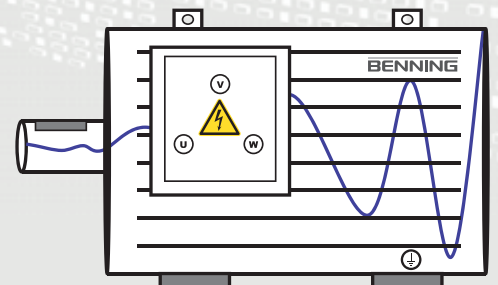


Excellent Technology, Efficiency and Quality



Electrical Machine Service

Overhaul, Conditioning,
On-Site Service and Diagnostics





Your partner for
Electrical Machine Service

Your partner for
the requirements of tomorrow



BENNING factory II
Robert-Bosch-Straße 20, 46397 Bocholt, Germany

Maintenance, Reproductions and Diagnostics

Since more than 7 decades machine repairs represents an essential part of the companies' activities. Today the company offers a large range of high quality service applications and some manufacturing of electrical motors additional to the standard repair service.

Customers are located in Germany and in neighbour countries.

In two plants more than 700 employees develop and produce a recognized product range.

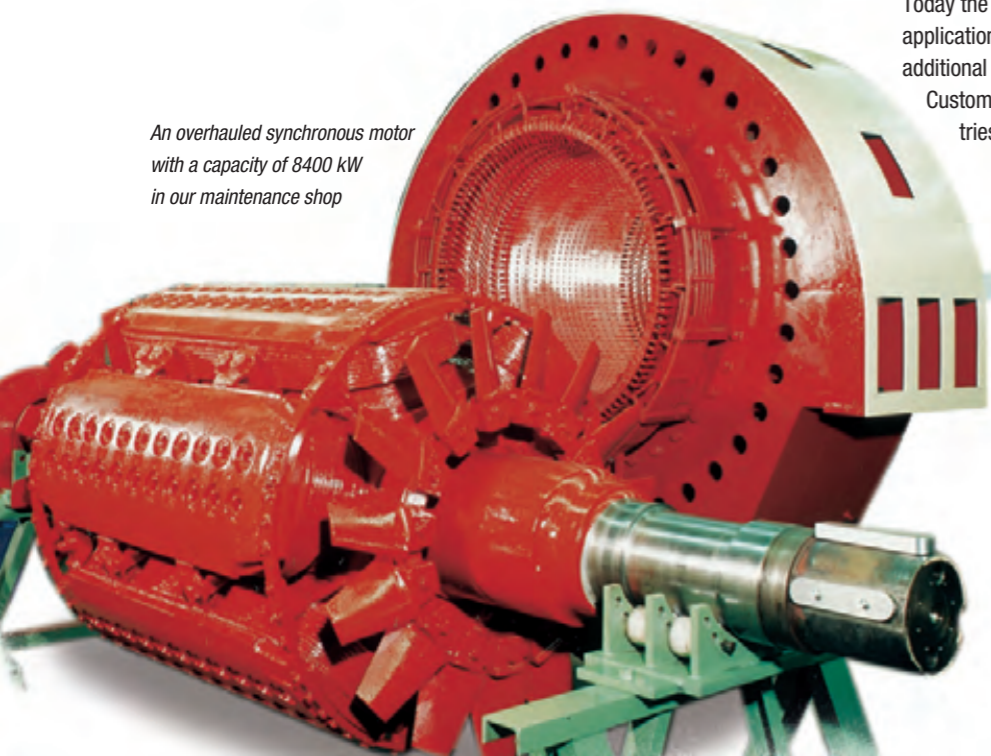
BENNING is the leading manufacturer of power supply.

We offer:

- Qualified employees
- Advanced manufacturing processes
- Diagnostic reports
- Performance analysis
- Short delivery time
- Short delivery periods due to high amount of spares and materials on stock

24 h service:
phone: +49 (0) 28 71 / 93 888

An overhauled synchronous motor with a capacity of 8400 kW in our maintenance shop



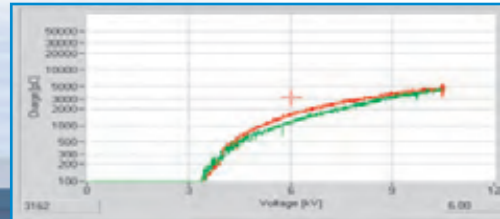
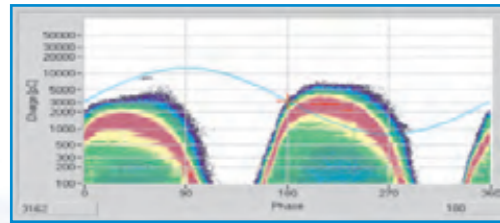
Overhaul of a 2000 kW DC motor with armature rewinding



