

ENGINEERING  
TOMORROW



Selection Guide 0.25 kW – 2 MW

# VLT® AQUA Drive FC 202 series delivers the **ultimate cost efficiency**

**30%**

cost reduction in  
1st year compared  
with traditional drive  
systems

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

**VLT®**







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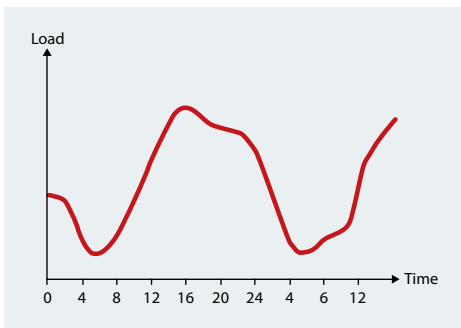
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# In modern plants, energy savings are just part of the cost equation



Here in Aarhus, Denmark, this wastewater treatment plant has changed the energy picture, based on advanced process control and extensive use of the VLT® AQUA Drive. It is no longer a question of 60 % energy savings, but rather of 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 more or less 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.

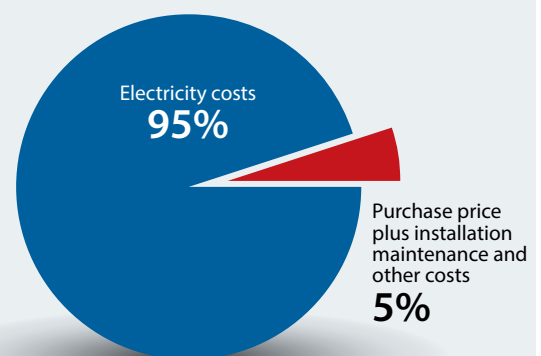
The benefits are obvious:

- Better water quality
- Better asset protection
- Less maintenance costs
- Reduced energy cost
- Higher plant reliability/performance

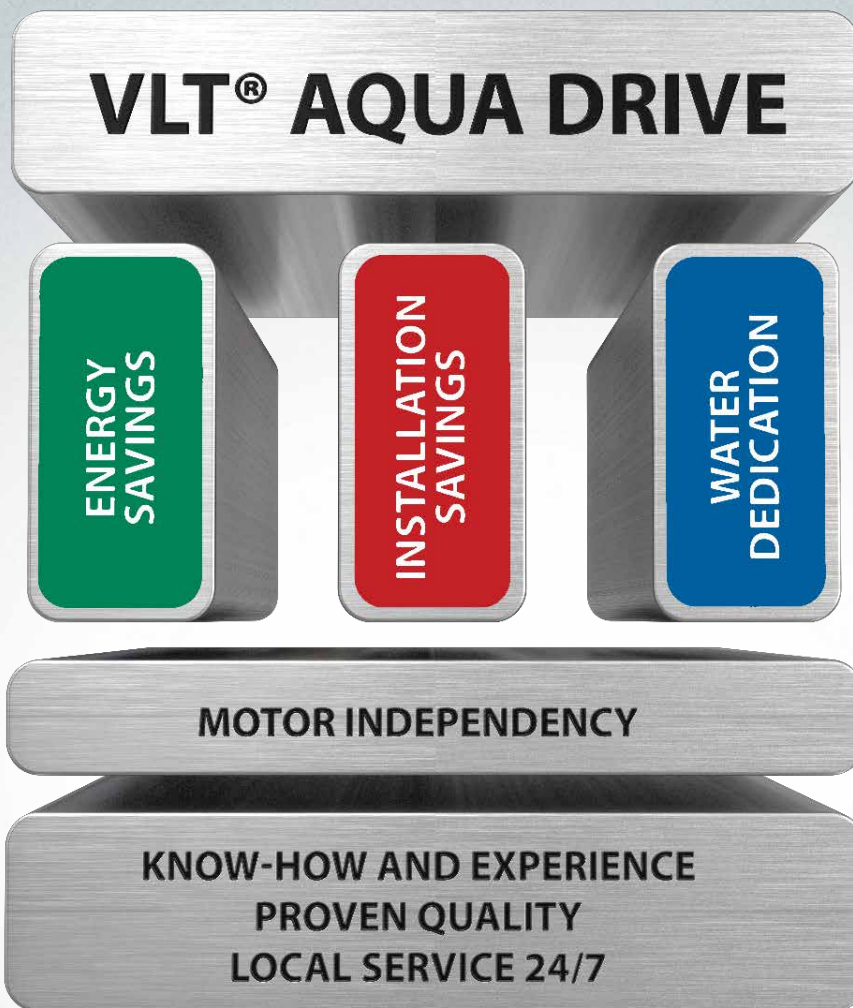
## Small investment – big returns Look at the lifetime savings

Over the last decades, the relative cost of Variable Speed Drives (VSDs) has dropped and energy prices have increased. This makes it more attractive to use VSDs on more or less all rotating equipment. Over the lifetime of the VSD, energy cost is the dominating economical factor. The energy efficiency of the VSD must therefore be a key selection parameter.

The new generation VLT® AQUA Drive's 0.5 to 2 % better installed energy efficiency compared with traditional drives is on same level as savings gained by moving from an IE2 to an IE3 motor.







*Nothing beats know how and experience*

The new generation VLT® AQUA Drive  
built from the bottom up  
To deliver the ultimate cost efficiency

The new generation VLT® AQUA Drive is built on a solid foundation of know-how and experience – combine this with Danfoss quality and our global network of local 24/7 service and you get 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, we can always offer you a free choice between motor suppliers.

#### **A powerful combination**

Three pillars raise the performance of the VLT® AQUA Drive to new heights: It's our unique combination of energy savings, reduced installation costs and a solid dedication to all your water applications that sets the new generation VLT® AQUA Drive above the competition when it comes to overall lifetime savings.

#### **Up to 30% first-year cost savings**

With a combination of powerful new features and functions, the new generation VLT® AQUA Drive can realistically offer first-year cost savings between 10 – 30%, relative to the investment made in the drives, compared to traditional drive solutions.



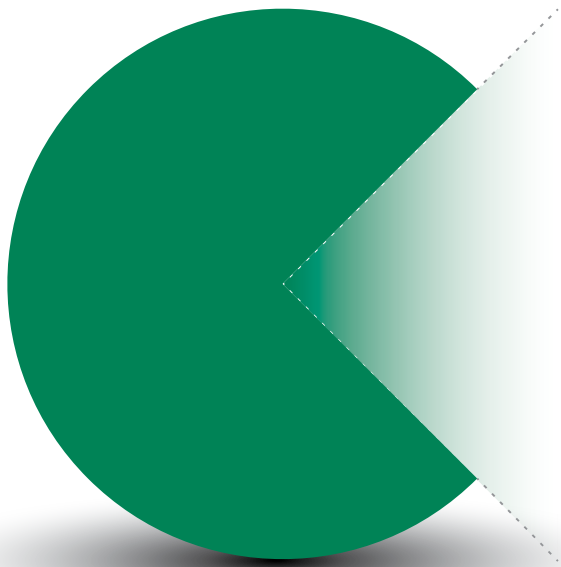
# Market leading energy efficiency

## Save up to 25% of investment first year

Our tight focus on energy efficiency at every stage of development including the net efficiency when the new generation VLT® AQUA Drive is installed means that you get a drive that delivers cost savings of up to 25 % of investment in the drive in its first year, when compared to traditional VSD solutions. That's the equivalent to the savings gained by choosing an IE 3 motor instead of an IE 2.

### Efficiency

## 5 reasons to choose 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

#### 1. Energy efficient design

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

#### 2. Intelligent heat management

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

Go to [www.danfoss.com](http://www.danfoss.com) for video.

#### 3. 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 the 90 % load, with typical savings up to 5 % over the whole range.

#### 4. Energy efficient harmonic mitigation

Our unique VLT® Low Harmonic Drive with integrated AAF filter delivers an energy efficiency that is 2-3 % better than traditional VSD with Active Front End technology. Sleep function at low load secures further energy savings.

#### 5. Optimal control of all motors

The VLT® AQUA Drive's capability to efficiently operate the different motor types in the market, secures you a free choice between motor suppliers. One of the latest developments is for high speed PM motors.

The unique Danfoss VVC+ control technology is ideal for high speed turbo blowers using PM motors, offering from 0.5 to 3 % additional installed energy savings compared with using traditional VSDs.



# Installation savings and user friendliness

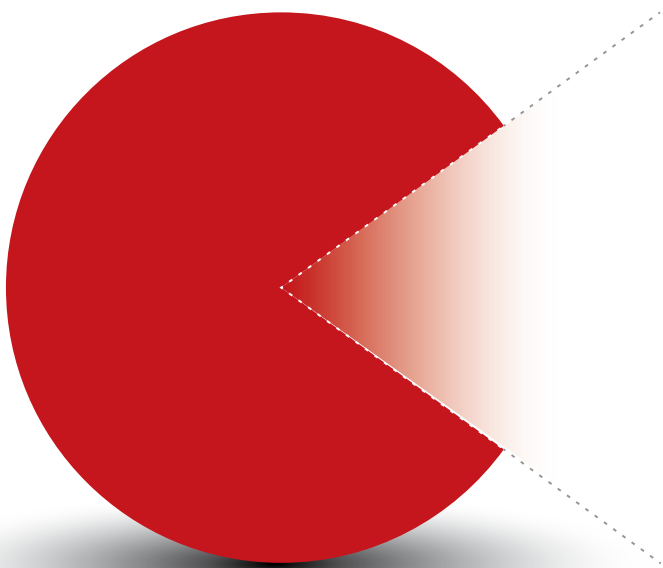
## Save up to 20%



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

### *Simplicity*

## 8 reasons to choose new VLT® AQUA Drive



1. Less panel space
2. Direct outdoor installation
3. Long cable capability as standard
4. Reduce air conditioning investment
5. Integrated harmonic mitigation
6. Printed circuit board protection as standard
7. Easy commissioning
8. Minimum 10 years' lifetime

### 1. Less panel space

The unique combination of Danfoss 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 offer a very space-friendly package when the complete solution is installed.

### 2. Direct outdoor installation

As standard, Danfoss offers VSD in IP66/NEMA 4X. In addition to the convenience of having the VSD close to the pump, for example, this typically reduces cable costs, removes the need for air condition capacity and lowers control room costs.

### 3. Long cable capability as standard

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

### 4. Air conditioning investment reduced by 90 %

Unique Danfoss back channel cooling system offers up to 90 % reduction in investment for air cooling systems to remove heat from the VSDs.

### 5. Integrated harmonic mitigation

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

### 6. Printed circuit boards protection as standard

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

### 7. Easy commissioning

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

### 8. Designed for a minimum 10 years' lifetime

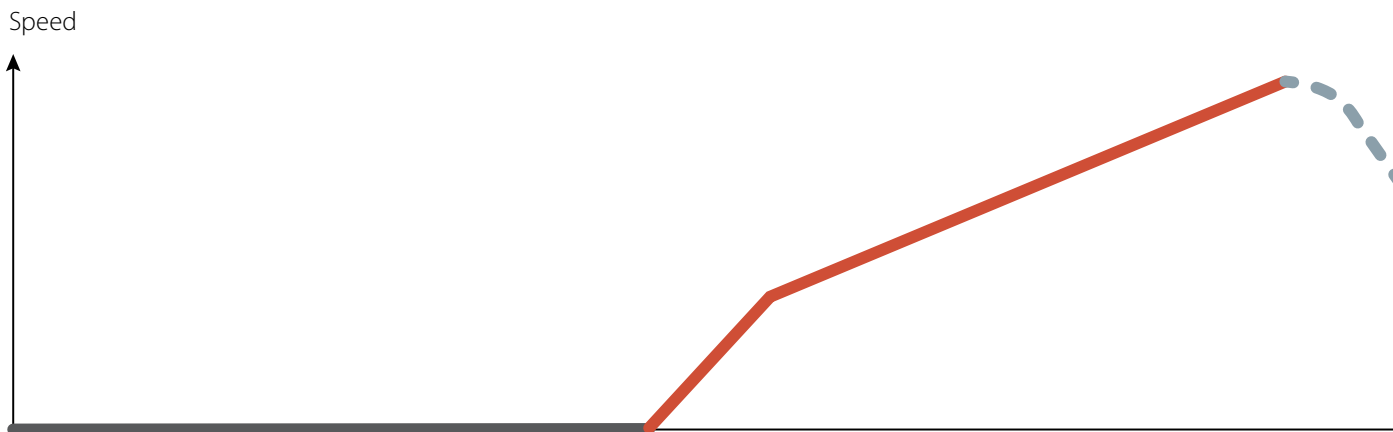
With the VLT® AQUA Drive's high quality components, maximum 80 % load on components and intelligent heat management reducing dust on PCB's, the need for routine scheduled parts replacements, such as electrolytic capacitors and fans has been removed.



# An unsurpassed fit for all your water applications

The new generation VLT® AQUA Drive is the perfect match for all water and wastewater applications. Specially designed software features help protect your assets in many ways such as by avoiding water hammer, reducing maintenance on pumps and blowers and by saving additional energy compared with 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
- High and normal overload
- 4 set ups
- Multi-zone
- 3 PID controllers for additional equipment
- Smart Logic Controller




### Starting

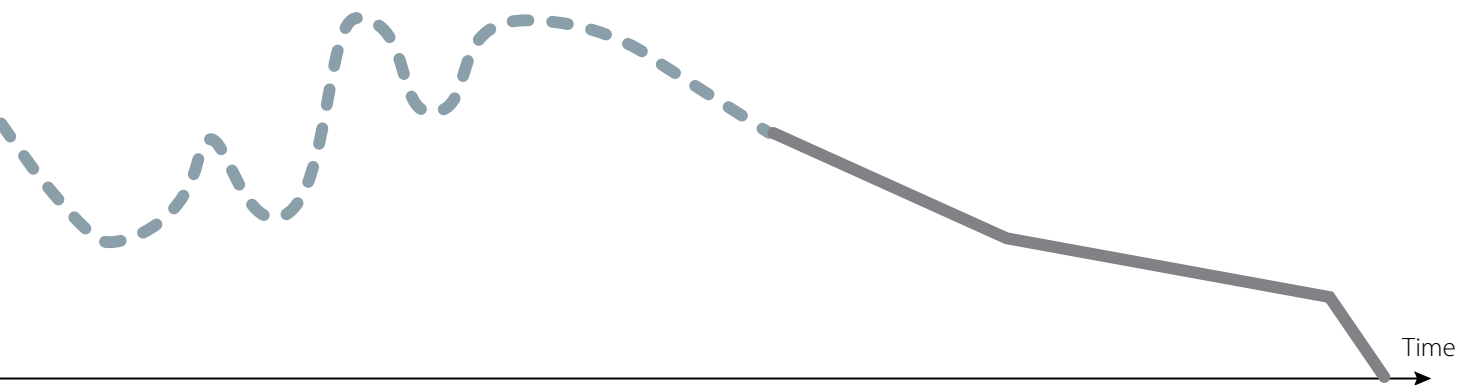
- Pre-lubrication
- Deragging
- Pipe filling
- Initial ramp
- Advanced minimum speed monitoring
- Flow confirmation



## Lifetime benefits

# 6 reasons to choose new VLT® AQUA Drive

- 
1. User friendliness
  2. Flexibility
  3. Reliability
  4. Energy saving
  5. Pipe and plant asset protection
  6. Reduced maintenance



### 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 infos, warnings and alarms
- Flow compensation



### Stopping

- Check valve ramp
- Final ramp
- Post lubrication
- Deragging

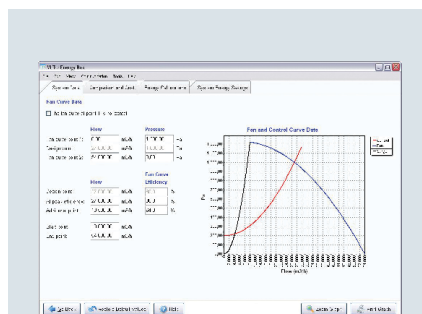


## Benefits of using VLT® AQUA Drive in water supply

Pumping water out to the customer from the water work can seem to be a simple process. The fact is, that energy for these pumps typically represent 60-80% of total energy consumption for the whole water supply system. Besides the major energy savings 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 tap water
- Lower the risk of road breaks and costly pipe repair
- Extend your network's service life
- Reduce water consumption
- Postpone investment in plant upgrades
- Reduce risk of water hammer



### Try it yourself

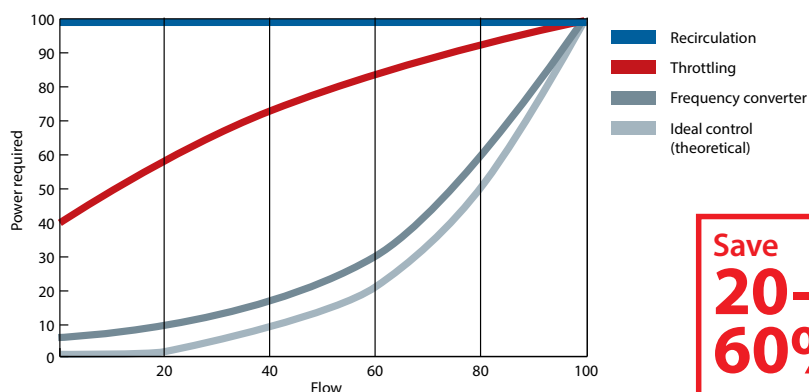
By using the VLT® Energy Box software you can easily get a complete financial analysis for pumps including payback time – download it here:

[www.danfoss.com/vltenergybox](http://www.danfoss.com/vltenergybox)

## Control your centrifugal pump or blower with 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. Just 20% reduction in pump speed/flowrate can offer up to 50% energy reduction, for example.



Save  
**20-60%**





## Benefits of using VLT® AQUA Drive in wastewater treatment

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%.

Beside these major benefits, a drive control of the aeration system will also offer:

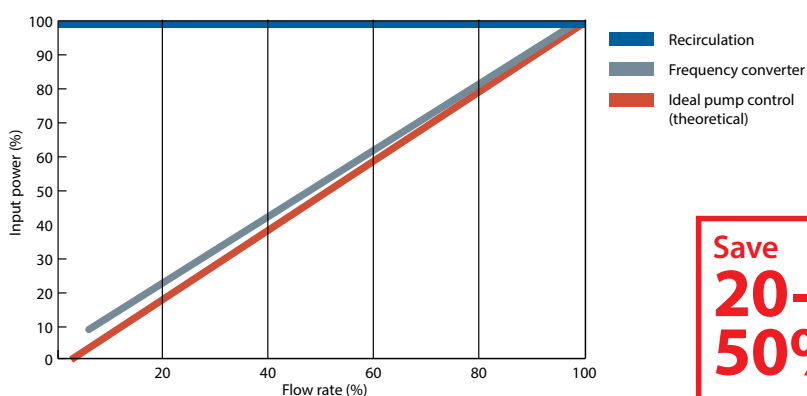
- Correct DO level, independent of load variations, reducing the risk that outlet values are outside permission level

- Regulation of nitrification capacity, as a function of temperature and load variations and limit energy and carbon use (giving more carbon for electricity production)
- Secure effective de-nitrification process by avoiding excessive DO
- Reduced wear on aeration equipment

## Control your positive displacement blower or pump with VLT® AQUA Drive

In a system using positive displacement blowers or pumps, high energy savings can be obtained by using VLT® AQUA

Drives. 30% reduction in speed will offer 30% energy savings (assuming constant pressure).



**Save  
20-  
50%**

Go to [www.danfoss.com](http://www.danfoss.com) for case stories.



# 3 Basic

The Basic Cascade Controller is built in to VLT® drives. It controls up to three pumps



## Maximum flexibility with VLT® Cascade Controller – customised for up to 3, 6 or 8 pumps

The controller provides accurate flow, pressure, and level control that make your multiple pump systems work in an optimised efficient way.

The VLT® drives have a basic cascade function embedded in the drive itself that controls up to three pumps.

Cascade control of more than three pumps requires the Multi-function Cascade Controller option.

The VLT® Cascade Controller controls speed and sequence of up to eight pumps or blowers in three modes.

### Standard cascade mode

- Variable speed of one motor and on/off control of the remainder

### Mixed pump mode

- Variable speed of a few pumps and on/off control of the remainder
- Support of unequal size pumps.

### Master/Follower mode

- Controls all pumps with optimised speed. This mode is the most energy optimised solution.
- Ensures maximum performance with minimum pressure surges.

In all three modes, pumps are staged on or off depending on the need.

### Run-time balancing

The cascade controller can be used to balance the run-time for each pump in a system.

# 6 Extended

The VLT® Extended Cascade Controller option MCO 101 controls up to six pumps. As an extension of the Basic Cascade Controller

- or for Mixed pump applications
- or for Master follower applications



# 8 Advanced

The VLT® Advanced Cascade Controller option MCO 102 controls up to eight pumps. As an extension of the Basic Cascade Controller  
– or for Mixed pump applications  
– or for Master follower applications

## Easy commissioning and service

The VLT® Cascade Controller can be commissioned from the drive display or using MCT 10 PC software in its free-of-charge download version. The MCT 10 configuration tool makes setup of the cascade controller parameters very easy.

The pump status can be followed in the drive display during operation and the run-time of each pump together with the number of starts are logged. System performance is easily tracked.

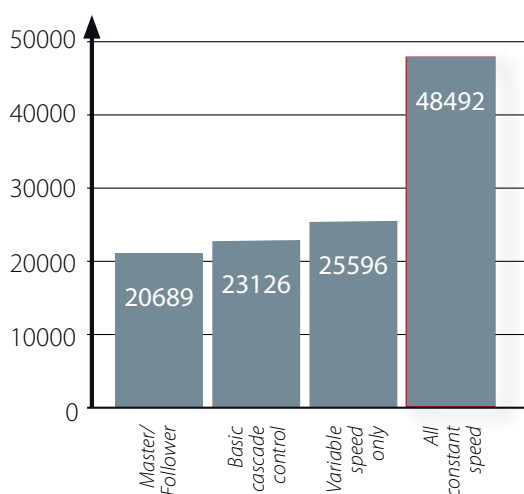
## Built-in

The Multi-function Cascade Controller option is mounted directly within the drive and includes a host of pump control features. This often eliminates the need for PLC's and other external control equipment.

## Easy upgrade

With the VLT® plug and play flexibility in adding option cards in the drive, it is very easy to expand the Basic Cascade Controller. Minimum time and no extra space is required.

## Energy consumption [kWh]



Using Master/Follower mode can reduce the energy consumption to less than half compared to traditional across the line on/off cycling of pumps/blowers and valve throttling.

## Same hardware up to 2 MW

The same cascade controller hardware is common to the entire power range up to 2 MW.

Lead pump alternation is possible with all VLT® Cascade Controllers, even the built-in Basic Cascade Controller.

The feature ensures that up to eight pumps or blowers are used equally and ensures that pumps will not run for extended periods.

Alternation can be programmed to take place on digital input, when in sleep mode, when a pump is degraded, or at preset times.

## Pump Interlocking

In case a pump or blower is out of order or being serviced the VLT® Cascade Controller can be set – manually or by digital input – in “Pump Interlocking”.

The cascade controller will then skip the specific pump or blower in its staging sequences.

Built for:	Who benefits?
<ul style="list-style-type: none"> <li>Water distribution and booster pumps</li> <li>Wastewater Lift stations (normal or inverse)</li> <li>Aeration blowers</li> <li>Irrigation pumps</li> </ul>	<ul style="list-style-type: none"> <li>Pump and blower OEMs with multiple pump/blower systems</li> <li>System integrators/installers – booster set manufacturers – pump skid manufacturers</li> <li>Anyone interested in a high level of process control and energy conservation in multi-pump or blower systems</li> </ul>

# Free choice of motor technology Easy commissioning and algorithms for optimal efficiency

As an independent manufacturer of drive solutions, Danfoss is committed to supporting all commonly used motor types and fostering ongoing development.

Danfoss frequency converters have traditionally offered control algorithms for high efficiency with standard induction motors and permanent magnet (PM) motors, and now they

also support synchronous reluctance motors. In this way Danfoss offers you to combine your favorite motor technology like asynchronous-, permanent magnet- or synchronous reluctance motors with a VLT® AQUA Drive.

Furthermore, the VLT® AQUA Drive makes commissioning just as easy as with standard induction motors by combining ease of use with additional

helpful functions such as SmartStart and automatic motor adaptation, which measures the motor characteristics and optimises the motor parameters accordingly. This way the motor always operates at the highest possible efficiency, allowing users to reduce energy consumption and cut costs.



# The most comprehensive programme to cover all your applications

With the introduction of the new generation VLT® AQUA Drive, you now get the most comprehensive dedicated AQUA programme in the market. Now you can cover all your applications with the same product series and user interface, whether you need a 0.25 kW or 2 MW 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 a focus on water

The new generation VLT® AQUA Drive represents the best combination of know how and experience – based on 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, Wertheim, Germany**  
*Raw water from deep wells is treated in a three stage process. VLT® AQUA Drives make it possible to balance these three processes to maximise treatment performance.*




**Wastewater treatment, Hanoi, Vietnam**  
*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, Romania**  
*10 high power VLT® AQUA Drives secure optimal energy and water control in major irrigation facility in Romania.*





Control motors  
down to 0.25 kW  
without a  
step-down  
transformer on  
690 V mains.

50 °C

ambient  
temperature  
without derating

### **Training based on experience**

*Keep up to date on trends, methods and features that save additional energy or offer new technical opportunities to increase your product quality or decrease the downtime of your plant.*

*Receive the same quality training anywhere in the world with Danfoss-developed material and trainers. Training can take place at one of Danfoss' facilities or directly at the customer's own facility. Teaching is conducted by local trainers who have broad experience in the many conditions that may affect performance, so you get the most out of your Danfoss solution.*

*Additionally, the online platform Danfoss Learning offers you the opportunity to extend your knowledge in small and compact lessons up to extensive training courses, when and wherever you want.*

*Read more at [learning.danfoss.com](https://learning.danfoss.com)*



# Flexible, modular and adaptable

## Built to last

**A VLT® AQUA Drive is built on a flexible, modular design concept to provide an extraordinarily versatile motor control solution. The drive is equipped with a wide range of features dedicated to the water/wastewater business.**

**Optimal process control, higher quality output and reduce costs related to spare parts and service, and much more can be achieved.**

### Up to 2 MW

Available in a performance range from 0.25 kW to 2 MW the VLT® AQUA Drive FC 202 series can control nearly all standard industrial motor technologies, including permanent magnet motors, synchronous reluctance motors, copper rotor motors and direct line PM.

The frequency converter is designed to work with all common supply voltage ranges: 200-240 V, 380-480 V, 525-600 V and 525-690 V. This means that system designers, OEMs and end users are free to connect the drive to their chosen motor and remain confident that the system will perform to the highest possible standards.

