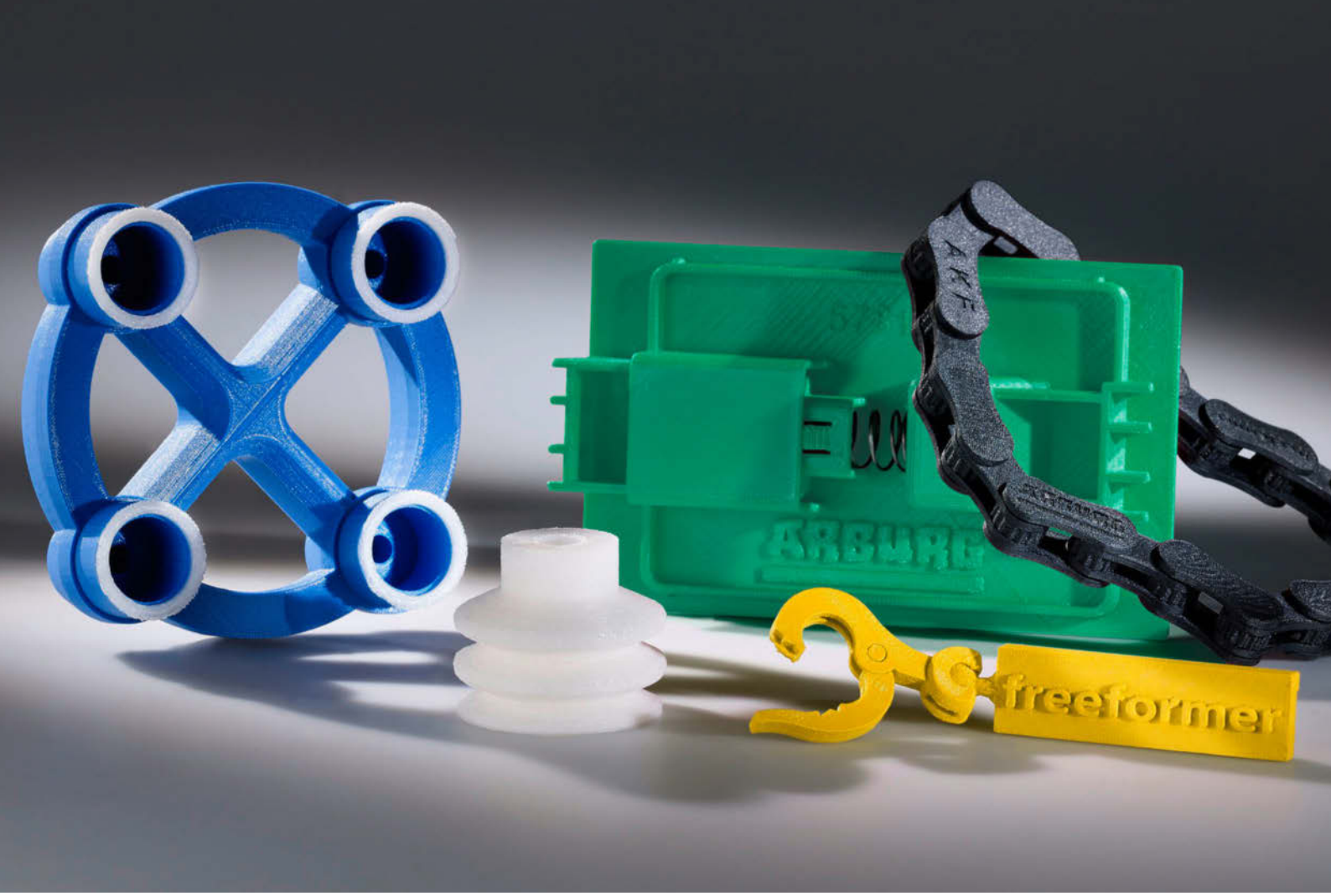


APF

ARBURG Plastic Freeforming

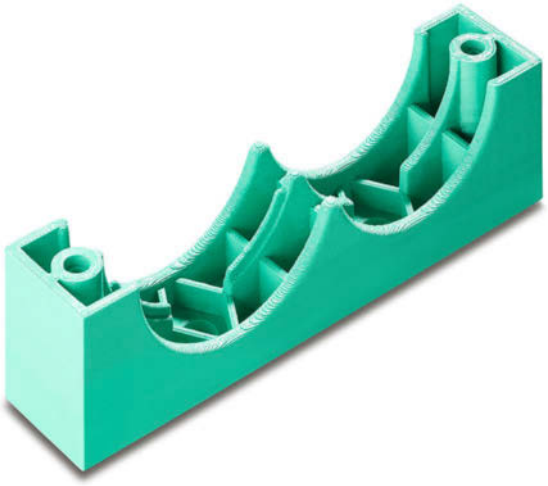
ARBURG

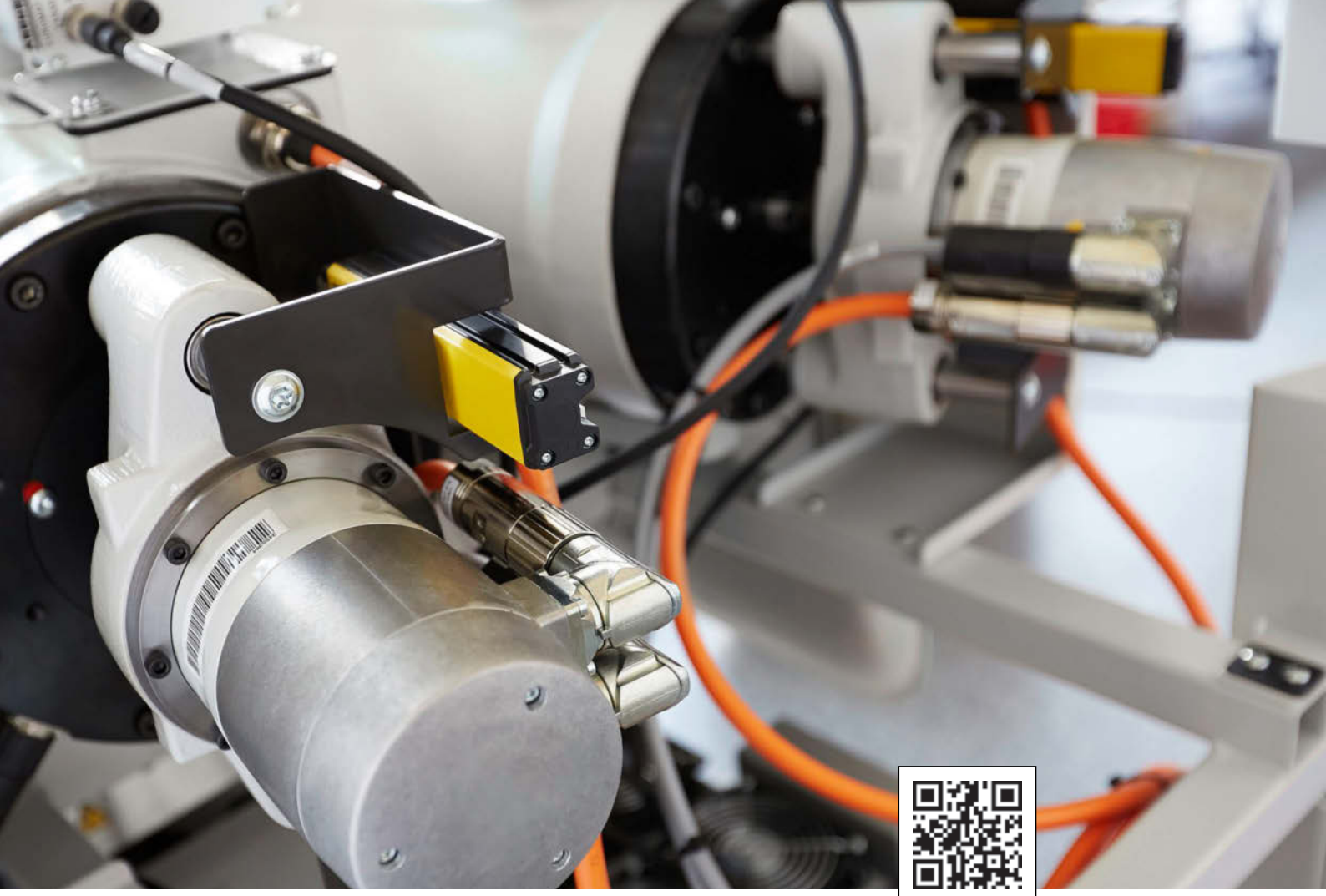
www.arburg.com

APF –

industrial additive manufacturing

Industrial additive manufacturing from the perspective of a machine manufacturer: this requires a practical approach involving many new solutions – and an innovative, patented process - ARBURG Plastic Freeforming (APF). In other words: a completely new way of working! Additive manufacturing. With qualified standard granulate and layers built up from tiny droplets of plastic.

