
FormUp 350
AddUp
BeAM
MODULO 400
an AddUp company
AddUp
GLOBAL ADDITIVE SOLUTIONS

AddUp

GLOBAL ADDITIVE SOLUTIONS

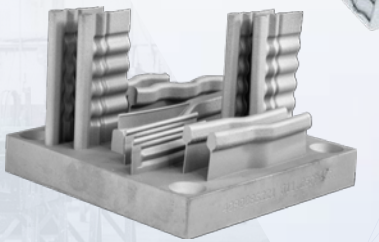
AddUp was created by Michelin and Fives after determining that the metal Additive Manufacturing (AM) machines on the market were not able to meet their requirements for high quality, serial production of maraging steel tire mold inserts. The collaboration sought to develop a Laser Powder Bed Fusion (L-PBF) machine that could build tire mold inserts and industrial parts with quality, accuracy, and repeatability at scale.

EXPERTISE IN AM DEVELOPMENT & SERIAL PRODUCTION

Since 1889, Michelin has been manufacturing tires for automobiles, aircraft, space shuttles, heavy equipment, motorcycles, and bicycles.

Today, Michelin is working with tires, around tires, and beyond.

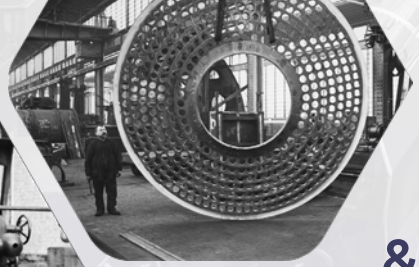
Michelin began utilizing additive manufacturing in 2002 for tire mold tooling and produces more than 1 million tire sipes using additive each year in a 24/7 lights out facility.



michelin.com

MICHELIN

A BETTER WAY FORWARD



EXPERTISE IN MACHINE DESIGN & MANUFACTURING

The historic origins of Fives dates back to 1812 and coincides with major industrial and economic world events. Fives is responsible for some of the most impressive achievements of the industrial age, including the first steam locomotives, the Pont Alexandre III deck arch bridge in Paris, the metal framework of the former Gare d'Orsay rail station in Paris, and the elevators for the Eiffel Tower.

fivesgroup.com

fives

A 50/50 JOINT VENTURE WITH INHERITED 210+ YEARS OF INDUSTRIAL MANUFACTURING EXPERIENCE

CREATED BY INDUSTRY FOR INDUSTRY

Quality, productivity, repeatability, and reproducibility are at the heart of our mission, whether for the design of our machines or the production of your parts. Our experts are here to help you, from qualification of your applications, to complete integration of additive manufacturing into your workshop.

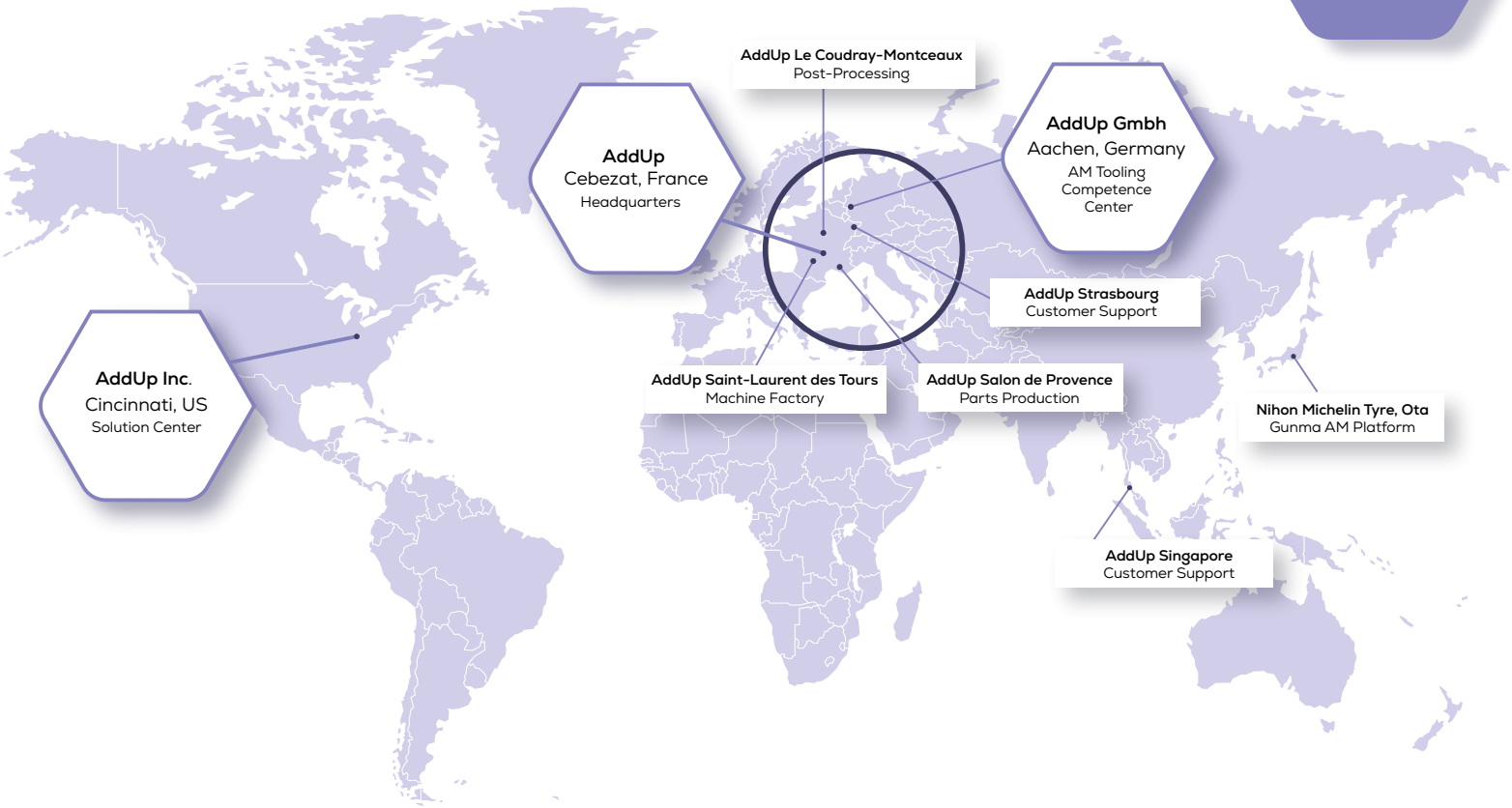
Fully Adaptable to Our Customer's Journey

