

UNITROL now



Meeting demanding grid codes

Retrofit at AGL Loy Yang 04

UNITROL® 6800 meets Australia's grid code requirements

Grid code compliance 08

Fault-Ride Through capability

Service agreements 12

Our answer for quality and timely support



08

Grid code compliance

Fault-Ride Through capability - A key challenge in network connection regulations.



04

Retrofit at AGL Loy Yang power station

UNITROL 6800 meets Australia's grid code requirements.



10

Center of excellence, India

Welcome to Nelemangala; India's center of excellence for excitation systems.



12

Quality and timely support

Service agreements - reducing downtime through guaranteed service.

UNITROL now 68|14



Aija Mankkinen
Head of Excitation Systems

Dear Reader,

First of all, as we move through the first quarter of 2014, I'd like to take this opportunity to personally thank you for your interest, trust and support that you have shown in our UNITROL, SYNCHROTECT and MEGATROL products/systems in the past year.

In this issue of *UNITROL now* we focus on the subject of grid codes. On page 4 discover how the grid code requirements at Australia's AGL Loy Yang power plant were successfully met using UNITROL 6800. On page 8 we describe grid code compliance and show how UNITROL excitation systems are complying with the most demanding network requirements.

A further important topic is functional safety and reliability in power plants. Recently excitation systems for two nuclear power stations in Switzerland successfully passed vibration testing (see page 6). Meanwhile, in Vietnam, we report on the installation of UNITROL 6000 motor excitation at a power plant while Limmatkraftwerke expe-

rience the benefits of UNITROL 1020 at a small hydro power plant (see page 7).

Our local engineering center for excitation systems in India opens its doors to you on page 10, showing off some of the excellent work that the team undertake.

Service agreements play a pivotal role in ensuring the uptime of our equipment. On page 12 we take a look at our service agreements and discover how valuable they can be to you.

Finally we take a look at the excitation systems course program for 2014 and provided by the ABB University as well as upcoming events where you can meet our experts.

I hope you enjoy reading this issue of *UNITROL now*.

Kind regards
Aija Mankkinen

Application

- 04 A steam turbine with a heart of UNITROL**
First UNITROL 6800 commissioned at AGL Loy Yang power station, Australia.
- 06 Protection of emergency generators**
Protection of nuclear power plants with highly reliable excitations systems - UNITROL 6080.
- 06 Motor excitation at Vietnamese power plant**
The largest coal-fired thermal power plant in Vietnam installs UNITROL 6000.
- 07 Perfect solutions for small hydro power plants**
UNITROL 1020 as an automatic voltage regulator in Limmatkraftwerke AG, Baden.

Products and technology

- 08 Grid code compliance - A key challenge in network connection**
Increasing the security level and effectiveness of power grid operation.

News

- 10 India's center of excellence**
LEC India opens its doors to reveal the center of excellence for excitations systems.
- 11 Marketing and communications, Switzerland**
Meet the new team member at excitation systems in Turgi.

Service

- 12 Service agreements**
A flexible option to keep plants fully operational.
- 14 Excitation systems course program 2014**
A range of courses are available at ABB University for excitation systems, services and technologies.

Events

- 15 Upcoming events**
Forthcoming opportunities to meet excitation systems experts and experience live demonstrations.



AGL Loy Yang power station, Victoria, Australia.

AGL Loy Yang – One of Australia's largest steam turbines with a heart of UNITROL®

Text Pedro Lopez



UNITROL 6800 successfully commissioned at AGL Loy Yang.

During the Australian summer of 2012 the first UNITROL 6800 static excitation system (SES) was successfully commissioned at the AGL Loy Yang power plant with support from the ABB local engineering center (LEC) in Australia. Altogether the customer ordered two UNITROL 6800 SESs for the retrofit of unit 1 and unit 3. There is a total of four UNITROLs with the SES of unit 2 and unit 4 using UNITROL 5000.

While this is not the first steam turbine application for UNITROL 6800, every new reference is of major importance, as it reinforces the high level of trust that customers have towards ABB's excitation solutions and local service.

