

THE INNOVATORS OF **THE ELECTRON BEAM**



SOLUTIONS FOR THE
AEROSPACE INDUSTRY



THESE ARE GLOBAL LINKS



Company headquarters in Maisach near Munich

GBT-GROUP – THE INNOVATORS OF THE ELECTRON BEAM

In our capacity as a globally operating medium-sized company, we are leaders in the development and manufacture of electron beam machines and equipment for welding, perforation, drilling and surface treatments. Customers benefit globally from our know-how, from reliable, innovative technology and from our many years of experience as electron beam specialists, ranging from the automotive and the aerospace industry covering all branches of mechanical and electrical engineering including special applications.

THE SPECIALIST FOR THE TURBO MACHINERY INDUSTRY

Steigerwald Strahltechnik GmbH acts globally as a partner, especially for the Turbo Machinery Industry. The company specialises within the Global Beam Technologies Group on chamber systems for welding and drilling and also for EB generators in high voltage technology (up to 150 kV/175 kV).

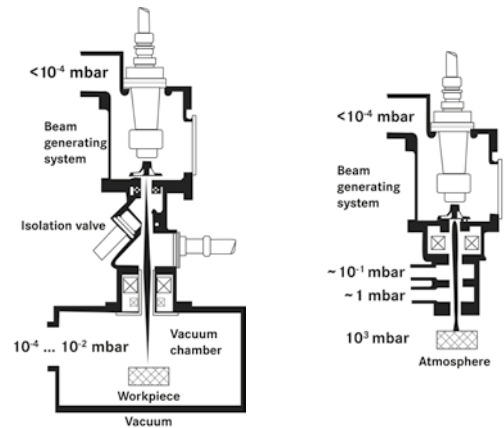


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HIGH TECH WITH THE ELECTRON BEAM

The EB welding process requires the lowest linear energy to create a certain welded connection, compared to other fusion welding processes. This means that the welding shrinkage is at a minimum and that prefabricated single parts can be added in practically all applications – a **gigantic advantage for industrial production processes.**



THE PROCESSES

UNDER VACCUM:

The seam configuration you want can be created by modulating the welding pool with small, low-frequency beam deflection, which can also eliminate irregularities. The innovative EBO Jump-Technology of the “fast beam deflection” makes the electron beam multi-talented so that it can execute several processes at the same time.

IN ATMOSPHERE:

Deep-weld effects of up to 20 mm are possible without evacuating the chamber, where

- **wide tolerances can be accommodated,**
- **high welding speeds are possible,**
- **heat input and component distortion are at a minimum and**
- **usually no inert gas is necessary.**



THE INNOVATIVE MULTI-BEAM TECHNOLOGY

EBO Jump is the fast deflection technology with frequencies up to 100 kHz which allows simultaneous welding of several joint positions and simultaneous execution of several welding processes. This process offers the user new options for improving or extending process technology.

Programmable, highly flexible deflection electronics which provide fast exact positioning and movement of the electronic beam are at the heart of EBO Jump. Innovative, digital power amplifiers for the deflection and focussing coils guarantee precise positioning of the beam, whereas the new control concept provides complete control of the CNC control and its sequences.



Simultaneous EB processing with pre-heating to the required temperature, welding and fully finished seam



Welded seam executed with EBO Jump technology



1. HIGH POWER DENSITY

The extremely high power density of the electron beam provides the so-called deep-weld effect, permitting even large material cross sections to be welded in a single pass – mostly without any filler material. Micro-welds can also be executed with the electron beam without any problems.

2. ECONOMICAL AND COST-SAVING

Higher efficiency, greater working speed and the contactless working method account for the excellent economy of electron beam technology applications.

3. THE RIGHT SEAM FOR EACH TECHNOLOGY

Electron beam welding is used to connect metallic materials with the usual welded seam depths. The very narrow seam configuration with its low heat-affected zones drastically minimises the input of energy, without distorting any part of the component. Precision parts or components with a high degree of mechanical processing can be easily joined through the process, usually without adding filler material.

