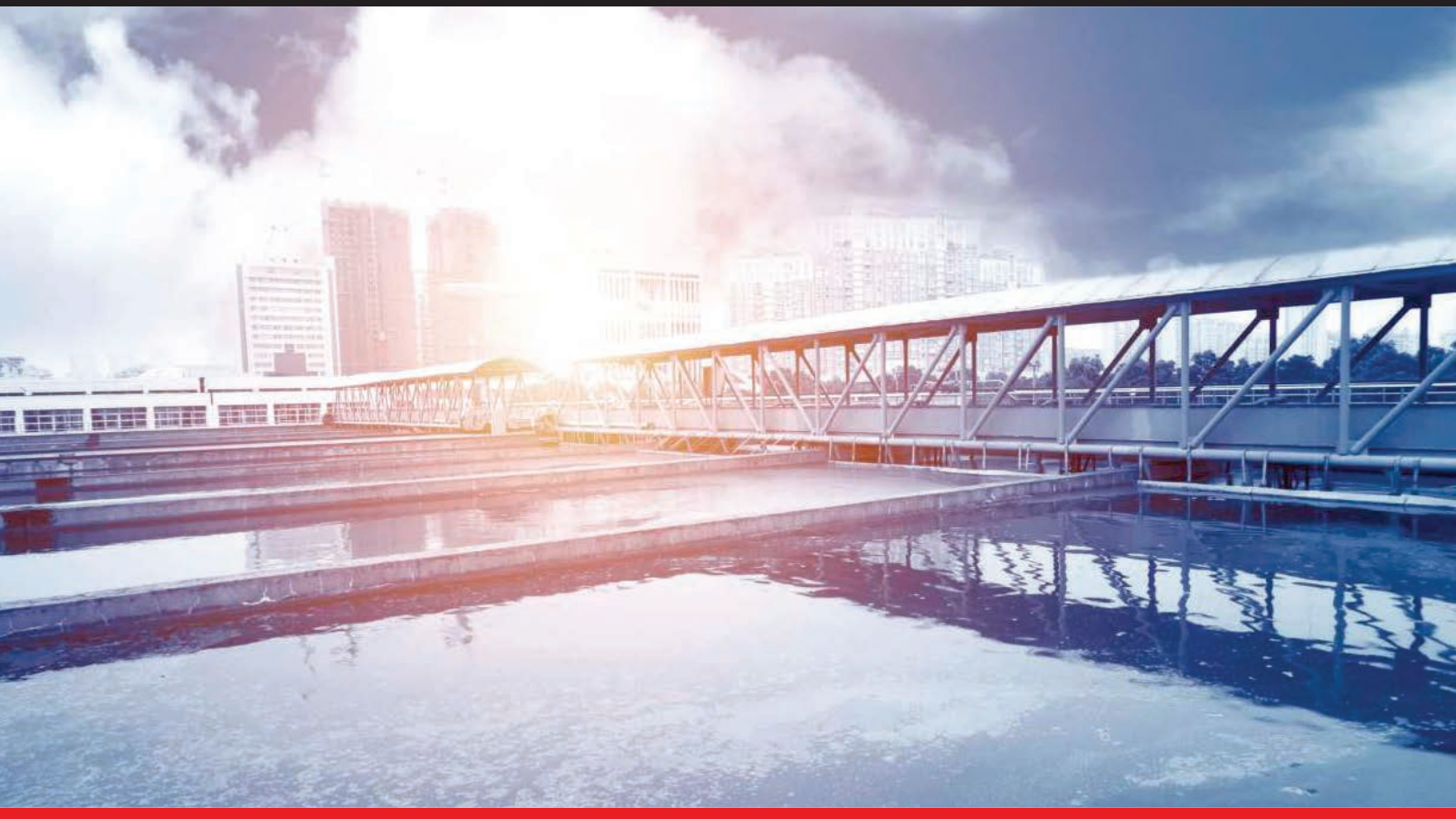


VLT® | VACON®

VLT® AQUA DRIVE

Product Overview

BEE 4
EMPOWERING SUPPLIER

ISO 9001	Certified
ISO 14001	Certified
ISO 45001	Certified

ABOUT US

Established in 1974 as a single bearing shop in Durban, South Africa; BMG's aggressive growth strategy has included acquisitions, supplemented by a steady organic growth discipline. BMG attracts best-of-breed talent resulting in technical expertise that differentiates BMG in the industry. Staff are truly part of the BMG family and its success.

BMG boasts an accredited in-house technical and commercial training academy which fosters a culture of staff development and career advancement; it's all about sustainability.

The net result, is a company that reliably supplies and supports 70 000 customers in 15 countries with the widest range of industrial engineered products and expert services in Africa via 105 branches.

