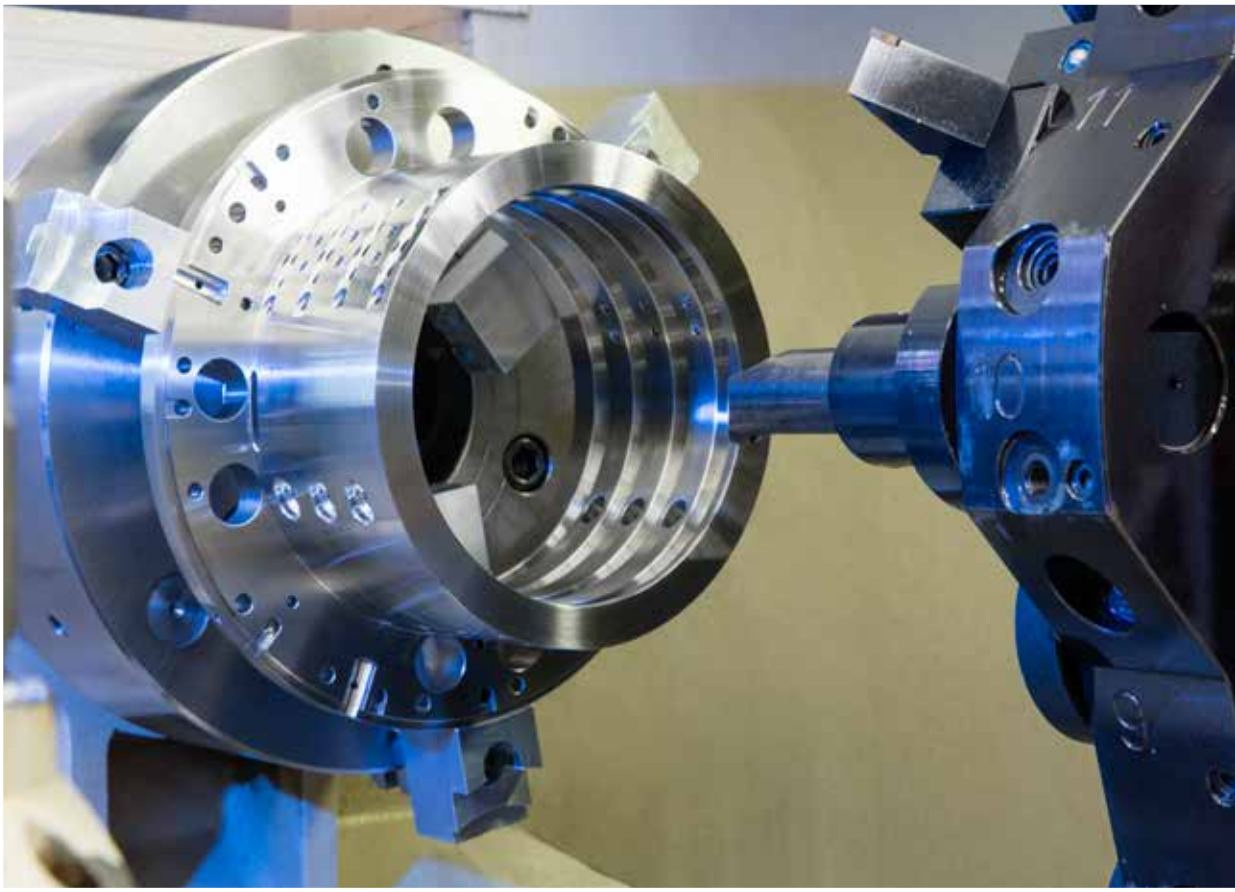
PINK®

Service Portfolio



Vacuum Technology

Design and production with maximum precision

Production and administration buildings of PINK GmbH Vakuumtechnik.

Quality, precision and productivity

The PINK brand has been synonymous with quality and precision in virtually all sectors of vacuum technology for over 30 years.

PINK's corporate philosophy is based on an integrated quality strategy documented by the quality management system practised in accordance with DIN EN ISO 9001:2008. Furthermore, its product policy includes the use of high-grade materials and components as well as production with maximum precision. PINK's customers thus receive high-performance and dependable systems.

