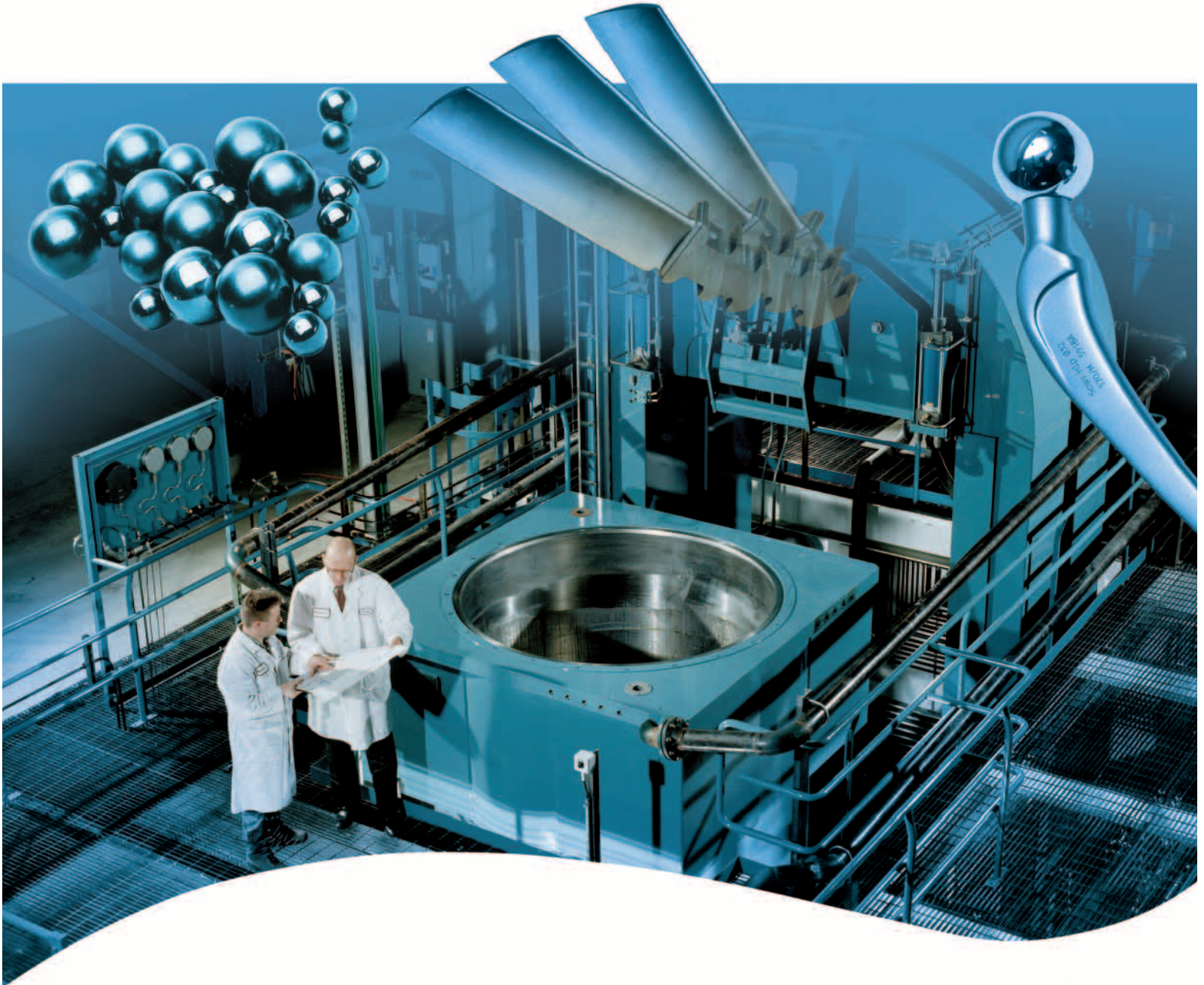




For better material performance

Hot Isostatic presses



AVURE TECHNOLOGIES



Hot Isostatic Pressing

New and better materials

Hot Isostatic Pressing (HIP) is a unique combination of high pressure and high temperature which makes it possible to produce materials and parts with substantially improved properties.