EBOMOVE

THE MACHINE DESIGN WITH INTERNAL MOBILE GENERATOR

The EBOMOVE machines of modular construction are suitable for the individual processing of larger and heavier workpieces with different welded seam geometries and processing zones. The equipment and the chamber size are variable. Low voltage generators (60 kV) from the MOBILGEN design series are used.

A longitudinal slide loads the workpiece into the chamber. Welding takes place with linear movements, or by rotating and tilting the EB generator and moving the longitudinal slide. The range of application of the machine can be usefully enhanced by using an optional turntable or a turn and tilt manipulator. The highest possible reproducibility and long-term stability of the beam parameters, extremely precise positioning and defined speeds with narrow tolerances for the moving equipment guarantee the quality of the processed results.

Special software for PLC or CNC control for quality assurance and reporting purposes is available.



THE HIGH-TECH SYSTEMS FOR PRODUCTION



EB welding and drilling technology as a reliable means of production have been used in industry for many years. The design of your suitable type of system depends on your requirements and your list of tasks. We will work together with you to find the suitable machine concept for your tasks.



The specialist for aerospace, research and development

■ LARGE-CHAMBER MACHINES

- For universal production with external generator **EBOGEN**
- Design series **EBOCAM®** and **EBOCAM®** Modular

■ LARGE-CHAMBER MACHINES

- For universal production with internal mobile generators **MOBILGEN**
- Design series **EBOMOVE**, **EBOFLEX** and **EBODISC**

■ SMALL-CHAMBER MACHINES

- For precision welds in small parts and for research and development (laboratory, university, ...)
- Design series **EBOCUBE**

■ DRILLING/PERFORATION MACHINES

- For drilling large volumes of small holes
- Design series **EBOPULS**

■ STRIP WELDING MACHINES

- Continuous air-to-air bi- or tri-metal strip production
- Design series **EBOCONT®**

■ GENERATOR UNITS

- External generator **EBOGEN®** Type 150 kV and 60 kV
- Internal mobile generator **MOBILGEN** Type 60 kV

INNOVATION IN PERFECTION

■ LARGE-CHAMBER MACHINES **EBOCAM**

This type of machine is a universal concept for solving the widest range of welding tasks. All the mechanical and electrical equipment is arranged in modules like the EBOCAM® machines. Individual processing of larger workpieces with complex welding geometries and processing zones is the main area of use for chamber machines.



EBOCAM EK125 – volume 12.5 m³



EBOCAM EK 610 – volume 61 m³



EBOCAM EK 100 – volume 10 m³



■ SMALL-CHAMBER MACHINES

This universal, compact type of machine consists of an inherently stable steel construction with an integrated working chamber and an optimised pump unit.



EBOCUBE PM 50

■ DRILLING/PERFORATION UNIT

EB drilling has economic superiority for workpieces if each individual workpiece has to be drilled with a large number of holes with a diameter of between 60 μm and approx. 1.2 mm. Typical application ranges for EB perforation are the drilling of glass-fibre spinners or the manufacture of all types of filter plates. The workpieces are manipulated into the drilling position with 4 or 5 axis manipulators or with drums with sheets rolled around the circumference and rotated at high speed and linear indexing.

