

BEAM TECHNOLOGY

WORLDWIDE



THE ELECTRON BEAM TECHNOLOGY

Electron beam technology meets all quality requirements for welding and surface technology. The central element of every EB system is the generator, which is similar in design to the picture tubes found in televisions.

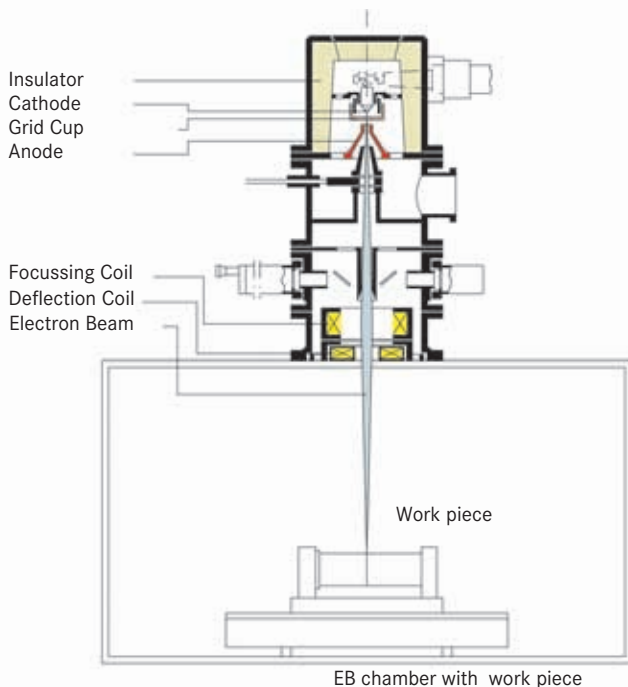
The electron beam

Accelerating voltage and beam current determine beam power. Electromagnetic systems manipulate the electron beam (deflection and focussing). The power density of the beam spot is up to 10^8 W/cm². All beam parameters can be adjusted continuously, accurately and rapidly to the task in hand.

Precision and reproducibility

The consistency of the small beam diameter at the focus point is the basis for high geometric precision. Almost all working parameters are controlled electronically and can be adjusted to suit different tasks. Excellent reproducibility of the application is the result.

The EB generator for working in vacuum (VEBW, Vacuum Electron Beam Welding)



Efficiency

High performance, high working speeds and contact-free operation all ensure the excellent efficiency of this beam technology.

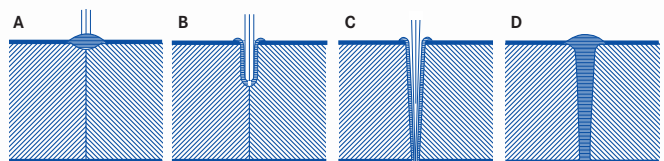
Cost-saving

- Wide choice of materials
- No additional welding material or protection gas required
- Avoidance of distortion or rework
- Welding can be final production process. Thereby minimising additional operations
- By recognizing the advantages of EB processes, improvements in current products and design of totally new ones can be made

EB welding

Beam welding is a precise welding process. Depending on the thickness of the material it can produce welds from 0.1 to a few millimetres wide. Narrow heat-affected zones and a welding depth-to-width ratio of 40:1 can be achieved.

The key hole welding effect



- (A) The high energy concentration at the beam spot melts the material.
- (B) Material vaporises in the center.
- (C) The beam penetrates deeper into the work piece through the vapor channel which is formed.
- (D) As the work piece is moved melted material flows from front to back, around the vapor channel, and solidifies.

