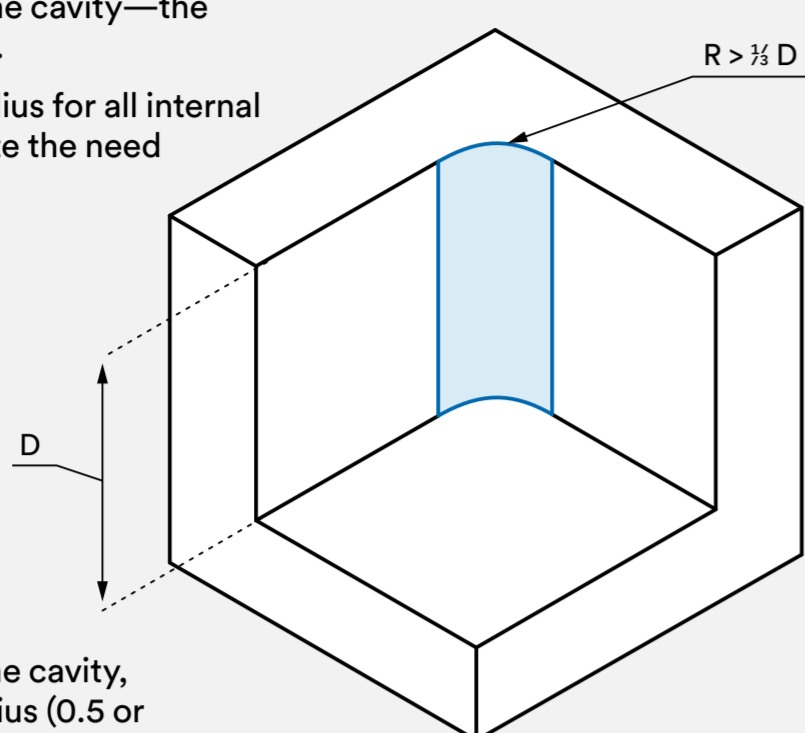


# 15 Design Tips to Reduce the Cost of CNC Machining

## Tip 1 Add a radius in internal vertical edges

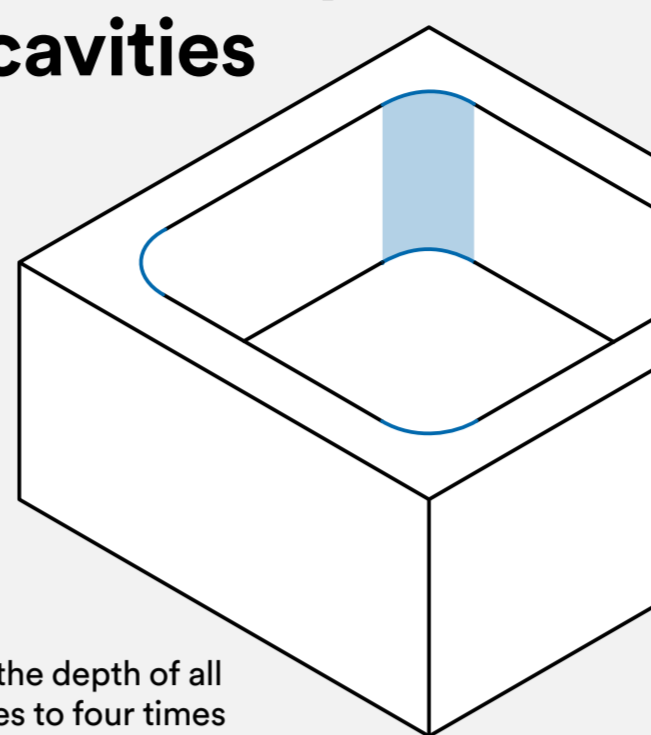
- Add a radius of at least one third of the depth of the cavity—the larger, the better.
- Use the same radius for all internal edges to eliminate the need for tool changes.



