





Machine Expertise³



Together we are strong





EPSI

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Uniaxial powder presses PA

14 Hot Isostatic Presses

15 Warm Isostatic Presses FREY & Co. GmbH in the Upper Bavarian Lenggries has been developing machines, adaptors and tools for powder metallurgy since its founding in 1989. Since 1991, we have been dealing with isostatic pressing processes in this field. We work closely with universities and research centres to optimise processes with innovative technologies. Our aim is to create systems that are equally successful from a technical and economic standpoint.









For more than 25 years, we have been working together with two companies that have profound expertise in the field of state-of-the-art pressing processes to expand our capabilities and spectrum for the benefit of our customers.

FCT Systeme GmbH in Frankenblick is our long-standing partner in the finishing and sintering processes field. FCT excels in these areas with its own developments and, at the same time, is always happy to use our machines. Which we are very pleased about. The third member of the group is another specialist in the field of powder pressing processes: **EPSI** based in Belgium. In cooperation with EPSI, we are working on developing optimised methods for pressure transmission and relief. EPSI is a renowned specialist for isostatic pressing processes and perfectly complements our range with its own developments.

Together, we offer our customers worldwide a comprehensive product range which is technologically and technically of the highest quality for state-of-the-art metallurgical processes.

Uniaxial powder presses PA





STANDARD SERIES

	PA50S	PA100S	PA200S	PA350S	PA500S	PA650S
Upper piston force (CN)	500	1000	2000	3500	5000	6500
Pulling force (CN)	200	400	800	1050	2000	

The uniaxial powder presses of the PA series were developed for compacting powdery materials and can be customised and expanded for specific applications.

With the use of state-of-the-art hydraulics and electronics, they are the perfect basis for manufacturing parts with max. precision. All presses of the series can be ordered not only as standard withdrawel mode, but also in counter-directional mode.

Advantages

- Compact
- High-precision
- Fast
- Various options and expansion options

Options

- Various adapter solutions
- Up to seven power and positioncontrolled axes

- Multi-layer fill
- Part handling variants
- Adapter change variants
- Complete process control

Uniaxial sizing presses KA





The uniaxial calibration presses of the KA series are designed for finishing sintered parts. They complement conventional powder presses and can be optimally integrated into the production process.

If required, the presses can be expanded by different upstream or downstream process steps such as aligning the pressed parts, wetting with calibration oil, faceting or thread cutting.

Advantages

- Compact
- High-precision
- Fast
- Various options and expansion options

Options

- Various adaptor solutions
- Up to seven power and positioncontrolled axes

- Faceting station
- Part handling variants
- Adapter change variants
- Complete process control

	KA50S	KA100S	KA200S	KA350S	KA500S	KA650S
Upper piston force (CN)	500	1000	2000	3500	5000	6500
Force of Ejection [kN]	300	600	1200	2000	2000	2500

Dry bag isostatic presses CISO



STANDARD SERIES

Isostatic pressing force (bar): 600/1000/1500/2000 Clamping forces (kN): 2000/4000/6000 The presses of the CISO series are designed with a pressure vessel rotating device. They are ideal for producing parts with uniform density distribution and large lengths.

The circular clocking of up to four pressure vessels allows large quantities with the highest degree of precision. Mixed operation is possible when two pressure vessels are used: One tool is used in each pressure vessel to produce two workpieces of different geometries at the same time.

The basic press has a pressure vessel, a pressure intensifier and a frame with a locking cylinder. We offer different configurations from simple manual removal and filling to fully automatic production lines.

Advantages

- Energy savings up to 60% via servo-hydraulic system
- Quiet
- Low operating costs little oil and cooling water needed
- Mixed operation is possible
- High output via two possible pressure vessels
- Various options and expansion options
- Easy to operate

Options

- Various pressure vessels
- Die can be filled outside or inside the pressure vessel
- One or multiple pressure vessels

- Automatic filling in different variants
- Part handling variants
- Automatic cleaning of the die, upper and lower punches
- Complete process control

Dry bag isostatic presses Easylso





STANDARD SERIES

Isostatic pressing force (bar): 600/1000/1500/2000 Clamping forces (kN): 2000/4000/6000 The models of the Easylso series are costeffective cold-isostatic presses that are exclusively fitted with a pressure vessel. They are perfectly suited to producing parts with uniform density distribution and large lengths. The specially developed hydraulics and electronics allow max. precision at high processing speeds.

The basic press has a pressure vessel, a pressure intensifier and a frame with a locking cylinder. In addition, the presses can be individually configured from simple manual removal and filling to fully automatic production lines.

Advantages

- Energy savings up to 60% via servo-hydraulic system
- Quiet
- Low operating costs little oil and cooling water needed
- Cheap to buy
- Various options and expansion options
- Easy to operate

Options

- Various pressure vessels
- Die can be filled outside or inside the pressure vessel

- Automatic filling in different variants
- Part handling variants
- Automatic cleaning of the die, upper and lower punches
- Complete process control

Uniaxial hot presses

Type HP W - Resistance heated



The concept of these hot presses for temperatures up to 2400 °C was developed to meet the requirements for developing and producing components made of new metallic and ceramic materials up to the highest temperatures. In addition this system's basic function, hot pressing with graphite tools, the option of carrying out sintering processes under vacuum and normal pressure by using Ar, N2, etc., was also given special importance.

