

POWERnews

Q4/2023

Customer Magazine informative · up-to-date · pioneering

85 YEARS FULL OF ENERGY Power on!

BENNING since 1938



Innovations and solutions for electricity



DUSPOL®
Anniversary **75**



75 years of DUSPOL® – The Original 4-7

BENNING

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Editorial



Dear Reader,

85 years filled with energy – this slogan represents our company history with innovations and sustainable solutions for electricity.

Founded in 1938 in Bocholt, Germany, the young company initially handled the repair of electric motors for the textile industry. With continuous investments, the electrical machinery sector has evolved into one of the most renowned in Europe. In this issue, we report on the installation of the new drying oven equipped with regenerative thermal oxidation, with which BENNING is advancing the energy-efficient production of winding goods.

In addition, we celebrate yet another anniversary with a dedicated article. As early as 1948, we began production of the DUSPOL®, whose brand name has become synonymous with a two-pole voltage tester over the past 75 years.

Today, our diversified manufacturing programme also includes AC and DC power supplies, UPS systems, power supply units, chargers for traction batteries and Li energy storage units. Our products can be found where renewable energy is generated and stored, where people receive medical care or where critical infrastructures need to be safely supplied with energy.

In this edition of POWER news, you can read all about why the public radio and television broadcaster Norddeutscher Rundfunk (NDR) relies on our power supplies for the modernisation of its transmitter sites and how our modular systems protect both an important distribution node in the European gas grid and the in-house power supply in a combined cycle power plant from grid disturbances.

Over the past 85 years, we have proven time and again that sustainability, safety and efficiency are of paramount importance to us. This is true for our products as well as the operation of more than 25 international subsidiaries. As a recent example, this issue discusses the expansion of our location in Austria. Here, many ecological aspects have been incorporated and, at the same time, we have strengthened our regional customer service. – Another building block that underpins a principle that has been in place for 85 years: Customers can rely on BENNING wherever they are in the world.

I hope you enjoy reading our latest issue and look forward to your feedback.

Best wishes,
Dietmar Papenfort

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Let yourself be inspired by our short video! It gives a small glimpse into our Bocholt location and shows the high production depth, which includes design, construction, and production of cabinets and electronics. It makes up one of the pillars of our customised, user-specific solutions.



To experience the world's first industrially mass-produced voltage tester in augmented reality, just scan the QR code.



Contents



75 years of DUSPOL®
– The Original since 1948
Safety and quality for generations

4–7



Always on! – The transmission network of the Norddeutscher Rundfunk (NDR) relies on UPS systems and the engineering of its partners rd Notstromtechnik and BENNING

8–15



TRUE RMS Digital Multimeter
BENNING MM 7-2
Application Report

18–21



Technical reliability for critical infrastructure
BENNING provides various power supplies for an important node in the European gas grid

26–29



A power supply for in-house needs, with an exceptional efficiency boost
BENNING supplies a new power supply system for Obernburg combined power station

30–35

BENNING Austria's new company building
Capacity expansion and investment in modern workplaces

16–17

Saving energy while safeguarding quality in the long term
The modernisation of the impregnation system for the production of windings at the Bocholt site

22–25

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Fairs, events and exhibitions
2023/2024

36

75 years of DUSPOL® – The Original since 1948

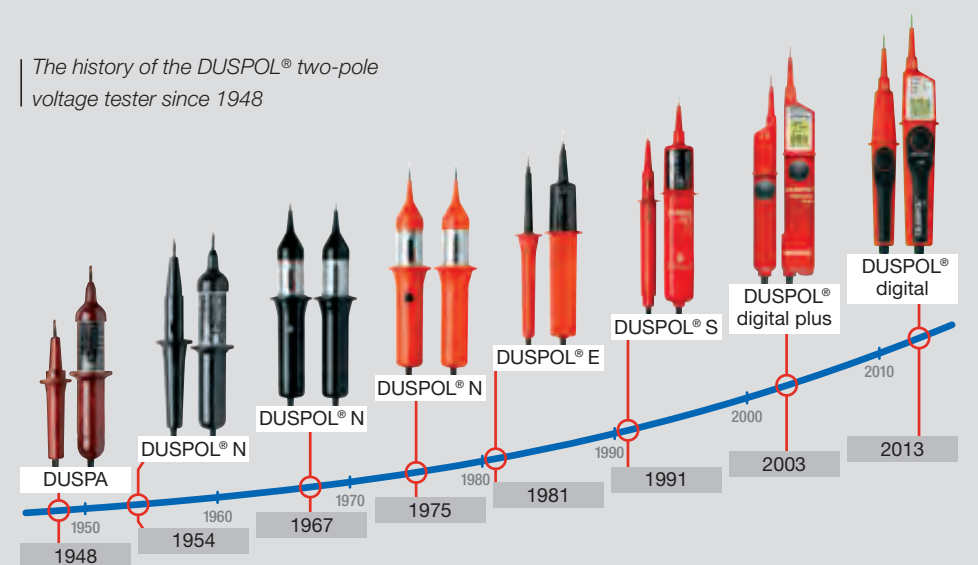
Safety and quality for generations

DUSPOL®

Anniversary **75**

DUSPOL®: For decades, the brand name has become synonymous with a two-pole voltage tester in the electrical trade. In doing so, it has joined the ranks of generic trademarks such as Kleenex® and Post-it®. Our recipe for success: Modern technology, superior production quality and the claim to have every product certified by the VDE testing and certification institute. Since its market launch in 1948, the DUSPOL® has been sold in millions. Let us take a look at DUSPOL®'s unique success story.

The history of the DUSPOL® two-pole voltage tester since 1948



As early as the 1930s, many new electrical devices and electrical machines found their way into the private and industrial sectors. When the three American scientists Bardeen, Brattain and Shockley invented the field effect transistor in 1947, the development of microelectronics began. This also resulted in a new requirement for repair, service or maintenance of electrical devices. Simply checking a voltage with the test lamps (on/off), as had been customary up until this point was often no longer sufficient.

BENNING took on this challenge in 1948 and developed the DUSPA, the world's first industrially mass-produced testing device for determining the absence of voltage. Since then, a small, handy device has made it possible to safely test voltages in the range from 110 V to 750 V AC/DC. The starting point was the invention of a moving coil level indicator.

Six years later, in 1954, BENNING integrated a phase and polarity indicator into the



Scan the QR code to discover DUSPA in AR



DUSPOL® digital – Checking the output voltage of a DC charging device

DUSPOL® digital – the flagship

DUSPOL®

Anniversary **75**

In the years that followed, extra-low voltages were increasingly used in industrial and communications engineering. To match this innovation, BENNING launched the DUSPOL® E in 1981, and introduced the possibility to display low voltages from 15 V using LEDs. For the first time, a large button was used to switch on the load.

In 1991, BENNING set new standards once again with the DUSPOL® S. Until then, it was only possible to carry out a rotary field direction test in the three-phase network with three-pole devices.

BENNING engineers solved the problem with an idea that was as simple as it was ingenious. They created a capacitive coupling to ground via the handle. The result was a new measurement method worldwide. In keeping with this new method, BENNING used the most modern LCD technology available at the time to display the rotating field direction and the single-pole phase display. For the first time, the limit values for the extra-low voltage of 50 V AC/120 V DC were displayed using LEDs. From this point onwards, our customers were able to use the DUSPOL® in dusty and damp environments without hesitation, thanks to the high degree of protection to IP 65.

