Sheet Metal Guidelines

HANSEN INDUSTRIES LTD.

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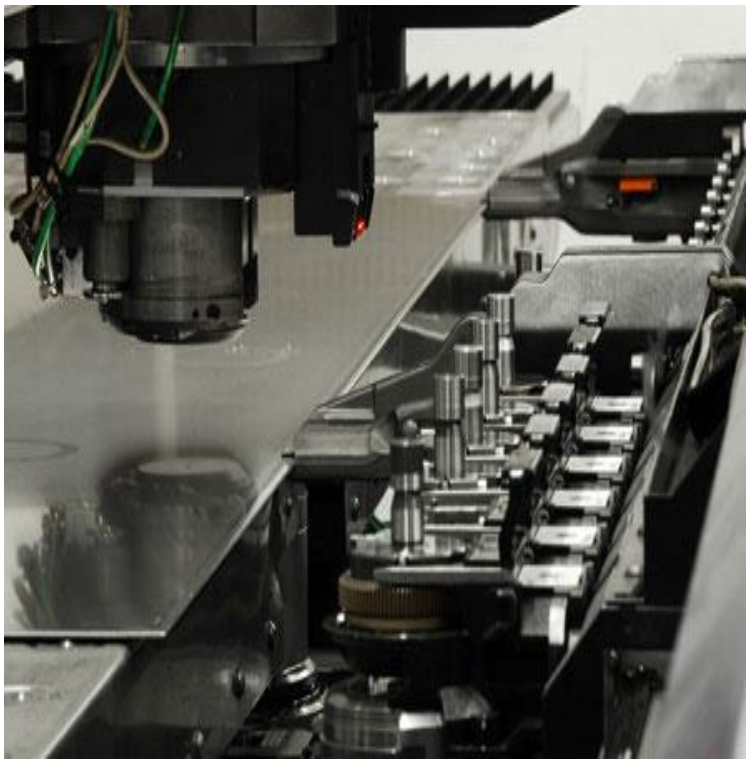
Overview

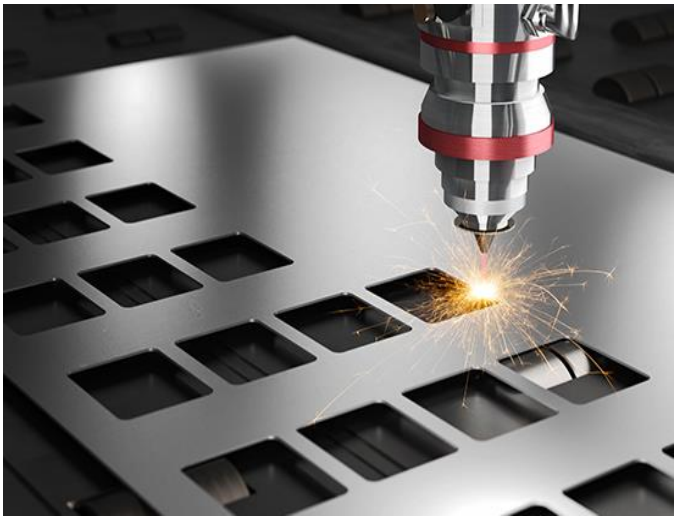
Hansen Industries Ltd. is a privately-owned company founded in 1975 in Richmond, British Columbia. Our company has grown from being a supplier of elevator replacement parts to a combined custom precision sheet metal, machine shop, stamping shop and waterjet cutting shop. Since 1975, Hansen Industries has earned a reputation for quality work in both precision sheet metal and machining. We were one of the first job shops in BC to adopt ISO 9001 quality standards and we are one of the most horizontally integrated metal shops in British Columbia. **"Quality on Time"** is the moto of our work.



Sheet metal is metal formed by an industrial process into thin, flat pieces. It is one of the fundamental forms used in metalworking and it can be cut and bent into a variety of shapes. Countless everyday objects are fabricated from sheet metal. Thicknesses can vary significantly; extremely thin thicknesses are considered foil or leaf, and pieces thicker than 6 mm (0.25 in) are considered plate.

Sheet Metal fabrication is the building of metal structures by cutting, bending, and assembling processes. It is a value added process that involves the construction of machines and structures from various raw materials. This guide will help you to understand sheet metal product design tips and fabrication techniques.

Capabilities



Our strength is manufacturing precision parts with tolerances up to +/- 0.005". Sheet metal shop has computer numerical controlled (CNC) equipment as well as traditional machinery. Three dimensional CAD/CAM systems allow low repeat coasts for both low and high quantities. Precision equipment is the basis to produce close tolerance parts. Our in-house capabilities are as follows:

CNC Punching (with automatic sheet loader)	Maximum Sheet size	48"x 96"(1.22m x 3.05m)
Shearing	Maximum Sheet size	10'x 6mm (.236") mild steel
Laser Cutting	Maximum Sheet size Max thickness	60"x120"(1.524m x 3.05m) 3/4" Steel
Bending and Forming (CNC brake press)	Maximum bend length Max Tonnage	120" 143 tons
Welding (Manual and Robotic)	MIG, TIG, Spot, Robotic	Material: Steel, Aluminum, Stainless steel
In-Line Finishing	Maximum width Maximum length	37"(93.98cm) Unlimited

Laser Cutting

Mitsubishi NX3015, 4000 watt flying optics Laser Processing system, 5′ x 10′ capacity. Automation includes 16 raw material shelves, suction cup load, and two over/under unload cart. This machine is design to cut up to one-inch mild steel 24 hours a day, seven days a week.

Cutting Condition Table

MATERIAL	ASSIST GAS	THICKNESS	FEEDRATE INCHES/MIN	PIERCE RATE SEC
STAINLESS	NITROGEN	0.030	220	0.1
STAINLESS	NITROGEN	0.036	240	0.1
STAINLESS	NITROGEN	0.048	240	0.1
STAINLESS	NITROGEN	0.060	195	0.1
STAINLESS	NITROGEN	0.074	190	0.1
STAINLESS	COMP. AIR	0.104	140	0.2
STAINLESS	NITROGEN	0.119	120	0.1
STAINLESS	NITROGEN	0.134	145	0.3
STAINLESS	NITROGEN	0.187	100	0.4
STAINLESS	NITROGEN	0.250	70	0.6
STAINLESS	NITROGEN	0.375	35	1.5

MATERIAL	ASSIST GAS	THICKNESS	FEEDRATE INCHES/MIN	PIERCE RATE SECONDS
ALUM	COMP.AIR	0.025	170	0.1
ALUM	COMP.AIR	0.030	170	0.1
ALUM	COMP.AIR	0.040	270	0.3
ALUM	COMP.AIR	0.050	270	0.2
ALUM	COMP.AIR	0.060	200	0.2
ALUM	COMP.AIR	0.080	170	0.1
ALUM	COMP.AIR	0.090	160	0.1
ALUM	COMP.AIR	0.100	100	0.1
ALUM	COMP.AIR	0.125	85	0.5
ALUM	NITROGEN	0.187	80	1.2
ALUM	NITROGEN	0.250	65	3.5
ALUM	NITROGEN	0.375	20	8

MATERIAL	ASSIST GAS	THICKNESS	FEEDRATE INCHES/MIN	PIERCE RATE SECONDS
MS	NITROGEN	0.030	265	0.1
MS	NITROGEN	0.036	230	0.1
MS	NITROGEN	0.048	180	0.1
MS	NITROGEN	0.059	190	0.1
MS	NITROGEN	0.074	170	0.1
MS	NITROGEN	0.104	140	0.4
MS	NITROGEN	0.119	120	0.3
MS	OXYGEN	0.134	140	0.3
MS	OXYGEN	0.187	130	1.7
MS	OXYGEN	0.250	90	4
MS	OXYGEN	0.312	78	5
MS	OXYGEN	0.375	50	10
MS	OXYGEN	0.500	38	26
MS	OXYGEN	0.625	40	36
MS	OXYGEN	0.750	32	35

Certification & Registrations

Our Quality Management System (QMS) is certified by the SAI Global to ISO 9001:2015 under Certificate Number 0100688, SAI file # 003235. Our Quality Statement is "Quality on Time". Our acceptance levels are 99% and our On-Time Delivery is tracking at 97%.

CERTIFICATE
OF REGISTRATION

This is to certify that

Hansen Industries Ltd.

2871 & 2700 Olafsen Avenue, Richmond, British Columbia V6X 2R4 Canada

operates a

Quality Management System

which complies with the requirements of

ISO 9001:2015

for the following scope of certification

Precision sheet metal and machined components for manufacturing companies.

Certificate No.:	CERT-0100688	Original Certification Date:	April 20, 1995
File No.:	003235	Certification Effective Date:	February 21, 2017
Issue Date:	February 22, 2017	Certificate Expiry Date:	February 20, 2020

Nicole Grantham
General Manager SAI Global Certification Services

Certified System
ISO 9001

ANAB ACCREDITED

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Stock Materials

Gauge	Mild Steel			Zinc coated steel RoHS compliance upon request			Stainless Steel			Aluminum	Copper
	CRS	HRS	P/O	Galvanized	Galvaneal	Satin coat	316L	304 2B	304 #4	5052	C110
3/4		0.750									
1/2		0.500									
3/8		0.375								0.375	
1/4		0.256					0.250			0.250	
3/16		0.187					0.187			0.187	
1/8										0.125	
10	0.134			0.138			0.135			0.100	0.125
11	0.119			0.123			0.121			0.090	
12	0.104			0.108			0.109			0.080	0.108
14	0.074			0.078			0.075			0.063	0.086
16	0.059			0.063			0.059			0.050	0.0647
18	0.047			0.051			0.048			0.040	0.048
20	0.035			0.039			0.036			0.032	
22	0.029			0.033			0.030			0.025	0.027
24	0.023			0.027			0.024			0.020	0.0216
26	0.017			0.021			0.018			0.015	

Design Guidelines

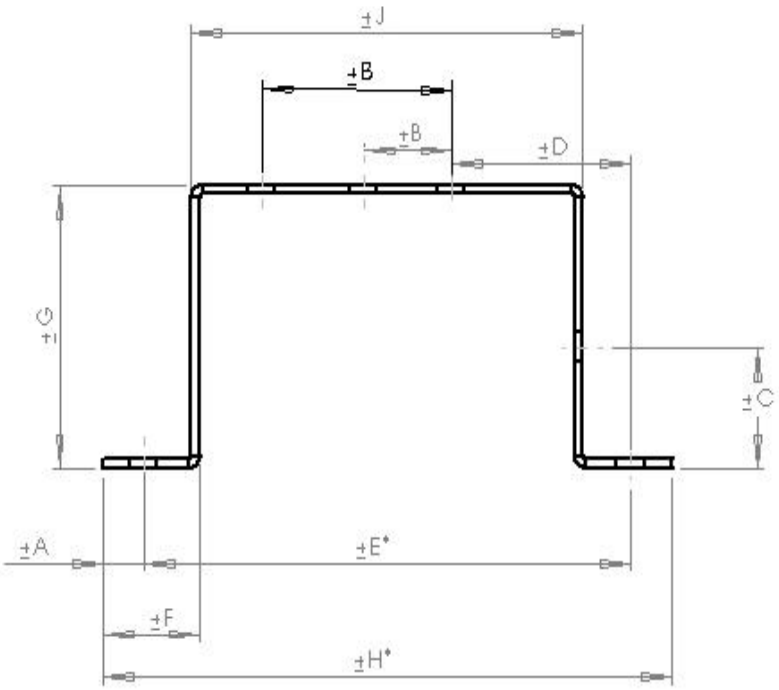
Tolerance

No machine can hold dimensions precisely to the nominal value, so there must be acceptable degrees of variation. If a part is manufactured, but has dimensions that are out of tolerance, it is not a usable part according to the design intent. Tolerances can be applied to any dimension.

For any type of material with thickness up to 0.135", Tolerance = ± 0.005" per bend. For example, a part with 5 bends, the linear dimensions that cross all 5 bends should have tolerance of ± 0.025" or more.

For any of material with thickness thicker than 0.135", Tolerance = ± 5% thickness per bend. For example, a 0.250" thick part with 5 bends, the linear dimensions that cross all 5 bends should have tolerance of (0.250"x5%) x 5 = ± 0.063" or more.

Recommended Default Sheet Metal Tolerances



*General purposed guideline only, please contacts Hansen for any special request.

DIM	Tolerance		Description
	Millimeter	Inches	
A	0.12	0.005	Sheared edge to hole
B	0.12	0.005	2 holes on one surface
C	0.25	0.010	Formed edge to hole
D*	0.38	0.015	Holes across 2 bends
E*	0.5	0.020	Holes across 4 bends
F	0.25	0.010	Sheared edge to bends
G	0.25	0.010	Across 2 bends
H*	0.64	0.025	Former part
J	0.25	0.010	Across 2 bends

Default Tolerances

General Dimensional Tolerances for Sheet Metal Formed Parts (Unless Otherwise Specified)				
Dimensional Range	Edge to edge or hole to hole, or edge to edge (No bend area) Flat	Edge or Hole to Bend	Bend to bend	Angular Tolerances
0.25" or less (6mm or less)	±0.005"(0.13mm)	±0.01"(0.25mm)	±0.01"(0.25mm)	±1 degree
Over 0.25" to 1" (over 6mm to 25mm)	±0.006"(0.15mm)	±0.01"(0.25mm)	±0.015"(0.38mm)	
Over 1" to 5" (over 25mm to 127mm)	±0.007"(0.18mm)	±0.01"(0.25mm)	±0.015"(0.38mm	
Over 5"to 16" (over 127mm to 406mm)	±0.008"(0.20mm)	±0.015"(0.38 mm)	±0.02"(0.51mm)	
Over 16" to 40" (over 406mm to 1016mm)	±0.01"(0.25mm)	±0.02"(0.51mm)	±0.02"(0.51mm)	
Over 40"to 90" (over 1016mm to 2286mm)	±0.02"(0.5mm)	±0.025"(0.64 mm)	±0.05"(1.27mm)	

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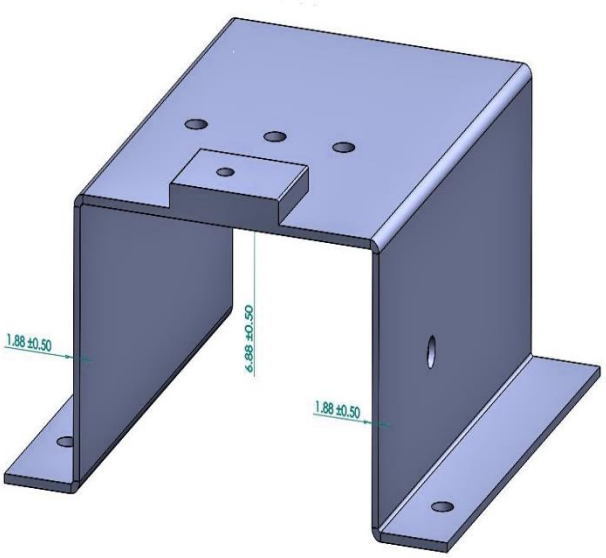
File Format and Sheet metal features

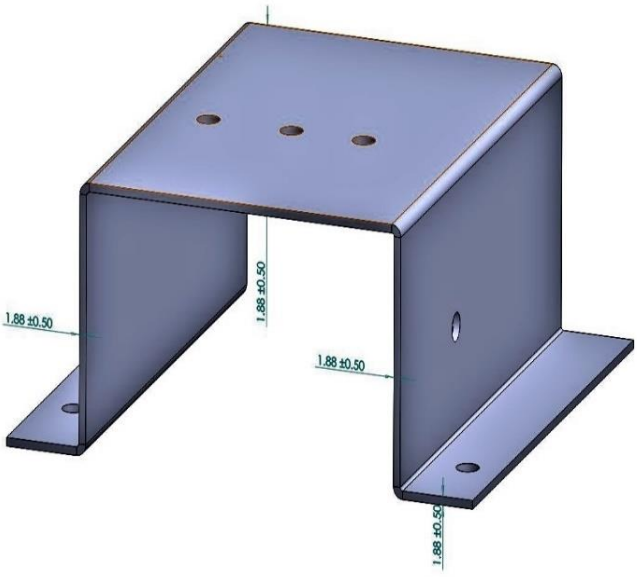
SolidWorks files use the Microsoft Structured Storage file format. This means that there are various files embedded within each SLDDRW (drawing files), SLDPRT (part files), SLDASM (assembly files) file, including preview bitmaps and metadata sub-files. Other formats are STEP, IGES, Dxf.