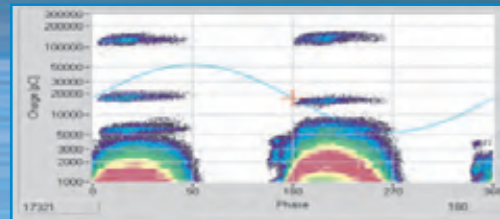


Diagnostics by using up-to-date equipment

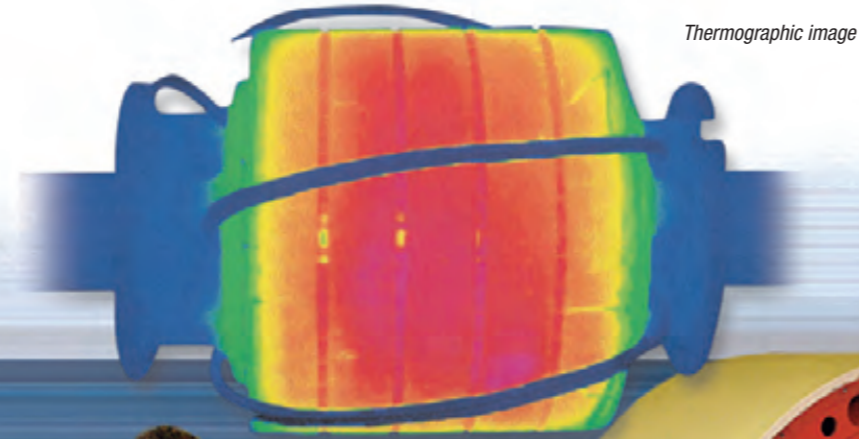
Decades of experience and reliability



Partial discharge test of an electrical machine in good condition (graphics above)



Partial discharge test of an electrical machine in critical condition



Thermographic image



Electrical performance analysis, for example HV-testing, impulse testing, PD-test, loss tangent acc. EN, IEC, VDE.



CNC stamping of laminations



Core stacking



Laser cutting technology

Condition monitoring for cost effective maintenance

Extract of tests and services:

- Insulation resistance test
- Insulation test
- Partial discharge (PD)
- Baker test
- Tan-delta test
- Polarization index (Pi test)
- Frequency analysis
- Vibration test
- Noise testing
- Laser alignment
- Thermographic image

Manufacturing of laminations

Manufacturing of laminated rotors and stators produced by stamping or laser cutting technology.



BENNING service vehicle

Standard scope of overhaul

Craftsman's tradition and state of the art technology

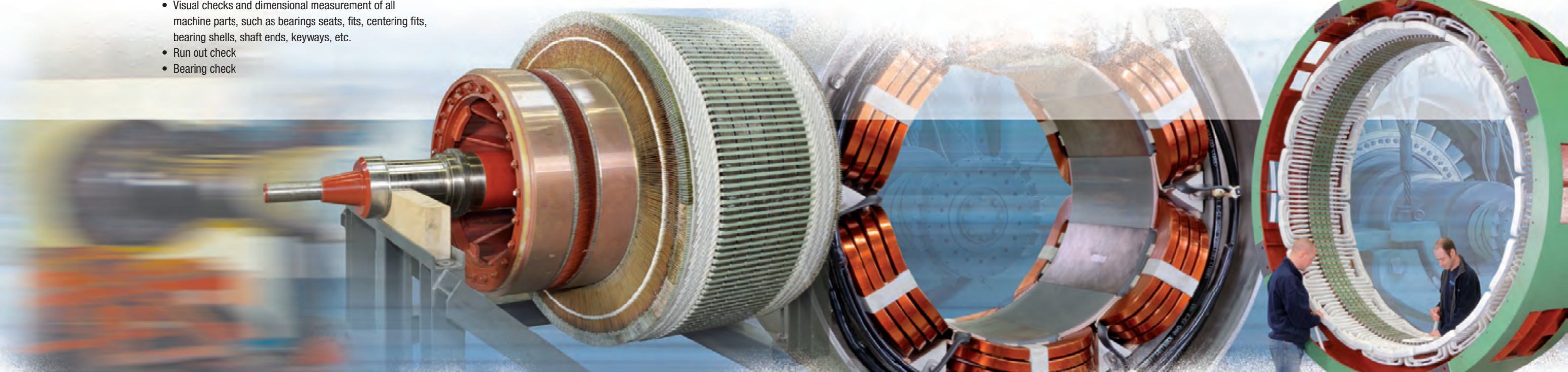
Our standard scope of overhaul includes the following services:

- Record of performance data
- Control of overall machine condition
- Checks of all machine parts and auxiliaries (such as external fans, speed detectors, brakes, sensors, etc.)
- Dismantling of machine
- Visual checks and dimensional measurement of all machine parts, such as bearings seats, fits, centering fits, bearing shells, shaft ends, keyways, etc.
- Run out check
- Bearing check

Organizational sequence of maintenance and repair tasks

You supply the machine specifications, such as manufacturer, type, capacity, voltage, rotational speed, model, type of bearing, etc., as well as the potential damage. We prepare an offer comprising the respective scope of repair work.

If you place your order, we draw up an inspection report after dismantling and testing the windings and mechanical parts.