- Rotary field test (left/right)
- Single-pole testing of the outer conductor (phase)
- Measuring point lighting
- Acoustic and optical continuity test
- Frequency display
- Voltage indicator 1 – 1,000 V AC TRUE RMS 1 – 1,200 V DC
- Resistance measurement and diode test with forward voltage display
- Illuminated LC display
- Contactless cable break detector sensor
- Load connection via large push button
- Vibration alarm in the test handle
- Dust and water jet-proof case (protection class IP 65) with rubberised test handles

**1,000 V AC
1,200 V DC**

**CAT IV
600 V**

DUSPOL® digital

IEC/EN 61243-3
DIN VDE 0682-401:2015

The DUSPOL® digital was developed as an advancement in the case of the DUSPOL® S – the first fully digital voltage tester from BENNING. Now it was also possible to continuously measure voltages starting from 1.5 V.

The next milestone followed in 2003: With the market launch of the DUSPOL® digital plus, BENNING fully implemented the requirements of the first internationally binding standard for voltage testers (IEC 61243-3).

Two large pushbuttons (two-handed operation), via which the load is switched on, prevent the user from touching the second tip during the measurement. Due to the wide variety of market requirements, BENNING has integrated a complete product family into this series of devices for the first time, optionally with a moving coil level display, an LED step display, an LC display or any combinations of the aforementioned. Even a solar cell for the power supply was introduced. We also included vibration alarms, test point lighting

and acoustic signals, which have already proven themselves a million times over. Today, high system voltages of up to 1,000 V AC and 1,200 V DC in photovoltaic systems, wind turbines and electric/hybrid vehicles are the benchmark for voltage testers. The most recent DUSPOL® generation meets the requirements from many areas of industry and renewable energies. It exceeds the criteria for the casing (IP 65) and overvoltage protection (CAT IV 600 V) required by the current EN standard.



DUSPOL® analog
– Testing a power outlet

A second, partially rubberised case component ensures non-slip handling and safe operation. The enlarged display field is intuitive as always and can be read quickly and easily in practice. All in all: “The best DUSPOL® ever made!”

You can experience our products live: Find us at electrical trade fairs or events organized by our partners in the specialist trade. ■

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Scan the QR code for further information

DUSPOL® expert
– the all-rounder





Always on! – The transmission network of the Norddeutscher Rundfunk (NDR; Northern German Broadcasting)

NDR continues to rely on UPS systems and the engineering of its partners rd Notstromtechnik and BENNING for the modernisation of the power supplies at its transmitter sites

One of the core missions of the public service media is to provide diverse and objective coverage that supports viewers in forming their own opinions freely and independently.

Continuous, area-wide reception of radio and TV is ensured by widely distributed, earth-bound transmitter stations with basic network and filler transmitters.

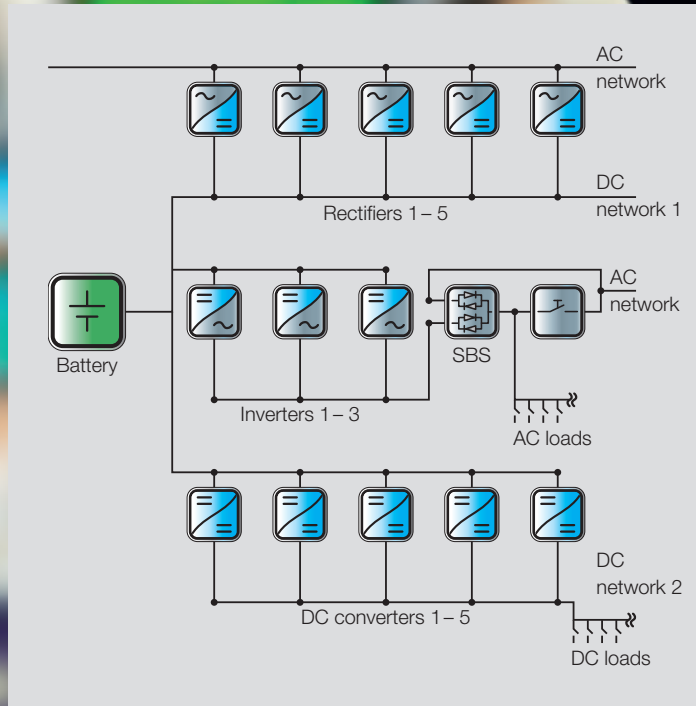
In case of a transmitter failure, it would no longer be possible to receive films and reports or even news and current warnings in the affected region. →





“We see the renewed order award as confirmation of this partnership-based cooperation and of NDR’s confidence in the reliability of our power supply systems.”

Paul-Gerd Demming,
BENNING Project leader



The block diagram shows the principle of the modular architecture of a power supply system with modular rectifiers, inverters and DC converters



Rectifier-inverter system cabinet equipped with 3 inverter modules, EUE and manual bypass as well as 5 rectifier modules

With that in mind, continuous availability of the operated transmitter systems around the clock is crucial. Downtimes are not acceptable. Therefore, the installations, controls and monitoring systems used here must be consistently protected against the failure or disturbances of the power supply network.

Tried and tested for decades

Norddeutscher Rundfunk (NDR) has been using BENNING power supplies for transmitter technology for decades.

Between 2004 and 2007, BENNING supplied fused, uninterruptible DC/AC power supply systems (60 V DC/230 V AC) to supply power to the transmitter systems, as well as modular 24 V power supplies responsible for starting the diesel engines in the emergency power systems.

These power supply systems already had monitoring and remote maintenance capabilities that enabled the service technicians,

who were usually responsible for multiple sites, to be efficient and proactive in their maintenance processes.

In northern Germany, NDR has further optimised the transmitter network in some regions, and additional transmitter sites have been added.

Furthermore, the ageing power supplies at the transmitter sites are gradually being replaced with modern power supply systems of equal capacity.

This is intended to guarantee a fail-safe but also sustainably economical operation of the transmitters for the future.

Launch at the Hanover Trade Fair 2016

The early planning for this project dates back to 2016. NDR employees visited BENNING during the Hanover Fair. At this time, the new modular rectifier series TEBECHOP SE was announced and the first prototypes were presented.



Extract: NDR transmitter sites in northern Germany



The NDR Hanover-Hemmingen transmitter



Photo: © NDR

(above) Transmission mast of the NDR station Hanover-Hemmingen



(below) View into the technical rooms of the transmitter

In the joint discussions, the idea arose to replace the old rectifier systems with these highly efficient, high-performance modules.

