

ENGINEERING  
TOMORROW

*Danfoss*

Selection Guide | VACON® 3000 Enclosed Drive

**Maximize your uptime**  
with rock-solid-reliable MV drives

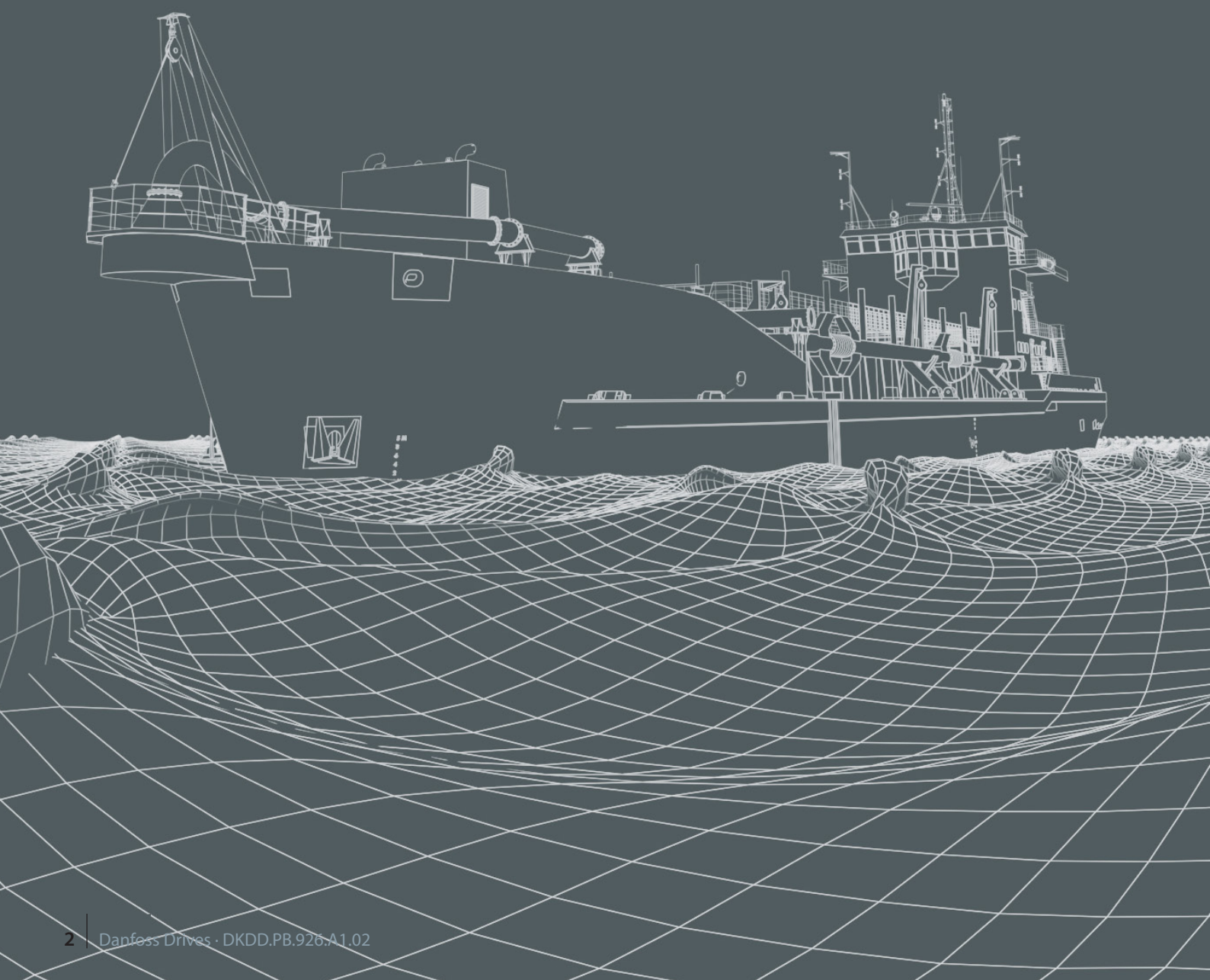
**Best**

total cost  
of ownership  
in the market

[drives.danfoss.com](https://drives.danfoss.com)

**VLT® | VACON®**





# Maximize your uptime

## - for the best bottom line

Need more uptime? Then the way to approach system design is by optimizing for "best lifetime value". The heavyweight costs lie in lifetime operation, rather than the initial installation.

So, if you had only one key criterion in choosing a medium-voltage drive, then overall lifetime value would be a good choice. Also known as optimal total cost of ownership (TCO), this holistic concept is an ideal indicator of maximum uptime and prime productivity for your entire operations.

Your first step in achieving more uptime in demanding applications, is to select the most suitable MV drive. How? For most applications, you want to look for minimal maintenance, long maintenance intervals, and high environmental resistance.

When talking medium-voltage drives, this one gives you the best lifetime value of all:  
VACON® 3000 Enclosed Drive

## A robust drive is your assurance of high availability

With VACON® 3000 Enclosed Drive you get exactly the robustness you need to reach the utmost in lifetime value. No matter what the exposure, this drive keeps on keeping on, with its rugged architecture and protective enclosed cabinet.

This drive is fully dust protected, and resistant to splashing water (IP 54). All options are pre-designed into the enclosed drive, and since they are integrated behind the housing, they are well protected from dust and water splashes. Even the cooling system is internal for reliable full-power operation at ambient temperatures up to 45 °C. With all these components integrated into the enclosure, your design task is immensely simplified.

For high reliability, the phase module in this drive is designed with no moving parts. In fact, there's altogether less maintenance required, with no need for air filter replacements, no need for deionized water, no need for water filter replacements, and no conductivity measurements required at all.

Heat management based on liquid cooling technology means there are vastly lower heat losses to air, than in a traditional air-cooled system. In turn, this means a lower air-conditioning load, smaller scale air conditioning units, and ultimately, less air conditioning maintenance effort too.

High performance ensuring reliable uptime is the starting point for every aspect of design.

The VACON® 3000 Enclosed Drive:

- Resists dust and splashing, and protects components well with protection rating IP54/NEMA 12
- Reduces design complexity, with integrated cooling system and options
- Extends maintenance intervals, with phase module free of moving parts
- Reduces upkeep, with fewer tasks related to the cooling system
- Runs reliably, maintaining full power in ambient temperatures up to 45 °C with internally cooled "closed circuit" air flow

# At the forefront of safe, low-cost maintenance - with easy service access

Make short work of service tasks, thanks to well-planned layout in the VACON® 3000 Enclosed Drive. When you open the cabinet, the streamlined layout gives you immediate overview. It's easy to get oriented fast, to find and identify each component. Front access to all components makes life easy for service staff. Not only is service access safer this way, it's also simpler and quicker to remove and replace parts. In particular, the phase module and coolant circuit give you quick and safe serviceability in every detail.

