



Special supplement
6th Technical Day in
Wernigerode on
4th/5th September

Photo: Bernd Wajtmus

IMPULSE SPECIAL



Shipbuilding
VEM drives
at home
on the world's oceans

Photo: © NORDCAPITAL

PAGES 2/3



Capacity
Sachsenwerk expands
production capacity with
a new hall

Photo: Karin Wagner

PAGE 4

Sailing the seven seas

ENGINEERING VEM also offers drive solutions tailored to the current shipbuilding boom

The current boom phase on the world shipbuilding market is running hand-in-hand with rapid technical progress, carried not least by the branch's supplier industry and equipment manufacturers. With its special know-how and technology capabilities, Sachsenwerk has been a traditional supplier to the shipbuilding industry for many decades. Special machines from Dresden, such as shaft and diesel generators, pod drives, or propulsion, thruster and propeller motors, are in use on passenger liners, luxury yachts, ferries, container ships and chemical tankers. The VEM works in Dresden builds motors and generators for a wide range of vessels, with weights up to 200 tonnes. For mega-yachts measuring over 90 metres from bow to stern, which have become popular with the big-spending clientele in recent years, Sachsenwerk offers propeller drives with outputs of 7.5 to 10 MW. VEM machines with a power generation capacity of up to 60 MW are designed specifically for the new generation of

passenger liners. These ships are no longer geared merely to gigantic dimensions, but instead concentrate on 5-star luxury, which in turn places high demands with regard to on-board energy supplies. Sachsenwerk passes its products on to renowned system suppliers, who then equip the entire vessels with drive technology and automation solutions. Individual engineering of the products and strict adherence to the valid classification regulations during manufacture characterise VEM as a strong partner. Punctual deliveries to the shipyards and competent customer service, however complicated the local conditions, are values which speak for VEM.

Read more about the services of the VEM Group as a supplier to the shipbuilding industry on pages 2/3.

This propeller motor was manufactured at VEM Sachsenwerk for a luxury yacht.



Photo: Karin Wagner

Energy efficiency of drive systems

INTERNATIONAL 5th EEMODS conference discusses worldwide standards harmonisation and programmes for energy saving

The 2007 event was already the fifth International Conference on Energy Efficiency in Motor Driven Systems (EEMODS), the world's largest and most important conference addressing the subject of energy efficiency in drive systems. The participants met this time in Beijing in China. Following Lisbon (1996), London (1999), Treviso/Venice (2002) and Heidel-

berg (2005), this venue was chosen to demonstrate the global significance of energy saving. In response to the enormous interest shown, the previous three-year cycle was also shortened to two years.

The conference organiser was again the Joint Research Centre of the European Commission, in conjunction with ICA China (International Copper

Association Ltd.) as the local host. A total of 119 technical papers discussed the most varied aspects of the topic. Key issues for the high-ranking specialist audiences were a lively discussion of the steps necessary to achieve a worldwide harmonisation of industrial standards and exchanges of the experience gained with various national energy-saving programmes. The contribution of the European motor manufacturers was presented by Jürgen Sander, managing director of VEM motors GmbH and chairman of the Low-Voltage Motor Work Group at CEMEP. Speaking on the latter's behalf, he announced official support for a mandatory regulation specifying the minimum efficiency class EFF1 (high efficiency) in the European Union. Further details are presented below.

The on-going developments in energy-saving motors over recent years have produced a broad spectrum of country-specific regulations, laws and standards. This makes comparative evaluation of the individual products rather difficult. Depending on the place of use, they must comply with the limit values of the CEMEP Voluntary Agree-

ment (VA), NEMA, EPAct or special Australian, Japanese or other regulations, and there are furthermore major differences in the test procedures to be applied. And the demands arising in future from implementation of the Energy-Using Products Directive (EuP) will no doubt add to the complications.

Concept of minimum efficiency standards

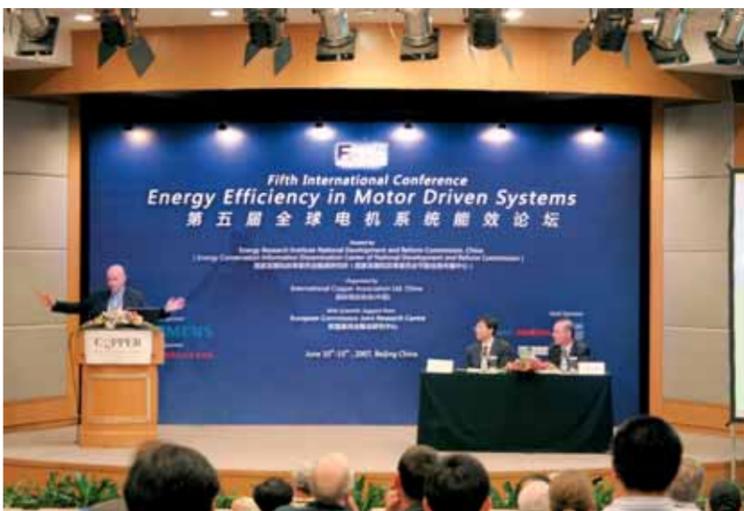
At the EEMODS conference, therefore, the concept of statutory "minimum efficiency performance standards" (MEPS) was presented. So far, five countries have already introduced such standards (USA, Canada, Mexico, Australia and New Zealand), and they are planned in a number of further countries (Israel, Korea, Brazil, China). The European motor manufacturers have within the framework of CEMEP similarly indicated their active support for the introduction of MEPS in Europe. There is still a certain dispute, however, regarding the general conditions for such minimum efficiency standards.



