Air Handling Solutions in Additive Manufacturing

Air filtration along the process chain

ULT
air quality

Tailor-made solutions

One-stop shop ULT

Basic idea

Additive manufacturing is revolutionizing numerous industries, but it also presents specific challenges in terms of air quality and occupational safety.

The initial analysis phase raises fundamental questions: Where is extraction and filtration technology needed? Where is it absolutely necessary? What specific features must be considered?

Answering these questions is the cornerstone of a safe, efficient, and legally compliant working environment in additive manufacturing.

- **Which additive manufacturing process is utilized? LPBF, SLA, FDM…**
- **What types of dust or emissions are produced?**
- **Does explosion protection need to be considered? Is there a risk of fire?**
- **Are the dusts reactive?**
- **What particle sizes are produced?**
- **Which laws/guidelines must be followed?**
- **What technical parameters must be considered?**
- **What air handling measures are necessary?**

Process diversity in additive manufacturing

Additive manufacturing offers an enormous variety of processes that make it possible to produce almost any conceivable component. Choosing the right process depends on factors such as material, component size, geometry, and desired properties. New technologies using different materials (metal, plastic, glass, organic material, etc.) are emerging and, in turn, generating new challenges for accompanying processes.

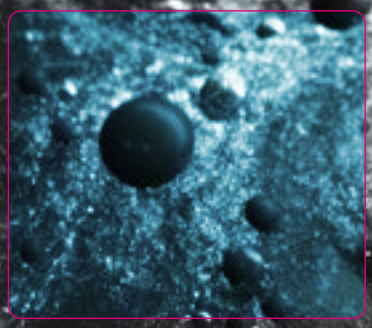
ULT provides solutions:
· Application-specific solutions
· Scalable gas purification systems
· Systems along the process chain

Finest particles: An under-estimated challenge

Contact with powders, condensates, and gases

During various process steps, users may come into contact with metal powders of different particle sizes or even condensates as separation material. Separated condensates (under inert gas, e. g., argon, nitrogen) are the biggest challenge here. Powders and condensates are highly reactive (explosion risk) and harmful to health (allergic reactions, skin and respiratory tract irritation). Contact with it must therefore be avoided at all costs. The utilization of appropriate safety measures in the form of extraction systems or process gas purification systems is essential, as it protects your health and ensures a safe production process.

Condensate



System preparation

Filter replacement

Removal of parts

System cleaning

Post processing

Dangers and risks in additive manufacturing

In addition to fine dust and condensate, solvent vapors and gases, or other waste products, can also be generated. These can also have negative effects on employee health, as well as process and product quality, and must therefore be removed.

Common processes employing extraction and filtration technology

Powder bed processes (e. g. LPBF, EBM):
· Powder handling: Fine powder particles are produced when filling and emptying the build chamber.
· Build process: During the construction process, the high energy input creates very fine particles and condensates.
· Post-processing: Fine particles are released when the component is removed from the build chamber and subsequently post-processed.

Material extrusion:
· Filament processing: During the processing of filaments, fine plastic particles and harmful gases can be produced due to thermal heating.

Directed energy deposition (DED):
· Welding fume occurs when the material is melted.

Jetting processes:
· Finest particles: Fine dust is produced when the particles are sprayed.

