

**YOUR PARTNER FOR
LASER SYSTEM TECHNOLOGY**

**SPECIAL-MACHINERY
3D LASER PORTAL
POWDER BUILD-UP WELDING**

SYSTEM PRINCIPLE

Our company was commissioned to develop the special machine (pictured here) with new, innovative functions for machining engine components using the laser build-up welding technology. The system would primarily be used for the build-up welding of turbine and nozzle vanes, as well as various housings made from nickel, titanium, cobalt or steel-based materials.

The typical diameter size of the components ranges between 30 mm up to 800 mm.

The 3D laser machining centre is a bend-resistant, vibration-damping [gantry type construction](#), and is designed to prevent soiling of the functional components as well as powder-induced wear and tear.

The system can be used for both fine (0.1) and rough build-up welding.

The goal is the near-net-shape build-up welding of engine components using a [teach-in method](#) in conjunction with specially developed adaptive software that compares the *actual contours* with the *target values* and then automatically generates an NC programme. The machine can process welding consumables in a powder or wire form on a [nickel, titanium, cobalt or steel basis](#).

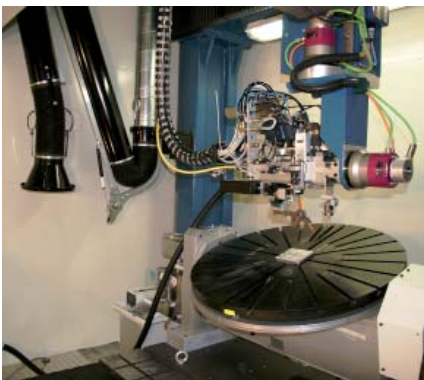


Machining head with rotary/tilt table

Wire feeder

Camera

Measuring probe



COMPONENTS AND FUNCTIONS (Layout)

The components and functions described below were implemented to meet the customer's requirements.

1 Control Panel

Siemens 840 D with supplementary PLC control unit and HT8 handheld terminal. During operation, all of the essential operating states are displayed on the control panel monitor. Additional screens show visual images of the working chamber, the focusing optics including the camera, and the Siemens OP monitor.

4 TrueDisc 2002 Disk Laser

Diode-pumped disk laser with an 8-mm mrad beam quality. The laser power output is 2000 watts at the workpiece, consisting of a cavity (disk).

2 GTV Powder Feeder

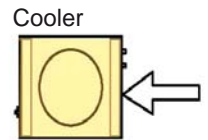
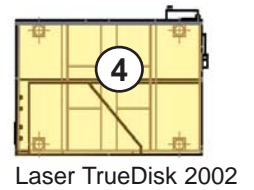
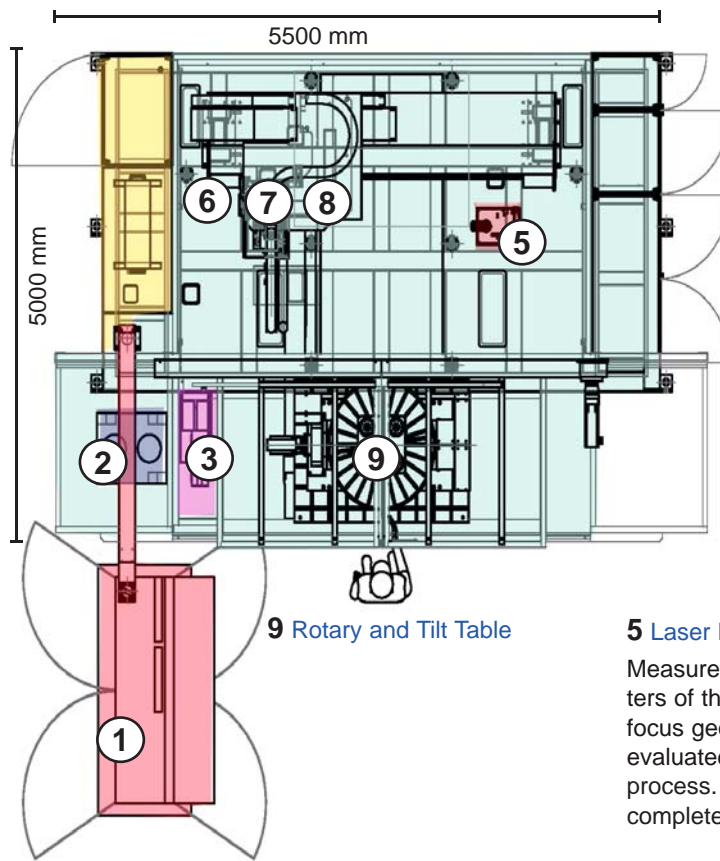
Laser welding and thermal spraying for powdery materials.

Automated, continuous monitoring of the material flow from the powder feeder. Automatic taring and measuring process executed by the machine control unit.

