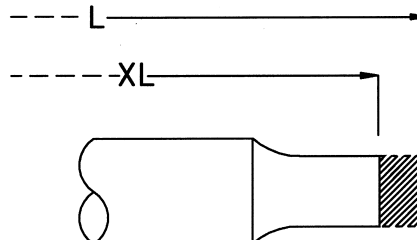
XT, XH

XT Reduced head thickness, and OAL. **XH** Reduced head diameter.



XL

Reduced overall length. Stock removed from point end, which also reduces B length.



Alterations

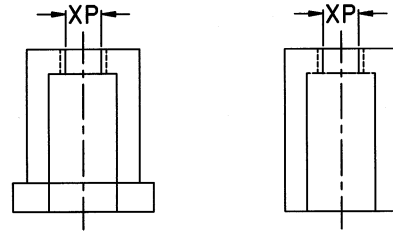
The manufacture of components with dimensions outside the ranges listed as standard in the catalog. The limits for each standard dimensions are available on request, and there will be an additional charge for these components.

Die Buttons

XP, XP/XW

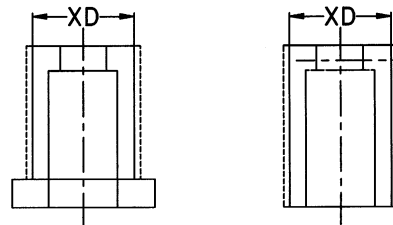
XP Hole smaller or larger than standard.

XP/XW Shape dimension smaller or larger than standard.



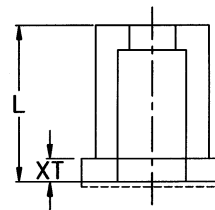
XD

Reduced shank diameter.



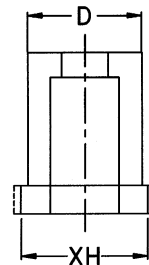
XT

Reduced head thickness, and OAL.



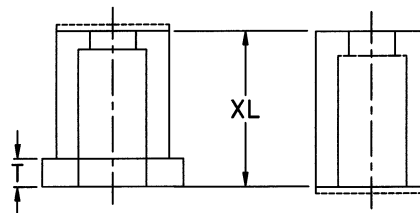
XH

Reduced head diameter.



XL

Shortened overall length. For Headed Buttons, material is moved from land end. For Headless Buttons, material is removed from relief end.



Calculation of Perforating Pressure

The formula for the force required to perforate a given material, using flat faced punches and dies, is

P=LTS

P=Punching load in Newtons

L=Length of cut in millimeters, use the circumference (π D) for round holes and the perimeter for holes of other shapes.

T=Thickness of material in millimeters

S=Ultimate shear strength of material in Mega-Pascals

EXAMPLE:

Material-AISI 1020 Cold Rolled Steel, 80mm thick

Punch or Hole Diameter 9.5mm

P=LTS=29.845mm x 345MPa=8237N

L=29.845mm from Circumference Chart

S=345 MegaPascals from shear strength table

LOAD DISTRIBUTION:

To determine whether a punch or die button will "sink" into the die set plates, calculation of the force per unit area by the formula **Sc: P** where:

As

Sc=Compressive stress, in MegaPascals

P=Perforation load in Newtons

A= Surface area, in square millimeters

Punches - Head Type...Use head area (Ball-Lock type are normally used with hardened backing plate)

Die Button - Head Type...Use head area minus slug hole area

Headless...Use body area minus slug hole area. If the calculated compressive strength(**Sc**) is greater than 138 MegaPascals Select a larger punch shank or body dia. or use a hardened backing plate. This rule applies for both all steel and semi-steel die set punch plates.

EXAMPLE:

Punching Load(**P**) = 8237 Newtons

Punch Data: Point Dia. 9.5mm

Shank Dia. 13.0mm

Head Dia. 16.0mm

Die Button Data: Body Dia. 25.0mm

Relief Hole Dia. 12.0mm

(See Dec. Equiv. Chart for areas)

Sc = P / A = 8237N / 201 mm sq = 41 MPa

A 201 mm sq.

