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➤ The path to
renewable energies

➤ Ever greener
Power alternators!

➤ Shaft voltages
and bearing currents

➤ National Pages

➤ Leroy-Somer motors
are being exported

➤ Variable speed drive
technology

➤ Onboard drive systems
for railway applications

The path to renewable energies

The Germans were bent upon it, the Twenty-Seven voted for it: by the year 2020, one fifth of the energy consumed in Europe must come from alternative sources that do not generate greenhouse gases, such as wind energy, solar energy and biomass. A change that will bring back into use some of the energy sources put to one side by the first industrial revolution.

In March 2007, the 27 member countries of the European Union, gathered together in Brussels, agreed upon an ambitious target: in 2020, renewable energies must make up 20% of European energy consumption. According to the President of the European Commission, José Manuel Barroso, this policy is the most ambitious ever accepted by a group of countries on energy and climate protection.

Following this, the member states committed themselves to reducing their emissions of greenhouse gases by 20% by 2020. This target could even be increased to 30% (the reduction threshold necessary to avoid a large-scale climate change) if other major economic powers, such as the United States, China or India, undertook to participate in a collective effort, within

the framework of a new protocol that will replace the Kyoto protocol, expiring in 2012. As a reminder, the Kyoto

provided that Europe succeeds in overcoming various technical and financial obstacles.



agreement aims to stabilise the atmospheric concentrations of greenhouse gases at a level that prevents any dangerous disruption to the planet's climate system. At that date, the European Union must have reduced its emissions by 8%.

Today, the share of renewable energies in the Union's total energy mix amounts to 7%. This is a little more than in 1990. Other changes are favourable to the environment: between 1990 and 2002, coal consumption decreased in favour of gas, which generates less carbon dioxide. But the effort to be made remains very significant.

Sun, wind and biomass

The main sources of renewable energy available in Europe are wind, sun and biomass. The potential of each is great,

Biomass includes various organic raw materials of plant origin, which can be converted into combustible material to produce heat, electricity or fuel. It provides 14% of the planet's energy consumption and as such constitutes the fourth largest resource exploited on the world scale. Having said this, apart from Austria, Finland and Sweden where it is relatively well exploited, biomass still represents only 2% of the European energy mix. This lack of interest is due in a large part to the relatively high cost of energy produced starting with biomass. To remedy this, various research programmes are in progress in Europe to develop new conversion technologies, based on thermochemical, chemical and biological processes. Researches that open the door to a great variety of uses, whether as a source of heat or electricity, or as a biofuel.

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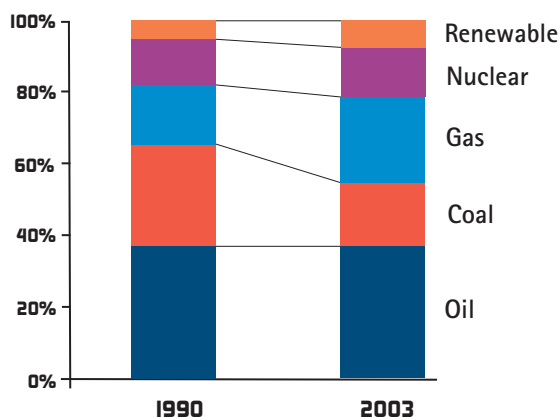
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The kinetic energy of the wind, converted into electricity by wind turbines, is another increasingly exploited energy source. In Europe, it literally has the wind in its sails, with a production that increased by 154% between 2000 and the beginning of 2006 (data from Eurostat). In 2006, Europe therefore provided 65% of the 74,000 MW of wind energy produced annually throughout the world. Furthermore, two European countries are at the top of the world ranking of wind energy producers: Germany, with almost a third of the world's production, and Spain (11,615 MW per annum), just in front of the United States and their 11,603 MW (data from the World Wind Energy Association, 2006). The development of this type of energy is dependent upon progress related to managing variations in wind speed, and also to storage of the energy produced for less windy periods.

Photovoltaic solar energy is a third energy source of interest to Europe. Solar radiation is converted into electricity by means of a solar voltaic power generation. At present, photovoltaic operation remains relatively expensive. Researches are in progress as part of the European Hercules programme, aimed at improving the performance of this type of system and making solar energy competitive for Europe. They have already demonstrated the feasibility of a new type of device, based on gallium arsenide

Changes in the European energy mix



Source : European Commission

photovoltaic cells, which would make it possible to reduce the cost per solar kilowatt to a more acceptable level.