Uniform Wall Thickness

Sheet metal parts are manufactured from single sheet of metal, so the part must contain a uniform wall thickness. Hansen sheet metal is capable of laser cutting parts with maximum thickness:

Aluminum	3/8" thick
Steel	3/4" thick
Stainless steel	3/8" thick





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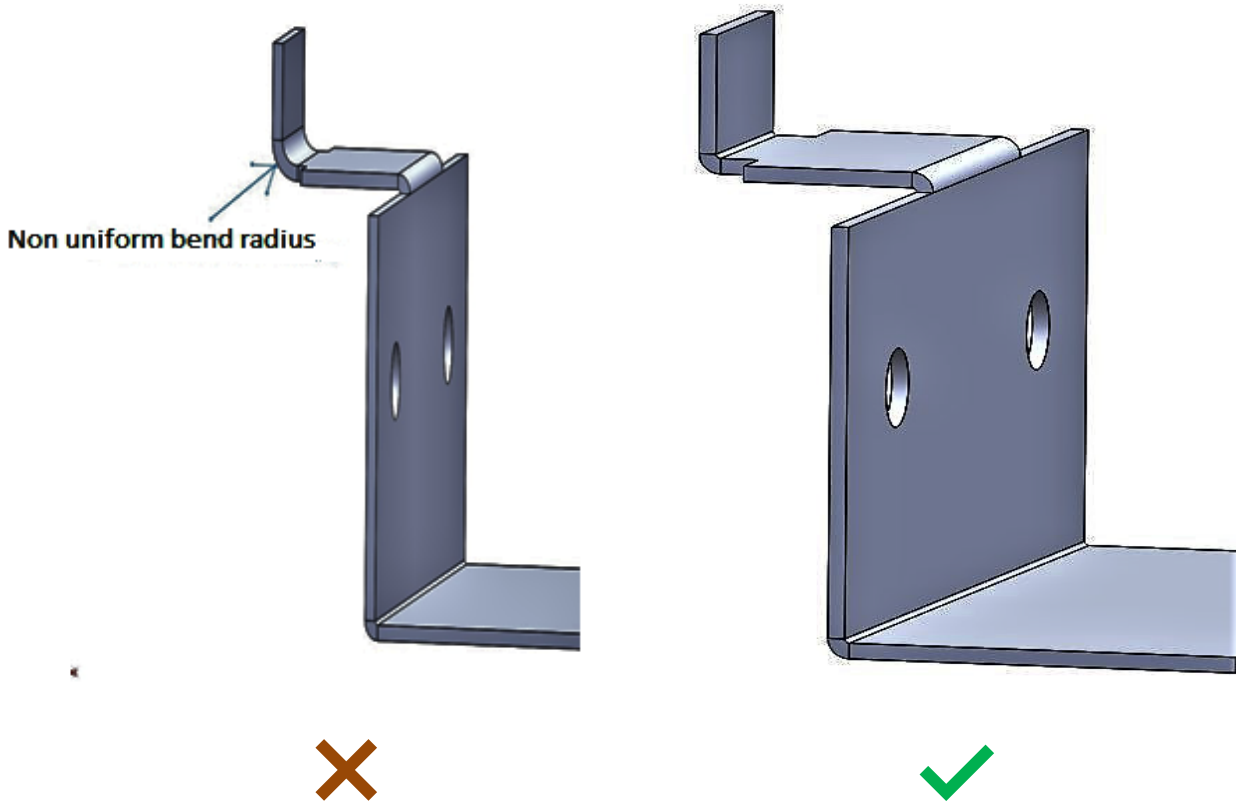
Bends

Bends in sheet metal are manufactured using brake presses. Hansen will hold a +/-1-degree tolerance on all bend angles. Hansen preferred bend radius is .032". Other standard bend radii available, some of them will add additional cost to your part, include:

0.020", 0.039", 0.0125", 0.250", 0.375", 0.500", 0.750", 1.000"

Uniform bend radius



Flange Size Chart

Forming near Holes- When a bend is made too close to a hole, the hole may become deformed. Figure "A" shows a hole that has become teardrop shaped because of this problem. To save the cost of punching or drilling in a secondary operation the following formula can be used to calculate the minimum distance required.

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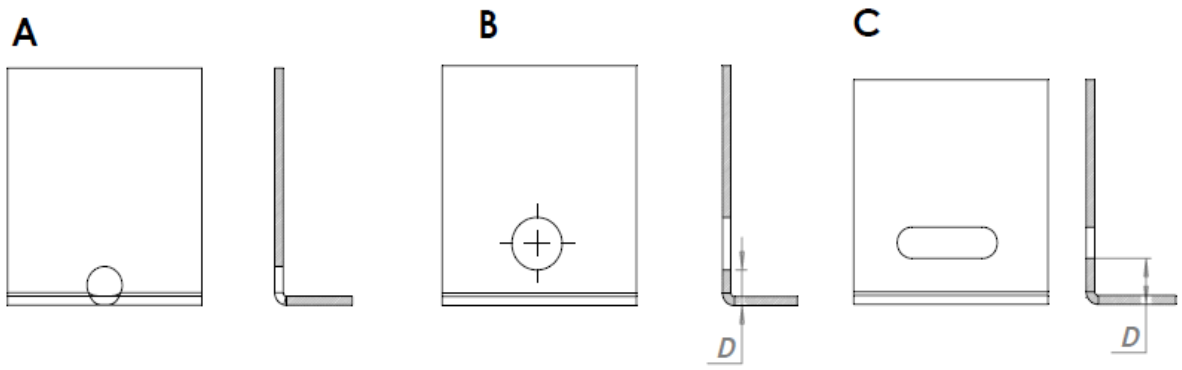


D=MINIMUM DISTANCE
T=MATERIAL THICKNESS
R=BEND RADIUS

Flange size for different bend radius

Aluminum										
GA	T Inch	R=0.032			R=0.125			R=0.250		
		Flange Min	Forming near hole		Flange Min	Forming near hole		Flange Min	Forming near hole	
			If hole dia < 1"	If hole dia > 1"		If hole dia < 1"	If hole dia > 1"		If hole dia < 1"	If hole dia > 1"
		D=2.5T+R	D=2T+R	D=2.5T+R	D=2.5T+R	D=2T+R	D=2.5T+R	D=2.5T+R	D=2T+R	D=2.5T+R
3/4	0.750	1.907	1.532	1.907	2.000	1.625	2.000	2.125	1.750	2.125
1/2	0.500	1.282	1.032	1.282	1.375	1.125	1.375	1.500	1.250	1.500
3/8	0.375	0.970	0.782	0.970	1.063	0.875	1.063	1.188	1.000	1.188
1/4	0.250	0.657	0.532	0.657	0.750	0.625	0.750	0.875	0.750	0.875
3/16	0.188	0.502	0.408	0.502	0.595	0.501	0.595	0.720	0.626	0.720
1/8	0.125	0.345	0.282	0.345	0.438	0.375	0.438	0.563	0.500	0.563
10	0.102	0.287	0.236	0.287	0.380	0.329	0.380	0.505	0.454	0.505
11	0.09	0.257	0.212	0.257	0.350	0.305	0.350	0.475	0.430	0.475
12	0.081	0.235	0.194	0.235	0.328	0.287	0.328	0.453	0.412	0.453
14	0.064	0.192	0.160	0.192	0.285	0.253	0.285	0.410	0.378	0.410
16	0.051	0.160	0.134	0.160	0.253	0.227	0.253	0.378	0.352	0.378
18	0.04	0.132	0.112	0.132	0.225	0.205	0.225	0.350	0.330	0.350
20	0.032	0.112	0.096	0.112	0.205	0.189	0.205	0.330	0.314	0.330
22	0.025	0.095	0.082	0.095	0.188	0.175	0.188	0.313	0.300	0.313
24	0.020	0.082	0.072	0.082	0.175	0.165	0.175	0.300	0.290	0.300
26	0.015	0.070	0.062	0.070	0.163	0.155	0.163	0.288	0.280	0.288

*General purposed guideline only, please contacts Hansen for any special request.

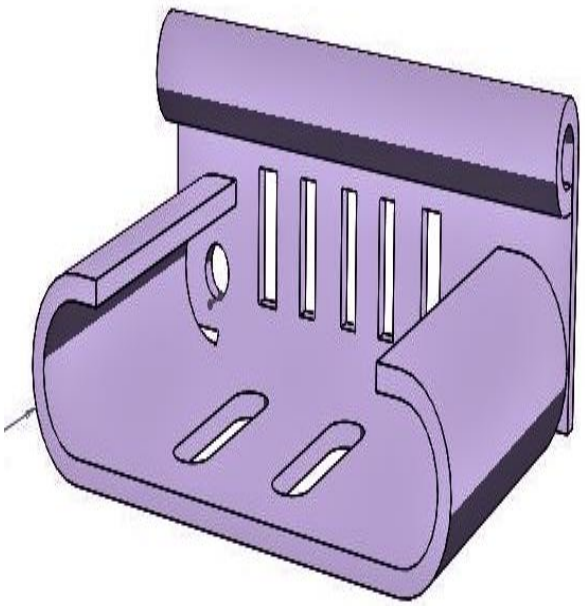
Steel										
GA	T Inch	R=0.032			R=0.125			R=0.250		
		Flange Min	Forming near hole		Flange Min	Forming near hole		Flange Min	Forming near hole	
			If hole dia < 1"	If hole dia > 1"		If hole dia < 1"	If hole dia > 1"		If hole dia < 1"	If hole dia > 1"
		D=2.5T+R	D=2T+R	D=2.5T+R	D=2.5T+R	D=2T+R	D=2.5T+R	D=2.5T+R	D=2T+R	D=2.5T+R
3/4	0.75	1.907	1.532	1.907	2.000	1.625	2.000	2.125	1.750	2.125
1/2	0.5	1.282	1.032	1.282	1.375	1.125	1.375	1.500	1.250	1.500
3/8	0.375	0.970	0.782	0.970	1.063	0.875	1.063	1.188	1.000	1.188
1/4	0.256	0.672	0.544	0.672	0.765	0.637	0.765	0.890	0.762	0.890
3/16	0.187	0.500	0.406	0.500	0.593	0.499	0.593	0.718	0.624	0.718
10	0.134	0.367	0.300	0.367	0.460	0.393	0.460	0.585	0.518	0.585
11	0.119	0.330	0.270	0.330	0.423	0.363	0.423	0.548	0.488	0.548
12	0.105	0.295	0.242	0.295	0.388	0.335	0.388	0.513	0.460	0.513
14	0.074	0.217	0.180	0.217	0.310	0.273	0.310	0.435	0.398	0.435
16	0.060	0.182	0.152	0.182	0.275	0.245	0.275	0.400	0.370	0.400
18	0.048	0.152	0.128	0.152	0.245	0.221	0.245	0.370	0.346	0.370
20	0.036	0.122	0.104	0.122	0.215	0.197	0.215	0.340	0.322	0.340
22	0.030	0.107	0.092	0.107	0.200	0.185	0.200	0.325	0.310	0.325
24	0.024	0.092	0.080	0.092	0.185	0.173	0.185	0.310	0.298	0.310
26	0.017	0.075	0.066	0.075	0.168	0.159	0.168	0.293	0.284	0.293

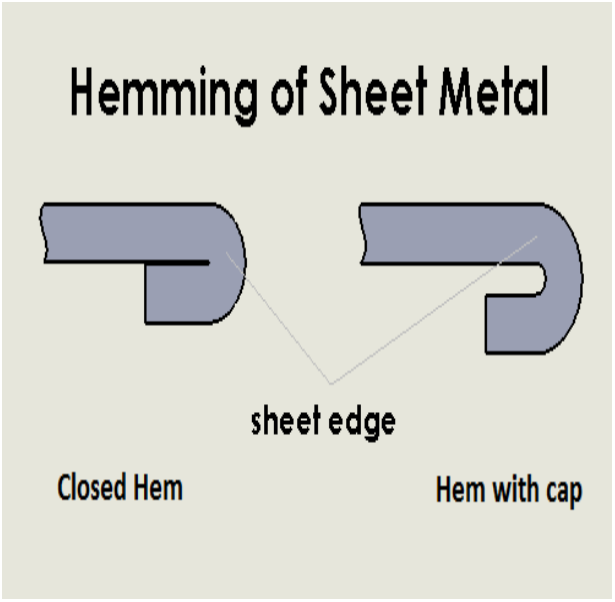
Stainless Steel										
GA	T Inch	R=0.032			R=0.125			R=0.250		
		Flange Min	Forming near hole		Flange Min	Forming near hole		Flange Min	Forming near hole	
			If hole dia < 1"	If hole dia > 1"		If hole dia < 1"	If hole dia > 1"		If hole dia < 1"	If hole dia > 1"
		D=2.5T+R	D=2T+R	D=2.5T+R	D=2.5T+R	D=2T+R	D=2.5T+R	D=2.5T+R	D=2T+R	D=2.5T+R
3/8	0.375	0.970	0.782	0.970	1.063	0.875	1.063	1.188	1.000	1.188
1/4	0.250	0.657	0.532	0.657	0.750	0.625	0.750	0.875	0.750	0.875
3/16	0.187	0.500	0.406	0.500	0.593	0.499	0.593	0.718	0.624	0.718
1/8	0.188	0.502	0.408	0.502	0.595	0.501	0.595	0.720	0.626	0.720
10	0.134	0.367	0.300	0.367	0.460	0.393	0.460	0.585	0.518	0.585
11	0.119	0.330	0.270	0.330	0.423	0.363	0.423	0.548	0.488	0.548
12	0.105	0.295	0.242	0.295	0.388	0.335	0.388	0.513	0.460	0.513
14	0.074	0.217	0.180	0.217	0.310	0.273	0.310	0.435	0.398	0.435
16	0.060	0.182	0.152	0.182	0.275	0.245	0.275	0.400	0.370	0.400
18	0.048	0.152	0.128	0.152	0.245	0.221	0.245	0.370	0.346	0.370
20	0.036	0.122	0.104	0.122	0.215	0.197	0.215	0.340	0.322	0.340
22	0.030	0.107	0.092	0.107	0.200	0.185	0.200	0.325	0.310	0.325
24	0.024	0.092	0.080	0.092	0.185	0.173	0.185	0.310	0.298	0.310
26	0.018	0.077	0.068	0.077	0.170	0.161	0.170	0.295	0.286	0.295

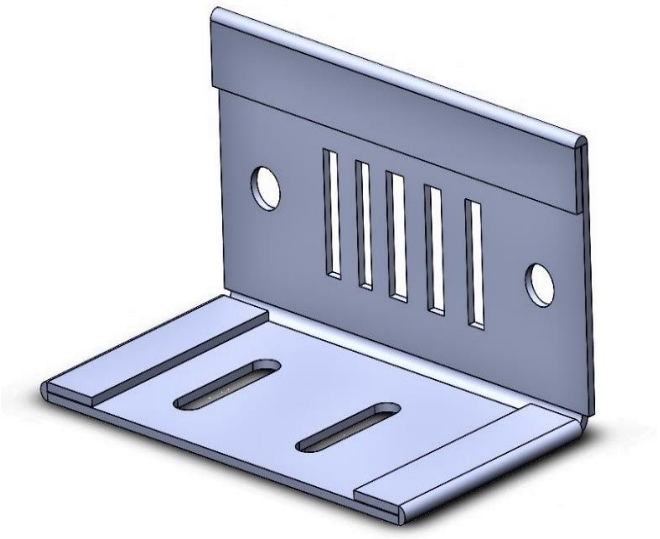
*General purposed guideline only, please contacts Hansen for any special request.

Hems

Hems are folds at the end of a part to create a rounded edge. Hansen can form both open and closed hems as required. The tolerance of hem is dependent upon the hem's radius, material thickness and features near the hem. It is recommended the minimum inside diameter equals the material thickness and the hem return length is at least 4 times the thickness.







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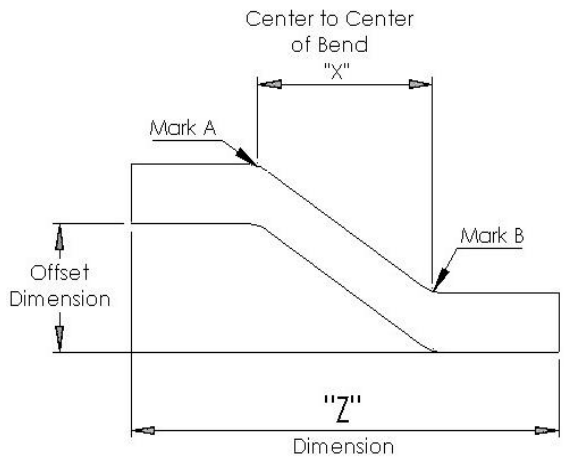
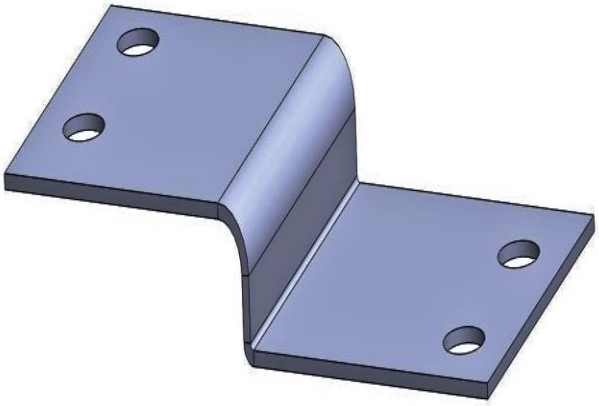
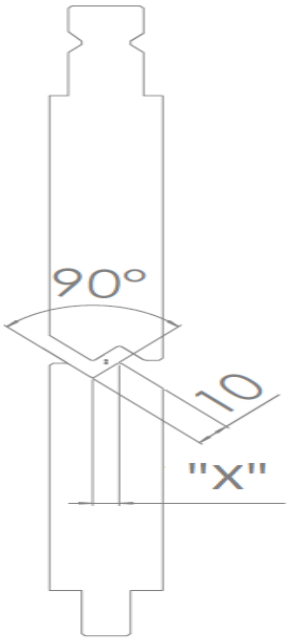
Offsets

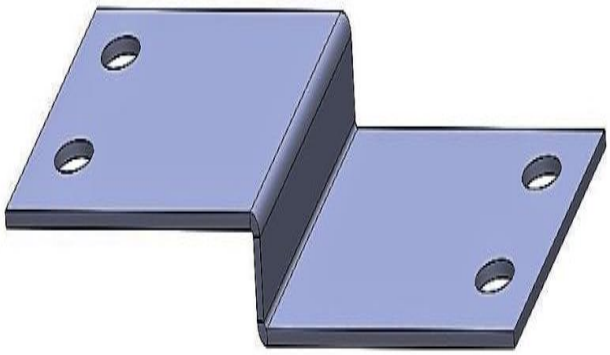


An offset is used to create a “Z” shaped profile in sheet metal part. Hansen offset height tolerance is +/-.016" top of sheet/top of form. Offset tooling allows two v bends to be formed closer together than regular Press Brake Dies would allow. This creates a z shaped profile in the sheet metal. This type of bend is also commonly referred to as a jog. Other standard offsets, which can add costs to your part, include:0.125",0.187",.0.250"0.394"





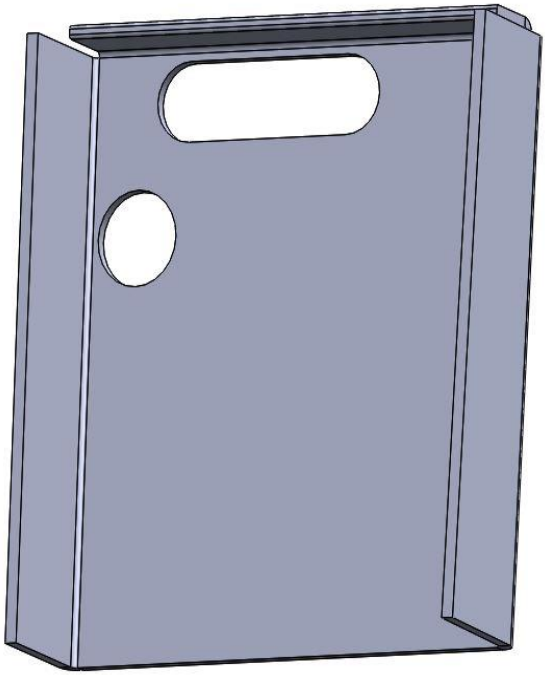
0.394" OFFSET TOOL

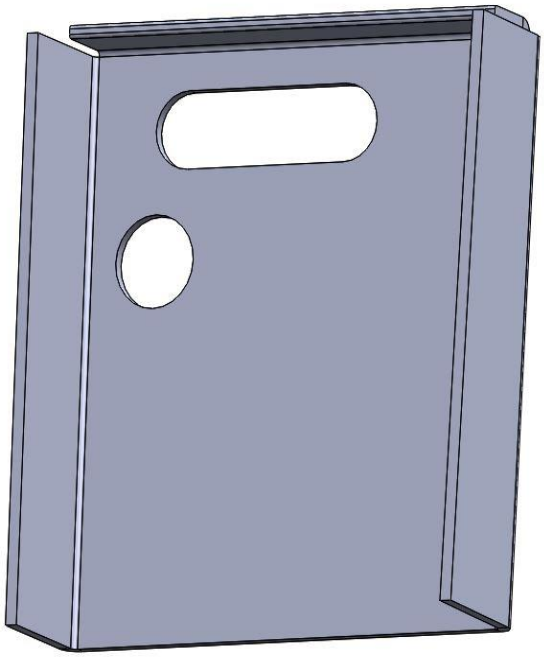


*General purposed guideline only, please contacts Hansen for any special request.