- Operating temperature up to 2200 °C (optional up to 2500 °C), optional in air max. 1400 °C
- Vacuum: 5 x 10⁻² mbar (a)
- Furnace atmosphere: Ar / N₂ (others on request)
- Servo-hydraulic force control
- Precise, rigid press frame with low deformation, precise guidance of the press punches
- Densification stroke path and speed measurement
- Double-walled water-cooled stainless steel vacuum vessels up to a leakage rate of 1×10^{-3} mbar (a) l/s
- Resistance heating (option: induction heating)
- Design and optimisation of press tools/concepts
- Mould filling and emptying systems
- Optional: rapid cooling systems
- Optional: overpressure up to 1.0 MPa*1
- Optional: debinding/dewaxing
- Optional: multi-zone heating
- Handling systems, in particular for large-scale systems
- Extensive user-friendly control via Siemens S7 and WinCC
- Special sizes and functions on request

HP W	Ø Heating	Height conductor	Max. Pressing force	Max. Press diameter	Max. Heating capacity
Standard types	[mm]	[mm]	[kN]	[mm]	[kW]
HP W 10	100	125	100	30	17
HP W 25	200	250	250	80	40
HP W 60	250	315	600	120	60
HP W 125	300	400	1250	200	100
HP W 250	440	550	2500	300	150
HP W 400	500	800	4000	400	180
HP W 600	600	1200	6000	500	240
HP W 900	750	1200	9000	550	400
 HP P					
Standard types"					

Standard types

HP P 12.5/4	155	200	125	60	125

Spark plasma sintering system



Type HP D and H-HP D



With this sintering process, the mould or component is heated in the direct current pulses, which allows cycle times of a few minutes. Using direct current pulses leads to an additional increase in sintering activity of many materials due to the contact points of the powder particle processes (Joule's heating, plasma formation, electromigration, etc.). This effect allows processing at significantly lower temperatures and/or pressures than with conventional hot pressing or sintering.

In addition, the systems can be equipped with a radial heating system (inductive) in order to avoid radial temperature gradients for large-format components or to inductively heat materials that are not sufficiently conductive at room temperature (hybrid technology). This opens up completely new possibilities in production of a multitude of materials with unique properties:

- Nanomaterials can be sintered without significant grain growth
- FGM ("Functionally Graded Materials")
- Composite materials
- Innovative carbide metals
- Aluminium and copper alloys as well as intermetallic compounds
- Structural and functional ceramics
- Optionally available with glove box
- Optional with flash (this function is used in addition to the conventional FAST/SPS, a further possibility for compaction at considerably higher voltage)⁻¹
- Optional additional radial heater (inductive/resistance)^{*2}
 Available as a hybrid system (H-HP D)

HP D	Dimensions Ø Component	Max. Pressing force	Max. Voltage	Max. Power	Max. Heating capacity
Standard types	[mm]	[kN]	[V]	[A]	[kW]
HP D 10	50	100	7,2	5500	37
HP D 25	80	250	8	8000	60
HP D 60	120	600	8	16000	120
HP D 125	150	1250	8	24000	180
HP D 250	300	2500	8/16	48000/24000	360
H-HP D Standard types*1					
H-HP D 10 ^{*1}	40 (60)	100	35	30	60
H-HP D 25 ^{*1}	100	250	60	80	100
H-HP D 60 ^{*1}	150	600	120	120	200
H-HP D 320	300	2500	300	300	500
H-HP D 400	400	4000	400	400	700

High-temperature vacuum sintering furnaces with horizontal loading

Type FH W - resistance heated



The system type FH W is designed for producing components made of reactive silicon carbide (LSI), pressure-less sintered SSiC and other material systems that require a high temperature, a vacuum and/or an inert gas atmosphere. Systems of this type have been in use for many years by various customers and have proven their worth.

As a manufacturer of high-temperature furnaces, FCT Systeme has more than 40 years of relevant experience in designing (process engineering) and building these types of systems.



Functions

- Operating temperature up to 2200 °C (optional up to 2500 °C)
- Vacuum: 5 x 10⁻² mbar (a)
- Leakage rate: 5 x 10⁻³ mbar (a) l/s
- Furnace atmosphere: Ar / N₂ (others on request)
- Heating zones up to 5000 mm length are possible
- Debinding and removal of temporary binders in the combination process optional
- Quick cooling system, insulation opening, gas circulation, heat exchanger optional
- Special sizes and functions on request
- Special solutions for C/C and C/SiC composites
- Special solutions for graphite cleaning
- Special designs on request

	Width	Height	Length		
FH W	Heatir	ng conduct	tor	Effective volume	Heating capacity
Standard types	[mm]	[mm]	[mm]	[dm³]	[kW] *1
FH W 9	250	250	300	9	20
FH W 90	500	500	800	90	80
FH W 250	500	710	1300	250	200
FH W 400	950	780	1000	400	250 ^{*2}
FH W 500	800	900	1400	500	270
FH W 1250	700	1000	2800	1250	300 ^{*2}
FH W 2500	900	1200	2800	2500	450 ^{*2}

^{*1}T = 2000 °C; gaseous atmosphere N2; ^{*2}optionally available as a twin system

High-temperature pressure sintering furnace (sinter HIP) with resistance heating, 10 MPa



Type FP W – resistance heated

This sintering furnace is designed for sintering under vacuum and especially for 100 bar overpressure (N_2 /Ar) and 2000 °C and enables the economical production of construction ceramics based on Si₃N₄, SIALON and Al₂O₃-TiC/TiN etc. as well as hard metals (WC/Co) and other composite materials.