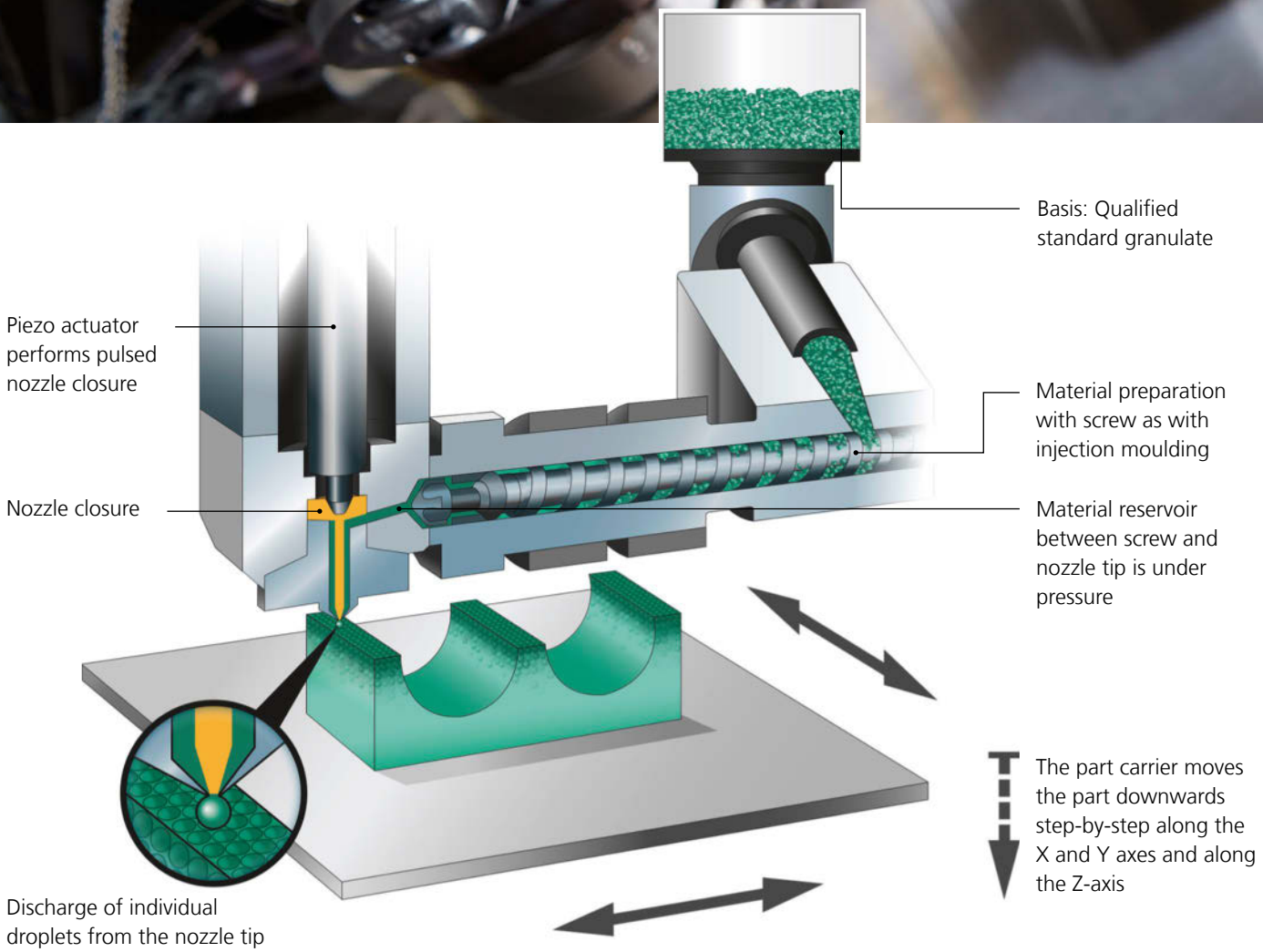




Process principle

Using the freeformer, a machine developed specially for the APF process, we melt the granulate in a process similar to injection moulding involving integrated material preparation.
A heated plasticising cylinder with a special screw produces a homogeneous plastic melt. The special discharge unit featuring a pulsed nozzle closure marks a new era in industrial processing: a nozzle closure driven by high-frequency Piezo technology enables extremely rapid opening and closing of the nozzle. Under a material pressure of up to 500 bar, up to 200 plastic droplets are produced per second with a diameter of between 0.2 and 0.4 mm, depending on the size of the nozzle. The moving part carrier is positioned so that each droplet is placed on the precise point previously calculated. No special processes or material additives are required in order to harden the plastic in the temperature-controlled build chamber; instead, the tiny droplets are bonded together as they cool. This enables us to build three-dimensional plastic parts layer-by-layer without requiring moulds or fixed cavities. In addition, the processing of materials with no emissions or waste is an interesting feature of our APF process. The freeformer does not require an active extraction system. No waste material such as excess powder remains in the machine.

