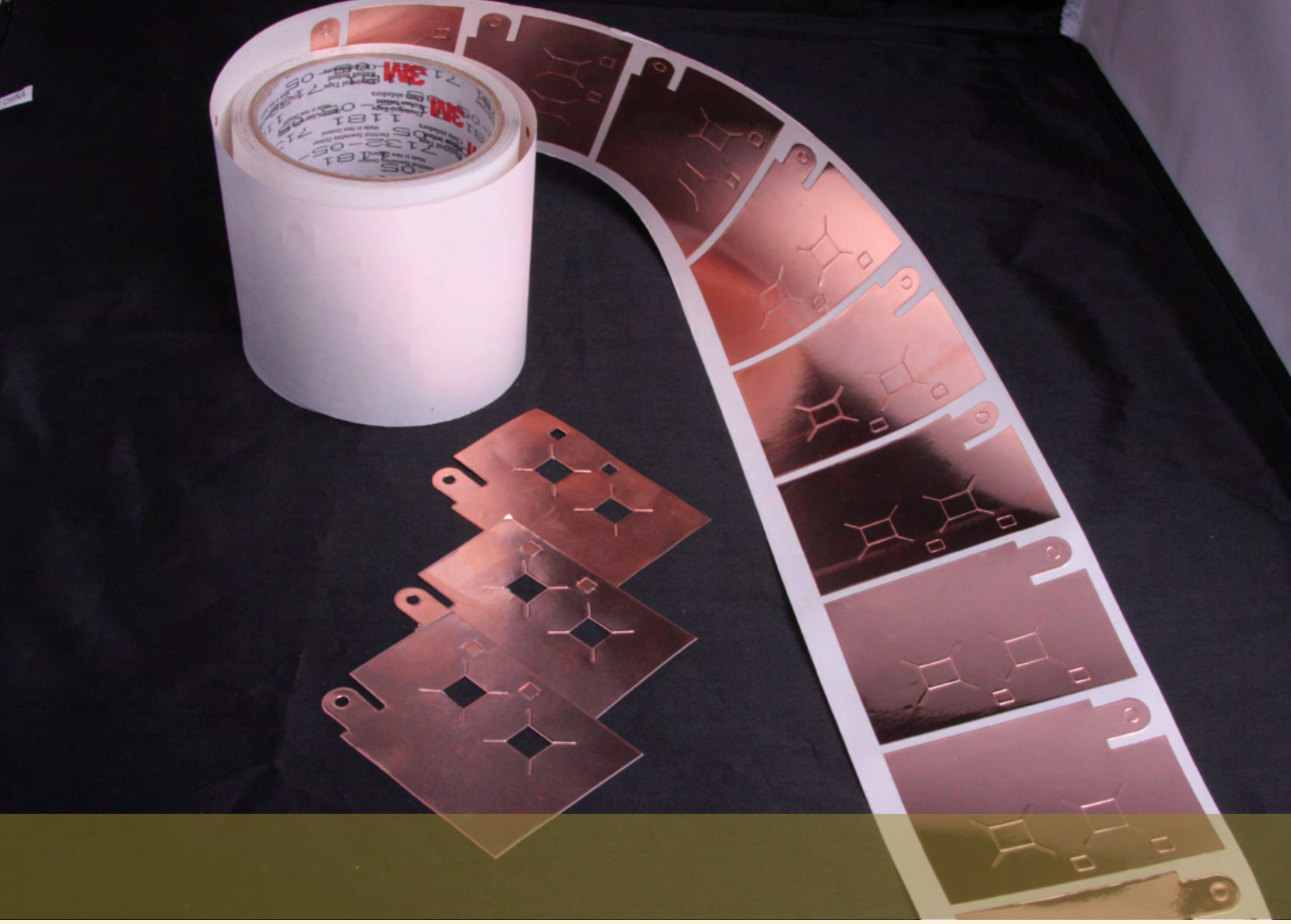


Key Considerations for Basic Die Cutting:

Tooling, Costs, Material Behaviors, and Tolerances

Die cutting is a versatile manufacturing process used to create precise shapes, designs, and patterns on flat, low-strength materials, such as fabric, film, foam, plastic, rubber, sponge, wood, and adhesives. Compared to other production methods, die cutting offers greater precision, complexity, and uniformity, all of which make it ideal for high-volume productions. Typical products range from common household goods and basic office supplies to complex industrial parts and products.

In the following eBook, we cover some of the key considerations to keep in mind when evaluating die cutting as your process of choice for part production. We do not consider processes such as rotary die cutting, laser cutting, CNC cutting or water jet cutting of parts as these may be better suited for a particular material, a desired cost, or quality requirement.

Traditional vs. High-Speed Die Cutting

At ETI, there are two main types of die cutting processes: traditional and high-speed. While both offer their own unique advantages, the right option will be based on the requirements and restrictions of the die cutting project.

Traditional die cutting operations generally have lower start-up costs and short lead times. These qualities make the process suitable for use in applications involving molded sheets and low volumes. In contrast, the high-speed die cutting process has faster cutting speeds, which can reduce production costs for high-volume runs. For this reason, many industry professionals turn to high-speed die cutting when looking to manufacture high-demand industrial parts and components, such as adhesive-backed materials, gaskets and washers, insulating foams, medical components, and packaging.