Photo: Karin Wagner

Given our continuing growth and the ever greater specialisation of our products, we have significantly increased the number of places for trainees this year. Graduate engineers are currently hard to find on the labour market. We were thus all the more amazed that the chair for electrical drive technologies at the Dresden University of Technology is to be abandoned. To secure our own future and growth, therefore, we have begun to promote mathematically talented high school pupils at all our German locations, and are encouraging them to take up degree studies in foundry technology, electrical engineering, electronics or mechanical engineering. At the beginning of their studies, the yo-

continued on page 4



The 2007 EEMODS conference was held in the Chinese capital Beijing.

continued on page 4

From luxury liners to container

The product range of the VEM group caters to all needs for special machines, generators and



The AHTS vessel Bourbon Orca is designed for offshore marine service.

Photo: Ulstein Group/Tony Hall

Vessel types with products of the VEM group

- Container ships
- Repair and supply vessels
- Bulk freighters
- Tankers
- Suction dredgers
- Lifeboats
- Fishery protection vessels
- Research vessels
- Survey vessels
- Jumbo ferries
- Passenger steamers
- Cruise liners and river cruise boats
- Motor yachts

Product range - selection

- Shaft and diesel generators
- Pod drives
- Propulsion, thruster and propeller motors
- Special drives for bevel gear motors
- Pump and fan drives
- Bow thruster drives
- Motors for anchor capstan drives
- Motors with frequency converters

The seas were already in ancient times trading routes and a source of food. Today, the oceans are furthermore increasingly important as resource reserves. Shipbuilding and its supplier industries have developed into a high-tech sector. South Korea, Japan and China are the world's biggest shipbuilding nations. When it comes to high-quality special vessels and passenger liners, Europe, too, plays a significant role. The German shipbuilding industry is similarly a growth branch. Cruise liners and naval vessels have in the meantime reached a level of technical complexity and innovation comparable to that

of aircraft or power stations. The productivity increases of the past years have even exceeded the successes of European aviation. The VEM group, too, has been able to record a good expansion of turnover in the shipbuilding segment of the market. The performance qualities and reliability of its motors and generators have made the company a sought-after partner in the industry. The comprehensive product range stretches from large machines and the most varied auxiliary drives to castings and windlasses. Customised designs satisfy the special requirements of the individual vessel types

to the highest quality standards. Shaft and diesel generators supply energy to the on-board power stations of luxury liners. Propeller motors replace enormous diesel counterparts and can be installed at distributed locations by implementing the principle of a so-called electronic shaft. Lateral thruster drives facilitate manoeuvres in the ports. Decades of experience have optimised the engineering design and dimensioning of the machines, taking into account the often restricted installation space on board, the special ventilation conditions and the classification standards of the shipping societies. In its

search for new applications, Sachsenwerk is currently discussing the possibilities for permanent-field machines with its industry partners. It is to be determined whether the systems which the company supplies in the 3 MW generator range for wind turbines could also be suitable for use in shipbuilding. The potential benefits are evident: Smaller frame sizes with reduced volumes and improved efficiency.

Solutions for all cases

The bed of the oceans holds vast untapped reserves of oil, gas and

mineral resources. Exploration of these resources requires that extreme technical hurdles be overcome. VEM drive technologies are in similarly great demand in marine engineering - not least due to their ability to operate reliably also in very damp and salty environments, unaffected by splashing seawater and major temperature fluctuations. VEM has been supplying motors for many years, for example as main and auxiliary drives for special vessels. VEM deliveries for research vessels have included brake motors from VEM motors for heavy winches. Pump and fan drives, three-phase frequency-controlled motors and jet pump drives from VEM are in use worldwide on suction dredgers. The MARUM Ocean Margins Research Centre at the University of Bremen uses a deep-sea robot for exploration down to depths of 4,000 metres (photo p.3 top right). Brake motors from VEM drive the 15.3 tonne winch to haul in the 4 km long cable at a variable winding speed between 1 and 60 m/min. The motors for the ventilation systems on one of the largest livestock transporters in the world are similarly from VEM. The "Al Shuwaikh" is able to carry 125,000 sheep. Many an unusual vessel, passenger ships, hundreds of container ships and special vessels, and even smaller motor yachts are sailing the seven seas safely and reliably with VEM drives. The robust, low-vibration design has proved ideally suited. Fully tested and certified, they comply with all the relevant regulations of the classification societies.

Shipbuilding certification for the VEM group

Taking into account their very specific ambient and operating conditions, together with the arising demands for absolute reliability, the marine versions of motors must be designed and manufactured to a high technical standard and in compliance with special regulations. Wherever ships are built, overhauled or repaired, the working procedures in the shipyards and at suppliers are subject to regular audits.

In some cases, the final product must also be approved by the responsible classification society. VEM possesses approvals for its supplies to the shipbuilding industry: Germanischer Lloyd, American Bureau of Shipping, Lloyds Register of Shipping, Bureau Veritas, China Classification Society, Russian Maritime Register of Shipping und Det Norske Veritas.



Photo: Karin Wagner



Photo: Hapag-Lloyd

Container ships - like this one from Hapag-Lloyd - are sailing the seven seas with shaft generators from Sachsenwerk (photo left) and various other motors from VEM.

er ships and motor yachts

low-voltage motors in the growth sector shipbuilding



The combi-drive is yet another innovative motor series from Sachsenwerk.



