ADDITIVE MANUFACTURING TECHNOLOGIES // AMT

AUTOMATED POST PROCESSING SOLUTIONS FOR ADDITIVE 2.0 MANUFACTURING

POSTPRO DP STUDIO • POSTPRO DP • POSTPRO DP PRO • POSTPRO DP MAX • POSTPRO SB • POSTPRO SF PP • POSTPRO SF100

AUTOMATED POST PROCESSING SOLUTIONS FOR ADDITIVE 2.0 MANUFACTURING

CONTENT

Joseph Crabtree
CEO and Founder

ABOUT AMT

AMT is a 3D printing technology company dedicated to unlocking 3D printing as a viable alternative to traditional manufacturing through its suite of post processing hardware.

PostPro, developed by AMT, is a digital post processing technology platform that automates the manual and costly steps associated with legacy additive 1.0 'low volume & prototyping' post processing and enables functional 'high-volume end-use parts' production from 3D printers.

PostPro allows companies to leverage the benefits of additive manufacturing at scale, by providing an order of magnitude improvement in part throughput, performance, quality, cost and safety.

AMT's technology platform currently underpins a significant proportion of the world's largest 3D printing contract manufacturing companies' part finishing operations. The systems are deployed across 30 countries in over 300 locations, and to date over 10 million parts have been processed with AMT's technology.

AMT was founded by CEO Joseph Crabtree in 2017 following his decade long experience in the traditional manufacturing industry. The company is venture backed and now has over 100 employees in the UK, Hungary, the USA, and Taiwan.

AMT POSTPRO ENABLES ADDITIVE 2.0

- CE and UL Certified
- Certified solutions for all industries
- No geometrical limitations
- Reproducible results
- Material & technology agnostic
- Reduces cost per part
- Automated, scalable, customizable

CLEANING

SURFACE FINISHING

1

2

3

4

5

UNPACKING

POSTPRO UP

DEPOWDERING

POSTPRO DP STUDIO
POSTPRO DP
POSTPRO DP PRO
POSTPRO DP MAX

SURFACE BLASTING

POSTPRO SB
POSTPRO SB PRO

CHEMICAL VAPOR SMOOTHING

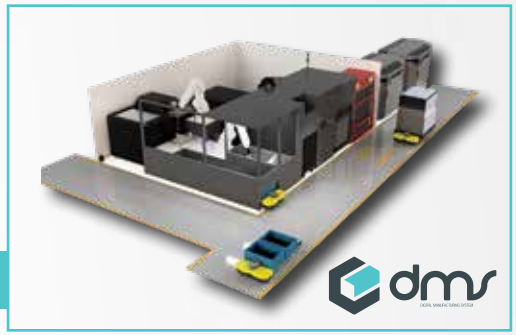
POSTPRO SF50
POSTPRO SF100

COLORING

POSTPRO COL

DIGITAL MANUFACTURING SYSTEM

6

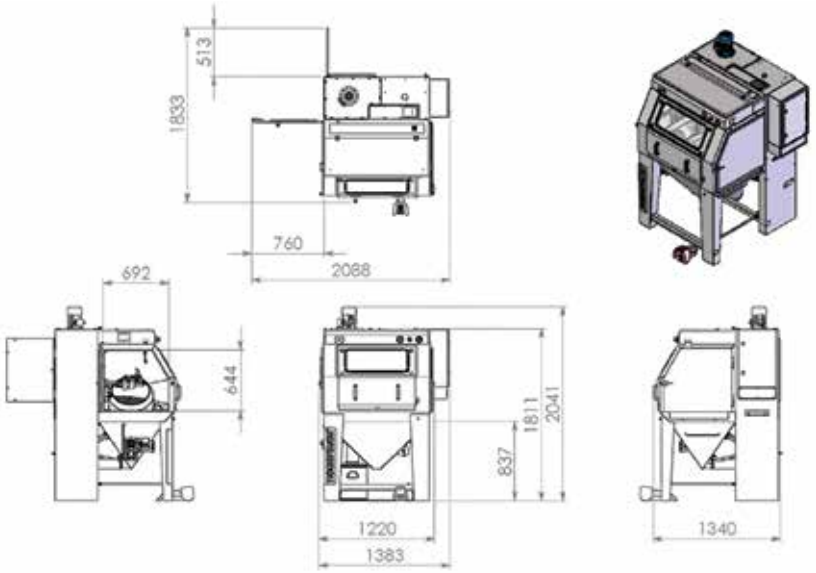


PRODUCTS

POSTPRO DP STUDIO

COMPACT DEPOWDERING SYSTEM DESIGNED FOR SMALLER PART SIZES AND STUDIO OPERATING ENVIRONMENTS.

