“Design is how it works”
Focus on usability and efficiency
Dear Reader,

in an era where services have to match the corresponding products, the concept of user experience is a crucial factor for quality. Where products and services have been accurately and painstakingly matched to their users’ custom requirements, the customer’s investment will be justified in terms of reliability, safety and good value for money.

We need to understand exactly how our products are going to be used, if we plan to enhance the effect of custom specification. That means continuously compiling, managing and expanding this knowledge. Then it provides an excellent basis for decision-making when it comes to developing products & services. And that goes for the design and planning of the new, forward-looking UXD (User Experience Design) which is part of the offering with the MCU 3000 (or Monitoring & Control Unit 3000).

Now power supplies and UPS systems can be used on the move; more than that: their operation becomes simpler, more intuitive and safer. We’ll be telling you more about that in this issue. And you’ll also be able to find out how – thanks to close collaboration with Marketing – our training concepts have been perfected, whilst enhancing the available scope of functions and ease of use.

And this issue also tells you how BENNING (working in close and confidential collaboration with customers) has developed and applied high-availability power supply and preventive service solutions, e.g. for the largest mobile telephony network in the Caribbean, to take one example; or – again – Russia’s most modern petrochemical plant (in Siberia).

Now read on, and I hope that you will find this to be the most interesting issue. I look forward to receiving your feedback.

Respectfully, Dietmar Papenfort

e-mail: d.papenfort@benning.de

EDITORIAL

Contents

3–5 Professional, user-friendly & individual DGUV (German Social Accident Insurance) Regulation 3 - Equipment testing

BENNING’s new-generation equipment testers – BENNING ST 755/760 – are amongst the most highly regarded instruments in their category.

6–11 Design is how it works

MCU 3000 offers a new, visionary User Experience Design which makes for straightforward, intuitive and transportable operation of power supplies.

12–16 Manufacturing batteries based on the highest quality and with sustainable management of energy

BENNING has been developing and manufacturing battery formation and test systems for decades. These systems have been installed at one of the world’s most modern automated industrial plants for the production of batteries.

17–19 Transfer of knowledge from manufacturer to user

Top quality training sessions avoid downtime and make a major contribution to the safe and reliable operation of plant and equipment.

20–25 5MW Wastafalen power station – Overhaul for Block E

Preventive maintenance and retrofit for protected power supply in order to achieve optimum plant availability.

26–29 Turnkey solutions for the largest mobile communications network in the Caribbean

BENNING power supplies and services significantly help to ensure the continuous operation of the largest Caribbean telephone and mobile communications network.

30–31 High-availability UPS systems for the harsh conditions of the petrochemical industry in Siberia

Modern BENNING power electronics as sure the operation of the largest and most modern petrochemical plant in Russia.

32 Fairs, events and exhibitions 2019

About us © BENNING Elektrotechnik und Elektronik GmbH & Co. KG © RWE © W. L. Glassel © frank peters, imageteam, jippu2498, denisismagilov, doris oberfrank-list, bigpa, butenkow, Connect world, Dreamstime.com, Fabrikbild, fabrikbild, francesco e marco fotografi, Franko Design & Media GmbH & Co. KG, Franko Design & Media GmbH & Co. KG, Franko Design & Media GmbH & Co. KG, stock.adobe.com

Legal and Copyright All editorial and advertising material property of copyright. The cladding and layout of this paper, as well as other information is subject to the written agreement from BENNING Elektrotechnik und Elektronik GmbH & Co. KG. The use of the materials, their reproduction in material form is subject to the following conditions: copying and any changes are not to be copied, nor can it be used in a transmission system, including networks and any other means (print, film, electronic data storage) without the written consent of the publisher. No part of this paper or any of its contents may be reproduced in whole or in part without written permission from the publisher. Any use of this material will be governed by the terms and conditions of use of the material as set out by the publisher. The publisher cannot accept any liability for any isssues arising from the use of this material.

PN: I expect that the question: “What’s new compared to the previous product range?” is one that has already been asked of you many times. However, could you go through a few of the main details, for the benefit of our readers?

Enck: User-friendliness and efficiency were central concerns in the new development. The hardware was completely revised and combined with high-performance components. The sustained, high level of demand for BENNING ST 755/760 is proof enough that it was good policy for them to incorporate quality, functionality and user-friendliness when these robust instruments were developed. Users are treated to a modern screen interface and well-organised structures offering ease of overview. The range of tasks in testing is simplified, right down to where work information is being placed on record, thanks to the useful special settings.

POWER news had the opportunity to speak to Mr Enck (of the sales division of BENNING’s testing and measurement equipment department) about the advantages and the new functions of this generation of equipment testers.

PN: Both of these equipment testers are suitable for the testing of mobile and medical electrical apparatus for the criteria of DGUV (German Social Accident Insurance) Regulation 3 (VDE 0701-0702, VDE 0751-1). Why do we have the choice of 2 models?
Enck: The two systems are used in basically the same way. But anyone intending to apply testing to welding machines that correspond to VDE 0544-4 standards may prefer to opt for the BENNING ST 760. This model has the necessary filtering circuitry including a variable resistor for measuring true RMS and peak voltage. The integrated filter circuit is a great advantage, otherwise you would need to buy it as an add-on adapter. The required test stages are run automatically by having selected the appropriate welding machine test procedure. To actively test welding machines that have 16 A / 32 A CEE connectors, you can use the BENNING MA 4 test adapter or alternative adapter solutions.

PN: Test operator sign-in is an innovation which is immediately conspicuous to the user. What is BENNING’s intention with this?

Enck: User administration enables various rights to be issued for persons who are “EUP” (electrotechnical training) and the authorised rights to be issued for persons who are “EUP”-trained. And the administrator can install up to 16 user profiles, test cycles and visual inspections can be copied straightforwardly. Other facilities available to the test operative include the setting of date, time of day, language, brightness, display of working media requiring replacement and test history together with results.

PN: To what extent are testing and metrology characteristics influenced by new hardware components?