After the industrial revolutions that relegated non-polluting energies in favour of performance, a new revolution is brewing to acclaim green energies, making them more competitive. Europe, its researchers and industries will have played a leading role in this beneficial return to the future.

The new industrial revolution

In the middle of the 18th century, the first industrial revolution gave birth to the machine. Muscular, water and wind energy were progressively replaced by steam.

At the end of the 19th century, the second industrial revolution began with the invention of electricity and the internal combustion engine. A divided organisation of work (Taylorism) was set up.

In the 1970s, the third industrial revolution started with the development of electronic tools and the invention of the Internet, the microprocessor and the desktop computer.

The 21st century will be that of the fourth revolution, which must enable a spectacular increase in the amount of low-emission energy produced and used in Europe, in order to "transform Europe into a high energy efficiency, low CO2 emission economy", in the words of the Commission.

Global warming

According to the European Environment Agency, energy production is responsible, in the European Union, for 80% of all greenhouse gas emissions, whose role in global warming is proclaimed by many scientists.

According to the intergovernmental group of experts on climate change, greenhouse gas emissions have already increased the world's temperature by 0.6°C and, if no measures are taken, man will be responsible for an increase of between 1.4 and 5.8°C by the end of the century. All regions of the world, including the European Union, will have to face serious repercussions on their economies and ecosystems. A significant increase in renewable energies in the European energy mix could help save up to 100 billion euros and 780 million tonnes of CO2 per year.

Ever greener Power alternators!



With the development of renewable energy sources such as wind, water power or biomass, alternators are enjoying an unprecedented boom. Leroy-Somer, world leader in industrial alternators, is involved in the deployment of these new energy sources with a range that suits all requirements: Power alternators.

One alternator out of four comes from a Leroy-Somer factory located in Europe, the USA or Asia. Besides its standard range (Partner), Leroy-Somer has developed an adaptable range, the Power range, directed at both manufacturers of engines (diesel or gas) and designers of gas, steam, water or wind turbines, in a 1 to 20 MW power range.

Power alternators intended for Europe are produced in Orléans (France) on a site where a surprisingly varied mixture of machines ranging from 2 to 80 tonnes exist side by side. Each represents an original solution to specific needs, in terms of electrical dimensioning (voltage, speed, power) and also mechanical configuration (open or totally-enclosed machines), and if necessary incorporating specific functionalities.

The Power range, highly diversified applications

The wind market is a special market where the manufacturers develop their own technologies and therefore expect a great deal of adaptability from their suppliers. In addition, the alternators designed for this sector, which must be sited at the top of masts in nacelles over 80 metres up, are totally customised. At present, Leroy-Somer manufactures 3 MW asynchronous alternators for the wind market and is also developing a 2 MW generator for this market.

Small hydroelectric power stations are finding a growing interest, mainly for sites with a small drop which do not require any major civil engineering investment. Here also, the availability of alternators perfectly adapted to the characteristics of the site (nature of the drop, and regulatory, environmental and mechanical constraints) is essential. For many

years, Leroy-Somer has offered a range of alternators specifically designed for driving by water turbines, and adaptable to a precise specification: overspeed, axial and/or radial loads, type of mounting, etc.

Leroy-Somer also supplies alternators suitable for biomass installations, whether these are for producing steam through combustion of plant matter or for recovering biogas (methane) coming from the fermentation of organic matter for powering gas engines.

As another field of application, waste incineration is a good example of recovery of steam converted into electricity using a steam turbine combined with a Leroy-Somer alternator, provided that the substances discharged into the atmosphere are strictly controlled. More generally, any industrial site using steam, such as paper mills or tyre factories, are yet more facilities capable of producing electricity or installing a cogeneration plant.

Leroy-Somer also has a great amount of expertise in working with manufacturers of power stations supplied with natural gas. This type of power station has the advantage of being able to be installed fairly quickly close to the place of end use, since the turbines and alternators can be transported in the form of packages to be installed and then connected to the local mains supply.

But for the time being, power stations, which convert the mechanical energy supplied by a diesel engine into electricity, still constitute the most frequent outlet for Leroy-Somer alternators. Many manufacturers have become specialised in the installation of power stations of this type, in partnership with Leroy-Somer who supplies the alterna-

tors matched to the most diverse specifications. They are used in particular by hospitals, hotels or large administrations, for which they provide energy self-reliance, integrated with the mains supply if applicable.

Similarly, the diesel engine is frequently used in the maritime field to provide the power supply and/or electrical propulsion for cruise ships, ferries or container ships, and also in the oil & gas market, as borne out by the recent orders for the FPSO (Floating Production Storage and Offloading) production platforms and LNG (liquefied natural gas) tankers.