PINK carries out production on highly advanced CNC-controlled machining centres. Continual investment in the very latest production technologies combined with on-going initial and further training of its employees enables PINK to maintain and build on its existing technological lead.

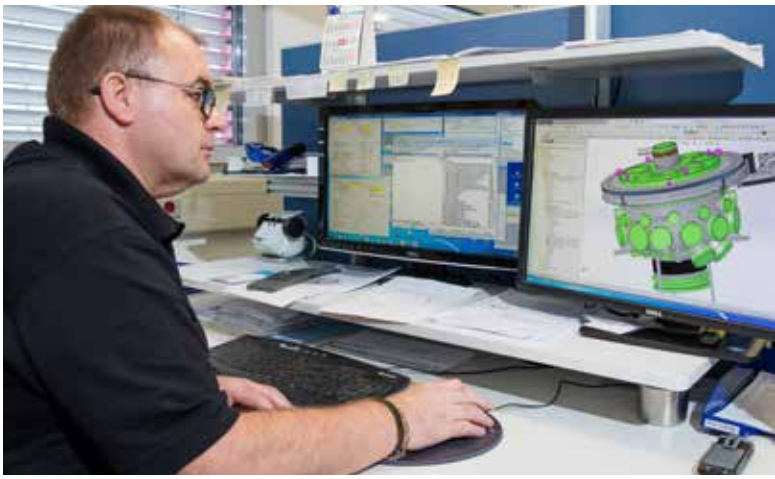
In this brochure, we are introducing you to our activities. Talk to us. We would be pleased to produce the precision components that you need.

Design and production processes

PINK's services extend from consultation, preparation and project planning through to design, production and installation on the customer site.

We consider it a challenge to meticulously analyse the customer's requirements in order to develop and produce optimum products. In doing so, we attach great importance to reliability, performance and cost-effectiveness.

In design, electrical design and equipment manufacture, PINK always uses modern software for conformity assessment in accordance with the currently valid EU Machinery Directive.



For the entire CAD/CAM process chain, extending from CAD and CAM systems to G-code simulation and tool management, PINK makes use of the latest, high-performance software.

R&D expertise for customer-specific product design

In the CAD sector, PINK works with SolidWorks, Pro/ENGINEER and PTC Creo. For CAM services, SolidCAM and TopSolidCAM are available. The range of services also comprises finite element calculations.

Quality engineering services from UHV specialist PINK

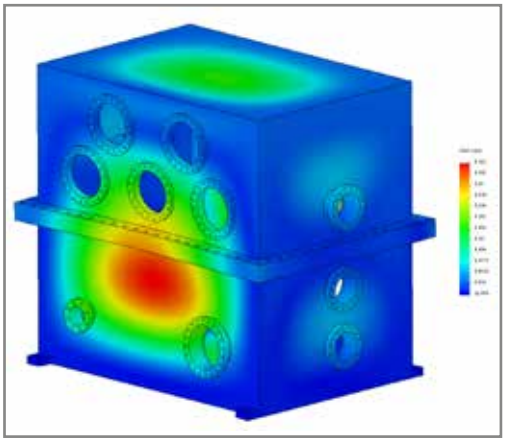
PINK's development engineers have many years of extensive experience, particularly in the development of tailor-made vacuum technology systems even within the XHV range.

Thanks to constant new tasks and the resultant development of innovations, our specialists are familiar with applying new technologies, using new materials and combining them to meet the requirements of our customers in high-precision, smooth-running and cost-effective solutions.

Our core competence in the field of customised product design is based on a huge wealth of experience. Numerous leading research institutions and industrial market leaders in vastly different technology sectors have been placing their trust in us for years.

Finite element calculations

For analysis during the design phase and in order to replicate the behaviour of designed components, PINK uses the finite element method (FEM).



Sample FEM calculation: stainless steel vacuum chamber exposed to atmospheric pressure (~10 t/m²). Our high-performance FEM simulation tool is fully integrated in the SolidWorks software and can thus be used at any stage in the development process.