The low sintering temperatures and the high isostatic pressure give better control of grain growth as well as isotropic properties resulting in superior performance characteristics.



Examples of silicon nitride parts produced to net shape in a unique precision process developed at AC Cerama AB. Green bodies are encapsulated in glass and HIP'ed. Fully dense and intricately shaped ceramic parts can be manufactured.

Improved castings

The HIP process heals internal cracks and porosity in sintered and cast parts. This improves the mechanical properties and reduces the scatter and thus allows greater freedom of design.



Examples of castings. It is common practice today to treat castings in the HIP process to eliminate the internal voids that form in the casting operation.

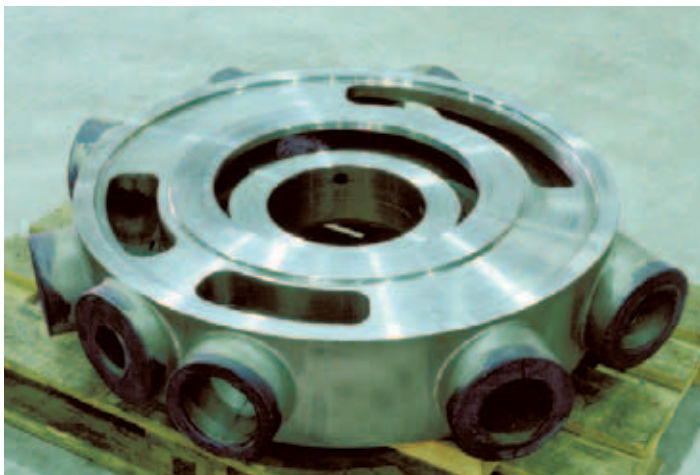
for Better Performance

Low product cost

Simple or complex, large or small, metal, ceramic or composite materials – the HIP process can produce a fully dense, near-net shaped part from powder in a single production cycle and thus at low cost.

