


INNOVATIVE SOLUTIONS FOR METAL POWDER PRODUCTION AND PROCESSING




BLUE POWER
CASTING AND POWDER
PRODUCTION SYSTEMS



One decade of metal powder production and processing machine solutions by Blue Power – 25 years of experience in induction heating

More than 10 years ago we started to develop and produce machine solutions for the metal powder production and processing industry, e.g., **Gas Atomizers** for the production of spherical metal powder in small to medium size batches (1.5-25 l crucible volume) and **Air Classifiers** for the precise separation of metal powders.

In addition to the existing Gas Atomizer Solutions, BluePower has now launched **Water Atomizer** and **Ultra-Sonic Atomizer** solutions to meet basically all the requirements for different powder properties and applications.

The vision of BluePower is to make the metal powder production and processing technology accessible for everybody. Therefore, we have developed different machine solutions which can be customized according to the unique needs of each customer.

ADVANTAGES OF ALL OUR SYSTEMS FOR POWDER PRODUCTION AND PROCESSING:

FOR ADDITIVE MANUFACTURING, MIM, AND FURTHER APPLICATIONS

with the need for high-quality powders with high purity, sphericity, and reproducible size distribution.

FOR HIGH VALUE E.G. PRECIOUS METAL POWDER PRODUCTION

where only small batch sizes are usually required and where any metal loss must be avoided.

OXIDATION-FREE PROCESSING

Possibility of oxidation-free processing by means of degassing, vacuum, and protective gas features.

EASY HANDLING & CLEANING

The user-oriented and modular structure of the systems ensures optimum accessibility for all work as well as for inspection and maintenance. Short installation and training periods.

QUICK ALLOY CHANGE WITH MINIMUM CROSS-CONTAMINATION

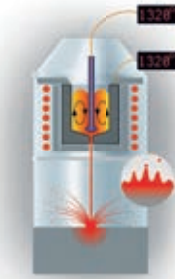
Polished stainless steel surfaces prevent powder adhesions – all parts are easy to clean without any residues. The risk of metal loss and cross-contamination is reduced to a minimum.



SPECIFIC ADVANTAGES OF OUR DIFFERENT SYSTEMS

SOLUTIONS FOR METAL POWDER PRODUCTION (VIM SYSTEMS)

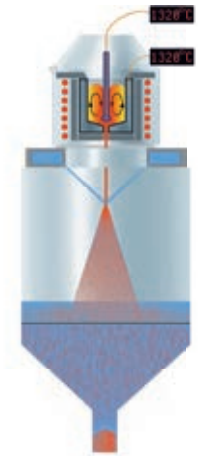
Ultrasonic Atomization AUS 500



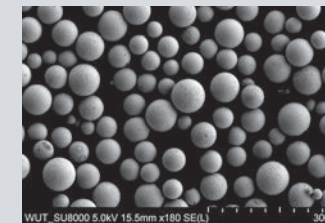
Gas Atomization AUG 1000-25000



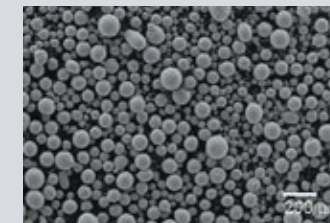
Water Atomization AUW 500-1000



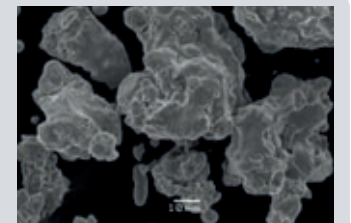
SHAPE OF THE POWDER



Maximum spherical
Ideal for LPBF, BJ, MIM, and other Additive Manufacturing processes



Highly spherical
deal for LPBF, BJ, MIM, and other Additive Manufacturing processes



More irregular
Ideal for recycling/refining processes, press & sinter processes, and others

PURITY

Very high purity
(oxidation-free processing in the closed-chamber machine by means of degassing, vacuum and protective gas features)

Very high purity
(oxidation-free processing in the closed-chamber machine by means of degassing, vacuum and protective gas features)

High purity
(oxidation-free melting by means of degassing, vacuum and protective gas features)

BATCH SIZE

Very small batch sizes
Down to ~ 100 g bronze or steel technically and financially viable

Small to medium amounts
Up to 180 kg bronze or steel per cycle (depending on version)

Small to medium amounts
Up to 9 kg bronze or steel per cycle (depending on version). Larger versions in development.