We can support our customers through qualification and help scale to production.

Design & Manufacturing Experience

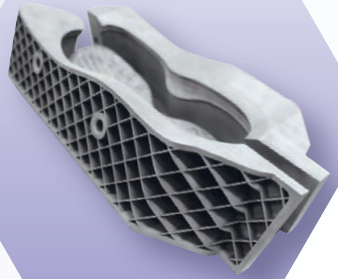
Our experience and partnerships give us the know-how to help solve your toughest challenges.

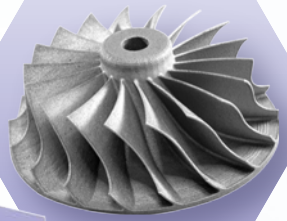
Global Additive Solutions



Customer Focused • Trusted Partner • Passion for Progress

FormUp® 350





A MODULAR, SCALABLE, POWDER BED FUSION MACHINE

PBF

POWDER BED FUSION

Find the best compromise between productivity and parts quality with AddUp's PBF technology. Our FormUp 350 machines are safe, efficient and scalable, integrating more than ten years of experience built by AddUp and Michelin in PBF technology, with safety at the heart of our concerns.

INDUSTRIAL BUILT FOR MASS PRODUCTION

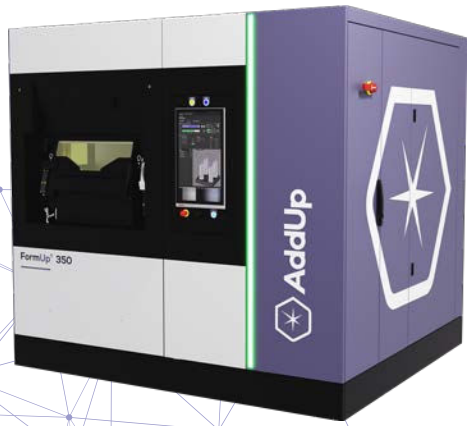
Reliability
Repeatability
Higher Yield

TIME & COST SAVINGS

Less Supports
Less Post Processing
Better Quality

MODULAR & SCALABLE MACHINES

Configurable Software
Upgradable Lasers



RECOATERS FOR POWDER BED FUSION MACHINES

Our roller system allows support-free production of your cantilevered parts and 10 µm reduction in arithmetic roughness (Ra) regardless of the surface angle.

LESS SUPPORTS

AddUp's roller increases the consistancy of the bed, reducing stresses and thermal deformations during the process

+

OPTIMAL SURFACE FINISH

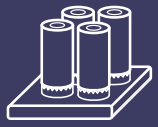
Fine powder used on the FormUp© 350 results in a surface finish as low at 4 Ra µm

=

Design Freedom

Less Post Processing

Cost Savings



Increase Productivity

AddUp's FormUp 350 is the only PBF machine to use a roller recoater combined with a fine powder particle size distribution (PSD).

MATERIALS

The architecture of the FormUp 350 allows you to use all types of metal powders, even the most reactive ones, such as titanium and aluminum alloys in fine powers. Here are some FormUp 350 tested materials:

- AlSi7Mg
- AlSi10Mg
- Ti64
- Stainless Steel 316L
- Stainless steel 17-4PH
- Maraging Steel 300
- Inconel 718
- Inconel 625
- R&D possible for other alloys

A MACHINE DESIGNED FOR OPERATOR SAFETY

Operators work in a completely safe enviornment with the FormUp 350's Autonomous Powder Module, which houses the powder storage, machine feeding, and unfused powder recovering and sieving. There is no exposure to smoke and melt residues with the inclusion of the automatic passivation filter system, which allows for safe waste disposal.

