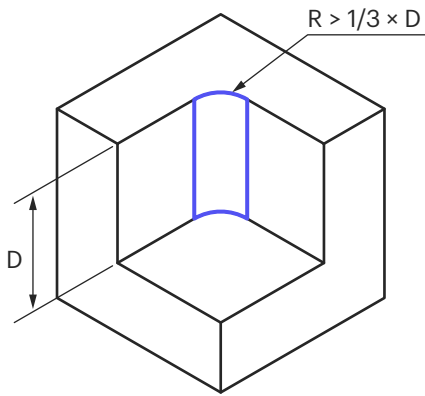# The Essential CNC Cost Reduction Checklist

15 practical design tips to minimize the cost of your CNC machined parts

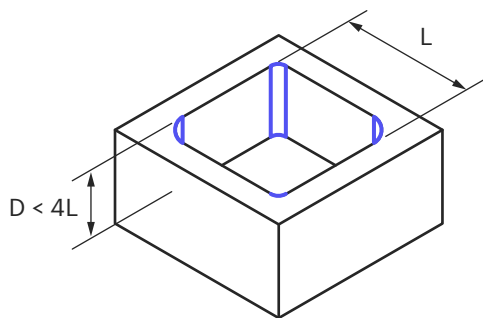R > 1/3 × D

D

1. ADD LARGE FILLETS TO ALL INTERNAL VERTICAL EDGES

Add a radius > 1/3 × the depth of the cavity - the larger the better
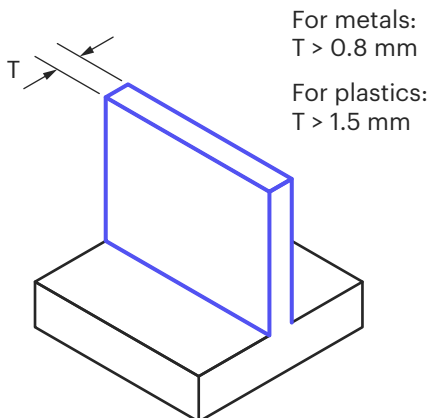
Use the same radius in all internal vertical edges

On cavity floors, add a small fillet (0.5 or 1 mm radius) or leave it sharp

L

D < 4L

2. LIMIT THE DEPTH OF ALL CAVITIES

Recommended max. cavity depth: 4 × their width

For deeper cavities, use a stair-step design:

For metals:
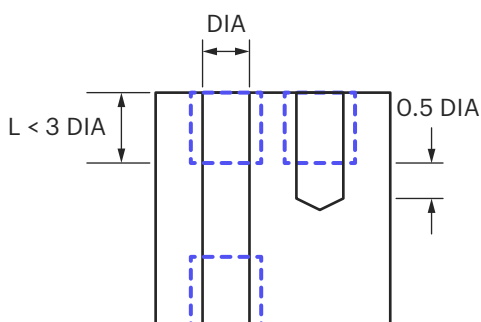T > 0.8 mm

For plastics:
T > 1.5 mm

T

3. INCREASE THE THICKNESS OF THIN WALLS

For metal parts: minimum wall thickness > 0.8 mm
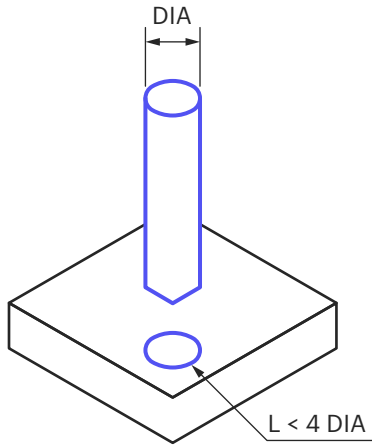
For plastic parts: minimum wall thickness > 1.5 mm

The thicker a section the better the achievable accuracy

DIA

L < 3 DIA

0.5 DIA

4. LIMIT THE LENGTH OF THREADS

Recommended max. thread length: 3 × the nominal diameter

For threads in blind holes: add a min. unthreaded length of 1.5 × the nominal diameter at the bottom