Lifetime extension measures

AGL Loy Yang power plant was originally constructed during the 1980s. With 2,100 megawatt (MW) capacity, AGL Loy Yang delivers more than 30 percent of all electricity produced in Victoria. The plant operator, AGL Loy Yang, started introducing life-time extension measures. Retrofit of the excitation systems is part of these measures. The client selected ABB

excitation systems. ABB already has an established reputation together with solid references in Australia. In order to cope with the plant's space limitations, AGL Loy Yang, ABB Australia and ABB Switzerland implemented a feasibility study and optimized the SES retrofit solution.

System configuration

The UNITROL 6800s have the following features:

- Totally segregated control channels
- Redundant power supplies
- Withdrawable converter bridge
- Customised enclosure and cooling system for the converter bridge
- Detached automated voltage regulator (AVR)

Segregated control redundancy of the control system and thyristor bridges means that maintenance can be carried out on a single channel or bridge at a time, without having to shutdown the entire system.

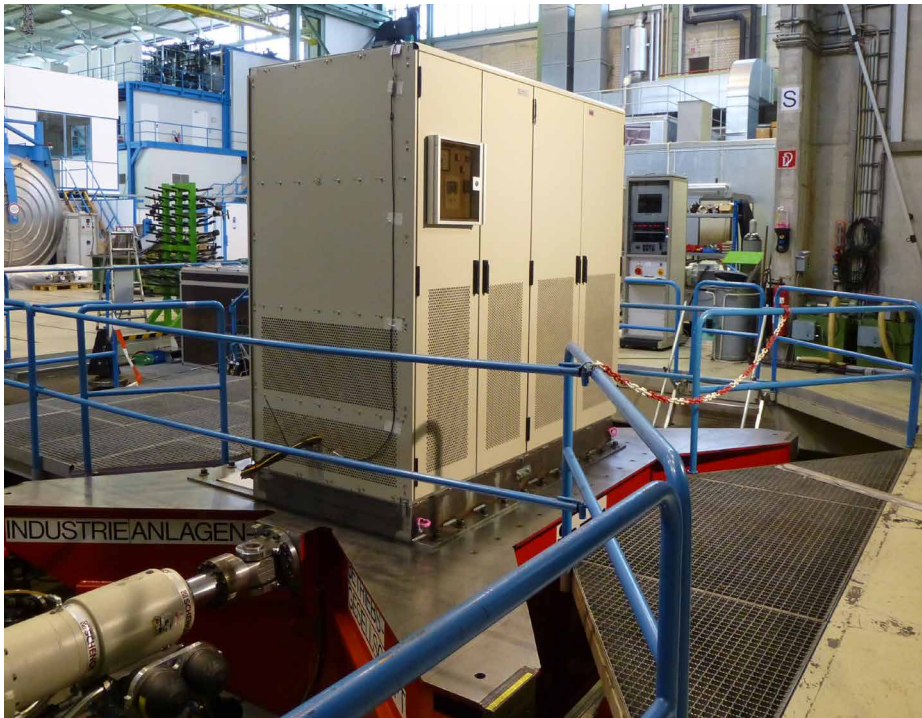
All systems have built-in power stabilizers, which ensures the stability of the grid. By following the stringent requirements of the Australia Energy Market Operator (AEMO), Australia's network regulator, AGL Loy Yang and ABB were able to

commission the units and successfully reconnect them to the network. The commissioning took only 24 hours by utilising two teams with two commissioning engineers in each team.

The second unit was delivered, installed and commissioned in October 2013. This order is the result of a good working relationship together with the customer, close collaboration and mutual support between ABB offices in Australia and Switzerland. ABB Australia was responsible for the electrical engineering, local project management, installation, integration engineering, design report, commissioning and compliance testing.

Long-term partnership

These major upgrades are an important success story for ABB in Australia. AGL Loy Yang is Australia's largest electricity and gas retailer. With this important milestone, it demonstrates, that AGL Loy Yang can rely on ABB and UNITROL for a long-term partnership.



UNITROL 6080 during earth quake simulation testing.

Excitation systems for emergency generators in nuclear power plants

Text Tobias Keller, Gunda Dresler

A loss of power in a nuclear power plant is critical as many auxiliary processes, especially the reactor cooling, will no longer work. It is essential to have a backup source. These back-up sources are typically redundant and housed in a protected building such as a bunker to protect them against natural or man-made disasters.

As synchronous machines are typically used for this application, an excitation system is required. ABB delivers highly reliable excitation systems and carries out all the relevant certifications so that the systems comply, not only with international rules, but local standards too.