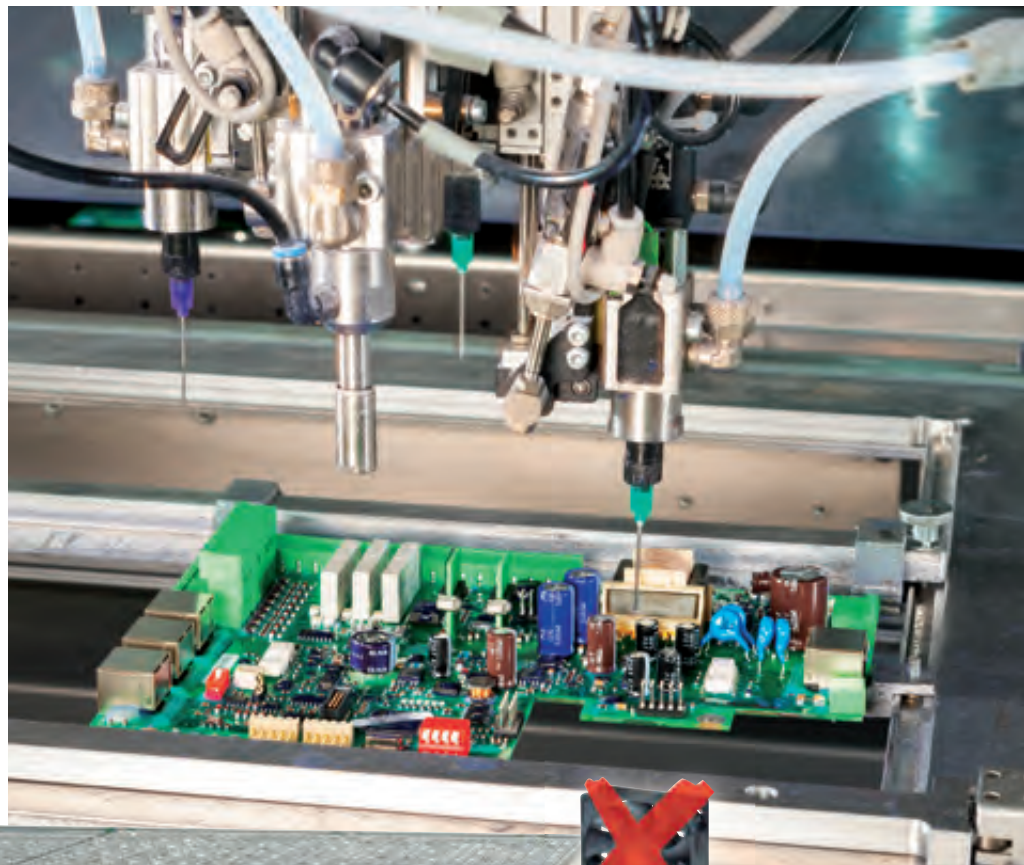
In combination with the modular 19" inverter systems INVERTRONIC compact (which were also new at this time), a very flexible and economic platform was created. Its purpose was to provide complete battery-supported backup power supplies with the highest availability, which reliably supply critical consumers with good quality electrical energy. At the same time, spare parts availability and proactive maintenance options are ensured. →

Confidence confirmed

Due to the positive experience with the previous modular BENNING UPS systems, rd Notstromtechnik and BENNING were to jointly prepare a corresponding offer. Flexibly responding to the special wishes of the customer, the project team developed the best possible solution together with NDR.

“We see the renewed contract as a confirmation of the previous cooperation based on partnership and the trust of NDR in the reliability of our power supply systems,” says Paul-Gerd Demming, responsible project manager at BENNING.

The company rd Notstromtechnik, as NDR’s contractor, is responsible for the replacement, installation, commissioning and instruction of the new power supplies. The detailed training of the NDR service technicians takes place at the BENNING training centre in Bocholt, North Rhine-Westphalia.



TEBECHOP 3000 SE –
Durable and reliable thanks to the protective coating of the boards (see picture above) and the fanless convection cooling

About rd Notstromtechnik*1

rd Notstromtechnik GmbH designs, supplies and installs high-quality power supply systems for critical areas of application. These include hospitals, energy suppliers, public authorities, broadcasters and also the industrial and telecommunications sectors.



2 Photos: © rd Notstromtechnik



The partnership with BENNING goes back more than 20 years. Since 2010, rd Notstromtechnik, as the official service point for northern Germany, has been looking after a large number of BENNING power supply systems for the telecommunications sector, among others.

In the spirit of sustainability and safety, spare parts for the sites that have not yet been converted are obtained from the old plants.

For instance, the rectifier and inverter modules, the electronic switching equipment and the remote monitoring unit are carefully removed and handed over to NDR for storage.

Coating for a secure seal

In the newly installed power supply systems, five 19” TEBECHOP SE rectifier modules (58 V/40 A) take over the uninterruptible supply of the critical 60 V consumers, which include the telecontrol system, the emergency lighting and the transmission technology in the signal transfer rooms. In order to keep the overall system as compact as possible, the

60 V system also simultaneously feeds the five inverters of the INVERTRONIC compact type (2500 VA/2000 W). The latter guarantee, among other things, the power supply of the transmitter control stages with 230 V alternating current. The boards of all 19” modules are sealed with a special coating. This way, BENNING takes into account the special environmental conditions of the various installation locations, for example condensation due to temperature fluctuations or corrosion due to the salty sea air in the coastal region of northern Germany.

Sustainable system architecture

Due to the modular system architecture, there is no need to over-dimension the power

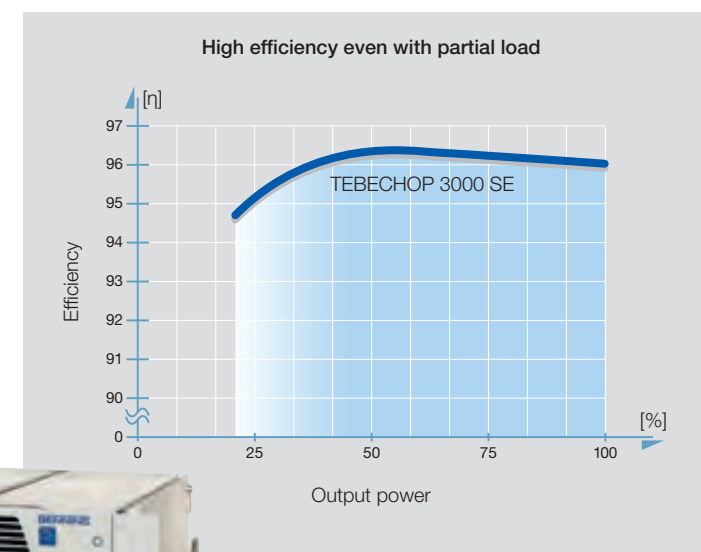
supply system at the time of installation. Instead, there is a redundant design in n+1 technology and additional reserve spaces are provided, which can simply be equipped with the corresponding number of power modules if an increase in power is required at a later date.

The transmitter station is thus ideally equipped for the challenges of today and the opportunities of tomorrow.

Although the maximum availability of the UPS system is in the foreground, it operates highly energy-efficiently due to its topology.

This is because the active power modules are utilised in such a way that they operate within their optimum efficiency. →

19” rack with TEBECHOP 3000 SE power modules: Each rectifier module provides a maximum output power of 1800 W or 3000 W. Up to 5 power modules can be installed in a 19” rectifier rack, covering the power range from 1800 W to 15000 W



The rectifiers of the TEBECHOP SE series operate with a very high efficiency even in the load range from 25% to 90%. For systems with a large rated output, the use of this rectifier series results in correspondingly significant savings in electrical energy



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The new power supply system with rectifier cabinet, DC distribution, inverter cabinet, AC distribution and battery cabinet (on the right in the picture)

The system controller (MCU 3000) built into the cabinet door of the power supply system with a 10.4" touch display

19" subrack with 3 INVERTRONIC compact inverter modules, manual bypass and electronic transfer switching device (EUE)

DC system, 58 V with TEBECHOP SE 3000 modules

DC distribution with battery connection

AC system with INVERTRONIC compact modules and bypass

AC consumer panel with switchable consumer outlets

Mobile MCU view on a smartphone

In addition to the rectifiers and inverters, the electronic switching device is also designed as a hot-swappable module. This means that the most important components can be serviced or replaced by service personnel in less than 10 minutes without affecting the connected consumers.

Smart monitoring with MCU 3000

In general, continuous and economical operation of power supply systems requires that they can be analysed and maintained with the help of powerful control and monitoring systems. Here, this is done by the Monitoring and Control Unit 3000 (MCU 3000).

