Part Optimization

Clever design: This is how your part gets more profitable
Design parts – add value

Get started now and launch your components to a whole new level. You will acquire the required knowledge in personal workshops with a sound technological basis which focus on sheet metal and tube design. As a beginner, you will learn the necessary skills related to design. As an expert, you will expand on your expertise and get more out of your parts.

The key to success – there’s more in your parts than meets the eye

You’re familiar with your components, and know that they do their job. But what other potential is hidden inside them? Find out now in our workshops and seminars on part optimization for sheet metal and tubes. Whether you wish to manufacture parts more profitably, produce new parts, or add an new application – the relevant knowledge regarding sheet metal and tube design will help you trim your parts for success, while saving money as well.

Cost-efficiently designed parts
- are the key to efficient manufacturing
- retain or increase their functionality
- reduce the need for reworking
- require fewer process steps
- pave the way to networked production

Cost-effective design: Cut down production steps and costs through the function-based redesign of your components.

Sharpen your view: Gain feedback for creative ideas and new solutions.

Apply your skills directly: Learn practically through exercises and your own components.

Make use of experience: Take advantage of our practical knowledge from more than 500 workshops.

Manufacture at maximum capacity: Use the production possibilities of your sheet metal processing facility to their fullest potential.
Sheet metal part design
Less is more

Lighter, cheaper, or more functional: How would you like your parts? When sheet metal parts have a well-thought-out design, this allows your machines for laser cutting, punching, or bending to reach their full potential – while saving on materials, costs, and effort.

Save while designing

The right tricks allow you to design your parts economically, for example by reducing the number of single parts and process steps. The support bracket shown here originally consisted of three parts connected with four weld seams, plus separately cut threads. It was redesigned out of just one bending part, welding is no longer necessary. An additional bend even allows you to reduce the sheet thickness and form the threads directly on the punching machine.

Conventionally manufactured axis stop

Welded design with a semifinished product and milled parts

The component is produced in four steps: The semifinished products and the square tube are sawed to size, and the parts are deburred in the second step. In the third step, the holes are milled and drilled. Finally, the single parts are welded together (MIG/MAG). This also includes weld seam preparation, positioning and fixing the components to a welding fixture, welding, as well as grinding.

The many work steps are both time-consuming and cost-intensive. The requirement for fixtures is great, as every part needs to be positioned. Although milling is highly precise, distortion still occurs during welding, which in turn means that precision can no longer be guaranteed.
The new design reduces the number of parts and thus the joining processes and material usage. Functionality increases at the same time. The double sheet attachment optimizes the flow of force in the cable tie fastenings. This allows you to save approximately 46% in costs.

Cost-effective solution made from two sheet metal parts

You cut the component to size on a laser flatbed machine – including oblong holes, round holes, and geometries – and then bend it as needed on a bending machine. Joining aids reduce the need for positioning, and therefore the need for welding fixtures. What changed during designing? Laser cutting and bending have replaced sawing, drilling, milling, and welding.

Cleverly designed axis stop

Bending
replaces welding and decreases the number of parts

Thread forming
for greater strength than that of thread cutting

Laser cutting
allows for any desired geometries to be cut into sheet metal, and creates bores

-46% in costs
Laser welding part design
Rethinking is worthwhile

A laser welding system allows you to manufacture for much less than with conventional welding, as long as you identify suitable parts and make these fit for laser welding. You can receive design and manufacturing-related tips and tricks from us.

Here is how you make your parts fit for laser welding

The proof is in the comparison with TIG manual welding: The laser allows you to weld up to 90% faster and for noticeably less – without filler material. The water tank shown here demonstrates how a manually welded part can become a cost-effective laser-welded part.

Its seams need to be watertight; the laser allows you to weld these in a fraction of the time. The lower heat input also reduces the amount of distortion.

Conventionally manufactured cover

Every part is an expensive, unique specimen

The cover for electronic components such as electrical cabinets must be sealed and free of distortion. Up until now it was produced in four steps: The sheet metal is cut with a laser and then bent ten times. The third step comprises TIG welding, prestapling, and rewelding. Finally, the cover is reground and buffed.