A 3D representation permits an insight into the internal workings of a combi-drive motor.

and the consequently minimised shipyard installation costs. At the same time, the elimination of an upstream gearbox increases the efficiency of the system. The motor can also be placed on the test stand separately before installation, and still remains freely accessible when mounted.

Brake motor for shipbuilding

Stromag offers its type 3BZ electromagnetic twin-disc spring-operated brakes with enhanced protection (photo below) in 8, 25 and 65 Nm versions. Thanks to the fully enclosed brake design, protection against all external influences is guaranteed. VEM motors has been building such brake motors, e.g. for winches, since 2003. They are certified by Germanischer Lloyd. A further Stromag brake with IP54 protection is similarly available with the same certification.



Motor with built-on brake in enclosed design



The deep-sea robot Quest is prepared for use.

Our customers can gain an insight into the VEM marine product range at the SMM 2008 fair. Alongside auxiliary drives, visitors to the world's most important international shipbuilding exhibition will for the first time be presented know-how concerning the use of large machines on special vessels. The fair is to be held in Hamburg from 23rd to 26th September 2008.

Innovation SCHOTTEL combi-drive

An innovative drive system combining the principal technical and economic features of both mechanical rudder propellers and pod drives is the SCHOTTEL combi-drive. VEM drive motors in combi-drive versions with power outputs of 2.75 MW and 3.3 MW have established yet another successful motor series from Sachsenwerk. Ten motors for ferries from Sachsenwerk. Already ten motors for ferries have already been delivered, and orders have been received for a further 14 motors for offshore supply vessels up to 2008. The drive motor is designed such that it can be integrated vertically in the suspension tube of the

rudder propeller. Cooling is by way of a water jacket, which makes optimum use of the installation volume, but at the same time demands a sophisticated design. This applies particularly to the ventilation and thus also to heat dissipation from the motor. A complex bearing guarantees a very long service life and is incorporated into the oil supply system of the gearbox. Considerable testing and inspection is necessary to achieve proper sealing for the machine cooling and bearing lubrication and thus to ensure the required high availability of the motor. The benefits of this drive concept are to be seen in the extremely compact system dimensions of an integrated drive motor,



This rotor with exciter for a synchronous generator is destined for a ro-ro ferry in Canada.

A sea of lights and fireworks

LUXURY LINER Our colleague Sabine Hartenstein experienced the official naming of the cruise liner AIDAdiva in Hamburg



Diva at her moorings. Three-and-a-half years passed between the start of planning and completion of the ship.

The liners for which VEM has been supplying motors for several decades include also the fleet of club ships belonging to German cruise operator AIDA Cruises. With the AIDAdiva, the first ship of a new generation of luxury liners has now taken to the seas. The operator placed the order for the first 68,500 GRT club ship with the Meyer shipyards in 2005. VEM supplied the full spectrum of low-voltage motors from 0.37 kW to 160 kW, with contributions to the ship coming from the VEM works in

Dresden, Wernigerode and Zwickau. Three further liners of this new AIDA generation are to be built and equipped with motors from VEM by 2010. The individual launches are scheduled for spring 2008, 2009 and 2010.

Naming ceremony on the Elbe

The naming of the first AIDA ship of the new generation - the AIDAdiva - took place in Hamburg on 20th April. For myself, this was the perfect occasion to experience first-hand the aura

and dimensions of a luxury cruise liner equipped above and below deck with motors from VEM.

The ceremony was not to be performed at the pier in the usual way, but instead mid-river in front of the Blom & Voss docks. Already in the early afternoon, hundreds of tourists from all over Germany began to gather on the quayside to witness the spectacle scheduled for 9 p.m. Very soon their number had reached the tens of thousands, and there was still no end to the stream in sight. The next day's local newspaper reported more than 220,000 spectators. By 6 p.m. it was clear that I could not afford to leave my observation point on the 2.5 km quayside, as otherwise my good vantage point for photos would be lost. During the long wait, I made the acquaintance of visitors from Berlin. They worked for AIDA Cruises and were interested to hear where VEM drives were installed all over the ship. Motors from Wernigerode and Zwickau are to be found in the engine room, in the air-conditioning systems, in the ventilation for the engine rooms, in the pump systems for all the on-board media distribution, in the waste incineration plant and as motors for the winches and capstans. Sachsenwerk supplied AIDA with thruster motors for the bow and stern thruster drives.

Then, at last, the wait was over. The five million euro party began with a sea of lights and an emotional fireworks display. Lasers flashed and

rockets were launched. The culmination of the ceremony was a pyramid of light. 260 spotlights lit up the skies over Hamburg, and thousands of cameras were held up to capture the atmosphere. When the naming was over - much too soon for most of us visitors - the 315 million euro ship turned and passed directly in front of the spectators. From such close quarters, it was scarcely possible to grasp its dimensions. It is 13 decks high and 25 metres long. The friendly smile on the bows of the AIDAdiva is already 16 metres wide, and the giant eyes cover an area of 150 m².

The ships of the AIDA fleet are operated in accordance with the strictest international quality, environment and safety standards. Our VEM drives satisfy all these requirements, as has already been demonstrated by the older cruise liners AIDAdiva and AIDAaura. They incorporate VEM motors for engine room fans of various sizes. The river cruisers of the AROSA fleet, which operates on the Rhone and Danube, are also equipped with pump drives from VEM.