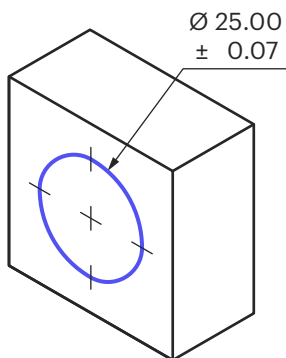## 5. DESIGN HOLES WITH STANDARD SIZE AND LIMIT THEIR LENGTH

For metric, specify a diameter in increments of:
- 0.1 mm up to ø10 mm
- 0.5 mm above ø10 mm

For inches, use conventional fractions of an inch or refer to a fractional-inch drill bit sizes table

Recommended max. hole depth: 4 × their diameter

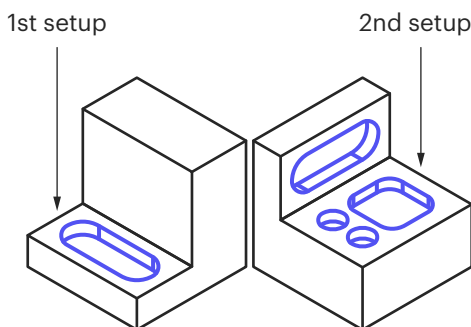Recommended min. hole diameter: 1 mm (3/64")

6. SPECIFY TOLERANCES ONLY WHERE NECESSARY

DO NOT OVER-TOLERANCE

Use a single datum as a reference for all dimensions (for example, the cross section of two edges)

If not defined, the standard tolerance is ± 0.125 mm

7. MINIMIZE THE NUMBER OF MACHINE SETUPS

Design parts that can be machined in only one setup on a 3-axis CNC milling machine or a CNC lathe
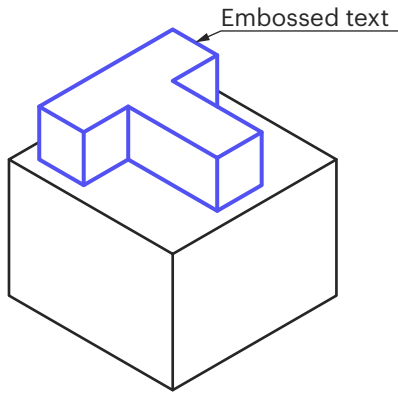
For complex parts, consider separating the geometry into multiple components that can be assembled later
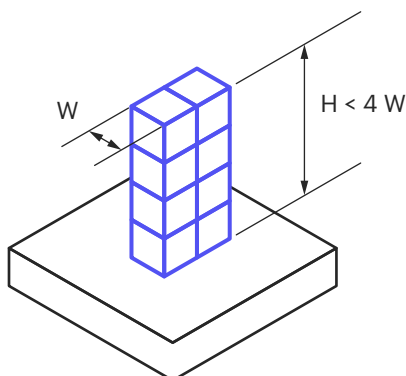
8. AVOID SMALL FEATURES WITH HIGH ASPECT RATIO

Recommended max. aspect ratio: 4 × width-to-height

To improve stiffness of small features, add bracing support or connect them to a thicker section
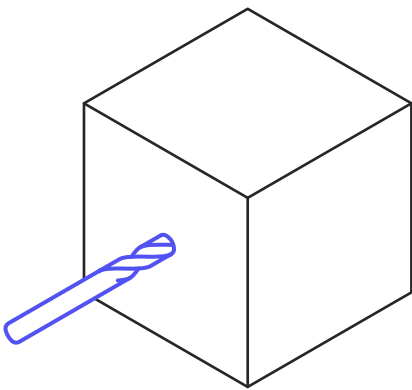
Embossed text

9. REMOVE ALL TEXT & LETTERING

Remove all text and lettering from your CNC machined parts

If text is needed, prefer engraved over embossed letters and use a font size of at least 20-points

Consider secondary operations instead for adding text, like silk screening

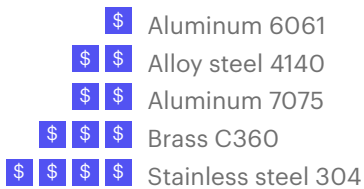## 10. CONSIDER THE MACHINABILITY OF THE MATERIAL