STANDARD MACHINE CONFIGURATION

SIZE	
Machine dimensions	L= 2.55 x W= 2.2 x H= 2.2 m
Weight w/o powder device	4 tons
Build volume	350 x 350 x 350 mm (~43L) - no bolt holes

POWDER	
Powder recoating device	Bidirectional roller or scraper (brush or silicone)
Autonomous powder module	For all types of powder, continous supply
Sieving	Sieving device integrated w/multiple mesh sizes
Powder recovery	High HSE powder recovery during production
Vacuum	Inerted and integrated

LASERS	
Optical type	Up to 4 Ytterbium continous fiber lasers
Laser power	500 W
Spot diameter	70 µm
Platform coverage	100% coverage by each laser
3D scanners	2 axes for X/Y displacement + 1 axis for focus
Max speed	10 m/s
Accuracy	35 µm
Wavelength	1070 nm

PART PROPERTIES	
Avg. time between production	1 hour or less
Precision	Up to 0.1 mm**
Density	Up to 99.99%**

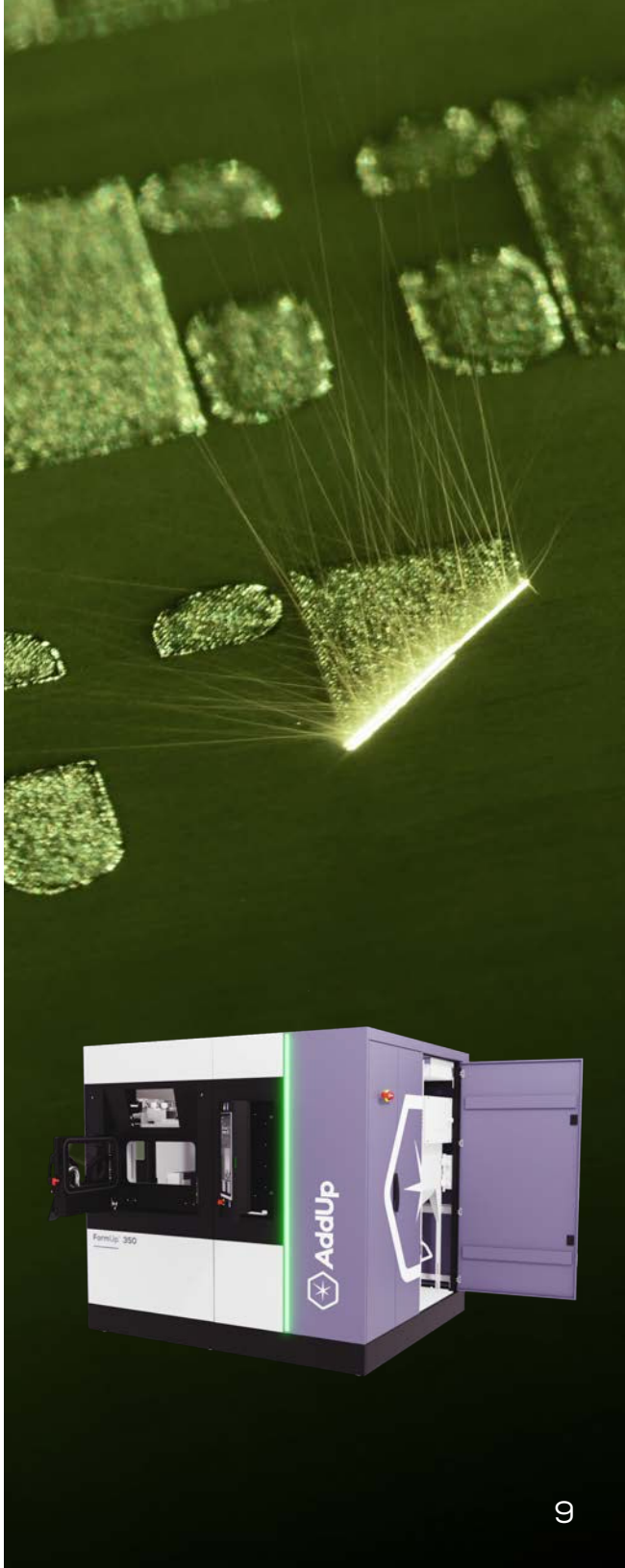
FILTRATION	
Laser glass protection	Cross jet system
Fume and fusion residue	Filtration device w/automatic unclogging Calcium carbonate residue passivation
Filter lifetime	> 3 years

GAS SUPPLY	
Gas type	Argon or nitrogen with programmable O_2 levels
Laminar flow	Adjustable from 0.5 to 3 m/s

SOFTWARE	
CAM solutions	AddUp Manager or Ntwin
Remote maintenance	AddUp Remote Control

VISUALS	
Visualization	Supervision camera on every layer

* Up to 370mm using a less thick platform
**depending on part geometry, material, and melting parameters used
***with AddUp validation