BMG is positioned to deliver bespoke 360 degree solutions to its customers, and subsequently return on investment to its investors and shareholders. BMG plays a pivotal role in supporting the productivity and production targets of all Industrial, Manufacturing, Mining and Agricultural sectors of the economies in the countries it serves. With an enviable reputation as Africa's largest distributor, manufacturer and service provider of the highest quality engineering consumables and components; including

- Bearings & Seals
- Power Transmission Components
- Drives, Motors and Controllers
- Hydraulics, Pneumatics and Filtration
- Heavy and Light Duty Materials Handling
- Valves and Lubrication
- Fasteners, Gaskets and Tools

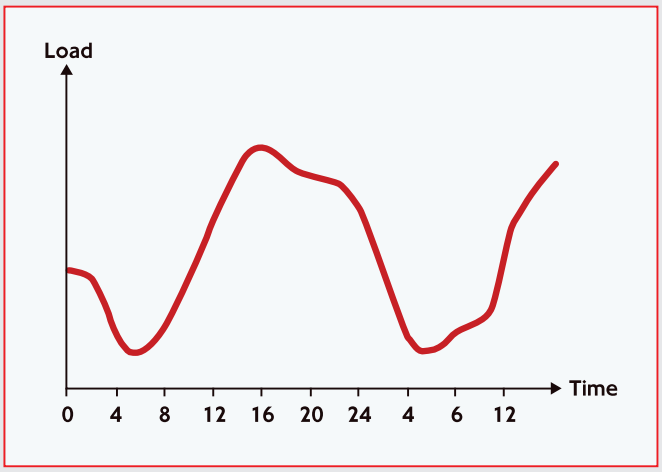
BMG is a level 4 BEE contributor with ISO 9001 Quality Assurance certification. Health and safety of its employees and customers is a paramount focus and the company adheres to ISO 45001. BMG is also committed to environmental care and sustainability and strictly follows the ISO 14001 charter.

As a key contributor to the Invicta Holdings stable, BMG has played a major part in Invicta's unique achievement of being rated in South Africa's Top 100 Companies for 21 consecutive years.

In Modern Plants, Energy Saving is Part of the Cost Equation

This wastewater treatment plant in Denmark redefined energy use based on an advanced process control and an extensive use of VLT® AQUA Drives. It is no longer a question of 60% energy saving, but rather a net production of energy from the whole plant.

The considerable daily load variation in water or wastewater treatment plants, makes it economically attractive to install control handles on all rotating equipment such as pumps and blowers. The new generation of the VLT® AQUA Drive is the ideal choice for the water industry, giving you precise control and a perfect match for all your applications.



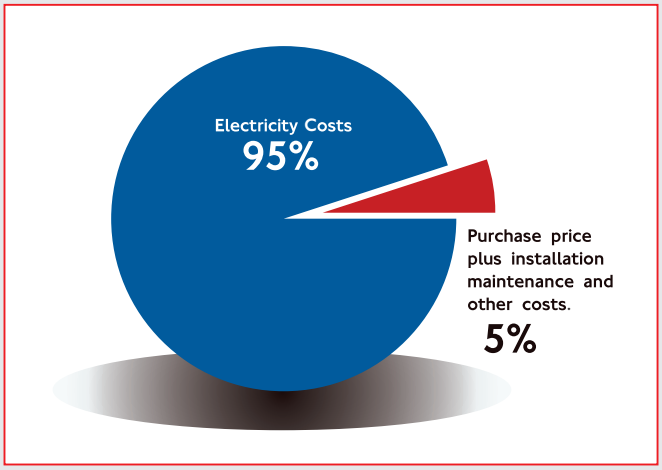
Benefits

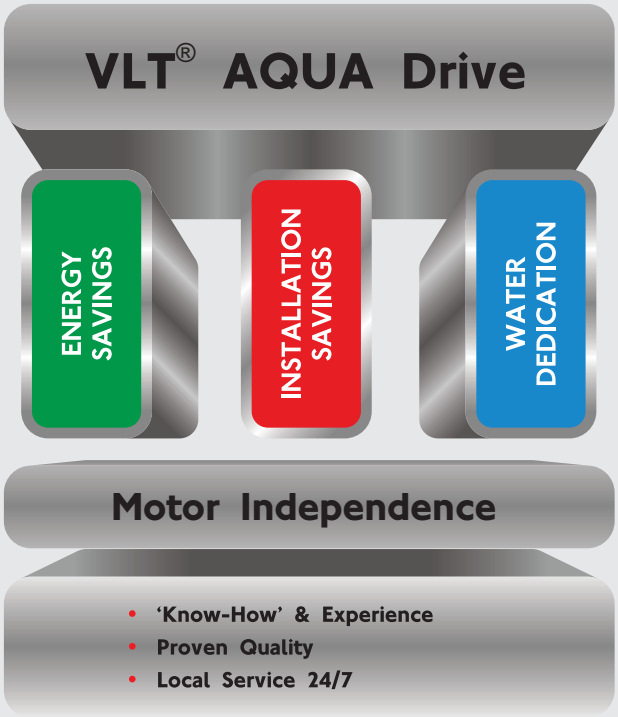
- Improved Water Quality
- Improved Asset Protection
- Lower Maintenance Costs
- Reduced Energy Costs
- Higher Plant Reliability/Performance

Small Investment - Big Returns (Lifetime Savings)

Over the past few decades, the relative cost of Variable Speed Drives (VSDs) have dropped and energy prices have increased. This makes it more attractive to use VSDs on most rotating equipment. Energy costs are a dominating economical factor over the lifetime of the VSD. The energy efficiency of the VSD must therefore be a key selection parameter.

The new generation of VLT® AQUA Drives are 0.5-2% more energy efficient in comparison to traditional drives in the same range.





VLT® AQUA Drive

The new generation VLT® AQUA Drive is built on a solid foundation of 'know-how' and experience. Combined with Danfoss' quality and BMG's network with 24/7 local service, we guarantee rock solid reliability.

