

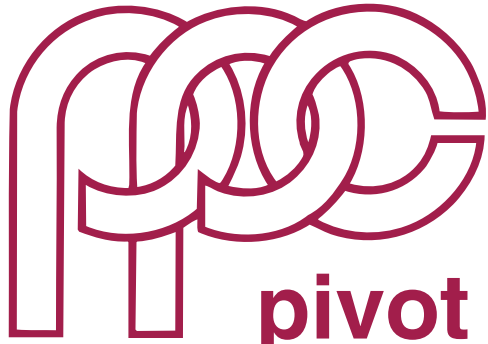
Selective

Catalog 4000



pivot punch corporation

January 2004



pivot punch corporation

SELECTIVE SERIES

MULTIPLE POINT LENGTH PRECISION
PUNCHES AND DIE COMPONENTS

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All Selective Series items in this section are manufactured to NAPMA standards.

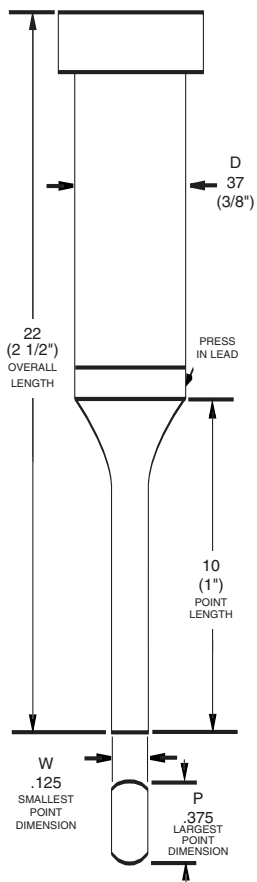
PIVOT SELECTIVE SERIES

HEAD TYPE PUNCHES,
DIE BUTTONS AND GUIDES,
EXPANDED SERIES,
PUNCHES AND DIES,
PERFORATORS

AVAILABLE FROM STOCK . . .

The complete line of precision punches, die buttons and other standard products offered in this catalog are available from stock or custom ground from stock. For your ordering convenience, Pivot maintains a complete inventory to meet your requirements in the shortest possible time.

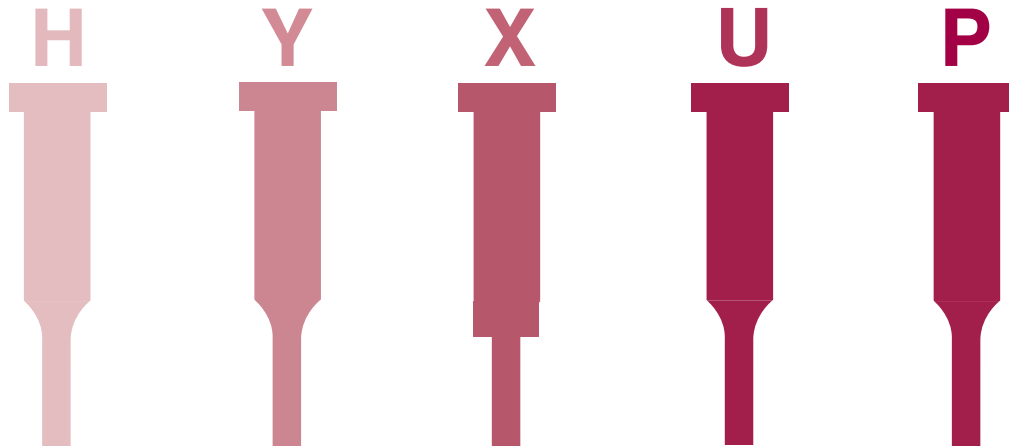
Heads of shoulder type punches are HOT FORGED to minimize breakage. Grain flow lines are uninterrupted and conform to the contour of the head, assuring maximum structural strength.



Note: Use of W and P to show largest and smallest point dimension is common to all items shown in this catalog.

IMPORTANT: When ordering Pilot Nose Punches specify length as same dimension as piercing punch. Pilot Nose punches are furnished with 1/4" pilot nose in addition to specified length.

TONDRA®
This exclusive surface treatment, available on all HSS punches and die buttons, imparts a glass hard surface (Rockwell 72-75) and offers the ultimate in resistance to abrasion, firing and galling. Performed after finished grinding, at temp. in excess of 1000°F, this treatment affords an excellent stress relieving and imparts maximum toughness for longer punch life. Recognized by its dull, mottled oxide finish, this treatment may be varied in depth for special ratio piercing, heading, forming, drawing and shaving applications. (.050 min.)



M2 HIGH SPEED STEEL

Recommended for a greater variety of industrial uses, including many "hot work" applications, this Molly-tough, high vanadium, high speed (M-2) tool steel offers uniform hardening quality, superior wear resistance and high impact strength.

STRAIGHT GROUND® TONDRA® TREATED

Grind lines are parallel to the axis and perpendicular to the line of potential fractures. This patented feature, exclusive with Pivot, resists wear, minimizes "pick-up" and achieves maximum strength and punchability. Available in M2 and PM.

Pivot's WHIP-SLEEVE®

STRAIGHT GROUND® TONDRA® TREATED punches are capable of piercing metal thicknesses which exceed the diameter of the punches. A vibration absorbing, inert metal sleeve is cast at the point of the punch where failure normally occurs, thus greatly increasing punch life. When used with a bushing in the stripper it eliminates whipping or shifting and transfers side thrust to the stripper rather than imposing all the force on the working point. Available in M2 and PM.

PM 3 ULTIMATE - EXTREME TOUGHNESS (IMPACT STRENGTH) AND HIGH WEAR

No high wear material has ever seen this amount of toughness before. Strength approaching S-7 material, wear exceeding M2 or D2. AVAILABLE IN BASIC HEAD TYPE, PUNCHES, SOLID, EJECTOR AND HEAVY DUTY BALL LOCK.

PM STEEL

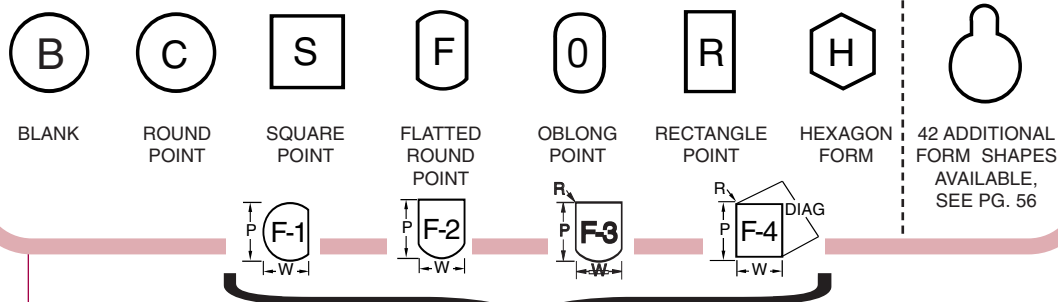
A unique high alloy Particle Metal Steel which provides exceptionally high wear resistance while maintaining very good toughness and strength characteristics. Due to their exceptionally high wear resistance, PM punches have also proven to be cost-effective when replacing carbide in many applications. All Pivot PM products are triple tempered for maximum strength and toughness.

FOR ADDITIONAL APPLICATION INFORMATION SEE COLOR-KEYED PUNCH SELECTION CHART 58-59.

AVAILABLE IN OUR SELECTIVE SERIES.

HOW TO ORDER Steel Shape
H **O**

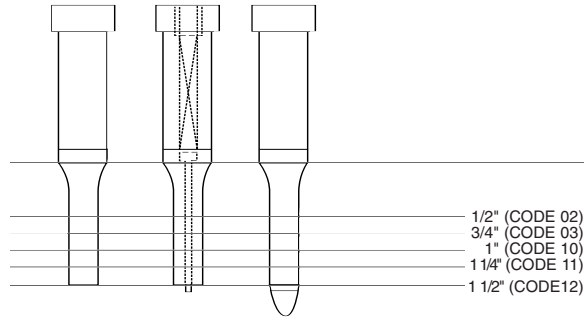
THIS SIMPLIFIED CATALOG ORDER CODE IS DESIGNED TO MAKE PUNCH, DIE BUTTON AND GUIDE BUSHING SELECTION EASIER AND MORE ACCURATE FOR YOU!



STANDARD FORM SHAPES

BODY DIAMETER — Available in 10 fractional body diameters, held to a press fit tolerance of $+.0002$ to $+.0004$. Press-in lead will be furnished unless otherwise specified. Order designation first two numbers of decimal equivalent.

OVERALL LENGTH — A full range to meet most applications. Order designation: first numeral — inch increments, second numeral — quarter inch increments

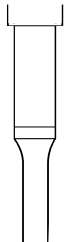


Point Length — Five selective lengths from 1/2" (code 02) to 1-1/2" (code 12) in 1/4" increments, to meet most die building requirements. These standard lengths afford the opportunity to select longer point lengths where additional guiding or point life is a factor

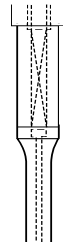
"P" LARGEST POINT DIMENSION — Available in .0001 increments at standard catalog prices.

"W" SMALLEST POINT DIMENSION — Available in .0001 increments at standard catalog prices. Use only where two dimensions are necessary to describe points.

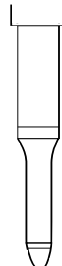
"P" PUNCH
PIERCING
PUNCHES IN
A WIDE
RANGE OF
SIZES



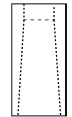
"E" EJECTOR
ASSURES
POSITIVE
SLUG EJECT-
TION



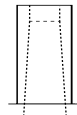
"N" PILOT NOSE
FOR EXTREME
ACCURACY IN
LOCATING STRIPS
FROM STATION TO
STATION ON PRO-
GRESSIVE DIES



"D" PRESS FIT,
HEADLESS DIE
BUTTONS, M2 OR
PM STEEL



"H" PRESS FIT,
HEAD TYPE DIE
BUTTONS, M2
OR PM STEEL

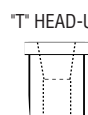


"B" HEAD-DOWN
GUIDE BUSHINGS
M2 STEEL ONLY

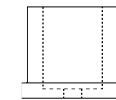
"S" TWO-STEP GUIDE AND
STRIPPER BUSHINGS. A-
2 STEEL ONLY



"G" HEADLESS



"T" HEAD-UP



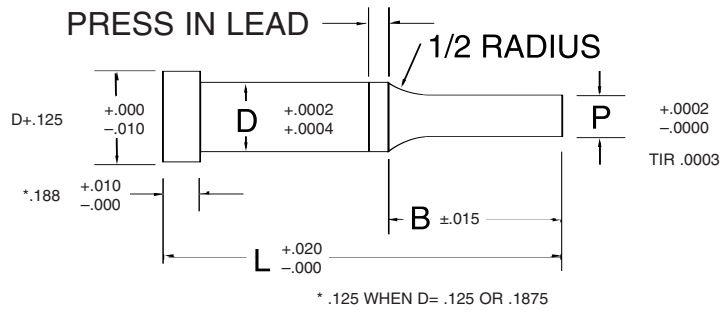
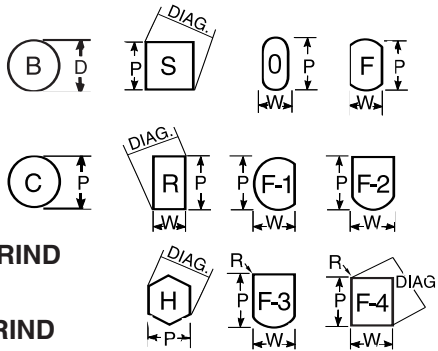
"OVERALL LENGTH
DIE BUTTONS AND
GUIDES INDICATED
BY TWO OR THREE
DIGIT DECIMAL.