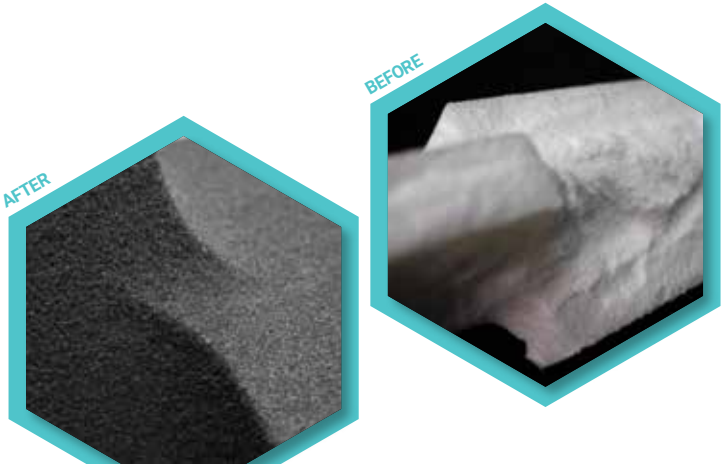
Commercially available since 2022.



TECHNICAL SPECIFICATIONS

Description	EU	US
External dimensions (w x d x h):	1383 x 1340 x 2041 mm	55 x 53 x 80 in
Effective blast room (w x d x h):	1105 x 800 x 800 mm	43 x 31.5 x 31.5 in
Working height:	840 mm	33 in
Door openings (w x h) (2 pieces):	692 x 640 mm	27 x 25 in
Basket with plastic lining and mixers: **• Dimensions** **• Maximum load (depends on product size and shape)** **• Loading weight**	 Ø450 x 210 mm 10 litre 10 kg	 Ø17.7 x 8.27 in 10 liter 22 lbs
View window left door (w x h):	450 x 300 mm	17.7 x 11.8 in
View window (w x h):	656 x 266 mm	25.6 x 10.23 in
Silica carbide blast nozzle:	Ø8 mm	0.31 in
Filter cartridges (polyester, M-class):	1 filter cartridge of 4 m²	1 filter cartridge of 4 m²
Capacity ventilator:	600 m³/h (0,75 kW)	353 cfm
ATEX classification:	**Class II 3/-D T125°C**	**Class II 3/-D T125°**
Dust emission:	< 1,8 mg/Nm³	< 1,8 mg/Nm³
Lighting:	LED light 20 Watt	LED light 20 Watt
Electrical connection:	230V, 50 Hz.	220V, 60Hz
Total power consumption:	0,85 kW	0,85 kW
Air consumption at 6 bar and 8 mm nozzle:	60 m³/h	35.5 cfm
Cabin weight (complete):	ca. 430 kg	948 lbs
Noise level:	Low noise level due to the installed silencer (<79dB(A) at 3 bar).	

amt postpro®



POSTPRO DP

ERGONOMIC DEPOWDERING SYSTEM FOR POLYMER POWDER-BED AM PROCESSES.

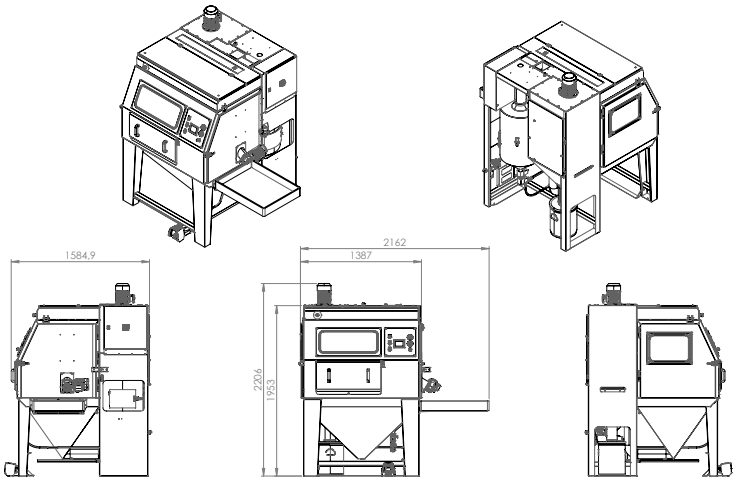
Affordable cleaning system that further reduces manual intervention in the process chain. Suitable for all common abrasives. Features include a large basket with 2 spray nozzles, ionization unit to reduce static electricity, and ventilator system with a high extraction rate to prevent windows from getting dusty. CE and ATEX certified.

Commercially available since Q2 2020.

TECHNICAL SPECIFICATIONS

Description	EU	US
External dimensions (w x d x h):	1.626 x 1.600 x 2.206 mm	64 x 63 x 87 in
Effective blast room (l x w x h):	1.320 x 940 x 1060 mm	52 x 37 x 42 in
Working height:	725 mm	28.5 in
Door openings (w x h) (2 pieces)	835 x 825 mm	35 x 31 in
View window (w x h):	656 x 266 mm	26 x 10 in
Maximum load cabinet:	350 kg	770 lbs
Basket with lining: **• Dimensions** **• Approx. volume (depends on size and form of products)** **• Maximum load**	 Ø 600 x 400 mm 30 liter 15 kg	 Ø 24 x 16 in 8 gallons 33 lbs
Blast guns basket (2 pieces):	Hardened blast guns with boron carbide nozzles (ø 8 mm)	Hardened blast guns with boron carbide nozzles (ø 0.3 in)
Filter cartridges (polyester, M-class):	2 filter cartridges of 4 m^2 each	2 filter cartridges of 4 m^2 each
Capacity ventilator:	800 m^3/h (1,1 kW)	52cfm (1.1kW)
Dust emission:	< 1,8 mg/Nm^3	< 1.8 mg/Nm^3
Atex classification:	Class II 3/-D T125°C	Class II 3/-D T125°C
Lighting:	LED light 50 Watt	LED light 50 Watt
Electrical connection:	3 x 400V, 50hz, earth and zero, 16A	3 x 480V + Earth, 60Hz, 16A
Total power consumption:	1,3 kW	1,3 kW
Pneumatic connection/pressure	G 1/2" air supply hose, 6 bar	G 1/2" air supply hose, 6 bar
Min. Pneumatic flow rate	Minimum 2.02m^3/min	Minimum 71.3 cfm
Cabin weight (complete):	570 kg	1,257 lbs

