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**Cases**

VLT® drives pay back in 9 months on boiler fans

VLT® control keeps SS Great Britain shipshape and Bristol fashion

VLT® AutomationDrives ensure steady flow of raw materials in Indian steel plant

SyncPos control hots up choc ice production

Frequency converters in the Inner Mongolia

VLT® AutomationDrive ensure speedy and safe opening of blood plasma packages

Earth, wind and power in harmony

**Drives**

The very first VLT® Micro Drive

Extended range of single phase VLT® 2800

Extended power range for VLT® HVAC Drive in IP 55 and IP66

New VLT® AutomationDrive features

**Technology**

Energy analysis in a box

**Relations**

The world on nightshift

# Danfoss Drives awarded for innovation

**Frost & Sullivan presented Danfoss Drives the 2006 Award for Product Innovation, recognizing the ingenuity in helping create a better, more effective, innovative product.**

The award recognizes the excellence demonstrated in the VLT® AutomationDrive - a single, flexible solution to a range of industrial applications requirements. The drive is designed to confer a combination of functionality and ease of use to the industrial user.

**Excellence in development**

The Frost & Sullivan company stated: "Danfoss Drives has demonstrated excellence in its development of an effective variable frequency drive that, like all good products, keeps applications requirements clearly in sight in its design."

**Outstanding achievement and superior performance**

Frost & Sullivan Best Practices Awards recognize companies in a variety of regional and global markets for demonstrating outstanding achievement and superior



performance in areas such as leadership, technological innovation, customer service, and strategic product development. Industry analysts compare market participants and measure performance through in-depth interviews, analysis, and extensive secondary research in order to identify best practices in the industry.

Frost & Sullivan is one of the world leaders in research, training, consulting and corporate strategy based in London, England, and with 25 global offices and more than 1000 analysts and consultants worldwide.



## VLT® drives pay back in 9 months on boiler fans

**Following the installation of a VLT® drive on an 11 kW boiler forced draft fan, Dairy Crest has achieved energy savings of over 47,000 kWh per annum, worth over £1,800, reduced associated carbon emissions by 5.52 tonnes per year and achieved a payback on the investment in only nine months.**

Dairy Crest Severnside in Stonehouse Gloucestershire is one of the most modern milk processing sites in the UK, producing fresh milk, butter, cream, buttermilk powder, skimmed milk concentrates and powder. The site is a very large steam energy user, the majority of the steam being used for the processing of dairy products and the steam boilers represent a major element of the site's £1.8 m annual utilities bill.

In 2000, Dairy Crest became a participant to the negotiated Climate Change Energy Agreement and since then, in the quest for energy savings, has invested in improved boiler control among other measures. One of the energy saving opportunities identified was associated with the low pressure (100 psi) boiler. Rated at 4,230 kg/hr of steam, this boiler was supplying an average of 2,200 kg/hr, only 52 % of its capability.

### **Inaccurate and wasteful damper control**

Combustion control was effected by damper control of the forced draft fan which was inaccurate and wasteful.

Craig Pepworth, Dairy Crest's Electrical Engineering Manager, initially considered

reducing the size of the boiler burner to match the steam load, which would have allowed them to reduce the size of the forced draft fan motor. However, process steam demand would eventually increase at some future point when new products were introduced, which ruled out any reduction in boiler capacity.

### **Improved control of the fuel/air ratio**

After consultation with the boiler burner manufacturer Saacke, it was established that more efficient control would be achieved through fitting a new electronic fuel control system and a variable speed controller to the forced draught fan motor. These simple retrofits would provide full optimisation through improved control of the fuel/air ratio. The drive speed would be regulated via a 4-20mA signal from the direct digital combustion controller (DDCC) and the drive in turn would provide a 4-20mA feedback signal back to the DDCC.

### **Reduced fuel consumption**

In addition to good electrical savings from efficient speed control of the motor, a reduction in fuel use on the boiler was expected and the electronic control

system would replace the mechanical system of fuel control, thereby reducing maintenance. Fan motor life would also be extended and fan noise levels would be reduced.