**TOLERANCE
AVAILABLE**
($+.0002$, $-.0000$)
TIR $.0003$ — for the most
exacting requirements

SOLID PUNCHES

STEEL: M2 R/C 60-62
PM R/C 60-62
HEADS DRAWN R/C 40-55

H()P
M-2 STEEL
P()P
PM STEEL
Y()P
M-2 STRAIGHT GRIND
PY()P
PM STRAIGHT GRIND



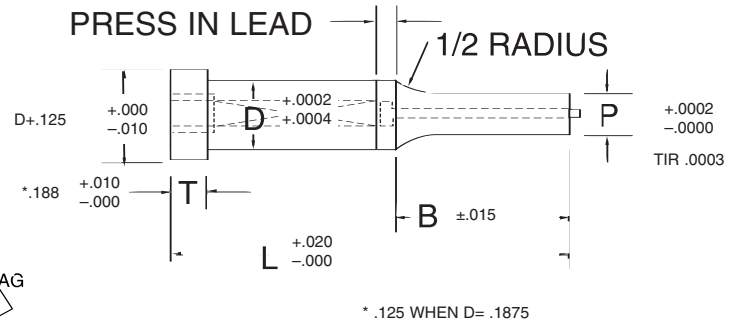
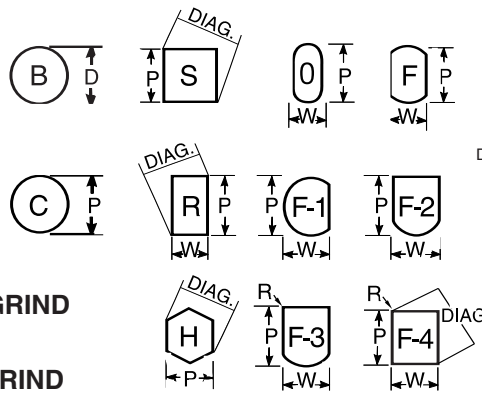
Shank		Point Length B	Round		Shape			Overall Length L														
D	Code		Min SP	Range P	Min SW	Min W	Max Diag	1.25	1.50	1.75	2.00	2.25	2.50	2.75	3.00	3.25	3.50	3.75	4.00			
.1250	12	.50	.031	.031-.1250	.062	.062-.1250																
.1875	18		.042	.046-.1875	.062	.062-.1875																
.2500	25		.062	.062-.2500	.062	.062-.2500	1102	1202	1302	2002	2102	2202	2302	3002	3102	3202	3302	4002				
.3125	31		.062	.093-.3125	.062	.093-.3125																
.3750	37		.062	.125-.3750	.080	.125-.3750																
.1250	12	.75	.042	.062-.1250	.062	.062-.1250																
.1875	18		.042	.062-.1875	.062	.062-.1875																
.2500	25		.062	.062-.2500	.062	.062-.2500																
.3125	31		.062	.093-.3125	.062	.093-.3125																
.3750	37		.062	.125-.3750	.080	.125-.3750		1203	1303	2003	2103	2203	2303	3003	3103	3203	3303	4003				
.4375	43		.093	.187-.4375	.109	.187-.4375																
.5000	50		.125	.225-.5000	.125	.187-.5000																
.6250	62		.235	.310-.6250	.235	.250-.6250																
.7500	75		.300	.390-.7500	.235	.312-.7500																
.8750	87		.355	.440-.8750	.300	.343-.8750																
1.000	100	.400	.485-1.000	.235	.375-1.000																	
.1250	12	1.00	.058	.062-.1250	.062	.062-.1250																
.1875	18		.058	.062-.1875	.062	.062-.1875																
.2500	25		.062	.062-.2500	.062	.062-.2500																
.3125	31		.062	.093-.3125	.093	.093-.3125																
.3750	37		.062	.125-.3750	.109	.125-.3750																
.4375	43		.093	.187-.4375	.109	.187-.4375																
.5000	50		.125	.225-.5000	.125	.187-.5000																
.6250	62		.235	.310-.6250	.235	.250-.6250																
.7500	75		.300	.390-.7500	.235	.312-.7500																
.8750	87		.355	.440-.8750	.300	.343-.8750																
1.000	100	.400	.485-1.000	.235	.375-1.000																	
.1250	12	1.25	.075	.093-.1250	.093	.093-.1250																
.1875	18		.075	.093-.1875	.093	.093-.1875																
.2500	25		.080	.093-.2500	.093	.093-.2500																
.3125	31		.093	.093-.3125	.093	.093-.3125																
.3750	37		.093	.125-.3750	.125	.125-.3750																
.4375	43		.093	.187-.4375	.141	.187-.4375																
.5000	50		.125	.225-.5000	.141	.187-.5000																
.6250	62		.234	.310-.6250	.235	.250-.6250																
.7500	75		.300	.390-.7500	.235	.312-.7500																
.8750	87		.355	.440-.8750	.300	.343-.8750																
1.000	100	.400	.485-1.000	.235	.375-1.000																	
.1875	18	1.50	.093	.125-.1875	.125	.125-.1875																
.2500	25		.093	.125-.2500	.125	.125-.2500																
.3125	31		.093	.125-.3125	.125	.125-.3125																
.3750	37		.125	.125-.3750	.125	.125-.3750																
.4375	43		.125	.187-.4375	.172	.187-.4375																
.5000	50		.125	.225-.5000	.172	.187-.5000																
.6250	62		.234	.310-.6250	.235	.250-.6250																
.7500	75		.300	.390-.7500	.235	.312-.7500																
.8750	87		.355	.440-.8750	.300	.343-.8750																
1.000	100		.400	.485-1.000	.235	.375-1.000																

UNIVERSAL CODE: 1101 (SEE PAGE 69)

HOW TO ORDER STEEL SHAPE PUNCH BODY DIA. CODE OVERALL LENGTH POINT LENGTH "P"

EJECTOR PUNCHES

H () E
M-2 STEEL
P () E
PM STEEL
Y () E
M-2 STRAIGHT GRIND
PY () E
PM STRAIGHT GRIND



Shank		Point Length B	Round		Shape			Overall Length L												
D	Code		Min SP	Range P	Min SW	Min W	Max Diag	1.25	1.50	1.75	2.00	2.25	2.50	2.75	3.00	3.25	3.50	3.75	4.00	
.1875	18	.50	.050	.062-.1875	.062	.062-.1875														
.2500	25		.080	.093-.2500	.080	.093-.2500	1102	1202	1302	2002	2102	2202	2302	3002						
.3125	31		.115	.125-.3125	.115	.125-.3125										3102	3202			
.3750	37		.158	.187-.3750	.158	.187-.3750												3302		
.1875	18	.75	.050	.062-.1875	.062	.062-.1875														
.2500	25		.080	.093-.2500	.080	.093-.2500														
.3125	31		.115	.125-.3125	.115	.125-.3125														
.3750	37		.158	.187-.3750	.158	.187-.3750														
.4375	43		.158	.187-.4375	.158	.187-.4375		1203	1303	2003	2103	2203	2303	3003	3103	3203	3303	4003		
.5000	50		.158	.225-.5000	.158	.250-.5000														
.6250	62		.235	.310-.6250	.235	.282-.6250														
.7500	75		.300	.390-.7500	.235	.312-.7500														
.8750	87		.355	.440-.8750	.300	.343-.8750														
1.0000	100		.400	.485-1.0000	.235	.375-1.0000														
.1875	18	1.00	.058	.062-.1875	.093	.093-.1875														
.2500	25		.080	.093-.2500	.093	.093-.2500														
.3125	31		.115	.125-.3125	.115	.125-.3125														
.3750	37		.158	.187-.3750	.158	.187-.3750														
.4375	43		.158	.187-.4375	.158	.187-.4375														
.5000	50		.158	.225-.5000	.158	.250-.5000														
.6250	62		.235	.310-.6250	.235	.282-.6250														
.7500	75		.300	.390-.7500	.235	.312-.7500														
.8750	87		.355	.440-.8750	.300	.343-.8750														
1.0000	100		.400	.485-1.0000	.235	.375-1.0000														
.2500	25	1.25	.080	.093-.2500	.093	.093-.2500														
.3125	31		.115	.125-.3125	.115	.125-.3125														
.3750	37		.158	.187-.3750	.158	.187-.3750														
.4375	43		.158	.187-.4375	.158	.187-.4375														
.5000	50		.158	.225-.5000	.158	.250-.5000														
.6250	62		.235	.310-.6250	.235	.282-.6250														
.7500	75		.300	.390-.7500	.235	.312-.7500														
.8750	87		.355	.440-.8750	.300	.343-.8750														
1.0000	100		.400	.485-1.0000	.235	.375-1.0000														
.3125	31		.115	.125-.3125	.115	.125-.3125														
.3750	37	.158	.187-.3750	.158	.187-.3750															
.4375	43	.158	.187-.4375	.158	.187-.3750															
.5000	50	.158	.225-.5000	.158	.250-.5000															
.6250	62	.235	.310-.6250	.235	.282-.6250															
.7500	75	.300	.390-.7500	.235	.312-.7500															
.8750	87	.355	.440-.8750	.300	.343-.8750															
1.0000	100	.400	.485-1.0000	.235	.375-1.0000															
.3125	31	1.50	.115	.125-.3125	.115	.125-.3125														
.3750	37		.158	.187-.3750	.158	.187-.3750														
.4375	43		.158	.187-.4375	.158	.187-.3750														
.5000	50		.158	.225-.5000	.158	.250-.5000														
.6250	62		.235	.310-.6250	.235	.282-.6250														
.7500	75		.300	.390-.7500	.235	.312-.7500														
.8750	87		.355	.440-.8750	.300	.343-.8750														
1.0000	100		.400	.485-1.0000	.235	.375-1.0000														

UNIVERSAL CODE: 1102 (SEE PAGE 69)

HOW TO ORDER

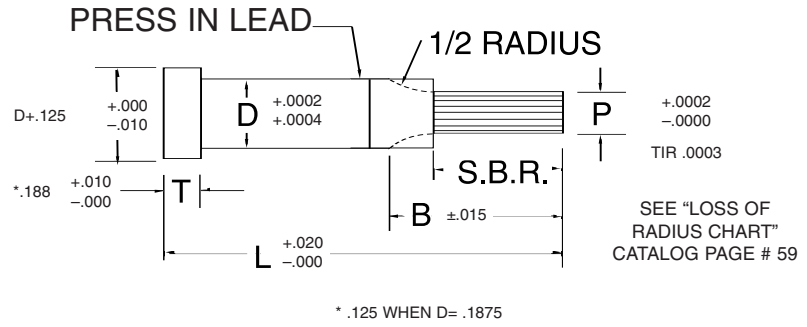
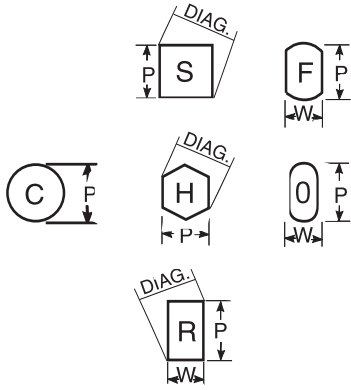
STEEL SHAPE PUNCH DIA. CODE BODY OVERALL POINT LENGTH LENGTH "T" "W"
H O E 37 22 10 X .250 X .125

PIVOT PUNCH CORPORATION / SELECTIVE SERIES
SOLID WHIPSLEEVE PUNCHES

STEEL: M-2 R/C 60/62
 PM R/C 60/62
 HEADS DRAWN TO R/C 40-55

X()P
 M-2 STEEL

PX()P
 PM STEEL



Shank		Point Length B	Round		Shape			Overall Length L								
D	Code		Min SP	Range P	Min SW	Min W	Max Diag	1.50	1.75	2.00	2.25	2.50	2.75	3.00	3.25	3.50
.1875	18	.50	.042	.046-.109	.062	.062-.109										
.2500	25		.062	.062-.125	.062	.062-.125	1202									
.3125	31		.062	.093-.172	.062	.093-.172			1302	2002	2102	2202				
.3750	37		.062	.125-.218	.080	.125-.218										
.1875	18	.75	.042	.062-.109	.062	.062-.109										
.2500	25		.062	.062-.125	.062	.062-.125										
.3125	31		.062	.093-.172	.062	.093-.172			1303							
.3750	37		.062	.125-.218	.080	.125-.218				2003						
.4375	43		.093	.187-.250	.109	.187-.250										
.5000	50		.125	.225-.297	.125	.187-.297					2103	2203	2303			
.6250	62		.235	.310-.375	.235	.250-.375								3003	3103	
.7500	75		.300	.390-.500	.235	.312-.500										
1.000	100	.400	.485-.687	.235	.375-.687											
.1875	18	1.00	.058	.062-.109	.062	.062-.109										
.2500	25		.062	.062-.125	.062	.062-.125										
.3125	31		.062	.093-.172	.093	.093-.172										
.3750	37		.062	.125-.218	.109	.125-.218										
.4375	43		.093	.187-.250	.109	.187-.250										
.5000	50		.125	.225-.297	.125	.187-.297										
.6250	62		.235	.310-.375	.235	.250-.375										
.7500	75		.300	.390-.500	.235	.312-.500										
1.000	100	.400	.485-.687	.235	.375-.687											
.1875	18	1.25	.075	.062-.109	.093	.093-.109										
.2500	25		.080	.093-.125	.093	.093-.125										
.3125	31		.093	.093-.172	.093	.093-.172										
.3750	37		.093	.125-.218	.125	.125-.218										
.4375	43		.093	.187-.250	.141	.187-.250										
.5000	50		.125	.225-.297	.141	.187-.297										
.6250	62		.234	.310-.375	.235	.250-.375										
.7500	75		.300	.390-.500	.235	.312-.500										
1.000	100	.400	.485-.687	.235	.375-.687											
.3125	31	1.50	.093	.125-.172	.125	.125-.172										
.3750	37		.125	.125-.218	.125	.125-.218										
.4375	43		.125	.187-.250	.172	.187-.250										
.5000	50		.125	.225-.297	.172	.187-.297										
.6250	62		.235	.310-.375	.235	.250-.375										
.7500	75		.300	.390-.500	.235	.312-.500										
1.000	100		.400	.485-.687	.235	.375-.687										
.3125	31															
.3750	37															
.4375	43															
.5000	50															
.6250	62															
.7500	75															
1.000	100															

HOW TO ORDER TYPE SHAPE PUNCH BODY DIA. OVERALL LENGTH POINT LENGTH "P"

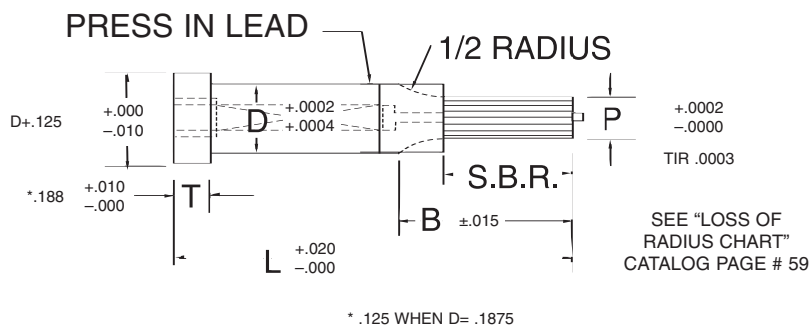
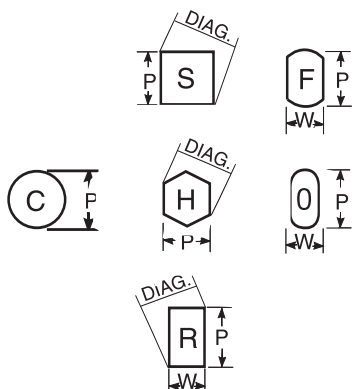
X C P 37 22 10 .187

PIVOT PUNCH CORPORATION / SELECTIVE SERIES
EJECTOR WHIPSLEEVE PUNCHES

STEEL: M-2 R/C 60/62
 PM R/C 60/62
 HEADS DRAWN TO R/C 40-55

X () E
 M-2 STEEL

PX () E
 PM STEEL

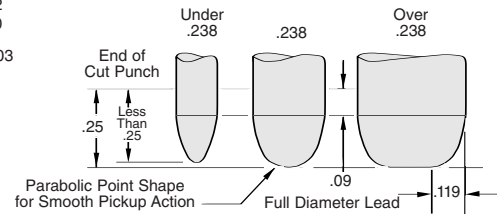
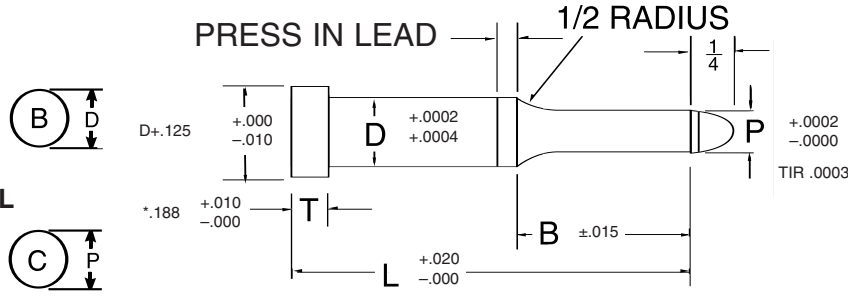


