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

WHAT WE ARE NOT

Progressive die stamping house

- We do not use coil material
- We cannot use tooling made at other companies

Metal fabricator

- No lasers
- No turret presses
- No press brakes

Prototype shop

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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

Low cost – typically $150-$1500 per part

100% built in-house

Dedicated for each part

Hardened A2 tool steel

Maintained by Winco for life-of-part

No common or shared tooling between parts or customers

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

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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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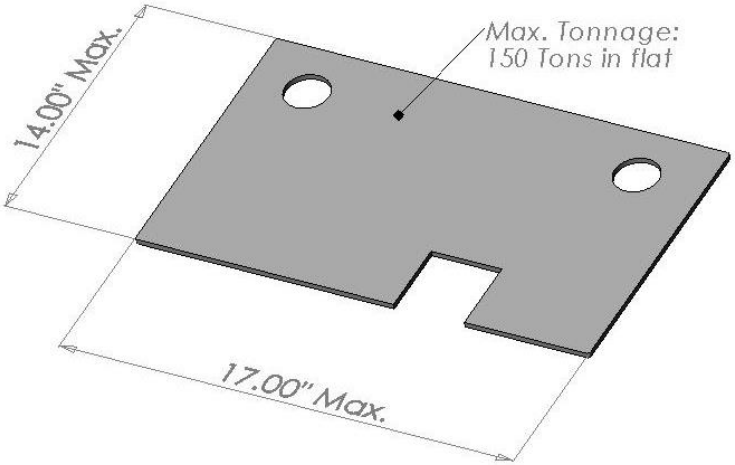
BLANKING REQUIREMENTS

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 – 150 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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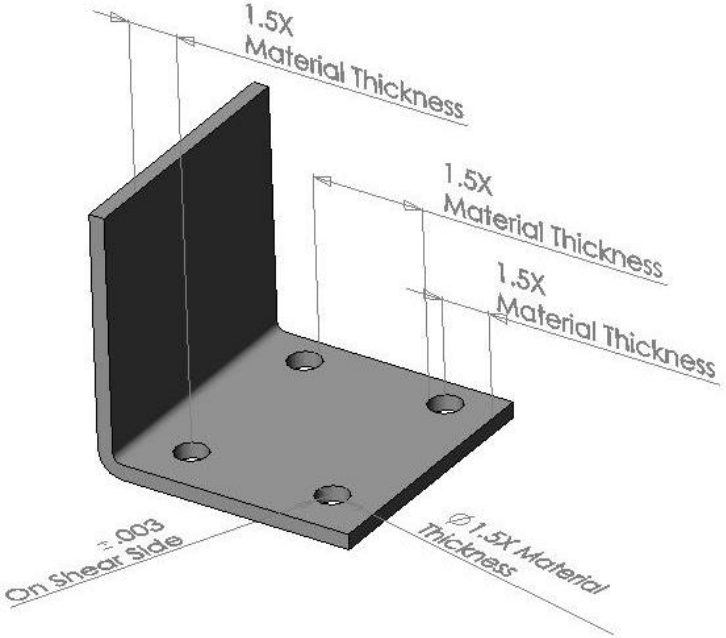
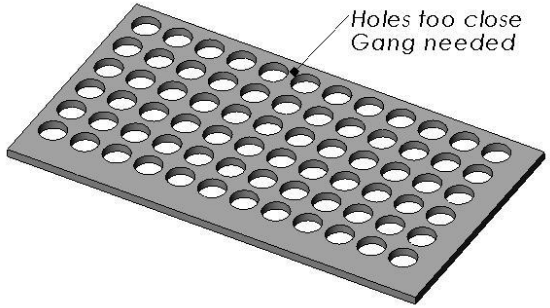
PART DESIGN CONSIDERATIONS





- 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.

