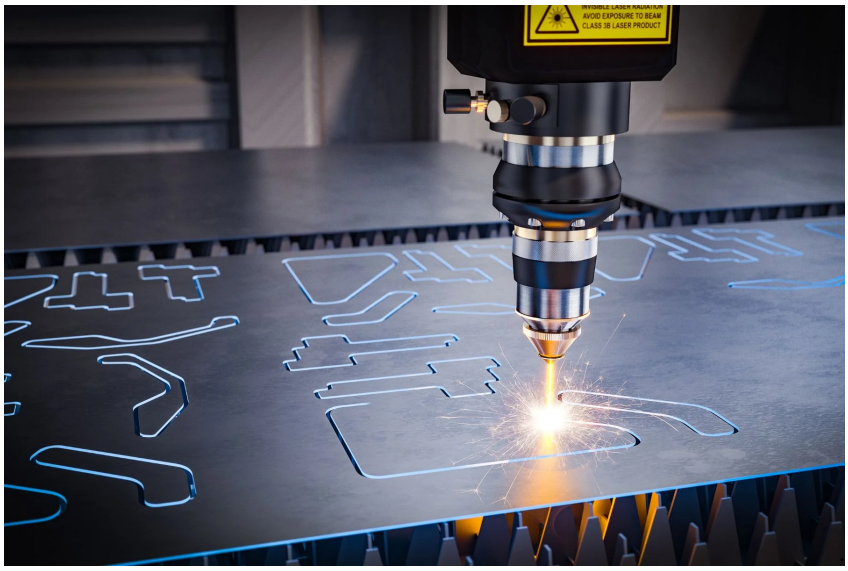
COMPLETE TECHNICAL GUIDE / ENGLISH

Laser cutting

From a DXF file to a manufacturable part



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.

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Contents

How a laser-cut part is made 3
Laser, waterjet or plasma? 4
LaserMet capacity and sheet format 5
Raster, vector and 3D models 6
CAD export: steps that prevent errors 7
CAD software and choosing an export 8
Cleaning geometry and organising layers 9
Tolerances: what to dimension and confirm 10
Kerf: cut width and compensation 11
Holes: diameter, webs and edges 12
Slots, notches and narrow cut-outs 13
Corners and assembly reliefs 14
Tab-and-slot joints and locating protrusions 15
Cut-out text and shapes with islands 16
Marking, identification and packaging 17
Materials: grade, condition and surface 18
Common thicknesses and availability 19
Deburring, edges and the visible face 20
Inserts, nuts and standoffs 21
Planning operations after cutting 22
Reducing cost while retaining function 23
Complete checklist and example request 24

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.

How a laser-cut part is made

From drawing to contour

Laser cutting separates the part from sheet metal along a programmed path. The beam heats the material locally and assist gas helps remove it from the cut. The resulting geometry is flat; the part thickness comes from the selected sheet. This operation produces external profiles, holes, slots, cut-outs and blanks for subsequent operations.

What CAM programming does

The CAD file is checked, nested on the sheet and converted into a machine program. The programmer sets lead-ins, cutting sequence, kerf compensation and any micro-joints. These are process features, rather than details the customer should automatically add to the drawing.

From contour to product

A bracket may require cutting, bending and coating. A flange may need boring, tapping and dimensional inspection after cutting. Identify the function of the part when requesting a quote: the same CAD shape may require different manufacturing routes when tolerances or appearance requirements change.

EXAMPLE / APPLICATION
A DXF for a 200 × 100 × 3 mm plate defines the 2D profile. The 3 mm thickness and material must be stated separately; a 1 mm-deep recess cannot be produced by 2D laser cutting.



Nominal profile → programming → production → inspection

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

Laser, waterjet or plasma?

Choosing a technology

This comparison helps select a suitable process; it is not an inventory of LaserMet machines. For the service covered by this guide, LaserMet confirms laser cutting within the stated limits. Requests requiring another process are assessed separately.