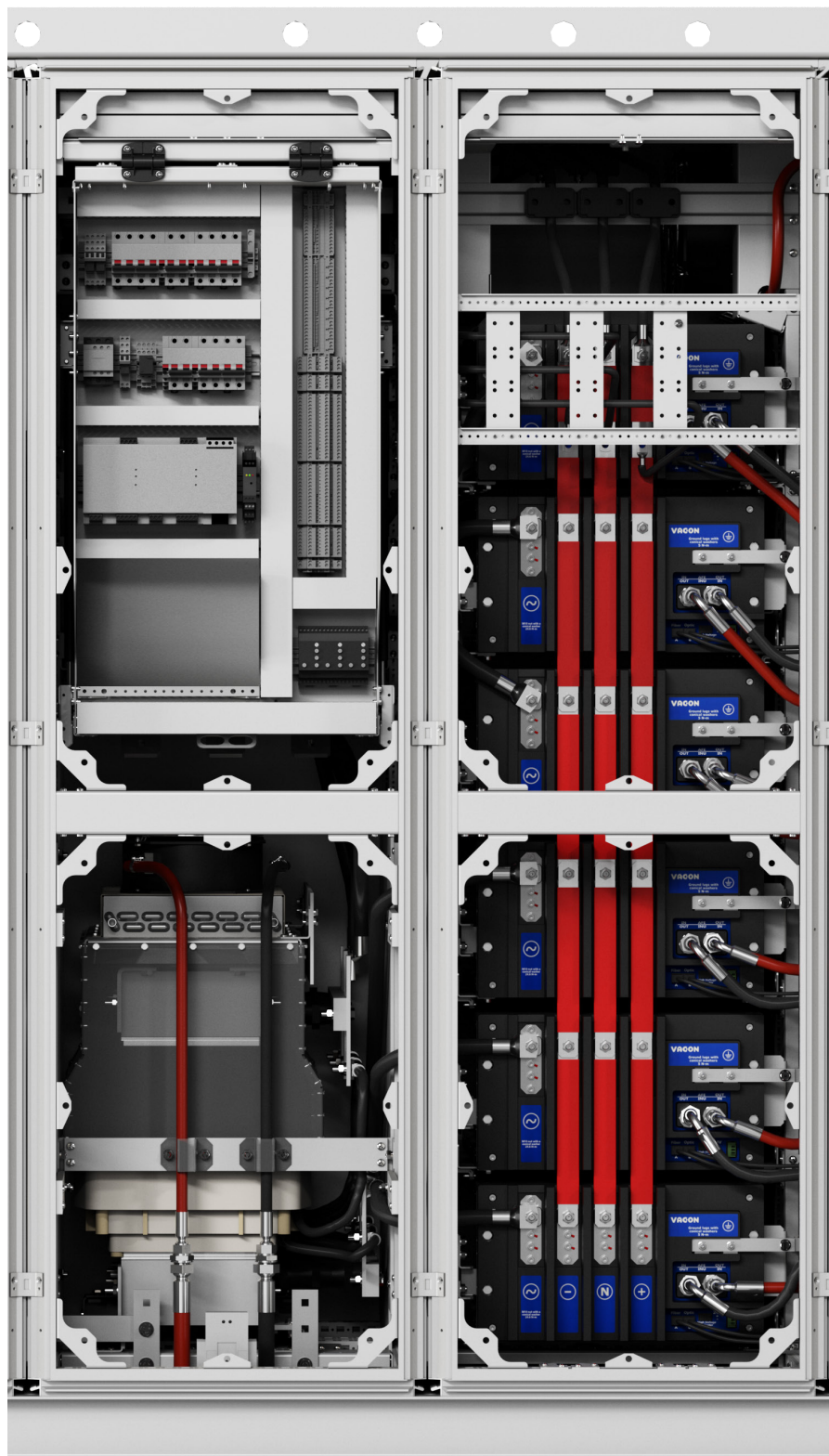
The robust phase module is easy to handle and quick to remove and exchange. All the connections are accessible from the front, and it's easy to remove and replace the phase module in the cabinet. Sensitive components are safely integrated, eliminating vulnerability. For speedy service, the coolant hose connections are equipped with quick connectors.

To ensure no corrosion or contamination vulnerability, the coolant circuit operates in a closed loop. The closed system is so reliable that you can count on longer intervals between routine flushing maintenance.

The inductors are equipped with an air-to-liquid heat exchanger and cooling fan with skirted inductor to ensure guided air-flow for optimal cooling.

Every aspect of serviceability is well-thought-through for safe and quick work:

- Front access to all parts
- Elegant phase module exchange
- Low maintenance coolant circuit
- Easy fan exchange



*Front access with no need to disconnect cables ensures easy phase module removal*



# Smaller electrical room reduces project costs

The compact size of VACON® 3000 Enclosed Drive often means integrators can build smaller electrical rooms, providing opportunities for significant electrical room cost savings: in the smaller construction of the electrical room itself, in the smaller scale of air conditioning equipment required, the significantly reduced air conditioning maintenance, and in the reduction of electricity consumed by air conditioning over the entire operational lifetime.

What exactly is it about the VACON® 3000 Enclosed Drive that allows integrators to reduce electrical room size?

Firstly, the compact size of the VACON® 3000 Enclosed Drive itself. Its small footprint is largely possible due to heat management based on liquid cooling technology and high power density power modules. At the same time, liquid cooling significantly reduces heat loads in electrical rooms, meaning smaller, lower-cost air-conditioning systems are adequate.

Secondly, it's in the mounting configuration. Because service access to components is always from the front, no space reservation for rear or side access is required. Furthermore, closed-loop liquid cooling means no air ventilation space is required. This means you can mount the drive up against the wall, back-to-back or side-by-side with no gaps between cabinets.

Thirdly, the cabling configuration is flexibly designed for top and/or bottom cable entry and exit. This means you can set up the cabling to suit your application exactly: top entry+top exit, top entry+bottom exit, bottom entry+top exit or bottom entry+bottom exit.

Flexible and spacious power terminals enable easy access and easy routing with no additional junction cabinets required for cabling.

To sum up, VACON® 3000 Enclosed Drive empowers integrators and end users to reduce capital and operating costs respectively, in these ways:

- Smaller electrical room construction due to compact cabinets which are mountable gap-free
- Smaller-scale air conditioning unit due to reduced electrical room heat load
- No need for cable junction cabinets
- Low energy consumption

Ask us, to learn more about how contractors, integrators and end users have saved significant capital and operating costs through the use of these innovative design features.

## Robust and ready to run

When you install the VACON 3000® Enclosed Drive you get a low-fuss medium-voltage drive that's ready to connect and run. The superior cabinet design matches standard dimensions, making the choice easy for you as system integrator or turnkey contractor. As owner of the installed system, you get a robust and state-of-the-art enclosed drive you can rely on for high availability, low maintenance and rock-bottom lifetime cost.

### Simplify the design phase

Save time and money on design. The cabinet complies with standard connectivity and dimensions. Just select the variants you need. Select variants to match your application needs. Configure with active front-end (AFE), diode front-end (DFE), or brake chopper unit (BCU) to optimize performance of your system.

Enjoy best purchase value for the most common applications. And best lifetime value for any system. Improve your competitive position with superior standard cabinet design:

- Meet your application needs with AFE, DFE, or BCU configurations
- Save design time by selecting a standard cabinet-built MV drive
- Minimize purchase cost by choosing the best value MV drive for common application needs
- Optimize total cost of ownership with high system availability and low maintenance requirement







# Single port of call

No matter what your motor control question, you can find the answer at Danfoss Drives. Obtain the optimum AC drive for the job, whatever the low- or medium-voltage application is on board the ship.

## Main propulsion

Electric propulsion provides a great deal of freedom in ship design, and ships can be designed much more efficiently without the traditional limits on equipment layout, due to mechanical restrictions (for example, the main engines having to be aligned to and in the vicinity of the propeller shafts). Due to its inflexibility, a fixed power transmission produces excessive mechanical stress. When the propeller is controlled by a drive, the power available to rotate the propeller can be contained with lighter and less robust mechanical constructions than would otherwise be needed with a fixed power transmission. This in turn means the vessel is cheaper to construct. The structure is also lighter.

With electric propulsion:

- The power can be supplied by any number of generators, which enables high redundancy.
- The motor + drive combination consumes energy only when the thruster or propulsion is actively turned
- The environment benefits from lower fuel consumption and exhaust emission

Electric propulsion is a good platform for the next phase of development – hybridization.