Enck: High-capacity switching relays have been installed, and they have no difficulty in coping with high switch-on currents. What their service life is very greatly extended. To a very great extent, the “sticking” of relays is avoided. And the equipment tester is now equipped for testing on IT networks. Examples of these non-earthed networks are to be found in laboratories, or in hospital operating theatres.

PN: What should a test operative do if he cannot find an appropriate test procedure – that fulfils the prerequisites described in hazard assessment – for a testpiece?

Enck: Here, too, there is a solution. A user who is registered as “admin” can input any test mode on the equipment tester to set up customer-specific test cycles with their own limit values and visual inspection questions. Individual test periods per test stage provide the test operative with the necessary timing dynamics. In this way, for example, the time-frame envisaged for function testing, including active testing of all of the testpiece’s functions and switching circuits, can either be very precisely defined or left “open”.

PN: Do these test cycles have to be set exclusively on the equipment tester?

Enck: BENNING PC WIN ST 750-760 software also fully supports the setting up of new test cycles.

PN: Consequently, admin and documentation software constitutes a crucial tool both for the user and for the customer. Even so, it is licence-free and can be used without restriction throughout the user’s company. What does it include?

Enck: The whole package that goes to make up the equipment tester’s universe must be compatible within itself. Equipment testers and PC software are designed so that virtually no limits are built into the system. BENNING provides free updates as changes to standards arise or as new functions are introduced. Installation is possible via W-LAN, LAN or USB stick. Downwards compatibility means that you can also work on the basis of the BENNING ST 750’s sSI databases, or otherwise these databases can be successfully converted into db formats for the new testers. Statistics and reports are straightforward and quick to set up. After a customer or a department has been selected, statistics will provide a numerical & graphic display of the quantity of “passed” and “failed” testpieces together with the nature of the critical defects. Because the database contains all of the details of the customer, the test operative and the operating media, it only takes a few moments to set up test reports. You can even automate the integration of a company logo, the date of a report and a signature, using “ReportSigner”, a program which has been incorporated into the software. All details and measurement results can be exported for further processing, and reports can be sent to the printer or output as PDF files.

PN: Are there any new ideas and solutions for the testing of testpieces with CEE connectors?

Enck: As early as the stage of designing our present BENNING MA 2-16 CEE active adapter and BENNING MA 3 CEE passive adapter kit, we had integrated initial steps in the right direction. In the autumn of 2019, we shall be introducing the BENNING MA 4 CEE adapter kit. This is suitable for active and passive testing and for full 32 A loading of single-phase and triple-phase test media in conjunction with equipment testers. This can be described as an “all-in-one solution”. This solution combines the previous range of adapter fittings, which was often very diverse, into one single product. And another feature is that you can now have automatic testing of 5-pole operating media.

After completion of the test cycle, measurements are carried out on the protective conductor and insulation resistances, on contact current and protection conductor current, together with function checks on CEE operating media and extension cables. When 5-pole extension cables are being tested, it’s also possible to test the rotating field and to detect if conductors have been connected the wrong way round. Status is indicated by LEDs, in the process. You can decide to connect a low fault current which checks the whole of the test system (self-check).

The BENNING ST 75 and BENNING ST 760 equipment testers have incorporated the BENNING MA 4 active/passive test adapter kit as a directly selectable option. Essentially these test adapter kits can be used on all equipment testers if they permit the connection of 230 V mains power.

PN: Many thanks for all of this information. No doubt there are customers who will have individual questions and requirements to put to you. In that case, who should they contact?

Enck: In practice, there is a wide range of different requirements and test concepts. Our equipment testers give operators the optimum basis for fulfilling all of these stipulations. We or our regional branches in industry will be glad to help with any questions or product concepts.

contact: Tobias Enck
telephone: +49 2871 93 111
e-mail: t.enck@benning.de

4 | BENNING | POWER news | Q4/2019
and safely when we use the MCU 3000 to operate the power supply system. To that end, one strategy involved reducing the MCU 3000’s UI (User Interface) to the essentials. Leaving out any elements, colours, shapes or textures that were not really needed. This minimalistic approach enhances user-friendliness. An example of this is where a screen display, in its present configuration, now presents the user with nothing more than the information actually needed for the requirements of the relevant types of user and combinations of tasks. And the various types of users involved will have various help levels available in their respective UI. Content is displayed in the form of readily understandable icons or symbols that denote functions and system statuses. Whilst keeping the option of fading in additional help content or explanatory notes. Skilful use of blank space means that the presented content is easy to take on board, mentally. The design achieved makes the user feel relaxed and in control.

Now, the priority is placed on maximum system availability and profitability, in addition to a UX that provides guidance for the operator of a power supply system. That system does, after all, represent an investment that was made in order to protect the procedures critical to his business.

A new generation with new functionality: the MCU 3000’s control and remote monitoring system - which features modernised UXD - means that both AC and DC power supplies are even more straightforward, more user-friendly and more reliable than they were. This is another step towards safer and more cost-effective operations.

As power supply systems come to incorporate more and more functions, we need improved control and display capabilities to be available so as to ensure the straightforward and safe use of complex systems thanks to specific man/machine interactions.

And this is the only way to achieve real added value. After all, it was Steve Jobs who pronounced, as long ago as 1993: “Design is not just what it looks like and feels like. Design is how it works.”

Keep it simple

The new interface design is ergonomic and object-centred. Accordingly, it draws upon a typical characteristic in the human brain which helps us to cut out any needless complexity, to make logical connections more quickly and to achieve further practical application of previously learnt knowledge or experience. The outcome is enhanced efficiency and safety when we use the MCU 3000 to operate the power supply system. To that end, one strategy involved reducing the MCU 3000’s UI (User Interface) to the essentials. Leaving out any elements, colours, shapes or textures that were not really needed. This minimalistic approach enhances user-friendliness.

An example of this is where a screen display, in its present configuration, now presents the user with nothing more than the information actually needed for the requirements of the relevant types of user and combinations of tasks.

And the various types of users involved will have various help levels available in their respective UI. Content is displayed in the form of readily understandable icons or symbols that denote functions and system statuses. Whilst keeping the option of fading in additional help content or explanatory notes. Skilful use of blank space means that the presented content is easy to take on board, mentally. The design achieved makes the user feel relaxed and in control.