### 690 V

The 690 V versions of VLT® AQUA Drive units can control motors down to 0.25 kW without step-down transformer. This enables you to choose from a broad variety of compact, reliable and efficient drives for demanding applications operating from 690 V mains networks.

### Reduce costs with compact drives

A compact design and efficient heat management enable the drives to take

up less space in control rooms and panels, thereby reducing initial costs. Compact dimensions are also an advantage in applications where drive space is restricted. This makes it possible for designers to develop smaller applications without being forced to compromise on protection and grid quality. For example, the D frame versions of the VLT® AQUA Drive FC 202 from 75-400 kW are 25-68% smaller than equivalent drives.

Especially impressive are the 690 V versions, which are among the smallest in its power class on the market today, and are available in an IP54 enclosure.

Despite the compact dimensions, all units are nevertheless equipped with integrated DC link chokes and EMC filters, which help to reduce grid pollution and reduce cost and efforts for external EMC-components and wiring.

The IP20 version is optimized for cabinet mounting and features covered power terminals to prevent accidental contact. The unit can also be ordered with optional fuses or circuit breakers in the same package size. Control and power cables are fed in separately at the bottom.

The frequency converters combine a flexible system architecture, which allows them to be adapted to specific applications, with a uniform user interface across all power classes. This allows you to adapt the drive to the exact needs of your specific application. As a result project work and costs are subsequently reduced. The easy to use interface reduces

training requirements. The integrated SmartStart guides users quickly and efficiently through the setup process, which results in fewer faults due to configuration.



### VLT® platform highlights

- Versatile, flexible, configurable
- Up to 2 MW in common voltages
- Asynchronous, Synchronous Reluctance and PM motor control
- 7 fieldbuses supported
- Unique user interface
- Globally supported
- EMC filters integrated as standard

# Configure for cost savings via intelligent heat management, compactness and protection

**All Danfoss VLT® frequency converters follow the same design principle for fast, flexible and fault-free installation and efficient cooling.**

VLT® AQUA Drives are available in a broad range of enclosures sizes and protection ratings from IP00 to IP66 to enable easy installation in all environments: mounted in panels, switch rooms or as stand-alone units in the production area.

## **Cost saving heat management**

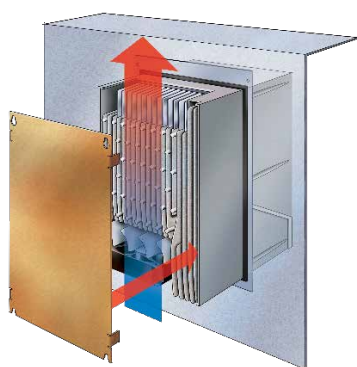
In VLT® AQUA Drives there is total separation between cooling air and the internal electronics. It protects electronics from contaminants. At the

same time it removes heat efficiently which helps to prolong product life, increase the overall availability of the system and reduce faults related to high temperatures.

For example, by exhausting heat directly outside it is possible to reduce the size of the cooling system in the panel or switch room. This can be achieved with Danfoss' panel through cooling system or the extremely efficient back channel cooling concept,

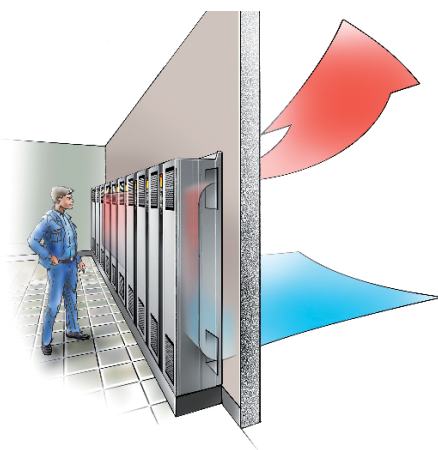
that also allows to conduct the heat into the outside of the control room. Both methods make it possible to reduce the initial cost of the panel or switch room.

In daily use the benefits are equally clear as the energy consumption related to cooling can be reduced significantly. This means that designers can reduce the size of the air conditioning system, or even eliminate it entirely.



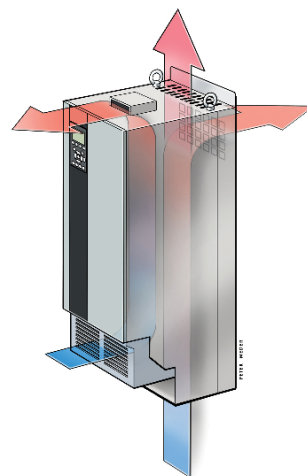
### **Panel through cooling**

*An accessory mounting kit for small and mid-range drives enables heat losses to be directed directly outside the panel room.*



### **Back-channel cooling**

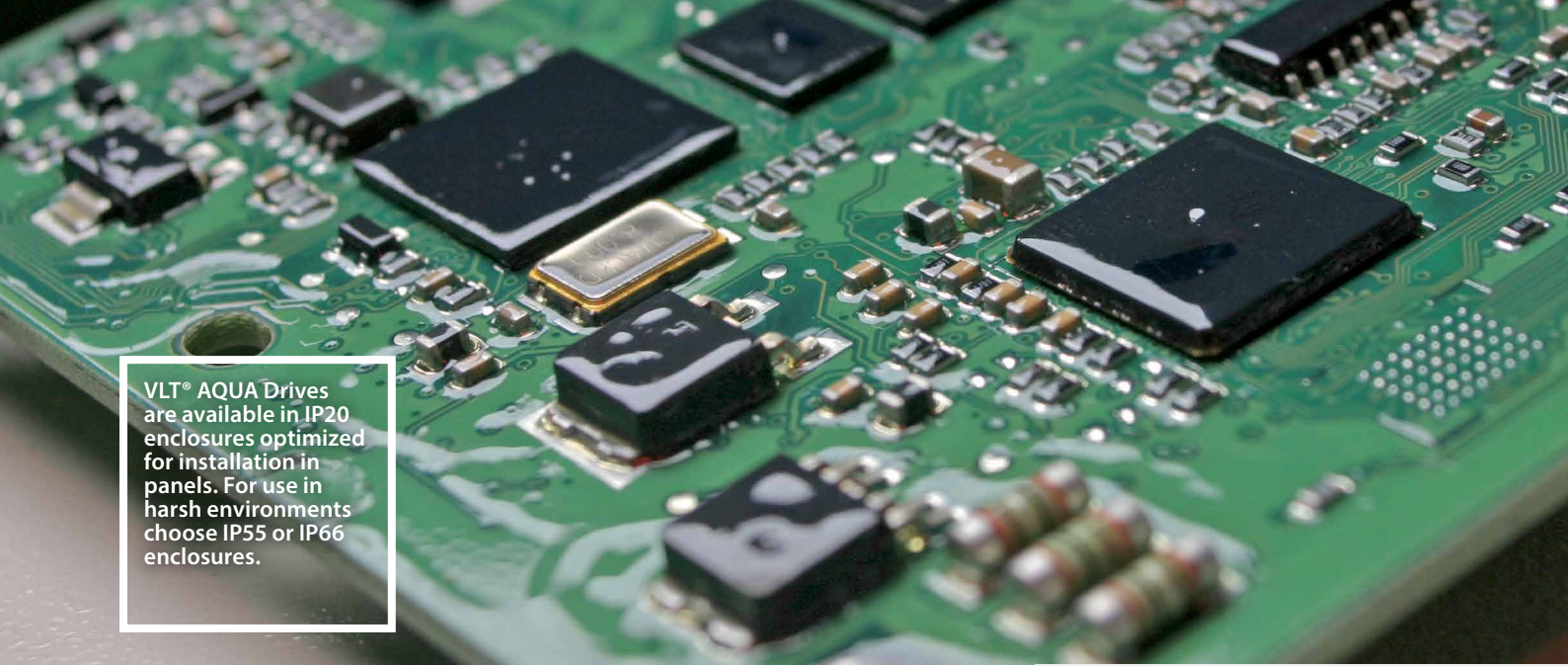
*By directing air through a rear cooling channel up to 85-90% of the drive's heat loss is removed directly outside the installation room.*



### **No air over electronics**

*Complete separation between cooling air and the internal electronics ensures efficient cooling.*





VLT® AQUA Drives are available in IP20 enclosures optimized for installation in panels. For use in harsh environments choose IP55 or IP66 enclosures.

### Coated circuit boards

The VLT® AQUA Drive is as standard conforming to class 3C2 (IEC 60721-3-3). If used in especially harsh conditions it is possible to order a special coating that complies with class 3C3.

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

### Ruggedized for extra protection

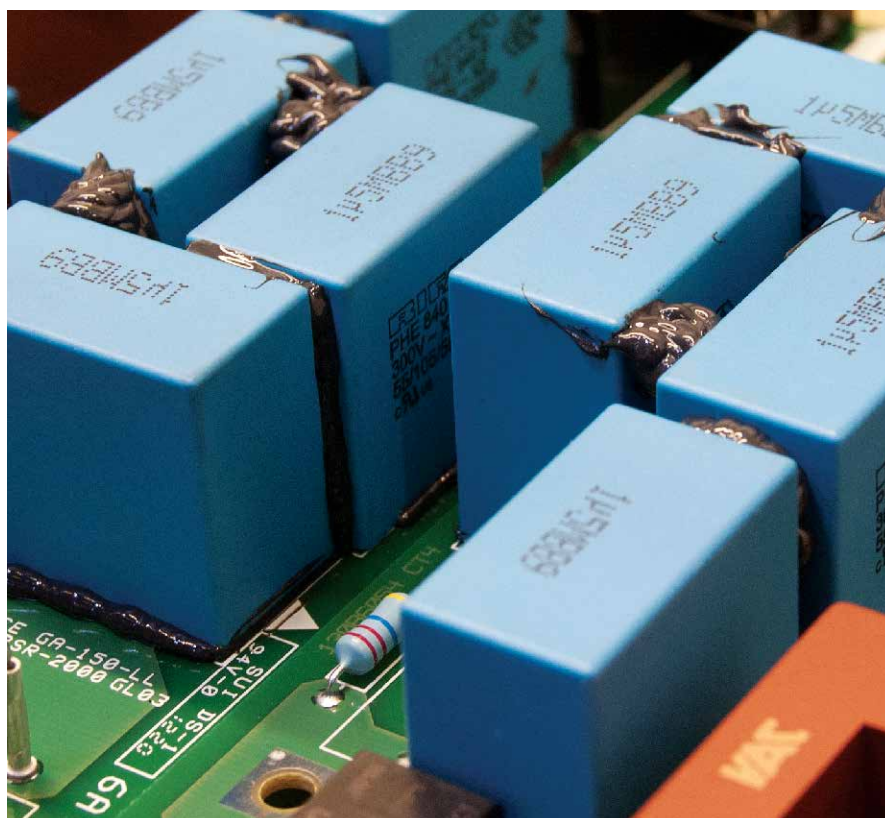
The VLT® AQUA Drive is available in a 'ruggedized' version, that ensures that components remain firmly in place in environments characterized by high degrees of vibration such as Marine and mobile equipment.



### Retrofitting. Fast upgrade to newest technology platform

As technologies evolve and newer, smaller and more efficient models replace old drives, it is important to Danfoss that you can change and upgrade as easily as possible. Minimize downtime in your production and update your installation in a few minutes with prepared tools from Danfoss. With a Danfoss conversion kit it is easy and fast to prepare your application for the future:

- Mechanical adaptation
- Electric adaptation
- Parameter adaptation with VLT® Motion Control Tool MCT 10







# Optimize performance and grid protection

## **Built-in protection as standard**

The VLT® AQUA Drive FC 202 contains all modules necessary for compliance with EMC standards.

A built-in, scalable RFI filter minimizes electromagnetic interference and the integrated DC link chokes reduce the harmonic distortion in the mains network, in accordance with IEC 61000-3-2. Furthermore, they increase the lifetime of the DC link capacitors and therefore also the drive's overall efficiency.

The solutions save cabinet space, as they are integrated in the drive from the factory. Efficient EMC mitigation also enables the use of cables with smaller cross-sections, which again reduces installation costs.

**Danfoss VLT® AQUA Drives are equipped with DC chokes that reduce mains interference to a THDi of**

**40%**



## Expand grid and motor protection with filter solutions

If needed, Danfoss' wide range of solutions for harmonic mitigation can provide additional protection, such as the

- VLT® Advanced Harmonic Filter AHF
- VLT® Advanced Active Filter AAF
- VLT® Low Harmonic Drives
- VLT® 12-pulse Drives

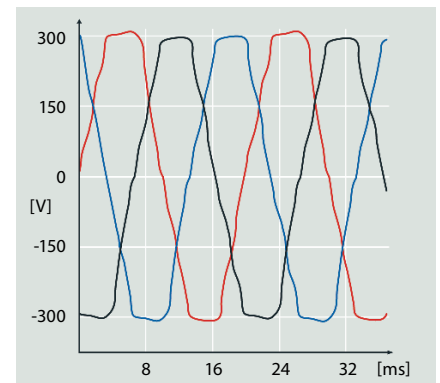
Provide motor protection with:

- VLT® Sine Wave Filter
- VLT® dU/dt Filter
- VLT® Common Mode Filters

With this solutions you may achieve optimum performance for your application, even in weak or unstable grids.

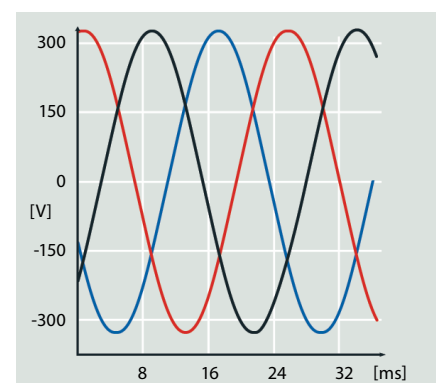
## Use motor cables up to 300 m

The design of the VLT® AQUA Drive makes it a perfect choice in applications that require long motor cables. Without needing additional components the drive provides trouble free operation with cable lengths of up to 150 m screened or 300 m unscreened. This allows the drive to be installed in a central control room a distance away from the application without affecting motor performance.



### Harmonic distortion

Electrical interference reduces efficiency and risks harming equipment.



### Optimised Harmonic performance

Efficient harmonic mitigation protects electronics and increases efficiency.

EMC Standards		Conducted emission		
Standards and requirements	EN 55011 Facility operators must comply with EN 55011	Class B Housing and light industries	Class A Group 1 Industrial environment	Class A Group 2 Industrial environment
	EN/IEC 61800-3 Converter manufacturers must conform to EN 61800-3	Category C1 First enviroment, home and office	Category C2 First enviroment, home and office	Category C3 Second enviroment
FC202 compliance <sup>1)</sup>		■	■	■

For further details see the VLT® AQUA Drive Design Guide

<sup>1)</sup> Compliance to mentioned EMC classes depends on the selected filter



## Adverse effects of harmonics

- Limitations on supply and network utilization
- Increased transformer, motor and cable heating
- Reduced equipment lifetime
- Costly equipment downtime
- Control system malfunctions
- Pulsating and reduced motor torque
- Audible noise

For technical details and further information please see also VLT® High Power Drive Selection Guide.

## Solutions for harmonics mitigation

**The mains voltage supplied by electricity utilities to homes, businesses and industry should be a uniform sinusoidal voltage with a constant amplitude and frequency.**

This ideal situation is no longer found in any power grid due to harmonics. This is mainly because consumers take non-sinusoidal current from the grid or have a nonlinear characteristic, e.g. strlPlights, light dampers, energy-saving bulbs and frequency converters.

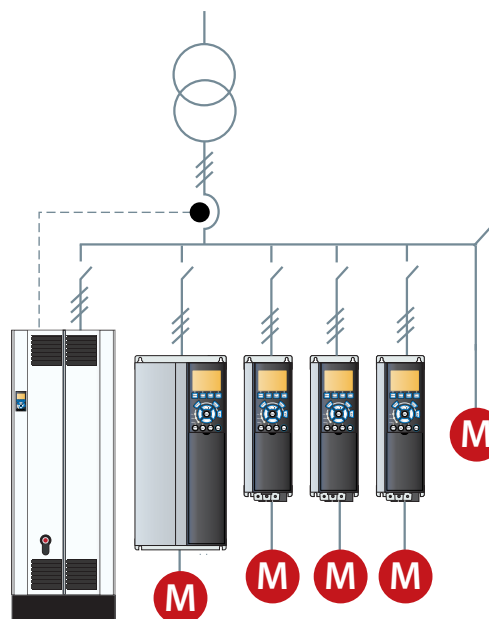
Because of the constantly increasing use of non-linear loads, deviations become increasingly serious. Irregular power supplies influence the performance and operation of electrical equipment, so motors, frequency converters and transformers must be more highly rated to maintain proper operation.

### VLT® Advanced Active Filter AAF 006

VLT® Advanced Active Filters identify harmonic distortion from non-linear loads and inject counter-phase harmonic and reactive currents into the AC line to cancel out the distortion, resulting in distortion levels of no more than 5% THvD. The optimal sinusoidal waveform of the AC power is restored and the power factor of the system is reestablished at 1.

Advanced Active Filters follow the same design principles as all our other drives. The modular platform provides high energy efficiency, user friendly operation, efficient cooling and high enclosure ratings.

VLT® Advanced Active Filter AAF 006  
Voltage range: 380-480 V  
Corrective current range: 190-400 A



## VLT® Advanced Harmonic Filter AHF 005/010

The Danfoss harmonic filters AHF 005/010 are specially designed to be connected in front of a VLT® frequency converter, and ensure that the harmonic current distortion generated back to the mains is reduced to a minimum.

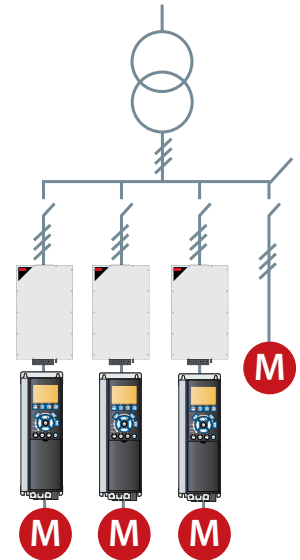
One filter can be used for several frequency converters, helping owners reduce system costs. Easy commissioning saves installation costs, and due to the filter's maintenance free design running expenses for the units are eliminated.

VLT® Advanced Harmonic Filter AHF 005 (5% THDi)

VLT® Advanced Harmonic Filter AHF 010 (10% THDi)

Voltage range: 380-690 V

Filter current range: 10-480 A



## VLT® Low Harmonic Drive

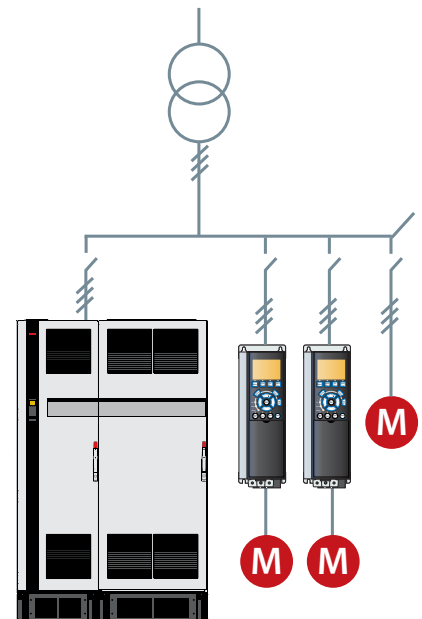
The VLT® Low Harmonic Drive continuously regulates the network and load conditions without affecting the connected motor.

The drive combines the well-known performance and reliability of standard VLT® drives with a VLT® Advanced Active Filter. The result is a powerful, motor friendly solution that provides the highest possible harmonic mitigation with THDi (total harmonic current distortion) of maximum 5%.

VLT® Low Harmonic Drive

Voltage range: 380-480 V

Power range: 160-710 kW



## VLT® 12-Pulse Drive

Robust and cost effective harmonic solution for the higher power range. The VLT® 12-pulse drive offers reduced harmonics for demanding industry applications above 315 kW.

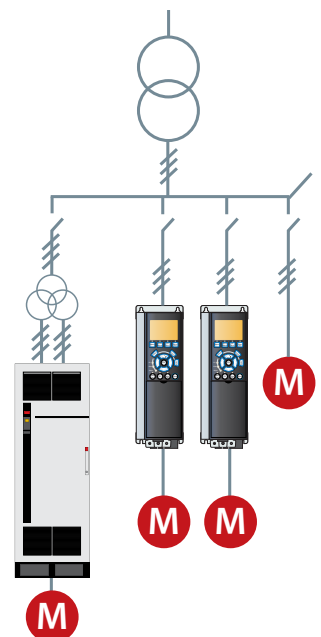
The VLT® 12-pulse is a high efficiency variable frequency converter which is built with the same modular design as the popular 6-pulse VLT® drives. It is offered with similar drive options and accessories and can be configured according to customer need.

The VLT® 12-pulse drive provides harmonic reduction without adding capacitive or inductive components which often require network analysis to avoid potential system resonance problems.

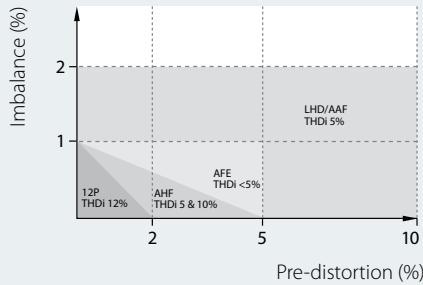
VLT® 12-Pulse Drive

Voltage range: 380-480 V

Power range 315 kW – 1.0 MW

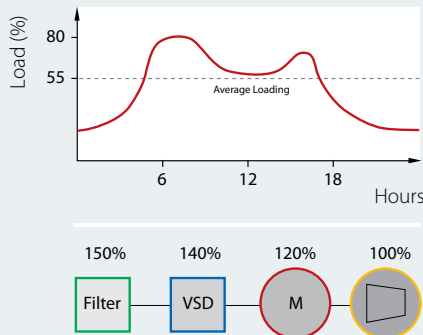
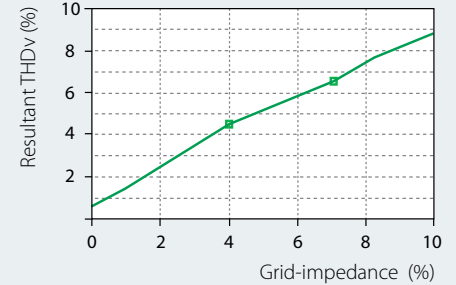


# Cost effective mitigation



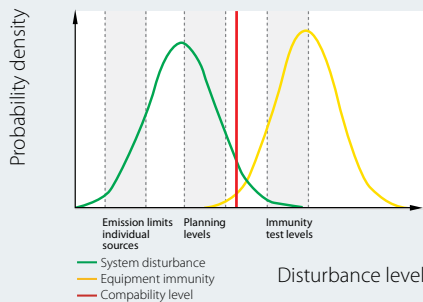
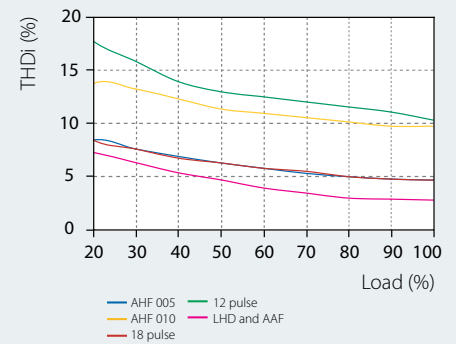
## Imbalance and pre-distortion

The harmonic mitigation performance of the different solutions depends on the grid quality. The higher the imbalance and pre-distortion, the more harmonic the equipment has to suppress. The graph shows at what pre-distortion and imbalance level each technology can keep its guaranteed THDi performance.



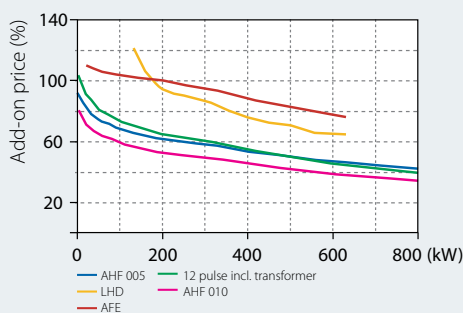
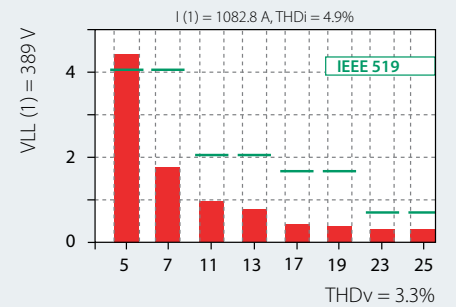
## Over-sizing

Published filter data are all given at 100% loading but filters are seldom run at full load due to over-sizing and load profile. Serial mitigation equipment must always be sized for the maximum current, but be aware of the duration of part load operation and evaluate the different filter types accordingly. Over-sizing gives poor mitigation performance and high running costs. It is also a waste of money.



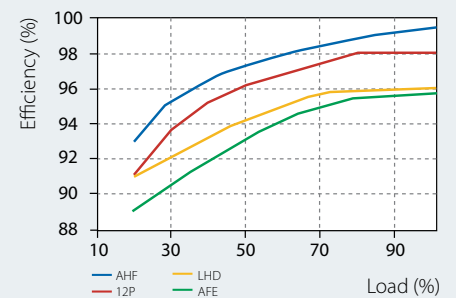
## Standards compliance

Keeping equipment immunity higher than system distortion ensures trouble free operation. Most standards set restrictions on total voltage distortion according to a planned level, often between 5% and 8%. Equipment immunity is, in most cases, far higher: for drives, between 15-20%. However, this influences product life adversely.



## Power size vs. initial costs

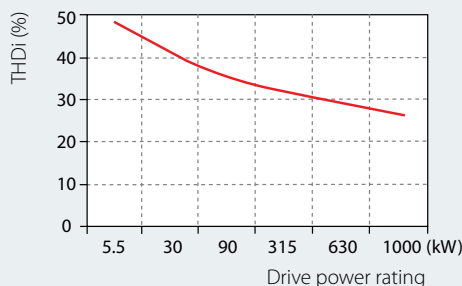
Compared to the frequency converter, the different solutions have different add-on prices depending on power size. The passive solutions in general offer the lowest initial cost and as the complexity of the solutions increase, so does the price.





### System impedance

As an example, a 400 kW FC 202 drive on a 1000 kVA transformer with 5% impedance results in ~5% THDv (total harmonic voltage distortion) at ideal grid conditions, whereas the same drive on a 1000 kVA, 8% imp. transformer leads to 50% higher THDv, namely 7.5%.