*Specifications are subject to change



POSTPRO DP PRO

AUTOMATED INDUSTRIAL DEPOWDERING SYSTEM FOR POLYMER POWDER-BED AM PROCESSES

DEPOWDERING

- Reduces time and labor cost
- Reduces scrap rate
- Ensures repeatable results
- Primes surfaces for secondary treatments e.g. chemical smoothing
- All materials and geometries

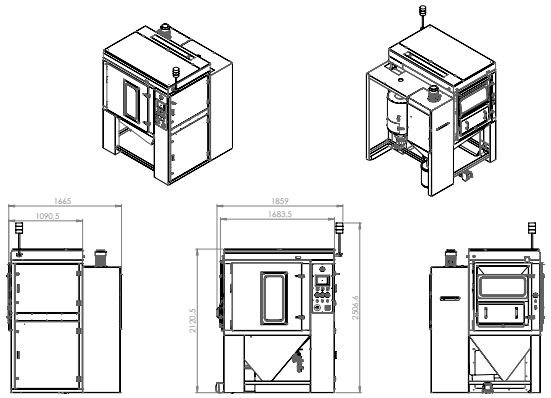
PRODUCTION-READY

- Increases throughput: large batches in 30 minutes or less
- Stores batch settings (material, build, or part-geometry specific)
- Adjustable angle of rotation for efficiency
- Reliable air filtration design extends life of media
- Ergonomic operator-friendly design
- Easy to install, use, and low maintenance
- CE and ATEX certified

Commercially available since Q2 2020.

TECHNICAL SPECIFICATIONS

Description	EU	US
External dimensions (w x d x h):	1.700 x 1.800 x 2.500 mm	67 x 71 x 98 in
Front door opening:	1.100 x 970 mm	44 x 39 in
Manual blasting door opening:	875 x 970 mm	35 x 39 in
Blasting Chamber Dimensions:	1287 x 1050 x 1100 mm	51 x 42 x 44 in
Manual Blasting Area:	420 x 1000 x 1100 mm	17 x 40 x 44 in
Basket with lining: **•Dimensions** **•Approx. volume (depends on size and form of products)** **• Maximum load**	 Ø 500 x 320 mm 20 liter 20 kg	 Ø 20 x 12.5 in 20 liter 44 lbs
Blast guns basket (2 pieces):	Hardened blast guns with boron carbide nozzles (ø 8mm)	Hardened blast guns with boron carbide nozzles (ø 0.3)
Filter cartridges (polyester, M-class):	2 filter cartridges of 4 m^2 each	2 filter cartridges of 4 m^2 each
Capacity ventilator:	900 m^3/h (1,1 kW)	52cfm (1.1kW)
Dust emission:	< 1,8 mg/Nm^3	< 1,8 mg/Nm^3
Option: HEPA filter with dust emission of:	< 0,1 mg/ Nm^3	< 0,1 mg/ Nm^3
Atex classification:	class II 3/-D T125°C	class II 3/-D T125°C
Lighting:	LED light 50 Watt	LED light 50 Watt
Electrical connection:	3 x 400V, 50hz, earth and zero, 25A	3 x 480V, 60Hz earth and zero, 25A
Total power consumption:	3,0 kW	3,6 kW
Min. Pneumatic flow rate:	Minimum 2.02m^3/min	Minimum 71.3 cfm
Cabin weight (complete):	ca. 1.000 kg	Ca. 2205 lbs
Pneumatic connection/pressure:	3/4 inch air supply hose, 6 bar	3/4 inch air supply hose, 6 bar



POSTPRO DP MAX

FULLY AUTOMATED INDUSTRIAL 2-IN-1 DEPOWDERING & SHOT BLASTING SYSTEM FOR MAXIMUM THROUGHPUT

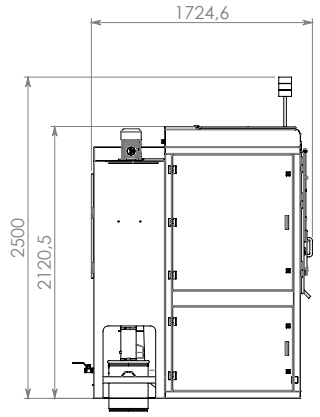
ADVANTAGES OF POSTPRO DP MAX

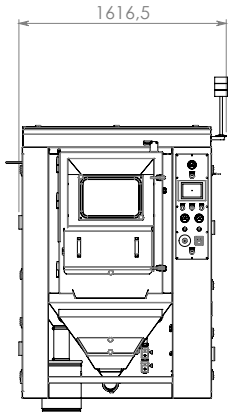
- Powered by continuous tumble belt technology for maximum throughput and part size flexibility.
- Designed for large parts and / or large batches of parts.
- Automated and ergonomic loading and unloading to and from the transport container.
- Processing volume of up to 63 liters.
- Moving nozzles speed up the process for maximum throughput.
- Built in cyclone for efficient dedusting and cleaning of the media.
- Compact design to reduce floor space.
- Safe and robust industrial design.
- Digitally connected to communicate with other EMS.
- Low maintenance cost.
- ATEX certified.

