COMPLETE TECHNICAL GUIDE / ENGLISH

Mechanical machining

Turning, milling, drilling and threads to drawing



Illustrative process image.

Information for design and quotation
Technical explanations, tables, diagrams and practical examples. Preliminary recommendations are checked for the project material, tooling and geometry. Tolerances and the final manufacturing route are confirmed in the quote.

lasermet.ro/en/guides
info@lasermet.ro · +40 723 644 039
Workshop: Bd. Dimitrie Pompeiu 10, Bucharest 020337, Romania

Contents

Files and requirements 3
Milling and pockets 4
Turning, holes and threads 5
Selecting stock and the manufacturing route 6
Pockets: tool radius and depth 7
Holes: drilling, boring and counterbores 8
Internal and external threads 9
Thin walls, long parts and workholding 10
Tolerances, datums and roughness 11
3D design and prototyping 12
Cost estimation and a complete request 13
Inspection and cost reduction 14

How to use this guide
Consult the geometry chapters before finalising the drawing. Check tables and examples, then use the quotation checklist. Example numbers illustrate calculations; they do not implicitly represent guaranteed capacities or tolerances.

Files and requirements

STEP plus PDF

For 3D design and prototyping, also send the sketch, part function and mounting interfaces. The model describes shape; the drawing specifies tolerances, roughness, threads and measurement datums. Include material grade and condition, quantity and revision.

Functional dimensions

Identify fits and contact surfaces. Very tight tolerances on every dimension may require unnecessary machining and inspection. Establish requirements according to each surface’s role.

Confirmed capacity

Maximum dimensions, materials, precision and required axis count are checked for the part. Do not assume every uploaded geometry can be manufactured by the same route.

Milling and pockets

Internal corners

A cylindrical cutter leaves a radius in internal corners. Avoid perfectly sharp pocket corners; reliefs can accommodate a rectangular component where function permits.

Depth and access

Deep, narrow pockets need long, less rigid tools. Increase radius and opening where possible. Hidden cavities and undercuts require access checks.

Thin walls

Thin walls can distort during clamping and machining. Permissible thickness depends on material, height and geometry; discuss workholding strategy and operation sequence.

Turning, holes and threads

Rotational parts

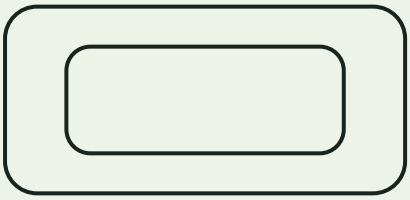
Use coaxial geometry where function permits and specify relationships between diameters. Side holes and non-circular features may require additional operations and setups.

Blind holes

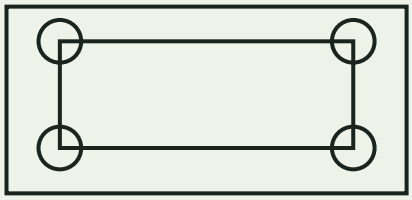
Specify usable cylindrical depth separately from the drill point. Do not implicitly require a flat bottom unless necessary. Long, small holes require chip-evacuation checks.

Threads

State type, diameter, pitch, class and usable length. For example: M6 × 1, usable thread 10 mm; drilling depth is established separately. Specify clearances for the screw and its head.



Internal radius



Corner relief: schematic example

Illustrative diagram; not to scale. This is not a manufacturing drawing.

Selecting stock and the manufacturing route

Turning or milling

Turning suits many rotational shapes; milling creates faces, pockets, profiles and other geometry. A part may need both, plus drilling or threading. Do not assume an entire part is produced in one setup because the model is a single solid.

Stock

Select bar, plate, section or cut blank according to dimensions, material and operations. Let the workshop establish process allowances compatible with the final drawing. Undersized stock may prevent workholding; excessively large stock increases consumption and time.

Material and condition

Grade, treatment and delivery condition affect machinability and stability. State whether requirements apply before or after treatment. Do not replace an alloy based solely on appearance; substitutions require explicit acceptance.

Shape	Route to assess
Shaft / bushing	Turning + additional operations
Plate with pockets	Milling, drilling and inspection
Sheet-metal part	Cutting + local machining
Welded assembly	Welding + final machined surfaces

Pockets: tool radius and depth

Internal radius

A cylindrical cutter cannot produce a perfectly sharp internal corner. Corner radius must allow access for a sufficiently rigid tool. Where function permits, a larger radius may reduce passes with small tools. Dimension corner reliefs and check against the component entering the pocket.