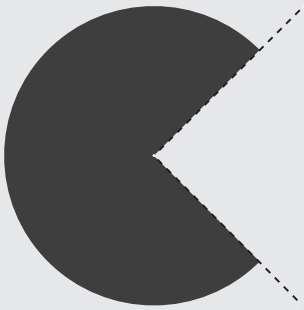
- **Fits All Motors**
  Danfoss is the world's largest dedicated and motor independent VSD supplier. By keeping at the forefront of control algorithms for new motor technologies, BMG offers you a choice between motor suppliers.

- **A Powerful Combination**
  Three pillars raise the performance of the VLT® AQUA Drive to new heights. Our unique combination of energy saving, reduced installation costs and a solid dedication to all your water applications, sets the new generation VLT® AQUA Drive above the competition when it comes to overall lifetime savings.

- **Up to 30% Cost Savings in the First Year**
  With powerful new features and functions, the VLT® AQUA Drive can realistically offer cost savings between 10-30% in the first year, relative to the investment made in the drive, in comparison to traditional drive solutions.

Market Leading Energy Efficiency - Save up to 25%

Our tight focus on energy efficiency at every stage of development, including the net efficiency when the VLT® AQUA Drive is installed, means that you get a drive that delivers cost savings of up to 25% of your investment first year, in comparison to traditional VSD solutions. That's the equivalent to the savings gained by choosing an IE3 motor instead of an IE2 motor.



EFFICIENCY

5 reasons to choose the new VLT® AQUA Drive

1. Energy Efficient VSD Design
2. Intelligent Heat Management
3. Automatic Adaption to Application
4. Energy Efficient Harmonic Mitigation
5. Optimal Control of all Motors

Energy Efficient Design

The new generation VLT® AQUA Drive's control algorithm and design focuses on reducing heat loss to maximise energy efficiency.

Intelligent Heat Management

A unique back channel cooling concept transfers up to 90% of heat away from the room. This results in large energy savings on unnecessary air conditioners.

Automatic Adaption to Application

Around 90% of all motors are oversized by more than 10%. AEO functionality can deliver energy savings of around 2% at 90% load, with typical savings of up to 5% over the whole range.

Energy Efficient Harmonic Mitigation

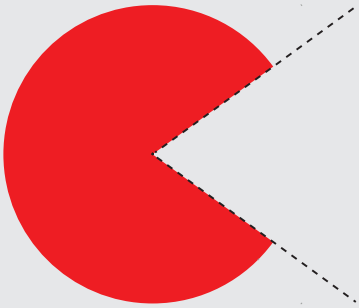
Our unique VLT® Low Harmonic Drive with integrated AFF filters delivers an energy efficiency that is 2-3% better in comparison to traditional VSDs with Active Front End technology. The 'Sleep' function at low load secures further energy savings.

Optimal Control of All Motors

The VLT® AQUA Drive's capability to efficiently operate different motor types in the market, secures you a free choice between motor suppliers. One of the latest developments is for high speed permanent magnet motors. The unique Danfoss VVC+ control technology is ideal for high speed turbo blowers using permanent magnet motors, offering 0.5 to 3% additional installed energy savings in comparison to traditional VSDs.

Installation Savings & User Friendliness - Save up to 20%

Based on our lengthy experience with the first ever dedicated water and wastewater drive on the market, the new generation VLT® AQUA Drive offers highly efficient installation and commissioning solutions which, compared to traditional VSDs, offer cost savings between 10-20%.



SIMPLICITY

8 reasons to choose the new VLT® AQUA Drive

1. Less Panel Space
2. Direct Outdoor Installation
3. Long Cable Capacity as Standard
4. Reduce Air-Conditioning Investment
5. Integrated Harmonic Mitigation
6. Printed Circuit Board Protection as Standard
7. Easy Commissioning
8. Minimum of 10 Years Lifetime

Less Panel Space

The unique combination of a VLT® Low Harmonic Drive with integrated AAF filters, the ability to install the new generation VLT® AQUA Drive side-by-side and its compact design, offers a space-friendly package when the complete solution is installed.

Direct Outdoor Installation

As a standard, Danfoss offers VSDs in IP 66/NEMA 4X. In addition to the convenience of having the VSD close to the pump, this reduces cable costs, removes the need for air-conditioning and lowers control room costs.

Long Cable Capability as Standard

Without the need for additional components, the VLT® AQUA Drive provides trouble-free operation with cable lengths of up to 150 m screened and 300 m unscreened.

Air Conditioning Investment Reduced by 90%

The unique Danfoss back channel cooling system offers a reduction of up to 90% in investment for air cooling systems that remove heat from the VSDs.

Integrated Harmonic Mitigation

The VLT® AQUA Drive is delivered with integrated harmonic mitigation solutions to a standard THDi level of 40%. This saves space and costs while making the installation easier.

Printed Circuit Boards

From 90kW, the VLT® AQUA Drive comes as a standard with a 3C3 class PCB coating, to ensure a long lifetime even in harsh wastewater environments.

Easy Commissioning

Whether it's a 0.25kW or 2MW drive, you get the same control panel, the new 'SmartStart' function and many other time-saving features.