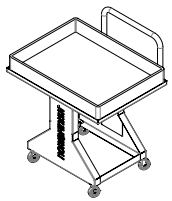
Commercially available since Q2 2021.

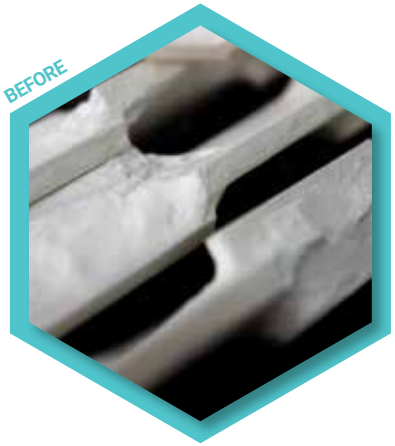
TECHNICAL SPECIFICATIONS

Description	EU	US
External Dimensions	1,617 x 1,725 x 2,500 mm	64 x 68 x 99 in
Front Door Opening	770 x 1070mm	30 x 42 in
Processing Belt - Dimensions	Ø590 x 770mm	Ø23 x 30 in
Processing Belt - Volume	63 Liter (part dependent)	63 Liter (part dependent)
Processing Belt - Maximum Load	20Kg	44 lbs
Blast Guns	3 x Hardened blast guns with boron carbide nozzles (ø 8 mm)	3 x Hardened blast guns with boron carbide nozzles (ø 8 mm)
Filter Cartridges	2 x Polyester, M-Class, 4m²	2 x Polyester, M-Class, 4m²
Ventilator Capacity	800 m³/h (1,1 kW)	52 cfm (1,1 kW)
Dust Emission with HEPA Filter	< 0,1 mg/ Nm³	< 0,1 mg/ Nm³
Dust Emission without HEPA Filter	< 1,8 mg/Nm³	< 1,8 mg/Nm³
ATEX Classification	class II 3/-D T125°C	class II 3/-D T125°C
Electrical Connection	3 x 400V, 50 Hz, earth and neutral, 25A	3 x 480V, 60 Hz, earth and neutral, 25A
Total Power Consumption	3.0kW	3.0kW
Minimum Pneumatic Flow Rate	3.0m³/min	106 cfm
Cabin Weight	1,250Kg	2,756 lbs