Our FEM services

- Static or tension studies
- Frequency studies
- Buckling studies
- Thermal studies
- Drop test studies
- Fatigue studies
- Nonlinear studies
- Linear dynamic studies
- Pressure vessel design studies

Cutting processes

Highly advanced CNC machines for all requirements

PINK has over 30 highly advanced CNC machining centres at its disposal – with equal numbers of turning and 5-axis milling machines of various series and sizes, e.g. in universal travelling-column or portal designs, as well as a turn/mill centre with a pallet changer.

PINK has special skills in the CNC machining of highly complex and high-precision workpieces.

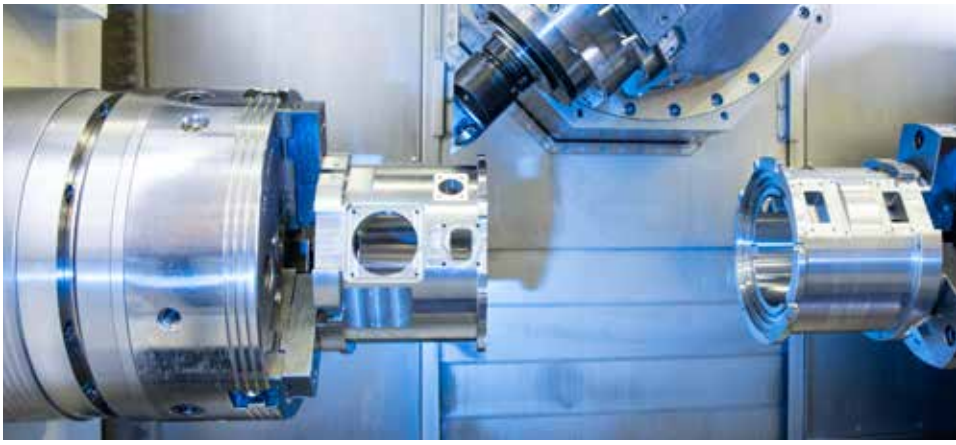
Service profile turning
- Max. workpiece length: 2,500 mm
- Max. workpiece diameter: 1,800 mm
- Max. bar capacity: 160 mm
- Max. workpiece weight: 5 t

Service profile milling
- Max. workpiece dimensions/ travel distances: X = 5,000 mm, Y = 2,100 mm, Ø = 3,400 mm
- Max. workpiece weight: 16 t
- Spindle speed: up to 18,000 rpm
- 5-axis simulation machining
- Integrated tool measurement
- Zero-point clamping systems
- 3D sensor for in-process measurement
- Tool presetters

Service profile deep-hole drilling
- Max. diameter: 32 mm
- Max. depth: 1,000 mm

On its CNC machining centres, PINK mainly processes high-grade stainless steels and stainless steel alloys with high-temperature strength, e.g. 316 L and 316 LN, Inconel, Invar, Hastelloy etc.

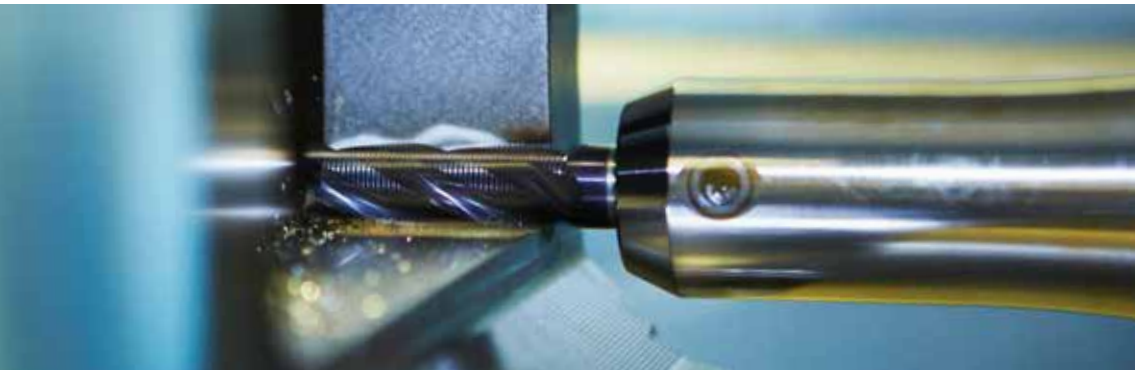
In addition, PINK has the expertise for machining numerous special materials for specific applications, e.g. titanium, molybdenum, Macor, ceramic, plastics, copper, brass, bronze and a wide range of aluminium alloys.