Why the same rules cannot be transferred

Cut width, heat-affected zone, taper and edge quality depend on the process. Results obtained on one machine or material do not automatically define the result for another setup. Compare costs for the complete part, including finishing and precision operations.

Process	Characteristics	When to consider it
Laser	Local heating, 2D profiles; process-dependent kerf	Sheet metal, parts with many profiles and details
Waterjet	Jet cutting, possibly with abrasive; without the heat-affected zone associated with laser cutting	Materials or geometries where thermal effects are critical
Plasma	Thermal process for conductive materials; different detail and edge characteristics	Parts where thickness and cost matter more than fine details

EXAMPLE / APPLICATION
Compare a delivered part, rather than only the cutting rate: a hole requiring boring or an edge requiring cleaning may change the most economical choice.

LaserMet capacity and sheet format

Working format

3,000 × 1,500 mm. The part must allow process margins and support; sheet format does not automatically equal the maximum usable part size.

Maximum thicknesses

Steel: 12 mm. Stainless steel: 8 mm. Aluminium: 6 mm. Grade, material condition and availability are confirmed in the quote. State, for example, S235JR or 304 stainless steel, rather than simply “metal”.

Process result

Laser cutting produces flat profiles. Threads, precision bores, chamfers and sealing surfaces may require separate operations. Specify edges and appearance in the drawing.

Material	Maximum laser thickness	Nominal working format
Steel	12 mm	3,000 × 1,500 mm
Stainless steel	8 mm	3,000 × 1,500 mm
Aluminium	6 mm	3,000 × 1,500 mm

EXAMPLE / APPLICATION
A nominally 3,000 mm-long part is not automatically confirmed from a 3,000 mm sheet: the profile, margins, lead-ins and support arrangement must be checked.

Raster, vector and 3D models

Raster: an image is not manufacturing geometry

JPEG, PNG and scans are made of pixels. They help identify appearance or discuss an idea, but do not reliably define dimensions and cutting coordinates. An enlarged or reduced photograph can retain its appearance while losing scale. Redraw and check dimensions before production.

Vector: coordinates and profiles

DXF and DWG can contain lines, arcs and polylines with measurable dimensions. However, a vector file can contain open contours, duplicate lines, blocks or incorrectly scaled geometry. The correct format is necessary, but does not by itself guarantee a correct drawing.

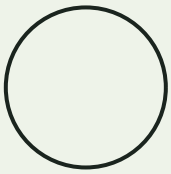
3D model: shape plus instructions

STEP/STP represents solid geometry and is useful for bent or machined parts and assemblies. Also specify tolerances, threads and finishes in the dimensioned PDF. STL describes a mesh and does not replace a precision solid model for this quotation workflow.

File	Recommended role
DXF	2D cutting profile, in mm at 1:1 scale
STEP / STP	3D geometry for checking and multiple operations
Dimensioned PDF	Material, tolerances, revision, finish and instructions
Image	Visual reference; verified geometry is required



Image: pixels



Vector: geometrically defined circle

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

CAD export: steps that prevent errors

DXF at 1:1 scale

Export in millimetres, with one part per file and closed contours. Remove duplicate lines, isolated points and zero-length segments. Check a known dimension after export.

Separate geometry from instructions

The cutting DXF contains the profile. The dimensioned PDF contains tolerances, material, revision and finish. Put bend or marking lines on separate layers and identify them explicitly.

Other files you can send

STEP for 3D geometry; DWG and PDF for assessment. A photograph or scanned PDF requires redrawing and dimensional verification. Instant estimates are available for eligible DXF files; production follows technical review.

One system of units

Check both model units and export settings. A 100 mm dimension exported in inches may be misinterpreted if the unit is not preserved. Measure a known dimension in the reimported file; the filename does not prove the scale.

Compatibility

For native SOLIDWORKS, Inventor or other models, also export STEP. For 2D drawings, export DXF. This reduces dependency on software versions and proprietary features. Accepting a file does not mean every format qualifies for instant pricing.