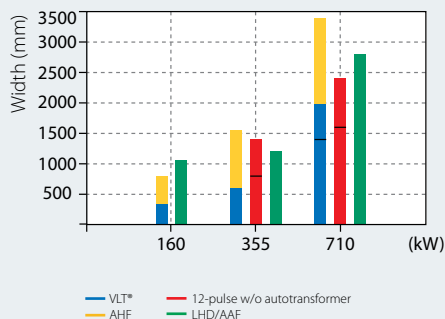


### Total Harmonic distortion

Each drive generates its own total harmonic current distortion (THDi) which depends on the grid conditions. The bigger the drive is in relation to the transformer the smaller the THDi.

### Harmonic performance

Each harmonic mitigation technology has its own THDi characteristic which is load dependent. These characteristics are set at ideal grid conditions without pre-distortion and with balanced phases. Variations hereof will result in higher THDi values.



### Wall space

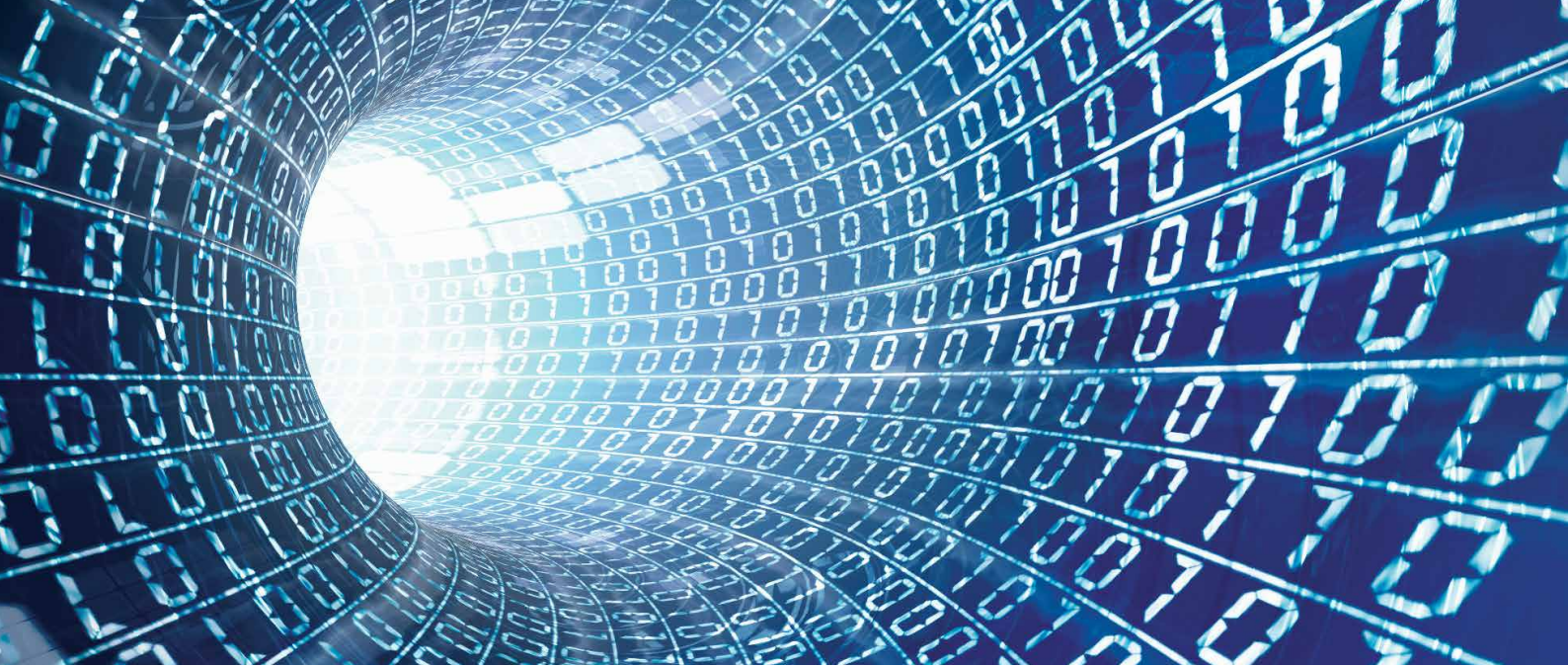
In many applications the amount of available wall space is limited and must be utilized to the greatest extent possible. Based on different technologies, the various harmonic solutions each have their optimum size and power relationship.

### Fulfilling the standards

To determine whether or not the harmonic pollution of a given application/grid exceeds a specific standard, many complex calculations must be done. With the help from free Danfoss MCT31 harmonic calculation software, this is made easy and less time consuming.

### System efficiency

The running cost is mainly determined by the overall system efficiency. This depends on the individual products, true power-factors and efficiencies. Active solutions tend to keep the true power-factor independent of load and grid variations. On the other hand, active solutions are less efficient than passive solutions.



# Support common fieldbusses

## Increase productivity

With the wide range of fieldbus options the VLT® AQUA Drive can be easily connected to the fieldbus system of your choice. This makes the AQUA Drive a future-ready solution that can easily be expanded and updated if your needs change. See the complete list of fieldbuses on page 39.

Danfoss fieldbus options can also be installed as a plug-and-play solution at a later stage, if the production layout demands a new communication platform. This way, you can be confident that you can optimize your plant without being forced to replace your existing drive system.

## Download drivers for easy PLC integration

Integrating a drive into an existing bus system can be time consuming and complicated. To make this process easy and more efficient, Danfoss provides all necessary fieldbus drivers and instructions, which can be downloaded for free from the Danfoss website.

After installation the bus parameters, typically only a few, can be set directly in the VLT® drive via the local control panel, the VLT® MCT 10 or the fieldbus itself.







# Energy documentation

VLT® Energy Box software is the most modern and advanced energy calculation tool available.

It allows energy consumption calculations and comparisons of AQUA pumps applications driven by Danfoss drives and alternative methods of flow control.

The program compares the total operational costs of various traditional systems to operation of the same systems with a VLT® AQUA Drive.

With this program it is easy to evaluate the savings by comparing a VLT® AQUA Drive over other types of capacity control systems in both new installations as well as retrofit situations.

## Complete financial analysis

VLT® Energy Box provides a complete financial analysis including:

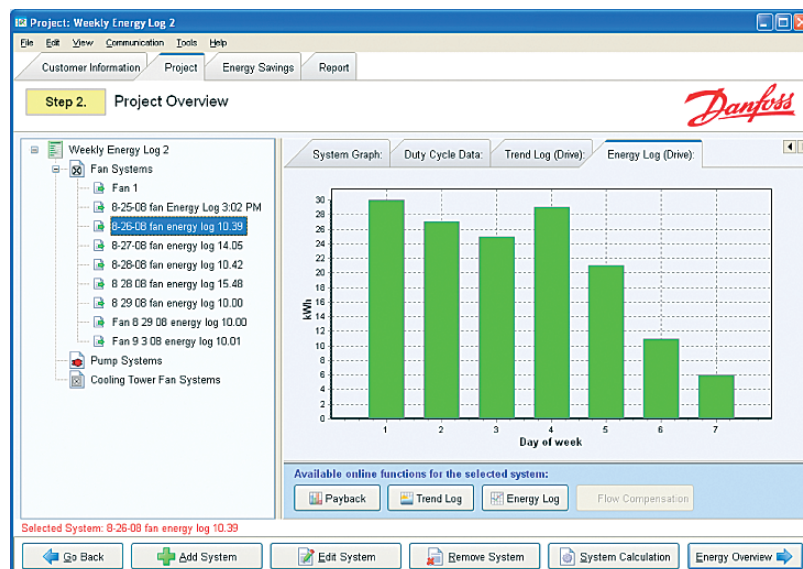
- Initial cost for the drive system and the alternative system
- Installation and hardware costs
- Annual maintenance costs and any utility company incentives for energy conservation products
- Payback time and accumulated savings
- Upload of actual energy consumption (kWh) and duty cycle from the VLT® AQUA Drive

VLT® Energy Box makes it possible to capture actual energy data from the drives and monitor energy consumption and overall system efficiency.

## Energy audit

The VLT® AQUA Drive coupled with Energy Box software enables the package to be used as the Energy Audit equipment for both the estimation and validation of savings.

VLT® AQUA Drive can be interrogated remotely for full energy data, making it easy to monitor your energy savings and return on investment. Monitoring via fieldbus often makes energy meters omisable.





# Software tools

## Easy engineering and setup with VLT® Motion Control Tool MCT 10

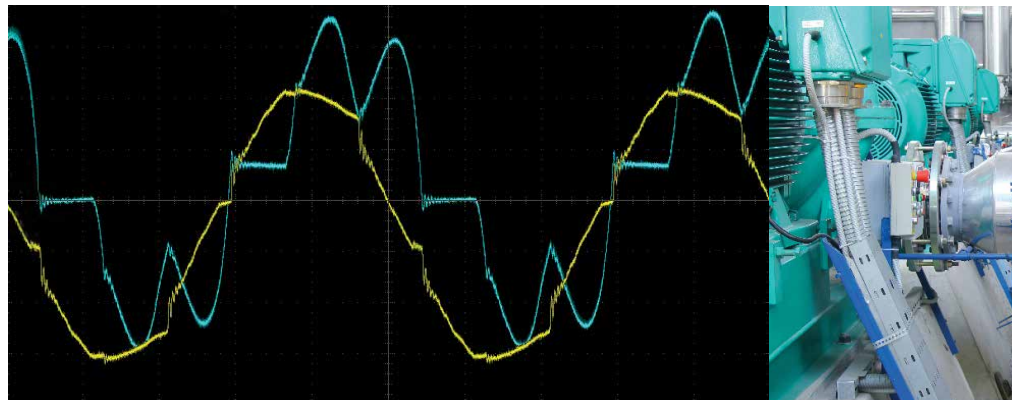
In addition to operating the drive via LCP (local control panel), VLT® drives can also be configured and monitored with Danfoss own PC software. This provides plant managers with a comprehensive overview of the system at any point in time, adding a new level of flexibility in configuration, monitoring and troubleshooting.

MCT 10 is a windows based engineering tool with a clearly structured interface that provides an instant overview of all the drives in a system of any size. The software runs under Windows and enables data exchange over a traditional RS485 interface, fieldbus (Profibus, Ethernet, etc.) or via USB.

Parameter configuration is possible both online on a connected drive and offline in the tool itself. Additional documentation, such as electrical diagrams or operating manuals, can be embedded in MCT 10. This reduces the risk of incorrect configuration while offering fast access to troubleshooting.

## Analyse harmonic distortion with VLT® Harmonic Calculation Software HCS

This is an advanced simulation program that makes calculating harmonic distortion in your mains network fast and easy. It is the ideal solution both if you are planning to extend your existing plant or installation or if you are planning a new installation from scratch.



The user-friendly interface allows you to configure the mains environment as desired and returns simulation results, which you can use to optimize your network.

Contact your local Danfoss sales office or visit our website for more information or visit directly at **[www.danfoss-hcs.com](http://www.danfoss-hcs.com)**

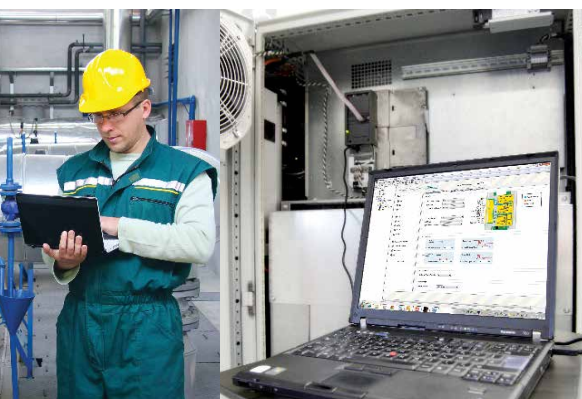
### **VLT® Motion Control Tool MCT 31 Harmonics Calculation Software**

VLT® MCT 31 calculates system harmonic distortion for both Danfoss and non-Danfoss drives. It is also able to calculate the effects of using various additional harmonic reduction measures, including Danfoss harmonic filters.

With VLT® Motion Control Tool MCT 31, you can determine whether harmonics will be an issue in your installation, and if so, what strategies will be most cost-effective in addressing the problem.

VLT® Motion Control Tool MCT 31 features include:

- Short circuit current ratings can be used instead of transformer size and impedance when transformer data is unknown
- Project oriented for simplified calculations on several transformers
- Easy to compare different harmonic solutions within the same project
- Supports current Danfoss product line as well as legacy drive models



# Intuitive setup with graphical interface

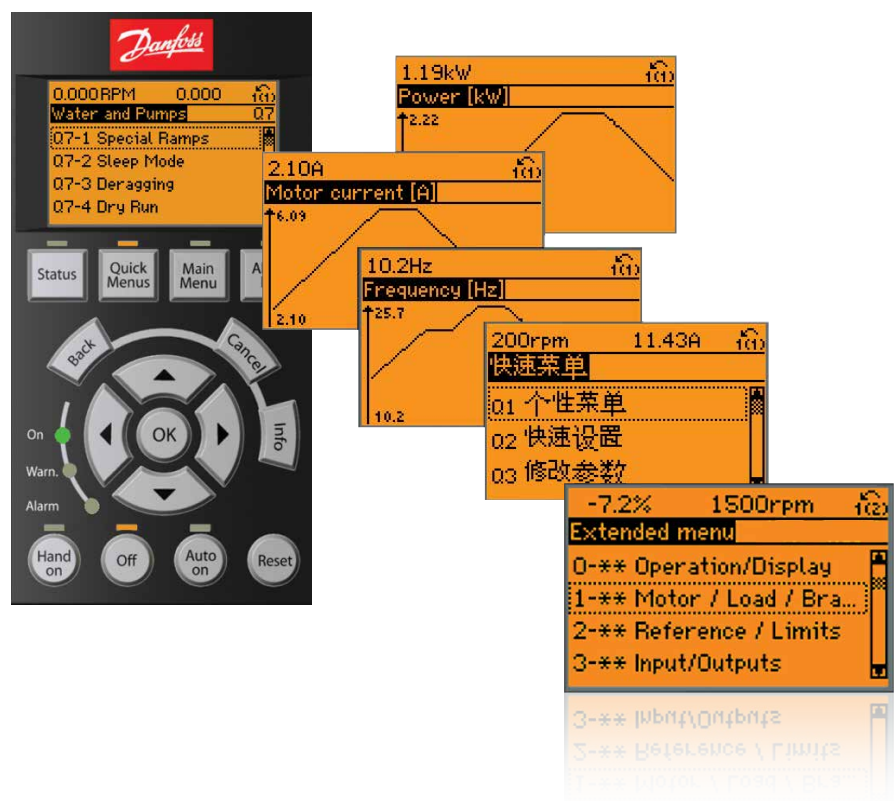
The VLT® AQUA Drive features a user-friendly, hot pluggable local control panel (LCP) for easy setup and parameter configuration.

After choosing language navigate through setup parameters individually. Alternatively, use a pre-defined quick menu or a SmartStart guide for application specific setup.

The LCP can be detached and used to copy settings to other AQUA Drives in the system. It can also be

mounted remotely on a control panel fascia. This enables the user to take full advantage of the LCP, eliminating the need for additional switches and instrumentation.

My Personal Menu allows direct access to up to 50 user-selectable parameters.





# Save commissioning time with SmartStart

SmartStart is a setup wizard that is activated at the first power up of the drive, or after a factory reset. Using easy to understand language, SmartStart guides users through a series of easy steps to ensure correct and efficient motor control. The wizard can also be started directly via the Quick Menu on the graphical control panel.

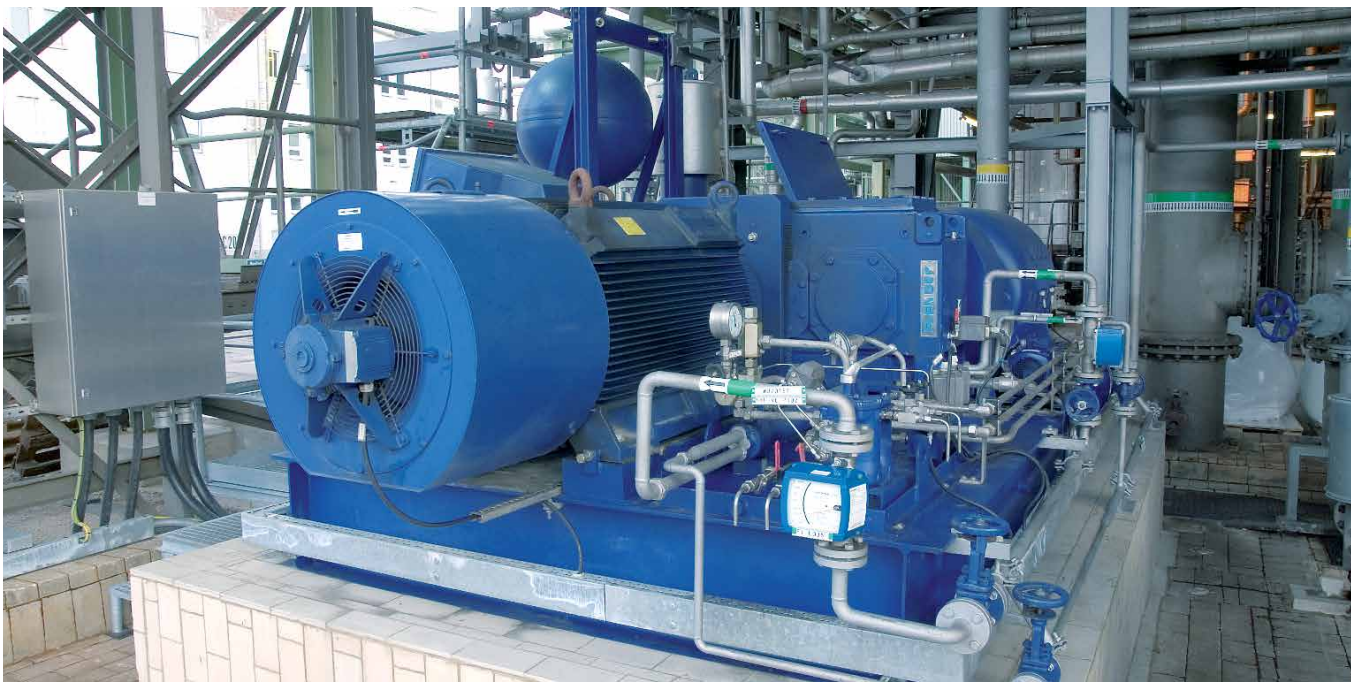
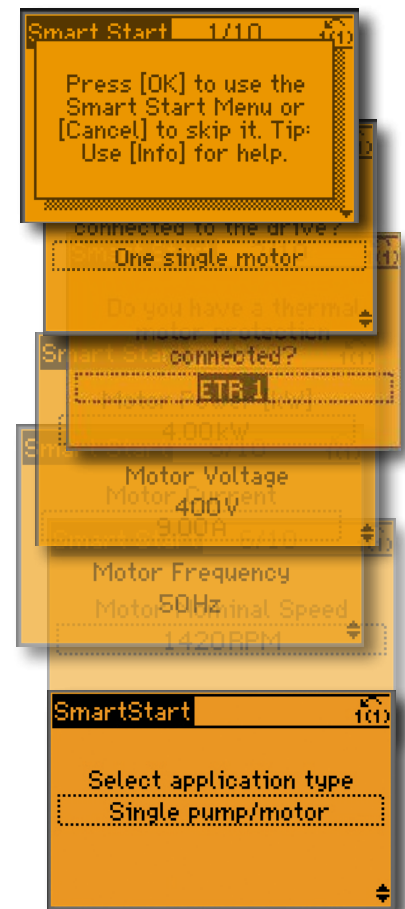
First, users are asked to set which type of motor setup is used in the application:

- **Single pump/motor** in open or closed loop
- **Motor alternation:** when two motors share one drive
- **Basic cascade control:** speed control a single pump in a multi pump system. This is a cost attractive solution in for example booster sets
- **Master-follower:** Control up to 8 drives and pumps to ensure smooth operation of the overall pump system
- **Automatic Motor Adaptation:** SmartStart also guarantees an optimised motor performance due to the adjustment of efficient settings regardless of the motor type. After entering the basic motor data,

the Automatic Motor Adaptation function measures the motor parameters and optimises the drive settings at standstill without the need to disconnect the load.

The guide then continues to dedicated water and pump features:

- **Flow compensation:** the drive adapts the set point according to the flow
- **Deragging:** removes clogs from impellers by reversing the direction of the flow in cycles. This can be used as proactive measure to avoid damaging the pump
- **Pipe fill:** helps to avoid water hammering by filling pipes smoothly
- **Dry run/end of curve detection:** protects the pump from damage. If a set point is not reached, the drive assumes that the pipe is dry or there is a leakage
- **Sleep mode:** saves energy by stopping the pump when there is no demand
- **Special ramps:** dedicated startup and stop ramps for specific applications





# Dedicated water and pump features

**Dedicated, integrated features that save energy and increase efficiency in all water and pump applications.**

## **Embedded multi-pump controller**

The Pump Cascade Controller distributes operation hours evenly across all pumps. Wear and tear on individual pumps is therefore reduced to a minimum, extending their lifetime expectancy and reliability considerably.

## **High overload capability**

For high inertia or high friction loads, extra torque is available for undersized motors. The current can be set to a maximum of up to 160% for a limited amount of time.

### **1. End of curve detection**

This feature is triggered if the pump runs without reaching a predefined set point. The drive then either sets off an alarm or performs another pre-programmed action. This happens for example when a pipe leaks.

### **2. Auto tuning of the 4 PI controllers**

Auto tuning enables the drive to learn how the system reacts to corrections made by the drive. Using what it has measured, the drive calculates the P and I values to restore precise and stable operation.

### **3. Flow compensation**

A pressure sensor mounted close to the fan or pump provides a reference point that enables pressure to be kept constant at the discharge end of the system. The drive constantly adjusts the pressure reference to follow the system curve. This method both saves energy and reduces installation costs.

### **4. No/low flow detection and sleep mode**

In situations with low or no flow, the drive enters sleep mode to conserve energy. When the pressure falls below the pre-defined set-point, the drive starts automatically. Compared to continuous operation this method reduces energy costs and equipment wear and helps extend the lifetime of the application.

### **5. Deragging feature**

This VLT® AQUA Drive software feature offers proactive pump protection. The deragging can be configured as either a preventative or reactive action. It optimises the efficiency of the pump by constantly monitoring the motor shaft power consumption relative to flow. In the reactive mode, the

drive senses the beginning of a pump clog and will reverse spin the pump to ensure a clear path for the water. As a preventative action, the drive will periodically reverse the pump to ensure a clean pump, or screen.

### **6. Pipe fill mode**

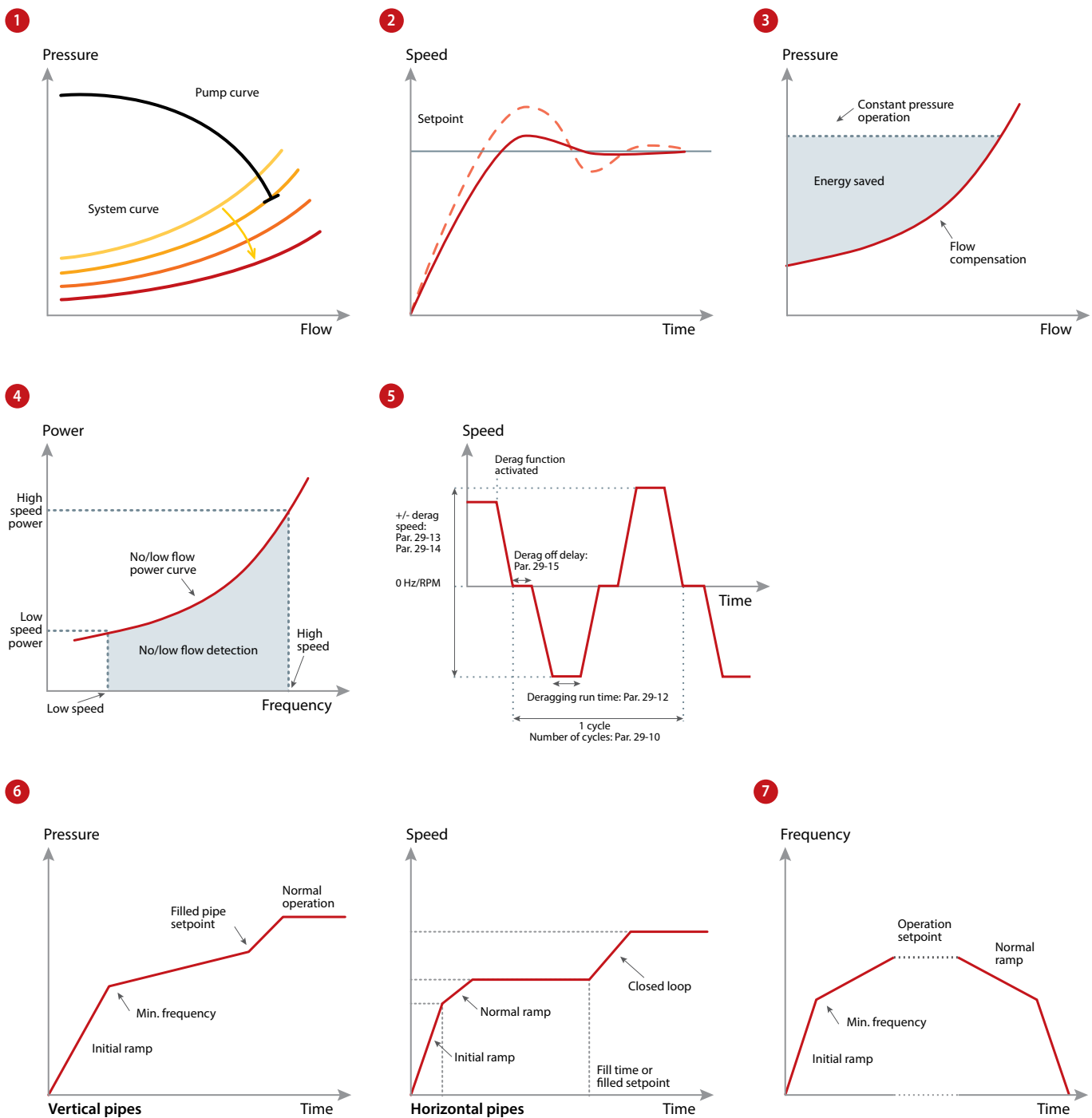
Useful in all applications where controlled pipe filling is essential, such as irrigation and water supply systems. Controlled (closed loop) filling of pipes prevents water hammering, bursting water pipes or blowing off sprinkler heads. Pipe fill mode can be used in both vertical and horizontal pipe systems.