FIELDS OF APPLICATION

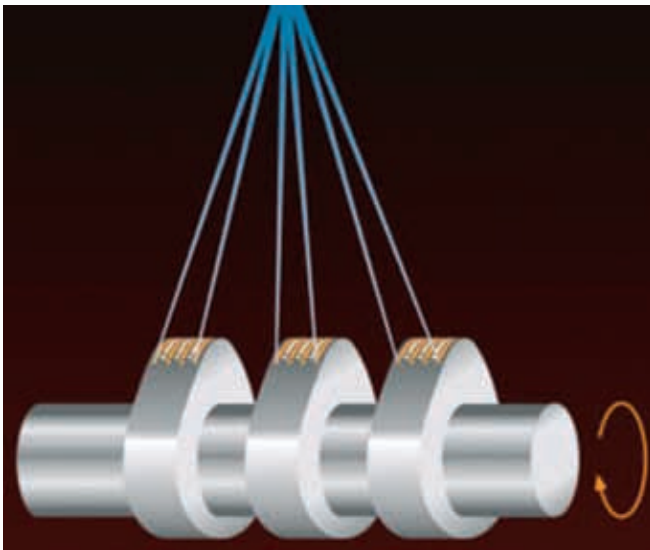
EB hardness – Maximising surface quality

Material improvement by hardening or adding alloys at the exact spot where it is needed. With programmable line and dot matrixes, hardened zones can be achieved on narrow areas or surfaces which are hard to reach.

Electron beam hardening can be used on areas requiring 0.1 to 1.0 (1.5) mm hardening depth and is used especially on parts subject to high wear or parts prone to warping. It can also be combined with other thermo-chemical hardening processes (eg. nitration).

EB re-melting

Surfaces are re-melted to change the chrystalline structure of the material which affects its wear attributes. This can be done with and without additional substances and can be carried out on different materials.



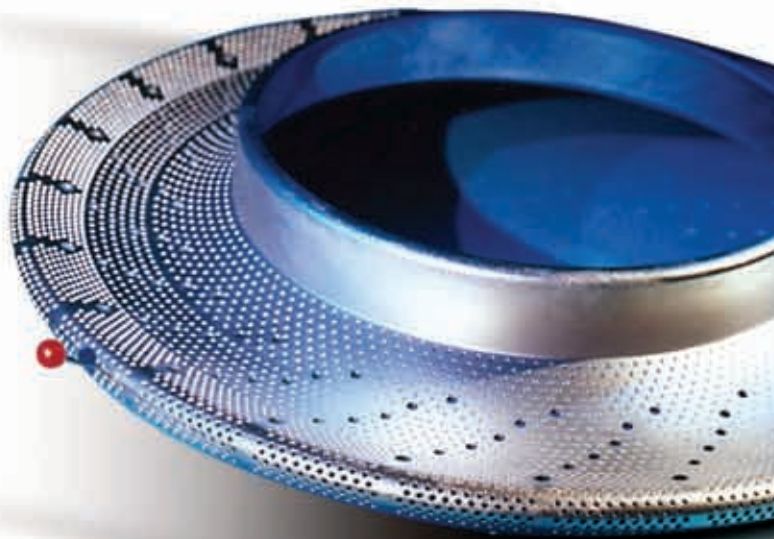
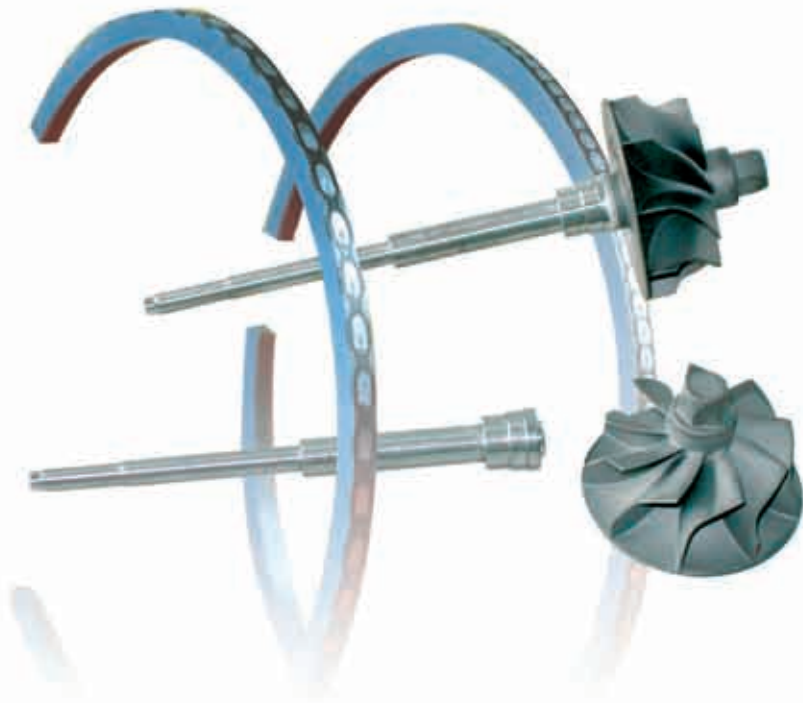
Re-melting of a camshaft