Shank		Point Length B	Round		Shape			Overall Length L											
D	Code		Min SP	Range P	Min SW	Min W	Max Diag	1.50	1.75	2.00	2.25	2.50	2.75	3.00	3.25	3.50			
.1875	18	.50	.042	.046-.109	.062	.062	.109	1202											
.2500	25		.062	.062-.125	.062	.062	.125			1302	2002	2102	2202						
.3125	31		.062	.093-.172	.062	.062	.172												
.3750	37		.062	.125-.218	.080	.080	.218												
.1875	18	.75	.042	.062-.109	.062	.062	.109												
.2500	25		.062	.062-.125	.062	.062	.125												
.3125	31		.062	.093-.172	.062	.062	.172		1303										
.3750	37		.062	.125-.218	.080	.080	.218			2003									
.4375	43		.093	.187-.250	.109	.109	.250												
.5000	50		.125	.225-.297	.125	.125	.297				2103	2203	2303						
.6250	62		.235	.310-.375	.235	.235	.375							3003	3103				
.7500	75		.300	.390-.500	.235	.235	.500												
1.000	100	.400	.485-.687	.235	.235	.687													
.2500	25	1.00	.062	.062-.125	.062	.062	.125												
.3125	31		.062	.093-.172	.093	.093	.172												
.3750	37		.062	.125-.218	.109	.109	.218		2010										
.4375	43		.093	.187-.250	.109	.109	.250												
.5000	50		.125	.225-.297	.125	.125	.297				2110	2210	2310	3010					
.6250	62		.235	.310-.375	.235	.235	.375								3110	3210			
.7500	75		.300	.390-.500	.235	.235	.500												
1.000	100		.400	.485-.687	.235	.235	.687												
.3125	31	1.25	.093	.093-.172	.093	.093	.172												
.3750	37		.093	.125-.218	.125	.125	.218												
.4375	43		.093	.187-.250	.141	.141	.250												
.5000	50		.125	.225-.297	.141	.141	.297				2111	2211	2311	3011					
.6250	62		.234	.310-.375	.235	.235	.375								3111	3211			
.7500	75		.300	.390-.500	.235	.235	.500												
1.000	100	.400	.485-.687	.235	.235	.687													

HOW TO ORDER

TYPE **X** SHAPE **C** PUNCH **E** BODY DIA. CODE **37** OVERALL LENGTH **22** POINT LENGTH **10** "P" **.187**

H()N
M-2 STEEL



UNIVERSAL CODE: 110107 (SEE PAGE 69)

* .125 WHEN D= .125 OR .1875

Shank		Point Length B	Round		Length L													
D	Code		Min SP	Range P	1.25	1.50	1.75	2.00	2.25	2.50	2.75	3.00	3.25	3.50	3.75	4.00		
.1250	12	.50	.050	.061-.1250														
.1875	18		.050	.061-.1875														
.2500	25		.061	.061-.2500	1102	1202	1302	2002	2102	2202	2302	3002						
.3125	31		.061	.092-.3125									3102	3202				
.3750	37		.061	.124-.3750												3302	4002	
.1250	12	.75	.050	.061-.1250														
.1875	18		.050	.061-.1875														
.2500	25		.061	.061-.2500														
.3125	31		.061	.092-.3125														
.3750	37		.061	.124-.3750														
.4375	43		.092	.186-.4375		1203	1303	2003	2103	2203	2303	3003	3103	3203	3303	4003		
.5000	50		.124	.224-.5000														
.6250	62		.234	.309-.6250														
.7500	75		.299	.389-.7500														
.8750	87		.354	.439-.8750														
1.0000	100	.399	.484-1.0000															
.1250	12	1.00	.057	.061-.1250														
.1875	18		.057	.061-.1875														
.2500	25		.061	.061-.2500														
.3125	31		.061	.092-.3125														
.3750	37		.061	.124-.3750														
.4375	43		.092	.186-.4375			1310	2010	2110	2210	2310	3010	3110	3210	3310	4010		
.5000	50		.124	.224-.5000														
.6250	62		.234	.309-.6250														
.7500	75		.299	.389-.7500														
.8750	87		.354	.439-.8750														
1.0000	100	.399	.484-1.0000															
.1250	12	1.25	.074	.092-.1250														
.1875	18		.074	.092-.1875														
.2500	25		.079	.092-.2500														
.3125	31		.092	.092-.3125														
.3750	37		.092	.124-.3750														
.4375	43		.092	.186-.4375				2011	2111	2211	2311	3011	3111	3211	3311	4011		
.5000	50		.124	.224-.5000														
.6250	62		.234	.309-.6250														
.7500	75		.299	.389-.7500														
.8750	87		.354	.439-.8750														
1.0000	100	.399	.484-1.0000															
.1875	18	1.50	.092	.124-.1875														
.2500	25		.092	.124-.2500														
.3125	31		.092	.124-.3125														
.3750	37		.124	.124-.3750														
.4375	43		.124	.186-.4375					2112	2212	2312	3012	3112	3212	3312	4012		
.5000	50		.124	.224-.5000														
.6250	62		.234	.309-.6250														
.7500	75		.299	.389-.7500														
.8750	87		.354	.439-.8750														
1.0000	100		.399	.484-1.0000														

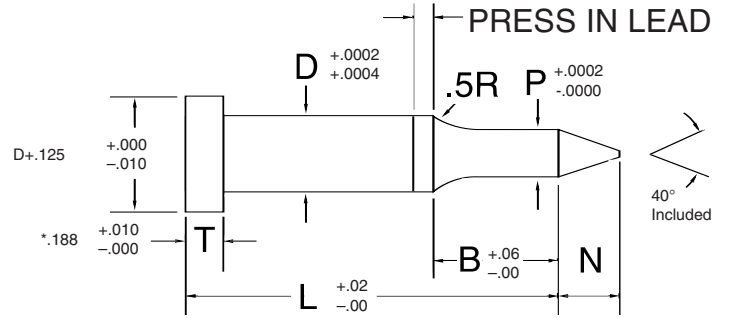
HOW TO ORDER STEEL SHAPE PUNCH BODY DIA. CODE "L" LENGTH POINT LENGTH "P"

H C N 37 22 10 X .250

Positive Pick Up Pilots

HLN()

M-2 STEEL ONLY

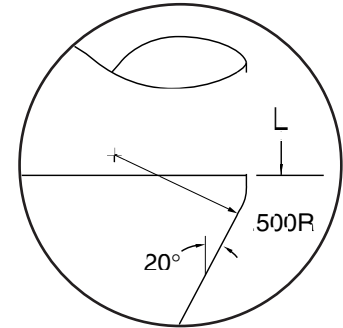


UNDER .186 SP PILOT NOSE IS 1.5P

P Tolerance +.0002
 -.0000

P to D + .0003 T.I.R.

When P = D Tolerance is +.0002
 +.0004



UNIVERSAL CODE: 110108 (SEE PAGE 69)

Shank		Point Length B	Round			Length L														
D	Code		Min SP	Range P	Max N	2.50	2.75	3.00	3.25	3.50	3.75	4.00	4.25	4.50	4.75	5.00	5.25	5.50		
.3750	37	.75	.092	.186-.3750	.37															
.4375	43		.092	.186-.4375	.43															
.5000	50		.124	.224-.5000	.50	2203	2303	3003	3103	3203	3303	4003	4103	4203	4303	5003	5103	5203		
.6250	62		.234	.309-.6250	.62															
.7500	75		.299	.389-.7500	.75															
.8750	87		.354	.439-.875	.87															
1.000	100	.399	.484-1.000	1.00																
.3750	37	1.00	.092	.186-.3750	.37															
.4375	43		.092	.186-.4375	.43															
.5000	50		.124	.224-.5000	.50	2210	2310	3010	3110	3210	3310	4010	4110	4210	4310	5010	5110	5210		
.6250	62		.234	.309-.6250	.62															
.7500	75		.299	.389-.7500	.75															
.8750	87		.354	.439-.875	.87															
1.000	100	.399	.484-1.000	1.00																
.3750	37	1.25	.092	.186-.3750	.37															
.4375	43		.092	.186-.4375	.43															
.5000	50		.124	.224-.5000	.50	2211	2311	3011	3111	3211	3311	4011	4111	4211	4311	5011	5111	5211		
.6250	62		.234	.309-.7500	.62															
.7500	75		.299	.389-.7500	.75															
.8750	87		.354	.439-.875	.87															
1.000	100	.399	.484-1.000	1.00																

HOW TO ORDER

**HIGH SPEED
 LONG NOSE PILOT
 HLNC**

**BODY
 DIA. CODE
 50**

**"L"
 LENGTH
 32**

**POINT
 LENGTH
 10**

**"P"
 .375**

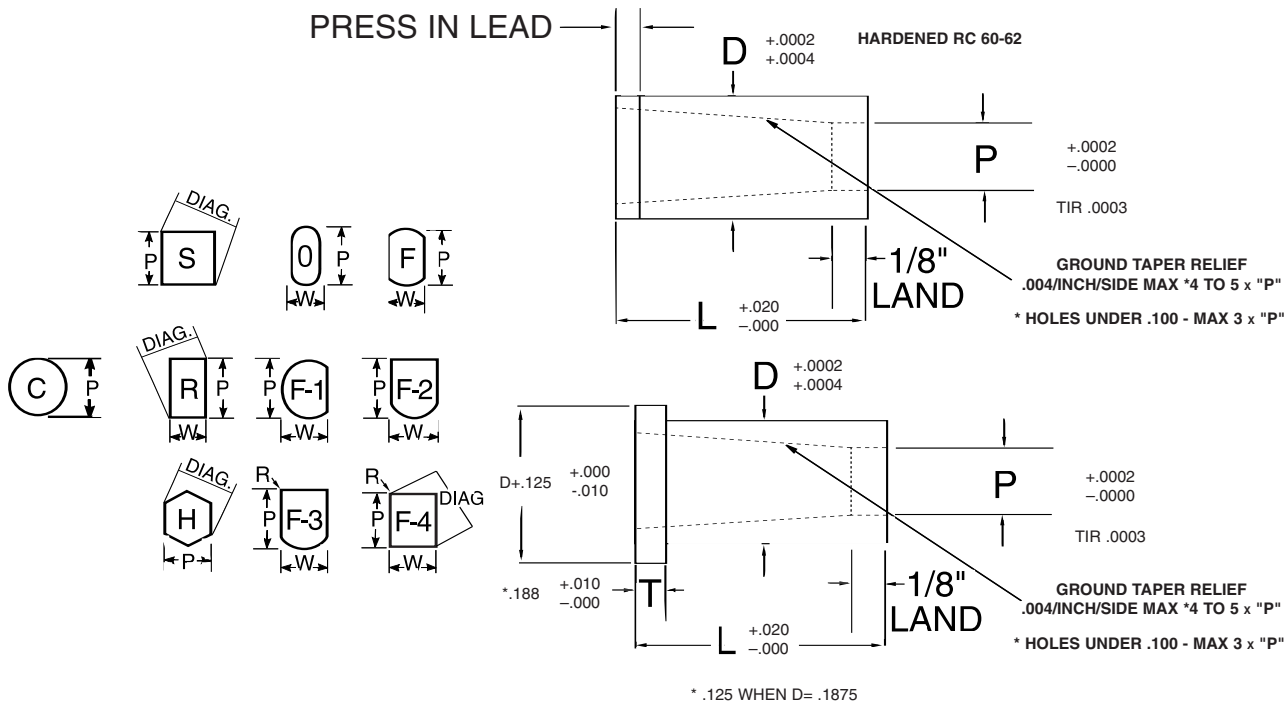
PRESS FIT DIE BUTTONS

HCD
H()DW
HEADLESS
M-2 STEEL

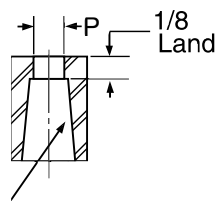
HCH
H()HW
HEADED
M-2 STEEL

PCD
P()DW
HEADLESS
PM STEEL

PCH
P()HW
HEADED
PM STEEL

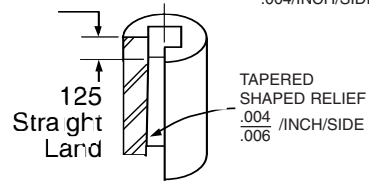
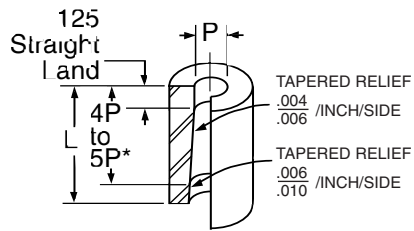


WHEN P < .100



STEPPED TAPER RELIEF-.006-.010/INCH/SIDE

WHEN P > .100



SHAPES
SOLID WIRE CUT CONSTRUCTION
TAPER RELIEF
.004/INCH/SIDE FULL LENGTH

TAPERED
SHAPED RELIEF
.004 /INCH/SIDE
.006

UNIVERSAL CODE: 1153 & 1154 (SEE PAGE 69)

Body		Round	Shape	Overall Length L									
D	Code	Range P	Min. W	Max. DIAG.	.500	.625	.750	.875	1.000	1.125	1.250	1.375	1.500
.1875	18	.038-.130	.050-	.130									
.2500	25	.050-.170	.050-	.170									
.3125	31	.062-.212	.050-	.212	50	62	75	87	100	112			
.3750	37	.075-.255	.050-	.255							125	137	150
.4375	43	.130-.297	.075-	.297									
.5000	50	.150-.344	.075-	.344	50	62							
.6250	62	.188-.425	.075-	.425			75	87	100	112	125	137	150
.7500	75	.225-.510	.075-	.510									
.8750	87	.300-.595	.075-	.595									
1.000	100	.400-.680	.075-	.680									
1.250	125	.500-.850	.075-	.850			75	87	100	112	125	137	150