## Pay back measurements

Payback on the investment in variable speed control was initially calculated at less than one year. To substantiate this, initial measurements were taken on the fan under damper control over a full year of operation. During 264 days running, the measured power taken by the 11 kW motor was reasonably constant at about 9.75 kW. The motor consumed 61,776 kWh, a running cost of £2,471/year.

Energy measurements were taken follow-

ing the retrofit of the new fuel system and the Danfoss VLT® 6000.

Average power consumed had reduced to 2.30 kW at 32 Hz running frequency. Extrapolating this average figure over a typical year of operation gives an annual energy consumption down to 14,572 kWh, and costs of £582 per year, an annual saving of £1,889.

The total installed cost of the Danfoss drive was £1,400 giving a return on investment in just 9 months. Equally important, a reduction in CO<sup>2</sup> of 20,294 kg was achieved.

## Installed the drive without help

“We are really happy with the new variable speed drive and boiler fuel control

system”, says Craig Pepworth, Dairy Crest.

“I installed the VLT® drive myself and found it simple to set up, and as a result, I have installed many similar drives on other plant in the factory. In addition to saving us money, the drive has made my life a little easier through reduced maintenance requirements on the boiler.

We are always looking for opportunities to reduce our energy consumption and costs, and this modification to the boiler has made a valuable contribution towards our commitment to savings under our climate change levy negotiated agreement. We are aware that we can claim valuable tax breaks from fitting energy saving equipment and, as a company, will take advantage of this benefit in the future”.



## VLT® control keeps SS Great Britain shipshape and Bristol fashion

**Beneath the water surface - separated by a glass plate - moisture is removed from using a specially designed air-handling unit operated 24 hours per day, 7 days per week by VLT® 6000.**

When she was launched in 1843, Brunel's SS Great Britain was the world's largest, screw propelled, wrought iron steamship. Built in the Great Western Dockyard in Bristol, she had a distinguished history as the world's first ocean liner, carrying emigrants to Australia and as a troop ship during the Crimean War but an ignominious end as a storage hulk in the Falkland Islands.

Now she is home again in Bristol and nearing the completion of an £11.3 m restoration supported by the Heritage Lottery Fund. Visitors to the ship, from July will have full access to all parts of

the ship, as no passenger of her heyday could, and will be able to see her in all her Victorian splendour.

### **Dry beneath water level**

A major aspect of that work is to stabilise the wrought iron hull and protect it from the ravages of further corrosion. The most innovative part of that work consists of constructing a sealed glass plate around the waterline of the ship to form a giant airtight chamber surrounding the ship's lower hull.

The glass plate will be covered with a 50mm layer of water, so that the ship appears to be floating at anchor.

Beneath the glass plate, moisture will be removed from the air using a specially designed air-handling unit operating 24 hours per day, 7 days per week. It consists of two sections, a process section within which air will be passed through desiccant in a hygroscopic wheel to remove excess moisture and take the humidity within the dock down to RH 20% - about



*Dehumidification ducts being installed aboard the restored SS Great Britain.*



*A water covered glass plate will create the illusion that the SS Great Britain is afloat*

the same as the Arizona desert. Within the regeneration section, direct fired gas heaters dry the desiccant after which the air is passed via the heat recovery system to the exhaust port.

A similar but larger unit will be installed within the ship's boiler room to control the ship's internal temperature and humidity and thus protect the hull both externally and internally from corrosion.

### **15 kW VLT® 6000**

The temperature and humidity control system is being provided by Tour Andover Controls, South West division. They specified a 15 kW VLT® 6000 drive to power the process supply fan for the enclosed dock, controlling volume between 5.7 m<sup>3</sup>/sec and 1.7 m<sup>3</sup>/sec, facilitating energy efficiency when ambient humidity is low. The larger system within the ship will utilise a 55 kW drive to provide up to 13 m<sup>3</sup>/sec of controlled air circulation.

Control is exercised via wireless temperature and humidity sensors, 3 along each side of the ship and 16 inside her.