EB drilling

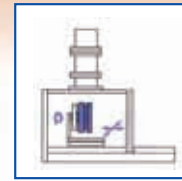
Nearly all metals and also ceramics can be drilled using an electron beam, independent of hardness, reflection characteristic, special alloys or high thermal conductivity.

The main fields of application are:

- Filter plates for the food, textile, plastic and paper industries
- Spinning heads for the production of glass fibre
- Mixer discs for jet engine technologies



CHAMBER MACHINES

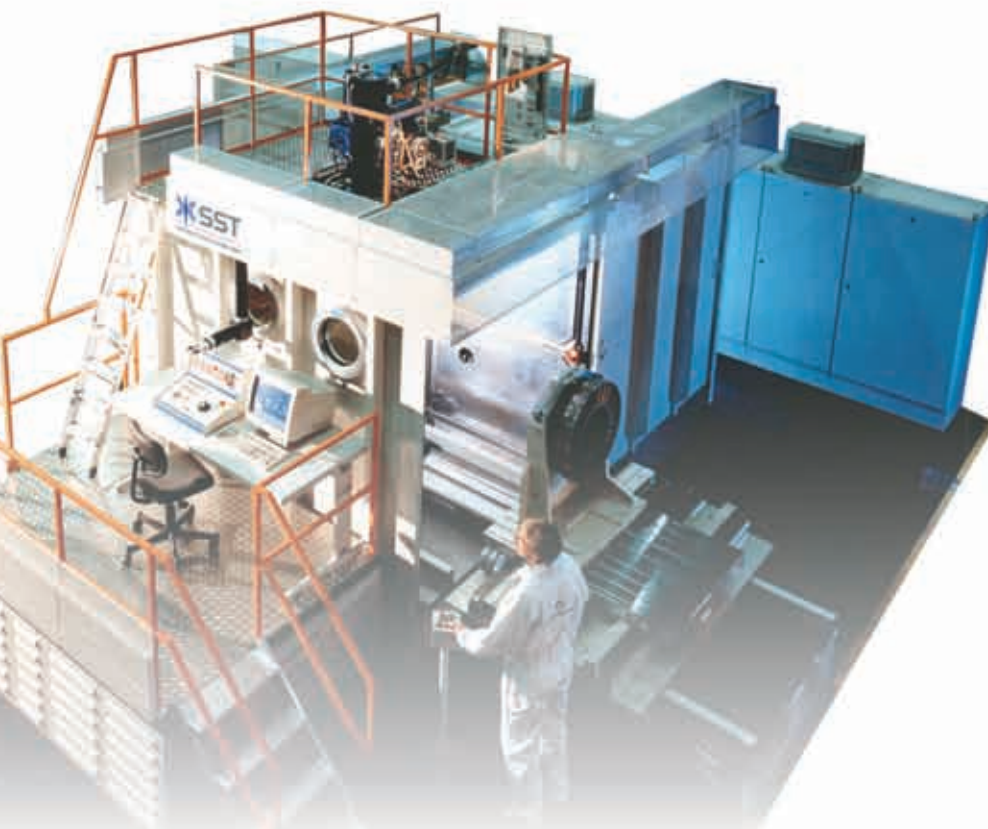


EB welding EBOCAM

Steigerwald Strahltechnik GmbH supplies machines with this universal concept for a variety of welding tasks. Different sized chambers with modular, mechanical and electrical equipment are combined with EB generators of selected ratings. The main areas of use are welding or processing of large components with complex welding seam geometry or processing areas.

