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LASER CUTTING PARTS ON DEMAND

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SHEET METAL FABRICATION | THE ULTIMATE GUIDE

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Sheet metal fabrication takes thin, flat, and bendable sheets of different types of metal and cuts, bends, and assembles them into a variety of products. Before this happens, you must decide what material, process, and finishes are best suited to your end goals and needs. This guide is designed to help you make some of those key decisions.

Choosing the right sheet metal fabrication process

There are many different options when using sheet metal to fabricate a product. Some processes are better suited to different uses, schedules, and budgets. Below we outline some of the most common sheet metal fabrication processes along with their advantages and disadvantages.

	Best used for	Process Precision Level	Thickness (mm)	Custom tooling required	Minimum order quantity	Lead Time from CAD to 1st production
Laser cutting	Small to large parts with every geometry possible	+/- 0.12mm	0.5mm to 20.0mm	No	1 to 10,000 units	Less than 1 hour
CNC sheet bending	Small to large parts with straight angle geometry, multiple bend possible	+/- 0.18mm	0.5mm to 20.0mm	No	1 to 10,000 units	Less than 1 hour
CNC Punching	Small to large parts with most geometry available, good for parts with multiple holes and embossed	+/- 0.12mm	0.5mm to 4.0mm*	No unless special form required	1 to 10,000 units	Less than 1 hour
Stamping	High volume production with tight tolerances, restricted geometry	+/- 0.12mm	0.5mm to 4.0mm*	Yes from 250 USD to 100,000 USD+	10,000 units and above	25 days or more
Shearing	Thin material with simple geometry (straight lines) and low tolerances requirements	+/- 0.50mm	0.5mm to 4.0mm*	No	1 to 10,000 Units	Less than 1 hour

** Higher gage may result in deformation or reduce precision*

CO_2 or Fiber Laser Cutting

Laser cutting uses a laser to cut sheet metal into the required shape. There are two broad categories of laser cutting: fusion cutting (melts material and add high pressure gas to sheer the melted material away) and ablative laser cutting (pulsive laser removing material layer by layer).

Today's lasers are either CO2 lasers or fiber lasers. CO2 lasers use infrared light to cut materials. They cut faster and leave a smoother surface finish when cutting thicker materials. A fiber laser is a single mode beam which direct higher power density to the sheet metal. The process is faster and well suited to applications that have a very narrow weld seam.

ADVANTAGES

- Faster and more efficient than traditional cutting methods with a smooth surface finish
- Highly accurate, precise results accommodating tight tolerances
- A custom die is not required
- Each piece is individually cut so changes can be made, or errors corrected easily
- Works on a wide variety of metals and other materials
- Accommodates a variety of material thicknesses and diverse shapes
- Go-to process for several industries
- Well suited for metal annealing, etching, and engraving for serial numbers, barcodes, part marking etc

DISADVANTAGES

- Potential for structural changes to the material impacting the final product
- Not all metals can be cut by lasers (reflective material for example will require a fiber laser)
- Requires adjustment when using sheet metal with varying thicknesses
- Work hardening of the edges may require additional processing before treatments like powder coating or painting
- Other cutting methods may be better options for long production runs

CNC Sheet Bending

CNC sheet bending uses a CNC press break or CNC folder to bend metal into two or three-dimensional shapes. This process can bend large or small sheets of metal, fabricating high quality pieces quickly. CNC sheet bending is also used to adjust a finished or near-finished product. Dies are available for standard angles and operations so custom tooling may not be required.

ADVANTAGES

- Highly accurate process ideal when high precision is required
- Can produce large volumes in a short time
- Low cost for production and minimal tooling costs
- Suitable for high or low volume production
- Can create multiple, custom shapes through a series of bending processes
- Standard punches and dies available including in V and U shapes

DISADVANTAGES

- The process can cause indentations or scratches on the product
- Can be labour intensive
- Custom tooling is required for specialized bending projects
- Bends need to be in a position on the sheet metal where there is enough material to fit into the equipment without slipping
- Fractures can occur when hard metals are bent parallel to the rolling direction of the sheet metal
- Holes, slots, or other features close to the bend can become distorted

Stamping

Stamping is the process of using a mechanical or hydraulic stamping press to create an indentation in the metal to bend or shape it. It's commonly used for forming shapes, letters, or images on the sheet metal, but is also used for processes like bending, stretching, hemming, flanging, and curling for more complex projects. Stamping presses can mold metal into more complex forms – including four-sided forming. Metal coining for items like coins or small parts for electronics is also possible. Customized dies are created for individual projects.