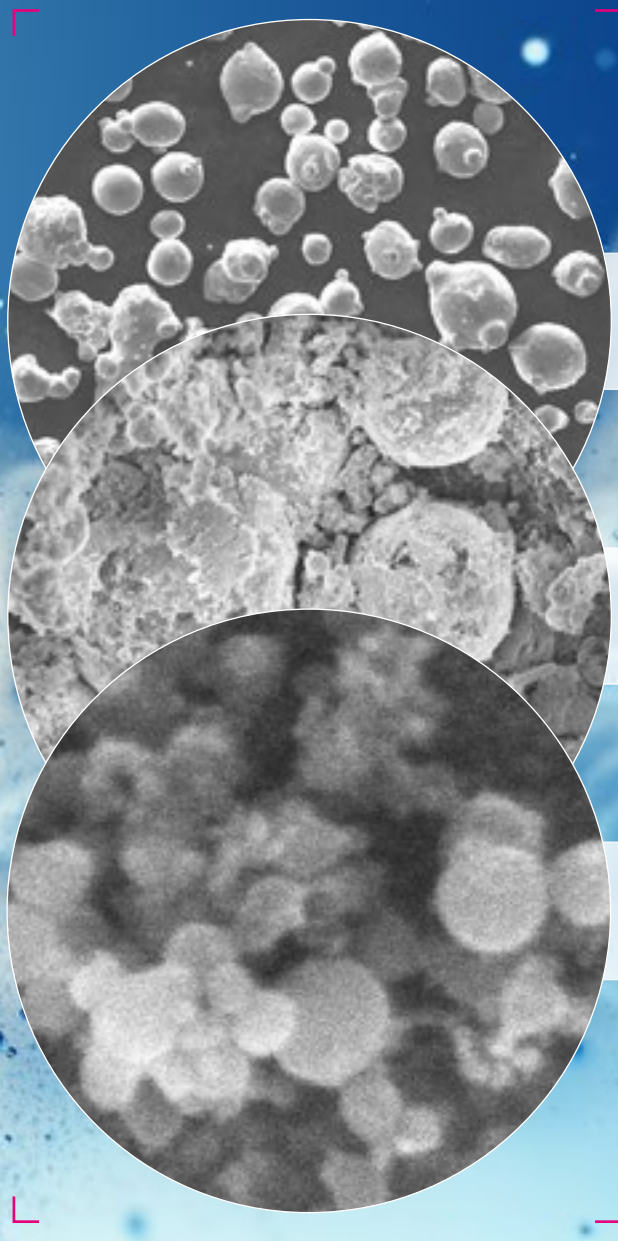
Stereolithography (SLA):
· Fumes and vapors are produced during the processing of resins and post-processing with solvents.

…and others

Which method do you use?
What are the associated risks?
We would be happy to advise you!

CONTACT

Looking closer...



Particle size 60 µm to 20 µm
e. g. powder bed material

Particle size 20 µm to 1 µm
e. g. fines from the powder bed or ultrafine dust

Particle size 1 µm to <100 nm
e. g. condensates separated under inert gas

The challenge is to avoid contact with powder, condensates, or gases. These can be highly reactive and cause serious health problems if inhaled or if they come into contact with the skin. The smaller the particles, the longer they remain in the ambient air. A 100 nm particle takes around 13 days to settle completely from a height of 1 m.

Caution: Even components resulting from a printing process can have condensate deposits, which are ultrafine emissions that can penetrate deep into the lungs and are therefore hazardous to health!

Contamination with the finest particles and...

...spread into the home environment

Standard and specialist pollutant capture

The filtration process starts with collection

Air pollutants are collected before filtration, because only what is captured can be filtered. The degree of capture forms the basis for the subsequent optimal filtration. Consequently, this results in the efficiency of the entire system and therefore the pollutant residues in the recirculated exhaust air.