Holes and Slots

Holes and slots should be a minimum of material thickness in diameter. If a material is .036" or thinner the hole should be 0.062" from the material edge. If the material is thicker than 0.036then the hole should be at least 0.125" from the material edge to avoid distortion. If hardware inserts are required, the spacing should be according to manufacturer's specification.

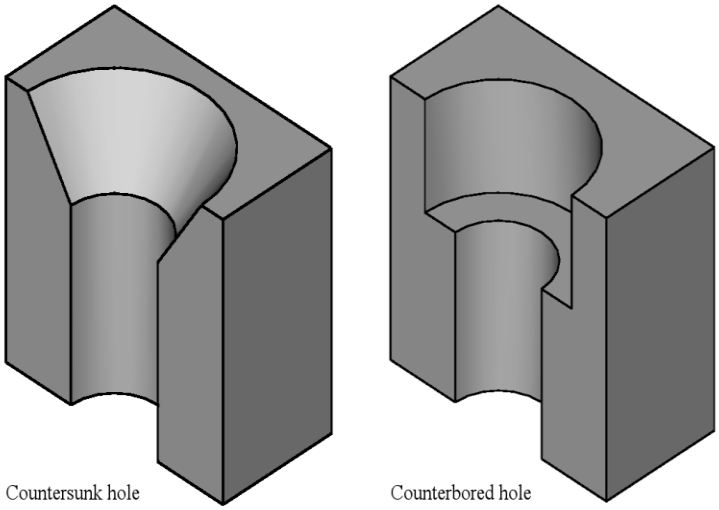




*General purposed guideline only, please contacts Hansen for any special request.

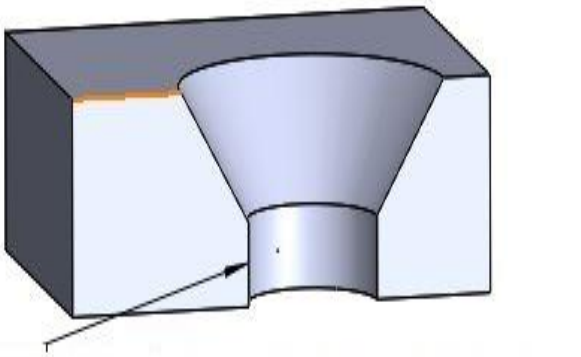
Counter Sink

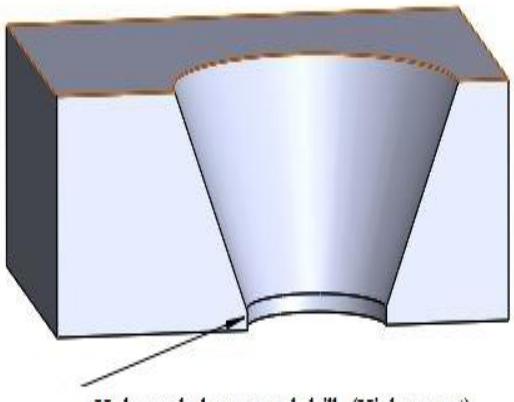
A countersink is a conical hole cut into a manufactured object, or the cutter used to cut such a hole. A common use is to allow the head of a countersunk bolt or screw, when placed in the hole, to sit flush with or below the surface of the surrounding material A countersink may also be used to remove the burr left from a drilling or tapping operation thereby improving the finish of the product and removing any hazardous sharp edges.



Counter Sink Tolerances:

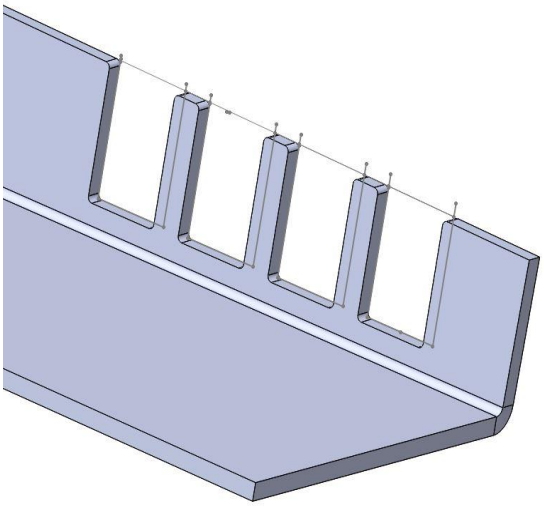
Drilled Counter Sink Major Diameter	+/-0.010"
Drilled Counter Sink Minor Diameter	+/-0.010"
Formed Counter Sink Minor Diameter	+/-0.025"
Formed Counter Sink Major Diameter	+/-0.020"


CNC for turned countersinks, minimum 15% of thickness required to avoid any unwanted burrs.

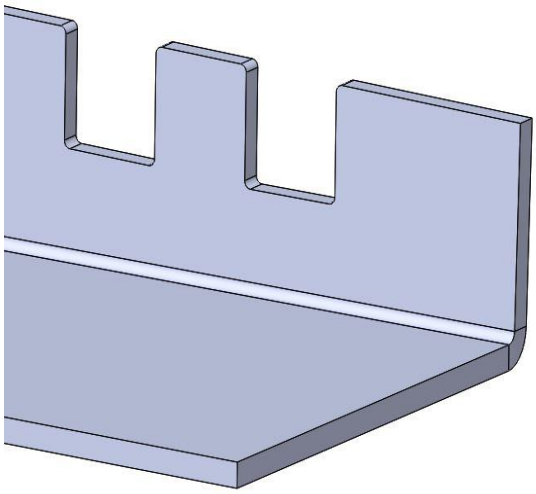

Hole made by manual drill (Higher cost)

*General purposed guideline only, please contacts Hansen for any special request.

Notches & Tabs



Notches must be at least the material thickness or 0.04", whichever is greater, and can be no longer than 5 times its width. Tabs must be at least 2 times the material thickness or 0.126", whichever is greater, and can be no longer than 5 times its width.



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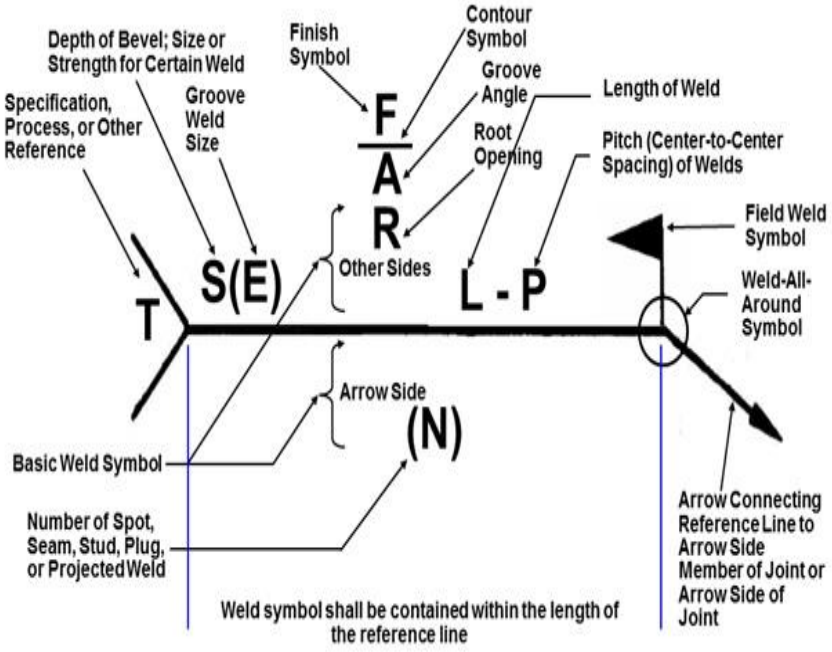
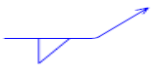
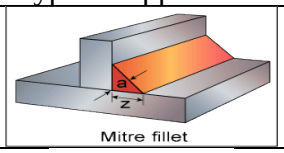
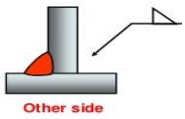
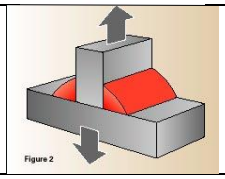
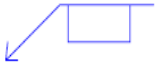
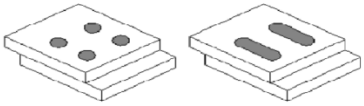
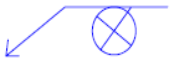
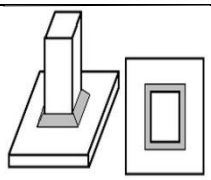
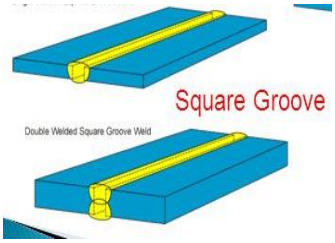
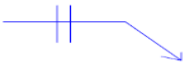
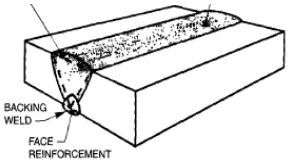
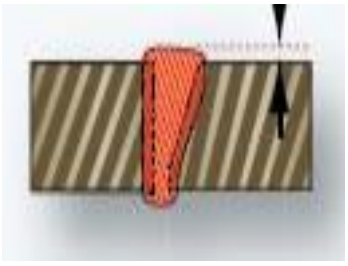
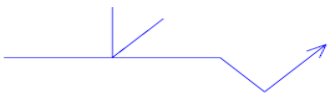
Welding

When designing a part requiring welding, it is best to not specify the exact method or type of welding unless required for function. This provides the manufacturer flexibility when fabricating the sheet metal part which often results in the most economical and fastest lead time choice for the customer. The three most common types of welding include Resistance Spot Welding (RSW), Gas Metal Arc Welding (MIG), Gas Tungsten Arc Welding (TIG).



Location	Symbol	Description	Typical Application
Arrow side		Fillet	
Other side		Fillet	
Both side		Fillet	
Arrow side		Plug or slot	
Other side		Plug or slot	

Arrow side		Stud	
Arrow side		Arc spot	
Other side		Arc spot	
All around		All around	
Arrow side		Square groove	
Other side		Square groove	
Both side		Square groove	
Arrow side		V Groove	
Other side		V Groove	
Both side		V Groove	
Arrow side		Bevel Groove	
Other side		Bevel groove	
Both side		Bevel Groove	

*General purposed guideline only, please contacts Hansen for any special request.

PEM Hardware

When designing sheet metal parts with PEM hardware it is important to make sure the hardware is not too close to bend, edge or another fastener. When designing near a bend or edge use the centerline to edge (C/L to Edge) value to find the minimum distance to the outside edge. When calculating the spacing between multiple pieces of hardware, use the C/L to edge formula plus ½ the diameter of the second mounting hole.

Material Thickness vs Shank Numbers

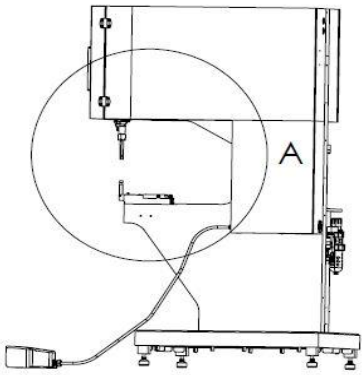
<table>
<tr><th>Hardware Type</th><th>Threaded ode</th><th>Min Sheet Thickness</th><th>Shank</th></tr>
<tr><td rowspan="4">S,SS,CLS,SP,CLA</td><td rowspan="3">AC,CLS,CLSS,F,FHS, SOS,BSOS,CLA</td><td>0.03"</td><td>0</td></tr>
<tr><td>0.04"</td><td>1</td></tr>
<tr><td>0.056"</td><td>2</td></tr>
<tr><td>632,832,024,032</td><td>0.091"</td><td>3</td></tr>
<tr><td rowspan="3">S,SS,CLS,SP,CLA</td><td rowspan="2">0420,0428,0518</td><td>0.056"</td><td>1</td></tr>
<tr><td>0.091"</td><td>2</td></tr>
<tr><td>M6,M8</td><td>0.0125"</td><td>3</td></tr>
<tr><td rowspan="2">F</td><td>256,440,632,832,032</td><td>0.060"-0.90</td><td>1</td></tr>
<tr><td>M2.5,M3,M4,M5</td><td>0.90"-U P</td><td>2</td></tr>
<tr><td rowspan="2">SO,SOS,SO4,BOS,BSOS BSO4</td><td>440,6440632,M3,4 8362,832,032</td><td colspan="2" rowspan="2">0.040", If less than 0.04", use TSIS(0.025" Minimum)</td></tr>
<tr><td>M3,M4</td></tr>
<tr><td>SO,SOS,SO4,BSO,BSOS, BSO4</td><td>8362,832,032</td><td>0.050"</td><td></td></tr>
<tr><td rowspan="4">FH,FHS,FH4,FHA</td><td rowspan="2">256,440,632,832,024,032, M2.5,M3,M4,M5</td><td>0.040"</td><td rowspan="2"></td></tr>
<tr><td>0.62"</td></tr>
<tr><td>0.0420</td><td rowspan="2">0.93"</td><td></td></tr>
<tr><td>0.0518</td><td></td></tr>
<tr><td>FEO (Locking), FEOX</td><td>440,632,832,0.032,M3 M4,M5</td><td>0.039"-0.045"</td><td rowspan="2">AFTER PLATING</td></tr>
<tr><td>FE(Locking) FEX</td><td>440,632,832,0.032,M3,M4,M5</td><td>0.059"-.070"</td></tr>
</table>

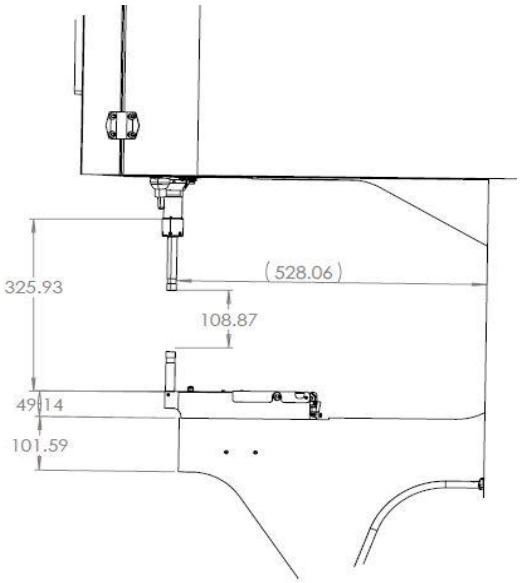
*General purposed guideline only, please contacts Hansen for any special request.

Special Case

Hardware Type	Special Info	Install in stainless
PL,PLC	Nylon Threads	NO
TD,RAS,RSS	Steel Only	NO
All Panel Fasteners:PF11,PF12,PFC2	Installed post finishing	NO
LK,LKS,LKA	Treated w/Black Dry Lubricant	NO

PEMSERTER





Sample A

Hansen have standard die of size

0.625-inch diameter.

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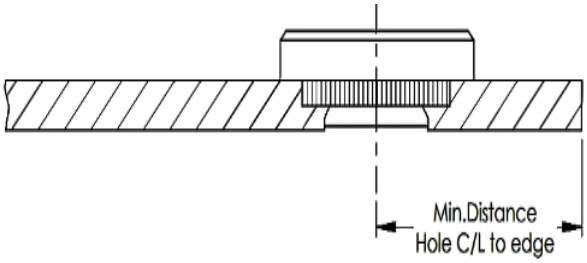
COMMON DESIGN DIFFICULTIES

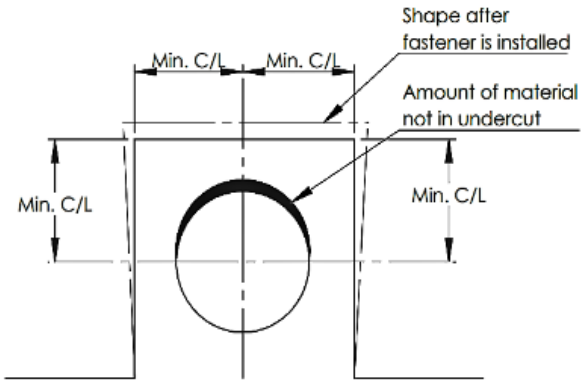
Close to the Edge(Single Edge)

Sheet metal may bulge or blow out, when PEM hardware are installing too close to the edge. Special anvils are used to support the edges for reinforcement. Special application would require additional tooling cost.



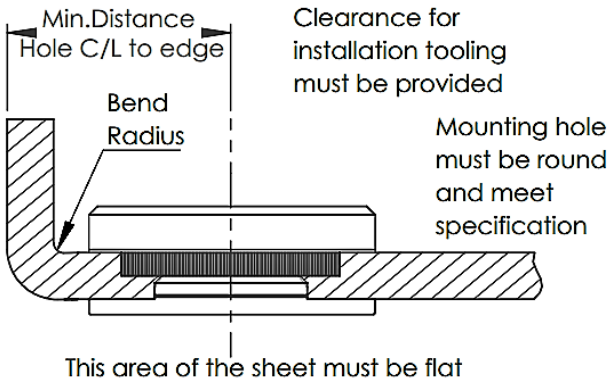
Multi sided and close to the edge

If the edges are not supported during installation there will be significant panel distortion as shown by construction lines. This distortion will reduce the holding power of the clinch feature.