### **7. Initial/final ramp**

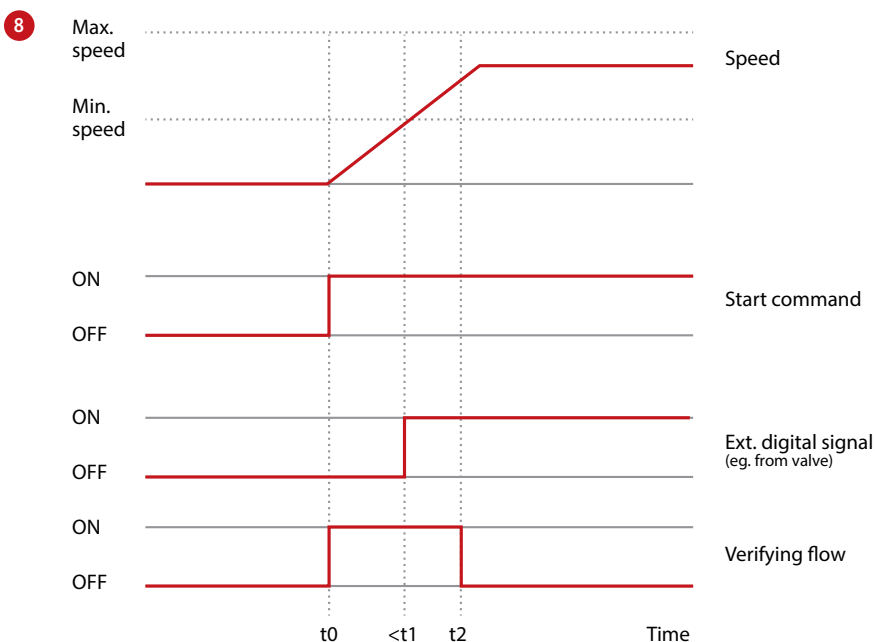
The initial ramp provides fast acceleration of pumps to minimum speed, from where the normal ramp takes over. This prevents damage to the thrust bearings on the pump. The final ramp decelerates pumps from the minimum speed to stop.

*Continued on next page*



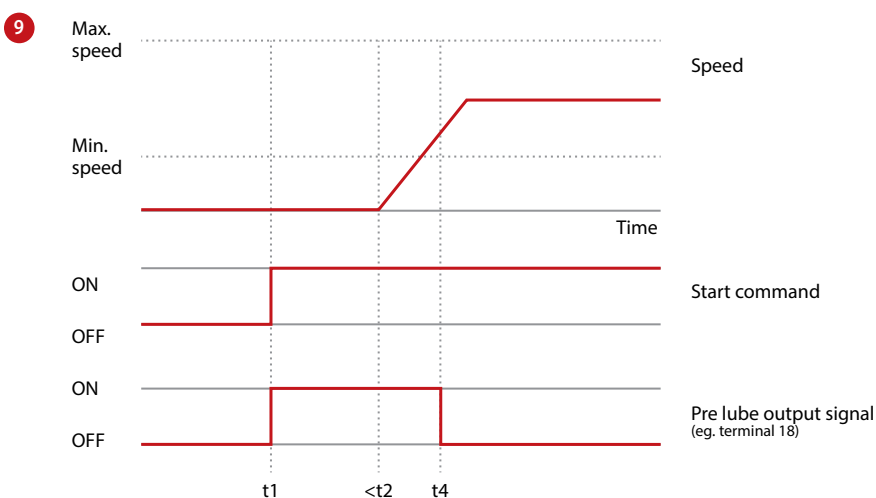






## 8. Flow confirmation

The flow confirmation monitor protects equipment from unexpected flow stoppage. The monitor communicates on an ongoing basis with an external device such as a valve or flow switch. If the signal from the external device times out, the monitor trips the frequency converter.



## 9. Pre/post lubrication

Some machines require lubrication of their mechanical parts before and during operation to prevent damage and reduce wear. During lubrication certain equipment must remain active, for example exhaust fans. To achieve this, the Pre Lube feature supports a signal to an external device to perform a specific action for a user-defined time period. Configurations available: "Pre Lube Only", "Pre & Running" and "Pre & Running & Post".

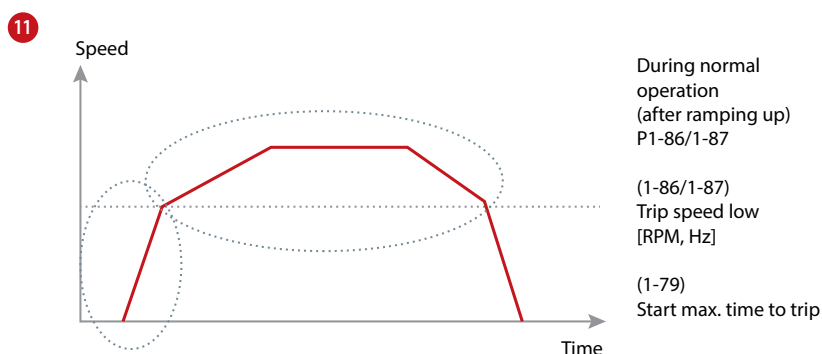
## 10. Freely programmable texts

This function supports versatile adaptation to the application. Use freely programmable text messages, based on internal or external events, for information, warnings or alerts. The function also supports actions based on events, for example initiation of a ramp down triggered by a valve opening.



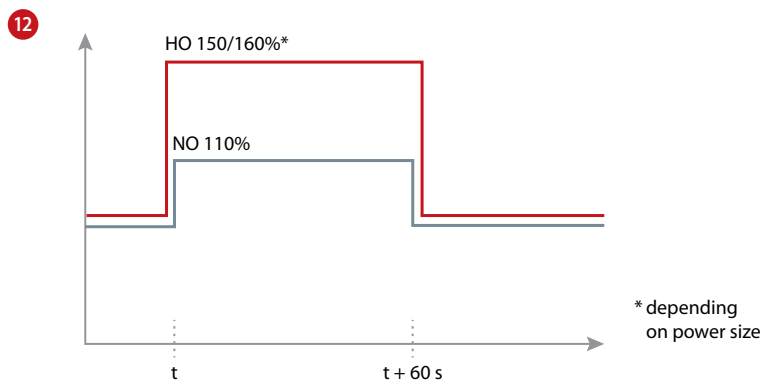
### 11. Advanced minimum speed monitor

Submersible pumps can suffer from insufficient cooling and lubrication when pump speed is too low. The advanced minimum speed monitor protects the pump by monitoring and adjusting the trip speed to reduce wear and tear. Downtime for maintenance is minimised, with no need for external monitoring equipment.



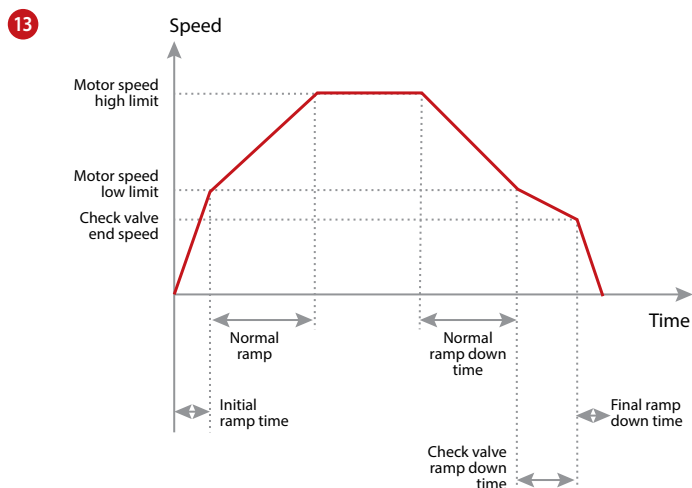
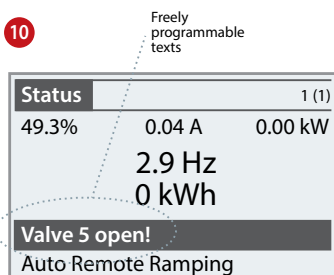
### 12. High/normal overload

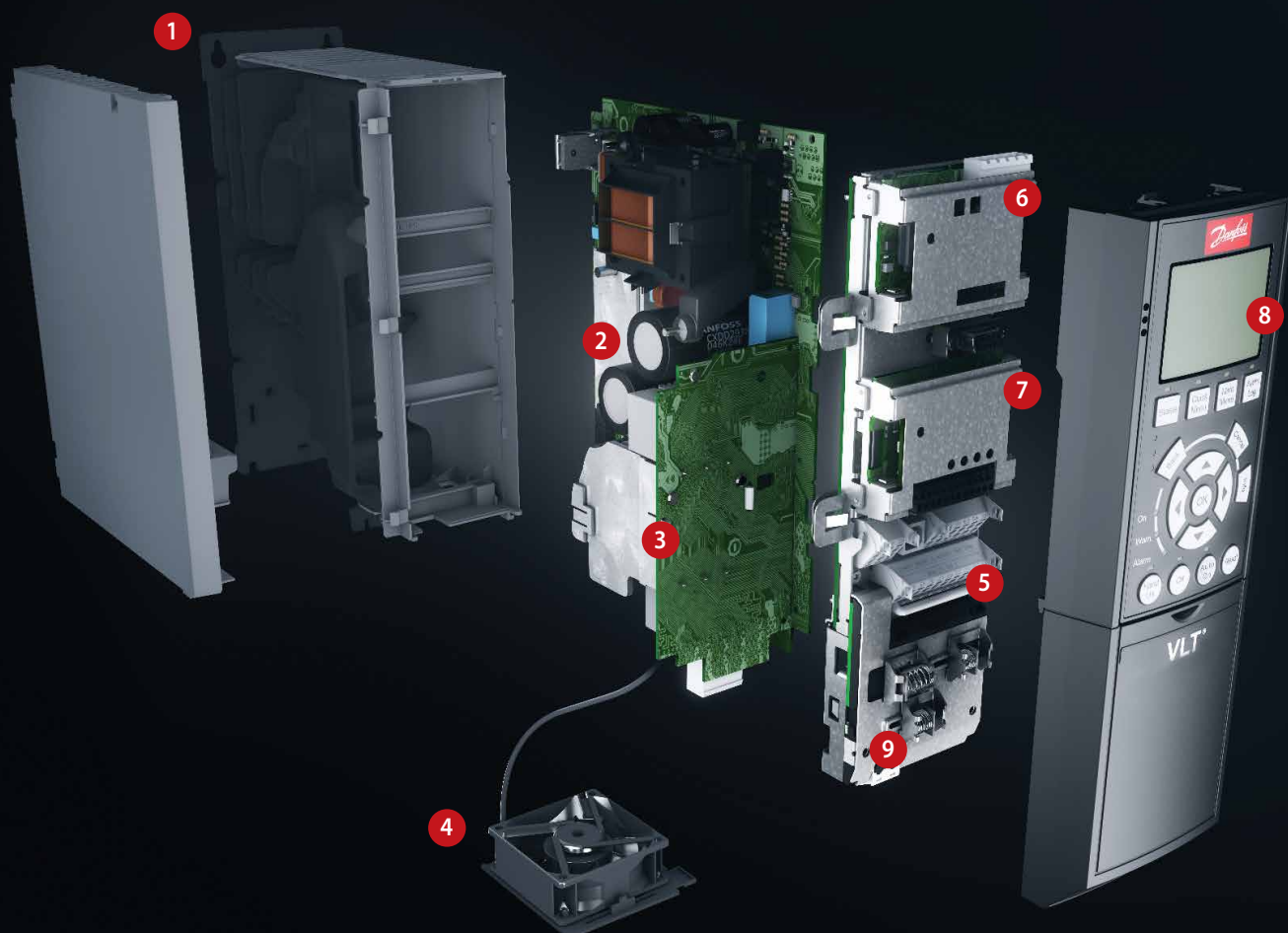
Use the overload rating functionality to adapt to different patterns of loading typical for water and wastewater applications. Normal overload is suitable for most centrifugal loads. Use high overload for loading involving periods of temporarily higher torque.



### 13. Check valve ramp

The check valve ramp prevents water hammering when stopping the pump, by ensuring slow pump speed ramp down just as the check valve ball is almost shut.





# Modular simplicity

**Delivered fully assembled and tested to meet your specific requirements**

## 1. Enclosure

The drive meets requirements for enclosure class IP20/Chassis. IP21/Type 1, IP54/Type 12, IP55/Type 12 or IP66/Type 4X.

## 2. EMC and Network effects

All versions of VLT® AQUA Drive comply as standard with EMC limits B, A1 or A2 according to the EN 55011 norm. The standard integrated DC coils ensure low harmonic load on the network according to EN 61000-3-12 and increase the lifetime of the DC link capacitors.

## 3. Protective coating

The electronic components are, as standard, coated as per IEC 60721-3-3, class 3C2. For harsh and aggressive environments, coating as per IEC 60721-3-3, class 3C3 is available.

## 4. Removable fan

Like most of the elements, the fan can be quickly removed and remounted for easy cleaning.

## 5. Control terminals

Double-stack, spring-loaded cage clamps enhance reliability and facilitate easy commissioning and service.

## 6. Fieldbus option

See complete list of available fieldbus options on page 39.

## 7. Cascade controller and I/O extensions

Controls multiple pumps. *See also pages 12 and 13.*

A wide range of I/O options are available either factory-mounted or as retrofit.

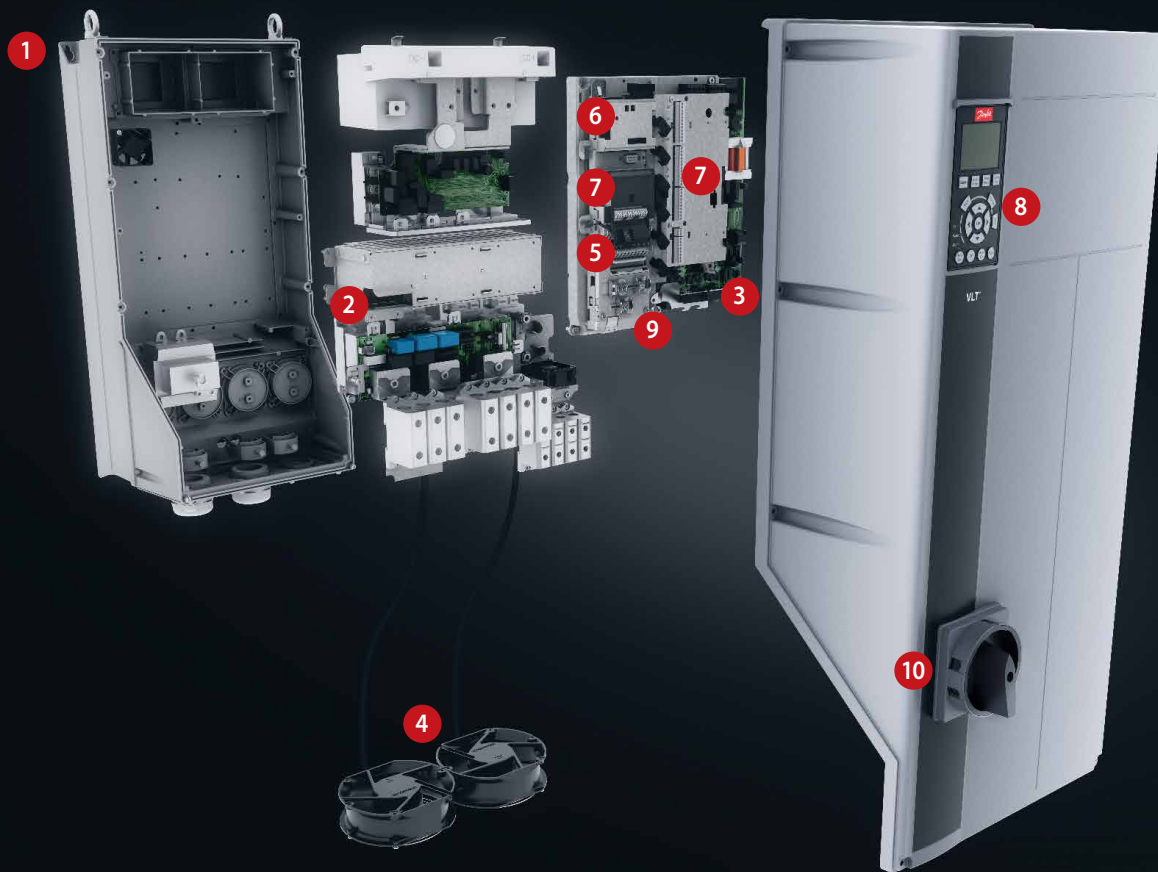
## 8. Display option

Danfoss Drives' removable Local Control Panel is available with a variety of language packs.

English is available in all drives.

Alternatively the drive can be commissioned via the built-in USB/RS485 connection or a fieldbus from with VLT® Motion Control Tool MCT 10 setup software.





### 9. 24 V external power supply

The external 24 V supply keeps the VLT® AQUA Drive logic “alive” when the AC mains is removed.

### 10. Mains disconnect

This switch interrupts the mains supply and has a free useable auxiliary contact.

### Safety

The VLT® AQUA Drive can optionally be delivered with the Safe Torque Off (Safe Stop) functionality suitable for category 3, performance level d according to EN 13849-1 and SIL 2 according to IEC 62061/IEC 61508. This feature prevents the drive from starting unintended.

### Built-in Smart Logic Controller

The Smart Logic Controller is a clever way to add customer-specific functionality to the drive and increase the opportunities for the drive, motor and application working together.

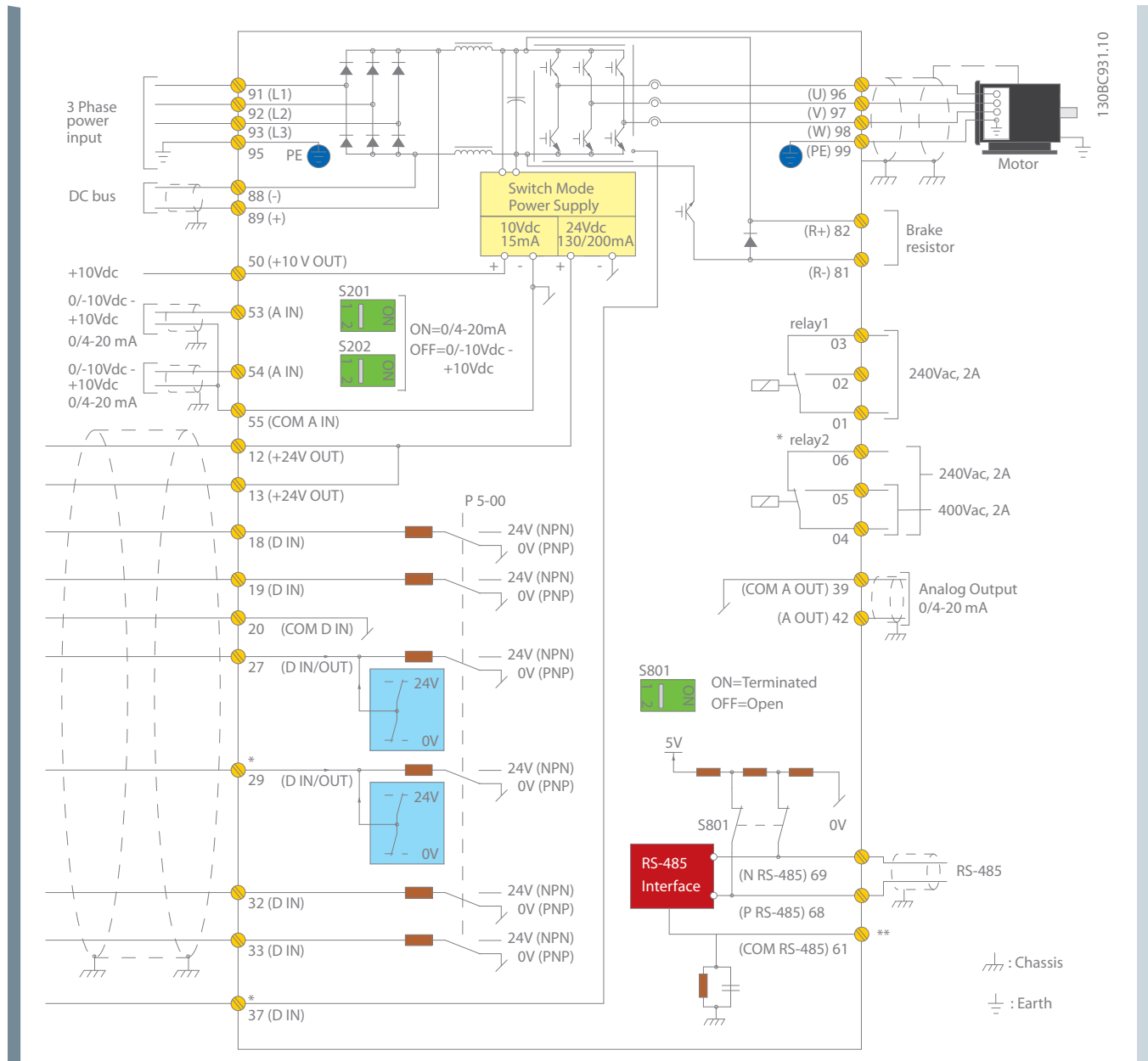
The controller monitors a specified event. When an event occurs, the controller performs a pre-defined action and then starts monitoring for the next pre-defined event. 20 steps of events and resulting actions are available before returning to the first set.

Logic functions can be selected and run independent from the sequence control. This enables drives to monitor variables or signal defined events in an easy and flexible way independently of the motor control.



# Connection example

The numbers represent the terminals on the drive



This diagram shows a typical installation of the VLT® AQUA Drive. Power is connected to the terminals 91 (L1), 92 (L2) and 93 (L3) and the motor is connected to 96 (U), 97 (V) and 98 (W).

Terminals 88 and 89 are used for load sharing between drives. Analogue inputs can be connected to the 53 (V or mA), and for 54 (V or mA) terminals.

These inputs can be set up as either reference, feedback or thermistor inputs.

There are 6 digital inputs to be connected to terminals 18, 19, 27, 29, 32, and 33. Two digital input/output terminals (27 and 29) can be set up as digital outputs to show an actual status or warning or can be used as pulse reference signal. The terminal 42

analogue output can show process values such as 0 -  $I_{max}$ .

On the 68 (P+) and 69 (N-) terminals' RS 485 interface, the drive can be controlled and monitored via serial communication.

# VLT® AQUA Drive technical data

## Basic unit without extensions

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..... 1.1 – 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 available on 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 Drive can provide 110%, 150% or 160% current for 1 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 analog 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 for 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 output	
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

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/IPMCA 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 overtemperature	
– The frequency converter is protected against short-circuits on motor terminals U, V, W	
– The frequency converter is protected against earth faults on motor terminals U, V, W	
– Protection against mains phase loss	
Application options	
Extend the functionality of the drive with integrated options:	
<ul style="list-style-type: none"> <li>• VLT® General Purpose I/O MCB 101</li> <li>• VLT® Extended Cascade Controller MCO 101</li> <li>• VLT® Advanced Cascade Controller MCO 102</li> <li>• VLT® Sensor Input MCB 114</li> <li>• VLT® PTC Thermistor Card MCB 112</li> <li>• VLT® Extended Relay Card MCB 113</li> <li>• VLT® 24 V External Supply MCB 107</li> </ul>	
Relay and analogue I/O option	
<ul style="list-style-type: none"> <li>• VLT® Relay Card MCB 105</li> <li>• VLT® Analog I/O MCB109)</li> </ul>	
Power options	
Choose from a wide range of external power options for use with our drive in critical networks or applications:	
<ul style="list-style-type: none"> <li>• VLT® Low Harmonic Drive</li> <li>• VLT® Advanced Active Filter</li> <li>• VLT® Advanced Harmonic Filter</li> <li>• VLT® dU/dt filter</li> <li>• VLT® Sine wave filter (LC filter)</li> </ul>	
High power options	
See the VLT® High Power Drive Selection Guide for a complete list.	
PC software tools	
<ul style="list-style-type: none"> <li>• VLT® Motion Control Tool MCT 10</li> <li>• VLT® Energy Box</li> <li>• VLT® Motion Control Tool MCT 31</li> </ul>	



Global Marine



# Enclosure overview A, B and C

## 3 phases

VLT® AQUA Drive			T2 200 – 240 V				T4 380 – 480 V						T6 525 – 600 V						T7 525 – 690 V				
FC 200	kW		IP20	IP21	IP55	IP66	IP00	IP20	IP21	IP54	IP55	IP66	IP20	IP21	IP54	IP55	IP66	IP00	IP20	IP21	IP54	IP55	
	HO	NO																					
PK25	0.25		A2	A2	A4/A5	A4/A5					A4/A5	A4/A5											
PK37	0.37																						
PK55	0.55																						
PK75	0.75																						
P1K1	1.1																						
P1K5	1.5		A3	A3	A5	A5						A3	A3			A5	A5			A3		A5	
P2K2	2.2																						
P3K0	3.0																						
P3K7	3.7																						
P4K0	4.0																						
P5K5	3.7	5.5	B3	B1	B1	B1		A3	A3		A5	A5	A3	A3		A5	A5			A3		A5	
P7K5	5.5	7.5																					
P11K	7.5	11																					
P15K	11	15																					
P18K	15	18.5																					
P22K	18.5	22	B4	B2	B2	B2		B3	B1		B1	B1	B3	B1		B1	B1			B4	B2	B2	
P30K	22	30																					
P37K	30	37																					
P45K	37	45																					
P55K	45	55																					
P75K	55	75	C3	C1	C1	C1		C3	C1		C1	C1	C3	C1		C1	C1			C3	C2	C2	
P90K	75	90																					

## 1 phase

VLT® AQUA Drive		S2 200 – 240 V				S4 380 – 480 V		
FC 200	kW	IP20	IP21	IP55	IP66	IP21	IP55	IP66
PK25	0.25							
PK37	0.37							
PK55	0.55							
PK75	0.75							
P1K1	1.1							
P1K5	1.5							
P2K2	2.2							
P3K0	3.0							
P3K7	3.7							
P5K5	5.5							
P7K5	7.5							
P11K	11							
P15K	15							
P18K	18.5							
P22K	22							
P37K	37							

- IP00/Chassis
- IP20/Chassis
- IP21/Type 1
- IP21 with upgrade kit – available in North America only
- IP54/Type 12
- IP55/Type 12
- IP66/NEMA 4X



# Electrical data – A, B, and C enclosures

## [S2] 1 x 200-240 V AC – normal overload

Normal overload (110% 1 min/10 min)						Enclosure size			
Type code	Output current (3 x 200-240 V)		Typical shaft output power		Estimated power loss	Protection rating [IEC/UL]			
	Con. I <sub>N</sub>	Inter. I <sub>MAX</sub> (60 s)	kW @ 208 V	Hp @ 230 V		IP20/21	IP21	IP55	IP66
FC-202	Con. I <sub>N</sub>	Inter. I <sub>MAX</sub> (60 s)	kW @ 208 V	Hp @ 230 V	[W]	Chassis	Type 1	Type 12	Type 4X
P1K1	6.6	7.3	1.1	1.5	44	A3	A3	A5	A5
P1K5	7.5	8.3	1.5	2	30	–	B1	B1	B1
P2K2	10.6	11.7	2.2	3	44	–	B1	B1	B1
P3K0	12.5	13.8	3	4	60	–	B1	B1	B1
P3K7	16.7	18.4	3.7	5	74	–	B1	B1	B1
P5K5	24.2	26.6	5.5	7.5	110	–	B1	B1	B1
P7K5	30.8	33.4	7.5	10	150	–	B2	B2	B2
P15K	59.4	65.3	15	20	300	–	C1	C1	C1
P22K	88	96.8	22	30	440	–	C2	C2	C2
P18K	74.8	112	18.5	25	740	C3	C1	C1	C1
P22K	88	132	22	30	874	C3	C1	C1	C1

## [T2] 3 x 200-240 V AC – normal overload

Normal overload (110% 1 min/10 min)						Enclosure size			
Type code	Output current (3 x 200-240 V)		Typical shaft output power		Estimated power loss	Protection rating [IEC/UL]			
	Con. I <sub>N</sub>	Inter. I <sub>MAX</sub> (60 s)	kW @ 208 V	Hp @ 230 V		IP20/21	IP21	IP55	IP66
FC-202	Con. I <sub>N</sub>	Inter. I <sub>MAX</sub> (60 s)	kW @ 208 V	Hp @ 230 V	[W]	Chassis	Type 1	Type 12	Type 4X
PK25	1.8	2	0.25	0.34	21	A2	A2*	A4/A5**	A4/A5**
PK37	2.4	2.6	0.37	0.5	29	A2	A2*	A4/A5**	A4/A5**
PK55	3.5	3.9	0.55	0.75	42	A2	A2*	A4/A5**	A4/A5**
PK75	4.6	5.1	0.75	1	54	A2	A2*	A4/A5**	A4/A5**
P1K1	6.6	7.3	1.1	1.5	63	A2	A2*	A4/A5**	A4/A5**
P1K5	7.5	8.3	1.5	2	82	A2	A2*	A4/A5**	A4/A5**
P2K2	10.6	11.7	2.2	3	116	A2	A2*	A4/A5**	A4/A5**
P3K0	12.5	13.8	3	4	155	A3	A3*	A5	A5
P3K7	16.7	18.4	3.7	5	185	A3	A3*	A5	A5
P5K5	24.2	26.6	5.5	7.5	310	B3	B1	B1	B1
P7K5	30.8	33.9	7.5	10	310	B3	B1	B1	B1
P11K	46.2	50.8	11	15	514	B3	B1	B1	B1
P15K	59.4	65.3	15	20	602	B4	B2	B2	B2
P18K	74.8	82.3	18.5	25	737	B4	C1	C1	C1
P22K	88	96.8	22	30	845	C3	C1	C1	C1
P30K	115	127	30	40	1140	C3	C1	C1	C1
P37K	143	157	37	50	1353	C4	C2	C2	C2
P45K	170	187	45	60	1636	C4	C2	C2	C2

\* Requires an IP21/Type 1 kit. Available in North America only.