HOW TO ORDER

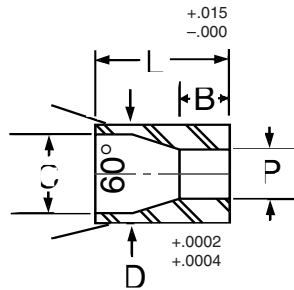
STEEL SHAPE HEAD DIE BODY DIA. OVERALL LENGTH "P"
H C H 100 - 112 X .625

HOW TO ORDER

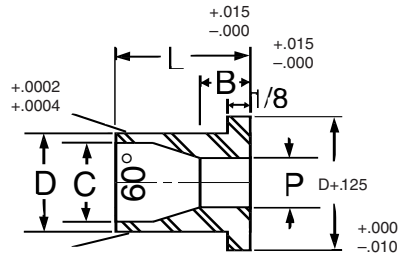
STEEL SHAPE PRESS FIT DIE WIRE BODY DIA. OVERALL LENGTH "P" "W"
H F D W 100 112 X .437 X .187

GUIDE BUSHINGS

HCG
H()GW
 HEADLESS

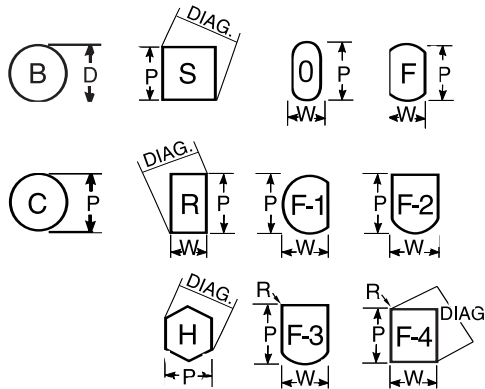
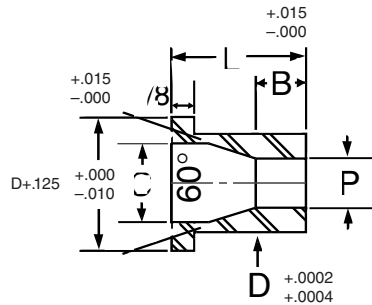


HCB
H()BW
 HEAD DOWN



P
+ .0002 - .0000
TIR .0003

HCT
H()TW
 HEAD UP



Guide Chart

Hole Range P/DIAG	Land Length B
Up to .0650	2P
.0651-.0950	P + .065
.0951-.4250	.80P + .080

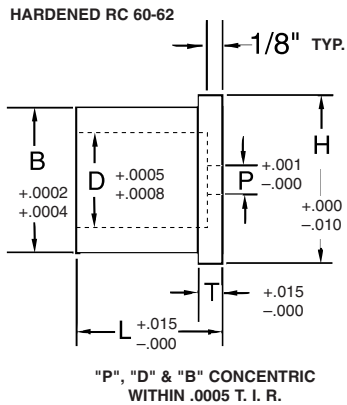
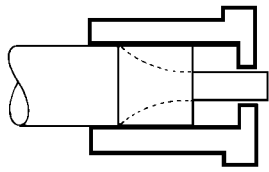
UNIVERSAL CODE: 1131, 1132, 1133 (SEE PAGE 69)

Body		Round	Shape	C'Bore	Overall Length L				
D	Code	Range P	Min. W Max. DIAG	Dia. C	.3125	.375	.500	.625	Code
.1875	18	.062-.130	.050-.130	.141	31				18
.2500	25	.062-.170	.050-.170	.201					25
.3125	31	.093-.212	.050-.212	.261		37			31
.3750	37	.125-.255	.050-.255	.323			50	62	37
.4375	43	.187-.297	.075-.297	.386					43
.5000	50	.212-.344	.075-.344	.448					50
.6250	62	.293-.425	.075-.425	.515					62

HOW TO ORDER

STEEL SHAPE PRESS-FIT GUIDE WIRE BODY DIA. OVERALL LENGTH "P" "W"
H O G W 50 - 62 X .250 X .062

TWO-STEP STRIPPER GUIDES



TWO-STEP STRIPPER GUIDES

This two-step stripper guide is to be used when guiding on the punch shank is required and where it is necessary to strip closely around the punch point.



ROUND HOLE
ORDER **ACS**

STEEL	CYLINDRICAL	SHANK GUIDE	BODY DIAMETER		HEAD		HOLE SIZE	L - OVERALL LENGTH						MIN.	P	MAX.
			B	H	T	D		5/8	15/16	1-7/32	1-1/4	1-1/2	1-3/4			
A	C	S	3/8	1/2	3/16	3/16	37-62							.050		.109
A	C	S	1/2	5/8	3/16	1/4		50-93						.050		.125
A	C	S	5/8	3/4	3/16	5/16		62-93						.062		.172
A	C	S	5/8	3/4	3/16	3/8		62A-93						.093		.218
A	C	S	7/8	1	3/16	1/2			87-121					.125		.297
A	C	S	1	1-1/8	3/16	5/8				100-125				.203		.375
A	C	S	1-1/8	1-1/4	3/16	3/4					112-150			.281		.500
A	C	S	1-1/4	1-3/8	3/16	7/8					125-150	125-175		.370		.595
A	C	S	1-3/8	1-1/2	3/16	1					137-150	137-175		.468		.687

HOW TO ORDER

STEEL SHAPE PUNCH BODY DIA. OVERALL LENGTH "T"

A C S 87 - 121 X .250

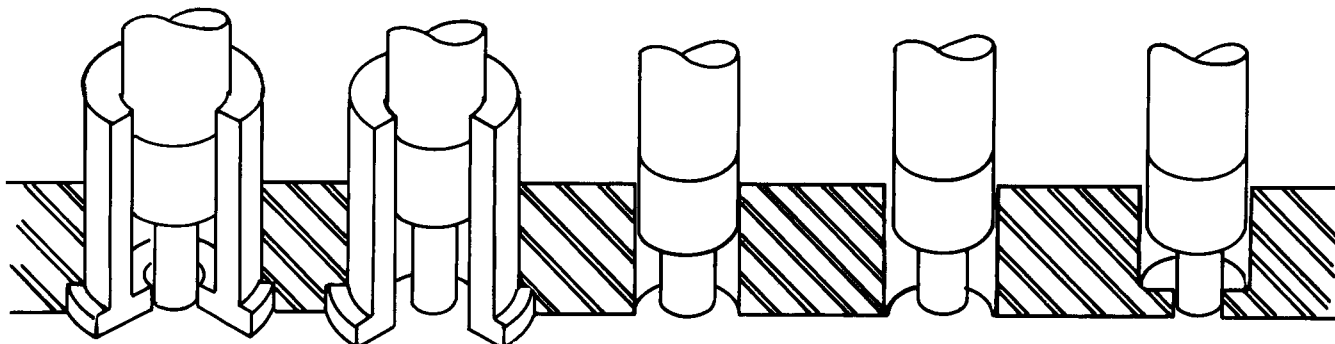
WHEN ORDERING WHIPSLEEVE PUNCHES:

1. Use shortest possible point length for added strength on critical punches.
2. Use largest practical size shank in relation to point diameter.
3. Use maximum punch and die clearance wherever possible.
4. Consider hardness as well as thickness of material to be punched in relation to point diameter. (In most cases, the XS punch will penetrate thickness as much as twice the diameter of the punch, — replacing many drilling operations.)
5. Provide depth stop so that punches cannot be set too deep.
6. Provide taper on die sections or die buttons all the way through.
7. Provide taper slug clearance in die shoe.

WHEN GUIDING IN STRIPPER BUSHING:

Make certain the whipsleeve is an easy slip-fit in the guide bushing. When guiding in the stripper itself use 4140 steel or equivalent, hardness approx. 300 Brinell, heat treated before machining. Be sure whipsleeve is engaged in guide before punch contacts material.

Pivot Punches are supplied without guides. Use "ACS" Stripper Guide Bushings, Standard Drill Bushings, or the type of guide that will give the punch the proper support for the particular application. Examples are shown below:



"ACS" TWO-STEP STRIPPER GUIDE
Guide on shank
Clearance on point

STRIPPER GUIDE
Guide on shank

PUNCH GUIDED IN STRIPPER

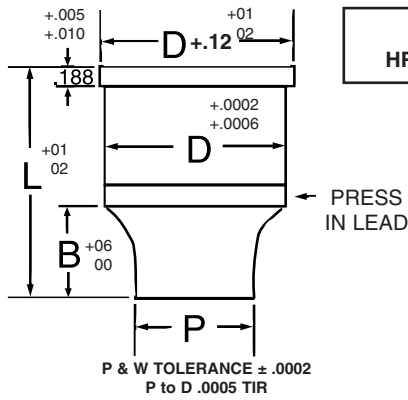
CLEARANCE HOLE IN STRIPPER
No guide

COUNTER BORED HOLE IN STRIPPER
No guide

STANDARDIZED COMPONENTS FOR LARGE HOLE PUNCHING, BLANKING, AND NOTCHING

EXPANDED SERIES HEAD-TYPE PUNCHES

M-2
RC 60-62



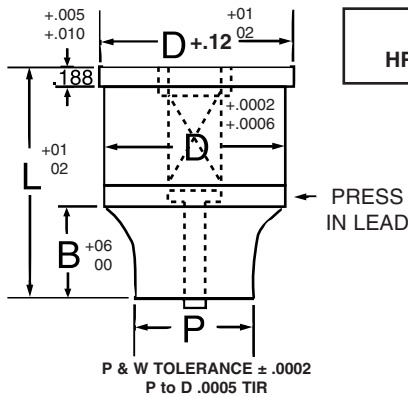
HOW TO ORDER:
HRP 175 2311 1.323 .707

SOLID

H () P

CATALOG CODE	BODY DIAMETER D	POINT LENGTH B	L - OVERALL LENGTH					ROUND PT.			STANDARD SHAPES	
			2-1/4	2-1/2	2-3/4	3	3-1/4	MIN.	P	MAX.	MIN. W	MAX. DIAG.
H () P	1 -1/4	1-1/4	125-2111	125-2211	125-2311	125-3011	125-3111	.625		1.250	.282	1.250
		1-1/2	125-2112	125-2212	125-2312	125-3012	125-3112					
H () P	1 -1/2	1-1/4	150-2111	150-2211	150-2311	150-3011	150-3111	.750		1.500	.300	1.500
		1-1/2	150-2112	150-2212	150-2312	150-3012	150-3112					
H () P	1-3/4	1-1/4	175-2111	175-2211	175-2311	175-3011	175-3111	1.000		1.750	.350	1.750
		1-1/2	175-2112	175-2212	175-2312	175-3012	175-3112					
H () P	2	1-1/4	200-2111	200-2211	200-2311	200-3011	200-3111	1.187		2.000	.400	2.000
		1-1/2	200-2112	200-2212	200-2312	200-3012	200-3112					
H () P	2-1/4	1-1/4	225-2111	225-2211	225-2311	225-3011	225-3111	1.375		2.250	.450	2.250
		1-1/2	225-2112	225-2212	225-2312	225-3012	225-3112					
H () P	2-1/2	1-1/4	250-2111	250-2211	250-2311	250-3011	250-3111	1.625		2.500	.500	2.500
		1-1/2	250-2112	250-2212	250-2312	250-3012	250-3112					

M-2
RC 60-62



HOW TO ORDER:
HRE 175 2311 1.323 .707

EJECTOR

H () E

CATALOG CODE	BODY DIAMETER D	POINT LENGTH B	L - OVERALL LENGTH					ROUND PT.			STANDARD SHAPES	
			2-1/4	2-1/2	2-3/4	3	3-1/4	MIN.	P	MAX.	MIN. W	MAX. DIAG.
H () E	1 -1/4	1-1/4	125-2111	125-2211	125-2311	125-3011	125-3111	.625		1.250	.282	1.250
		1-1/2	125-2112	125-2212	125-2312	125-3012	125-3112					
H () E	1 -1/2	1-1/4	150-2111	150-2211	150-2311	150-3011	150-3111	.750		1.500	.300	1.500
		1-1/2	150-2112	150-2212	150-2312	150-3012	150-3112					
H () E	1-3/4	1-1/4	175-2111	175-2211	175-2311	175-3011	175-3111	1.000		1.750	.350	1.750
		1-1/2	175-2112	175-2212	175-2312	175-3012	175-3112					
H () E	2	1-1/4	200-2111	200-2211	200-2311	200-3011	200-3111	1.187		2.000	.400	2.000
		1-1/2	200-2112	200-2212	200-2312	200-3012	200-3112					
H () E	2-1/4	1-1/4	225-2111	225-2211	225-2311	225-3011	225-3111	1.375		2.250	.450	2.250
		1-1/2	225-2112	225-2212	225-2312	225-3012	225-3112					
H () E	2-1/2	1-1/4	250-2111	250-2211	250-2311	250-3011	250-3111	1.625		2.500	.500	2.500
		1-1/2	250-2112	250-2212	250-2312	250-3012	250-3112					

STANDARDIZED COMPONENTS FOR LARGE HOLE PUNCHING, BLANKING, AND NOTCHING

EXPANDED SERIES HEAD-TYPE DIES

HOW TO ORDER:
HOHW 200-100 1.450 .650

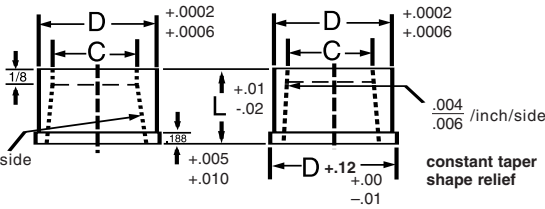
HCH



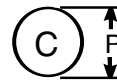
**Solid
H () HW**

HCH

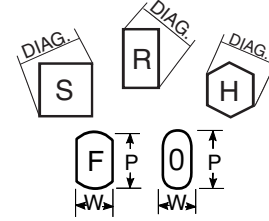
H () HW



ROUND PT.