Designed for a Minimum Lifetime of 10 Years

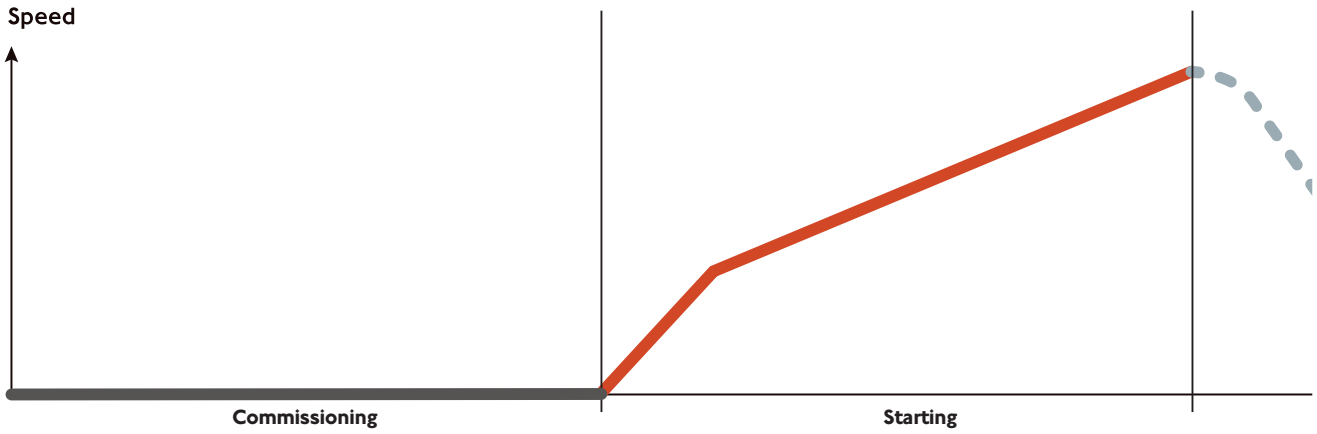
With the VLT® AQUA Drive's high-quality components, a maximum of 80% load on components and intelligent heat management that reduces dust on PCB's, the need for routine scheduled parts replacements, such as electrolytic capacitors and fans have been removed.

An Unsurpassed fit for all Your Water Applications

The new generation VLT® AQUA Drive is a perfect match for all water and wastewater applications. Specially designed software features help protect your assets in many ways, for example, by avoiding water hammer, reducing maintenance on pumps, blowers and by saving additional energy in comparison to traditional VSD controls.

The new generation VLT® AQUA Drive gives your rotating equipment the best possible lifetime, with the lowest energy consumption and maintenance costs, all while protecting your assets.

The New Generation VLT® AQUA Drive has Features for all Operation Conditions, from Commissioning to Stopping.

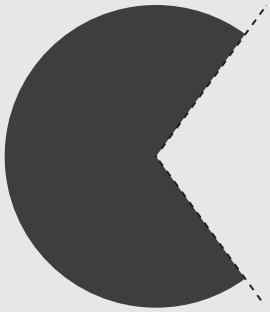


Commissioning

- "SmartStart"
- Quick Menu "water and pumps"
- Motor Independency
- Automatic Motor Adaptation
- Single and Multiple Motor Applications
- Constant and Variable Torque
- 4 Setup Options
- Multi-zone
- 3 PID Controllers for Additional Equipment
- Smart Logic Controller

Starting

- Pre-Lubrication
- Deragging
- Pipe Filling
- Initial Ramp
- Advanced Minimum Speed Monitoring
- Flow Confirmationers for Additional Equipment.

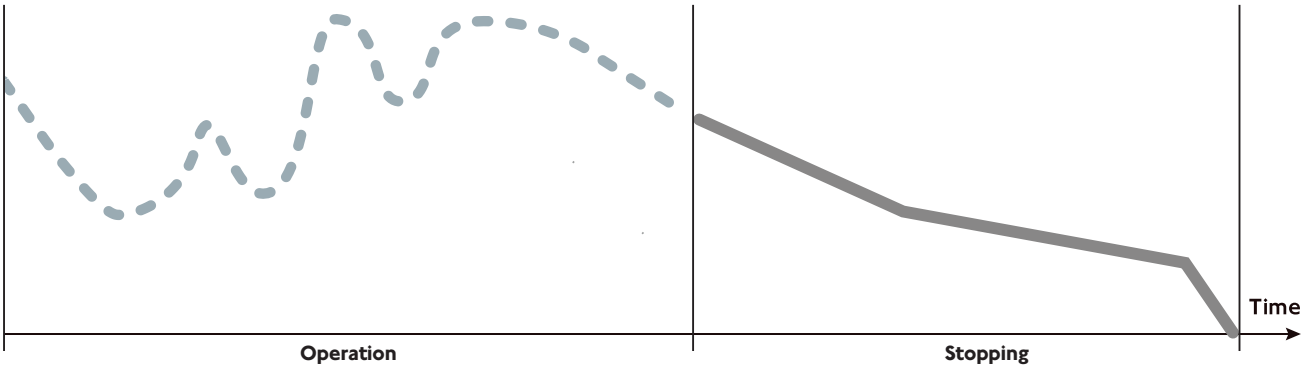


LIFETIME BENEFITS

6 reasons to choose the new VLT® AQUA Drive

1. User Friendliness
2. Flexibility
3. Reliability
4. Energy Saving
5. Pipe & Plant Asset Protection
6. Reduced Maintenance

The New Generation VLT® AQUA Drive has Features for all Operation Conditions, from Commissioning to Stopping.