Every 30 seconds, readings are transmitted to the receiver in the ship's plant room and relayed to the Ship's Management System via the Ethernet communications system. PID control averages out the humidity reading and controls the dryer burner rate.

Fan speed is linked to the burner rate and the fans are run at full speed when the regeneration burner rate exceeds 20 % output. When the ship and museum are closed and output to the regeneration burner drops below 20 %, the fan operates at its preset low speed.

The circulating air temperature is controlled by an indirect gas fired heater battery and a water cooled chiller battery in the air path to maintain temperature between 160° C and 230° C. Should the cooling requirement exceed 15 % at times when the visitor centre is open, then fan speed is increased to maximum to achieve a more rapid return to the preferred control zone.



## Steady feed control

### **VLT® AutomationDrives ensure the steady flow of raw materials in Indian steel plant**

In 2005, India-based Neepaz Metaliks LTD established a new mini-integrated steel plant. After thorough comparison Neepaz Metaliks chose the VLT® drive from Danfoss.

The high ambient temperature in the steelworks was one of the main reasons why the customer chose Danfoss. It was important that the drive would function without problems in the extreme working environment, which not only is hot, but also dusty.

A total of 26 VLT® AutomationDrives and 6 VLT® 5000 drives have been supplied and installed at different points

in the three-step production process. The main use of the drives is to control the feed of raw and processed materials throughout the melting and casting processes.

#### **Very little support needed**

All drives were supplied with Profibus connectivity, and the customer was able to install them with just a little support from Danfoss, proving another important advantage: The VLT® AutomationDrive is easy to handle.



## VLT® SyncPos control hots up choc ice production

**At Frederick's Dairies ice cream plant in Skelmersdale, they try to meet a seemingly insatiable demand for choc ices, manufacturing, on just one of its lines alone, close to 1,000,000 choc ices daily, from May to September. At this rate of production, downtime is costly so system reliability is critical.**

Twenty four continuous lanes of solid ice-cream bar flow from the blast freezer, to be cut-to-length and enrobed in chocolate before passing through the after-cooler to solidify the chocolate. Every 2 seconds, a line of 24 choc ices drops into a 24 to 12 transfer plate which is mechanically linked to the wrapper. The cam-driven transfer plate then flips back to a horizontal position and offset push rods position 12 of the ices in the 12 wrapper lanes, leaving the remainder on a receiver plate.

The receiver plate moves one position sideways and the remaining 12 bars are pushed into the wrapping lanes, before the next 24 bars are received from the transfer plate.

The cutter, chocolate enrober and after-cooler are all ac variable speed driven from the same 0 - 10v speed reference. Synchronism between the cutter and the wrapper/transfer plate is critical. Otherwise there would be frequent jamming of the line with significant loss of production.

### **Frost disturbed synchronisation**

Initially a through beam photocell on the end of the after-cooler plus a proximity switch on the transfer plate formed

a timer/counter feeding to a PLC which corrected the 4 - 20 mA speed signal to the Danfoss VLT® wrapper drive, keeping the wrapper in sync with the cutter.

This was frequently problematical because of the low ambient temperature, with mist forming in front of the photocell or condensation forming on the lens and subsequent loss of synchronisation. Curling of the edges of the after-cooler conveyor-belt, or loose strands of the belt, also caused false triggering and sync loss.

As often as not, the operators would disconnect the photo-cell and run the line without autocompensation.

Without continuous corrective input via manual speed correction buttons, the line would lose sync and frequent product pile-ups did occur.

### **VLT® SyncPos**

When the ageing wrapper drive was replaced with a new, physically smaller VLT® 5000 drive, Mike Sexton, Electrical Systems Manager at Fredericks decided to install the optional Sync-Pos feature.

By fitting encoders to the cutter and wrapper drives and deriving marker pulses from proximity switches fitted to the cutter and transfer-plate bottom posi-

tions, the optical system and the PLC could be superseded. Add/subtract position increment pushbuttons at the after-cooler operator station were added to enable fine-tuning of the positioning to be achieved simply by the line operators during production.