6-sided complete machining by turning and milling: this CNC machining centre has a main and counter spindle for the cost-effective machining of precision components.

CNC lathe for large components with complex geometries.

High-precision turning, milling and drilling



CNC milling of a large, cubic workpiece made of a high-strength aluminium alloy.

Finish machining of fully assembled modules with high precision (± 0.005 mm).

This turn/mill centre with a flat machine table offers all the possibilities of machining in a single clamping (up to Ø 1,250 mm). The workpieces are precisely aligned and machined like on a vertical lathe. In addition, they can be milled in 5 axes and, on the machine itself, assembled with extreme accuracy into complex modules.

Tool measurement in the production process on a special component made of a stainless steel alloy with high-temperature strength.

Precision welding of stainless steel, aluminium and special metals

Welding processes

The highly qualified welding specialists working at PINK process high-grade materials like stainless steel, steel, aluminium and special metals with great precision. Far from being out of the ordinary, for PINK vacuum-tight welds within the UHV and XHV ranges are part and parcel of everyday production.

Welding qualifications

- Procedure test to DIN EN 288-3
- Permit for the production of pressure vessels to AD 2000 HP0
- Welding staff tested to DIN EN 287-1

Welding processes

- TIG and MIG/MAG welding
- Microplasma welding (superfine welds in the mA range, e.g. for diaphragm bellows/corrugated tube)
- Orbital welding (closed welding systems: Ø ¼" to 2", Ø 6-57 mm, open welding systems: individually adjustable for high-purity gas lines)
- Electron-beam welding: 2 EBW units up to max. component size (LxWxH): 2,350 x 1,400 x 1,500 mm, length extendable to max. 6,400 mm

Modern electron-beam welding units

Electron beam welding (EBW) is the only reliable joining method that meets the high quality requirements of many special applications.

With its contactless mode of operation under vacuum, it displays low distortion thanks to minimal heat input. In combination with electronically controlled work parameters, the constant beam diameter at the focus ensures excellent reproducibility and a high rate of progress.

EB welding unit EBW 5003/15-150 CNC

- Beam power: 15 kW
- Accelerating voltage: 150 kV
- Working vacuum: 5 x 10^{-4} mbar

Our micro-electron beam welding unit has an SEM imaging system with scan & view mode.

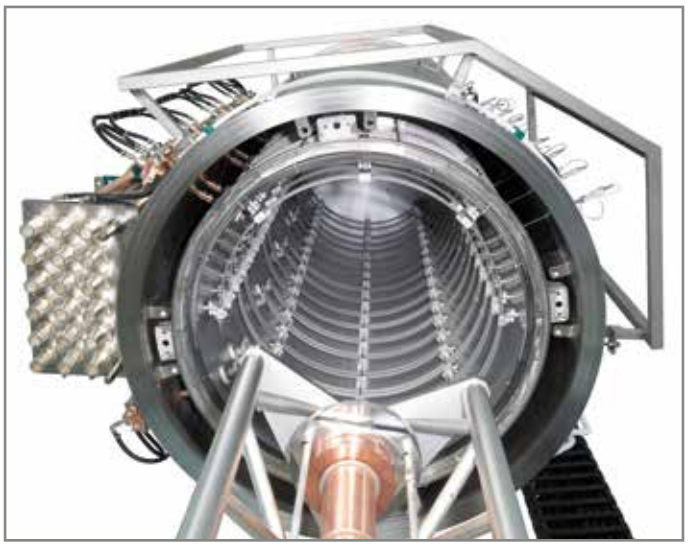
Micro-EB welding unit MEBW-60/2

- Beam power: 2 kW
- Accelerating voltage: 60 kV
- Working vacuum: 5 x 10^{-4} mbar (< 2 min)

Special joining technology: high-temperature precision soldering under high vacuum

HV vertical soldering ovens

PINK Vakuumtechnik is one of the leaders in high-temperature soldering. PINK HV vertical soldering ovens have been developed and built for the two particle accelerator projects SwissFEL and FAIR. These are used for joining together very long and complex structures and different combinations of materials with high precision.