Europe's ability to increase the share of green energies in the total energy mix will depend to a large extent on its talent for using these new energies efficiently. A venture in which the Power alternator range and Leroy-Somer's expertise could be called upon to play a leading role.

...and the barge Thialf works hard!

On the other hand, no holidays for the barge Thialf, designed to carry out work installing drilling and production platforms for the Dutch ship operator Heerema. With a length of 200 m, and equipped with two cranes with a lifting capacity of 15,000 tons, it can accommodate up to 736 people on board. It is the most powerful work vessel in the world. Nevertheless, to be able to carry out work offshore in deep water in the Gulf of Mexico, it had to be equipped with a dynamic positioning system requiring more power. Leroy-Somer supplied four 5 MVA LSA 58 XL115 alternators and two 7 MVA LSA 60 B105 alternators driven by diesel engines at 514 rpm.



Cruising is fun...

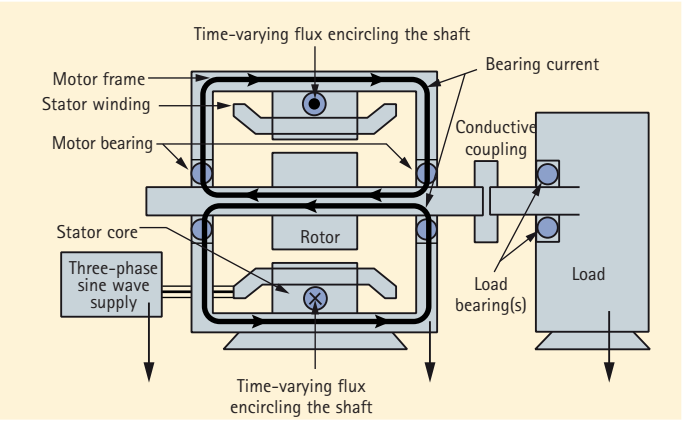
The final phase of modernising the first of four Millenium cruise liners, in service in the Caribbean since 2000, is in progress: an 11.5 MW heavy fuel oil diesel generating set must be added to the two fuel-thirsty 25 MW gas turbines, for more economical propulsion, in particular in port areas at reduced speed. To limit the time the ship is out of action, a complete 300-ton unit, consisting of a Wartsila 16V38B diesel engine and an LSA 62 B100/12p alternator, has been prepared by the Aker workshop, whilst the liner has continued to sail for the greatest pleasure of its 2000 passengers. Its stay in dry dock will be reduced to the strict minimum – 17 days to cut open the hull and insert the new module!



SHAFT VOLTAGES AND BEARING CURRENTS

The issue

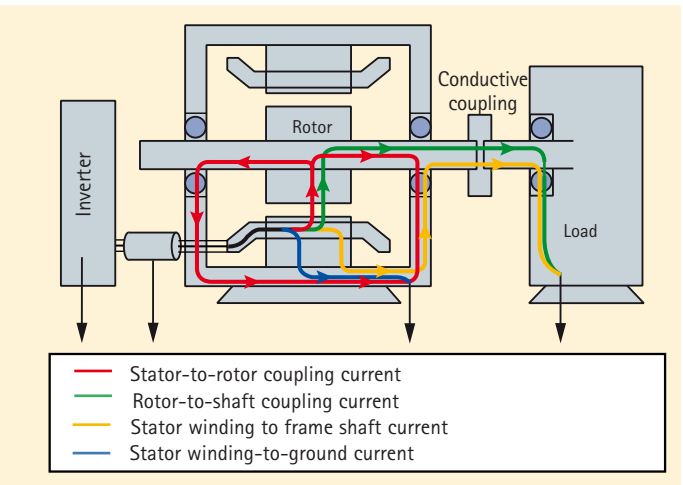
Shaft voltage and bearing currents arise from various sources in an induction motor and are not just a result of using inverter drives.



Poor electrical steel homogeneity, rotor concentricity, alignment, uneven air-gaps, inadequate manufacturing tolerances and unbalanced windings are construction factors that cause asymmetrical magnetic fields, leading to the flow of bearing currents **even when a motor is operated from a pure sine wave supply**. In addition common mode voltages caused by unbalanced excitation of the motor windings coupled with shaft grounding current can also produce bearing currents.

Leroy Somer has effectively overcome these problems with the introduction of computer-aided design, precision tools, and advanced production techniques. Shaft voltage levels are now below 300mv (peak) complying with NEMA MG1, 1993 Rev 3 and IEC 60034-17.