EXAMPLE / APPLICATION
Export a 100 × 50 mm plate, reimport the DXF into a new document and measure both dimensions. Then check that every hole is present and the part is flat.

CAD software and choosing an export

No particular application is required

LaserMet needs geometry and verifiable requirements, rather than a particular design program. You can work in a 2D application or 3D modeller, then export neutral files. A native file may help with changes, but also send DXF or STEP together with a dimensioned PDF for assessment.

Flat pattern versus presentation drawing

For bent sheet metal, export the flat geometry from a verified unfolding function, rather than a projected view of the bent part. Decide whether bend lines are excluded from the cutting DXF or retained on a separate layer with explicit instructions. Do not automatically export the bounding box as a cutting path.

Checking after export

Open the exported file in a new document. Check scale, contours and the distinction between cutting lines and instructions. When exporting from a presentation sheet, sheet scale may affect the result; a reference dimension measured in the DXF is more reliable than its on-screen appearance.

Application / workflow	Useful export	Check
AutoCAD / 2D drawing	DXF of flat geometry	Units, 1:1 scale and selected objects
SOLIDWORKS / sheet metal	Flat-pattern DXF	Bend lines, contours and revision
Inventor / model and sheet metal	STEP; flat-pattern DXF	Final geometry and export scale
Other CAD applications	DXF / STEP + PDF	Compatibility and reimported dimensions

Cleaning geometry and organising layers

Cutting contours

Keep the geometry flat, at the same Z level, with every contour closed. Remove duplicate lines and partially overlapping segments; they can change contour recognition and calculated length. Check self-intersections, very short arcs and polylines with excessive unnecessary points.

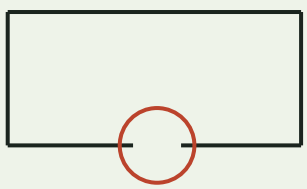
Separate instructions

Dimensions, title blocks, centre lines, hatching and auxiliary views belong in the PDF. For marking or bending, use clearly named separate layers and explain the operation in the request. A red line is insufficient if colour is lost during export or the application interprets it as a cutting path.

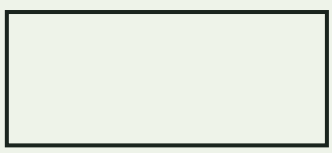
Several parts in one file

Preferably send each part separately. If supplying a combined file, explicitly identify each part and its quantity; their arrangement on screen is not the ordered quantity. Do not duplicate geometry instead of providing a parts list.

Element	In the cutting DXF?
External contour and openings	Yes, closed and without duplicates
Dimension lines / title block	No; in the PDF
Bend line	Separate layer, with instructions
Marking / engraved text	Separate layer, with the operation identified
Points and auxiliary profiles	Remove unless they serve a process purpose



Open contour: correct it



Closed contour: check in CAD

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

Tolerances: what to dimension and confirm

A nominal dimension is not an acceptance range

A 100 mm dimension describes the reference size. The tolerance establishes the permissible range. Specify applicable general tolerances and highlight functional exceptions. An indicative value of ±0.2 or ±0.25 mm does not automatically apply to all LaserMet parts.

Size, form and position

Hole diameter, axis position, plate flatness and edge perpendicularity are different requirements. A part can have the correct diameter but an unsuitable assembly position. Identify measurement datums and avoid contradictory closed dimension chains.

Surface quality and inspection

Identify the visible face and the surface on which a critical dimension is checked. A cut edge may have striations, burrs or taper; assess these for the material and thickness. For fit bores, the solution may be cutting a blank followed by machining, rather than promising identical precision throughout the thickness.

EXAMPLE / APPLICATION

For four mounting holes, dimension their diameters and positions from two common datums. For a centring bore, specify the required fit and request assessment of the additional operation.