- On the floor of the cavity, use a smaller radius (0.5 or 1mm) or no radius at all.

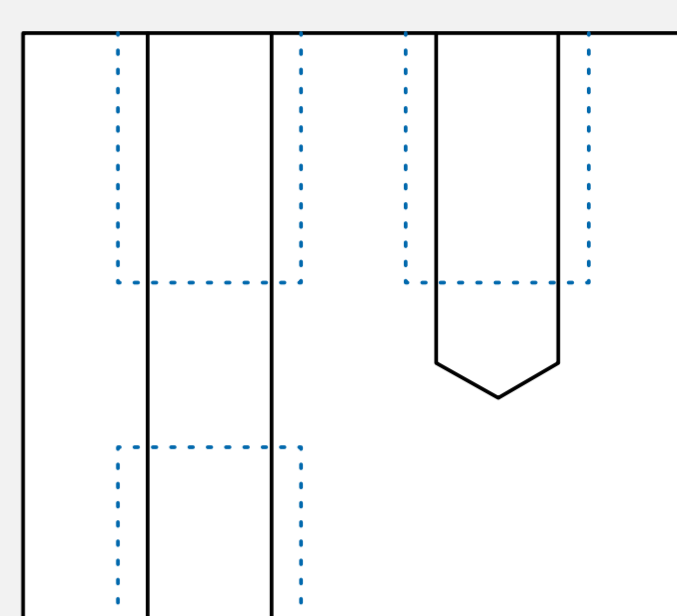
## Tip 2 Limit the depth of cavities

- Limit the depth of all cavities to four times their length—that is, the largest dimension on the XY plane.
- Adjust the internal corner radii accordingly. Use the advice in tip number 1 if needed.



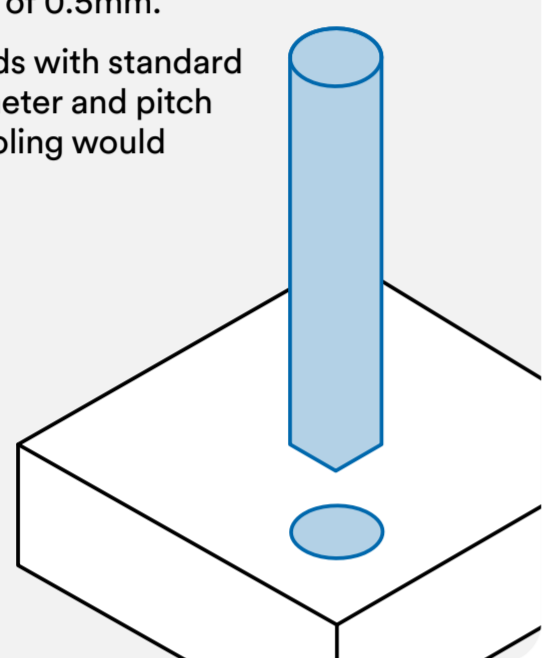
## Tip 3 Limit the length of threads

- For threads in blind holes, add at least half of the diameter of the unthreaded length at the bottom of the hole.
- Design threads with a maximum length of up to three times the hole diameter.



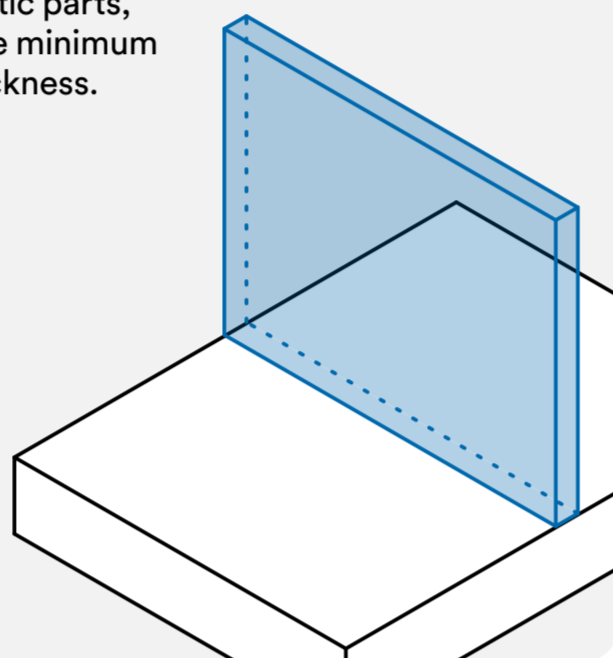
## Tip 4 Use standard drill and tap sizes for holes and threads