The introduction of the fast switching power devices, such as IGBT's, in Variable Speed Drives has led to the resurfacing of shaft



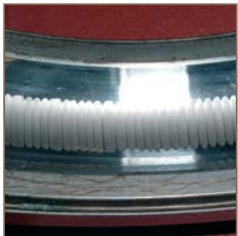
voltage and bearing current problems due to common mode voltage generation of the high switching frequencies (up to 20kHz) and associated high rate rise of voltage (dv/dt). These high switch-

ing frequencies can give rise to an induced voltage in the shaft which builds to a level that can discharge to ground through the bearings and then charge again. Damage occurs to the bearing surfaces due to the electric discharge machining (EDM) effect.



The solutions

The phenomenon is well understood but its occurrence is un-predictable, put in context however it **very rarely** is a problem particularly below 280 frames. Its appearance is not the result of a manufacturing defect of either the motor or the drive.



Determining whether protection systems are required is a pure cost and risk analysis exercise: e.g. an insulated bearing for a small motor costs more than the stator. It therefore needs to be a whole system design approach.

Action	Comment
Ensure High frequency system grounding	<ul style="list-style-type: none">- Shielded cable, drive to motor with correct grounding- Low impedance grounding of the driven machine
Reduce the switching frequency	Avoid frequencies above 6kHz the higher the frequency the higher the rate of current discharge.
Inductive line filters	Particularly for long cable lengths. Any attenuation in the common mode drive voltage reduces the capacitive discharge energy by the square law.
Vibration analysis equipment installation	Useful in trending energy spikes in the 2-4kHz range indicative of EDM.
Insulated bearings (optional from 160 frame)	Consider for motors >280 frame. Will not eliminate shaft voltages which may then cause a problem in the driven machine.
Shaft grounding brush	Can be considered for motors >280 frame.
Insulated coupling	Between motor and driven machine.

MOD

Leroy Somer has had a long experience and association with Naval Defence applications and has developed a range of motors, converters and alternators meeting stringent requirements for the national navy's of Europe and world-wide.

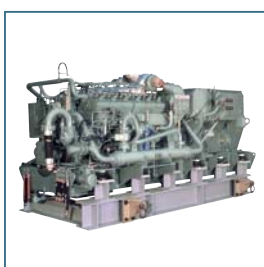
Navy specification applies to product design and also the ability of the suppliers to assist the navy's design teams during the life of the project from the viability study through to the equipment installation and staff training.

Leroy Somer has well understood these requirements and has in place a group of multi-skilled engineers dedicated to naval activities.

This team has developed compliant products meeting the navy requirement in term of shock resistance, vibration and noise. They have also integrated into their design, the high life expectancy requirement as ships are in operation for prolonged period of time.

Through the application experience gained, Leroy Somer is now an expert in integrating motors & converters which guarantee the product performance and is now the reference and prime motor supplier for over a dozen navy's for surface ships and submarines.

Recent Royal Navy projects include the supply of motor drives into a number of strategic applications for the Type 45 Destroyers and quoting motors for several applications such as HVAC, pumping and winches for the CVF- Royal Navy Future Aircraft Carriers which are expected to enter into service in 2012 & 2015.



Smooth Operators

When lift systems come to the end of their operational life, refurbishment rather than complete replacement can often be the best option for future life expectancy. Reduced disruption, building and associated works, shorter programme times and the retention of useful existing equipment can all make it the preferred solution. The decision to replace or refurbish the drive system, however, depends on the age, condition and serviceability of existing equipment and generally, if it can be, will be replaced to ensure long term spares availability, higher efficiency, reduced power consumption and noise output.

The business of refurbishing lifts is a specialist one best left to experts. Those in the business also know that the electrical drive and control systems are specialised and require engineers with knowledge and experience. When University College London wanted to

refurbish the lifts in its office block, it asked consultant Dave Smith to design the system and coordinate the tendering of the project.

The original lifts were driven by Otis 131HT gearless DC drives installed 25 to 30 years ago. It was decided to replace them with an AC solution mainly for reasons of cost, efficiency and maintenance. A gearless drive was selected for power efficiency reasons but also because of size, weight, noise and cost.

The time allocated for total refurbishment of both lifts was 26 weeks on site and the whole project cost about £250 000. The successful tender came from the specialist lift contractor Guideline Lift Services Limited, who chose to use Leroy Somer permanent magnet AC Gearless motors for the first time in the UK.