MCU 3000 offers a new, visionary User Experience Design which makes for straightforward, intuitive and transportable operation of power supplies.

In developing the UXD (User Experience Design) for the new MCU 3000, our main concern was to come up with a convincing and exciting user experience.”

Stefan Kleefeld, Sales

“Design is how it works!”

MCU 3000 offers a new, visionary User Experience Design which makes for straightforward, intuitive and transportable operation of power supplies.

In developing the UXD (User Experience Design) for the new MCU 3000, our main concern was to come up with a convincing and exciting user experience.”

Stefan Kleefeld, Sales

And this is the only way to achieve real added value. After all, it was Steve Jobs who pronounced, as long ago as 1993: “Design is not just what it looks like and feels like. Design is how it works.”

Keep it simple

The new interface design is ergonomic and object-centred. Accordingly, it draws upon a typical characteristic in the human brain which helps us to cut out any needless complexity, to make logical connections more quickly and to achieve further practical application of previously learnt knowledge or experience. The outcome is enhanced efficiency and safety when we use the MCU 3000 to operate the power supply system. To that end, one strategy involved reducing the MCU 3000’s UI (User Interface) to the essentials. Leaving out any elements, colours, shapes or textures that were not really needed. This minimalistic approach enhances user-friendliness. An example of this is where a screen display, in its present configuration, now presents the user with nothing more than the information actually needed for the requirements of the relevant types of user and combinations of tasks.

And the various types of users involved will have various help levels available in their respective UI. Content is displayed in the form of readily understandable icons or symbols that denote functions and system statuses. Whilst keeping the option of fading in additional help content or explanatory notes. Skilful use of blank space means that the presented content is easy to take on board, mentally. The design achieved makes the user feel relaxed and in control.

Now, the priority is placed on maximum system availability and profitability, in addition to a UX that provides guidance for the operator of a power supply system. That system does, after all, represent an investment that was made in order to protect the procedures critical to his business.
Clarity of design reduces complexity as seen from the user’s viewpoint and makes for ease of access to all functions via a user-friendly interface. The start-up screen was intentionally stripped to the essentials, and consists of an isolated single-line comprising the main measurement values and system statistics. The guidance gained by the user is enhanced by the sparing use of colours, by clarity of navigation and by the straightforward facilities for interaction. Controls have been packed into a 10-inch touch display, and you can also swipe in the same way as you would with a smartphone or a tablet.

Kleefeld: Yes, it goes without saying that the prime concern is that the power supply must be operational! And this is just what the UXD provides in the new MCU 3000. We only have to consider the servicing procedures that are carried out – depending on the required service level – not only by the operator’s employees but also by external providers.

Changes in plant configuration can be applied whilst operations are ongoing. The UXD ensures the correspondingly required transparency, reproducibility and safety of operation. In the process, it simplifies and expedites servicing tasks on-site – in the context of regularly recurring servicing processes, for example – it should be necessary for system information or log files to be output or if selected portions of the system have to be switched off or restarted altogether.

In parallel, intuitive controls mean that learning times are reduced. That has to be good for safety and cost-effectiveness of operation.

PN: High availability is crucially dependent on faults and their causes being detected rapidly – followed by the necessary response. The corresponding signal processing is brilliantly integrated in your interface design. But what is it based on, at a technical level?

Kleefeld: The MCU provides all of the necessary data in logbook form, as it features chronological storage of all incidents, fault reports and system reports. Each dataset which is stored contains not only the corresponding value but a timestamp. This means that data can be organised and correctly analysed at all times. The necessary processes will be triggered on the basis of limit values, filter options and assigned priorities. As early as the project management stage, we determine which limit-value overshoots will trigger an alarm. Automatic, event-driven responses are achieved as these statuses are combined with actions. Furthermore, a hysteresis range or a threshold value can be defined for alarms and reports. All alarms require reset or cancellation, this is how we make certain that the alarm has been noted.

PN: Quick response to reports and alarms means that shutdown times are avoided, and that the whole process chain’s efficiency is maximised. How is this supported by the MCU?

Kleefeld: In the age of Industry 4.0 and the Smart Factory, the topic of connectivity was a central prerequisite for development. There is intercommunication between power supply, consumers and batteries and consequently there will be changes in the demands not only on the power supply but also on the operator himself. To meet this challenge, the MCU 3000 supports all communications protocols currently recognised in the energy industry, such as DNP 3, profibus and modbus, for example. Accordingly, this robust, high-performance controller is accessible from all directions: whether it is connected into a power supply within a windfarm, in a hydroelectric power station or in any other market segment. Whatever its location at any given time, it will report back to the operating personnel and keep them informed. All required information is made available irrespective of location, via webserver: mobile access.

PN: So, assuming that the operating staff have already received the alarm, how does the MCU contribute to rapid troubleshooting?

Kleefeld: The locating of faults has been significantly speeded up and simplified. The MCU provides information about faults, short-circuits and shorts to earth. Signals from safety devices are incorporated and integrated in order to highlight the positions.
The controls for future BENNING power supply systems are centred on the following main criteria, amongst others:

- Use of multi-touch HMIs
- Integration of smartphones & tablets into control concepts
- Use of mobile communications technology in a working context
- Reducing the time spent on documentation, thanks to mobile terminals
- Mobile use of current system data
- Early notification so as to avoid disrupted processes
- Use of a responsive website with the following objectives:
  - For configuration
  - For logging of measurement values
  - For alarm and status displays
  - For troubleshooting

Illustration: Showing 7 factors from the interaction design that flowed into UXD

Kleefeld: From our viewpoint, the deployment of service doesn’t end with troubleshooting. You have to track faults down to their origins in order to ensure continuous, safe operation. For example, why did a power failure arise in the first place? To that end, we need to reconstruct situations historically. The database which is provided by our logbook makes it possible to achieve rapid analysis of incidents and disruptions in conjunction with the respective operating statuses of the power supply, batteries or switch gear. On that basis, it is then possible to develop a concept such as to avoid future recurrence of the corresponding type of fault.

