Design for Manufacturability Guide

WHO WE ARE

Short-to-medium run metal stamping manufacturer
Annual volume of 1,000 to 100,000 per part number

We serve a very diversified mix of customers & markets

Our niches:

- Product start-ups
- “Legacy” products
- Low-to-medium volume product lines

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ADVANTAGES TO STAMPING

Single-hit blank/pierce

- Continuous part edges
- No nibble marks
- Dimensions die controlled
- All burrs on same side of part

Repeatability

Low cost alternative to fabrication

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WHAT WE ARE NOT

Progressive die stamping house

- We cannot use tooling made at other companies

Metal fabricator

- No turret presses
- No press brakes

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WHAT MAKES WINCO STAMPING UNIQUE

Technology driven manufacturing processes

Quick-change tooling for fast set-ups

Low cost customer & part dedicated tooling

Vision inspection equipment

Tooling & processes assure part quality

conformance

Focus on our capability niche

Commitment to 100% service & on-time deliveries

J.B.R. - Just-Be-Ready manufacturing philosophy

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TOOLING

One-time engineering charge

$1,500 typical cost of new tooling

100% built in-house

Dedicated for each part

Hardened A2 tool steel

Maintained by Winco for life-of-part

Unique and proprietary to Winco

Quick-change technology utilized

THE TYPICAL WINCO PROCESS

Shear sheet material to strips

Blank – pierce

Machine features – tap, countersink, etc. (if applicable)

Timesaver sand deburr

Form

Finish (if applicable)

PEM or assembly (if applicable)

Pack

MATERIALS

Cold Rolled Steel

.0149” (28 gage) to .1345” (10 gage)

Hot Rolled Steel

.1495” (9 gage) to .1945” (6 gage)

Pre-galvanized Steel

.0157” (30 gage) to .1681” (8 gage)

Annealed Spring Steel

1074/1075, 1050 and 1095 usually requiring post heat treatment

Aluminum (1100, 2024, 3003, 5052 & 6061)

Various tempers – up to .190” thick

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MATERIALS (CONTINUED)

Stainless Steel

301, 304, 316, 430
Annealed only – up to .090” thick

Brass (mostly CA-260)

Up to .187” thick

Copper (mostly CA-110)

Various tempers – up to .187” thick

Stampable Plastics

e.g. UHMW, HDPE & Nylon 6/6

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BLANKING REQUIREMENTS

Unfolded flat blank

- Ideal – less than 10” x 10” in the flat
- Visual image – size of an 8½” x 11”
- sheet of paper
- Maximum up to 14” x 17” in the flat
- Limitation – 170 ton blanking presses
    - See tonnage formula on next page
- Blanking radii (inside and outside)
    - ½ material thickness ideal
    - .015” minimum

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CALCULATING TONNAGE

(Cutting edge inches) x (material thickness) x (material constant)
***Cutting Edge inches to include internal hole features**
Material Constants:
Carbon Steel: 25
Annealed Stainless Steel: 50
5052 Aluminum: 12
6061 Aluminum: 15
2024 Aluminum: 20
½ Hard Copper & Brass:22
Full Hard Copper & Brass: 28
1050 Annealed Spring Steel: 41
1074/1075 Annealed Spring Steel: 45
1095 Annealed Spring Steel: 50
Example: A 3" x 4" rectangular part made from .059" carbon steel
3 + 4 + 3 + 4 = 14 cutting edge inches
14 (CEI) x .059 (material thickness) x 25 (constant) = 20.65 tons

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PART DESIGN CONSIDERATIONS

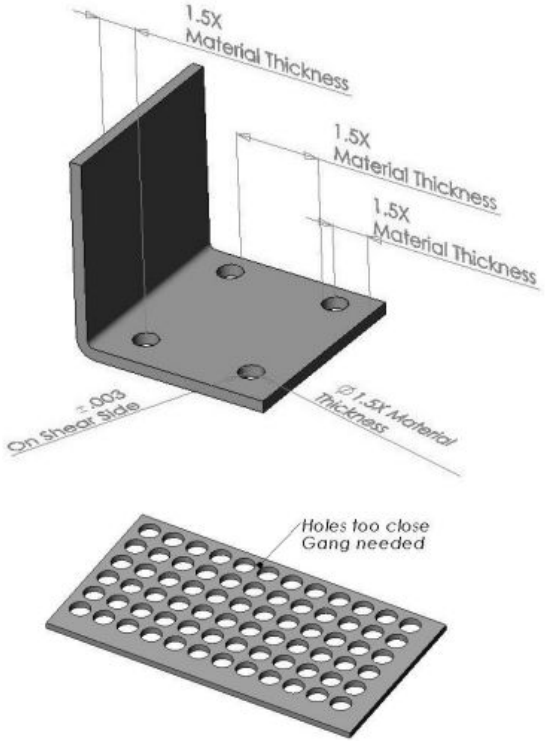
Hole diameters – 1 ½ x material thickness minimum
(smaller holes require machining at extra cost)

Web between holes – 1 ½ x material thickness minimum
(smaller webs require extra operations at extra cost)

Edge of part to edge of hole – 1 ½ x material thickness
(holes closer require extra operations at extra cost)

Bend line to edge of hole – 1 ½ x material thickness
(holes closer require extra operations at extra cost)

Class A & B holes require the tolerance to be held through the entire hole. This will require additional machining at extra cost.