STANDARD SHAPES



M-2
RC 60-62

P & W +.0004
Tolerance -.0000

P to W .0005 TIR
.004/.006 /inch/side

constant taper
shape relief

BODY DIA.		L - OVERALL LENGTH			MIN.	P	MAX.	MIN. W	MAX. DIAG.
HCH	H () HW	3/4"	1"	1-1/4"					
1-1/2	1-1/2	150-75	150-100	150-125	.600	1.050	.130	1.050	
1-3/4	1-3/4	175-75	175-100	175-125	.750	1.400	.130	1.400	
2	2	200-75	200-100	200-125	.875	1.600	.130	1.600	
2-1/4	2-1/4	225-75	225-100	225-125	1.000	1.800	.130	1.800	
2-1/2	2-1/2	250-75	250-100	250-125	1.125	2.000	.130	2.000	
2-3/4	2-3/4	275-75	275-100	275-125	1.250	2.200	.130	2.200	

EXPANDED SERIES HEADLESS DIES

HOW TO ORDER:
HODW 200-100 1.450 .650

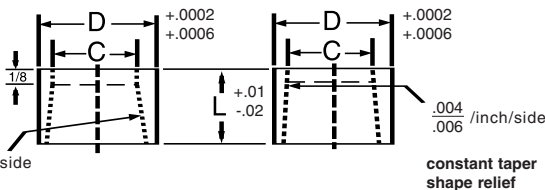
HCD



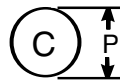
**Solid
H () DW**

HCD

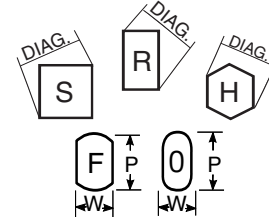
H () DW



ROUND PT.



STANDARD SHAPES



M-2
RC 60-62

P & W +.0004
Tolerance -.0000

P to W .0005 TIR
.004/.006 /inch/side

constant taper
shape relief

BODY DIA.		L - OVERALL LENGTH			MIN.	P	MAX.	MIN. W	MAX. DIAG.
HCD	H () DW	3/4"	1"	1-1/4"					
1-1/2	1-1/2	150-75	150-100	150-125	.600	1.050	.130	1.050	
1-3/4	1-3/4	175-75	175-100	175-125	.750	1.400	.130	1.400	
2	2	200-75	200-100	200-125	.875	1.600	.130	1.600	
2-1/4	2-1/4	225-75	225-100	225-125	1.000	1.800	.130	1.800	
2-1/2	2-1/2	250-75	250-100	250-125	1.125	2.000	.130	2.000	
2-3/4	2-3/4	275-75	275-100	275-125	1.250	2.200	.130	2.200	

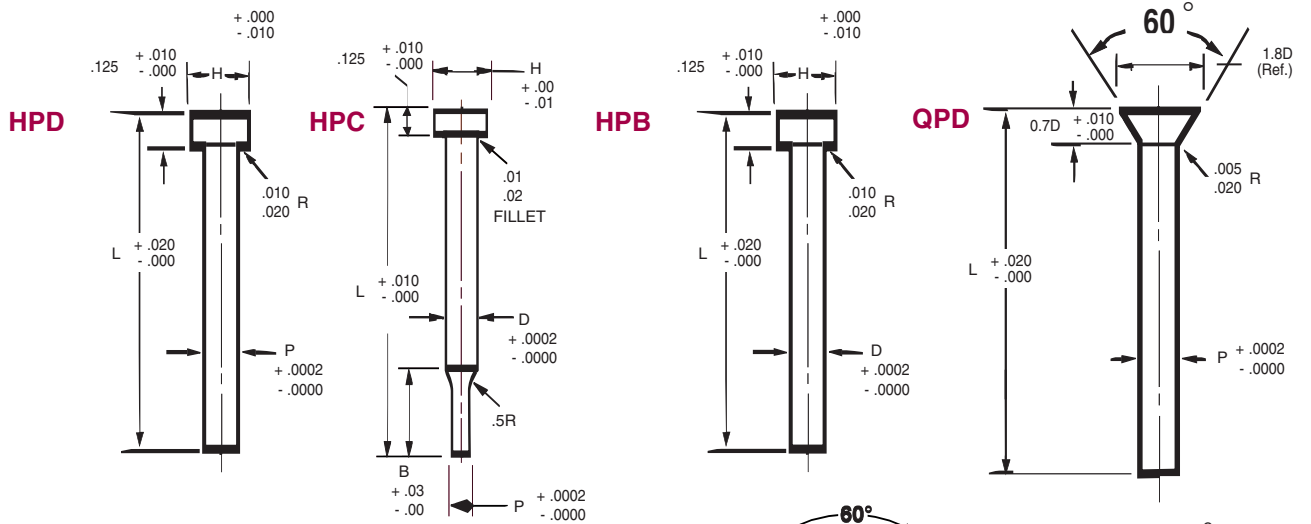
PRECISION PERFORATORS BLANK & POINTED

HEAD TYPE

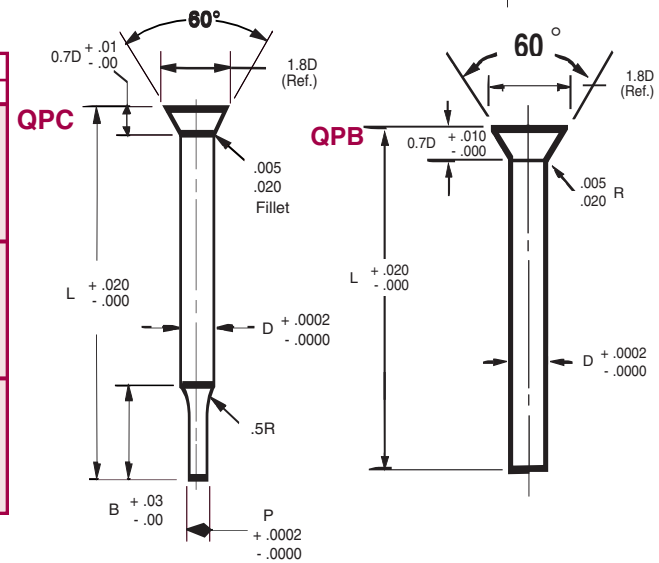
HPD
HPC
HPB

QUILL TYPE

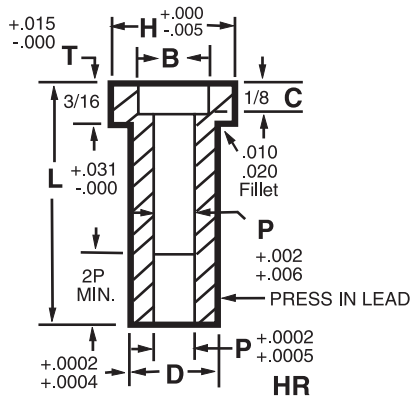
QPD
QPC
QPB



Shank	Head Dia. H	Point Length B	Range P	Overall Length L						
				1.50	1.75	2.00	2.25	2.50		
Straight Punches										
HPD QPD	N/A	N/A	.0300-.0630 .0631-.0940 .0941-.1250 .1251-.1570 .1571-.1880 .1881-.2190 .2191-.2500	150	175	200	225	250		
Regular Punches										
HPC QPC	.0625 .0938 .1250 .1562 .1875 .2188 .2500	06 09 12 15 18 21 25	.125 .160 .190 .220 .250 .282 .313	.19 .25 .31 .31 .31 .31 .31	.0310-.0624 .0626-.0937 .0939-.1249 .1251-.1561 .1563-.1874 .1876-.2187 .2189-.2499	150	175	200	225	250
Punch Blanks										
HPB QPB	.0625 .0938 .1250 .1562 .1875 .2188 .2500	06 09 12 15 18 21 25	.125 .160 .190 .220 .250 .282 .313	N/A						



PRECISION RETAINERS



precision retainers

SERIES

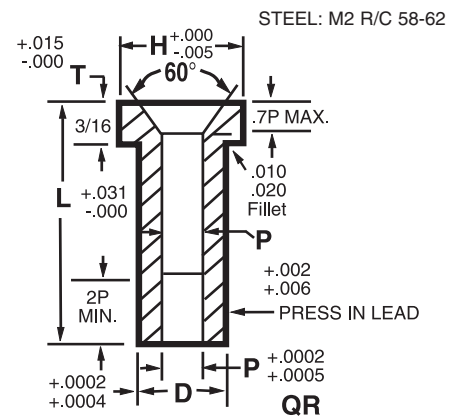
HR

M2 STEEL
R/C 58-62

SERIES

QR

M2 STEEL
R/C 58-62



CAT. NO.	D	H	B	P	Overall Lengths Available (L)					CAT. NO.	D	H	P
					3/4	1	1 1/4	1 1/2	1 3/4				
HR-18	3/16	5/16	9/64	.0625	X	X	X			QR-18	3/16	5/16	.0625
HR-25	1/4	3/8	11/64	.0938	X	X	X			QR-25	1/4	3/8	.0938
HR-31	5/16	7/16	13/64	.1250	X	X	X	X	X	QR-31	5/16	7/16	.1250
HR-37	3/8	1/2	15/64	.1562	X	X	X	X	X	QR-37	3/8	1/2	.1562
HR-43	7/16	9/16	17/64	.1875	X	X	X	X	X	QR-43	7/16	9/16	.1875
HR-50	1/2	5/8	19/64	.2178	X	X	X	X	X	QR-50	1/2	5/8	.2178
HR-62	5/8	3/4	21/64	.2500	X	X	X	X	X	QR-62	5/8	3/4	.2500

HOW TO ORDER

CAT. NO. **QR-37**
OVERALL LENGTH **1**
"P" **.1562**

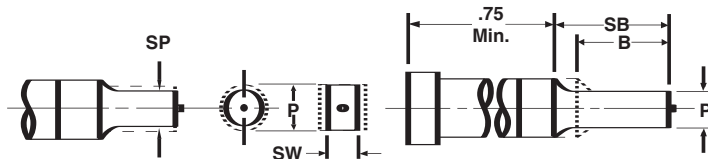
STANDARD ALTERATIONS

Standard alterations are the ranges beyond those sizes listed in the catalog which can be manufactured for a slight additional charge. Does not add to delivery unless noted.

Ejector Punch

H()E P()E Y()E PY()E

SP, SW P & W Dimensions Smaller than Standard
SB Point Length Longer than Standard

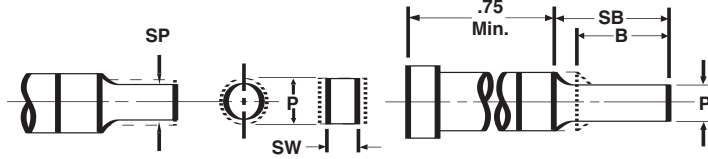


Point Length	.500-.750	.751-1.000	1.001-1.250	1.251-1.500	1.501-1.625	.500-.750	.751-1.000	1.001-1.250	1.251-1.500	1.501-1.625
Code	Min. P (Rounds)					Min. W (Shapes)				
18	.050	.058				.062	.093			
25	.080	.080	.080			.080	.093	.093		
31	.115	.115	.115	.115	.115	.115	.115	.115	.115	.115
37	.158	.158	.158	.158	.158	.158	.158	.158	.158	.158
43	.158	.158	.158	.158	.158	.158	.158	.158	.158	.158
50	.158	.158	.158	.158	.158	.158	.158	.158	.158	.158
62	.235	.235	.235	.235	.235	.235	.235	.235	.235	.235
75	.300	.300	.300	.300	.300	.235	.235	.235	.235	.235
87 or 100	.400	.400	.400	.400	.400	.235	.235	.235	.235	.235

Solid

H()P P()P Y()P PY()P

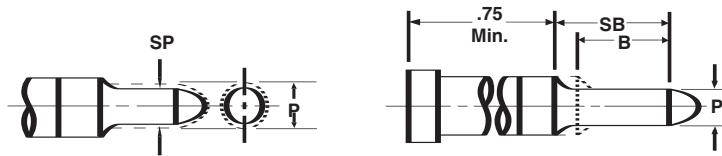
SP, SW P & W Dimensions Smaller than Standard
SB Point Length Longer than Standard



Point Length	.500-.750	.751-1.000	1.001-1.250	1.251-1.500	1.501-1.625	.500-.750	.751-1.000	1.001-1.250	1.251-1.500	1.501-1.625
Code	Min. P (Rounds)					Min. W (Shapes)				
12	.042*	.058	.075			.062	.062	.093		
18	.042*	.058	.075	.093		.062	.062	.093	.125	
25	.062	.062	.080	.093		.062	.062	.093	.125	
31	.062	.062	.093	.093	.125	.062	.093	.093	.125	.195
37	.062	.062	.093	.125	.125	.080	.109	.125	.125	.195
43	.093	.093	.093	.125	.125	.109	.109	.141	.172	.195
50	.125	.125	.125	.125	.125	.125	.125	.141	.172	.195
62	.235	.235	.235	.235	.235	.235	.235	.235	.235	.235
75	.300	.300	.300	.300	.300	.235	.235	.235	.235	.235
87 or 100	.400	.400	.400	.400	.400	.235	.235	.235	.235	.235

Pilots H()N

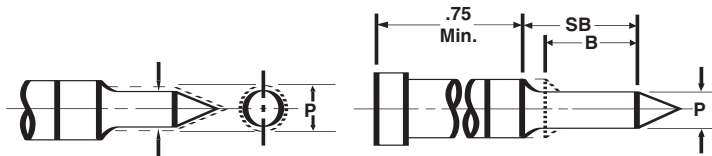
SP, SW P & W Dimensions Smaller than Standard
SB Point Length Longer than Standard



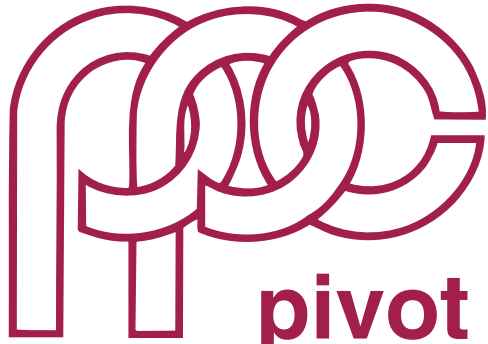
Point Length	.500-.750	.751-1.000	1.001-1.250	1.251-1.500	1.501-1.625
Code	Min. P (Rounds)				
12	.050	.057	.074		
18	.050	.057	.074	.092	
25	.061	.061	.079	.092	
31	.061	.061	.092	.092	.124
37	.061	.061	.092	.124	.124
43	.092	.092	.092	.124	.124
50	.124	.124	.124	.124	.124
62	.234	.234	.234	.234	.234
75	.299	.299	.299	.299	.299
87 or 100	.399	.399	.399	.399	.399

Long Nose Pilots HLN()

SP, SW P & W Dimensions Smaller than Standard
SB Point Length Longer than Standard



Point Length	.500-.750	.751-1.000	1.001-1.250	1.251-1.500	1.501-1.625
Code	Min. P (Rounds)				
37	.092	.092	.092	.124	.157
43	.092	.092	.092	.140	.157
50	.124	.124	.124	.140	.157
62	.234	.234	.234	.234	.234
75	.299	.299	.299	.299	.299
87 or 100	.399	.399	.399	.399	.399



pivot punch corporation

CATALOG INFORMATION

Catalog Information

CATALOG INFORMATION INDEX

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For Fast Deliveries. . .

pivot punch corporation

PIVOT FAST DELIVERY SCHEDULE (PFDS)

		Working Days													
		PUNCHES									DIE BUTTONS/GUIDES				
		STD	FORM	STD	LG. NOSE	EXPANDED	EXPANDED	KNOB STYLE	KNOB STYLE		STD	FORM	EXPANDED	EXPANDED	
PRODUCT	QUANTITY	ROUND	SHAPE	SHAPE	PILOT	PILOT	ROUND	SHAPE	ROUND	SHAPE	ROUND	SHAPE	ROUND	SHAPE	
SELECTIVE	1-19	2	4	6	3	3	6	8			2	4	6	6	8
BASIC	1-19	2	4	6	3	3					2	4	6		
BALLOCK	1-19	2	4	6	3	3			6	8	2	4	6		
ALL ABOVE	20-49	4	6	9	5	5	8	11	8	11	4	6	9	8	11
	STR. GRIND	+2	+2	+2											
	TONDRA														
	WHIPSLEEVE	+3	+3	+3											

Note: The day of receipt of order is not counted as a working day.

