Description

Image

Image caption

(1) Bending machine © Metaveld BV at Wikimedia Commons (CC BY 3.0) (2) Bystronic bending © Bystronic at Wikimedia Commons (CC BY 2.5) (3) Body cans made by deep drawing © Byrev at Pixabay [Public domain]

The process

STAMPING is a generic term for a range of sheet-forming processes involving dies and press. They include blanking, shearing, drawing, bending, forming and coining, performed singly or consecutively to form complex shapes with a uniform cross-sectional thickness. Progressive dies allow a number of operations at the same station giving high production rates. Tools are dedicated, so tooling costs are high. Stamping is limited to materials available in sheet form.

Process schematic

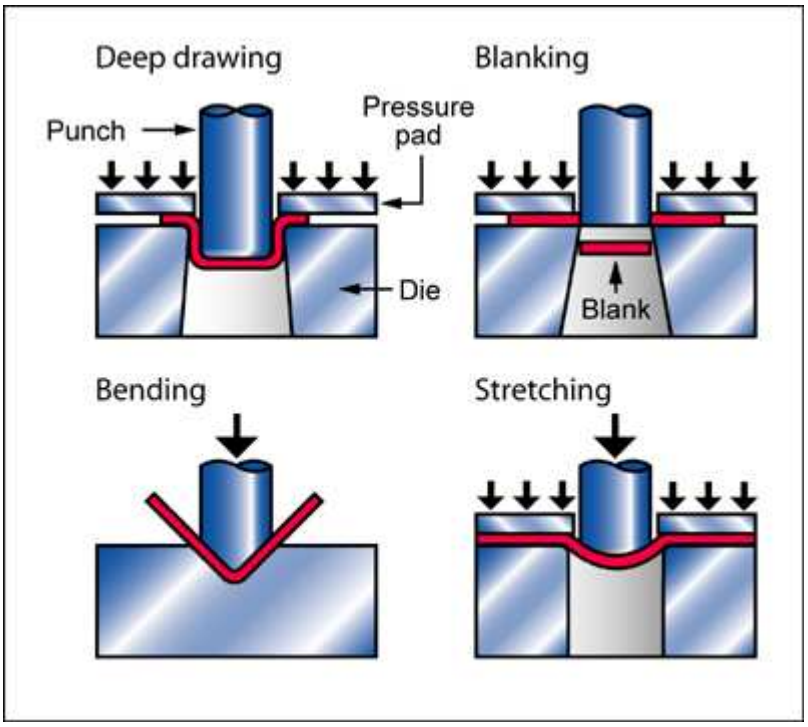


Figure caption

Sheet stamping operations.

Material compatibility

Metals - ferrous	✓
Metals - non-ferrous	✓

Shape

Flat sheet	✓
Dished sheet	✓

Economic compatibility

Relative tooling cost	medium			
Relative equipment cost	medium			
Labor intensity	low			
Economic batch size (units)	1e3	-	1e8	

Physical and quality attributes

Mass range	0.0022	-	11	lb
Range of section thickness	7.87	-	197	mil
Tolerance	3.94	-	31.5	mil
Roughness	0.0197	-	0.492	mil
Surface roughness (A=v. smooth)	A			

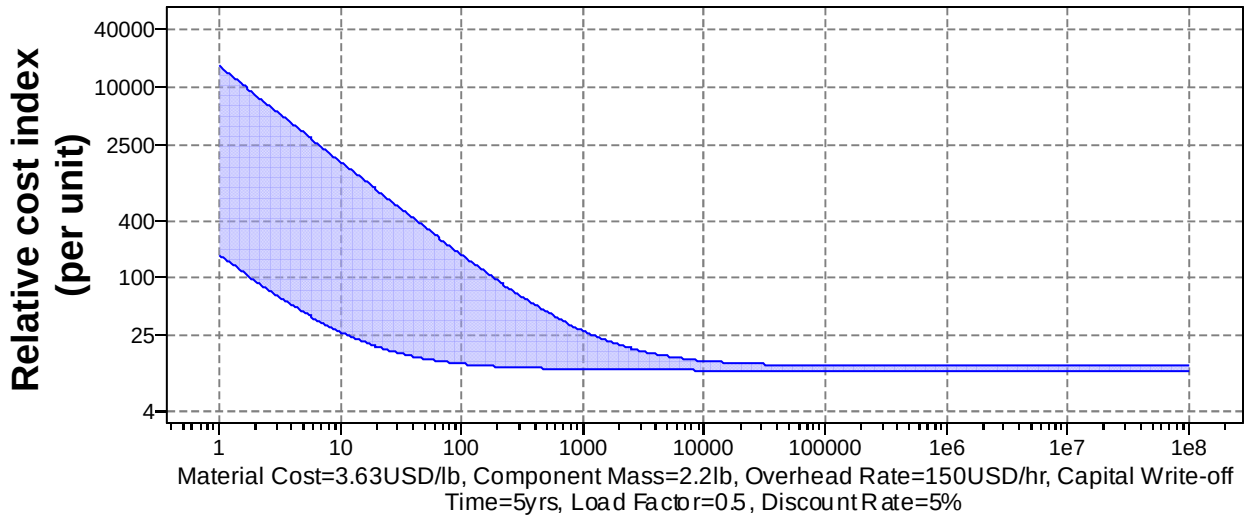
Process characteristics

Primary shaping processes	✓
Machining processes	✓
Cutting processes	✓
Discrete	✓

Cost model and defaults

Relative cost index (per unit)	11.2	-	28.4	

Parameters: Material Cost = 3.63USD/lb, Component Mass = 2.2lb, Batch Size = 1e3, Overhead Rate = 150USD/hr, Discount Rate = 5%, Capital Write-off Time = 5yrs, Load Factor = 0.5



Capital cost	8.2e3	-	8.2e4	USD
Material utilization fraction	0.7	-	0.8	
Production rate (units)	200	-	5e3	/hr
Tooling cost	164	-	1.64e4	USD
Tool life (units)	1e4	-	1e6	

Supporting information

Design guidelines

Shapes are formed from sheet stock and so have near-constant cross-sectional thickness (allowing for thinning caused by drawing operations). Intricate shapes possible using sequential drawing/bending/forming steps. Shapes with holes, tabs, recesses, cavities and raised sections are common.

Technical notes

Sheet stamping is most commonly used with metals, particularly steels. but Al, Cu, Ni, Zn, Mg and Ti alloys can all be processed. Polymeric and composite sheet can be shaped by blanking and shearing but drawing operations are less common.

Typical uses

Brackets, various mechanical parts, pans, cups, key blanks, hinges, washers, small watch parts.

The economics

Dies for forging have to be made from exceptionally hard materials and are expensive, meaning that shape rolling and closed die forging are suitable only for large batches.

The environment

The processes carry no particular environmental

Links

MaterialUniverse

Reference