Since **Sc** is less than 138 MegaPascals the punch head will not "sink" into the die set plate.

Sc = P / A = 8237N / 491 mm sq = 22 MPa

A (491-113) mm sq.

Sc is less than 138 MegaPascals and the die button will not "sink".

Shear Strength Chart

Material Description	Hardness	Ultimate		Material Description	Hardness	Ultimate	
		Tensile MPa	Shear MPa			Tensile MPa	Shear MPa
STEELS				ALUMINUM BASE*			
Low Carbon, H.R. Sheet ASTMA-415	Rb 70	414	345	ALLOY - TEMPER			
Low Carbon, C.R. Sheet Special Killed Drawing Quality	Rb 50	345	276	1100- 0	BHN23	90	62
Low Carbon, C.R. Sheet (Soft)	Rb 46-50	366	290	- H14	BHN32	124	76
(1/4 Hard)	Rb 60-75	414	310	2024- 0	BHN47	186	124
(1/2 Hard)	Rb 70-85	497	345	-T3	BHN120	483	283
(Hard)	Rb 80-95	635	421	3003- 0	BHN28	110	76
.40-.50% Carbon Steel	BHN200	690	552	- H14	BHN40	152	97
H.R. Steel				- H16	BHN47	179	103
SAE 1074 C.R.Annealed Spring Steel	Rb 90	655	517	3105- H25	BHN47	179	110
SAE 1095 C.R.Annealed Spring Steel	Rb 95	690	552	5005- H34	BHN41	159	97
SAE 1074 or 1095 Spring Steel	Rc 45-50	1793	1379	5052- 0	BHN47	193	124
Hardened to Spring Temper				5052- H32	BHN60	228	138
Abrasion-Resisting	BHN200/245	828	690	6061- 0	BHN30	124	83
Cor-Ten Steel	BHN140	483	345	-T6	BHN95	310	207
Tri-Ten Steel	BHN120	414	345	7075- 0	BHN60	228	152
T-1 Steel (Types A&B)	BHN260	897	724	-T6	BHN150	572	331
100,000 P.S.I. Y.S.							
STAINLESS STEEL				COPPER BASE			
202-Annealed	Rb 95	759	621	**ALLOY- TEMPER			
302, 303, 304-Annealed	Rb85	655	517	110- Electrolytic Tough			
310-Annealed	Rb90	724	621	Pitch Copper			
316, 321, 430-Annealed	Rb 90	655	517	- .050mm G.S.	Rb40	221	152
410-Annealed	Rb85	586	517	-1/2 Hard	Rb40	290	179
				-Hard	Rb50	345	193
				220 Comm Bronze, 90 %			
				-1/2 Hard	Rb58	359	241
				320 Red Brass, 85 %			
				-1/4 Hard	Rb55	345	241
				260 Cartridge Brass, 70 %			
				- .035mm G.S.	Rf68	338	234
				-1/2 Hard	Rb70	428	276
				-Spring	Rb91	648	331
				280 Muntz Metal			
				-1/8 Hard	Rb55	414	290
				342-A High Leaded Brass			
				-1/2 Hard	Rb70	421	276
				675 Manganese Bronze, A			
				-Soft Anneal	Rb65	448	290

