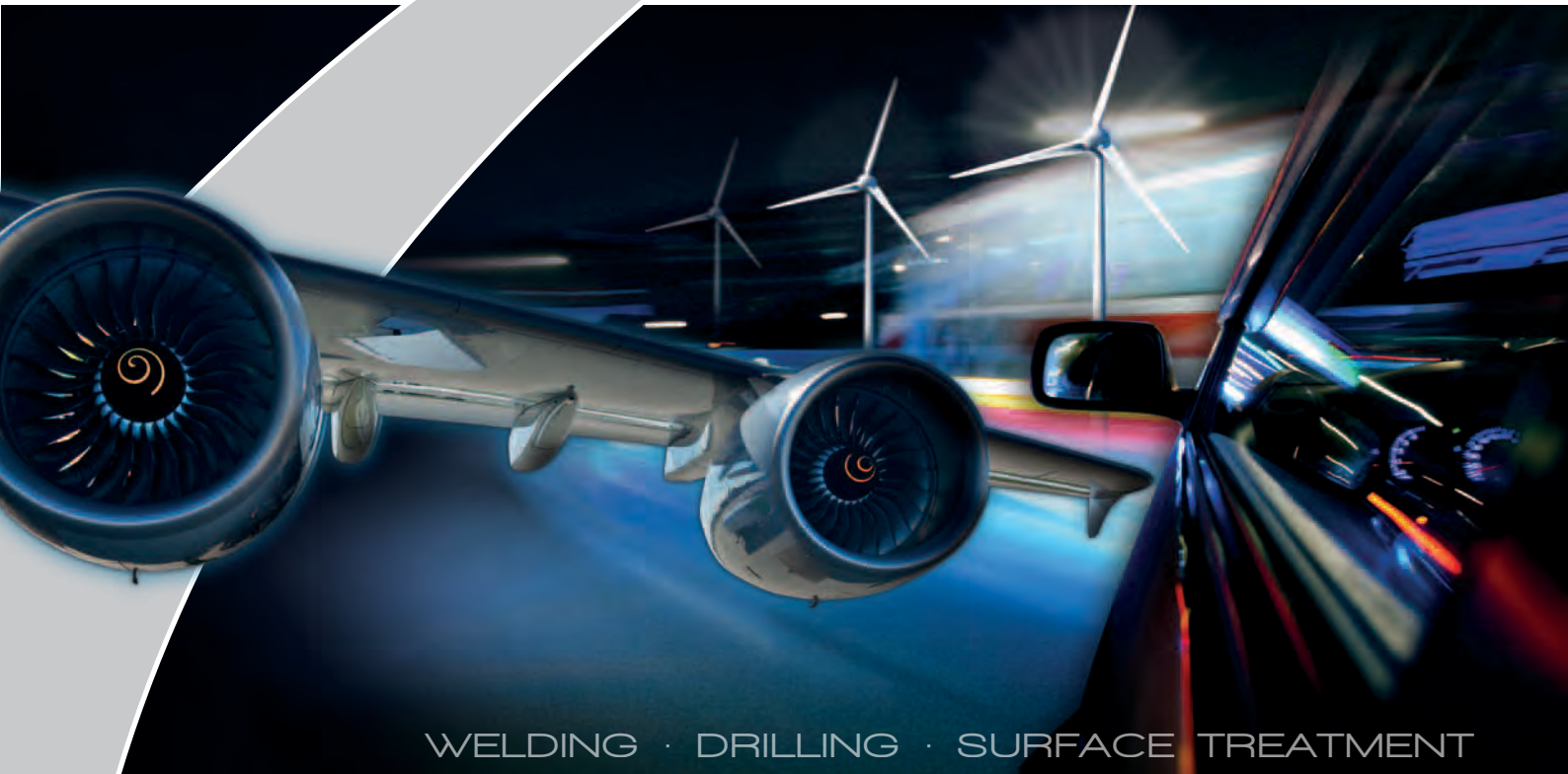




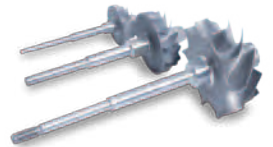
THE INNOVATORS OF THE ELECTRON BEAM



WELDING · DRILLING · SURFACE TREATMENT

ELECTRON BEAM WELDING

CONTRACT MANUFACTURING SERVICES



Members of Global Beam Technologies AG

WE'RE TALKING ABOUT GLOBAL CONNECTIONS



As a medium-sized corporate group operating on a global scale, we are the leading developer and manufacturer of electron beam systems for welding, drilling and hardening. And as a part of Global Beam Technologies AG, the name PTR Strahltechnik GmbH not only stands for developing and producing high-quality and reliable EB systems. PTR also stands for high-performance contract manufacturing. PTR can access a combination of employees with many years of experience and the potential of state-of-the-art EB systems.

