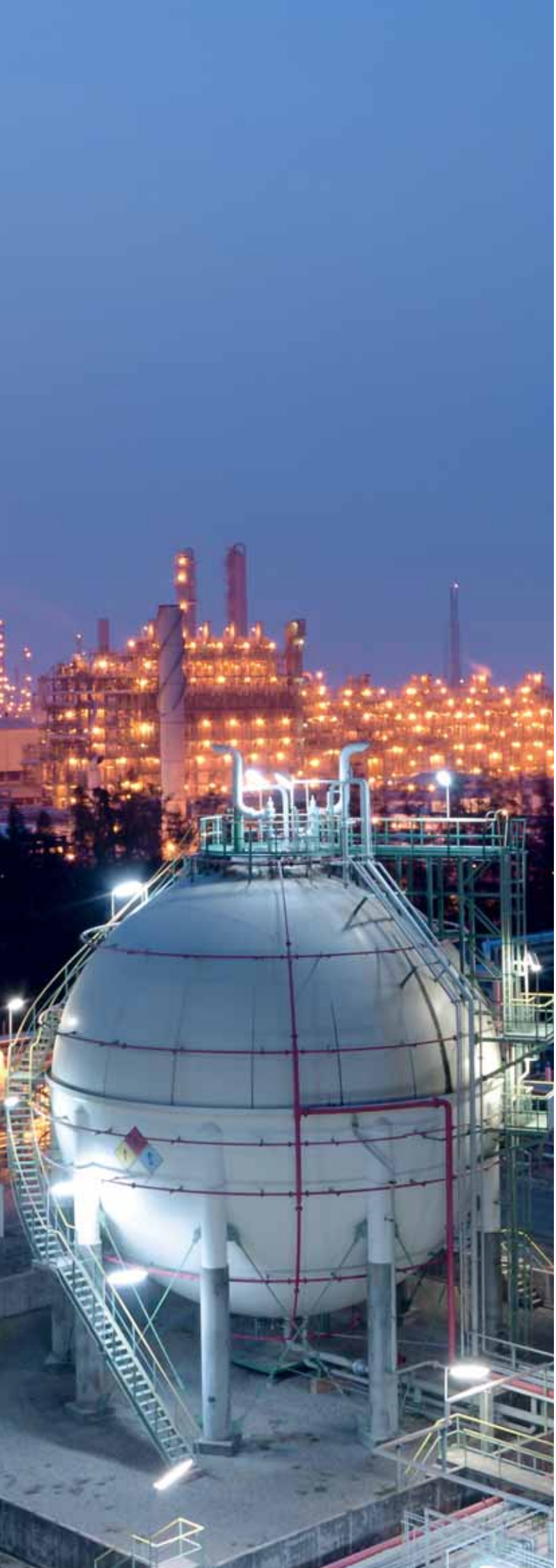
ENGINEERING TOMORROW

Selection Guide

# VLT® High Power Drives to **fit your application**


drives.danfoss.com | VLT®



# Contents

# **Easy-to-own** AC drives with **application-specific** functionality

Welcome to a world of energy-saving opportunities delivered by high-power VLT® drives.

The Danfoss VLT® High Power Drive series is built on the success of the renowned VLT® name, created when Danfoss introduced the first mass-produced AC drives in 1968.

VLT® High Power Drives feature all the advantages you are already familiar with in the other Danfoss products, including user-friendly commissioning and operation. In addition, the high-power range offers a host of advanced yet easy-to-use features and options, that are built-in and factory tested to meet the unique demands of any application.

### Enjoy savings

Reap the rewards of extremely low total cost of ownership. VLT® drives are designed for maximum efficiency with state-of-the-art power components. In all **free-standing** or **wall-mounted** drives, **cabinet** drives, and single **drive modules**, VLT® engineering delivers:

- >98% efficiency reduces operating costs
- Unique back-channel cooling design reduces the need for additional cooling equipment, resulting in lower installation and recurring costs
- Lower power consumption for control room cooling equipment
- Reduced lifecycle costs and lower overall cost of ownership

**Enjoy ease of use**

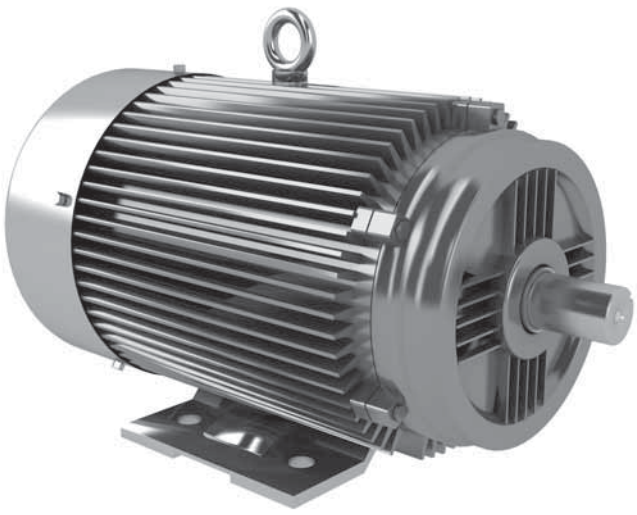
- Consistent familiar user interface across the entire range means once you know one, you know them all
- Application-oriented startup wizards are tuned to your industry, presenting the most relevant parameters first
- The user interface displays your own language

## Choose the best motor for your application – free choice of motor technology

Each VLT® drive is configurable, compatible and efficiency-optimized for all standard motor types. This means you can escape the restrictions of motor-drive package deals.

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

Danfoss VLT® drives have traditionally offered control algorithms for high efficiency with standard induction and permanent magnet (PM) motors, and now they also support high-efficiency synchronous reluctance motors. In this way, Danfoss offers you the opportunity to combine your favorite motor technology such as induction or permanent magnet motors with a VLT® drive.



## Easy commissioning – and algorithms for optimal efficiency

Furthermore, a VLT® drive makes commissioning equally easy for all motor types by combining ease of use with additional helpful functions such as SmartStart and automatic motor adaptation, which measures the motor characteristics and optimizes the motor parameters accordingly. This way the motor always operates at the highest possible efficiency, allowing you to reduce energy consumption and cut costs.

## Free-standing and wall-mounted drives

### No need to compromise

Can't make space for a cabinet? Now there is no need. VLT® drives are so robust that you can mount them virtually anywhere, even right beside the motor. Free-standing and wall-mounted drives are equipped for the toughest of environments. So they suit your heavy-duty application, no matter whether the requirement is resistance to the industrial environment, clean power supply, or stable grid compliance with EMC and harmonic mitigation. More features which save on compromise:

- Enclosure types rated up to IP54/NEMA 3R
- Full EMC compliance according to international standards
- Ruggedized and coated PCBs
- High temperature resistance, operating up to 50 °C without derating
- Motor cable lengths up to 150 m as standard, with uncompromised performance
- Integrated components save the need for extra externally-mounted equipment

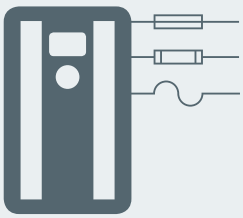
## Cabinet drives

### Win time

VLT® drives are designed with the installer and operator in mind to save time on installation, commissioning and maintenance.

VLT® High Power Drives are designed for full access from the front. Just open the cabinet door and all components can be reached without removing the drive, even when mounted side by side. More time-saving features:

- An intuitive user interface with an award-winning Local Control Panel (LCP) that streamlines start-up and operating procedures
- The full power range utilizes a common control platform for consistent interface and predictable operation
- Robust design and advanced controls make VLT® drives virtually maintenance free



## Drive modules

### Win space

The compact design of VLT® drives – and high-power VLT® drives in particular – makes them easy to fit even in small spaces.

Integrated filters, options and accessories provide additional capabilities and protection without increasing the enclosure size. More space-saving features:

- Built-in DC link reactors for harmonic suppression eliminate the need for higher loss external AC line reactors
- Optional built-in RFI filters are available throughout the power range
- Optional input fuses and loadshare terminals are available within standard enclosures
- In addition to the many valuable features that VLT® drives offer as standard, there are numerous other control, monitoring and power options available in pre-engineered factory configurations

TS16949

***Manufactured to the highest quality standards*** *VLT® series drives are UL listed and made in ISO 9001-2000 certified facilities.*

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

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

VLT® High Power Drives are available in a broad range of enclosure sizes and protection ratings from IP20 to IP54 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® High Power Drives there is total separation between the back-channel cooling air and the internal electronics. This separation greatly reduces the airflow over the sensitive electronics, minimizing the exposure to 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' extremely efficient back-channel cooling concept, allowing heat to be vented outside the control room.

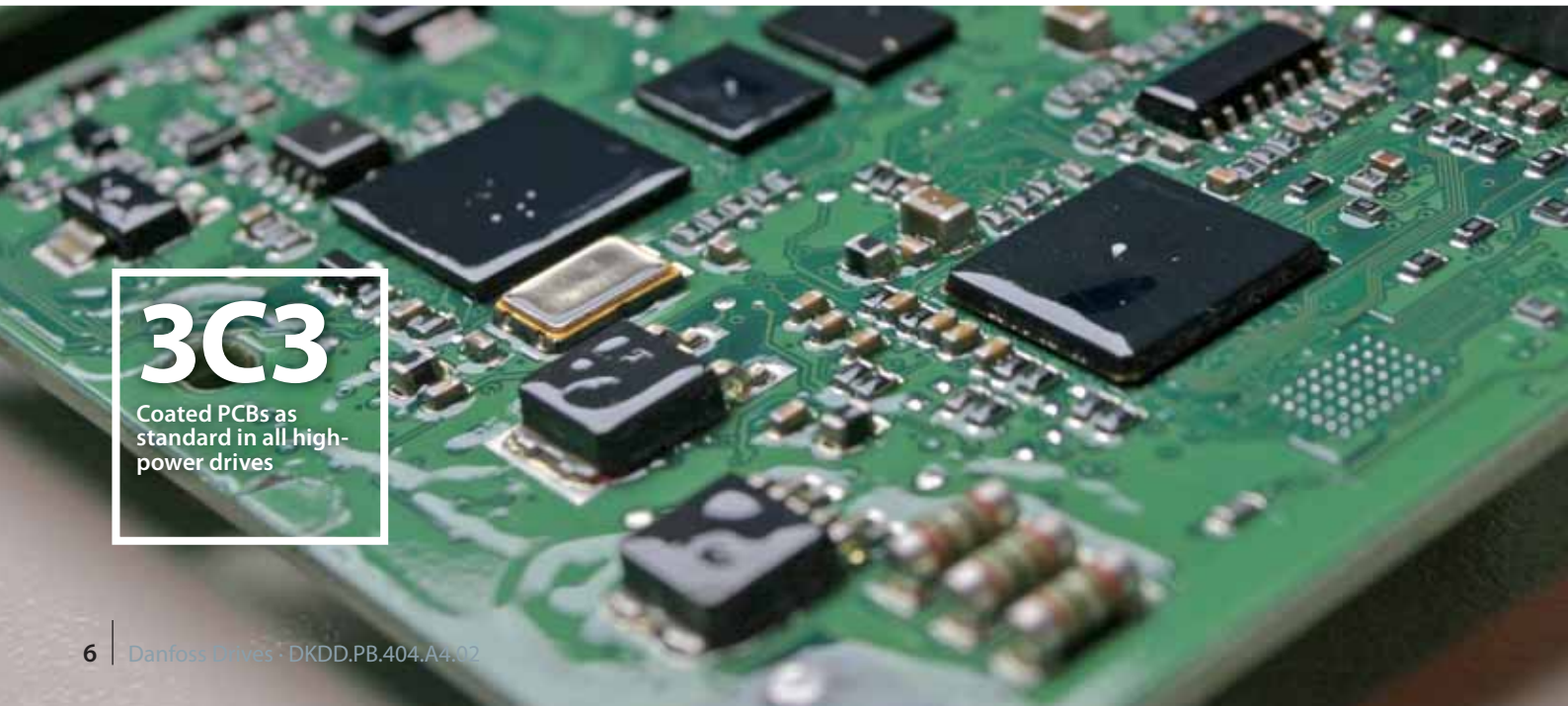
In daily use the benefits are equally clear as the energy consumption related to cooling can be reduced significantly. This means that designers can reduce the size of the air conditioning system, or even eliminate it entirely.

## Coated circuit boards

The VLT® High Power Drive conforms as standard to class 3C3 (IEC 60721-3-3) to ensure long lifetime even in harsh environments.

## Ruggedized for extra protection

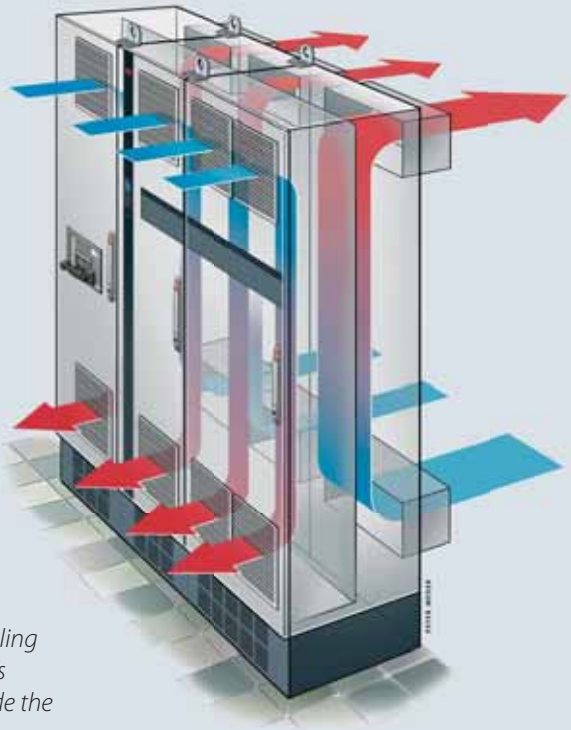
The VLT® High Power Drive in a D enclosure is available in a 'ruggedized' version that ensures the components remain firmly in place in environments characterized by high degrees of vibration, such as Marine and mobile equipment.



**Back-channel cooling gives up to**

# 90%

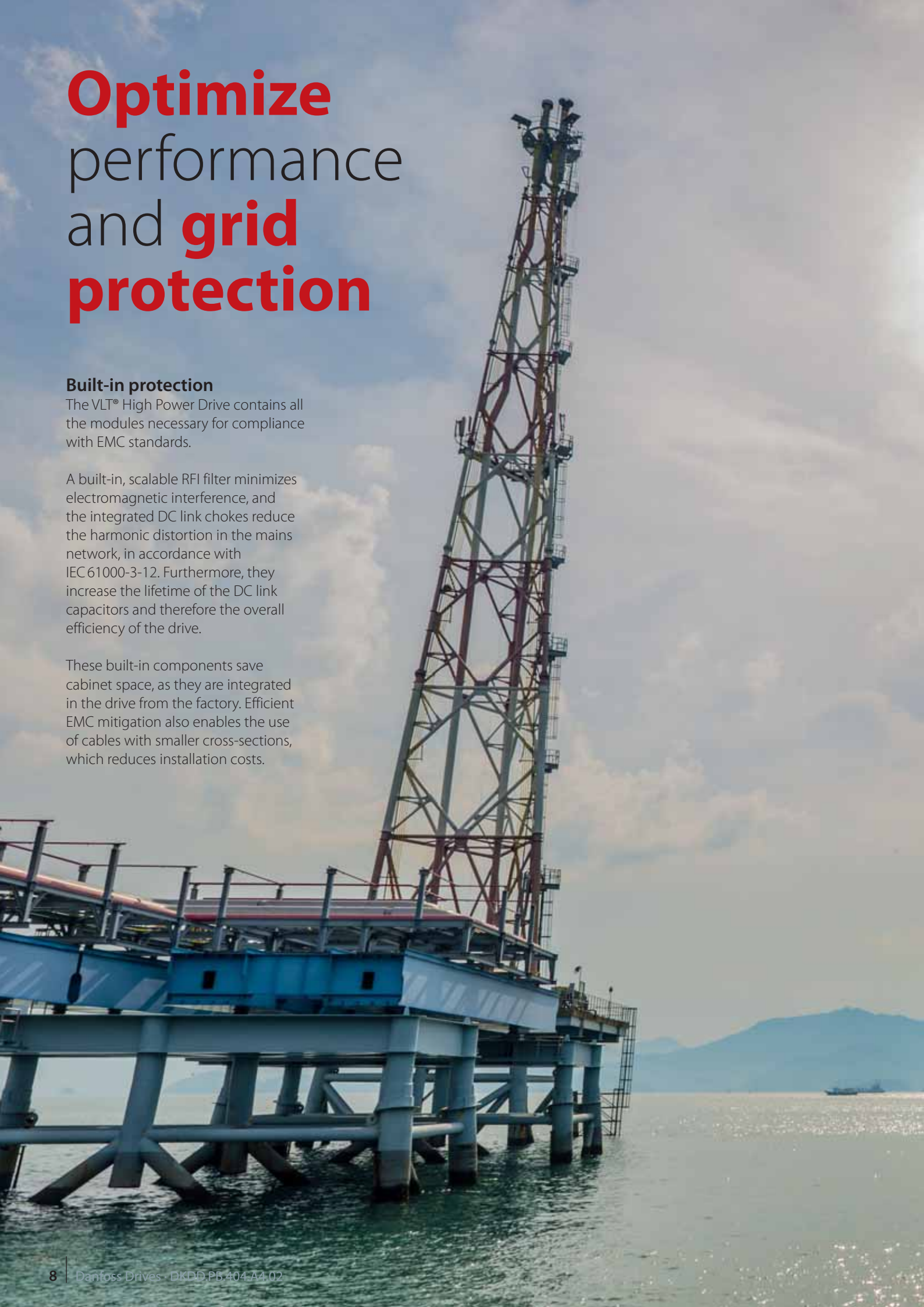
**reduction**
**in investment for air cooling systems**



***Minimal airflow over electronics***
*Complete separation between back-channel cooling air and the internal electronics ensures efficient cooling.*

***Back-channel cooling***
*By directing air through a rear cooling channel up to 80-90% of the drive's heat loss is removed directly outside the installation room.*

# **Optimize** performance and **grid protection**



### Built-in protection

The VLT® High Power Drive contains all the 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 61000-3-12. Furthermore, they increase the lifetime of the DC link capacitors and therefore the overall efficiency of the drive.

These built-in components 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 reduces installation costs.

## Expand grid and motor protection with filter solutions

Danfoss' wide range of solutions for harmonic mitigation ensures a clean power supply and optimal equipment protection, and includes:

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

Provide extra motor protection with:

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

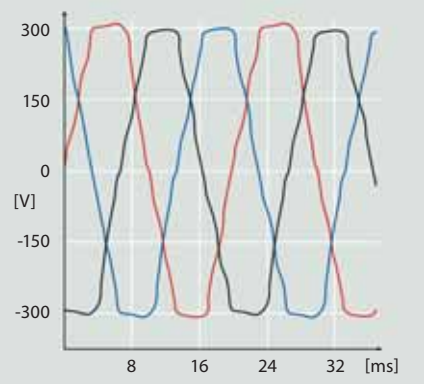
Achieve optimum performance for your application, even where the grid is weak or unstable.

## Use motor cables up to 300 m

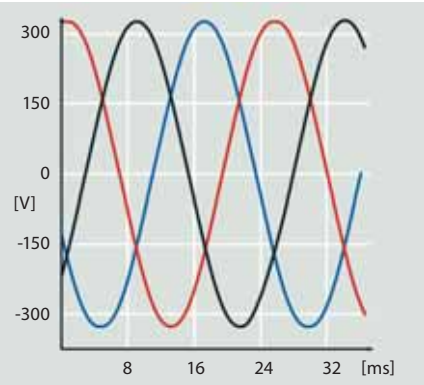
The design of the VLT® High Power Drive makes it a perfect choice in applications that require long motor cables. Without needing additional components, the drive provides trouble-free operation with cable lengths of up to 150 m shielded or 300 m unshielded. This allows the drive to be installed in a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

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

[1] *Compliance to mentioned EMC classes depends on the selected filter. For further details see the design guides.*




***Harmonic distortion***
*Electrical interference reduces efficiency and risks harming equipment.*




***Optimized harmonic performance***
*Efficient harmonic mitigation protects electronics and increases efficiency.*

## Harmonic filters

- Advanced active filter
- Advanced harmonic filter
- Low harmonic drives
- 12-pulse drives

## 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

**DC chokes that reduce mains interference to a THDi of**

**40%**

# 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.

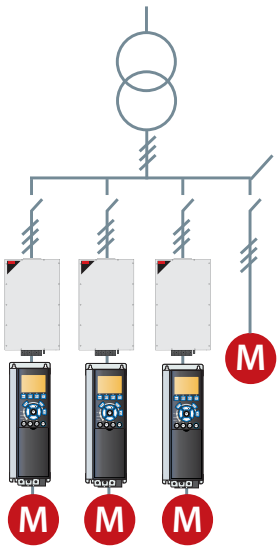
This ideal condition no longer exists in any power grid due to harmonics. Irregularities exist mainly because consumers take non-sinusoidal current from the grid, or connect items that have a nonlinear characteristic, for example strip lights, light dampers, energy-saving bulbs and AC drives.