Depth and narrowness

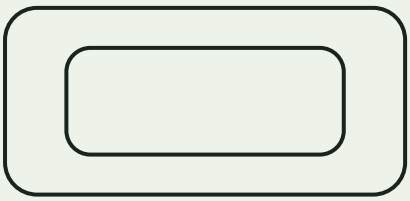
Depth-to-opening ratio indicates access difficulty but does not by itself establish a universal limit. Long tools may deflect or vibrate, and chip evacuation becomes harder. State whether pocket shape can change without changing function.

Bottom and surfaces

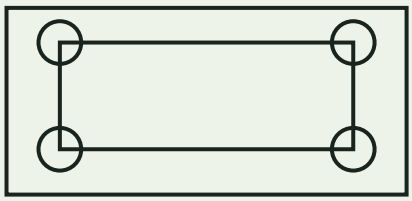
State whether the bottom must be flat, whether a radius is permitted and where roughness is specified. A sealing surface has different requirements from a weight-reduction recess. Do not impose the same roughness on every surface unless needed.

EXAMPLE / APPLICATION

A pocket for a square component can use corner radii or reliefs. If no relief is permitted and the corner must be sharp, assess an additional process rather than assuming conventional milling.



Internal radius



Corner relief: schematic example

Illustrative diagram; not to scale. This is not a manufacturing drawing.

Holes: drilling, boring and counterbores

Simple hole and precision bore

A bolt clearance hole and a centring bore have different requirements. For centring, dimension the fit, position and datums. Manufacturing may involve drilling followed by boring, reaming or another operation, according to geometry and tolerance.

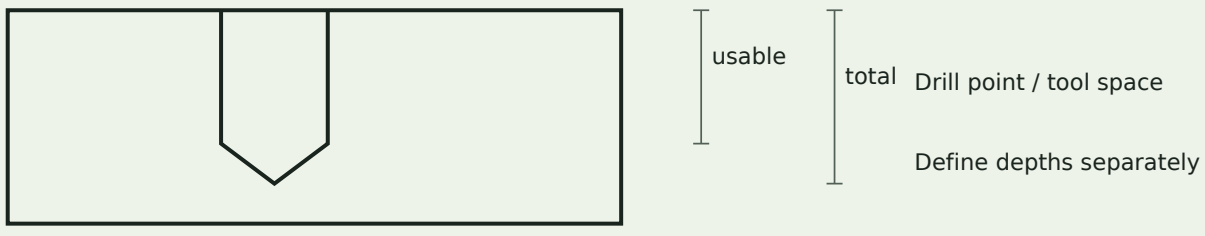
Counterbores and countersinks

A cylindrical counterbore defines a head recess or bearing surface. A conical countersink has diameter/depth and angle. Do not confuse a screw-head countersink with a small deburring chamfer. Explicitly dimension functional geometry.

Blind and through holes

State usable depth and whether a conical drill point is allowed. Check remaining thickness to the opposite face or a pocket. Discuss long holes with the workshop; diameter alone does not describe deviation and chip-evacuation risk.

Operation	Drawing requirement
Drilling	Diameter, position, through / blind
Boring / reaming	Fit and inspection datums
Cylindrical counterbore	Diameter, depth, face
Countersink	Angle, diameter / depth



Illustrative diagram; not to scale. This is not a manufacturing drawing.

Internal and external threads

Complete specification

For metric threads, state M, diameter, pitch, class and usable length; for other families identify the standard and required form. A thread drawn in a model can be interpreted differently unless defined in the PDF. Explicitly state left-hand threads.

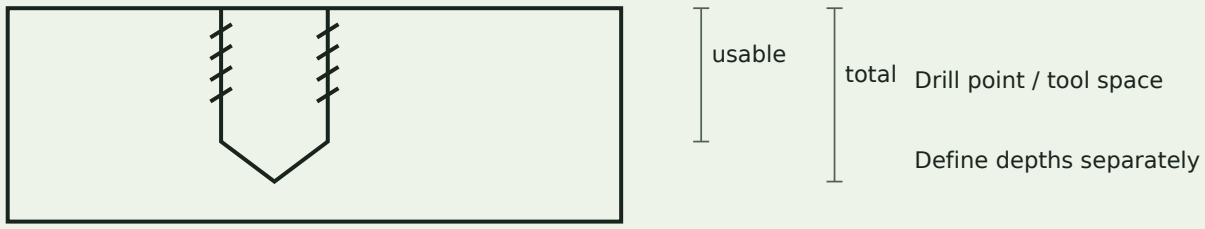
Usable depth and drilling

In a blind hole, full thread does not automatically extend to drilling depth. Space is needed for tool entry, thread runout and any drill point. Specify the required usable length; the workshop checks depth and remaining material.