PTR JOB SHOP: EB WELDING SERVICES

Essential to our success is our expertise and many years of experience as an EB specialist. And don't forget that our multiple certifications, welding specifications approvals, and WPQ's are just as important.





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AND ALSO FOR YOUR INDUSTRIAL SEGMENT EB WELDING AS A SERVICE



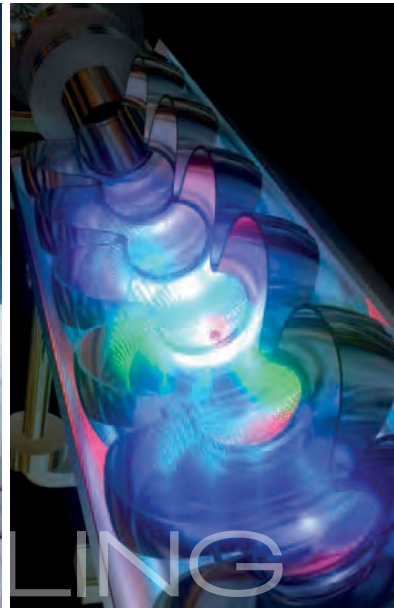
RENEWABLE ENERGY



AUTOMOTIVE INDUSTRY



AVIATION AND SPACE TRAVEL



RESEARCH & DEVELOPMENT

PTR JOB-SHOP: EB WELDING AS A SERVICE

Contract manufacturing is not just contract manufacturing – that applies especially when using EB technology. After all, here it is more a question of high-strength welds that are subject to enormous loads later. It doesn't matter whether it's the automotive industry, machine engineering, aviation, space travel or defense engineering – we have had the specific expertise needed for years. Our products range from components valued at just a couple of euros right up to component parts installed in the Tornado fighter jet; because they must stand up to the highest requirements. Our lot sizes range from a single prototype right up to 100,000 parts a year.

It often makes more sense for companies to farm out production temporarily or even permanently. We carry out your orders on time while meeting all specifications with our world-class machinery and expert operating personnel – whether it's EB welding, EB drilling or EB hardening. Don't forget, we also provide offloading welding services whenever there may be bottlenecks in your own production. Our Job-Shop will advise and guide you in product development and in producing prototypes.

We are your partner for:

- EB welding
- EB drilling
- EB hardening
- single contracts and mass production from cleaning right down to testing
- all materials suited to welding
- all seam depths
- large and small component parts





UTILITY VEHICLE INDUSTRY



DEFENSE



MEDICAL TECHNOLOGY



SHIPBUILDING

JOINING FORCES TO REACH OUR TARGET

To fully exploit the potential of the electron beam, you should integrate its features as early on as possible in the design phase. That ranges from selecting the right materials, through defining the joints, right down to defining inspection criteria. We would be glad to support you in this process from the first idea right down to the finished design. We are regularly in contact with universities and welding institutes which means that we can even master very special challenges.



EB – A VALUABLE INVESTMENT

If you are planning a change-over to electron beam equipment and invest in your own EB system, our project engineers will devise technical solutions adapted to your welding jobs and production line. This guarantees efficient and low-cost production conditions.

In other words, don't take any chances – our service centre will give you the opportunity

- **to use models produced by us to see the increase in quality even before investing and**
- **to make an evaluation of economic efficiency with proven data.**



EB WELDING

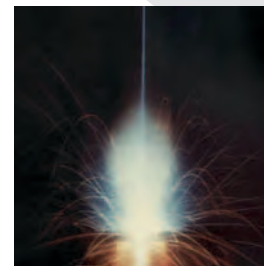
THE BENEFITS OF EB WELDING

One essential feature of the electron beam is its extremely concentrated energy that is maintained through a large depth of focus. That means that you can join even large material cross-sections in one single “pass” with a weld shape that also has an extremely parallel sidewalls. This characteristic generally enables you to design the joint as a butt joint without a gap and without any special preparation for the seam – generally without filler material.