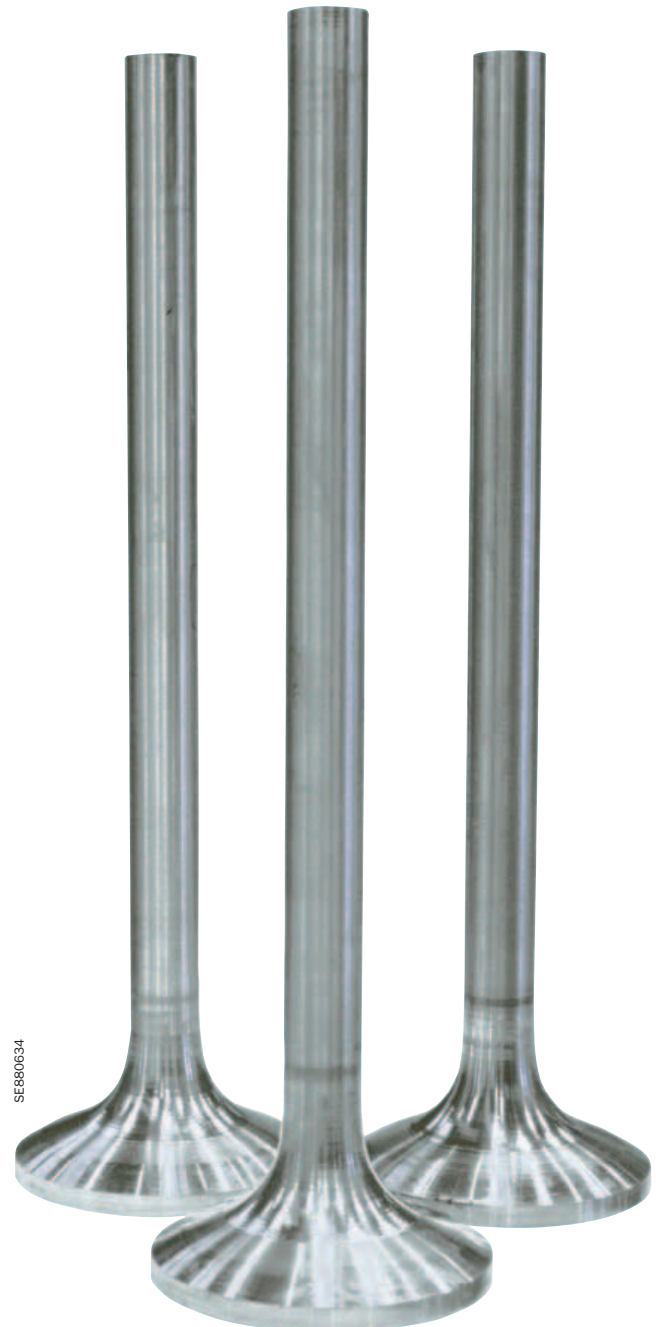
High productivity

The QUINTUS® (trademark for the Avure Technologies wire-wound presses) Hot Isostatic Presses guarantee high productivity and safety. Fast heat-up and controlled rapid cooling have reduced cycle times considerably. Several loads a day can be processed even in presses having a very large work zone volume.



Examples of near-net shaped parts produced from metal powder at Bodycote Powdermet AB.

To the right: marine diesel engine valves. The parts are used in industrial applications, superseding conventional forgings and castings. Starting from powder and using the HIP process for consolidation, excellent and isotropic properties can be achieved due to the absence of macro-segregation.



Wire-wound Design for

High up-time

Both QUINTUS laboratory units and production systems are characterised by their high up-time. This achievement is based on more than 50 years of diversified experience and research in the high pressure field and 1000 deliveries of QUINTUS presses ranging from research systems to the largest presses in the world, and other wire-wound components for high pressure.

Safe and secure

QUINTUS is synonymous with safety. The frame concept makes it possible to design a pressure vessel that is free of stress concentrations and is a prerequisite for acceptable safety at the high gas pressures used in a hot isostatic press. The pre-stressing with wire results in very favourable fatigue properties and obstructs crack propagation. The vessels are designed to leak-rather-than-break to prevent a catastrophic failure.



A QUINTUS hot isostatic press designed for 103 MPa (15,000 psi) pressure. Internally the furnace is 1.7 m (66 in.) in diameter and 2.5 m (100 in.) high. Temperature 1260°C (2300°F). Uniform rapid cool rate with full load, 40°C/minute. Courtesy of Bodycote Inc., USA.

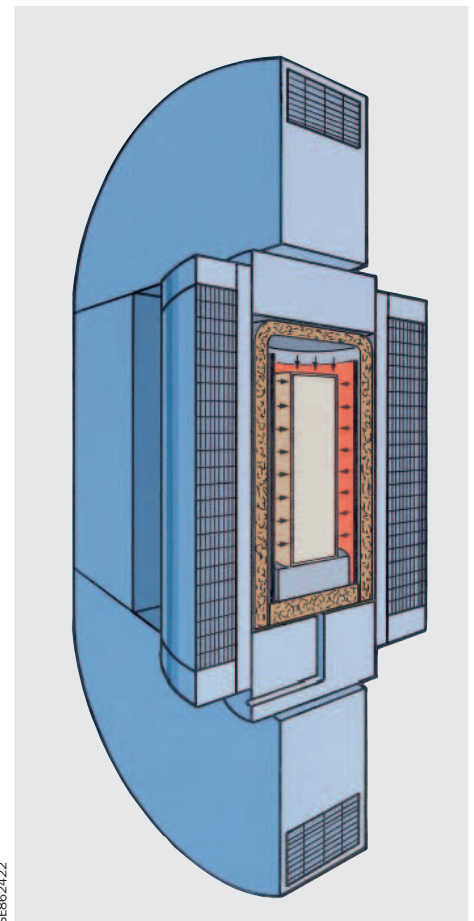
Long Life and Safety

Quality

Our **Quality Management System** is approved according to ISO 9001. We are also authorised according to ASME Boiler & Pressure Vessel Code, Section VIII, Div. 3.

Easy periodic inspection of pre-stress and surfaces provides essential information about the condition of the QUINTUS press.

Special presses for extreme pressures or special applications can also be supplied.



A QUINTUS hot isostatic press designed for 200 MPa (29,000 psi) pressure. Internally, the furnace is 0.385 m (15.2 in.) in diameter and 1.2 m (47.2 in.) high. Uniform rapid cool rate with full load, 50 °C/min (90 °F/min).