The firework display at the naming ceremony was to be seen all over the port area in Hamburg.

Sebastian Schmidt takes over East European sales

The designated future head of the sales department working specifically with and for our customers in Eastern Europe is Sebastian Schmidt (43). With effect from 1st



Sebastian Schmidt is married and the father of two sons.

September, he is taking over the reins in Wernigerode from Jürgen Reinhold, who will be going into a well-earned retirement. Sebastian Schmidt joined the sales team at VEM motors at the beginning of the year. As a graduate electrical/electronics engineer, he has gathered career experience in numerous branches. He was active in technical customer service for the IT branch for many years. He speaks perfect Russian and is well acquainted with the local situations in the Eastern European countries. With the move of the East European exports team from Dresden to Wernigerode, all the sales departments of VEM motors are now located together at the company headquarters.

Photo: Karin Wagner

Extended capacity

LOGISTICS Full orders books make a new hall necessary

A new 3,000 m² hall on the Sachsenwerk site in Dresden is to become the company's dispatch and logistics centre. When the dispatch department moves into the new building, this will free up valuable space in the production halls. This is also urgently necessary, as full order books and increasing turnover mean that present capacities are exhausted. The company is expecting an 11.7% increase

in turnover in 2007 compared to the previous year. This trend is set to continue in 2008.

To be able to handle the greater volume of orders, the additional floor space is required above all for the final assembly of the large drives and generators. In total, it is planned to invest some 28 million euros in construction and equipment up to the beginning of 2009.



The new hall at Sachsenwerk will be ready for occupation at the end of August 2007.

Photo: Karin Wagner

Gerhard Freymuth honoured for 10 years of service

Gerhard Freymuth has been guiding the fortunes of the company as Sachsenwerk managing director for sales and engineering for exactly 10 years. On this occasion, proprietor Dr. A. Merckle praised his outstanding success in this capacity, giving special mention to his great commitment and excellent sales achievements. Gerhard Freymuth, who was born in Lower Saxony, joined the company in 1995, initially as sales manager for plant installations. Under his leadership, and with the support of a successful sales team, turnover at Sachsenwerk increased from 34 million € in 1997 to an expected 95 million € in the current year. That has contributed in no small way to the safeguarding and creation of countless jobs and trainee places, and has served to further strengthen the reputation of the VEM group all over the world.

Energy efficiency of drive systems

continued from page 1

Assignments to the different efficiency classes are currently governed by the draft of the IEC standard 60034-30. Many countries have already announced that this IEC standard is to be transferred into national legislation. We can thus expect a globally common procedure to emerge at least for classification. Further measures, such as tax privileges for purchasers of energy-saving motors, transition periods and possible penalties in case of violation, on the other hand, are still totally unresolved.

In the European Union so far, the "Voluntary Agreement of CEMEP" has prevailed with its efficiency classifications EFF1, EFF2 and EFF3. The initial target was for the market share of energy-saving motors of classes EFF1 and EFF2 to exceed 50 per cent by the end of 2003. Today, the market share of energy-saving motors lies above 90 per cent. The number of EFF1 motors, however, is increasing only slowly.

In autumn 2005, CEMEP decided to renew the Voluntary Agreement and to tighten the rules. In this way, it was to be ensured that only competent European motor manufacturers would be able to participate. The sphere of application and the "EFF" logo remained unchanged. VEM motors has reaffirmed its commitment to the "Renewed Voluntary Agreement" and has thereby demonstrated its readiness to push the use of energy-optimised motors and drive systems together with the OEMs. Beyond the objectives of the CEMEP agreement, VEM has discontinued all production of motors assigned to efficiency class EFF 3.

The criteria of efficiency classes EFF 2 and EFF 1 are also to be applied as far as possible to special motors such as marine motors, brake motors and compact drives.

European proposal for premium class

For all new and further developed products, VEM attaches particular importance to positive energy parameters in accordance with the limits defined by the VA. Alongside these immediately effective measures, the European manufacturers have elaborated a proposal of their own for a premium class. In addition to the actual classification of efficiency, this proposal assumes a common and binding methodology for the determination of efficiency.

"Round robin" test accompanying studies

A first draft for the IEC standard 60034-2-1, defining different methods for the determination of efficiency, was well received at the EEMODS conference. An accompanying "round robin" test, furthermore, is to permit optimisation and the description of suitable test procedures and measuring tolerances.

The previously mentioned IEC draft 60034-30: "Rotating electrical machines - Part 30: Efficiency classes of single-speed three-phase induction motors" was also a subject of interested discussion. It refers to an extended output range from 0.75 kW to 200 kW for 2, 4 and 6-pole standard motors. Furthermore, 50 Hz and 60 Hz systems are to be taken into account in the future. The new classification system leaves room for further improved-efficiency classes, as they are already being demanded in the USA ("Premium", "Super premium", etc.). Especially in the lower power range up to around 10 kW, there is still considerable scope for improvements in efficiency. The old EFF3 class, on the other hand, is no longer included.