A view inside a HV cold-wall oven: molybdenum radiant heating elements permit process temperatures of up to 1,200 °C; the base pressure of 1 x 10^{-5} mbar is generated with the aid of a totally oil-free system.

The company's own ovens have 5 heating zones and permit a uniform temperature distribution over their full length and the setting of different temperature zones. Under customer contract, they can be used for soldering and annealing components up to a size of Ø 400 x H 3,500 mm and a weight of 350 kg at a temperature of max. 1,200 °C and a base pressure of $1 \cdot 10^{-5}$ mbar. Depending on requirements, different process gases (e.g. Ar, He, N_2) can also be admitted.

High-temperature vacuum ovens

PINK has two high-temperature vacuum ovens that permit working temperatures of up to 1,500 °C and are designed for loads of up to 300 kg. These ovens are suitable for a wide range of soldering requirements, e.g. the joining of different special materials (copper, stainless steels, ceramic compounds etc.) and the simultaneous soldering of several parts, multiple faces and other complex geometries.

Vacuum-tight, thin-walled soldered joints on thick-walled components are just as possible as the soldering of very poorly accessible areas.

High temperature HV oven

- Chamber dimensions (WxHxL): 720 x 540 x 1,250 mm
- Soldering processes, e.g. Ag/Au/Pd/Ni-based

Reliable joint between stainless steel and ceramic: this high-temperature HV soldering chamber is equipped with a molybdenum rope heater and is therefore suitable for absolutely clean processes. If required, the soldering and heat treatment (see following page) can take place in a single work cycle to make the process especially cost-effective.

High-temperature HV degassing soldering chamber

- Chamber dimensions (WxHxL): Ø 400 x H 700 mm
- 3 heating zones
- Molybdenum rope heating up to 1,500 °C
- AL_2O_3 soldered joints

Non-cutting forming, material treatment, finishing

Water-jet cutting

With our large CNC-controlled water-jet cutting unit, even small series and prototypes can be cost-effectively produced.

Thanks to the CNC control of our water-jet cutting unit, we can process very different materials quickly and with high precision.

Depending on the material (e.g. stainless steel, standard steel, aluminium, lead, bronze, graphite, Hastelloy, Inconel, ceramic, copper, Macor, brass, molybdenum, titanium, tungsten, plastics like PTFE etc.), workpieces with material thicknesses up to 250 mm and dimensions of 4,000 x 2,000 mm can be processed.

Sheet working

- Press brakes (up to L 3,000 mm and 100 t pressing force)
- Sheet-metal cutters (up to L 3,000 mm and 8 mm stainless steel material thickness)
- Universal press with 100 t pressing force
- Stamping, rolling, collaring

In our high-vacuum ovens, components can be subjected to special high-temperature treatments and a particularly high degree of cleanliness can be achieved in addition.

Heat treatment processes

In addition to standard heat treatments like annealing, hardening and tempering, PINK also offers heat treatments in high-temperature ovens under high vacuum (stress-relief heat treatment, low-hydrogen annealing, recrystallisation annealing, demagnetisation annealing etc.).

The application of our heat treatment practices permits high-purity processes resulting in extremely clean components. This is due to the fact that surface reactions are prevented.

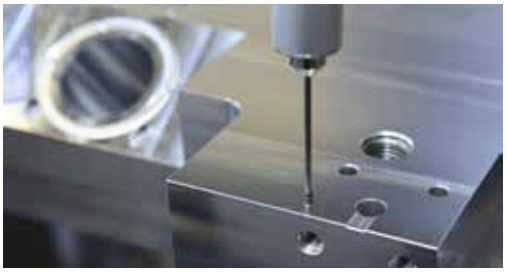
Surface finishing

It goes without saying that PINK is capable of giving your components a particularly high surface quality. The following processes are available for this:

- Flat grinding/honing
- Internal and external cylindrical grinding
- Glass bead blasting
- Electropolishing
- Polishing/manual finishing

Quality testing

All components have to undergo our production-independent quality assurance. The quality test involves a target/performance comparison showing to what extent products actually satisfy the demanded quality standards.