3 Wire Feeder

As an alternative to powder, there is the option to weld on the components using wire. A slide is used to position the wire feeder at the focus of the laser. In addition, the angle of the wire feeder is infinitely variable up to 45°.

6 7 8 Processing Optics



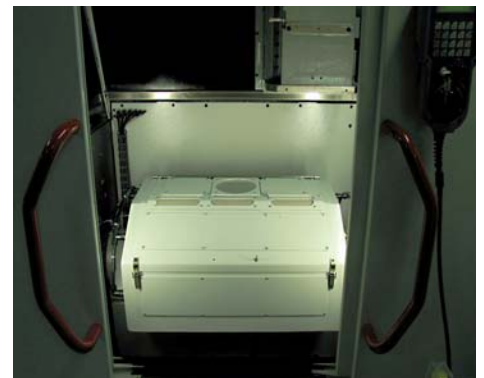
5 Laser Beam Control Monitor

Measurement of the key beam parameters of the laser. The power output and focus geometry are measured and evaluated in a fully automatic, cyclical process. The machine's housing is completely sealed and dustproof..

Laser beam control monitor Precision scale

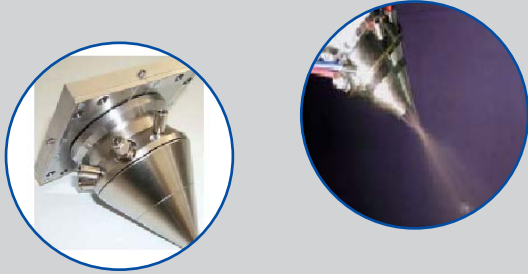
Powder feeder

Inert gas chamber



6 Optics, Coating Heads

2 angle optics, focal length 200mm,
spot 0.2mm, 1 coaxial powder nozzle
IWS Dresden



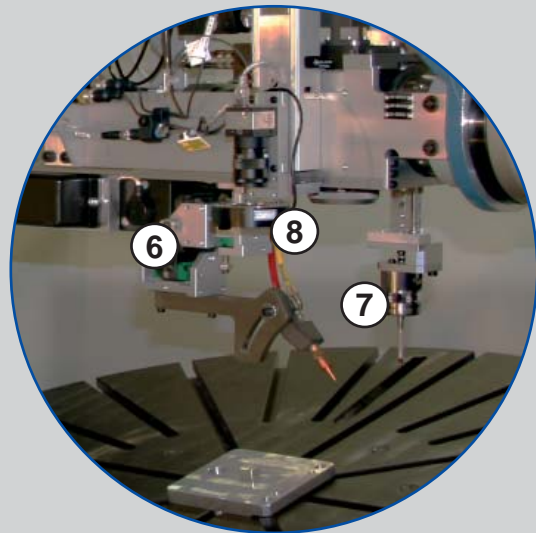
7 Measuring Probe

As an additional alternative, a measuring probe (Renishaw OMP400) is also integrated on the z-axis for mapping the workpiece contours.



8 Camera for Contour Mapping

To map the contours during the adaptive laser machining process, a pneumatically adjustable camera with a 35mm Pentax lens and its own LED ring light is mounted on the z-axis



SPECIAL FEATURES:

Automatic Weld Pool Width Monitoring

The software for generating the NC programme runs on a separate computer and communicates directly with the Siemens 840 D. To increase process reliability during the build-up welding operation, there is an integrated automatic monitoring system that **monitors and regulates** the weld pool width. The monitoring system consists of an additional camera for mapping the actual **contour** of the "powder width" (powder spread) as well as newly developed software for automatically regulating the layer thickness.

Inert Gas Chamber for Welding in an Argon Atmosphere

Build-up welding for titanium materials in an inert gas chamber with flexible textile locking unit and measurement of the argon atmosphere.

Technical data:

Traversing paths X = 1800
Y = 2000
Z = 1000

C1 (optics) +/-90°

B (optics) +/-90°

Rotary/tilt table
max. 200 kg +/-90° tilt

A (rotary axis) +/-90°

C2 (rotary axis) n x 360°

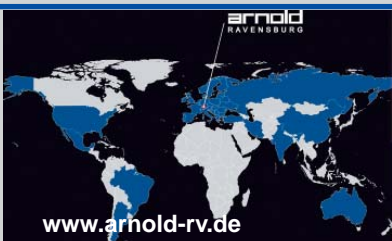
Control unit: Sinumerik 840 D

Dimensions without accessories:
5000 x 3500 x 4550 mm

Dimensions of complete system:
8000 x 5400 x 4550 mm

Accessories depending on application

- Laser
- Powder feeder / wire feeder
- Camera for contour mapping
- Measuring probe
- Automatic weld pool width monitoring
- Rotary/tilt table
- Laser quality monitoring system
- Processing optics



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