The UCL project involves two lifts, each with a 1125kg capacity and 42m travel. The Leroy Somer 18.2kW motors are powered via Control Techniques variable-speed drives, Liftstore control panels and travel at a maximum speed of 2.5m/s.

Guideline Managing Director, Alan Knight explains: "We worked with Leroy Somer originally as they were the only independent company that could meet a 3.5m/sec speed specification with a gearless drive for a project we had previously secured. Over the years we have developed a sound working relationship with Leroy Somer and they are now our preferred AC gearless motor suppliers."

The Leroy Somer Z series, permanent magnet, AC synchronous, gearless lift motors are a newly introduced standard product from Leroy Somer. Already, they



are changing the way that many people in the industry feel about lift drive systems.

The benefits of a gearless motor over a geared solution are numerous. Better efficiency and energy saving, less to go wrong, easier maintenance if it does, smoother control, better overall ride quality and all at a lower price. Permanent magnet, synchronous motors take the size and efficiency equation to yet another level when compared to a standard gearless asynchronous solution.

Smith elaborates: "The project went very smoothly, running to time and budget. Everyone is very pleased with the results. In addition to the engineering benefits that we expected, ride quality is much improved and reliability is better. AC motors are much easier to look after than the old DC ones but

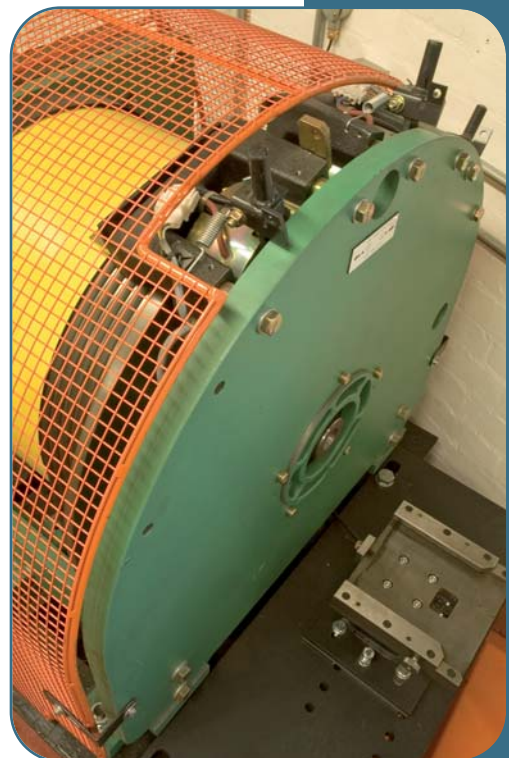
these new synchronous motors are really excellent."

The complete range of Leroy Somer Permanent Magnet Synchronous motors with external rotor is suitable for new installations and refurbishments.

Suitable for loads up to 2000kg (4400lbs) and speeds up to 4m/s (13.2ft/s).

This new range has been designed for low noise which makes them ideally suitable for Machine Roomless Installations (MRL) combined with low vibration levels for increased comfort in the lift car.

The design reduces the need for maintenance when compared to a geared solution but most importantly offers increased level of efficiency necessary in today's environment.



INVERTER RANGE

C
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0.25kW — DIGIDRIVE SK — 132kW

IP21 single phase or three phase chassis mounted standard drive suitable for all applications.



0.75kW — UNIDRIVE SP — 132kW

IP21 universal inverter (U/F, open loop and closed loop) dedicated for special machines. Wide range of application possibilities with specific solutions for hoisting, positioning, winding/unwinding and synchronisation.



45kW — POWERDRIVE — 900kW

Modular inverter in a cabinet (IP21 or IP54) customised to your requirement. This drive can be used to control induction motors or permanent magnet motors.

NEW

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D



0.37kW — PROXIDRIVE — 7.5kW

IP66 chassis design inverter suitable for wash down duty. All features are integrated to enable a localised control including PLC functions.



0.25kW — VARMECA — 11kW

IP65 single phase or three phase inverter integrated in the terminal box with local or remote control. The whole range operates in vector control mode.

NEW

Leroy-Somer motors are being exported to the United States and Canada

Globalisation requires many of Leroy-Somer's customers to have factories in several continents or export their machines abroad. Whether they are multinationals or smaller companies, it is essential to be able to partner them in this by providing them with products complying with local standards, certifications or regulations. Therefore it is necessary to be aware that Leroy-Somer manufactures complete ranges of motors meeting the American NEMA (National Electrical Manufacturers Association) electrical and mechanical construction standards and motors having UR or CSA certification.



