micro waterjet®

Fluid Precision. Flawless Results.

# OVERCOMING QUALITY & PRECISION CHALLENGES IN CUTTING APPLICATIONS

A review of available cutting methods and solutions

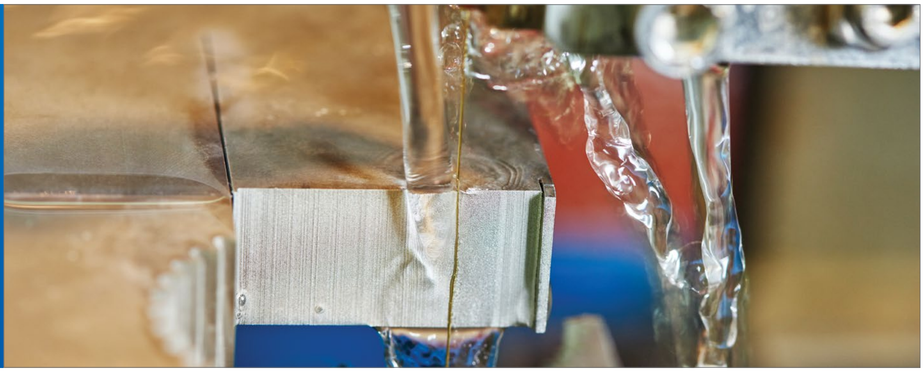
# Having Trouble Finding a Method to Manufacture Complicated Parts?

When it comes to creating new, specialized, or intricate parts and components there simply is no substitute for **precision.**

In fact, in certain industries such as aviation or aerospace, there is zero room for any acceptable error - parts either meet specifications or they are rejected. In other applications, a lack of precision can interfere with the proper function of other components, causing mechanical failures or decreased system performance.

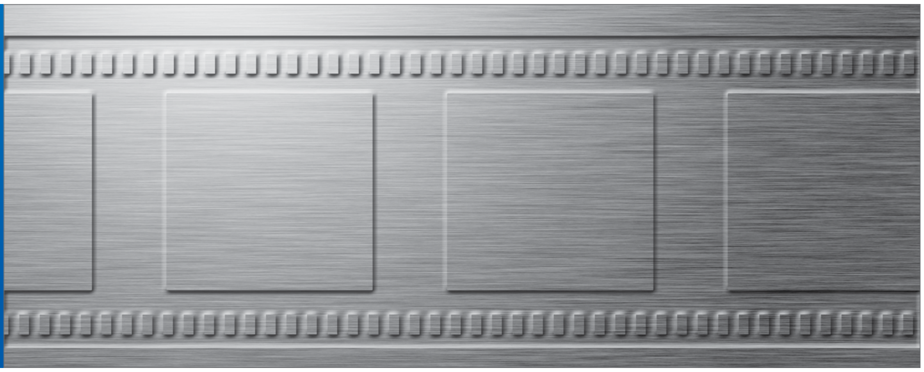
And yet, there are only a handful of established cutting methods considered appropriate enough for complex parts. **These include:**

**Wire EDM**



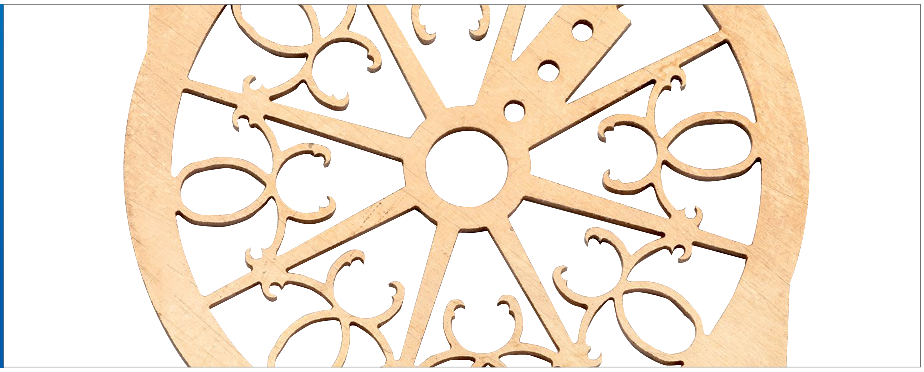
**Laser**

Chemical Etching



Conventional Abrasive Waterjet

Micro Waterjet



Each cutting method is best suited for certain materials and is dependent on the desired technical specifications.

Better understanding which cutting process best suits your project is imperative in selecting the ideal cutting solution.

# Fed up with existing suppliers not meeting your specifications?

Often, human error is the first place considered when a complicated part fails to meet manufacturing specifications. While it's true that operator error does occur, this is rarely the reason a part fails to meet specifications.

More often, it is a result of the limitations of the selected cutting method and/or the material that must be used for creation of the part. Depending on the selected method, there will be variables such as:

**Accuracy Range:** Varies based on factors including the cutting process, input specifications, material thickness and characteristics.

**Kerf Width:** The width of material that is removed by a cutting process.

**Heat Affected Zone:** With some methods, heat causes undesirable changes to the structure or temper of material.

**Finish Quality:** It is important to understand that some cutting methods, while precise, are not intended as final finish solutions. Additional post processing is necessary and this is a recognized 'next-step' when these methods are used.