PN: Accordingly, the logbook is another component which is central to the assurance of maximum reliability of operations together with cost-effectiveness; and that goes for the long-term view as well. This is something that must be welcomed by users of the new MCU generation. And we are very much looking forward to finding out what other innovative developments your engineers are going to present us with in the future. Many thanks for this exciting and informative interview, Mr. Kleefeld.

Contact: Stefan Kleefeld
telephone: +49 2871 93 358
e-mail: s.kleefeld@benning.de
Manufacturing batteries based on
the highest quality and with sustainable
management of energy

BENNING has been developing and manufacturing battery
formation and test systems for decades. These systems have
been installed at one of the world’s most modern automated
industrial plants for the production of batteries.

Even now, the majority of energy stor-
age materials in use in many areas of
industry and logistics will be based on
lead acid batteries. For decades now,
these have proven their capability in in-
dustrial and in logistics applications.

SYSTEMS SUNLIGHT S.A. is one of the
World’s leading manufacturers of energy
storage products. It specialises in the devel-
opment and production of batteries and
energy storage systems for industrial and ad-
vanced technology applications.

SYSTEMS SUNLIGHT’s main centre of busi-
ness is in Greece (Athens). They have one of
the world’s most modern, automated indus-
trial plants for battery production which is
to be found in the north of the country, in
Xanthi. The works site covers an area of
200,000m², comprising more than 60,000m²
of production floor space.

Highest standards of quality

Following a fire which devastated the old
works in 2018, the production plant was re-
designed from scratch and was up & running
in the shortest possible time. The incident
itself constituted one of the most serious of
its kind at a European level, resulting in a
major claim on the Greek insurance market-
place. Production capacity had been completely re-
stored by the end of May 2019 and has con-
tinued to increase ever since then.

Lead acid batteries and lithium ion-based en-
ergy storage systems are manufactured on
four production lines at the new works,
where manufacturing is governed by strict
process control and quality assurance. Every-
ingthing is controlled according to the
most stringent European and international
standards applying management systems
for Quality (ISO 9001:2008), Environment
(ISO 14001:2004), Occupational Health and
Safety (BS OHSAS 18001:2007), Anti-
bribery (ISO 37001:2016) and Compliance

So this is how SYSTEMS SUNLIGHT ap-
plies the main core values of its corporate
philosophy. These values include sustain-
ability, long service life and the highest
product quality.
Collaboration and partnership

The business relationship between SYSTEMS SUNLIGHT and BENNING has been in place for approximately 15 years. Since then, the Greek company has placed its trust in BENNING’s reliable and robust systems that are “Made in Germany”.

When the majority of the battery production equipment in Xanthi was destroyed on 1st of May 2018, it became the prime objective to begin rebuilding and to restore production readiness as quickly as possible.

Thanks to the reliability and remote-control facility offered by BENNING systems, combined with their assurance of prompt delivery, it was BENNING that won the order to fit out the entirety of the new industrial premises with the type BFS 2000 battery formation and testing systems. The first systems to be constructed were delivered after no more than three months’ planning and production time. The entire project was completed in 2019 and comprised the supply of 120 units of the following types: 270V/500A, 30 of the 270V/300A type systems and the various equipment corresponding to the specifications of 18V/3500A, 520V/1800A, 18V/6000A/1500A and 36V/7500A/1500A.

Making quality conspicuous

Subject to proper maintenance and correct use, lead acid batteries offer a service life of between 1,000 and 1,500 charging cycles. Operators wishing to obtain the ideal return on their investment are best advised to obtain high-powered, long-lasting energy storage media in order to achieve the above-mentioned level of service life.

Regrettably, the quality of a manufactured battery cannot be assessed externally, and the measurement of acid density or cell voltage are relatively basic methods of measurement which are not adequate to achieve an accurate assessment.

The solution is a procedure referred to as the “capacity test”. For this, we start by fully charging the battery and then discharging it at a defined current value down to the level of switch-off voltage. This method makes it possible, subject to taking account of certain variable conditions, to determine residual capacity.

For several decades now, BENNING has been manufacturing specialised battery formation and testing systems for undertaking the above-described test procedure. These power converters enable reliable testing and can be used for purposes of the formation procedures entailed in the manufacture of batteries. They are equally suitable for routine testing of both new and used batteries.

Sustainable handling of energy

The BENNING BFS 2000 systems cover the functions of charging and discharging in a single unit. During the charging procedure, energy is drawn from the grid and fed to the battery in a fully controlled manner. In order to avoid the non-productive cost of waste energy that would arise if the power removed from the batteries in the discharge process was merely converted into heat, the BENNING BFS 2000 systems operate as two-way converters such that the energy is fed back into the grid. The power that has been taken out is fed into the on-site grid and, in this way, can be efficiently put to use supplying other consumers.

Accordingly, the operator saves power and expense thanks to the advanced mode of operation of the BENNING BFS 2000. And it also makes good environmental sense to feed energy back into the grid, especially when undertaken regularly, as is the case in the standard production of the batteries for energy storage.
Quality certification that’s backed up by test records

In practice, it’s a straightforward matter to operate the BENNING BFS 2000, because all formation and testing functions take place via software management.

Up to 625 systems, made up in groups of 25 units, can be managed and monitored thanks to this management software. It is possible to select a range of characteristics, for example, Ia, IU, IUa, IUa, Wa and PUa. It is also possible to ramp the current up or down.

The detected measurement values are automatically stored and recorded. This means that all information is available in electronic form for reports. This comprehensive record of battery status, which includes the stored measurement values and reports, can then be used for fully documented certification of the condition of the manufactured battery.

Maximum availability

Following the complete commissioning of BENNING’s BFS 2000 systems, the SYSTEMS SUNLIGHT company is able to claim ownership of one of Europe’s largest battery production facilities. Accordingly, the company is assured of the maximum continuity of production and cost-effectiveness in the formation of accumulators and their performance testing. It can give its customers the assurance of guaranteed, cost-effective energy storage media comprising the greatest of performance and length of service life.