A high degree of processing flexibility was a further key objective taken into account during the development of the APF process. For this reason, our freeformer is equipped with two discharge units. These enable functional parts to be produced from several components – even as durable hard/soft combinations. In the case of complex part geometries, the second component can alternatively be used to build up support structures from a special, water-soluble material.

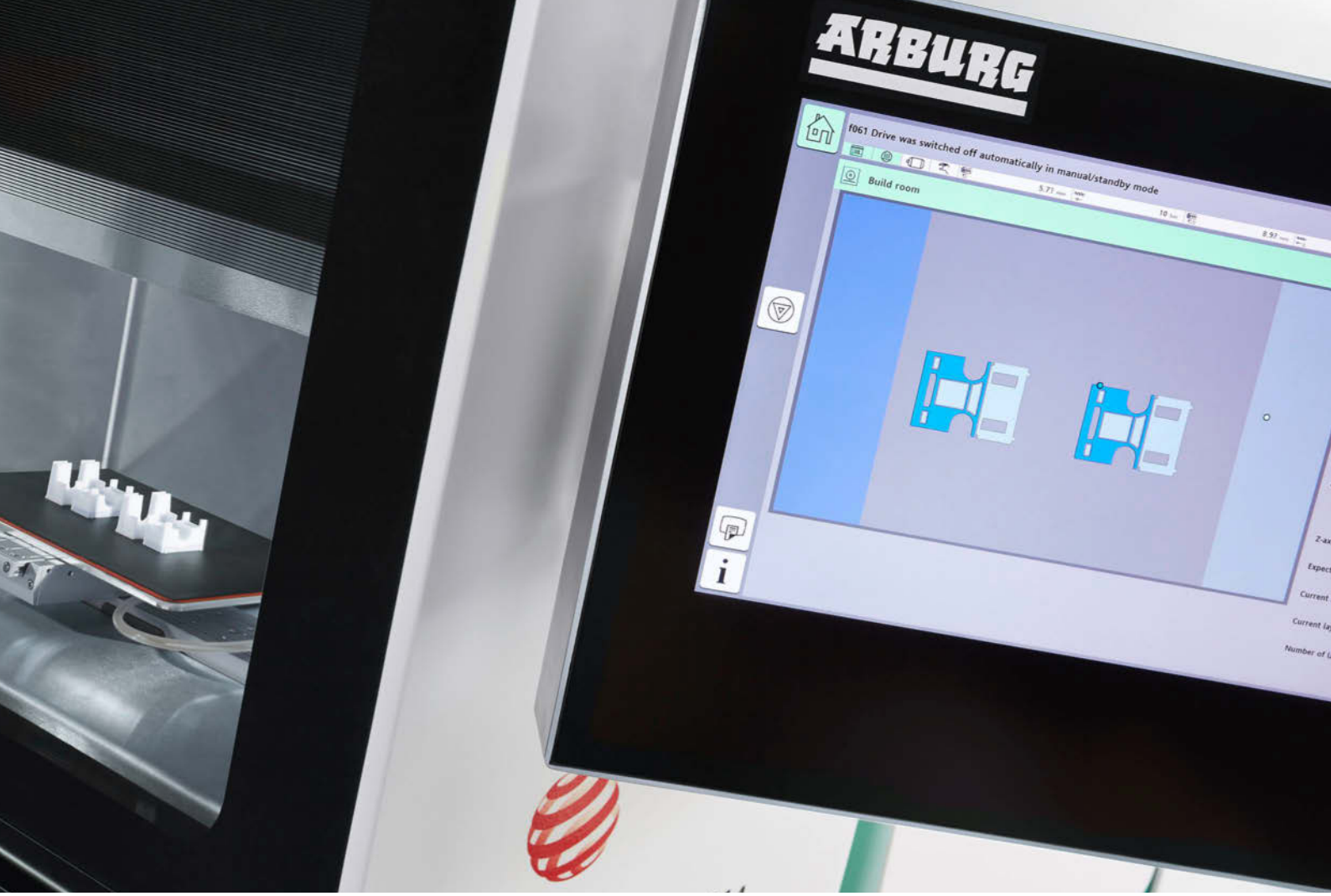

Basis: Qualified standard granulate
Piezo actuator performs pulsed nozzle closure
Material preparation with screw as with injection moulding
Nozzle closure
Material reservoir between screw and nozzle tip is under pressure
The part carrier moves the part downwards step-by-step along the X and Y axes and along the Z-axis
Discharge of individual droplets from the nozzle tip

APF –

materials and properties

ARBURG Plastic Freeforming means entering into a completely new technology. Our freeformer can manufacture individual one-off parts and small-volume batches using qualified standard granulates. No injection mould required.