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, AC drives and transformers must be more highly rated to maintain proper operation.

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

The Danfoss harmonic filters AHF 005 and AHF 010 are specially designed to connect to the front of a VLT® drive, ensuring that the harmonic current distortion generated back to the mains is reduced to a minimum.

VLT® Advanced Harmonic Filter AHF 005 (5% THDi)
VLT® Advanced Harmonic Filter AHF 010 (10% THDi)
Voltage range: 380-690 V
Filter current range: 10-1720 A



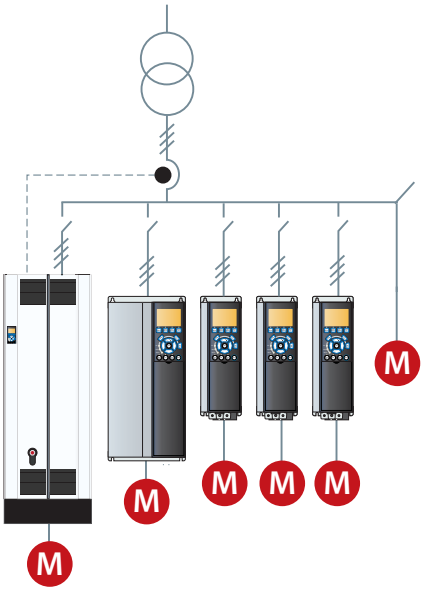
## VLT® Advanced Active Filter AAF 006

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% THDv. 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 ingress protection ratings up to IP54.

One filter can be used for several AC drives, helping owners reduce system costs. Easy commissioning saves installation costs, and the filter's maintenance free design eliminates the running expenses.

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



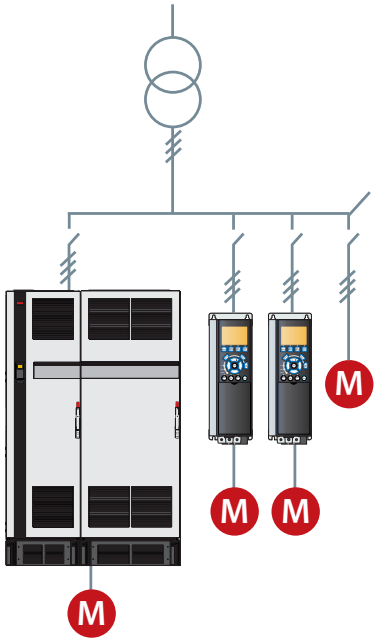

## VLT® Low Harmonic Drive

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%.

Completely integrated without need for additional components such as an LCL filter.

VLT® Low Harmonic Drive
Voltage range: 380-480 V
Power range: 160-710 kW



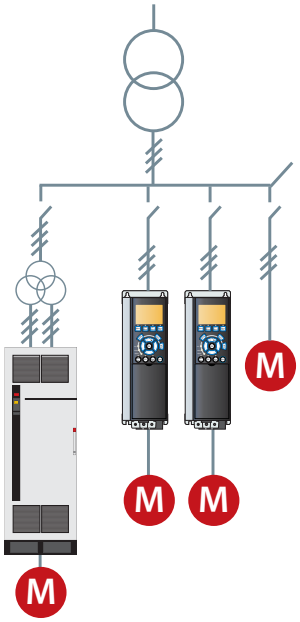

## VLT® 12-Pulse Drive

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

The VLT® 12-pulse is a high efficiency AC drive, which is built with the same modular design as the popular 6-pulse VLT® drives. It is equipped 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: 250-690 V
Power range 315-1400 kW



# Software tools

## VLT® Motion Control Tool MCT 10

VLT® Motion Control Tool MCT 10 is a windows-based engineering tool with a clearly structured interface that provides an instant overview of all the AC drives in a system of any size. The software runs under Windows and enables data exchange over a traditional RS485 interface, fieldbus (PROFIBUS, Ethernet, or other) 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 VLT® Motion Control Tool MCT 10. This reduces the risk of incorrect configuration, while offering fast access to troubleshooting.

## VLT® Energy Box

Calculate the energy consumption of HVAC applications controlled by VLT® drives and compare this with alternative – and less energy efficient – methods of air flow control.

For new installations or retrofit situations, VLT Energy Box makes it easy to evaluate and document the savings achieved by using a VLT® HVAC Drive by comparison with other types of capacity control systems.

## VLT® Motion Control Tool MCT 31

The MCT 31 harmonic simulation tool is a stand-alone program for Windows and useful in the planning phase. It is easy to use, includes a database of VLT® drives products, and provides a fast overview of the expected general system performance. It can also propose a cost-effective harmonics mitigation strategy based on the Danfoss product range.

## Danfoss HCS

Danfoss HCS is a professional harmonics simulation tool that is web-based. It provides harmonic analysis of systems using VLT® and VACON® products. This tool uses a scientific simulation platform with an advanced simulation model. It uses more system parameters than the other harmonics simulation tools offered by Danfoss Drives, and therefore delivers more accurate results. Danfoss HCS presents the results of the simulation in table or graphical form.

# Everything at your fingertips

## Danfoss ecoSmart™

Now it's easy to determine IE and IES classes according to EN 50598-2 for VLT® and VACON® drives either alone or with a motor.

Danfoss ecoSmart™ uses nameplate data to perform the efficiency calculations, and produces a pdf report for documentation.

**Danfoss ecoSmart™ app:**

ANDROID APP ON Google play | Available on the iPhone App Store

**Danfoss ecoSmart™ online tool:**
http://ecosmart.danfoss.com

## MyDrive® Portfolio

MyDrive® Portfolio provides an overview of the entire Danfoss AC-drives portfolio. You can use it to search for information on a particular product or to find comprehensive material related to a specific industry and its applications and products. There are also links to case studies, videos, brochures and manuals. You can browse through the information online and also download the PDFs to your mobile device. Everything you find can also be added to an e-mail for sharing.

**MyDrive® Portfolio app:**

ANDROID APP ON Google play | Available on the iPhone App Store

# Intuitive set-up with graphical interface

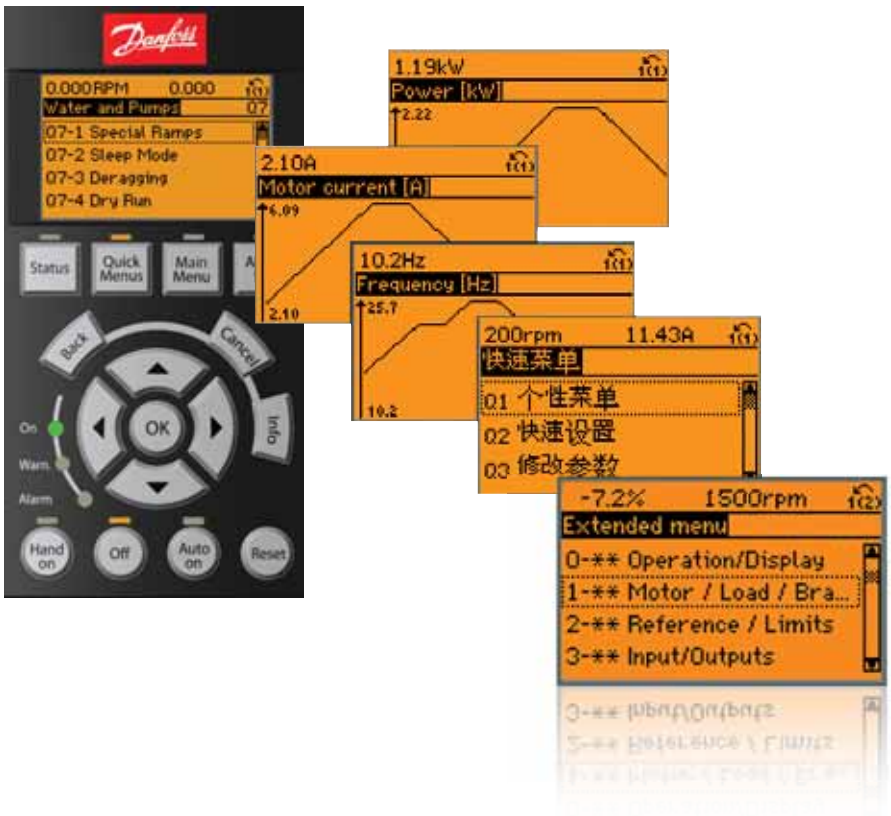
VLT® drives feature a user-friendly, hot pluggable local control panel (LCP) for easy set-up and parameter configuration.

After choosing language, navigate through set-up parameters, or you can use a pre-defined quick menu or a SmartStart guide for application specific set-up.

The LCP can be detached and used to copy settings to other 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.



# The modular VLT® technology platform adapted to your requirements

VLT® AutomationDrive, VLT® HVAC Drive, VLT® Refrigeration Drive and VLT® AQUA Drive are all built on a modular platform allowing for highly-customized drives which are mass produced, tested, and delivered from the factory.

Upgrades and further options dedicated to your industry are a matter of plug-and-play. Once you know one, you know them all.

**1. Display options**
Danfoss drives' renowned removable Local Control Panel (LCP) has an improved user interface. Choose between 27 built-in languages (including Chinese) or have it customized with your own. Languages can be changed by the user.

**2. Hot pluggable LCP**
The LCP can be plugged in or unplugged during operation. Settings are easily transferred via the control panel from one drive to another or from a PC with MCT 10 set-up software.

**3. Integrated manual**
The info button makes the printed manual virtually redundant. Users have been involved throughout development to ensure optimum overall functionality of the drive. The user group has significantly influenced the design and functionality of the LCP.

The Automatic Motor Adaptation (AMA), the Quick Set-Up menu and the large graphic display make commissioning and operation a breeze.

**4. Fieldbus options**
See complete list of available fieldbus options on page 61.

**5. I/O options**
The general purpose I/O, relay and thermistor expands the flexibility of the drives.

**6. Control terminals**
Specially developed removable spring-loaded cage clamps add to reliability and facilitate easy commissioning and service.

**7. 24 V supply**
A 24 V supply keeps the VLT® drives logically "alive" in situations when the AC power supply is removed.

**8. RFI filter suitable for IT-grids**
All high-power drives come standard with RFI filtering according to EN 61800-3 Cat. C3/EN 55011 class A2. A1/C2 RFI filters according to IEC 61000 and EN 61800 standards as integrated options.

**9. Modular construction and ease of maintenance**
All components are easily accessible from the front of the drive, allowing for ease of maintenance and side-by-side mounting of drives. The drives are constructed using a modular design that allows for the easy replacement of modular sub-assemblies.

**10. Programmable options**
A freely-programmable motion control option for user-specific control algorithms and programs allows the integration of PLC programs.

**11. Ruggedized printed circuit boards**
Drives in a D enclosure size are ruggedized to withstand vibration levels. All high power drive circuit boards are conformal coated to withstand the salt mist test. Meets IEC 60721-3-3 Class 3C3. The conformal coating complies with ISA (International Society of Automation) standard S71.04 1985, class G3.

**12. Back-channel cooling**
The unique design uses a back channel to pass cooling air over heat sinks. This design allows 80-90% of the heat losses to be exhausted directly outside of the enclosure with minimal air passing through the electronics area. This reduces temperature rise and contamination of the electronic components for improved reliability and increased functional life.

As an option, the back-channel cooling duct can be supplied in stainless steel to provide a degree of corrosion resistance against conditions such as those found in salt-air environments near the ocean.

**13. Enclosure**
The drive meets relevant requirements for all possible installation conditions. Enclosure class IP00/chassis, IP20/chassis, IP21/NEMA Type 1, and IP54/NEMA Type 12. A kit is available to increase the enclosure class on the D drive to NEMA 3R.

**14. DC-link reactor**
The built-in DC-link reactor ensures low harmonic disturbance of the power supply in accordance with IEC-61000-3-12. The result is a more compact design with higher efficiencies than competitive systems with external mounted AC chokes.

**15. Input mains option**
Various input configurations are available, including fuses, mains disconnect switch, or RFI filter.



**Efficiency is vital for high-power drives**

Efficiency is essential in the design of the high-power VLT® drive series. Innovative design and exceptionally high-quality components have resulted in unsurpassed energy efficiency.

VLT® drives pass more than 98% of the supplied electrical energy on to the motor. Only 2% or less is left in the power electronics as heat to be removed.

Energy is saved and electronics last longer because they are not exposed to high temperatures within the enclosure.

**Safety**

VLT® High Power Drive can be ordered with the Safe Torque Off (Safe Stop) function in compliance with EN ISO 13849-1 Category 3 PL d and SIL 2 according to IEC 62061/IEC 61508. This feature prevents the unit from generating the voltage required to rotate the motor.

The safety functions can be extended to include SS1, SLS, SMS, SSM, safe jog mode and more with the VLT® Safety Option MCB 140 Series and VLT® Safety Option MCB 150 Series (FC 302 only).

# Technical data

## Basic unit without extensions

| Main supply (L1, L2, L3) | |
|---|---|
| Supply voltage | 380-500 V AC<br>525-690 V AC |
| Supply frequency | 50/60 Hz |
| Displacement power factor (cos ϕ) near unity | > 0.98 |
| Switching on input supply L1, L2, L3 | 1-2 times/min. |
| **Output data (T1, T2, T3)** | |
| Output voltage | 0-100% of supply voltage |
| Output frequency | 0-500 Hz |
| Switching on output | Unlimited |
| Ramp times | 0.01-3600 s |
| **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 | 1 ms / 5 ms** |

** Two of the inputs can be used as digital outputs*
*** 1 ms for FC 302 and 5 ms for FC 102/103/202*

| Analog inputs | |
|---|---|
| Analog 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 | 0-32 kHz |
| Accuracy on frequency output | Max. error: 0.1% of full scale |
| **Analog outputs** | |
| Programmable analog outputs | 1 |
| Current range at analog output | 0/4-20 mA |
| Max. load to common at analog output (clamp 30) | 500 Ω |
| Accuracy on analog output | Max. error: 0.5 % 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 outputs** | |
| Programmable relay outputs | 2 |
| Max. terminal load (AC) on 1-3 (NC), 1-2 (NO), 4-6 (NC) power card | 240 V AC, 2 A |
| Max. terminal load (AC -1) on 4-5 (NO) power card | 400 V AC, 2 A |
| Min. terminal load on 1-3 (NC), 1-2 (NO), 4-6 (NC), 4-5 (NO) power card | 24 V DC 10 mA, 24 V AC 20 mA |
| **Surroundings/external** | |
| Ingress protection class | IP: 00/20/21/54<br>UL Type: Chassis/1/12 Outdoor/3R |
| Vibration test | 0.7 g |
| Max. relative humidity | 5-95% (IEC 721-3-3); Class 3K3 (non-condensing) during operation |
| Ambient temperature | Max. 50° C without derating |
| Galvanic isolation of all | I/O supplies according to PELV |
| Aggressive environment | Designed for 3C3 (IEC 60721-3-3) |

| Ambient temperature |
|---|
| – Operating temperature range is -10 °C to 50 °C without derating<br>Max 55 °C with derating |
| – Electronic motor thermal protection against overload |
| – Protection against overtemperature |
| – The AC drive is protected against short circuits on motor terminals R, S, T |
| – The AC drive is protected against ground faults on motor terminals U, V, W |
| – Protection against mains phase loss |

Global Marine

# Industry-specific solutions for high-power applications

What is your industry? Where are your opportunities to save energy? Find just the drive you need to improve efficiency and reduce operating costs in a wide range of heavy duty applications. Danfoss offers an extensive range:

- Broad power size and supply voltage range
- Drives tailored to uses such as HVAC, water, wastewater, and more
  - Customized set-up wizards suited to the industry, enabling fast commissioning
  - Specialized application-related features for optimal performance
  - Fieldbus options and connectivity to suit your communications environment
- Compact modules and innovative cooling concepts to save space and costs in your facilities
- Built-in harmonic mitigation, as well as filter options, for high-quality supply and protection of equipment
- Ingress protection and corrosion resistance to enable reliable performance in a wide variety of environments
- Robust products that are individually factory-tested to ensure you receive top quality

We also offer comprehensive support before, during and after installation. With local offices in more than 100 countries, we are never far away with these services:

- Application engineering in the planning phase
- Useful PC tools to support easy and fast commissioning and service
- Local service and support to react fast and minimize downtime

Use the guide below to see where VLT® drives are already saving energy in a broad range of applications and industries.

| Application | Mining and cement | Chemical | Food and beverage | Material handling | Textile | Water and wastewater | HVAC | Refrigeration |
|---|---|---|---|---|---|---|---|---|
| Auger conveyor | ■ | | ■ | | | | | |
| Ball mill | ■ | | | | | | | |
| Beater type mixer | ■ | | ■ | | | | | |
| Belt conveyor | ■ | | ■ | ■ | | | | |
| Center-driven winder | | | | | ■ | | | |
| Centrifugal fan | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ |
| Centriful pump | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ |
| Centrifuge | | ■ | ■ | | | ■ | | |
| Compressor | | ■ | ■ | | | ■ | ■ | ■ |
| Cone crusher | ■ | | | | | | | |
| Cooling/baking conveyor | | | ■ | ■ | | | | |
| Crane | | | | ■ | | | | |
| Decanter | | ■ | | | | | | |
| Diverter | | | ■ | ■ | | | | |
| Dosing | | ■ | | | | ■ | | |
| Dryer | | ■ | | | | ■ | | |
| Extruder | | ■ | ■ | | | | | |
| Grinder/roller mill | | ■ | | | | | | |
| Hoist | | | | ■ | | | | |
| Impact crusher | ■ | | | | | | | |
| Induced draft fan | ■ | | ■ | | | | | |
| Jaw crusher | ■ | | | | | | | |
| Kneader | | ■ | | | | | | |
| Mixer | | ■ | | | | ■ | | |
| Palletizer | | | ■ | ■ | ■ | | | |
| Positive displacement pump | ■ | | ■ | ■ | ■ | ■ | | |
| Rotary kiln | ■ | | | | | | | |
| Screw compressor | | | ■ | | ■ | ■ | ■ | ■ |

## Dedicated

**Application-optimized products that target your needs**

# VLT® AutomationDrive FC 302

**A VLT® AutomationDrive is built on a flexible, modular design to provide an extraordinarily versatile motor control solution. The drive is equipped with a wide range of industry features that enable optimal process control, higher quality output and reduce costs related to spare parts and service.**

## Motor independent

The VLT® AutomationDrive FC 302 can control nearly all standard industrial motor technologies, including permanent magnet motors, copper rotor motors and direct line PM.

The AC drive is designed to work with all common supply voltages: 380-500 V and 525-690 V. This means that system designers, OEMs and end users are free to connect the drive to their selected motor and remain confident that the system will perform to the highest possible standards.

## Safety where it matters

The VLT® AutomationDrive FC 302 features Safe Torque Off as standard. Easily configurable options are available: SS1, SLS, SMS and SSM.

## Integrated Motion Controller

The Integrated Motion Controller software enables the VLT® AutomationDrive FC 302 to run induction and PM motors in positioning and synchronization applications, both with and without encoders.

## Harmonic mitigation

Advanced active filter variants reduce harmonics to below 3% at best. 12-pulse drives provide robust, cost-effective harmonics reduction in supply applications.

## 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, making it possible for designers to develop smaller applications without being forced to compromise on protection and grid quality. For example, VLT® AutomationDrive FC 302 in a D enclosure size is 25-68% smaller than equivalent drives.

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 brake chopper in the same package size. Control and power cables are fed in separately at the bottom.

The AC drives combine a flexible system architecture that 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 set-up process, resulting in fewer faults due to configuration and parameterization errors.

## Power range

**380-500 V**

**Normal overload:**

400 V.....212-1720 A, 110-1000 kW,
460 V.....190-1530 A, 150-1350 hp

**High overload:**

400 V.....177-1460 A, 90-800 kW,
460 V.....160-1380 A, 125-1200 hp

**525-690 V**

**Normal overload:**

575 V.....86-1415 A, 75-1550 hp
690 V.....86-1415 A, 75-1400 kW

**High overload:**

575 V.....73-1260 A, 60-1350 hp
690 V.....73-1260 A, 55-1200 kW

## Ingress protection ratings

IP00, IP20, IP21 and IP54.