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PART DESIGN CONSIDERATIONS (CONTINUED)

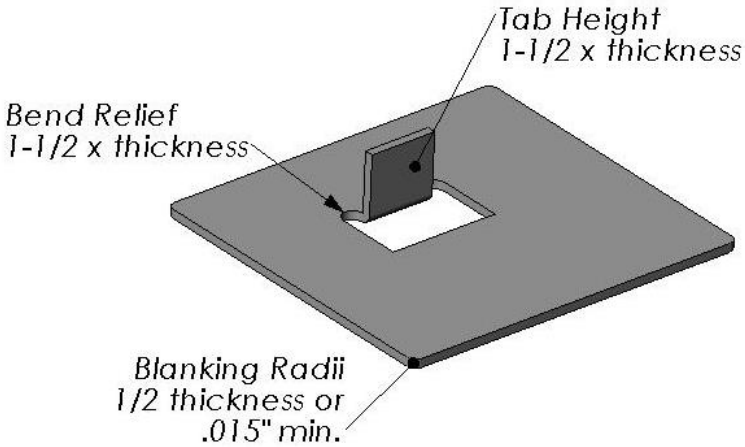
Bend reliefs or undercuts – 1 ½ x material thickness minimum

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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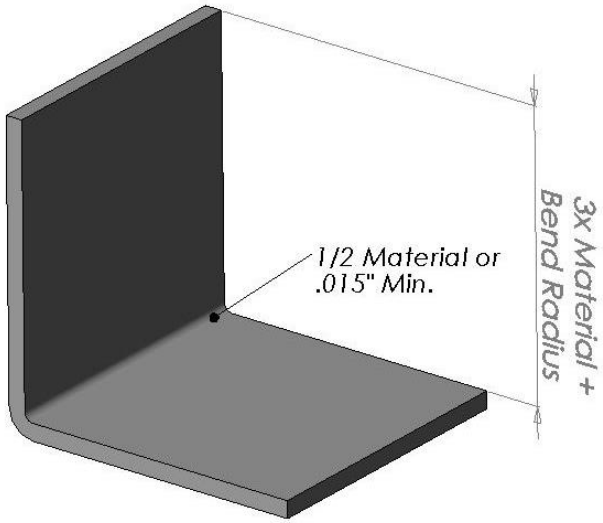
PART DESIGN CONSIDERATIONS (CONTINUED)

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

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

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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

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OUTSOURCED PROCESSES

Welding

Special machining

Heat treating

Tumble deburring

Finishing:

- Painting
- Plating
- E-coating
- Anodizing

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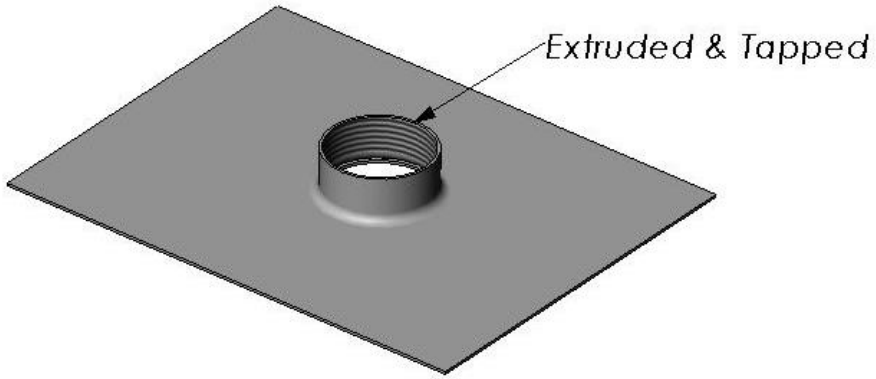
PART DESIGN CONSIDERATIONS (CONTINUED)

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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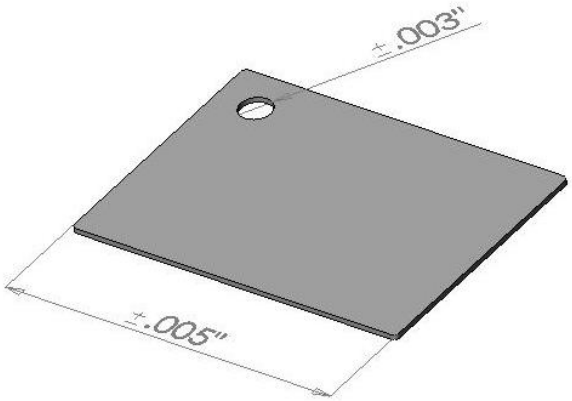
DIMENSIONING, TOLERANCING & MEASURING FEATURES