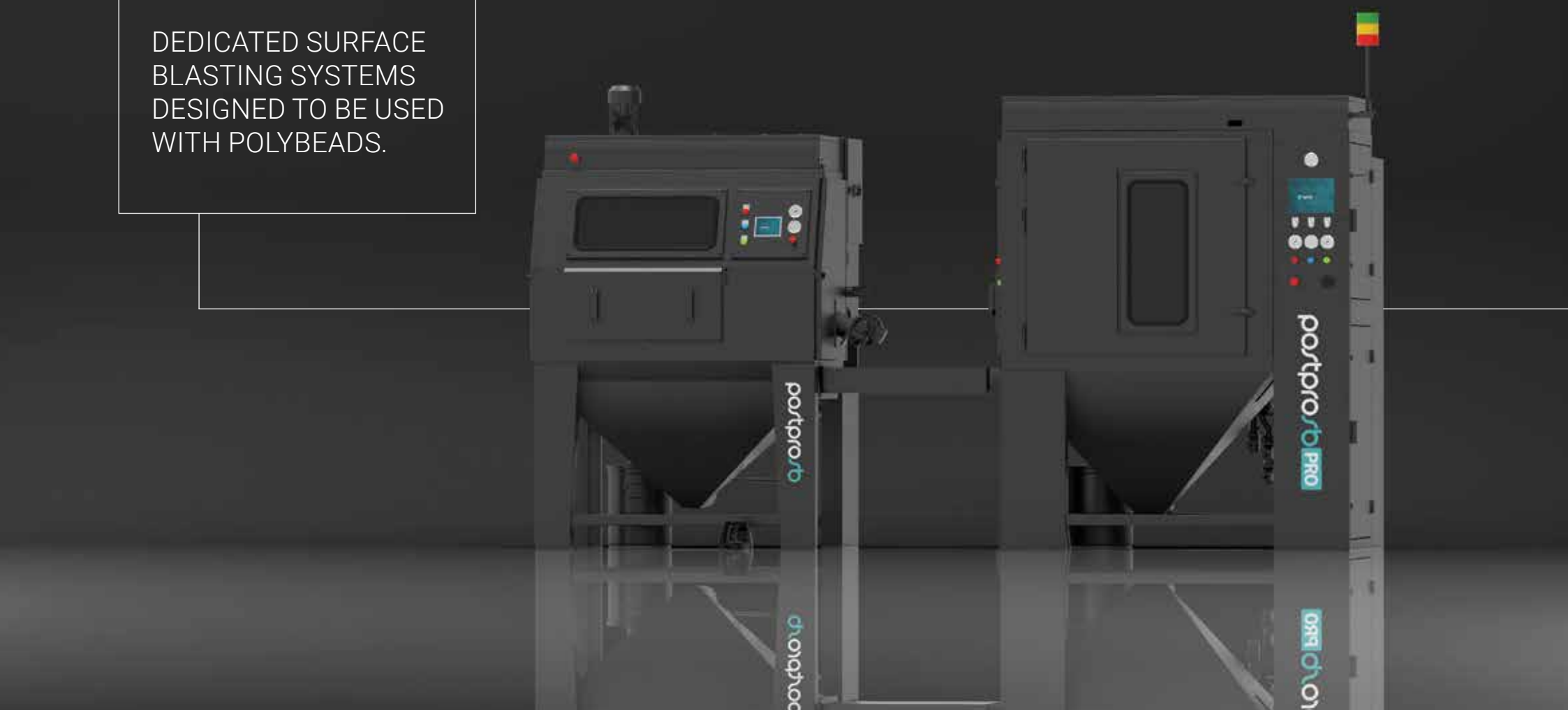




POSTPRO SB

SURFACE BLASTING SYSTEMS

DEDICATED SURFACE BLASTING SYSTEMS DESIGNED TO BE USED WITH POLYBEADS.

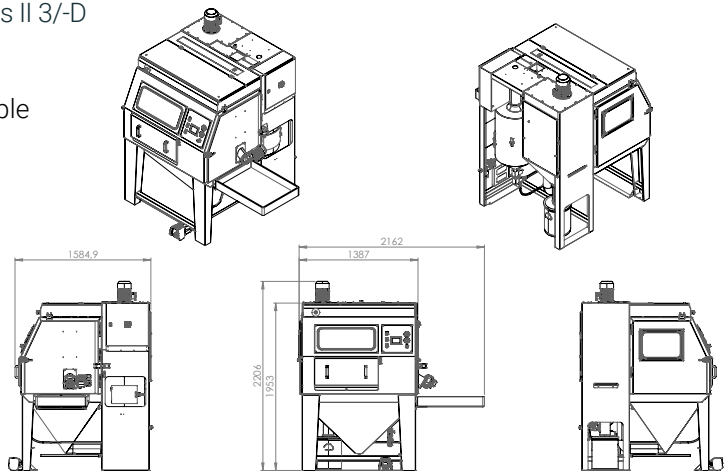


POSTPRO SB

DEDICATED SURFACE BLASTING SYSTEM DESIGNED TO BE USED WITH POLYBEADS AND HEAVY MEDIA.

The PostPro SB is CE certified and is designed to be used in processes where the consumable media and dust generated may be combustible. ATEX certified to Class II 3/-D T125°C.

Commercially available since 2022.



TECHNICAL SPECIFICATIONS

Description	EU	US
External Dimensions (w x d x h):	1,626 x 1,600 x 2,206 mm	64 x 63 x 87 in
Effective Blast Room (w x d x h):	1,320 x 940 x 1,060 mm	52 x 37 x 42 in
Working Height:	725 mm	28.5 in
Door Openings (w x h) (2 pieces):	835 x 825 mm	32.5 x 32.5 in
View Window (w x h):	656 x 266 mm	25.5 x 10.5 in
Maximum Load Cabinet:	350 kg	770 lbs
Basket with Lining: **• Dimensions** **• Approx. Volume (depends on size and form of products)** **• Maximum Load**	 Ø 600 x 400 mm 30 liter 15 kg	 Ø 23.5 x 15.5 in 30 liter 33 lbs
Blast Guns Basket (2 pieces):	Hardened blast guns with boron carbide nozzles (ø 8 mm)	Hardened blast guns with boron carbide nozzles (ø 0.3in)
Filter Cartridges (polyester, M-class):	2 filter cartridges of 4 m^2 each	2 filter cartridges of 4 m^2 each
Capacity Ventilator:	900 m^3/h (1,1 kW)	52cfm (1.1kW)
Dust Emission:	< 1.8 mg/Nm^3	< 1.8 mg/Nm^3
Atex Classification:	Class II 3/-D T125°C	Class II 3/-D T125°C
Lighting:	LED light 50 Watt	LED light 50 Watt
Electrical Connection:	3 x 400V, 50hz, earth and zero, 16A	3 x 480V + Earth, 60Hz, 16A
Total Power Consumption:	1,3 kW	1.3 kW
Pneumatic Connection/Pressure:	G 1/2" air supply hose, 6 bar	1/2 inch air supply hose, 6 bar
Cabin Weight (complete):	570 kg	1,257 lbs
Min. Pneumatic Flow Rate:	2.02m^3/min	Minimum 71.3 cfm

*Specifications are subject to change

POSTPRO SF PP

PRODUCTION READY FINISHING SOLUTION FOR POLYPROPYLENE

Validated by

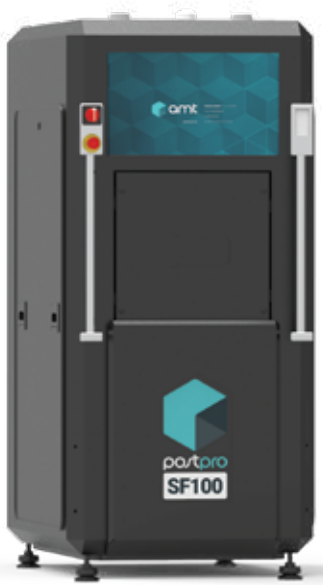
BASF We create chemistry | FORWARD AM Innovating Additive Manufacturing | RICOH imagine. change. | AM Polymers