## Options

See page 61.

*For more detailed information please see the FC 300 Design Guide, MG.34.xx.yy available at http://drivesliterature.danfoss.com/*

# VLT® AutomationDrive (FC 302) 380-500 V AC – High overload [1)]

| | High overload [1)] | | | | | | | | | | | Type code | Enclosure size and ingress protection rating | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Output current | | Typical shaft output | Output power | | Rated input current | Estimated power loss at max load [2)] | Output frequency [2)] | Max. external input mains fuses [2)] | Weight, kg (lbs) [2)] | | | Beginning with [3)] | VLT® 6-Pulse | | | VLT® 12-Pulse | VLT® Low Harmonic Drive |
| | [A] | | [kW] | [kVA] | | [A] | [W] | | | | | | | | | | | |
| | Con. $I_{n}$ | Inter. $I_{VLT,max}$ (60 s) [4)] | | Con. | Inter. (60 s) | | | Hz | | IP00 | IP20 | IP21/IP54 | | IP00 | IP20 | IP21/IP54 | | |
| 400 V motor nominal voltage (380-440 V) | 177 | 266 | 90 | 123 | 185 | 171 | 2031 | 0-590 | 315 | | 62 (135) | 62 (135) | FC-302N90KT5 | | D3h | D1h/D5h/D6h | | |
| | 212 | 318 | 110 | 147 | 221 | 204 | 2289 | | 350 | | | | FC-302N110T5 | | D3h | D1h/D5h/D6h | | |
| | 260 | 390 | 132 | 180 | 270 | 251 | 2923 | | 400 | | | | FC-302N132T5 | | D3h | D1h/D5h/D6h | | D1n |
| | 315 | 473 | 160 | 218 | 327 | 304 | 3093 | | 550 | | 125 (275) | 125 (275) | FC-302N160T5 | | D4h | D2h/D7h/D8h | | D2n |
| | 395 | 593 | 200 | 274 | 411 | 381 | 4039 | | 630 | | | | FC-302N200T5 | | D4h | D2h/D7h/D8h | | D2n |
| | 480 | 720 | 250 | 333 | 500 | 463 | 5005 | | 800 | | | | FC-302N250T5 | | D4h | D2h/D7h/D8h | | |
| | 480 | 720 | 250 | 333 | 499 | 472 | | | 700 | | | | FC-302P250T5 | | | | F8/F9 | E9 |
| | 600 | 900 | 315 | 416 | 624 | 590 | 6794 | | | 234 (516) | | 270 (595) | FC-302P315T5 | E2 | | E1 | F8/F9 | E9 |
| | 658 | 987 | 355 | 456 | 684 | 647 | 7498 | | 900 | 236 (520) | | 272 (600) | FC-302P355T5 | E2 | | E1 | F8/F9 | E9 |
| | 695 | 1043 | 400 | 482 | 722 | 684 | 7976 | | | 277 (611) | | 313 (690) | FC-302P400T5 | E2 | | E1 | F8/F9 | E9 |
| | 800 | 1200 | 450 | 554 | 831 | 779 | 9031 | | 1600 | | | 1045 (2300)/ 1364 (3000) | FC-302P450T5 | | | F1/F3 | F10/F11 | F18 |
| | 880 | 1320 | 500 | 610 | 915 | 857 | 10146 | | | | | | FC-302P500T5 | | | F1/F3 | F10/F11 | F18 |
| | 990 | 1485 | 560 | 686 | 1029 | 964 | 10649 | | 2000 | | | | FC-302P560T5 | | | F1/F3 | F10/F11 | F18 |
| | 1120 | 1680 | 630 | 776 | 1164 | 1090 | 12490 | | | | | | FC-302P630T5 | | | F1/F3 | F10/F11 | F18 |
| | 1260 | 1890 | 710 | 873 | 1309 | 1227 | 14244 | | 2500 | | | 1293 (2850)/ 1633 (3600) | FC-302P710T5 | | | F2/F4 | F12/F13 | |
| | 1460 | 2190 | 800 | 1012 | 1517 | 1422 | 15466 | | | | | | FC-302P800T5 | | | F2/F4 | F12/F13 | |
| 460 V motor nominal voltage (441-500 V) | 160 | 240 | 125 hp | 127 | 191 | 154 | 1828 | 0-590 | 315 | | 62 (135) | 62 (135) | FC-302N90KT5 | | D3h | D1h/D5h/D6h | | |
| | 190 | 285 | 150 hp | 151 | 227 | 183 | 2051 | | 350 | | | | FC-302N110T5 | | D3h | D1h/D5h/D6h | | |
| | 240 | 360 | 200 hp | 191 | 287 | 231 | 2689 | | 400 | | | | FC-302N132T5 | | D3h | D1h/D5h/D6h | | D1n |
| | 302 | 453 | 250 hp | 241 | 362 | 291 | 2872 | | 550 | | 125 (275) | 125 (275) | FC-302N160T5 | | D4h | D2h/D7h/D8h | | D2n |
| | 361 | 542 | 300 hp | 288 | 432 | 348 | 3575 | | 630 | | | | FC-302N200T5 | | D4h | D2h/D7h/D8h | | D2n |
| | 443 | 665 | 350 hp | 353 | 530 | 427 | 4458 | | 800 | | | | FC-302N250T5 | | D4h | D2h/D7h/D8h | | |
| | 443 | 665 | 350 hp | 353 | 529 | 436 | | | 700 | | | | FC-302P250T5 | | | | F8/F9 | E9 |
| | 540 | 810 | 450 hp | 430 | 645 | 531 | 6118 | | | 234 (516) | | 270 (595) | FC-302P315T5 | E2 | | E1 | F8/F9 | E9 |
| | 590 | 885 | 500 hp | 470 | 705 | 580 | 6672 | | 900 | 236 (520) | | 272 (600) | FC-302P355T5 | E2 | | E1 | F8/F9 | E9 |
| | 678 | 1017 | 550 hp | 540 | 810 | 667 | 7814 | | | 277 (611) | | 313 (690) | FC-302P400T5 | E2 | | E1 | F8/F9 | E9 |
| | 730 | 1095 | 600 hp | 582 | 872 | 711 | 8212 | | 1600 | | | 1045 (2300)/ 1364 (3000) | FC-302P450T5 | | | F1/F3 | F10/F11 | F18 |
| | 780 | 1170 | 650 hp | 621 | 932 | 759 | 8860 | | | | | | FC-302P500T5 | | | F1/F3 | F10/F11 | F18 |
| | 890 | 1335 | 750 hp | 709 | 1064 | 867 | 9414 | | 2000 | | | | FC-302P560T5 | | | F1/F3 | F10/F11 | F18 |
| | 1050 | 1575 | 900 hp | 837 | 1255 | 1022 | 11581 | | | | | | FC-302P630T5 | | | F1/F3 | F10/F11 | F18 |
| | 1160 | 1740 | 1000 hp | 924 | 1386 | 1129 | 13005 | | 2500 | | | 1293 (2850)/ 1633 (3600) | FC-302P710T5 | | | F2/F4 | F12/F13 | |
| | 1380 | 2070 | 1200 hp | 1100 | 1649 | 1344 | 14556 | | | | | | FC-302P800T5 | | | F2/F4 | F12/F13 | |
| 500 V motor nominal voltage (441-500 V) | 160 | 240 | 110 | 139 | 209 | 154 | 1828 | 0-590 | 315 | | 62 (135) | 62 (135) | FC-302N90KT5 | | D3h | D1h/D5h/D6h | | |
| | 190 | 285 | 132 | 165 | 248 | 183 | 2051 | | 350 | | | | FC-302N110T5 | | D3h | D1h/D5h/D6h | | |
| | 240 | 360 | 160 | 208 | 312 | 231 | 2089 | | 400 | | | | FC-302N132T5 | | D3h | D1h/D5h/D6h | | D1n |
| | 302 | 453 | 200 | 262 | 393 | 291 | 2872 | | 550 | | 125 (275) | 125 (275) | FC-302N160T5 | | D4h | D2h/D7h/D8h | | D2n |
| | 361 | 542 | 250 | 313 | 470 | 348 | 3575 | | 630 | | | | FC-302N200T5 | | D4h | D2h/D7h/D8h | | D2n |
| | 443 | 665 | 315 | 384 | 576 | 427 | 4458 | | 800 | | | | FC-302N250T5 | | D4h | D2h/D7h/D8h | | |
| | 443 | 665 | 315 | 384 | 575 | 436 | | | 700 | | | | FC-302P250T5 | | | | F8/F9 | E9 |
| | 540 | 810 | 355 | 468 | 701 | 531 | 6118 | | | 234 (516) | | 270 (595) | FC-302P315T5 | E2 | | E1 | F8/F9 | E9 |
| | 590 | 885 | 400 | 511 | 766 | 580 | 6672 | | 900 | 236 (520) | | 272 (600) | FC-302P355T5 | E2 | | E1 | F8/F9 | E9 |
| | 678 | 1017 | 500 | 587 | 881 | 667 | 7814 | | | 277 (611) | | 313 (690) | FC-302P400T5 | E2 | | E1 | F8/F9 | E9 |
| | 730 | 1095 | 530 | 632 | 948 | 711 | 8212 | 0-590 | 1600 | | | 1045 (2300)/ 1364 (3000) | FC-302P450T5 | | | F1/F3 | F10/F11 | F18 |
| | 780 | 1170 | 560 | 675 | 1013 | 759 | 8860 | | | | | | FC-302P500T5 | | | F1/F3 | F10/F11 | F18 |
| | 890 | 1335 | 630 | 771 | 1156 | 867 | 9414 | | 2000 | | | | FC-302P560T5 | | | F1/F3 | F10/F11 | F18 |
| | 1050 | 1575 | 710 | 909 | 1364 | 1022 | 11581 | | | | | | FC-302P630T5 | | | F1/F3 | F10/F11 | F18 |
| | 1160 | 1740 | 800 | 1005 | 1507 | 1129 | 13005 | | 2500 | | | 1293 (2850)/ 1633 (3600) | FC-302P710T5 | | | F2/F4 | F12/F13 | |
| | 1380 | 2070 | 1000 | 1195 | 1793 | 1344 | 14556 | | | | | | FC-302P800T5 | | | F2/F4 | F12/F13 | |

[1)] *Drive defaults to high overload. Normal overload is an optional software setting.*
[2)] *VLT® 6-Pulse only. Please see VLT® 12-Pulse and VLT® Low Harmonic Drives dimension tables.*
[3)] *See pages 70 to 71 for the complete type code.*
[4)] *Intermittent duty rated for 150% of continuous current for high overload.*

# VLT® AutomationDrive (FC 302) 380-500 V AC – Normal overload [1)]

| Normal overload | | | | | | | | | | | | Type code | Enclosure size and ingress protection rating | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Output current | | Typical shaft output | Output power | | Rated input current | Estimated power loss at max load [2)] | Output frequency [2)] | Max. external input mains fuses | Weight, kg (lbs) [2)] | | | Beginning with [3)] | VLT® 6-Pulse | | | VLT® 12-Pulse | VLT® Low Harmonic Drive | |
| [A] | | [kW] | [kVA] | | [A] | [W] | Hz | | IP00 | IP20 | IP21/IP54 | | IP00 | IP20 | IP21/IP54 | | | |
| Con. $I_{VLT,N}$ | Inter. $I_{VLT,MAX}$ (60 s) [4)] | | Con. | Inter. (60 s) | | | | | | | | | | | | | | |
| 212 | 233 | 110 | 147 | 162 | 204 | 2559 | 0-590 | 315 | | 62 (135) | 62 (135) | FC-302N90KT5 | | D3h | D1h/D5h/D6h | | | 400 V motor nominal voltage (380-440 V) |
| 260 | 286 | 132 | 180 | 198 | 251 | 2954 | | 350 | | | | FC-302N110T5 | | D3h | D1h/D5h/D6h | | | |
| 315 | 347 | 160 | 218 | 240 | 304 | 3770 | | 400 | | | | FC-302N132T5 | | D3h | D1h/D5h/D6h | | D1n | |
| 395 | 435 | 200 | 274 | 301 | 381 | 4116 | | 550 | | 125 (275) | 125 (275) | FC-302N160T5 | | D4h | D2h/D7h/D8h | | D2n | |
| 480 | 528 | 250 | 333 | 366 | 463 | 5137 | | 630 | | | | FC-302N200T5 | | D4h | D2h/D7h/D8h | | D2n | |
| 588 | 647 | 315 | 407 | 448 | 567 | 6674 | | 800 | | | | FC-302N250T5 | | D4h | D2h/D7h/D8h | | | |
| 600 | 660 | 315 | 416 | 457 | 590 | | | 700 | | | | FC-302P250T5 | | | | F8/F9 | E9 | |
| 658 | 724 | 355 | 456 | 501 | 647 | 7532 | | 900 | 234 (516) | | 270 (595) | FC-302P315T5 | E2 | | E1 | F8/F9 | E9 | |
| 745 | 820 | 400 | 516 | 568 | 733 | 8677 | | | 236 (520) | | 272 (600) | FC-302P355T5 | E2 | | E1 | F8/F9 | E9 | |
| 800 | 880 | 450 | 554 | 610 | 787 | 9473 | | | 277 (611) | | 313 (690) | FC-302P400T5 | E2 | | E1 | F8/F9 | E9 | |
| 880 | 968 | 500 | 610 | 671 | 857 | 10162 | | 1600 | | | 1045 (2300)/ 1364 (3000) | FC-302P450T5 | | | F1/F3 | F10/F11 | F18 | |
| 990 | 1089 | 560 | 686 | 754 | 964 | 11822 | | | | | | FC-302P500T5 | | | F1/F3 | F10/F11 | F18 | |
| 1120 | 1232 | 630 | 776 | 854 | 1090 | 12512 | | 2000 | | | | FC-302P560T5 | | | F1/F3 | F10/F11 | F18 | |
| 1260 | 1386 | 710 | 873 | 960 | 1227 | 14674 | | | | | | FC-302P630T5 | | | F1/F3 | F10/F11 | F18 | |
| 1460 | 1606 | 800 | 1012 | 1113 | 1422 | 17293 | | 2500 | | | 1293 (2850)/ 1633 (3600) | FC-302P710T5 | | | F2/F4 | F12/F13 | | |
| 1720 | 1892 | 1000 | 1192 | 1311 | 1675 | 19278 | | | | | | FC-302P800T5 | | | F2/F4 | F12/F13 | | |
| 190 | 209 | 150 hp | 151 | 166 | 183 | 2261 | 0-590 | 315 | | 62 (135) | 62 (135) | FC-302N90KT5 | | D3h | D1h/D5h/D6h | | | 460 V motor nominal voltage (441-500 V) |
| 240 | 264 | 200 hp | 191 | 210 | 231 | 2724 | | 350 | | | | FC-302N110T5 | | D3h | D1h/D5h/D6h | | | |
| 302 | 332 | 250 hp | 241 | 265 | 291 | 3628 | | 400 | | | | FC-302N132T5 | | D3h | D1h/D5h/D6h | | D1n | |
| 361 | 397 | 300 hp | 288 | 317 | 348 | 3569 | | 550 | | 125 (275) | 125 (275) | FC-302N160T5 | | D4h | D2h/D7h/D8h | | D2n | |
| 443 | 487 | 350 hp | 353 | 388 | 427 | 4566 | | 630 | | | | FC-302N200T5 | | D4h | D2h/D7h/D8h | | D2n | |
| 535 | 588 | 450 hp | 426 | 469 | 516 | 5714 | | 800 | | | | FC-302N250T5 | | D4h | D2h/D7h/D8h | | | |
| 540 | 594 | 450 hp | 430 | 473 | 531 | | | 700 | | | | FC-302P250T5 | | | | F8/F9 | E9 | |
| 590 | 649 | 500 hp | 470 | 517 | 580 | 6724 | | 900 | 234 (516) | | 270 (595) | FC-302P315T5 | E2 | | E1 | F8/F9 | E9 | |
| 678 | 746 | 600 hp | 540 | 594 | 667 | 7819 | | | 236 (520) | | 272 (600) | FC-302P355T5 | E2 | | E1 | F8/F9 | E9 | |
| 730 | 803 | 600 hp | 582 | 640 | 718 | 8527 | | | 277 (611) | | 313 (690) | FC-302P400T5 | E2 | | E1 | F8/F9 | E9 | |
| 780 | 858 | 650 hp | 621 | 684 | 759 | 8876 | | 1600 | | | 1045 (2300)/ 1364 (3000) | FC-302P450T5 | | | F1/F3 | F10/F11 | F18 | |
| 890 | 979 | 750 hp | 709 | 780 | 867 | 10424 | | | | | | FC-302P500T5 | | | F1/F3 | F10/F11 | F18 | |
| 1050 | 1155 | 900 hp | 837 | 920 | 1022 | 11595 | | 2000 | | | | FC-302P560T5 | | | F1/F3 | F10/F11 | F18 | |
| 1160 | 1276 | 1000 hp | 924 | 1017 | 1129 | 13213 | | | | | | FC-302P630T5 | | | F1/F3 | F10/F11 | F18 | |
| 1380 | 1518 | 1200 hp | 1100 | 1209 | 1344 | 16229 | | 2500 | | | 1293 (2850)/ 1633 (3600) | FC-302P710T5 | | | F2/F4 | F12/F13 | | |
| 1530 | 1683 | 1350 hp | 1219 | 1341 | 1490 | 16624 | | | | | | FC-302P800T5 | | | F2/F4 | F12/F13 | | |
| 190 | 209 | 132 | 165 | 182 | 183 | 2261 | 0-590 | 315 | | 62 (135) | 62 (135) | FC-302N90KT5 | | D3h | D1h/D5h/D6h | | | 500 V motor nominal voltage (441-500 V) |
| 240 | 264 | 160 | 208 | 229 | 231 | 2724 | | 350 | | | | FC-302N110T5 | | D3h | D1h/D5h/D6h | | | |
| 302 | 332 | 200 | 262 | 288 | 291 | 3628 | | 400 | | | | FC-302N132T5 | | D3h | D1h/D5h/D6h | | D1n | |
| 361 | 397 | 250 | 313 | 344 | 348 | 3569 | | 550 | | 125 (275) | 125 (275) | FC-302N160T5 | | D4h | D2h/D7h/D8h | | D2n | |
| 443 | 487 | 315 | 384 | 422 | 427 | 4566 | | 630 | | | | FC-302N200T5 | | D4h | D2h/D7h/D8h | | D13 | |
| 535 | 588 | 355 | 463 | 509 | 516 | 5714 | | 800 | | | | FC-302N250T5 | | D4h | D2h/D7h/D8h | | | |
| 540 | 594 | 355 | 468 | 514 | 531 | | | 700 | | | | FC-302P250T5 | | | | F8/F9 | E9 | |
| 590 | 649 | 400 | 511 | 562 | 580 | 6724 | | 900 | 234 (516) | | 270 (595) | FC-302P315T5 | E2 | | E1 | F8/F9 | E9 | |
| 678 | 746 | 500 | 587 | 646 | 667 | 7819 | | | 236 (520) | | 272 (600) | FC-302P355T5 | E2 | | E1 | F8/F9 | E9 | |
| 730 | 803 | 530 | 632 | 695 | 718 | 8527 | | | 277 (611) | | 313 (690) | FC-302P400T5 | E2 | | E1 | F8/F9 | E9 | |
| 780 | 858 | 560 | 675 | 743 | 759 | 8876 | | 1600 | | | 1045 (2300)/ 1364 (3000) | FC-302P450T5 | | | F1/F3 | F10/F11 | F18 | |
| 890 | 979 | 630 | 771 | 848 | 867 | 10424 | | | | | | FC-302P500T5 | | | F1/F3 | F10/F11 | F18 | |
| 1050 | 1155 | 710 | 909 | 1000 | 1022 | 11595 | | 2000 | | | | FC-302P560T5 | | | F1/F3 | F10/F11 | F18 | |
| 1160 | 1276 | 800 | 1005 | 1105 | 1129 | 13213 | | | | | | FC-302P630T5 | | | F1/F3 | F10/F11 | F18 | |
| 1380 | 1518 | 1000 | 1195 | 1315 | 1344 | 16229 | | 2500 | | | 1293 (2850)/ 1633 (3600) | FC-302P710T5 | | | F2/F4 | F12/F13 | | |
| 1530 | 1683 | 1100 | 1325 | 1458 | 1490 | 16624 | | | | | | FC-302P800T5 | | | F2/F4 | F12/F13 | | |