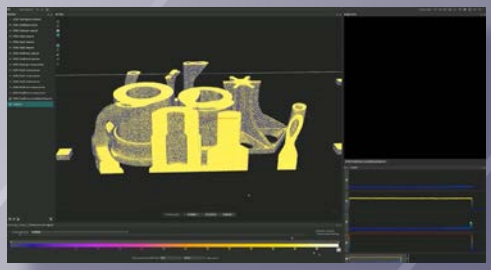


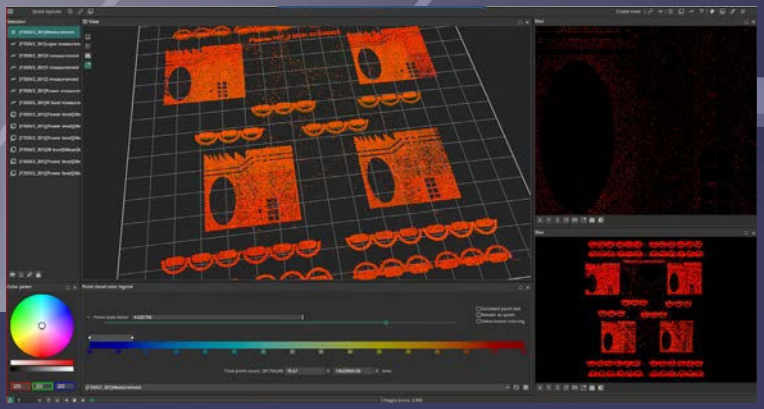
MONITORING SOLUTIONS

AddUp Dashboards

AddUp Dashboards is a multiscale monitoring software that is available with all AddUp Powder Bed Fusion (PBF) and Directed Energy Deposition (DED) machines. The software collects and displays data for an unlimited number of machines regardless of their location and displays a summary on an overview home screen. This provides a bird's-eye view of a production fleet of machines, offering status and progress at a glance. Users can see what took place during the last month or check what occured during the layering cycle for a particular build.

The AddUp Dashboards platform offers over 25 data visualization styles that can be customized to meet the needs of specific users. Panels can easily be moved, resized, duplicated, and edited to show information that is most important to your parts. The software also includes an alerting system with email notification capabilities, including custom threshold definition. This gives users the ability to informed when a machine status changes enabling them to address a potential fault before it becomes a problem.





Melting Monitoring

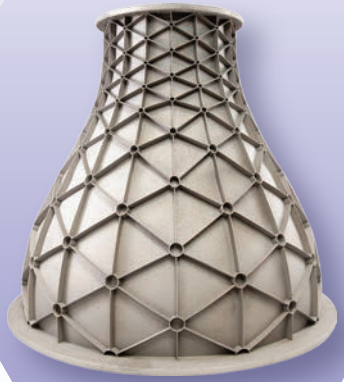
The most advanced solution in AddUp's Monitoring Suite provides visibility of the printing at the microscopic scale in real time. Several parameters are measured at high frequency, such as the position of the laser spot, the power actually delivered, and the emissivity of the melt pool temperature.

This system makes it possible to characterize any defects without destroying the part, which is beneficial for unique one-off builds. In the case of mass production, it can be used to create a footprint to serve as a point of comparison for all future production builds.

Recoat Monitoring

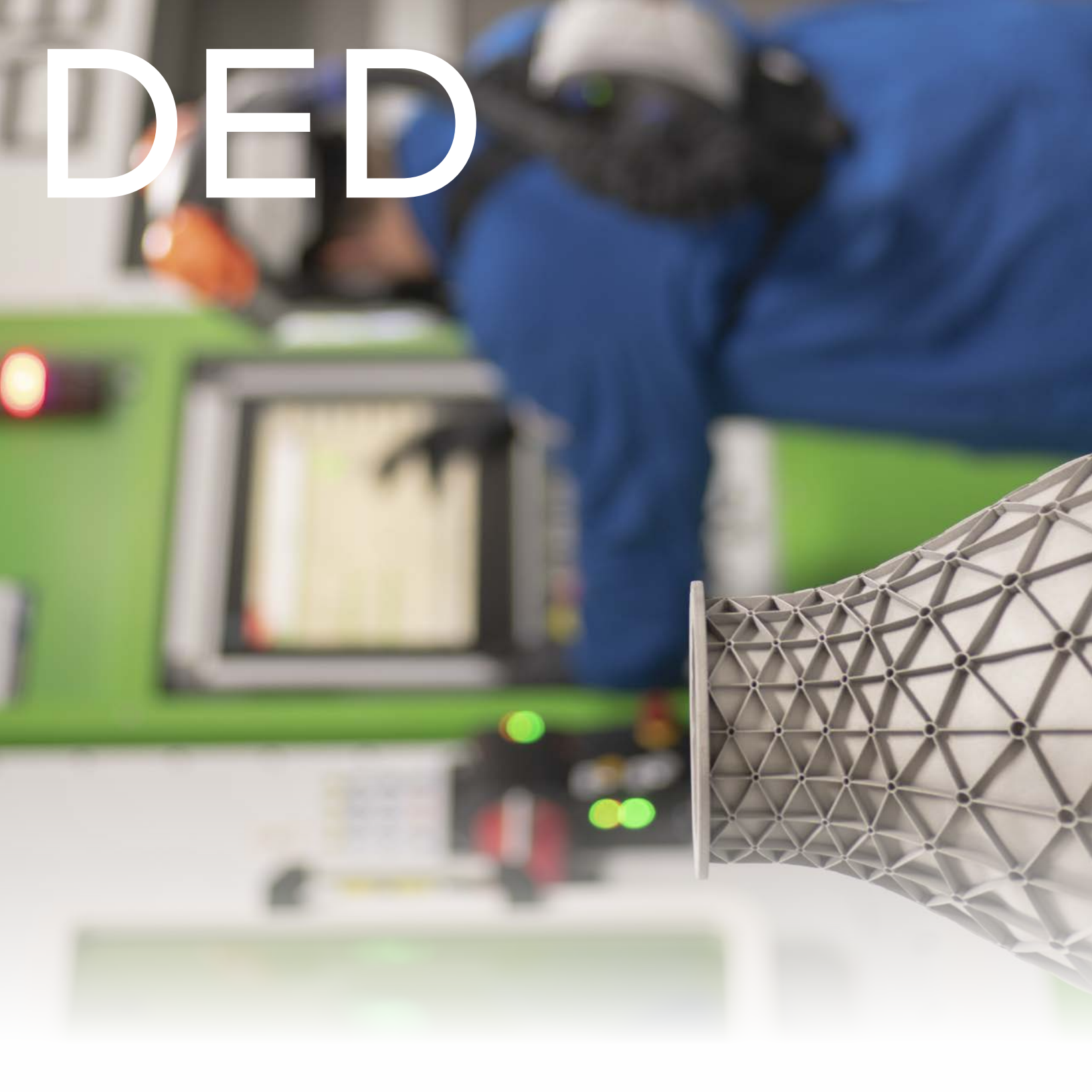
The layering phase is a key step during the production of parts in L-PBF technology. Any defects can cause melting problems or lead to a production interruption. One of the key elements in our monitoring suite offer is an automatic analysis of the quality of the bed, which proactively corrects faults during production. Operating on a closed loop principle, this analysis occurs during production and checks the homogeneity of the powder bed, revealing the possible presence of deposits or lack of powder. These algorithms allow users to assign a score and automatically triggers a correction sequence when necessary.