An ABB excitation system not only features a redundant topology but a diverse set-up whereby all the main components - power supply, protection, software, semiconductors, etc - are replicated in each channel.

As example, in one channel there are thyristors, while in the other channel diodes and adjustable transformers with automatic tab changer are used to prevent inherent failures.

Part of the certification process is to ensure that the excitation system is robust enough to withstand earthquakes or any other natural or man-made disaster. Following simulation of these disasters to verify the design, the excitation system is then subjected to a "real-life" simulation at vibration test laboratory. This system is mounted on a vibration table and needs to survive different scenarios whilst running. The output current is continuously monitored to detect any small disturbance or fault.

ABB recently passed two such tests for the nuclear power plants Leibstadt (KKL) and Beznau (KKB), both located in Switzerland.

UNITROL® motor excitation helps crush coal at thermal plant in Vietnam

With a total installed capacity of 1,040 megawatt (MW), Pha Lai is the largest coal-fired thermal power plant in Vietnam, located 65 kilometers (km) north-east of Hanoi. The first stage, with four 110 MW shafts, was installed in 1986.

For crushing 60 metric tons of coal per hour, two mills are installed per shaft, each driven by a 2 MW synchronous motor. In 2009, two of the eight original Russian motor exciters were replaced by competitor systems, but performance and services remained below the customers' expectations.

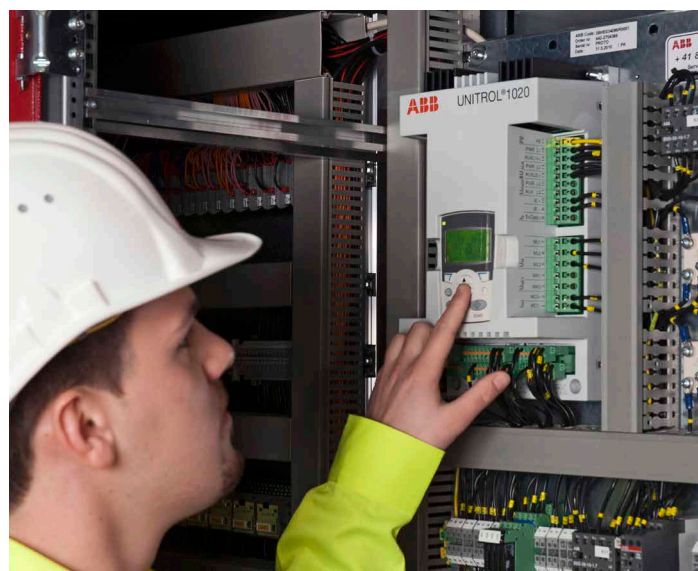
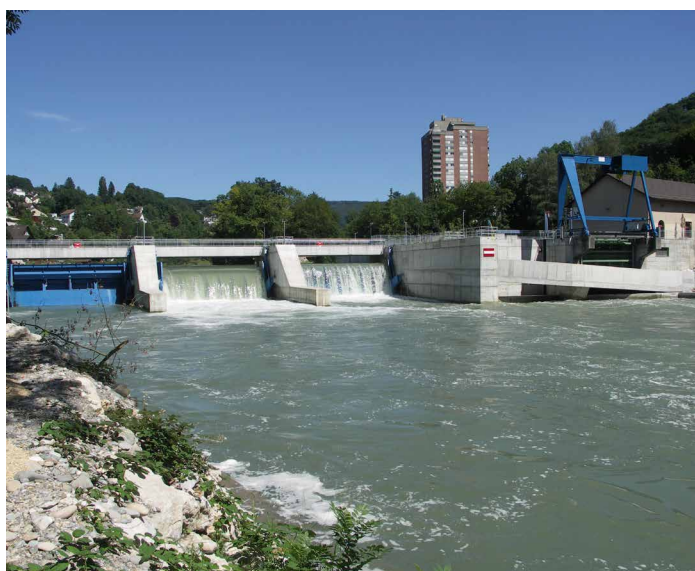
In 2011 ABB won an open bid with UNITROL 6000 motor excitation, which was installed on time in May 2012. The customer was pleased with ABB's overall performance and ordered three additional systems – all operating by the end of 2012 and flawlessly since.