***Consult factory for higher output drives***

*[1)] Drive defaults to high overload. Normal overload is an o ptional software setting.*
*[2)] VLT® 6-Pulse only. Please see VLT® 12-Pulse and VLT® Low Harmonic Drives dimension tables.*
*[3)] See pages 70 to 71 for the complete type code.*
*[4)] Intermittent duty rated for 110% of continuous current for normal overload.*

# VLT® AutomationDrive (FC 302) 525-690 V AC – High overload [1)]

| | High overload [1)] | | | | | | | | | | | Type code | Enclosure size & ingress protection rating | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Output current | | Typical shaft output | Output power | | Rated input current | Estimated power loss at max load [2)] | Output frequency [2)] | Max. external input mains fuses (mains) | Weight, kg (lbs) [2)] | | | Beginning with [2)] | VLT® 6-Pulse | | | VLT® 12-Pulse |
| | [A] | | [kW] | [kVA] | | [A] | [W] | Hz | | IP00 | IP20 | IP21/IP54 | | IP00 | IP20 | IP21/IP54 | |
| | Con. $I_{N}$ | Inter. $I_{VT,max}$ (60 s) [4)] | | Con. | Inter. (60 s) | | | | | | | | | | | | |
| 525V motor nominal voltage (525-550 V) | 76 | 122 | 45 | 72 | 108 | 77 | 1018 | 0-590 | 160 | | 62 (135) | 62 (135) | FC-302N55KT7 | | D3h | D1h/D5h/D6h | |
| | 90 | 135 | 55 | 86 | 129 | 89 | 1162 | | 200 | | | | FC-302N75KT7 | | D3h | D1h/D5h/D6h | |
| | 113 | 170 | 75 | 108 | 161 | 110 | 1430 | | | | | | FC-302N90KT7 | | D3h | D1h/D5h/D6h | |
| | 137 | 206 | 90 | 131 | 196 | 130 | 1742 | | 315 | | | | FC-302N110T7 | | D3h | D1h/D5h/D6h | |
| | 162 | 243 | 110 | 154 | 231 | 158 | 2080 | | | | | | FC-302N132T7 | | D3h | D1h/D5h/D6h | |
| | 201 | 302 | 132 | 191 | 287 | 198 | 2361 | | 550 | | 125 (275) | 125 (275) | FC-302N160T7 | | D4h | D2h/D7h/D8h | |
| | 253 | 380 | 160 | 241 | 362 | 245 | 3012 | | | | | | FC-302N200T7 | | D4h | D2h/D7h/D8h | |
| | 303 | 455 | 200 | 289 | 433 | 299 | 3642 | | | | | | FC-302N250T7 | | D4h | D2h/D7h/D8h | |
| | 360 | 540 | 250 | 343 | 516 | 355 | 4146 | | | | | | FC-302N315T7 | | D4h | D2h/D7h/D8h | |
| | 395 | 593 | 300 | 376 | 564 | 381 | 4424 | | 700 | 221 (487) | | 263 (580) | FC-302P355T7 | E2 | | E1 | F8/F9 |
| | 429 | 644 | 315 | 409 | 613 | 413 | 4795 | | | | | | FC-302P400T7 | E2 | | E1 | F8/F9 |
| | 523 | 785 | 400 | 498 | 747 | 504 | 6493 | | 900 | 236 (520) | | 272 (600) | FC-302P500T7 | E2 | | E1 | F8/F9 |
| | 596 | 894 | 450 | 568 | 852 | 574 | 7383 | | | 277 (611) | | 313 (690) | FC-302P560T7 | E2 | | E1 | F8/F9 |
| | 659 | 989 | 500 | 628 | 942 | 642 | 8075 | | 1600 | | | 1045 (2300)/ 1364 (3600) | FC-302P630T7 | | | F1/F3 | F10/F11 |
| | 763 | 1145 | 560 | 727 | 1090 | 743 | 9165 | 0-500 | | | | | FC-302P710T7 | | | F1/F3 | F10/F11 |
| | 889 | 1334 | 670 | 847 | 1270 | 866 | 10860 | | | | | | FC-302P800T7 | | | F1/F3 | F10/F11 |
| | 988 | 1482 | 750 | 941 | 1412 | 962 | 12062 | | | | | 1260 (2778)/ 1561 (3441) | FC-302P900T7 | | | F2/F4 | F12/F13 |
| | 1108 | 1662 | 850 | 1056 | 1583 | 1079 | 13269 | | 2000 | | | | FC-302P1M0T7 | | | F2/F4 | F12/F13 |
| | 1317 | 1976 | 1000 | 1255 | 1380 | 1282 | 16089 | | 2500 | | | 1294 (2853)/ 1595 (3516) | FC-302P1M2T7 | | | F2/F4 | F12/F13 |
| 575 V motor nominal voltage (551-690 V) | 73 | 117 | 60 hp | 73 | 110 | 74 | 1018 | 0-590 | 160 | | 62 (135) | 62 (135) | FC-302N55KT7 | | D3h | D1h/D5h/D6h | |
| | 86 | 129 | 75 hp | 86 | 129 | 85 | 1162 | | 200 | | | | FC-302N75KT7 | | D3h | D1h/D5h/D6h | |
| | 108 | 162 | 100 hp | 108 | 161 | 106 | 1430 | | | | | | FC-302N90KT7 | | D3h | D1h/D5h/D6h | |
| | 131 | 197 | 125 hp | 130 | 196 | 124 | 1800 | | 315 | | | | FC-302N110T7 | | D3h | D1h/D5h/D6h | |
| | 155 | 233 | 150 hp | 154 | 232 | 151 | 2159 | | | | | | FC-302N132T7 | | D3h | D1h/D5h/D6h | |
| | 192 | 288 | 200 hp | 191 | 287 | 189 | 2446 | | 550 | | 125 (275) | 125 (275) | FC-302N160T7 | | D4h | D2h/D7h/D8h | |
| | 242 | 363 | 250 hp | 241 | 362 | 234 | 3123 | | | | | | FC-302N200T7 | | D4h | D2h/D7h/D8h | |
| | 290 | 435 | 300 hp | 289 | 433 | 286 | 3771 | | | | | | FC-302N250T7 | | D4h | D2h/D7h/D8h | |
| | 344 | 516 | 350 hp | 343 | 516 | 339 | 4258 | | | | | | FC-302N315T7 | | D4h | D2h/D7h/D8h | |
| | 380 | 570 | 400 hp | 378 | 568 | 366 | 4424 | | 700 | 221 (487) | | 263 (580) | FC-302P355T7 | E2 | | E1 | F8/F9 |
| | 410 | 615 | 400 hp | 408 | 612 | 395 | 4795 | | | | | | FC-302P400T7 | E2 | | E1 | F8/F9 |
| | 500 | 750 | 500 hp | 498 | 747 | 482 | 6493 | | 900 | 236 (520) | | 272 (600) | FC-302P500T7 | E2 | | E1 | F8/F9 |
| | 570 | 855 | 600 hp | 568 | 852 | 549 | 7383 | | | 277 (611) | | 313 (690) | FC-302P560T7 | E2 | | E1 | F8/F9 |
| | 630 | 945 | 650 hp | 627 | 941 | 613 | 8075 | | 1600 | | | 1045 (2300)/ 1364 (3600) | FC-302P630T7 | | | F1/F3 | F10/F11 |
| | 730 | 1095 | 750 hp | 727 | 1091 | 711 | 9165 | 0-500 | | | | | FC-302P710T7 | | | F1/F3 | F10/F11 |
| | 850 | 1275 | 950 hp | 847 | 1270 | 828 | 10860 | | | | | | FC-302P800T7 | | | F1/F3 | F10/F11 |
| | 945 | 1418 | 1050 hp | 941 | 1412 | 920 | 12062 | | | | | 1260 (2778)/ 1561 (3441) | FC-302P900T7 | | | F2/F4 | F12/F13 |
| | 1060 | 1590 | 1150 hp | 1056 | 1584 | 1032 | 13269 | | 2000 | | | | FC-302P1M0T7 | | | F2/F4 | F12/F13 |
| | 1260 | 1890 | 1350 hp | 1255 | 1381 | 1227 | 18536 | | 2500 | | | 1294 (2853)/ 1595 (3516) | FC-302P1M2T7 | | | F2/F4 | F12/F13 |
| 690 V motor nominal voltage (551-690 V) | 73 | 110 | 55 | 87 | 131 | 77 | 1057 | 0-590 | 160 | | 62 (135) | 62 (135) | FC-302N55KT7 | | D3h | D1h/D5h/D6h | |
| | 86 | 129 | 75 | 103 | 155 | 87 | 1205 | | 200 | | | | FC-302N75KT7 | | D3h | D1h/D5h/D6h | |
| | 108 | 162 | 90 | 129 | 194 | 109 | 1480 | | | | | | FC-302N90KT7 | | D3h | D1h/D5h/D6h | |
| | 131 | 197 | 110 | 157 | 235 | 128 | 1800 | | 315 | | | | FC-302N110T7 | | D3h | D1h/D5h/D6h | |
| | 155 | 233 | 132 | 185 | 278 | 155 | 2159 | | | | | | FC-302N132T7 | | D3h | D1h/D5h/D6h | |
| | 192 | 288 | 160 | 229 | 344 | 197 | 2446 | | 550 | | 125 (275) | 125 (275) | FC-302N160T7 | | D4h | D2h/D7h/D8h | |
| | 242 | 363 | 200 | 289 | 434 | 240 | 3123 | | | | | | FC-302N200T7 | | D4h | D2h/D7h/D8h | |
| | 290 | 435 | 250 | 347 | 520 | 296 | 3771 | | | | | | FC-302N250T7 | | D4h | D2h/D7h/D8h | |
| | 344 | 516 | 315 | 411 | 617 | 352 | 4258 | | | | | | FC-302N315T7 | | D4h | D2h/D7h/D8h | |
| | 380 | 570 | 355 | 454 | 681 | 366 | 4589 | | 700 | 221 (487) | | 263 (580) | FC-302P355T7 | E2 | | E1 | F8/F9 |
| | 410 | 615 | 400 | 490 | 735 | 395 | 4970 | | | | | | FC-302P400T7 | E2 | | E1 | F8/F9 |
| | 500 | 750 | 500 | 598 | 896 | 482 | 6707 | | 900 | 236 (520) | | 272 (600) | FC-302P500T7 | E2 | | E1 | F8/F9 |
| | 570 | 855 | 560 | 681 | 1022 | 549 | 7633 | | | 277 (611) | | 313 (690) | FC-302P560T7 | E2 | | E1 | F8/F9 |
| | 630 | 945 | 630 | 753 | 1129 | 613 | 8388 | | 1600 | | | 1045 (2300)/ 1364 (3600) | FC-302P630T7 | | | F1/F3 | F10/F11 |
| | 730 | 1095 | 710 | 872 | 1309 | 711 | 9537 | 0-500 | | | | | FC-302P710T7 | | | F1/F3 | F10/F11 |
| | 850 | 1275 | 800 | 1016 | 1524 | 828 | 11291 | | | | | | FC-302P800T7 | | | F1/F3 | F12/F11 |
| | 945 | 1418 | 900 | 1129 | 1694 | 920 | 12524 | | | | | 1260 (2778)/ 1561 (3441) | FC-302P900T7 | | | F2/F4 | F12/F13 |
| | 1060 | 1590 | 1000 | 1267 | 1900 | 1032 | 13801 | | 2000 | | | | FC-302P1M0T7 | | | F2/F4 | F12/F13 |
| | 1260 | 1890 | 1200 | 1506 | 2259 | 1227 | 16719 | | 2500 | | | 1294 (2853)/ 1595 (3516) | FC-302P1M2T7 | | | F2/F4 | F12/F13 |

***Consult factory for higher output drives***

*[1)] Drive defaults to high overload. Normal overload is an optional software setting.*
*[2)] VLT® 6-Pulse only. Please see VLT® 12-Pulse and VLT® Low Harmonic Drives dimension tables.*
*[3)] See pages 70 to 71 for the complete type code.*
*[4)] Intermittent duty rated for 150% of continuous current for high overload.*

# VLT® AutomationDrive (FC 302) 525-690 V AC – Normal overload [1]

| Normal overload | | | | | | | | | | | | Type code | Enclosure size & ingress protection rating | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Output current | | Typical shaft output | Output power | | Rated input current | Estimated power loss at max load [2] | Output frequency [2] | Max. external input mains fuses | Weight, kg (lbs) [2] | | | Beginning with [3] | VLT® 6-Pulse | | | VLT® 12-Pulse | |
| [A] | | [kW] | [kVA] | | [A] | [W] | | | | | | | | | | | |
| Cont. $I_{VLT,N}$ | Inter. $I_{VLT,max}$ (60 s) [4] | | Con. | Inter. (60 s) | | | Hz | | IP00 | IP20 | IP21/IP54 | | IP00 | IP20 | IP21/IP54 | | |
| 90 | 99 | 55 | 86 | 95 | 89 | 1162 | 0-590 | 200 | | 62 (135) | 62 (135) | FC-302N55KT7 | | D3h | D1h/D5h/D6h | | 525V motor nominal voltage (525-550 V) |
| 113 | 124 | 75 | 108 | 119 | 110 | 1428 | | | | | | FC-302N75KT7 | | D3h | D1h/D5h/D6h | | |
| 137 | 151 | 90 | 131 | 144 | 130 | 1740 | | 250 | | | | FC-302N90KT7 | | D3h | D1h/D5h/D6h | | |
| 162 | 178 | 110 | 154 | 170 | 158 | 2101 | | 315 | | | | FC-302N110T7 | | D3h | D1h/D5h/D6h | | |
| 201 | 221 | 132 | 191 | 211 | 198 | 2649 | | | | | | FC-302N132T7 | | D3h | D1h/D5h/D6h | | |
| 253 | 278 | 160 | 241 | 265 | 245 | 3074 | | 550 | | 125 (275) | 125 (275) | FC-302N160T7 | | D4h | D2h/D7h/D8h | | |
| 303 | 333 | 200 | 289 | 318 | 299 | 3723 | | | | | | FC-302N200T7 | | D4h | D2h/D7h/D8h | | |
| 360 | 396 | 250 | 343 | 377 | 355 | 4465 | | | | | | FC-302N250T7 | | D4h | D2h/D7h/D8h | | |
| 418 | 460 | 315 | 398 | 438 | 408 | 5028 | | | | | | FC-302N315T7 | | D4h | D2h/D7h/D8h | | |
| 470 | 517 | 355 | 448 | 493 | 453 | 5323 | 0-500 | 700 | 221 (487) | | 263 (580) | FC-302P355T7 | E2 | | E1 | F8/F9 | |
| 523 | 575 | 400 | 498 | 548 | 504 | 6010 | | | | | | FC-302P400T7 | E2 | | E1 | F8/F9 | |
| 596 | 656 | 450 | 568 | 625 | 574 | 7395 | | 900 | 236 (520) | | 272 (600) | FC-302P500T7 | E2 | | E1 | F8/F9 | |
| 630 | 693 | 500 | 600 | 660 | 607 | 8209 | | | 277 (611) | | 313 (690) | FC-302P560T7 | E2 | | E1 | F8/F9 | |
| 763 | 839 | 560 | 727 | 800 | 743 | 9500 | | 1600 | | | 1045 (2300)/ 1364 (3600) | FC-302P630T7 | | | F1/F3 | F10/F11 | |
| 889 | 978 | 670 | 847 | 932 | 866 | 10872 | | | | | | FC-302P710T7 | | | F1/F3 | F10/F11 | |
| 988 | 1087 | 750 | 941 | 1035 | 962 | 12316 | | | | | | FC-302P800T7 | | | F1/F3 | F10/F11 | |
| 1108 | 1219 | 850 | 1056 | 1161 | 1079 | 13731 | | | | | 1260 (2778)/ 1561 (3441) | FC-302P900T7 | | | F2/F4 | F12/F13 | |
| 1317 | 1449 | 1000 | 1255 | 1380 | 1282 | 16190 | | 2000 | | | | FC-302P1M0T7 | | | F2/F4 | F12/F13 | |
| 1479 | 1627 | 1100 | 1409 | 1550 | 1440 | 18536 | | 2500 | | | 1294 (2853)/ 1595 (3516) | FC-302P1M2T7 | | | F2/F4 | F12/F13 | |
| 86 | 95 | 75 hp | 86 | 95 | 85 | 1162 | 0-590 | 200 | | 62 (135) | 62 (135) | FC-302N55KT7 | | D3h | D1h/D5h/D6h | | 575 V motor nominal voltage (551-690 V) |
| 108 | 119 | 100 hp | 108 | 119 | 106 | 1428 | | | | | | FC-302N75KT7 | | D3h | D1h/D5h/D6h | | |
| 131 | 144 | 125 hp | 130 | 144 | 124 | 1740 | | 250 | | | | FC-302N90KT7 | | D3h | D1h/D5h/D6h | | |
| 155 | 171 | 150 hp | 154 | 170 | 151 | 2101 | | 315 | | | | FC-302N110T7 | | D3h | D1h/D5h/D6h | | |
| 192 | 211 | 200 hp | 191 | 210 | 189 | 2649 | | | | | | FC-302N132T7 | | D3h | D1h/D5h/D6h | | |
| 242 | 266 | 250 hp | 241 | 265 | 234 | 3074 | | 550 | | 125 (275) | 125 (275) | FC-302N160T7 | | D4h | D2h/D7h/D8h | | |
| 290 | 319 | 300 hp | 289 | 318 | 286 | 3723 | | | | | | FC-302N200T7 | | D4h | D2h/D7h/D8h | | |
| 344 | 378 | 350 hp | 343 | 377 | 339 | 4465 | | | | | | FC-302N250T7 | | D4h | D2h/D7h/D8h | | |
| 400 | 440 | 400 hp | 398 | 438 | 390 | 5028 | | | | | | FC-302N315T7 | | D4h | D2h/D7h/D8h | | |
| 450 | 495 | 450 hp | 448 | 493 | 434 | 5323 | 0-500 | 700 | 221 (487) | | 263 (580) | FC-302P355T7 | E2 | | E1 | F8/F9 | |
| 500 | 550 | 500 hp | 498 | 548 | 482 | 6010 | | | | | | FC-302P400T7 | E2 | | E1 | F8/F9 | |
| 570 | 627 | 600 hp | 568 | 624 | 549 | 7395 | | 900 | 236 (520) | | 272 (600) | FC-302P500T7 | E2 | | E1 | F8/F9 | |
| 630 | 693 | 650 hp | 627 | 690 | 607 | 8209 | | | 277 (611) | | 313 (690) | FC-302P560T7 | E2 | | E1 | F8/F9 | |
| 730 | 803 | 750 hp | 727 | 800 | 711 | 9500 | | 1600 | | | 1045 (2300)/ 1364 (3600) | FC-302P630T7 | | | F1/F3 | F10/F11 | |
| 850 | 935 | 950 hp | 847 | 931 | 828 | 10872 | | | | | | FC-302P710T7 | | | F1/F3 | F10/F11 | |
| 945 | 1040 | 1050 hp | 941 | 1035 | 920 | 12316 | | | | | | FC-302P800T7 | | | F1/F3 | F10/F11 | |
| 1060 | 1166 | 1150 hp | 1056 | 1161 | 1032 | 13731 | | | | | 1260 (2778)/ 1561 (3441) | FC-302P900T7 | | | F2/F4 | F12/F13 | |
| 1260 | 1386 | 1350 hp | 1255 | 1380 | 1227 | 16190 | | 2000 | | | | FC-302P1M0T7 | | | F2/F4 | F12/F13 | |
| 1415 | 1557 | 1550 hp | 1409 | 1550 | 1378 | 18536 | | 2500 | | | 1294 (2853)/ 1595 (3516) | FC-302P1M2T7 | | | F2/F4 | F12/F13 | |
| 86 | 95 | 75 | 103 | 113 | 87 | 1204 | 0-590 | 200 | | 62 (135) | 62 (135) | FC-302N55KT7 | | D3h | D1h/D5h/D6h | | 690 V motor nominal voltage (551-690 V) |
| 108 | 119 | 90 | 129 | 142 | 109 | 1477 | | | | | | FC-302N75KT7 | | D3h | D1h/D5h/D6h | | |
| 131 | 144 | 110 | 157 | 172 | 128 | 1798 | | 250 | | | | FC-302N90KT7 | | D3h | D1h/D5h/D6h | | |
| 155 | 171 | 132 | 185 | 204 | 155 | 2167 | | 315 | | | | FC-302N110T7 | | D3h | D1h/D5h/D6h | | |
| 192 | 211 | 160 | 229 | 252 | 197 | 2740 | | | | | | FC-302N132T7 | | D3h | D1h/D5h/D6h | | |
| 242 | 266 | 200 | 289 | 318 | 240 | 3175 | | 550 | | 125 (275) | 125 (275) | FC-302N160T7 | | D4h | D2h/D7h/D8h | | |
| 290 | 319 | 250 | 347 | 381 | 296 | 3851 | | | | | | FC-302N200T7 | | D4h | D2h/D7h/D8h | | |
| 344 | 378 | 315 | 411 | 452 | 352 | 4616 | | | | | | FC-302N250T7 | | D4h | D2h/D7h/D8h | | |
| 400 | 440 | 400 | 478 | 526 | 400 | 5155 | | | | | | FC-302N315T7 | | D4h | D2h/D7h/D8h | | |
| 450 | 495 | 450 | 538 | 592 | 434 | 5529 | 0-500 | 700 | 221 (487) | | 263 (580) | FC-302P355T7 | E2 | | E1 | F8/F9 | |
| 500 | 550 | 500 | 598 | 657 | 482 | 6239 | | | | | | FC-302P400T7 | E2 | | E1 | F8/F9 | |
| 570 | 627 | 560 | 681 | 749 | 549 | 7653 | | 900 | 236 (520) | | 272 (600) | FC-302P500T7 | E2 | | E1 | F8/F9 | |
| 630 | 693 | 630 | 753 | 828 | 607 | 8495 | | | 277 (611) | | 313 (690) | FC-302P560T7 | E2 | | E1 | F8/F9 | |
| 730 | 803 | 710 | 872 | 960 | 711 | 9863 | | 1600 | | | 1045 (2300)/ 1364 (3600) | FC-302P630T7 | | | F1/F3 | F10/F11 | |
| 850 | 935 | 800 | 1016 | 1117 | 828 | 11304 | | | | | | FC-302P710T7 | | | F1/F3 | F10/F11 | |
| 945 | 1040 | 900 | 1129 | 1242 | 920 | 12798 | | | | | | FC-302P800T7 | | | F1/F3 | F10/F11 | |
| 1060 | 1166 | 1000 | 1267 | 1394 | 1032 | 14250 | | | | | 1260 (2778)/ 1561 (3441) | FC-302P900T7 | | | F2/F4 | F12/F13 | |
| 1260 | 1386 | 1200 | 1506 | 1656 | 1227 | 16821 | | 2000 | | | | FC-302P1M0T7 | | | F2/F4 | F12/F13 | |
| 1415 | 1557 | 1400 | 1691 | 1860 | 1378 | 19247 | | 2500 | | | 1294 (2853)/ 1595 (3516) | FC-302P1M2T7 | | | F2/F4 | F12/F13 | |