MODULO 400



A MODULAR, SCALABLE, DIRECTED ENERGY DEPOSITION MACHINE

DED



DIRECTED ENERGY DEPOSITION

Our DED technology is designed for industrial production and equipped with numerous production monitoring systems. Suitable for the manufacturer of large parts, the repair of worn or deteriorated parts, and adding new features to existing geometries.

INDUSTRIAL BUILT FOR PRODUCTIVITY

Reliability
High Volume
Production Ready

OPTIMIZES COST, QUALITY, & TIME

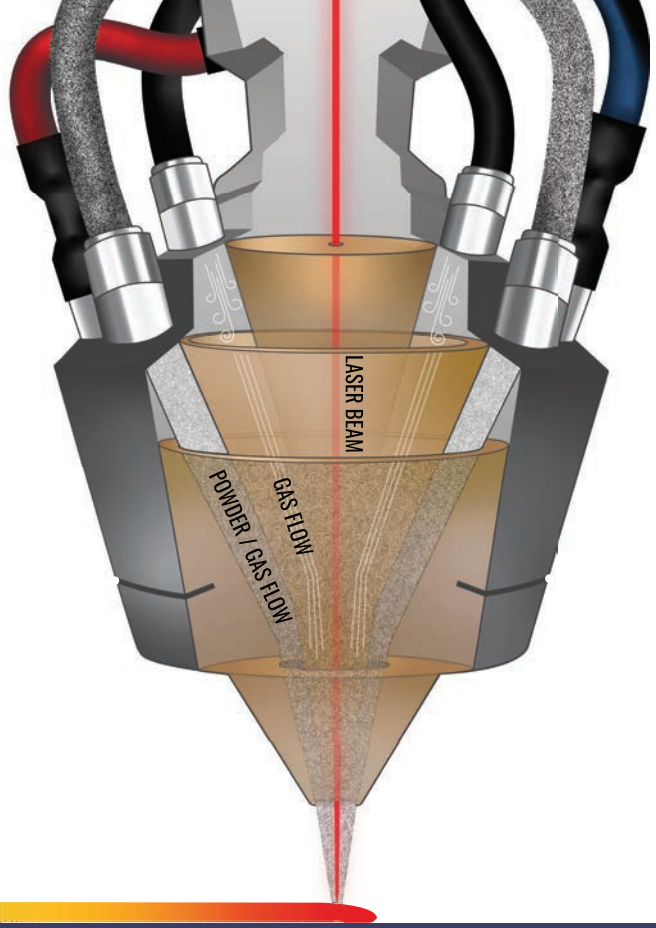
Repair Parts
Add Features
Minimal
Post Processing

VERSATILE, UPGRADABLE MACHINES

In-house Nozzle Design
Upgradable Powder Feeders

NOZZLES FOR DIRECTED ENERGY DEPOSITION MACHINES

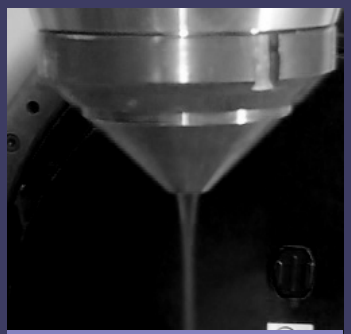
NOZZLE	10Vx - STANDARD	24Vx - OPTIONAL
Deposition width	0.8 mm-1.2 mm	1.8 mm-2.2 mm
Deposition accuracy	+/-0.1 mm	+/-0.2 mm
Average deposition rate	15-25 cm^3/hr	90-150 cm^3/hr
Laser power range	200-500 W	400-2000 W
Standard laser power	500 W	2000 W
Optical fiber type	Ytterbium Fiber	Ytterbium Fiber
Optical fiber diameter	200 µm	600 µm
Electrical supply voltage	400 v-50 Hz	460 v-60 Hz



The Co-Axial Difference

Our in-house designed nozzles achieve a smoother finish, with better meltpool control, and less overspray for minimal post processing.