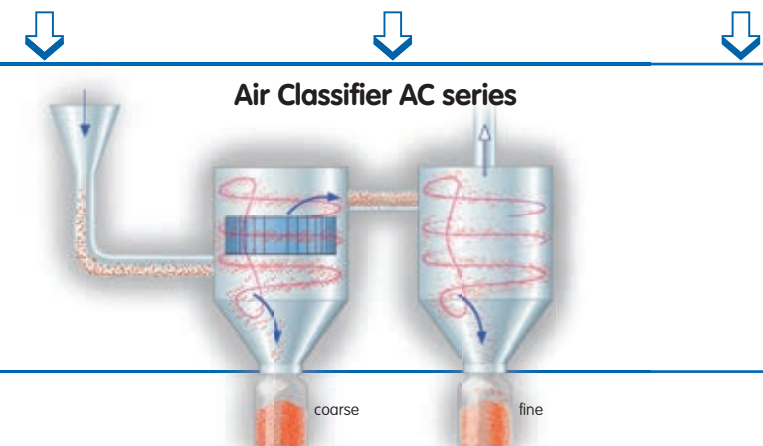
OTHER CHARACTERISTICS

From alloy creation to powder within 1 hour

Numerous variations of process parameters
allow very wide range of particle size distribution within one machine

Production of almost spherical powder is also possible

SOLUTIONS FOR METAL POWDER SEPARATION





Polished stainless steel surfaces prevent powder adhesions in spray chamber, cyclone and collector – all parts are easy to clean without any residues.

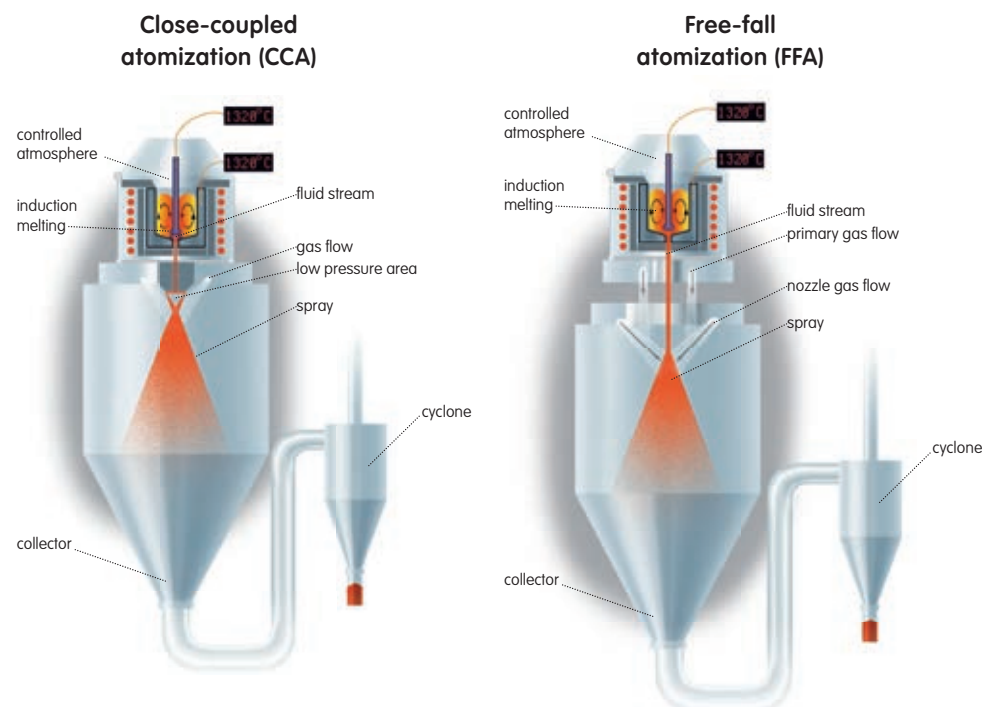
THE GAS ATOMIZATION PLANTS AUG series

For numerous applications and a wide spectrum of alloys

The AUG machines are designed for numerous applications in the most diversity thanks to their narrow particle size distribution and high yield and the possibility of flexible usage provided by different nozzle systems. They are generally suitable for gas atomization of a wide spectrum of alloys; such as those based on Cu, Au, Ag, Sn, or Zn (standard versions) as well as Fe, Co, Ni, Pd, or Pt (high-temperature versions HT, HTC, and HTC+). The inductive heating takes place in graphite crucibles (up to 1600° C) or in ceramic crucibles: HT up to 1750° C, HTC up to 1850° C, HTC+ up to 2100° C. The crucible volumes reach from ~1.5 l to ~25 l. For the production of reactive materials like Al or Mg, please ask us for our solutions.