And, When you need it even ***FASTER. . .***

PIVOT QUICKIE SERVICE

- On all standard catalog items (1-19 qty.) except Expanded Series & PM Products
- PIVOT **guarantees** maximum delivery will be cut in half, or you don't pay the service charge.
- The service charge is 20% of the total order - Note: \$30.00 minimum order.
- Please advise fastest shipping method - F.O.B. our plant.

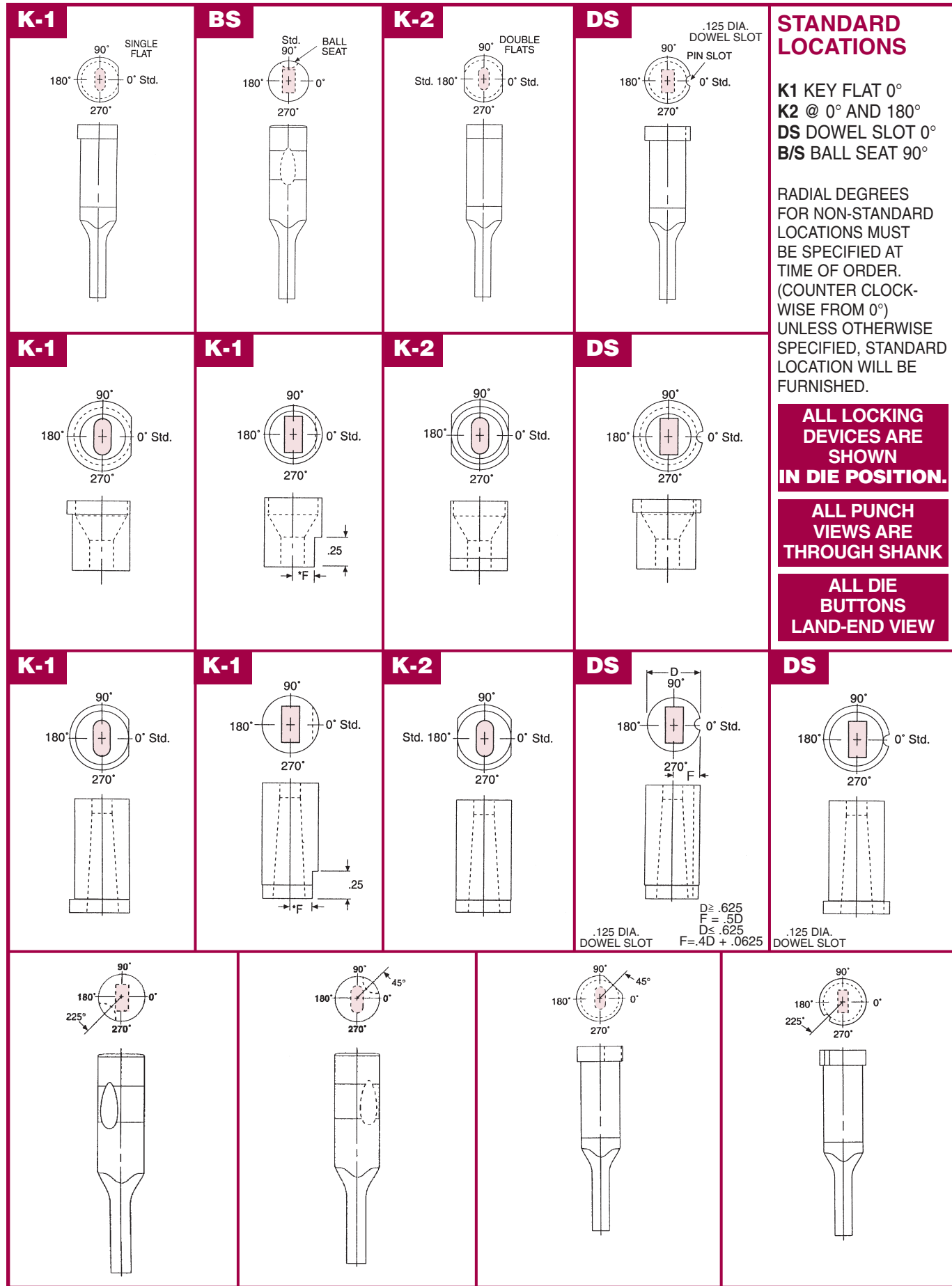
Or, for the ***FASTEST*** possible deliveries. . .

PIVOT MAYDAY SERVICE

- On all standard catalog items (1-19qty.) except Expanded Series & PM Products
- PIVOT **guarantees** orders will be shipped with in 24 hours of receipt of order (phone orders only), or you don't pay the service charge.
- The service charge is \$10.00 for each round, \$15.00 for each shape - \$30.00 minimum order.
- Please advise fastest shipping method - F.O.B. our plant.

LOCKING DEVICES

90°



180°

0°

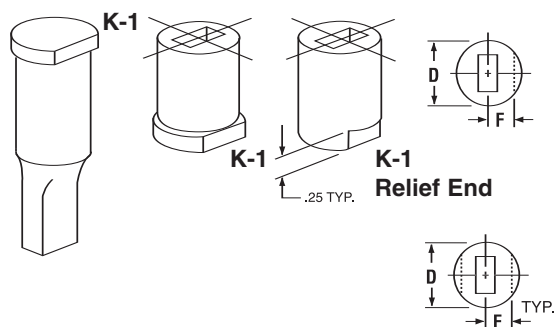
270°

ALL LOCKING DEVICES ARE SHOWN IN DIE POSITION.

ALL PUNCH VIEWS ARE THROUGH SHANK

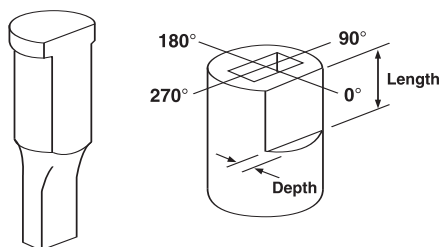
ALL DIE BUTTONS LAND-END VIEW

Flats



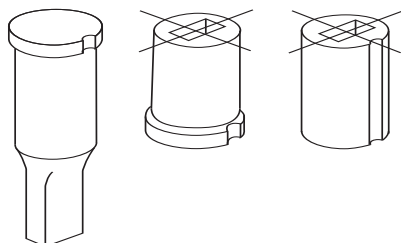
F Dimension (.5D on Headed Products)
Headless Die Buttons & Guide Busing Only

Body Dia.	18	25	31	37	43	50
F	.080	.110	.135	.165	.190	.220
Body Dia.	62	75	87	100	125	150
F	.270	.325	.380	.435	.540	.650
Body Dia.	175	200	225	250	275	
F	.775	.900	1.025	1.150	1.275	



Note: depth of flat is taken from shank, not the head on punches.

Dowel Slots



Standard and Alternate Locations

Definitions:

Standard Location is at 0°.

Alternate Location is 90°, 180° or 270°.

Alternate Locations are available at no additional charge.

Single Flats: K-1

Locking Devices	Punches	Die Button
K-1	On Head	Relief End

Order Example:

K-1 - 90°

Double Flats:

Locking Devices	Punches	Die Button
K-2	On Head	Relief End

Order Example:

K-2 - 90°

Second Flat is *always parallel* to the first flat.

Additional Flats

Code*	Depth	Length
K-5	.060	.500
K-6	.060	.625
K-7	.060	.750
K-8	.060	Full Length

Land End Shown

Relief End Optional

Dowel Slots: DS

Locking Devices	Dowel Dia.
DS	.125

Order Example:

DS - 180°

Custom Locations

Definition:

Custom Location is *any angle*

other than: 0°, 90°, 180° or 270°.

Single Flats: K-3

Locking Devices	Punches	Die Button
K-3	On Head	Relief End

Order Example:

K-3 - 150°

Double Flats:

Locking Devices	Punches	Die Button
K-4	On Head	Relief End

Order Example:

K-4 - 150°

Second Flat is *always parallel* to the first flat.

Additional Flats

Code*	Depth	Length
K-9	.060	.500
K-10	.060	.625
K-11	.060	.750
K-12	.060	Full Length

Land End Shown

Relief End Optional

Dowel Slots: CDS

Locking Devices	Dowel Dia.
CDS	.125

Order Example:

CDS - 150°

Ball Seat: CBS

Order Example:

CBS - 110°

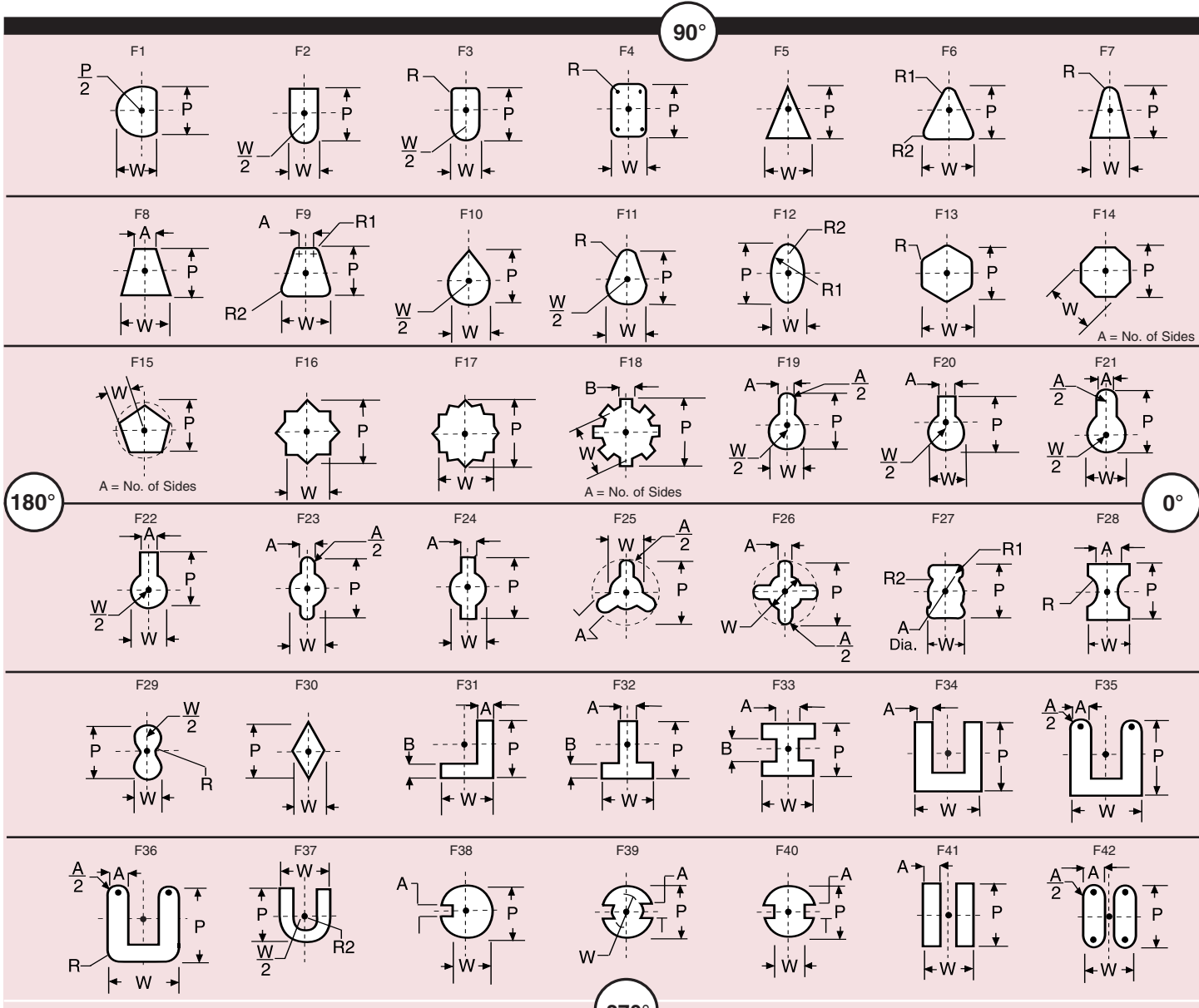
42 additional form shapes

FOR PUNCHES: View through shank.
FOR DIES: View of land end.

AVAILABLE IN ALL CLASSIFICATIONS SHOWN IN THIS CATALOG –

M2 High Speed Steel, Straight Ground or Whipsleeve

This easy to use table, designed to provide 42 additional form shapes without the need for special drawings, has been prepared for your ordering convenience. Pivot is also prepared to furnish other special shapes not shown, as required. When ordering shapes, other than shown below, submit twice size (or larger) drawing of point or hole and indicate sizes, tolerance required and relationship to shank or body centerlines and flats or dowels.