Features and benefits

- Chambers of 0.8 to more than 50 m³
- High current generators with a power of 60 kW for working distances of up to 1500 mm (without affecting the beam quality)
- Optimum reproduction ability and long-term stability of beam parameters produce consistent results
- Short replacement times for the filaments without the need for readjustment of the beam position or parameters
- Position accuracy comparable with machine tools and close tolerances for speed and motion equipment



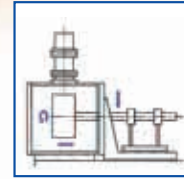
The standard equipment is an X-Y table for work piece motion and a machine control, which can be supplemented in various ways:

- Additional positioning axes such as turntables, tilting jigs or swinging devices
- Multiple work piece jigs
- Special software for SPS or CNC machines for quality assurance and documentation



Vacuum technology

SPECIAL MACHINES



EBOPULS Drilling machine

Steigerwald Strahltechnik GmbH has integrated special EB generators in its machines. The used EBCON[®] CNC technology has been designed and optimised for drilling.

EB drilling is economically efficient when processing individual work pieces requiring a high number of drilled holes.

A typical example is drilling spinning heads for manufacturing glass fibre and the production of filter plates.

Features and Benefits:

- Chambers of 0.8 to 2.5 m³ and above.
- Extremely high drilling speed due to drilling “on the fly”
- Precise drilling diameter and positioning tolerance, beam emission side without burrs
- Wear-free work on all hardnesses and surfaces
- Fast adjustment of beam parameters for complex drilling geometries
- CNC easy to program
- Angled hole axes with shallow angle relative to the surface

Air-to-Air processing machines EBOCONT[®]

Strip material is welded together on complete production lines with pre- and post-welding stations. The main use is found in the saw band industry. Square wires made of quality steel are welded onto strips made of spring steel to ensure high wear resistance and optimum flexibility. The high welding speed and quality achieved today with this machine have made SST Steigerwald Strahltechnik GmbH the market leader for EB welded saw bands.



PRODUCTION MACHINES

Mass production

Car and gear production are the main areas requiring welding of complex parts in large numbers and with the highest precision (exact seam position, least distortion). A further important field is also welding of difficult, high-temperature materials, eg. rotors for turbochargers. Other examples include the mass production of hydraulic pressure accumulators. For this kind of welding it is important that the interior membranes are not damaged and that no welding spatters into the interior.



Pressure accumulator

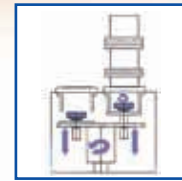
Gear production

EBW P – a classic

The Type P indexing welding machines from PTR Präzisionstechnik GmbH have been used successfully for over 40 years for this type of welding. The machines operate with indexing tables having 2 to 4 workstations.

The basic machines include an integrated working chamber with the capability of processing one (single spindle) or more parts (eg. triple spindle) in a single batch.





EBW S – the new generation

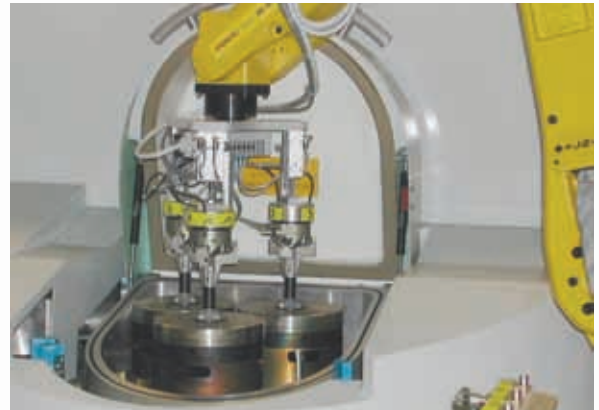
In order to shorten production time of each individual unit PTR Präzisionstechnik GmbH has continuously developed its products to reach perfection with the S machine.

EBW S cells and production lines are widely used for industrial production. The concept of the S-machine is the indexing table which is used to transfer parts from the load chamber to the processing chamber without ever having to vent the processing chamber.