Kerf: cut width and compensation

What kerf means

Kerf is the width of material removed by the process. It is neither sheet thickness nor a general tolerance. It depends on material, thickness, configuration and parameters. Do not use a fixed 0.2 or 0.3 mm value for all parts or transfer a value from another technology.

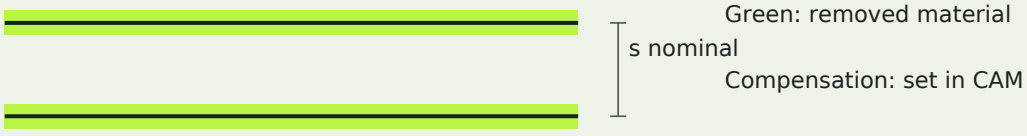
Nominal drawing, compensation in CAM

The customer provides the desired contour size. Programming offsets the path so that the resulting edge meets the agreed geometry. Manual compensation added in CAD can accumulate with CAM compensation, producing an oversized part or undersized hole.

Features close to the kerf width

A single-line cut does not automatically define a functional slot of precise width. If a slot must have width s, draw both edges and the ends. Extremely narrow slots, fragile islands and small details require checks of piercing and heat evacuation.

EXAMPLE / APPLICATION
For a nominal 3.2 mm slot in a plate, send 3.2 mm in CAD. Do not change it to 3.0 mm by assuming a 0.2 mm kerf. The workshop checks geometry and compensation.



Two contours define the slot

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

Holes: diameter, webs and edges

Define what you measure

Use d = diameter, t = thickness, e = clear distance between the cut hole and the part edge, and p = web between two holes. Centre-to-edge distance is not the same as e: for a circle it is e + d/2. Confusing these radically changes the geometry.

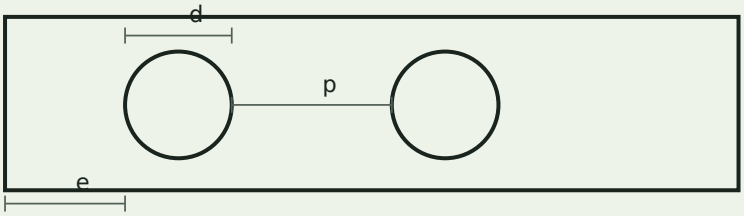
Preliminary LaserMet criteria

As a conservative initial design screen, start from d ≥ t, e ≥ t and p ≥ t. These are recommendations for initial assessment, not guaranteed process minima or a strength calculation. Holes smaller than sheet thickness, narrow webs and dense perforations can be submitted for review; the workshop determines manufacturability.

Why the remaining material matters

Closely spaced holes and thin edges can be affected by heat and become fragile during handling. For mechanically loaded parts, web size must also be established through structural design. A cutting criterion does not verify bolt loading or in-service part strength.

Symbol	Definition	Example at t = 3 mm
d	Hole diameter	Preliminary starting point: d ≥ 3 mm
e	Clear hole-to-edge distance	Preliminary starting point: e ≥ 3 mm
p	Web between contours	Preliminary starting point: p ≥ 3 mm
c	Centre-to-edge distance	c = e + d/2



d: diameter

e: clear edge distance

p: web between holes

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

Slots, notches and narrow cut-outs

A slot is an area, not a line

Draw nominal slot width and length, including end shape. For an adjustment slot, check bolt diameter, washer access and usable travel length. A very long slot can weaken a part even if it can be cut.