The fact that the welding process takes place in a vacuum guarantees optimum material protection. There isn't any better protection in welding metallurgy because a vacuum is the optimum requirement for unbeatable void-free seam quality. It even guarantees you can safely weld reactive materials such as titanium.

And don't forget, since the electron beam consists of electrically charged particles, the beam can be deflected with magnetic fields at extreme frequencies up to 1 MHz. This opens up entirely new possibilities such as simultaneous welding at various locations, welding while preheating and smoothing with two other beams, and other process combinations.

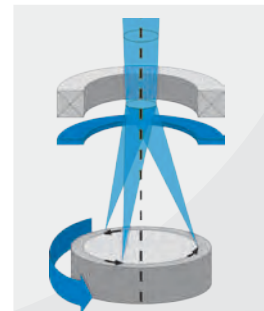
- **welding depths from < 1 mm to 100 mm and more can be made in a single pass**
- **highly precise, adjustable electrical process parameters guarantee maximum weld reproducibility**
- **completely automatic welding processes**
- **narrow, parallel-sided seams and minimal heat-affected zone**
- **welding processes with minimum energy per length of weld, minimum material affected and smallest workpiece distortion**
- **vacuum environment supports void free, flawless welding seams**



The electron beam is generated and applied in a vacuum – there isn't any better protection in welding metallurgy.



Thanks to the maximum power density, the electron beam generates very narrow seams (depth/width up to 40:1).



Low-distortion welding of gear wheels: simultaneous welding at three positions. This is where welding distortion compensates for itself and the joining pieces do not shift in relation to one another.

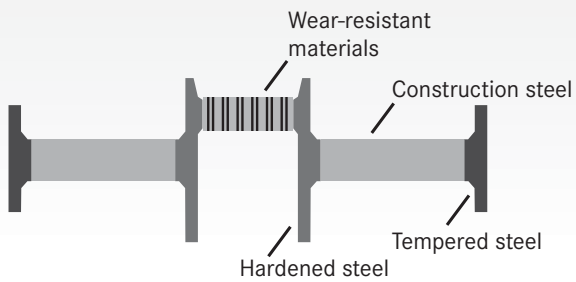




EB WELDING

STREAMLINED WORKPIECE ENGINEERING

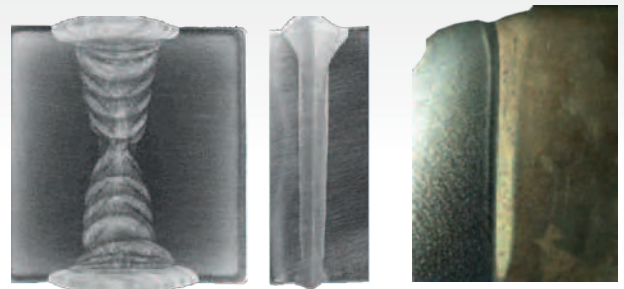
Dissimilar materials can be used which are excellently suited to one another depending upon the specific mechanical requirement for each segment of the workpiece. With EB welding of final-processed components, the material and production costs are often lower than if the component is produced from a single piece.



On worm gears for instance, the hub can be made of steel while bronze is selected for gearing because of its more favourable sliding characteristics.

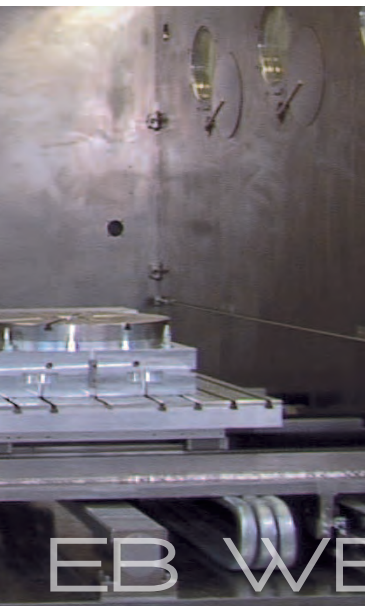


Worm gear

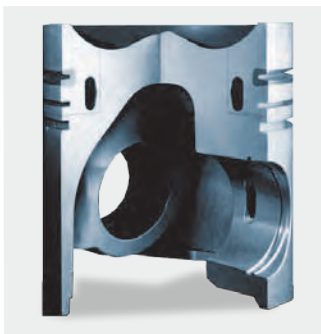


Comparison:
Multiple-layer arc versus single-pass EB welding.