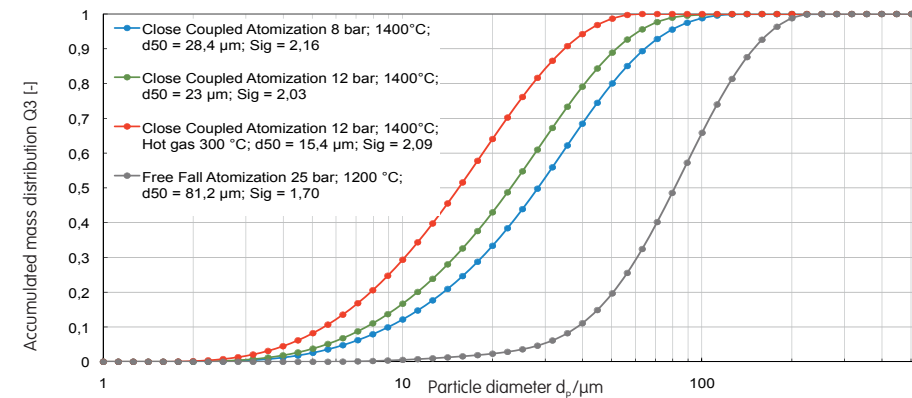
Powder characteristics and particle sizes for every request

To obtain specific metal powder characteristics and particle sizes, the AUG machines work with different easy-to-change nozzle systems: free-fall and close-coupled atomization nozzles. Optionally, an anti-satellite system for highest sphericity is available.

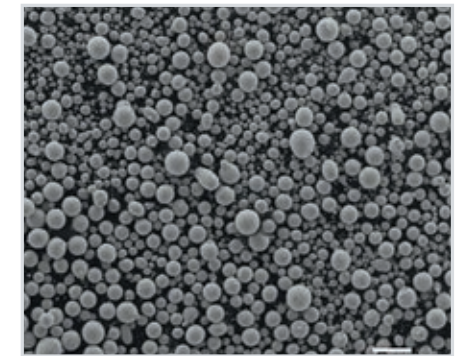


Melting chamber and nozzle plate can be raised and turned to the side independently. Rotatable nozzle plate.

Fine-tuning of the particle size distribution is obtained by variation of gas pressure, gas temperature (up to 450°C) and metal mass flow:



Particle size distributions of gas atomized CuSn₆ powders.



Ag-based solder alloy powder with an average particle size of ~60 µm

MINIMUM RISK OF MATERIAL LOSS AND CROSS CONTAMINATION

Electropolished inner surfaces prevent powder adhesions and avoid material loss and cross contamination.

GAS SEPARATION BY TREATMENT IN CYCLONES, MINIMUM RISK OF POWDER AGGLOMERATION

Water-cooled parts like spray tower and cyclone for fast cooling of the atomized material, optionally in combination with a passivation feature to avoid agglomerations especially of soft and high purity materials like Cu, Ag, Au, and/or in case of very fine powders (diam. < 20 µm).

OXIDATION-FREE PROCESSING

Oxidation-free processing in the closed-chamber machine by means of degassing, vacuum, and protective gas features to realize the highest level of cleanliness. Oxygen sensor values below 0.5 ppm can be achieved reproducibly.

DYNAMIC DIFFERENTIAL PRESSURE SYSTEM FOR CONSTANT METAL MASS FLOW

The DDP system is ensuring a constant and controllable metal mass flow, and therewith a constant gas-to-metal ratio, independent from the melt level in the crucible.

Five different versions

	AUG 500	AUG 1000	AUG 3000	AUG 12000	AUG 25000
Temperature max.	2,100° C	2,100° C	2,100° C	1,850° C	1,500° C
Crucible volume in l *	0.25 - 0.7	1.5 - 1.7	3.4 - 3.9	12.0 - 14.0	25.0
Volume in kg bronze **	1 (optional 1.5 or 4)	9	22	80	180
Volume in kg steel ** (HTC)	2.5	8	22	90	on request
Single cycle time	1 - 1.5 h	1.5 - 2 h	3 - 4 h	4 - 5 h	5 - 6 h
Generator kw	12	20	30	40-60	60+

* Liquid metal up to top level of the crucible – other volumes on request.