- Design holes with a diameter that is an increment of 0.1mm for diameters up to 10mm. For those above 10mm, use an increment of 0.5mm.
- Design threads with standard nominal diameter and pitch or custom tooling would be needed.



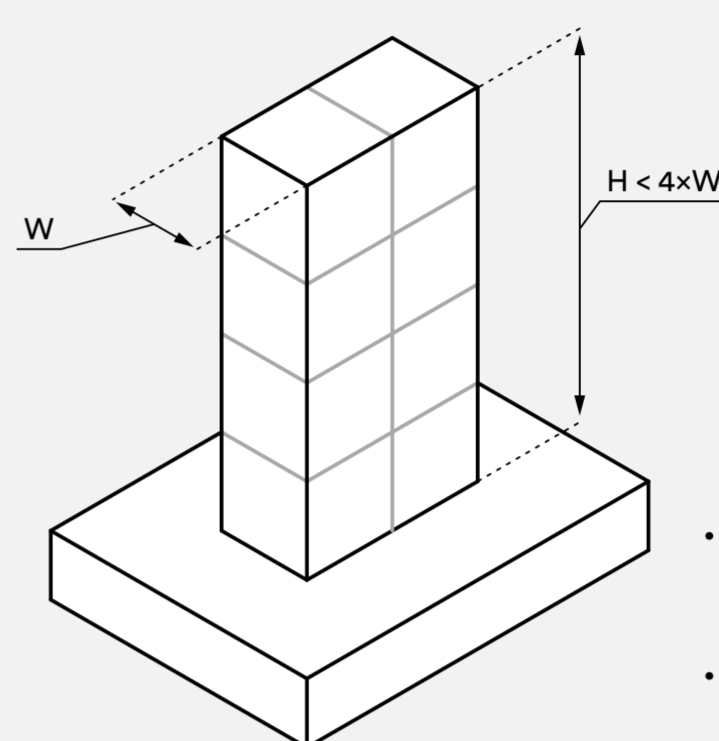
## Tip 5 Increase the thickness of thin walls

- For metal parts, design walls thicker than 0.8mm—the thicker, the better.
- For plastic parts, keep the minimum wall thickness.