LS series three-phase motor
with IP 55 aluminium housing

UR logo certification or certification in accordance with the USA "Underwriters Laboratories" specification

For the American market, Leroy-Somer is developing a specific offer of motors with a nameplate including UR (Underwriters Laboratories Recognized Component) certification indicating that the motor is "recognised" as a component.

The ranges of motors marketed by Leroy-Somer satisfy not only the UR certification requirements but also the EPA federal regulations on energy efficiency.

Leroy-Somer's offer consists of two levels:

Level 1 : Recognition of the insulation system (OBJY2).

All Class F Leroy-Somer products can be manufactured with this insulation system (file E 68554). These motors bear the UR logo and the number E68554 on their nameplates.

Level 2 : Recognition of the complete motor as a component in accordance with UL 1004.

The LS, FLS, FLSC, LSES and LSMV ranges are approved (file E 206450) and the motors bear the UR logo and the number E206450 on their nameplate.

CSA certification

Similarly for Canada, Leroy-Somer offers ranges of motors including the CSA (Canadian Standards Association) mark: these are the LS, LSES and PLS series. The EEV (Energy Efficiency Verification) label shows that the product's per-

Laboratories, which issue the UR mark, and the CSA.

A worldwide service network

Lastly, Leroy-Somer has a subsidiary responsible for selling products in the United States, and a vast service network for providing support to customers in North America.



Rotor/stator assembly for semi-hermetically sealed compressors

formance and energy efficiency have been verified in accordance with the CSA standards; the very high efficiency LSES ranges are examples of such products.

Mutual recognition mechanisms exist between the Underwriters

Sources and links of interest:

<http://www.nema.org/>
<http://www.iec.ch/>
<http://www.ul.com/>
<http://www.csa.ca/>
<http://oee.nrcan.gc.ca/>

Variable speed drive technology

Johnson Controls Denmark ApS, Sabroe Products

Most people are aware that the market for refrigeration products increasingly focuses on energy consumption, reliability, environmental issues and overall costs of ownership.



With these highly valued market needs in mind, the SABCube was created by Johnson Controls Denmark ApS, Sabroe Products. It was invented to fulfil these demands and those of the future. The SABCube compressor is an efficient, reliable and compact solution that completely revolutionises the market for small screw compressors.

The variable speed drive technology has been optimised and combined with both a specially designed Leroy-Somer permanent magnet drive motor and a screw compressor with fewer moving parts and greater efficiency. The SABCube also features an innovative and fully integrated oil management system.

The only external tubing seen on the SABCube is a very short connection at the POV bypass valve system and the oil return line from the coalescer filter – all other components, including the oil cooler, are integrated in the oil separator or the compressor block casing, without compromising easy service access.

Anybody can apply a frequency converter to a screw compressor package and control the capacity by variable speed – the challenge is to avoid vibration and noise in all load situations and, not to forget, avoid additional costs.

The package comes fully enclosed – the combined converter, power supply and control panel are part of the enclosure and fully meet IP 54 protection demands. Both the power electronics and the entire electrical panel are cooled by a separate heat exchanger circuit in the oil cooler.



"Our cooperation with Leroy-Somer has been absolutely crucial during this project, partly because their HPM (hybrid permanent magnet) motor technology fits in perfectly with the SABCube concept and partly because Leroy-Somer has the expertise on variable speed regulation," explains Christian Christensen from Johnson Controls Denmark (Sabroe Products).

Hear less, see less, experience more ...