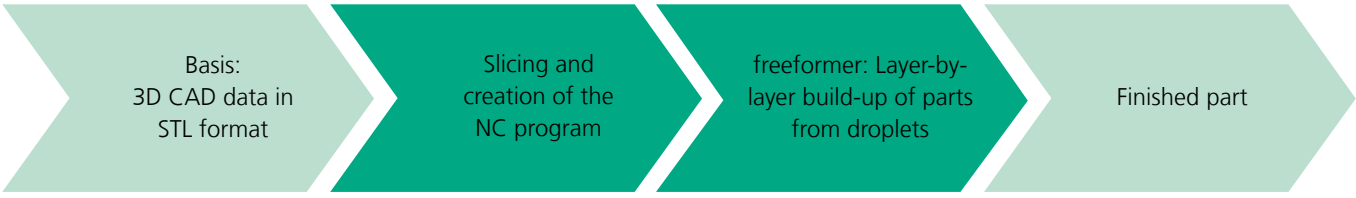
Parts created directly from 3D CAD data. With an open machine controller that permits individual process optimisation and qualification for your own materials. Tap into a whole new range of options for industrial additive manufacturing!

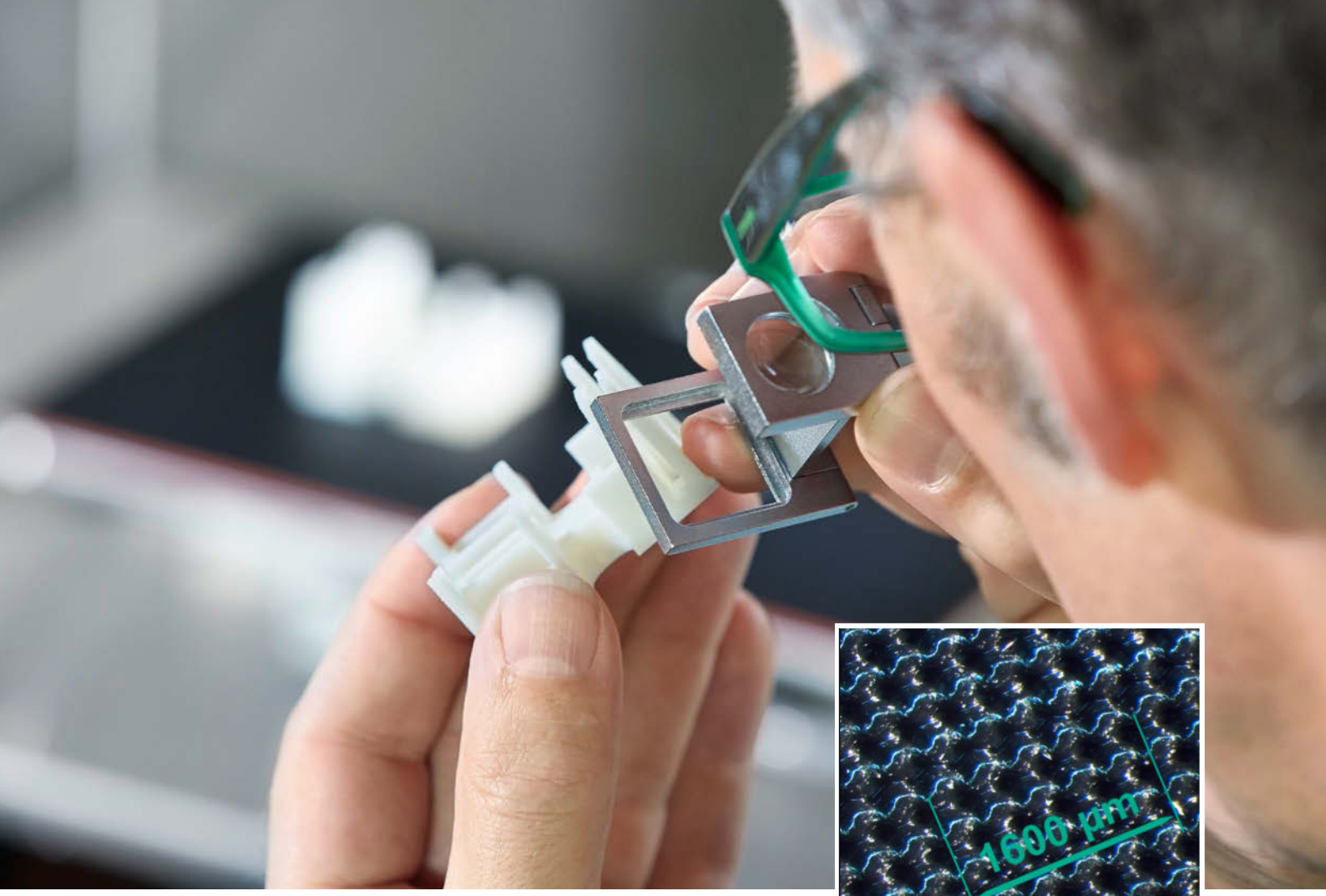


No injection moulds or predefined cavities are required for the free forming of plastics. In the APF process, software is used to prepare 3D CAD data (STL format) in layers for the machine-specific requirements (slicing). You can then use our freeformer to build your part drop-by-drop, layer-by-layer, from standard granulates. Individualised, but still cost effective. Without the aid of an injection mould. From batch sizes of a single unit upwards. This starting point offers a host of interesting options:

- Low operating costs - low material price, procurement not restricted to a single manufacturer