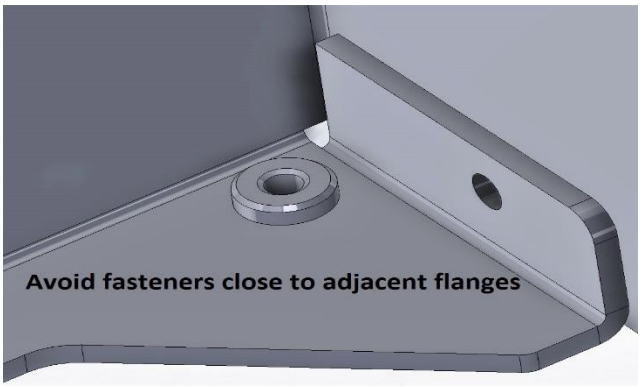
Near a Bend

Use the "Centerline-to-edge" value to find the minimum distance to the outside of the bend radius. Do the bending before installing PEM hardware. Avoid fasteners close to the adjacent flanges.



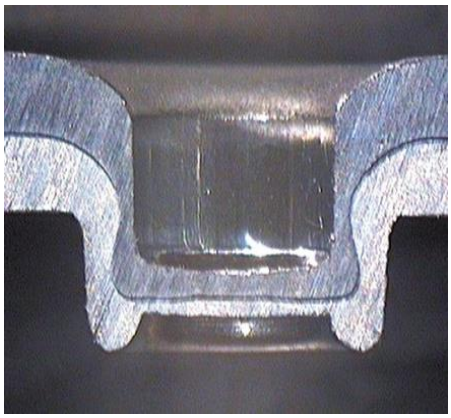
Multiple fasteners

Enough spacing should give for adjacent fasteners to avoid distortion each other's holes. Calculate the distance by the formula C/L to edge +1/2 the diameter of the second mounting hole.



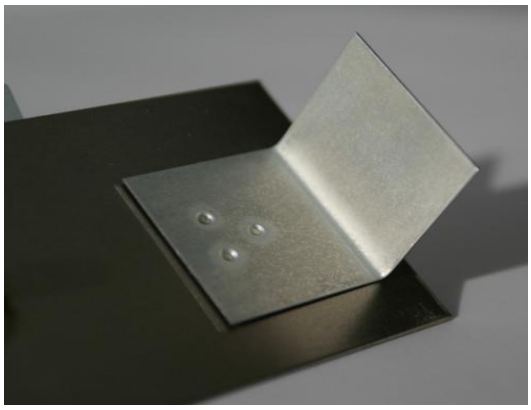
*General purposed guideline only, please contacts Hansen for any special request.

CLINCHING (Tog-L-Loc)



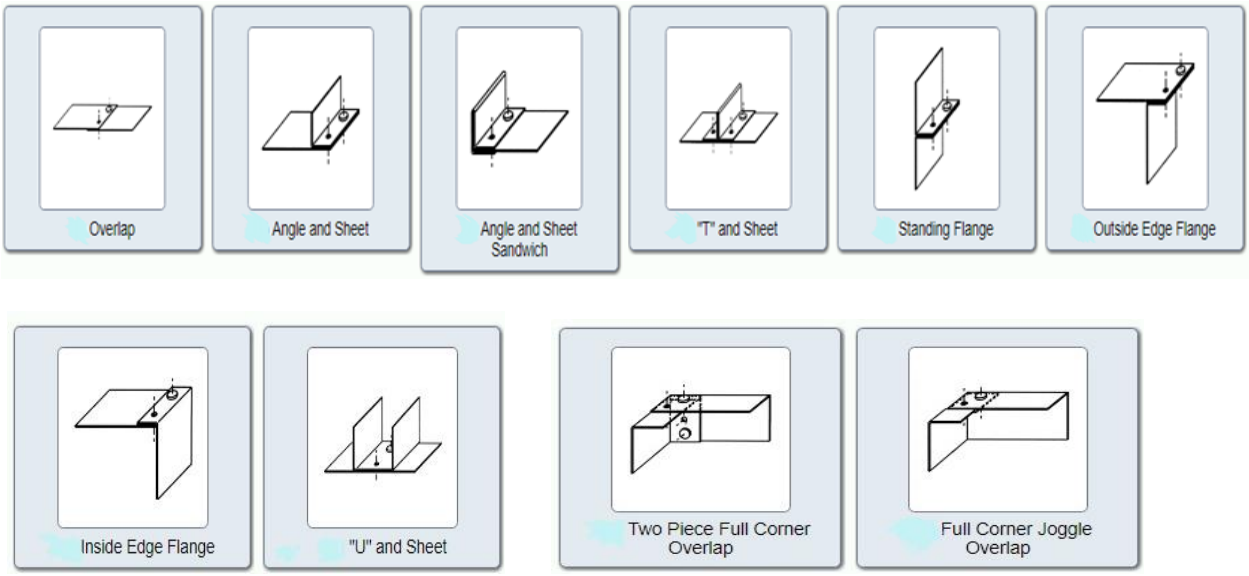
Cold-forms the part metal using a special punch and die to form a strong interlocking clinch joint. The result of the process is a round, button shaped extrusion on the die side of the assembly, and a small cylindrical cavity on the punch side. The clinch joint requires only the sheet metals that were joined.

Clinching tool sizes are measured at the punch tip diameter. Hansen currently offer one standard clinching button size ϕ4.6mm [.18in]. It can be able to join two different type of metal part together by clinching.



Clinch joint strength is determined by the type and thickness of the materials on both the punch and die side. Clinch joints are stronger when the punch side material is thicker than the die side material. Hansen offers clinching range of 2x0.3 mm to 2x2 mm thickness of the material.

Clinching application



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Standard Tooling

Tooling, also known as machine tooling, is the process of acquiring the manufacturing components and machines needed for production. The common categories of machine tooling from sheet metal shop of Hansen Industries include, CNC punch press tooling and CNC brake press tooling. Proper tooling directly affects output capacity as well as product lifecycle, quality and pricing.

Please refer to the Appendix for a complete list of Trumpf punch press tooling, Trumpf and Amada brake press tooling.

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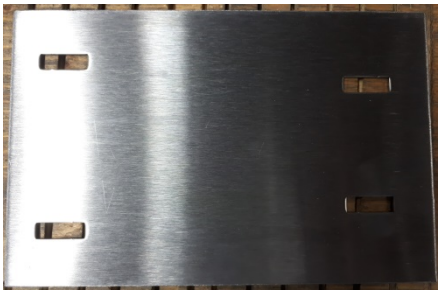
Deburring and surface finishing

Mechanical deburring is a process that either mechanically grinds a burr off of metal or rolls the edge of dangerous slit or sheared metal burrs into it, Burrs are sharp edges resulting from cutting and stamping operations. Although usually small in size, burrs can cause assembly problems, interfere with fluid flow, and are a common cause of worker injury. Burrs can also cause increased stresses and subsequent fatigue failure of the part. Hansen has the following types of deburring process to remove any unwanted burrs on metal parts.

In line finishing

Deburring, edge rounding, graining on one side in a single pass. The machine will remove burrs, slag and clean edges and surfaces of the part. Machines work unsupervised in automatic cycles.



Applications: Plating, finishing with grain direction, #4 finish

Vibrating deburring

The pneumatic linear vibrating machine controlled by compressed air can edge rounding, de-slagging and oxide removal from the parts. The sand paper grade will make different finishing. Grades 60,120,220 grit are commonly used.

Application: powder coating

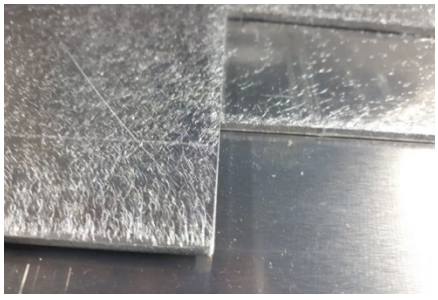
Stroke sanding

A large production sander that uses a hand-operated platen on a standard sanding belt to apply pressure. For large surfaces such as tabletops, doors, and cabinets. It is possible to make higher depth grinding.

Applications: Plating, finishing with grain direction, #4 finish

Break sharp edges

Sharp edges can deburr by moving the belt file down the length of the part once, or rounded edges by moving it several times at different angles.



Application: powder coating

*General purposed guideline only, please contacts Hansen for any special request

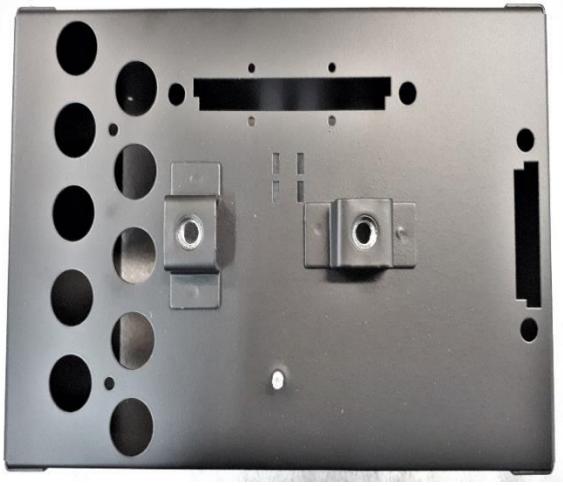
Plating

Plating is a surface covering in which a metal is deposited on a conductive surface. Plating is used to decorate objects, for corrosion inhibition, to improve solder ability, to harden, to improve wear ability, to reduce friction, to improve paint adhesion, to alter conductivity, for radiation shielding, and for other purposes.

Plating	Type	Description	Class
ANODIZE			
MIL-A-8625	Type -I	Chromic, Thickness .00002" - .0003"	Class I-Non- Dyed **Natural or Clear** Class II-Dyed **Specify color: Black, Blue, Red, etc**
MIL-A-8625	Type -II	Sulphuric Acid Electrolyte standard Thickness 0.00007" - 0.010"	
MIL-A-8625	Type III	Hard Coat Specialty Thickness 0.002" - 0.0005"	Class I-Non- Dyed **Natural or Clear** Class II-Dyed **Specify color: Black, Blue, Red, etc**
CHROMATE			
MIL-DTL-5541	Type I	Contains Hex Chrome Non- RoHS yellow unless Specified	Class IA-Maximum Protection, Thick coating Class II- Corrosion protection, Thin coating
MIL-DTL-5541	Type II	Contains Non- Hex chrome **RoHS clear only**	Class IA-Maximum Protection, Thick coating Class II- Corrosion protection, Thin coating
Zinc			
ASTM-B-633	Type I	Non- chromate conversion	SC1-Durability Mild SC2-Durability Moderate SC3-Duarability severe SC4-Durability very severe
ASTM-B-633	Type II	Colored chromate conversion Black or Yellow, is RoHS complaint	SC1-Durability Mild SC2-Durability Moderate SC3-Duarability severe SC4-Durability very severe
ASTM-B-633	Type III	Colorless chromate conversion Please specify RoHS compliancy	SC1-Durability Mild SC2-Durability Moderate SC3-Duarability severe SC4-Durability very severe
TIN			
MIL-T-10727	Type I	Electrodeposited	
MIL-T-10727	Type II	Hot dipped	
Black Oxide			
MIL-C-13924			Class I-Iron &steel Class II-400 series stainless steel Class III-fused salt process Class IV-Stainless steel MIL-F-495

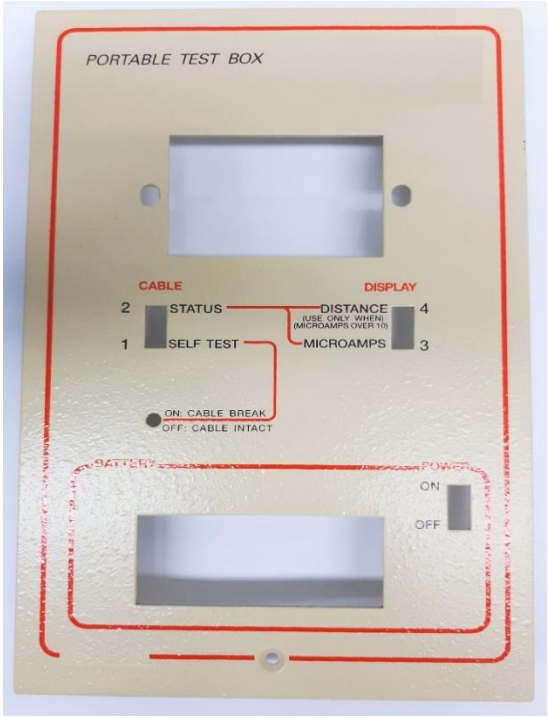
*General purposed guideline only, please contacts Hansen for any special request.

Powder Coating



Powder Coating is a type of coating that is applied as a free-flowing, dry powder. The main difference between a conventional liquid paint and powder coating is that the powder coating does not require a solvent to keep the binder and filler parts in a liquid suspension form. The coating is typically applied electrostatically and is then cured under heat to allow it to flow and form a "skin". The powder may be a thermoplastic or a thermoset polymer. Hansen offers powder coating from reliable third-party sources with an additional lead time of 1to 2 weeks.

Wet Paint



Wet paint is ideal for products which cannot be heated for powder coating because wet paint does not require an oven for finishing. Wet paint can produce a wider range of colors than powder coating so more custom color work could require spray painting and plating. Wet paint and plating can produce a much thinner finish than powder coating. Products with demand a thin finish can benefit greatly from wet paint. Finally, wet paint is a much more economic finishing process, particularly for smaller jobs. Hansen offers wet paint coating from reliable third-party sources with an additional lead time of 1to 2 weeks.

*General purposed guideline only, please contacts Hansen for any special request.

Silk screening

Our silk-screening process utilizes the latest in screen preparation technology, as well as using durable epoxy based inks, ensuring a high resolution and quality finish. Every sheet metal prototype part requiring screening uses a dedicated screen that our in-house silk screening professionals use to produce the finest prototype silk screening available. Our in-house silk screening service includes the custom creation of screens for the printing process and can provide custom colors upon request.

Preferred screen file format: .ai, pdf, dxf, dwg

*General purposed guideline only, please contacts Hansen for any special request.

Geometric Tolerance and Dimensioning GD & T

FEATURE	TYPE OF TOLERANCE	CHARACTERISTIC	SYMBOL
INDIVIDUAL FEATURES	FORM	STRAIGHTNESS	
		FLATNESS	
		CIRCULARITY (ROUNDNESS)	
		CYLINDRICITY	
INDIVIDUAL OR RELATED FEATURES	PROFILE	PROFILE OF A LINE	
		PROFILE OF A SURFACE	
RELATED FEATURES	ORIENTATION	ANGULARITY	
		PERPENDICULARITY	
		PARALLELISM	
	LOCATION	POSITION	
		CONCENTRICITY	
		SYMMETRY	
	RUNOUT	CIRCULAR RUNOUT	
		TOTAL RUNOUT	
SUPPLEMENTARY SYMBOLS		AT MAXIMUN MATERIAL CONDITION	
		AT LEAST MATERIAL CONDITION	
		PROJECTED TOLERANCE ZONE	
		BASIC DIMENSION	
		DATUM FEATURE	
		DATUM TARGET	

*General purposed guideline only, please contacts Hansen for any special request.