# A Comparison of Cutting Methods

## Wire EDM

**Pros:** This extremely accurate process is able to offer excellent precision with no burr on the cutting edge and virtually no edge taper. This results in a superior surface finish under the right conditions. As well, Wire EDM is suitable for cutting multiple parts out of a "stack" of substrate materials, which allows for cost-effective production of large quantities.

**Cons:** Despite its advantages, common complaints regarding Wire EDM include slow cutting speed compared to other processes, heat affected zones, recast layers in material, and the possibility of thin materials welding or melting together. As well, only conductive materials are suitable for EDM, so certain materials will not be compatible. Because of set-up, small runs and prototypes can be expensive to produce.

## Laser

**Pros:** Exact beam positioning, fast cutting speeds, and a narrow kerf width have long made laser cutting an attractive option for a variety of fabrication situations. As well, because there is no actual "wear" on the cutting surface edge, the ability to deliver consistent results run after run is very desirable.

**Cons:** Lasers cut with heat - which means heat affected zones are to be expected, as are recast layers. This means a number of materials are not compatible with this cutting method. As well, lasers are calibrated for a single thickness of material making stacking not practical. As well, like all heat-producing technologies, lasers often consume high quantities of energy in comparison with other cutting methods.

## Chemical Etching

**Pros:** In applications where other cutting methods are simply not suitable, chemical etching can accommodate many different kinds of designs. Multiple features can all be created simultaneously within each piece and across production runs. Etching is also ideal for very thin, delicate, or lightweight materials that may not be able to withstand other cutting methods.

**Cons:** Because etching is somewhat organic in that it relies on a chemical reaction, straightness and consistency can be difficult to achieve and maintain across production runs. There may also be challenges resulting from accumulative tolerances or thicker materials that may need to sacrifice dimensional tolerance in order for etching to be successful.

# A Comparison of Cutting Methods (cont'd)

## Conventional Abrasive Waterjet

**Pros:** This cutting method is valued for its accuracy (generally to 0.1 mm), suitability across a wide range of materials and thicknesses (5 mm to 300mm), and lack of heat affected zones and recast layers. As such, there are few material limitations. Abrasive waterjets can also cut holes and inside details independent of the surface edge, which is not possible with some other methods.

**Cons:** The stability and speed of the waterjet often means sacrificing some accuracy as it is not the thinnest kerf width available. And, though nearly any material is suitable for traditional waterjet cutting, it is not ideal for delicate materials because it uses a coarse abrasive and a larger diameter water stream.

## Micro Waterjet

**Pros:** Designed as a more precise process from traditional waterjet technology, the Micro Waterjet is a proprietary solution that cuts a wide range of materials (including heat-sensitive and/or delicate materials) with an accuracy of +/- 0.01mm and a positioning accuracy of +/- 0.003mm. The quick cutting method produces finish-quality pieces with little to no burr and zero heat deformation. The Micro Waterjet can also be set up with a water-only configuration to eliminate abrasive challenges when cutting softer materials like rubber or silicone.

**Cons:** While stacking can be accommodated by the Micro Waterjet, some tapering or inconsistencies may occur depending on the selected substrate material. The Micro Waterjet is only suited for 2-dimensional cutting and should not be considered for 3D, tubing, round bar, or engraving applications.

# Worried about the cut quality of conventional cutting methods?

As previously mentioned, cut quality is largely a reflection of both the cutting method and the selected material.

Micro Waterjet can cut a wide-range of materials, including metals, metal alloys, plastics, rubber and exotic materials.

**A list of compatible materials with Micro Waterjet:**

### GLASS

- Bullet proof glass
- Glass (un-tempered)
- Mirror
- Stained Glass

### METALS

- Cast iron materials
- Hardened steel
- Nickel
- Noble metals: Gold, Silver, Platinum, etc.
- Steel and steel alloy
- Titanium, Tantalum, Inconel

### METAL ALLOYS

- Aluminum and aluminum alloy
- Aluminum cast materials
- Beryllium
- Brass
- Bronze
- Copper and copper alloy
- Inconel
- Molybdenum
- Nitinol

### MINERALS

- Ceramic
- Mica
- Precious stone
- Quartz
- Stone

### PLASTICS

- Acetal
- Curable plastics
- Elastomer
- Norlyl
- PEEK
- Plexiglas
- PPS
- PTFE
- Thermoplastic
- Torlon
- Ultem
- Vespel

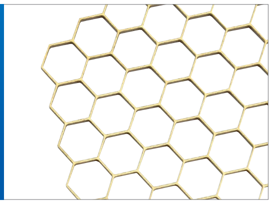
### SOFT MATERIALS

- Foam Rubber
- Leather
- Polyurethane
- Silicone
- Viton
- Wood

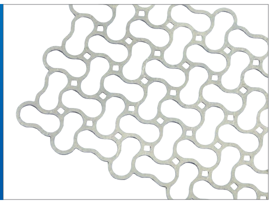
### OTHER MATERIALS

- Adhesive Materials
- Composites
- Layer materials
- Perforated sheets
- Sandwich materials
- Shim Stock
- Structured materials
- Friction Materials

Metal



Plastic



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