Following the launch of UNITROL® 1010 and UNITROL® 1020 in February 2012, the automatic voltage regulators are now established as proven technology across the power sector.

A perfect solution for small hydro power plants

Text Rudolf Moeckli



Hydro power plant, Kappelerhof, Limmatkraftwerke AG, Baden Switzerland. UNITROL 1020 installed in Kappelerhof's hydro power plant.

Since June 2011, the retrofitted Kappelerhof hydro power plant is providing electricity to the city of Baden, Switzerland. The utility, Limatkraftwerke AG, selected UNITROL 1020 as an automatic voltage regulator (AVR). Since commissioning, the AVR is working continuously, without disruption, thereby proving the reliability of the device. Following this success, Limatkraftwerke AG selected another UNITROL 1020 for its upcoming retrofit projects, including four machines. The first project is the bypass hydro plant, Schiffmühle in Turgi, where the commissioning was completed in February 2013. The next retrofit project for the hydro power plant Aue, in Baden is still ongoing. However, the bypass hydro

plant was commissioned in August 2013. Three main machines will be commissioned in April 2014. A total of 26 megawatt (MW) will be controlled by UNITROL 1020 AVRs.

The customer is fully satisfied with ABB's product and services, as highlighted by Mr. Rothenfluh from Limatkraftwerke AG, who expressed his confidence in the extensive know-how and experience of ABB's service engineers.

The customer is also impressed with ABB's commissioning and maintenance tool, the CMT 1000, which is available free-of-charge as part of the project. Furthermore, ABB's AVRs fulfill today's grid code requirements, thus providing a smooth implementation worldwide.

Since their introduction two years ago, the UNITROL 1010 and UNITROL 1020 are successfully operating in numerous applications.

The hydro power plant Kappelerhof is the first power plant equipped with BBC machines and was constructed around 1900. With the upgrade and installation of UNITROL 1000 automatic voltages regulators, Kappelerhof has once again the newest generation of UNITROL voltage regulators installed after more than 100 years.

Fault-Ride Through capability – A key challenge in network connection regulations

Text Valerijs Knazkins

The key purpose of a network connection regulation - which is sometimes referred to as a network code - is to provide harmonized guidelines to the network operators. This allows increased level of security and effectiveness of the power grid operation.

Since the network code has to encompass a broad variety of generation technologies and operating conditions, the grid code requirements pose several challenges to any specific generator and its control systems.

One of the most challenging requirements in existing network regulations is the so-called Fault-Ride Through (FRT) capability. This is a requirement for a generator to maintain synchronous operation when a severe disturbance occurs in electrical proximity of the generator. This requirement plays an important role in enhancing the overall power system transient stability. It helps the grid operator to prevent system-wide disturbances such as, for example, cascading failures and blackouts.

It is well-known that the excitation system of a synchronous machine has

a strong influence on the transient stability of that machine; therefore, fulfilling the FRT capability requirement is tightly related to the properties of the excitation system.

The powerful hardware and exceptionally flexible software, allow UNITROL excitation systems to comply with the most demanding network requirements.

Since the FRT involves severe disturbances to the power system and to the generator, the fulfillment of FRT requirements must be verified in computer-aided simulations rather than on site. Therefore, in specific cases, ABB experts perform network code verification simulations in order to ensure that UNITROL 6000 excitation systems are compliant with the most stringent network regulations. Typically such simulations are performed using a hardware-in-the-loop (HIL) setup and a real-time simulator. This way, the simulations do not need to rely on any simplifying modeling assumptions, providing high fidelity simulation results.