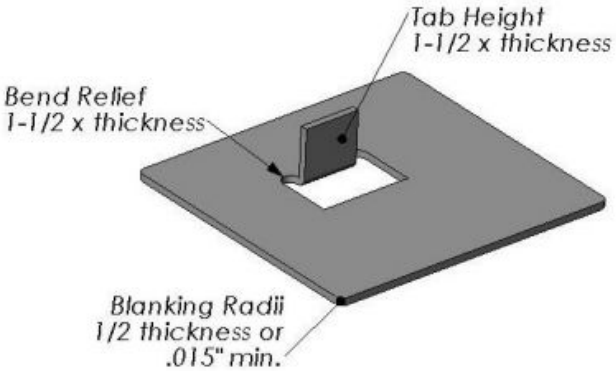


PART DESIGN CONSIDERATIONS (CONTINUED)

Bend reliefs or undercuts – 1 ½ x material thickness minimum

Tabs

- 1 ½ x material thickness minimum
- If interior to part, bend relief required



Blanking burr

- Typically less than 10% of material thickness
- Sand deburring will remove

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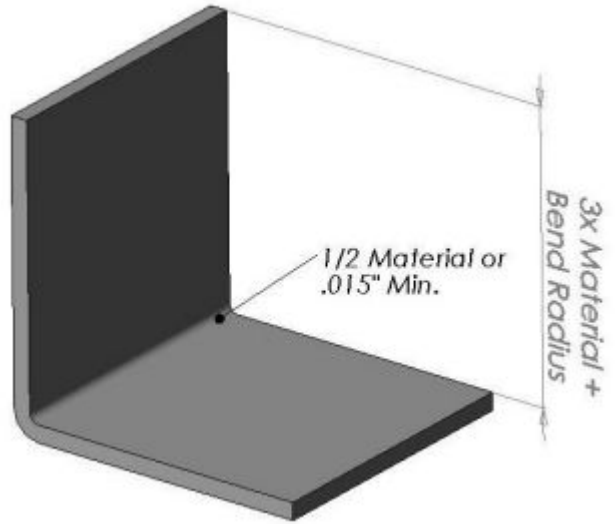
PART DESIGN CONSIDERATIONS (CONTINUED)

Forming (bending)

- Inside bend radii
  - ½ x material thickness is best
  - 1/64” minimum depending on material
- thickness
- Flange height (measured to inside) 3 x
- material thickness + bend radius
- Holes too close to bends distort



Special forming

- Requires discussion with tooling engineers

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PART DESIGN CONSIDERATIONS (CONTINUED)

Embossing

- Example – ribs
- Height
- Maximum of 2x material thickness, over material
- thickness
- Depends upon material thickness

Bend Gussets

- Reference dimensions preferred for size & location
- 45° by 2x material thickness, over material thickness

Drawing

- Round best - ½” height maximum
- Irregular shapes – requires discussion with tooling engineers

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SECONDARY PROCESSES PERFORMED IN-HOUSE

Machining of part features

- Tapping of threaded holes
- Countersinking of holes
- Counterbored holes
- Reaming of holes
- Milling

SECONDARY PROCESSES PERFORMED IN-HOUSE (CONTINUED)

Assembly

- PEM insertion
- Orbital riveting
- Solid
- Semi-tubular
- Custom screw machine parts
- Mechanical fastening, e.g. screws

SECONDARY PROCESSES PERFORMED IN-HOUSE (CONTINUED)

Kitting

- Hardware
- Instructions
- Labeling
- Bagging
- Boxing

OUTSOURCED PROCESSES

Welding

Special machining

Heat treating

Tumble deburring

Finishing:

- Painting
- Plating
- E-coating
- Anodizing

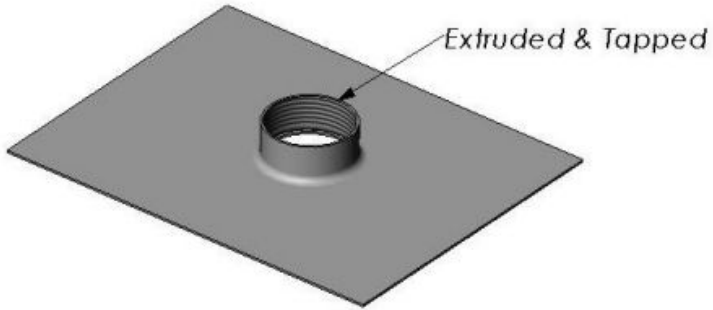
PART DESIGN CONSIDERATIONS (CONTINUED)