The QUINTUS press consists of a wire-wound, pre-stressed vessel with axially slidable end closures. The end closures are supported by a wire-wound frame. All ducts and electrical feedthroughs are in the end closures. Opening and closing of the pressure vessel is carried out using hydraulic cylinders. The closures and the vessel liner are efficiently cooled.

Reliable Furnaces

The furnace

The high pressure furnace is the key element in the success of the HIP system. Avure has a furnace to offer for each specific HIP process requirement. Extensive experience from more than 300 HIP installations guarantees that Avure can design and manufacture just the furnace you need.

Temperature uniformity

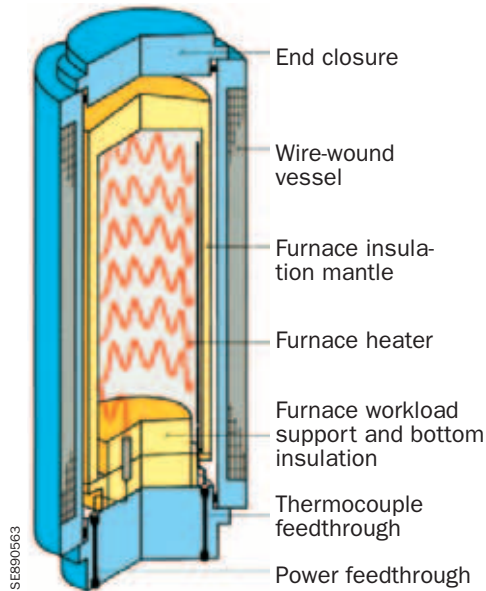
Precise control of the HIP process temperature is important as it affects the properties of the products. QUINTUS furnaces, with their patented insulation mantle design, multiple heating zones and sophisticated computer control assure extremely accurate temperature uniformity.

Clean atmosphere

The furnace most frequently used in the HIP process to date is the molybdenum furnace. Its clean atmosphere is well suited to materials that are non-encapsulated and sensitive to contamination. Maximum temperature is 1450°C (2640°F).

Special requirements

For special process requirements like low operating temperature levels, special process gases, modular furnace systems or hot unloading, we deliver specially adapted furnaces.



The QUINTUS furnace is designed in the form of an insert and its main components are shown above. The ease of access to the plug-in furnace insert cuts system downtime for overhaul and maintenance to a minimum.



80 MN QUINTUS HIP. The cold loaded molybdenum furnace has a hot zone that is 0.55 m (21 in.) in diameter and 1.5 m (59 in.) high. Temperature 1400°C (2550°F). Uniform rapid cool rate with full load, 100 °C/min (180 °F/min). Courtesy of Bodycote Metal Technology.

for All Applications

Vacuum and high temperature

The QUINTUS multi-purpose graphite furnace can operate under extreme conditions, managing temperatures up to 2400 °C (4350 °F) under pressure and 2000 °C (3630 °F) in vacuum. This furnace type is especially suitable for processing ceramics but can also be used in applications requiring lower temperatures. The furnace's low voltage, rigid design and protective container guarantee very high reliability.

Low voltage

Low voltage is essential for reliable operation. QUINTUS graphite furnaces are designed for 15-50 V and molybdenum furnaces for 50-100 V. This ensures a very high tolerance against impurities which can cause arcing.

Measure 2600 °C (4710 °F)

The thermocouples available today have a very limited life at temperatures above 1700 °C (3090 °F). Avure has developed an all-graphite mechanical measuring system capable of reliable and repetitive measurement of temperatures up to 2600 °C (4710 °F).

Rapid cooling – Quenching

The QUINTUS standard rapid cooling system can easily cool a HIP furnace with full load from maximum furnace temperature to 400 °C (750 °F) in less than 20 min. This results in shorter cycle time, increased productivity and decreased production costs.