There is still no agreement on the designations to be used. The working group "Low-voltage three-phase motors" of the ZVEI submitted a suggestion based on the designations for housing protection ratings (IP = International Protection). The idea was that efficiency could be assigned an

IE rating (IE = International Efficiency). The IEC has taken up this suggestion and has since presented the following classification:

- IE1 Standard efficiency (formerly EFF2)
- IE2 High efficiency (formerly EFF1)
- IE3 Premium
- IE4 Super premium

VEM is also contributing actively to this process and is preparing the development of even more efficient drives and drive solutions. The issues are next to be discussed within the framework of the 6th VEM Technical Conference in Wernigerode on 4th and 5th September 2007. With all these activities, the European motor manufacturers are lending active support to implementation of the general EuP directive.

What does this directive entail?

The directive defines specifications for an environment-compatible design of energy-driven products and is thus an important contribution to reducing CO₂ emissions.

It addresses primarily energy-driven products in the consumer sector, but also names electric drive systems. The EuP directive was published in the EU journal on 22nd July 2005 and must be implemented in the individual member states by 11th August 2007. It is thus not yet properly in force. Criteria for future product groups are to be defined by later "implementing measures", which are expected to follow from 2008.

To this end, the EU Commission issued a tender for a study. In the field of drive systems (lot 11 of the study) the following products are to be investigated:

- Electric motors with outputs from 1 to 150 kW
- Water pumps (in commercial buildings, drinking water pump systems, in the foods industry and in agriculture)
- Circulation pumps in buildings
- Ventilation fans (buildings other than for residential purposes).

The study was awarded to motor expert Prof. Almeida from the Coimbra University in Portugal. The key date for all efforts regarding the EuP directive and the remaining standardisation activities is 2008. We will then know whether or not we have been successful in finding practicable limit values and solutions conducive to sustained reductions in global CO₂ emissions.



Example of a 18.5 kW compact drive M21R 160 L 2 HS VS TWS EW HW EFF 1



The efficient handling of electrical energy, environmental awareness and careful use of our natural resources were also key topics for the EEMODS conference. Our photo shows the Boxberg power station in Eastern Saxony from the perspective of the newly established Nochten Boulder Park, a former open-cast mining area.

Photo: Karin Wagner

EDITORIAL

continued from page 1

ing students receive partial or even full grants for the standard duration of their course. The usual obligation to repay the grant is waived if they work for VEM for at least five years.

But in all modesty, an employee who has been with us for five years will stay with us. We are a reliable, demanding, but also supportive employer. At the same time, we are trying to secure the financing for a professorship at the TU Dresden and the Harz University of Applied Sciences in Wernigerode, in order to save or establish chairs for electrical drive technologies. With your hard work and your ideas, and with our loyal and quality-aware customers, we are optimistic as we enter the second decade of our cooperation. We will continue to grow and will invest further at all our locations in productivity, logistics processes and new products.

I wish you joy and satisfaction from your interesting and in many respects pioneering work.

Yours,
R. von Rothkirch

INTERNATIONAL

VEM group takes over BoHo Most

With effect from 1st June, the VEM group has acquired full ownership of the Czech company BoHo Most. This company has in the past provided winding services for Sachsenwerk and motors Thurm. The focus is placed on windings for motors Thurm, accounting for around 70% of the machine windings. The business relationship with BoHo Most, which counts 100 employees, approx. 80% of them women, began in 1994. Through the take-over, as a complement to VEM Slovakia, the VEM group has secured its necessary winding services for the future. VEM Czech Republic - the new company name - boasts a highly motivated workforce and thus ideal prerequisites for sustained positive development of the location.

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Electric drives with a consideration for environmental aspects

TECHNICAL DAY

The 6th Technical Day in Wernigerode welcomes its visitors with a wide range of technical lectures

This year's 6th Technical Day in Wernigerode will be looking at "Environmentally sound design and construction solutions for drive engineering". The lectures and discussions during the two day event will be focusing on three main topics: The implementation of the EUP guidelines, the next generation of energy saving motors and new, highly efficient driving power solutions. In the following we will be presenting our readers with extracts from the papers which have been received prior to our going to press.

Copper rotors – A success story



Stefan Fassbinder, Deutsches Kupferinstitut e.V.

For years now the rotor cages used for squirrel-cage motors have been cast from aluminium. Copper with its approx. 50% higher conductivity allows an equivalent reduction in the losses of the rotor. This is the topic of the review presented by Stefan Fassbinder from the Deutsches Kupferinstitut e.V. (German Copper Institute). Aluminium is only being used because of its greatly reduced casting temperature. An efficient casting form has however now been developed which allows the casting of copper cages. This advantage can be used to produce either a motor of the same size with less losses or to make a smaller motor with the same performance characteristics. The operating characteristics differ in degrees from those of an equivalent motor with aluminium rotors. Stefan Fassbinder will be looking at possible improvements as well as the limits of the use of these new rotors.

An ecological comparison of drive solutions



Prof. Andrea Heilmann, Harz University of Applied Studies

Prof. Andrea Heilmann (photo) of the Harz University of Applied Studies and Dr.-Ing. Peter Zwanziger from SIEMENS AG will be presenting three different ways of reducing energy consumption and the environmental impact of motors in their operating phase. Peter Zwanziger will be listing the existing energy saving motors, frequency converters and the optimisation of drive engineering systems of individual countries and within the EU. According to the EUP guidelines, not only the operating phase but also the complete product lifecycle must be accounted for when evaluating the environmental impact – an analysis which requires the use of special software tools. This review will be show-

ing the effect on various efficiency rates both with and without the use of frequency converters while using EFF1 motors in comparison to an EFF2 standard motor with the use of software tools prescribed by the EU. Information regarding the ecological impact during the complete lifecycle will also be provided in the form of ecological profiles and Environmental Product Declarations. An analysis of the available software tools has led to the formulation of various propositions and simplifications with partly considerable differences in the results including a reduction of the relevant materials and lifecycle phases as well the establishment of a lifetime guideline, an annual serviceable life, and the observed load type of the drive system. The paper will be comparing the various software tools with regard to assumptions being made on the final result. It will also be considering the legislative standards required to allow comparisons to be made.