Operation

- Automatic Energy Optimisation
- Lubrication
- End of Curve Detection
- Dry Run Detection
- Low Flow Detection and Sleep Mode
- Flying Start and Kinetic Backup
- Timed Actions
- Preventative Maintenance
- Deragging
- Flexible and Intelligent Handling of User Information, Warnings and Alarms
- Flow Compensation

Stopping

- Check Valve Ramp
- Final Ramp
- Post Lubrication
- Deragging

Benefits of Using the VLT® AQUA Drive in Water Supply

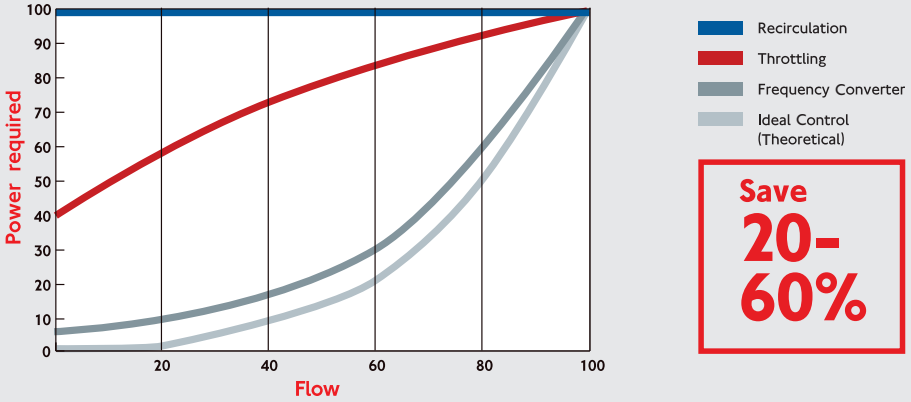
Pumping water out of the waterwork to customers is seen as a simple process. However, the energy used to run these pumps typically represents 60-80% of the total energy consumption for the whole water supply system. Besides the major energy saving of around 40% obtained by regulating the pressure in the network with VLT® AQUA Drives, the regulation will typically also:

- Limit the risk of bacteria and contamination of the tap water
- Lower the risk of road breaks and costly pipe repairs
- Extend your networks service life
- Reduce water consumption
- Postpone investment in plant upgrades
- Reduce the risk of water hammer

Control your Centrifugal Pump or Blower with a VLT® AQUA Drive

In a system using centrifugal or rotodynamic pumps or blowers and predominated with friction loss, major energy savings can be obtained by using VLT® AQUA Drives. A 20% reduction in the pump speed/flow rate can offer an energy reduction of 50%.

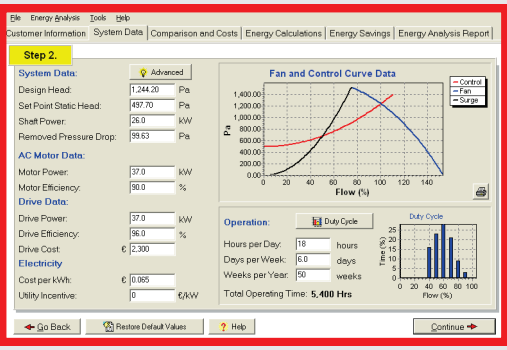
Even with a high content of static pressure, major savings can be obtained:
A 20% speed reduction typically offers a 20-30% saving.



Save 20-60%

TRY IT YOURSELF

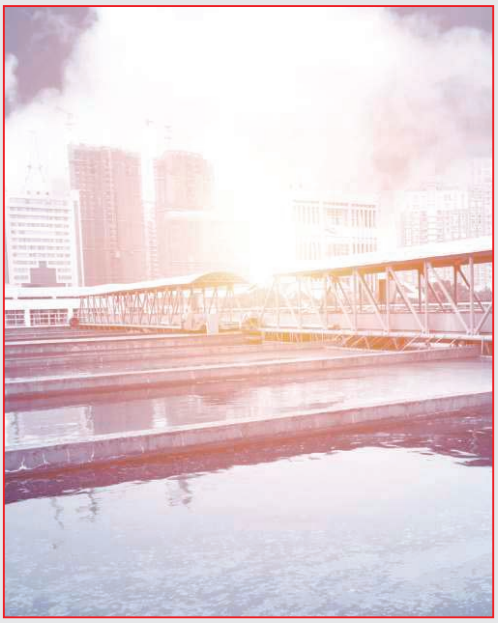
By using the VLT® Energy Box software you can easily get a complete financial analysis for pumps, including payback time.



Benefits of Using a VLT® AQUA Drive in Wastewater

Blowers or surface aerators typically consume 40-70% of the total energy used in wastewater treatment plants. Controlling the aeration equipment with VLT® AQUA Drives can deliver energy savings of up to 30-50%. Besides these major benefits, a drive control of the aeration system will also offer:

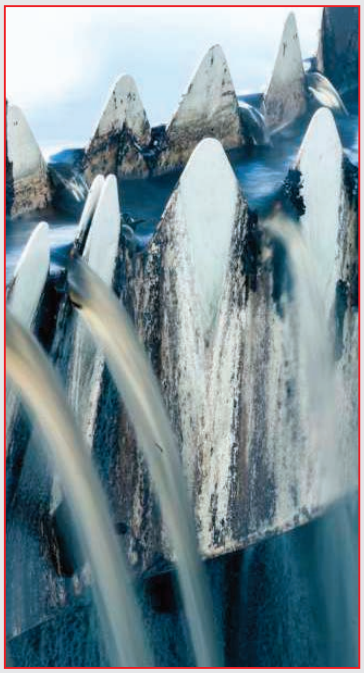
- A correct dissolved oxygen level, independent of load variations, reducing the risk that outlet valves are outside the permission level.
- Regulation of the nitrifaction capacity, as a function of temperature, load variations, limit energy and carbon use (giving more carbon for electricity production).
- A secure and effective de-nitrification process by avoiding excessive dissolved oxygen.
- Reduced wear on the aeration equipment.