Transfer of knowledge from manufacturer to user

Top quality training sessions avoid downtime and make a major contribution to the safe and reliable operation of plant and equipment.

In the age of Industry 4.0 and digital networking, it’s of major importance to have a continuously reliable power supply. After all, even short-lived mains failures or disruptions can result in considerable downtime for production processes. The result is that there is increased consideration concerning, not only quality requirements as to the power supply to be used, but also concerning the personnel who are responsible for safe and reliable operation of the equipment.

Today, many systems can be operated straightforwardly and much more reliably thanks to “HMI”s (human-machine-interfaces). And, if we place any priority on safety, there is no benefit to be gained merely from operating by guess and by good luck or using “trial & error” as a principle.

Minimise faults with adequate personnel instruction

The fact is that incorrect operation due to human error continues to represent a significant risk of failure. In order to prevent this, it makes sense for personnel to be adequately trained. This can easily be done at the stage of commissioning, for example.

Go with the possibilities

Modern power supply systems come ready equipped with a range of functions that are standard or available as options and which, if used to their best advantage, make it possible to achieve particularly effective operation and efficient monitoring of the system.

Consequently, it may be helpful when using a product for the first time to book in for a training course that goes above and beyond basic instruction. Attendees are explained the details of the scope of functions and are then able to assess the related benefit which they can apply when they are back at work.

For example, if it is possible for the system to be monitored via a network connection, then we need to find out the available interfaces and make an assessment of the safety functions. We should then take account of any safety precautions that may be necessary.

Rapid trouble-shooting

The period required for a given fault to be resolved may be anything from a few hours up to several days. The corresponding period breaks down as follows:

• Response time (from the point at which the alarm goes off until help arrives on site)
• Diagnosis period (time taken to detect the specific problem)
• Time taken to complete the repair
• Time required for recommissioning of the system

This period carries serious risks with regard to critical load, and frequently may result in financial losses. You need employees on site who are trained to carry out initial troubleshooting, especially if your system is operating somewhere remote from the manufacturer’s base.

Then the diagnostic period is drastically reduced, because it means that you can gather the right fault information together and send it to the manufacturer’s service department. The manufacturer can then supply the required spares and get the system up and running. Thus avoiding additional downtimes resulting from multiple journeys/visits, and that applies not only to troubleshooting but also to the spare parts that are not yet in hand.
In addition to this there is the fact that modular power supply systems not only enable much more straightforward troubleshooting, but are also quicker to repair. Faults can be resolved by replacing the defective module. This is where crucial advantages are obtained with “hot swap” capability systems, since modules can be swapped over on site, and this is something that can be entrusted with appropriately trained employees. If such employees are trained in the aspect of required safety, then downtime can be reduced as a result. Alternatively, or at least reduced to a minimum.

Training courses as a multiplying factor

If products are marketed and distributed via a multi-level structure, then the end user will, in many cases have no direct contact with the equipment manufacturer. In such cases, the customer’s 1st point of contact will be someone in the trade. This problem area can be resolved expertly and rapidly thanks to appropriate training as sourced from the manufacturer. This is how the customer’s satisfaction with the installed system can be enhanced as the product’s life-cycle evolves, subject to good training. When new products come onto the market, such as the new BELATRON range of chargers for example, then you have to make certain that the associated distributor is acquainted with all of the product’s functions and capabilities and that the distributor is capable of assessing which product is ideally suited for which purpose. Subject to this knowledge, the distributor will then be able to offer the end customer the optimum solution for their respective application. This is why BENNING places such a high priority on ensuring that its associated distributors undergo rigorous training. This relates in particular to the range of traction chargers, and of course it is also worthwhile for the end customer to receive training.

Correct application of knowledge

In many cases, however, knowledge concerning the scope of functions of an item of equipment and how it has to be handled, will not be enough. In that respect, let’s take a look at the range of testing, metrology and safety instrumentation. It is now many years ago that legislation introduced the requirement for regular inspection/testing of all electrical plant and equipment, as the result of the regular occurrence of accidents that had arisen in the past. Such inspection/testing is conducted using modern test apparatus which carries out the inspection/test procedures (and places them on record) on a partially automated basis. However, we should be wary of the impression, based on only these automated features, that everything is straightforward. After all, the direct responsibility rests with the inspector/tester to enable the apparatus to conduct the appropriate tests, so the inspector/tester has to expressly stipulate what is required from the corresponding test results. Given the diversity of the various products to be tested, there must be no oversights especially where knowledge which is not regularly called to mind will very soon fade. Not forgetting the fact that standards which reflect the state-of-the-art are subject to regular change. Accordingly, the inspector/tester will need to be continuously re-trained in order to meet any additional or latest requirements. BENNING bears this situation in mind during the training. Training will cover not only the efficient operation of one’s plant but also the details of how to apply standards correctly and how to compare historic changes or innovations which may represent a departure from the previous status. As an example, for BENNING’s IT 105, IT 115 and IT 130 installation test instruments and also for its ST 710, ST 725, 750 A and ST 755/760 device testers, specifically tailored training resources are available.

Collaborating with the sales department

Training courses that are tailored to fit specific needs are designed according to present and future market requirements. Direct contact with customers is always undertaken specifically by the BENNING sales team, at trade shows and exhibitions, for example. A regular exchange of information between the sales department and training centre, makes certain that customer’s specific needs and preferences are included in future training courses. For example, at the suggestion of the sales department, individually planned as well as fixed training dates can be offered today. If the requirement is for several training courses, from the field of measuring and testing for example, then the corresponding course dates can be co-ordinated with each other. This avoids the need for additional travelling.

Training in the manufacturer’s works

Modern seminar premises, equipped with the latest range of instrumentation, are available at the BENNING company site in Bocholt, so as to meet the various training requirements. Training at the manufacturer’s works is conducted in a clearly demarcated framework. Training is very effective in as much as the distracting effects of daily business in your working environment can be avoided. Further product specialists are available, should they need to be consulted in matters relating to development and production. Although instructions on fixed installations can be given on site, it’s beneficial going to the manufacturer’s base for an external training course. An example of the advantages of travelling to an industrial training centre is that the type of switching operations that can only be explained practically if you are in your working environment can be carried out, and learnt about, without placing the respective consumer at any risk.