## Refrigeration compressors

Compressors controlled by a drive typically use 15% less energy than traditional compressors with valve control only.

Optimized start/stop cycles reduce wear and tear on the compressor. Drive-controlled compressors have a higher coefficient of performance (COP) under partial load.

## Pumps

AC drives control the pump to match actual process need, leading to reduced energy consumption. Reducing the speed by 20% reduces the power consumption by 50%.

As well as saving energy, these AC drives also protect the pump in many different marine applications.

Due to increasingly stringent exhaust emission limits, scrubbers are frequently installed. They act as SO<sub>x</sub> abatement devices on the main and auxiliary engines and boilers, using water as a medium for sulfur absorption. Optimization of water pumps for these scrubbers is the ideal task for VLT® and VACON® drives. Other typical application areas: ballast water, bilge water, circulation, cargo, firefighting, feeding pumps, lubrication, and sea water pumps.

# Vessel-wide systems

## Thrusters

VACON® 3000 drives' high torque capabilities and their fast and accurate performance provide precise maneuverability in all seas.

AC drive-controlled variable speed propellers with fixed pitch are typically 20-30% more energy efficient than fixed-speed variable-pitch propellers – which waste approximately 20% of the power at zero thrust.

Frequency-controlled variable-speed propellers use 50% less energy than hydraulic variable-speed propellers.

Electrically-powered thrusters provide more accurate control and respond more quickly than hydraulic-powered systems. A minimum of two parallel motors and drives are always in use. If one combination stops, the steering system continues to operate.

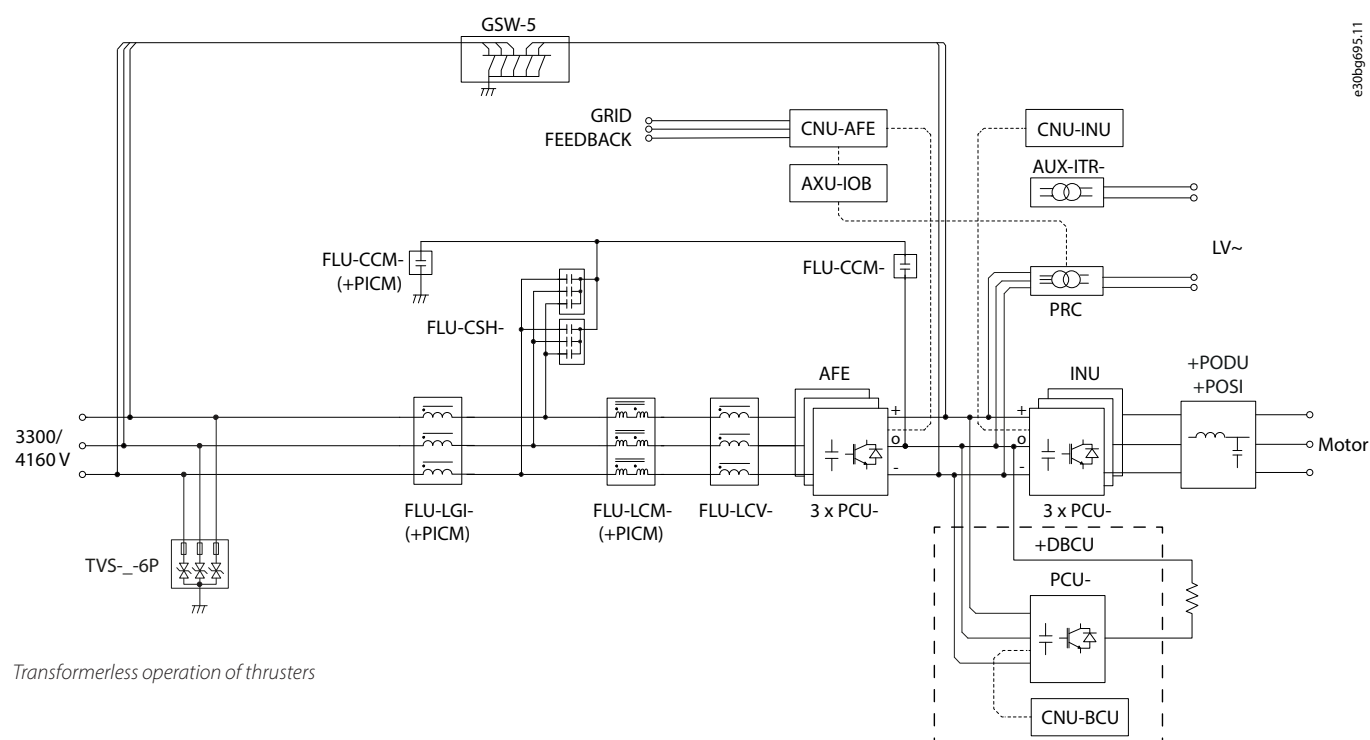
## Cutter suction dredgers

A cutter suction dredger consists of two main elements: the rotary cutter head and dredge pump. The rotating cutter head is used for cutting and fragmenting hard soil, while the dredge

pump sucks up the soil and discharges it on shore, by means of a floating pipeline or a barge.

Depending on the size and design, there can be several pumps discharging the soil.

The high powers required for cutting and pumping makes it the perfect application for electric motors controlled by drives, ensuring high efficiency and minimum downtime.



Transformerless operation of thrusters

e30bg695.11





# Marine certification

Marine certification by DNV-GL and Lloyd's Register is your assurance that the VACON® 3000 Enclosed Drive meets the most demanding marine standards:

- Assurance that the vessel meets the industry standards from most demanding classification societies
- Compliance with a detailed inspection and verification process
- Improved crew confidence
- Liability protection and product liability insurance discounts

- Trust and confidence from customers as products comply with the high quality and safety standards
- Smooth approval and certification processes that save time and effort
- Ongoing support from classification societies, e.g. DNV-GL experienced electrical systems and components experts

Need a different certification? Just ask. Other marine certifications are available on request.







# Reliable operation of slurry pumps throughout your processing facility

Medium-voltage pumps such as slurry pumps are used extensively in processing facilities, with MV drives often regulating them using variable speed control. MV drives provide flexibility in control and optimize yields from equipment, therefore enhancing the overall efficiency of the plant. For example, use of a drive to control the flow of feed pumps to a dense medium cyclone on a coal handling and preparation plant (CHPP) helps deliver greater yield.

A slurry pump is typically a centrifugal pump with a quadratic pump curve. Energy savings of 50% are achievable with just 20% reduction in pressure, by continuously matching the power supply to the actual load.

Under normal operating conditions, the MV drive will operate reliably to control the pump when selected on the basis of normal overload or normal duty rating. However, normal operating conditions do not always prevail on a mine site:

- Mains supply interruptions or emergency stop conditions which cause equipment to stop in an uncontrolled manner can result in slurry pumps and pipelines being full of the slurry when the pump stops
- If the slurry is particularly dense, and the duration of downtime is long, the dense material in the slurry settles to the bottom of the pump and pipeline, often making it difficult to restart.

For such situations, best practice in selecting AC drives for slurry pumps is to size the drive based on an overload rating that at least ensures 150% motor torque for 30 seconds. Match your choice of VACON® 3000 Enclosed Drive to the overload requirements, to ensure reliable operation of all medium-voltage slurry pumps throughout your facility.

## The optimum choice for electric-driven dewatering pump skids

For environmental and lower maintenance and operating cost reasons, many mine sites prefer to use an electric-driven pump skid instead of the traditional diesel-engine-driven pump skid. This is possible when there is an electrical supply close to the dewatering pump skid location.