\*\* A4 does not accept any C options

## [T2] 3 x 200-240 V AC – high overload

High overload (160% 1 min/10 min)						Enclosure size			
Type code	Output current (3 x 200-240 V)		Typical shaft output power		Estimated power loss	Protection rating [IEC/UL]			
	Con. I <sub>N</sub>	Inter. I <sub>MAX</sub> (60 s)	kW @ 208 V	Hp @ 230 V		IP20/21	IP21	IP55	IP66
FC-202	Con. I <sub>N</sub>	Inter. I <sub>MAX</sub> (60 s)	kW @ 208 V	Hp @ 230 V	[W]	Chassis	Type 1	Type 12	Type 4X
PK25	1.8	2.7	0.25	0.34	21	A2	A2*	A4/A5**	A4/A5**
PK37	2.4	3.6	0.37	0.5	29	A2	A2*	A4/A5**	A4/A5**
PK55	3.5	5.3	0.55	0.75	42	A2	A2*	A4/A5**	A4/A5**
PK75	4.6	6.9	0.75	1	54	A2	A2*	A4/A5**	A4/A5**
P1K1	6.6	9.9	1.1	1.5	63	A2	A2*	A4/A5**	A4/A5**
P1K5	7.5	11.3	1.5	2	82	A2	A2*	A4/A5**	A4/A5**
P2K2	10.6	15.9	2.2	3	116	A2	A2*	A4/A5**	A4/A5**
P3K0	12.5	18.8	3	4	155	A3	A3*	A5	A5
P3K7	16.7	25	3.7	5	185	A3	A3*	A5	A5
P5K5	16.7	26.7	3.7	5	239	B3	B1	B1	B1
P7K5	24.2	38.7	5.5	7.5	239	B3	B1	B1	B1
P11K	30.8	49.3	7.5	10	371	B3	B1	B1	B1
P15K	46.2	73.9	11	15	463	B4	B2	B2	B2
P18K	59.4	89.1	15	20	624	B4	C1	C1	C1
P22K	74.8	112	18.5	25	740	C3	C1	C1	C1
P30K	88	132	22	30	874	C3	C1	C1	C1
P37K	115	173	30	40	1143	C4	C2	C2	C2
P45K	143	215	37	50	1400	C4	C2	C2	C2

\* Requires an IP21/Type 1 kit. Available in North America only.

\*\* A4 does not accept any C options

## [S4] 1 x 380-480 V AC – normal overload

Normal overload (110% 1 min/10 min)								Enclosure size			
Type code	Output current				Typical shaft output power		Estimated power loss	Protection rating [IEC/UL]			
	(3 x 380-440 V)		(3 x 441-480 V)					IP20/21	IP21	IP55	IP66
FC-202	Con. I <sub>N</sub>	Inter. I <sub>MAX</sub> (60 s)	Con. I <sub>N</sub>	Inter. I <sub>MAX</sub> (60 s)	kW @ 400 V	Hp @ 460 V	[W]	Chassis	Type 1	Type 12	Type 4X
P7K5	16	17.6	14.5	15.4	7.5	10	300	–	B1	B1	B1
P11K	24	26.4	21	23.1	11	15	440	–	B2	B2	B2
P18K	37.5	41.2	34	37.4	18.5	25	740	–	C1	C1	C1
P37K	73	80.3	65	71.5	37	50	1480	–	C2	C2	C2



## [T4] 3 x 380-480 V AC – normal overload

Normal overload (110% 1 min/10 min)								Enclosure size			
Type code	Output current				Typical shaft output power		Estimated power loss	Protection rating [IEC/UL]			
	(3 x 380-440 V)		(3 x 441-500 V)					IP20/21	IP21	IP55	IP66
FC-202	Con. I <sub>N</sub>	Inter. I <sub>MAX</sub> (60 s)	Con. I <sub>N</sub>	Inter. I <sub>MAX</sub> (60 s)	kW @ 400 V	Hp @ 460 V	[W]	Chassis	Type 1	Type 12	Type 4X
PK37	1.3	1.4	1.2	1.3	0.37	0.5	35	A2	A2*	A4/A5**	A4/A5**
PK55	1.8	2	1.6	1.8	0.55	0.75	42	A2	A2*	A4/A5**	A4/A5**
PK75	2.4	2.6	2.1	2.3	0.75	1	46	A2	A2*	A4/A5**	A4/A5**
P1K1	3	3.3	2.7	3	1.1	1.5	58	A2	A2*	A4/A5**	A4/A5**
P1K5	4.1	4.5	3.4	3.7	1.5	2	62	A2	A2*	A4/A5**	A4/A5**
P2K2	5.6	6.2	4.8	5.3	2.2	3	88	A2	A2*	A4/A5**	A4/A5**
P3K0	7.2	7.9	6.3	6.9	3	4	116	A2	A2*	A4/A5**	A4/A5**
P4K0	10	11	8.2	9	4	5	124	A2	A2*	A4/A5**	A4/A5**
P5K5	13	14.3	11	12.1	5.5	7.5	187	A3	A3*	A5	A5
P7K5	16	17.6	14.5	16	7.5	10	225	A3	A3*	A5	A5
P11K	24	26.4	21	23.1	11	15	392	B3	B1	B1	B1
P15K	32	35.2	27	29.7	15	20	392	B3	B1	B1	B1
P18K	37.5	41.3	34	37.4	18.5	25	465	B3	B1	B1	B1
P22K	44	48.4	40	44	22	30	525	B4	B2	B2	B2
P30K	61	67.1	52	61.6	30	40	739	B4	B2	B2	B2
P37K	73	80.3	65	71.5	37	50	698	B4	C1	C1	C1
P45K	90	99	80	88	45	60	843	C3	C1	C1	C1
P55K	106	117	105	116	55	75	1083	C3	C1	C1	C1
P75K	147	162	130	143	75	100	1384	C4	C2	C2	C2
P90K	177	195	160	176	90	125	1474	C4	C2	C2	C2

\* Requires an IP21/Type 1 kit. Available in North America only.

\*\* A4 does not accept any C options

## [T4] 3 x 380-480 V AC – high overload

High overload (160% 1 min/10 min)								Enclosure size			
Type code	Output current				Typical shaft output power		Estimated power loss	Protection rating [IEC/UL]			
	(3 x 380-440 V)		(3 x 441-500 V)					IP20/21	IP21	IP55	IP66
FC-302	Con. I <sub>N</sub>	Inter. I <sub>MAX</sub> (60 s)	Con. I <sub>N</sub>	Inter. I <sub>MAX</sub> (60 s)	kW @ 400 V	Hp @ 460 V	[W]	Chassis	Type 1	Type 12	Type 4X
PK37	1.3	2	1.2	1.8	0.37	0.5	35	A2	A2*	A4/A5**	A4/A5**
PK55	1.8	2.7	1.6	2.4	0.55	0.75	42	A2	A2*	A4/A5**	A4/A5**
PK75	2.4	3.6	2.1	3.2	0.75	1	46	A2	A2*	A4/A5**	A4/A5**
P1K1	3	4.5	2.7	4.1	1.1	1.5	58	A2	A2*	A4/A5**	A4/A5**
P1K5	4.1	6.2	3.4	5.1	1.5	2	62	A2	A2*	A4/A5**	A4/A5**
P2K2	5.6	8.4	4.8	7.2	2.2	3	88	A2	A2*	A4/A5**	A4/A5**
P3K0	7.2	10.8	6.3	9.5	3	4	116	A2	A2*	A4/A5**	A4/A5**
P4K0	10	15	8.2	12.3	4	5	124	A2	A2*	A4/A5**	A4/A5**
P5K5	13	19.5	11	16.5	5.5	7.5	187	A3	A3*	A5	A5
P7K5	16	24	14.5	21.8	7.5	10	225	A3	A3*	A5	A5
P11K	16	25.6	14.5	23.2	7.5	10	291	B3	B1	B1	B1
P15K	24	38.4	21	33.6	11	15	291	B3	B1	B1	B1
P18K	32	51.2	27	43.2	15	20	379	B3	B1	B1	B1
P22K	37.5	60	34	54.4	22	30	444	B4	B2	B2	B2
P30K	44	70.4	40	64	22	30	547	B4	B2	B2	B2
P37K	61	91.5	52	78	30	40	570	B4	C1	C1	C1
P45K	73	110	65	97.5	37	50	697	C3	C1	C1	C1
P55K	90	135	80	120	45	60	891	C3	C1	C1	C1
P75K	106	159	105	158	55	75	1022	C4	C2	C2	C2
P90K	147	221	130	195	75	100	1232	C4	C2	C2	C2

\* Requires an IP21/Type 1 kit. Available in North America only.

\*\* A4 does not accept any C options

## [T6] 3 x 525-600 V AC – normal overload

Normal overload (110% 1 min/10 min)						Enclosure size			
Type code	Output current (3 x 525-600 V)		Typical shaft output power		Estimated power loss	Protection rating [IEC/UL]			
						IP20/21	IP21	IP55	IP66
FC-202	Con. I <sub>N</sub>	Inter. I <sub>MAX</sub> (60 s)	kW @ 575 V	Hp @ 575 V	[W]	Chassis	Type 1	Type 12	Type 4X
PK75	1.7	1.9	0.75	1	35	A3	A3	A5	A5
P1K1	2.4	2.6	1.1	1.5	50	A3	A3	A5	A5
P1K5	2.7	3	1.5	2	65	A3	A3	A5	A5
P2K2	3.9	4.3	2.2	3	92	A3	A3	A5	A5
P3K0	4.9	5.4	3	4	122	A3	A3	A5	A5
P4K0	6.1	6.7	4	5	145	A3	A3	A5	A5
P5K5	9	9.9	5.5	7.5	195	A3	A3	A5	A5
P7K5	11	12.1		10	261	A3	A3	A5	A5
P11K	18	20	11	15	300	B3	B1	B1	B1
P15K	22	24	15	20	300	B3	B1	B1	B1
P18K	27	30	18.5	25	370	B3	B1	B1	B1
P22K	34	37	22	30	440	B4	B2	B2	B2
P30K	41	45	30	40	600	B4	B2	B2	B2
P37K	52	57	37	50	740	B4	C1	C1	C1
P45K	62	68	45	60	900	C3	C1	C1	C1
P55K	83	91	55	75	1100	C3	C1	C1	C1
P75K	100	110	75	100	1500	C4	C2	C2	C2
P90K	131	144	90	125	1800	C4	C2	C2	C2

## [T6] 3 x 525-600 V AC – high overload

High overload (160% 1 min/10 min)						Enclosure size			
Type code	Output current (3 x 525-600 V)		Typical shaft output power		Estimated power loss	Protection rating [IEC/UL]			
						IP20/21	IP21	IP55	IP66
FC-202	Con. I <sub>N</sub>	Inter. I <sub>MAX</sub> (60 s)	kW @ 575 V	Hp @ 575 V	[W]	Chassis	Type 1	Type 12	Type 4X
PK75	1.7	2.6	0.75	1	35	A3	A3	A5	A5
P1K1	2.4	3.6	1.1	1.5	50	A3	A3	A5	A5
P1K5	2.7	4.1	1.5	2	65	A3	A3	A5	A5
P2K2	3.9	5.9	2.2	3	92	A3	A3	A5	A5
P3K0	4.9	7.4	3	4	122	A3	A3	A5	A5
P4K0	6.1	9.2	4	5	145	A3	A3	A5	A5
P5K5	9	13.5	5.5	7.5	195	A3	A3	A5	A5
P7K5	11	16.5	7.5	10	261	A3	A3	A5	A5
P11K	11	17.6	7.5	10	220	B3	B1	B1	B1
P15K	18	29	11	15	220	B3	B1	B1	B1
P18K	22	35	15	20	300	B3	B1	B1	B1
P22K	27	43	18.5	25	370	B4	B2	B2	B2
P30K	34	54	22	30	440	B4	B2	B2	B2
P37K	41	62	30	40	600	B4	C1	C1	C1
P45K	52	78	37	50	740	C3	C1	C1	C1
P55K	62	93	45	60	900	C3	C1	C1	C1
P75K	83	125	55	75	1100	C4	C2	C2	C2
P90K	100	150	75	100	1500	C4	C2	C2	C2

## [T7] 3 x 525-690 V AC – normal overload

Normal overload (110% 1 min/10 min)								Enclosure size		
Type code	Output current				Typical shaft output power		Estimated power loss	Protection rating [IEC]*		
	(3 x 525-550 V)		(3 x 551-690 V)							
FC-202	Con. I <sub>N</sub>	Inter. I <sub>MAX</sub> (60 s)	Con. I <sub>N</sub>	Inter. I <sub>MAX</sub> (60 s)	kW @ 690 V	Hp @ 575 V	[W]	IP20	IP21	IP55
P1K1	2.1	2.3	1.6	1.8	1.1	1.5	44	A3	A3	–
P1K5	2.7	3	2.2	2.4	1.5	2	60	A3	A3	–
P2K2	3.9	4.3	3.2	3.5	2.2	3	88	A3	A3	–
P3K0	4.9	5.4	4.5	5	3	4	120	A3	A3	–
P4K0	6.1	6.7	5.5	6.1	4	5	160	A3	A3	–
P5K5	9	9.9	7.5	8.3	5.5	7.5	220	A3	A3	–
P7K5	11	12.1	10	11	7.5	10	300	A3	A3	–
P11K	14	15.4	13	14.3	11	15	220	B4	B2	B2
P15K	19	20.9	18	19.8	15	20	220	B4	B2	B2
P18K	23	25.3	22	24.2	18.5	25	300	B4	B2	B2
P22K	28	30.8	27	29.7	22	30	370	B4	B2	B2
P30K	36	39.6	34	37.4	30	40	440	B4	B2	B2
P37K	43	47.3	41	45.1	37	50	740	B4	C2	C2
P45K	54	59.4	52	57.2	45	60	900	C3	C2	C2
P55K	65	71.5	62	68.2	55	75	1100	C3	C2	C2
P75K	87	95.7	83	91.3	75	100	1500	–	C2	C2
P90K	105	115.5	100	110	90	125	1800	–	C2	C2

\*Note: T7 drives are not UL certified. Select T6 for UL certification.

## [T7] 3 x 525-690 V AC – high overload

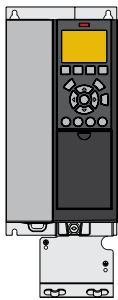
High overload (160% 1 min/10 min)								Enclosure size		
Type code	Output current				Typical shaft output power		Estimated power loss	Protection rating [IEC]*		
	(3 x 525-550 V)		(3 x 551-690 V)							
FC-202	Con. I <sub>N</sub>	Inter. I <sub>MAX</sub> (60 s)	Con. I <sub>N</sub>	Inter. I <sub>MAX</sub> (60 s)	kW @ 690 V	Hp @ 575 V	[W]	IP20	IP21	IP55
P1K1	2.1	3.2	1.6	2.4	1.1	1.5	44	A3	A3	–
P1K5	2.7	4.1	2.2	3.3	1.5	2	60	A3	A3	–
P2K2	3.9	5.9	3.2	4.8	2.2	3	88	A3	A3	–
P3K0	4.9	7.4	4.5	6.8	3	4	120	A3	A3	–
P4K0	6.1	9.2	5.5	8.3	4	5	160	A3	A3	–
P5K5	9	13.5	7.5	11.3	5.5	7.5	220	A3	A3	–
P7K5	11	16.5	10	15	7.5	10	300	A3	A3	–
P11K	11	17.6	10	16	7.5	10	150	B4	B2	B2
P15K	14	22.4	13	20.8	11	15	150	B4	B2	B2
P18K	19	30.4	18	28.8	15	20	220	B4	B2	B2
P22K	23	36.8	22	35.2	18.5	25	300	B4	B2	B2
P30K	28	44.8	27	43.2	22	30	370	B4	B2	B2
P37K	36	54	34	51	30	40	600	B4	C2	C2
P45K	43	64.5	41	61.5	37	50	740	C3	C2	C2
P55K	54	81	52	78	45	60	900	C3	C2	C2
P75K	65	97.5	62	93	55	75	1100	–	C2	C2
P90K	87	130.5	83	124.5	75	100	1500	–	C2	C2

\*Note: T7 drives are not UL certified. Select T6 for UL certification.

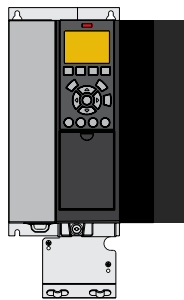


## Dimensions enclosure sizes A, B and C

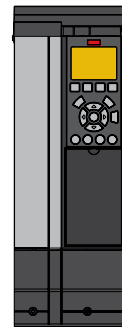
		VLT® AQUA Drive													
Enclosure size		A2		A3		A4	A5	B1	B2	B3	B4	C1	C2	C3	C4
Protection rating [IEC/UL]		IP20 Chassis	IP21 Type 1	IP20 Chassis	IP21 Type 1	IP55/Type 12 IP66/Type 4X		IP21/Type 1 IP55/Type 12 IP66/Type 4X		IP00/Chassis		IP21/Type 1 IP55/Type 12 IP66/Type 4X		IP00/Chassis	
[mm]	Height	268	375	268	375	390	420	480	650	399	520	680	770	550	660
	Height with decoupling plate	374	–	374	–	–	–	–	–	420	595	–	–	630	800
	Width	90	90	130	130	200	242	242	242	165	230	308	370	308	370
	Width with one C option	130	130	170	170	–	242	242	242	205	230	308	370	308	370
	Depth	205	207	205	207	175	200	260	260	249	242	310	335	333	333
	Depth with A, B option	220	222	220	222	175	200	260	260	262	242	310	335	333	333
	Depth with mains disconnect	–	–	–	–	206	224	289	290	–	–	344	378	–	–
[kg]	Weight	4.9	5.3	6	7	9.7	14.2	23	27	12	23.5	45	64	35	50
[in]	Height	10.6	14.8	10.6	14.8	15.4	16.6	18.9	25.6	15.8	20.5	26.8	30.4	21.7	26
	Height with decoupling plate	14.8	–	14.8	–	–	–	–	–	16.6	23.5	–	–	24.8	31.5
	Width	3.6	3.6	5.2	5.2	7.9	9.6	9.6	9.6	6.5	9.1	12.2	14.6	12.2	14.6
	Width with one C option	5.2	5.2	6.7	6.7	–	9.6	9.6	9.6	8.1	9.1	12.2	14.6	12.2	14.6
	Depth	8.1	18.2	8.1	8.2	6.9	7.9	10.3	10.3	9.8	9.6	12.3	13.2	13	13
	Depth with mains disconnect	–	–	–	–	8.2	8.9	11.4	11.5	–	–	13.6	14.9	–	–
	Depth with A, B option	8.7	8.8	8.7	8.8	6.9	7.9	10.3	10.3	10.4	9.6	12.3	13.2	13	13
[lb]	Weight	10.8	11.7	14.6	15.5	21.5	31.5	50.7	59.6	26.5	52	99.3	143.3	77.2	110.2



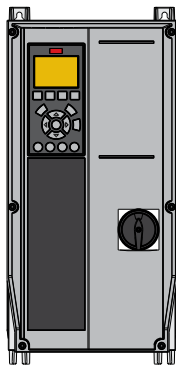
A3 IP20/Chassis  
with decoupling plate



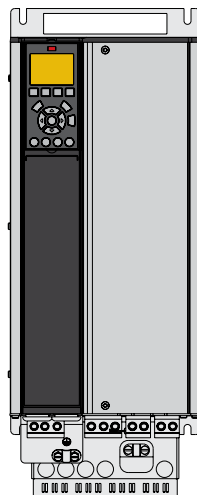
A3 IP20 with option C



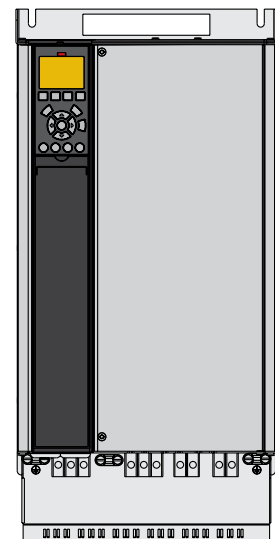
A3 with IP21/Type 12 NEMA 1 Kit



A4 IP55 with mains disconnect



B4 IP20



C3 IP20

# Ordering typecode for A, B and C enclosures

[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]	[10]	[11]	[12]	[13]	[14]	[15]	[16]	[17]	[18]	[19]
FC-																		

[1] Application (character 4-6)	
202	VLT® AQUA Drive FC 202
[2] Power size (character 7-10)	
PK25	0.25 kW/0.33 Hp
PK37	0.37 kW/0.50 Hp
PK55	0.55 kW/0.75 Hp
PK75	0.75 kW/1.0 Hp
P1K1	1.1 kW/1.5 Hp
P1K5	1.5 kW/2.0 Hp
P2K2	2.2 kW/3.0 Hp
P3K0	3.0 kW/4.0 Hp
P3K7	3.7 kW/5.0 Hp
P4K0	4.0 kW/5.5 Hp
P5K5	5.5 kW/7.5 Hp
P7K5	7.5 kW/10 Hp
P11K	11 kW/15 Hp
P15K	15 kW/20 Hp
P18K	18.5 kW/25 Hp
P22K	22 kW/30 Hp
P30K	30 kW/40 Hp
P37K	37 kW/50 Hp
P45K	45 kW/60 Hp
P55K	55 kW/75 Hp
P75K	75 kW/100 Hp
P90K	90 kW/125 Hp
N75K	75 kW/100 Hp
N90K	90 kW/125 Hp
[3] AC Line Voltage (character 11-12)	
S2	1 x 200/240 V AC
T2	3 x 200-240 V AC
S4	1 x 380/480 V AC
T4	3 x 380-480 V AC
T6	3 x 525-600 V AC
T7	3 x 525-690 V AC <sup>2)</sup>
[4] IP/UL protection ratings (character 13-15)	
IP20/Chassis enclosures	
E20	IP20/Chassis
P20	IP20/Chassis + backplate
IP21/UL Type 1 enclosures	
E21	IP21/Type 1
P21	IP21/Type 1 + backplate
IP55/UL Type 12 enclosures	
E55	IP55/Type 12
P55	IP55/Type 12 + backplate
Y55	IP55/Type 12 + backplate (A4 enclosure, no C-options)
Z55	IP55/Type 12 (A4 enclosure, no C-options)
UL Type 3R enclosures	
E3R	UL Type 3R (North America only)
P3R	UL Type 3R + backplate (North America only)
IP66/UL Type 4X enclosures	
E66	IP66/Type 4X
Y66	IP66/Type 4X + backplate (A4 enclosure, no C-options)
Z66	IP66/Type 4X (A4 enclosure, no C-options)

[5] RFI filter, terminal and monitoring options – EN/IEC 61800-3 (character 16-17)	
H1	RFI-Filter Class A1/B (C1)
H2	RFI-Filter, Class A2 (C3)
H3	RFI-Filter Class A1/B <sup>1)</sup>
H4	RFI-Filter, Class A1 (C2)
H5	RFI-Filter, Class A2 (C3) Marine ruggedized
HX	No RFI-Filter
[6] Braking and safety (character 18)	
X	No brake IGBT
B	Brake IGBT
T	Safe Stop without brake
U	Brake IGBT plus Safe Torque Off
[7] LCP Display (character 19)	
X	Blank faceplate, no LCP installed
N	Numerical Local Control Panel (LCP 101)
G	Graphical Local Control Panel (LCP 102)
[8] PCB Coating – IEC 721-3-3 (character 20)	
X	Standard coated PCB Class 3C2
C	Coated PCB Class 3C3
[9] Mains input (character 21)	
X	No mains option
1	Mains disconnect (A4, A5, B1, B2, C1 and C2 enclosures only)
8	Mains disconnect and load sharing (B1, B2, C1 and C2 enclosures only)
D	Load sharing terminals (B1, B2, C1, C2 enclosures only)
[10] Hardware option A (character 22)	
X	Standard cable entries
O	Metric cable entry (threaded)
S	Imperial cable entry
[11] Hardware option B (character 23)	
X	No adaptation
[12] Special version (character 24-27)	
SXXX	Latest released standard software
S067	Integrated Motion Control
[13] LCP language (character 28)	
X	Standard language package including English, German, French, Spanish, Danish, Italian, Finnish and others
Contact factory for other language options	
[14] A-options: Fieldbus (character 29-30)	
AX	No option
A0	VLT® PROFIBUS DP V1 MCA 101
A4	VLT® DeviceNet MCA 104
AL	VLT® PROFINET MCA 120
AN	VLT® EtherNet/IP MCA 121
AQ	VLT® Modbus TCP MCA 122
[15] B-options (character 31-32)	
BX	No option
BK	VLT® General Purpose MCB 101
BP	VLT® Relay Option MCB 105
B2	VLT® PTC Thermistor Card MCB 112
B4	VLT® Sensor Input Card MCB 114
BY	VLT® Extended Cascade Controller MCO 101

[16] C0-option (character 33-34)	
CX	No option
[17] C1-option (character 35)	
X	No option
5	VLT® Advanced Cascade Controller MCO 102
R	VLT® Extended Relay Card MCB 113
[18] C1-option software (character 36-37)	
XX	No software option
[19] Control Power Backup Input (character 38-39)	
DX	No DC input installed
D0	VLT® 24 V DC Supply Option MCB 107
D1	VLT® Real-time Clock Option MCB 117

1) Reduced motor cable length

2) Note: T7 drives are not UL certified.  
Select T6 for UL certification.