Surface crack testing

Surface crack testing is used for the reliable, non-destructive testing of materials for flaws with dye penetrant testing, magnetic flux leakage methods or even eddy current crack testing.

Stage 2 visual inspection to DIN EN ISO 9712

A visual inspection involves the localisation and assessment of surface-related quality features such as deviation in shape, flaws or the surface quality of a product with the human eye or by using optical aids (e.g. magnifying glass, microscope, endoscope etc.).

Permeability measurement

Where demanded, PINK measures the permeability μ_r which describes a material's magnetic conductivity.

Large, temperature-controlled measuring room

Our temperature-controlled measuring room has 90 m² of floor space and is equipped with two ZEISS measuring machines incl. Calypso software and three FARO measurement arms. Thanks to the regular training (ZEISS) and testing (AUKOM) of our employees, we uphold the highest possible product quality standards.

Measuring equipment

- The latest ZEISS measuring machines with work volumes of 2,000 x 1,000 x 800 mm (ZEISS Prismo) and 500 x 500 x 500 mm (ZEISS DuraMax)
- Faro arms (EDGE) for high-speed measuring tasks (spherical work range: 2,700 mm)

Leak tests

Leak tests for continuous testing in production and for final inspection

Because PINK products are exposed to high-vacuum conditions, our quality assurance department has an experienced and certified team (to DIN EN ISO 9712, Stage 2) that is capable of reliably testing components for leaks even within the UHV and XHV range.

Manual helium leak testing of a vacuum component between two stages in production: this test method works particularly quickly and reliably even with the smallest leaks, as the test gas helium penetrates readily into the vacuum and is reliably detected.

We therefore offer our customers a broad spectrum of leak test services and methods, ranging from leak tests to check pressurised systems (test pressure up to 300 bar) to products that have to be tested under space travel conditions. However challenging the test criteria, we are capable of reliably verifying and documenting the results for our customers.

Leak tests

- Leak tests using the rising pressure method
- Integral leak tests
- Helium leak tests
- Leak tests in the UHV/XHV range
- Burst tests with high test pressure and different test media

Marking

If desired by the customer, our QS services also comprise product marking with engraving lasers for component identification and traceability.

It is also possible to apply a 2D barcode straight onto the component.

With our engraving laser, we mark components whose subsequent identification and traceability have to be assured.

QS certifications

PINK has been awarded numerous QS certificates by independent certification bodies and customers in special sectors:

- QM system to DIN EN ISO 9001:2008
- Pressurised equipment guideline DIN EN ISO 3834-2
- AUKOM certificates
- TÜV certification of re-marking
- KTA 1401 and AVS D 100/50
- Cleanliness class verifications to DIN EN ISO 14644-3
- ZEISS certificate for cleaning and qualification for EUV optical modules

Cleanroom services to customer requirement

Hypermodern cleanroom areas and systems

Complex and highly sensitive subassemblies, modules and structures, e.g. in electron microscopy, aerospace, semiconductor technology and lithography, call for extremely clean environments and particle-free cleanroom assembly.

PINK offers a comprehensive cleanroom package comprising everything from cleaning and assembly through to packaging.

To satisfy the customer's high expectations of purity and cleanliness, PINK built a new hall containing several highly advanced cleanrooms on a footprint of over 1,600 m² at the beginning of 2013. These cleanroom areas, which are independent of each other, are certified to DIN EN ISO 14644-1.

PINK has installed spacious Class ISO 8 preparation areas as well as independent Class ISO 5 to 7 cleanrooms.

All the cleanrooms are fully air-conditioned, equipped with air locks for materials and personnel and subject to stringent cleanliness regulations and access authorisations.

With the aid of the very latest measuring instruments, particle-freedom in the air and on the surface is constantly monitored and controlled in order to ensure ultraclean conditions – even during assembly.

Cleanliness inspections: qualification and improvement of vacuum properties

A peculiarity of this cleanroom is its integrated, jacket-heated UHV residual gas analysis chamber measuring Ø 1.8 m x 2.7 m with a volume of 7.7 m³.