Conventional component

Optimized component

Laser cutting including free corner cutting

Welding Supplementary wire and the weld seam thickness compensate for bending tolerances

Grinding/polishing as manual work

Bending ten bends

Welding results in distortion that needs to be corrected. Welding, grinding, and polishing are also time-consuming and expensive aspects of manual work. It is impossible to achieve reproducible quality in this way.
The optimized design separates the tolerance chain and simplifies the process of fitting the parts to one another. External access is improved at the same time. It is no longer necessary to weld gaps shut. The actual welding process is shortened and automated. Laser welding also replaces multiple work steps. Seam preparation is no longer necessary, and you also need to do fewer corrections as the lowered heat input means barely any distortion occurs. In total, the processing time in the example can be lowered by 82%.

Cleverly designed cover

**Reproducible quality**

The design which is suitable for laser welding consists of three sheet metal parts, which are cut with a laser in the initial step.

The sheets are bent eight times to make the elements that comprise the covers. The single parts are joined via laser welding. In doing so, only minimal distortion occurs, and the weld seams create joints. No reworking is necessary.

**Laser cutting**

three parts from one sheet

**Laser welding**

with minimal distortion and high optical quality

-30% in costs
Sheet metal fixture design
There’s a simpler way

Fixtures guarantee quality and more reliable processes during laser welding. However, what even experienced practitioners often don’t know is that fixtures are often cheaper and more flexible when they are produced from single sheet metal parts. Additionally, you can reduce production tolerances during welding. When are you going to make work easier for yourself?

A knockout punch with every fixture

Clamping fixtures made from sheet metal are economically superior to conventionally milled fixtures. This is because they lower manufacturing costs as well as weight. They also allow for additional functions to be integrated. Our example shows a milling block with clamping devices that were purchased additionally, requiring numerous holes to be drilled and deburred, as well as threads to be cut – all of which entails a great deal of detailed work. On the other hand, the alternative plug-in design made from sheet metal is simple, quick, and affordable. It uses commercially available nuts for clamping as well as copper sheets as insertion guides and for protection.

Conventionally manufactured welding fixture

Solid milled part

The fixture is made from a block: You saw the raw material and mill it in two clampings. Afterward, the complete block is deburred and anodized.

Milling all reference surfaces and mounts as well as all through holes and threads

Conventional component

Optimized component

Sawing ready-made raw material to size

Finishing by deburring and anodizing

Milling is expensive, and surface finishing is time-consuming. Additional problems are the inadequate passive cooling of sheet metal parts during welding, which contributes to distortion and affects precision. Welded parts must be laboriously tapped out of the milled fixture, as the lack of space means they shrink onto the fixture.
With the right design rules, you can improve the clamping process and design the fixtures as lightweight parts. You can also increase heat dissipation and reduce the number of clamping devices. In doing so you lower the manufacturing costs, weight, as well as the loading and unloading times for the fixture.

Cleverly designed welding fixture

A functional lightweight design

Fixtures manufactured from sheet metal can be made lighter: Single sheet metal parts are produced using laser cutting – including bores and other geometries. These reduce the time and effort required for assembly and enable flexible use of fixtures. Simply connect the precut laser parts together.

Assembling and welding of single parts

Laser cutting any desired geometries and holes

-17% in costs
Cantilevers such as this one are used in scaffolds, machine frames, cranes, and balcony railings. In conventional manufacturing, the vertical and horizontal tube, as well as the connecting rib, are adjusted to one another in individual process steps. This includes sawing, deburring, milling, grinding, fixture construction, measuring, and welding.

**Conventional manufactured cantilever**

**High demands on time and logistics**

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**Optimized bend connection made from tubes**

**Conventional component**

**Conventional corner connection**

**Optimized component**

**Sawing**

all components to size

**Milling**

contact surfaces, oblong holes, and stepping

**Welding**

all three components

**Deburring**

sawed and milled areas

A large number of simple yet time-consuming work steps, buffer time, and a high degree of logistical effort make production difficult.

**Tube part design**

**Conquer the world of tubes**

Laser tube cutting saves entire process steps, which allows you to save money. Secure your share of the growing market for laser-cut tubes. We will advise you on exactly how this works with the appropriate advice.