Please beware that not all combinations are possible.  
Find help configuring your drive with the online  
configurator found under: [driveconfig.danfoss.com](https://driveconfig.danfoss.com)

# Enclosure overview D, E, and F

## 6-pulse

VLT® AQUA Drive			T4 380 – 480 V			T7 525 – 690 V		
FC 200	kW		IP20	IP21	IP54	IP20	IP21	IP54
	NO	HO						
N75K	75	55						
N90K	90	75						
N110	110	90						
N132	132	110	D3h	D1h D5h D6h	D1h D5h D6h	D3h	D1h D5h D6h	D1h D5h D6h
N160	160	132						
N200	200	160						
N250	250	200	D4h	D2h D7h D8h	D2h D7h D8h	D4h	D2h D7h D8h	D2h D7h D8h
N315	315	250						
N355	355	315						
N400	400	355	E3h	E1h	E1h	D4h	D2h D7h D8h	D2h D7h D8h
N450	450	400						
N500	500	450	E4h	E2h	E2h	E3h	E1h	E1h
N560	560	500						
N630	630	560						
N710	710	630				E4h	E2h	E2h
N800	800	710						
P500	500	450						
P560	560	500						
P630	630	560		F1/F3	F2/F4			
P710	710	630						
P800	800	710		F1/F3	F2/F4		F1/F3	F2/F4
P900	900	800						
P1M0	1000	900		F1/F3	F2/F4			
P1M2	1200	1000					F1/F3	F2/F4
P1M4	1400	1200						

## 12-pulse

VLT® AQUA Drive			T4 380 – 480 V				T7 525 – 690 V			
FC 200	kW		IP21	IP21 + options	IP54	IP54 + options	IP21	IP21 + options	IP54	IP54 + options
	NO	HO								
P315	315	250								
P355	355	315								
P400	400	355	F8	F9	F8	F9				
P450	450	400								
P500	500	450								
P560	560	500								
P630	630	560	F10	F11	F10	F11	F8	F9	F8	F9
P710	710	630								
P800	800	710	F12	F13	F12	F13	F10	F11	F10	F12
P900	900	800								
P1M0	1000	800	F12	F13	F12	F13	F12	F13	F12	F13
P1M2	1200	1000								
P1M4	1400	1200								

- IP21/Type 1
- IP54/Type 12





# Electrical data – D, E and F enclosures

## [T5] 3 x 380-480 V AC – normal overload

Normal overload (110% 1 min/10 min)								Enclosure size		
Type code	Output current				Typical shaft output power		Estimated power loss	Protection rating [IEC/UL]		
	(3 x 380-440 V)		(3 x 441-500 V)					IP20	IP21	IP54
FC-202	Con. I <sub>N</sub>	Inter. I <sub>MAX</sub> (60 s)	Con. I <sub>N</sub>	Inter. I <sub>MAX</sub> (60 s)	kW @ 400 V	Hp @ 460 V	[W]	Chassis	Type 1	Type 12
N110	212	233	190	209	110	150	2559	D3h	D1h/D5h/D6h	
N132	260	286	240	264	132	200	2954	D3h	D1h/D5h/D6h	
N160	315	347	302	332	160	250	3770	D3h	D1h/D5h/D6h	
N200	395	435	361	397	200	300	4116	D4h	D2h/D7h/D8h	
N250	480	528	443	487	250	350	5137	D4h	D2h/D7h/D8h	
N315	588	647	535	588	315	450	6674	D4h	D2h/D7h/D8h	
N355	658	724	590	649	355	500	6928	E3h	E1h	E1h
N400	745	820	678	746	400	600	8036	E3h	E1h	E1h
N450	800	880	730	803	450	600	8783	E3h	E1h	E1h
N500	880	968	780	858	500	650	9473	E4h	E2h	E2h
N560	990	1089	890	979	560	750	11102	E4h	E2h	E2h
P500	880	968	780	858	500	650	10162	–	F1/F3	F1/F3
P560	990	1089	890	979	560	750	11822	–	F1/F3	F1/F3
P630	1120	1232	1050	1155	630	900	12512	–	F1/F3	F1/F3
P710	1260	1386	1160	1276	710	1000	14674	–	F1/F3	F1/F3
P800	1460	1606	1380	1518	800	1200	17293	–	F2/F4	F2/F4
P1M0	1720	1892	1530	1683	1000	1350	19278	–	F2/F4	F2/F4

## [T5] 3 x 380-480 V AC – high overload

High overload (150% 1 min/10 min)								Enclosure size		
Type code	Output current				Typical shaft output power		Estimated power loss	Protection rating [IEC/UL]		
	(3 x 380-440 V)		(3 x 441-500 V)					IP20	IP21	IP54
FC-202	Con. I <sub>N</sub>	Inter. I <sub>MAX</sub> (60 s)	Con. I <sub>N</sub>	Inter. I <sub>MAX</sub> (60 s)	kW @ 400 V	Hp @ 460 V	[W]	Chassis	Type 1	Type 12
N110	177	266	160	240	90	125	2031	D3h	D1h/D5h/D6h	
N132	212	318	190	285	110	150	2289	D3h	D1h/D5h/D6h	
N160	260	390	240	360	132	200	2923	D3h	D1h/D5h/D6h	
N200	315	473	302	453	160	250	3093	D4h	D2h/D7h/D8h	
N250	395	593	361	542	200	300	4039	D4h	D2h/D7h/D8h	
N315	480	720	443	665	250	350	5005	D4h	D2h/D7h/D8h	
N355	600	900	540	810	315	450	6178	E3h	E1h	E1h
N400	658	987	590	885	355	500	6851	E3h	E1h	E1h
N450	695	1043	678	1017	400	550	7297	E3h	E1h	E1h
N500	800	1200	730	1095	450	600	8352	E4h	E2h	E2h
N560	880	1320	780	1170	500	650	9449	E4h	E2h	E2h
P500	800	1200	730	1095	450	600	9031	–	F1/F3	F1/F3
P560	880	1320	780	1170	500	650	10146	–	F1/F3	F1/F3
P630	990	1485	890	1335	560	750	10649	–	F1/F3	F1/F3
P710	1120	1680	1050	1575	630	900	12490	–	F1/F3	F1/F3
P800	1260	1890	1160	1740	710	1000	14244	–	F2/F4	F2/F4
P1M0	1460	2190	1380	2070	800	1200	15466	–	F2/F4	F2/F4

## [T7] 3 x 525-690 V AC – normal overload

Normal overload (110% 1 min/10 min)								Enclosure size		
Type code	Output current				Typical shaft output power		Estimated power loss	Protection rating [IEC/UL]		
	(3 x 525-550 V)		(3 x 551-690 V)					IP20	IP21	IP54
FC-202	Con. I <sub>N</sub>	Inter. I <sub>MAX</sub> (60 s)	Con. I <sub>N</sub>	Inter. I <sub>MAX</sub> (60 s)	kW @ 690 V	Hp @ 575 V	[W]	Chassis	Type 1	Type 12
N75K	90	99	86	95	75	75	1162	D3h	D1h/D5h/D6h	
N90K	113	124	108	119	90	100	1428	D3h	D1h/D5h/D6h	
N110	137	151	131	144	110	125	1740	D3h	D1h/D5h/D6h	
N132	162	178	155	171	132	150	2101	D3h	D1h/D5h/D6h	
N160	201	221	192	211	160	200	2649	D3h	D1h/D5h/D6h	
N200	253	278	242	266	200	250	3074	D4h	D2h/D7h/D8h	
N250	303	333	290	319	250	300	3723	D4h	D2h/D7h/D8h	
N315	360	396	344	378	315	350	4465	D4h	D2h/D7h/D8h	
N400	418	460	400	440	400	400	5028	D4h	D2h/D7h/D8h	
N450	470	517	450	495	450	450	6062	E3h	E1h	E1h
N500	523	575	500	550	500	500	6879	E3h	E1h	E1h
N560	596	656	570	627	560	600	8076	E3h	E1h	E1h
N630	630	693	630	693	630	650	9208	E3h	E1h	E1h
N710	763	839	730	803	710	750	10346	E4h	E2h	E2h
N800	889	978	850	935	800	950	12723	E4h	E2h	E2h
P710	763	839	730	803	710	750	9212	–	F1/F3	F1/F3
P800	889	978	850	935	800	950	10659	–	F1/F3	F1/F3
P900	988	1087	945	1040	900	1050	12080	–	F1/F3	F1/F3
P1M0	1108	1219	1060	1166	1000	1150	13305	–	F2/F4	F2/F4
P1M2	1317	1449	1260	1386	1200	1350	15865	–	F2/F4	F2/F4
P1M4	1479	1627	1415	1557	1400	1550	18173	–	F2/F4	F2/F4

## [T7] 3 x 525-690 V AC – high overload

High overload (150% 1 min/10 min)								Enclosure size		
Type code	Output current				Typical shaft output power		Estimated power loss	Protection rating [IEC/UL]		
	(3 x 525-550 V)		(3 x 551-690 V)					IP20	IP21	IP54
FC-202	Con. I <sub>N</sub>	Inter. I <sub>MAX</sub> (60 s)	Con. I <sub>N</sub>	Inter. I <sub>MAX</sub> (60 s)	kW @ 690 V	Hp @ 575 V	[W]	Chassis	Type 1	Type 12
N75K	76	122	73	117	55	60	1098	D3h	D1h/D5h/D6h	
N90K	90	135	86	129	75	75	1162	D3h	D1h/D5h/D6h	
N110	113	170	108	162	90	100	1430	D3h	D1h/D5h/D6h	
N132	137	206	131	197	110	125	1742	D3h	D1h/D5h/D6h	
N160	162	243	155	233	132	150	2080	D3h	D1h/D5h/D6h	
N200	201	302	192	288	160	200	2361	D4h	D2h/D7h/D8h	
N250	253	380	242	363	200	250	3012	D4h	D2h/D7h/D8h	
N315	303	455	290	435	250	300	3642	D4h	D2h/D7h/D8h	
N400	360	540	344	516	315	350	4146	D4h	D2h/D7h/D8h	
N450	395	593	380	570	355	400	4989	E3h	E1h	E1h
N500	429	644	410	615	400	400	5419	E3h	E1h	E1h
N560	523	785	500	750	500	500	6833	E3h	E1h	E1h
N630	596	894	570	855	560	600	8069	E3h	E1h	E1h
N710	659	989	630	945	630	650	8543	E4h	E2h	E2h
N800	763	1145	730	1095	710	750	10319	E4h	E2h	E2h
P710	659	989	630	945	630	650	7826	–	F1/F3	F1/F3
P800	763	1145	730	1095	710	750	8983	–	F1/F3	F1/F3
P900	889	1334	850	1275	800	950	10646	–	F1/F3	F1/F3
P1M0	988	1482	945	1418	900	1050	11681	–	F2/F4	F2/F4
P1M2	1108	1662	1060	1590	1000	1150	12997	–	F2/F4	F2/F4
P1M4	1317	1976	1260	1890	1200	1350	15763	–	F2/F4	F2/F4

## Dimensions enclosure size D

		VLT® AutomationDrive									
Enclosure size		D1h	D2h	D3h	D3h <sup>(1)</sup>	D4h	D4h <sup>(1)</sup>	D5h <sup>(2)</sup>	D6h <sup>(3)</sup>	D7h <sup>(4)</sup>	D8h <sup>(5)</sup>
Protection rating [IEC/UL]		IP21 /Type 1 IP54 /Type 12		IP20 /Chassis				IP21 /Type 1 IP54 /Type 12			
[mm]	Height	901.0	1107.0	909.0	1026.5	1122.0	1293.8	1324.0	1663.0	1978.0	2284.0
	Width	325.0	420.0	250.0	250.0	350.0	350.0	325.0	325.0	420.0	420.0
	Depth	378.4	378.4	375.0	375.0	375.0	375.0	381.0	381.0	386.0	406.0
[kg]	Weight	62.0	125.0	62.0	108.0	125.0	179.0	99.0	128.0	185.0	232.0
[in]	Height	35.5	43.6	35.8	39.6	44.2	50.0	52.1	65.5	77.9	89.9
	Width	12.8	12.8	19.8	9.9	14.8	13.8	12.8	12.8	16.5	16.5
	Depth	14.9	14.9	14.8	14.8	14.8	14.8	15.0	15.0	15.2	16.0
[lb]	Weight	136.7	275.6	136.7	238.1	275.6	394.6	218.3	282.2	407.9	511.5

<sup>(1)</sup> dimensions with regeneration or load share terminals

<sup>(2)</sup> D5h is used with disconnect and/or brake chopper options

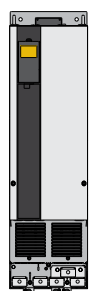
<sup>(3)</sup> D6h is used with contactor and/or circuit breaker options

<sup>(4)</sup> D7h is used with disconnect and/or brake chopper options

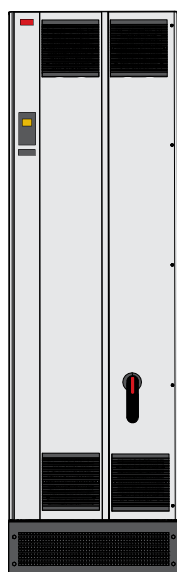
<sup>(5)</sup> D8h is used with contactor and/or circuit breaker options

## Dimensions enclosure sizes E and F

		VLT® AutomationDrive							
Frame		E1h	E2h	E3h	E4h	F1	F2	F3	F4
Protection rating [IEC/UL]		IP21 /Type 1 IP54 /Type 12		IP20 /Chassis IP21 /Type 1		IP21 /Type 1 IP54 /Type 12			
[mm]	Height	2043.0	2043.0	1578.0	1578.0	2204.0	2204.0	2204.0	2204.0
	Width	602.0	698.0	506.0	604.0	1400.0	1800.0	2000.0	2400.0
	Depth	513.0	513.0	482.0	482.0	606.0	606.0	606.0	606.0
[kg]	Weight	295.0	318.0	272.0	295.0	1017.0	1260.0	1318.0	1561.0
[in]	Height	80.4	80.4	62.1	62.1	86.8	86.8	86.8	86.8
	Width	23.7	27.5	19.9	23.9	55.2	70.9	78.8	94.5
	Depth	20.2	20.2	19.0	19.0	23.9	23.9	23.9	23.9
[lb]	Weight	650.0	700.0	600.0	650.0	2242.1	2777.9	2905.7	3441.5



D3h/D4h



E1h



F



# Electrical data and dimensions – VLT® 12-Pulse

## [T5] 6 x 380-480 V AC – normal overload

Normal overload (110% 1 min/10 min)								Enclosure size			
Type code	Output current				Typical shaft output power		Estimated power loss	Protection rating [IEC/UL]			
	(3 x 380-440 V)		(3 x 441-500 V)					IP21/Type 1		IP54/Type 12	
FC-302	Con. I <sub>N</sub>	Inter. I <sub>MAX</sub> (60 s)	Con. I <sub>N</sub>	Inter. I <sub>MAX</sub> (60 s)	kW @ 400 V	Hp @ 460 V	[W]	AC drive	+ options	AC drive	+ options
P315	600	660	540	594	315	450	6790	F8	F9	F8	F9
P355	658	724	590	649	355	500	7701	F8	F9	F8	F9
P400	745	820	678	746	400	600	8879	F8	F9	F8	F9
P450	800	880	730	803	450	600	9670	F8	F9	F8	F9
P500	880	968	780	858	500	650	10647	F10	F11	F10	F11
P560	990	1089	890	979	560	750	12338	F10	F11	F10	F11
P630	1120	1232	1050	1155	630	900	13201	F10	F11	F10	F11
P710	1260	1386	1160	1276	710	1000	15436	F10	F11	F10	F11
P800	1460	1606	1380	1518	800	1200	18084	F12	F13	F12	F13
P1M0	1720	1892	1530	1683	1000	1350	20358	F12	F13	F12	F13

## [T5] 6 x 380-480 V AC – high overload

High overload (150% 1 min/10 min)								Enclosure size			
Type code	Output current				Typical shaft output power		Estimated power loss	Protection rating [IEC/UL]			
	(3 x 380-440 V)		(3 x 441-500 V)					IP21/Type 1		IP54/Type 12	
FC-302	Con. I <sub>N</sub>	Inter. I <sub>MAX</sub> (60 s)	Con. I <sub>N</sub>	Inter. I <sub>MAX</sub> (60 s)	kW @ 400 V	Hp @ 460 V	[W]	AC drive	+ options	AC drive	+ options
P315	480	720	443	665	250	350	5164	F8	F9	F8	F9
P355	600	900	540	810	315	450	6960	F8	F9	F8	F9
P400	658	987	590	885	355	500	7691	F8	F9	F8	F9
P450	695	1043	678	1017	400	550	8178	F8	F9	F8	F9
P500	800	1200	730	1095	450	600	9492	F10	F11	F10	F11
P560	880	1320	780	1170	500	650	10631	F10	F11	F10	F11
P630	990	1485	890	1335	560	750	11263	F10	F11	F10	F11
P710	1120	1680	1050	1575	630	900	13172	F10	F11	F10	F11
P800	1260	1890	1160	1740	710	1000	14967	F12	F13	F12	F13
P1M0	1460	2190	1380	2070	800	1200	16392	F12	F13	F12	F13

## [T7] 6 x 525-690 V AC – normal overload

Normal overload (110% 1 min/10 min)								Enclosure size			
Type code	Output current				Typical shaft output power		Estimated power loss	Protection rating [IEC/UL]			
	(3 x 525-550 V)		(3 x 551-690 V)					IP21/Type 1		IP54/Type 12	
FC-302	Con. I <sub>N</sub>	Inter. I <sub>MAX</sub> (60 s)	Con. I <sub>N</sub>	Inter. I <sub>MAX</sub> (60 s)	kW @ 690 V	Hp @ 575 V	[W]	AC drive	+ options	AC drive	+ options
P450	395	593	380	570	355	400	4589	F8	F9	F8	F9
P500	429	644	410	615	400	400	4970	F8	F9	F8	F9
P560	523	785	500	750	500	500	6707	F8	F9	F8	F9
P630	596	894	570	855	560	600	7633	F8	F9	F8	F9
P710	659	989	630	945	630	650	8388	F10	F11	F10	F11
P800	763	1145	730	1095	710	750	9537	F10	F11	F10	F11
P900	889	1334	850	1275	800	950	11291	F10	F11	F10	F11
P1M0	988	1482	945	1418	900	1050	12524	F12	F13	F12	F13
P1M2	1108	1662	1060	1590	1000	1150	13801	F12	F13	F12	F13
P1M4	1317	1976	1260	1890	1200	1350	16719	F12	F13	F12	F13

## [T7] 6 x 525-690 V AC – high overload

High overload (150% 1 min/10 min)								Enclosure size			
Type code	Output current				Typical shaft output power		Estimated power loss	Protection rating [IEC/UL]			
	(3 x 525-550 V)		(3 x 551-690 V)					IP21/Type 1		IP54/Type 12	
FC-302	Con. I <sub>N</sub>	Inter. I <sub>MAX</sub> (60 s)	Con. I <sub>N</sub>	Inter. I <sub>MAX</sub> (60 s)	kW @ 690 V	Hp @ 575 V	[W]	AC drive	+ options	AC drive	+ options
P450	470	517	450	495	450	450	5529	F8	F9	F8	F9
P500	523	575	500	550	500	500	6239	F8	F9	F8	F9
P560	596	656	570	627	560	600	7653	F8	F9	F8	F9
P630	630	693	630	693	630	650	8495	F8	F9	F8	F9
P710	763	839	730	803	710	750	9863	F10	F11	F10	F11
P800	889	978	850	935	800	950	11304	F10	F11	F10	F11
P900	988	1087	945	1040	900	1050	12798	F10	F11	F10	F11
P1M0	1108	1219	1060	1166	1000	1150	13801	F12	F13	F12	F13
P1M2	1317	1449	1260	1386	1200	1350	16821	F12	F13	F12	F13
P1M4	1479	1627	1415	1557	1400	1550	19247	F12	F13	F12	F13

## Dimensions enclosure size F

		VLT® AutomationDrive					
Enclosure size		F8	F9	F10	F11	F12	F13
Protection rating [IEC/UL]		IP21/Type 1 IP54/Type 12					
[mm]	Height	2204.0	2204.0	2204.0	2204.0	2204.0	2204.0
	Width	800.0	1400.0	1600.0	2400.0	2000.0	2800.0
	Depth	606.0	606.0	606.0	606.0	606.0	606.0
[kg]	Weight	447.0	669.0	893.0	1116.0	1037.0	1259.0
[in]	Height	86.8	86.8	86.8	86.8	86.8	86.8
	Width	31.5	55.2	63.0	94.5	78.8	110.2
	Depth	23.9	23.9	23.9	23.9	23.9	23.9
[lb]	Weight	985.5	1474.9	1968.8	2460.4	2286.4	2775.7

# Ordering typecode for D, E and F enclosures

[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]	[10]	[11]	[12]	[13]	[14]	[15]	[16]	[17]	[18]	[19]
FC-																		

[1] Application (character 4-6)	
202	VLT® AQUA Drive FC 202
[2] Power size (character 7-10)	
N75K	75 kW / 100 Hp
N90K	90 kW / 125 Hp
N110	110 kW / 150 Hp
N132	132 kW / 200 Hp
N160	160 kW / 250 Hp
N200	200 kW / 300 Hp
N250	250 kW / 350 Hp
N315	315 kW / 450 Hp
P315	315 kW / 450 Hp
N355	355 kW / 500 Hp
P355	355 kW / 500 Hp
N400	400 kW / 550 Hp
P400	400 kW / 550 Hp
N450	450 kW / 600 Hp
P450	450 kW / 600 Hp
N500	500 kW / 650 Hp
P500	500 kW / 650 Hp
N560	560 kW / 750 Hp
P560	560 kW / 750 Hp
N630	630 kW / 900 Hp
P630	630 kW / 900 Hp
N710	710 kW / 1000 Hp
P710	710 kW / 1000 Hp
N800	800 kW / 1200 Hp
P800	800 kW / 1200 Hp
P900	900 kW / 1250 Hp
P1M0	1.0 MW / 1350 Hp
P1M2	1.2 MW / 1600 Hp
P1M4	1.4 MW / 1900 Hp
[3] AC mains voltage (character 11-12)	
T5	3 x 380-500 V AC
T7	3 x 525-690 V AC 690 V kW. See manuals for 575 V Hp
[4] IP/UL protection ratings (character 13-15)	
IP00 / IP20 Chassis enclosures	
E00	IP00 / Chassis (D4, E2 enclosures)
C00	IP00 / Chassis – Stainless steel back channel
E20	IP20 / Chassis
E2S	IP20 / Chassis (D3h enclosure)
C20	IP20 / Chassis – Stainless steel back channel
C2S	IP20 / Chassis – Stainless steel back channel (D3h enclosure)
IP21 / UL Type 1 enclosures	
E21	IP21 / Type 1
E2M	IP21 / Type 1 + mains shield
E2D	IP21 / Type 1 (D1h, D5h, D6h enclosures)
H21	IP21 / Type 1 + space heater

C21	IP21 / Type 1 – Stainless steel back channel
C2M	IP21 / Type 1 – Stainless steel back channel + mains shield
C2H	IP21 / Type 1 – Stainless steel back channel + space heater
L2A	IP21 / Type 1 + cabinet light + 115 V power outlet
L2X	IP21 / Type 1 + cabinet light + 230 V power outlet
R2A	IP21 / Type 1 + space heater + cabinet light + 115 V power outlet
R2X	IP21 / Type 1 + space heater + cabinet light + 230 V power outlet
C2E	IP21 / Type 1 – Stainless steel back channel + Cooling out the back
IP54 / UL Type 12 enclosures	
E54	IP54 / Type 12
E5D	IP54 / Type 12 (D1h, D5h, D6h frames)
E5M	IP54 / Type 12 + mains shield
E5S	IP54 / Type 12, NEMA 3R ready – Stainless steel screws + space heater (D1h, D2h frames)
H54	IP54 / Type 12 + space heater + thermostat
C54	IP54 / Type 12 – Stainless steel back channel
C5M	IP54 / Type 12 – Stainless steel back channel + mains shield
C5H	IP54 / Type 12 – Stainless steel back channel + space heater
L5A	IP54 / Type 12 + cabinet light + 115 V power outlet
L5X	IP54 / Type 12 + cabinet light + 230 V power outlet
R5A	IP54 / Type 12 + space heater + cabinet light + 115 V power outlet
R5X	IP54 / Type 12 + space heater + cabinet light + 230 V power outlet
[5] RFI filter, terminal and monitoring options – EN/IEC 61800-3 (character 16-17)	
H2	RFI filter, Class A2 (C3)
H4	RFI filter, Class A1 (C2) (Enclosure sizes D and F only)
H5	RFI filter, Class A2 (C3) Marine ruggedized
HG	IRM for IT mains with Class A2 RFI (Enclosure sizes F1, F2, F3, F4)
HE	RCD for TN/TT mains with Class A2 RFI (Enclosure sizes F1, F2, F3, F4)
HX	No RFI filter
HF	RCD for TN/TT mains and Class A1 RFI (Enclosure sizes F1, F2, F3, F4)
HH	IRM for IT mains and Class A1 RFI (Enclosure sizes F1, F2, F3, F4)
VLT® Low Harmonic Drive	
N2	VLT® Low Harmonic Drive, active filter based with Class A2 RFI
N4	VLT® Low Harmonic Drive, active filter based with Class A1 RFI