The unit built into the front door monitors the entire power supply system and controls the

power management, among other things. Individually adjustable, automatable or event-controlled processes significantly reduce the time required for installation, monitoring and maintenance.

Preventive maintenance or service processes are triggered in good time on the basis of freely definable limit values and tolerances even before major damage occurs.

The 10.4-inch touch display not only simplifies operation, but also contributes to a clear display of the current energy flow in the UPS system.

A large LED strip integrated into the carrier frame of the MCU clearly signals the system status.

To enable messages and operating values to be read out remotely via the MCU's web-based interface, a network connection is provided by means of a surge-protected RJ45 connector.

Data transmission is secured using SSL encryption and the service technicians responsible for the respective location can use either a PC or a mobile device for secure access.

Hanover transmitter project completed

With the proper commissioning of the new power supply system at the Hanover broadcasting site, another UPS system was handed over to NDR on 24 January 2023.

The conversion of the NDR transmitter sites is progressing steadily and will thus ensure

that NDR can continue to broadcast its diverse radio and television programmes nationwide and without interruption. ▣

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New building at left in picture



Workshop for BENNING's test and metrology equipment, in the new technical area



Gerhard Pfann, Managing Director BENNING Austria

"For us, it's important for our employees to experience well-being in their working environment. For that reason, both in the new building and in the existing building, we placed particular priority on how the workplaces were configured."

With BENNING Austria's new company building, it's paving the way for a successful future

Capacity expansion and investment in modern workplaces will make it possible to provide expert customer service, enhancing the status of the site

Now that the Company has built a new office building and modernised its service area, it has set a clear focus on customer proximity, innovation and sustainability. Now, the site fulfils the ideal pre-requisites for expert training courses, customer training events or project meetings.

In just 2 ½ years, all of the required pre-requisites were fulfilled, starting with the initial planning stages in October 2020, followed by the move into the new office building in May 2022 and culminating in the modernisation of the technical section in the existing building.

The new office building has achieved impressive climate-friendliness and a mode of construction which has saved resources. Accordingly, BENNING Austria has made a contribution to environmental protection and reducing the ecological footprint. And this

building fulfils the highest energy performance standards: the outer walls have been made in "wood-frame" construction, which is a laminated structure created with a high-performance thermal insulation core. An energy-efficient heat pump provides heat in the winter or cooling in the summer.

A customer-oriented approach

A central feature of the new company building is the generously sized conference room, which is handicapped-accessible. Firstly, customers can come here for project meetings and secondly the conference room can also be used as a social area for employees. An appropriately equipped room in the upper storey is available for customer meetings on a smaller scale, and for videoconferencing.

The modernised premises in the existing building can be used for extensive customer training events, using custom application

BENNING test systems. In the future – the new technical area will provide the setting for organising workshops featuring BENNING's innovative test and metrology equipment.

Capacity for future growth

In the course of the conversion project, the entirety of the original office section was gutted and rebuilt. The most modern workplaces were installed in the service area, and – at the same time – the repair capacities were markedly expanded. All of the ground floor offices and the technical workplaces are handicapped-accessible and promote an inclusive working environment. New parking spaces – currently providing 10 charging points for EVs – have been provided for customers and employees.

In BENNING's project for expanding and modernising its offices and its technical area, it is clearly demonstrating its commitment to

Austria as a location. As emphasised by Gerhard Pfann, BENNING Austria's Managing Director: "For us, it's important for our employees to experience well-being in their working environment. For that reason, both in the new building and in the existing building, we placed particular priority on how the workplaces were configured".

BENNING currently has 22 employees at its St. Andrä-Wördern site. The new building has created new capacities, thus enabling further growth. ■

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Scan the QR code for further information



Joint campaign for planting trees: Each of the employees has planted their own tree on the company site

TRUE RMS Digital Multimeter BENNING MM 7-2

Application Report

BENNING has developed the new TRUE RMS MM 7-2 Digital Multimeter for demanding requirements in terms of the scope of functions and measurement accuracy.



What's included

You immediately notice two things the first time you take the BENNING MM 7-2 out of its box: The black surround around the instrument casing is not made from some cheap and nasty plastic, but a rubber-feel synthetic material. And it's a welcome discovery to find that it doesn't give that overtacky feel that characterises so many other silicon type materials, also making them difficult to clean. The other point you notice is the form of the case, and how it's made. They have kept the MM 7-2 relatively compact, so it's very easy to hold. This casing gives the impression of being tremendously robust: there are absolutely no squeaks or rattles when you grasp the instrument with both hands for a closer look.

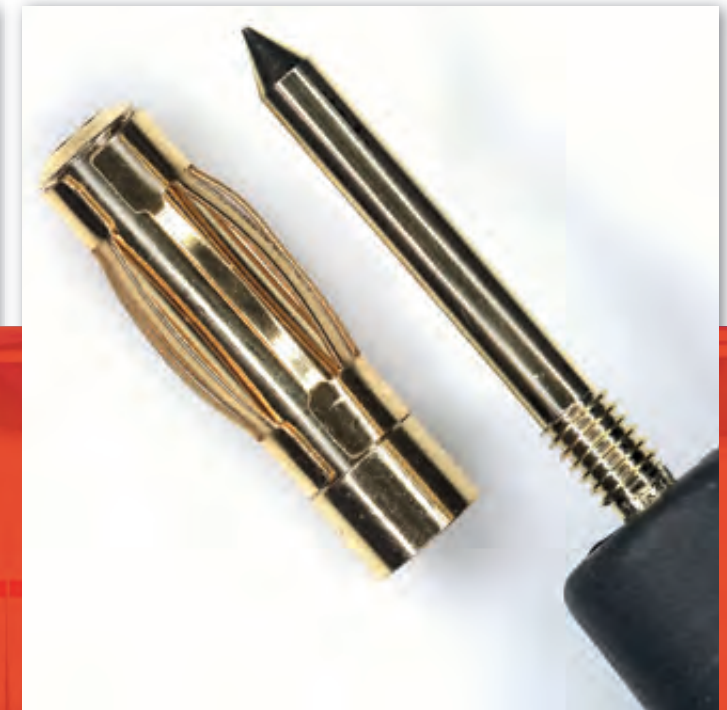
And, as we've come to expect with many BENNING instruments, the MM 7-2 ships with some accessories. Out of the box, you get the multimeter itself plus high-quality silicon measurement cables with gold-plated contact probes and protective caps, a temperature sensor, batteries and a cushioned transport case for the instrument and its accessories. What a joy to find that BENNING include a printed and – even better – complete set of operating instructions. They don't inflict you with those infamous and hard-to-read “Brief Instructions” consisting of one piece of paper which has been folded a dozen times (and which never folds back again in the correct way). Rather, they've invested in easy to read, useable instructions.



High-contrast display with characters 15 mm high, and a 30-segment bar graph



10-position rotary switch plus 8 function keys



High-quality, gold-plated test probes, ensuring permanently low transfer resistance levels. 4-mm bunch plugs

And because the booklet fits neatly into its own compartment in the carry-case, you've got the instructions to hand whenever you need them.

Generously sized display and a range of different measurement functions

And it's easy – even at awkward viewing angles – to read the large LCD display, which can be backlit if desired. Its five-cell main display (with four settings for 5 to 6 decimal places, or 60,000 digits) also includes – in its lower area – a quasi-analog bar graph display. This is always useful if there are major fluctuations in readings, and it makes it easier to detect any short-term changes in readings.