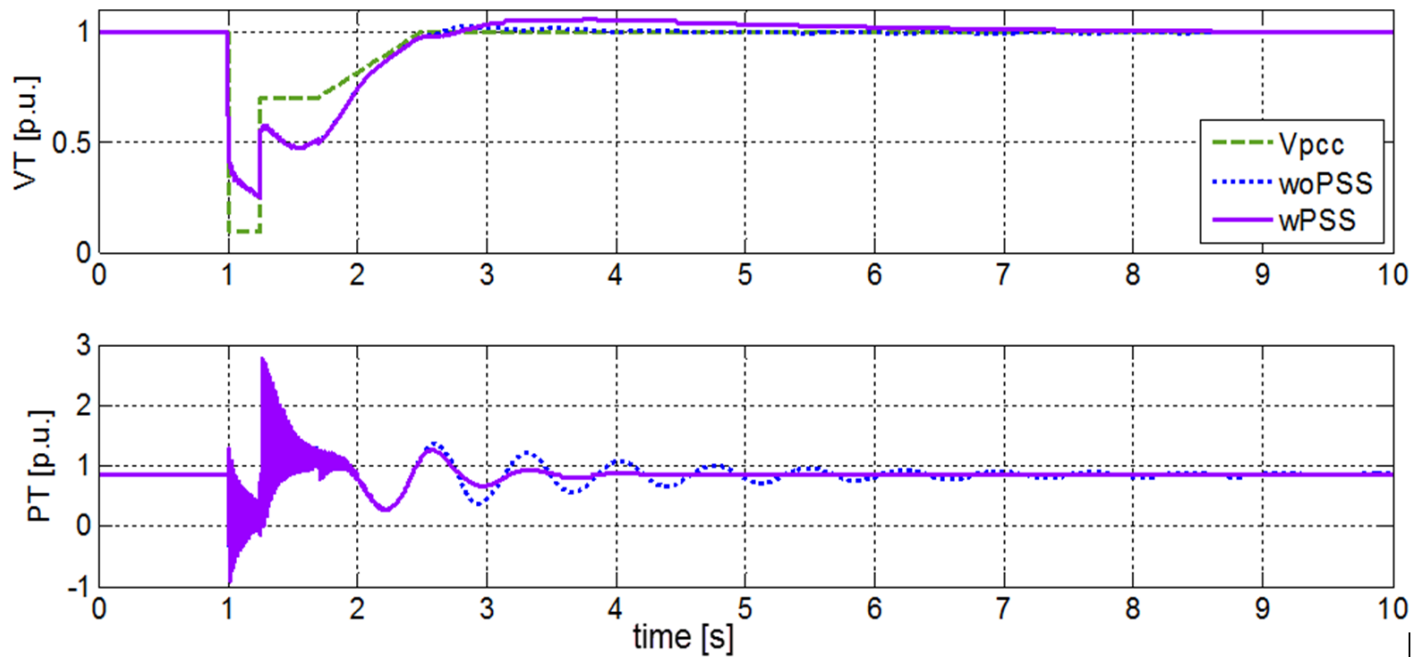


Figure 3 shows the positive impact of the power system stabilizer on the dynamic properties of the power system.

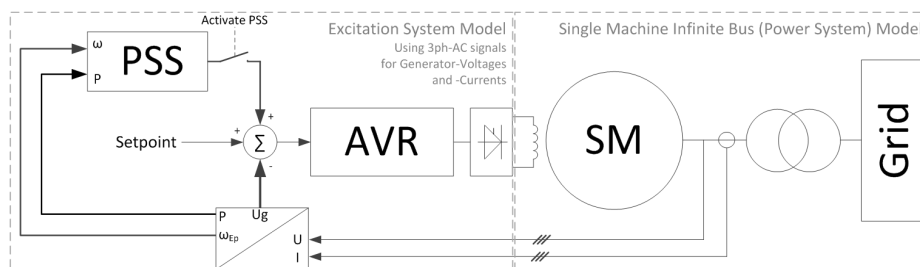
To illustrate the verification process, let us consider the figure below.

It is assumed that a fault occurred on the high-voltage side of the unit trans-

Figure 3, above, shows the positive impact of the power system stabilizer on the dynamic properties of the power system.

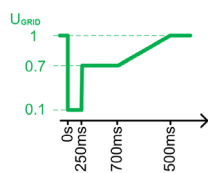
It is worth mentioning that compliance of an excitation system with a network code, in most cases, can only be verified by means of labor-intensive HIL simulations.

Thanks to the powerful hardware and exceptionally flexible software, UNITROL excitation systems have always been able to comply with the most demanding network requirements.



The figure shows a HIL setup, which consists of (i) actual UNITROL hardware and software shown left and (ii) detailed models of synchronous machine, its speed regulator, the unit transformer, and the power grid, shown right. The set-up runs in real-time and simulates grid disturbances according to the network code of interest.

One such disturbance is depicted in the figure below.



former, which resulted in the voltage profile shown in the figure.