FCT has already delivered more than 130 gas pressure sintering systems worldwide for use in labs and production. we are here for you, with more than 40 years of experience in producing engineering ceramics and hard metals.



Functions

- Operating temperature up to 2000 °C (optional up to 2400 °C)
- Vacuum: 5 x 10⁻² mbar (a)
- Operating pressure: 100 bar (g) (10 MPa), optional: up to 20 MPa
- Debinding/dewaxing, sintering and gas pressure sintering in a combination process (Sinter-HIP)
- Fast cooling system (over pressure)
- Optional hot pressing function available (FP H)^{*1}
- Construction: Floor loading
- Special sizes and functions on request
- Loading and handling system on request
- Processor control systems with superordinate visualisation system
- Temperature measurement and control using an optional pyrometer and/or TC
- Adjustable gas mixtures
- Special MIM/CIM furnaces (MIM = metal injection moulding, CIM = ceramic injection moulding)
- Dilatometer as an option
- 3-D printing components

	Ø	пеідпі			
HP W	Heating conductor		Effective volume	Heating capacity	
Standard types	[mm]	[mm]	[dm³]	[kW]	
FP W 1.25	125	180	1,25	25	
FP W 6	180	300	6	60	
FP W 12.5	250	315	12,5	80	
FP W 25	280	550	25	120	
FP W 90	400	900	90	160	
FP W 250	600	1600	250	250	
FP W 600	700	1800	600	350	
FP W 900	860	2000	900	500	
FP H Standard types ^{*1}					
FP H 6/12.5	220	300	6	60	

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Cold Isostatic Presses





Laboratory system Ø 78 mm, H 150mm, up to 400 MPa



Production system Ø 800 mm, H 4200mm, up to 100 MPa

Production system with automatic loading and unloading \varnothing 400 mm, H 1000mm, up to 400 MPa



Functions

- Custom designed systems: in all sizes up to a diameter of more than 2 m, with options for control, automation, decompression, etc.
- For pressures up to 600 MPa
- Monolithic forged high-pressure vessel made from a single vacuum-gasified steel block
- Complete proofing degassed in accordance with EN10204/3.2 possibility of thorough inspection
- Special high-pressure vessel designs: Inner bushing with preload, wire-wound vessel body
- Systems manufactured from the highest quality components and materials
- Controlled pressure build-up and release to avoid stress and cracks in pressed parts
- Provision of highly automated solutions
- Additional mould handling, washing and conveying equipment, etc. (highly automated solutions available)

Cold Isostatic Presses









Hot Isostatic Presses



Functions

- Laboratory equipment with automatic controls and heating zones with diameters from 76 mm to 165 mm
- Equipment for pilot production; heating zones with diameters up to 400 mm
- Equipment for series production; heating zones with diameters up to 1250 mm
- Replaceable plug-in types of furnaces for various temperatures and atmospheres
- Cycle programming, easy to customise, with PC monitoring, data acquisition, etc.
- Additional devices such as load preparation station, dilatometer, gas bottles for storage, gas analysers, gas purification system etc.
- Pressures up to 400 MPa
- Temperatures up to 2000 °C
- Argon or other processing medium
- Monolithic forged high-pressure vessel made of a single vacuumdegassed steel block; complete test according to EN10204/3.2 and possibility thorough inspection
- Protection against power failure, as a result of the particularly high heat absorption capacity of the high-pressure vessel
- Uniform rapid cooling for high load dimensions
- Systems manufactured from safe, high-quality components and materials





Ø 850 mm, H 2500 mm, up to 140 MPa and 1400 °C

Warm Isostatic Presses





Functions

- Water or oil as a pressing liquid
- Temperature via external dry jacket and/or internal heat exchanger
- High-pressure applications combined with high temperatures (up to 300 °C)
- Custom designed systems: in all sizes up to a diameter of more than 2 m
- Pressures up to 400 MPa
- Monolithic forged high-pressure vessel made from a single vacuum-degassed steel block
- Complete test in accordance with EN10204/3.2, option of inspection possibility
- Special high-pressure vessel designs: Inner pre-stressed liner, wire-wound vessel body
- Plate frame or wire-wound frame
- Systems manufactured from the highest quality components and materials
- Controlled pressure build-up and release to avoid stress and cracks in pressed parts.
- Various filtration options
- Provision of highly automated solutions



Ø 600 mm, H 600 mm, up to 200 MPa and 150 °C







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