The BENNING MM 7-2's wide range of measurement functions far exceeds the basic facilities of a conventional digital multimeter. These days, any multimeter required for

professional use has to be equipped with TRUE RMS (RMS metrology). And, because BENNING expressly recommends the MM 7-2 for demanding measurement duties, including industrial applications, this TRMS technology is on board, as you would expect. Accordingly, the instrument has high basic accuracy extending to an impressive 0.03% in the DC range.

Good readings are dependent on good contacts

You can pretty much bet that measurement probes with poor-quality surface treatment will result in loose contacts and corresponding measurement errors. Measurement technicians are not impressed by test cables which lack flexibility and which become even more stiff in a cold environment. We are glad to see that BENNING has provided the MM 7-2 with test cables whose quality matches the unit it-

self. Accordingly, the cable insulation is made of silicon, which means that the measurement cables themselves retain great flexibility even at low temperatures, and can also withstand contact with hot objects (such as soldering irons) with no problems.

Special measurement functions for HVAC technicians make it possible to conduct inspection measurements for ionisation currents in flame sensors, and they can also measure the sacrificial anode current in boilers. Within the 600 μA measurement range, the BENNING MM 7-2 gives 0.01 μA resolution, thus enabling precise assessment of low DC values.

In the temperature measurement range, for example, it's possible to measure flue gas temperatures together with water and air temperatures in heating and air-conditioning systems. This will often do away with the need to bring further special measurement instruments on-site. →



Practical solution: the removable battery case means that batteries can be swapped over conveniently



(at right) Contactless voltage detection. This also means that line breaks – such as in extension cables, for example – can be readily traced



0.01 nF to 10 mF capacity measurement range



0.03% basic volts DC accuracy for precise readings and demanding metrology tasks (comparative measurement in laboratory with a calibrated precision laboratory multimeter)

Temperature measurement with the K type thermocouple wire (included as standard) with 0.1 °C resolution, with the support unfolded

User-friendly functions

You can use the VoltSensor function for contactless voltage detection. A voltage detector for detecting alternating fields is integrated into the front section of the casing. This is operated by means of the “VoltSense” key. Sensitivity can be selected by pressing the key repeatedly. More than this, the MM 7-2 gives an audio indication of the potential field strength, together with a 4-level, horizontal bar chart display. It’s of practical value that they provide the automatic AC/DC switchover function in the voltage measurement range, which is termed “AutoV”, supplementary to the automatic measurement range selection which is (of course) provided. The multimeter provides fully automated selection not only of the appropriate measurement range but also the measurement function (AC or DC) which means that the operator can fully concentrate on his measurement task.

Universal diagnostics tool

For troubleshooting, there’s a continuity test function – with audio-visual operation – and this is extraordinarily responsive, with a reaction time of less than 100 µs.

This is most welcome, because so many multimeters prove to be sluggish in this respect: making it difficult or impossible to detect “loose connections”.

The BENNING MM 7-2 is equally impressive when it comes to diode testing. This is another important feature, one which saves a whole lot of time for service engineers trying to trace defective semiconductors, especially as the instrument also gives audio warning of any defective diodes.

Overall, the new BENNING MM 7-2 qualifies admirably as a universal diagnostic tool,

thanks to the wide measurement ranges which it provides in addition to its extensive range of functions.

Diverse measurement functions – does that mean it’s complicated to operate?

Although the MM 7-2 is very extensively equipped, the clear layout and the clear labelling provided in the control area make it easy and straightforward for you to find your way around. The functions identified in blue on the second level of the measurement range selector are easy to select by just pressing the (also) blue key, and can then be deactivated in precisely the same way. The operating concept has been well thought through, with a simple structure: no need to spend hours reading through the operating instructions. Even when you first use this instrument – or if you only use it from time to time – you shouldn’t experience any problems.

Conclusion

The BENNING MM 7-2 offers impressively high accuracy, extensive measurement functions and a tough, two-component casing. With a view to preventing accidental errors of operation, it possesses integrated socket monitoring and gives audio-visual warnings if the measurement cables have been plugged into the unit incorrectly. Thanks to covering the CAT IV to 600 V and the CAT III to 1000 V overvoltage categories, the BENNING MM 7-2 is as suitable for industrial applications as it is in conventional electrical installations. Service engineers in industrial systems will benefit in particular from the measurement functions provided for 4 – 20 mA current loop signals, duty cycles (in %) and a switchable HFR lowpass filter, and the LoZ (low input impedance) voltage measurement function for suppressing ghost voltages.

Installation engineers and service staff for “wall boxes” (EV charging stations) will be impressed by the integrated measurement function for the CP control signal which the BENNING MM 7-2 fulfils with two measurement adapters that can be obtained as accessories. Because the product ships as standard with a thoroughly adequate transport case, high-quality measurement cables and a temperature sensor for measuring the temperatures of wires, you don’t need to buy these additional fittings – which is most welcome as in most cases they will be essential anyway. Considering the scope of functions, the items included as standard and the level of measurement accuracy provided, the current selling price of less than 300 euros is extremely reasonable. ■

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For further information about the BENNING MM 7-2, visit:
www.benning.de

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Saving energy while safeguarding quality in the long term

With the modernisation of the impregnation system, BENNING is setting the course for the long-term, economical production of windings of the highest quality at the Bocholt (North-Rhine Westphalia, Germany) site

The commissioning of the new, spacious drying oven with regenerative thermal oxidation (RTO) in the electrical machinery (BeM) area successfully achieves the first phase of the “Impregnation Modernisation and Expansion” project.

Preparations for the second phase, in which the vacuum impregnation systems

will also be replaced during the course of next year, are already in full swing. With these investments, BENNING is securing the energy-efficient and environmentally friendly production of wound equipment such as coils and transformers for the next one or two decades.

It is a clear commitment to Bocholt as a location.



DC rotors after impregnation and drying

Wound equipment is everywhere. They can be found in medical technology systems, in the automotive sector, in electrical engineering and electronics, in electric motors as well as in energy generation and supply systems.

In these demanding areas, the components used must meet high technical requirements and withstand high demands. A defect and the associated failure – such as of a hydropower generator – is usually associated with large economic losses for the operator of the plant.

Once installed, these components can often only be replaced on site with a great deal of time or not at all.

A finished component is moved out of the drying oven



Installation of the drying oven: Delivery and installation of the chimney

High voltage and insulation resistance

Therefore, at BENNING, the transformers for stationary power supply systems, traction chargers as well as coils and other components or component groups for electrical machines, are cast with special resins and lacquers under vacuum. This sealing with so-called secondary insulating materials guarantees high mechanical resistance and protection against environmental influences. In addition, maximum high-voltage and insulation protection is achieved.

Three factors are decisive for the quality of the impregnation and the associated service life

of the winding; the secondary insulating materials used, the vacuum impregnation and the final drying process.

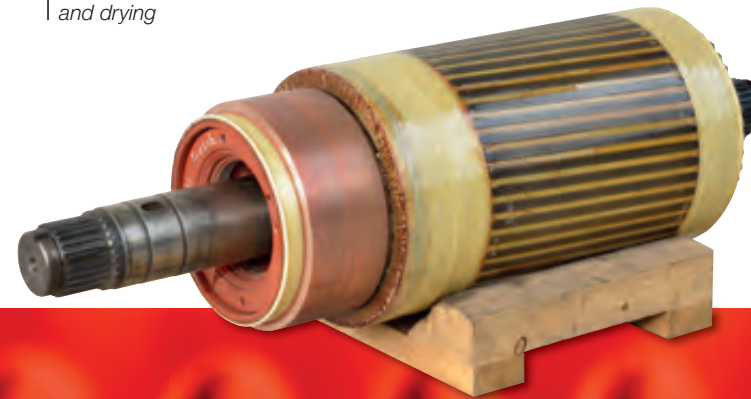
The respective purpose of the various components to be treated requires an individual composition of the insulating materials to be used.