***Consult factory for higher output drives***

1) *Drive defaults to high overload. Normal overload is an optional software setting.*
2) *VLT® 6-Pulse only. Please see VLT® 12-Pulse and VLT® Low Harmonic Drives dimension tables.*
3) *See pages 70 to 71 for the complete type code.*
4) *Intermittent duty rated for 110% of continuous current for normal overload.*

**Highest**
**harmonic performance**
at lowest operating expenses in its power range

**30%**
cost reduction in 1st year compared with traditional drive systems

# VLT® AQUA Drive FC 202

**A VLT® AQUA Drive is built on a flexible, modular design 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 1.4 MW

Available in a performance range from 0.25 kW to 1.4 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 AC drive is designed to work with all common supply voltage ranges: 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 selected 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 up to 1.4 MW 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.

## Focus on water and pumps

The VLT® AQUA Drive FC 202 drives and controls all types of pumps. In addition to the widely-used centrifugal pumps (quadratic load torque), the VLT® AQUA Drive FC 202 is ideal for displacement pumps or eccentric screw pumps (constant load torque).

Dedicated functions such as burst pipe monitoring, dry-running protection and flow compensation provide security and empower your pumping application independent of the motor technology.

## Cascade controller as standard

The cascade controller connects or disconnects pumps as necessary and according to specified limits. It also enables master/follower operation. Extended functionality is an available option.

## Direct outdoor installation

As standard, Danfoss offers AC drives with protection class IP54/NEMA 3R enclosures. In addition to the convenience of having the AC drive close to the pump, this type of installation typically reduces cable costs, removes the need for air-conditioning capacity and lowers control room costs.

## Designed for 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.

## Power range

**380-480 V**
**Normal overload:**
400 V.....212-1720 A, 110-1000 kW
460 V.....190-1530 A, 150-1350 hp

**High overload:**
400 V..... 177-1460 A, 90-800 kW
460 V.....160-1380 A, 125-1200 hp

**525-690 V**
**Normal overload:**
575 V..... 86-1415 A, 75-1550 hp
690 V..... 86-1415 A, 75-1400 kW

**High overload:**
575 V..... 73-1260 A, 60-1350 hp
690 V..... 73-1260 A, 55-1200 kW

## Ingress protection ratings

IP00, IP20, IP21 and IP54.

## Options

See page 61.

*For more detailed information please see the FC 200 Design Guide, MG.20.xx.yy available at http://drivesliterature.danfoss.com/*

# VLT® AQUA Drive (FC 202) 380-480 V AC– High overload [5]

| | High overload [5] | | | | | | | | | | | Type code | Enclosure size & ingress protection rating | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Output current | | Typical shaft output | Output power | | Rated input current | Estimated power loss at max load [1] | Output frequency [2] | Max. external input mains fuses [A] [2] | Weight, kg (lbs) [2] | | | Beginning with [3] | VLT® 6-Pulse | | | VLT® 12-Pulse | VLT® Low Harmonic Drive |
| | [A] | | [kW] | [kVA] | | [A] | [W] | | | | | | | | | | | |
| | Con. $I_{VLT,N}$ | Inter. $I_{VLT,Max}$ (60 s) [4] | | Con. | Inter. (60 s) | | | Hz | | IP00 | IP20 | IP21/IP54 | | IP00 | IP20 | IP21/IP54 | | |
| 400 V motor nominal voltage (380-440 V) | 177 | 266 | 90 | 123 | 185 | 171 | 2031 | 0-590 | 315 | 234 (516) | 62 (135) | 62 (135) | FC-202N110T4 | | D3h | D1h/D5h/D6h | | |
| | 212 | 318 | 110 | 147 | 220 | 204 | 2289 | | 350 | | | | FC-202N132T4 | | D3h | D1h/D5h/D6h | | |
| | 260 | 390 | 132 | 180 | 270 | 251 | 2923 | | 400 | | | | FC-202N160T4 | | D3h | D1h/D5h/D6h | | D1n |
| | 315 | 473 | 160 | 218 | 327 | 304 | 3093 | | 550 | | 125 (275) | 125 (275) | FC-202N200T4 | | D4h | D2h/D7h/D8h | | D2n |
| | 395 | 593 | 200 | 274 | 411 | 381 | 4039 | | 630 | | | | FC-202N250T4 | | D4h | D2h/D7h/D8h | | D2n |
| | 480 | 720 | 250 | 333 | 500 | 463 | 5005 | | 800 | | | | FC-202P315T4 | | D4h | D2h/D7h/D8h | F8/F9 | E9 |
| | 600 | 900 | 315 | 416 | 624 | 590 | 6794 | | 900 | 234 (516) | | 270 (595) | FC-202P355T4 | E2 | | E1 | F8/F9 | E9 |
| | 658 | 987 | 355 | 456 | 684 | 647 | 7498 | | | 236 (520) | | 272 (600) | FC-202P400T4 | E2 | | E1 | F8/F9 | E9 |
| | 695 | 1043 | 400 | 482 | 722 | 684 | 7976 | | | 277 (611) | | 313 (690) | FC-202P450T4 | E2 | | E1 | F8/F9 | E9 |
| | 800 | 1200 | 450 | 554 | 831 | 779 | 9031 | | 1600 | | | 1045 (2300)/ 1364 (3000) | FC-202P500T4 | | | F1/F3 | F10/F11 | F18 |
| | 880 | 1320 | 500 | 610 | 915 | 857 | 10146 | | | | | | FC-202P560T4 | | | F1/F3 | F10/F11 | F18 |
| | 990 | 1485 | 560 | 686 | 1029 | 964 | 10649 | | 2000 | | | | FC-202P630T4 | | | F1/F3 | F10/F11 | F18 |
| | 1120 | 1680 | 630 | 776 | 1164 | 1090 | 12490 | | | | | | FC-202P710T4 | | | F1/F3 | F10/F11 | F18 |
| | 1260 | 1890 | 710 | 873 | 1309 | 1227 | 14244 | | 2500 | | | 1293 (2850)/ 1633 (3600) | FC-202P800T4 | | | F2/F4 | F12/F13 | |
| | 1460 | 2190 | 800 | 1012 | 1517 | 1422 | 15466 | | | | | | FC-202P1M0T4 | | | F2/F4 | F12/F13 | |
| 460 V motor nominal voltage (441-480 V) | 160 | 240 | 125 hp | 127 | 191 | 158 | 1828 | 0-590 | 315 | 234 (516) | 62 (135) | 62 (135) | FC-202N110T4 | | D3h | D1h/D5h/D6h | | |
| | 190 | 285 | 150 hp | 151 | 227 | 183 | 2051 | | 350 | | | | FC-202N132T4 | | D3h | D1h/D5h/D6h | | |
| | 240 | 360 | 200 hp | 191 | 287 | 231 | 2689 | | 400 | | | | FC-202N160T4 | | D3h | D1h/D5h/D6h | | D1n |
| | 302 | 453 | 250 hp | 241 | 362 | 291 | 2872 | | 550 | | 125 (275) | 125 (275) | FC-202N200T4 | | D4h | D2h/D7h/D8h | | D2n |
| | 361 | 542 | 300 hp | 288 | 432 | 348 | 3575 | | 630 | | | | FC-202N250T4 | | D4h | D2h/D7h/D8h | | D2n |
| | 443 | 665 | 350 hp | 353 | 530 | 436 | 4458 | | 800 | | | | FC-202P315T4 | | D4h | D2h/D7h/D8h | F8/F9 | E9 |
| | 540 | 810 | 450 hp | 430 | 645 | 531 | 6118 | | 900 | 234 (516) | | 270 (595) | FC-202P355T4 | E2 | | E1 | F8/F9 | E9 |
| | 590 | 885 | 500 hp | 470 | 705 | 580 | 6672 | | | 236 (520) | | 272 (600) | FC-202P400T4 | E2 | | E1 | F8/F9 | E9 |
| | 678 | 1017 | 550 hp | 540 | 810 | 667 | 7814 | | | 277 (611) | | 313 (690) | FC-202P450T4 | E2 | | E1 | F8/F9 | E9 |
| | 730 | 1095 | 600 hp | 582 | 872 | 711 | 8212 | | 1600 | | | 1045 (2300)/ 1364 (3000) | FC-202P500T4 | | | F1/F3 | F10/F11 | F18 |
| | 780 | 1170 | 650 hp | 621 | 932 | 759 | 8860 | | | | | | FC-202P560T4 | | | F1/F3 | F10/F11 | F18 |
| | 890 | 1335 | 750 hp | 709 | 1064 | 867 | 9414 | | 2000 | | | | FC-202P630T4 | | | F1/F3 | F10/F11 | F18 |
| | 1050 | 1575 | 900 hp | 837 | 1255 | 1022 | 11581 | | | | | | FC-202P710T4 | | | F1/F3 | F10/F11 | F18 |
| | 1160 | 1740 | 1000 hp | 924 | 1386 | 1129 | 13005 | | 2500 | | | 1293 (2850)/ 1633 (3600) | FC-202P800T4 | | | F2/F4 | F10/F11 | |
| | 1380 | 2070 | 1200 hp | 1100 | 1649 | 1344 | 14556 | | | | | | FC-202P1M0T4 | | | F2/F4 | F10/F11 | |

***Consult factory for higher output drives***

[1] *Does not apply to VLT® Low Harmonic Drive.*
[2] *VLT® 6-Pulse only. Please see VLT® 12-Pulse and VLT® Low Harmonic Drives dimension tables..*
[3] *See pages 70 to 71 for the complete type code.*
[4] *Intermittent duty rated for 110% of continuous current for normal overload*
[5] *Drive defaults to normal overload. High overload is an optional software setting.*

# VLT® AQUA Drive (FC 202) 380-480 V AC– Normal overload

| Normal overload | | | | | | | | | | | | Type code | Enclosure size & ingress protection rating | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Output current | | Typical shaft output | Output power | | Rated input current | Estimated power loss at max load [1] | Output frequency [2] | Max. external input mains fuses [A] [2] | Weight, kg (lbs) [2] | | | Beginning with [3] | VLT® 6-Pulse | | | VLT® 12-Pulse | VLT® Low Harmonic Drive |
| [A] | | [kW] | [kVA] | | [A] | [W] | | | | | | | | | | | |
| Con. $I_{VLT,N}$ | Inter. $I_{VLT,Max}$ (60 s) [4] | | Con. | Inter. (60 s) | | | Hz | | IP00 | IP20 | IP21/IP54 | | IP00 | IP20 | IP21/IP54 | | |
| 212 | 233 | 110 | 147 | 162 | 204 | 2555 | 0-590 | 315 | | 62 (135) | 62 (135) | FC-202N110T4 | | D3h | D1h/D5h/D6h | | |
| 260 | 286 | 132 | 180 | 198 | 251 | 2949 | | 350 | | | | FC-202N132T4 | | D3h | D1h/D5h/D6h | | |
| 315 | 347 | 160 | 218 | 240 | 304 | 3764 | | 400 | | | | FC-202N160T4 | | D3h | D1h/D5h/D6h | | D2n |
| 395 | 435 | 200 | 274 | 301 | 381 | 4109 | | 550 | | 125 (275) | 125 (275) | FC-202N200T4 | | D4h | D2h/D7h/D8h | | D2n |
| 480 | 528 | 250 | 333 | 366 | 463 | 5129 | | 630 | | | | FC-202N250T4 | | D4h | D2h/D7h/D8h | | D2n |
| 588 | 647 | 315 | 407 | 448 | 567 | 6663 | | 800 | | | | FC-202N315T4 | | D4h | D2h/D7h/D8h | | |
| 600 | 660 | 315 | 416 | 457 | 590 | 6705 | | 700 | 221 (487) | | 263 (580) | FC-202P315T4 | | | | F8/F9 | E9 |
| 658 | 724 | 355 | 456 | 501 | 647 | 7532 | | 900 | 234 (516) | | 270 (595) | FC-202P355T4 | E2 | | E1 | F8/F9 | E9 |
| 745 | 820 | 400 | 516 | 568 | 733 | 8677 | | | 236 (520) | | 272 (600) | FC-202P400T4 | E2 | | E1 | F8/F9 | E9 |
| 800 | 880 | 450 | 554 | 610 | 787 | 9473 | | | 277 (611) | | 313 (690) | FC-202P450T4 | E2 | | E1 | F8/F9 | E9 |
| 880 | 968 | 500 | 610 | 671 | 857 | 10162 | | 2000 | | | 1045 (2300)/ 1364 (3000) | FC-202P500T4 | | | F1/F3 | F10/F11 | F18 |
| 990 | 1089 | 560 | 686 | 754 | 964 | 11822 | | | | | | FC-202P560T4 | | | F1/F3 | F10/F11 | F18 |
| 1120 | 1232 | 630 | 776 | 854 | 1090 | 12512 | | | | | | FC-202P630T4 | | | F1/F3 | F10/F11 | F18 |
| 1260 | 1386 | 710 | 873 | 960 | 1227 | 14674 | | | | | | FC-202P710T4 | | | F1/F3 | F10/F11 | F18 |
| 1460 | 1606 | 800 | 1012 | 1113 | 1422 | 17293 | | | | | 1293 (2850)/ 1633 (3600) | FC-202P800T4 | | | F2/F4 | F12/F13 | |
| 1720 | 1892 | 1000 | 1192 | 1311 | 1675 | 19278 | | 2500 | | | | FC-202P1M0T4 | | | F2/F4 | F12/F13 | |
| 190 | 209 | 150 hp | 151 | 167 | 185 | 2257 | 0-590 | 315 | | 62 (135) | 62 (135) | FC-202N110T4 | | D3h | D1h/D5h/D6h | | |
| 240 | 264 | 200 hp | 191 | 210 | 231 | 2719 | | 350 | | | | FC-202N132T4 | | D3h | D1h/D5h/D6h | | |
| 302 | 332 | 250 hp | 241 | 265 | 291 | 3622 | | 400 | | | | FC-202N160T4 | | D3h | D1h/D5h/D6h | | D2n |
| 361 | 397 | 300 hp | 288 | 316 | 348 | 3561 | | 550 | | 125 (275) | 125 (275) | FC-202N200T4 | | D4h | D2h/D7h/D8h | | D2n |
| 443 | 487 | 350 hp | 353 | 388 | 427 | 4558 | | 630 | | | | FC-202N250T4 | | D4h | D2h/D7h/D8h | | D2n |
| 535 | 588 | 450 hp | 426 | 469 | 516 | 5703 | | 800 | | | | FC-202N315T4 | | D4h | D2h/D7h/D8h | | |
| 540 | 594 | 450 hp | 430 | 473 | 531 | 5930 | | 700 | 221 (487) | | 263 (580) | FC-202P315T4 | | | | F8/F9 | E9 |
| 590 | 649 | 500 hp | 470 | 517 | 580 | 6724 | | 900 | 234 (516) | | 270 (595) | FC-202P355T4 | E2 | | E1 | F8/F9 | E9 |
| 678 | 746 | 550/ 600 hp | 540 | 594 | 667 | 7819 | | | 236 (520) | | 272 (600) | FC-202P400T4 | E2 | | E1 | F8/F9 | E9 |
| 730 | 803 | 600 hp | 582 | 640 | 718 | 8527 | | | 277 (611) | | 313 (690) | FC-202P450T4 | E2 | | E1 | F8/F9 | E9 |
| 780 | 858 | 650 hp | 621 | 684 | 759 | 8876 | | 2000 | | | 1045 (2300)/ 1364 (3000) | FC-202P500T4 | | | F1/F3 | F10/F11 | F18 |
| 890 | 979 | 750 hp | 709 | 780 | 867 | 10424 | | | | | | FC-202P560T4 | | | F1/F3 | F10/F11 | F18 |
| 1050 | 1155 | 900 hp | 837 | 920 | 1022 | 11595 | | | | | | FC-202P630T4 | | | F1/F3 | F10/F11 | F18 |
| 1160 | 1276 | 1000 hp | 924 | 1017 | 1129 | 13213 | | | | | | FC-202P710T4 | | | F1/F3 | F10/F11 | F18 |
| 1380 | 1518 | 1200 hp | 1100 | 1209 | 1344 | 16229 | | | | | 1293 (2850)/ 1633 (3600) | FC-202P800T4 | | | F2/F4 | F12/F13 | |
| 1530 | 1683 | 1350 hp | 1219 | 1341 | 1490 | 16624 | | 2500 | | | | FC-202P1M0T4 | | | F2/F4 | F12/F13 | |

400 V motor nominal voltage (380-440 V)

460 V motor nominal voltage (441-480 V)

***Consult factory for higher output drives***

1) *Does not apply to VLT® Low Harmonic Drive.*
2) *VLT® 6-Pulse only. Please see VLT® 12-Pulse and VLT® Low Harmonic Drives dimension tables..*
3) *See pages 70 to 71 for the complete type code.*
4) *Intermittent duty rated for 110% of continuous current for normal overload*