- Use of original materials, e.g. to ensure resistance to ageing
- Moulded parts can be additively individualised, e.g. through the combination of injection moulding and additive manufacturing
- Material diversity – in principle, any qualified plastic can be used

The APF process allows standard granulate and support materials to be processed in a flexible way. However, reproducible additive manufacturing requires that every material should be pre-qualified. Our APF process therefore meets all the requirements for industrial additive manufacturing, while also requiring individual development input. A team of APF specialists with external support is currently working on the qualification of standard materials. This qualification requires intensive testing.





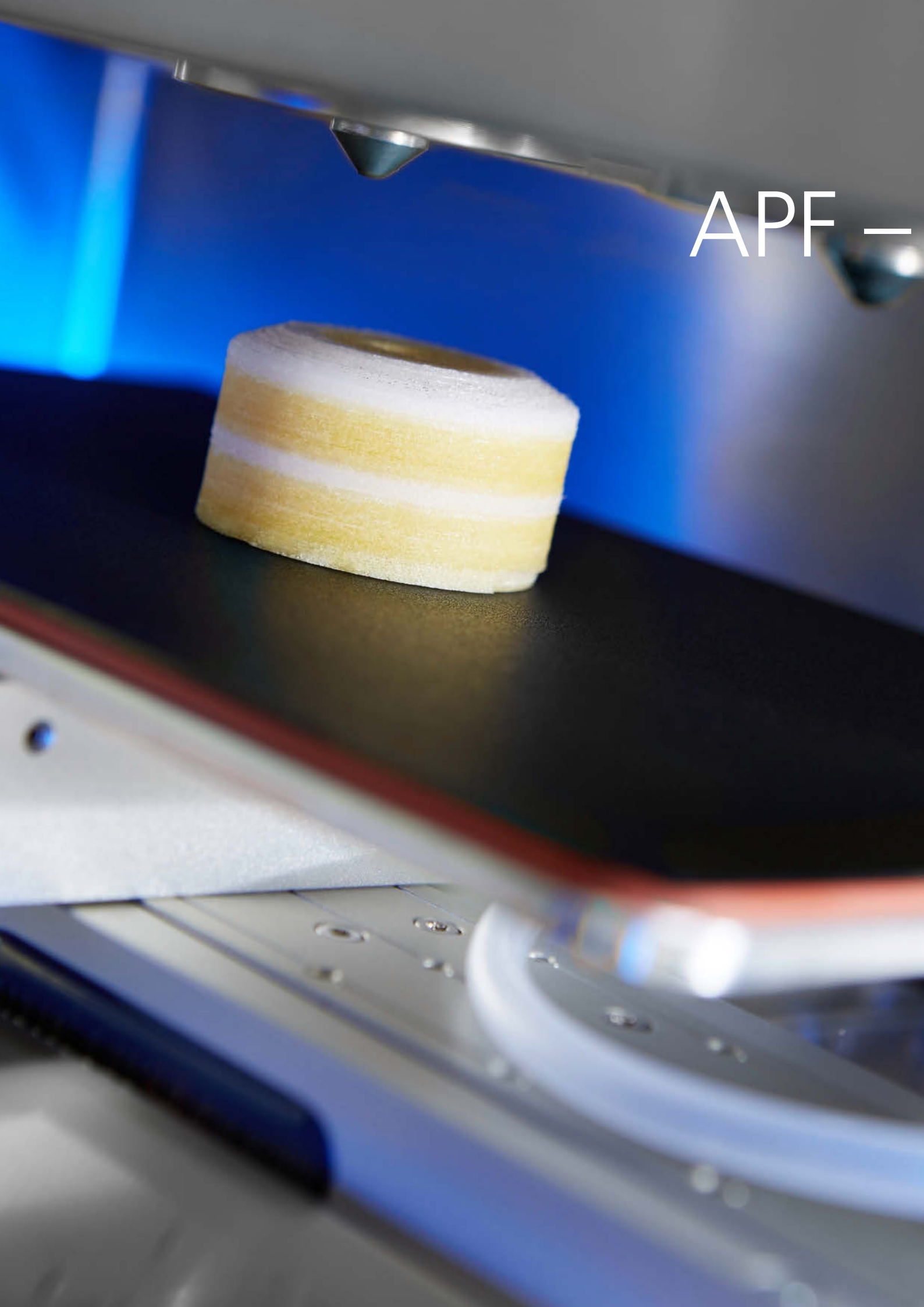
A close-up of the surface of a part produced using the APF process: homogeneous, densely structured layers.