An increasing trend

Over the last 10 years, there has been more than a 40% rise in the number of attendees using BENNING’s training centre. This is a trend which is going to continue in the current year 2019. This constitutes overwhelming evidence that companies are increasingly realising the extent to which safe and economic viable operation can be greatly enhanced by attending training courses.

|  BENNING  |
|  POWER news  |
|  Q4/2019  |

Training courses with practical relevance – conducted on permanently installed power supply systems – also cover switching procedures most of whose content can only be covered theoretically if instruction is given on site at the customer’s premises. The precise content of training courses is individually tailored in consultation with the customer, so as to be relevant to the employed systems.

Available training courses cover:

**Test/metrology instrumentation range**
- BENNING IT 105, IT 115 and IT 130 installation tests
- BENNING ST 710, ST 725, ST 750 A and ST 755/760 system tests
- Testing of BENNING PV 1-1, PV 2 and PV 3 photovoltaic systems

(Dates of training courses can be seen on www.benning.de or by direct enquiry)

**Traction charger/rectifiers range**
- BELATRON range of chargers
- TEBETRON range of chargers
- LIONIC battery systems
- BATCOM digital battery controller

(Training dates available on request)

**Range of stationary systems**
- Range of EMETRONIC UPS systems
- Range of BIL power supplies
- Range of BLU power supplies
- MCU 3000 remote monitoring system

(Training dates available on request)

**Range of stationary systems**
- Range of EMETRONIC UPS systems
- Range of BIL power supplies
- Range of BLU power supplies
- MCU 3000 remote monitoring system

(Training dates available on request)

**Range of stationary systems**
- Range of EMETRONIC UPS systems
- Range of BIL power supplies
- Range of BLU power supplies
- MCU 3000 remote monitoring system

(Training dates available on request)

**Range of stationary systems**
- Range of EMETRONIC UPS systems
- Range of BIL power supplies
- Range of BLU power supplies
- MCU 3000 remote monitoring system

(Training dates available on request)

**Range of stationary systems**
- Range of EMETRONIC UPS systems
- Range of BIL power supplies
- Range of BLU power supplies
- MCU 3000 remote monitoring system

(Training dates available on request)

**Range of stationary systems**
- Range of EMETRONIC UPS systems
- Range of BIL power supplies
- Range of BLU power supplies
- MCU 3000 remote monitoring system

(Training dates available on request)

**Range of stationary systems**
- Range of EMETRONIC UPS systems
- Range of BIL power supplies
- Range of BLU power supplies
- MCU 3000 remote monitoring system

(Training dates available on request)
Fans employed in forced ventilation systems are subject to mechanical wear. Accordingly, they constitute a wear and tear part which needs to be replaced on a regular basis.

Thermal imaging has an important part to play in the servicing process. Thermal imaging is used as the means of enhancing operational safety, since this technology makes it possible to detect hotspots, loose terminal connections or excessively high contact resistance levels.

It was in 1963 that the Westfalen power station, which is located in the municipality of Hamm-Uentrop, was commissioned. Nowadays, power is generated exclusively from Block E, which was completed in 2014. This coal-fired power station, with 46% net efficiency, has reduced its CO₂ emissions by approximately 20%, relative to the older-type plants. Accordingly, a saving of approximately 1.3 million tonnes of CO₂ per annum is achieved.

The most modern procedures for desulphurisation and denitrification of flue gases are used. Thanks to these highly efficient filtering and purification systems, the result is not only reliable compliance with the legally permissible limit values for atmospheric pollutants such as sulphur dioxide, nitric oxide and dust, but compliance with a clearly creditable margin.

The maximum output, 800 MW, can be selected on a very versatile basis. Accordingly, there is the option for responding at short notice to fluctuations on the grid as they arise. These are ideal prerequisites for interactive operation with production of power from regenerative energy sources in the medium load range.

Fuel is brought to the power station primarily via the Datteln-Hamm canal. From that point the coal is conveyed by belt to the coal bunkers for the steam generator. The rail network also offers an alternative supply route.

Thermal imaging has an important part to play in the servicing process. Thermal imaging is used as the means of enhancing operational safety, since this technology makes it possible to detect hotspots, loose terminal connections or excessively high contact resistance levels.

It was in 1963 that the Westfalen power station, which is located in the municipality of Hamm-Uentrop, was commissioned. Nowadays, power is generated exclusively from Block E, which was completed in 2014. This coal-fired power station, with 46% net efficiency, has reduced its CO₂ emissions by approximately 20%, relative to the older-type plants. Accordingly, a saving of approximately 1.3 million tonnes of CO₂ per annum is achieved.

The most modern procedures for desulphurisation and denitrification of flue gases are used. Thanks to these highly efficient filtering and purification systems, the result is not only reliable compliance with the legally permissible limit values for atmospheric pollutants such as sulphur dioxide, nitric oxide and dust, but compliance with a clearly creditable margin.

The maximum output, 800 MW, can be selected on a very versatile basis. Accordingly, there is the option for responding at short notice to fluctuations on the grid as they arise. These are ideal prerequisites for interactive operation with production of power from regenerative energy sources in the medium load range.

Thermal imaging has an important part to play in the servicing process. Thermal imaging is used as the means of enhancing operational safety, since this technology makes it possible to detect hotspots, loose terminal connections or excessively high contact resistance levels.
Plant servicing as such has to wait for the refit to be completed. In this process, the system is checked over for performance data and tolerances. Values as measured must match up to those delivered by a brand-new plant.

Maximising availability

After the costs of initial investment, it’s primarily the fuelling and operating costs that determine a power station’s profitability. Availability represents a crucial factor. It determines the plant’s capability for converting energy and placing it in store. It determines a power station’s potential output: both technically and according to economic criteria.