Automatic feeding and pre- and post-operations are standard today, eg.:

- Cleaning and drying
- Joining by pressing, shrinking or assembly in one device
- Demagnetisation to remove magnetic fields
- Pre-heating the material (also possible during the EB process)

All processing steps as well as testing and palletising finished pieces are coordinated from the main controls of the production line and so ensure high quality.

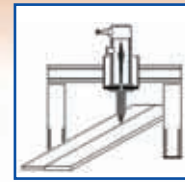


Loading turbo chargers parts onto a triple spindle

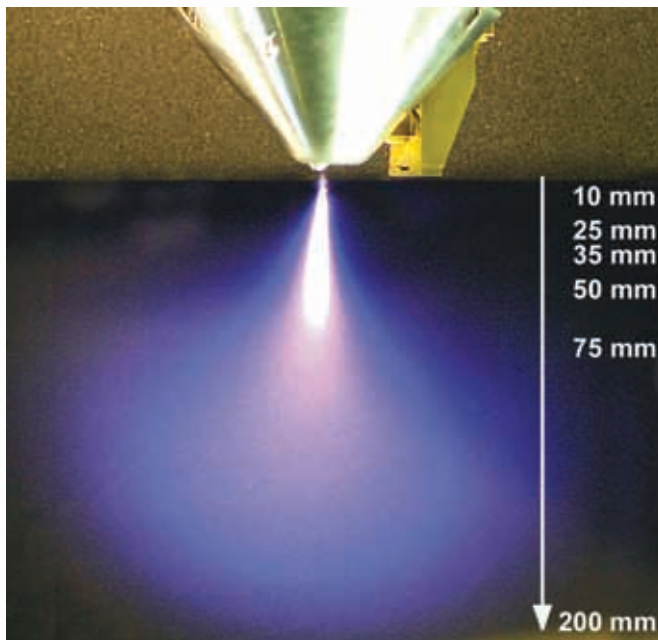
Benefits of the S machines:

- Loading and unloading of the work pieces and evacuation of the loading station during welding
- Working vacuum of 5×10^{-3} mbar
- Generators of varying power
- Welding axial and/or radial seams
- Work pieces up to $\varnothing 390$ mm and $L = 340$ mm
- Multiple spindles possible
- Easy replacement of tooling
- Complete machines on one platform enabling container transport
- Ergonomic design for manual operation
- Easy service and maximum operational safety





Vacuum electron beam welding (VEBW) is an established process for welding thermal and highly rigid and/or reactive materials. The laser is often used as an alternative in order to avoid evacuation. The Non-Vacuum Electron Beam Welding (NVEBW) from PTR Präzisionstechnik GmbH which operates at atmospheric conditions, is an economical alternative as it is decisively more powerful.



Dispersion of an electron beam in atmosphere

Principle and special characteristics:

The Electron beam is generated in the high vacuum of the EB generator and transferred to the atmosphere via a pressure step system. Evacuation times no longer exist. The electron beam is focussed magnetically onto the work piece. In order to achieve narrow seams the working distances are generally between 6 and 30 mm. The work piece and/or the generator are moved during welding. The diffusion effect of the beam exiting into atmosphere can be reduced by letting out a stream of helium coaxial to the electron beam.

Areas of use

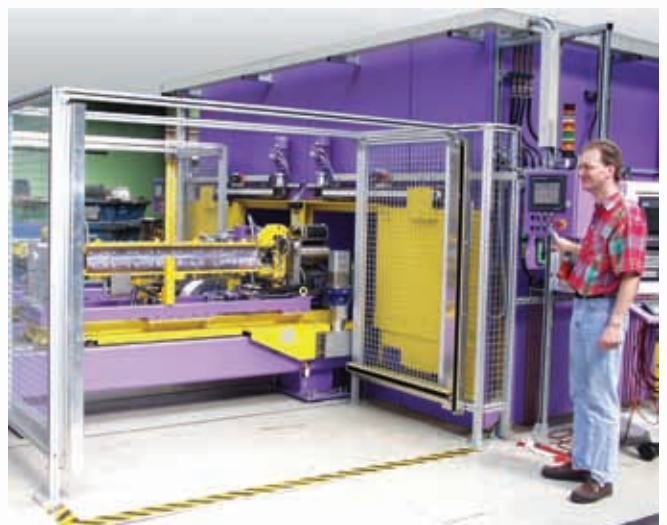
This form of welding is carried out preferably without additional material. Butt joints, overlapping seams, T-joints, leaf-edge joints, edge fillet welds, raised seams are especially economical. In the preferred applications the thickness of the welded materials is between 0.5 to 5 mm. This process can be used for all welding materials.