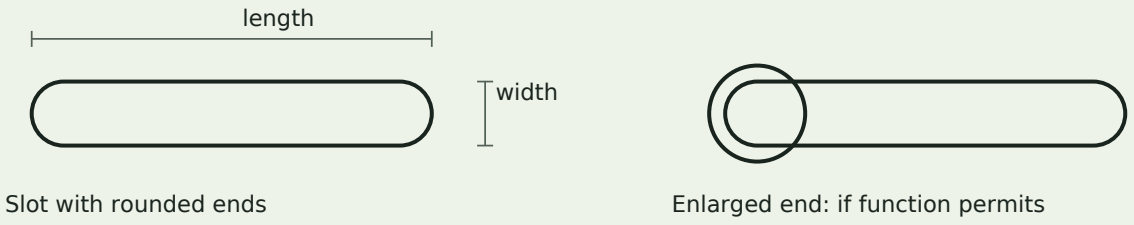
Piercing at the start of a contour

The process requires an entry point. Lead-in and sequence are set in CAM; a narrow slot may provide insufficient space. An enlarged end can be a solution, but do not add it automatically: enlargement must be compatible with part function and appearance.

Edge notches

Deep notches, very sharp corners and slots close to the contour can concentrate stress and leave thin features. Select radii or reliefs for the assembly. For a locating function, dimension from a datum rather than specifying only cut-out width.

EXAMPLE / APPLICATION
Define an adjustment slot for a bolt by its width, length, end radii and position. Bolt diameter does not automatically equal slot width: include the clearance required for assembly.



Slot with rounded ends

Enlarged end: if function permits

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

Corners and assembly reliefs

Internal versus external corners

A very sharp internal corner can prevent insertion of an edged component or concentrate stress. A circular dog-bone relief or controlled notch can help assembly. Dimension the shape in the drawing; do not add it to a functional part without agreement.

Radius and strength

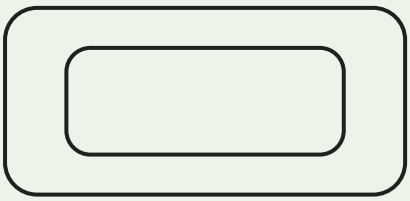
Rounding a corner can reduce sensitivity to stress concentration, but does not by itself verify part strength. For a loaded part, choose radius based on function, material, loads and assembly space. No universal thickness multiplier defines the radius for every material and function.

Edges accessible during handling

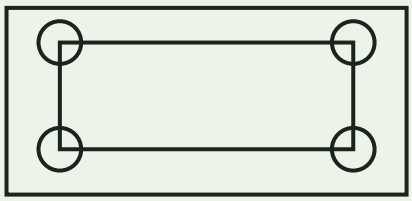
Exposed external corners can be rounded or deburred. State whether burr removal is sufficient or a controlled radius/chamfer is required. Deburring does not automatically produce the same dimension as a machined chamfer.

EXAMPLE / APPLICATION

In a slot receiving a rectangular tab, corner relief can enable assembly without grinding every tab. Check that the relief does not encroach on a sealing area.



Internal radius



Corner relief: schematic example

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

Tab-and-slot joints and locating protrusions

Clearance must be defined

For a tab of width b in a slot s, nominal total clearance is j = s - b. Assembly depends on tolerances of both parts, burrs, flatness and coating. For production runs, validate the joint using the actual material and finish before release.

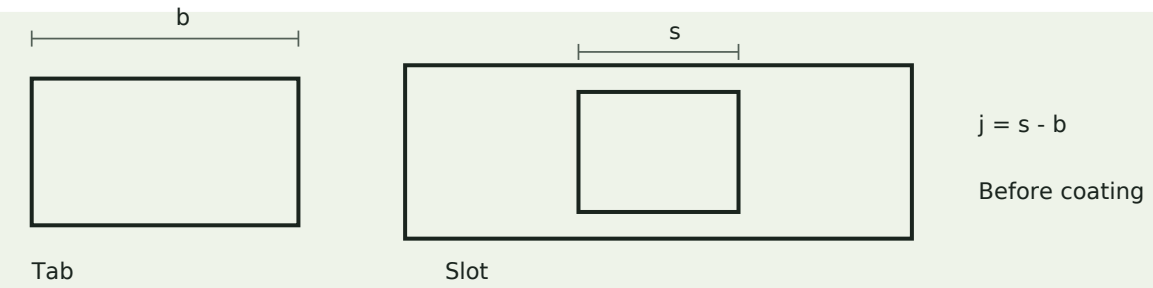
Local nodes / protrusions

Small protrusions can localise contact or increase friction in a joint. They do not guarantee retention or replace calculations for a loaded joint. An oversized node may block assembly or distort the plate; an undersized one may be removed or affected during cutting.