# VLT® AQUA Drive (FC 202) 525-690 V AC – High overload [5]

| | High overload [5] | | | | | | | | | | | Type code | Enclosure size & ingress protection rating | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Output current | | Typical shaft output | Output power | | Rated input current | Estimated power loss at max load [1] | Output frequency [1] 6-Pulse only | Max. external input mains fuses [A] [1] | Weight, kg (lbs) [1] | | | Beginning with [2] | VLT® 6-Pulse | | | VLT® 12-Pulse |
| | [A] | | [kW] | [kVA] | | [A] | [W] | Hz | | IP00 | IP20 | IP21/IP54 | | IP00 | IP20 | IP21/IP54 | |
| | Cont. $I_{VLT,N}$ | Inter. $I_{VLT,MAX}$ (60 s) [4] | | Con. | Inter. (60 s) | | | | | | | | | | | | |
| 525 V motor nominal voltage (525-550 V) | 76 | 122 | 45 | 72 | 108 | 77 | 1018 | 0-590 | 160 | | 62 (135) | 62 (135) | FC-202N75KT7 | | D3h | D1h/D5h/D6h | |
| | 90 | 135 | 55 | 86 | 129 | 89 | 1162 | | 200 | | | | FC-202N90KT7 | | D3h | D1h/D5h/D6h | |
| | 113 | 170 | 75 | 108 | 161 | 110 | 1430 | | | | | | FC-202N110T7 | | D3h | D1h/D5h/D6h | |
| | 137 | 206 | 90 | 131 | 196 | 130 | 1742 | | 315 | | | | FC-202N132T7 | | D3h | D1h/D5h/D6h | |
| | 162 | 243 | 110 | 154 | 231 | 158 | 2080 | | | | | | FC-202N160T7 | | D3h | D1h/D5h/D6h | |
| | 201 | 302 | 132 | 191 | 287 | 198 | 2361 | | 550 | | 125 (275) | 125 (275) | FC-202N200T7 | | D4h | D2h/D7h/D8h | |
| | 253 | 380 | 160 | 241 | 362 | 245 | 3012 | | | | | | FC-202N250T7 | | D4h | D2h/D7h/D8h | |
| | 303 | 455 | 200 | 289 | 433 | 299 | 3642 | | | | | | FC-202N315T7 | | D4h | D2h/D7h/D8h | |
| | 360 | 540 | 250 | 343 | 514 | 355 | 4146 | | | | | | FC-202N400T7 | | D4h | D2h/D7h/D8h | |
| | 395 | 593 | 300 | 376 | 564 | 381 | 4424 | 0-500 | 700 | 221 (487) | | 263 (580) | FC-202P450T7 | E2 | | E1 | F8/F9 |
| | 429 | 644 | 315 | 409 | 613 | 413 | 4795 | | | | | | FC-202P500T7 | E2 | | E1 | F8/F9 |
| | 523 | 785 | 400 | 498 | 747 | 504 | 6493 | | 900 | 221 (487) | | 272 (600) | FC-202P560T7 | E2 | | E1 | F8/F9 |
| | 596 | 894 | 450 | 568 | 852 | 574 | 7383 | | | | | 313 (690) | FC-202P630T7 | E2 | | E1 | F8/F9 |
| | 659 | 989 | 500 | 628 | 942 | 642 | 8075 | | 1600 | | | 1045 (2300)/ 1364 (3000) | FC-202P710T7 | | | F1/F3 | F10/F11 |
| | 763 | 1145 | 560 | 727 | 1090 | 743 | 9165 | | | | | | FC-202P800T7 | | | F1/F3 | F10/F11 |
| | 889 | 1334 | 670 | 847 | 1270 | 866 | 10860 | | | | | | FC-202P900T7 | | | F1/F3 | F10/F11 |
| | 988 | 1482 | 750 | 941 | 1412 | 962 | 12062 | | | | | 1260 (2778)/ 1561 (3441) | FC-202P1M0T7 | | | F2/F4 | F12/13 |
| | 1108 | 1662 | 850 | 1056 | 1583 | 1079 | 13269 | | 2000 | | | | FC-202P1M2T7 | | | F2/F4 | F12/13 |
| | 1317 | 1976 | 1000 | 1255 | 1381 | 1282 | 18536 | | 2500 | | | 1294 (2853) / 1595 (3516) | FC-202P1M4T7 | | | F2/F4 | F12/13 |
| 575 V motor nominal voltage (551-690 V) | 73 | 117 | 75 hp | 73 | 110 | 74 | 1018 | 0-590 | 160 | | 62 (135) | 62 (135) | FC-202N75KT7 | | D3h | D1h/D5h/D6h | |
| | 86 | 129 | 100 hp | 86 | 129 | 85 | 1162 | | 200 | | | | FC-202N90KT7 | | D3h | D1h/D5h/D6h | |
| | 108 | 162 | 125 hp | 108 | 161 | 106 | 1430 | | | | | | FC-202N110T7 | | D3h | D1h/D5h/D6h | |
| | 131 | 197 | 150 hp | 130 | 196 | 124 | 1800 | | 315 | | | | FC-202N132T7 | | D3h | D1h/D5h/D6h | |
| | 155 | 233 | 200 hp | 154 | 232 | 151 | 2159 | | | | | | FC-202N160T7 | | D3h | D1h/D5h/D6h | |
| | 192 | 288 | 250 hp | 191 | 287 | 189 | 2446 | | 550 | | 125 (275) | 125 (275) | FC-202N200T7 | | D4h | D2h/D7h/D8h | |
| | 242 | 363 | 300 hp | 241 | 362 | 234 | 3123 | | | | | | FC-202N250T7 | | D4h | D2h/D7h/D8h | |
| | 290 | 435 | 350 hp | 289 | 433 | 286 | 3771 | | | | | | FC-202N315T7 | | D4h | D2h/D7h/D8h | |
| | 344 | 516 | 400 hp | 343 | 516 | 339 | 4258 | | | | | | FC-202N400T7 | | D4h | D2h/D7h/D8h | |
| | 380 | 570 | 400 hp | 398 | 568 | 366 | 4424 | 0-500 | 700 | 221 (487) | | 263 (580) | FC-202P450T7 | E2 | | E1 | F8/F9 |
| | 410 | 615 | 500 hp | 448 | 612 | 395 | 4795 | | | | | | FC-202P500T7 | E2 | | E1 | F8/F9 |
| | 500 | 750 | 600 hp | 498 | 747 | 482 | 6493 | | 900 | 236 (520) | | 272 (600) | FC-202P560T7 | E2 | | E1 | F8/F9 |
| | 570 | 855 | 650 hp | 568 | 852 | 549 | 7383 | | | 277 (611) | | 313 (690) | FC-202P630T7 | E2 | | E1 | F8/F9 |
| | 630 | 945 | 750 hp | 627 | 941 | 613 | 8075 | | 1600 | | | 1045 (2300)/ 1364 (3000) | FC-202P710T7 | | | F1/F3 | F10/F11 |
| | 730 | 1095 | 950 hp | 727 | 1091 | 711 | 9165 | | | | | | FC-202P800T7 | | | F1/F3 | F10/F11 |
| | 850 | 1275 | 1050 hp | 847 | 1270 | 828 | 10860 | | | | | | FC-202P900T7 | | | F1/F3 | F10/F11 |
| | 945 | 1418 | 1150 hp | 941 | 1412 | 920 | 12062 | | | | | 1260 (2778)/ 1561 (3441) | FC-202P1M0T7 | | | F2/F4 | F12/13 |
| | 1060 | 1590 | 1350 hp | 1056 | 1584 | 1032 | 13269 | | 2000 | | | | FC-202P1M2T7 | | | F2/F4 | F12/13 |
| | 1260 | 1890 | 1550 hp | 1255 | 1381 | 1227 | 18536 | | 2500 | | | 1294 (2853)/ 1595 (3516) | FC-202P1M4T7 | | | F2/F4 | F12/13 |
| 690 V motor nominal voltage (551-690 V) | 73 | 110 | 75 | 87 | 131 | 77 | 1057 | 0-590 | 160 | | 62 (135) | 62 (135) | FC-202N75KT7 | | D3h | D1h/D5h/D6h | |
| | 86 | 129 | 90 | 103 | 155 | 87 | 1205 | | 200 | | | | FC-202N90KT7 | | D3h | D1h/D5h/D6h | |
| | 108 | 162 | 110 | 129 | 194 | 109 | 1480 | | | | | | FC-202N110T7 | | D3h | D1h/D5h/D6h | |
| | 131 | 197 | 132 | 157 | 235 | 128 | 1800 | | 315 | | | | FC-202N132T7 | | D3h | D1h/D5h/D6h | |
| | 155 | 233 | 160 | 185 | 278 | 155 | 2159 | | | | | | FC-202N160T7 | | D3h | D1h/D5h/D6h | |
| | 192 | 188 | 200 | 229 | 344 | 197 | 2446 | | 550 | | 125 (275) | 125 (275) | FC-202N200T7 | | D4h | D2h/D7h/D8h | |
| | 242 | 363 | 250 | 289 | 434 | 240 | 3123 | | | | | | FC-202N250T7 | | D4h | D2h/D7h/D8h | |
| | 290 | 435 | 315 | 347 | 520 | 296 | 3771 | | | | | | FC-202N315T7 | | D4h | D2h/D7h/D8h | |
| | 344 | 516 | 400 | 411 | 617 | 352 | 4258 | | | | | | FC-202N400T7 | | D4h | D2h/D7h/D8h | |
| | 400 | 570 | 450 | 454 | 681 | 366 | 4589 | 0-500 | 700 | 221 (487) | | 263 (580) | FC-202P450T7 | E2 | | E1 | F8/F9 |
| | 450 | 615 | 500 | 490 | 735 | 395 | 4970 | | | | | | FC-202P500T7 | E2 | | E1 | F8/F9 |
| | 500 | 750 | 560 | 598 | 896 | 482 | 6707 | | 900 | 236 (520) | | 272 (600) | FC-202P560T7 | E2 | | E1 | F8/F9 |
| | 570 | 855 | 630 | 681 | 1022 | 549 | 7633 | | | 277 (611) | | 313 (690) | FC-202P630T7 | E2 | | E1 | F8/F9 |
| | 630 | 945 | 710 | 753 | 1129 | 613 | 8388 | | 1600 | | | 1045 (2300)/ 1364 (3000) | FC-202P710T7 | | | F1/F3 | F10/F11 |
| | 730 | 1095 | 800 | 872 | 1309 | 711 | 9537 | | | | | | FC-202P800T7 | | | F1/F3 | F10/F11 |
| | 850 | 1275 | 900 | 1016 | 1524 | 828 | 11291 | | | | | | FC-202P900T7 | | | F1/F3 | F10/F11 |
| | 945 | 1418 | 1000 | 1129 | 1694 | 920 | 12542 | | | | | 1260 (2778)/ 1561 (3441) | FC-202P1M0T7 | | | F2/F4 | F12/13 |
| | 1060 | 1590 | 1200 | 1267 | 1900 | 1032 | 13801 | | 2000 | | | | FC-202P1M2T7 | | | F2/F4 | F12/13 |
| | 1260 | 1890 | 1400 | 1506 | 2259 | 1227 | 16719 | | 2500 | | | 1294 (2853)/ 1595 (3516) | FC-202P1M4T7 | | | F2/F4 | F12/13 |

***Consult factory for higher output drives***

[1] *VLT® 6-Pulse only. Please see VLT® 12-Pulse and VLT® Low Harmonic Drives dimension tables.*
[2] *See pages 70 to 71 for the complete type code.*
[4] *Intermittent duty rated for 110% of continuous current for normal overload*
[5] *Drive defaults to normal overload. High overload is an optional software setting.*

# VLT® AQUA Drive (FC 202) 525-690 V AC – Normal overload

| Normal overload | | | | | | | | | | | | Type code | Enclosure size & ingress protection rating | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Output current | | Typical shaft output | Output power | | Rated input current | Estimated power loss at max load [1] | Output frequency [1] 6-Pulse only | Max. external input mains fuses [A] [1] | Weight, kg (lbs) [1] | | | Beginning with [1] | VLT® 6-Pulse | | | | VLT® 12-Pulse |
| [A] | | [kW] | [kVA] | | [A] | [W] | Hz | | IP00 | IP20 | IP21/IP54 | | IP00 | IP20 | IP21/IP54 | | |
| Cont. $I_{VLT,N}$ | Inter. $I_{VLT,MAX}$ (60 s) [4] | | Con. | Inter. (60 s) | | | | | | | | | | | | | |
| 90 | 99 | 55 | 86 | 95 | 89 | 1162 | 0-590 | 200 | | 62 (135) | 62 (135) | FC-202N75KT7 | | D3h | D1h/D5h/D6h | | 525 V motor nominal voltage (525-550 V) |
| 113 | 124 | 75 | 108 | 119 | 110 | 1428 | | | | | | FC-202N90KT7 | | D3h | D1h/D5h/D6h | | |
| 137 | 151 | 90 | 131 | 144 | 130 | 1739 | | 250 | | | | FC-202N110T7 | | D3h | D1h/D5h/D6h | | |
| 162 | 178 | 110 | 154 | 170 | 158 | 2099 | | 315 | | | | FC-202N132T7 | | D3h | D1h/D5h/D6h | | |
| 201 | 221 | 132 | 191 | 211 | 198 | 2646 | | 350 | | | | FC-202N160T7 | | D3h | D1h/D5h/D6h | | |
| 253 | 278 | 160 | 241 | 265 | 245 | 3071 | | | | 125 (275) | 125 (275) | FC-202N200T7 | | D4h | D2h/D7h/D8h | | |
| 303 | 333 | 200 | 289 | 318 | 299 | 3719 | | 400 | | | | FC-202N250T7 | | D4h | D2h/D7h/D8h | | |
| 360 | 396 | 250 | 343 | 377 | 355 | 4460 | | 500 | | | | FC-202N315T7 | | D4h | D2h/D7h/D8h | | |
| 418 | 460 | 315 | 398 | 438 | 408 | 5023 | 0-500 | 550 | | | | FC-202N400T7 | | D4h | D2h/D7h/D8h | | |
| 470 | 517 | 355 | 448 | 493 | 453 | 5323 | | | 221 (487) | | 263 (580) | FC-202P450T7 | E2 | | E1 | F8/F9 | |
| 523 | 575 | 400 | 498 | 548 | 504 | 6010 | | 700 | | | | FC-202P500T7 | E2 | | E1 | F8/F9 | |
| 596 | 656 | 450 | 568 | 625 | 574 | 7395 | | | 236 (520) | | 272 (600) | FC-202P560T7 | E2 | | E1 | F8/F9 | |
| 630 | 693 | 500 | 600 | 660 | 607 | 8209 | | 900 | 277 (611) | | 313 (690) | FC-202P630T7 | E2 | | E1 | F8/F9 | |
| 763 | 839 | 560 | 727 | 800 | 743 | 9500 | | | | | 1045 (2300)/ 1364 (3000) | FC-202P710T7 | | | F1/F3 | F10/F11 | |
| 889 | 978 | 670 | 847 | 932 | 866 | 10872 | | | | | | FC-202P800T7 | | | F1/F3 | F10/F11 | |
| 988 | 1087 | 750 | 941 | 1035 | 962 | 12316 | | | | | | FC-202P900T7 | | | F1/F3 | F10/F11 | |
| 1108 | 1219 | 850 | 1056 | 1161 | 1079 | 13731 | | 2000 | | | 1260 (2778)/ 1561 (3441) | FC-202P1M0T7 | | | F2/F4 | F12/F13 | |
| 1317 | 1449 | 1000 | 1255 | 1380 | 1282 | 16190 | | | | | | FC-202P1M2T7 | | | F2/F4 | F12/F13 | |
| 1479 | 1627 | 1100 | 1409 | 1550 | 1440 | 18536 | | | | | 1294 (2853)/ 1595 (3516) | FC-202P1M4T7 | | | F2/F4 | F12/F13 | |
| 86 | 95 | 75 hp | 86 | 95 | 85 | 1162 | 0-590 | 200 | | 62 (135) | 62 (135) | FC-202N75KT7 | | D3h | D1h/D5h/D6h | | 575 V motor nominal voltage (551-690 V) |
| 108 | 119 | 100 hp | 108 | 119 | 106 | 1428 | | | | | | FC-202N90KT7 | | D3h | D1h/D5h/D6h | | |
| 131 | 144 | 125 hp | 130 | 144 | 124 | 1739 | | 250 | | | | FC-202N110T7 | | D3h | D1h/D5h/D6h | | |
| 155 | 171 | 150 hp | 154 | 170 | 151 | 2099 | | 315 | | | | FC-202N132T7 | | D3h | D1h/D5h/D6h | | |
| 192 | 211 | 200 hp | 191 | 210 | 189 | 2646 | | 350 | | | | FC-202N160T7 | | D3h | D1h/D5h/D6h | | |
| 242 | 266 | 250 hp | 241 | 265 | 234 | 3071 | | | | 125 (275) | 125 (275) | FC-202N200T7 | | D4h | D2h/D7h/D8h | | |
| 290 | 319 | 300 hp | 289 | 318 | 286 | 3719 | | 400 | | | | FC-202N250T7 | | D4h | D2h/D7h/D8h | | |
| 344 | 378 | 350 hp | 343 | 377 | 339 | 4460 | | 500 | | | | FC-202N315T7 | | D4h | D2h/D7h/D8h | | |
| 400 | 440 | 400 hp | 398 | 438 | 390 | 5023 | 0-500 | 550 | | | | FC-202N400T7 | | D4h | D2h/D7h/D8h | | |
| 450 | 495 | 450 hp | 448 | 493 | 434 | 5323 | | | 221 (487) | | 263 (580) | FC-202P450T7 | E2 | | E1 | F8/F9 | |
| 500 | 550 | 500 hp | 498 | 548 | 482 | 6010 | | 700 | | | | FC-202P500T7 | E2 | | E1 | F8/F9 | |
| 570 | 627 | 600 hp | 568 | 624 | 549 | 7395 | | | 236 (520) | | 272 (600) | FC-202P560T7 | E2 | | E1 | F8/F9 | |
| 630 | 693 | 650 hp | 627 | 690 | 607 | 8209 | | 900 | 277 (611) | | 313 (690) | FC-202P630T7 | E2 | | E1 | F8/F9 | |
| 730 | 803 | 750 hp | 727 | 800 | 711 | 9500 | | | | | 1045 (2300)/ 1364 (3000) | FC-202P710T7 | | | F1/F3 | F10/F11 | |
| 850 | 935 | 950 hp | 847 | 931 | 828 | 10872 | | | | | | FC-202P800T7 | | | F1/F3 | F10/F11 | |
| 945 | 1040 | 1050 hp | 941 | 1035 | 920 | 12316 | | | | | | FC-202P900T7 | | | F1/F3 | F10/F11 | |
| 1060 | 1166 | 1150 hp | 1056 | 1161 | 1032 | 13731 | | 2000 | | | 1260 (2778)/ 1561(3441) | FC-202P1M0T7 | | | F2/F4 | F12/F13 | |
| 1260 | 1386 | 1350 hp | 1255 | 1380 | 1227 | 16190 | | | | | | FC-202P1M2T7 | | | F2/F4 | F12/F13 | |
| 1415 | 1557 | 1550 hp | 1409 | 1550 | 1378 | 18536 | | | | | 1294 (2853)/ 1595 (3516) | FC-202P1M4T7 | | | F2/F4 | F12/F13 | |
| 86 | 95 | 75 | 103 | 113 | 87 | 1204 | 0-590 | 200 | | 62 (135) | 62 (135) | FC-202N75KT7 | | D3h | D1h/D5h/D6h | | 690 V motor nominal voltage (551-690 V) |
| 108 | 119 | 90 | 129 | 142 | 109 | 1477 | | | | | | FC-202N90KT7 | | D3h | D1h/D5h/D6h | | |
| 131 | 144 | 110 | 157 | 172 | 128 | 1796 | | 250 | | | | FC-202N110T7 | | D3h | D1h/D5h/D6h | | |
| 155 | 171 | 132 | 185 | 204 | 155 | 2165 | | 315 | | | | FC-202N132T7 | | D3h | D1h/D5h/D6h | | |
| 192 | 211 | 160 | 229 | 252 | 197 | 2738 | | 350 | | | | FC-202N160T7 | | D3h | D1h/D5h/D6h | | |
| 242 | 266 | 200 | 289 | 318 | 240 | 3172 | | | | 125 (275) | 125 (275) | FC-202N200T7 | | D4h | D2h/D7h/D8h | | |
| 290 | 319 | 250 | 347 | 381 | 296 | 3848 | | 400 | | | | FC-202N250T7 | | D4h | D2h/D7h/D8h | | |
| 344 | 378 | 315 | 411 | 452 | 352 | 4610 | | 500 | | | | FC-202N315T7 | | D4h | D2h/D7h/D8h | | |
| 400 | 440 | 400 | 478 | 526 | 400 | 5150 | | 550 | | | | FC-202N400T7 | | D4h | D2h/D7h/D8h | | |
| 450 | 495 | 450 | 538 | 592 | 434 | 5529 | 0-500 | | 221 (487) | | 263 (580) | FC-202P450T7 | E2 | | E1 | F8/F9 | |
| 500 | 550 | 500 | 598 | 657 | 482 | 6239 | | 700 | | | | FC-202P500T7 | E2 | | E1 | F8/F9 | |
| 570 | 627 | 560 | 681 | 749 | 549 | 7653 | | | 236 (520) | | 272 (600) | FC-202P560T7 | E2 | | E1 | F8/F9 | |
| 630 | 693 | 630 | 753 | 828 | 607 | 8495 | | 900 | 277 (611) | | 313 (690) | FC-202P630T7 | E2 | | E1 | F8/F9 | |
| 730 | 803 | 710 | 872 | 960 | 711 | 9863 | | | | | 1045 (2300)/ 1364 (3000) | FC-202P710T7 | | | F1/F3 | F10/F11 | |
| 850 | 935 | 800 | 1016 | 1117 | 828 | 11304 | | | | | | FC-202P800T7 | | | F1/F3 | F10/F11 | |
| 945 | 1040 | 900 | 1129 | 1242 | 920 | 12798 | | | | | | FC-202P900T7 | | | F1/F3 | F10/F11 | |
| 1060 | 1166 | 1000 | 1267 | 1394 | 1032 | 14250 | | 2000 | | | 1260 (2778)/ 1561 (3441) | FC-202P1M0T7 | | | F2/F4 | F12/F13 | |
| 1260 | 1386 | 1200 | 1506 | 1656 | 1227 | 16821 | | | | | | FC-202P1M2T7 | | | F2/F4 | F12/F13 | |
| 1415 | 1557 | 1400 | 1691 | 1860 | 1378 | 19247 | | | | | 1294 (2853)/ 1595 (3516) | FC-202P1M4T7 | | | F2/F4 | F12/F13 | |

***Consult factory for higher output drives***

*[1] VLT® 6-Pulse only. Please see VLT® 12-Pulse and VLT® Low Harmonic Drives dimension tables.*
*[2] See pages 70 to 71 for the complete type code.*
*[4] Intermittent duty rated for 110% of continuous current for normal overload*


Up to
68%
smaller footprint
provides ease of installation and lower material costs.