** Average capacities. Quantity may be increased by optimizing metal load using feeding systems.



THE ULTRASONIC ATOMIZATION PLANTS AUS series

The new Atomizer Solution by BLUE POWER and AMAZEMET – from alloy creation to powder within 1 hour

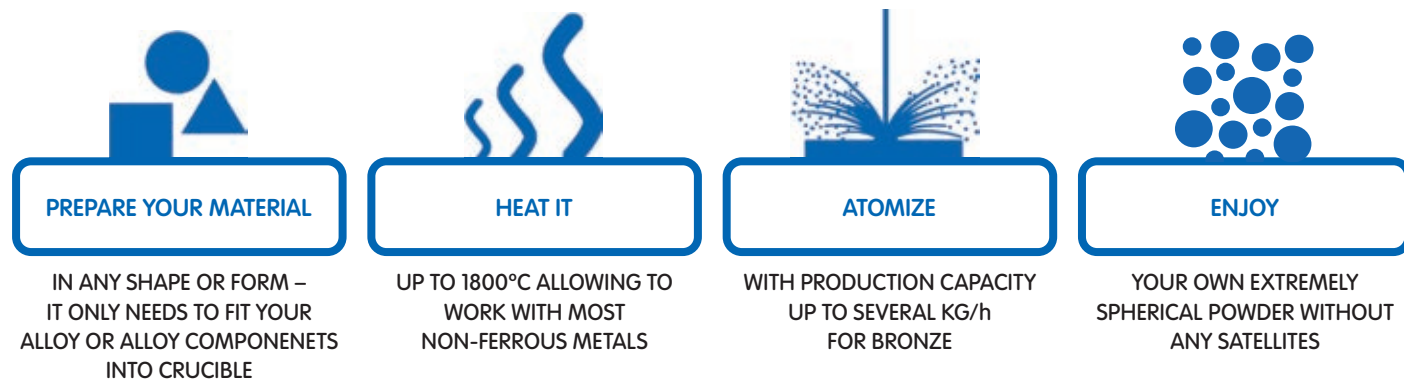


In cooperation with AMAZEMET, a Warsaw University of Technology company, BLUE POWER has developed an extremely compact Ultrasonic Atomization Unit for R&D purposes and small powder batch production. While BLUE POWER has 25 years of experience in induction melting technology, AMAZEMET provides know-how in ultra-high temperature ultrasonic technology and materials science in additive manufacturing.

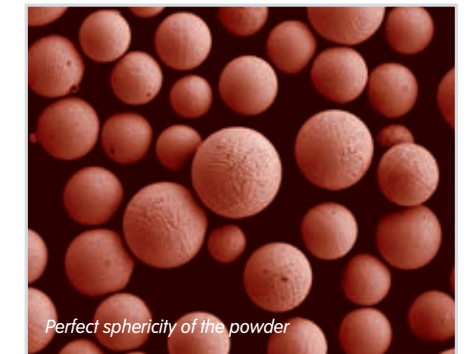
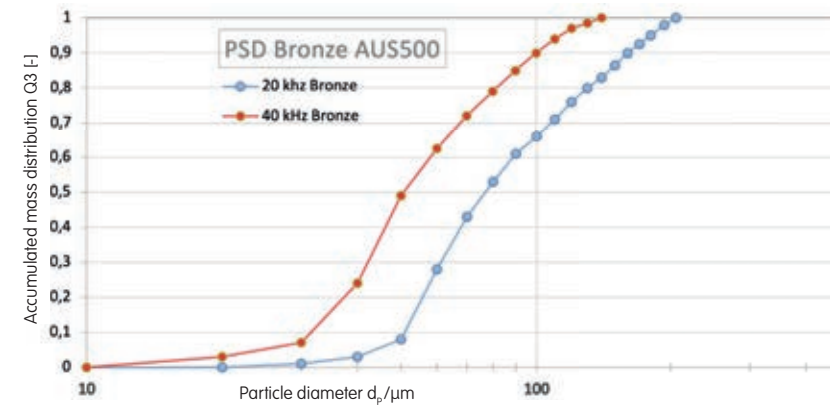
The Atomizer Unit enables almost anybody to produce small batches of high-quality, spherical powder for the same target application as gas atomized powder at an affordable price and without having a complex infrastructure.

The AUS 500 is available in different batch sizes from 0.25-0.7l. The melting and alloying of the material in the crucible takes place with an indirect induction system (e.g. graphite crucible) or a direct induction system for high temperatures (ceramic crucible). With a diversity of optional features, the machine could be equipped according to the specific requirements.