Efficiency classes of cage motors



Martin Doppelbauer, SEW-Eurodrive GmbH & Co. KG

Martin Doppelbauer (photo) and Dipl.-Ing. Ulrich Bomke from the company SEW-Eurodrive GmbH & Co. KG will be reporting on the developments of a CEMEP-related project. They will be looking at a harmonisation of the efficiency classes of three-phase cage induction motors as an IEC standard. They will also be presenting the strategic goals of the project which is aiming at releasing a propelling force for motors with a higher and a very high efficiency rate to be able to comply with the Kyoto CO₂ reduction targets and to achieve a benefit for the customer through savings in energy costs as well as to increase the sales of these motors. The rules applying to the efficiency regulations must be easily understood and capable of being easily applied throughout the world as well as meeting with a maximum approval by customers, producers and national authorities alike. The standardisation initiative should be focusing on the most popular motor sizes and types in order to achieve the greatest ecological and economic effect and to be in harmony with the worldwide standards applying to efficiency classes. To avoid any loopholes in the regulations, all technical exceptions will be clearly defined while at the same time allowing for driving mechanisms with special requirements. Regulations governing the application such as certification procedures and other requirements in connection with inspections carried out by independent testing stations will remain within the competence of the national legislation of the respective countries. In Europe, for example, the rules could be incorporated in the implementation regulations of the EUP guidelines. In the USA these rules already constitute an essential part of the EPACT regulations.

Putting lifetime costs to the test



Prof. Peter F. Brosch, Hanover University of Applied Sciences and Arts

Prof. Peter F. Brosch from the Hanover University of Applied Sciences will be looking at the lifetime costs of driving mechanisms which have been manufactured on a large scale and which feature high operating hours, a topic which is increasingly gaining interest among users. Since the price of energy is once more sharply rising after a brief spell where the prices were even dropping slightly, attention is now once more focusing on reducing operating costs by conserving energy. Research shows that around 70% of electric power is being transformed into driving power of which 60% is used to drive pumps and ventilators. These devices work for long operating hours with many even coming close to 8,760 operating hours a year while being driven at between 20% and 80% of their rated capacity. More and more of these devices are being efficiently supplied with power using frequency converters while operating at variable speeds. Previously only "normal" asynchronous motors were being used with highly efficient types rarely being deployed.

With permanent magnets becoming less expensive, permanently excited synchronous motors can be made today with even better efficiency rates in their range of operation through these drives which in turn reduces the lifetime costs of driving mechanisms which have been manufactured on a large scale.

Permanent magnet technology for wind generators



Dipl.-Ing. Joachim Zwick, VEM Sachsenwerk GmbH

Dipl.-Ing. Joachim Zwick from the company VEM Sachsenwerk will be talking about the use of permanent magnet technology in constructing wind generators to enable alternative energy to be produced more efficiently. He will be contrasting the latest technical solutions with the strand-type drive mechanism of the generators developed by Sachsenwerk. Here he will be looking at different solutions including gear transmission concepts such as asynchronous generators for a direct mains connection or with slip regulation, twin-fed asynchronous generators using cascade converters, and synchronous or asynchronous generators with solid converters. Direct drive mechanisms such as synchronous generators with an electric or a permanent magnet excitation will also be presented as well as alternatives



6th TECHNICAL CONFERENCE

WERNIGERODE
4th/5th September 2007



Date:
Tue, 4th Sept 2007, 9.45 a.m. to 17.45 p.m.
Wed, 5th Sept 2007, 9.45 a.m. to 15.30 p.m.

Venue:
Harzer Kultur- und Kongresshotel Wernigerode
Pfarrrstrasse 41, 38855 Wernigerode

featuring multi-generator and single stage driving solutions. Efficiency comparisons with the help of conventional generator concepts and comparable turbine concepts will be made using the examples of fast and slow running synchronous generators. An outlook on the development of the worldwide use of wind power stations reveals that permanently excited generator concepts will be significantly increasing their market share because of their highly efficient use of energy.

Measurement signal analyses of incremental transmitters



René Noack, Lausitz University of Applied Science

René Noack (photo), S. Laass and E. Stein from the Lusatia University of Applied Sciences, D. Wulkow from the Johannes Hübner Fabrik elektrischer Maschinen GmbH, and D. Gleinig from Vattenfall Europe Mining AG will be presenting their joint research on this topic. Maintenance costs are a major cost factor along with investment and operating costs in industry. A central task of maintenance work is to determine the characteristic damage parameters and to plan maintenance cycles. This paper will be presenting the project "Analysis of signals of high res-

olution incremental transmitters". Procedures will be shown which enable propositions to be made regarding the condition of a system – from the transmitters to the motors – using the existing signals of the incremental transmitters. This work is being carried out both in a laboratory as well as in the field with large equipment in open-pit mining operations. The first part of this presentation will be looking at the attachment quality and the wear and tear of the incremental transmitters. Here the measuring and analysis methods, the hardware being used and the initial results will be presented.