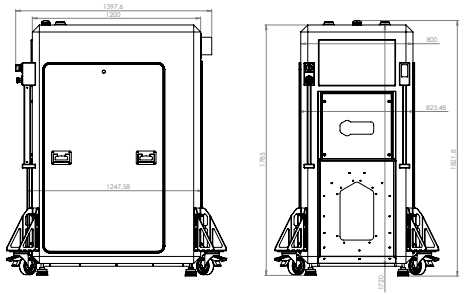
POSTPRO SF100

PATENTED, AUTOMATED CHEMICAL VAPOR SMOOTHING SYSTEM DELIVERING END-USE PARTS FOR PRODUCTION.

The PostPro SF100 is a step up in post processing technology and includes advanced features to provide a state-of-the-art production experience. PostPro SF100 has been designed and built for production environments and high-volume throughput to enable industrial scale additive manufacturing.

Commercially available since 2021. Automatic loading & unloading add-ons available. Contact AMT for more information.





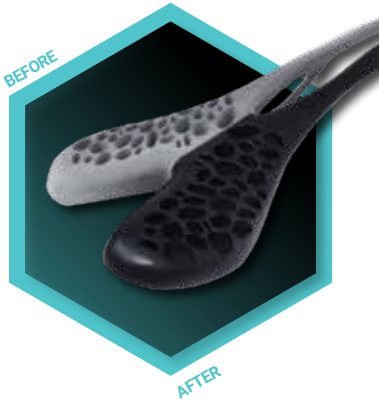
TECHNICAL SPECIFICATIONS

Description	EU	US
External Dimensions (WDH)	830 x 1400 x 1830 mm	33 x 55.5 x 72 in
Weight	850 Kg	1,875 lbs
Recommended Operating Area	2,350 x 3,200 mm	92.5 x 126 in
Capacity		
Process Chamber Dimensions (WDH)	400 x 600 x 400 mm	15.7 x 23.6 x 15.7 in
Process Chamber Volume	96 Litres	96 Litres
Consumable Canister Volume	10 Litres	10 Litres
Power		
Three Phase	300 - 400V, 50/60Hz, (L1+L2+L3+N+PE)	300 - 400V, 50/60Hz, (L1+L2+L3+PE)

Additional electrical supplies can be accommodated via an optional internal transformer. Please contact AMT for further details.

FEATURES INCLUDE:

- **Safety Circuit:** Light curtain and front mounted E-Stop button.
- **User Interface (HMI):** 1080p Full HD. 21.5" touch screen.
- **Consumable Management:** RFID canister recognition and fool proof connections.
- **Multiple Consumables:** Can be used with all of AMT's processing consumables.
- **Small Footprint:** Reduced footprint and working area requirements.
- **Chamber Loading:** Front loading at an ergonomic height.
- **User Access:** RFID controlled user access.
- **Industry 4.0 Ready:** Built-in capability to connect with MES/ERP systems.
- **Easy Transport:** Optional removable stabilizers for ease of movement and positioning during installation
- **Flexible Power Supply:** Optional internal transformer to suit the majority of local power supplies*



DIGITAL MANUFACTURING SYSTEM

END-TO-END INTEGRATED POST PROCESSING SYSTEM FOR SERIES PRODUCTION

ENABLING PRINT TO PRODUCTION ADDITIVE MANUFACTURING

AMT's DMS is a scalable modular system that is fully automated — enabled by AI and advanced robotics — with a quality management system built in to provide a real end-to-end, fully-automated, lights-out production solution for 3D printed parts.

TECHNICAL SPECIFICATIONS

CUSTOMIZED ON DEMAND

AUTOMATED LOADING/UNLOADING

Parts with different geometries can be automatically loaded/unloaded into/from the PostPro machines.

AUTOMATED INSPECTION

Parts are individually inspected to guarantee part quality and process repeatability.

AUTOMATED SORTING

Parts are sorted into bins to facilitate downstream processes.