Once the simulation work is completed, conclusions regarding the stability properties of the power plant can be drawn. To highlight the process, let us analyze the results of a sample simulation. The HIL was configured for UNITROL 6000 with a large turbo-generator and simulations were carried out.

The stator voltage and the active power of the generator are presented in the above figure. It is evident that the simulated power plant complies with the FRT requirement, since the generator preserves stability for the given disturbance.

Local engineering center (LEC) in India

Text Nagaraja V

Nagaraja V, Manager of the excitation systems LEC in India, opens the door to his organization and introduces the Indian center of excellence.



ABB's facility, where the LEC is located in Nelen



Nagaraja V

From mid-2013 Nagaraja V took over the excitation business responsibility within the local engineering center (LEC) in India. Alongside India, the LEC looks after Nepal, Bangladesh and Sri Lanka with a strong pedigree in UNITROL. Nagaraja started his career in 1996 with small voltage regulators and excitation systems for small machines in Bangalore, India. He took control of larger systems, including ABB's UNITROL, in 1996 handling various portfolios like service, engineering and sales. Nagaraja V., the new business responsible for the Indian LEC, holds 17 years' of experience in excitation systems.

Welcome to Nelemangala, India! Nagaraja V, Manager of the local engineering center (LEC) for excitation systems in Bangalore, India, opens the doors and guides us through the center of excellence for excitation in India.

Expertise and experience in a very demanding environment; this describes the daily business of the local engineering center (LEC) in India. But, of course, that's not all. LEC India introduced UNITROL 6000 immediately after its launch and has delivered 300 units of UNITROL 6080 and 25 units of UNITROL 6800 to different customers in various applications.

The experience from former UNITROL generations, an enthusiastic team and excellent relations to OEMs, turned LEC India into one of the most important producers of UNITROL 6080. These units are not only installed in India but also exported to other countries. Nagaraja highlights the perfor-

mance and the technology behind ABB's newest excitation system generation: "There are very demanding applications and requirements and with the newest generation of UNITROL we can meet them." UNITROL's leading market position has resulted in 10 excitation systems from another manufacturer being replaced with UNITROL 6800. These systems have been operating for three 3 years and have, therefore, already proved their reliability and performance.

The benchmark is not only limited to the control, the first UNITROL system containing D6 converters was built at the LEC in India. Thanks to the cooperation with the product responsible unit in Turgi, Switzerland, it was possible to build a system with this new converter type and to commission it successfully in 2013. There are also more technical challenges, in industrial applications as well as in power plants. There is often a requirement to deliver systems with series or vectorial compounding. "We are combining these requirements with



Bangalore, Bangalore India

the UNITROL 6080", Nagaraja says. The number of installed, commissioned and operating units is a clear indication for this successful combination.

Regarding the most prestigious project ever done, Nagaraj points to Tangedco Kadampari. "This is a pump storage power plant with 4 x 100 megawatt (MW) turbines. With our expertise, we were able to convince the customer and we are now delivering the next four excitation systems including a static starter. With this setup we not only cover pump starts with the static starter but also support back-to-back starts and operation of the generators as synchronous condensers", Nagaraja says. Excitation systems for Indian OEMs are exported to many countries and bring Indian expertise to all parts of the globe.

The future in India looks bright. The Indian grid has an installed capacity of 193 gigawatts (GW) and there is a plan from the government to add another 75 GW in the next five years. This is enough potential for retrofit and new installations.

News

Marketing and communications

Switzerland. Claudia Bingen started as Marketing and Communications Manager for Excitation Systems in December 2013.



Claudia is originally from Germany. She studied economics and successfully completed a postgraduate course in marketing. She joined ABB Switzerland in 2007 and started her career within ABB as a Marketing and Communication Manager in Front End Sales – Sales Power Products and Power Systems in Baden. During this time she gained a lot of experience in the product range of Power Products and Power Systems. She organized customer events, fairs and developed marketing strategies and concepts. She had dealings with the excitation systems portfolio, so she already has familiarity within the product line. In 2013 Claudia spent half a year at ABB Medium Voltage Products in Germany, working for site marketing before returning to Switzerland.

Claudia is excited about joining the team and says: "For me it is very interesting and a challenge to learn more about the products/markets and to work closely with a global team. I enjoy working in an international environment with a worldwide network where the customers are being served by local teams at its best."