Blank dimensions are measured on the shear side of the part

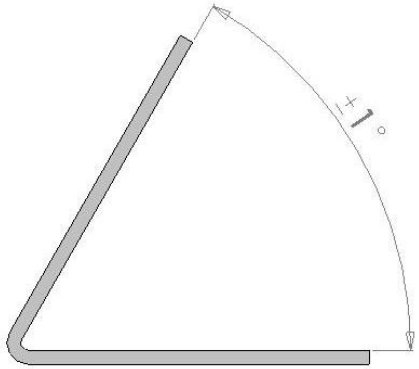
Hole diameters +/-.003”

Blank linear dimensions +/-.005”



Flatness – typical .005” per inch

Formed angles +/- 1 degree



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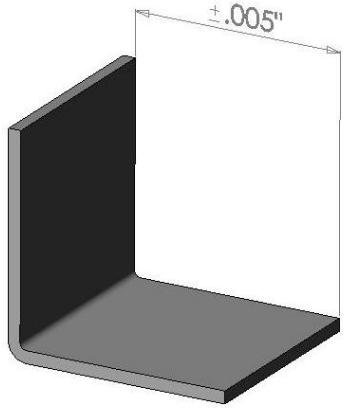
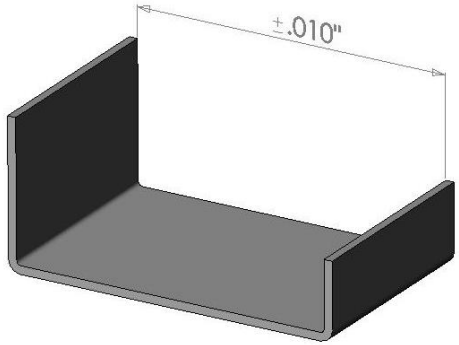
DIMENSIONING, TOLERANCING & MEASURING FEATURES

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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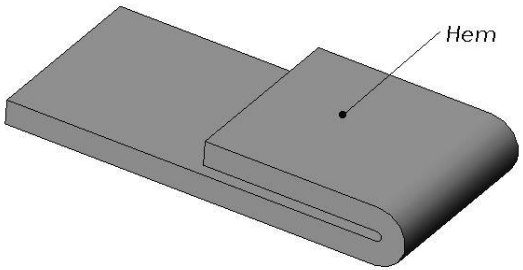
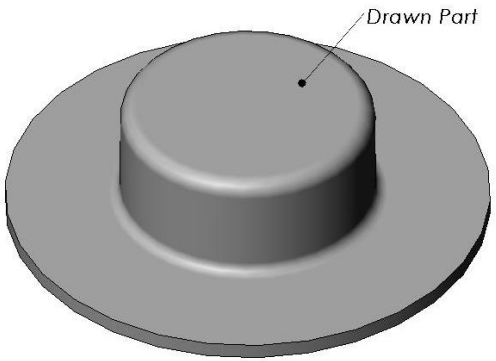
WHAT WE DON'T DO

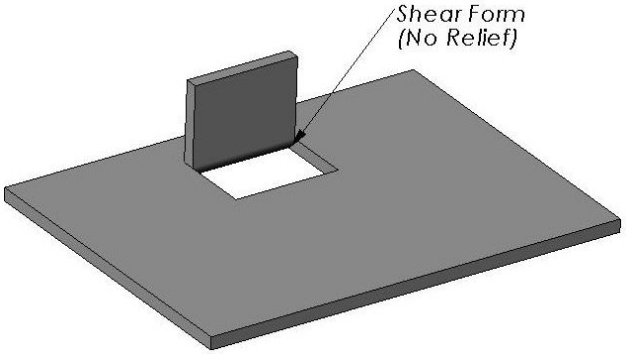
Hems – where material is folded over on itself

Shear forms

Drawn parts > ½" deep







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