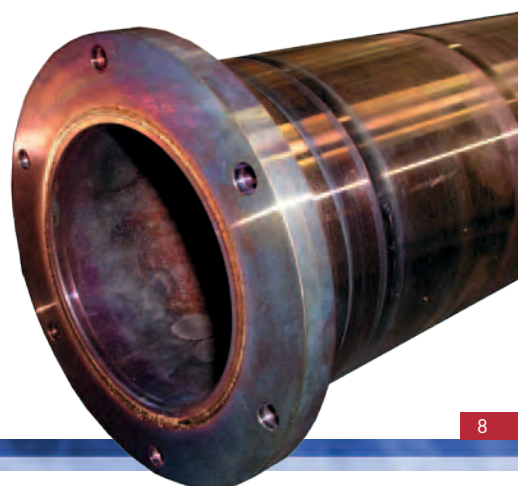
The high level of beam output available with EB gives you entirely new design options. For example, you can weld materials with a high thermal conductivity such as aluminium or copper without any problems. The figure below shows a large diesel piston from an aluminium alloy with an extreme seam depth of 80 mm at a width of about 1 mm!



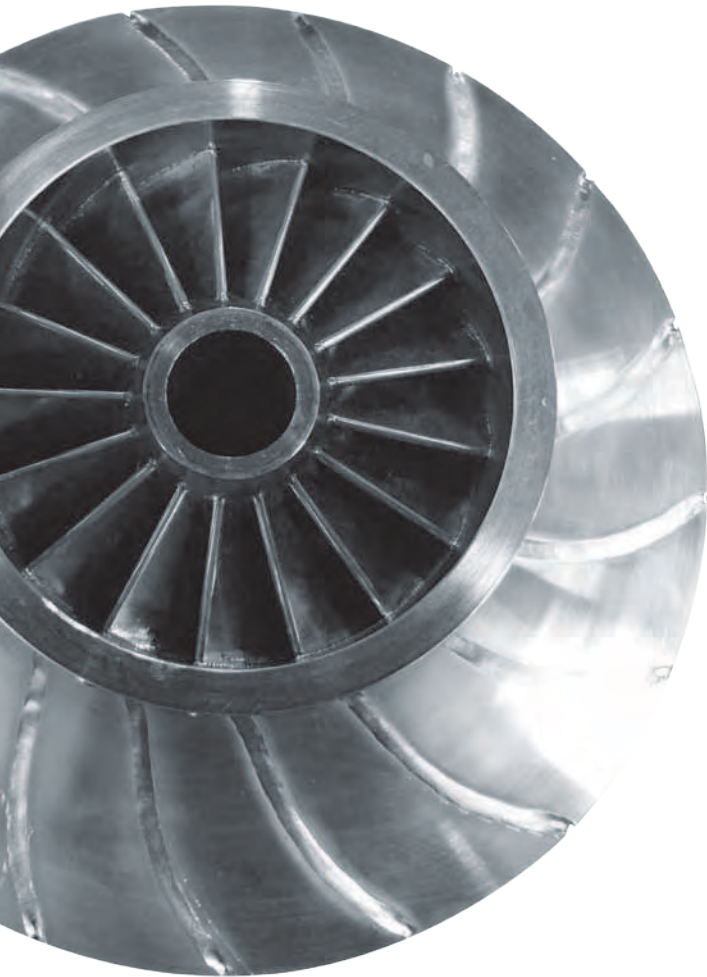
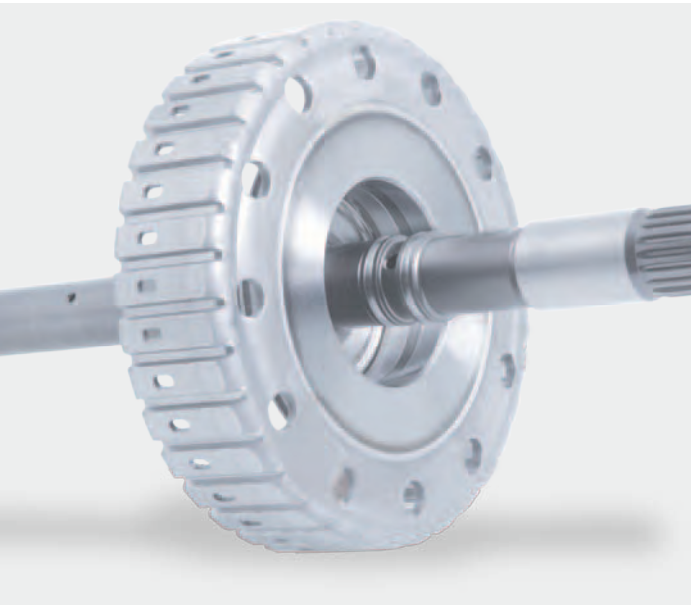
Cooling channels are often formed with precisely shaped and mechanically produced inlay parts. However, it is more economical to enclose the channels with a “cover”. Finally, a seam is made by the electron beam through the cover into the base plate guaranteeing the strength and consistency needed with a very safe and reproducible process.