Processing advantages of NVEBW:

- Overall efficiency (wall plug to work piece) > 50%
- Energy coupling efficiency >90%
- High welding speeds and low energy useage with beam power up to 30 kW
- Low operational costs and inexpensive spare parts
- High processing safety and easy quality assurance

Areas of use for NVEBW machines

- Car industry: tailored banks, instrument panels, exhaust systems
- Tool building
- Welding technology laboratories

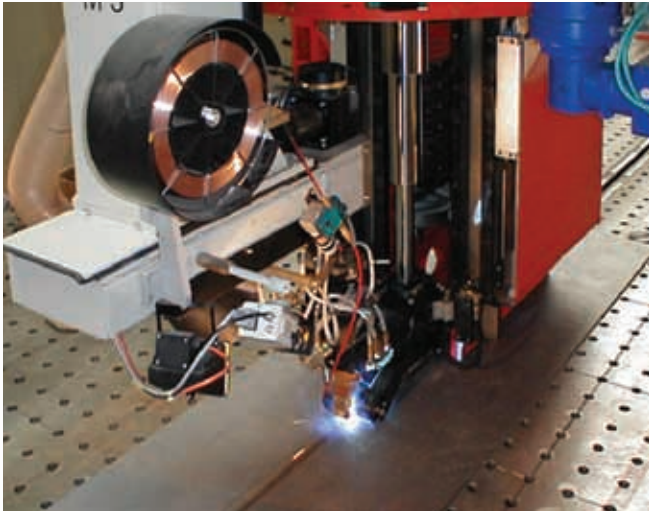


LASER BEAM MACHINES



Areas of use

The laser is the basic tool used for material processing in the car industry, household appliance technology, train industry as well as the ship-building industry.



Butt seam welding with additional material



Welding T-joints

Plate heat exchangers

In the conventional production of large plate heat exchangers so much heat is produced that the work pieces must be trimmed, straightened and polished on the back after welding.

The laser avoids this additional work and allows for complex cooling structures with flexible programming. The laser makes the production of heat exchangers much more economical.

Special applications

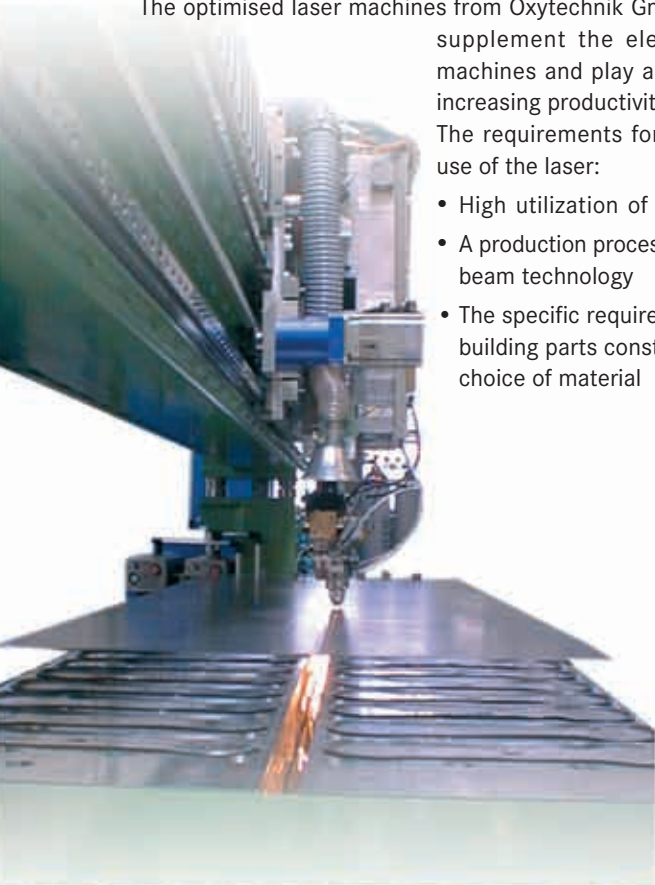
The optimised laser machines from Oxytechnik GmbH & Co.KG supplement the electron beam machines and play a large role in increasing productivity.

