

February 2021

## ARBURG – Grippers for Robotic Systems



## NO LIMITS

Additively manufactured gripper for removing injection moulded parts

## SUMMARY

The issue of how to print functional parts from hard and soft components at the same time had always posed a big challenge to the field of additive manufacturing (AM). AM parts either lacked functional strength or engineers were forced to bond hard and soft materials together, which obviously gave rise to concerns about durability. ARBURG was faced with this same challenge when it came to developing a gripper for a robotic system that was to combine strength with soft-touch properties. By designing a form-closure gripper –

an innovation only possible with the freeformer system – ARBURG solved the problem and invented a new way to automatically remove injection moulded parts. In so doing, it did away with the limitations associated with manual work steps, improving the aesthetics, quality and performance of the component.

## INTRODUCTION

The anticipated growth of additive manufacturing is reliant on progress being made in terms of new materials that can be used for industrial purposes. According to the „Global Additive Manufacturing Market and Technology Forecast to 2028“ (Research and Markets, July 2020), the global additive manufacturing market is expected to reach \$78 billion in turnover by 2028, with North America, the Asia-Pacific region and Europe accounting for a large share of that revenue. This can largely be traced

back to the huge investments many manufacturers are making in digitalisation, as well as the good prospects in these regions for agile production and flexible supply chain management. Prototype production is a viable solution for many. But it is the additive manufacturing of innovative, complex functional parts and multi-material component assemblies that will really take the industry to the next level: there is an almost endless array of possibilities opening up for AM to exploit here.

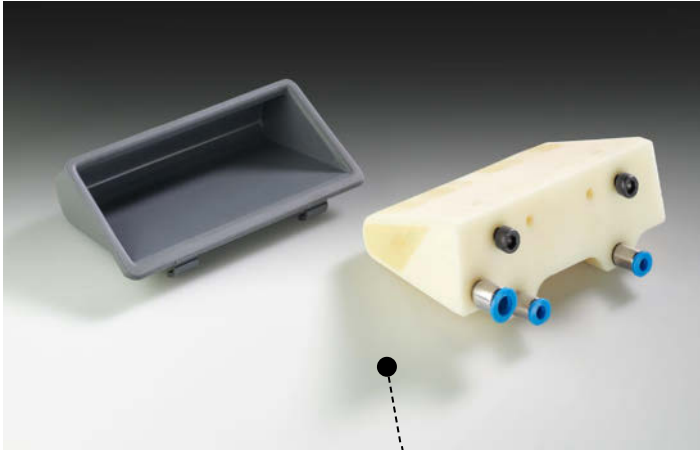
## CHALLENGE

ARBURG produces its machines for plastics processing exclusively at its parent location in Lossburg, Germany. The Customer Center there is home to a number of ALLROUNDER injection moulding machines that are available for running tests and mould trials on customer moulds. Plastic parts for in-house use are made here as well.

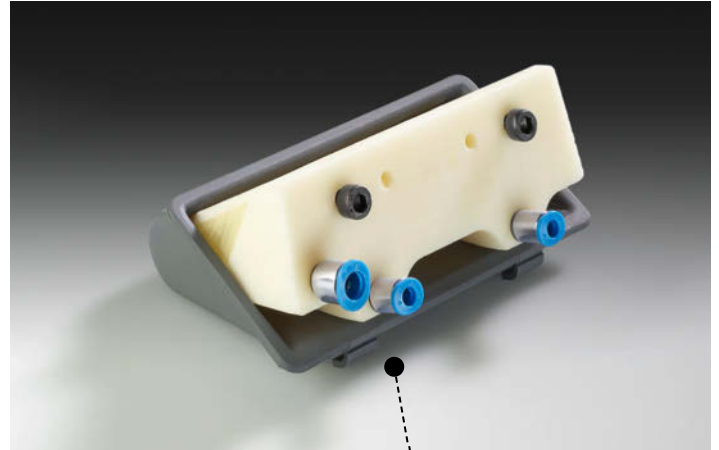
As ARBURG was optimising a plastic part like this to make it smoother and less angular, it needed a new method to remove the part from the injection mould gently, without damaging or squeezing it. Parts usually fall out of the injection moulding machine and into a catch pan, but this can cause various problems, particularly with curved parts. Shape, draft and texture must be considered when developing the mould's ejector pins and there will always be a risk of spoiling the appearance of a part. This is also highly relevant for many companies making medical devices and consumer products. What's more, in the existing process, the sprues and injection moulded parts have to be separated manually. ARBURG made it its mission to design a more efficient production process. It wanted to automate the manual work steps and improve part quality at the same time.

