



## **PART CNC Machining: A Customer's Guide to Precision Manufacturing**

PART CNC Machining: A Customer's Guide to Precision Manufacturing

## Chapter 1: Introduction to CNC Machining

CNC (Computer Numerical Control) machining is the process of using computer-controlled machines to manufacture parts from solid materials. Unlike manual machining, which requires a human operator to guide cutting tools, CNC machines follow programmed instructions to execute precise movements and cuts.

### Why It Matters

CNC machining allows for repeatability, high accuracy, and efficient production. Customers benefit from predictable quality, consistent part dimensions, and quick turnaround — especially for prototyping and small- to medium-volume production runs.

Example: A prototype aluminum bracket can be milled within hours and be identical to future production parts, making it ideal for product development.

## Chapter 2: Understanding the PART CNC Process

The PART process stands for:

- Precision
- Accuracy
- Repeatability
- Tolerance

These four pillars guide every job we run. The PART approach ensures that customer parts meet specifications, every time. We specialize in high-mix, low-volume production as well as high-precision one-offs.

Materials We Work With

- Aluminum (6061, 7075)
- Stainless steel (304, 316)
- Mild steel

Types of Parts

We typically machine brackets, housings, shafts, enclosures, and complex geometries used in robotics, aerospace, medical, and electronics industries.

## Chapter 3: Key CNC Capabilities

Milling: 3-axis, 4-axis, and 5-axis milling using a Haas VF2SS with a TRT160 rotary for simultaneous 5-axis operations.

Drilling & Tapping: Tapped holes and patterns, precise bore diameters.

Surface Finishing: Parts can be machined with cosmetic or functional finishes.

Tolerances: We regularly hold tolerances as tight as  $\pm 0.001$  inches (25 microns).

Example: A machined enclosure for electronics may require both a  $\pm 0.005$ " tolerance for fit and a uniform surface for anodizing — we can do both in one run.

## Chapter 4: The Design-to-Part Workflow

### 1. Submit Your Files

We accept STEP, IGES, STL, and native CAD files. Include any drawing with callouts or tolerance expectations.

### 2. Review and Quote

We review your part for manufacturability and provide a quote within 1–2 business days.

### 3. Program and Setup

Using Fusion 360 with the machining extension, we create optimized toolpaths tailored to your part geometry.

### 4. Machining and Inspection

Parts are machined and precisely located using a Renishaw probing system for both part alignment and inspection accuracy.

### 5. Delivery

We ship parts with full traceability and optional inspection reports.

**Pro Tip:** Early involvement during design ensures you avoid unnecessary machining costs.

## Chapter 5: Tooling and Machines We Use

Our equipment includes:

- Haas VF2SS with TRT160 5th Axis Rotary
- Renishaw probe system for part locating and quality verification

We use carbide and HSS tooling selected based on material and feature type. Fusion 360's machining extension allows for adaptive clearing, rest machining, and advanced surface finishing.

Example: Deep pockets in aluminum are machined with long-reach tools and multiple roughing/finishing passes to avoid deflection.

## Chapter 6: Quality Assurance

We perform inspection at every stage:

- First Article Inspection (FAI)
- In-process checks using micrometers and calipers
- Final inspection using height gauges and pin gauges
- Renishaw probing system for automated alignment and feature measurement

Customer Benefit: You get parts that are consistent, verifiable, and ready to use out of the box.

## Chapter 7: Materials and Finishes

Metals: Aluminum, stainless steel, mild steel

Finishes Available:

- Bead blasting
- Anodizing (clear, black, custom colors)
- Powder coating
- Electropolishing

Example: A customer ordering aluminum panels for aerospace may request Type II black anodizing for corrosion resistance and a professional appearance.



## Chapter 8: Ordering and Communication

We make ordering simple:

- Send your files via email or secure upload
- Receive a quote with estimated lead time
- Approve and pay to initiate the job
- Receive tracking info and updates

We communicate proactively during each step. If there's a question, change, or risk, you'll know before it impacts your deadline.

## Chapter 9: Real-World Applications

Case Study 1: Robotics startup needs custom sensor mounts. We delivered 20 precision-machined parts in 3 days to meet their demo deadline.

Case Study 2: Medical device client requires  $\pm 0.001$ " tolerances on stainless steel parts. We delivered fully inspected and certified components.

Industries Served:

- Robotics
- Aerospace
- Electronics
- Medical
- Industrial automation

## Chapter 10: FAQs and Glossary

### FAQs

- What's your typical lead time? 5–10 business days depending on complexity.
- Can you anodize or finish parts? Yes — we offer multiple finishing options.
- Do you accept rush jobs? Yes. Expedited services are available upon request.

### Glossary

- CNC – Computer Numerical Control
- DFM – Design for Manufacturability
- FAI – First Article Inspection
- Tolerance – Allowable deviation from a specified dimension

Thank You for Choosing Ellis Design and Fabrication

We hope this guide helps you better understand how PART CNC machining works — and how it benefits your projects. We look forward to working with you!

For inquiries or quotes, visit [www.edf.llc](http://www.edf.llc) or contact [dave@edf.llc](mailto:dave@edf.llc) | 734-368-2285