An electric driven pump skid typically uses an AC motor and drive to set the flow rate of the dewatering pump, instead of a diesel engine. Typically, the initial cost of an electric-driven skid will be higher, but the operating costs are significantly lower. The higher

initial investment is recovered very quickly, often within months. As there is no need to change the oil of a diesel engine every few hundred operating hours, or pay for refueling trucks and labor, this results in even greater savings in maintenance and operating costs.

Common challenges for drives on electric-driven pump skids include the space available (because the size of the drive often impacts the size and therefore cost of the pump skid) and the harsh, dusty and often hot environment where the pump skid is installed.

VACON® 3000 Enclosed Drive addresses these challenges with ease. The compact enclosure often enables the pump skid manufacturer to minimize the size and cost of the skid. Their robust performance at high ambient temperatures ensures reliable, long lifetime of operation even when installed on a dewatering pump skid on a hot, humid mine site with mining trucks kicking up dust as they pass by every few minutes.

# Robust mine ventilation

Ensuring reliable ventilation is paramount for the health and safety of workers in the underground mine. This is necessary to ensure particles from diesel engines are adequately diluted, for example.

Ventilation operating costs are often a significant proportion of the total electrical energy costs on site, and being able to ventilate in the most efficient manner saves significant operating costs.

Variable speed control is recognized as the most flexible, energy-efficient, low-maintenance method for controlling mine ventilation fans. MV drives are used to control the air flow of main ventilation fans on the surface as well as auxiliary ventilation and booster fans underground, and can be easily integrated into Ventilation on Demand (VOD) control systems.

The VACON® 3000 Enclosed Drive ensures reliable operation of the fan even in harsh operating conditions, and optimizes energy consumption too.

# Long conveyor capability

Smooth control of acceleration and deceleration of long conveyors reduces mechanical stress through all drive-train components and within the conveyor belt itself. This leads to longer lifetime for the belt and other drive components, increasing asset availability and lowering maintenance and operating costs. Having the flexibility to control the speed of long conveyors can help optimize the complete system, reduce bottlenecks and maximize the efficiency of a material flow process, resulting in operating cost savings.

## Maximize belt life

It's common practice to install multiple motors on long conveyors and the drives need to ensure load sharing between each motor for reliable operation and to maximize belt life. VACON® 3000 Enclosed Drive includes both for this. Selection of the control solution depends on the configuration of the conveyor drives on the conveyor (for example, all drives at the head end or drives at both the head and tail end). They are both easy to implement and have proven to be robust, reliable solutions for long conveyors.

## Bulk handling

For downhill conveyors, where continuous regenerative braking operation is typically required, an active front-end (AFE) drive is the best solution.

VACON® 3000 Enclosed Drive is suitable for long conveyors in excess of 1 km length, which are common on bulk material applications on mine sites, processing plants and port facilities such as:

- Run-of-mine (ROM) bin feeder conveyors
- Stockyards
- Train loadout conveyors
- Pipe conveyors
- Long overland conveyors





# Ball mills

Milling, commonly ball milling, is the largest power consumer in the mining operation. Therefore, optimizing system efficiency using variable speed ball mill control is critical for achieving fast return on investment, and maintaining a healthy operating budget. Energy savings in milling also give the greatest CO<sub>2</sub> reduction of any installed process equipment. Typically the high power load makes speed regulation by medium-voltage drives the optimal choice.

## Save both energy and consumables

Speed control by MV drives influences the effectiveness of ball mill speed optimization in both direct and indirect ways. High uptime and reduced energy consumption are obvious benefits. Powerful starting torque is critical for reliable ball mill operation, combined with smooth speed transition across the full operating range. Superior torque control is particularly valuable in optimizing productivity and protecting equipment well, when a mill is starting up from stationary whilst bearing a potentially frozen or partly frozen load.

Good equipment protection due to speed regulation delivers even more savings, however, by reducing service intervals and material costs. For example, variable speed control can significantly reduce wear on the mill lining. Indirect savings also include reduced consumption of ball charge and lubricants, achieved by intelligent open or closed loop speed and torque regulation of the ball mill.

## High availability

This is where the VACON® 3000 Enclosed Drive is a strong performer, offering not only intelligent control but also rugged, reliable performance in all conditions, to improve uptime and availability of the ball mill in these diverse ways. Unique algorithms ensure precision torque control to manage extreme start-up loads with consistently fast recovery.

Your benefits:

- Superior torque performance for productivity and equipment protection
- Longer service intervals due to less wear and less consumables
- Speedy serviceability due to streamlined access in the cabinet





# The critical differences

- easy access, compact size, and rugged resistance

Time is money, and money is time. We understand this at Danfoss. That's why the VACON® 3000 Enclosed Drive is packed full of useful features to speed up your servicing process, and extend the intervals between scheduled maintenance.

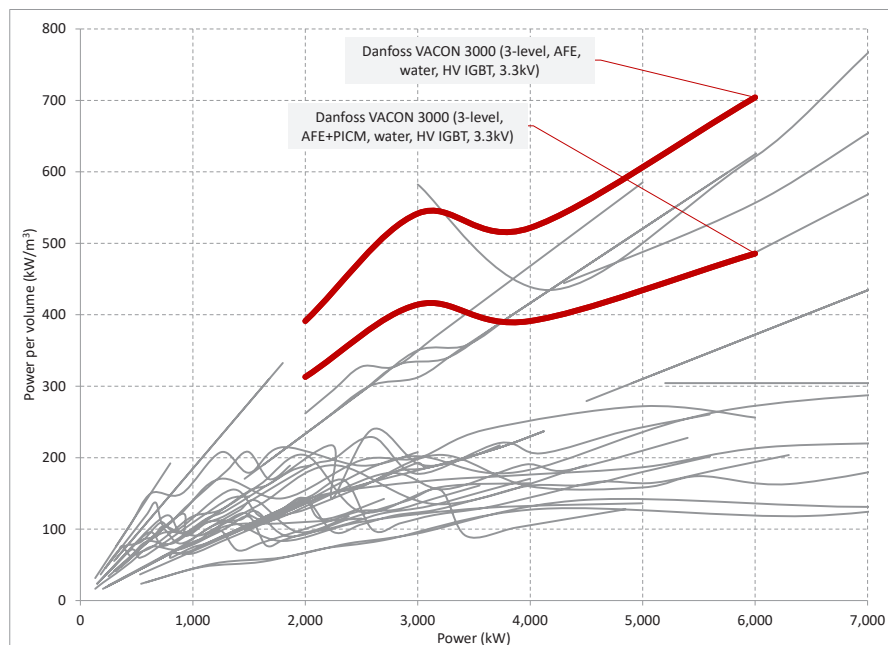
Easy-to-handle power modules make fast work of component exchanges in the unlikely event of component failure. These units are so robust that no special care is required during service. So they are easier to work fast with, than the more fragile alternatives on the market. Since AFE, INU and BCU modules are all based on the same hardware, there are fewer spare parts required than for alternative drives, meaning a smaller spare part inventory to finance and maintain.

For longer life and less maintenance, this MV drive is equipped with a grounded heatsink. This design enables us to manage heat using a simpler cooling unit which is highly robust with low maintenance needs, since deionized cooling water is not required.

Save on airconditioning in two ways: Firstly, order a smaller unit. Due to the market's most compact drive construction with gap-free mountability, you can reduce the floor area of your entire e-room to an absolute minimum, scaling down the dimensioning of the air conditioning system accordingly. Secondly, the liquid-cooled heat management system in the drive ensures only very low heat losses to the room, which reduces your electricity bill considerably.