Additionally, PTR has a wide range of systems from production welders for small parts that can be efficiently welded in fast production lines to large chamber machines equipped with an X-Y table, for component parts with an edge length of several meters.



JOB SHOP:
PRECISION FOR DIVERSE APPLICATIONS



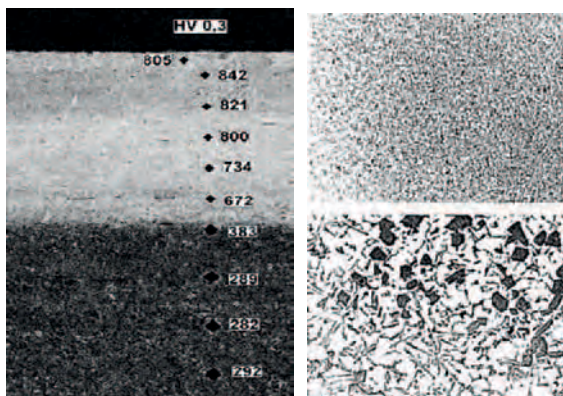
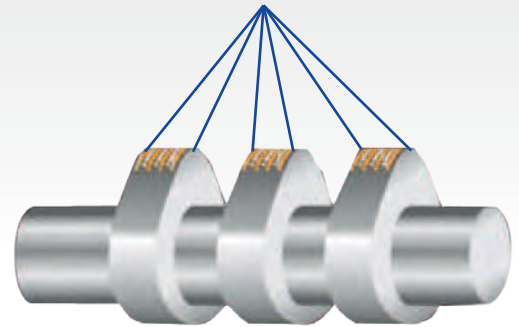
JOB SHOP: SURFACE TREATMENT



THE BENEFITS OF EB HARDENING

The electron beam enables you to harden precisely defined zones of the workpiece. That means the hardness only forms where it is needed – on the surface. Meanwhile, the material below the surface is not affected so that it maintains its original properties such as toughness and ductility. Furthermore, workpieces are heated only slightly since it is only the edge layer that is heated and only at the places you want it. This is why there is only minimum mechanical distortion.

This is why this process is preferably applied as the last step on final-machined workpieces.



The microstructure of the refined edge layer on basic non-affected materials



The view into a flexible chamber system with all of the technical options including fast beam deflection.



Millions of passenger car camshaft pieces are partially surface hardened with the electron beam: the individual camshaft running paths, the flanks, and some of the inside gearing.

Due to the minimal part distortion, workpieces are hardened after final machining.



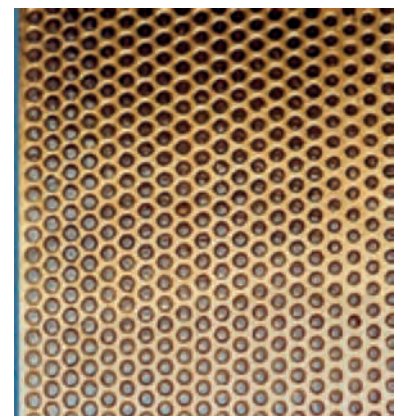


THE BENEFITS OF EB DRILLING

Mechanical or eroding processes are often ruled out if you need a large number of holes at a high level of precision – often with high-strength or creep-resistant materials. However, almost all metallic materials can be drilled with the electron beam regardless of hardness or reflection behaviour – several hundred times per second. That’s the reason why this process is used to drill spinning heads for producing glass fibres, filters and nozzles for combustion chambers.