After curing, the precisely coordinated formulations give the impregnated component exactly the desired electrical, mechanical and thermal properties it needs for its application.

For example, the rated voltages range from a few volts (< 100 V) to high-voltage coils with 13,000 volts. →



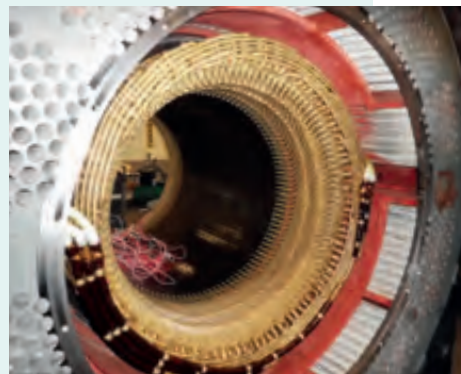
DC rotor after impregnation and drying



Newly wound stator before impregnation



Power supply systems above with winding components



Newly wound motor (above) after and (below) before impregnation



Another challenge is the careful impregnation of the components themselves. Because of the complexity of the components with many edges and corners, cavities can quickly form.

The air bubbles trapped inside would significantly reduce the high-voltage insulation and possibly even render the component unusable. Therefore, a vacuum is created in the impregnation container, which eliminates even the smallest air pockets and accurately fills all cavities with the impregnation medium.

Robust, durable insulation system

Finally, the drying and curing process takes place in the new chamber oven. In order for the substances present in the formula of the impregnation medium to react with each other as desired, the temperature curve must be finely adjusted during the drying time. For this purpose, individually adjusted temperature curves can be programmed and stored in the control system of the new chamber oven. The result is a robust and durable insulation system of the best quality. The furnace chamber has an internal dimension of 3x3x3 m and is loaded with the

impregnated windings such as transformers, coils, chokes, motor or generator windings via a movable table – the so-called furnace trolley. With a maximum output of 200 kW, temperatures of up to 180 °C can be generated inside in a controlled manner. Specially programmable temperature-time curves are used for this purpose.

The volatile hydrocarbons (VOC – Volatile Organic Compounds) produced during the curing process are completely converted into harmless components post-combustion in the regenerative thermal oxidation plant (RTO plant).

Efficient energy recovery

Two heat recovery chambers are located below the central combustion chamber, where the thermal oxidation of the pollutants takes place. They are equipped with a heat storage mass that can absorb, store and release energy. This way, the heat from the clean exhaust air is transferred to the raw gas. Thus, by the time it reaches the combustion chamber, it is preheated close to the temperature needed

for oxidation. The combustion of the organic components contained in the raw gas, which already takes place autothermally from a concentration of approximately 1.8 g/Nm³, is now sufficient to transform the raw gas into clean gas by means of oxidation.

This reduces the use of the main burner to the start-up phase of the oven. From the combustion chamber, the hot clean gas flows through the heat recovery chambers and leaves the plant as clean exhaust air.

Quality, sustainability, economic efficiency

This efficient form of heat recovery, combined with the modern oven control, now saves about 70 % of the natural gas used in the BeM compared to the old system. At the same time, these optimised manufacturing

methods contribute to a reproducible level of quality that guarantees the longevity of the manufactured windings for electrical machines as well as for the transformers of the company's stationary power supplies and traction chargers used worldwide.

Cost-effectiveness, quality and a careful approach to our environment go hand in hand here. The project "Watering House Modernisation and Expansion" is another example of a corporate philosophy that intelligently combines the sustainable use of our natural resources with economic action and maximum quality standards. ■

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BENNING

Technical reliability for critical infrastructure

BENNING provides various power supplies for an important node in the European gas grid

Whether from Norway, Belgium or the Netherlands: Gaseous energy sources are not only a cornerstone of the energy supply of today and tomorrow – they also ensure that the European gas grid remains indispensable in the long term. As an important node in this network, the recently built Rimpar^{*1} compressor station has now been equipped with various BENNING power supply systems for optimum protection against power failures.

The compressor station in the territory of the small town of Rimpar near Wuerzburg, Bavaria belongs to MEGAL GmbH & Co. KG and is operated by Open Grid Europe GmbH. It is an important hub in the German and European gas network, as a whole series of pipelines cross here, including the important MEGAL pipeline, the Central European Gas Pipeline. It connects Czechia and Austria with France and thus represents a crucial east-west or west-east connection in the European long-distance gas network. From the control centre of the station in Rimpar, the gas can be forwarded in other directions.^{*2/3}

Self-contained battery room with 24 V DC and 110 V DC batteries, incl. single cell monitoring

The main power supply room with BENNING system cabinets

This profile alone illustrates the enormous importance of the Rimpar compressor station as part of the critical infrastructure. In order to secure and expand this significance, the Gas Network Development Plan 2016-2026 of the Federal Network Agency (NEP 2016)^{*4} envisaged the construction of an additional compressor station at the Rimpar compressor site, which has existed since the 1980s. This new addition to the station has received the new power supplies from BENNING as a functionally independent unit. The final acceptance took place in March 2023.

No compaction without power supply

The demands on these systems are high. After all, there are also a lot of critical components working in a gas compressor station that depend on a secure power supply.

More specifically, these critical components are the measuring systems, the entire control technology, solenoid valves, emergency lighting as well as emergency and extinguishing water pumps, the entire network and telecommunication technology and, finally, safety-relevant air-conditioning units and fans. →

^{*1} https://wuerzburgwiki.de/wiki/Verdichterstation_Rimpar

^{*2} [ibid](#)

^{*3} https://en.wikipedia.org/wiki/MEGAL_pipeline

^{*4} https://www.bundesnetzagentur.de/SharedDocs/Downloads/DE/Sachgebiete/Energie/Unternehmen_Institutionen/NetzentwicklungUndSmartGrid/Gas/NEP_2016/NEPGas2016Final.pdf?__blob=publicationFile&v=1

The rectifiers of the **THYROTRONIC** series used for stationary battery systems are operationally safe, reliable and powerful and have proven themselves thousands of times over. They are particularly suitable for use with battery-supported DC power supplies and offer a comprehensive signalling and monitoring concept in addition to the basic features mentioned.

The rectifiers operate with an electronically controlled output characteristic (IU characteristic according to DIN 41773) and are suitable for use with lead-acid and NiCd batteries as well as other modern battery technologies.



THYROTRONIC

Inverters of the **INVERTRONIC** series are very robust single- and three-phase inverter systems for heavy-duty use in power plants, as well as the oil, gas and petrochemical industries.

They offer the highest availability and maximum economic efficiency and are connected to secured (e.g. battery-supported) direct current grids and reliably supply critical loads with high quality electrical power.



INVERTRONIC

The **TEBECHOP** modular rectifier systems and DC converters are tailored to the industry's requirements. They are performance-scalable, robust and economical, and have proven themselves many times over in the petrochemical industry, in power generation and distribution, as well as in automation and traffic engineering. Together with lead or NiCd batteries connected in parallel, these systems can be expanded to battery-supported backup power supplies.



19" rack with 3 convection cooled TEBECHOP 3000 SE power modules



DC power supply with 4 TEBECHOP 13500 SE plug-in units



The MCU 3000 display and control unit with 10" touch display

If these systems were to stop working as a result of a power failure, the compressor station would no longer be operational – and that would have serious consequences for large parts of the long-distance gas network.