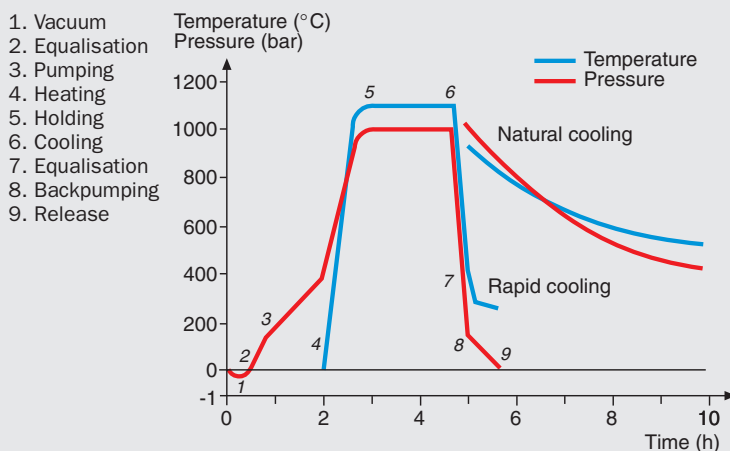
The QUINTUS super rapid cooling system achieves programmable uniform cooling rates of up to 1000 °C/min (1800 °F/min). This feature offers the unique possibility to combine hot isostatic pressing and quenching in the same cycle. The cooling medium is an inert gas under pressure of up to 207 MPa (30,000 psi). This implies an extremely efficient heat transfer, elimination of surface reactions and the possibility to control the cooling rate with very small variations within the workpiece.



40 MN QUINTUS press. Furnace diameter 0.36 m (14 in.). Furnace height 0.82 m (32 in.). Temperature 2200 °C (3990 °F) at pressure 200 MPa (29,000 psi) and 2000 °C (3630 °F) in vacuum with Avure's high temperature measuring system. Rapid cool rate with full load, 40 °C/min (72 °F/min.).

80 MN QUINTUS HIP installation at Lake City Heat Treating Corp., USA. The cold loaded molybdenum furnace has a hot zone that is 0.55 m (21 in.) in diameter and 1.5 m (59 in.) high. Temperature 1400°C (2550°F). Uniform rapid cool rate with full load, 100 °C/min (180 °F/min).

HIP cycle for a large QUINTUS HIP with rapid cooling.