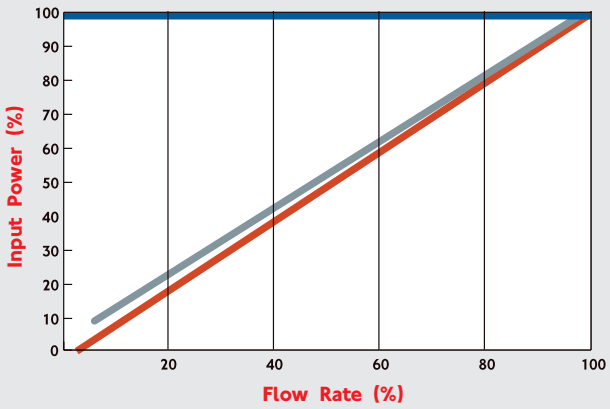


Control your Positive Displacement Blower or Pump with a VLT® AQUA Drive

A system using positive displacement blowers or pumps can obtain high energy saving using the VLT® AQUA Drives.

A 30% reduction in speed will offer 30% energy savings (assuming constant pressure is maintained).





Recirculation
Frequency Converter
Ideal pump control (theoretical)

Ideal Pump Control

Save 20-50%

A Comprehensive Programme to Cover All Applications

With the introduction of the new generation VLT® AQUA Drive, you now get the most comprehensive and dedicated AQUA programme in the market. You can now cover all of your applications with the same product series and user interface, whether you need a 0.25kW or 2MW drive, IP00 or IP66 protection, different overload ratings, AC, PM or synchronous reluctance motor controls, or any of our dedicated water features.

A World of Experience with the Focus on Water

The new generation VLT® AQUA Drive represents the best combination of 'know-how' and experience, based on an in-depth understanding of the changing nature of the water and wastewater industries. No matter where in the world, or what your water project, AQUA Drives are there for you.

Water Supply

Raw water from deep wells are treated in a three stage process. VLT® AQUA Drives make it possible to balance these three processes to maximise on treatment performance.

Wastewater Treatment

The wastewater treatment plant, Yen So Park, treats 50% of Hanoi's wastewater. More than 90 VSDs are installed, of which 12 450 kW VLT® AQUA Drives control the blowers.

Sincrondraiv SRL

10 High powered VLT® AQUA Drives secure optimal energy and water control in major irrigation facilities.

Main Supply (L1, L2, L3)	
Supply Voltage	1 x 200 - 240 V AC.....1.1 - 22 kW 1 x 380 - 480 V AC.....7.5 - 37 kW 3 x 200 - 240 V AC.....0.25 - 45 kW 3 x 380 - 480 V AC.....0.37 - 1000 kW 3 x 525 - 600 V AC.....0.75 - 90 kW 3 x 525 - 690 V AC.....11 - 1400 kW*
Supply Frequency	50/60 Hz
Displacement Power Factor (Cos ϕ) Near Unity	> 0.98
True Power Factor (λ)	≥ 0.9
Switching On Input Supply L1, L2, L3	1-2 Times/min.
Harmonic Disturbance	Meets EN 61000-3-12
*Up to 2000 kW is available upon request.	
Output Data (U, V, W)	
Output Voltage	0-100% of supply Voltage
Output Frequency (Dependent on Power Size)	0-590 Hz
Switching on Output	Unlimited
Ramp Times	0.1 - 3600 sec.
NOTE: VLT® AQUA Drives can provide a 110%, 150% or 160% current for one minute, dependent on power, size and parameter settings. Higher overload rating is achieved by oversizing the drive.	
Digital Inputs	
Programmable Digital Inputs	6*
Changeable to Digital Output	2 (Terminal 27, 29)
Logic	PNP or NPN
Voltage Level	0-24 V DC
Maximum Voltage on Input	28 V DC
Input Resistance, Ri	Approx. 4 kΩ
Scan Interval	5 ms
*Two of the inputs can be used as digital outputs	
Analog Inputs	
Analogue Inputs	2
Modes	Voltage or Current
Voltage Level	0 to +10 V (Scaleable)
Current Level	0/4 to 20 mA (scaleable)
Accuracy of Analogue Inputs	Max. Error: 0.5% of Full Scale
Pulse Inputs	
Programmable Pulse Inputs	2*
Voltage Level	0 - 24 V DC (PNP Positive Logic)
Pulse Input Accuracy (0.1-1 kHz)	Max. Error: 0.1% of Full Scale
*Two of the digital inputs can be used as pulse inputs.	
Digital Outputs	
Programmable Digital/Pulse Outputs	2
Voltage Level at Digital/Frequency Output	0-24 V DC
Max. Output Current (Sink or Source)	40 mA
Maximum Output Frequency at Frequency Output	0 to 32 kHz
Accuracy on Frequency Output	Max. Error: 0.1% of Full Scale
Analogue Outputs	
Programmable Analogue Outputs	1
Current Range at Analogue Output	0/4 - 20 mA
Max. Load to Common at Analogue Output (Clamp 30)	500 Ω
Accuracy on Analogue Output	Max. Error: 1% of Full Scale