Requirements concerning maintenance planning, preparation and implementation are correspondingly high. This is also especially applicable to the power supply systems that are deployed for operation, and likewise applicable to the issue of protection for process-critical consumers. For example, these include the electrical switchgear, the power station’s extensive controls and the standby power supply for the oil pumps, for flue gas cleaning, for water processing and for the water-steam circuit.

Late in the summer of 2018, RWE AG started work on the detail planning for the extensive overhaul for Block E. The aim being to secure uninterrupted, fault-free operation for the next 4 years. The operation was planned for completion within the period from 27-04-2019 to 07-06-2019. Co-ordinating and reconciling the closely inter-related tasks would prove to be a particular challenge. Consequently, the companies to be entrusted with servicing had to exhibit the maximum of flexibility and reliability.

Retrofitting as a preventive measure

In essence, there have to be two independent channels for supply to the consumers that are crucial to operation – and this applies to all large power stations in general. Consequently, all power-supply systems need to be fully-redundant.

For the power station’s Block E, in 2010 BENNING supplied a wide range of equipment that was specifically tailored to the levels of reliability and quality that are associated with industrial operating conditions. This includes not only static rectifier and UPS equipment but also modular inverters and DC/DC converter systems.

“...
In conjunction with high battery capacities, these systems guarantee a protected supply of 220 V/24 V direct current and 400 V alternating current. Overall, the total power output installed on-site is in excess of 1.6 MW DC and 1 MW AC.

The installed systems combine the maximum of availability with low operating costs. In order to assure this in the long term, BENNING recommends not only regular servicing but also the precaution of preventively replacing all electrical and mechanical components that have a limited service life.

Accordingly, servicing plans work on the assumption of various replacement intervals for components such as fans, input capacitors, output capacitors and intermediate-circuit capacitors, because they are subject to a certain degree of ageing and/or wear.

Various system topologies

A wide range of topologies in power supply systems had to be taken into account when configuring the servicing tasks to be completed in the process of overhauling the power station. Monoblock systems tend to be very heavy, due to the transformers that are normally used. Consequently, these static power supply systems were overhauled exclusively on-site.

This task comprised a detailed analysis of assemblies and the replacement of various parts at component level. Only in the power-off state could such tasks be completed – given the level of complexity in the employed power circuits.

Servicing of modular systems

Servicing tasks on modular systems are conducted in quite a varied range of ways. Should it be necessary to minimise the degree of servicing time or shutdown time whilst power station operation is ongoing, then there is the option of rapidly replacing on-site installed modules, and this approach is described as a revolving exchange. Alternatively, recourse can be had to retrofit modules from BENNING’s stores.

In this instance, the modules were overhauled in the repair shop at BENNING’s Bocholt works. The various components and circuit boards were replaced in accordance with an extensive test/inspection procedure. By this means it was made certain that all of the parameters of a new system were fulfilled in their entirety.

By 29-05-2019, all of the maintenance and servicing tasks on the BENNING power supply systems had been completed on time. Accordingly, BENNING’s power supply solutions have, once again, contributed to the maximum possible power station availability, making the process, an important contribution to its safe, legally compliant and trouble-free operation.
Turnkey solutions for the largest mobile communications network in the Caribbean

BENNING power supplies and services significantly help to ensure the continuous operation of the largest Caribbean telephone and mobile communications network.

“Keeping customers connected, anytime and anywhere” – connecting customers anytime and anywhere and providing them with quick and efficient communication solutions is the primary guiding principle of the mobile and telecommunications provider, Digicel. Founded in April 2001, the company currently serves 33 markets in the Caribbean, Central America and in Oceania.

In order to ensure the communication and reachability of millions of people here and to comply with the company’s own philosophy, robust BENNING power supplies are relied upon.

They ensure that all critical applications, in particular the computer centre, the central telecoms exchange in Acierie, Haiti are not without power at any time even in the event of network interruptions. Therefore, maximum security and availability are ensured for a complex, highly-sensitive range of applications.

Complex & future-proof solution

The power supply system originally installed on-site was composed of technical components from different manufacturers. A series of interruptions and failures occurred necessitating a modern system replacement.

The company, BENNING was chosen for its know-how and experience in the search for a new partnership, which provides technically complex, maximum availability and future-proof solutions corresponding to the high requirements profile of system-critical loads.

The photo shows the installed BENNING power supply systems on site. Due to the high power density only a small footprint is required.
Firstly, since BENNING is capable of providing Digicel with a complete package from one single source, consisting of rectifiers, inverters, distribution units and comprehensive services.

Secondly, BENNING power supply systems could already prove their reliability in critical situations.

Since 2010, following a serious earthquake, large parts of the infrastructure in Digicel’s telecom buildings had been destroyed, the power supplies installed there continued to provide the mains voltage required to operate the mobile communications network.

Permanent system availability

The cooperation between Digicel and BENNING is characterised by intensive and trusting dialogue. The planning phase of this project began in April 2018 and was completed in June. The installation at the Acierie site began on 21 July and ended on 31 August 2018 with entry into service.

BENNING also took care of the construction of a temporary power supply infrastructure in order to ensure continuous system availability in the period between the project planning and the final installation on-site.

The components and modules used for this purpose can be reinstalled and reused at another location by Digicel following the entry into service of the current new power supply.

Low volume, high performance

The newly installed power supplies are robust power supply systems providing maximum operational safety. The rectifier modules of the TEBECHOP 13500 SE type form the basis of the systems. These modules are characterised by an extremely high power density and the associated low footprint at the installation site. They can therefore be integrated without problems into narrow and small spaces.

The DC distribution unit fitted with 192 load outputs in this context offers a further significant advantage. A technical feature, which significantly surpasses the usual market distribution units with only 168 distribution points. But the high number of 88 outputs on the inverter distribution unit also represents a unique selling point.

Excellent energy efficiency

The systems are also characterised by their energy efficiency and the good degree of effectiveness. The former is always above 96 percent, even in the partial-load range. In the case of very high-performance systems like the ones in Acierie, high savings of electric energy are provided. Since significantly less heat is released due to the high degree of effectiveness, energy is also saved in the ventilation or air-conditioning system present.

This series is therefore also an environmentally-friendly hot pluggable modules. This also allows the simple and quick replacement of the subsequent addition of individual modules during continuous operation.