# VLT® HVAC Drive FC 102

**The VLT® HVAC Drive is built on a flexible, modular design to provide an extraordinarily versatile motor control solution. Equipped with a wide range of HVAC features, owners can achieve optimal fan and pump control, higher quality output and reduce costs related to spare parts and service, and much more.**

## Reduce costs with compact drives

A compact design and efficient heat management enable the drive to take up less space in control rooms and panels in various environments. Especially impressive is the 400 V version, which is among the smallest in its power class on the market today, and is available in an IP54 enclosure.

## Built-in EMC filters

VLT® HVAC Drive units are equipped with integrated DC link chokes and EMC filters as standard features. This enables them to reduce grid pollution and eliminate the cost and effort of fitting external EMC components and related wiring.

## HVAC Inside

Engineered specifically for use with building automation, the VLT® HVAC Drive FC 102 features intelligent HVAC functions for pumps, fans, and compressors. For more information refer to pages 40-47.

Unlike many other makes, all important components and functions are integrated as standard features:

- Built-in RFI filter compliant with EN 61800-3 category C1 (Class B limits as defined by EN 55011)
- Built-in mains interference chokes (UK 4%)
- AEO function for especially high energy savings
- USB interface
- Real time clock
- VLT® HVAC Drive in low harmonic version
- Integrated cascade controller for three fans, pumps or compressors
- Optional active and passive mains filters for additional harmonic reduction
- Optional sine-wave filter and du/dt filter for all power ratings
- RS485 serial interface
- Dimensioned for long service life
- Full mains voltage at the output
- Long motor cables may be connected (150 m shielded or 300 m unshielded)
- PTC thermistor monitoring

## EC+

The intelligent VVC+ control principle enables the use of permanent magnet motors or synchronous reluctance motors with VLT® HVAC Drive, providing efficiency equal to or better than EC technology.

Danfoss has integrated the necessary control algorithm into the existing VLT® drive series. This means that there are no changes for the operator. After entering the relevant motor data, the user benefits from the high motor efficiency of EC technology.

**Advantages of the EC+ concept**

- Free choice of motor technology: control a SynRM, PM or induction motor with the same AC drive
- Device installation and operation remain unchanged
- Manufacturer independence in the choice of all components
- Superior system efficiency thanks to a combination of individual components with optimum efficiency
- Retrofitting of existing systems is possible
- Wide range of rated powers for SynRM, PM and induction motors.

## Power range

**380-480 V**
**Normal overload:**
400 V.....212-1720 A, 110-1000 kW
460 V.....190-1530 A, 150-1350 hp

**525-690 V**
**Normal overload:**
575 V.....86-1415 A, 75-1550 hp
690 V.....86-1415 A, 75-1400 kW

## Ingress protection ratings

IP00, IP20, IP21 and IP54.

## Options

See page 61.

*For more detailed information please see the FC 100 Design Guide, MG.16.xx.yy available at http://drivesliterature.danfoss.com/*

# VLT® HVAC Drive (FC 102) 380-480 V AC – Normal overload

| | Normal overload | | | | | | | | | | | Type code | Enclosure size & ingress protection rating | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Output current | | Typical shaft output | Output power | | Rated input current | Estimated power loss at max load [1] | Output frequency [2] | Max. external input mains fuses [A] [2] | Weight, kg (lbs) [2] | | | Beginning with [3] | VLT® 6-Pulse | | | VLT® 12-Pulse | VLT® Low Harmonic Drive |
| | [A] | | [kW] | [kVA] | | [A] | [W] | | | | | | | | | | | |
| | Con. $I_{n}$ | Inter. $I_{VLT,max}$ (60 s) [4] | | Con. | Inter. (60 s) | | | Hz | | IP00 | IP20 | IP21/IP54 | | IP00 | IP20 | IP21/IP54 | | |
| 400 V motor nominal voltage (380-440 V) | 212 | 233 | 110 | 147 | 162 | 208 | 2555 | 0-590 | 315 | | 62 (135) | 62 (135) | FC-102N110T4 | | D3h | D1h/D5h/D6h | | |
| | 260 | 286 | 132 | 180 | 198 | 251 | 2949 | | 350 | | | | FC-102N132T4 | | D3h | D1h/D5h/D6h | | |
| | 315 | 347 | 160 | 218 | 240 | 304 | 3764 | | 400 | | | | FC-102N160T4 | | D3h | D1h/D5h/D6h | | D2n |
| | 395 | 435 | 200 | 274 | 301 | 381 | 4109 | | 550 | | 125 (275) | 125 (275) | FC-102N200T4 | | D4h | D2h/D7h/D8h | | D2n |
| | 480 | 528 | 250 | 333 | 366 | 463 | 5129 | | 630 | | | | FC-102N250T4 | | D4h | D2h/D7h/D8h | | D2n |
| | 588 | 647 | 315 | 407 | 448 | 567 | 6663 | | 800 | | | | FC-202N315T4 | | D4h | D2h/D7h/D8h | | |
| | 600 | 660 | 315 | 416 | 457 | 590 | 6705 | | 700 | 221 (487) | | 263 (580) | FC-102P315T4 | | | | F8/F9 | E9 |
| | 658 | 724 | 355 | 456 | 501 | 647 | 7532 | | 900 | 234 (516) | | 270 (595) | FC-102P355T4 | E2 | | E1 | F8/F9 | E9 |
| | 745 | 820 | 400 | 516 | 568 | 733 | 8677 | | | 236 (520) | | 272 (600) | FC-102P400T4 | E2 | | E1 | F8/F9 | E9 |
| | 800 | 880 | 450 | 554 | 610 | 787 | 9473 | | | 277 (611) | | 313 (690) | FC-102P450T4 | E2 | | E1 | F8/F9 | E9 |
| | 880 | 968 | 500 | 610 | 671 | 857 | 10162 | | 2000 | | | 1045 (2300)/ 1364 (3000) | FC-102P500T4 | | | F1/F3 | F10/F11 | F18 |
| | 990 | 1089 | 560 | 686 | 754 | 964 | 11822 | | | | | | FC-102P560T4 | | | F1/F3 | F10/F11 | F18 |
| | 1120 | 1232 | 630 | 776 | 854 | 1090 | 12512 | | | | | | FC-102P630T4 | | | F1/F3 | F10/F11 | F18 |
| | 1260 | 1386 | 710 | 873 | 960 | 1227 | 14674 | | | | | | FC-102P710T4 | | | F1/F3 | F10/F11 | F18 |
| | 1460 | 1606 | 800 | 1012 | 1113 | 1422 | 17293 | | | | | 1293 (2850)/ 1633 (3600) | FC-102P800T4 | | | F2/F4 | F12/F13 | |
| | 1720 | 1892 | 1000 | 1192 | 1311 | 1675 | 19278 | | 2500 | | | | FC-102P1M0T4 | | | F2/F4 | F12/F13 | |
| 460 V motor nominal voltage (441-480 V) | 190 | 209 | 150 hp | 151 | 167 | 185 | 2257 | 0-590 | 315 | | 62 (135) | 62 (135) | FC-102N110T4 | | D3h | D1h/D5h/D6h | | |
| | 240 | 264 | 200 hp | 191 | 210 | 231 | 2719 | | 350 | | | | FC-102N132T4 | | D3h | D1h/D5h/D6h | | |
| | 302 | 332 | 250 hp | 241 | 265 | 291 | 3622 | | 400 | | | | FC-102N160T4 | | D3h | D1h/D5h/D6h | | D2n |
| | 361 | 397 | 300 hp | 288 | 316 | 348 | 3561 | | 550 | | 125 (275) | 125 (275) | FC-102N200T4 | | D4h | D2h/D7h/D8h | | D2n |
| | 443 | 487 | 350 hp | 353 | 388 | 427 | 4558 | | 630 | | | | FC-102N250T4 | | D4h | D2h/D7h/D8h | | D2n |
| | 535 | 588 | 450 hp | 426 | 469 | 516 | 5703 | | 800 | | | | FC-102N315T4 | | D4h | D2h/D7h/D8h | | |
| | 540 | 594 | 450 hp | 430 | 473 | 531 | 6705 | | 700 | 221 (487) | | 263 (580) | FC-102P315T4 | | | | F8/F9 | E9 |
| | 590 | 649 | 500 hp | 470 | 517 | 580 | 6724 | | 900 | 234 (516) | | 270 (595) | FC-102P355T4 | E2 | | E1 | F8/F9 | E9 |
| | 678 | 746 | 550/ 600 hp | 540 | 594 | 667 | 7819 | | | 236 (520) | | 272 (600) | FC-102P400T4 | E2 | | E1 | F8/F9 | E9 |
| | 730 | 803 | 600 hp | 582 | 640 | 718 | 8527 | | | 277 (611) | | 313 (690) | FC-102P450T4 | E2 | | E1 | F8/F9 | E9 |
| | 780 | 858 | 650 hp | 621 | 684 | 759 | 8876 | | 2000 | | | 1045 (2300)/ 1364 (3000) | FC-102P500T4 | | | F1/F3 | F10/F11 | F18 |
| | 890 | 979 | 750 hp | 709 | 780 | 867 | 10424 | | | | | | FC-102P560T4 | | | F1/F3 | F10/F11 | F18 |
| | 1050 | 1155 | 900 hp | 837 | 920 | 1022 | 11595 | | | | | | FC-102P630T4 | | | F1/F3 | F10/F11 | F18 |
| | 1160 | 1276 | 1000 hp | 924 | 1017 | 1129 | 13213 | | | | | | FC-102P710T4 | | | F1/F3 | F10/F11 | F18 |
| | 1380 | 1518 | 1200 hp | 1100 | 1209 | 1344 | 16229 | | | | | 1293 (2850)/ 1633 (3600) | FC-102P800T4 | | | F2/F4 | F12/F13 | |
| | 1530 | 1683 | 1350 hp | 1219 | 1341 | 1490 | 16624 | | 2500 | | | | FC-102P1M0T4 | | | F2/F4 | F12/F13 | |

***Consult factory for higher output drives***

*[1] Does not apply to VLT® Low Harmonic Drive.*
*[2] VLT® 6-Pulse only. Please see VLT® 12-Pulse and VLT® Low Harmonic Drives dimension tables.*
*[4] See pages 70 to 71 for the complete type code.*
*[4] Intermittent duty rated for 110% of continuous current for normal overload*

# VLT® HVAC Drive (FC 102) 525-690 V AC – Normal overload

| Normal overload | | | | | | | | | | | Type code | Enclosure size & ingress protection rating | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Output current | | Typical shaft output | Output power | | Rated input current | Estimated power loss at max load [1] | Output frequency [1] | Max. external input mains fuses [A] [1] | Weight, kg (lbs) [1] | | | Beginning with [2] | VLT® 6-Pulse | | | VLT® 12-Pulse |
| [A] | | [kW] | [kVA] | | [A] | [W] | | | | | | | | | | |
| Cont. $I_{VLT,N}$ | Inter. $I_{VLT,MAX}$ (60 s) [4] | | Con. | Inter. (60 s) | | | Hz | | IP00 | IP20 | IP21/IP54 | | IP00 | IP20 | IP21/IP54 | |
| 90 | 99 | 55 | 86 | 95 | 89 | 1162 | 0-590 | 200 | | 62 (135) | 62 (135) | FC-102N75KT7 | | D3h | D1h/D5h/D6h | |
| 113 | 124 | 75 | 108 | 119 | 110 | 1428 | | | | | | FC-102N90KT7 | | D3h | D1h/D5h/D6h | |
| 137 | 151 | 90 | 131 | 144 | 130 | 1739 | | 250 | | | | FC-102N110T7 | | D3h | D1h/D5h/D6h | |
| 162 | 178 | 110 | 154 | 170 | 158 | 2099 | | 315 | | | | FC-102N132T7 | | D3h | D1h/D5h/D6h | |
| 201 | 221 | 132 | 191 | 211 | 198 | 2646 | | 350 | | | | FC-102N160T7 | | D3h | D1h/D5h/D6h | |
| 253 | 278 | 160 | 241 | 265 | 245 | 3071 | | | | 125 (275) | 125 (275) | FC-102N200T7 | | D4h | D2h/D7h/D8h | |
| 303 | 333 | 200 | 289 | 318 | 299 | 3719 | | 400 | | | | FC-102N250T7 | | D4h | D2h/D7h/D8h | |
| 360 | 396 | 250 | 343 | 377 | 355 | 4460 | | 500 | | | | FC-102N315T7 | | D4h | D2h/D7h/D8h | |
| 418 | 460 | 315 | 398 | 438 | 408 | 5023 | 0-500 | 550 | | | | FC-102N400T7 | | D4h | D2h/D7h/D8h | |
| 470 | 517 | 355 | 448 | 493 | 453 | 5323 | | | 221 (487) | | 263 (580) | FC-102P450T7 | E2 | | E1 | F8/F9 |
| 523 | 575 | 400 | 498 | 548 | 504 | 6010 | | 700 | | | | FC-102P500T7 | E2 | | E1 | F8/F9 |
| 596 | 656 | 450 | 568 | 625 | 574 | 7395 | | | 236 (520) | | 272 (600) | FC-102P560T7 | E2 | | E1 | F8/F9 |
| 630 | 693 | 500 | 600 | 660 | 607 | 8209 | | 900 | 277 (611) | | 313 (690) | FC-102P630T7 | E2 | | E1 | F8/F9 |
| 763 | 839 | 560 | 727 | 800 | 743 | 9500 | | | | | 1045 (2300)/ 1364 (3000) | FC-102P710T7 | | | F1/F3 | F10/F11 |
| 889 | 978 | 670 | 847 | 932 | 866 | 10872 | | | | | | FC-102P800T7 | | | F1/F3 | F10/F11 |
| 988 | 1087 | 750 | 941 | 1035 | 962 | 12316 | | | | | | FC-102P900T7 | | | F1/F3 | F10/F11 |
| 1108 | 1219 | 850 | 1056 | 1161 | 1079 | 13731 | | 2000 | | | 1260 (2778)/ 1561 (3441) | FC-102P1M0T7 | | | F2/F4 | F12/13 |
| 1317 | 1449 | 1000 | 1255 | 1380 | 1282 | 16190 | | | | | | FC-102P1M2T7 | | | F2/F4 | F12/13 |
| 1479 | 1627 | 1100 | 1409 | 1550 | 1440 | 18536 | | | | | 1294 (2853)/ 1595 (3516) | FC-102P1M4T7 | | | F2/F4 | F12/13 |
| 86 | 95 | 75 hp | 86 | 95 | 85 | 1162 | 0-590 | 200 | | 62 (135) | 62 (135) | FC-102N75KT7 | | D3h | D1h/D5h/D6h | |
| 108 | 119 | 100 hp | 108 | 119 | 106 | 1428 | | | | | | FC-102N90KT7 | | D3h | D1h/D5h/D6h | |
| 131 | 144 | 125 hp | 130 | 144 | 124 | 1739 | | 250 | | | | FC-102N110T7 | | D3h | D1h/D5h/D6h | |
| 155 | 171 | 150 hp | 154 | 170 | 151 | 2099 | | 315 | | | | FC-102N132T7 | | D3h | D1h/D5h/D6h | |
| 192 | 211 | 200 hp | 191 | 210 | 189 | 2646 | | 350 | | | | FC-102N160T7 | | D3h | D1h/D5h/D6h | |
| 242 | 266 | 250 hp | 241 | 265 | 234 | 3071 | | | | 125 (275) | 125 (275) | FC-102N200T7 | | D4h | D2h/D7h/D8h | |
| 290 | 319 | 300 hp | 289 | 318 | 286 | 3719 | | 400 | | | | FC-102N250T7 | | D4h | D2h/D7h/D8h | |
| 344 | 378 | 350 hp | 343 | 377 | 339 | 4460 | | 500 | | | | FC-102N315T7 | | D4h | D2h/D7h/D8h | |
| 400 | 440 | 400 hp | 398 | 438 | 390 | 5023 | 0-500 | 550 | | | | FC-102N400T7 | | D4h | D2h/D7h/D8h | |
| 450 | 495 | 450 hp | 448 | 493 | 434 | 5323 | | | 221 (487) | | 263 (580) | FC-102P450T7 | E2 | | E1 | F8/F9 |
| 500 | 550 | 500 hp | 498 | 548 | 482 | 6010 | | 700 | | | | FC-102P500T7 | E2 | | E1 | F8/F9 |
| 570 | 627 | 600 hp | 568 | 624 | 549 | 7395 | | | 236 (520) | | 272 (600) | FC-102P560T7 | E2 | | E1 | F8/F9 |
| 630 | 693 | 650 hp | 627 | 690 | 607 | 8209 | | 900 | 277 (611) | | 313 (690) | FC-102P630T7 | E2 | | E1 | F8/F9 |
| 730 | 803 | 750 hp | 727 | 800 | 711 | 9500 | | | | | 1045 (2300)/ 1364 (3000) | FC-102P710T7 | | | F1/F3 | F10/F11 |
| 850 | 935 | 950 hp | 847 | 931 | 828 | 10872 | | | | | | FC-102P800T7 | | | F1/F3 | F10/F11 |
| 945 | 1040 | 1050 hp | 941 | 1035 | 920 | 12316 | | | | | | FC-102P900T7 | | | F1/F3 | F10/F11 |
| 1060 | 1166 | 1150 hp | 1056 | 1161 | 1032 | 13731 | | 2000 | | | 1260 (2778)/ 1561 (3441) | FC-102P1M0T7 | | | F2/F4 | F12/F13 |
| 1260 | 1386 | 1350 hp | 1255 | 1380 | 1227 | 16190 | | | | | | FC-102P1M2T7 | | | F2/F4 | F12/F13 |
| 1415 | 1557 | 1550 hp | 1409 | 1550 | 1378 | 18536 | | | | | 1294 (2853)/ 1595 (3516) | FC-102P1M4T7 | | | F2/F4 | F12/F13 |
| 86 | 95 | 75 | 103 | 113 | 87 | 1204 | 0-590 | 200 | | 62 (135) | 62 (135) | FC-102N75KT7 | | D3h | D1h/D5h/D6h | |
| 108 | 119 | 90 | 129 | 142 | 109 | 1477 | | | | | | FC-102N90KT7 | | D3h | D1h/D5h/D6h | |
| 131 | 144 | 110 | 157 | 172 | 128 | 1796 | | 250 | | | | FC-102N110T7 | | D3h | D1h/D5h/D6h | |
| 155 | 171 | 132 | 185 | 204 | 155 | 2165 | | 315 | | | | FC-102N132T7 | | D3h | D1h/D5h/D6h | |
| 192 | 211 | 160 | 229 | 252 | 197 | 2738 | | 350 | | | | FC-102N160T7 | | D3h | D1h/D5h/D6h | |
| 242 | 266 | 200 | 289 | 318 | 240 | 3172 | | | | 125 (275) | 125 (275) | FC-102N200T7 | | D4h | D2h/D7h/D8h | |
| 290 | 319 | 250 | 347 | 381 | 296 | 3848 | | 400 | | | | FC-102N250T7 | | D4h | D2h/D7h/D8h | |
| 344 | 378 | 315 | 411 | 452 | 352 | 4610 | | 500 | | | | FC-102N315T7 | | D4h | D2h/D7h/D8h | |
| 400 | 440 | 400 | 478 | 526 | 400 | 5150 | | 550 | | | | FC-102N400T7 | | D4h | D2h/D7h/D8h | |
| 450 | 495 | 450 | 538 | 592 | 434 | 5529 | 0-500 | | 221 (487) | | 263 (580) | FC-102P450T7 | E2 | | E1 | F8/F9 |
| 500 | 550 | 500 | 598 | 657 | 482 | 6239 | | 700 | | | | FC-102P500T7 | E2 | | E1 | F8/F9 |
| 570 | 627 | 560 | 681 | 749 | 549 | 7653 | | | 236 (520) | | 272 (600) | FC-102P560T7 | E2 | | E1 | F8/F9 |
| 630 | 693 | 630 | 753 | 828 | 607 | 8495 | | 900 | 277 (611) | | 313 (690) | FC-102P630T7 | E2 | | E1 | F8/F9 |
| 730 | 803 | 710 | 872 | 960 | 711 | 9863 | | | | | 1045 (2300)/ 1364 (3000) | FC-102P710T7 | | | F1/F3 | F10/F11 |
| 850 | 935 | 800 | 1016 | 1117 | 828 | 11304 | | | | | | FC-102P800T7 | | | F1/F3 | F10/F11 |
| 945 | 1040 | 900 | 1129 | 1242 | 920 | 12798 | | | | | | FC-102P900T7 | | | F1/F3 | F10/F11 |
| 1060 | 1166 | 1000 | 1267 | 1394 | 1032 | 14250 | | 2000 | | | 1260 (2778)/ 1561 (3441) | FC-102P1M0T7 | | | F2/F4 | F12/F13 |
| 1260 | 1386 | 1200 | 1506 | 1656 | 1227 | 16821 | | | | | | FC-102P1M2T7 | | | F2/F4 | F12/F13 |
| 1415 | 1557 | 1400 | 1691 | 1860 | 1378 | 19247 | | | | | 1294 (2853)/ 1595 (3516) | FC-102P1M4T7 | | | F2/F4 | F12/F13 |

525 V motor nominal voltage (525-550 V)

575 V motor nominal voltage (551-690 V)

690 V motor nominal voltage (551-690 V)

***Consult factory for higher output drives***

1) *VLT® 6-Pulse only. Please see VLT® 12-Pulse and VLT® Low Harmonic Drives dimension tables..*
2) *See pages 70 to 71 for the complete type code.*
4) *Intermittent duty rated for 110% of continuous current for normal overload.*


## Accelerate

**system payback with best-practice speed control.**

# VLT® Refrigeration Drive FC 103

## Drive down lifecycle cost

Drive down lifecycle costs of your refrigeration systems by putting the VLT® Refrigeration Drive FC 103 to work. You win extended life and cost savings via its efficiency, reliability enhancing features and integrated process control functions.