Buying you time, saving you money:

- Power modules are fast and easy to handle
- No deionized cooling water needed. No need for deionizing unit and related service
- Reduced spare parts inventory
- Save on capital and operating costs of air conditioning, due to compact drive footprint and advanced heat management



# No

deionized water  
required in the  
cooling unit

*The most compact MV drive available:  
Power per volume of  
VACON® 3000 Enclosed Drive compared  
with alternative MV drives*



# The MV drive you can rely on

A significant contribution to the long maintenance intervals of VACON® 3000 Enclosed Drive is its totally enclosed cabinet with protection rating IP54. Being less susceptible to contaminants, poor air quality has little or no effect on its performance.

Equally important to a long reliable lifetime is the intense quality control during design and manufacture. The drive configuration is based on proven solutions, pre-engineered with standard options. Modular selections are based on single-phase modules which are pre-tested at full current and full voltage simultaneously to ensure reliable performance in the field.

Choose medium-voltage drives for a low component count. Where there are fewer components, there is less likelihood of wear or breakdown. How does the design influence reliability?

- Integrated liquid-to-liquid heat exchanger facilitate high ingress protection class (IP54)
- Robust thermal management due to integrated hybrid cooling magnetics and with air-to-liquid heat exchangers ensures reliable operation
- The topology used to design the VACON® 3000 Enclosed Drive uses as few power semiconductors as possible

- Less contamination due to no internal cooling fan drawing air into in power modules
- Pre-tested and pre-engineered modular components with proven performance



## Speedy serviceability

During service, it's easy to work safely and fast, thanks to clever design with front access, enabling quick and safe handling of power modules and spare parts. There is no need to re-program modules before replacement, since AFE, INU and BCU modules are all based on the same hardware. Therefore, there are fewer spare parts required than for alternative drives, meaning a smaller spare part inventory to finance and maintain.

These special features are your guarantee for safe and fast service:

- Reduced risk of damage to spares due to rigid and robust design, and ESD-safe handling
- Sealed phase module (IPx1) as option
- Film capacitors, no reforming needed
- No re-programming of modules required
- All connections accessible from the front
- Quick connectors on the coolant hoses



# Innovative integrated cooling

## – more than just cool

Not only do you need to maintain a constant temperature, you also need to optimize space. That's why the heat management system for VACON® 3000 Enclosed Drive is highly compact, with no compromise on highly effective performance.

The secret is in the elegant design, optimized for simplicity. The internal temperature of the cabinet is closely controlled. This drive uses hybrid cooling for magnetic components such as the inductor. No external air enters the cabinet. Instead, the cabinet internal temperature is controlled internally by air-to-liquid heat transfer.

- Inductor with hybrid cooling
- Cabinet internal temperature controlled
- No external air enters the cabinet
- Single coolant inlet and single outlet on phase power modules

## More than cool – also low-maintenance

But there's more. Did you know liquid-cooled drives can also be easy to service? This cooling unit is altogether less complex to work with, than other liquid-cooled systems. This saves you time and cost for every scheduled service, which - by the way - are few and far between.

Why is the cooling unit so dramatically low on maintenance? Uniquely to this MV drive, there is no need to use deionized water, no need to monitor coolant conductivity, and no need to change filters. The system uses the same cooling liquid as used in low-voltage Danfoss drives.

This is possible thanks to Danfoss' own solution <sup>1)</sup> which limits ground fault current at catastrophic fault level. The solution meets UL requirements. Using this approach, you no longer need a de-ionized heat-transfer fluid with conduction monitoring heat exchanger.

The simpler design is less complex which in turn means lower maintenance. All in all, you can expect to service the cooling unit as infrequently as once every 5 years.

- No deionized water, uses ordinary ethylene glycol based coolant with corrosion inhibitors
- No need to monitor coolant conductivity
- No filter replacements
- No conduction monitoring heat exchanger
- Maintenance interval typically 5 years

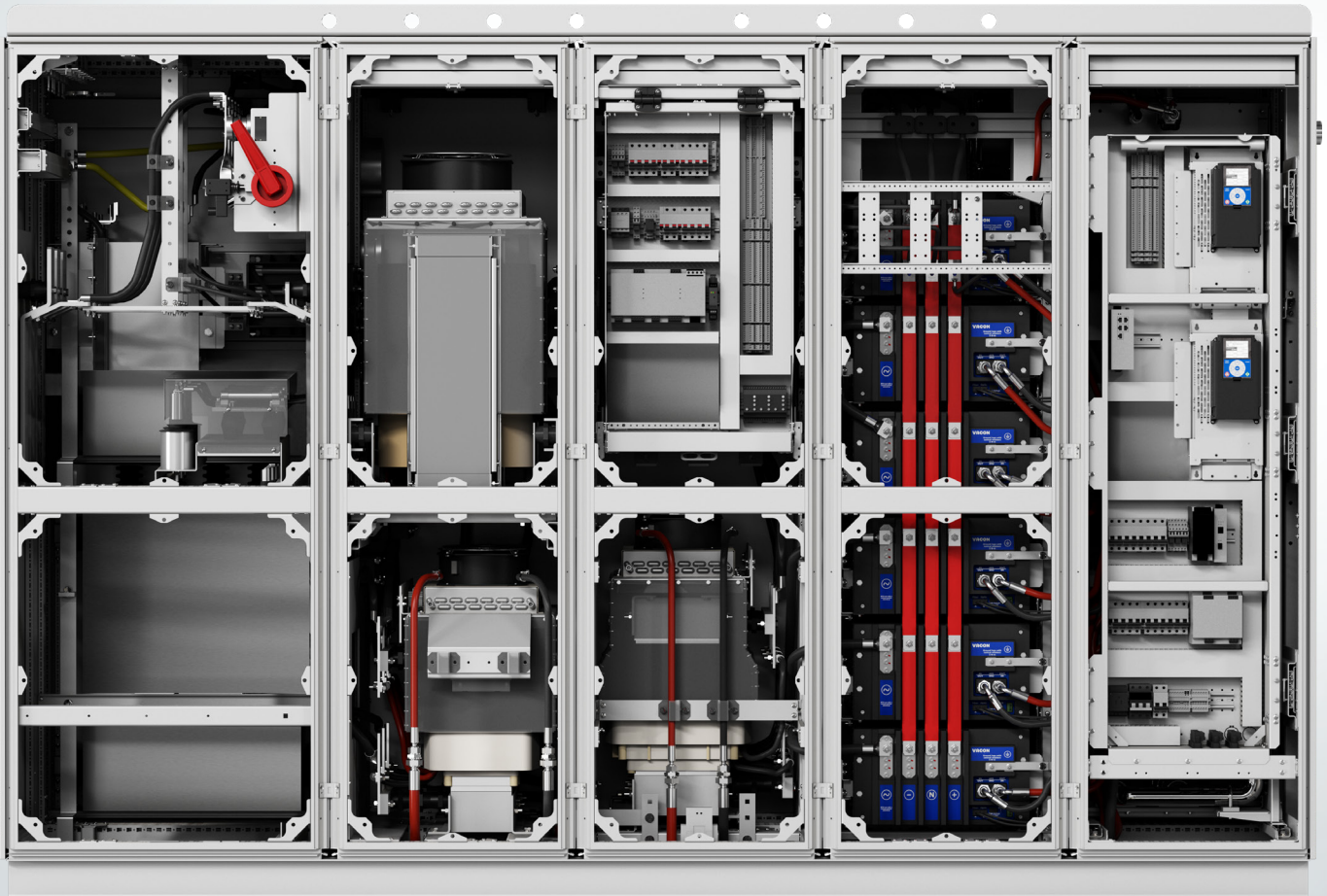
<sup>1)</sup> Patent pending





# VACON® 3000 Enclosed Drive

- take a look inside





## Safety first

- Separate LV and MV sections with galvanic isolation
- Bolted front, back, and side panels
- Integrated pressure relief on top of the cabinet
- Partitioned sections
- Arc flash detection
- Optional hardware-based Safe Torque Off function
- Short circuit ratings
  - AFE 25 kA standard, with optional 40 kA
  - DFE 25 kA
- Safe operation in the control section:
  - Door mounted control components are separated from MV power devices
  - MV section control compartment can be tilted up for easy access
- Easy to commission and run
  - All auxiliary devices are pre-wired to control terminal blocks
  - Easy and safe fault tracing