Locating for welding

Tabs can help assemble subassemblies repeatably, but access for welding and fixtures must remain. Check whether they are visible in the product and whether they must be removed. Do not request an interference press fit followed by welding without assessing the effect on final position.

EXAMPLE / APPLICATION
If b = 20.00 ±0.10 mm and s = 20.30 ±0.10 mm, total clearance can range from 0.10 to 0.50 mm before finishing. This is a calculation example, not a LaserMet production tolerance.



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

Cut-out text and shapes with islands

Letters with enclosed areas

In letters such as A, B, D, O, P, Q and R, internal islands detach unless connected by bridges. For negative text in sheet metal, use a stencil design or add bridges compatible with the desired appearance. The same principle applies to logos with isolated areas.

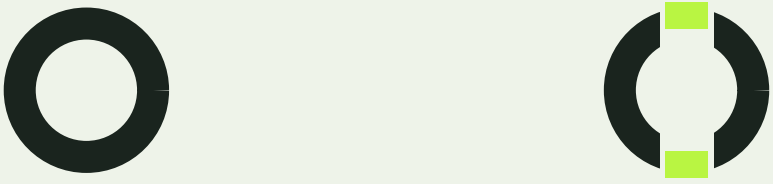
Convert fonts to outlines

Editable text can depend on installed fonts and may be substituted when opened. Export letters as vector geometry. After conversion, check closed contours, duplicates and every island; an “explode” command alone does not guarantee clean geometry.

Legibility and detail

Check minimum stroke and bridge widths at actual scale. Font size is not the width of the thinnest feature. Large letters in a fine font can be harder to manufacture than smaller letters with thick strokes. Approve a sample before production if appearance matters.

EXAMPLE / APPLICATION
On a panel reading “PORT”, the islands in P, O and R must connect to the remaining sheet. For marking rather than cutting, these bridges are unnecessary: the operation is different.



No bridges: detached island

Bridges: island attached to sheet

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

Marking, identification and packaging

Identify the operation, not just the colour

Separate marking text from the cutting path. Explicitly state MARKING, position, size and face in the request. Availability is checked for the project material and finish; this guide does not promise decorative engraving or identical contrast on every surface.

Files and revisions

For logos or graphics, provide vector geometry and a reference PDF. For a part code, specify exact text and revision. If marking must remain legible after coating, assess this before selecting the method and operation sequence.

A label is not permanent marking

Packaging labels help receiving, kitting and batch identification. Specify whether each part, bag or box needs a label. Include code, quantity, revision and any batch number; do not assume full traceability unless agreed in the quote.

Solution	Role	What to specify
Marking on the part	Direct identification	Text, position, face, permanence and appearance
Label on the part	Removable identification	Adhesive / permitted area / information
Packaging label	Receiving and separating parts	Code, revision, quantity, kit / batch

Materials: grade, condition and surface

Sheet steels

S235JR and S355J2 are structural steel grades; DC01 is steel for cold forming. DX51D identifies a category used for coated products, with coating type and mass specified separately. These designations are not interchangeable, even at the same thickness. For high-strength steels, request separate assessment of subsequent operations.

Stainless steel

304 / 1.4301 and 304L / 1.4307 are distinct designations; 316L commonly corresponds to 1.4404. “2B”, “brushed” and “bright” describe the surface and do not replace the grade. Also state brushing direction, visible face and protective film. Film compatibility with cutting is confirmed.

Aluminium

Specify alloy and temper, for example EN AW-5754 H111. Two aluminium sheets of the same thickness can behave differently in bending, welding and finishing. For a part involving multiple operations, select material for the entire route, rather than only cutting.