DATA ACQUISITION

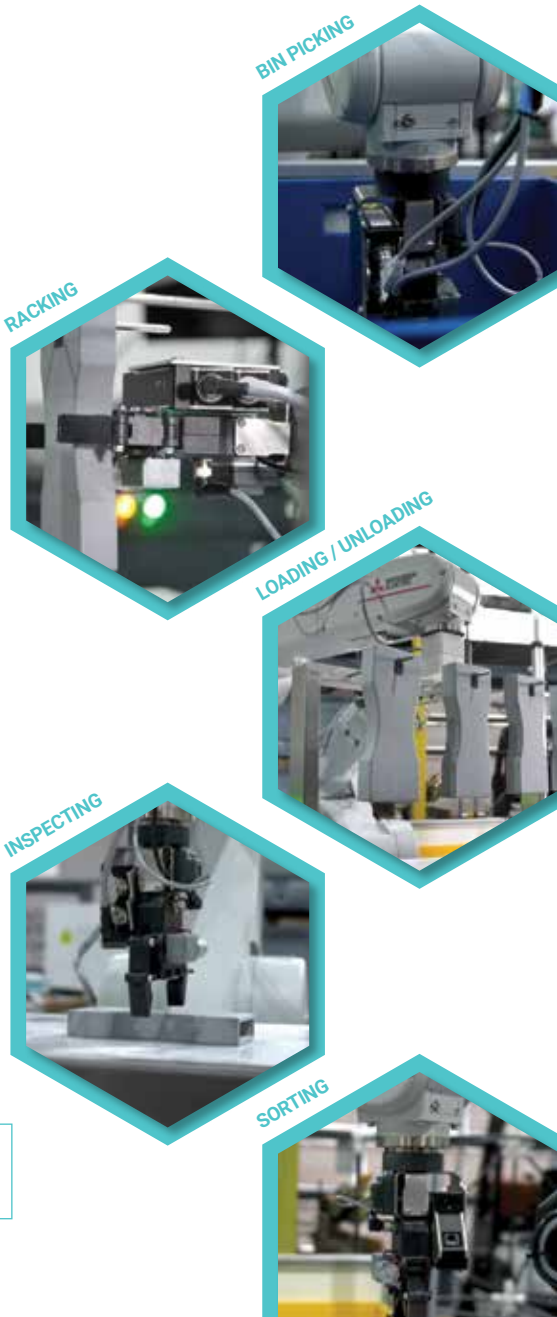
Traceable process and part parameters facilitate troubleshooting and system maintenance.

INTEGRATION

Industry 4.0 ready with workflow integration capability.

LIGHTS-OUT OPERATION

24-hour operation.



dms
DIGITAL MANUFACTURING SYSTEM

FULLY CUSTOMIZABLE TO YOUR PRODUCTION REQUIREMENTS

amt postpro SF100 AUTO-LOADING SYSTEM

MODULAR AUTOMATED LOADING SYSTEM TO FURTHER OPTIMIZE THE SF100 WORKFLOW. THE AUTOMATED LOADER EFFICIENTLY LOADS BATCHES OF 3D PRINTED PARTS TO AND FROM THE POSTPRO SF 100 SYSTEM, ENABLING LIGHTS-OUT, CHEMICAL VAPOR SMOOTHING FOR MASS PRODUCTION.

THE SYSTEM HAS BEEN DESIGNED WITH THE GOAL OF ALLOWING CHEMICAL VAPOR SMOOTHING OPERATIONS TO BE RUN UNATTENDED OVERNIGHT.

FEATURES INCLUDE

User-Configurable Behaviour: Choose what kind of parts get loaded and when. Prioritize system throughput or consumable efficiency.

Safety Circuit: The system uses scanners to detect when an operator is nearby, and stops the robot from moving until they leave. The system also has an emergency stop button.

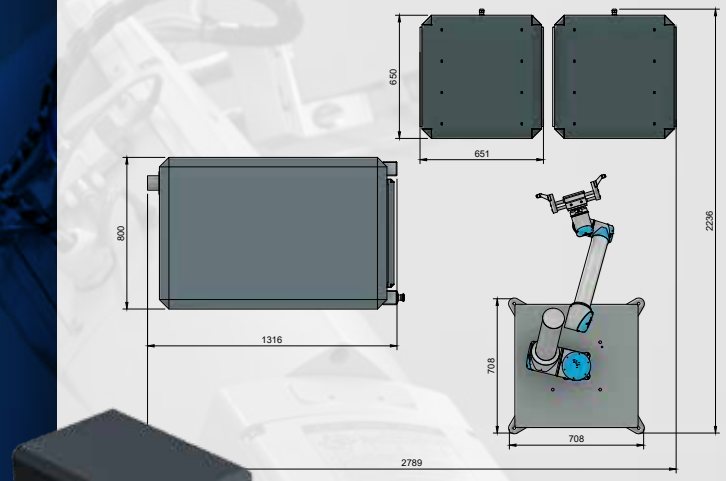
Smart Tray Monitoring: The system automatically recognizes any trays that are inserted, and the simple marker system allows the SF100 to select the correct recipe for each tray of parts.

Enhanced Storage Queue: The tray buffer holds up to 12 trays, enough for two complete SF100 cycles, or four with two buffers in the system.

TECHNICAL SPECIFICATIONS

Description	EU	US
Dimensions	3 x 2.5m	9.8 x 8.2 ft
Power Supply	Single-phase 240V, ~ 16A	
Mass (Approx)		
Robot	130 kg	286 lbs
Robot Stand Mass	80 kg	176 lbs
Control Hardware	20 kg	44 lbs
Tray Buffers	160 kg	352 lbs
SF100	850 kg	1,875 lbs

*Specifications subject to change



AMT's Automated-Loader System is now available for purchase as an upgrade option with AMT's PostPro SF100.

Contact info@amtechnologies.com, or your AMT Sales Representative for more information.

ORGANIC FINISHING AGENTS

AMT'S PORTFOLIO OF GREEN, BIO-RENEWABLE SOLVENTS WERE DESIGNED SPECIFICALLY TO FIT THE REQUIREMENTS FOR POST-PROCESSING OVER 100 THERMOPLASTIC MATERIALS.