Single Gas Flow

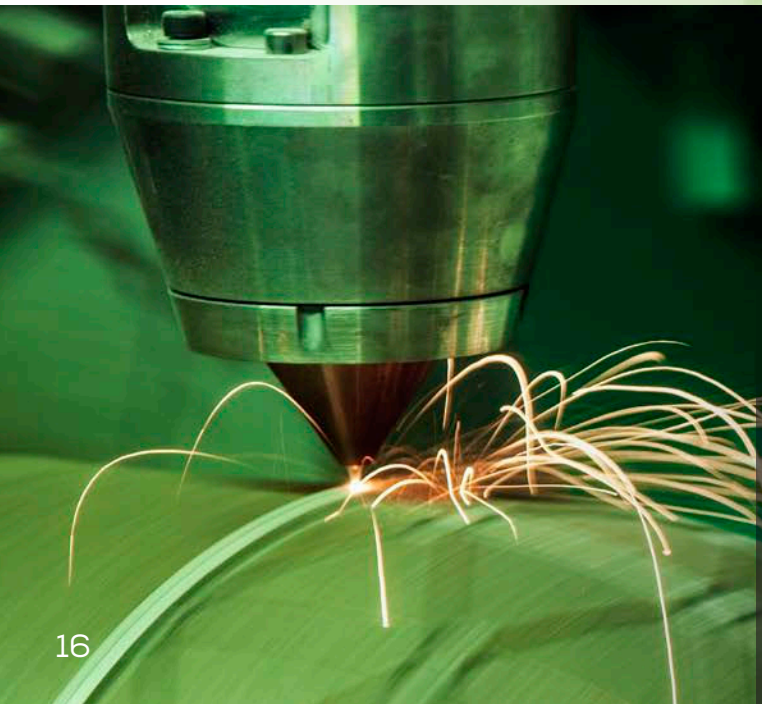


Dual Gas Flow

MATERIALS

Our Directed Energy Deposition machines allow the use of many different types of metal powders. Here are some of our machine tested materials:

- Ti64
- Stainless steel 316L
- Stainless steel 17-4PH
- Maraging steel 300
- H13
- CoCrWC
- CuAl
- Inconel 625
- Inconel 718
- Hastelloy X
- R&D possible for other alloys



All depostion parameters are modifiable:

- Powder mass flow
- Deposition speed
- Laser power

To optimize the material properties:

- Optimize the height to width ratio and the layer dilution
- Minimize porosity
- Optimize the microstructure
- Minimize the heat affected zone
- Avoid material oxidation

STANDARD MACHINE CONFIGURATION

SIZE	
Overall machine height	2820 mm
Recommended height	3500 mm
Max floor load	200 kg/m^2
Total machine weight	6600 kg

POWDER	
Powder feeder count	2
Powder feeder technology	Vibration
Powder feeder capacity	2.5 L (approx. 13 kg of standard steel)
Powder flow rate range	1 - 50 g/min
Closed loop control system	Optical sensor of the amplitude displacement

MECHANICAL DESCRIPTION	
Axis count	Simultaneous 5
Linear axis stroke	X= 800 mm, Y= 410 mm, Z= 450 mm
Rotary axis stroke	B= +/-110°, C= +/-360°

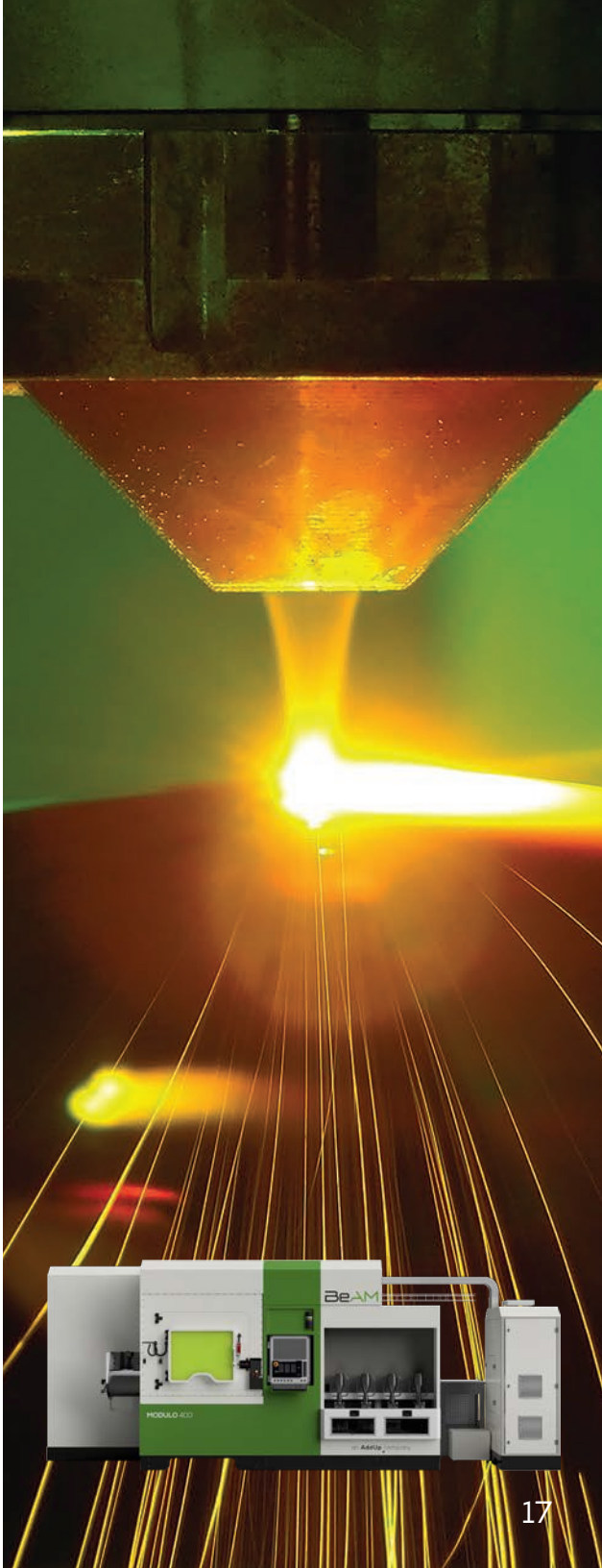
TABLE	
Table diameter Ø	400 mm
Build volume	650 x 400 x 400 mm
Maximum table load	100 kg
Sensors	Temperature Sensors
Monitoring	Optional process monitoring package