## Power interface

- Power terminals with good access
- Connection for wide range of MV cable sizes
- Top or bottom input and output cabling

## Integrated features

Available as standard, integrated into the VACON® 3000 Enclosed Drive cabinet:

- Auxiliary Isolation Transformers
- Grounding Switch
- Auxiliary I/O-board

## Auxiliary equipment

- Industrial-quality power supplies: High reliability, efficiency and loadability
- Fan monitoring: Current measurement on fan supplies
- Ethernet switch and network: internal and external communications
- Cabinet heaters:
  - Prevent condensation in the cabinet
  - Controlled for temperature and humidity
- Control terminals
- Input filters: common-mode filters, optional
- Output filters, optional

## Integrated protection equipment

- Leak detection: Sensors in every section with liquid connections
- Arc flash detection: < 2 ms detection with fiber sensor
- Protection relay for DFE:
  - Current measurement on every incoming phase
  - Fast tripping for external breaker
- Crowbar in two variants:
  - DC crowbar integrated in the DFE power converter unit
  - AC crowbar in the input section for AFE drives, optional

## Mechanical construction

- 100% front access to components during service
- Separate LV and MV control sections
  - Accessible but compact
  - Easy connections for customer terminals
  - Safe low-voltage (LV) access due to isolation transformer
  - Heat exchanger integrated in the LV section
  - Innovative solution for control compartments
- Rugged design
  - Protection rating IP54 as standard
  - Cabinet internal air-to-liquid cooling
  - "Hybrid" cooling of inductors
  - Sealed phase modules (optional)
  - No fan inside phase modules
- Installation made easy
  - Split into sections for transport section
  - Top/bottom cabling
  - Single cooling connections
  - Lifting rail
  - Plinth









# Digital tools empower you - convenient and fast

Need help to set up and maintain your drive? Danfoss provides digital tools to give you the information you need, at your fingertips, either hands-on or remote.

## Local access

Set up and monitor your drive hands-on, via the touch screen on the cabinet door. You get access to the drive status in overview form, with more detail on sub-menus. The display also offers the choice of local operation and maintenance modes.

- Drive status overview, at a glance
- Sub-menus for interlocking, cooling system and diagnostic information
- Local operation and maintenance modes

## Remote access

Access the drive remotely through a PC interface using the VACON® Live tool. VACON® Live is a software tool enabling you to perform commissioning, parameterization, monitoring and diagnosis from a remote site.



Download VACON® Live here:  
**VACON® Live**

## Collect data

When the drive is commissioned and running, use the VACON® 3000 LogBox to collect data locally and securely with no need for internet connection. This tool can be made available case by case, so please contact your local Danfoss office for support.

- Huge volume of correlating high-resolution data available
- Continuous datalogging stores data on-site from one or multiple drives
- No need for a server or continuous internet connection
- Scalable and available for analysis locally or remotely

# DrivePro® Life Cycle services

## Delivering a customized service experience!

We understand that every application is different. Having the ability to build a customized service package to suit your specific needs is essential.

DrivePro® Life Cycle Services is a collection of tailor-made products designed around you. Each one engineered to support your business through the different stages of your AC drive's life cycle.

From optimized spare-part packages to condition-monitoring solutions, our products can be customized to help you achieve your business goals.

With the help of these products, we add value to your application by ensuring you get the most out of your AC drive.

When you deal with us, we also offer you access to training, as well as the application knowledge to help you in planning and preparation. Our experts are at your service.

**[drivepro.danfoss.com](http://drivepro.danfoss.com)**





# You're covered

## with DrivePro® Life Cycle service products

Every AC drive application is different. DrivePro® Life Cycle Services is a collection of tailor-made products designed around your needs.

From optimized spare part packages to condition-monitoring solutions, customize our products to support your business through the different stages in the life cycle of your AC drive.



### DrivePro® Site Assessment

**Optimize planning based on a site-wide survey**

Optimize your maintenance strategy with a complete onsite survey and risk analysis of all your AC drives collected in one detailed report. Together with a Danfoss expert, you can build a tailored plan for future maintenance, retrofits, and upgrades based on your exact needs.



### DrivePro® Spare Parts

**Plan ahead with your spare part package**

Maintain maximum uptime with a spare parts package that covers you in any AC drive breakdown. Choose from three customized packages to get your AC drive back up and running with minimal impact to operations.



### DrivePro® Start-up

**Fine-tune your drive for optimal performance today**

Take the complexity out of commissioning with DrivePro® Start-up's full range of health checks and adjustments. Our DrivePro® experts inspect and test your AC drive and motor performance to ensure the best configuration of your AC drives.



### DrivePro® Exchange

**The fast, most cost-efficient alternative to repair**

Maintain uptime with a fast alternative to repair when there is no time to waste. If an AC drive fails, the DrivePro® Exchange service can quickly exchange any drive to ensure as little production delay as possible.



### DrivePro® Extended Warranty

**Long-term peace of mind**

Even the best performing AC drives need protection. DrivePro® Extended Warranty offers a wide range of warranty options and provides the longest coverage in the industry. Enjoy better uptime, repairs, replacements, and spare-part support for up to six years.



### DrivePro® Preventive Maintenance

**Take preventive action**

Take the guesswork out of your maintenance plan. With a structured maintenance program tailored to your needs, you can boost operational efficiency and reduce the effects of wear and tear.



To learn which products are available in your region, please reach out to your local Danfoss Drives sales office or **visit our website**