* 500 Kg Load 10mm Ball

** Copper Development Association No.

Decimal Equivalents Chart

Metric Circumference and Area Chart					
Dia. mm.	Circum. mm.	Area Sq. mm.	Dia. mm.	Circum. mm.	Area Sq. mm.
0.5	1.57080	0.19635	25.5	80.11061	510.70516
1.0	3.14159	0.78540	26.0	81.68141	530.92916
1.5	4.71239	1.76715	26.5	83.25221	551.54586
2.0	6.28319	3.14159	27.0	84.82300	572.55526
2.5	7.85398	4.90874	27.5	86.39380	593.95736
3.0	9.42478	7.06858	28.0	87.96459	615.75216
3.5	10.99557	9.62113	28.5	89.53539	637.93966
4.0	12.56637	12.56637	29.0	91.10619	660.51986
4.5	14.13717	15.90431	29.5	92.67698	683.49275
5.0	15.70796	19.63495	30.0	94.24778	706.85835
5.5	17.27876	23.75829	30.5	95.81858	730.61664
6.0	18.84956	28.27433	31.0	97.38937	754.76764
6.5	20.42035	33.18307	31.5	98.96017	779.31133
7.0	21.99115	38.48451	32.0	100.53096	804.24772
7.5	23.56194	44.17865	32.5	102.10176	829.57681
8.0	25.13274	50.26548	33.0	103.67256	855.29860
8.5	26.70354	56.74502	33.5	105.24335	881.41309
9.0	28.27433	63.61725	34.0	106.81415	907.92028
9.5	29.84513	70.88218	34.5	108.38495	934.82016
10.0	31.41593	78.53982	35.0	109.95574	962.11275
10.5	32.98672	86.59015	35.5	111.52654	989.79804
11.0	34.55752	95.03318	36.0	113.09734	1017.87602
11.5	36.12832	103.86891	36.5	114.66813	1046.34670
12.0	37.69911	113.09734	37.0	116.23893	1075.21009
12.5	39.26991	122.71846	37.5	117.80972	1104.46617
13.0	40.84070	132.73229	38.0	119.38052	1134.11495
13.5	42.41150	143.13882	38.5	120.95132	1164.15643
14.0	43.98230	153.93804	39.0	122.52211	1194.59061
14.5	45.55309	165.12996	39.5	124.09291	1225.41748
15.0	47.12389	176.71459	40.0	125.66371	1256.63706
15.5	48.69469	188.69191	40.5	127.23450	1288.24934
16.0	50.26548	201.06193	41.0	128.80530	1320.25431
16.5	51.83628	213.82465	41.5	130.37610	1352.65199
17.0	53.40708	226.98007	42.0	131.94689	1385.44236
17.5	54.97787	240.52819	42.5	133.51769	1418.62543
18.0	56.54867	254.46900	43.0	135.08848	1452.20120
18.5	58.11946	268.80252	43.5	136.65928	1486.16967
19.0	59.69026	283.52874	44.0	138.23008	1520.53084
19.5	61.26106	298.64765	44.5	139.80087	1555.28471
20.0	62.83185	314.15927	45.0	141.37167	1590.43128
20.5	64.40265	330.06358	45.5	142.94247	1625.97055
21.0	65.97345	346.36059	46.0	144.51326	1661.90251
21.5	67.54424	363.05030	46.5	146.08406	1698.22718
22.0	69.11504	380.13271	47.0	147.65485	1734.94454
22.5	70.68583	397.60782	47.5	149.22565	1772.05461
23.0	72.25663	415.47563	48.0	150.79645	1809.55737
23.5	73.82743	433.73614	48.5	152.36724	1847.45283
24.0	75.39822	452.38934	49.0	153.93804	1885.74099
24.5	76.96902	471.43525	49.5	155.50884	1924.42185
25.0	78.53982	490.87385	50.0	157.07963	1963.49541

Punch and Die Materials Offered by Danly IEM

High strength tool steels are used in punch components and are heat treated to assure uniform characteristics and relieve thermal stresses. The structural strength is also enhanced by the precision grinding process, which minimizes stress concentration.

The standard steels used include:

A2

A2 - 5% chrome - high performance tool steel. Hardness Rc 60 - 63.

A good combination of toughness and wear resistance, it is used where shock and abrasion are prime considerations.

M2

M2 - HSS triple tempered high speed steel. Hardness Rc 60 - 63.

Suitable for long runs where abrasion resistance is a main requirement. It also will withstand high temperatures without softening, and this makes it suitable for perforating at high speeds.

PM4

PM4 - High vanadium, high carbon particle metal steel. Also triple tempered. Hardness Rc 62 - 64.