APPENDIX

HANSEN Industries Ltd
Tool Library

Regular Shape/Punch Tool

SHAPE	SIZE IN	MULTI TOOL	DIE CLEARANCE								CUTTING THICKNESS (Inch)		
			.002"	.004"	0.006"	0.010"	0.012"	0.020"	0.03"	0.035"	Aluminum	CRS	Stainless steel
Circle	0.040					1					0.080 TO 0.090	0.059 TO 0.074	0.048 TO 0.059
Circle	0.063				2		1				0.015 TO 0.090	0.017 TO 0.074	0.018 TO 0.059
Circle	0.074				2	4					0.015 TO 0.090	0.017 TO 0.074	0.018 TO 0.059
Circle	0.086	TC 2020			1	1					0.015 TO 0.090	0.017 TO 0.074	0.018 TO 0.059
Circle	0.089					1					0.080 TO 0.090	0.059 TO 0.074	0.048 TO 0.059
Circle	0.094				1		1	1			0.015 TO 0.250	0.017 TO 0.134	0.018 TO 0.121
Circle	0.101				2						0.015 TO 0.063	0.017 TO 0.047	0.018 TO 0.036
Circle	0.107				1						0.015 TO 0.063	0.017 TO 0.047	0.018 TO 0.036
Circle	0.113				2		2	2			0.015 TO 0.250	0.017 TO 0.134	0.018 TO 0.121
Circle	0.120				2	1		1			0.015 TO 0.250	0.017 TO 0.134	0.018 TO 0.121
Circle	0.125	TC2020,200				1					0.080 TO 0.090	0.059 TO 0.074	0.048 TO 0.059
Circle	0.131				1	1					0.015 TO 0.090	0.017 TO 0.074	0.018 TO 0.059
Circle	0.137	TC2020			2	1		2			0.015 TO 0.250	0.017 TO 0.134	0.018 TO 0.121
Circle	0.139				1	1					0.015 TO 0.090	0.017 TO 0.074	0.018 TO 0.059
Circle	0.140	TC2020,200			1						0.015 TO 0.063	0.017 TO 0.047	0.018 TO 0.036
Circle	0.143	TC2020				2					0.080 TO 0.090	0.059 TO 0.074	0.048 TO 0.059
Circle	0.149						1				0.080 TO 0.090	0.059 TO 0.074	0.048 TO 0.059
Circle	0.156	TC2020,200			1	1					0.015 TO 0.090	0.017 TO 0.074	0.018 TO 0.059
Circle	0.161				1						0.015 TO 0.063	0.017 TO 0.047	0.018 TO 0.036
Circle	0.166	TC2020,200			1	1					0.015 TO 0.090	0.017 TO 0.074	0.018 TO 0.059
Circle	0.169							3			0.100 TO 0.250	0.104 TO 0.134	0.063 TO 0.121
Circle	0.171							1			0.100 TO 0.250	0.104 TO 0.134	0.063 TO 0.121
Circle	0.177				2	1		1			0.015 TO 0.250	0.017 TO 0.134	0.018 TO 0.121
Circle	0.180	TC2020				1					0.080 TO 0.090	0.059 TO 0.074	0.048 TO 0.059
Circle	0.187	TC2020				1					0.080 TO 0.090	0.059 TO 0.074	0.048 TO 0.059
Circle	0.188				1	1					0.015 TO 0.090	0.017 TO 0.074	0.018 TO 0.059
Circle	0.189	TC2020,200				1					0.080 TO 0.090	0.059 TO 0.074	0.048 TO 0.059
Circle	0.190				1						0.015 TO 0.063	0.017 TO 0.047	0.018 TO 0.036
Circle	0.194	TC2020			2	1	1				0.015 TO 0.090	0.017 TO 0.074	0.018 TO 0.059
Circle	0.198	TC2020			2	1	1	1			0.015 TO 0.250	0.017 TO 0.134	0.018 TO 0.121
Circle	0.203	TC2020			1						0.015 TO 0.063	0.017 TO 0.047	0.018 TO 0.036
Circle	0.205					1					0.080 TO 0.090	0.059 TO 0.074	0.048 TO 0.059
Circle	0.211					1					0.080 TO 0.090	0.059 TO 0.074	0.048 TO 0.059
Circle	0.213	TC2020,200			1	1	1				0.015 TO 0.090	0.017 TO 0.074	0.018 TO 0.059
Circle	0.216					1		1			0.080 TO 0.250	0.059 TO 0.134	0.048 TO 0.121
Circle	0.219	TC2020,200						1			0.100 TO 0.250	0.104 TO 0.134	0.063 TO 0.121
Circle	0.221					2					0.080 TO 0.090	0.059 TO 0.074	0.048 TO 0.059
Circle	0.229					1					0.080 TO 0.090	0.059 TO 0.074	0.048 TO 0.059
Circle	0.236	TC2020,200			2			1			0.015 TO 0.250	0.017 TO 0.134	0.018 TO 0.121
Circle	0.244					1					0.080 TO 0.090	0.059 TO 0.074	0.048 TO 0.059
Circle	0.250	TC200				1					0.080 TO 0.090	0.059 TO 0.074	0.048 TO 0.059
Circle	0.257	TC2020			1	1					0.015 TO 0.090	0.017 TO 0.074	0.018 TO 0.059
Circle	0.266				1	1	1				0.015 TO 0.090	0.017 TO 0.074	0.018 TO 0.059
Circle	0.271	TC2020				1					0.080 TO 0.090	0.059 TO 0.074	0.048 TO 0.059
Circle	0.277					1					0.080 TO 0.090	0.059 TO 0.074	0.048 TO 0.059
Circle	0.281	TC2020			1	1					0.015 TO 0.090	0.017 TO 0.074	0.018 TO 0.059
Circle	0.285	TC2020			1	1	1				0.015 TO 0.090	0.017 TO 0.074	0.018 TO 0.059
Circle	0.290					1					0.080 TO 0.090	0.059 TO 0.074	0.048 TO 0.059
Circle	0.291					3		1			0.080 TO 0.250	0.059 TO 0.134	0.048 TO 0.121
Circle	0.295					1					0.080 TO 0.090	0.059 TO 0.074	0.048 TO 0.059
Circle	0.313	TC200					1				0.080 TO 0.090	0.059 TO 0.074	0.048 TO 0.059
Circle	0.324					1					0.080 TO 0.090	0.059 TO 0.074	0.048 TO 0.059
Circle	0.328					1	2				0.080 TO 0.090	0.059 TO 0.074	0.048 TO 0.059
Circle	0.332	TC2020				1	1				0.080 TO 0.090	0.059 TO 0.074	0.048 TO 0.059
Circle	0.344	TC2020,200			1						0.015 TO 0.063	0.017 TO 0.047	0.018 TO 0.036
Circle	0.346					2					0.080 TO 0.090	0.059 TO 0.074	0.048 TO 0.059
Circle	0.358					1		1			0.080 TO 0.250	0.059 TO 0.134	0.048 TO 0.121

HANSEN Industries Ltd
Tool Library

Regular Shape/Punch Tool

SHAPE	SIZE IN	MULTI TOOL	DIE CLEARANCE								CUTTING THICKNESS (Inch)		
			.002"	.004"	0.006"	0.010"	0.012"	0.020"	.030"	.035"	Aluminum	CRS	Stainless steel
Circle	0.360	TC2020				1					0.080 TO 0.090	0.059 TO 0.074	0.048 TO 0.059
Circle	0.375	TC2020,200			1	1					0.015 TO 0.090	0.017 TO 0.074	0.018 TO 0.059
Circle	0.391				1	1					0.015 TO 0.090	0.017 TO 0.074	0.018 TO 0.059
Circle	0.393	TC2020			1		1				0.015 TO 0.090	0.017 TO 0.074	0.018 TO 0.059
Circle	0.406	TC2020			1	1	1				0.015 TO 0.090	0.017 TO 0.074	0.018 TO 0.059
Circle	0.413	TC2020,200			1		1				0.015 TO 0.090	0.017 TO 0.074	0.018 TO 0.059
Circle	0.415					1					0.080 TO 0.090	0.059 TO 0.074	0.048 TO 0.059
Circle	0.426					1		1			0.080 TO 0.250	0.059 TO 0.134	0.048 TO 0.121
Circle	0.427					1					0.080 TO 0.090	0.059 TO 0.074	0.048 TO 0.059
Circle	0.438				1		1	1			0.015 TO 0.250	0.017 TO 0.134	0.018 TO 0.121
Circle	0.450					2		1			0.080 TO 0.250	0.059 TO 0.134	0.048 TO 0.121
Circle	0.453						2				0.080 TO 0.090	0.059 TO 0.074	0.048 TO 0.059
Circle	0.469				1	1	1	1			0.015 TO 0.250	0.017 TO 0.134	0.018 TO 0.121
Circle	0.485					1		1			0.080 TO 0.250	0.059 TO 0.134	0.048 TO 0.121
Circle	0.500				1	1	1				0.015 TO 0.090	0.017 TO 0.074	0.018 TO 0.059
Circle	0.515				2	2					0.015 TO 0.090	0.017 TO 0.074	0.018 TO 0.059
Circle	0.531				1						0.015 TO 0.063	0.017 TO 0.047	0.018 TO 0.036
Circle	0.547					1					0.080 TO 0.090	0.059 TO 0.074	0.048 TO 0.059
Circle	0.551				1	1	2	1			0.015 TO 0.250	0.017 TO 0.134	0.018 TO 0.121
Circle	0.560					1					0.080 TO 0.090	0.059 TO 0.074	0.048 TO 0.059
Circle	0.563				1		1				0.015 TO 0.090	0.017 TO 0.074	0.018 TO 0.059
Circle	0.570				1						0.015 TO 0.063	0.017 TO 0.047	0.018 TO 0.036
Circle	0.594				1		1				0.015 TO 0.090	0.017 TO 0.074	0.018 TO 0.059
Circle	0.600					1					0.080 TO 0.090	0.059 TO 0.074	0.048 TO 0.059
Circle	0.610					1					0.080 TO 0.090	0.059 TO 0.074	0.048 TO 0.059
Circle	0.625				1	1	2	2			0.015 TO 0.250	0.017 TO 0.134	0.018 TO 0.121
Circle	0.640					1		1			0.080 TO 0.250	0.059 TO 0.134	0.048 TO 0.121
Circle	0.650					1					0.080 TO 0.090	0.059 TO 0.074	0.048 TO 0.059
Circle	0.656						1				0.080 TO 0.090	0.059 TO 0.074	0.048 TO 0.059
Circle	0.675					1					0.080 TO 0.090	0.059 TO 0.074	0.048 TO 0.059
Circle	0.687					1					0.080 TO 0.090	0.059 TO 0.074	0.048 TO 0.059
Circle	0.688				1		1				0.015 TO 0.090	0.017 TO 0.074	0.018 TO 0.059
Circle	0.719										0.080 TO 0.090	0.059 TO 0.074	0.048 TO 0.059
Circle	0.750				1	1	1				0.015 TO 0.090	0.017 TO 0.074	0.018 TO 0.059
Circle	0.787				1	1	1	1			0.015 TO 0.250	0.017 TO 0.134	0.018 TO 0.121
Circle	0.790					1					0.080 TO 0.090	0.059 TO 0.074	0.048 TO 0.059
Circle	0.813				1		1	1			0.015 TO 0.250	0.017 TO 0.134	0.018 TO 0.121
Circle	0.850					1		1			0.080 TO 0.250	0.059 TO 0.134	0.048 TO 0.121
Circle	0.860				1	1					0.015 TO 0.090	0.017 TO 0.074	0.018 TO 0.059
Circle	0.875				2	2					0.015 TO 0.090	0.017 TO 0.074	0.018 TO 0.059
Circle	0.885					2					0.080 TO 0.090	0.059 TO 0.074	0.048 TO 0.059
Circle	0.891					1					0.080 TO 0.090	0.059 TO 0.074	0.048 TO 0.059
Circle	0.906				1	1		1			0.015 TO 0.250	0.017 TO 0.134	0.018 TO 0.121
Circle	0.938				1		1				0.015 TO 0.090	0.017 TO 0.074	0.018 TO 0.059
Circle	0.968					1		1			0.080 TO 0.250	0.059 TO 0.134	0.048 TO 0.121
Circle	0.980					1		1			0.080 TO 0.250	0.059 TO 0.134	0.048 TO 0.121
Circle	1.000				1	2		1			0.015 TO 0.250	0.017 TO 0.134	0.018 TO 0.121
Circle	1.015					1		1			0.080 TO 0.250	0.059 TO 0.134	0.048 TO 0.121
Circle	1.030					1					0.080 TO 0.090	0.059 TO 0.074	0.048 TO 0.059
Circle	1.062					1		1			0.080 TO 0.250	0.059 TO 0.134	0.048 TO 0.121
Circle	1.095					1		1			0.080 TO 0.250	0.059 TO 0.134	0.048 TO 0.121
Circle	1.125						1	1			0.080 TO 0.250	0.059 TO 0.134	0.048 TO 0.121
Circle	1.187				1	1		1			0.015 TO 0.250	0.017 TO 0.134	0.018 TO 0.121
Circle	1.250					1		1			0.080 TO 0.250	0.059 TO 0.134	0.048 TO 0.121

HANSEN Industries Ltd
Tool Library

Regular Shape/Punch Tool

SHAPE	SIZE IN	MULTI TOOL	DIE CLEARANCE								CUTTING THICKNESS (Inch)		
			.002"	.004"	0.006"	0.010"	0.012"	0.020"	.030"	.035"	Aluminum	CRS	Stainless steel
Circle	1.300					1					0.080 TO 0.090	0.059 TO 0.074	0.048 TO 0.059
Circle	1.312					1		1			0.080 TO 0.250	0.059 TO 0.134	0.048 TO 0.121
Circle	1.350					1					0.080 TO 0.090	0.059 TO 0.074	0.048 TO 0.059
Circle	1.375						1				0.080 TO 0.090	0.059 TO 0.074	0.048 TO 0.059
Circle	1.500				2						0.015 TO 0.063	0.017 TO 0.047	0.018 TO 0.036
Circle	1.627					1					0.080 TO 0.090	0.059 TO 0.074	0.048 TO 0.059
Circle	1.750					1					0.080 TO 0.090	0.059 TO 0.074	0.048 TO 0.059
Circle	1.875							1			0.100 TO 0.250	0.104 TO 0.134	0.063 TO 0.121
Circle	2.000						2	1			0.080 TO 0.250	0.059 TO 0.134	0.048 TO 0.121
Circle	2.119					1					0.080 TO 0.090	0.059 TO 0.074	0.048 TO 0.059
Circle	2.125						1	1			0.080 TO 0.250	0.059 TO 0.134	0.048 TO 0.121
Circle	2.500					1		1			0.080 TO 0.250	0.059 TO 0.134	0.048 TO 0.121

Regular Shape/Punch Tool

SHAPE	SIZE IN	MULTI TOOL	DIE CLEARANCE								CUTTING THICKNESS (Inch)		
			.002"	.004"	0.006"	0.010"	0.012"	0.020"	.030"	.035"	Aluminum	CRS	Stainless steel
Square	0.125	TC2020,200					1				0.080 TO 0.090	0.059 TO 0.074	0.048 TO 0.059
Square	0.166			1		1					0.080 TO 0.090	0.059 TO 0.074	0.048 TO 0.059
Square	0.187	TC2020,200		1		1		1			0.080 TO 0.250	0.059 TO 0.134	0.048 TO 0.121
Square	0.208					1		1			0.080 TO 0.250	0.059 TO 0.134	0.048 TO 0.121
Square	0.235				1						0.015 TO 0.063	0.017 TO 0.047	0.018 TO 0.036
Square	0.250	TC2020			1	1	1	1			0.015 TO 0.250	0.017 TO 0.134	0.018 TO 0.121
Square	0.251					1		1			0.080 TO 0.250	0.059 TO 0.134	0.048 TO 0.121
Square	0.255	TC200		1		1		1			0.080 TO 0.250	0.059 TO 0.134	0.048 TO 0.121
Square	0.281				1	1	1	2			0.015 TO 0.250	0.017 TO 0.134	0.018 TO 0.121
Square	0.328				1		1				0.015 TO 0.090	0.017 TO 0.074	0.018 TO 0.059
Square	0.335				1		1				0.015 TO 0.090	0.017 TO 0.074	0.018 TO 0.059
Square	0.375			1			1	1			0.080 TO 0.250	0.059 TO 0.134	0.048 TO 0.121
Square	0.393				1		1				0.015 TO 0.090	0.017 TO 0.074	0.018 TO 0.059
Square	0.437				1	1		1			0.015 TO 0.250	0.017 TO 0.134	0.018 TO 0.121
Square	0.484				1	1					0.015 TO 0.090	0.017 TO 0.074	0.018 TO 0.059
Square	0.505			1	1	1		1			0.015 TO 0.250	0.017 TO 0.134	0.018 TO 0.121
Square	0.625				1			1			0.015 TO 0.250	0.017 TO 0.134	0.018 TO 0.121
Square	0.640					2		1			0.080 TO 0.250	0.059 TO 0.134	0.048 TO 0.121
Square	0.750			1	1			1			0.015 TO 0.250	0.017 TO 0.134	0.018 TO 0.121
Square	0.800			1		1		1			0.080 TO 0.250	0.059 TO 0.134	0.048 TO 0.121
Square	0.875				1			1			0.015 TO 0.250	0.017 TO 0.134	0.018 TO 0.121
Square	1.000				1			1			0.015 TO 0.250	0.017 TO 0.134	0.018 TO 0.121
Square	1.375				1	1		1			0.015 TO 0.250	0.017 TO 0.134	0.018 TO 0.121
Square	1.500					1		1			0.080 TO 0.250	0.059 TO 0.134	0.048 TO 0.121
Square	2.000					1		1			0.080 TO 0.250	0.059 TO 0.134	0.048 TO 0.121

Regular Shape/Punch Tool

SHAPE	SIZE IN	MULTI TOOL	DIE CLEARANCE								CUTTING THICKNESS (Inch)		
			.002"	.004"	0.006"	0.010"	0.012"	0.020"	.030"	.035"	Aluminum	CRS	Stainless steel
Obround	0.094 x 0.188					1		1			0.080 TO 0.250	0.059 TO 0.134	0.048 TO 0.121
Obround	0.094 x 0.300					1		1			0.080 TO 0.250	0.059 TO 0.134	0.048 TO 0.121
Obround	0.100 x 0.400					1					0.080 TO 0.090	0.059 TO 0.074	0.048 TO 0.059
Obround	0.100 x 1.000				1						0.015 TO 0.063	0.017 TO 0.047	0.018 TO 0.036
Obround	0.100 x 1.200					1					0.080 TO 0.090	0.059 TO 0.074	0.048 TO 0.059
Obround	0.100x 2.500					1					0.080 TO 0.090	0.059 TO 0.074	0.048 TO 0.059
Obround	0.125 x 0.218				2						0.015 TO 0.063	0.017 TO 0.047	0.018 TO 0.036
Obround	0.125 x 0.375					1		1			0.080 TO 0.250	0.059 TO 0.134	0.048 TO 0.121
Obround	0.125 x 0.500				1	1		1			0.015 TO 0.250	0.017 TO 0.134	0.018 TO 0.121
Obround	0.125 x 0.875					1		1			0.080 TO 0.250	0.059 TO 0.134	0.048 TO 0.121
Obround	0.125 x 2.200					1		1			0.080 TO 0.250	0.059 TO 0.134	0.048 TO 0.121
Obround	0.147 x 0.194				1						0.015 TO 0.063	0.017 TO 0.047	0.018 TO 0.036
Obround	0.156 x 0.218										0.080 TO 0.090	0.059 TO 0.074	0.048 TO 0.059
Obround	0.156 x 0.375				1	1		1			0.015 TO 0.250	0.017 TO 0.134	0.018 TO 0.121
Obround	0.156 x 0.75				1	1		1			0.015 TO 0.250	0.017 TO 0.134	0.018 TO 0.121
Obround	0.170 x 0.375					1					0.080 TO 0.090	0.059 TO 0.074	0.048 TO 0.059
Obround	0.187 x 0.250				1		1	1			0.015 TO 0.250	0.017 TO 0.134	0.018 TO 0.121
Obround	0.187 x 0.375				1	1		1			0.015 TO 0.250	0.017 TO 0.134	0.018 TO 0.121
Obround	0.187 x 0.437						1	1			0.080 TO 0.250	0.059 TO 0.134	0.048 TO 0.121
Obround	0.187 x 0.750				1		1	1			0.015 TO 0.250	0.017 TO 0.134	0.018 TO 0.121
Obround	0.187 x 1.000				2						0.015 TO 0.063	0.017 TO 0.047	0.018 TO 0.036
Obround	0.187 x 2.000					1					0.080 TO 0.090	0.059 TO 0.074	0.048 TO 0.059
Obround	0.188 x 0.888					1		1			0.080 TO 0.250	0.059 TO 0.134	0.048 TO 0.121
Obround	0.196 x 0.315					1		1			0.080 TO 0.250	0.059 TO 0.134	0.048 TO 0.121
Obround	0.200 x 1.910					1					0.080 TO 0.090	0.059 TO 0.074	0.048 TO 0.059
Obround	0.203 x 0.468					1		1			0.080 TO 0.250	0.059 TO 0.134	0.048 TO 0.121
Obround	0.203 x 1.203					1		1			0.080 TO 0.250	0.059 TO 0.134	0.048 TO 0.121
Obround	0.218 x 0.281						1	1			0.080 TO 0.250	0.059 TO 0.134	0.048 TO 0.121
Obround	0.218 x 0.375				1	1		1			0.015 TO 0.250	0.017 TO 0.134	0.018 TO 0.121
Obround	0.218 x 0.500				1		1	1			0.015 TO 0.250	0.017 TO 0.134	0.018 TO 0.121
Obround	0.250 x 0.307				1		1				0.015 TO 0.090	0.017 TO 0.074	0.018 TO 0.059
Obround	0.250x 0.375				1		1				0.015 TO 0.090	0.017 TO 0.074	0.018 TO 0.059
Obround	0.250 x 0.437				1		1				0.015 TO 0.090	0.017 TO 0.074	0.018 TO 0.059
Obround	0.250 x 0.450					1					0.080 TO 0.090	0.059 TO 0.074	0.048 TO 0.059
Obround	0.250 x 0.625				1		1				0.015 TO 0.090	0.017 TO 0.074	0.018 TO 0.059
Obround	0.250 x 1.000					1		1			0.080 TO 0.250	0.059 TO 0.134	0.048 TO 0.121
Obround	0.250 x 2.750					1		1			0.080 TO 0.250	0.059 TO 0.134	0.048 TO 0.121
Obround	0.263 x 0.550						1	1			0.080 TO 0.250	0.059 TO 0.134	0.048 TO 0.121
Obround	0.266 x 0.500				1		1	1			0.015 TO 0.250	0.017 TO 0.134	0.018 TO 0.121
Obround	0.281 x 0.437				1		1				0.015 TO 0.090	0.017 TO 0.074	0.018 TO 0.059
Obround	0.312 x 0.553					1		1			0.080 TO 0.250	0.059 TO 0.134	0.048 TO 0.121
Obround	0.312 x 0.984				1		1	1			0.015 TO 0.250	0.017 TO 0.134	0.018 TO 0.121
Obround	0.327 x 0.406							1			0.100 TO 0.250	0.104 TO 0.134	0.063 TO 0.121
Obround	0.328 x 0.984				1		1	1			0.015 TO 0.250	0.017 TO 0.134	0.018 TO 0.121
Obround	0.375 x 0.625				1		1	1			0.015 TO 0.250	0.017 TO 0.134	0.018 TO 0.121
Obround	0.375 x 2.829							1			0.100 TO 0.250	0.104 TO 0.134	0.063 TO 0.121
Obround	0.410 x 0.630							1			0.100 TO 0.250	0.104 TO 0.134	0.063 TO 0.121
Obround	0.420 x 0.660						1				0.080 TO 0.090	0.059 TO 0.074	0.048 TO 0.059
Obround	0.420 x 1.750					1					0.080 TO 0.090	0.059 TO 0.074	0.048 TO 0.059
Obround	0.437 x 2.000							1			0.100 TO 0.250	0.104 TO 0.134	0.063 TO 0.121
Obround	0.438 x 0.750							1			0.100 TO 0.250	0.104 TO 0.134	0.063 TO 0.121
Obround	0.438 x 2.000					1		1			0.080 TO 0.250	0.059 TO 0.134	0.048 TO 0.121
Obround	0.136x0.250				2								