Service agreements

Text Marc-Julian Herrmann, Natalie Delucca

<div><div><div><div>Level 3</div><div>PREMIUM PACKAGE</div><div><div><div>– Top priority for on-site troubleshooting support</div><div>– Additional price reduction on daily rates</div><div>– Additional price reduction on spare parts</div><div>– Yearly performance review on-site</div><div>– Unlimited phone support without additional costs</div><div>– Field service engineers are ready for dispatch in between 24h, 48h or 72h*</div></div></div></div></div></div>	<div><div><div>Additional options</div><div><div>– Remote access</div><div>– Training courses</div></div></div></div>
<div><div><div><div>Level 2</div><div>STANDARD PACKAGE</div><div><div><div>– Field service engineers are ready for dispatch in 24h, 48h or 72h*</div><div>– Prioritization for on-site troubleshooting support</div><div>– Discount on daily rates</div><div>– Discount on spare parts</div><div>– Unlimited phone support without additional costs</div></div></div></div></div></div>	<div><div><div><div><div>– Yearly performance review</div><div>– Remote access</div><div>– Training courses</div></div></div></div></div>
<div><div><div><div>Level 1</div><div>BASIC PACKAGE</div><div><div><div>– Unlimited phone support without additional costs</div><div>– Maintenance servicing is provided during 24 hours per day, 365 days per year</div><div>– Maximum call-back time of 60 minutes</div><div>– Prioritization of phone support against customers without Service contract</div></div></div></div></div></div>	<div><div><div><div><div>– Yearly performance review</div><div>– Remote access</div><div>– Training courses</div></div></div></div></div>

Service agreement packages and options for UNITROL®, MEGATROL and SYNCHROTACT®.

*Travel restrictions to be considered

ABB's main target is to support customers in reducing downtime through guaranteed service support, at a predictable cost. A service agreement could be the answer to quality and timely support.

Service agreements are a flexible and cost effective option to realize the benefits of the product or system which is a key component in the plant operation.

The service offerings for excitation systems or synchronizing equipment are customized to acknowledge in-house expertise. In addition they provide the required capabilities for the correct maintenance to ensure a smooth and continuous operation.

A service agreement contains different packages that range from telephone support and emergency field services to periodic maintenance activities. Certified service engineers support customers with fast failure identification and troubleshooting. This results in a fast response time and individual technical support for a safe operation of the system.

ABB developed three levels of service agreements with additional options (see details on page 12). All levels of service packages can be purchased on a yearly basis or subscribed to for several years. Contact ABB to learn more about the service package options and how your particular needs can be fulfilled.

Basic Package

This includes unlimited telephone support via ABB engineers, 24 hours a day, 365 days a year. Guaranteed response time and priority call status are also part of the Basic Package.

Standard Package

As well as the services offered with the Basic Package, the Standard Package gives priority to guaranteed on-site troubleshooting. Our certified service engineers are ready to travel on-site for instant troubleshooting for any problem that may occur to the excitation system. Moreover a special price reduction on daily rates and spare parts is provided.

Premium Package

In order to help our customers to meet demanding production schedules, we have developed the Premium Package. In addition to the scope of service included in the Standard Package, we offer periodic on-site performance reviews. This includes a complete inspection of customer's excitation system. Furthermore additional discount rates for on-site activities and spare parts are included.

[ABB Power Electronics Service - online](#)

Key facts

Products and systems covered

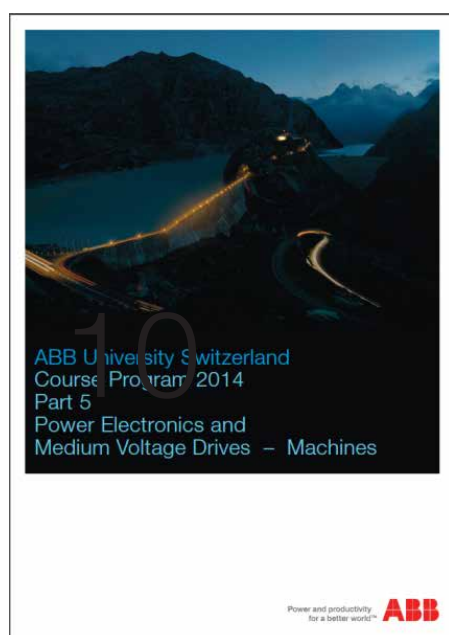
MEGATROL
UNITROL® 6080/ 6800
UNITROL® 1010/ 1020
SYNCHROTECT® 5
UNITROL® 5000
UNITROL® F

Benefits

- Unlimited 24/7 telephone support, 365 days a year
- Guaranteed response time ensuring minimized down-time
- Individual technical support
- Guaranteed support through certified and experienced engineers
- Customized service packages

2014 course program out now

A range of courses are available to help increase awareness, skills and know-how about ABB's excitation systems, services and technologies.