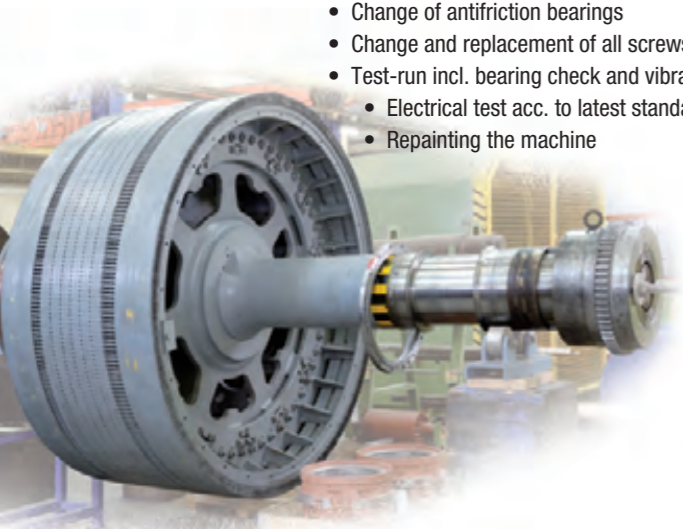
DC rotor after re-winding (1,600 kW, 8 t, 600 rpm)

Assembling and preparation of machines

- Cleaning of all machine parts and windings by special cleaning treatment incl. drying procedure by vacuum-oven treatment
- Control of cleaning results and electrical measurements after cleaning
- Impregnation of existing windings
- Dynamic balancing of rotors
- Check of sleeve bearings (white metal, bearing clearance, appearance of bearing surface after bedding in) incl. auxiliaries such as oilrings, sealings etc.
- Change of antifriction bearings
- Change and replacement of all screws
- Test-run incl. bearing check and vibration check
 - Electrical test acc. to latest standards EN, IEC, VDE
 - Repainting the machine

Control of electrical parts

- Check of windings and winding support elements
- Check of press fit of cores and slot wedges
- Check of banding insulation, terminal boxes, terminal bolts, insulators and winding leads
- Check of rotor cage in order for cracks in rotor bars and short-circuit-rings
- Check and overhaul of brush-arrangements
- Overhaul slip-ring surfaces by turning procedure
- Check of pole fastening of salient pole rotors
- Adjust salient pole fixing
- Adjust commutator fixing
- Check connection between windings and commutator
- Overhaul commutator by turning procedure
- Adjust commutator by segment cutting procedure
- Sawing out mica and adjust shape of edges of segments
- Thermographic image



New winding of a HV stator

Additional scope of work

In case other originally unknown damages on the machine are found during this inspection, which we think should be repaired, we draw up an additional offer. The decision regarding the execution of this additional repair work is made after consulting you.



Craftsman's tradition and state of the art technology

Experienced winding experts

BENNING manufactures HV-windings up to 11 kV nominal voltage using latest technologies. Coil inserting, electrical connections, providing winding overhang supports is carried out by experienced staff in our winding shop. Wound stators run through a process of vacuum impregnation and drying process using high quality materials.



Original machine and reproduction:
DC motor, 780 kW, 500/100/1500 rpm



GR. WT. KG. 19100
CK/304/256/228

BENNING guarantees

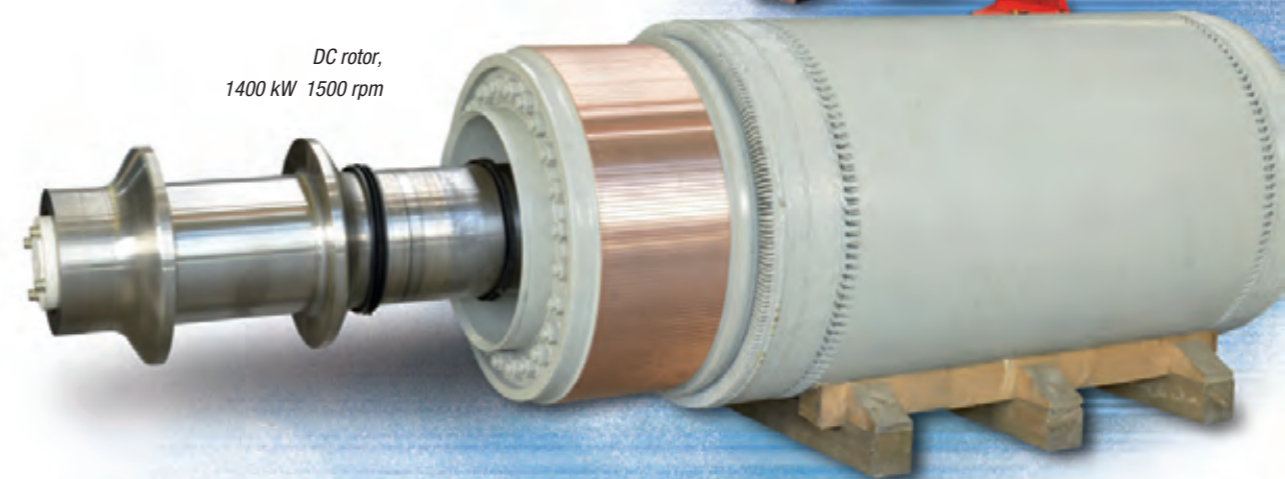
Competent order execution by experienced staff.
Preparation of design and testing documentation.