NOTES PERTAINING TO TABLE

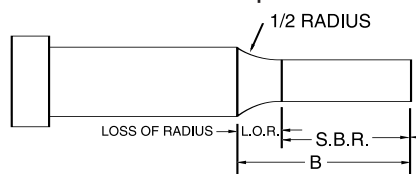
- 90° Location is found at 12 o'clock on vertical center line.
- Punch and Die Corner Radius – inside (both) .003 to .008; outside (both) SHARP.
- Additional Order Coding – P = largest shape dimension, W = small shape dimension, R = radius (when only one radius is required), R1 = first radius when more than one is required, R2 = second radius when more than one is required, A,B,C, etc. additional dimensions.
- Center line on drawings indicate center line of body diameter.
- For standard method of keying punches, die buttons and guide bushings, see page 50.
- Standard Ball Lock Location – Ball on “W” or 90° – See page 50.
- Standard Dowel (DS) or Single Flat (K1) location is at 0° Degrees.

HOW TO ORDER	Steel	Punch	Shape	Body Dia.	Overall Length	P	W	A
	H	S	F20	50	x 2-1/2	x .437	x .312	x .125

LOSS OF RADIUS CHART

This catalog encompasses a full range of "B" dimension point lengths – 1/2"– 3/4" – 1" – 1-1/4" – 1-1/2". To calculate straight before radius or effective point length, use the following formula:

"B" less "LOR" from chart equals "S.B.R."



USE "W" DIM. FOR FLATTED ROUND – OBLONG – RECTANGLE
 "P" DIM. FOR ROUND – SQUARE – HEXAGON

STRAIGHT BEFORE RADIUS
 EFFECTIVE POINT LENGTH

"W" or "P" POINT DIAMETERS 1/32" INCREMENTS															
"D"	.031	.062	.093	.125	.156	.187	.218	.250	.281	.312	.343	.375	.406	.437	.468
1/8	.212	.176	.125												
5/32	.241	.212	.176	.125											
3/16	.268	.241	.212	.176	.125										
1/4	.313	.292	.268	.241	.212	.176	.125								
5/16		.348	.313	.292	.268	.241	.212	.176	.125						
3/8			.348	.332	.313	.292	.268	.241	.212	.176	.125				
7/16			.377	.372	.348	.332	.313	.292	.268	.241	.212	.176	.125		
1/2				.382	.377	.364	.348	.332	.313	.292	.268	.241	.212	.176	.125
5/8						.414	.403	.391	.377	.364	.348	.332	.313	.292	.268
3/4									.424	.414	.403	.391	.377	.364	.348
1															.443

"W" or "P" POINT DIAMETERS 1/32" INCREMENTS															
"D"	.500	.531	.562	.593	.625	.656	.687	.718	.750	.781	.812	.843	.875	.906	.937
5/8	.241	.212	.176	.125											
3/4	.332	.313	.292	.268	.241	.212	.176	.125							
1	.433	.424	.414	.403	.391	.377	.364	.348	.332	.313	.292	.268	.241	.212	.176

PUNCH SELECTION CHART

For selecting the best type punch and the right clearance, according to hardness of material, thickness of material, and low or high production, where good die-making principles are followed.

NOTICE: The chart below does not include Pivot's PM punches. In many applications much longer tool life can be achieved by substituting PM for added wear where HSS or HSS Straight Ground are indicated. If breaking or chipping we suggest CPM 3V. For more information, contact Pivot distributor.

SHEAR STRENGTH LBS. PER SQ. IN.	BRINELL 10 mm BALL	SHADING INDICATES TYPE OF PUNCH <div style="display: flex; flex-direction: column; gap: 5px;"> <div style="display: flex; align-items: center;"> High Speed Steel</div> <div style="display: flex; align-items: center;"> Straight Ground High Speed Steel</div> <div style="display: flex; align-items: center;"> Whipsleeve – High Speed Steel, Straight Grinding, and Tondra Treat are Standard</div> </div> <p>The chart below is based primarily on average punching requirements where material thickness is one half or less than punch diameter. Guiding of punches and point length should be determined by punch diameter to thickness ratio.</p>			MATERIAL THICKNESS .005-.020						MATERIAL THICKNESS .021-.062							
					TOTAL CLEARANCE IN PERCENT OF MATERIAL THICKNESS	SHORT RUNS			LONG RUNS			TOTAL CLEARANCE IN PERCENT OF MATERIAL THICKNESS	SHORT RUNS			LONG RUNS		
						HIGH SPEED STEEL (HSS)	HSS STRAIGHT GROUND® (SG)	HSS (SG) WHIPSLEEVE®	HIGH SPEED STEEL (HSS)	HSS STRAIGHT GROUND® (SG)	HSS (SG) WHIPSLEEVE®		HIGH SPEED STEEL (HSS)	HSS STRAIGHT GROUND® (SG)	HSS (SG) WHIPSLEEVE®	HIGH SPEED STEEL (HSS)	HSS STRAIGHT GROUND® (SG)	HSS (SG) WHIPSLEEVE®
15,000 AND UNDER	35	PLASTIC PHENOLIC SHEET	PAPER LEATHER MASONITE	MIN.	3-3-1/2													
				STD.	4-4-1/2													
				MAX.	Var.													
20,000	45	ALUMINUM 2024-O SOFT	MIN.	3-1/2-4														
			STD.	5-6														
			MAX.	22%														
32,000	95	ALUMINUM 6061-T6 BRASS-YELLOW-SOFT	COPPER SOFT ZINC	MIN.	4-5													
				STD.	7-7-1/2													
				MAX.	24													
40,000 TO 50,000	110 TO 130	ALUMINUM - 2024-T-3 HARD STEEL - SAE 1018 HOT ROLLED	BRASS 1/2 HARD	MIN.	5-6													
				STD.	9-10													
				MAX.	24													
	STEEL - GALVANIZED - SAE 1018	GALVANIZED LONG TERN	MIN.	5-6														
			STD.	9-10														
			MAX.	24														
60,000	170	BRASS-YELLOW-HARD STEEL - SAE 1018 - COLD DRAWN	MIN.	5-6														
			STD.	10-11														
			MAX.	25														
85,000	185	STAINLESS STEEL (ANNEALED)	MONEL NICKOL	MIN.	6-8													
				STD.	11-12													
				MAX.	27													
100,000	200	TOOL STEEL (ANNEALED)	MIN.	7-8														
			STD.	12-13														
			MAX.	30														
110,000	220	PHOSPHOR BRONZE (SPRING TEMPERED)	MIN.	14-16														
			STD.	16-18														
			MAX.	30														
200,000	380	SPRING STEEL (TEMPERED)	MIN.	16-18														
			STD.	20-22														
			MAX.	30														
RATIO PIERCING	WHERE THE STOCK THICKNESS APPROACHES OR IS GREATER THAN THE POINT DIAMETER 2-1 MAXIMUM IN MILD STEEL – 115 BRINELL	MIN.	CHECK CLEAR. ABOVE															
		STD.	CHECK CLEAR. ABOVE															
		MAX.	CHECK CLEAR. ABOVE															
SHAVING PUNCHES	FOR MATERIALS LESS THAN 205 BRINELL	MIN.	METAL TO METAL															
		STD.	METAL TO METAL															
		MAX.	METAL TO METAL															
HOT PUNCHING	1550° FAHRENHEIT MAXIMUM	CASTINGS FORGINGS	MIN.															
			STD.															
			MAX.															

recommended percent of clearances

Clearances are total, both sides, and are indicated according to hardness and thickness of material. They are based upon average punching requirements where thickness of the material is approximately one-half or less than the diameter of the punch point. Note that recommended minimum, standard and maximum clearances are quoted in percent of thickness of material.

Die buttons - The same type of steel used for punches, is recommended in most cases when selecting die buttons.

Slug Ejectors - We also strongly recommend that slug ejectors be used wherever physically possible to insure trouble free production. Slug ejectors guard against slugs being drawn back out of the die. This is more likely to occur when the clearance exceeds 15%, such as when punching hard or thick material. Minimum point diameter is .062. (If you have strength enough and room enough, use a slug ejector.)

SHEAR STRENGTH LBS. PER SQ. IN.	BRINNELL 10mm BALL	TOTAL CLEARANCE IN PERCENT OF MATERIAL THICKNESS					
		TYPE OF MATERIAL	.005-.020	.021-.062	.063-.125	.126-.375	
15,000 AND UNDER	35	PHONEOLIC SHEET PAPER LEATHER MASONITE	MIN.	3-3 1/2	3 1/2-4	4-4 1/2	4 1/2-5
			STD.	4-4 1/5	4 1/2-5	5-5 1/2	5 1/2-6
			MAX.	Var.	Var.	Var.	Var.
20,000	45	ALUMINUM 2024-0 SOFT COPPER SOFT ZINC	MIN.	3 1/2-4	4-5	5-6	6-7
			STD.	5-6	6-7	7-10	10-14
			MAX.	22	22	22	22
32,000	95	ALUMINUM 6061 -T6 BRASS YELLOW-SOFT	MIN.	4-5	5-6	6-7	7-8
			STD.	7-7 1/2	7 1/2-8	8-11	11-18
			MAX.	24	24	24	24
40,000 TO 50,000	110	ALUMINUM 2024-T-3 HARD BRASS STEEL - SAE 1018 HOT ROLLED 1/2 HARD	MIN.	5-6	6-7	7-8	8-9
			STD.	9-10	10-11	11-15	15-22
			MAX.	24	24	24	24
	130	STEEL- GALVANIZED- SAE 1018 GALVANNEALED LONG TERN	MIN.	5-6	6-7	7	8-9
			STD.	9-10	10-11	11-15	15-22
			MAX.	24	24	24	24
60,000	170	BRASS - YELLOW - HARD STEEL - SAE 1018 - COLD DRAWN	MIN.	5-6	6-7	7-8	8-9
			STD.	10-11	11-12	12-16	16-24
			MAX.	25	25	25	25
85,000	185	STAINLESS STEEL MONEL NICKOL	MIN.	6-8	8-10	10-12	12-15
			STD.	11-12	12-13	13-17	17-26
			MAX.	27	27	27	27
100,000	200	TOOL STEEL (ANNEALED)	MIN.	7-8	8-10	10-12	12-15
			STD.	12-13	13-14	14-18	18-27
			MAX.	30	30	30	30
110,000	220	PHOSPHOR BRONZE (SPRING TEMPERED)	MIN.	14-16	16-18	18-20	
			STD.	16-18	18-21	21-24	
			MAX.	30	30	30	
200,000	380	SPRING STEEL (TEMPERED)	MIN.	16-18	18-20		
			STD.	20-22	22-24		
			MIN.	30	30		

STANDARD ALTERATIONS

Standard Alterations Solid Punches

Standard alterations are the ranges beyond those sizes listed in the catalog which can be manufactured for a slight additional charge.

SD Reduced Shank Diameter

Head diameter does not change with body diameter.

Shank Dia.	12	18	25	31	37	43	50	62	75	87	100
Min. SD	.063	.126	.188	.251	.313	.376	.438	.562	.688	.812	.938

SL Overall Length Shortened (1.00 min.)

Stock removal from point end which shortens B length. To maintain "B" specify "SB"

PLL Precision Overall Length

Same as SL except overall length is held to ± 0.001 .

ST Thinner Head than Standard

Stock removal from head end which shortens overall length.

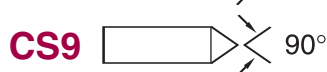
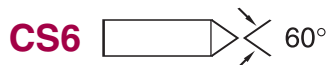
PTT Precision Head Thickness

Same as ST except head thickness tolerance is held to ± 0.0005

SH Reduced Head Diameter

Minimum head diameter equals $D + .000 - .001$

SLD Longer Lead on Punches



TONDRA® (.050 MIN)
A unique wear-resistant surface treatment for M2 & PM only.

Standard Alterations Ejector Punches

Standard alterations are the ranges beyond those sizes listed in the catalog which can be manufactured for a slight additional charge.

SD Reduced Shank Diameter

Head diameter does not change with body diameter.

Shank Dia.	18	25	31	37	43	50	62	75	87	100
Min. SD	.172	.218	.282	.344	.376	.438	.562	.688	.812	.938

SL Overall Length Shortened (1.00 min.)

Stock removal from point end which shortens B length. To maintain "B" specify "SB"

PLL Precision Overall Length

Same as SL except overall length is held to ± 0.001 .

ST Thinner Head than Standard

Stock removal from head end which shortens overall length.

PTT Precision Head Thickness

Same as ST except head thickness tolerance is held to ± 0.0005

SH Reduced Head Diameter

Minimum head diameter equals $D + .000 - .001$

SEC Smaller Ejector Components

See page 66

STN Titanium Nitride coating for extra wear. For M2 & PM only.

STANDARD ALTERATIONS

Standard Alterations Pilot Punch

Standard alterations are the ranges beyond those sizes listed in the catalog which can be manufactured for a slight additional charge.

Standard Alterations Long Nose Pilot

Standard alterations are the ranges beyond those sizes listed in the catalog which can be manufactured for a slight additional charge.

SD Reduced Shank Diameter

Head diameter does not change with body diameter.

Shank Dia.	12	18	25	31	37	43	50	62	75	87	100
Min. SD	.063	.126	.188	.251	.313	.376	.438	.562	.688	.812	.938

SD Reduced Shank Diameter

Head diameter does not change with body diameter.

Shank Dia.	37	43	50	62	75	87	100
Min. SD	.313	.376	.438	.562	.688	.812	.938

SL Overall Length Shortened (1.00 min.)

Stock removal from point end which shortens B length. To maintain "B" specify "SB"

SL Overall Length Shortened (1.00 min.)

Stock removal from point end which shortens B length. To maintain "B" specify "SB"

ST Thinner Head than Standard

Stock removal from head end which shortens overall length.

ST Thinner Head than Standard

Stock removal from head end which shortens overall length.