These tests produce optimised process data that contain all the most important settings for additive manufacturing, for example the processing temperature and layer thickness. We also take account of aspects such as edges, filling, strength strategy and build chamber temperature. The open system of the freeformer ensures that all parameters are always freely programmable. Our database currently contains process data for a wide range of qualified amorphous thermoplastics (up to 300°C) and support material.

This enables you to optimise processes and material qualification on an individualised basis, for example for certain additives or colour schemes.

However, as with injection moulding, this requires some knowledge of plastics processing. Here our expert technology consulting will help you every step of the way.

The surface quality achievable with APF features a particularly uniform and dense structure - in every direction. In the test, the mean roughness value Ra was around 20 micrometres, corresponding to a coarsely structured moulded part. Examinations of the mechanical properties also indicate the superior quality of the parts: compared to moulded parts, it is currently possible to achieve tensile strengths with ABS of around 80 percent at layer level. This means that your APF parts are immediately ready for use as soon as they leave the freeformer.


APF –

in practice

Our innovative APF process enables you to combine design freedom with a wide choice of materials. This enables you to quickly produce replacement parts or functional samples from the desired qualified material, for example. Whatever industry you may work in, the freeformer offers you a wide range of new options: from consumer goods and automotive parts to medical technology - to name just a few examples.

Complex geometry: the elastic bellows made from TPU is produced with the help of water-soluble support material.

One-off parts and small-volume batches

Jig for holding office scissors |
Material: ABS | Layer height: 0.27 mm |
Build time: approx. 19 hours

60 holders for LED lamps in a build job |
Material: ABS | Layer height: 0.21 mm |
Build time: approx. 14 hours

Functional integration

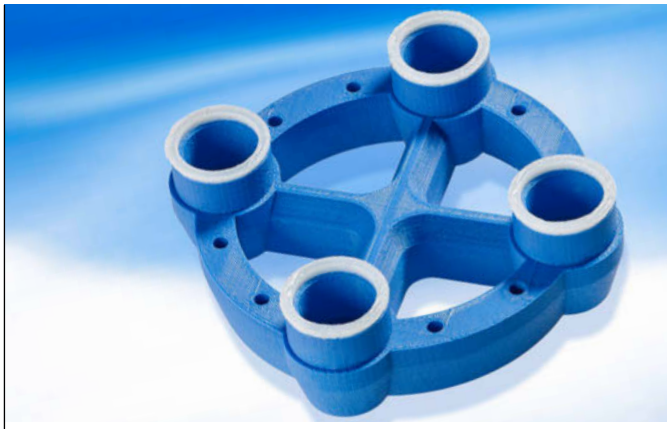
Hose clamp with closure | Material:
PA or PC | Layer height: 0.27 mm |
Build time: approx. 4.5 hours

Toothbrush with flexible head |
Material: ABS | Layer height: 0.21 mm |
Build time: approx. 8 hours

Chain produced as a component without an assembly step | Material: ABS | Layer height:
0.21 mm | Build time: approx. 8 hours

Multi-component technology

Folding cube |
Material: ABS + TPE (80 Shore) | Layer height: 0.21 mm |
Build time: approx. 1 hour



Gripper with sealing lip and integrated air channels |
Material: ABS + TPE (80 Shore) | Layer height: 0.21 mm |
Build time: approx. 9.5 hours