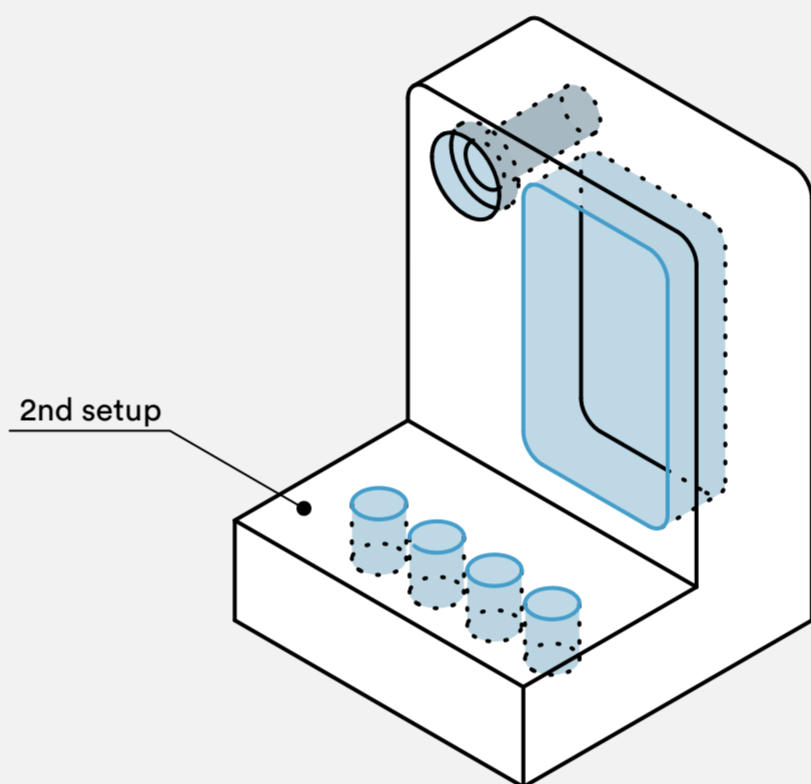
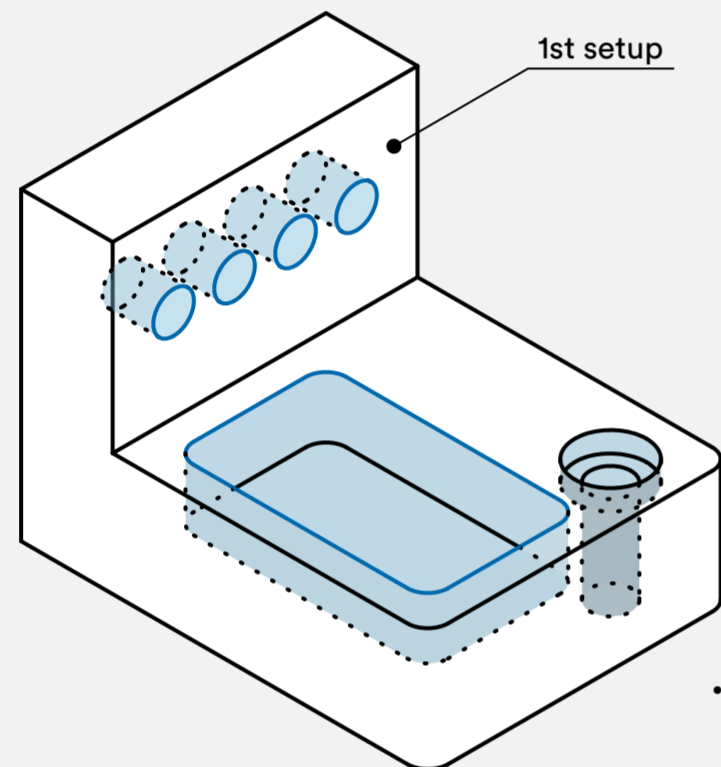


## Tip 6 Avoid small features with high aspect ratio

- Design features with a width-to-height aspect ratio of less than four.
- Add bracing support around small features or connect them to a wall to improve their stiffness.



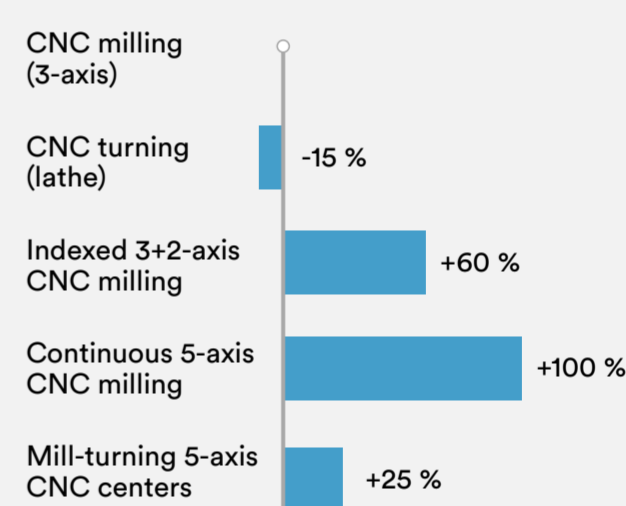
## Tip 7 Minimize the number of machine setups



- Design parts with a simple 2.5D geometry that can be manufactured in a single CNC machine setup.
- If this is not possible, separate the part into multiple geometries that can be assembled later.