The requirements for economical use of the laser:

- High utilization of the machine
- A production process suitable for beam technology
- The specific requirements for building parts construction and choice of material



Cutting of titan tubes for Airbus



AUTOMATION

Highly efficient mass production

Beam technology is suitable for the mass-production of parts. Lasers are often used, but these have limits and the electron beam is often an alternative or even the only tool for certain welding problems.

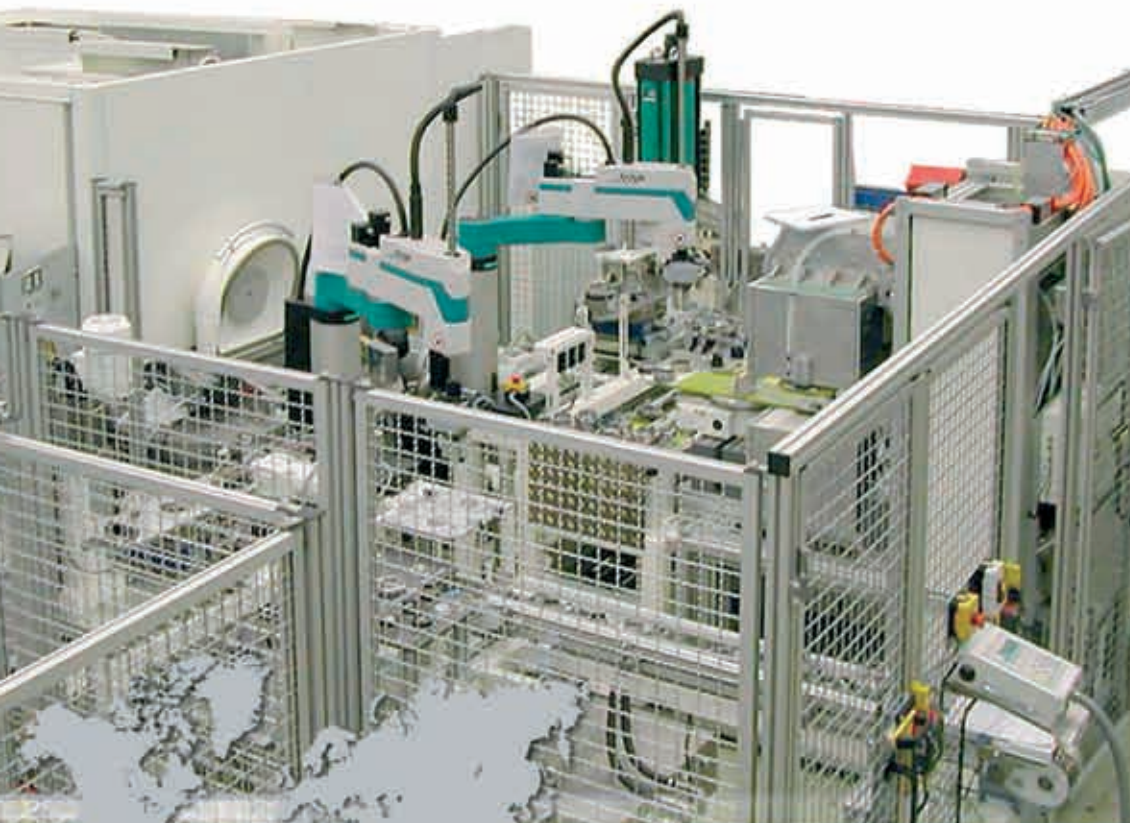
Mass produced parts are manufactured in highly efficient lines by stamping and/or metal-cutting methods. The cutting and cooling fluids used here can make the work piece dirty. For welding, the parts must be thoroughly cleaned and not be magnetic. Some welding materials require thermal pre- and post-treatment and suitable mounting devices are required to ensure that all the parts are welded at the exact same point.