Discover more about DrivePro® services **here**

## DrivePro® Life Cycle Services

Delivering a customized service experience



DrivePro® Site Assessment



DrivePro® Start-up



DrivePro® Extended Warranty



DrivePro® Spare Parts



DrivePro® Exchange



DrivePro® Preventive Maintenance





**MAGDALEN**  
**NEW YORK, NY**  
IMO 9652210



# Technical data

<b>Topology</b>	3-level neutral point clamped (NPC)	HV-IGBT
<b>Drive capacity</b>	3300 V	425 A, 3300 V, 2.4 MVA   640 A, 3300 V, 3.7 MVA 820 A, 3300 V, 4.7 MVA   1230 A, 3300 V, 7.0 MVA
	4160 V	340 A, 4160 V, 2.5 MVA   510 A, 4160 V, 3.7 MVA 650 A, 4160 V, 4.7 MVA   980 A, 4160 V, 7.1 MVA
<b>Input operating voltage</b>	Active Front End	3300 V, 3 phases $\pm 10\%$   4160 V, 3 phases $\pm 10\%$
	12-pulse DFE*	2x 1850 V AC $\pm 10\%$   2x 2360 V AC $\pm 10\%$
<b>Input frequency</b>		50 Hz $\pm 5\%$ (3300 V) or 60 Hz $\pm 5\%$ (4160 V)
<b>Rectifier</b>	Active Front End	AFE
	Diode Front End	12-pulse DFE
<b>Input current THD</b>	AFE	<5%
	12-pulse DFE	Typically <15%
<b>Protection rating</b>		IP54 (NEMA 12)
<b>Power factor</b>		>0.95
<b>Short circuit rating</b>	AFE	25 kA for 100 ms, or 40 kA for 100 ms (option, +PUFE)
	12-pulse DFE	25 kA for 100 ms
<b>Output voltage levels</b>		3 (5 phase-to-phase)
<b>Output frequency</b>		0-120 Hz
<b>Acceleration/deceleration time</b>		0.1-3600 s
<b>Common mode capacitor ground</b>		25 $\mu$ F
<b>Grounding</b>		Isolated neutral, resonant earthing, high resistive earthing or solid earthing (IEC61936-1) For operation in unearthed neutral systems without a dedicated transformer, contact Danfoss Drives
<b>Control voltage</b>		120 V (4160 V) or 240 V (3300 V)
<b>Switching frequency</b>	AFE	1050 Hz (50 Hz) and 1260 Hz (60 Hz)
	12-pulse DFE	900 Hz synchronous PWM
<b>Motor control method</b>	Asynchronous (induction) motor	U/f control Sensorless vector control (open loop) Vector control (closed loop, with fallback to sensorless operation available if encoder fails)
	SoftSync® functionality	Integrated SoftSync® functionality protects and enhances motor performance The SoftSync® function reduces typical motor current transients and lowers the current harmonic distortion during motor acceleration and deceleration, preventing pulsation or reduced motor shaft torque
<b>Communication</b>		AI/O, DI/O, fieldbuses (e.g. PROFIBUS DPV1, DeviceNet), industrial Ethernet protocols (PROFINET IO and EtherNet/IP), VACON® PC tool
<b>Main protective functions</b>		Torque and power limit, current limit, overcurrent, overvoltage, undervoltage, loss of auxiliary power, loss of communication, ground fault detection, arc detection, leak detection
<b>Efficiency at rated load</b>	12-24-pulse DFE	$\geq 98.8\%$ , excluding the input transformer
	AFE for dedicated transformer	$\geq 97.8\%$ , excluding the input transformer
	AFE with input common mode filter (+PICM)	$\geq 97.4\%$
<b>Temperature</b>	Operational ( <i>ambient</i> )	0 °C to +45 °C (+30 °F to +113 °F)
	Storage ( <i>ambient</i> )	-40 °C to +70 °C (-40 °F to +158 °F); No liquid in heat sink under 0 °C (+32 °F)
	Enclosed drive inlet cooling liquid	0 °C to +38 °C (+32 °F to +100 °F). Lowest permitted cooling liquid temperature 2 °C (3.6 °F) above the dew point.
<b>Relative humidity</b>		< 95 % RH, non-condensation, non-corrosive
<b>Cooling</b>	Power and phase modules ( <i>Rectifier, inverter, &amp; brake chopper units</i> )	Closed-loop liquid cooling with grounded heatsink using ethylene glycol-based heat transfer fluid with corrosion inhibitors (Deionized water not needed)
	Chokes	Hybrid cooling (forced air cooled with air-to-liquid heat exchanger)
	Other components inside the cabinet, for example capacitors	Internal forced air circulation with air-to-liquid heat exchange
<b>Standards</b>		IEC**, cUL**, marine standards**

\*For lower voltage operation, please contact Danfoss Drives

\*\* certification pending for 12-pulse DFE enclosed drives

# Power rating

## 12-pulse Diode Front End (DFE) enclosed drives

AC drive type	Continuous rating (variable torque)		Low overload rating 110% (constant torque)		High overload rating 150% (constant torque)		Cabinet dimensions HxWxD [mm]
	Continuous current I <sub>th</sub> [A]	Continuous power [MVA]	Continuous current I <sub>L</sub> [A]	Continuous power [MVA]	Continuous current I <sub>H</sub> [A]	Continuous power [MVA]	
Nominal voltage 3300 V							
VACON3000-ED-12-0425-03	425	2.4	386	2.2	283	1.6	2130x2400x1000
VACON3000-ED-12-0640-03	640	3.7	582	3.3	427	2.4	2130x2600x1000
VACON3000-ED-12-0820-03	820	4.7	745	4.3	547	3.1	2130x3400x1000
VACON3000-ED-12-1230-03	1230	7.0	1118	6.4	650	3.7	2130x3800x1000
Nominal voltage 4160 V							
VACON3000-ED-12-0340-04	340	2.4	309	2.2	227	1.6	2130x2400x1000
VACON3000-ED-12-0510-04	510	3.7	464	3.3	340	2.4	2130x2600x1000
VACON3000-ED-12-0650-04	650	4.7	591	4.3	433	3.1	2130x3400x1000
VACON3000-ED-12-0980-04	980	7.1	891	6.4	650	4.7	2130x3800x1000

## Active Front End (AFE) enclosed drives

AC drive type	Continuous rating (variable torque)		Low overload rating 110% (constant torque)		High overload rating 150% (constant torque)		Cabinet dimensions HxWxD [mm]
	Continuous current I <sub>th</sub> [A]	Continuous power [MVA]	Continuous current I <sub>L</sub> [A]	Continuous power [MVA]	Continuous current I <sub>H</sub> [A]	Continuous power [MVA]	
Nominal voltage 3300 V							
VACON3000-ED-4Q-0425-03	425	2.4	386	2.2	283	1.6	2130x2400x1000
VACON3000-ED-4Q-0640-03	640	3.7	582	3.3	427	2.4	2130x2600x1000
VACON3000-ED-4Q-0820-03	820	4.7	745	4.3	547	3.1	2130x3800x1000
VACON3000-ED-4Q-1230-03	1230	7.0	1118	6.4	650	3.7	2130x4400x1000
Nominal voltage 4160 V							
VACON3000-ED-4Q-0340-04	340	2.4	309	2.2	227	1.6	2130x2400x1000
VACON3000-ED-4Q-0510-04	510	3.7	464	3.3	340	2.4	2130x2600x1000
VACON3000-ED-4Q-0650-04	650	4.7	591	4.3	433	3.1	2130x3800x1000
VACON3000-ED-4Q-0980-04	980	7.1	891	6.4	650	4.7	2130x4400x1000

## Active Front End (AFE) transformerless enclosed drives

AC drive type	Continuous rating (variable torque)		Low overload rating 110% (constant torque)		High overload rating 150% (constant torque)		Cabinet dimensions HxWxD [mm]
	Continuous current I <sub>th</sub> [A]	Continuous power [kW]	Continuous current I <sub>L</sub> [A]	Continuous power [kW]	Continuous current I <sub>H</sub> [A]	Continuous power [kW]	
Nominal voltage 3300 V							
VACON3000-ED-4Q-0425-03+PICM	425	2430	386	2209	283	1620	2130x3000x1000
VACON3000-ED-4Q-0640-03+PICM	640	3660	582	3327	427	2440	2130x3400x1000
VACON3000-ED-4Q-0820-03+PICM	820	4690	745	4264	547	3127	2130x5200x1000
VACON3000-ED-4Q-1230-03+PICM	1230	7030	1118	6391	650	4680	2130x6000x1000
Nominal voltage 4160 V							
VACON3000-ED-4Q-0340-04+PICM	340	2450	309	2227	227	1633	2130x3000x1000
VACON3000-ED-4Q-0510-04+PICM	510	3670	464	3336	340	2447	2130x3400x1000
VACON3000-ED-4Q-0650-04+PICM	650	4680	591	4255	433	3120	2130x5200x1000
VACON3000-ED-4Q-0980-04+PICM	980	7060	891	6418	650	4680	2130x6000x1000