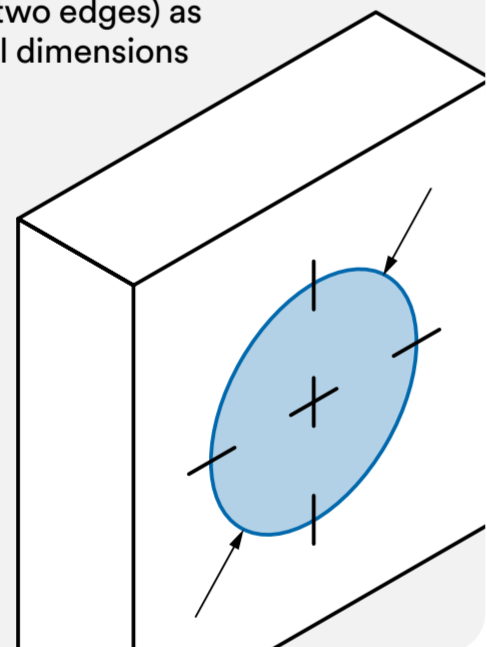
## Tip 8 Design parts with axial symmetry

- 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.



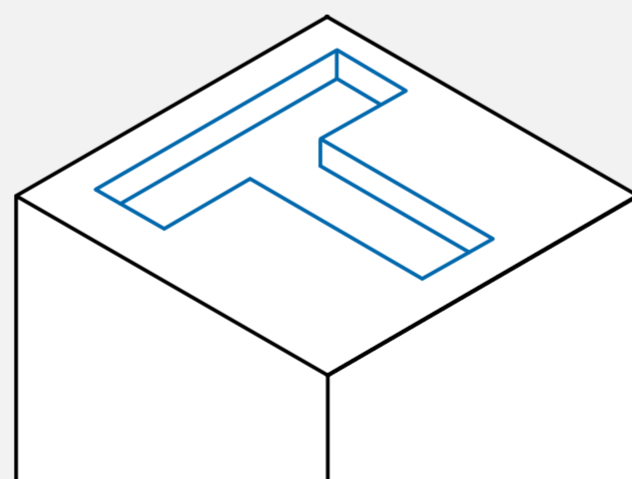
## Tip 9 Only specify tolerances when necessary

- Only define tighter tolerances when it is absolutely necessary.
- Define a single datum (e.g. the cross-section of two edges) as a reference for all dimensions with tolerances.



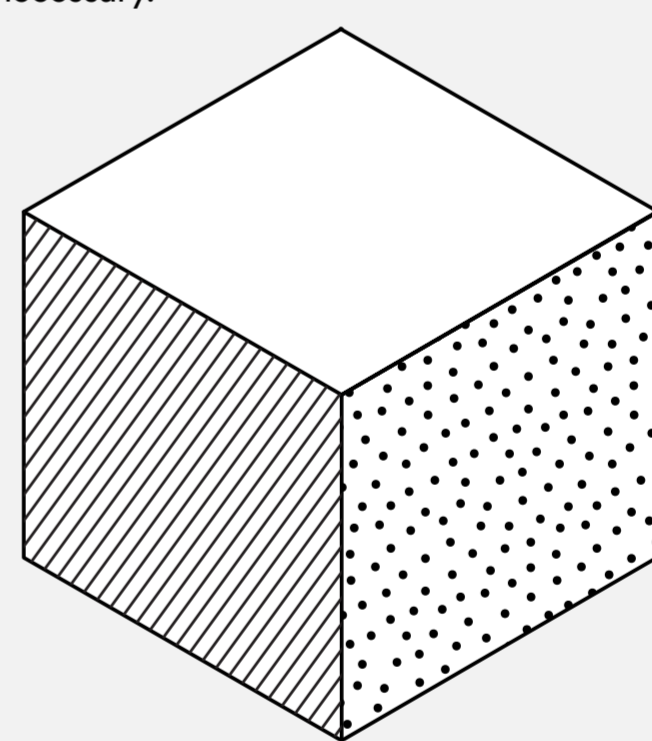
## Tip 10 Choose laser engraving instead of CNC engraving