Regular Shape/Punch Tool

SHAPE	SIZE IN	MULTI TOOL	DIE CLEARANCE								CUTTING THICKNESS (Inch)		
			.002"	.004"	0.006"	0.010"	0.012"	0.020"	.030"	.035"	Aluminum	CRS	Stainless steel
Rectangle	0.040 x 0.300		1	1	2		1	1			0.015 TO 0.250	0.017 TO 0.134	0.018 TO 0.121
Rectangle	0.040 x 0.400				1		1				0.015 TO 0.090	0.017 TO 0.074	0.018 TO 0.059
Rectangle	0.040 x 0.500				1	1					0.015 TO 0.090	0.017 TO 0.074	0.018 TO 0.059
Rectangle	0.052 x 0.200				2	1					0.015 TO 0.090	0.017 TO 0.074	0.018 TO 0.059
Rectangle	0.055 x 0.300										0.080 TO 0.090	0.059 TO 0.074	0.048 TO 0.059
Rectangle	0.063 x 0.500				1	1		1			0.015 TO 0.250	0.017 TO 0.134	0.018 TO 0.121
Rectangle	0.066 x 0.500	TC2020						1			0.100 TO 0.250	0.104 TO 0.134	0.063 TO 0.121
Rectangle	0.072 x 0.316				1	1		1			0.015 TO 0.250	0.017 TO 0.134	0.018 TO 0.121
Rectangle	0.072 x 0.375				1	1		1			0.015 TO 0.250	0.017 TO 0.134	0.018 TO 0.121
Rectangle	0.080 x 1.000					1					0.080 TO 0.090	0.059 TO 0.074	0.048 TO 0.059
Rectangle	0.090 x 0.188				1	1					0.015 TO 0.090	0.017 TO 0.074	0.018 TO 0.059
Rectangle	0.090 x 0.550					1		1			0.080 TO 0.250	0.059 TO 0.134	0.048 TO 0.121
Rectangle	0.100 x 0.250						1				0.080 TO 0.090	0.059 TO 0.074	0.048 TO 0.059
Rectangle	0.100 x 2.750				1	1		1			0.015 TO 0.250	0.017 TO 0.134	0.018 TO 0.121
Rectangle	0.112 x 0.600				1		1				0.015 TO 0.090	0.017 TO 0.074	0.018 TO 0.059
Rectangle	0.120 x 0.240							1			0.100 TO 0.250	0.104 TO 0.134	0.063 TO 0.121
Rectangle	0.122 x 0.600				1	1		1			0.015 TO 0.250	0.017 TO 0.134	0.018 TO 0.121
Rectangle	0.125 x 0.500	TC2020		1	1	1					0.015 TO 0.090	0.017 TO 0.074	0.018 TO 0.059
Rectangle	0.125 x 1.000			1		2		1			0.080 TO 0.250	0.059 TO 0.134	0.048 TO 0.121
Rectangle	0.125 x 2.000				1	1		1			0.015 TO 0.250	0.017 TO 0.134	0.018 TO 0.121
Rectangle	0.126 x 0.251					1		1			0.080 TO 0.250	0.059 TO 0.134	0.048 TO 0.121
Rectangle	0.138 x 0.220					1		1			0.080 TO 0.250	0.059 TO 0.134	0.048 TO 0.121
Rectangle	0.140 x 0.300				1	1					0.015 TO 0.090	0.017 TO 0.074	0.018 TO 0.059
Rectangle	0.150 x 0.625					1					0.080 TO 0.090	0.059 TO 0.074	0.048 TO 0.059
Rectangle	0.150 x 1.050							1			0.100 TO 0.250	0.104 TO 0.134	0.063 TO 0.121
Rectangle	0.156 x 0.500				1	1		1			0.015 TO 0.250	0.017 TO 0.134	0.018 TO 0.121
Rectangle	0.156 x 1.000				1		1	1			0.015 TO 0.250	0.017 TO 0.134	0.018 TO 0.121
Rectangle	0.157 x 0.315							2			0.100 TO 0.250	0.104 TO 0.134	0.063 TO 0.121
Rectangle	0.170 x 0.385							1			0.100 TO 0.250	0.104 TO 0.134	0.063 TO 0.121
Rectangle	0.178 x 0.312					1					0.080 TO 0.090	0.059 TO 0.074	0.048 TO 0.059
Rectangle	0.178 x 0.626					1		1			0.080 TO 0.250	0.059 TO 0.134	0.048 TO 0.121
Rectangle	0.187 x 0.312				1	1		1			0.015 TO 0.250	0.017 TO 0.134	0.018 TO 0.121
Rectangle	0.187 x 1.000				1		1	1			0.015 TO 0.250	0.017 TO 0.134	0.018 TO 0.121
Rectangle	0.215 x 0.250				1		1	1			0.015 TO 0.250	0.017 TO 0.134	0.018 TO 0.121
Rectangle	0.220 x 0.710					1		1			0.080 TO 0.250	0.059 TO 0.134	0.048 TO 0.121
Rectangle	0.225 x 2.450					1					0.080 TO 0.090	0.059 TO 0.074	0.048 TO 0.059
Rectangle	0.236 x 0.750				1	1		1			0.015 TO 0.250	0.017 TO 0.134	0.018 TO 0.121
Rectangle	0.245 x 0.385							1			0.100 TO 0.250	0.104 TO 0.134	0.063 TO 0.121
Rectangle	0.245 x 0.52				1	2		1			0.015 TO 0.250	0.017 TO 0.134	0.018 TO 0.121
Rectangle	0.250 x 0.438					1		1			0.080 TO 0.250	0.059 TO 0.134	0.048 TO 0.121
Rectangle	0.250 x 1.000			1	1	1			1		0.015 TO 0.090	0.017 TO 0.074	0.018 TO 0.059
Rectangle	0.250 x 2.101					1		1			0.080 TO 0.250	0.059 TO 0.134	0.048 TO 0.121
Rectangle	0.250 x 2.750				1	1		1	2	2	0.015 TO 0.250	0.017 TO 0.134	0.018 TO 0.121
Rectangle	0.286 x 2.750					1		1			0.080 TO 0.250	0.059 TO 0.134	0.048 TO 0.121
Rectangle	0.313 x 2.750					1					0.080 TO 0.090	0.059 TO 0.074	0.048 TO 0.059
Rectangle	0.330 x 1.430					1		1			0.080 TO 0.250	0.059 TO 0.134	0.048 TO 0.121
Rectangle	0.375 x 0.500					1		1			0.080 TO 0.250	0.059 TO 0.134	0.048 TO 0.121
Rectangle	0.375 x 0.750					1		1			0.080 TO 0.250	0.059 TO 0.134	0.048 TO 0.121
Rectangle	0.375 x 1.180				1	1		1			0.015 TO 0.250	0.017 TO 0.134	0.018 TO 0.121
Rectangle	0.376 x 1.251										0.080 TO 0.090	0.059 TO 0.074	0.048 TO 0.059
Rectangle	0.475 x 0.875				1		1	1			0.015 TO 0.250	0.017 TO 0.134	0.018 TO 0.121
Rectangle	0.562 x 0.875					1		1			0.080 TO 0.250	0.059 TO 0.134	0.048 TO 0.121
Rectangle	0.634 x 1.759							1			0.100 TO 0.250	0.104 TO 0.134	0.063 TO 0.121
Rectangle	0.687 x 0.875				1	1		1			0.015 TO 0.250	0.017 TO 0.134	0.018 TO 0.121
Rectangle	0.695 x 0.795					1					0.080 TO 0.090	0.059 TO 0.074	0.048 TO 0.059
Rectangle	0.800 x 1.000							1			0.100 TO 0.250	0.104 TO 0.134	0.063 TO 0.121
Rectangle	0.820 x 2.100				1		1	1			0.015 TO 0.250	0.017 TO 0.134	0.018 TO 0.121
Rectangle	0.875 x 1.125					1		1			0.080 TO 0.250	0.059 TO 0.134	0.048 TO 0.121
Rectangle	0.432x2.069				1								

Regular Shape/Punch Tool

SHAPE	SIZE IN	MULTI TOOL	DIE CLEARANCE								CUTTING THICKNESS (Inch)		
			.002"	.004"	0.006"	0.010"	0.012"	0.020"	.030"	.035"	Aluminum	CRS	Stainless steel
Rounded Rectangle	0.118 x 0.433, R 0.031				1						0.015 TO 0.063	0.017 TO 0.047	0.018 TO 0.036
Rounded Rectangle	0.118 x 0.630, R 0.031							1			0.100 TO 0.250	0.104 TO 0.134	0.063 TO 0.121
Rounded Rectangle	0.255 x 2.575, R 0.063							1			0.100 TO 0.250	0.104 TO 0.134	0.063 TO 0.121
Rounded Rectangle	0.580 x 0.940, R 0.031					1		1			0.080 TO 0.250	0.059 TO 0.134	0.048 TO 0.121
Rounded Rectangle	0.730 x 1.539, R 0.250					1					0.080 TO 0.090	0.059 TO 0.074	0.048 TO 0.059
Rounded Rectangle	0.787 x 1.103, R 0.157					1		1			0.080 TO 0.250	0.059 TO 0.134	0.048 TO 0.121
Rounded Rectangle	0.900 x 1.200, R 0.234							1			0.100 TO 0.250	0.104 TO 0.134	0.063 TO 0.121
Rounded Rectangle	1.351 x 1.473, R 0.065					1					0.080 TO 0.090	0.059 TO 0.074	0.048 TO 0.059

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Tool Library

Irregular Shape/Forming GPT Tool

Number	Type	Description
800	CUTTING	"[◯" Ø0.166" X 0.188" KEY SLOT
903	CUTTING	"[⎺⎺]" 1.185" X .465" BELT CLIP BLANK
004	FORMING	10-32 EXTRUSION [↑ BOTTOM UP]
300	FORMING	6-32 EXTRUSION [↑ BOTTOM UP]
003	FORMING	8-32 EXTRUSION [↑ BOTTOM UP]
530	CUTTING	BANANA: I.R. 0.886" / O.R. 1.102"
531	CUTTING	BANANA: I.R. 1.220" / O.R. 1.437"
532	CUTTING	BANANA: I.R. 1.625" / O.R. 2.000" (85°)
103	CUTTING	BANANA: I.R. 2.820" / O.R. 2.945"
802	CUTTING	BANANA: I.R. 2.940" / O.R. 3.065"
1006	CUTTING	BANANA: I.R. 4.281" / O.R. 4.719"
122	FORMING	BEAD: 0.680" X 0.350" X H.10" [↑ BOTTOM UP]
895	FORMING	BEND DIMPLE [↑ BOTTOM UP]
795	FORMING	BEND DIMPLE [↓ TOP DOWN]
127	FORMING	CENTER PUNCH: [↑ BOTTOM UP]
124	FORMING	CENTER PUNCH: [↓ TOP DOWN]
996	CUTTING	CLUSTER: 4 HITS - SQ 0.251; 0.680" SPACING
992	CUTTING	CLUSTER: 5 HITS - Ø 0.074; 0.250" SPACING
991	CUTTING	CLUSTER: 5 HITS - Ø 0.156; 0.500" SPACING
993	CUTTING	CLUSTER: 5 HITS - Ø 0.171; 0.500" SPACING
990	CUTTING	CLUSTER: 5 HITS - Ø0.156; 0.437" SPACING
114	FORMING	C'SINK: I.D. 0.088" O.D. 0.373",100º [↓ TOP DOWN]
115	FORMING	C'SINK: I.D. 0.100" O.D. 0.228",100º [↓ TOP DOWN]
070	FORMING	C'SINK: I.D. 0.100" O.D. 0.250",120º [↓ TOP DOWN]
110	FORMING	C'SINK: I.D. 0.110" O.D. 0.255",90º [↓ TOP DOWN]
100	FORMING	C'SINK: I.D. 0.125" O.D. 0.225",82º [↓ TOP DOWN]
080	FORMING	C'SINK: I.D. 0.125" O.D. 0.280",120º [↓ TOP DOWN]
111	FORMING	C'SINK: I.D. 0.150" O.D. 0.375",90º [↓ TOP DOWN]
880	FORMING	C'SINK: I.D. 0.162" O.D. 0.280",82º [↓ TOP DOWN]
090	FORMING	C'SINK: I.D. 0.170" O.D. 0.350",82º [↓ TOP DOWN]
060	FORMING	C'SINK: I.D. 0.180" O.D. 0.343",120º [↓ TOP DOWN]
020	FORMING	C'SINK: I.D. 0.187" O.D. 0.372",82º [↓ TOP DOWN]
112	FORMING	C'SINK: I.D. 0.200" O.D. 0.400",90º [↓ TOP DOWN]
008	FORMING	C'SINK: I.D. 0.234" O.D. 0.343",82º [↑ BOTTOM UP]
113	FORMING	C'SINK: I.D. 0.240" O.D. 0.514",90º [↓ TOP DOWN]
050	FORMING	C'SINK: I.D. 0.266" O.D. 0.410",82º [↓ TOP DOWN]
010	FORMING	C'SINK: I.D. 0.390" O.D. 0.665",82º [↓ TOP DOWN]
030	FORMING	C'SINK: I.D. 0.391" O.D. 0.528",82º [↓ TOP DOWN]
040	FORMING	C'SINK: I.D. 0.500" O.D. 0.665",82º [↓ TOP DOWN]
806	CUTTING	DB9: 0.816" X 0.450"
998	CUTTING	DD: 0.115 X Ø0.156 "(▭)"
131	CUTTING	DD: 0.130 X Ø0.232 "(▭)"
130	CUTTING	DD: 0.130 X Ø0.240 "(⎺)"
214	CUTTING	DD: 0.214 X Ø0.280 "(⎺)"
295	CUTTING	DD: 0.295 X Ø0.410 "(▭)"
430	CUTTING	DD: 0.430 X Ø0.480 "(⎺)"
470	CUTTING	DD: 0.470 X Ø0.505 "(⎺)"
500	CUTTING	DD: 0.500 X Ø0.563 "(▭)"
520	CUTTING	DD: 0.520 X Ø0.625 "(⎺)"
510	CUTTING	DD: 0.550 X Ø0.625 "(▭)"
502	CUTTING	DD: 0.550 X Ø0.650 "(▭)"
571	CUTTING	DD: 0.571 X Ø0.630 "(▭)"
625	CUTTING	DD: 0.625 X Ø0.750 "(▭)"
650	CUTTING	DD: 0.650 X Ø0.750 "(⎺)"
669	CUTTING	DD: 0.670 X Ø0.709 "(▭)"
983	CUTTING	DD: 0.750 X Ø0.875 "(▭)"
787	CUTTING	DD: 0.787 X Ø0.906 "(▭)"
875	CUTTING	DD: 0.875 X Ø1.000 "(▭)"
419	CUTTING	DD: 1.122 X Ø1.362 => 28.5mm X 34.6mm
189	CUTTING	STAR Punch: 0.320"X0.732" "<=▭=> "
135	FORMING	SYMBOL: ARROW "<==" 0.5X0.225 [↓ TOP DOWN]
994	FORMING	SYMBOL: GROUND Ø0.500 [↑ BOTTOM UP]
420	FORMING	SYMBOL: GROUND Ø0.500 [↓ TOP DOWN]
421	FORMING	SYMBOL: LOCK Ø0.290 [↓ TOP DOWN]
422	FORMING	SYMBOL: UNLOCK Ø0.290 [↓ TOP DOWN]
912	FORMING	SYMBOL: 0.250" CORNER STAMP "⌝" [↓ TOP DOWN]
913	FORMING	SYMBOL: 0.250" LINE "—" [↑ BOTTOM UP]
916	FORMING	TOOTH SHAPE: 0.430"X0.495" "[⊓]"
750	FORMING	TRAP: 0.250 X 0.750 @ 45° "/⎺⎺\"