PERFECT POWDER IN 4 EASY STEPS

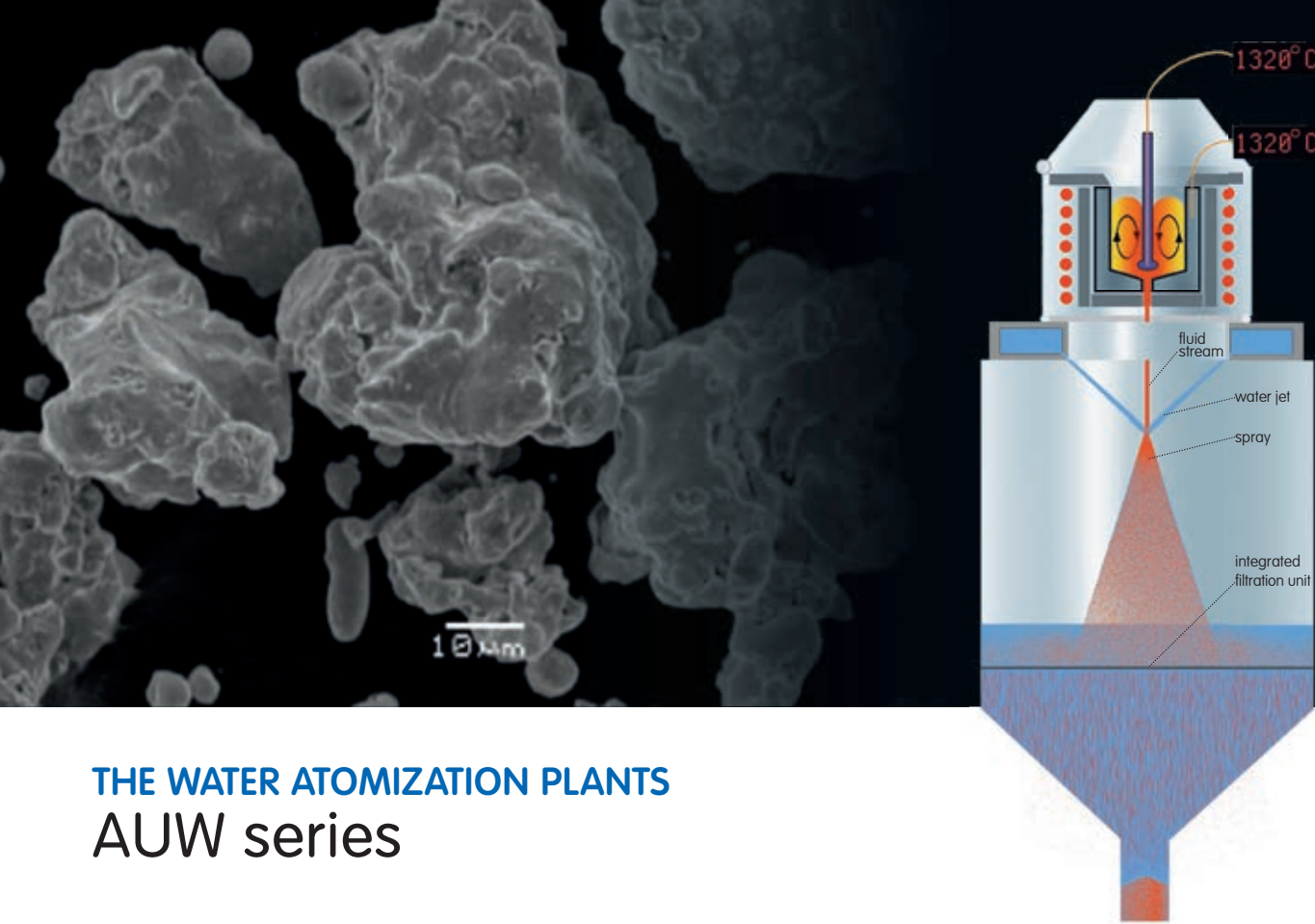


Fine-tuning of the particle size distribution is obtained by variation of the ultrasonic frequency and the metal mass flow:



ADVANTAGES OF OUR CRUCIBLE-BASED ULTRASONIC ATOMIZING PRINCIPLE

<p>PREVENTION OF MATERIAL LOSS AND INACCURACY OF ALLOY CHEMISTRY</p> <p>due to precise control of the melting temperature via a crucible based induction heating system, while evaporation of alloy ingredients like Zn, Cr etc. is a common issue during plasma-assisted atomization.</p>	<p>NO SOPHISTICATED AND EXPENSIVE FILTER REQUIRED</p> <p>for evaporated alloy ingredients otherwise caused by plasma melting</p>
<p>POSSIBILITY TO CREATE OWN ALLOY COMPOSITION INSIDE OF THE ATOMIZER'S CRUCIBLE-BASED MELTING SYSTEM</p> <p>Alloying with a good stirring/mixing effect due to strong medium-frequency induction generator with simultaneous high heating efficiency. Melting under vacuum or inert gas atmosphere and atomizing under inert gas atmosphere.</p>	<p>FEEDSTOCK CAN BE IN MORE OR LESS ANY SHAPE – NOT JUST PRE-ALLOYED WIRE OR BAR</p> <p>No need for complex and expensive wire production as feedstock material for atomizing, which is time-consuming and requires additional infrastructure like continuous casting machines, a drawing bench etc.</p>
<p>INCREASED YIELD AND PRODUCTION CAPACITY DUE TO HIGHER FREQUENCY</p> <p>Yield for example for Bronze $d_{50} = 40-60 \mu\text{m}$. Bronze throughput up to several kg/h. Very small batch sizes down to ~100 g technically and financially viable.</p>	<p>EXTREMELY SPHERICAL POWDER</p> <p>without any satellites for the highest powder fluidity and bulk density. Could be basically used as well for non-metallic materials (certain fluidity required).</p>
<p>SMALL FOOTPRINT</p> <p>Footprint of just a few square meters including infrastructure</p>	<p>ADDITIONAL VERSIONS FOLLOWING SOON</p> <p>In development: e.g. larger version offering a crucible volume of 1.5 l</p>



THE WATER ATOMIZATION PLANTS AUW series

While the Gas as well as Ultra-Sonic Atomiser Solutions are designed for the production of spherical powders by avoiding any contact with fast quenching media during particle formation, water-atomized powders typically have a more irregular shape which is an advantage for some applications like the recycling/refining process, press & sinter processes, and others.

However, it is also possible to produce almost spherical, fine powder by water atomization with appropriate process parameters, which makes the powder potentially suitable for AM applications.

THE MAIN DIFFERENCES INCLUDE

SIGNIFICANTLY LOWER RUNNING COSTS

Compared to Gas Atomization due to the use of water as the spraying medium, but also lower purity and increased surface oxidation

USUALLY MORE IRREGULARLY SHAPED POWDERS WITH INCREASED SURFACE AREA

Beneficial for recycling/refining and sintering processes. Almost spherical, fine powders suitable for Additive Manufacturing can be obtained, too.

	AUW 500	AUW 1000	larger capacities
Temperature up to	2,100°C	2,100°C	-
Crucible volume in l *	0.25 - 0.7	1.5 - 1.7	on request
Volume in kg bronze**	1 (optional 1,5 or 4)	9	-
Volume in kg steel ** (HTC)	2.5	8	-
Single cycle time	1 - 1.5	1.5 - 2 h	-
Generator kw	12	20	-

* Liquid metal up to top level of the crucible – other volumes on request.

** Average capacities. Quantity may be increased by optimizing metal load using feeding systems.



OUR SOLUTIONS FOR Quality and Process Management

More safety, more control, higher productivity: The remote control functions allow the operator to watch and control the process conveniently from the office or any other location at a safe distance. We use complex control electronics as well as the existing sensors on the powder atomizing machines for data acquisition. This allows numerous parameters to be recorded and processed via sensors, such as power output, temperatures, compression ratios, and many more. Each individual process can be precisely analyzed and archived.

Three Modules for Customized Solutions

The system consists of individual modules that can be configured according to customer-specific requirements:

INDUTHERM DMS
(App, Shell and NEW: Panel)