Modification of existing machines, such as:

- Changes of nominal power
- Increase of efficiency
- Noise reduction
- Modification of bearing arrangement

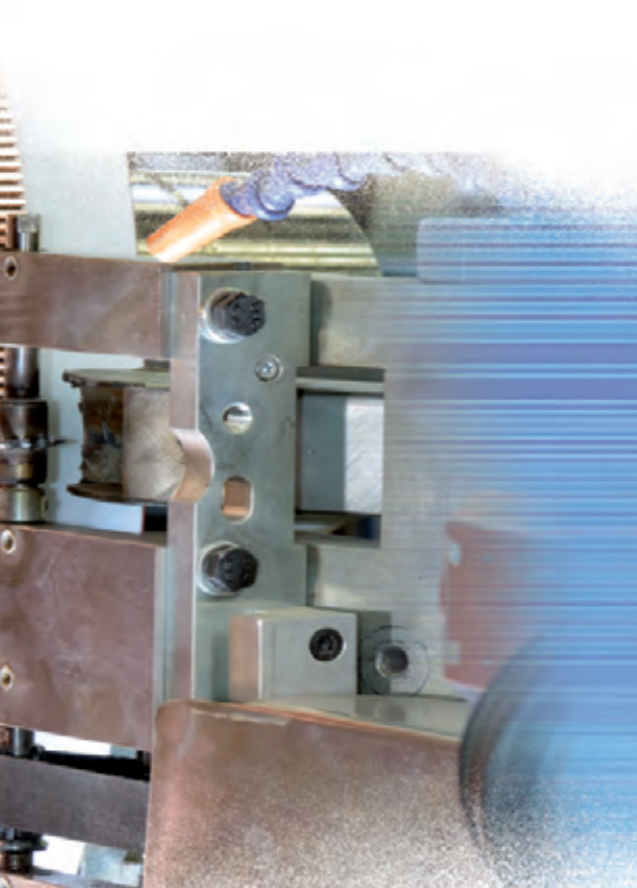
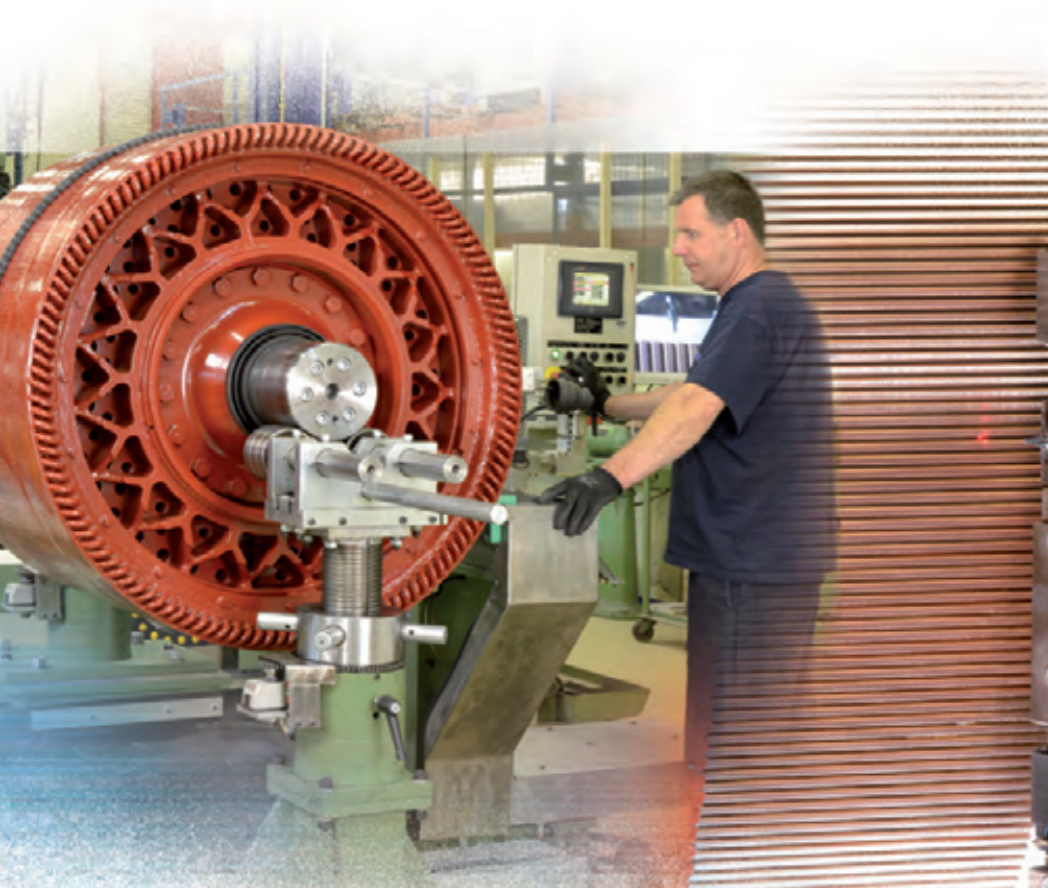