Safety as the top priority

To prevent this from happening, Open Grid Europe GmbH, on behalf of MEGAL GmbH & Co. KG has developed a detailed specification and launched it on the market. BENNING was able to win the bid.

The project requirements to be fulfilled were tailored to the specific requirements and demanded a high degree of adaptability from all potential suppliers. With its comprehensive product portfolio, BENNING was able to offer the customer, in line with this bid, a tailor-made solution at the highest level of performance and safety, combining the best of the worlds of monobloc and modular power supplies and especially adapted to the requirements at high power levels.

The solution includes – as system elements in a monobloc design – two thyristor rectifiers (110 V / 1000 A) of the THYROTRONIC type, four three-phase 80 kVA inverters of the INVERTRONIC type and two single-phase 50 kVA INVERTRONIC inverters.

The modular systems used are a 24 V DC / 1050 A rectifier of the type TEBECHOP 3000 HDi and two 48 V DC / 130 A DC converters of the type TEBECHOP 3000 HDi DC. The configuration is complemented by two additional cabinets and a total of four stationary lead-acid battery systems, two each with 110 V and two with 24 V.

Proximity and quality as winning factors

BENNING's solution, as outlined here, won over MEGAL GmbH & Co. KG and Open Grid Europe GmbH for other reasons too: BENNING has years of experience as a supplier of power supply systems for the oil and gas industry. BENNING has a long-standing business relationship with Open Grid Europe

and its predecessor E.ON Ruhrgas. The fact that BENNING systems are made in Germany was seen as an additional advantage.

Local proximity with short distances and fast response times from order processing and ongoing service to maintenance operations played an important role in Open Grid Europe GmbH's selection. Of course, this also applies to the high quality of the components produced by BENNING in-house.

Future projects

High product quality and responsive, reliable service at competitive prices will continue to be the basis for joint projects between BENNING and Open Grid Europe in the future. They will include the Federal Network Agency's Gas Network Development Plan 2016-2026. This plan specifies actions and measures for optimisation and reinforcement

as well as expansion of the network in line with demand and to ensure security of supply.*5 Thus, by 2026 there will be various projects for the new construction and expansion or revision of compressor stations, gas pressure regulating and metering stations (GDRM) and other facilities important for gas storage and transport. BENNING will be involved in at least three of Open Grid Europe GmbH's future projects - and thus contribute to maintaining the performance and reliability of the German gas distribution infrastructure. □

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*5 https://www.bundesnetzagentur.de/SharedDocs/Downloads/DE/Sachgebiete/Energie/Unternehmen_Institutionen/NetzentwicklungUndSmartGrid/Gas/NEP_2016/NEPGas2016Final.pdf?__blob=publicationFile&v=1



3 Photos: © Kraftwerk-Obernburg GmbH

The technical room in which the new BENNING power supply plant has been installed is positioned in the ICO's most eye-catching building complex, and this characterises the already conspicuous outline of this innovative industrial location.

The chimney, which is 186 m high, together with the three single-pass boilers (120 m in height) belonging to the site power station, are the core components of the Obernburg Industry Centre, and they provide convincing evidence of how advanced it is, accommodating the turbine complex with the corresponding electrotechnical room from which the BENNING system drives the power station's most important components.

A power supply for in-house needs, with an exceptional efficiency boost

BENNING supplies a new power supply system for Obernburg combined power station, with the emphasis on safety and sustained efficiency

It has long been a logical and cost-effective solution for major corporations and business parks to use natural gas in order to generate power and heat.*¹ Rising gas prices are now placing operators under massive pressure, which calls for a logical optimisation of efficiency – and

this also includes the self-generation option. The combined power station at Obernburg am Main stands as a model project for optimisation in this field – thanks to using BENNING's modern, highly efficient components.



The three steam turbines, some of which are over 50 years old, were modernized in 2018 and brought up to the current state of the art



The Obernburg Industry Centre – abbreviated to "ICO" in German – is located in Miltenburg, in the Unterfranken region, adjacent to the banks of the River Main, at the base of the Bavarian Spessart forest. Its position is idyllic, by way of a contrast to the status of the Centre, which – being operated by Mainsite GmbH & Co. KG – stands as a modern industry park on a site measuring in excess of 170 hectares and retaining over 3,000 employees.

This site was set up in 1924 – as a production centre for textile viscose threads – by Vereinigte Glanzstoff-Fabriken AG. Since that time, ICO has expanded to be more than just Europe's largest and most diverse chemical fibres centre. It also provides a home for more than 30 successful international com-

panies of varying sizes and specialist fields. In addition to some firms which have come through from the Group's previous structure, these are providers from the fields of medtech, medical analytics, plastics tech, paints and inks, reaction tech, logistics, chemicals and industrial services.*²

Energy for financial success

All of this business activity naturally requires energy – and this is generated by the specifically founded "Kraftwerk Obernburg GmbH" power station on a scale tailored to the onsite companies' particular needs.

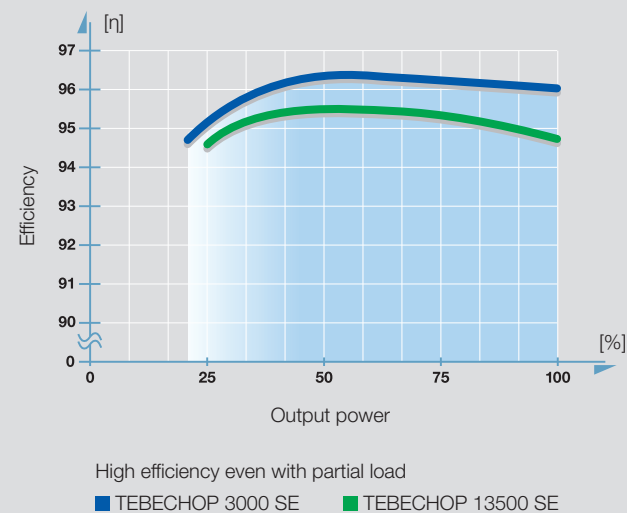
The power for the ICO – with any surplus output going to the public grid – depends on a combined gas/steam process, driven by a

gas turbine supplying 60 MW with steam turbines downstream. The steam is then also utilised as a heat source and as process steam. The modern combined gas/steam process and the power station's combined electricity/heat production inherently means that the Centre possesses high efficiency. This is and has always been central to the operating company: many years before today's price rises, the new core component of the power station – a gas turbine supplying 60 MW – was installed in the context of a renovation project commencing in 2018 and comprising a level of investment in excess of €50 million. And the three steam turbines, dating back as far as 50 years, and located downstream from the gas turbine, were renovated in order to enhance energy efficiency thanks to power/heat coupling. →

*¹ <https://www.manager-magazin.de/fotostrecke/selbst-ist-die-fabrik-welche-firmen-auf-eigene-kraftwerke-setzen-fotostrecke-68313.html>

*² https://de.wikipedia.org/wiki/Industrie_Center_Obernburg
https://de.wikipedia.org/wiki/Obernburg_am_Main
<https://www.mainsite.de/de/>

TEBECHOP SE series rectifiers offer very high levels of efficiency even within the load range of 25% to 90%. In systems with a high output, significant savings in electrical power can be achieved using this highly efficient range of rectifiers.