FINISHING AGENT PORTFOLIO

POSTPRO PURE

PostPro Pure is a fully green, FDA-approved, chemistry that is sustainably manufactured. It is non-toxic, non-halogenated, readily biodegradable, non-marine pollutant, food grade and has no regulatory restrictions.

PostPro Pure is available for AMT's new PostPro SF systems, and will be made available to current and new customers on a case by case basis.

FA 9202 - POLYPROPYLENE

Finishing Agent (FA) 9202 is AMT's dedicated consumable for surface finishing Polypropylene material. Compatible with AMT's PostPro SF PP technology.

PRINTER & MATERIAL AGNOSTIC
DESIGNED FOR ANY INDUSTRY

PRINTER AND MATERIAL COMPATIBILITY

Powder Bed Fusion	SLS • MJF • HSS • SAF
Extrusion	FFF • FGF • HSE
Rigid Plastics	PA6 • PA11 • PA12 • ABS • PC • Polypropylene
Elastomers	TPU • TPE • SBC • PEBA
Composites	Glass & Carbon-filled

POWDER BED FUSION // MJF • SLS • HSS • SAF

3D SYSTEMS · EOS · FARSOON TECHNOLOGIES · HP · formlabs · voxeljet · PRODWAYS TECH

PA 11	PA 12	TPU	Polypropylene
			
			

EXTRUSION // FDM • FFF • HSE

ESSENTIUM · Markforged · stratasys · Ultimaker · Desktop Metal · Roboze

PA 6	PA 12 CF	ONYX	ULTEM
			

STANDARDS & QUALIFICATIONS TRACKER

TEST TYPE	INDUSTRY	TEST STANDARD	PRINT TECHNOLOGY	MATERIAL	PASS / FAIL
Skin Irritation	Medical	ISO 10993-10 (2013)	MJF	BASF Ultrasint TPU01	Pass
Skin Sensitivity	Medical	ISO 10993-10 (2013)	MJF	BASF Ultrasint TPU01	Pass
Hemolysis	Medical	ISO 10993-4	MJF	PA11	Pass
Cytotoxicity	Medical / Dental	ISO 10993-5 (2009)	MJF	PA11	Pass
Skin Irritation	Medical	ISO 10993-10 (2013)	MJF	PA11	Pass
Flammability	Automotive	FMVSS 302	MJF	PA12	Pass
Antibacterial Activity	Medical / Dental	ISO 22196 (2011)	MJF	PA12	Pass
Aquatic / Acute Toxicity	Medical	ISO 11348-3	MJF	PA12	Pass
Cytotoxicity	Medical	ISO 10993-5 (2009)	MJF	PA12	Pass
Intradermal Reactivity (Irritation)	Medical	ISO 10993-10 (2013)	MJF	PA11	Pass
Skin Irritation	Medical	ISO 10993-10 (2013)	MJF	Lubrizol TPU	Pass
Cytotoxicity	Medical	ISO 10993-5 (2009)	MJF	Lubrizol TPU	Pass
Food Contact	Industrial	DS/EN1186-01:2002, DS/EN1186-03:2002, DS/EN1186-14:	SLS	PA12	Pass
Skin Irritation	Medical	ISO 10993-10 (2013)	SLS	PA12	Pass
Cytotoxicity	Medical	ISO 10993-5 (2009)	SLS	PA12	Pass
Cytotoxicity	Medical	ISO 10993-5 (2009)	SLS	RICOH PP S5500P	Pass
Skin Sensitivity	Medical	ISO 10993-10 (2013)	SLS	PA12	Pass
Cytotoxicity	Consumer	ISO 10993-5(2009)	SLS	Covestro Addigy P3001	Pass
Irritation	Consumer	ISO 10993-10(2013)	SLS	Covestro Addigy P3001	Pass
Sensitization	Consumer	ISO 10993-10(2013)	SLS	Covestro Addigy P3001	Pass

Verified by Dr. Konstantin Rybalcenko
Global Head of R&D at AMT

BROAD HORIZONTAL ADOPTION ACROSS MULTIPLE INDUSTRIES

INCREASE THROUGHPUT AND LOWER COST
Our technologies generate up to a +200% return to our customers on their initial investment, when compared to manually post processing a part.

SEALED SURFACES
3D printed parts are porous and rough. Our technologies clean, smooth, and seal the surface. This enables the ability to pass regulatory testing for end-use in various industries.

FINISH AND ACCURACY
Our technologies reduce the surface roughness of a 3D printed part to that equivalent of an injection molded or CNC milled part. The process does not affect the dimensional stability of the part.

IMPROVED PROPERTIES
Our technologies improve the anisotropy of the printed part, while at the same time improving elongation at break.

CONSUMER EYEWEAR

AUTOMOTIVE

DENTAL

CONSUMER FOOTWEAR

AEROSPACE

MEDICAL

FOOD INDUSTRY

ELECTRONICS

ORTHOPEDICS

ADDITIVE MANUFACTURING TECHNOLOGIES // AMT

AUTOMATED POST PROCESSING SOLUTIONS FOR ADDITIVE 2.0 MANUFACTURING

319 S. 1st Street
Temple, TX 76504

www.impacsystems.com