Further projects

The successful cooperation between both companies will continue beyond the project in Acierie. Digicel contracted BENNING at the beginning of 2019 to provide power supplies and services for two additional company sites. They are located on the British Virgin Islands and on the Caribbean island state of St. Lucia.

Highest earthquake safety

The compact structure (3HE) of the TEBECHOP 13500 SE allows for systems with an output power of up to 135 kW in only one system cabinet with the dimensions (H x W x D) 2000 mm x 600 mm x 600 mm. Corresponding system cabinets can also be supplied for the battery and consumer unit which can also house the modules for the reporting and monitoring system MCU 3000.

Protection against external influences such as strong earthquakes is very important in particular in states like Haiti. For this reason, BENNING provides its customers with the most robust cabinet system which meets the safety requirements of the highest earthquake category. Even in the case of strong shocks, these systems experience only precisely defined movements due to their construction (UC-HE, heavy earthquake resistance) without the cabinet system being weakened (see POWER news 10/2018).

An additional bonus in terms of safety and maximum availability, just like the user-friendly hot pluggable modules. This also allows the simple and quick replacement or the subsequent addition of individual modules during continuous operation.

In-house Refurbishment Repairs / In-house Maintenance

Remote Monitoring Corrective Maintenance Preventive Maintenance

Commissioning & Installation Maintenance Corrective Replacement Management and Battery Service

Operation & Maintenance

Production Spare Parts

Consulting

Battery Management and Replacement Customer, Training & Support

Inverter

DC Power System

H INVERTRONIC modular SE, is certified for seismic applications.

The UC-HE Cabinet used for the TEBECHOP 13500 SE, DC Power System, 48 V DC - 250 A, is certified for seismic applications.

BENNING subsidiary

TEBECHOP 13500 SE, DC Power System, 48 V DC - 250 A
High-availability UPS systems for the harsh conditions of the petrochemical industry in Siberia

Modern BENNING power electronics secure the operation of the largest and most modern petrochemical plant in Russia.

The former capital of Siberia, Tobolsk, is located east of the Urals, about 2500 kilometres from Moscow.

A Russian chemicals group operates several plants there, which focus on the production of monomers and polymers. Recently a new petrochemical complex has been integrated into the existing production facilities at the Tobolsk location. It is considered the largest and most modern petrochemical plant in Russia. It is used for the extensive conversion of refined oil and gas products from the region of Western Siberia. This also includes the processing of associated petroleum gas (APG), which occurs as a by-product of oil production. Hitherto, this had to be burnt off in the oil fields.

The new petrochemical plant makes it possible to utilise up to 22.4 billion cubic metres of APG in processing. This avoids incineration in the field and reduces pollutant emissions by 40 million tonnes per year.

This complex includes:
- A pyrolysis plant with a capacity of 1.5 million tonnes of ethylene, 500,000 tonnes of propylene and 240,000 tonnes of various by-products, such as butadiene, butene-1, MTBE and pyrobenzene per year
- Two plants with 4 production lines producing different grades of polyethylene, with a total capacity of 1.5 million tonnes per year
- A chain polymerisation system for polypropylene with an annual capacity of 500,000 tonnes

The new petrochemical plant makes it possible to utilise up to 22.4 billion cubic metres of APG in processing. This avoids incineration in the field and reduces pollutant emissions by 40 million tonnes per year.

This modern complex includes:
- A pyrolysis plant with a capacity of 1.5 million tonnes of ethylene, 500,000 tonnes of propylene and 240,000 tonnes of various by-products, such as butadiene, butene-1, MTBE and pyrobenzene per year
- Two plants with 4 production lines producing different grades of polyethylene, with a total capacity of 1.5 million tonnes per year
- A chain polymerisation system for polypropylene with an annual capacity of 500,000 tonnes

The chemical company relies not only on the most innovative technologies in the area of hydrocarbon conversion, but also in the selection of products, components and services necessary for the construction and subsequent operation of the new refinery.

This is to ensure the reliability, safety and efficiency of the plant. The criteria for selecting suppliers and project partners were correspondingly high. In total, more than 100 companies from 35 regions of Russia participated in the implementation of the project. Secure power supply

Wherever electrical power must be available to provide protection against a temporary power outage or grid failures, an uninterruptible power supply (UPS) compliant with the 9000-65S-0007 standard was required.

These UPS systems are designed for the continuous supply of performance-critical consumers, control systems and production lines. Therefore, highest availability and cost-effective operation were important criteria in the selection of the UPS systems. BENNING offers systems that meet these requirements with the product lines ENERTRONIC modular and ENERTRONIC I.

BENNING Power Electronics was contracted to supply and install more than 20 UPS systems of the ENERTRONIC I (20 kW to 400 kW) and ENERTRONIC modular (20 kW to 40 kW) series.

To maximise their availability, the UPS systems are designed to be parallel redundant (N+1). They also have a galvanic isolation at the input of the bypass network.

In the meantime, commissioning of the UPS systems on site has been completed, thus ensuring the reliable supply of electrical energy to all critical consumers of the pyrolysis plant.

In the future, if higher performance of the electrical power supply systems is needed, for example due to expanding production, the modular UPS architecture enables a simple pay-as-you-grow extension.

Convincing know-how

The excellent collaboration as well as the quality and efficiency of the UPS systems installed, demonstrates once again, that BENNING can produce optimum product solutions for highly demanding process-critical applications of the petrochemical industry. Offering the best features, therefore, to contribute to the success of similar projects in the future.

author/contact: Youri Bolshakov
telephone: +7 495 967 68 50
e-mail: bolshakov@benning.ru
Fairs, events and exhibitions 2019

ADIPEC
11/11 – 14/11
in Abu Dhabi/United Arab Emirates

SPS
26/11 – 28/11 in Nuremberg/Germany

Data Centre World
27/11 – 28/11 in Paris/ France

RENEPO interHYDRO
28/11 – 29/11 in Salzburg/Austria

Russian Grid
03/12 – 06/12 in Moscow/Russia

All details provided without liability.