“Position synchronisation using the Danfoss Sync-Pos card alone is accurate enough to ensure that the transfer plate is always in the correct position to receive the choc-ices after each cycle and requires only occasional adjustment via the offset buttons to compensate for ice build up on the after cooler belt drive roller, which happens after several days non-stop production,” remarked Mike Sexton. “I also found commissioning the Sync-Pos system surprisingly simple. We modified

the system during a short maintenance window and commissioned it ourselves. Everything fitted into the existing control panel which saved quite a bit of time and cost. During commissioning we made a couple of phone calls to Danfoss for clarifications but apart from that the calculations and settings were straightforward and the line now runs problem free with significantly improved production”







## Frequency converters in the Inner Mongolia

**In 2004 North China Power Engineering Institute started the construction of the Fengzhen Power Plant in Inner Mongolia. Beijing International Trust and Investment Corporation Limited invested almost RMB 6 billion Yuan (about US\$ 747 million) in the power plant, which will have a capacity of 2 x 600 MW when finished.**

**114 VLT® 8000 drives was provided for the plant.**

Danfoss Drives has been involved in the project since the beginning of 2004 when the first contact to North China Power Engineering Institute and Fengzhen Power Plant was established.

Danfoss provided knowledge about applications of frequency converters, technological features, system solutions, etc., and prepared a complete and reliable technical plan based on application characteristics of cooling fans.

### **Long motor cables**

Danfoss VLT® frequency converters are equipped with a 300-meter long motor cable and built-in DC link reactors, which solve the problem of harmonic disturbance.

### **Service around the clock**

An important issue for the power plant is Danfoss' ability to serve customers 24-hours per day.

Due to the rapid and sustained development of its economy, China has experienced constant power shortages over the past few years. Therefore the National Development and Reform Commission have directed investments to building power plants all over the country, particularly in the north-western part of China.

Because of rich coal reserves in this part of the country and the insufficient power supply, it is an efficient solution to construct power plants in direct connection to mines.



## Clean cut – safe cut

**The PLASCUT 591 from cutter specialist MAGURIT uses the VLT® AutomationDrive with its "Safe Stop" feature to ensure the speedy and safe opening of blood plasma packages.**

Drugs and vaccines based on blood and blood plasma are crucial in the treatment of many illnesses or injuries, such as bleeding disorders, immune system deficiencies or extensive skin injuries. Therefore, all handling of blood related products needs to take place under controlled, clean and safe conditions.

The PLASCUT 591 is a six-chamber rotation bag cutter that is designed to open 30 bags of frozen blood plasma per minute swiftly and safely.

Operation is simple: The machine operator places the bag manually in one of the chambers that then rotates, passes a cutter and ejects the now open bag onto a workbench for further processing.

### Swift and precise control

It is a fast process that requires swift and precise control to ensure the highest levels of hygiene and efficiency.

This is supplied by a VLT® 2800 that controls cutting depth and a VLT® AutomationDrive that synchronises the rotating table.

Exactly one second passes from loading until the chamber moves on to its next position. But if the next bag is not yet in place the machine pauses until it has been inserted by the operator.

### Safety first

Safety is a key issue for drives at all times, which is why light curtain above the chambers is connected to the special "Safe Stop" input in the VLT® AutomationDrive. If the curtain is disrupted during operation, i.e. by the hand of the machine operator, the frequency converter disables the power to the motor and stops the machine immediately.

After being stopped the process can only be reactivated when confirmed by the operator. The integrated Smart Logic feature displays the confirmation on a screen and only starts the machine again when the light curtain senses there is no more danger for the operating personnel.



*The cube has the remarkable dimensions of 10 x 10 x 6 meters and is the logo for the electric power company RWE.*

## Earth, wind and power in harmony

**A turning cube sculpture is rotating on the top of a 96-meter high tower block in the middle of Essen, Germany.**

A turning cube sculpture is rotating on the top of a 96-meter high tower block in the middle of Essen, Germany.