Number	Type	Description
840	CUTTING	DIAMOND "<⎺⎺⎺>": 0.05" X 0.35"
101	FORMIMG	DIMPLE: 2.362 X 2.242 X H0.059 [↓ TOP DOWN]
123	FORMIMG	DIMPLE: ID0.312" OD0.770" H0.20"[↑ BOTTOM UP]
915	FORMIMG	DIMPLE: ID0.480" OD0.810" H0.16" [↑ BOTTOM UP]
2058	FORMIMG	DIMPLE: ID0.480" OD0.960" H0.25" [↑ BOTTOM UP]
129	FORMIMG	DIMPLE: ID0.570" OD0.880" H0.14" [↓ TOP DOWN]
128	FORMIMG	DIMPLE: ID0.570" OD1.020" H0.18" [↓ TOP DOWN]
910	FORMIMG	DIMPLE: ID1.040" OD1.450" H0.10"[↑ BOTTOM UP]
120	FORMIMG	DIMPLE: ID1.125" OD1.625" H0.20" [↓ TOP DOWN]
4131	CUTTING	Dumbell Slot (37.95 x 6.2)mm "[_]=[_]"
170	CUTTING	HALF OBROUND: 0.17X0.357 "(▭)"
770	CUTTING	HALF OBROUND: 0.25X0.75 "(⎺⎺)"
125	FORMIMG	HALF SHEAR: Ø0.125" [↓ TOP DOWN]
187	FORMIMG	HALF SHEAR: Ø0.187" [↓ TOP DOWN]
902	CUTTING	HEART MARKER ♥ 1.050" X 0.517"
037	CUTTING	HEXAGON: 0.468" , Ø0.541"
911	FORMIMG	K.O.: DOUBLE ID 0.870" OD 1.080" [↑ BOTTOM UP]
901	FORMIMG	K.O.: DOUBLE ID 0.875" OD 1.125" [↑ BOTTOM UP]
907	FORMIMG	K.O.: DOUBLE ID 1.094" OD 1.375" [↑ BOTTOM UP]
975	FORMIMG	K.O.: SINGLE Ø0.500 [↑ BOTTOM UP]
978	FORMIMG	K.O.: SINGLE Ø0.875" [↓ TOP DOWN]
007	FORMIMG	LANCE .130WX.220HX.232LTX.680LB[↑ BOTTOM UP]
118	FORMIMG	LANCE .170WX.160HX.21LTX.557LB [↑ BOTTOM UP]
748	FORMIMG	LOUVER: 2.00LX.40WX.25HX.125GAP[↑ BOTTOM UP]
748	FORMIMG	LOUVER: 2.00LX.40WX.25HX.15GAP[↑ BOTTOM UP]
748	FORMIMG	LOUVER: 2.00LX.40WX.25HX.20GAP[↑ BOTTOM UP]
749	FORMIMG	LOUVER: 2.36LX.50WX.25HX.15GAP[↑ BOTTOM UP]
997	FORMIMG	MARKER: BEND LINE 0.550" "—" [↓ TOP DOWN]
995	FORMIMG	MARKER: BEND LINE 1.072" "—" [↑ BOTTOM UP]
313	FORMIMG	MARKER: WELD STUD Ø0.313" [↑ BOTTOM UP]
555	FORMIMG	OFFSET: 0.047" DEEP [0° ⌐▲¬⌐┘]
556	FORMIMG	OFFSET: 0.080" DEEP [0° └▼┘└┐]
005	FORMIMG	PART NUMBER: 2 X 10 [↓ TOP DOWN]
904	FORMIMG	PART NUMBER:1X16@2.05"X0.28" [↑ BOTTOM UP]
914	FORMIMG	PART NUMBER:2X14@1.75"X0.6" [↑ BOTTOM UP]
981	CUTTING	QUAD: FAN 1.000X1.800
126	CUTTING	QUAD: R1, R1.5, R2, R2.5, r0.03
413	CUTTING	RAD: R0.030 4-WAY
116	CUTTING	RAD: R0.063 4-WAY
418	CUTTING	RAD: R0.125 4-WAY
188	CUTTING	RAD: R0.187 CRESCENT
414	CUTTING	RAD: R0.250 4-WAY
433	CUTTING	RAD: R0.330 4-WAY
375	CUTTING	RAD: R0.375 CRESCENT
425	CUTTING	RAD: R0.394 4-WAY (R 10MM)
979	CUTTING	RAD: R0.500 CRESCENT
376	CUTTING	RAD: R2.000 CRESCENT
415	CUTTING	RAD: R2.750 CRESCENT
908	CUTTING	RECT WITH 2 CORNER RAD: 1.20"X1.12"XR0.2"
876	CUTTING	RECT WITH 2 NOTCH: 1.575"X1.271" "⊓"
801	CUTTING	RECT: 0.157X0.540 SPECIAL
900	CUTTING	RECT: 0.195X0.625 SPECIAL "[⌐¬⌋"
921	CUTTING	RECT: 0.820X0.870 WITH NOTCH & R.317 CORNER
920	CUTTING	RECT: 0.920X1.640 WITH NOTCH & R.090 CORNER
609	FORMIMG	RECT: IRREGULAR 0.162X0.750 LEFT
610	FORMIMG	RECT: IRREGULAR 0.162X0.750 RIGHT
976	CUTTING	RECT: IRREGULAR 0.307X2.820
240	CUTTING	SD: 0.226 X Ø0.240
235	CUTTING	SD: 0.235 X Ø0.250
380	CUTTING	SD: 0.346 X Ø0.380
505	CUTTING	SD: 0.465 X Ø0.505
473	CUTTING	SD: 0.473 X Ø0.505
525	CUTTING	SD: 0.488 X Ø0.525
570	CUTTING	SD: 0.570 X Ø0.610
001	CUTTING	SD: 0.593 X Ø0.625
701	CUTTING	SD: 1.455 X Ø1.510
909	CUTTING	TRIANGLE: 0.480X0.480X0.600 @ 30°,30°,60° R.025
999	CUTTING	TRIANGLE: 0.537X0.537X0.690 @ 30°,30°,60°
1009	CUTTING	TRIANGLE: 1.448"X1.408"X1.245" @ 51.7°,62.5°,65.8°

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Tool Library

Irregular Shape/Forming GPT Tool

Number	Type	Description
009	FORMING	ROLLER DEBURR
012	CUTTING	HEXAGON:0.250
013	FORMING	FORM DOWN OB 0.200X1.910
014	FORMING	ID.317XOD.483XH.080 DIMPL UP
018	CUTTING	0.25" CHAMBER SQ CLUSTER .125" SPACING
021	CUTTING	BANANA:IR0.618 OR0.835
022	CUTTING	BANANA:IR0.953 OR1.169
027	CUTTING	CB-9
028	CUTTING	AH-10
029	CUTTING	HDMI CUTOUT
033	FORMING	LOUVRE CONTINOUS L2.360
034	FORMING	OFFSET TAB UP L.419 W.230 H.200
035	CUTTING	CLUSTER ; 4HITS-DIA 0.250, 0.787 SPACING
038	CUTTING	ELECTRICAL CUTOUT
039	FORMING	ID 1.031XOD2.065XH0.3 DIMPL DOWN
042	FORMING	KO SINGLE 1.375 DOWN
044	FORMING	KO SINGLE 1.734 DOWN
045	FORMING	OFFSET H0.125"XW0.830" DOWN
046	CUTTING	RAD: R0.045 4-WAY
50	CUTTING	URETHANE REC : 0.187 X 1.000
40	FORMING	DIMPL ID.700XOD1.00XH.170 UP
047	CUTTING	RAD: R0.090 4-WAY
048	CUTTING	CLUSTER ; 4HITS-DIA 0.313, 0.750 SPACING
032	CUTTING	MILLSON PUNCH

Number	Type	Description
103	CUTTING	R2.820 CRESCENT
1159	FORMING	DIMPLE 0.150
140	FORMING	DIMPLE .37 FORM UP
2058	FORMING	ID.42XOD1.02XH.244 DIMPLE UP
313	FORMING	WELD STUD MARKER UP
375	CUTTING	RAD: R0.375 R0.625 CRESCENT
425	CUTTING	RAD:R0.394(10MM) 4-WAY
433	CUTTING	RAD:R0330 4-WAY
611	CUTTING	RECTANGLE WITH NOTCH,DT60-009 RIGHT
613	CUTTING	.791 RAD SQUAREKEY SLOT
780	FORMING	CSK DOWN
869	CUTTING	CF-TB-CB
870	CUTTING	CF-TB-CCP
907	FORMING	KO DOUBLE 1.094/1.375 UP
975	FORMING	KO SINGLE 0.500
977	CUTTING	AIM 512-020-102
997	FORMING	0.550" LINE DOWN
049	CUTTING	URETHANE REC 0.125 X 2.000
003	FORMING	8-320EXTRUSION UP
004	FORMING	10-32 EXTRUSION UP
010	FORMING	RAD SQ 1.120" DIMOL DOWN .03" DEEP
020	CUTTING	BANANA: IR1.287 OR 1.504
030	FORMING	0.300" FLANGE

TOOL / DIE SUMMARY

Shape	Tool	Die
Circle	122	251
Square	25	63
Obround	52	98
Rectangle	58	131
Rounded rectangle	8	10
Custom	113	113
TOTAL	**378**	**666**

OVER 1000 PIECES OF TOOLING TO SUIT YOUR DESIGN NEEDS!

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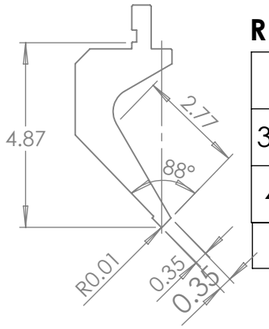
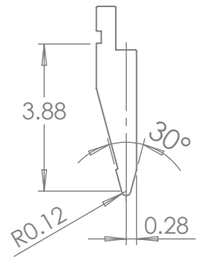


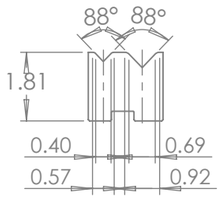
R 0.008 Gooseneck extended Punch

SEGMENTATION (Inch)												
32	12	7.5	5	4	3.4	3.2	3.2	1.6	0.8	0.6	0.5	0.4
4	1	1	1	1	2	1	1	3	3	2	1	2
Total length								179.4"				



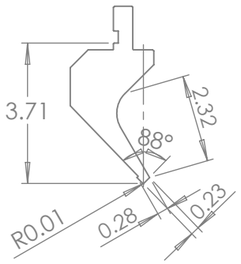
R 0.125" Straight Punch

SEGMENTATION (Inch)								
33	12	8	4	2	1.5	1	0.5	0.25
2	1	1	1	1	1	1	1	1
Total length							95.25	



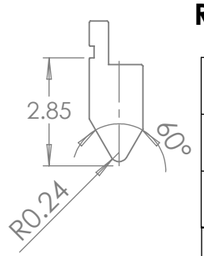
12mm & 20mm Radius Double V

SEGMENTATION (Inch)							
32	12	8	2	1.75	0.8	0.6	0.4
2	2	2	2	2	2	2	2
Total length						115.1	



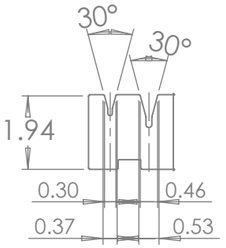
R 0.008" Gooseneck Punch

SEGMENTATION (Inch)								
33	12	8	4	2	16	.08	.06	.04
2	1	1	1	1	1	1	1	1
Total length						108.18"		



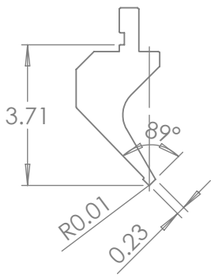
R 0.250" Straight Punch

SEGMENTATION (Inch)							
33	12	4	2	1.5	0.75	0.5	0.25
2	1	2	1	1	1	1	1
Total length						91	



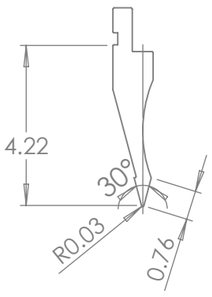
8mm & 12mm Acute Double V

SEGMENTATION (Inch)							
32	12	8	4	1.75	0.8	0.6	0.4
2	2	1	2	1	1	1	1
Total length						107.55	



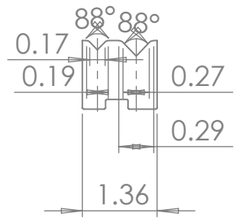
R 0.008" Gooseneck Punch

SEGMENTATION (Inch)						
12	8	4	2	.08	0.06	0.04
1	1	1	1	1	1	1
Total legth					26.18	



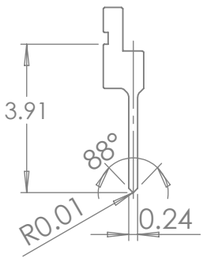
R 0.032" Straight Punch

SEGMENTATION (Inch)												
33	30	12	11	10	8	4	3	2	0.75	0.5	0.375
3	2	1	1	1	1	6	2	2	3	1	3
Total length									237.87		



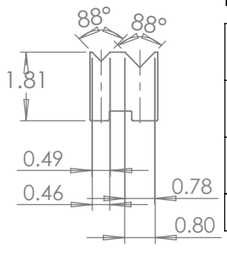
4mm & 7mm Double V

SEGMENTATION (Inch)								
33	17	8	2	1.5	1	0.6	0.5	.25
2	1	1	2	2	3	1	2	3
Total length							103.35	



R 0.008" Straight Punch

SEGMENTATION (Inch)								
33	12	8	4	3	2	.75	0.5	0.375
3	2	2	6	1	2	3	3	3
Total length							174.87	



12mm & 20mm Regular Double V

SEGMENTATION (Inch)										
32	16	8	6	5	4	2	1.5	0.8	0.6	0.4
4	1	1	1	1	3	1	3	3	3	2
Total length								186.5		

TRUMPF BEND DEDUCTION USED.

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
TOLERANCES ARE:
DECIMAL: .X ±0.030" .XX ±0.015" .XXX ±0.010"
ANGULAR: ±0.5°

HANSEN INDUSTRIES LTD

CUSTOMER: CUSTOMER

TITLE_LINE_1

-

K factor	Bend Deduction
K Factor	- OBD

MATERIAL: MATL

GAUGE	BOTTOM DIE
GA	- mm

FINISH: SEE CUSTOMER DRAWING(S)

DRAWN BY: INITIALS
CREATED: Friday, July 28, 2017 9:36:13 AM
LAST SAVED: Friday, August 18, 2017 11:18:14 AM

SIZE: B DWG. NO.: Amada bending tools REV.: -

SMP DIR: P:/CUSTOMER/ASSEMBLY/COMP SHEET: 1 OF 3

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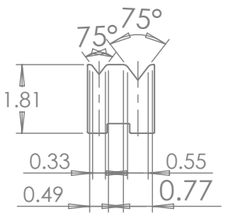
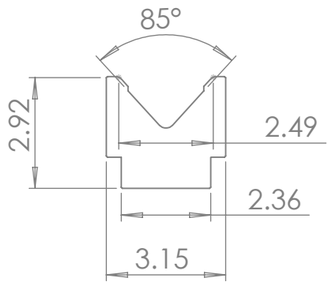


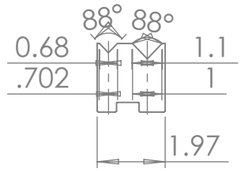
10mm & 16m Radius Double V

SEGMENTATION (Inch)								
32	12	8	4	2	1.5	0.75	0.6	0.4
2	2	2	4	2	2	2	2	2
Total length								130.5



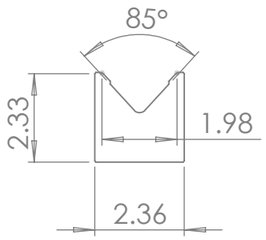
2-1/2" Single V

SEGMENTATION (Inch)	
49	
1	
Total length	49



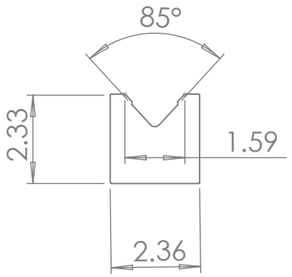
16mm & 25 Radius Double V

SEGMENTATION (Inch)									
33	12	10.5	8	4	2	1.5	1	0.5	0.1
3	1	1	1	1	1	1	1	2	3
Total Length									139.3



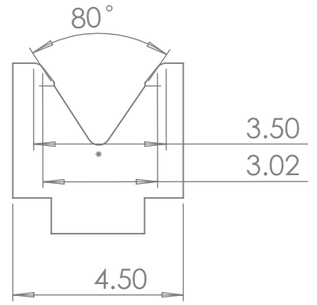
2" Single V

SEGMENTATION (Inch)	
33	
2	
Total length	66



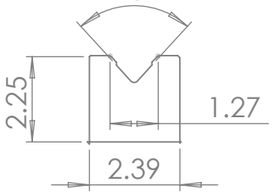
1-1/2" Single V

SEGMENTATION (Inch)	
33	
3	
Total length	99



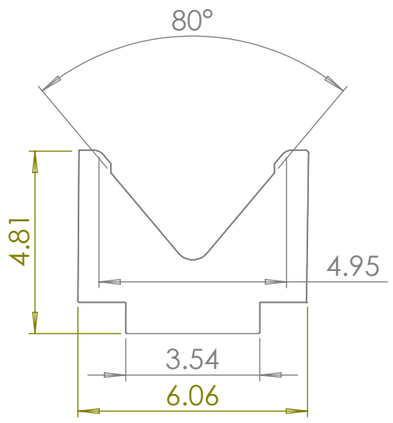
3" Single V

SEGMENTATION (Inch)	
33	
1	
Total length	33



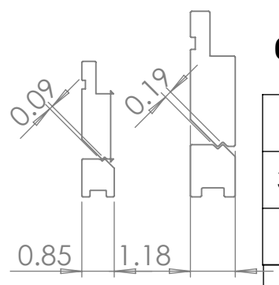
1-1/4" Single V

SEGMENTATION (Inch)	
33	
3	
Total length	99



5" Single V

SEGMENTATION (Inch)	
16	
2	
Total length	32



0.25" Jogggle(offset) Die

SEGMENTATION (Inch)								
33	12	8	4	2	1.5	0.75	0.5	0.375
1	1	1	2	1	1	1	1	1
Total length								66.12

0.125" Jogggle(offset) Die

SEGAMENTATION (Inch)							
12	8	4	2	1.5	0.75	0.575	0.375
2	2	4	2	2	1	3	2
Total length							66.22

0.188" Jogggle(offset) Die

SEGMENTATION (Inch)						
12	8	4	2	0.75	0.575	0.375
1	2	4	2	2	1	2
Total length						50.82

TRUMPF BEND DEDUCTION USED.