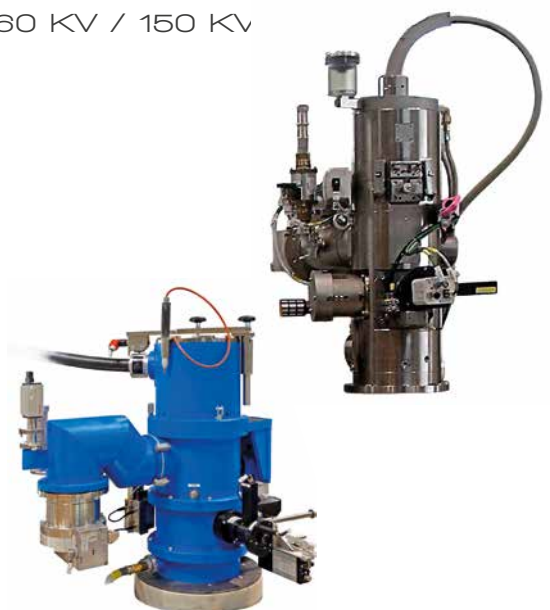


■ STRIP WELDING MACHINES

Strips of bi- or tri-metal combinations are continuously welded in air-to-air machines with linear drives, which also include pre- and post-weld processing stations. The main users of these machines are in the saw-band industries and the electronic components. High-performance steel rectangular wires are welded to backing strips of spring steel to produce high wear resistance and optimum flexibility bi-metallic and tri-metallic band.

■ **EBOGEN** GENERATOR UNIT 60 KV / 150 KV

The generator is at the heart of each EB system. Electrons are accelerated from a tungsten alloy cathode in the beam generator of the electron beam generator with 60 to 175 kV at approx. 2/3 the speed of light and focussed to a beam of high power density onto the workpiece. The electrons are absorbed there and the beam energy is converted into heat. Power flux-densities of approx. 10^7 W/cm^2 lead to spontaneous vaporisation of the material to produce the so-called deep-weld effect. The electron beam generators reach power flux densities of over 100 kW/mm^2 to open up a further area of application.



SOLUTIONS FOR THE AEROSPACE INDUSTRY

The electron beam had already been used in the sixties as an outstandingly suitable tool for the manufacture of aircraft engines because of the materials used in the aerospace industry with special characteristics, such as titanium, aluminium and their alloys.

The electron beam provides for

- **highest precision with narrow tolerances,**
- **practically no distortion due to the lowest heat input and**
- **reliable reproducibility of welding result,**

giving the EB welding unlimited priority over other welding processes, even today.



EBOCAM EK 78

The Series EBOCAM and EBOMOVE developed by Steigerwald Strahltechnik are especially designed to meet the highest requirements of our customers concerning the components to be produced.

LEADING GLOBALLY

Many globally operating companies use the advantages of the electron beam and the high developed machine technology for the production of their products used globally, e.g.:

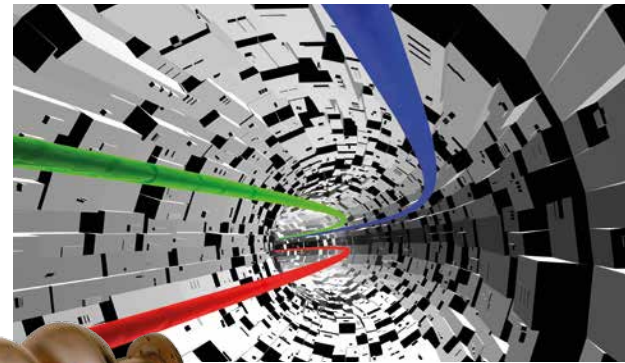
- **Rolls Royce**
- **Pratt & Whitney**
- **General Electric**
- **SAFRAN-Group**
- **EADS**
- **Kawasaki**
- **Lufthansa Technik**



The SAFRAN Group is an international high-tech company and a top-ranking supplier for equipment and systems for the core markets of aerospace and astronautics, defence and security with headquarters in France. A total of 70,000 specialists are employed by SAFRAN which earned a turnover in 2015 of more than 17 billion EUR. New types of components which are constructed to be welded cost-effectively with electron beam machines from Steigerwald Strahltechnik profit from the budget of more than 2 billion EUR.



The largest research centre in the world in the area of particle physics with 21 member states and over 3,300 members of staff working together with CERN, the European Organisation for Nuclear Research, uses electron beam technology from Steigerwald Strahltechnik. Basic research in physics takes place in Meyrin in the canton of Geneva in Switzerland. SST electron beam machines are used for joining tasks for the manufacture of components for the particle accelerator, used to research the structure of matter. The largest unit at the moment is the Large Hadron Collider which came into service in 2008.



The electron beam is used to weld the widest possible range of components of drive units for aircraft, such as turbines, rotors and stators.





WORLDWIDE SALES



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