PTT Precision Head Thickness

Same as ST except head thickness tolerance is held to $\pm .0005$

PTT Precision Head Thickness

Same as ST except head thickness tolerance is held to $\pm .0005$

SH Reduced Head Diameter

Minimum head diameter equals $D + .000 - .001$

SH Reduced Head Diameter

Minimum head diameter equals $D + .000 - .001$

SLD Longer Lead on Punches

TONDRA® (.050 MIN)
A unique wear-resistant surface treatment for M2 & PM only.

STN Titanium Nitride coating for extra wear. For M2 & PM only.

STANDARD ALTERATIONS

Standard Alterations Die Buttons

Standard alterations are the ranges beyond those sizes listed in the catalog which can be manufactured for a slight additional charge.

P & W Dimensions Larger than Standard

SP, SW

Body Code	Max DIAG.
18	.130
25	.190
31	.240
37	.290
43	.340
50	.390
62	.500
75	.600
87	.700
100	.800
125	1.000
150	1.200

Land Length Shorter or Longer than Standard

SB

Rounds	
Hole Range	Max B
.0310-.0620	2P
.0621-.0930	.187
.0931-.1580	.250
.1581-.2350	.312
.2351-.3000	.375
.3001-.4000	.437
.4001-Over	.500

Reduced Body Dia.

Head dia. does not change with body reduction.

SD

Body Code	Min SD	Max DIAG.
18	.126	.076
25	.188	.130
31	.251	.190
37	.313	.240
43	.376	.290
50	.438	.340
62	.562	.437
75	.688	.550
87	.813	.650
100	.938	.750
125	1.188	.950
150	1.438	1.150

SL

Overall Length Shortened

Min. overall length: Headless = .25
Headed = .25 + T

PLL

Precision Overall Length

Same as SL except overall length is held to ± .001.

ST

Thinner Head than Standard

Stock removal from head and end which shortens overall length.

PTT

Precision Head Thickness

Same as ST except head thickness tolerance is held to ± .0005.

SH

Reduced Head Diameter

Minimum head diameter equals D + .000 - .001

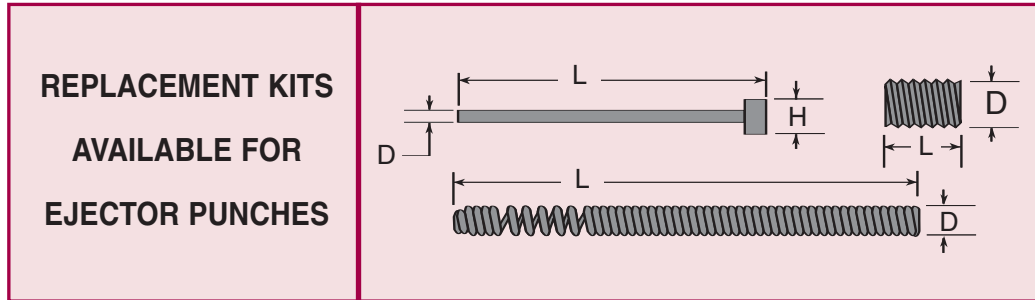
TONDRA®

(.050 MIN)
A unique wear-resistant surface treatment for M2 & PM only.

STN

Titanium Nitride coating for extra wear. For M2 & PM only.

**EJECTOR DATA
& EJECTOR KITS**



	PIN SIZE			PIN HOLE	SPRING SIZE		SPRING HOLE	TAP SIZE	
	D	L	H		D	L		D	L
PE-2	.020	2	.072	.025	3/32	3	.106	5-40	1/8
PE-3	.030	2	.072	.035	1/8	3-1/4	.144	8-32	1/8
PE-4	.040	2	.072	.045	1/8	3-1/4	.144	8-32	1/8
PE-6	.060	2	.109	.065	1/8	3-1/4	.144	8-32	1/8
PE-9	.090	2	.187	.095	3/16	3-1/4	.213	1/4-20	3/16
PE-12	.120	2	.187	.125	3/16	3-1/4	.213	1/4-20	3/16

SELECTIVE		BASIC	
O.D.	PIN SIZE	O.D.	PIN SIZE
.1875	.020	.1875	.020
.250	.030	.250	.030
.3125	.040	.3125	.040
.375	.060	.375	.060
.4375	.060	.4375	.060
.500	.060	.500	.060
.625	.090	.625	.090
.750	.090	.750	.090
.875	.090	.875	.090
1.000	.090	1.000	.090
1.250	.120		
1.500	.120		
1.750	.120		
2.000	.120		
2.250	.120		
2.500	.120		

BALL LOCK			
LIGHT DUTY		HEAVY DUTY	
O.D.	PIN SIZE	O.D.	PIN SIZE
.250	.020 (.060-.0799)	3/8	.020 (.062-.1149)
.250	.030 (OVER .080)	3/8	.040 (OVER .115)
.375	.040	1/2	.060
.500	.060	5/8	.060
.625	.060	3/4	.090
.750	.090	7/8	.090
.875	.090	1.000	.090
1.000	.090	1.250	.120

TONS OF PRESSURE REQUIRED FOR PUNCHING MILD STEEL

This table below shows the tons of pressure required for single mild steel derived by the formula: Tons of pressure required = hole size x material thickness x constant 80. All figures shown are tons or percentages of tons. For intermediate sizes interpolations can be made.

By use of this chart, the tons of pressure required for multiple punching can also be figured.

Example: Can eight holes 1/8" round and two holes 3/16" round be punched in 16 gauge material on a 10 ton press?
 Yes.
 Tons pressure requires for one hole 1/8" round in 16 ga. = .60 tons.
 Tons of pressure requires for one hole 3/16" round in 16 ga. = .90 tons.
 8 holes x .60 tons = 4.80
 2 holes x .90 tons + 1.80
 6.60 tons

Tons of pressure for punch sizes over 1" round can also be computed
 Example: What pressure is required to punch a 2-1/4" round hold in 7/8" thick material? Since a 1" round hole in 7/8" thick material requires 70 tons pressure, a 2-1/4" round hole in 7/8" thick material requires 157.50 tons.

STOCK THICKNESS	PUNCH SIZE															
	1/8	3/16	1/4	5/16	3/8	7/16	1/2	9/16	5/8	11/16	3/4	13/16	7/8	15/16	1"	
26 ga. .0179	.18	.27	.36	.45	.54	.63	.72	.81	.90	.99	1.07	1.16	1.25	1.34	1.43	
24 ga. .0239	.24	.36	.48	.60	.72	.84	.96	1.08	1.20	1.31	1.43	1.55	1.67	1.89	1.91	
22 ga. .0299	.30	.45	.60	.75	.90	1.05	1.20	1.35	1.50	1.65	1.80	1.95	2.10	2.24	2.39	
20 ga. .0359	.36	.54	.72	.90	1.08	1.26	1.44	1.62	1.80	1.98	2.15	2.33	2.51	2.69	2.87	
18 ga. .0478	.48	.72	.96	1.20	1.43	1.67	1.91	2.15	2.39	2.63	2.87	3.11	3.34	3.58	3.82	
16 ga. .0598	.60	.90	1.20	1.50	1.79	2.09	2.39	2.69	2.99	3.29	3.59	3.89	4.19	4.49	4.78	
14 ga. .0747	.75	1.12	1.49	1.87	2.24	2.61	2.99	3.36	3.73	4.11	4.48	4.86	5.23	5.60	5.97	
12 ga. .1046	1.05	1.57	2.09	2.62	3.14	3.66	4.18	4.71	5.23	5.75	6.28	6.80	7.32	7.85	8.57	
10 ga. .1345	1.34	2.02	2.69	3.36	4.04	4.71	5.38	6.05	6.73	7.40	8.07	8.74	9.42	10.09	10.76	
3/16 .187	1.87	2.81	3.74	4.68	5.61	6.55	7.48	8.42	9.35	10.29	11.22	12.16	13.09	14.03	14.96	
1/4 .250	2.50	3.75	5.00	6.25	7.50	8.75	10.00	11.25	12.50	13.75	15.00	16.25	17.50	18.75	20.00	
3/8 .375		5.62	7.50	9.37	11.25	13.13	15.00	16.88	18.75	20.63	22.50	24.38	26.25	28.13	30.00	
1/2 .500			10.00	12.50	15.00	17.50	20.00	22.50	25.00	27.50	30.00	32.50	35.00	37.50	40.00	
5/8 .625				15.62	18.75	21.87	25.00	28.12	31.25	34.38	37.50	40.63	43.75	46.88	50.00	
3/4 .750					22.50	26.25	30.00	33.75	37.50	41.25	45.00	48.75	52.50	56.25	60.00	
7/8 .875						30.62	35.00	39.37	43.75	48.12	52.50	56.84	61.25	65.63	70.00	
1" 1.000							40.00	44.96	50.00	54.96	60.00	64.96	70.00	74.96	80.00	

Pressures above are reduced by shear on punch end or staggering punches.

Ratio holes requiring Pivot Whipsleeve type punches

WHEN ORDERING WHIPSLEEVE PUNCHES:

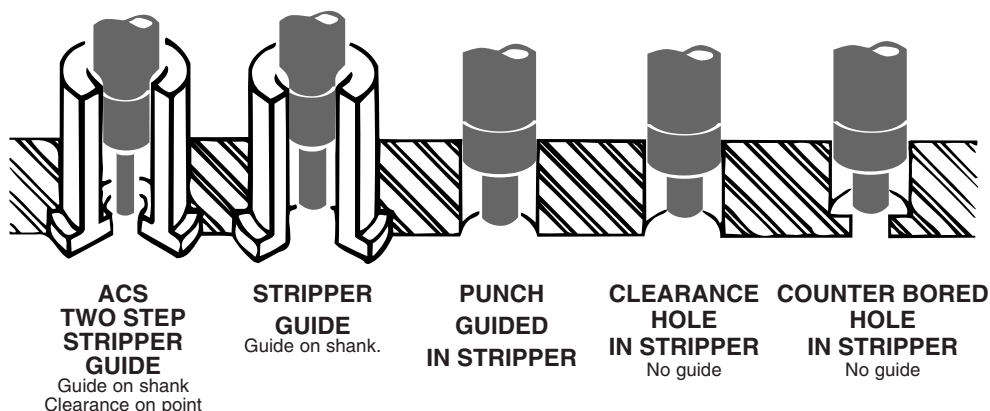
1. Use shortest possible point length for added strength on critical punches.
2. Use largest practical size shank in relation to point diameter
3. Use maximum punch and die clearance wherever possible.
4. Consider hardness as well as thickness of material to be punched in

relation to point diameter. (in most cases, the XS punch will penetrate thickness as much as twice the diameter of the punch – replacing many drilling operations.)

5. Provide depth stop so that punches cannot set too deep
6. Provide taper on die sections or die buttons all the way through
7. Provide taper slug clearance in die shoe

WHEN GUIDING IN STRIPPER BUSHING

Make certain the shipsleeve is an easy slipfit in the guide bushing. When guiding in the stripper itself itself use 4140 steel or equivalent, hardness approx. 300 Brinell, heat treated before machining. Be sure shipsleeve is engaged in guide before punch contacts material. Pivot Punches are supplied without guides. Use ACS Stripper Guide Bushings. (See Selective Series Catalog Page 16), Standard Drill Bushings, or the type of guide that will give the punch the proper support for the particular application. Examples are shown.



KEY UNIVERSAL NUMBERING

POSITION ONE - SERIES

	DESCRIPTION
19	Other - Inch
10	Basic - Inch - Steel
11	Variable - Inch - Steel
12	Light Duty Ball Lock - Inch - Steel
13	Heavy Duty Ball Lock - Inch - Steel
20	Basic Machinable Head - Carbide
21	Precision Machinable Head - Carbide
30	Basic Step-A-Head - Carbide
31	Precision Step-A-Head - Carbide
40	Basic With Sleeve - Carbide
41	Precision With Sleeve - Carbide
59	Other - Metric
50	Basic - Metric - Steel
51	Variable - Metric - Steel
52	Light Duty Ball Lock - Metric - Steel
53	Heavy Duty Ball Lock - Metric - Steel
61	Precision Machinable Head - Metric - Carbide

POSITION TWO - TYPE

	DESCRIPTION
01	Solid Punch
02	Ejector Punch
03	Wire Punches (Basic Only)
04	Angle Head Punches
05	Combination Angle Head Punches
06	Cylindrical Head Punches
07	Air Hole Punch
08	Solid Center Dowel Punch
09	Ejector Center Dowel Punch
21	Angle Head Punch Holder
22	Combination Angle Head Punch Holder
23	Cylindrical Head Punch Holder
31	Headless Punch Guide Bushing
32	Head Down Punch Guide Bushing
33	Head Up Punch Guide Bushing

POSITION TWO - (CONT'D)

	DESCRIPTION
41	Headless Press Fit Die Button
42	Headed Press Fit Die Button
43	Ball Lock Die Button
51	Headless Precision Press Fit Die Button
52	Headed Precision Press Fit Die Button
53	Headless Precision Press Fit Die Button - Full Taper
54	Headed Precision Press Fit Die Button - Full Taper
55	Headless Precision Press Fit Die Button - Split Type
61	Retainers
62	Backing Hole
71	Ball Lock Punch & Die Button Gage
72	Ball Lock Punch & Die Button Gage Check Master
73	Ball Lock Retainer Gage
91	Lite Duty Urethane Stripper - Tube
92	Medium Duty Urethane Stripper - Tube
93	Heavy Duty Urethane Stripper - Tube
94	Extra Heavy Duty Urethane Stripper - Tube
95	Lite Duty Urethane Stripper - Closed End
96	Medium Duty Urethane Stripper - Closed End
97	Heavy Duty Urethane Stripper - Closed End
98	Extra Heavy Duty Urethane Stripper - Closed End

POSITION THREE - CONFIGURATION

	DESCRIPTION
01	Round
02	Rectangle
03	Obround
04	Square
05	End
06	Universal
07	Pilot - Parabolic
08	Pilot - Long Nose
09	Blank
10	Round Straight Punch
11	EDM Die Button Blank - Drilled Wire Hole
12	EDM Die Button Blank - Ground Wire Hole

SPECIFY MATERIAL	M-2
SHAPE SIZE	.312x.250
POINT LENGTH	062 5/8
OVERALL LENGTH	250 2-1/2"
BODY DIAMETER	037 3/8
POSITION THREE	03 Obround
POSITION TWO	01 Solid Punch
POSITION ONE	10 Basic



ON THE CUTTING EDGE OF INDUSTRY

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PS1015M