Global Marine

Control Card	
USB Interface	1.1 (Full Speed)
USB Plug	Type "B"
RS485 Interface	Up to 115 kBaud
Max. Load (10 V)	15 mA
Max. Load (24 V)	200 mA
Relay Output	
Programmable Relay Outputs	2
Max. Terminal Load (AC) on 1-3 (break), 1-2 (make), 4-6 (break) Power Card	240 V AC, 2 A
Max. Terminal Load (AC) on 4-5 (make) Power Card	400 V AC, 2 A
Min. Terminal Load on 1-3 (break), 1-2 (make), 4-6 (break), 4-5 (make) Power Card	24 V DC 10 mA, 24 V AC 20 mA
Surroundings/External	
Enclosure	IP: 00/20/21/54/55/66 UL Type: Chassis/1/12/4x Outdoor
Vibration Test	1.0 g (D, E & F-enclosures: 0.7 g)
Max. Relative Humidity	5% – 95% (IEC 721-3-3; Class 3K3 (non-condensing) during operation
Ambient Temperature	Up to 55° C (50°C without derating; D-frame 45°C)
Galvanic Isolation of All	I/O supplies according to PELV
Aggressive Environment	Designed for Coated/Uncoated 3C3/ 3C2 (IEC 60721-3-3)
Fieldbus Communication	
Standard Built-In FC Protocol Modbus RTU	Optional: VLT® PROFIBUS DP V1 MCA 101 VLT® DeviceNet MCA 104 VLT® PROFINET MCA 120 VLT® EtherNet/IP MCA 121 VLT® Modbus TCP MCA 122

Ambient Temperature

- Electronic Thermal Motor Protection Against Overload
- Up to 55°C (50°C without derating; D-frame 45°C)
- Temperature monitoring of the heatsink ensures that the frequency converter trips in case of overheating
- The frequency converter is protected against short-circuits on the motor terminals U, V, W
- The frequency converter is protected against earth faults on the motor terminals U, V, W
- Protect against mains phase loss

Application Options

Extend the functionality of the drive with integrated options:

- VLT® General Purpose I/O MCB 101
- VLT® Extended Cascade Controller MCO 101
- VLT® Advanced Cascade Controller MCO 102
- VLT® Sensor Input MCB 114
- VLT® PTC Thermistor Card MCB 112
- VLT® Extended Relay Card MCB 113
- VLT® 24 V External Supply MCB 107

Relay and Analogue I/O Option

- VLT® Relay Card MCB 105
- VLT® Analog I/O MCB 109

Power Options

Choose from a wide range of external power options for use with our drive in critical networks or applications.

- VLT® Low Harmonic Drive
- VLT® Advanced Active Filter
- VLT® Advanced Harmonic Filter
- VLT® dU/dt Filter
- VLT® Sine Wave Filter (LC Filter)

High Power Options

See the VLT® High Power Drive Selection Guide for a complete list.

PC Software Tools

- VLT® Motion Control Tool MCT 10
- VLT® Energy Box
- VLT® Motion Control Tool MCT 31

Technical Expertise & Services

Customers in every industry are faced with increased demands for optimized productivity, cost contamination and profitability.

Harness BMG's technical expertise for reliable and cost effective solutions. Our team is at your service from concept and design through to diagnosis and control for preventative maintenance of critical automation functions.

PART OF *EVERY* PROCESS - we aim to give our customers total satisfaction through the quality of our products and services by committing to the development of your business.

Commissioning & Installation

Our qualified team is able to assist you with telephonic or on-site commissioning, as well as the installation of your equipment.

Repair Facility

Limit your machine downtime through the availability of our stock and national footprint. BMG can supply a full range of certified spare parts compatable with your equipment with fast turn around times. Repair work can be done on-site or at our central workshop facility.

Maintenance Contracts

The reliability and long term performance of your facilities is our top priority. BMG offers maintenance contracts, giving you priority access to our group of experts with the latest software for on-site assistance. This will enable you to anticipate technical risks, plan for maintenance to avoid detrimental production shutdown and control over your maintenance costs.

Training

Let our technical experts provide you with training solutions tailored to your requirements. A large range of training options are available, standard or personalized courses at your premises or in our training facilities.

Technical Helpline

BMG is committed to 24/7/356 day service. In case of a breakdown or emergency, a technical expert is ready to assist you.

NOTES

BRINGING THE WORLD'S BEST BRANDS TO YOU

In the bid to procure cutting-edge components at competitive prices, BMG is able to capitalise on long-standing relationships with leading manufacturers dedicated to excellence in design and production.

Products are imported from around the globe and brought to BMG's strategically located distribution facilities and regional service centres via the main distribution hub in Johannesburg - BMG World. A world-class facility boasting 308 000m^3 of fully stocked warehouse space, an accredited training facility and unlimited engineering capabilities.