Eh-star as an alternative measuring method



Prof. Andreas Binder, Darmstadt University of Technology

Prof. Andreas Binder (photo) and Mr M. Aoulkadi, both from the Darmstadt University of Technology, will be presenting the results of a project sponsored by the CEMEP. They have investigated which alternative measuring methods could be used along with the measuring methods already prescribed in standards to determine

Continued overleaf

Electric drives with a consideration for environmental aspects

Continued from front page

which load-controlled additional losses can occur in mains-supplied squirrel-cage asynchronous motors. Based on research in alternative procedures, the eh-star method of E. Richter and H. Jordan has been selected as representing a suitable method. Binder and Aoulkadi will be explaining in detail the choice of this method.

Because of the high degree of accuracy required to measure the intake and output performance, the use of direct measuring methods is limited here. Although the alternative measuring method is simple to use, its analysis is mathematically more complicated than other methods. Andreas Binder and A. Aoulkadi distributed a measuring rule to the project partners from industry and the university together with an EXCEL sheet for a simple mathematical analysis. In comparison to the results with the direct measuring method and the calorimetrically gained measuring results, the measured results of 15 motors which were measured at the Darmstadt University of Technology as well as of 20 other motors which were tested at the University of Nottingham/UK and in Canada show a good correlation for the load-controlled additional losses with deviations in the repeatability range of approx. +/- 20%. Comparative measurements using the standardised Reverse Rotation Test show significantly higher deviations so that despite it being a substitute measuring method, the eh-star method can be viewed as being an efficient alternative to direct measuring methods.

New developments in POD drives



Andreas Böltzig,
VEM Sachsenwerk
GmbH

Andreas Böltzig (photo) and Jens Proske from the company VEM Sachsenwerk will be presenting the development and construction of a compact ship's propulsion system. Beginning with the requirements of a POD drive, they will be presenting a compact drive solution. The development of a special 3MW asynchronous mechanism enabled one drive step to be eliminated. The motor becomes an integral component of the POD construction. Böltzig and Proske will be describing details of the drive concept and the motor design.

Limiting excess voltage through varistors



Dipl.-Ing.
Alexander Rocks,
Darmstadt University of Technology

When using pulse converters to control the speed and torque of asynchronous driving mechanisms under the influence of transient waves, excess voltage arises at the incoming feeder. The reason for this phenomenon

is the topic of a joint project undertaken by Prof. Volker Hinrichsen and Dipl.-Ing. Alexander Rocks (photo) from the Darmstadt University of Technology together with Mr Wulkow from the company Johannes Hübner Fabr. El. Maschinen GmbH. The excess voltage being examined can even reach the threefold value of the intermediate circuit voltage. This problem has traditionally been solved by using filters which however can take on great dimensions with the attendant costs depending on the driving power being used. A research project which is being carried out at the Darmstadt University of Technology is now investigating whether or not and to what degree excess voltage can be limited by the use of varistors. Until now voltage-dependent resistors have been used as overvoltage suppressors in electronic switches or in medium-voltage and high-voltage systems where they are rarely being stressed by overvoltage. Modern IGBT converters allow elementary frequencies of 10 kHz and more with voltage build-up times of only a few hundred nano seconds. Accordingly, the number of surge voltages which the varistor has to cope with is incomparably higher than in conventional operations. This places special demands on the geometry and the material being used. Another discussion point is the question of acceptable surge voltage values for machine operators and the operating conditions of machines required to enable the varistors to be correctly dimensioned for their respective use.

Ventilators as high-end products

Dipl.-Ing. Sylvia Blankenhagen from the company Ziehl-Abegg AG will be talking about the opportunities and problems involved in increasing the energy efficiency in the "Ventilator" drive system using the example of the Ziehl-Abegg ventilators with their external rotor motor. The company is aiming at developing ventilators with a high efficiency rate as high-end products. This required a change in the company's product philosophy, i.e. away from the development of low-cost standard products with simple application and at least two ventilation relevant speeds and more towards a high-end product with a variable speed and an excellent efficiency rate. Here emphasis is being placed on using an asynchronous motor type with a copper rotor. Sylvia Blankenhagen will be presenting the results of this change as well as the marketing challenges faced by this advanced new generation of ventilators.

Use of compact drive – an optimal system approach



Dipl.-Ing.
Wolfdietrich Risch,
VEM motors GmbH

Dipl.-Ing. Wolfdietrich Risch from the company VEM Motors GmbH will be talking about the consequences of the 2007 UN climate report which makes mankind responsible for the present climate changes. About 30% of the electric power produced in

Germany is being used by the electrical drives of industry. VEM is facing the challenge of reducing the electric power consumed by its robust grey cast iron motors designed for industrial use with the priority not only being placed on the motor itself but also on the optimisation of the effectiveness of the whole driver unit. Low-loss speed regulators only draw as much electric power from the mains as is required by the technical process being employed, whereby increased losses as experienced through the use of underload operations are being largely avoided.

A product of the VEM group which meets these requirements in an exemplary manner is the compact drive. For seven years now VEM has been manufacturing this variable speed drive unit which is in a working order and complete in itself and ready to be connected as well as featuring a performance range of 0.55 kW to 22 kW. Through the use of a different principle, the planning services, the filters at the exit of the converter and the screened motor cables are no longer required, all of which leads to considerable cost savings. Not only materials such as copper, dynamo sheet, special insulation material, etc. are being saved, but also the energy required to exploit, manufacture and transport these materials is also reduced. Wolfdietrich Risch will be reporting on the advantages of the compact drives compared with drive units featuring a central arrangement of the frequency converters under the aspect of an active environmental protection.