The cube has the remarkable dimensions of 10 x 10 x 6 meters and is the logo for the electric power company RWE. The cube moves on a rotary joint controlled by a VLT® frequency converter and a Danfoss Bauer geared motor.

Hoerner Corporate Branding in Eberstadt projected and produced the cube. Danfoss Drive Center "Klebs + Hartmann" in Ludwigshafen assisted in developing the right dimensions for application of the frequency converter.





## The very first VLT® Micro Drive

### The very first VLT® Micro Drive off the production line

Development of the new VLT® Micro Drive has entered its final stage - on target for global Introduction in December 2006.

The VLT® Micro Drive is a general purpose drive, to be provided via distributors and directly to OEMs.

The drive is easy to install and easy to use. Mount the drive, connect the mains and the motor, press the start button, turn the potentiometer on the control panel, and the motor is running. No programming is needed.

To facilitate the demands from OEMs a simplified yet comprehensive AutomationDrive parameter set has been implemented. Terminal and parameter numbers are all inherited from the FC 300 series.

The new VLT® Micro Drive is a true VLT® quality product.



## Extended range of single phase VLT® 2800

**Danfoss Drives now provides single phase VLT® 2800 drives up to 3.7 kW / 5 HP .**

Danfoss Drives now provides single phase VLT® 2800 drives up to 3.7 kW / 5 HP.

The drives are equipped with the same hardware features as the successful VLT® 2800 units already introduced.

The drives will be available in bookstyle IP20 and Nema1 (VLT® 2840 only).

The power range for single phase VLT® 2800 is now from 0.37 to 3.7 kW (0.5 – 5 HP).



## Extended power range for VLT® HVAC Drive in IP 55 and IP66

**VLT® HVAC Drive in IP21/55 now comes in up to 55 kW and IP66 enclosed up to 30 kW.**

VLT® HVAC Drive is now available in enclosure class IP21 and IP55 up to 55kW, 380-480V, and in IP66 up to 30kW, 380-480V.

**New features**

Both coated and non coated versions can be ordered directly, as can versions with or without Safe Stop functionality.



## New VLT® AutomationDrive features

- **Hoist mechanical brake**
- **Faster power up times**
- **Choose warning or alarm**
- **Reverse possible in torque mode**
- **Converter VLT® 3000 to VLT® AutomationDrive**

### Hoist mechanical brake

The new functionality is applied in the situation where the mechanical brake is released. The VLT® AutomationDrive will monitor the holding torque and release the mechanical brake when the torque is sufficient.

The functionality requires Flux control and closed loop.

The functionality is similar to the known special VLT® 5000 Crane-feature.

### Faster power up times

Power up times on both VLT® AutomationDrive FC301 and FC302 are significantly reduced.

### Choose warning or alarm

The alarm signal can be replaced by a warning in the safe stop function.

The safe stop functionality is unchanged.