2014 course program

The new course brochure can be downloaded [online](#) or a hardcopy can be ordered via e-mail from the responsible learning center.

Benefits of training

The training courses support ABB's customers to increase their return on investment, reduce down time and improve the skills and motivation of their personnel.

Extended course offering

The course range is extended to cover the new product family. A new standard training course, named J670 UNIREC Service and Commissioning is now part of the course program.

Course goal

UNIREC is a combined excitation and rectifier system used to supply the on-board DC grid of a vessel.

This combination includes two functions: the excitation of the main generator with an UNITROL 6080 excitation system and a main rectifier, UNL14300 or UNL13300 thyristor converter to supply the DC-bus.

The course goal is to teach students to start-up, adjust, operate, maintain and troubleshoot the UNIREC system.

Learning objectives

Upon completion of the course, students are able to adjust the system using the Control Builder and AC 800PEC tool, perform standard maintenance and troubleshooting work and put the UNIREC in operation.

Course information and registration

Information about standard training courses such as course descriptions, prices, schedules and registration forms can be found through our course locator on the following web portal:

www.abb.ch/abbuniversity

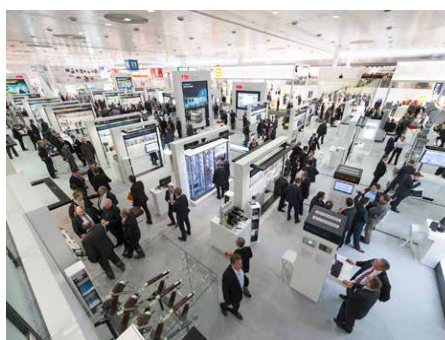
For customized training courses, please contact:

ABB Switzerland Ltd
Learning Center Power Electronics
and MV Drives
Austrasse
CH-5300 Turgi
E-mail: training-pesmvd@ch.abb.com

Upcoming events



POWER-GEN Europe 2012, Cologne, Germany



Hannover Fair 2013, Hannover, Germany



Powertage 2012, Zurich, Switzerland

Upcoming Events

Arabian MEP 2014

Exhibition and Conference
Bahrain
17 - 19 March, 2014

Hannover Fair 2014

Trade Show
Hannover, Germany
7 - 11 April, 2014

Powertage 2014

Exhibition and Conference
Zurich, Switzerland
3 - 5 June, 2014

POWER-GEN Europe 2014

Exhibition and Conference
Cologne, Germany
3 - 5 June, 2014

POWER-GEN Europe 2014

This year, POWER-GEN Europe takes place 3 - 5 June, 2014 in Cologne, Germany. Valerijs Knazkins, Matthias Bächle, David Stutz and Ralf Bachmann-Schiavo, from the Excitation Technology department ABB Switzerland Ltd in Turgi, are taking part with a paper entitled: "Challenges of the ENT-SO-E Network Code for Excitation Systems".



UNITROL® 6000. Proven excitation solutions with over 100 years of experience.



ABB is the world leading volume supplier of UNITROL automatic voltage regulators (AVR) and static excitation systems (SES) - known to provide a high return on investment year after year. UNITROL 6080 (AVR/SES) and UNITROL 6800 (SES) are designed for any type and size of power plant and bring a new benchmark in flexibility, reliability and connectivity. They are built to meet plant-related operational requirements, as well as relevant industrial standards. Moreover, the flexible engineering concept ensures smooth refurbishment solutions that perfectly suit given plant conditions. To find out more, visit www.abb.com/unitrol

ABB Switzerland Ltd
Excitation Systems
Phone: +41 58 589 24 86
E-Mail: pes@ch.abb.com

Power and productivity
for a better world™