Every seam error can cause considerable damage and for this reason all seams must be carefully controlled.

All companies within the ALL WELDING TECHNOLOGIES GROUP are also specialised in the design and production of such complex machines and the supply of complete manufacturing lines.

Typical processes in a production line:

- Cleaning of parts before and after welding
- Demagnetising
- Joining/pressing
- Pre-heating
- Automatic loading/unloading
- Welding – EB or laser
- Cooling of parts
- Inspection (eg. Ultrasound)
- Palletising



Service

FROM THE ENQUIRY TO THE END PRODUCT

Machine and process development

We work together with our customers as partners from the initial enquiry through to production. Years of experience and the most up-to-date electron and laser beam technologies are available to our customers. Together with them we develop the best concept for a processing machine.

At all its locations the ALL WELDING Group offers technically mature and economical beam technology for welding, hardening, re-melting and drilling.

Job-shop production

With our job-shop production we accompany and advise our customers from the development of a prototype, on to the planning stage and through to purchase of a production machine.

Our high-quality machines and competent service team ensure punctual delivery of your quality products.

Sales

The companies within the ALL WELDING TECHNOLOGIES GROUP are active worldwide. Sales engineers are on hand to give qualified, expert advice both nationally and internationally and our know-how and excellent application laboratories remain available to our customers even after they receive their machine.

Training

As part of the whole project we offer substantial training programmes targeting your maintenance and service personnel to explain and teach them about the electron beam technology and to set up the machines at the customers' sites. This results in the best possible operation times of the machines and the best product quality.

After Sales Service

Our commitment to you does not end at the delivery and initial operation of the machine. We offer our customers a much more comprehensive service package throughout the entire operational life of the machine to help maximise productivity and minimise operating costs. This includes:

- Training for existing and new staff
- Software upgrades
- Maintenance and inspection contracts to guarantee continuous service
- Spare parts management
- Machine inspection and advice centre
- Maintenance and rebuilding
- Re-engineering of used equipment to adapt it to new needs
- Further development and modernisation of machines and controls
- Assistance during times of high production by offering production in our Job Shop



Our customers speak for us.

Their success is our motivation.



PRÄZISIONSTECHNIK GMBH
PTR PRÄZISIONSTECHNIK GMBH
Am Spitzen Sand 1
D-63477 Maintal, Germany
Tel.: +49(0)6181.4094-0
Fax: +49(0)6181.4094-13
E-Mail: zentrale@ptr-gmbh.de
Internet: www.ptr-gmbh.de



STEIGERWALD STRAHLTECHNIK GMBH

STEIGERWALD STRAHLTECHNIK GMBH
Emmy-Noether-Straße 2
D-82216 Maisach
Tel.: +49(0)8141.3535-0
Fax: +49(0)8141.3535-215
E-Mail: info@steigerwald-eb.de
Internet: www.steigerwald-eb.de



SYSTEMS · ENGINEERING

OXYTECHNIK GMBH & CO.KG
Königsteiner Str. 20a
D-65812 Bad Soden
Tel.: +49(0)6196.6518-0
Fax: +49(0)6196.6518-19
E-Mail: mail@oxytechnik.de
Internet: www.oxytechnik.de



PRECISION TECHNOLOGIES INC.

PTR-PRECISION TECHNOLOGIES, INC.
120 Post Road Enfield,
CT 06082-5625, USA
Tel.: +1 860.741-2281
Fax: +1 860.745-7932
E-Mail: info@ptreb.com
Internet: www.ptreb.com