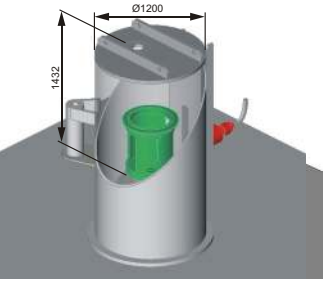
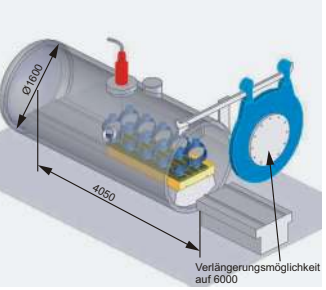
Plant engineering / Possible fields of application



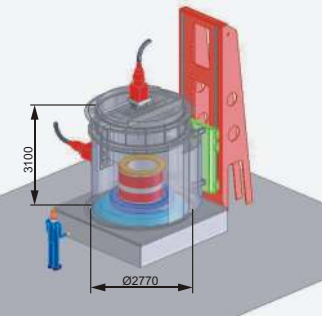
Electron beam welding system Josch 1

Components with up to 500 kg of weight,
1100 mm diameter and
1400 mm height.
The beam generator may be positioned radially and axially. Component and beam positioning through 9 mechanical and electrical axes.



Electron beam welding system Josch 2

Components with up to 1200 kg of weight,
800 mm diameter and
4000 mm height.
The beam generator may be positioned radially and axially. Component and beam positioning through 9 mechanical and electrical axes.



Electron beam welding system Josch 3

Components with up to 5000 kg of weight,
2500 mm diameter and
2500 mm height.
The beam generator may be positioned radially and axially. Component and beam positioning through
13 mechanical and 5 electrical axes.

Possible field of application:
Welding with HP0 approval by TÜV

- Fine-grained, structural and Cr-Ni steels with higher C content.
- Light metals like aluminium, magnesium and titanium
- Special materials like tantalum zirconium and tungsten, copper, niobium, molybdenum, nickel, nickel-based alloys
- Material combinations like copper/steel, platinum / titanium, stellite / stainless steel, molybdenum / steel

Surface treatment

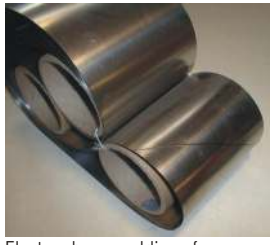
- Partial hardening
- Re-melt alloying

Electron beam soldering

Manufacturing examples

Angle valve body with 3D saddle contour, 30 mm wall thickness

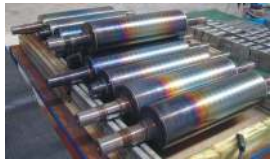
Electron beam welded tungsten anode



Electron beam welding of conveying belts 0.2 mm

Electron beam welding system Josch 1

Lever on crossbeam, 40 mm deep



Edge zone hardening and welding of sockets in a clamping fixture

Angle valve body for nuclear valves, 3D socket welding

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Electron Beam Technology

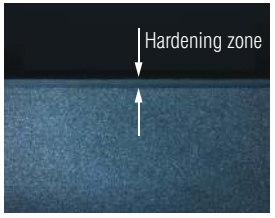
- Hardening
- Welding

Advantages of electron beam welding:

- Narrow weld seam: Minimum energy input → Minimum shrinkage Minimum distortion
- Narrow heat affected zone → Reduction in weld stresses by compensation through elasticity of basic material
- Welding under vacuum → Perfect gas shielding
- Simple weld seam preparation → Square butt joint as standard
- High welding speeds → Welding in one course with welding depths of 0.2 up to 100 mm
- Welding of critical and different types of material → Permits totally new and cost-saving designs in one complex of material, machining and welding

Inert gas welding
Double V-weld 30 mm
Strong shrinkage

Beam welding
Plain butt weld 30 mm
Almost no shrinkage



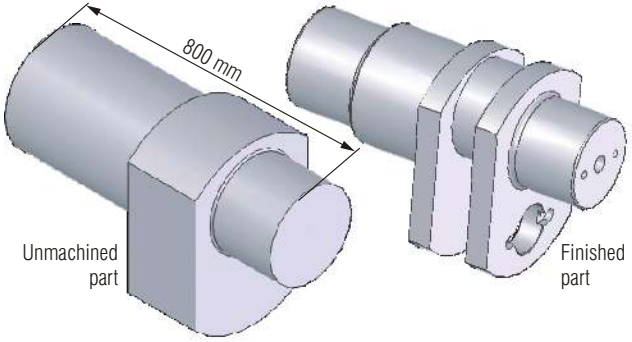
Micrograph
Material: C45
Hardness depth t = 0.7 mm
Hardness: 500 HV

Electron beam hardening

- Edge zone hardening Penetration depth of 0.3 mm up to 1.5 mm
- Hardness depending on material up to 60 HRC (for materials with a carbon content of ≥ 0,3%, such as C45, 42CrMo4, GGG60 ...)
- Accurate spot hardening of exactly defined zones
- Hardening and welding possible in one clamping position

Comparison between traditional manufacture and electron beam technology when taking a shaft as example:

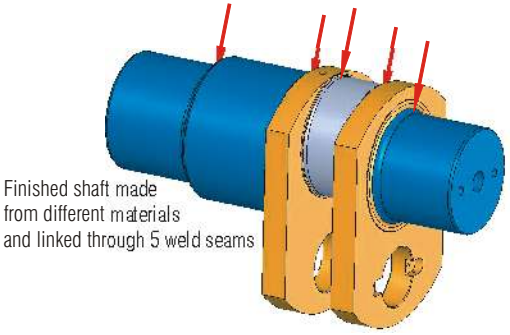
1. Traditional manufacture



- Open-die forging → Cost and time intensive (complete from high-grade material of running faces)
- High machining effort → Cost and time intensive (machines are required for large material weight)
- Hardening as extra operation

2. Manufacture with application of electron beam technology

(The shaft is composed of single parts that are butt welded by means of electron beam welding)



- Optimum material selection for each single part → Minimisation of material expenses
- Smaller components are partially made from standard sections → Low-cost manufacture on small machines
- Electron beam welding and hardening of running faces in one clamping position → Reduction in overall expenditures

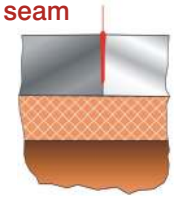
Examples for electron beam welding

Standard variant

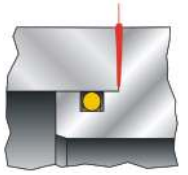
- Axial seam
- Radial seam
- Radial seam inclined to axis of rotation
- Mitre seam

Special applications without effect on components located near seam

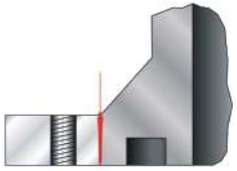
- No destruction of plastic bush 1 mm below the weld seam



- Installed O-ring 3 mm close to the seam



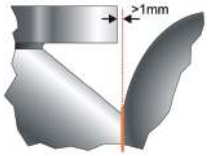
- Groove and thread in a distance of 3 mm



Advantages in problematic zones

- Diagonally across

- In areas difficult to reach



- Without influence on the fit in the socket