- If text is necessary, choose engraved over embossed lettering.
- Use a minimum of size-20 sans serif font (e.g. Arial or Verdana).
- Include a vector (.ai) file to improve the accuracy of engraving.



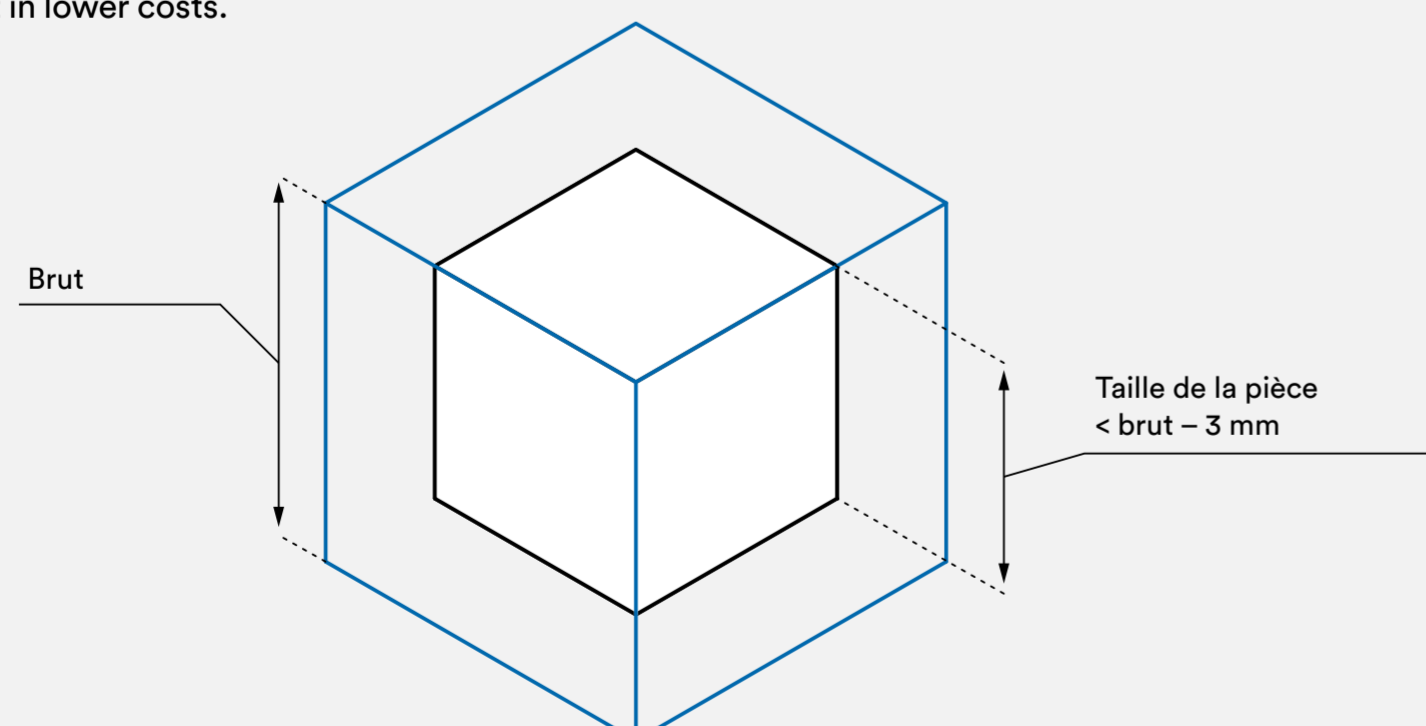
## Tip 11 Avoid multiple surface finishes

- Mixing surface finishes on a part adds additional processing steps, which adds costs.
- Only request multiple surface finishes when absolutely necessary.