VACON® 3000 Enclosed Drive



# Options

## VACON® 3000 Enclosed Drive

AFE supply type <sup>1)</sup>	
+PHSI	High Source Impedance
+PICM	LCL with common mode filter
Functional safety	
+QSTO	Safe Torque Off function, Safe Torque Off and Safe Stop 1, SIL3
Precharge input voltage	
+QP24	240 VAC
+QP40	400 VAC
+QP48	480 VAC
Dynamic braking <sup>2)</sup>	
+DBCU	Brake Chopper
Output filter <sup>3)</sup>	
+PODU	dU/dt filter
+POSI	Sine wave filter
+POCM	Common mode filter
Common mode capacitor to ground <sup>4)</sup>	
+PGCO	Removed <sup>6)</sup>

## VACON® 3000 Enclosed Drive

Heat exchanger option <sup>5)</sup>	
+PH00	Liquid/liquid HEX not included
+PHET	Titanium Liquid/liquid HEX included
Coolant connection <sup>5)</sup>	
+PLCT	From top
Control & fan voltage	
+QFV1	115 VAC
+QFV2	230 VAC
DC grounding resistor	
+PGDN	DC neutral-to-ground resistor not connected <sup>6)</sup>
AFE short circuit current	
+PUFE	40 kA, for 100 ms
CE Certificates	
+GACE	EU declaration, CE mark
UL Certificates	
+GAUL	cUL certificate
Marine approvals <sup>7)</sup>	
+GALR	Lloyd's Register
+GADN	Det Norske Veritas

Please contact Danfoss Drives to check the

<sup>1)</sup> source impedance specification and supply type selection

<sup>2)</sup> brake chopper option selection for DFE enclosed drives

<sup>3)</sup> output filter specification/selection and availability

<sup>4)</sup> common mode capacitor option selection

<sup>5)</sup> heat exchanger and coolant connection options availability

<sup>6)</sup> operation in an IT network without a dedicated transformer. Dedicated to IT grids.

<sup>7)</sup> other marine approvals availability

Board & function	Option code & slots	Loose option
OPT-B1 <sup>7)</sup>   6 x DI/DO	+S_B1   C, D, E	OPT-B1-V
OPT-B2   2 x RO + Thermistor	+S_B2   C, D, E	OPT-B2-V
OPT-B4   1 x A1, 2 x AO	+S_B4   C, D, E	OPT-B4-V
OPT-B5   3 x RO	+S_B5   C, D, E	OPT-B5-V
OPT-B9   3 x RO	+S_B9   C, D, E	OPT-B9-V
OPT-BF   1 x AO, 1 x DO, 1 x RO	+S_BF   C, D, E	OPT-BF-V
OPT-BH   Temperature measurement (non-ATEX) (1x, 2x, 3x PT100, PT1000, Ni1000, KTY84)	+S_BH   C, D, E	OPT-BH-V

<sup>7)</sup> OPT-B1-V default for DFE systems and default for AFE control unit for AFE systems

Protocol <sup>8)</sup>	Option code & slot	Loose option
PROFIBUS DP	+S_E3   D, E	OPT-E3-V
PROFIBUS DP with Sub-D9	+S_E5   D, E	OPT-E5-V
CANopen	+S_E6   D, E	OPT-E6-V
DeviceNet	+S_E7   D, E	OPT-E7-V
Dual-port Ethernet	+S_E9   D, E	OPT-E9-V
Advanced dual-port Ethernet	+S_EA   D, E	OPT-EA-V
EtherCAT	+S_EC   D, E	OPT-EC-V

<sup>8)</sup> If fieldbus protocol option board selected, will be installed into INU and AFE control units.

# Integrated liquid-to-liquid heat exchangers

We have a range of cooling units based on integrated liquid-to-liquid heat exchangers, which improve the availability and usability of AC drive systems. The integrated heat exchanger is a pre-designed, pre-tested and fully functional package that ensures safety and reliability.

## Intelligent system interfaces for heavy industries

- Self-supporting module rack construction
- Cooling circuit equipped with threaded joints or flanges
- Heavy industry, stainless steel
- Industrial water heat exchanger, three-way-valve, pump
- Flow and pressure sensors
- Stainless steel AISI piping
- Two-way-valve
- Double pumps for marine class requirements

## Integrated liquid-to-liquid heat exchanger specifications

Cooling capacity	up to 200 kW
Coolant flow	up to 450 l/min
Expansion tank	12 liters, stainless steel
Instrumentation	Temperature sensors (2 pcs)
	Pressure sensors (2 pcs)
	Coolant level indicator
	Coolant level alarms (2 pcs)
Materials	Stainless steel and aluminum
	All materials are copper free
	No surface coatings
Coolant	Water-glycol mixture
Interfaces for water lines	Water to water heat exchanger
	Cooling manifolds
Option	Electrical heater



# Typecode key example

## VACON® 3000 Enclosed Drive

VACON3000	ED	4Q	0425	03	+PICM
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VACON3000	Product range VACON® 3000 w
ED	Product class ED = Enclosed drive
4Q	Front end 12 = 12-pulse 24 = 24-pulse 4Q = AFE
0425	Drive rating e.g. 0425 = 425 A
03	Motor voltage/output voltage (Same terminology as for LV) 03 = 3300 V 04 = 4160 V
+PICM	Options e.g. +PICM = Input common mode filter

## Optimize your configuration using our expertise

When configuring and installing the VACON® 3000 Enclosed Drive, you can draw upon the experience of experts in Danfoss Drives' Application Development Centres (ADCs). Consulting and testing services provided by application experts are available to you as a customer from anywhere in the world. Simply contact your local Danfoss Drives sales office.

### Medium Voltage

Services offered at the Medium Voltage Application Development Center (ADC) include production and testing of medium-voltage AC drives. Full testing of configurations is available.

The Medium Voltage ADC is located in Research Triangle Park (RTP), Raleigh-Durham area, North Carolina. Close to research centers, universities and existing power electronic clusters,

this is an ideal location, where our customers benefit from the knowledge density in the local power electronics environment.

### Marine and Offshore

The focus at the Marine Application Development Center (ADC) is on hybridization, including storage, and medium-voltage drives. Danfoss is renowned for long-term stability in product quality, and the ADC combines that with short-term agility to be able to act as an early adapter of Megatrends. Through its partners, the ADC has test facilities available to build, test and validate new solutions at full scale, with a direct interaction between key partner engineers and Danfoss R&D engineers.

The Marine ADC is located in the Netherlands, and is equipped with a range of testing and demo units. These include a full-scale medium-voltage test setup with loads up to 2 MW, and a second LV motor load test bench for regenerative applications, and multiple VACON® drives for drive sync applications, generator synchronizing and load sharing.

A power-conversion-technology test bench with battery system is available for testing and demonstrating energy storage and grid converter applications for hybrid propulsion systems, and ship-to-shore power supply.

# A better tomorrow is **driven by drives**

## **Danfoss Drives is a world leader in variable speed control of electric motors.**

We offer you unparalleled competitive edge through quality, application-optimized products and a comprehensive range of product lifecycle services.

You can rely on us to share your goals. Striving for the best possible performance in your applications is our focus. We achieve this by providing the innovative products and application know-how required to optimize efficiency, enhance usability, and reduce complexity.

From supplying individual drive components to planning and delivering complete drive systems; our experts are ready to support you all the way.

You will find it easy to do business with us. Online, and locally in more than 50 countries, our experts are never far away, reacting fast when you need them.

You gain the benefit of decades of experience, since 1968. Our low voltage and medium-voltage AC drives are used with all major motor brands and technologies in power sizes from small to large.

### **For more information visit our website**



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