Subsynchronous converter cascade



Dr.-Ing.
Thomas Sadowski,
transresch Antriebssysteme Berlin GmbH

Dipl.-Ing. Rainer Hübner and Dipl.-Ing. Thomas Sadowski (photo) from the company Transresch Antriebssysteme Berlin GmbH will be presenting economic energy-saving solutions for drive mechanisms. Although knowledge of the quantitative energy-saving potential of electric drive mechanisms has existed since the end of the 1970s, this technology is still relatively unused. That is why even in 2007 the classic example of an electronically adjustable pump can be used to clearly demonstrate energy saving potential. Along with systems with frequency-controlled asynchronous and synchronous motors, converter cascades represent an economic solution for regulating speed incrementally and with a minimum of loss. Since the first half of the last century, this technology has been determining electrical drive engineering. If, for example, the required speed regulating range of machines such as pumps, compressors, ventilators, excavators, cylindrical rotary kilns, presses, extruders, conveyor belt systems, etc. is limited, then for the medium and top performance ranges a mains-friendly design accommodating the latest standards of technology using subsynchronous converter cascades would present itself. Considerable progress in the constructional elements being used in

control technology and in electrical machines has for example led to an incomparable rebirth of this method of electronic power drive. Beginning with the EuP regulations and an overview of energy-efficient drive engineering, the review will be reminding us of the reliable and safe function of the cascades used in power converters, slip ring motors, safety devices and information electronics. This concept has proven itself by being successfully applied in VEM machines.

Retrofitting of frequency converters



Dr.-Ing.
Christian Lehmann,
Physikalisch-Technische Bundesanstalt Braunschweig

Dr.-Ing. Christian Lehmann from the Brunswick PTB (national metrology institute) will be talking about the energy saving potential of driving turbo machines used in the chemical industry where most of the motors are being used to drive turbo machines. An optimal process control requires the ability of the conveying capacity to be adjusted to the current process requirements. In large chemical companies in Germany about 20% of the driving mechanisms of the potentially explosive areas of newly installed systems are being equipped with frequency converters with the percentage of all existing driving units equalling about 15%. These figures show that especially with older drives an increased retrofitting of frequency converters can be expected in the next years. Since many driving mechanisms in the chemical industry are being used in Zone 1, a test and certification of the drive through an authority is necessary. To enable the energetic benefits of frequency converters to take effect, a simple and cost-effective testing and certification procedure is important for the manufacturer and operator with the observation of a reasonable safety standard being of the highest priority. This certification concept based on detailed research has now been successfully applied to various types of motors at the PTB for about half a year now.

Driving mechanisms in the chemical process technology



Dr.-Ing.
Hans Linnenbrink,
Bayer MaterialScience AG

Dr.-Ing. Hans Linnenbrink from the company Bayer Material Science AG will be reporting on the requirements of electromotive drives which along with the predominantly pneumatically operated flow fittings are among the most frequently used actuators in the field of chemical process technology. From a process technology point of view, they have to be integrated into the automation process of the process control system and connected electri-

cally to the power supply system in a suitable manner. In the chemical industry the number of motors is reaching 100,000, whereby depending on the production requirements, the medium performance lies between 5 and 20 kW. The applications are numerous, with about 2/3 of the uses affecting turbo machines. An essential marginal condition is the erection in the Ex-area which already considerably limits any potential application. The mechanism's efficiency is mainly influenced by its availability. This leads to qualitative demands on the equipment. The use of drives with variable speeds has provided opportunities for adapting the equipment to the requirements of process technology while saving electric power and optimising the dimensioning of the installed equipment. With the advent of suitable power semiconductors, the number of adjustable drives will continue to greatly rise in the future. This will also have an influence on the planning and equipping of industrial plants. Manufacturers and operators are therefore being challenged to jointly solve this problem. The VIK and NAMUR organisations will be supporting this effort.

Torque development of permanent magnet machines



Dr. Pia Salminen,
Lappeenranta University of Technology

Permanent magnet motors and their ability to produce torque are studied by Dr. Pia Salminen from the Lappeenranta University of Technology. The maximum torque is inversely proportional to the synchronous inductance of the machine if the speed and the supply voltage of the machine are kept as constants. In this study the maximum available torque of a PM machine is examined as the pole pair number and the number of slots per pole and per phase q are varied within compatible constraints. The aim of the study is to determine an optimal pole and slot number combination for various permanent magnet machines. The performance characteristics of the concentrated wound machines are compared to those of integer slot wound machines. Concentrated wound machines belong to the group of fractional slot wound machines; however, the number of slots per pole and per phase $q \leq 0.5$. In a concentrated wound machine, each coil is wound around one tooth. This makes the machine winding process easy and inexpensive, and consequently, the machine type is an interesting option in mass production. Several concentrated wound PM machines were computed applying an analytical method and a finite-element method. In most cases, the concentrated wound machines give a lower pull-out torque than integer wound machines with the same frame size. However, the concentrated wound PM machines may offer some other benefits such as small copper losses, small end windings and a low current density in some applications. It was noticed, that it is possible to find optima for p values with q as a parameter, at which the pull-out torque is at highest.