DC rotor,
1400 kW 1500 rpm





Technical know-how is our strength
 Grinding of commutator, spot welding



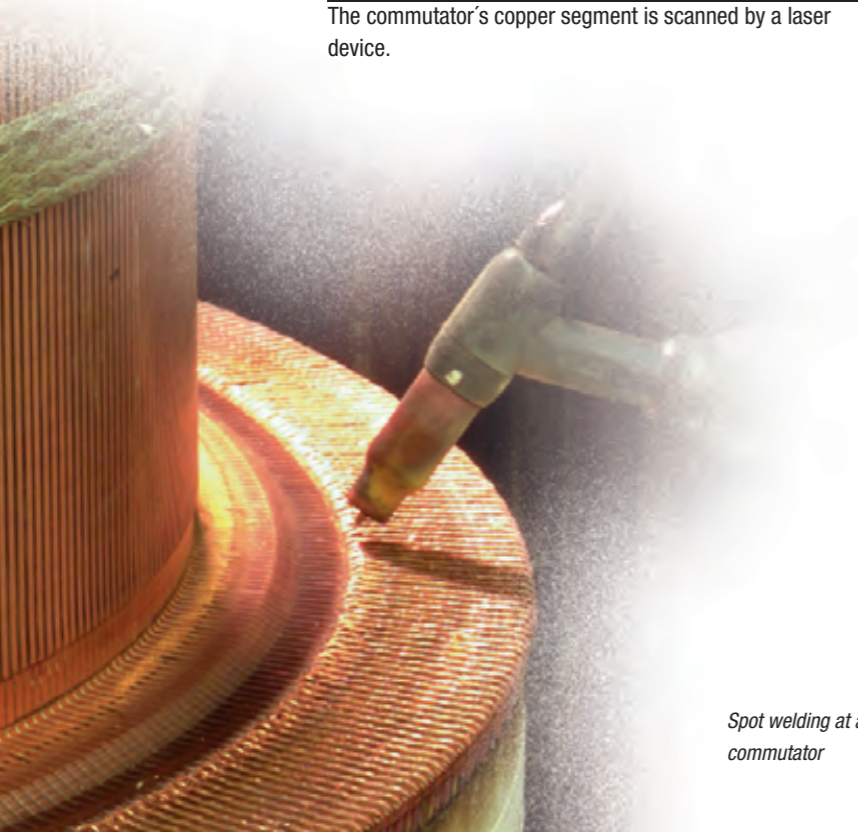
BENNING overhaul services comply with highest requirements

The commutator's copper segment is scanned by a laser device.

The grinding tool is operating with a speed of 9000 rpm.

Spot welding

Winding bars and round-wire windings can be welded to the commutator risers ensuring a high quality. This ensures a high amount of operational safety of the machine especially when operating in higher thermal classes (e.g. traction applications).



Spot welding at a commutator

Cleaning is a core competence for overhaul activities
 Cleaning with dry ice or solid carbon dioxide snow

Environment-friendly and cost effective

Dry ice cleaning ensures an environment-friendly and cost effective method of cleaning for surface treatment.

While other blast cleaning methods are based on using sand, glass, water, steam or solvents have an impact on environment, dry ice cleaning is uncritical in this respect.

Further on the dry ice equipment can be used for on-site services as well.



The above detail of the foto shows the comparison of a dry-ice cleaned part before and after cleaning.

Long term experience for cleaning of:

- Electrical motors
- Generators
- Turbines and other driven equipment in many applications and customer sites



Dry ice cleaning of a generator rotor on job site



Explosion protected machines (ex) Mobile test bench

By developing a mobile test bench (for AC and DC motors) BENNING offers a solution for no-load-motor testing

- Test bench will be delivered as "ready for use"
- Recording of test values
- Easy operation by touch panel
- 3" or DC version available
- Incl. CE connector
- Made for motor service center or enduser's service shops



SCCP



Motors for mining application Zone 0

Know-how in the field of special machines

Overhaul and repair activities of explosion protected machines requires to fulfil several standards and legal requirements. BENNING is certified to carry out services for explosion protected machines (ex-machines incl. machines for use in zone 0, 1, 2, 20, 21, 22)