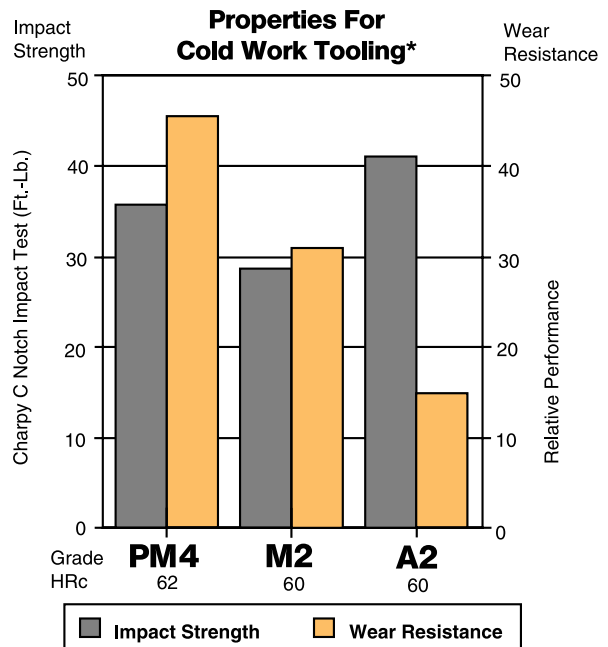
PM4 has improved wear and impact characteristics over M2, together with the ability to withstand high temperatures without softening.

Selection of a suitable steel

Danly IEM will assist you with your material selection, to help you gain optimum performance from your punches and die buttons.

If you do not select a steel for the punches and dies that you order, Danly IEM will supply M2 for punches, and A2 for die buttons.

Comparative properties



Other steels available

Danly IEM will also make available other types of tool steel, on special order, to meet any custom requirement you may have.

Surface Coating of Punches

Available as a service to Danly Customers, for applications requiring special wear resistance and lubricity.

A Selection of more popular Physical Vapor Deposition (PVD) Coatings Suitable for Metal Forming and Piercing Punches is given below.

PVD coatings generally have a film thickness of 40 - 200 micro-inches (1-5 microns). Since the recommended application is PVD, as opposed to CVD (Chemical Vapor Deposition), there is minimal effect on the heat treated hardness of the punch material. Danly does not usually recommend the use of CVD coatings, for this reason.

TiN (Titanium Nitride)

An excellent general purpose coating for the protection of punch surfaces against abrasive and adhesive wear.

TiCN (Titanium Carbonitride)

This coating has a fine grain interlocked structure that has excellent toughness. It is particularly effective for punching applications that encounter excessive mechanically stressed cutting edges. Also effective in the punching of highly abrasive and/or gummy materials, such as brass, stainless steel, and aluminum alloys.

CrN (Chromium Nitride)

Suitable for wear problems where titanium-based coatings are not successful. It resists adhesive wear, corrosion, and oxidation, and is recommended primarily for use with titanium and copper.

Strip/part Material	Suitable Coating
Ferrous	TiCN/TiN
Aluminum	TiCN/TiN
Copper	CrN/TiCN
Titanium	TiCN/CrN
Nickel	TiCN/CrN

Physical Properties of these Coatings

Coating Type	Visual Appearance	Vickers Micro-Hardness	Thermal Stability	Dry Coeff. of Friction vs. Steel	Resist. to Abrasive Wear	Protection vs. Cold Welding and Galling
TiN	Gold/Yellow	2300 (80-85 Rc)	1100° F (600°C)	0.4	Very Good	Excellent
TiCN	Blue/Gray	3000 (90 Rc)	750° F (400°C)	0.3	Excellent	Excellent
CrN	Silver/Gray	1750 (75-80 Rc)	1300° F (700°C)	0.5	Good	Very Good

General Ranking of Coatings by Key Characteristics

Key Characteristic	1	2	3
Hardness	TiCN	TiN	CrN
Toughness	TiCN	TiN	CrN
Heat Transmission	CrN	TiN	TiCN
Chemical Stability	TiN	TiCN	CrN
Corrosion Resistance	CrN	TiCN	TiN

Technical Information supplied courtesy of Balzers Tool Coating Inc.

Ordering Information

After catalog number, dimensions, and material, specify "TiN coated", or other coating selected.

Nitriding as a surface treatment is also available on request.