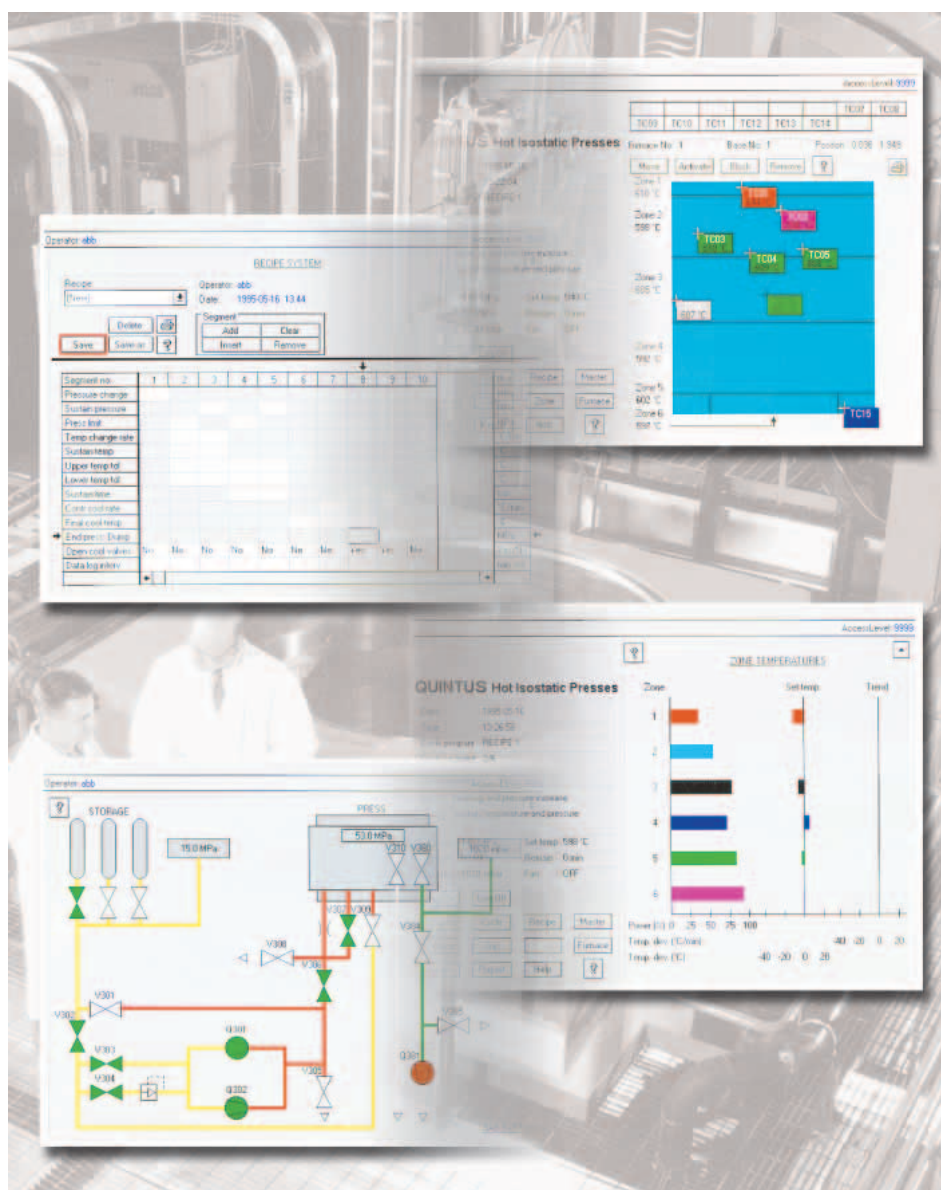


Reliability

Avure has comprehensive engineering experience from more than 300 HIP deliveries. All subsystems of the QUINTUS press are designed for maximum safety and reliability.

Advanced power supply and computer control systems

Automatic operation of the QUINTUS HIP process is accomplished by means of an intelligent, programmable controller. Man-machine communication, data presentation, data acquisition and cycle programming are executed by Avure software, complete with colour graphic panel and printer.



Subsystems

Low installation cost

The unique QUINTUS pre-stressed press design results in up to 50 % lower installation weight than forged monoblock presses. This simplifies the foundation, building and installation work.

Efficient cooling system

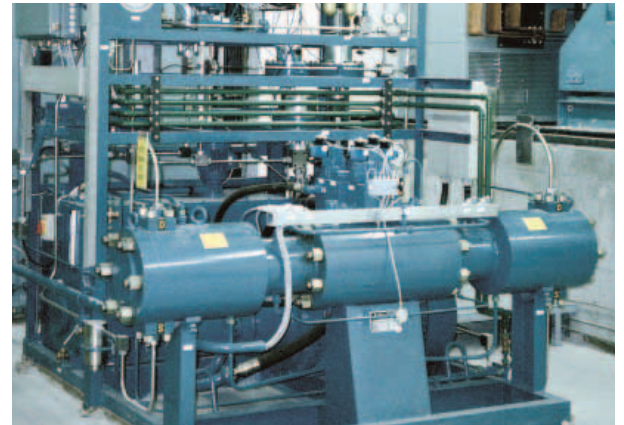
During the HIP cycle the thin QUINTUS pressure vessel liner and the end closures are cooled by water containing an anticorrosive additive circulating in a closed loop. The QUINTUS HIP design, in which the cooling water circulates in ducts located between the vessel liner and the wire winding, makes it possible to utilise the QUINTUS rapid cooling feature to full capacity.

Vacuum system

In order to prevent oxidation of the furnace and load, a vacuum system is supplied. The system makes it possible to run sinter-HIP cycles.