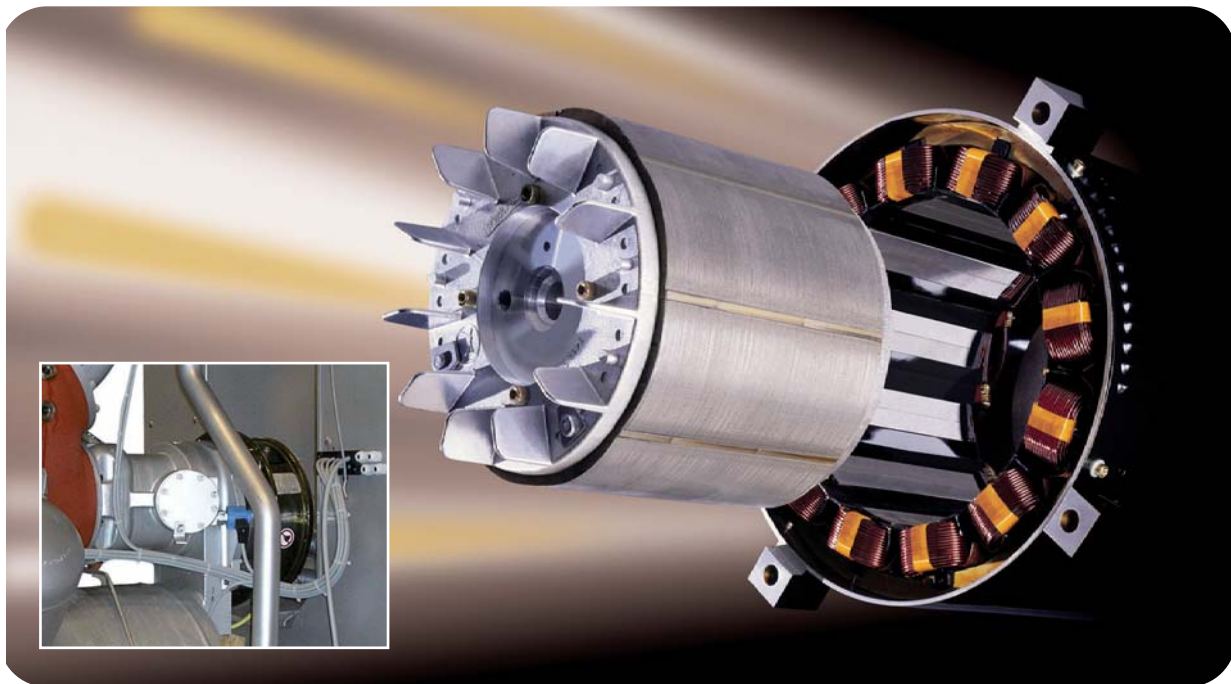
The SABCube compressor is a quiet, compact and efficient solution that completely revolutionises the market for small screw compressors.

The SABCube compressor package reduces energy costs by as much as 30%. It is specially designed to automatically operate at the maximum efficiency available for any required output.



Proven reliability and the unique service concept, with a clear focus on preventive maintenance, result in service cost reductions by no less than 25%.

The SABCube is also extremely compact and quiet compared with conventional fixed-speed compressors.



Revolutionary motor technology

The SABCube is a compressor concept never seen before, with well-proven technology applied in a highly innovative way to achieve exceptional operating efficiency.

Variable speed drive technology has been optimised and combined with both a specially Leroy-Somer designed hybrid permanent magnet motor and a screw compressor with fewer moving parts and greater efficiency.

The SABCube also features an innovative oil management system.

These technologies are all fully integrated into one compact integrated unit that is managed by a Unisab control system.

Onboard drive systems for railway applications

The international rail market has a high potential for growth. With the benefit of more than 40 years' experience and more than 350,000 motors installed, Leroy-Somer offers a complete range of asynchronous or D.C. drives for the rail industry.

Now the company has also established a highly-qualified multidisciplinary engineering team, enabling it to undertake global project management throughout the world.

Type of function and onboard equipment

Whether for use on a High Speed Train such as the TGV (220 mph), a conventional passenger train (70 mph) or an underground train (44 mph), a rail application usually includes five types of function: the pull chain, power supply, production of air, accessibility and comfort.