If you would like tailored recommendations for whether the traditional or high-speed die cutting process is right for your project, collaborate closely with your part fabricator to help you determine the best solution.

Types of Die Cutting Dies

Regardless of the type of process employed, basic die cutting operations rely on four key components: the raw material, the cutting machine, the operator, and the cutting tool. The latter takes the form of a die, which is available in many variations. The three most common are:

- **Steel rule dies.** While these dies are usually available at a lower cost, they offer the least accuracy. They feature three main elements—a die board, a cutting edge, and a rubber ejector. The die cutting machine punches the carefully pre-bent cutting edge into the pre-cut outline of the desired part on the die board. As it applies pressure, the edge pushes into the cutout through the raw material, producing a piece in the shape of the design.

- **Custom milled component dies.** Solid mill dies—also referred to as solid milled or custom punch dies—function similarly to steel rule dies. However, they allow for greater reliability, consistency, and repeatability when made correctly and treated properly. As the solid steel construction material has less flex and distortion, these dies can achieve parts with tolerances ranging between ±.005 to ±.010 inches per inch of dimension. Compared to steel rule dies, they also provide higher accuracy at a higher cost.

- **Matched metal dies.** Matched metal dies—also known as male/female dies—offer tighter tolerances than both steel rule and solid mill dies. As these dies consist of a machined and usually hardened top and bottom component mounted in a rigid steel die shoe, they are stable and provide excellent repeatability and achieve higher precision cuts. However, attaining these qualities typically comes at a higher production cost.

Some die cutting production operations combine different tooling types and processes for more versatility. A particular part might be molded in sheets containing multiple parts and then flash trimmed using basic die cutting. Sometimes two die cutting processes can be used to achieve a desired outcome that is more accurate or adds a valuable feature to part at a better cost.

Cost Factors for the Die Cutting Process

There are many factors that influence the cost of a die cutting operation. The three main cost factors are:

1. **Tooling.** The price of tooling depends on the type of die employed. As stated previously, matched metal dies come with a higher price tag than steel rule or milled metal dies but offer greater accuracy and precision.

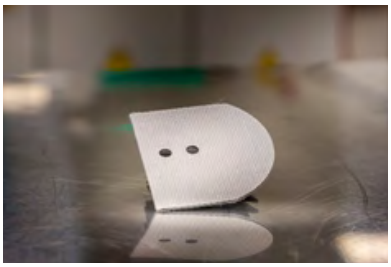
2. **Material.** The material selected can account for a large proportion of the overall production cost—especially when the material comes with a minimum purchase requirement. Partnering with a material supplier to find an alternative that meets the performance requirements at a lower price point can significantly lower expenses.

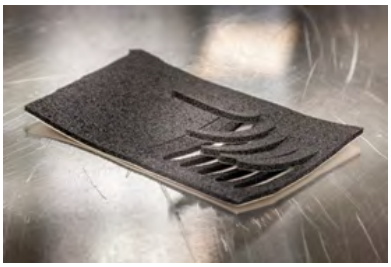
3. **Secondary and finishing requirements.** Secondary and finishing operations, such as grinding, slitting, and assembling, require additional resources that contribute to higher production costs.

Material Behaviors Influencing the Die Cutting Process

The die cutting process accommodates a wide range of materials, including:

- **Composites**
- **Adhesive**
- **Fabric**
- **Film**
- **Foam**
- **Metal**
- **Paper**
- **Plastic**
- **Rubber**
- **Wood**





The material used in a die cutting operation affects both the cost of production (as outlined above) and the parameters of the process, such as material preparation, machine choice, and tooling employed. This relationship can impose constraints on material selection. For example:

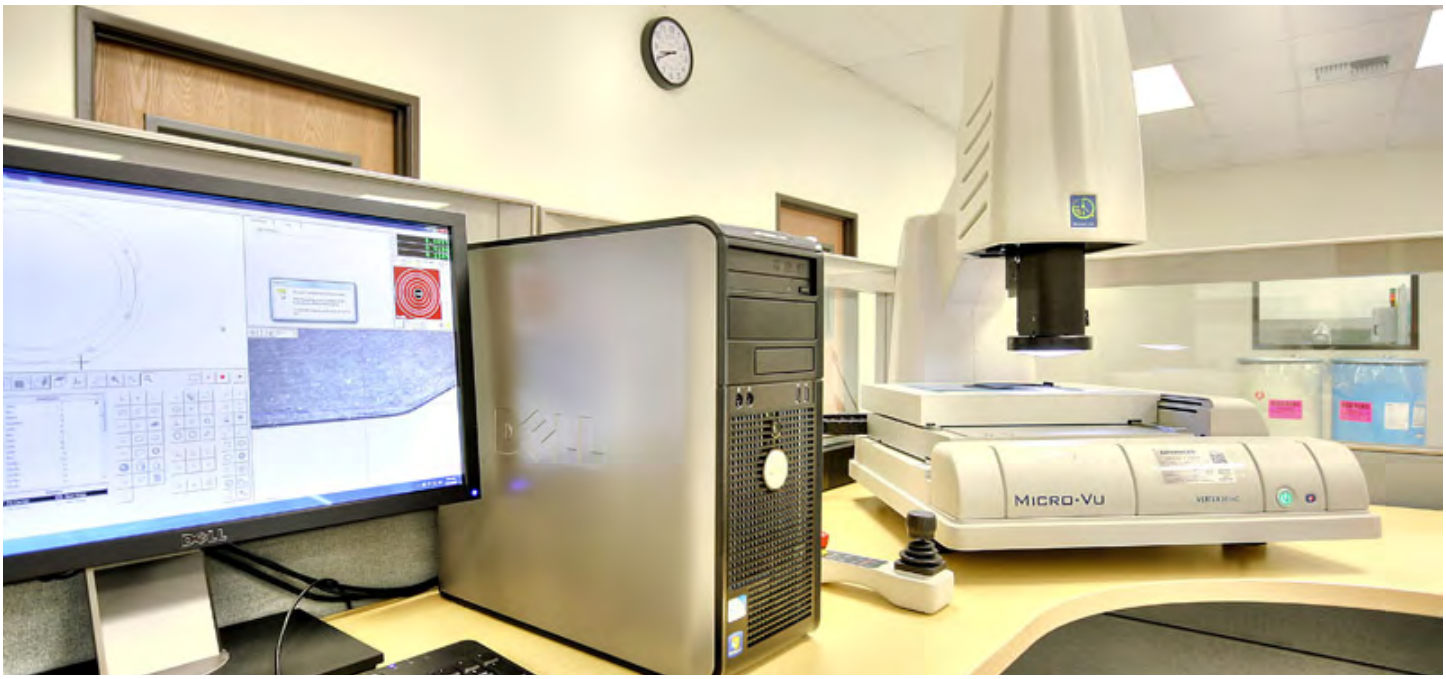
- Parts made from materials such as foam, sponge, rubber, and some thermoplastic are susceptible to distortions and defects resulting from compressive and extruding forces when cut with dies.
- Parts manufactured from various materials such as sponge and thermoplastic may be prone to shrinkage and other post-production changes when exposed to fluctuations in temperature, humidity, and other environmental factors .
- Very dense, thick, or filled materials can cause pronounced wear on dies and even break them.

Tolerance Variables for the Die Cutting Process

Several factors affect dimensional tolerances in die cutting operations, including the tooling, the material, and the parameters of the production and post-production processes. Tooling influences the possible precision and accuracy achievable, materials affect the performance of the tooling and the machine, and post-production processes may determine the final quality of the piece given the other two sets of factors.

In regard to tooling, you can expect the following ranges:

- **For steel rule dies:** Steel rule die cutting is the least accurate option. Die base tolerance, dimensional tolerance of the rule combined with operator consistency, along with the compression and extrusion of the material during die cutting will result in a final part with a tolerance between .007 inches to .010 inches per inch. The exact tolerance depends on the material processed. For instance a thick foam material would probably be given a more generous dimensional tolerance allowance due to variation inherent in cutting of this material as pressure is applied.
- **Custom milled component dies:** In most cases, solid mill dies achieve tolerances of ±.005 inches to ±.010 inches per inch. However, like with steel rule dies, the value depends on the physical properties of the material being cut.
- **For matched metal dies:** If tight tolerances are a priority, matched metal tooling is ideal for a compatible material and quantity of parts needed. These dies can achieve tolerances of ±.002 inches to ±.005 inches.



Choose ETI for Your Next Die Cutting Project

When planning for die cutting production, it is important to keep in mind the above considerations. Key die cutting factors include: the type of process, tooling type, production costs, materials, and tolerance requirements. Partnering with an experienced supplier and/or service provider can help you evaluate your choices and make decisions that suit your part and production needs.

For over 35 years, Elastomer Technologies, Inc. (ETI) has offered custom die cutting services to customers across a diverse set of industries, such as aerospace, defense, film, medical, and packaging. We employ multiple processes, including high-speed automatic work centers, to accommodate various materials, part designs, and production volumes. Additional services include molding, slitting, sewing, assembly, and packaging. From one hundred to one million piece volumes, our customers know they can rely on us to deliver their orders on time. Our typical lead times for first article delivery range between four to seven days.

For additional information about our custom die cutting capabilities, **contact us** or **submit an RFQ** today.

About Elastomer Technologies

Our company has over 30 years of experience providing industry-leading solutions from our Corona, California based facility. Offering numerous services such as liquid injection molding, rubber molding, die cutting, and transfer and compression molding, we've created parts, components, and products for businesses and individuals across the globe. No matter your project's requirements, we'll work with you to determine the best process, the most suitable material, and cost-efficiency to ensure you receive the highest-quality product that fits within your budget.

Contact Us Now

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Elastomer Technologies, Inc.
255 Glider Circle, Corona, California 92880
Phone: 951.272.5820
Email: mbarbour@etirolec.com Website: www.etirolec.com

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