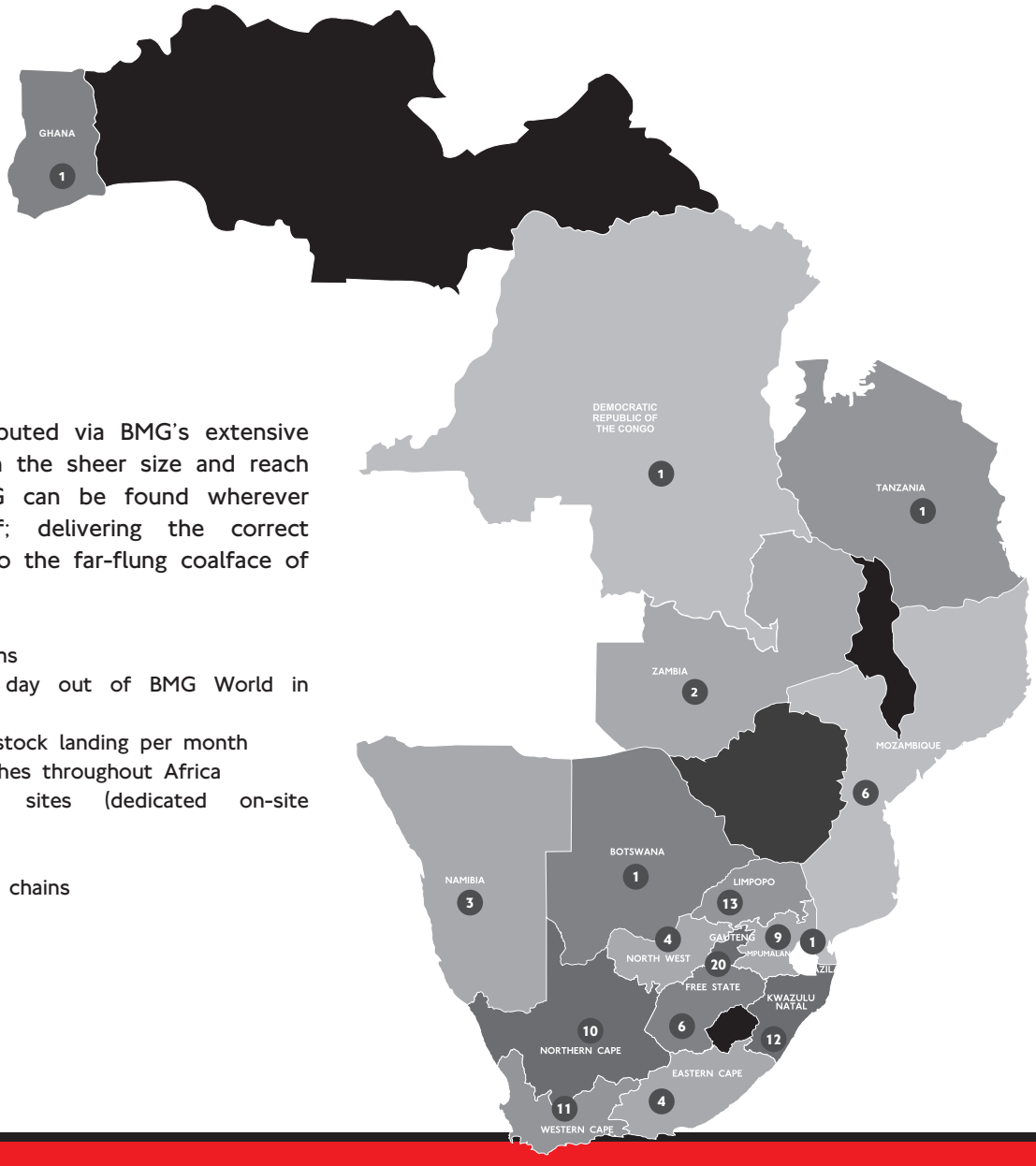
Preferred Brands:

NORD DRIVESYSTEMS · VARVEL · Sumitomo Drive Technologies · Hansen industrial gearboxes · ZOLLERN dorstener · dinamic oil

BMG MOTOLINE · Danfoss · VACON · SYNERGY · Fenner · VISAM · BTC

Our Extensive Coverage Throughout Africa

105
BRANCHES



Products and services are distributed via BMG's extensive distribution network. It's through the sheer size and reach of our infrastructure, that BMG can be found wherever industry has established itself; delivering the correct components at the right time, to the far-flung coalface of our customers' operations.

- Over 300 000 product line items
- Around 4 500 transfers per day out of BMG World in Johannesburg
- Over 1 000 tons of imported stock landing per month
- 105 strategically situated branches throughout Africa
- Vendor Managed Inventory sites (dedicated on-site stockholding)
- International exports
- Locally empowered distribution chains

Be PART

24 HR TOLL-FREE EMERGENCY
BRANCH HELPLINE:

0800 022 224

WEBSITE:

www.bmgworld.net

BMG

An Invicta Holdings Group Company

BEARINGS • SEALS • POWER TRANSMISSION • DRIVES & MOTORS
MATERIALS HANDLING • FASTENERS & TOOLS • HYDRAULICS
PNEUMATICS • FILTRATION • LUBRICATION • VALVES
TECHNICAL RESOURCES • FIELD SERVICES

BEE 4
EMPOWERING SUPPLIER

ISO 9001	Certified
ISO 14001	Certified
ISO 45001	Certified