VLT® 12-Pulse, encl. sizes F8, F9, F10, F11, F12, F13	
B2	12-Pulse with Class A2 RFI
B4	12-Pulse with Class A1 RFI
BE	12-Pulse with RCD / A2 RFI
BF	12-Pulse with RCD / A1 RFI
BG	12-Pulse with IRM / A2 RFI
BH	12-Pulse with IRM / A1 RFI
[6] Braking and safety (character 18)	
X	No brake IGBT
B	Brake IGBT
C	Safe Torque Off with Pilz Safety Relay (enclosure sizes F1, F2, F3, F4)
D	Safe Torque Off with Pilz Safety Relay and brake IGBT (enclosure sizes F1, F2, F3, F4)
E	Safe Torque Off with Pilz Safety Relay and regeneration terminals (enclosure sizes F1, F2, F3, F4)
T	Safe Torque Off without brake
R	Regeneration terminals (enclosure sizes D & F)
S	Regeneration terminals and brake chopper
U	Brake IGBT plus Safe Torque Off
Enclosure sizes F3, F4	
M	IEC Emergency Stop Pushbutton (includes Pilz Relay)
N	IEC Emergency Stop Pushbutton with brake IGBT and brake terminals (includes Pilz Safety Relay)
P	IEC Emergency Stop Pushbutton with regeneration terminals (includes Pilz Safety Relay)
[7] LCP display (character 19)	
X	Blank faceplate, no LCP installed
N	Numerical Local Control Panel (LCP 101)
G	Graphical Local Control Panel (LCP 102)
Enclosure size D and E, IP21/IP54 only	
J	No Local Control Panel + USB through door
L	Graphical Local Control Panel (LCP 102) + USB through door
K	Numerical Local Control Panel (LCP 101) + USB through door
[8] PCB coating – IEC 721-3-3 (character 20)	
X	Standard coated PCB Class 3C2
C	Coated PCB Class 3C3
R	Coated PCB Class 3C3 + ruggedized
[9] Mains input (character 21)	
X	No mains option
7	Fuses
A	Fuses and load sharing terminals (enclosure sizes D/IP20 and F3, F4, F9, F11, F14, F18 only)
D	Load sharing terminals (enclosure sizes D/IP20 and F3, F4, F9, F11, F14, F18 only)



	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]	[10]	[11]	[12]	[13]	[14]	[15]	[16]	[17]	[18]	[19]
FC-																			

3	Mains disconnect + fuse (enclosure sizes D, E and F3, F4, F9, F11, F14, F18)
4	Mains contactor + fuse (enclosure size D)
5	Mains disconnect, fuse and load sharing (Not available for enclosure size F18)
E	Mains disconnect + contactor + fuse (enclosure sizes D, E and F3, F4, F9, F11, F14, F18)
J	Circuit breaker + fuse (enclosure sizes D, E and F3, F4, F9, F11, F14, F18)
F	Mains circuit breaker, contactor and fuses (enclosure sizes F3, F4, F9, F11, F14, F18)
G	Mains disconnect, contactor, load sharing terminals and fuses (enclosure sizes F3, F4, F9, F11, F14, F18)
H	Mains circuit breaker, contactor, load sharing terminals and fuses (enclosure sizes F3, F4, F9, F11, F14, F18)
K	Mains circuit breaker, load share and fuses (enclosure sizes F3, F4, F9, F11, F14, F18)
T	Cable connection cabinet (enclosure size D5h/D7h only)
W	Cable connection cabinet and fuse (enclosure size D5h/D7h only)
<b>[10] Hardware option A (character 22)</b>	
X	Standard cable entries
<b>Enclosure sizes F1, F2, F3, F4, F10, F11, F12, F13, F18</b>	
E	30 A fuse protected power terminals
F	30 A fuse protected power terminals and 2.5-4 A manual motor starter
G	30 A fuse protected power terminals and 4-6.3 A manual motor starter
H	30 A fuse protected power terminals and 6.3-10 A manual motor starter
J	30 A fuse protected power terminals and 10-16 A manual motor starter
K	Two 2.5-4 A manual motor starters
L	Two 4-6.3 A manual motor starters
M	Two 6.3-10 A manual motor starters
N	Two 10-16 A manual motor starters

<b>[11] Hardware option B (character 23)</b>	
X	No adaptation
Q	Heat sink access panel (enclosure size D and E only)
<b>Enclosure sizes F1, F2, F3, F4, F10, F11, F12, F13, F18</b>	
G	5 A 24 V supply (customer use) and external temperature monitoring
H	5 A 24 V supply (customer use)
J	External temperature monitoring
K	Common motor terminals
L	5 A 24 V supply + common motor terminals
M	External temperature monitoring + common motor terminals
N	5 A 24 V supply + external temperature monitoring + common motor terminals
<b>[12] Special version (character 24-27)</b>	
SXXX	Latest released standard software
S067	Integrated Motion Control
<b>[13] LCP language (character 28)</b>	
X	Standard language package including English, German, French, Spanish, Danish, Italian, Finnish and others
<b>Contact factory for other language options</b>	
<b>[14] A-options: Fieldbus (character 29-30)</b>	
AX	No option
A0	VLT® PROFIBUS DP MCA 101
A4	VLT® DeviceNet MCA 104
AL	VLT® PROFINET MCA 120
AN	VLT® EtherNet/IP MCA 121
AQ	VLT® Modbus TCP MCA 122
<b>[15] B-options (character 31-32)</b>	
BX	No application option
BK	VLT® General Purpose MCB 101
BP	VLT® Relay Option MCB 105
B2	VLT® PTC Thermistor Card MCB 112
B4	VLT® Sensor Input Card MCB 114
BY	VLT® Extended Cascade Controller MCO 101

<b>[16] C0-option (character 33-34)</b>	
CX	No option
<b>[17] C1-option (character 35)</b>	
X	No option
5	VLT® Advanced Cascade Controller MCO 102
R	VLT® Extended Relay Card MCB 113
<b>[18] C1-option software (character 36-37)</b>	
XX	No software option
<b>[19] Control Power Back-up Input (character 38-39)</b>	
DX	No DC input installed
D0	VLT® 24 V DC Supply Option MCB 107

Please beware that not all combinations are possible.  
Find help configuring your drive with the online  
configurator found under: [driveconfig.danfoss.com](https://driveconfig.danfoss.com)

# Electrical data – VLT® Low Harmonic Drive and VLT® Advanced Active Filters

## [T5] 3 x 480 V AC – VLT® Low Harmonic Drive

Normal overload (110% 1 min/10 min)									Enclosure size	
Type code	Output current				Typical shaft output power		Continuous input current	Estimated power loss	Protection rating [IEC/UL]	
	(3 x 380-440 V)		(3 x 441-480 V)						IP21	IP54
FC-302	Con. I <sub>N</sub>	Inter. I <sub>MAX</sub> (60 s)	Con. I <sub>N</sub>	Inter. I <sub>MAX</sub> (60 s)	kW @ 400 V	Hp @ 460 V	[A]	[W]	Type 1	Type 12
N132	315	347	302	332	160	250	304	8725	D1n	D1n
N160	395	435	361	397	200	300	381	9831	D2n	D2n
N200	480	528	443	487	250	350	463	11371	D2n	D2n
N250	600	660	540	594	315	450	590	14051	E9	E9
P315	658	724	590	649	355	500	647	15320	E9	E9
P355	745	820	678	746	400	600	733	17180	E9	E9
P400	800	880	730	803	450	600	787	18447	E9	E9

## [T5] 3 x 480 V AC – VLT® Low Harmonic Drive

High overload (150% 1 min/10 min)									Enclosure size	
Type code	Output current				Typical shaft output power		Continuous input current	Estimated power loss	Protection rating [IEC/UL]	
	(3 x 380-440 V)		(3 x 441-480 V)						IP21	IP54
FC-302	Con. I <sub>N</sub>	Inter. I <sub>MAX</sub> (60 s)	Con. I <sub>N</sub>	Inter. I <sub>MAX</sub> (60 s)	kW @ 400 V	Hp @ 460 V	[A]	[W]	Type 1	Type 12
N132	260	390	240	360	132	200	251	7428	D1n	D1n
N160	315	473	302	453	160	250	304	8048	D2n	D2n
N200	395	593	361	542	200	300	381	9753	D2n	D2n
N250	480	720	443	665	250	350	472	11587	E9	E9
P315	600	900	540	810	315	450	590	14140	E9	E9
P355	658	987	590	885	355	500	647	15286	E9	E9
P400	695	1043	678	1017	400	550	684	16063	E9	E9

## [T4] 3 x 380-480 V AC VLT® Advanced Active Filter

Normal overload (110% 1 min/10min automatically regulated)											Enclosure size	
Type code	Corrected Current								Recommend- ed fuse and disconnect*	Estimated power loss	Protection rating [IEC/UL]	
	@ 400 V		@ 460 V		@ 480 V		@ 500 V				IP21	IP54
AAF006	Cont.	Int.	Cont.	Int.	Cont.	Int.	Cont.	Int.	[A]	[W]	Type 1	Type 12
A190	260	390	240	360	260	390	240	360	350	5000	D14	D14
A250	315	473	302	453	315	473	302	453	630	7000	E1	E1
A310	395	593	361	542	395	593	361	542	630	9000	E1	E1
A400	480	720	443	665	480	720	443	665	900	11100	E1	E1

\* Built-in options for fuses and disconnect recommended

## Typecode VLT® Advanced Active Filter

The different VLT® Active Filters can easily be configured according to customer request at [drives.danfoss.com](http://drives.danfoss.com)

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	..	39
A	A	F	0	0	6	A	x	x	x	T	4	E	x	x	H	x	x	G	C	x	x	x	S	.	X

**8-10:**  
190: 190 A correction current  
250: 250 A correction current  
310: 310 A correction current  
400: 400 A correction current

**13-15:**  
E21: IP 21/NEMA 1  
E2M: IP 21/NEMA 1 w. mains shield  
C2M: IP 21/NEMA 1 w. stainless steel back-channel and mains shield

**E54:** IP 54/NEMA 12  
**E5M:** IP 54/NEMA 12 w. mains shield  
**C5M:** IP 54/NEMA 12 w. stainless steel back-channel and mains shield

**16-17:**  
HX: No RFI Filter  
H4: RFI class A1

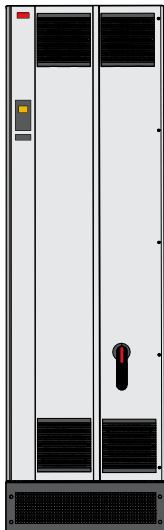
**21:**  
X: No mains options  
3: Disconnect & Fuse  
7: Fuse

## Dimensions – VLT® Low Harmonic Drive and VLT® Advanced Active Filter

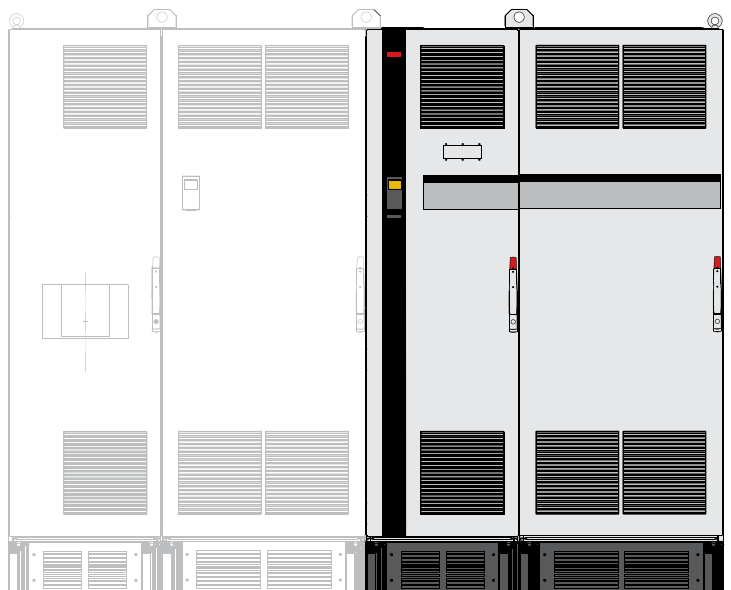
		VLT® Low Harmonic Drive			VLT® Advanced Active Filter	
Enclosure size		D1n	D2n	E9	D14	E1
Protection rating [IEC/UL]		IP21 /Type 1 IP54 /Type 12			IP21 /Type 1 IP54 /Type 12	
[mm]	Height	1915.91	1914.7	2000.7	1780.0	2000.0
	Width	929.2	1024.2	1200.0	600.0	600.0
	Depth	418.4	418.4	538.0	418.4	538.0
[kg]	Weight	353.0	413.0	676.0	238.0	453.0
[in]	Height	75.4	75.4	78.8	70.0	78.7
	Width	36.6	40.3	47.2	23.6	23.6
	Depth	16.5	16.5	21.0	16.5	21.0
[lb]	Weight	777.0	910.0	1490.0	524.7	998.7

## Specifications VLT® Advanced Active Filter

<b>Filter type</b>	3P/3W, Active Shunt Filter (TN, TT, IT)	<b>Individual harmonic current allocation in selective mode</b>	I5: 63%, I7: 45%, I11: 29%, I13: 25%, I17: 18%, I19: 16%, I23: 14%, I25: 13%
<b>Frequency</b>	50 to 60 Hz, ± 5%	<b>Reactive current compensation</b>	Yes, leading (capacitive) or lagging (inductive) to target power factor
<b>Enclosures</b>	IP21 – NEMA 1, IP54 – NEMA 12	<b>Flicker reduction</b>	Yes
<b>Max. voltage pre-distortion</b>	10% 20% with reduced performance	<b>Compensation priority</b>	Programmable to harmonics or displacement power factor
<b>Operating temperature</b>	0-40 °C +5 °C with reduced performance -10 °C with reduced performance	<b>Paralleling option</b>	Up to 4 units of same power rating in master follower
<b>Altitude</b>	1000 m without derating 3000 m with reduced performance (5%/1000 m)	<b>Current Transformer Support (Customer supply and field mounting)</b>	1 A and 5 A secondary with auto tuning Class 0.5 or better
<b>EMC standards</b>	IEC61000-6-2 IEC61000-6-4	<b>Digital inputs /outputs</b>	4 (2 programmable) Programmable PNP or NPN logic
<b>Circuitry coating</b>	Conformal coated – per ISA S71.04-1985, class G3	<b>Communication interface</b>	RS485, USB1.1
<b>Languages</b>	18 different	<b>Control type</b>	Direct harmonic control (for faster response)
<b>Harmonic compensation modes</b>	Selective or overall (90% RMS for harmonic reduction)	<b>Response time</b>	< 15 ms (including HW)
<b>Harmonic compensation spectrum</b>	2 <sup>nd</sup> to 40 <sup>th</sup> in overall mode, including triplens 5 <sup>th</sup> , 7 <sup>th</sup> , 11 <sup>th</sup> , 13 <sup>th</sup> , 17 <sup>th</sup> , 19 <sup>th</sup> , 23 <sup>rd</sup> , 25 <sup>th</sup> in selective mode	<b>Harmonic settling time (5-95%)</b>	< 15 ms
		<b>Reactive settling time (5-95%)</b>	< 15 ms
		<b>Maximum overshoot</b>	5%
		<b>Switching frequency</b>	Progressive control in the range of 3 – 18 kHz
		<b>Average switching frequency</b>	3 – 4.5 kHz



VLT® Advanced Active Filter AAF 006



VLT® Low Harmonic Drive

# A options: Fieldbuses

Available for the full product range

Fieldbus	Typecode position
<b>A</b>	
VLT® PROFIBUS DP MCA 101	14
VLT® DeviceNet MCA 104	
VLT® PROFINET MCA 120	
VLT® EtherNet/IP MCA 121	
VLT® Modbus TCP MCA 122	

## PROFIBUS DP

Operating the AC drive via a fieldbus enables you to reduce the cost of your system, communicate faster and more efficiently and benefit from an easier user interface.

Other features:

- Wide compatibility, a high level of availability, support for all major PLC vendors, and compatibility with future versions
- Fast, efficient communication, transparent installation, advanced diagnosis and parameterization and auto-configuration of process data via GSD-file
- Acyclic parameterization using PROFIBUS DP-V1, PROFIdrive or Danfoss FC (MCA101 only) profile state machines, PROFIBUS DP-V1, Master Class 1 and 2

### VLT® PROFIBUS DP MCA 101

#### Order code

130B1100 standard  
130B1200 coated

## DeviceNet

DeviceNet offers robust, efficient data handling thanks to advanced Producer/Consumer technology.

- Support of ODA's AC drive profile supported via I/O instance 20/70 and 21/71 secures compatibility to existing systems
- Benefit from ODA's strong conformance testing policies, which ensure that products are interoperable
- Built-in web server
- E-mail client for service notification

### VLT® DeviceNet MCA 104

#### Order code

130B1102 standard  
130B1202 coated

## PROFINET

PROFINET uniquely combines the highest performance with the highest degree of openness. The option is designed so that many of the features from the PROFIBUS can be reused, minimizing user effort to migrate PROFINET and securing the investment in a PLC program.

- Same PPO types as PROFIBUS for easy migration to PROFINET
- Support of MRP
- Support of DP-V1 Diagnostic allows easy, fast and standardized handling of warning and fault information into the PLC, improving bandwidth in the system
- Implementation in accordance with Conformance Class B
- Built-in web server
- E-mail client for service notification

### VLT® PROFINET MCA 120

#### Order code

130B1135 standard, dual-port  
130B1235 coated, dual-port

## EtherNet/IP

Ethernet is the future standard for communication at the factory floor. EtherNet/IP is based on the newest technology available for industrial use and handles even the most demanding requirements.

EtherNet/IP™ extends commercial off-the-shelf Ethernet to the Common Industrial Protocol (CIP™) – the same upper-layer protocol and object model found in DeviceNet.

The option offers advanced features such as:

- Built-in high performance switch enabling line-topology, and eliminating the need for external switches
- DLR Ring
- Advanced switch and diagnosis functions
- Built-in web server
- E-mail client for service notification
- Unicast and Multicast communication

### VLT® EtherNet/IP MCA 121

#### Order code

130B1119 standard, dual-port  
130B1219 coated, dual-port

## Modbus TCP

Modbus TCP is the first industrial Ethernet-based protocol for automation. Modbus TCP is able to handle connection intervals down to 5 ms in both directions, positioning it among the fastest performing Modbus TCP devices in the market. For master redundancy, it features hot swapping between two masters.

Other features:

- Dual Master PLC connection for redundancy in dual port options (MCA 122 only)

### VLT® Modbus TCP MCA 122

#### Order code

130B1196 standard, dual-port  
130B1296 coated, dual-port



# B options: Functional extensions

Available for the full product range

Functional extensions	Typecode position
<b>B</b>	
VLT® General Purpose MCB 101	<b>15</b>
VLT® Relay Option MCB 105	
VLT® Analog I/O Option MCB 109	
VLT® PTC Thermistor Card MCB 112	
VLT® Sensor Input Card MCB 114	
VLT® Extended Cascade Controller MCO 101	

## VLT® General Purpose I/O MCB 101

This I/O option offers an extended number of control inputs and outputs:

- 3 digital inputs 0-24 V: Logic '0' < 5 V; Logic '1' > 10V
- 2 analog inputs 0-10 V: Resolution 10 bit plus sign
- 2 digital outputs NPN/PNP push pull
- 1 analog output 0/4-20 mA
- Spring-loaded connection

### Ordering number

130B1125 standard  
130B1212 coated (Class 3C3/IEC 60721-3-3)

## VLT® Relay Card MCB 105

Makes it possible to extend relay functions with 3 additional relay outputs.

- Max. switch rate at rated load/min. load .....6 min<sup>-1</sup>/20 sec<sup>-1</sup>
- Protects control cable connection
- Spring-loaded control wire connection

### Max. terminal load:

- AC-1 Resistive load .....240 V AC 2 A
- AC-15 Inductive load @cos phi 0.4 .....240 V AC 0.2 A
- DC-1 Resistive load .....24 V DC 1 A
- DC-13 Inductive load @cos phi 0.4 .....24 V DC 0.1 A

### Min. terminal load:

- DC 5 V .....10 mA

### Ordering number

130B1110 standard  
130B1210 coated (Class 3C3/IEC 60721-3-3)

## VLT® Analog I/O Option MCB 109

This analog input/output option is easily fitted in the AC drive for upgrading to advanced performance and control using the additional I/O. This option also upgrades the AC drive with a battery back-up supply for the AC drive built-in clock. This provides stable use of all AC drive clock functions as timed actions.

- 3 analog inputs, each configurable as both voltage and temperature input
- Connection of 0-10 V analog signals as well as Pt1000 and Ni1000 temperature inputs
- 3 analog outputs each configurable as 0-10 V outputs
- Back-up supply for the standard clock function in the AC drive

The back-up battery typically lasts for 10 years, depending on environment.

### Ordering number

130B1143 standard  
130B1243 coated (Class 3C3/IEC 60721-3-3)

## VLT® PTC Thermistor Card MCB 112

The VLT® PTC Thermistor Card MCB 112 enables improved surveillance of the motor condition compared to the built-in ETR function and thermistor terminal.

- Protects the motor from overheating
- ATEX-approved for use with Ex d and Ex e motors
- Uses Safe Torque Off function, which is approved in accordance with SIL 2 IEC 61508

### Ordering number

130B1137 coated (Class 3C3/IEC 60721-3-3)

## VLT® Sensor Input Card MCB 114

This option protects the motor from being overheated by monitoring the temperature of bearings and windings in the motor.

- Protects the motor from overheating
- 3 self-detecting sensor inputs for 2 or 3 wire PT100/PT1000 sensors
- 1 additional analog input 4-20 mA

### Ordering number

130B1172 standard  
130B1272 coated (Class 3C3/IEC 60721-3-3)

## VLT® Extended Cascade Controller MCO 101

Easily fitted and upgrades the built-in cascade controller to operate more pumps and more advanced pump control in master/follower mode.

- Up to 6 pumps in standard cascade setup
- Up to 5 pumps in master/follower setup
- Technical specifications:  
See VLT® Relay Option MCB 105

### Ordering number

130B1118 standard  
130B1218 coated (Class 3C3/IEC 60721-3-3)

# C options: Motion control and relay card

Available for the full product range

Motion control and relay card	Typecode position
<b>C</b>	
VLT® Motion Control MCO 305	<b>16</b>
VLT® Extended Relay Card MCB 113	<b>17</b>

## VLT® Advanced Cascade Controller MCO 102

Easy to fit, the VLT® Advanced Cascade Controller MCO 102 upgrades the built-in cascade controller to operate up to 8 pumps and more advanced pump control in master/follower mode.

MCO 102 supports the combination of multiple variable speed and fixed speed pumps, as well as configurations with pumps of differing capacity (mixed pump control). The additional 7 digital inputs and the 24 V DC connection to the drive enable flexible adaptation to the application. The same cascade-controller hardware is compatible with for the entire power range up to 2 MW.

- Up to 8 pumps in standard cascade set-up
- Up to 8 pumps in master/follower set-up

### Ordering number

130B1154 standard  
130B1254 coated (Class 3C3/IEC 60721-3-3)

## VLT® Extended Relay Card MCB 113

The VLT® Extended Relay Card MCB 113 adds inputs/outputs for increased flexibility.

- 7 digital inputs
- 2 analog outputs
- 4 SPDT relays
- Meets NAMUR recommendations
- Galvanic isolation capability

### Ordering number

130B1164 standard  
130B1264 coated (Class 3C3/IEC 60721-3-3)

# D option: 24 V back-up power supply

Available for the full product range

24 V back-up power supply	Typecode position
<b>D</b>	
VLT® 24 V DC Supply Option MCB 107	<b>19</b>

## VLT® 24 V DC Supply MCB 107

Connect an external DC supply to keep the control section and any installed option functioning during power failure.

This enables full operation of the LCP (including the parameter setting) and all installed options without connection to mains.