Test bench for functional-checks and performance data testing



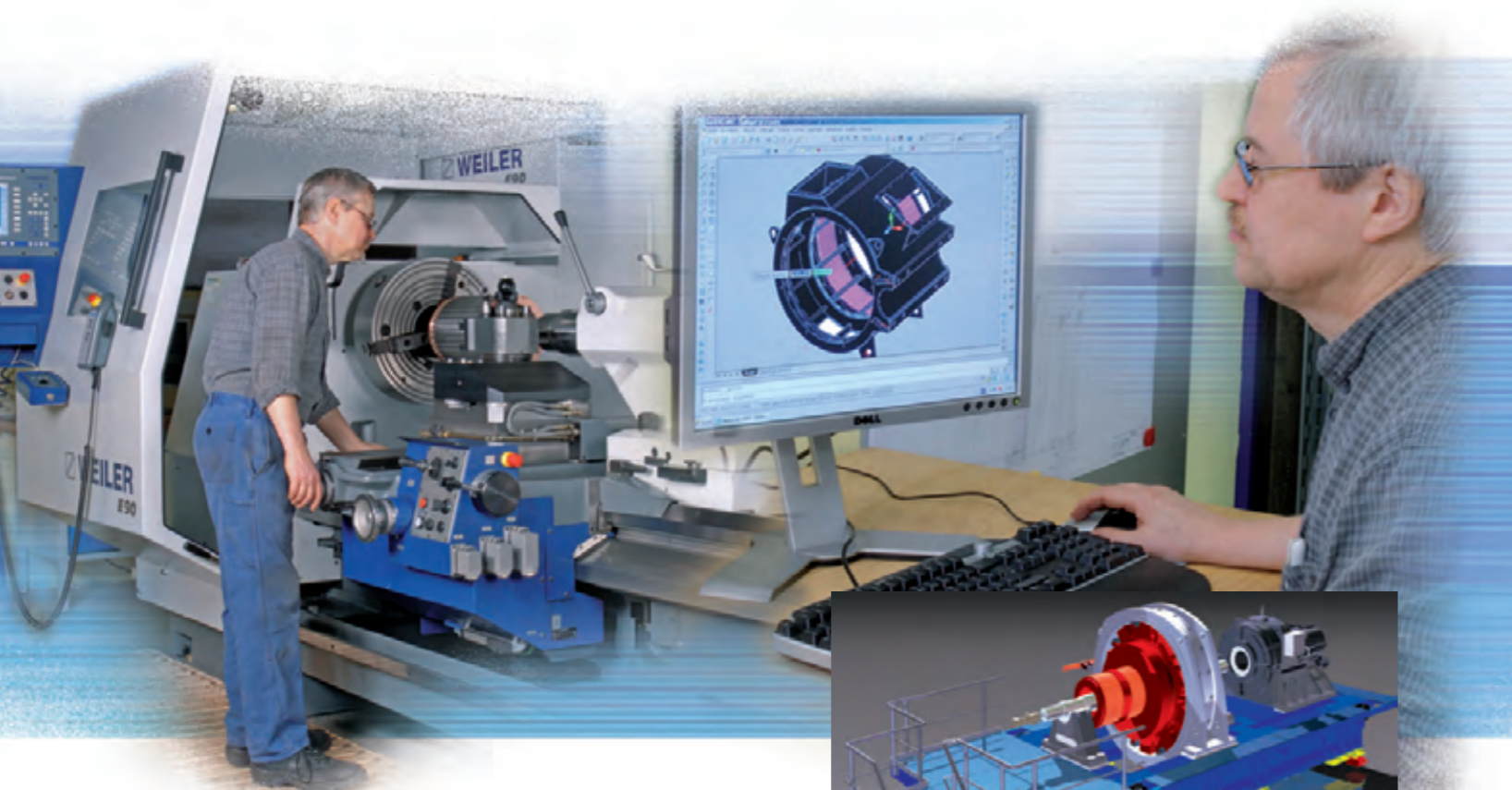
Mechanical machining Flexibility and high precision

Safety and testing

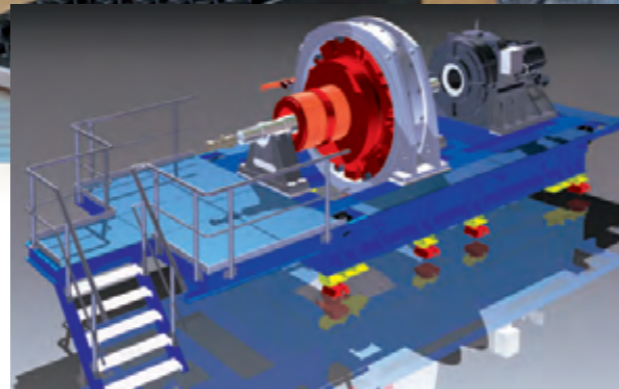
Up-to-date maintenance requires diagnostic measures from beginning to delivery. All machines have to pass a final test run in our own test facility.