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
TOLERANCES ARE:
DECIMAL: .X ±0.030" .XX ±0.015" .XXX ±0.010"
ANGULAR: ±0.5°

HANSEN INDUSTRIES LTD

CUSTOMER: CUSTOMER

TITLE_LINE_1

-

K factor	Bend Deduction
K Factor	- OBD

MATERIAL: MATL

GAUGE	BOTTOM DIE
GA	- mm

FINISH: SEE CUSTOMER DRAWING(S)

DRAWN BY: INITIALS
CREATED: Friday, July 28, 2017 9:36:13 AM
LAST SAVED: Friday, August 18, 2017 11:18:14 AM

SIZE B | DWG. NO. Amada bending tools | REV. -

SMP DIR: P:/CUSTOMER/ASSEMBLY/COMP | SHEET: 2 OF 3

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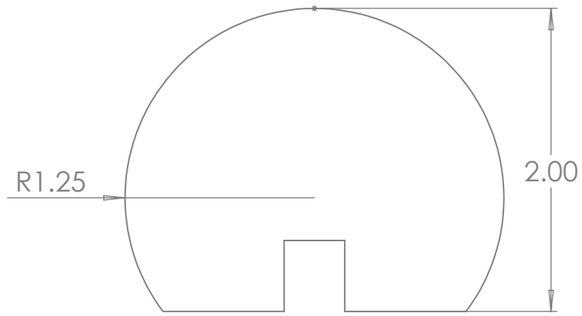
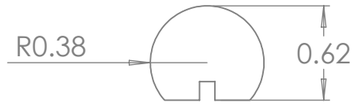


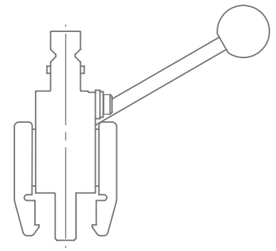
1-1/4" Radius Punch

SEGMENTATION (inch)
16
1



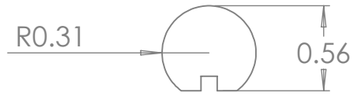
3/8" Radius Punch

SEGMENTATION (inch)
33
2



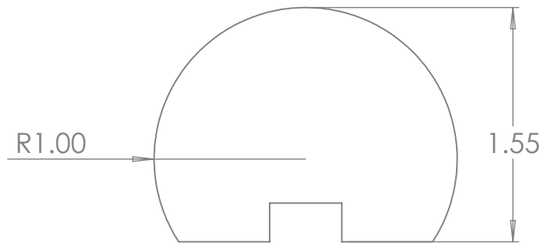
Punch holder

Quantity	30



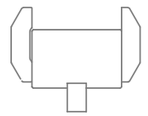
5/16" Radius Punch

SEGMENTATION (inch)
33
3



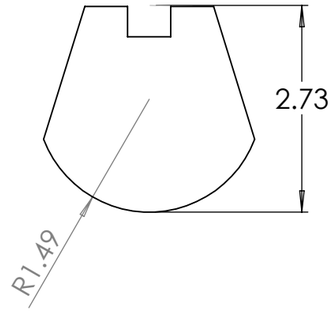
1" Radius Punch

SEGMENTATION (inch)	
33	3.7
2	1



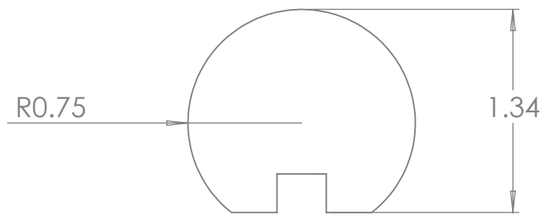
Botttom Die Holder

SEGMENTATION (inch)
33
3
99



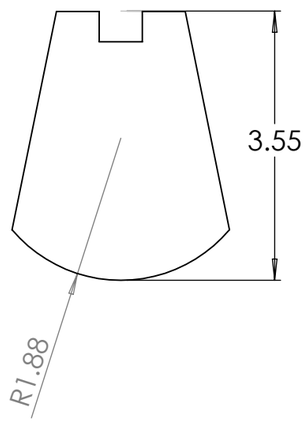
R1.49" Radius Punch

SEGMENTATION (inch)
16
1



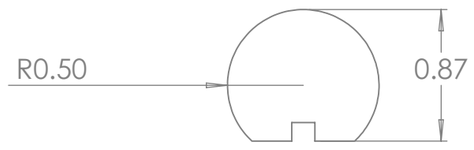
3/4" Radius Punch

SEGMENTATION (inch)
33
2



R1.88" Radius Punch

SEGMENTATION (inch)
16
1



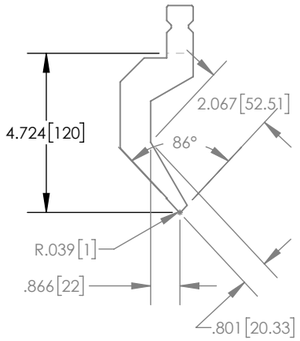
1/2" Radius Punch

SEGMENTATION (inch)	
33	16
4	1

TRUMPF BEND DEDUCTION USED.

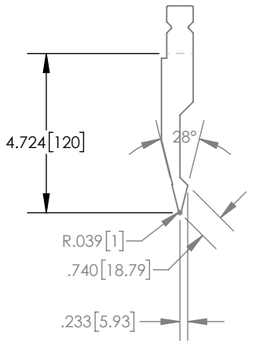
REFER TO CUSTOMER TOLERANCE ON CUSTOMER DRAWING. HANSEN TOLERANCE IS ONLY VALID WHEN CUSTOMER TOLERANCE UNSPECIFIED.

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ARE: DECIMAL: .X ±0.030" .XX ±0.015" .XXX ±0.010" ANGULAR: ±0.5°	HANSEN INDUSTRIES LTD
	CUSTOMER: CUSTOMER
K factor: K Factor; Bend Deduction: - OBD	TITLE_LINE_1 -
MATERIAL: MATL	DRAWN BY: INITIALS; CREATED: Friday, July 28, 2017 9:36:13 AM; LAST SAVED: Friday, August 18, 2017 11:18:14 AM
GAUGE: GA; BOTTOM DIE: - mm	SIZE: B; DWG. NO.: Amada bending tools; REV.: -
FINISH: SEE CUSTOMER DRAWING(S)	SMP DIR: P:/CUSTOMER/ASSEMBLY/COMP; SHEET: 3 OF 3



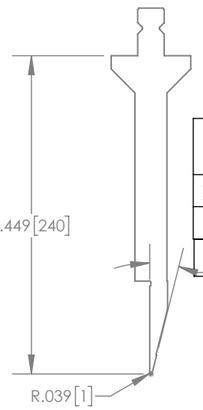
OW200/K R1/86° H120

SEGAMENTATION (mm)							L HORN	R HORN
20	25	30	35	40	200	515	100	100
1	1	1	1	1	1	3	1	1
Total length								82.48"



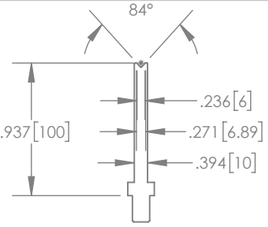
OW202/K R1/28° H120

SEGAMENTATION (mm)							L HORN	R HORN
20	25	30	35	40	200	515	100	100
1	1	1	1	1	1	3	1	1
Total length								82.48"



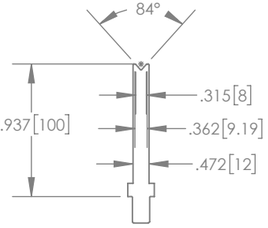
OW210/S R1/28° H240

SEGAMENTATION (mm)										L HORN	R HORN
25	30	35	40	45	50	100	200	300	500	100	100
4	2	2	2	2	2	2	1	1	4	3	3
Total length											149.606"



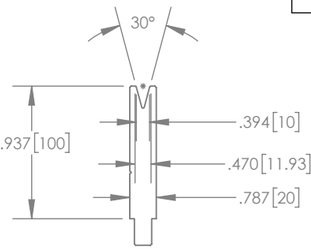
EV/S W6/84° R0.6

SEGAMENTATION (mm)										
25	30	35	40	45	50	100	200	300	500	
2	1	1	1	1	1	3	1	1	4	
Total length										120.08"



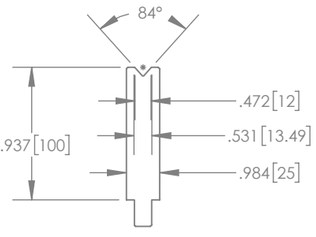
EV/S W8/84° R0.8

SEGAMENTATION (mm)										
25	30	35	40	45	50	100	200	300	500	
2	1	1	1	1	1	3	1	1	2	
Total length										80.70"



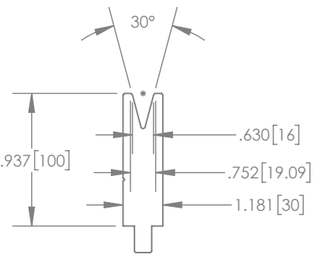
EV003 W10/30° R1

SEGAMENTATION (mm)										
25	30	35	40	45	50	100	200	300	500	
2	1	1	1	1	1	3	1	1	4	
Total length										120.07"



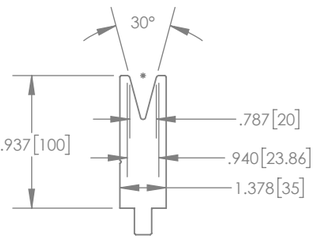
EV W12/84° R1

SEGAMENTATION (mm)										
25	30	35	40	45	50	100	200	300	500	
2	1	1	1	1	1	3	1	1	2	
Total length										80.70"



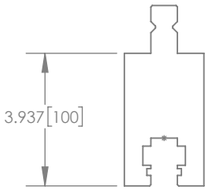
EV005 W16/30° R1.6

SEGAMENTATION (mm)										
25	30	35	40	45	50	100	200	300	500	
2	1	1	1	1	1	3	1	1	4	
Total length										120.07"



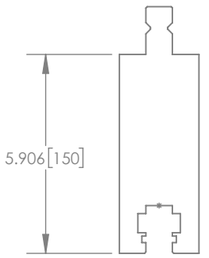
EV006 W20/30° R2

SEGAMENTATION (mm)										
25	30	35	40	45	50	100	200	300	500	
2	1	1	1	1	1	3	1	1	4	
Total length										120.07"



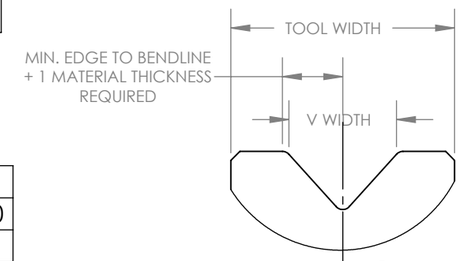
MF/S H100 EXTENSION ADAPTOR

SEGAMENTATION (mm)
100
2



MF/S H150 EXTENSION ADAPTOR

SEGAMENTATION (mm)	
100	
2	
Total length	7.88"



DETAIL C
SCALE 1.5 : 1

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
TOLERANCES ARE:
DECIMAL: .X ±0.030" .XX ±0.015" .XXX ±0.010"
ANGULAR: ±0.5°

K factor	Bend Deduction
	-

MATERIAL

GAUGE	BOTTOM DIE
	mm

FINISH: SEE CUSTOMER DRAWING(S)

HANSEN INDUSTRIES LTD

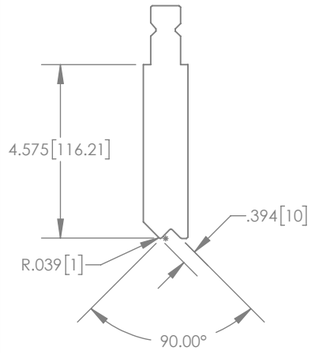
CUSTOMER: HANSEN

Trumpf Brake
Tooling List

DRAWN BY: ET
CREATED: Tuesday, September 3, 2013 4:04:18 PM
LAST SAVED: Tuesday, October 24, 2017 2:20:18 PM

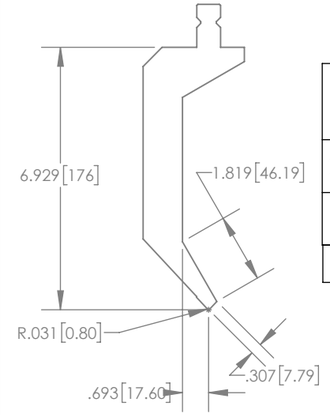
SIZE: B | DWG. NO.: Trumpf Tools | REV.: -

SMP DIR: P:/CUSTOMER/ASSEMBLY/COMP | SHEET: 1 OF 2



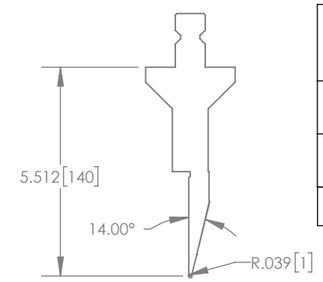
OWZ/K 10/90

SEGMENTATION (mm)									
25	30	35	40	45	50	100	200	300	500
4	2	2	2	2	2	2	2	2	0
Total length									66.92"



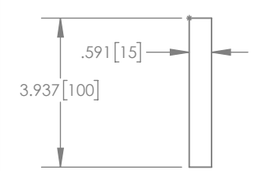
OW200/S R3/86H218.5

SEGMENTATION (mm)										L HORN	R HORN
25	30	35	40	45	50	100	200	300	500	100	100
2	1	1	1	1	1	1	1	1	2	1	1
Total length											80.70"



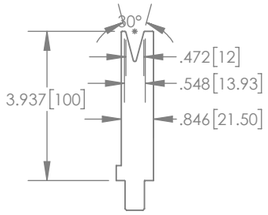
OW210 R1/28 H140

SEGMENTATION (mm)										L HORN	R HORN
25	30	35	40	45	50	100	200	300	500	100	100
2	1	1	1	1	1	1	1	1	1	1	1
Total length											61.02"



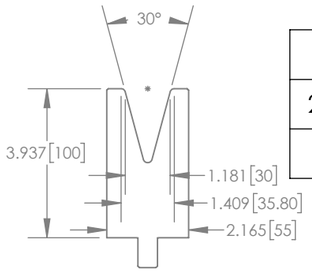
FWZ ZDL

SEGMENTATION (mm)									
25	30	35	40	45	50	100	200	300	500
2	1	1	1	1	1	1	1	1	1
Total length								53.14"	



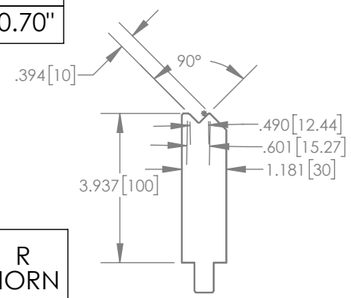
EV004/S W12/30 R1

SEGMENTATION (mm)									
25	30	35	40	45	50	100	200	300	500
2	1	1	1	1	1	3	2	1	0
Total length								49.21"	



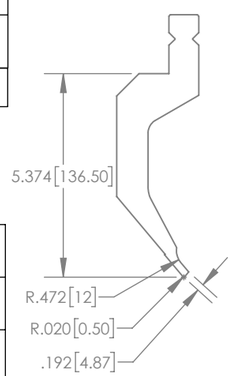
EV W30/30 R3

SEGMENTATION (mm)									
25	30	35	40	45	50	100	200	300	500
2	1	1	1	1	1	3	1	1	2
Total length								80.70"	



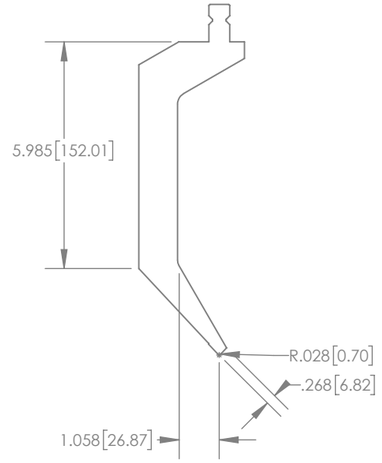
EVZ 10/90

SEGMENTATION (mm)									
25	30	35	40	45	50	100	200	300	500
4	2	2	2	2	2	2	2	2	0
Total length								66.92"	



OW280/K R0.5/80 H140

SEGMENTATION (mm)										L HORN	R HORN
25	30	35	40	45	50	100	200	300	500	100	100
2	1	1	1	1	1	1	1	1	0	1	1
Total length										29.52"	



OW300/S R1/86 H300

SEGMENTATION (mm)										L HORN	R HORN
25	30	35	40	45	50	100	200	300	500	100	100
1	1	1	1	1	1	2	3	0	0	1	1
Total length											48.22"

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
TOLERANCES ARE:
DECIMAL: .X ±0.030" .XX ±0.015" .XXX ±0.010"
ANGULAR: ±0.5°

K factor: K Factor	Bend Deduction: - Bend Deduction
MATERIAL: MATL	
GAUGE: GA	BOTTOM DIE: 16 mm
FINISH: SEE CUSTOMER DRAWING(S)	

HANSEN INDUSTRIES LTD

CUSTOMER: CUSTOMER

TITLE_LINE_1
TITLE_LINE_2

DRAWN BY: ET	CREATED: Tuesday, September 3, 2013 4:04:18 PM
	LAST SAVED: Tuesday, October 24, 2017 2:20:18 PM
SIZE: B	DWG. NO.: Trumpf Tools
	REV.: -
SMP DIR: P:/CUSTOMER/ASSEMBLY/COMP	SHEET: 2 OF 2