Family	Example specifications	Detail not to omit
Steel	S235JR / S355J2 / DC01	Thickness, condition, protection
Stainless steel	304 / 304L / 316L	Surface, film, direction
Aluminium	EN AW-5754 H111	Alloy, temper, subsequent operations

Common thicknesses and availability

A reference table, not an inventory

The table lists common examples for preparing a request; availability depends on the required grade and condition, supplier and batch. It does not represent LaserMet stock. Thicknesses above cutting limits are not included as a standard offer in this guide.

Format and stock tolerances

The 3,000 × 1,500 mm format is the nominal working limit. Material may also come from other compatible formats, such as 2,000 × 1,000 or 2,500 × 1,250 mm, depending on supply. Actual thickness and flatness follow stock tolerances, which can affect joints and bending.

Customer-supplied material

State grade, thickness, condition, surface and available documents. Rusted, distorted, unidentified material or material with an unknown coating requires assessment. Do not plan production on the assumption that any sheet offcut matches the quality specified in the design.

Family	Examples of common thicknesses, mm	LaserMet maximum
Structural steel	2; 2.5; 3; 4; 5; 6; 8; 10; 12	12 mm
Forming steel	0.5; 0.8; 1; 1.2; 1.5; 2; 2.5; 3	Within the 12 mm limit
Stainless steel	0.5; 1; 1.5; 2; 2.5; 3; 4; 5; 6; 8	8 mm
Aluminium	0.5; 1; 1.5; 2; 2.5; 3; 4; 5; 6	6 mm

Deburring, edges and the visible face

What is removed

Cutting can leave burrs, local dross, lead-in marks or micro-joint marks. Specify the required treatment: burr removal, a handling-safe edge, local grinding or a controlled chamfer. These requirements involve different operations and times.

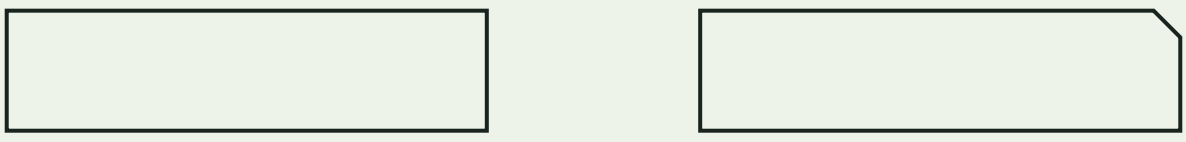
Tolerances after finishing

Edge treatment can alter local dimensions. Do not combine a functional edge with uncontrolled grinding when fit is critical. Dimension the radius or chamfer where important and state whether dimensions are checked before or after deburring.

Sensitive surfaces

For brushed stainless steel or film-covered sheet, identify the visible face, direction and acceptable scratches. Temporary protective oil on steel is not a final coating and may need degreasing before painting or welding. Select protection and packaging together with the required finish.

Requirement	Meaning for quotation
Deburring	Removal of residual material from the edge
Dimensioned chamfer / radius	Controlled geometry; operation to be checked
Cosmetic grinding	Defined appearance and acceptable surfaces
Temporary protection	Storage / transport; distinct from final coating



Raw edge: check appearance

Controlled chamfer: dimension it

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

Inserts, nuts and standoffs

Choose the right family

Self-clinching nuts, rivet nuts, weld nuts, cage nuts and standoffs do not share the same installation method. Specify a code or functional requirement, material and installation direction. The workshop checks availability and the operation before confirmation.