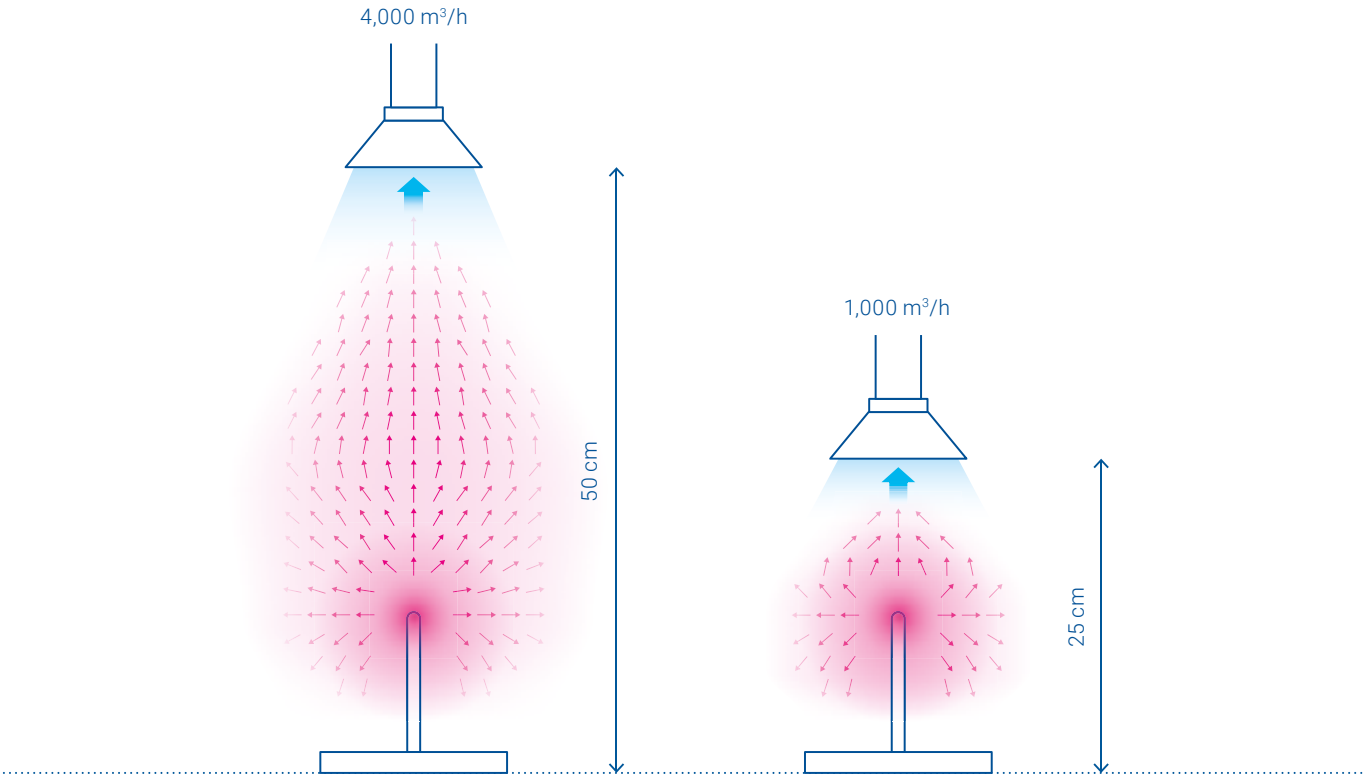
The greatest proximity to the pollutant source is crucial here.

The selection of the best-suited collection element is also of great importance. ULT is at the customer's side to provide advice and support.

Further information on the capture of airborne pollutants:

MORE ON POLLUTANT CAPTURE

BROCHURE BY THE GERMAN PROFESSIONAL ASSOCIATION VDMA



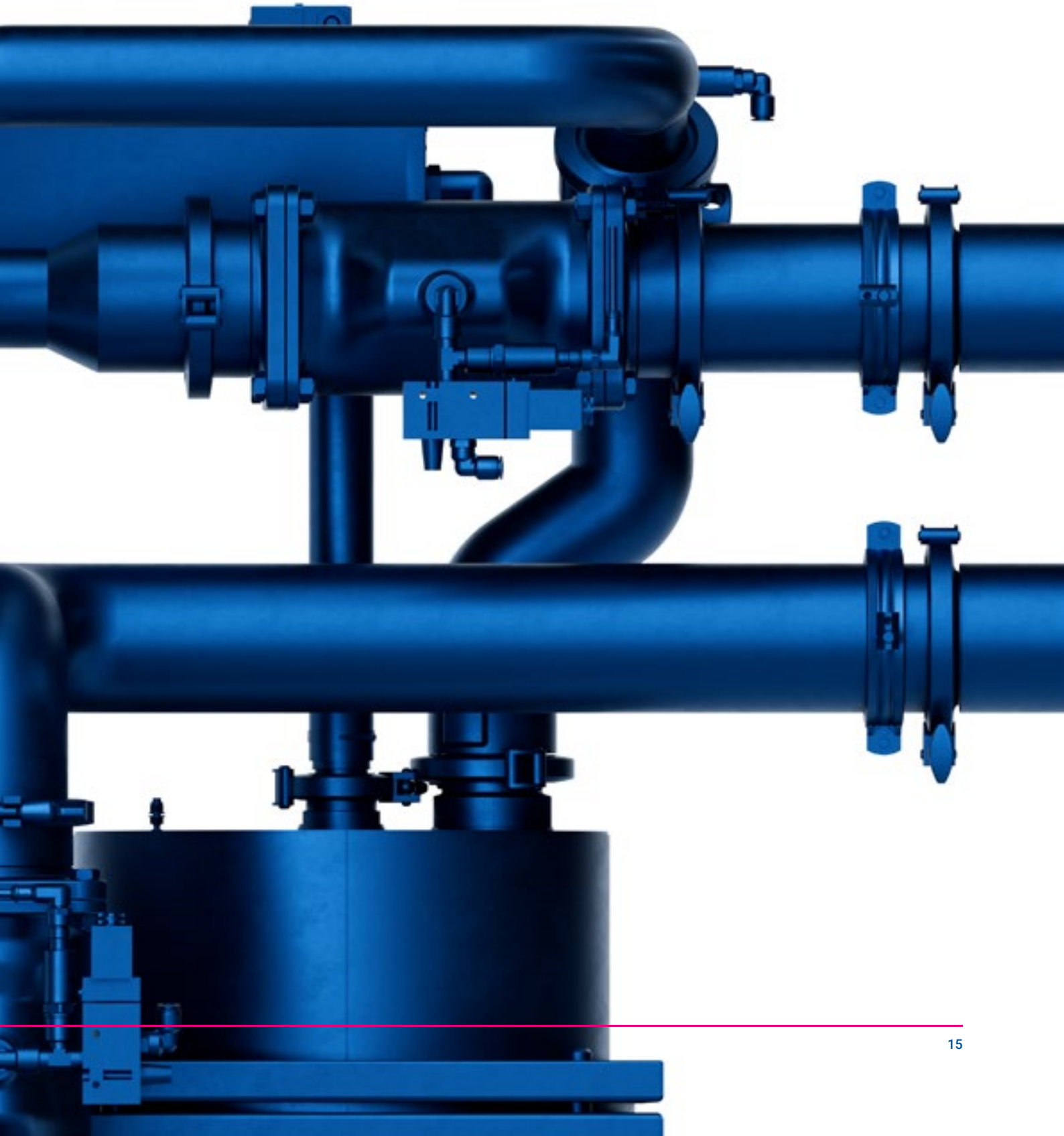

3D Printer

Design of the ducting

The design of the ducting (piping, hoses, etc.) is crucial for the energy consumption, as well as the extraction and filtration efficiency.

The flow rate within the ducting should be at least 12–20 m/s.

As a general rule: the larger the particle, the higher the flow rate. In addition, the pressure loss in the pipeline is crucial. Kinks, branches, rough inner walls, etc. can cause additional costs that can be avoided if these ducting is carefully designed at an early stage of development.