Mechanical machining Flexibility and high precision



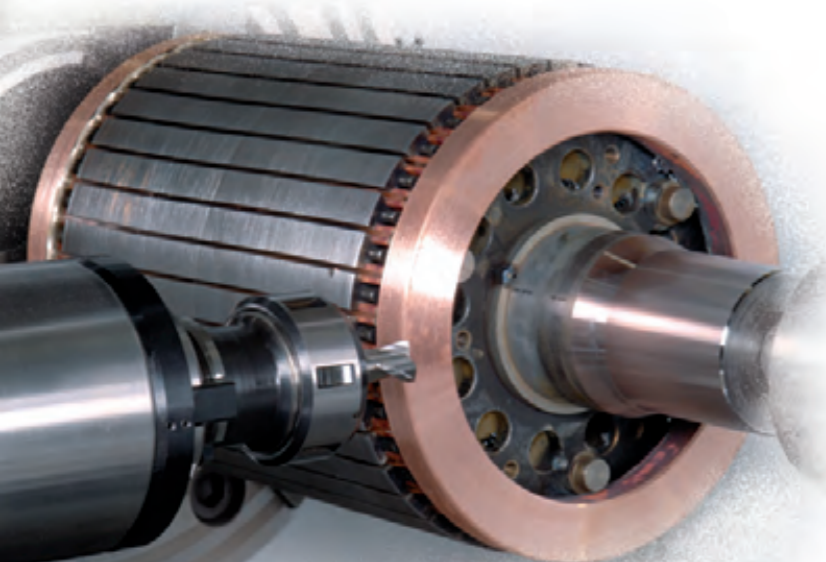
CNC Turning machine



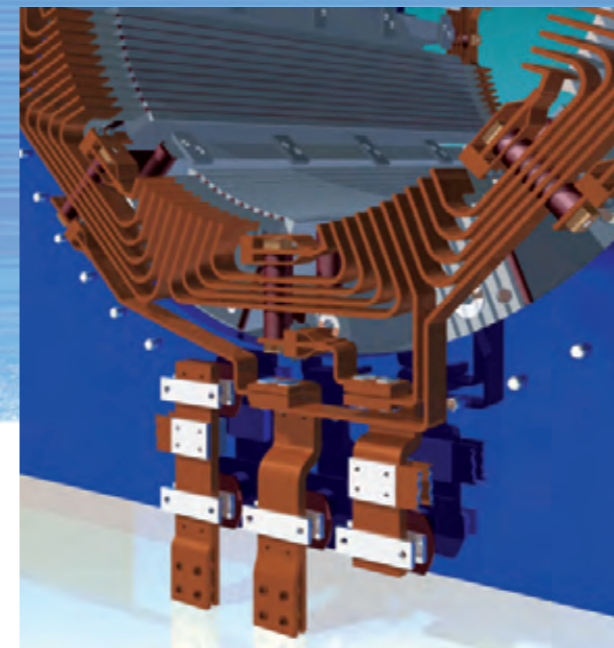
Mechanical machining for professional manufacturing of components

High precision CNC turning machines are directly linked to an AUTOCAD (3D) system. The system has a capability to machine shafts up lengths of 4500 mm.

Due to additional machining devices, drilling and grinding operations (such as grinding of keyways) can be machined by using the same clamping.

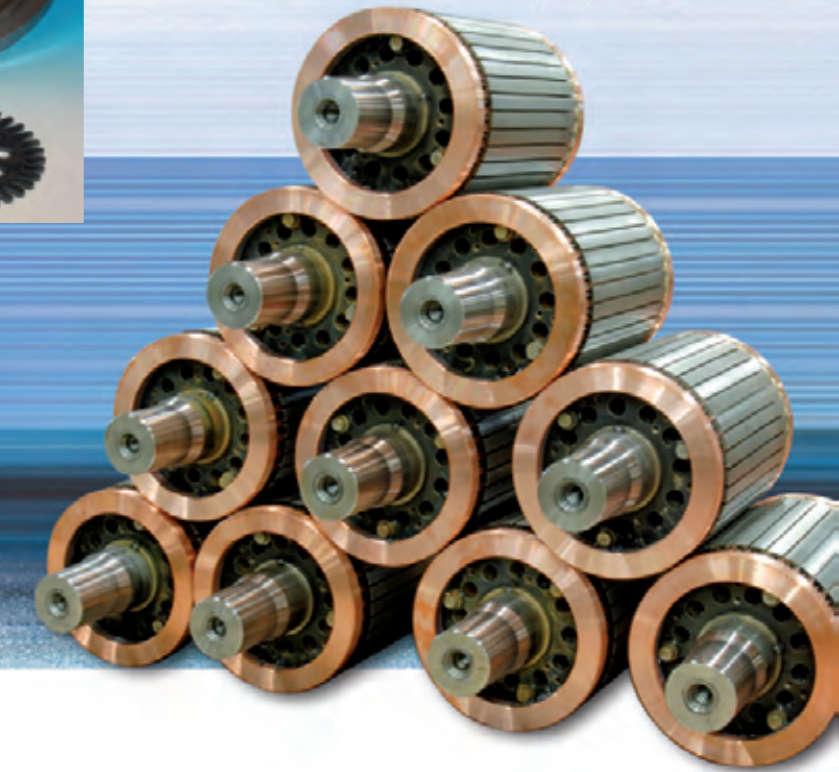


Manufacturing and re-design of machine parts

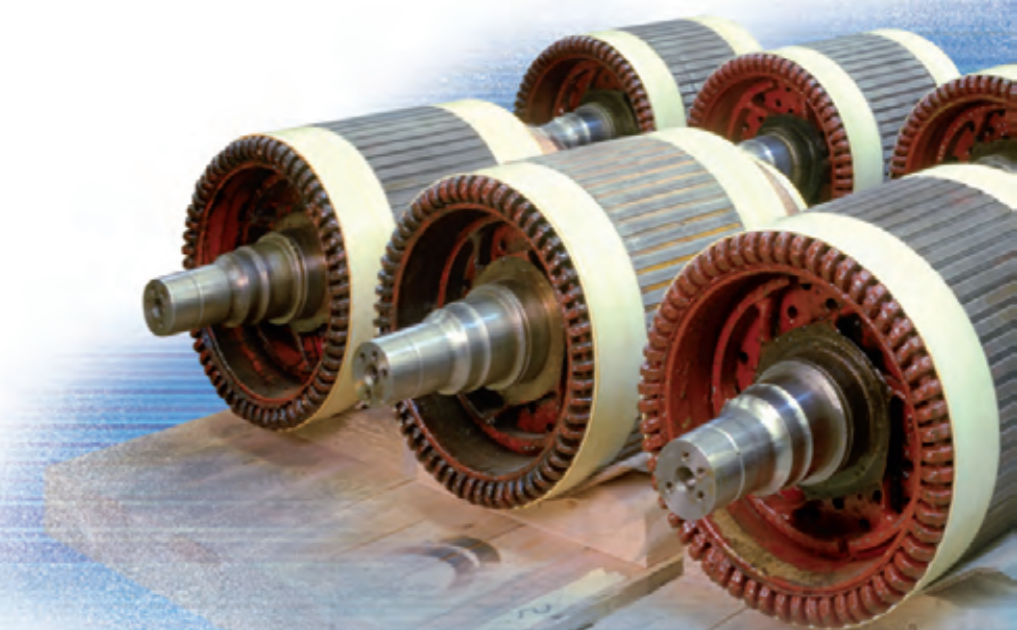


Duplicates of machine parts:

Several machine parts and components made of copper, steel, aluminium etc. can be manufactured as new parts, even if there are no more drawings available from the original machine manufacturer.