Safe high pressure gas system

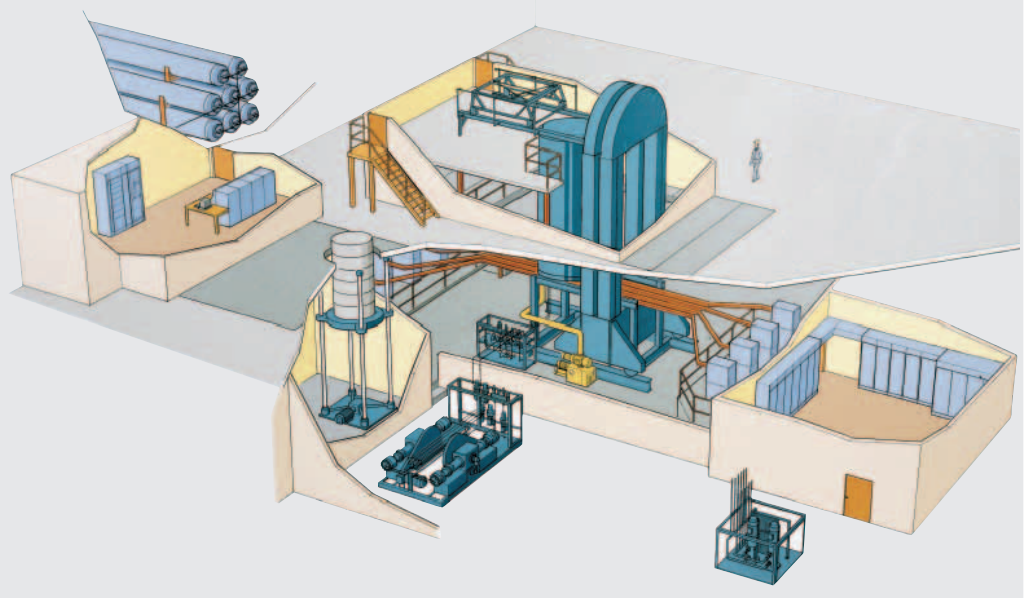
The gas system used to pressurise and decompress the QUINTUS press incorporates non-contaminating gas compressors and high pressure components from leading manufacturers.



Gas compression unit with piston compressor

Example of a large QUINTUS HIP installation

1. Gas storage
2. Control room
3. Gas system
4. Vacuum system
5. Cooling system
6. Power supply
7. Loading station



Customer Services

Service

Service is available through Avure's extensive world-wide service network.

Training

Basic theoretical and practical training in the use of HIP can be provided at the customer's plant or at Avure's high pressure test centres.

Test pressing

Try out your ideas in our laboratory hot isostatic presses and make use of our HIP know-how.



Training in programming a HIP cycle

Research Scale

Standard

The QUINTUS Mini-HIPper comes in several sizes and with a choice of Kanthal (Hoskins), molybdenum or graphite furnace for temperatures from 1200 °C to 2200 °C (2200 °F to 3990 °F). The smallest of the research-scale presses is 102 mm (4 in.) in diameter and 127 mm (5 in.) high and the largest is 254 mm (10 in.) in diameter and 762 mm (30 in.) high. Standard pressure is 207 MPa (30,000 psi). Partial oxygen pressure can be used with Kanthal (Hoskins).



Mini-HIPper
type QIH 9



Research and pilot production scale system, type QIH 21

Also manufactured by Avure Technologies



SE 900873

The world's most powerful press for flexforming of sheet metal parts for automotive prototypes and short series production. (Courtesy of DaimlerChrysler AG).



AVURE ultrahigh-pressure food processing systems for pressure up to 600 MPa (87,000 psi).



SE 940762

Wire-wound frames for diamond manufacturing presses ready for delivery from the Avure workshop.

Sheet metal forming

Avure's Flexform sheet metal forming presses are used to economically create complex, low volume parts and prototypes for the aerospace, automotive and white goods industries.

Food Processing

Food processors use Avure's market leading high pressure processing solutions to naturally eliminate food borne pathogens and extend shelf life without the addition of chemicals or taste and texture degrading heat treatments.

Special high tonnage presses

Our unique wire-wound design and high pressure know-how are also utilised to build customised presses and components as well as special presses such as high pressure laboratory equipment, hydrostatic extrusion presses and presses for synthetic diamond manufacture.

Several industries use Avure's hot and cold isostatic presses to densify advanced materials to improve quality. Presses designed and manufactured by Avure are currently producing parts for the automotive, aerospace, electronics, cutting tools and medical device industries to name a few.

Avure Technologies is the recognized global leader for expertise in high pressure applications and the design and manufacture of high pressure processing equipment. Though the Avure name is a relative new-comer, the company itself is over 50 years old originating as a division of ASEA, later ABB. Today the company is in the enviable position of being the dominate supplier for the markets it serves and has a who's who list of customers.

Avure is headquartered in Kent, WA, USA with engineering and manufacturing facilities in Västerås, Sweden and sales and service offices around the globe.

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