Reliefs and assembly

External threads near a shoulder may require relief for the tool and mating-part seating. Check wrench access, screw head and wall thickness. Thread length is sized for material and load; a generic multiplier does not replace calculation.

EXAMPLE / APPLICATION
Example requirement: M6 × 1 - 6H, usable thread 10 mm, blind hole. This does not mean total hole depth is 10 mm; drilling depth and remaining thickness must be checked separately.



Illustrative diagram; not to scale. This is not a manufacturing drawing.

Thin walls, long parts and workholding

Rigidity

A tall, thin wall may distort under cutting forces or clamping. Minimum manufacturable thickness depends on material, height, shape and access. Sometimes operation sequence changes or supports are used; other cases require geometry revision.

Shafts and bushings

A long, thin shaft may require support, while a thin-walled bushing may distort in a chuck. Specify functional diameters and required concentricity relative to datums. Do not treat clamped dimensions as equivalent to dimensions after release.

Workholding areas

The workshop must hold the part safely and reach its surfaces. Geometry without useful clamping areas may need a fixture or sacrificial allowance. State whether temporary holes or marks on nonfunctional areas are allowed; they are not added arbitrarily.

Problem	Option to assess
Flexible wall	Greater rigidity / support / different sequence
Long shaft	Suitable support and workholding
All surfaces functional	Dedicated fixture
Clamping marks unacceptable	Protected areas and appearance criteria

Tolerances, datums and roughness

Size versus geometry

Diameter tolerance does not define concentricity, cylindricity or position. Face flatness alone does not define perpendicularity to an axis. If functional, specify these characteristics in the drawing with identifiable datums and verification conditions.

General dimensions and exceptions

Use general tolerances appropriate to the design and highlight critical dimensions. Tight tolerances may require different tooling, settings, inspection temperatures and measuring methods. LaserMet confirms them per part; this guide does not establish universal precision for all dimensions.

Roughness and marks

Identify surfaces needing roughness control and state the parameter, such as Ra, with units. A “shiny” rendered surface does not specify roughness. Also state chamfers, radii and edges that must not be rounded, so deburring does not affect assembly.

EXAMPLE / APPLICATION
For a shaft, define mounting diameter, reference axis and seating face separately. A single “±0.05 everywhere” does not describe their relationship and may impose cost without clarity.

3D design and prototyping

Starting from a sketch

Send function, main dimensions, known loads, mating parts and space constraints. Photographs and sketches help, but mounting dimensions must be verified. Defining geometry does not automatically include structural verification or product certification.

What needs approval

Before manufacturing, clarify model, drawing, material, operations and functional criteria. For a replacement part, establish whether to copy measured geometry or design a modified solution. A worn part can provide dimensions that differ from the original drawing.

Prototype versus production

A prototype can validate fit and the manufacturing route. After testing, update every file and approve the production revision. State which tests the customer performs and which checks the workshop performs; a fitting prototype alone does not prove service life.

Stage	Result to agree
Definition	Function, interfaces, dimensions
Design	Model and drawing for approval
Prototype	Fit and agreed checks
Production	Accepted revision and inspection

Cost estimation and a complete request

More than weight

Time depends on material removal, access, setup count, tools, tolerances and inspection. A light part with deep pockets and many holes may cost more than a heavy part with simple geometry. Stock consumption differs from final mass.

Useful optimisations

Reduce orientations, allow tool-compatible radii and remove unnecessary precision. Avoid nonfunctional thread depths and very fine surfaces where unnecessary. Request a price comparison for actual quantities, rather than only one prototype.

Quotation package

STEP and PDF, material grade and condition, quantity, tolerances, roughness, threads, finish and requested documents. State whether design is included and whether the model is final or can be optimised. Indicative online pricing is technically confirmed before manufacturing.

EXAMPLE / APPLICATION
LM-310 rev. D | 5 prototypes + pricing for 60 pcs/year | STEP model and PDF drawing | material defined | two fit bores | four threads | surfaces and inspection stated.

Inspection and cost reduction

Checklist

Consistent model and drawing; datums; tolerances; roughness; threads; material and condition; quantity; finish; measurement and traceability requirements.

Revision example

A pocket with sharp internal corners may require another process. Adding a tool-compatible radius, where function permits, simplifies manufacturing.

Cost

Reduce setups, use common holes and threads, and specify fine roughness only where needed. Request prototype and production prices separately; material availability is confirmed.