ADVANTAGES

- Faster and cost-effective production for large volume production
- Accuracy and precision for complex shapes and producing identical pieces
- Once the die is created, can produce large volumes quickly
- Well suited for small parts requiring micro-precision
- Versatile process that can include punching, blanking, embossing, flanging, bending, or coining
- Scrap leftovers can be recycled

DISADVANTAGES

- Higher pre-production time to make a custom die
- Changes once the die is created are costly and impact the schedule
- Errors in the die result in errors with entire production
- Pieces may require additional processes including deburring, tapping, reaming, or counterboring
- Less cost effective for smaller order production
- Must use materials that are malleable enough to form without breaking

Shearing

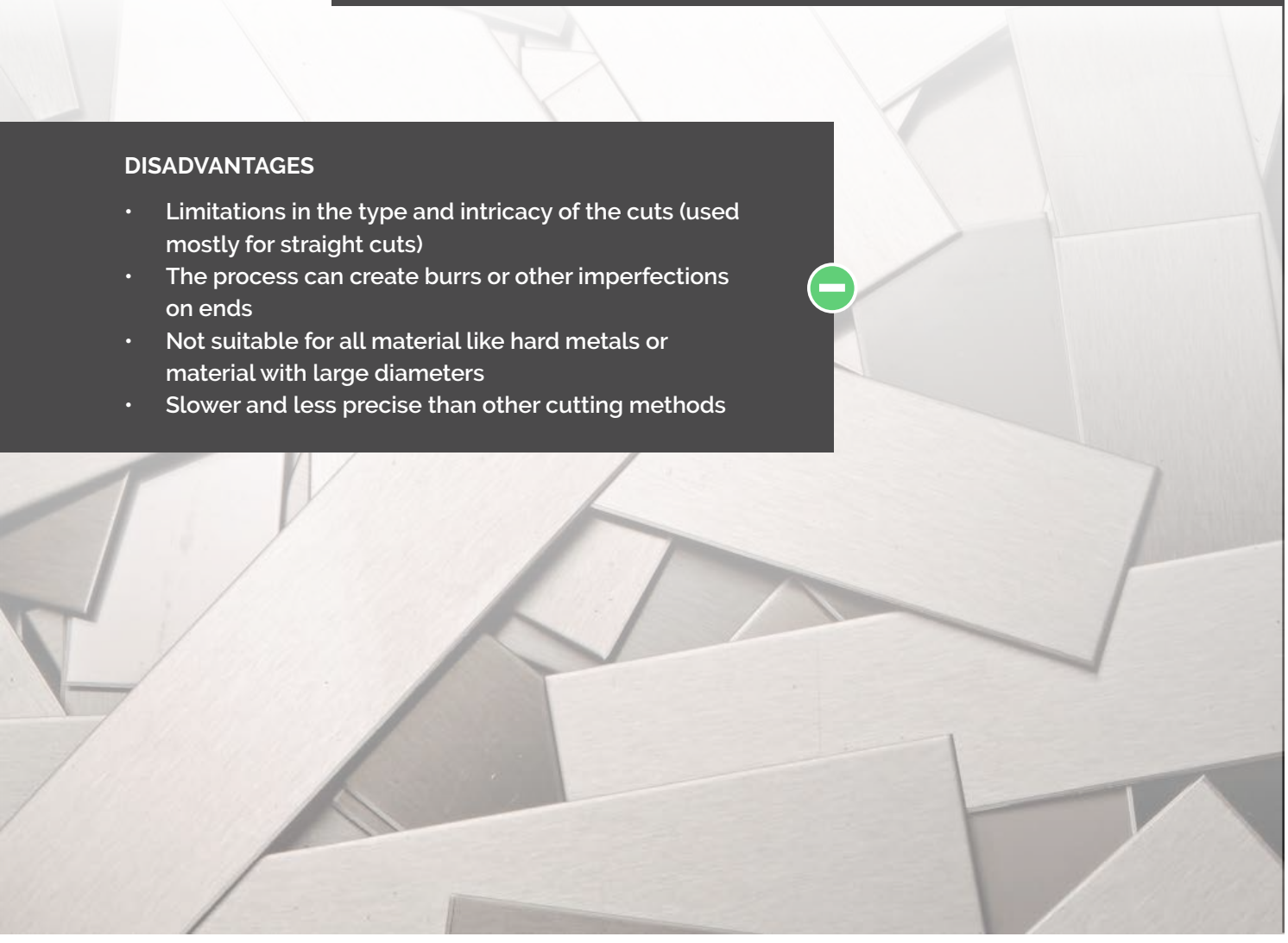
Shearing is the application of enough force to cause the sheet metal to fail and separate in the location of the desired cut. The shearing force is applied by either a punch, a die, or a blade. This process is typically used for straight line cuts but can also produce angled cuts.

ADVANTAGES

- Can produce very long, straight lines on sheet stock
- Works well with soft metals
- Cost effective for high output projects
- Good choice for cutting small lengths or different shaped material

DISADVANTAGES

- Limitations in the type and intricacy of the cuts (used mostly for straight cuts)
- The process can create burrs or other imperfections on ends
- Not suitable for all material like hard metals or material with large diameters
- Slower and less precise than other cutting methods



CNC Punching

Sheet metal is cut using a punch press to push the material into a die to create holes or cut-outs. The CNC punch machine can also be used for secondary processes like tapping, blanking, forming, extruding, and deburring.

ADVANTAGES

- Stronger cutting power than some other methods making it suitable for a wide variety of metals
- Fast and cost-effective way for punching holes, squares, slots, notching or other shapes into flat metal
- Well suited to medium to large quantities
- Good precision and uniform cuts
- Multiple standard punches available for different requirements
- Can produce intricate designs using overlapping cuts or 3D forms such as dimples or countersinks

DISADVANTAGES

- Not well suited for complex shapes
- Edges will have burs and may require secondary finishing
- Diameter of the holes generally shouldn't be smaller than the sheet metal gauge