Hypermodern cleanroom with RGA chamber

Components for UHV and XHV facilities, as used in the semiconductor industry, particle accelerators and space simulations, call for special quality controls. For this, PINK has developed a new ultra-high vacuum system integrated in the cleanroom. By baking out the chamber to 110 °C, a base pressure of $\leq 5 \times 10^{-9}$ mbar is achieved. On request, components can be baked out at up to 110 °C under inert gas. This additional cleaning step reduces the component desorption rate.

With an inbuilt, highly sensitive quadrupole mass spectrometer, the purity/cleanliness of components can be qualified by means of residual gas analysis (RGA). Residual gases with masses of 1-512 amu can be automatically measured and documented and desorption rate measurements can be conducted and assessed.

For the next stage of analysis chamber upgrading, the plans envisage the integration of plasma cleaning in addition. With this new cleanroom strategy PINK sets new standards in cleaning and qualification.

UHV analysis facilities

To optimise and qualify the vacuum properties, PINK has further pumping stations that can used for baking purposes.

In combination with circulating air ovens, UHV and XHV chambers can be baked out at up to 300 °C. Desorption rates can be significantly improved particularly at higher bake-out temperatures.

The possible vacuum qualifications include the measurement of final pressure, residual gas analysis, measurement of the desorption rate and a He integral leak test.

Certified cleaning, assembly and packaging

This vacuum cleaning and drying unit developed by PINK is designed for fully automatic operation.

Meticulous cleaning

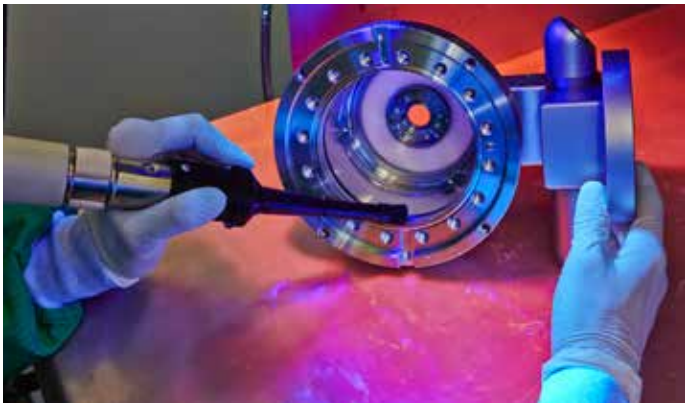
Various cleaning sections have been created at PINK, starting with wet cleaning. These include ultrasonic baths, a hot steam device and a fully automated vacuum cleaning and drying unit with an air lock function.

Throughout the washing area, osmosis water from our own reprocessing plant is exclusively used for flushing and cleaning. After wet and final cleaning with various cleaning agents and special processes (e.g. vacuum drying, baking out etc.), the components are subjected to high-accuracy inspections and controls for particulate emission limit values.

Cleanroom assembly services

If desired by the customer, PINK provides a wide range of cleanroom assembly services. This range includes the assembly of components, modules and complete systems, mainly in the vacuum technology sector.

Put us to the test!



Particle-freedom is checked among other things with UV white and black light systems.

Packaging in cleanrooms

In order to ensure continued cleanliness during the transport process, the cleaned products are carefully packaged in antistatic LDPE pouches or films and labelled. At PINK, all cleanroom process steps are conducted exclusively by skilled staff.

From the idea to the customer-specific system

High-performance systems supplier

PINK's services are not confined solely to workpiece processing. As a result of our leading position in vacuum equipment manufacture, our customers can also benefit from this special expertise. Commissioning, repairs, training and maintenance are conducted by our skilled service staff.

Via our own VPN server, our service staff are able to conduct remote maintenance via a direct link. By means of this VPN link, the service specialists can access the controls and visualisations.

When existing plant is modified to boost capacity, we can offer you our expert solutions. We are also the company to contact for updating software on existing systems.

Systems expertise in plant manufacture

- PLC controls with complete process monitoring
- Visualisation, recording and archiving of process data
- Links to various database systems
- Remote maintenance via our own VPN server
- Switch cabinet construction
- Electrical assembly

PINK is also one of the leading equipment manufacturers on the market for customer-specific leak test systems.