Design the hole for the component

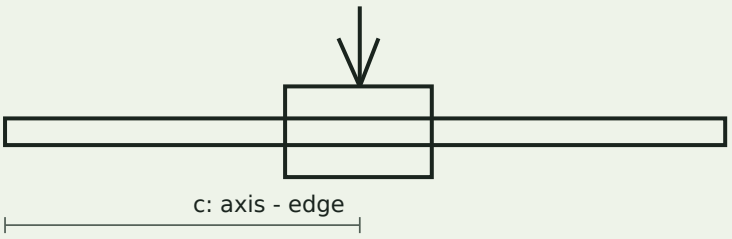
Hole diameter and tolerance, minimum thickness, substrate hardness and edge distance come from the insert datasheet. Do not confuse hole-axis-to-edge distance with clear distance from the contour. Do not use thread diameter as installation-hole diameter.

Sequence and surfaces

For press-in inserts, changing the hole edge or installing after coating may affect retention; check conditions for the selected type. Do not automatically deburr or countersink holes dedicated to inserts. Check pressing access and whether bending deformation may affect the hole.

Element	Information to supply
Press-in nut / stud	Code, hole, thickness, hardness, direction
Rivet nut	Code, grip range, hole, access
Weld nut	Material, position, weld and protection
Standoff / cage nut	Mounting interfaces and available space

EXAMPLE / APPLICATION
An M6 thread does not define an insert hole. Dimension the hole according to the selected component datasheet, then check edge and bend distances.



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

Planning operations after cutting

Bending

Send the final model and drawing with radii, angles and dimensions. The flat pattern is checked against tooling and actual bending data. Holes near the deformation zone may require relocation, relief or later machining; cuttable geometry does not automatically guarantee bendable geometry.

Welding and machining

For assemblies, include the parts list, locations and welds. For bores, threads or precision surfaces, specify operation and tolerance. Some cases need machining allowance; agree it with the workshop rather than modifying the final profile without notice.

Coating and assembly

Coating changes clearances and diameters. Identify threads, electrical contacts and sealing surfaces requiring masking. If two parts are assembled after coating, check clearance in the final condition. Include assembly and packaging in the same request for a complete price.

EXAMPLE / APPLICATION
Possible route: cutting → bending → installation of compatible inserts → welding where required → surface preparation → coating → inspection → packaging. Actual sequence depends on geometry and components.

Reducing cost while retaining function

What affects price

Cost depends on material and consumption, contour length, number of piercings, thickness, setup time and subsequent operations. A small, heavily perforated plate may need more cutting time than a larger plate with a simple outline. Weight alone does not describe total cost.

What can be optimised

Use common thicknesses and grades where function permits. Remove nonfunctional details, rather than necessary holes. Group quantities by material and revision, and request prototype and production pricing separately. An approved production sample reduces the risk of reworking an entire batch.

Before confirming an order

Check whether the quote includes material, cutting, deburring, bending, welding, inserts, finishing, inspection and transport. LaserMet minimum order value is €50 excluding VAT; this does not replace calculation for each part. Online estimates for eligible files are followed by technical review before production.

Factor	Useful action
Many internal contours	Review the purpose of perforations
Multiple revisions	Retain only the ordered revision
Unnecessary tolerances	Limit precision to actual functions
Production run	Approve the sample and inspection criteria

Complete checklist and example request

Files

Clean DXF at 1:1 scale; STEP for 3D geometry where applicable; dimensioned PDF with material grade, thickness, tolerances and revision. The same code must identify the same part in every document. Drawing and model must not contain conflicting revisions.

Manufacturing and appearance

State quantity per part, subsequent operations, visible face, deburring level, inserts and marking. For coating, provide RAL, texture, gloss and masking. For fit components, state the final condition in which the dimension must be met.

Delivery and documents

State requested deadline, packaging and address. Material certificates, inspection reports and traceability must be explicitly requested and confirmed in the quote. For kits, attach the parts list per kit and number of kits; quantities shown in an image are not an order list.

EXAMPLE / APPLICATION
LM-101 rev. B | 20 pcs | S235JR, 3 mm | DXF + PDF | cutting + deburring + two bends | RAL 9005 coating, texture and gloss specified | threads masked | delivery and deadline stated. Contact: info@lasermet.ro / +40 723 644 039.