Die Cutting Tolerances

Introduction

Part tolerances are allowable variations in the dimensions of manufactured components. They are expressed as plus or minus values, or as a range of measurements (typically inch-based). If a part is out of tolerance, performance can suffer. For example, if a rubber enclosure gasket is out of tolerance, the gasket may not perform as designed.

Die cutting is a manufacturing process that produces precision-cut gaskets and other components from non- metallic materials with varying degrees of precision. Tight tolerances are achievable, but product designers may need to balance die cutting tolerances with die cutting costs. It's also important to understand how die cutting tolerances are determined by multiple factors.

What Determines Die Cutting Tolerances?

Die cutting tolerances are a function of material type, part features, tool type, and production technique. Tool costs, turnaround times, and specific design and manufacturing advantages are also important to consider. The following table shows how die cutting tolerances vary.

Die Cutting Technique	**Precision Die Cutting**			**Rotary Die Cutting**	**Digital Die-Less Cutting**
Tool Type	**Steel Rule Die**	**Solid Milled Die**	**Male/Female Die**	**Rotary Die**	**Digital Knife**
Part Features					
1" to 12"	.010"	.005" to .010"	.001" to .005"	.010"	.010"
12" to 24"	.015"	N/A	N/A	.015"	.020"
Punched Holes	.010"	.005"	.001" to .005"	.005"	.010"
Hole Position	.015"	.015"	.005"	.010"	.015"
Radii .062" to .50"	.030"	.015"	.010"	.015"	.020"
Other Considerations					
Tool Cost	$	$$$	$$$$	$$$$	N/A
Turnaround Time	2 days	2 to 3 weeks	4 to 6 weeks	2 to 3 weeks	N/A
Advantage	Cost/ turnaround	Accuracy/ reliability	Accuracy/ reliability	High speed/ reliability	Cost/ turnaround

The next sections examine the role of material types, part sizes, tool types, and production techniques

Material Types

For elastomeric materials, the Rubber Manufacturers Association (RMA) publishes tolerance tables based on material type, thickness, width, length, and other variables (such as wall thickness for tubing). Different types of elastomeric materials belong to different RMA classes. For example, RMA Class ATH1 defines die cutting tolerances for open-cell sponge materials.

Designer engineers also need to consider that different types of materials have different properties, and that these properties can contribute to changes in part size. Environmental variables and the die cutting process itself can both affect the physical dimensions of die cut parts.

Environment

Changes in temperature, moisture content, or relative humidity can affect the dimensions of die cut parts. For example, parts made of closed cell sponge may shrink during storage or shipping at elevated temperatures. Die cut parts made of rigid plastics exhibit greater dimensional stability than flexible rubber and foam materials. Pressure-sensitive adhesives with carriers can add stability.

Processing

Material distortions can also occur during die cutting operations. In addition to concavities and other cut-edge irregularities, die cut materials can exhibit beveling and edge distortion. Typically, beveling occurs with soft, pliable materials that conform to applied forces. Specifically, beveling happens when a die cutting tool flexes outward from the cavity. However, with proper bevel design in the blade, there are production techniques that can control or minimize beveling.

Part Sizes

Die cutting tolerances also vary by part size. As a rule, die cutting tolerance increases as part size increases.

Part Size	Tolerance
Under 5”	± 0.005"- ± 0.010"
5” – 12”	± 0.010"
Over 12”	± 0.015"

Die cutting tolerances can also vary with part features such as punched holes, or with the position or radius of the hole. Different types of die cut parts can also have different part tolerances.

Please note that all the information provided here is for reference only, it is not to be take as a guarantee of production capabilities.