**The stage is set for your ideas**

Tubes and profiles are used everywhere – from mechanical engineering and system construction all the way to the furniture industry, and lasers open up entirely new design possibilities.

Instead of welding two single parts together to make a corner connection, for example, you can achieve the same result more efficiently using a laser-cut tube with bend connections and positioning aids. When manufacturing with a laser tube cutting machine, you save 31% in costs, and produce the component in half the time.
The laser beam is an extremely flexible tool. It allows a laser tube cutting machine to take over many of the previously required process steps such as sawing, milling, grinding, and measuring. Bevel cuts replace weld seam preparation and laser-cut joining aids take over positioning with welding fixtures. The weld seam is also shortened. All in all, you save on components, process steps, and costs.

Cleverly designed cantilever

Fewer components, production steps, and lower costs

The cantilever is now manufactured from two tubes with identical shape and dimensions. Both parts are adjusted to one another on a laser tube cutting machine and then connected together; the joining aids reduce the effort needed for positioning.

Assembling and welding the two single parts

Laser tube cutting the entire assembly with just one clamping

-83% in costs
The numerous milled parts are both time-consuming and cost-intensive. The costs of chipping manufacture are high, and fits for pins and threads are necessary. This leads to enormous assembly effort. There is even room for improvement with the ergonomics, as the assembly must be welded when it is lying down.

**Tube fixture design**

**Better utilization for greater profit**

Would you like to increase your vertical range of manufacture, improve your machine utilization rate, or lower the costs for fixtures? Then you should manufacture fixtures from laser-cut tubes in the future. It’s easier than you think.

**Simply produce your own fixtures**

The design of tube fixtures allows you to tap into an additional application field and utilize more of your laser tube cutting machine’s capacity. Learn about the design rules for tube fixtures and how you can optimally design your assemblies through training sessions and consultations. These will allow you to design, adapt, and replicate assemblies quickly and cost-effectively in the future.

The example shows that while the conventionally manufactured welding fixture needs to be laboriously adjusted via a clamping device, the new design features a spring effect for tolerance compensation.

**Conventionally manufactured welding fixture**

**Many parts and elaborate assembly**

Raw material and semifinished products are sawn and then bolted or joined. Afterward, numerous precision fits are created in the milling block for gauges, through holes, and threads.

**Drilling**

precision fits, through holes, and threads

**Milling**

all surfaces which are to be bolted or joined

**Conventionally milled fixture**

Optimized fixture made from tubes

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**Optimized fixture made from tubes**

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Cleverly designed welding fixture

Ergonomic solution including spring effect and tolerance compensation

A tube plug-in design replaces the entire milling block. The laser tube cutting machine not only cuts the tube cross section to size, it also provides all parts with joining aids, which allow for precise positioning. The laser tube cutting machine also creates threads directly.

You benefit from fewer parts and less effort. Only one clamping device is required in the upper clamping tube. The visible longitudinal sections provide a spring effect to the fixture, and compensate for the tolerances in the component. The vertical design of the fixture makes it easily accessible and ergonomic. The entire welding assembly can now be welded in one clamping, in the exact size, and with higher quality. All in all, the manufacturing time and weight are reduced.

-80% in costs
What part are you starting with?

The first step is very easy: Talk to us. Together we will come up with ideas for how you can take full advantage of the potential within your parts.

Here is how to reach your goals

Part consulting: Get the best out of your parts. Work with TRUMPF experts to establish how you can design your parts to be more economical.

Workshop: Gain personalized practical knowledge. Beyond the seminar, we look for potential within the parts range in your business. Working together, we will optimize and manufacture selected parts which you can directly implement into your designs and manufacture more cost-effectively.

Seminar: Become the expert in your sector. TRUMPF seminars combine parts consultation with technology days. You will gain knowledge about processes, production, and design. You will also perfect a sample part as part of a team.

Technology day: Deepen your production expertise. Whether at your site or at TRUMPF: learn the latest about manufacturing methods, receive an assessment about the status of your technology, and discover the potential for improvement.

Contact us: partdesign@trumpf.com

Whether you’d like more information, an appointment, or an offer, we look forward to hearing from you.

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