19" rack insert with TEBECHOP SE rectifier modules



INVERTRONIC compact rack with electronic bypass switch unit



© Kraftwerk Obernburg GmbH

"Due to the positive experience that we had already gained in other projects, the decision was made relatively quickly in favor of working with BENNING"



Günther Wörner
 Head of Electrical, Measurement and Control Technology, Kraftwerk Obernburg GmbH, Industrie Center Obernburg



© Kraftwerk Obernburg GmbH



Inspection and revision work on a turbine

Guaranteeing operating safety

The primary anticipated service life of the newly installed gas turbine exceeds 100,000 operating hours. In the interests of making it possible to achieve the projected service life, turbine shutdowns are planned for intervals of 4 years, which will enable the required overhauls to take place.

They will make use of the 2023 shutdown phase as a platform for optimising efficiency and uptime, plus the opportunity for replacing the power station's existing conventional internal power supply profile with a state-of-the-art tech concept.

In addition to the essential consumers in the turbine system, critical to operation – especially the standby oil pumps – the systems installed to cover in-house requirements can also be upgraded with new control panels as

the project continues. Consequently, the new in-house supply system had to be capable of providing reliable power in both direct current and alternating current formats.

Maximum safety for critical consumers

Background: when a gas turbine comes to be switched off, the resultant cooling gives rise to mechanical loads on the turbine's main components. In order to minimise the heat load on these components – thus also minimising negative repercussions on service life – the cool-down rate has to be precisely controlled.

And this can be achieved only if – in the event of an unplanned switch-off, for example due to an external grid failure – there is going to be battery backup to power the standby oil pumps feeding the turbine bearings and all of the metrology and control electronics. Oth-

erwise there's no chance of any controlled rundown, and that will mean losses on a scale of millions.

This was the demanding, highly-crucial challenge that BENNING took on. In conjunction with Kraftwerk Obernburg GmbH – as represented by the manager responsible for electricity, metrology and controls, Mr Günther Wörner – BENNING came up with a proposed solution relying on the most modern and highly efficient components, offering the customer the required degree of future-proofing thanks to its modular equipment topology.

And it was the latter point, plus the essential need to achieve a modern level of high efficiency, that had to be seen as prime con-

cerns for Kraftwerk Obernburg GmbH. Finally, the existing system, dating from 1996, had originally been specified in monoblock design – clearly outmoded by now.

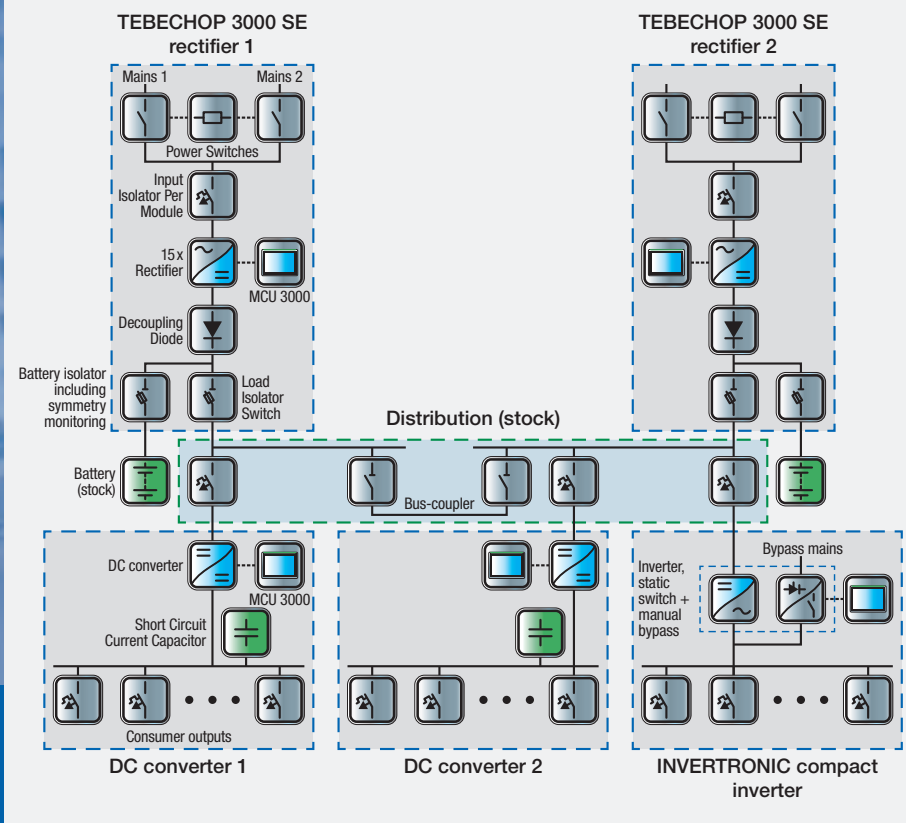
Modular architecture offering the highest efficiency

The solution offered by BENNING for the power station at the Obernburg Industry Centre was based on INVERTRONIC compact inverter systems, TEBECHOP SE rectifier systems and DC converters. With its INVERTRONIC compact module inverter series, BENNING supplies very safe, cost-effective, single-phase inverter systems producing high-quality electrical energy for the critical consumers, and with the maximum of reliability. →

The fuel supply at the gas turbine in the area of the turbine rotor



Single line diagram of the power supply system



Generator part of the 60 MW gas turbine

In conjunction with TEBECHOP modular rectifier systems, the net result is a very versatile, cost-effective platform for the construction of comprehensive, battery-supported standby power supplies with the maximum of availability, which is how the ICO needs it to be.

BENNING's TEBECHOP SE product range offers a new generation of highly affordable modular rectifiers which go all the way to meet the requirements of sensitive, process-critical systems, also offering expansion to battery-supported standby power supplies if lead or nickel cadmium accumulators are combined in parallel.

Monitoring with overview; Smart controls

An impressive sight, for the operator, is this solution's most conspicuous element: the MCU 3000 remote monitoring system with

its user-friendly, 10-inch TFT display, constituting a consistent man/machine interface in the system comprising rectifiers, DC converters and inverters.

Remote monitoring can be used in addition to the use of the potential-free contacts either by ethernet, web, SNMP, MODbus or Profibus.

Using existing cable infrastructure

Maybe less conspicuous, but no less important: connection technology. In order to make it possible to avoid further use of cables routed in the far-reaching branches of the building complex, whilst also avoiding costly new installations, the specialists at BENNING placed particular priority (from the planning stage through to the implementation of the design) on a like for like layout for cable connection points.

Smooth progress management culminates in prompt completion

The entire project was completed in less than one year. Technical planning commenced in the autumn of 2022, and BENNING delivered and installed the entire power supply system on-site precisely at the beginning of the planned three-week plant overhaul at the start of July 2023. Commissioning was completed within the envisaged timeframe: 10 days before the posted closing date for the project.

Significantly enhanced efficiency

What was impressive was not just the fact of meeting the planned timeframe but also the conspicuous, marked improvement in the achieved level of efficiency – and this also provides the following benefits in terms of capacity as a fully modular, cycled system for in-house energy production: a before/after

assessment of the primary feed – the 220 V rectifier system – resulted in a reduction in the amount of energy required annually of over 71,000 kWh relative to the old power supply system. So, going forward, BENNING's highly efficient power supply solution will not only contribute to continuous, reliable operation of the gas/steam power station in Obernburg, but will also reduce operating costs and slash the annual CO₂ output by approx. 26.9 tonnes. ■

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Claus Kirmaier, Head of Office South, Germany BENNING

Fairs, events and exhibitions

2023

SPS

14.11. – 16.11. in Nuremberg/Germany

REBUILD UKRAINE

14.11. – 15.11. in Warsaw/Poland

2024

LogiMAT

19.03. – 21.03. in Stuttgart/Germany

The smarter E Europe / ees

19.06. – 21.06. in Munich/Germany

All details provided without liability

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