NEW: IThermControl

NEW: Indutherm Cloud

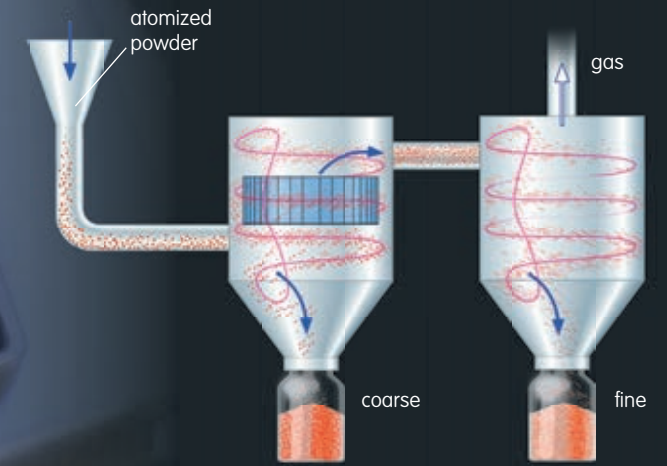
Depending on the application, the user has various user interfaces available for control and management. After all, information for employees on the shop floor is generally different from that which is relevant for material planning, quality assurance, or management.

You can benefit now from the following functions:

- Process data output and its visualization (analytics, live views, evaluation)
- Report output (documentation, quality assurance)
- Script control (production control, process control)
- Remote control (process control, process monitoring)
- Statistics (evaluations, efficiency analysis, optimizations)
- Flexible data access including cloud communication (process monitoring, process statistics, process documentation)
- Software updating (maintenance, service)



The coarse fraction settles down in the first collector (in the background), the fine fraction is transferred via the cyclone to the second collector.



THE AIR CLASSIFIERS AC series

1 or 2 Stage Air Classifier systems for the precise separation of metal powders

The AC series Air Classifiers are designed for the precise separation of metal powders into fine and coarse powder fractions especially in the range < 25 µm, where conventional sieving operations fail.

For processing of small to medium size powder batches

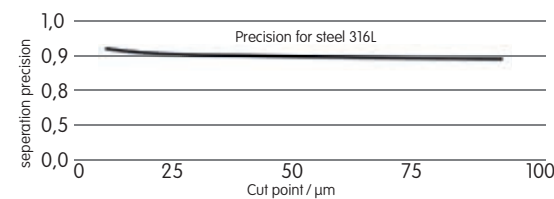
Due to the Easy-to-Clean concept our Air Classifiers are ideally suited for any production with the need for frequent alloy or desired particle size changes, and especially for precious and other specialty metals. These characteristics qualify the AC series machines for applications in research and development and also for large systems with a throughput of up to 200 kg / h (bronze or steel) and with double stage classification.

Classification under protective gas atmosphere: the G versions AC 1000 G / 3000 G

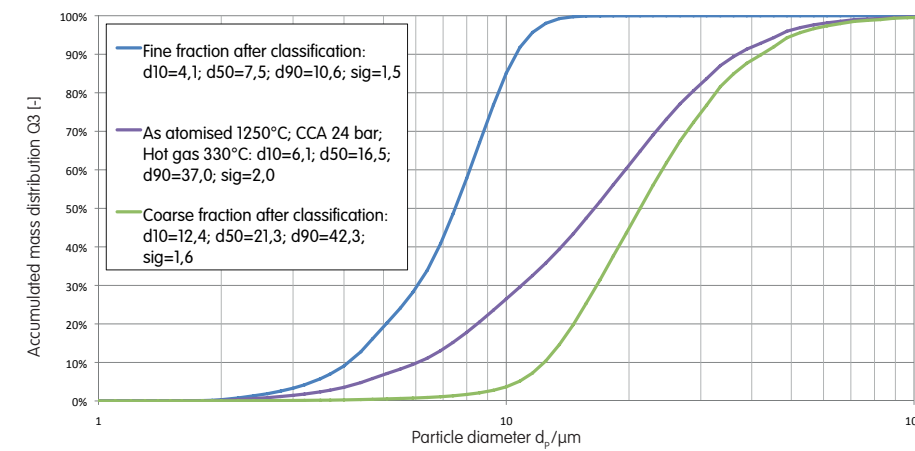
We particularly recommend the AC G-series for the separation of metals or alloys where the uptake of oxygen, moisture, or contamination from the room air must be avoided. An oxygen measuring system controls the process according to the set values. For example, a defined target O₂ value can be programmed for the process start. For the classification of reactive metals, please contact us for more information.