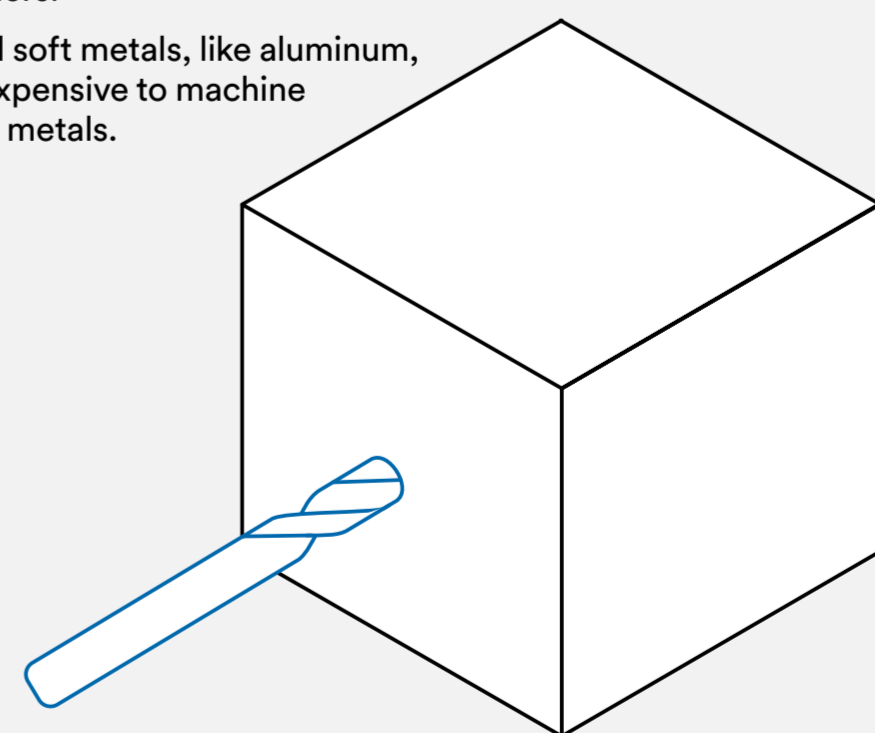
## Tip 12 Account for blank size

- Try to minimize material removal. The closer the geometry is to its bounding box, the less material will have to be removed, which may result in lower costs.



## Tip 13 Consider the machinability of the material

- If you have options, choose the material with better machinability, especially for larger orders.
- In general soft metals, like aluminum, are less expensive to machine than hard metals.



## Tip 14 Consider the price of the bulk material

- Even though metals that offer greater machinability, such as stainless steel 303 and C360 brass, cost more, they are better suited for larger volume production because the higher material cost is offset by the much shorter machining times.
- Economies of scale come into play because the higher material cost is outweighed by the much shorter machining times.

Metals	Price	Plastics	Price
Aluminum 6061	\$25	ABS	\$17
Aluminum 7075	\$80	Nylon 6	\$30
Stainless steel 304	\$90	POM (Delrin)	\$27
Stainless steel 303	\$150	PEEK	\$300
C360 brass	\$148		

## Tip 15 Take advantage of economies of scale

- Take advantage of economies of scale by ordering higher quantities.
- Unit price per part will drop over a certain threshold depending on the quantity requested.