The ARBURG product was an arched shaped handle for the THERMOLIFT, which is a 2-in-1 dryer and conveyor for plastic granules. The challenge for production was that the injection moulded part was positioned obliquely at an angle of 15 degrees in the mould and there could be no question of compromising any of its aesthetic qualities. ARBURG decided to develop a customised gripper for its MULTILIFT robotic system so the part could be removed from the mould gently. Automating the process meant that unmanned production (also known as „lights-out production“) could be introduced too. But this specific component came with some more requirements that demanded a customised solution. Since there is very little space between the two mould halves, there is no flat surface available for a traditional gripper with a suction cup. So ARBURG developed its own alternative, which is opening up a whole host of new possibilities when it comes to removing injection moulded parts.

## SOLUTION



Moulded part (left) and additively manufactured gripper



The gripper with expanded TPU membrane can remove the moulded part

In and of itself, it is nothing unusual to design a gripper for additive manufacturing. Many manufacturers use a 3D printer and just one material to create that very thing. But it is the ability to combine multiple materials for new applications that makes ARBURG Plastic Freeforming (APF) unique. In this case, ARBURG used the freeformer to manufacture an application-specific gripper that takes aesthetically pleasing injection moulded parts with complex geometries and removes them from the mould gently, without marring their surface. This was accomplished by combining a hard housing with a soft membrane, conceived as a finished component assembly, which is connected to the robot arm directly.

The gripper features a form-closure grip mechanism inside a thermoplastic polyurethane membrane, as well as a hard housing made of polycarbonate/acrylonitrile-butadiene-styrene copolymer. The trick is that the soft membrane expands as soon as compressed air passes through ducts inside it, while the hard housing ensures the gripper retains its shape. This method means injection moulded parts can be removed from the mould safely, which is not possible with conventional 3D printers.

Using the patented APF process, the freeformer delivers tiny droplets of material and positions them strategically on a part carrier so the material being deposited maintains maximum mechanical strength. The ability to combine multiple materials is unique and gives designers the freedom to create 3D-printed parts with both rigid and flexible characteristics. This may be, for example, a handle formed from a soft material to make it pleasing to the touch or a seal reinforced with stiff webs to make it stronger. Or take it a step further like ARBURG and create a TPU membrane that can fill tiny mould cavities and safely remove injection moulded parts from the mould.

## RESULTS

Process	Time	Cost
Traditional process	No details	No details
freeformer	2 days	< EUR 15

## ADVANTAGES AT A GLANCE

- Combination of hard and soft components creates space for innovation and development of new grippers
- Complete component assemblies made of different materials in a single work step – with no time or effort spent on assembly or bonding
- Components that can be customised to individual requirements and applications
- Quick and immediate turnaround time
- Injection moulded parts look better, with fewer surface flaws
- Automated process for unmanned production

## OUTLOOK

„The great thing about the APF process is it can be adapted in so many different ways to solve problems typically encountered with traditional production methods,” explained Lukas Pawelczyk, Head of freeformer Sales. „The freeformer liberates us from any technical limitations.” An expert in additive manufacturing, Pawelczyk is well

versed in many 3D printing technologies and is convinced the freeformer can meet the needs of strategic markets such as healthcare, the automotive industry or aerospace. According to him, the robotic system gripper is just one example of what can be achieved with the freeformer.

## COMPANY

ARBURG is one of the world's leading manufacturers of plastics processing machines. Its product portfolio includes ALLROUNDER injection moulding machines and the freeformer for industrial additive manufacturing, as well as robotic systems and turnkey solutions. ARBURG makes its products exclusively at its parent location in Lossburg, Germany. The Customer Center there is home to a number of ALLROUNDER machines that are available for running tests and mould trials on customer moulds. Some customers produce plastic parts for in-house use here as well.

First-class local customer support is guaranteed by the international sales and service network. ARBURG has its own organisations in 26 countries at 35 locations and, together with trading partners, is represented in over 100 countries. Of a total of around 3,200 employees, about 2,650 work in Germany. About 550 further employees work in ARBURG's organisations around the world.

More information: [www.arburg.com](http://www.arburg.com)

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