Spinning head drilled with EB for manufacturing glass fibres.

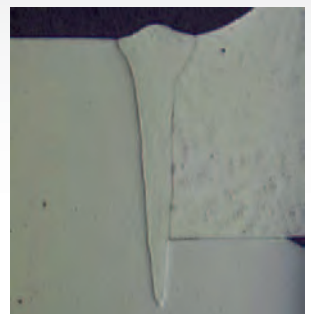


CERTIFIED QUALITY FROM THE START



DOCUMENTED QUALITY

Trained and expert EB welders using high-performance and reliable machines make it possible to plan on high quality welds. PTR documents quality with our own qualified and certified testing personnel. Whenever necessary, we also use external test laboratories.



We prepare and evaluate cross sections in our own metallographic laboratory.

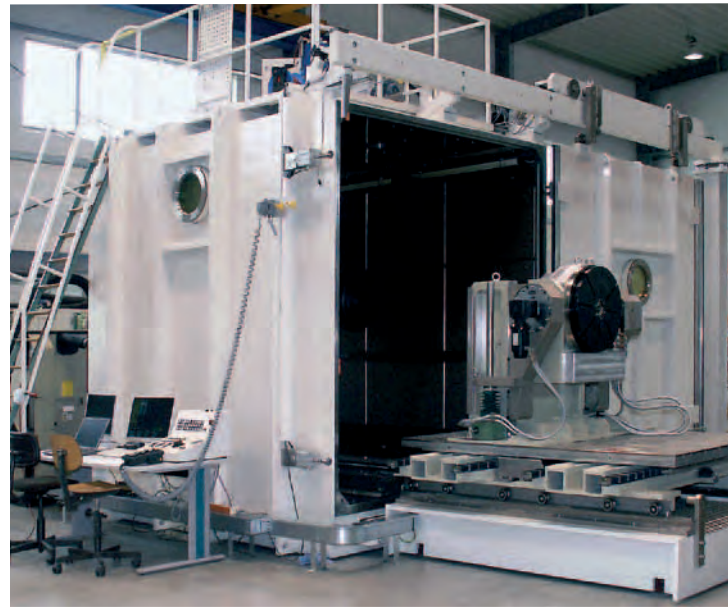
CERTIFICATIONS AND WPQ'S

Certifications are needed to weld workpieces from various industries. This is the reason why PTR Strahltechnik GmbH has the following certificates:

- **DIN EN ISO 9001**
- **DIN EN ISO 3834**
- **DIN EN ISO 14732**
- **AD 2000 –HP0 code of practice (pressure vessels)**
- **DIN EN 15085-2 (railway permit)**
- **Marine permit in conformity with Germanisches Lloyd and the American Bureau of Shipping (ABS)**

If your line of business requires other certifications, we would be glad to provide the basis for acquiring it. Get in contact with us.



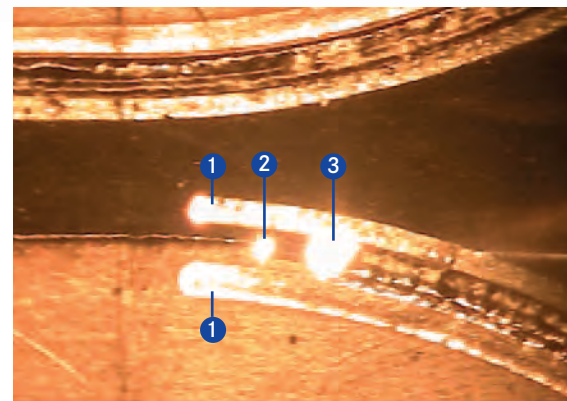


OUR JOB SHOP MACHINERY

Our Job-Shop has a varied array of tried and true EB machines from our own factory. This guarantees that you can select the optimum plant for your project. Some of these are certified in conformity with EN ISO 14744 or can be certified at your request. A brief outline illustrates the variety of our systems:

- cycle machines with short evacuation times
- universal chamber machines with an x-y table for any workpieces
- large-scale chamber systems for component parts with several meters of edge length
- systems with fast beam deflection for hardening and multiple pool welding
- systems with as much as 30 kW of output for welding seams to 150 mm depth
- systems for electron beam drilling

Some of these systems are equipped with wire feeders as well as having the option of recording and monitoring the current machine data during the welding process. Beyond this, there are various furnaces available to preheat components, defined cooling down or for general heat treatment.