Cut point and separation precision

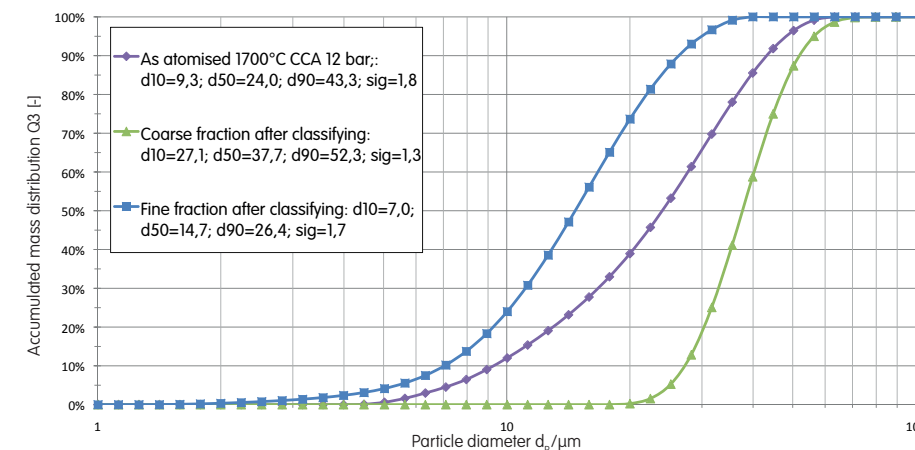
The cut point can be shifted by varying the classifier wheel speed and the fan settings over a wide range while maintaining a very high separation precision.



The following examples show a cut point at ~10 µm for 18ct gold powder and at ~25 µm for steel powder.



Particle size distribution of gas-atomized 18ct gold powder separated into coarse and fine powder fractions with the AC 1000 Air Classifier. Cut point in this example ~10 µm.



Particle size distribution of gas-atomized steel powder separated into coarse and fine powder fractions with the AC 1000 Air Classifier. Cut point in this example ~25 µm.

PARTICULAR ADVANTAGES OF THE AC SERIES AIR CLASSIFIERS

SEPARATION EFFICIENCY

Very sharp separation
Wide classifying range, e.g. separation of steel or bronze from ~4 to ~120 µm.
Throughput up to 200 kg/h bronze/steel (depending on version, separation at 10 µm), adjustable by the material feed

EASY HANDLING AND HIGH PROCESS RELIABILITY

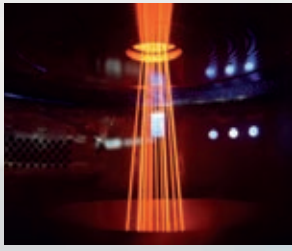
Short training period, easy and reliable handling
Optimum accessibility for inspection and maintenance, low cleaning effort
Minimum metal loss and cross-contamination
High process stability

FLEXIBLY ADAPTABLE TO YOUR NEEDS

Remote control function available
Optional upgrade features like gates for powder supply and the conveying of powder, special filter systems and interfaces to connect to your powder receivers.

Three different versions available:

	AC 1000	AC 1000 G	AC 3000 G
Throughput (steel)	75 kg / h	75 kg / h	200 kg / h
Classifier range (steel)	4 - 120 µm	4 - 120 µm	4 - 120 µm
Number of cut points	Single stage	Single stage	Single/double stage
Process atmosphere	Air	Inert gas	Inert gas



BluePower Casting Systems is a subsidiary of Indutherm Erwärmungsanlagen GmbH which has 25 years of experience and numerous references in vacuum metallurgy and induction melting furnaces.

Besides the metal powder solutions presented in this leaflet, BluePower Casting Systems can offer you a wide range of systems for casting processes with lost and permanent molds, for the production of first-class semi-finished products and for recycling:

- Compact MC-series vacuum pressure casting machines for use in R&D as well as for the casting of very small parts. Temp. up to max. 2,000 °C.
- VC-series vacuum pressure casting machines (stopper rod principle) with crucible volume of up to 25 liters. Temp. up to max. 2,000 °C.
- VTC-series vacuum pressure casting machines (tilt casting systems) for high-melting alloys such as steel, platinum, or titanium. Temp. up to max. 2,100 °C.
- Continuous casting plants (CC/VCC-series) for the production of high quality strips, wires, bars, tubes, or to produce feedstock for e.g. EIGA based atomization systems.
Also available with vacuum function as well as cutting, sawing, or coiling devices.
- Granulating plants and micro-granulating plants. Temp. up to max. 2,000 °C.
- Open melting plants and tilting furnaces e.g. for scrap remelting, with crucible volume up to 25 liters

Our sales and service partners provide professional support around the world.

You can find the dealer for your country on www.bluepower-casting.com in the "Company" section.

BLUE POWER

CASTING AND POWDER PRODUCTION SYSTEMS

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