For 100+ parts, select an easy-to-machine material

The easiest to machine metals: Brass, Aluminum alloys

The easiest to machine plastics: POM (Delrin), ABS
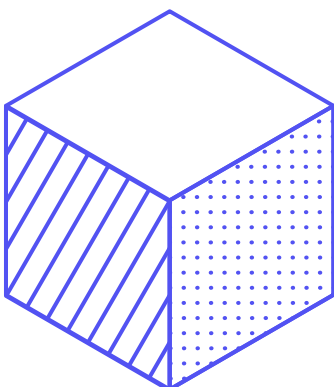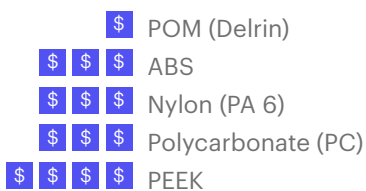
Metals

			$	Aluminum 6061
		$	$	Alloy steel 4140
		$	$	Aluminum 7075
	$	$	$	Brass C360
$	$	$	$	Stainless steel 304

Plastics

		$	POM (Delrin)
$	$	$	ABS
$	$	$	Nylon (PA 6)
$	$	$	Polycarbonate (PC)
$	$	$	$ PEEK

11. CONSIDER THE COST OF THE BULK MATERIAL

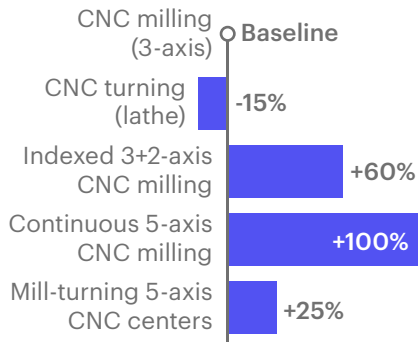Each $ in the reference table (left) represents roughly a 25% price increase in material cost

12. AVOID (MULTIPLE) SURFACE FINISHES

For the lowest cost possible, select the "as-machined" surface finish

Only request multiple surface finishes on the same part when absolutely necessary

Machining cost comparison

|	
CNC milling (3-axis)	Baseline
CNC turning (lathe)	-15%
Indexed 3+2-axis CNC milling	+60%
Continuous 5-axis CNC milling	+100%
Mill-turning 5-axis CNC centers	+25%

13. DESIGN PARTS WITH AXIAL SYMMETRY

Parts machined on a lathe or a mill-turning center are more economical than parts machined on a 3-axis or 5-axis CNC milling machine

Part size < Blank size - 3mm
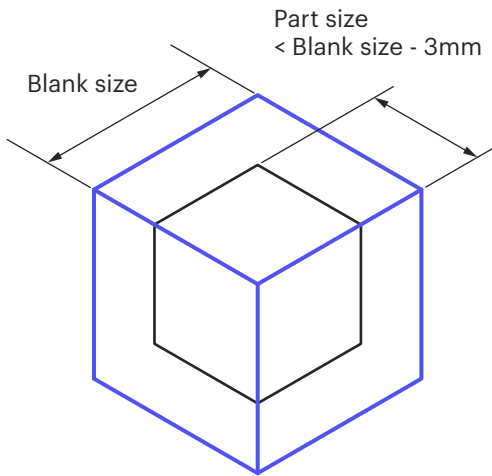
Blank size

14. THINK BLANK SIZE

Design parts with bounding dimensions 3 mm smaller than a standard blank size
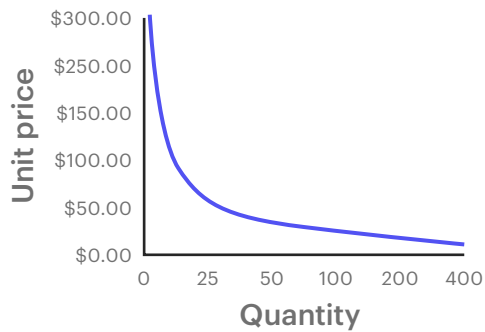
15. TAKE ADVANTAGE OF ECONOMIES OF SCALE

Larger volumes almost completely eliminate the effect of startup costs on the unit price

Increasing the quantity from 1 to 5 can decrease the unit price by more than 50%