CNC	
Controller	Siemens 840DSL
Compatability	G-code

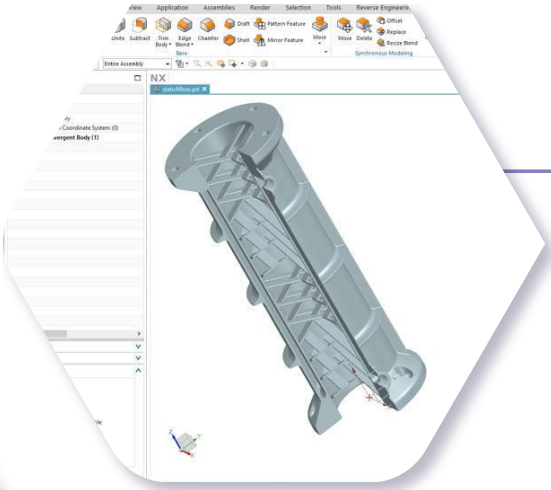
FILTRATION	
Laser filtration	Door
Air extraction filtration	3 levels: Prefilter, HEPA, Chemical Filter

GAS SUPPLY	
Gas required	Argon
Gas consumption	Up to 20 L/min

OPTIONAL CONFIGURATION	
A	24Vx nozzle with 2000 W laser
B	Controlled atmosphere
C	Automatic tool changer
D	Touch probe (requires option C)
E	Electrical supply 400 V/60 Hz
F	Additional hoppers

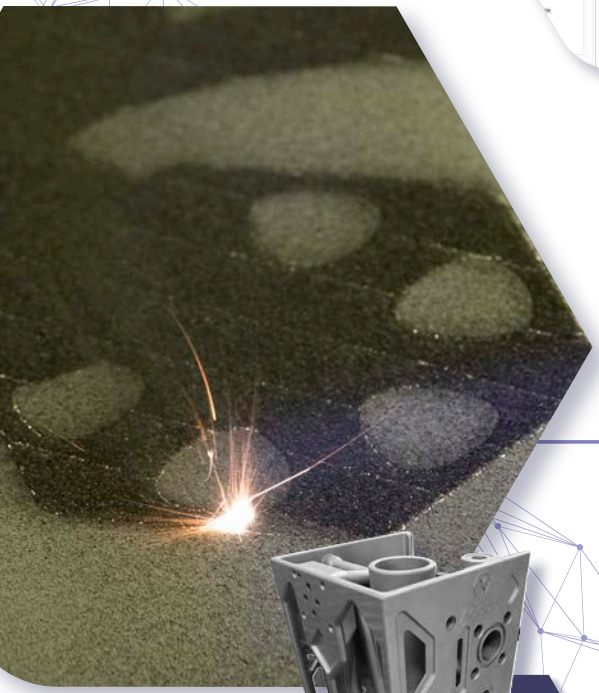


APPLICATION DEVELOPMENT



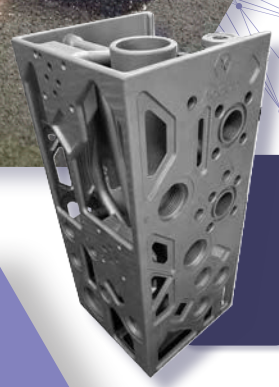
DESIGN

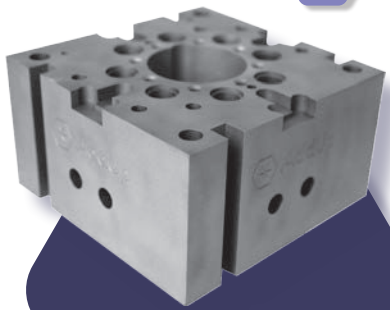
- Design Assistance
- Optimization for AM
- DfAM qualified engineers



PRINT

- Over 40 Machines deployed globally
- 20+ materials
- 4 global production facilities with the highest HSE standards





QUALIFY

- Metallurgical labs
- Quality Assurance Software
- Certifications:
  ITAR (USA), ISO 13485:2016 (USA),
  AS9100 (USA), ISO 9001:2015 (USA)
  EN9100 (FR), ISO 9001:2015 (FR),
  ISO 14001 (FR)

SCALE

- Build your AM workshop
- Global customer support
- Industrialize the process to your space and needs