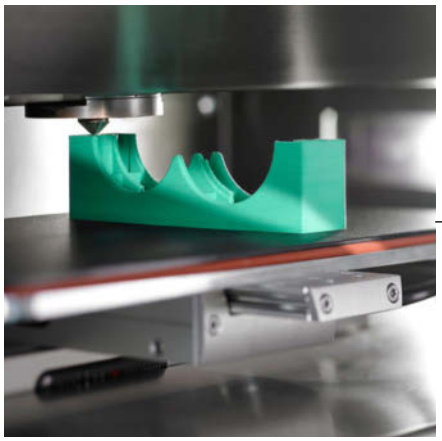
More examples

Individualisation

Office scissors with additively applied 3D lettering |
Material: PP | Layer height: 0.21 mm |
Build time: approx. 1 minute

Rocker-type light switch with additive 3D finishing |
Material: ABS + TPU | Layer height: 0.21 mm |
Build time: approx. 5 minutes

Free for



Efficient use of materials.

Without waste.

Combining different materials.

Without problems.

Safe operation.

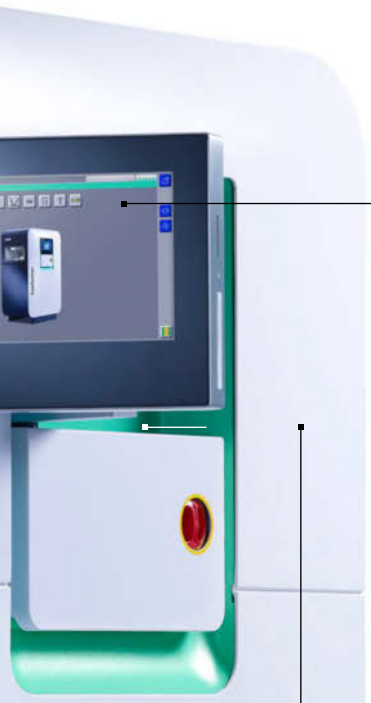
Free from dust and emissions.

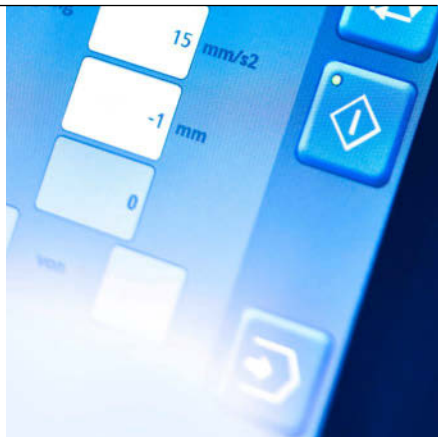
greater efficiency

First we continuously perfected injection moulding.

Now we are developing industrial additive manufacturing. Our objective has always remained the same: quality at affordable unit costs.

We believe there is a great deal of potential for the future in this.





Simple, intuitive operation.

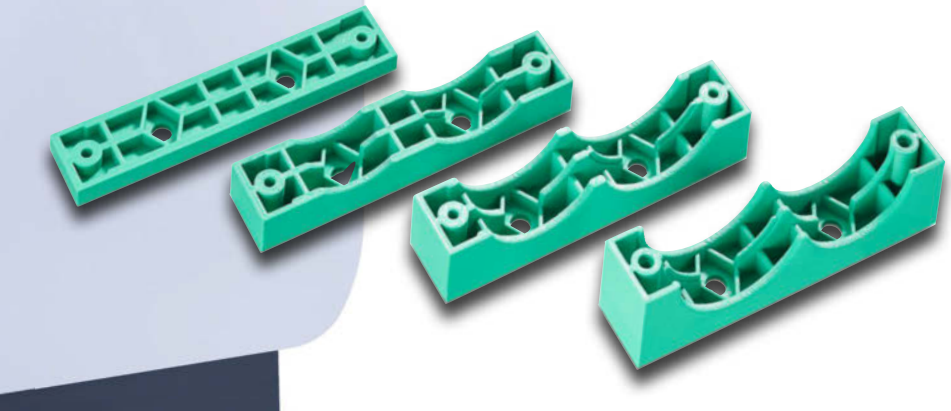
Without requiring special skills.

Process optimisation.

Without limitation.

Using qualified granulates.

Without prior preparation.



Producing fully functional parts.

No injection mould required.

APF – more than just 3D printing:

- Making plastic products using qualified standard granulate
- Broad range of processable materials
- Individual process settings and material qualification
- High-grade mechanical properties
- Efficient use of materials

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