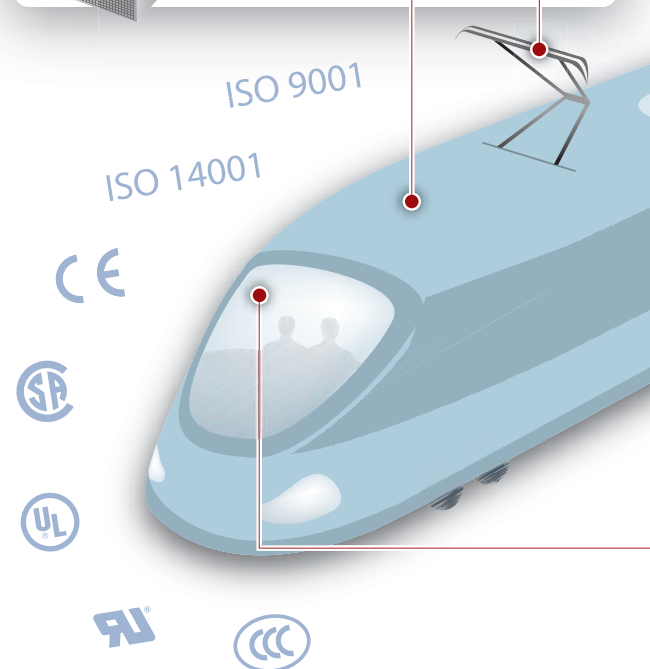
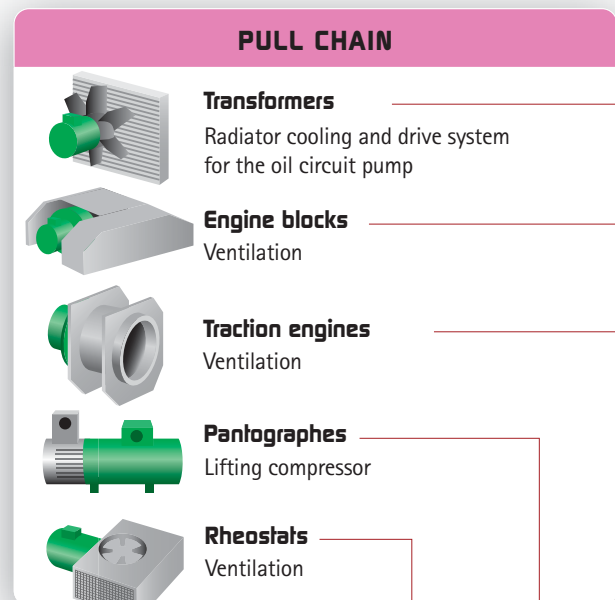
The functions relating to the pull chain and braking constitute the most critical functions. In the event of an anomaly or malfunction, this involves stopping the train immediately! Air conditioning, linked to passenger comfort, or opening of doors, linked to accessibility, constitute other extremely important functions.

The electric motors equipping these functions are subjected to severe mechanical and electrical stress from the onboard railway equipment. Indeed, vibrations, shocks, temperature rises (between -30°C and $+90^{\circ}\text{C}$), and a solid state converter (power supply) which generates low-quality sine waves, are the main stresses encountered, resulting in accelerated ageing of both the motors and the winding in particular.

A complete rail offer

To satisfy the mechanical and electrical requirements of the various international programmes, Leroy-Somer has defined a special offer of onboard drive systems for railways. The proposed range has 4 different levels, depending on the degree of resistance required. Level 2 to 4 motors have, for example, a stator with "coated technology", which has a highly resistant motor core and they are therefore particularly well suited to carrying out the train's vital functions. The first level corresponds to the standard industrial motor.

Reducing maintenance, increasing component reliability, increasing train service life and complying with standards have now become essential criteria for users. They are expressed through such notions as LCC (Life Cycle Cost) and MTBF (Mean Time Between Failure). Level 4 Leroy-Somer motors can satisfy 100% of these requirements with their particularly high MTBF, of around 1.5 million hours!



Always on technology watch

Leroy-Somer's engineering team is totally up to speed with the various requirements of today's market and is supporting the drive for innovation in onboard equipment for rail transport by proposing, for example:

- Revamping solutions on all types of existing rolling stock (replacement of D.C. motors with A.C.

motors, customised motors to fit in the space available, etc)

- Solutions to thermal, mechanical, electrical constraints, plus those affecting logistics and standards, for all the major international programmes: EMU, DMU, Urban and Suburban, locomotives, TGV

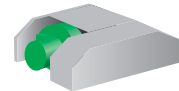
- Continual monitoring of technological change of the power supply for D.C. motors to asynchronous current via high-demand IGBT converters,

- Involvement in the development of "new (brushless) technology" motors, in response to the current requirements for weight reduction, compactness and performance.

NF F 65101 SQ 900 D CEI 349 CEI 77

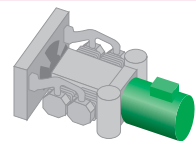
POWER SUPPLY

Auxiliary blocks
Ventilation



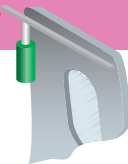
PRODUCTION OF AIR

Braking
Compressor



ACCESSIBILITY

Doors
Opening



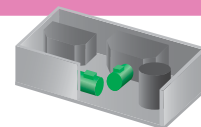
Access for people
with restricted mobility
Platform



COMFORT

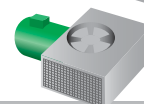
Air conditioning for passengers

Cooling unit fans, condenser fans and extractor fans



Air conditioning for the driver's cab

Cooling unit fans and condenser fans



Millions of tomatoes to sort.
Impeccable hygiene standards.
The cleanliness of a laboratory.
**The objective? To withstand daily
high-pressure cleaning operations!**



THE LEROY-SOMER SOLUTION: THE 3000 IA RANGE

Innovation, performance, flexibility and service.

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