Examples of machine parts manufactured by BENNING





Let our service convince you

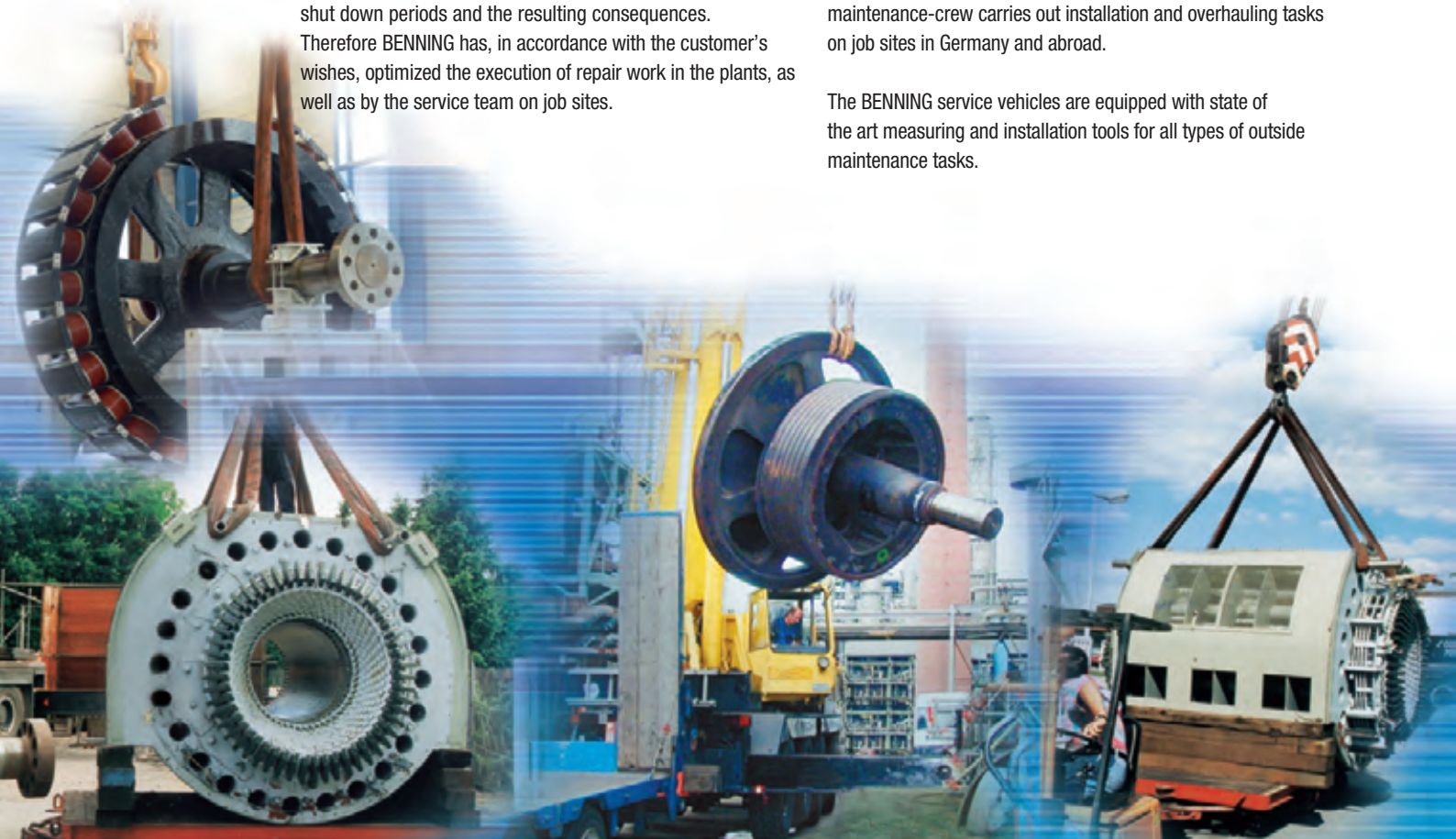
Service package

Time is money. And this fact especially applies to unnecessary shut down periods and the resulting consequences.

Therefore BENNING has, in accordance with the customer's wishes, optimized the execution of repair work in the plants, as well as by the service team on job sites.

Supervised by competent specialized site managers, the BENNING maintenance-crew carries out installation and overhauling tasks on job sites in Germany and abroad.

The BENNING service vehicles are equipped with state of the art measuring and installation tools for all types of outside maintenance tasks.



These maintenance tasks comprise:

- Execution of diagnostic, inspection and repair tasks on site
- Dismantling and assembling of machines
- Execution of balancing work, vibration measurements and bearing performance checks
- Supplementary installation of additional equipment (Thermometers and temperature sensors, tacho-generators, stand still heaters, etc.)
- Commissioning



BENNING

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