Extruded holes

- Pre-pierce minimum of material thickness
- Height – typically enough for 2 ½ threads if tapped
- No reduced material wall thicknesses

Stenciling

- Part numbers
- Identification
- Logo
- Symbols



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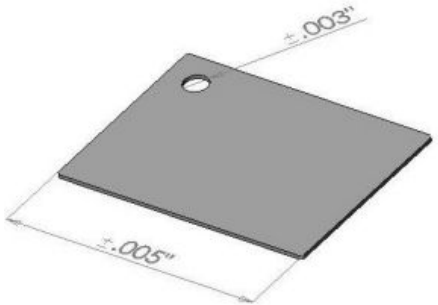
DIMENSIONING, TOLERANCING & MEASURING FEATURES

Blank dimensions are measured on the shear side of the part

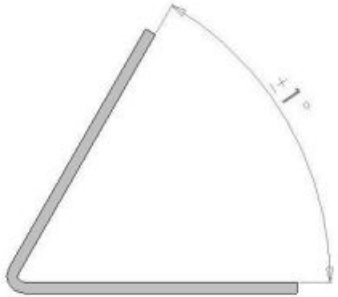
Hole diameters +/-.003”

Blank linear dimensions +/-.005”



Flatness – typical .005” per inch

Formed angles +/- 1 degree



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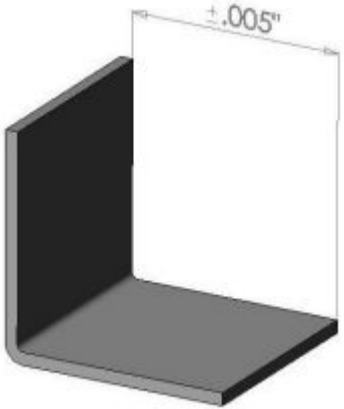
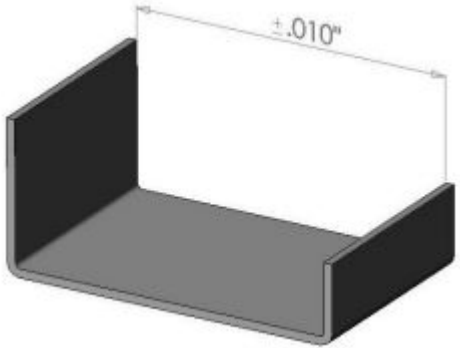
DIMENSIONING, TOLERANCING & MEASURING FEATURES

Formed dimensions, edge-to-hole &

form-to-hole

- One bend +/-.005” measured to inside
- of material
- Multiple bends +/-.010” depending on
- material thickness





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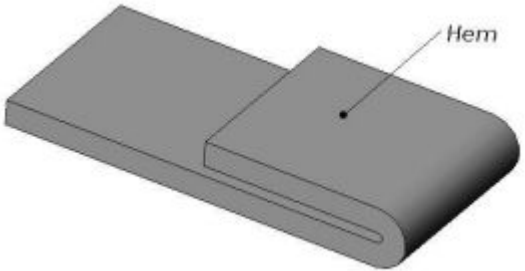
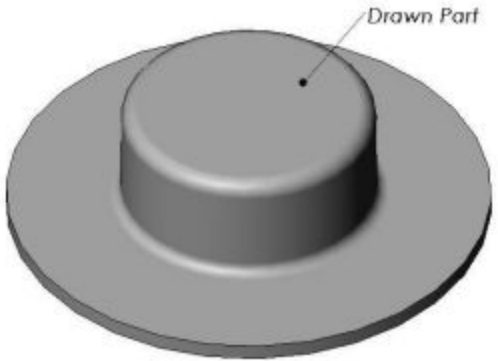
WHAT WE DON'T DO

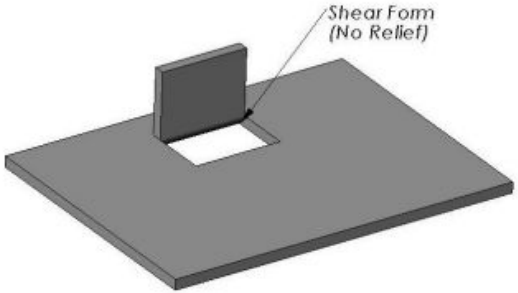
Hems – where material is folded over on itself

Shear forms

Drawn parts > ½" deep







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