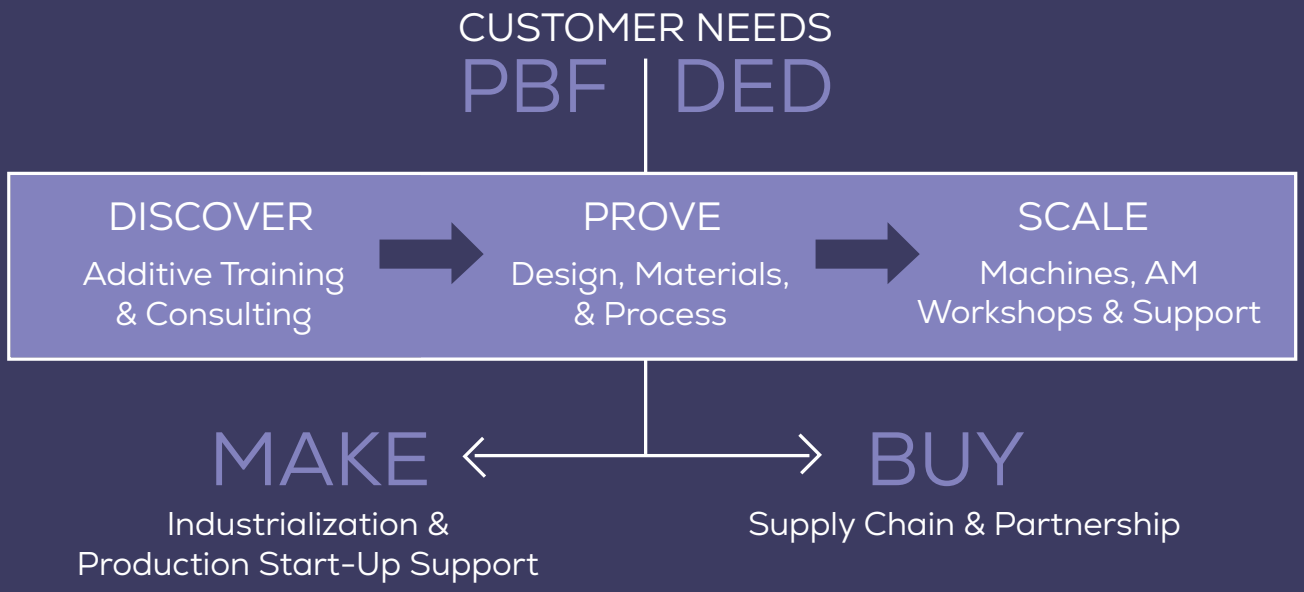
AT ANY STEP OF YOUR PROJECT, WE HAVE THE EXPERTISE TO SUPPORT YOUR JOURNEY

AddUp's FormUp 350 PBF machine is modular and scalable to provide high quality fine feature parts and industry leading productivity, all while adhering to the highest level of safety standards.

Our DED machines are designed for industrial production and are equipped with in-house designed and developed nozzles to optimize precision and productivity.

AddUp also provides a complete monitoring solution providing quality assurance after each and every build.

HIGHLY ADAPTABLE TO YOUR NEEDS AND STRATEGY



fives

MICHELIN
A BETTER WAY FORWARD

With over 210 years of inherited expertise and a focus on progress and the growth of our customers, AddUp is your trusted partner for metal additive solutions.

CONNECT

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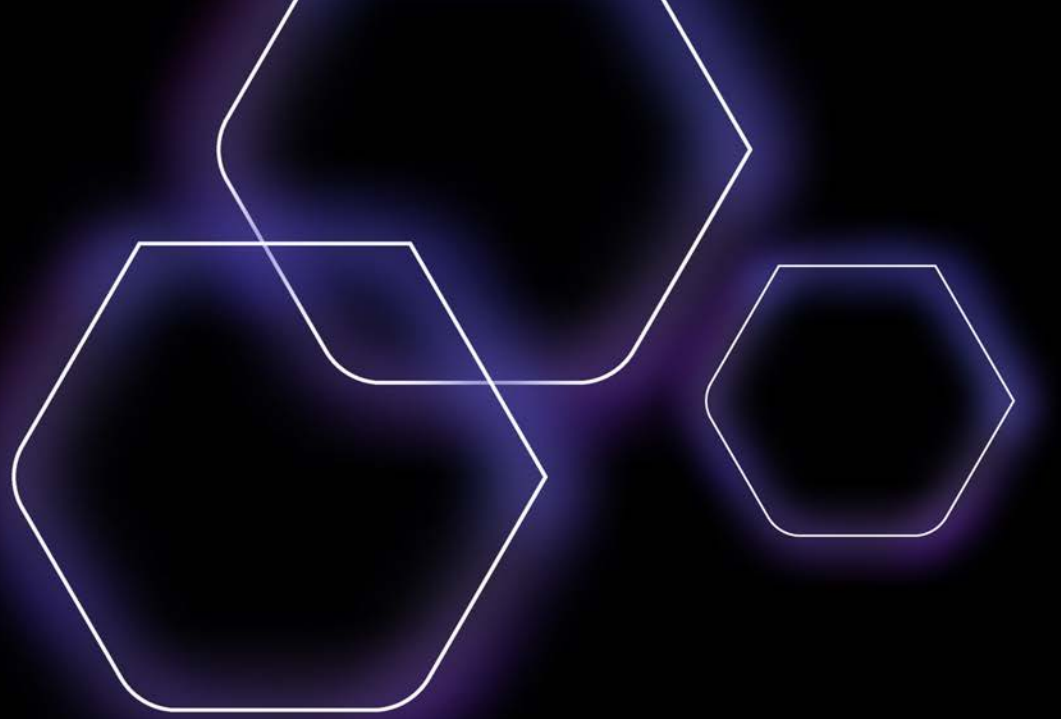
- AddUp_Solutions
- AddUp Solutions
- www.addupsolutions.com



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