High technology for diversified sectors

Market leader with special-purpose vacuum technology equipment

Thanks to its decades of customer satisfaction, PINK has succeeded in cementing its leading position with user-specific vacuum technology equipment and systems.

Its comprehensive product spectrum includes UHV systems for particle accelerators, ion beam therapy units, precision coating equipment, leak test systems, high-vacuum soldering systems and much more besides.

Leading technology companies from the following sectors trust in PINK's innovative products:

- Semiconductor and electronics industry
- Automotive industry
- Medical technology
- Optical industry
- Aerospace
- Science and research

Equipment for aerospace

For the European space laboratory on the ISS, PINK has not only produced systems for on-board water, CO_2 and oxygen management but also a unit for materials research experiments in weightless conditions.

High tech for space travel: for Airbus Defence & Space, PINK has produced several systems that are in operation in the European research laboratory on the ISS.

This experimental chamber for the DynaMax project (BESSY II) with DN 800/850 COF and DN 160 CF rotary feedthroughs is intended for basic research with the aid of time-resolved experiments in the 100 fs range (angle resolution of the rotary feedthrough: ≤0.001° per motor step).

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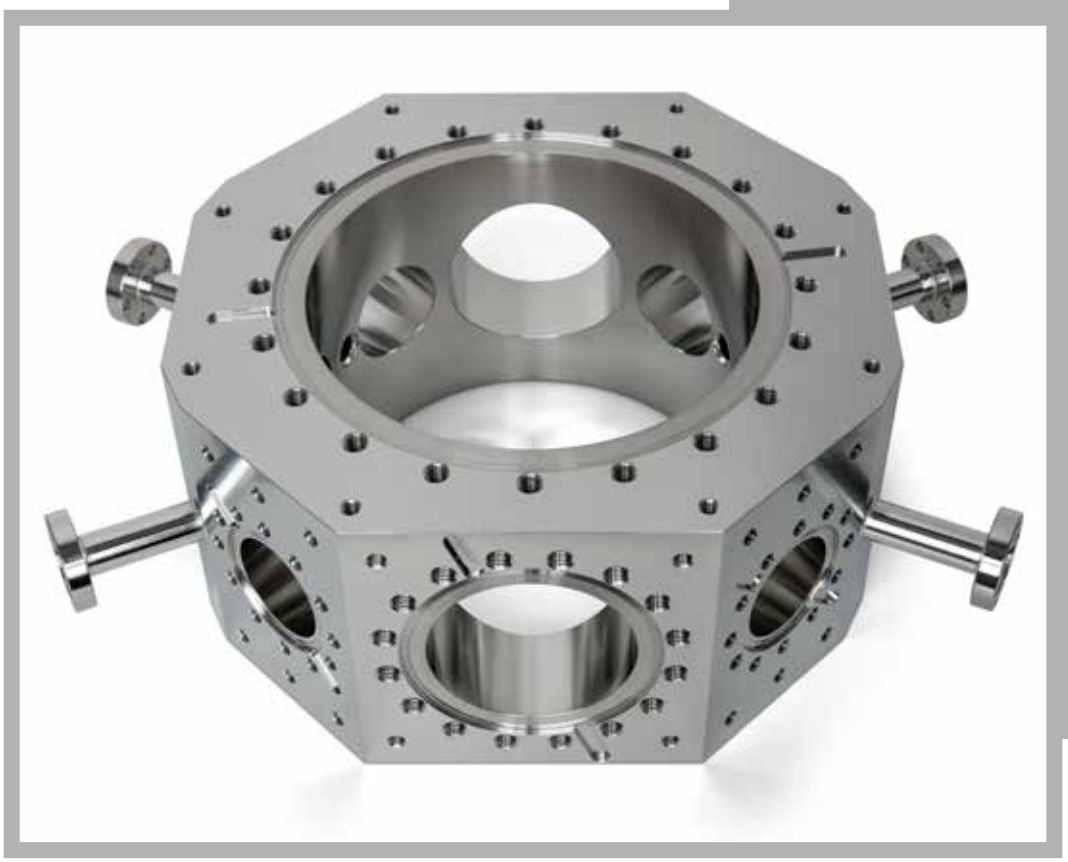

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