### Reverse possible in torque mode

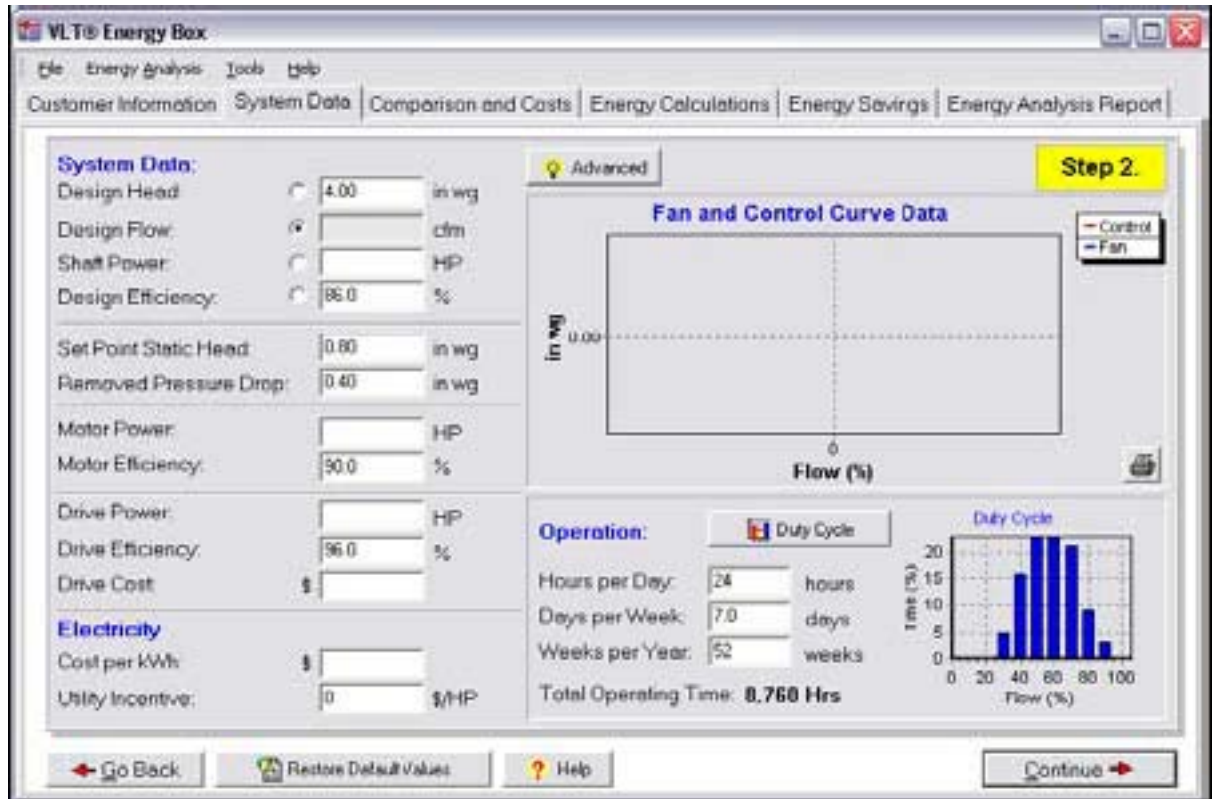
In torque mode, the drive have until now overruled reverse signals and continued constant torque in same direction.

Now it will react and reverse when receiving the reverse signal.

### Converter VLT® 3000 to VLT® AutomationDrive

The MCA113 Profibus converter option can be used when substituting a VLT® 3000 Profibus DP unit with a VLT® AutomationDrive.

The option understands the VLT® 3000 parameter read/write requests and map them into the VLT® AutomationDrives parameter structure.



## Energy Analysis in a box

**With energy costs on the rise, it's no wonder there's increasing demand from builders and building managers for energy analysis tools.**

**Costs and payback time are the main concern, but legislative actions and rising environmental concerns are also stepping up needs for accurate energy data.**

Energy represents 30 percent of a typical office building's costs and is a property's single largest operating expense. That consumption can be cut by 25 percent or more through retrofits, improved operation, and energy savings technology, including installation of frequency converters. Energy analysis to develop efficient designs also greatly benefits new construction.

Calculating how much energy a building consumes and how to reduce energy use, however, requires the right software tools. Manufacturers of HVAC (heating, ventilation, and air conditioning) equipment often provide energy analysis programs to help customers find solutions to rising utility costs. "From a customer perspective, there is a need to identify what kind of actual savings he'll achieve if he installs a frequency converter on a fan or pump," says Ken Fonstad, Danfoss HVAC training manager.

Danfoss constantly develops its own en-

ergy analysis tools to provide the most accurate picture of HVAC system energy use. The latest release, VLT® Energy Box, incorporates high levels of flexibility and user-friendliness for users around the world. Keith Kempster, Danfoss global application specialist, explains, "We test each software release to ensure that it meets the global needs of customers."

### Software with a history and a future

Fonstad developed the first version of the software about two decades ago, and since then has worked on the software to include more features to meet customers' demands.

"Estimates until now haven't taken into consideration all the factors, such as what it takes to maintain the equipment over several years, what it takes to install the device, and so on," he explains. "This software gives a more accurate picture. The latest version of VLT® Energy Box allows the customer to make a simple analysis or

a more complex one, depending on the kind of output he needs." The program also takes into account the complete system control curve and allows the user to customize the fan or pump curve to accurately model specialized types of equipment.

