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Overview

Rapid Machining was launched in 2009 to fill an industry void and customer demand for prototype machined parts. The manufacturing facility is structured similar to an additive manufacturing facility. This approach uses 3D CAD data to streamline the quoting and manufacturing process which eliminates long que times. Currently Rapid Machining has two facilities totaling 85,000 square feet of space dedicated to prototype and low volume production quantities.

Machining is the creation of parts using a CNC milling machine or CNC lathe to remove material from stock to form a part. This guide will cover machining best practices and tips to ensure your machined part is designed for durability, manufacturability, and end-use applications.
Capabilities

Part Size:

- Vertical Milling: < 38” x 24” XY Footprint
- Lathe Parts: < 12” diameter 18” length

In-House Capabilities:

- Vertical CNC Milling
- CNC Turning (Lathe Parts)
- Assembly
- Knurling
- Drilling
- Tapping
- Threading
- Bead Blasting
- Tumbling
- Powder Coating
- Silk Screening
- Plating
- Welding

Certifications & Registrations:

- ITAR Registered
- ISO 9001:2008
- AS9100
- RoHS Compliant
Stock Materials

- Aluminum 6061
- Aluminum 7075
- Stainless Steels
- Carbon Steels
- Tool Steels
- Brass
- Copper
- ABS, PVC, Radel
- Acetel (Delrin)
- Polycarbonate
- Various other metals & plastics
Tolerances

Rapid Machining uses customers’ 3D CAD files to manufacture parts. The tolerance should be determined by the designer based on the function and form of the part. RAPID uses a standard tolerance of +/- 0.005” for metal parts and plastic parts unless otherwise specified by the customer.

NOTE: RAPID is capable of manufacturing to tighter tolerances. If this is required it may increase both lead time and cost due to potential additional steps during the manufacturing process.
Wall Thickness

The wall thickness should be greater than .060”. If walls are too thin the part can distort and warp, especially if using a plastic material.
Outside Corners

Designing parts with an outside radius can be expensive and time consuming to manufacture. Parts that require this feature use both a very precise set-up and form-relieved cutter to achieve the shape. To avoid this additional cost design parts with chamfers. A chamfer is a symmetrical sloping surface on a corner.
Hole Depth
When designing a part holes should have a depth less than 4 times the hole diameter. This will prevent endmill chatter which creates an uneven or blemished surface.
Designers and engineers creating parts for vertical or horizontal milling should consider areas where a radius will occur. When designing a part with an inside corner radius, a non-standard radius, slightly larger than a standard radius, should be used. By designing a part with a larger non-standard radius the milling tool is able to continue milling as it traces the corner.

The ability to continue milling prevents the machine from slowing down which can create chatter marks due to vibration.

NOTE: Looking to save costs? The larger the radius, the larger tool and less machine time to remove material saving both time and money.
Floor Fillets

CAD systems have a short cut for designers, and with one click of the mouse the floor radius and wall radius are the same. These parts are difficult to mill and can be expensive if multiple tools are required to remove the material. For a clean, smooth corner it is recommended to make the floor radius smaller than the corner radius.
Mating Parts

Parts being designed to fit together should have the corners of the pocket cut away with an end mill. This will allow the mating part with sharp corners to fit without alignment issues.
Undercuts result when a machine cutting tool cannot reach a designed feature and should be avoided as they add cost and possibly lead-time to the part. The reasons undercuts can be costly is the requirement of a special tool and special programming / slow cutting speeds for the feature.

Undercuts require custom tools when they are not a standard dimension. The requirement of a custom tool can both increase the cost and lead time for the part.
Threads

There are several ways to manufacture threads including cut taps, form taps and thread mills. When designing parts with threads it is recommended to use the largest thread size possible. RAPID requires a 3 thread lead minimum. There is no depth maximum, but threaded holes should only be as deep as necessary. If thread holes are deeper than standard tooling a custom tool will need to be ordered and lead time and cost will increase.
## Metal Finishes

<table>
<thead>
<tr>
<th>Finish</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Standard</td>
<td>This finish is how the part looks after it is machined. Tool marks will be visible.</td>
</tr>
<tr>
<td>Bead Blasted</td>
<td>This matte finish is created by glass beads blowing against the parts.</td>
</tr>
<tr>
<td>Anodize</td>
<td>This finish creates a corrosion and water resistant surface. RAPID offers clear, black, blue, green and red colors with or without masking. <strong>Type I, II, &amp; III</strong></td>
</tr>
<tr>
<td>Chromate</td>
<td>This finish is used on metals as a primer, corrosion inhibitor, or to retain electrical conductivity.</td>
</tr>
<tr>
<td>Etch</td>
<td>This creates a dull rough finish because the process removes a layer of the steel.</td>
</tr>
<tr>
<td>Nickel</td>
<td>This finish adds nickel lacquer to a part for either a dull or shiny finish.</td>
</tr>
<tr>
<td>Passivate</td>
<td>This finished is a light layer of protective material applied to a part to prevent corrosion.</td>
</tr>
<tr>
<td>Tin</td>
<td>This is a hard ceramic material finish that is used to improve the surface properties of a part and add a conductive finish.</td>
</tr>
<tr>
<td>Zinc</td>
<td>This protective finish is applied to parts that are susceptible to lots of wear and tear and corrosion. RAPID offers black, blue, clear, phosphate, yellow, and yellow (RoHS) for colors.</td>
</tr>
</tbody>
</table>
RAPID offers in-house powder coating and silk screening to ensure fast deliveries. RAPID facilities are ITAR registered and we powder coat or silk screen your parts in compliance with government regulations. In addition, we can order any other powder you need but it will extend lead-times. Silk screen colors can be matched to any Pantone number you provide and all inks are in stock.
Resources

myRAPID:
myRAPID is the RAPID customer portal. It allows you to quote multiple files at once (instantly quoting sheet metal parts), see past quotes, update contact and shipping information, and order multiple parts.

Visit: rapidmanufacturing.com/myrapid

RapidQuote:
Upload 3D CAD files and our team of engineers will process your request and send a quote out within 24 hours.

Visit: quote.rapidmanufacturing.com/

Powder Coat Library:
To see a list of powders we keep in stock.

Visit: rapidmanufacturing.com/powdercoat

Machined Part Design for Manufacturing – LinkedIn Group:
This group is designed for engineers who design machined parts to collaborate and discuss techniques to better design machined parts for manufacturability.

Join: https://www.linkedin.com/groups/8531417