Air and gas purification along the process chain

1. Process preparation – powder handling

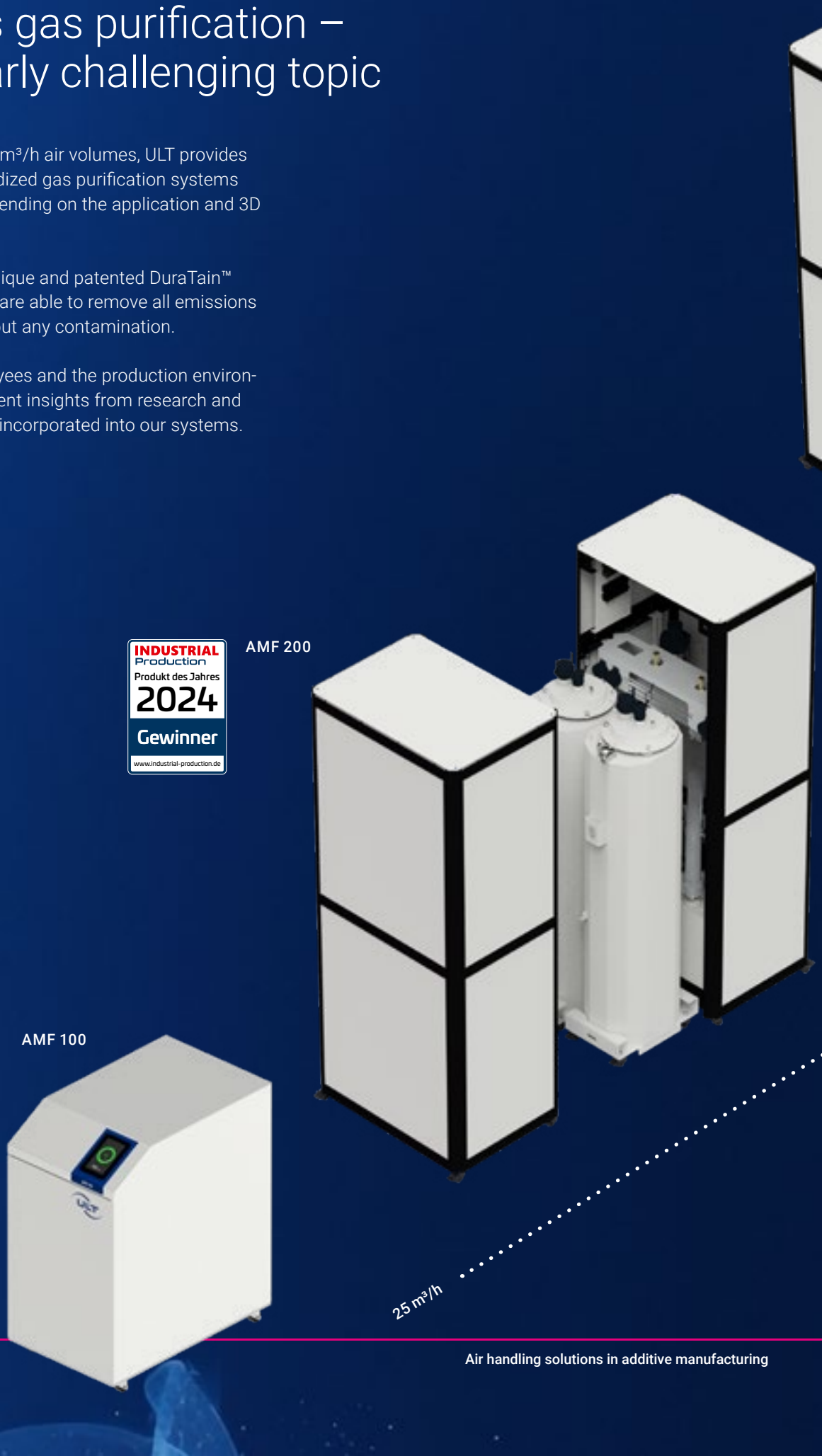

DRY TEC
ACD 160
ULT

2. Process gas purification – a particularly challenging topic

From 25 m³/h to >1,000 m³/h air volumes, ULT provides quite a range of standardized gas purification systems that can be adapted depending on the application and 3D printer version.

Based on our globally unique and patented DuraTain™ barrel technology, users are able to remove all emissions from the system – without any contamination.

This means, your employees and the production environment are protected. Recent insights from research and development have been incorporated into our systems.



AMF 200 SCALED
(MODULE)

DuraTain™ technology for filter barrels

· Maximum safety during filter replacement
· Longest filter service life on the market
· Fastest and easiest filter replacement

GLOBALLY UNIQUE
MADE IN GERMANY

Endurelon™ technology for oxidation neutralization

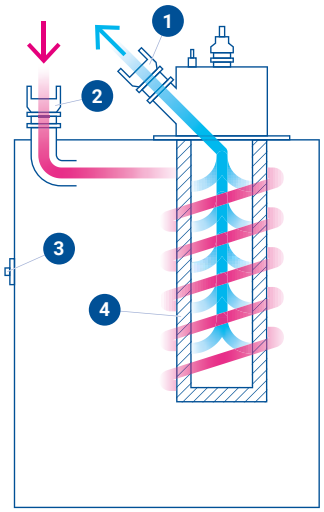
· Zero risk – from operation to disposal
· Simple and safe to use
· Sustainable throughout the entire life cycle

Globally unique barrel technology

Process gas purification for metal AM (LPBF)

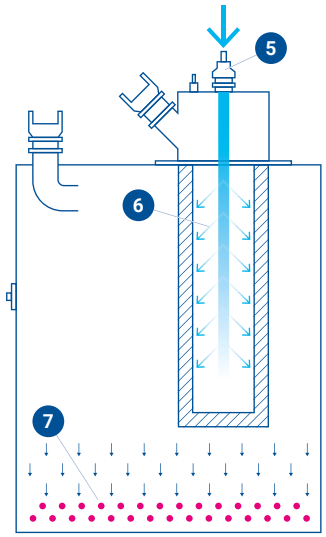
Imagine your 3D printer just keeps running and running and running – without you having to intervene…

Thanks to ULT's patented DuraTain™ Technology, this is possible – without you ever coming into contact with dust or filter elements. And when the time comes – perhaps after two years or 10,000 laser hours – it takes less than five minutes to connect a new filter barrel. For almost a decade, hundreds of our ULT systems with the DuraTain™ technology have been in operation worldwide. Our customers particularly value the technology's safety, speed, and low operating costs.