- Input voltage range.....24 V DC +/- 15%  
(max. 37 V for 10 sec.)
- Max. input current .....2.2 A
- Max. cable length .....75 m
- Input capacitance load ..... < 10 µF
- Power-up delay ..... < 0.6 s

### Ordering number

130B1108 standard  
130B1208 coated (Class 3C3/IEC 60721-3-3)





# Accessories

Available for the full product range

## LCP

VLT® Control Panel LCP 101 (Numeric)

**Ordering number:** 130B1124

VLT® Control Panel LCP 102 (Graphical)

**Ordering number:** 130B1107

VLT® Wireless Communication Panel LCP 103

**Ordering number:** 134B0460

LCP Panel Mounting Kit

**Ordering number for IP20 enclosure**

130B1113: With fasteners, gasket, graphical LCP and 3 m cable

130B1114: With fasteners, gasket, numerical LCP and 3 m cable

130B1117: With fasteners, gasket and without LCP and with 3 m cable

130B1170: With fasteners, gasket and without LCP

**Ordering number for IP55 enclosure**

130B1129: With fasteners, gasket, blind cover and 8 m "free end" cable

LCP Remote Mounting Kit

**Ordering number:**

134B5223 – Kit with 3 m cable:

134B5224 – Kit with 5 m cable

134B5225 – Kit with 10 m cable

## Accessories

PROFIBUS SUB-D9 Adapter

IP20, A2 and A3

**Ordering number:** 130B1112

Option Adapter

**Ordering number:** 130B1130 standard, 130B1230 coated

Adapter Plate for VLT® 3000 and VLT® 5000

**Ordering number:** 130B0524 – to be used only for IP20/NEMA type 1 units up to 7.5 kW

USB Extension

**Ordering number:**

130B1155: 350 mm cable

130B1156: 650 mm cable

IP21/Type 1 (NEMA 1) kit

**Ordering number**

130B1121: For enclosure size size A1

130B1122: For enclosure size size A2

130B1123: For enclosure size size A3

130B1187: For enclosure size size B3

130B1189: For enclosure size size B4

130B1191: For enclosure size size C3

130B1193: For enclosure size size C4

NEMA 3R outdoor weather shield

**Ordering number**

176F6302: For enclosure size size D1h

176F6303: For enclosure size size D2h

NEMA 4X outdoor weather shield

**Ordering number**

130B4598: For enclosure size size A4, A5, B1, B2

130B4597: For enclosure size size C1, C2

Motor connector

**Ordering number:**

130B1065: enclosure size A2 to A5 (10 pieces)

Mains connector

**Ordering number:**

130B1066: 10 pieces mains connectors IP55

130B1067: 10 pieces mains connectors IP20/21

Relays 1 terminal

**Ordering number:** 130B1069 (10 pieces 3 pole connectors for relay 01)

Relays 2 terminal

**Ordering number:** 130B1068 (10 pieces 3 pole connectors for relay 02)

Control card terminals

**Ordering number:** 130B0295

VLT® Leakage Current Monitor Module RCMB20/RCMB35

**Ordering number:**

130B5645: A2-A3

130B5764: B3

130B5765: B4

130B6226: C3

130B5647: C4

## PC software

VLT® Motion Control Tool MCT 10

VLT® Motion Control Tool MCT 31

Danfoss HCS Harmonic Calculation Software

VLT® Energy Box

Danfoss ecoSmart™



# Power options

## Power option

VLT® Sine-Wave Filter MCC 101

VLT® dU/dt Filter MCC 102

VLT® Common Mode Filters MCC 105

VLT® Advanced Harmonic Filter AHF 005/010

VLT® Brake Resistors MCE 101

VLT® Line Reactor MCC 103

### VLT® Sine-wave Filter MCC 101

- VLT® Sine-wave Filters are positioned between the AC drive and the motor to provide a sinusoidal phase-to-phase motor voltage
- Reduces motor insulation stress
- Reduces acoustic noise from the motor
- Reduces bearing currents (especially in large motors)
- Reduces losses in the motor
- Prolongs service lifetime
- VLT® FC series family look

#### Power range

3 x 200-500 V, 2.5-800 A

3 x 525-690 V, 4.5-660 A

#### Enclosure ratings

- IP00 and IP20 wall-mounted enclosures rated up to 75 A (500 V) or 45 A (690 V)
- IP23 floor-mounted enclosures rated 115 A (500 V) or 76 A (690 V) or more
- IP54 both wall-mounted and floor-mounted enclosures rated up to 4.5 A, 10 A, 22 A (690 V)

#### Ordering number

See relevant Design Guide

### VLT® dU/dt Filter MCC 102

- Reduces the dU/dt values on the motor terminal phase-to-phase voltage
- Positioned between the AC drive and the motor to eliminate very fast voltage changes
- The motor terminal phase-to-phase voltage is still pulse shaped but its dU/dt values are reduced
- Reduces stress on the motor's insulation and are recommended in applications with older motors, aggressive environments or frequent braking which cause increased DC link voltage
- VLT® FC series family look

#### Power range

3 x 200-690 V (up to 880 A)

#### Enclosure ratings

- IP00 and IP20/IP23 enclosure in the entire power range
- IP54 enclosure available up to 177 A

#### Ordering number

See relevant Design Guide

### VLT® Common Mode Filter MCC 105

- Positioned between the AC drive and the motor
- They are nano-crystalline cores that mitigate high-frequency noise in the motor cable (shielded or unshielded) and reduce bearing currents in the motor
- Extends motor bearing lifetime
- Can be combined with dU/dt and sine-wave filters
- Reduces radiated emissions from the motor cable
- Reduces electromagnetic interference
- Easy to install – no adjustments necessary
- Oval shaped – allows mounting inside the AC drive enclosure or motor terminal box

#### Power range

380-415 V AC (50 and 60 Hz)

440-480 V AC (60 Hz)

600 V AC (60 Hz)

500-690 V AC (50 Hz)

#### Ordering number

130B3257 Enclosure size A and B

130B7679 Enclosure size C1

130B3258 Enclosure size C2, C3 and C4

130B3259 Enclosure size D

130B3260 Enclosure size E and F

### VLT® Advanced Harmonic Filter AHF 005 and AHF 010

- Optimized harmonic performance for VLT® drives rated up to 250 kW
- A patented technique reduces THD levels in the mains network to less than 5-10%
- Perfect match for industrial automation, highly dynamic applications and safety installations

#### Power range

380-415 V AC (50 and 60 Hz)

440-480 V AC (60 Hz)

600 V AC (60 Hz)

500-690 V AC (50 Hz)

#### Enclosure ratings

- IP20  
(An IP21/NEMA 1 upgrade kit is available)
- IP00  
(Forced cooling is required. There is no fan in the IP00 unit. Separate cooling measures must be implemented in the cabinet as part of the installation)

#### Ordering number

See relevant Design Guide

### VLT® Brake Resistor MCE 101

- Energy generated during braking is absorbed by the resistors, protecting electrical components from heating up
- Optimized for the FC-series and general versions for horizontal and vertical motion are available
- Built-in thermo switch
- Versions for vertical and horizontal mounting
- A selection of the vertically mounted units are UL-recognized

#### Power range

Precision electrical match to each individual VLT® drive power size

#### Enclosure ratings:

- IP20
- IP21
- IP54
- IP65

#### Ordering number

See relevant Design Guide

### VLT® Line Reactor MCC 103

- Ensures current balance in load-sharing applications, where the DC-side of the rectifier of multiple drives is connected together
- UL-recognized for applications using load sharing
- When planning load-sharing applications, pay special attention to different enclosure type combinations and inrush concepts
- For technical advice regarding load-sharing applications, contact Danfoss application support
- Compatible with VLT® AutomationDrive 50 Hz or 60 Hz mains supply

#### Ordering number

See relevant Design Guide



# Accessory compatibility with enclosure size

Overview for enclosure sizes D, E and F only

Enclosure size	Typecode position	D1h/ D2h	D3h/ D4h	D5h/ D7h	D6h/ D8h	D1n/ D2n	E1h/ E2h	E3h/ E4h	E9	F1/F2	F3/F4 (w/ options cabinet)	F8	F9 (w/ options cabinet)	F10/ F12	F11/F13 (w/options cabinet)
Enclosure with corrosion-resistant back channel	4	–	□	–	–	–	□	□	–	□	□	–	–	–	–
Mains shielding	4	□	–	□	□	□	□	–	□	■	■	■	■	■	■
Space heaters and thermostat	4	□	–	□	□	–	□	–	–	□	□	–	–	□	□
Cabinet light with power outlet	4	–	–	–	–	–	–	–	–	□	□	–	–	□	□
RFI filters (+)	5	□	□	□	□	□	□	□	□	–	□	–	□	–	□
Insulation Resistance Monitor (IRM)	5	–	–	–	–	–	–	–	–	–	□	–	□	–	□
Residual Current Device (RCD)	5	–	–	–	–	–	–	–	–	–	□	–	□	–	□
Brake Chopper (IGBTs)	6	–	□	□	□	□	□	□	□	□	□	□	□	□	□
Safe Torque Off with Pilz Safety Relay	6	□	□	□	□	□	□	□	□	□	□	□	□	□	□
Regeneration terminals	6	–	□	□	□	□	□	□	□	□	□	□	□	□	□
Common Motor Terminals	6	■	■	■	■	■	■	■	■	□	□	■	■	□	□
Emergency Stop with Pilz Safety Relay	6	–	–	–	–	–	–	–	–	–	□	–	–	–	–
Safe Torque Off + Pilz Safety Relay	6	–	–	–	–	–	–	–	–	□	□	□	□	□	□
No LCP	7	□	□	□	□	–	□	□	–	–	–	–	–	–	–
VLT® Control Panel LCP 101 (Numeric)	7	□	□	□	□	–	–	–	–	–	–	–	–	–	–
VLT® Control Panel LCP 102 (Graphical)	7	□	□	□	□	■	■	■	■	■	■	■	■	■	■
Fuses	9	□	□	□	–	□	■	□	□	□	□	□	□	□	□
Load sharing terminals	9	–	□	–	–	–	–	□	–	□	□	–	–	–	–
Fuses + load sharing terminals	9	–	□	–	–	–	–	□	–	□	□	–	–	–	–
Disconnect	9 <sup>(1)</sup>	–	–	–	□	□	□	–	□	–	□	–	□	–	□
Circuit breakers	9 <sup>(1)</sup>	–	–	–	□	–	–	–	–	–	□	–	–	–	–
Contactors	9 <sup>(1)</sup>	–	–	–	□	–	–	–	–	–	□	–	–	–	–
Manual motor starters	10	–	–	–	–	–	–	–	–	□	□	–	–	□	□
30 A, fuse-protected terminals	10	–	–	–	–	–	–	–	–	□	□	–	–	□	□
24V DC supply	11	–	–	–	–	–	–	–	–	□	□	–	–	□	□
External temperature monitoring	11	–	–	–	–	–	–	–	–	□	□	–	–	□	□
Heat sink access panel	11	□	□	□	□	–	□	□	–	–	–	–	–	–	–
NEMA 3R ready drive	11	□	–	–	–	–	–	–	–	–	–	–	–	–	–

<sup>(1)</sup> Options supplied with fuses

<sup>(+)</sup> Not available in 690 V

□ Optional

■ Standard

## Enclosure with corrosion-resistant back channel

For additional protection from corrosion in harsh environments, units can be ordered in an enclosure that includes a stainless steel back channel, heavier plated heat sinks and an upgraded fan.

This option is recommended in salt-air environments, such as those near the ocean.

## Mains shielding

Lexan® shielding can be mounted in front of incoming power terminals and the input plate to protect from accidental contact when the enclosure door is open.

## Space heaters and thermostat

Mounted in the cabinet interior of drives with enclosure sizes D and F and controlled via an automatic thermostat, space heaters controlled via an automatic thermostat prevent condensation inside the enclosure.

The thermostat default settings turn on the heaters at 10 °C (50 °F) and turn them off at 15.6 °C (60 °F).

## Cabinet light with power outlet

A light can be mounted on the cabinet interior of drives with enclosure size F, to increase visibility during servicing and maintenance. The light housing includes a power outlet for temporarily powering laptop computers or other devices. Available in two voltages:

- 230 V, 50 Hz, 2.5 A, CE/ENEC
- 120 V, 60 Hz, 5 A, UL/cUL

## RFI filters

VLT® Series drives feature integrated Class A2 RFI filters as standard. If additional levels of RFI/EMC protection are required, they can be obtained using optional Class A1 RFI filters, which provide suppression of radio frequency interference and electromagnetic radiation in accordance with EN 55011.

On drives with enclosure size F, the Class A1 RFI filter requires the addition of the options cabinet.

Marine-use RFI filters are also available.

## Insulation Resistance Monitor (IRM)

Monitors the insulation resistance in ungrounded systems (IT systems in IEC terminology) between the system phase conductors and ground. There is an ohmic pre-warning and a main alarm setpoint for the insulation level. Associated with each setpoint is an SPDT alarm relay for external use. Only one insulation resistance monitor can be connected to each ungrounded (IT) system.

- Integrated into the drive's Safe Torque Off circuit
- LCD display of insulation resistance
- Fault memory
- INFO, TEST and RESET key

## Residual Current Device (RCD)

Uses the core balance method to monitor ground fault currents in grounded and high-resistance grounded systems (TN and TT systems in IEC terminology). There is a pre-warning (50% of main alarm setpoint) and a main alarm setpoint. Associated with each setpoint is an SPDT alarm relay for external use. Requires an external "window-type" current transformer (supplied and installed by customer).

- Integrated into the drive's Safe Torque Off circuit
- IEC 60755 Type B device monitors, pulsed DC, and pure DC ground fault currents
- LED bar graph indicator of the ground fault current level from 10-100% of the setpoint
- Fault memory
- TEST / RESET key

## Safe Torque Off with Pilz Safety Relay

Available for drives with enclosure size F. Enables the Pilz Relay to fit in the enclosure without requiring an options cabinet.

## Emergency Stop with Pilz Safety Relay

Includes a redundant 4-wire emergency stop pushbutton mounted on the front of the enclosure, and a Pilz relay that monitors it in conjunction with the drive's Safe Torque Off circuit and contactor position. Requires a contactor and the options cabinet for drives with enclosure size F.

## Brake Chopper (IGBTs)

Brake terminals with an IGBT brake chopper circuit allow for the connection of external brake resistors. For detailed data on brake resistors please see the VLT® Brake Resistor MCE 101 Design Guide, MG.90.Ox.yy, available at <http://drivesliterature.danfoss.com/>

## Regeneration terminals

Allow connection of regeneration units to the DC bus on the capacitor bank side of the DC-link reactors for regenerative braking. The enclosure size F regeneration terminals are sized for approximately 50% of the power rating of the drive. Consult the factory for regeneration power limits based on the specific drive size and voltage.

## Load sharing terminals

These terminals connect to the DC-bus on the rectifier side of the DC-link reactor and allow for the sharing of DC bus power between multiple drives. For drives with enclosure size F, the load sharing terminals are sized for approximately 33% of the power rating of the drive. Consult the factory for load sharing limits based on the specific drive size and voltage.

## Disconnect

A door-mounted handle allows for the manual operation of a power disconnect switch to enable and disable power to the drive, increasing safety during servicing. The disconnect is interlocked with the cabinet doors to prevent them from being opened while power is still applied.

## Circuit breakers

A circuit breaker can be remotely tripped, but must be manually reset. Circuit breakers are interlocked with the cabinet doors to prevent them from being opened while power is still applied. When a circuit breaker is ordered as an option, fuses are also included for fast-acting current overload protection of the AC drive.

## Contactors

An electrically controlled contactor switch allows for the remote enabling and disabling of power to the drive. An auxiliary contact on the contactor is monitored by the Pilz Safety Module if the IEC Emergency Stop option is ordered.

## Manual motor starters

Provide 3-phase power for electric cooling blowers that are often required for larger motors. Power for the starters is provided from the load side of any supplied contactor, circuit breaker or disconnect switch. If a Class 1 RFI filter option is ordered, the input side of the RFI provides the power to the starter. Power is fused before each motor starter and is off when the incoming power to the drive is off. Up to two starters are allowed. If a 30 A, fuse-protected circuit is ordered, then only one starter is allowed. Starters are integrated into the drive's Safe Torque Off circuit.

Unit features include:

- Operation switch (on/off)
- Short circuit and overload protection with test function
- Manual reset function

## 30 A, fuse-protected terminals

- 3-phase power matching incoming mains voltage for powering auxiliary customer equipment
- Not available if two manual motor starters are selected
- Terminals are off when the incoming power to the drive is off
- Power for the fused-protected terminals will be provided from the load side of any supplied contactor, circuit breaker, or disconnect switch. If a Class 1 RFI filter option is ordered, the input side of the RFI provides the power to the starter.

## Common Motor Terminals

The common motor terminal option provides the bus bars and hardware required to connect the motor terminals from the paralleled inverters to a single terminal (per phase) to accommodate the installation of the motor-side top entry kit.

This option is also recommended to connect the output of a drive to an output filter or output contactor. The common motor terminals eliminate the need for equal cable lengths from each inverter to the common point of the output filter (or motor).

## 24 V DC supply

- 5 A, 120 W, 24 V DC
- Protected against output overcurrent, overload, short circuits, and overtemperature
- For powering customer-supplied accessory devices such as sensors, PLC I/O, contactors, temperature probes, indicator lights and/or other electronic hardware
- Diagnostics include a dry DC-ok contact, a green DC-ok LED and a red overload LED
- Version with RTC available

## External temperature monitoring

Designed for monitoring temperatures of external system components, such as the motor windings and/or bearings. Includes eight universal input modules plus two dedicated thermistor input modules. All ten modules are integrated into the drive's Safe Torque Off circuit and can be monitored via a fieldbus

network, which requires the purchase of a separate module/bus coupler. A Safe Torque Off brake option must be ordered when selecting external temperature monitoring.

### Universal inputs (5)

Signal types:

- RTD inputs (including Pt100), 3-wire or 4-wire
- Thermocouple
- Analog current or analog voltage

Additional features:

- One universal output, configurable for analog voltage or analog current
- Two output relays (N.O.)
- Dual-line LC display and LED diagnostics
- Sensor lead wire break, short circuit and incorrect polarity detection
- Interface set-up software
- If 3 PTC are required, an MCB 112 control card option must be added.

Additional external temperature monitors:

- This option is available in case you need more than the MCB 114 and MCB 112 provides.

## VLT® Control Panel LCP 101 (Numeric)

- Status messages
- Quick menu for easy commissioning
- Parameter setting and adjusting
- Hand-operated start/stop function or selection of Automatic mode
- Reset function

**Ordering number**  
130B1124

## VLT® Control Panel LCP 102 (Graphical)

- Multi-language display
- Quick menu for easy commissioning
- Full parameter back-up and copy function
- Alarm logging
- Info key explains the function of the selected item on display
- Hand-operated start/stop or selection of Automatic mode
- Reset function
- Trend graphing

**Ordering number**  
130B1107

## VLT® Wireless Communication Panel LCP 103

- Full access to the drive
- Real-time error messages
- PUSH notifications for alarms/warnings
- Safe and secure WPA2 encryption
- Intuitive parameter functionalities
- Live graphs for monitoring and fine tuning
- Multi-language support
- Upload or download parameter file to the built-in memory or to your smartphone

**Ordering number**  
134B0460

# Loose kits for enclosure sizes D, E and F

Kit	Available for following enclosure sizes
NEMA 3R outdoor weather shield	D1h, D2h
USB in the door kit	D1h, D2h, D3h, D4h, D5h, D6h, D7h, D8h, E1h, E2h, E3h, E4h, F
Enclosure size F top entry kit motor cables	F
Enclosure size F top entry kit mains cables	F
Common motor terminal kits	F1/F3, F2/F4
Adapter plate	D1h, D2h, D3h, D4h
Back-channel duct kit	D1h, D2h, D3h, D4h, E3h, E4h
NEMA 3R Rittal and welded enclosures	D3h, D4h
Back-channel cooling kits for non-Rittal enclosures	D3h, D4h
Back-channel cooling kit (in-bottom/out-top)	D1h, D2h, D3h, D4h, E3h, E4h
Back-channel cooling kit (in-back/out-back)	D1h, D2h, D3h, D4h, E3h, E4h, F
Pedestal kit with in-back/out-back cooling	D1h, D2h
Pedestal kit	D1h, D2h, D5h, D6h, D7h, D8h
Top entry of fieldbus cables	D3, D4, D1h-D8h
LCP Remote Mounting Kit	Available for the full product range
Ground bar kit	E1h, E2h

## NEMA 3R outdoor weather shield

Designed to be mounted over the VLT® drive to protect from direct sun, snow and falling debris. Drives used with this shield must be ordered from the factory as "NEMA 3R Ready". This is an enclosure option in the type code – E5S.

### Ordering number

D1h ..... 176F6302  
D2h ..... 176F6303

## USB in the door kit

Available for all enclosure sizes, this USB extension cord kit allows access to the drive controls via laptop computer without opening the drive.

The kits can only be applied to drives manufactured after a certain date. Drives built prior to these dates do not have the provisions to accommodate the kits. Reference the following table to determine which drives the kits can be applied to.

### Ordering number

Enclosure sizes D ..... 130B1155  
Enclosure sizes E ..... 130B1156  
Enclosure sizes F ..... 176F1784

## Enclosure size F top entry kit motor cables

To use this kit, the drive must be ordered with the common motor terminal option. The kit includes everything to install a top entry cabinet on the motor side (right side) of an F size enclosure.

### Ordering number

F1/F3, 400 mm ..... 176F1838  
F1/F3, 600 mm ..... 176F1839  
F2/F4 400 mm ..... 176F1840  
F2/F4, 600 mm ..... 176F1841  
F8, F9, F10, F11, F12, F13 ..... Contact factory



## Enclosure size F top entry kit mains cables

The kits include everything required to install a top entry section onto the mains side (left side) of an F size enclosure.

### Ordering number

F1/F2, 400 mm .....	176F1832
F1/F2, 600 mm .....	176F1833
F3/F4 with disconnect, 400 mm .....	176F1834
F3/F4 with disconnect, 600 mm .....	176F1835
F3/F4 without disconnect, 400 mm .....	176F1836
F3/F4 without disconnect, 600 mm .....	176F1837
F8, F9, F10, F11, F12, F13 .....	Contact factory

## Common motor terminal kits

The common motor terminal kits provide the busbars and hardware required to connect the motor terminals from the paralleled inverters to a single terminal (per phase) to accommodate the installation of the motor-side top entry kit. This kit is equivalent to the common motor terminal option of a drive. This kit is not required to install the motor-side top entry kit if the common motor terminal option was specified when the drive was ordered.

This kit is also recommended to connect the output of a drive to an output filter or output contactor. The common motor terminals eliminate the need for equal cable lengths from each inverter to the common point of the output filter (or motor).

### Ordering number

F1/F2, 400 mm .....	176F1832
F1/F2, 600 mm .....	176F1833

## Adapter plate

The adapter plate is used to replace an old enclosure size D drive with the new enclosure size D drive, using the same mounting.

### Ordering number

D1h/D3h adapter plate to replace D1/D3 drive.....	176F3409
D2h/D4h adapter plate to replace D2/D4 drive.....	176F3410

## Back-channel duct kit

Back-channel duct kits are offered for conversion of enclosure sizes D and E. They are offered in two configurations – in-bottom/out-top venting and top only venting. Available for enclosure sizes D3h and D4h.

### Ordering number top and bottom

D3h kit 1800 mm without pedestal .....	176F3627
D4h kit 1800 mm without pedestal .....	176F3628
D3h Kit 2000 mm with pedestal .....	176F3629
D4h Kit 2000 mm with pedestal .....	176F3630

## NEMA 3R Rittal and welded enclosures

The kits are designed to be used with the IP00/IP20/Chassis drives to achieve an ingress protection rating of NEMA 3R or NEMA 4. These enclosures are intended for outdoor use to provide a degree of protection against inclement weather.

### Ordering number for NEMA 3R (welded enclosures)

D3h back-channel cooling kit (in back out back) .....	176F3521
D4h back-channel cooling kit (in back out back) .....	176F3526

### Ordering number for NEMA 3R (Rittal enclosures)

D3h back-channel cooling kit (in back out back) .....	176F3633
D4h Back-channel cooling kit (in back out back) .....	176F3634

## Back-channel cooling kits for non-Rittal enclosures

The kits are designed to be used with the IP20/Chassis drives in non-Rittal enclosures for in-back/out-back cooling. Kits do not include plates for mounting in the enclosures.

### Ordering number

D3h .....	176F3519
D4h .....	176F3524

### Ordering number for corrosion resistant

D3h .....	176F3520
D4h .....	176F3525

## Back-channel cooling kit (in-bottom/out-back)

Kit for directing the back-channel air flow in the bottom of the drive and out the back.

### Ordering number

D1h/D3h .....	176F3522
D2h/D4h .....	176F3527

### Ordering number corrosion resistant

D1h/D3h .....	176F3523
D2h/D4h .....	176F3528

## Back-channel cooling kit (in-back/out-back)

These kits are designed to be used for redirecting the back-channel air flow. Factory back-channel cooling directs air in the bottom of the drive and out the top. The kit allows the air to be directed in and out the back of the drive.

### Ordering number for in-back/out-back cooling kit

D1h .....	176F3648
D2h .....	176F3649
D3h .....	176F3625
D4h .....	176F3626
D5h/D6h .....	176F3530
D7h/D8h .....	176F3531

### Ordering number for corrosion resistant

D1h .....	176F3656
D2h .....	176F3657
D3h .....	176F3654
D4h .....	176F3655

### Ordering number for VLT® Low Harmonic Drives

D1n .....	176F6482
D2n .....	176F6481
E9 .....	176F3538
F18 .....	176F3534

### Ordering number for VLT® Advanced Active Filter AAF 006

D14 .....	176F3535
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## Telescopic back-channel cooling kit

Back-channel cooling kits for IP20/Chassis drives allow the heat sink air of the drive to be directed out of the panel in which the drive is installed. The new telescopic provides more flexibility and easier installation to fit inside the panel.

The kits are supplied in almost pre-assembled condition, and include a gland plate that fits standard Rittal enclosures.

### Ordering numbers for E-frames:

E3h (in bottom/out top) .....	176F6606
600 mm bottom plate .....	176F6607
E3h (in bottom/out top) .....	176F6607
800 mm bottom plate .....	176F6608
E4h (in bottom/out top) .....	176F6608
800 mm bottom plate .....	176F6610
E3h (in back/out back) .....	176F6610
E4h (in back/out back) .....	176F6611

E3h (in bottom/out back) .....	176F6612
600 mm bottom plate .....	176F6612
E3h (in bottom/out back) .....	176F6613
800 mm bottom plate .....	176F6614
E4h (in bottom/out back) .....	176F6614
800 mm bottom plate .....	176F6615
E3h (in back/out top) .....	176F6616
E4h (in back/out top) .....	176F6616

## Pedestal kit with in-back/out-back cooling

See additional documents 177R0508 and 177R0509.

### Ordering number

D1h 400 mm kit .....	176F3532
D2h 400 mm kit .....	176F3533

## Pedestal kit

The pedestal kit is a 400 mm high pedestal for enclosure sizes D1h and D2h, and 200 mm high for enclosure sizes D5h and D6h, that allows the drives to be floor mounted. The front of the pedestal has openings for input air to cool the power components.

### Ordering number

D1h 400 mm kit .....	176F3631
D2h 400 mm kit .....	176F3632
D5h/D6h 200 mm kit .....	176F3452
D7h/D8h 200 mm kit .....	176F3539

## Input-plate option kit

Input-plate option kits are available for enclosure sizes D and E. The kits can be ordered to add fuses, disconnect/fuses, RFI, RFI/fuses and RFI/disconnect/fuses. Please consult the factory for kit ordering numbers.

## Top entry of fieldbus cables

The top entry kit provides the ability to install fieldbus cables through the top of the drive. The kit is IP20 when installed. If an increased rating is desired, a different mating connector can be used.

### Ordering number

D1h-D8h .....	176F3594
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## LCP Remote Mounting Kit

The LCP Remote Mounting Kit offers an easy-to-install, IP54 design which you can mount on panels and walls of 1-90 mm thickness. The front cover blocks the sunlight for convenient programming. The closed cover is lockable to prevent tampering, while keeping the On/Warning/Alarm LEDs visible. It is compatible with all VLT® Local Control Panel options.

### Ordering number for IP20 enclosure

3 m cable length .....	134B5223
5 m cable length .....	134B5224
10 m cable length .....	134B5225

## Ground bar kit

More grounding points for E1h and E2h drives. The kit includes a pair of ground bars for installation inside the enclosure.

### Ordering number

E1h/E2h .....	176F6609
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