Common Pitfalls in Designing Machined Parts (and How to Avoid Them)

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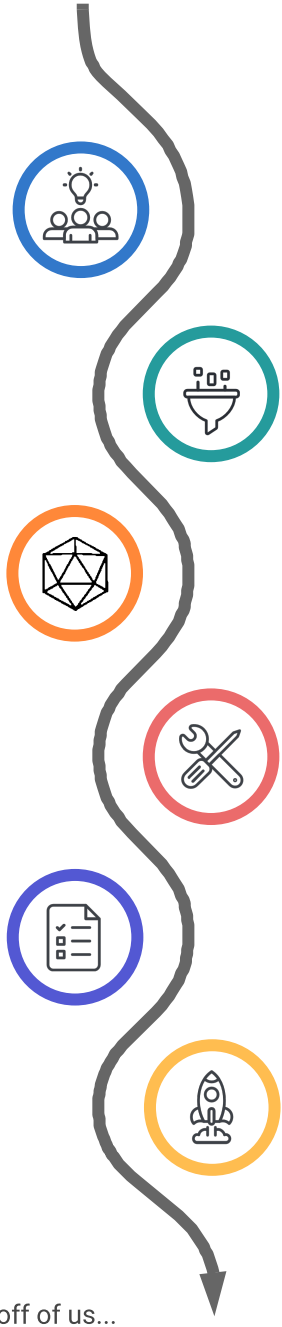
*transforming your product through **engineered manufacturing***

Considering Manufacturability Too Late
When manufacturability is addressed late in the design process, it can lead to specifying processes or features that aren't standard for most vendors.
Why it matters:
Non-standard processes often increase cost, lead time, and risk.
What helps:
Engage manufacturing input early. Even quick feedback from a vendor can steer designs toward more standard, cost-effective approaches.

Geometry That's Expensive to Machine
Some geometries are inherently more complex or costly to produce with standard machining methods.
Common examples:
- Very tight internal radii
- Threaded holes without proper tool clearance at the bottom
- Extensive use of fillets requiring specialized tooling or surfacing

Why it matters:
These features can increase machining time, require custom tools, or reduce tool life.
What helps:
Design with standard tooling in mind. Slight adjustments—like increasing radii or adding tool clearance—can significantly reduce cost and complexity.

Unnecessary Number of Tight Tolerances
It's expensive to apply tight tolerances broadly across a part.
Why it matters:
While a single tight tolerance may be manageable, multiple tight tolerances compound and can dramatically reduce overall yield.
What helps:
Apply tight tolerances only where functionally necessary. Loosening non-critical dimensions can improve manufacturability and reduce cost without impacting performance.



CAD Not Prepared for Real-World Variation
If CAD geometry isn't centered within its tolerance zone, natural process variation can push parts out of spec.
Why it matters:
This reduces yield and increases cost due to scrap or rework.
What helps:
Model features at the midpoint of their tolerance zones whenever possible. This gives the manufacturing process room to vary while still producing acceptable parts.

Unrealistic Expectations of Process Stability
Some designs don't fully account for how materials and processes behave in the real world.
Common examples:
- Warping from heat treatment exceeding specified tolerances
- Thermal expansion already exceeds tolerance given room temperature stability
- Flatness requirements tighter than necessary for thin parts that conform in assembly

Why it matters:
Ignoring these effects can lead to parts that are technically "out of spec" but functionally acceptable—or worse, parts that truly fail to meet requirements.
What helps:
Align tolerances with real process capability and functional needs. Consider how the part behaves during manufacturing and in its final application.

Misalignment Between Design, Process, and Cost Expectations
Sometimes the selected manufacturing approach or material doesn't match the functional or economic goals.
Common examples:
- A machined design where forming, bending, or welding would be more efficient
- Material choices that meet one requirement (e.g., corrosion resistance) but introduce others (e.g., galling or low strength)
- Designs intended for low-volume production competing in cost-sensitive markets

Why it matters:
These mismatches can significantly impact cost, performance, and business viability.
What helps:
Evaluate multiple manufacturing approaches early. Balance material properties, production volume, and cost targets to find the best overall solution.

Ready to ramp up production?

Feel free to bounce some ideas off of us...

720-261-7208
sales@eccentroid.com