Filtration process

1. Clean gas outlet
2. Raw gas inlet
3. Transport interface
4. Filter elements



Filter cartridge cleaning process

5. Cleaning air stream
6. Filter cleaning
7. Dust hopper for separated particles

The most sustainable gas purification system worldwide

The advantages in using our DuraTain™ technology:

- **Contamination-free handling with dust waste and filters**
- **Very long service life of up to 10,000 laser hours**
- **Material change within minutes; filter barrels for different materials can be stored temporarily**
- **Easy passivation and disposal**
- **Extremely low operating costs**
- **Easiest maintenance and service**
- **Double protection thanks to the security filter**
- **Optional sensors and modules (e. g. pre-separator) can be integrated**
- **Any other requirements? We'll gladly integrate them!**

Under optimal conditions, up to two years of non-stop productivity – no filter changes, no production interruptions, no maintenance costs!

3. Post processing – manually or automated

For a clean working environment:

· Extraction and filtration of emissions
· Remove solvent vapors from the air
· Remove excess material

Manual post processing

Automated solution

Industrial air filtration – not only in additive manufacturing

ULT systems and their typical applications

VAPORS, GASES, ODORS

LASER FUME AND DUST

DUST AND FINE DUST

SOLDERING FUME

Additional air handling solutions

ULT also offers other comprehensive and technologically proven solutions for processes and ancillary processes in additive manufacturing.

SPECIALIST WEBPAGE ADDITIVE MANUFACTURING

PROCESS AIR DRYING

COMPLETE SOLUTIONS

CUSTOMIZED SOLUTIONS

EXPERT CENTER

Information on the practical application of ULT air technology in additive manufacturing can be found in our ULT Expert Center.

ULT EXPERT CENTER

25 years of concentrated experience

1999
Development of the first gas purification system for the Laser Powder Bed Fusion (LPBF) process

2014
Development of the M-400 series (cleanable filters) for gas purification in LPBF processes

2015
Development of a modular device system for odor and pollutant removal in 3D plastic printing

2016
Development of the GRS-80 series (storage filters) for gas purification in LPBF processes

Grown together with a market

Additive manufacturing (3D printing) has its roots in the 1960s and was initially used for rapid prototyping. In the late 1990s, it developed into an industrial production method whose applications range from prototypes and tools to end products.

That's where ULT came into play.

Through intensive collaboration with leading industrial partners and continuous research and development, we have developed innovative process solutions. Our goal has always been to grow together with our customers and offer top-notch solutions. In close cooperation with industry and research, we drive the further development of our products and set new standards in the sector.

2017
Development of encapsulated pollutant handling (barrel technology), which prevents users from coming into contact with hazardous substances

2018
Development of a filtration system for the cold spray process

2022
Development of the AMF-200 series: a modular system for gas purification in LPBF processes

2024
Winner of the "Product of the Year" award from Industrial Production magazine with AMF 200. Development of the AMF 60 series for compact 3D printing systems.

2025
Development of the gas purification system AMF 100

Research and development – driving force and core priority at ULT

We live in a world of change: standing still means falling behind.

Straightforward and precise:
We continuously invest in research and development for new technologies and market-leading solutions.

Future-oriented:
We drive innovation and are already working on the solutions of tomorrow.

Important collaboration:
We are partners of universities, institutes, and industry in many research projects.

Our commitment:

- Membership and board work in various industry associations such as VDMA, VDI, VE.MAS, and others.
- Participation in the development of standards and guidelines.

ULT COMMITMENT

R&D AT ULT

Extensive network

VDMA VDI Bundesministerium für Bildung und Forschung


ULT

Intelligent solutions for best air quality

ULT AG

ULT – air quality

Since the air quality is of fundamental importance for work and production processes, ULT, as a full-service provider, develops air purication solutions for the highest demands—to protect employees, equipment, products, and the environment.

The reliability of our products ensures manufacturing processes and the profitability of our customers.

The proximity of the ULT experts to the processes and requirements of our customers enables the development of tailor-made and needs-oriented solutions—from the standard product to the individual system.

Our own research and development department as well as numerous cooperations with professional associations, education institutions and industry form the basis for the permanent further development of our ventilation systems and solutions for the best air quality of tomorrow.

Made in Germany.

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