The latest system technology such as the fast EBO Jump multiple beam equipment can generate an additional smoothing pass and other heat fields parallel to the actual penetration welding.

- 1 Workpiece pre-heating
- 2 Welding
- 3 Cosmetic pass



www.ptr-gmbh.de/en



MEMBER OF

THE JOB SHOP SITE MAP

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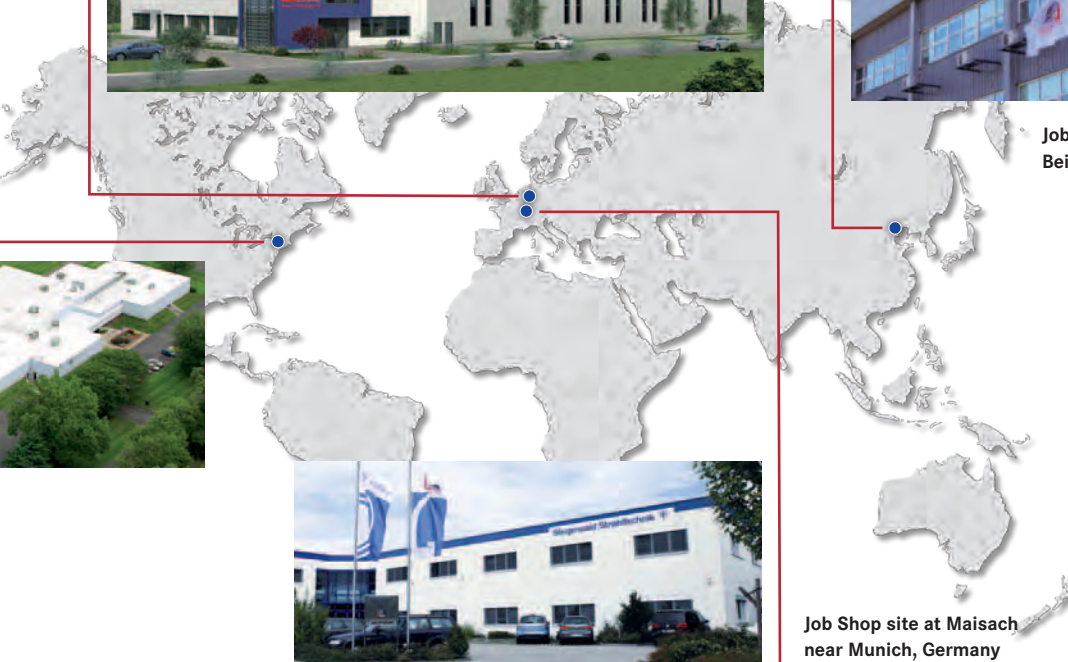


The Job Shop Innovation Center in Langenselbold near Frankfurt, Germany



Job Shop site at Beijing 102202, China

Job Shop site at Enfield, Connecticut USA



Job Shop site at Maisach near Munich, Germany



Steigerwald Strahltechnik GmbH
Emmy-Noether-Str. 2 · 82216 Maisach · Germany
Tel: +49 8141 3535-0 · Fax: +49 8141 3535-215
info@steigerwald-eb.de · www.steigerwald-eb.de



PTR Strahltechnik GmbH
Am Erlenbruch 9 · 63505 Langenselbold · Germany
Tel: +49 6184 2055-0 · Fax: +49 6184 2055-300
zentrale@ptr-gmbh.de · www.ptr-gmbh.de



PTR-Precision Technologies, Inc.
120 Post Road Enfield · CT 06082 · USA
Tel: +1 860 741-2281 · Fax: +1 860 745-7932
sales@ptreb.com · www.ptreb.com



AJM Robotic System Co., Ltd.
Building 40 · No. 4 Dongdajie · Nankou Town · Changping District · Beijing 102202 · China
Tel: +86 (10) 6977 8000-10 · Fax: +86 (10) 6977 8005-10
eb@igm-china.com · www.aijiemo-eb.com