The program takes the user through a simple 7 step process to calculate energy savings.

The software's capabilities will soon expand even more with the launch of the new VLT® HVAC Drives later this year. "The program will communicate directly with the drive," explains Mark Hansen, director business development for HVAC Danfoss Drives.

"When used with the new drives, it will also be possible to do a post-analysis of the drives performance."

### **Nine-month payback for geothermal system**

The VLT® Energy Box software has proven to be an effective tool for determining payback time on investment in drives, and also to determine energy-loss points in a system.

One university used the VLT® Energy Box software to determine how installing VLT® Series variable frequency drives could increase the energy efficiency of a water-source heat pump. A multi-story building, first constructed in 1979, had

gone through several expansions and renovations. The university decided to analyze energy use in this building, which includes health science classrooms, laboratories, offices and two libraries.

Water-source heat pumps efficiently heat and cool the building by using geothermal energy – heat transferred between the building's HVAC system and deep wells in the earth. A 55 kW constant speed pump is used to continuously circulate water so that it is always available to meet the building's heating or cooling demands.

An analysis of the system showed that a pressure of 25 m of water is required to provide the flow in the system. However, the pump provides 38 m of pressure when it is run at full speed. The pressure delivered to the system was reduced from 38 to 25 m by partially closing a throttling valve. This pressure drop and the continuous flow caused a significant energy loss. Although the pump's capacity could be reduced by trimming its impeller, this would require shutting down the system, disassembling the pump, machining its impeller, and reassembling the pump.

Trimming the impeller also reduces the efficiency of the pump and makes it difficult to later increase the capacity of the pump.

An analysis was made using VLT® Energy Box to determine if it would be more eco-

nomical to open the valve fully and use a VLT® 6000 Drive to control the speed of the pump and thus the flow from the main circulation pump. This would eliminate the need to introduce a 13 m pressure drop across the valve, since the drive would simply slow the pump so that it produced the required pressure and flow. The program also provides a place to enter the 13 m pressure drop that will be removed from the system when the throttling valve is replaced by a drive.

While analyzing the system, power measurements indicated that the motor produced 47 kW at the pump's shaft. The program allows the shaft power to be entered directly so that it can take into account any efficiency losses that result from running the motor at less than full load.

Even when including installation and start-up costs for the drive system, the payback period in this case will be less than 9 months.

The VLT® Energy Box software is freely available and used by customers and consultants in conjunction with Danfoss sales and application engineers.

"The program is not only useful for pre-selling VLT® drives and helping the customer to determine the energy savings he will achieve, but it can also help the customer to troubleshoot energy losses," adds Hansen.





## The world on nightshift

**The conversation is lively when the team enjoys a break in the canteen, despite the fact that the nightshift team in the Danfoss Drives factory in Graasten, Denmark, represents five nationalities.**



Thavaruban Perinpam – called Ruban – comes from Sri Lanka, Betty Jørgensen comes from the Philippines. Hanne Christensen, Michael Lemke, Nadja Budde, Max Chr. Beck and Walid S.Z. El Tawancy come from Denmark, Germany and Egypt. They speak to each other in Danish. “If one of us turns the words upside down, others, of course, correct us,” says Betty Jørgensen. “But the worst problems occur when the Danish people fall back into the local dialect”, says Ruban. “Then it’s literally impossible for others to understand”.

Political issues are rare in the conversation, but everyone is interested in cultural aspects in the different countries. Once Walid S.Z. El Tawancy brought items from Egypt to show his colleagues and told about life in his homeland.

### Positive shock

Walid S.Z. El Tawancy experienced what he calls a “positive shock” when he was employed at Danfoss. “I met a very open attitude and readiness to help,” he says. Nadja Budde agrees. Like Ruban and Walid, she is temporarily employed on her holiday from study, where several of her colleagues have different ethnical backgrounds. “We talk with each other in another way here”, she says.