Installation and commissioning are simple and fast. Integrated functions conserve energy and protect equipment. The robust construction is almost maintenance-free, and long life means change outs are rare – everything you need to achieve rock-bottom lifecycle cost.

The more often a drive system operates under partial load, the higher the potential savings in terms of energy and maintenance costs. With an electronic speed control system, the flow, pressure or differential pressure can be matched to the actual demand instead of running constantly at full capacity. Due to this high potential, the extra cost of an electronic speed control system can be recovered within a few months.

- **Pack control for optimal energy savings**
  Cascade configuration enables optimal interaction between compressor and drive under partial load. The base load is handled by a single compressor controlled by a VLT® Refrigeration Drive. When consumption rises, the drive starts up additional compressors one at a time. As a result, the compressors work largely at their optimum efficiency point, and the drive constantly maintains maximum energy efficiency throughout the system. The same principle also applies to drive-controlled fans and pumps.

- **Optimal operating point adjustment**
  Using VLT® Refrigeration Drive, you can save energy by ensuring the system always runs at the optimal operating point. This point, where the refrigeration system works most effectively, varies depending on system capacity utilization. Thanks to its continuously variable speed, the Danfoss VLT® drive can drive the system at exactly the optimal operating point.

- **Limit start-up current**
  Save on start-up energy consumption by avoiding start-up current peaks. Switching on equipment connected directly to the AC mains generates peak currents up to eight times greater than the rated current.
  The VLT® Refrigeration Drive limits the start-up current, so it does not exceed the rated motor current.
  In this way, the drive eliminates switch-on current peaks and avoids voltage sags due to transient heavy loading of the supply network.

## Energy-saving features

Time and energy saving features are specifically tailored to meet the needs of refrigeration compressor, condenser, evaporator, fan and pump applications. The VLT® Refrigeration Drive offers:

- Top efficiency 98%
- Automatic Energy Optimization (AEO)
- Quick menu
- Refrigeration-oriented commissioning wizard
- Multi-zone cascade controller
- Neutral zone controller
- Floating condensing temperature control
- Oil return management
- Multi-feedback evaporator control
- Sleep mode

## Life-extending features

These are just some of the ways VLT® Refrigeration Drive extends system component lifetimes:

For pump control
- Dry-running protection
- Overload protection
- Flow compensation
- For compressor control
- Built-in soft starter function
- Built-in oil return management to improve reliability
- Low and high pressure monitoring
- Reduced mechanical load
- Fewer starts & stops

For condensor fan control
- Reduced charge of refrigerant
- Less build-up of dirt on the condenser
- Floating setpoint for energy savings

## Power range

**380-480 V**
**Normal overload:**
400 V.....212-800 A, 110-450 kW,
460 V..... 190-730 A, 150-600 hp,

**525-690 V**
**Normal overload:**
575 V.....86-630 A, 75-650 hp
690 V.....86-630 A, 75-630 kW

## Ingress protection ratings

IP00, IP20, IP21 and IP54.

## Options

See page 61.

*For more detailed information please see the FC 103 Design Guide, MG.16.Gx.yy, available at http://drivesliterature.danfoss.com/*

# VLT® Refrigeration Drive (FC 103) 380-480 V AC – Normal overload

| | Normal overload | | | | | | | | | | | | Type code | Enclosure size & ingress protection rating | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Output current | | Typical shaft output | Output power | | Rated input current | Estimated power loss at max load | Output frequency | Max. external input mains fuses [A] | Weight, kg (lbs) [1] | | | Beginning with [1] | VLT® 6-Pulse | | |
| | [A] | | [kW] | [kVA] | | [A] | [W] | | | | | | | | | |
| | Con. $I_{VLT,N}$ | Inter. $I_{VLT,max}$ (60 s) [2] | | Con. | Inter. (60 s) | | | Hz | | IP00 | IP20 | IP21/IP54 | | IP00 | IP20 | IP21/IP54 |
| 400 V motor nominal voltage (380-440 V) | 212 | 233 | 110 | 147 | 162 | 208 | 2555 | 0-590 | 315 | | 62 (135) | 62 (135) | FC-103N110T4 | | D3h | D1h/D5h/D6h |
| | 260 | 286 | 132 | 180 | 198 | 251 | 2949 | | 350 | | | | FC-103N132T4 | | D3h | D1h/D5h/D6h |
| | 315 | 347 | 160 | 218 | 240 | 304 | 3764 | | 400 | | | | FC-103N160T4 | | D3h | D1h/D5h/D6h |
| | 395 | 435 | 200 | 274 | 301 | 381 | 4109 | | 550 | | 125 (275) | 125 (275) | FC-103N200T4 | | D4h | D2h/D7h/D8h |
| | 480 | 528 | 250 | 333 | 366 | 463 | 5129 | | 630 | | | | FC-103N250T4 | | D4h | D2h/D7h/D8h |
| | 600 | 660 | 315 | 416 | 457 | 590 | 6663 | | 800 | | | | FC-103P315T4 | | D4h | D2h/D7h/D8h |
| | 658 | 724 | 355 | 456 | 501 | 647 | 7532 | | 700 | 234 (516) | | 270 (595) | FC-103P355T4 | E2 | | E1 |
| | 745 | 820 | 400 | 516 | 568 | 733 | 8677 | | 900 | 236 (520) | | 272 (600) | FC-103P400T4 | E2 | | E1 |
| | 800 | 880 | 450 | 554 | 610 | 787 | 9473 | | 900 | 277 (611) | | 313 (690) | FC-103P450T4 | E2 | | E1 |
| 460 V motor nominal voltage (441-480 V) | 190 | 209 | 150 hp | 151 | 167 | 185 | 2257 | 0-590 | 315 | | 62 (135) | 62 (135) | FC-103N110T4 | | D3h | D1h/D5h/D6h |
| | 240 | 264 | 200 hp | 191 | 210 | 231 | 2719 | | 350 | | | | FC-103N132T4 | | D3h | D1h/D5h/D6h |
| | 302 | 332 | 250 hp | 241 | 265 | 291 | 3622 | | 400 | | | | FC-103N160T4 | | D3h | D1h/D5h/D6h |
| | 361 | 397 | 300 hp | 288 | 316 | 348 | 3561 | | 550 | | 125 (275) | 125 (275) | FC-103N200T4 | | D4h | D2h/D7h/D8h |
| | 443 | 487 | 350 hp | 353 | 388 | 427 | 4558 | | 630 | | | | FC-103N250T4 | | D4h | D2h/D7h/D8h |
| | 540 | 594 | 450 hp | 430 | 473 | 531 | 5703 | | 800 | | | | FC-103P315T4 | | D4h | D2h/D7h/D8h |
| | 590 | 649 | 500 hp | 470 | 517 | 580 | 6724 | | 900 | 234(516) | | 270(595) | FC-103P355T4 | E2 | | E1 |
| | 678 | 746 | 600 hp | 540 | 594 | 667 | 7819 | | 900 | 236(520) | | 272(600) | FC-103P400T4 | E2 | | E1 |
| | 730 | 803 | 600 hp | 582 | 640 | 718 | 8527 | | 900 | 277(611) | | 313(690) | FC-103P450T4 | E2 | | E1 |

***Consult factory for higher output drives***

*[1] See pages 70 to 71 for the complete type code.*
*[2] Intermittent duty rated for 110% of continuous current for normal overload.*

# VLT® Refrigeration Drive (FC 103) 525-690 V AC – Normal overload

| Normal overload | | | | | | | | | | | | Type code | Enclosure size & ingress protection rating | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Output current | | Typical shaft output | Output power | | Rated input current | Estimated power loss at max load [1] | Output frequency [1] | Max. external input mains fuses [A] [1] | Weight, kg (lbs) [1] | | | Beginning with [1] | VLT® 6-Pulse | | | |
| [A] | | [kW] | [kVA] | | [A] | [W] | | | | | | | | | | |
| Cont. $I_{N}$ | Inter. $I_{Max}$ (60 s) [2] | | Con. | Inter. (60 s) | | | Hz | | IP00 | IP20 | IP21/IP54 | | IP00 | IP20 | IP21/IP54 | |
| 90 | 99 | 55 | 86 | 95 | 89 | 1162 | 0-590 | 160 | | 62 (135) | 62 (135) | FC-103N75KT7 | | D3h | D1h/D5h/D6h | 525 V motor nominal voltage (525-550 V) |
| 113 | 124 | 75 | 108 | 119 | 110 | 1428 | | 200 | | | | FC-103N90KT7 | | D3h | D1h/D5h/D6h | |
| 137 | 151 | 90 | 131 | 144 | 130 | 1739 | | | | | | FC-103N110T7 | | D3h | D1h/D5h/D6h | |
| 162 | 178 | 110 | 154 | 170 | 158 | 2099 | | 315 | | | | FC-103N132T7 | | D3h | D1h/D5h/D6h | |
| 201 | 221 | 132 | 191 | 211 | 198 | 2646 | | 515 | | | | FC-103N160T7 | | D3h | D1h/D5h/D6h | |
| 253 | 278 | 160 | 241 | 265 | 245 | 3071 | | 550 | | 125 (275) | 125 (275) | FC-103N200T7 | | D4h | D2h/D7h/D8h | |
| 303 | 333 | 200 | 289 | 318 | 299 | 3719 | | | | | | FC-103N250T7 | | D4h | D2h/D7h/D8h | |
| 360 | 396 | 250 | 343 | 377 | 355 | 4460 | | | | | | FC-103N315T7 | | D4h | D2h/D7h/D8h | |
| 418 | 460 | 315 | 398 | 438 | 408 | 5023 | | | | | | FC-103N400T7 | | D4h | D2h/D7h/D8h | |
| 470 | 517 | 355 | 448 | 493 | 453 | 5323 | 0-500 | 700 | 221(487) | | 263 (580) | FC-103P450T7 | E2 | | E1 | |
| 523 | 575 | 400 | 498 | 548 | 504 | 6010 | | | | | | FC-103P500T7 | E2 | | E1 | |
| 596 | 656 | 450 | 568 | 625 | 574 | 7395 | | 900 | 236 (520) | | 272 (600) | FC-103P560T7 | E2 | | E1 | |
| 630 | 693 | 500 | 600 | 660 | 607 | 8209 | | | 277 (611) | | 313 (690) | FC-103P630T7 | E2 | | E1 | |
| 86 | 95 | 75 | 86 | 95 | 85 | 1162 | | 160 | | 62 (135) | 62 (135) | FC-103N75KT7 | | D3h | D1h/D5h/D6h | 575 V motor nominal voltage (551-690 V) |
| 108 | 119 | 100 | 108 | 119 | 106 | 1428 | | 200 | | | | FC-103N90KT7 | | D3h | D1h/D5h/D6h | |
| 131 | 144 | 125 | 130 | 144 | 124 | 1739 | | | | | | FC-103N110T7 | | D3h | D1h/D5h/D6h | |
| 155 | 171 | 150 | 154 | 170 | 151 | 2099 | | 315 | | | | FC-103N132T7 | | D3h | D1h/D5h/D6h | |
| 192 | 211 | 200 | 191 | 210 | 189 | 2646 | | 515 | | | | FC-103N160T7 | | D3h | D1h/D5h/D6h | |
| 242 | 266 | 250 | 241 | 265 | 234 | 3071 | | 550 | | 125 (275) | 125 (275) | FC-103N200T7 | | D4h | D2h/D7h/D8h | |
| 290 | 319 | 300 | 289 | 318 | 286 | 3719 | | | | | | FC-103N250T7 | | D4h | D2h/D7h/D8h | |
| 344 | 378 | 350 | 343 | 377 | 339 | 4460 | | | | | | FC-103N315T7 | | D4h | D2h/D7h/D8h | |
| 400 | 440 | 400 | 398 | 438 | 390 | 5023 | | | | | | FC-103N400T7 | | D4h | D2h/D7h/D8h | |
| 450 | 495 | 450 | 448 | 493 | 434 | 5323 | | 700 | 221(487) | | 263 (580) | FC-103P450T7 | E2 | | E1 | |
| 500 | 550 | 500 | 498 | 548 | 482 | 6010 | | | | | | FC-103P500T7 | E2 | | E1 | |
| 570 | 627 | 600 | 568 | 624 | 549 | 7395 | | 900 | 236 (520) | | 272 (600) | FC-103P560T7 | E2 | | E1 | |
| 630 | 693 | 650 | 627 | 690 | 607 | 8209 | | | 277 (611) | | 313 (690) | FC-103P630T7 | E2 | | E1 | |
| 86 | 95 | 75 | 103 | 113 | 87 | 1204 | | 160 | | 62 (135) | 62 (135) | FC-103N75KT7 | | D3h | D1h/D5h/D6h | 690 V motor nominal voltage (551-690 V) |
| 108 | 119 | 90 | 129 | 142 | 109 | 1477 | | 200 | | | | FC-103N90KT7 | | D3h | D1h/D5h/D6h | |
| 131 | 144 | 110 | 157 | 172 | 128 | 1796 | | | | | | FC-103N110T7 | | D3h | D1h/D5h/D6h | |
| 155 | 171 | 132 | 185 | 204 | 155 | 2165 | | 315 | | | | FC-103N132T7 | | D3h | D1h/D5h/D6h | |
| 192 | 211 | 160 | 229 | 252 | 197 | 2738 | | 515 | | | | FC-103N160T7 | | D3h | D1h/D5h/D6h | |
| 242 | 266 | 200 | 289 | 318 | 240 | 3172 | | 550 | | 125 (275) | 125 (275) | FC-103N200T7 | | D4h | D2h/D7h/D8h | |
| 290 | 319 | 250 | 347 | 381 | 296 | 3848 | | | | | | FC-103N250T7 | | D4h | D2h/D7h/D8h | |
| 344 | 378 | 315 | 411 | 452 | 352 | 4610 | | | | | | FC-103N315T7 | | D4h | D2h/D7h/D8h | |
| 400 | 440 | 400 | 478 | 526 | 400 | 5150 | | | | | | FC-103N400T7 | | D4h | D2h/D7h/D8h | |
| 450 | 495 | 450 | 538 | 592 | 434 | 5529 | | 700 | 221(487) | | 263 (580) | FC-103P450T7 | E2 | | E1 | |
| 500 | 550 | 500 | 598 | 657 | 482 | 6239 | | | | | | FC-103P500T7 | E2 | | E1 | |
| 570 | 627 | 560 | 681 | 749 | 549 | 7653 | | 900 | 236 (520) | | 272 (600) | FC-103P560T7 | E2 | | E1 | |
| 630 | 693 | 630 | 753 | 828 | 607 | 8495 | | | 277 (611) | | 313 (690) | FC-103P630T7 | E2 | | E1 | |

***Consult factory for higher output drives***

[1] *See pages 70 to 71 for the complete type code.*
[2] *Intermittent duty rated for 110% of continuous current for normal overload.*

# Integrated features for every purpose imaginable

When your application requires special performance features, consider the Danfoss range of purpose-designed functionalities. All have been developed to improve efficiency while meeting the needs of specific industries and applications. The integrated features of dedicated VLT® drives cater for nearly every need imaginable:

- Safety of personnel and equipment protection
- Specialized torque and loading conditions
- Tailored performance curves
- Temperature and pressure extremes
- Power supply quality variations
- Regional and industry-specific compliance
- Special needs for specific industries

| Features | FC 302 | FC 202 | FC 102 | FC 103 |
|---|---|---|---|---|
| **Pump** | | | | |
| End of curve detection | | ■ | ■ | ■ |
| Auto tuning of the 4 PI controllers | | ■ | ■ | ■ |
| Flow compensation | | ■ | ■ | ■ |
| No/low flow detection and sleep mode | | ■ | ■ | ■ |
| Deragging feature | | ■ | | |
| Pipe fill mode | | ■ | | |
| Initial/final ramp | | ■ | | |
| Flow confirmation | | ■ | | |
| Pre/post lubrication | | ■ | | |
| Freely programmable texts | | ■ | | |
| Advanced minimum speed monitor | | ■ | | |
| High/normal overload | ■ | ■ | | |
| Check valve ramp | | ■ | | |
| Embedded multi-pump controller | | ■ | ■ | ■ |
| High overload capability | ■ | ■ | | |
| Vital water supply | | | ■ | |
| Leakage or broken pipe | | | | ■ |
| **Fan** | | | | |
| Velocity-to-flow conversion | | | ■ | |
| Fire override mode | | | ■ | |
| Drive bypass | | | ■ | |
| Extend BMS capacity | | | ■ | |
| Resonance monitoring | | | ■ | |
| Stairwell pressurization | | | ■ | |
| Smart logic reduces costs | ■ | | ■ | |
| Intelligent AHU functions | | | ■ | |
| **Condenser and evaporater** | | | | |
| Floating condensing temperature optimizes COP | | | | ■ |
| Resonance monitoring | | | | ■ |
| Intelligent functions | | | | ■ |
| Extended I/O capacity | | | | ■ |
| **Compressor** | | | | |
| Day/night control | | | | ■ |
| Neutral zone | | | | ■ |
| Oil return management | | | | ■ |
| Condensing temperature monitoring | | | | ■ |
| Single compressor or pack | | | | ■ |
| Direct entry of evaporator temperature | | | | ■ |
| Inject ON | | | | ■ |
| Fewer starts and stops | | | | ■ |
| Unloaded start | | | | ■ |
| 135% starting torque | ■ | | | ■ |
| Smaller compressors with the same peak load | | | | |
| P0 optimization | | | | ■ |

# Water and pump features

### 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.

### Leakage or broken pipe
Continuous liquid supply can be assured in the event of leakage or a broken pipe. For example, overload is prevented by reducing drive speed – and supply is secured at lower flow.

### Vital water supply
If a pipe leaks or breaks, the HVAC Drive can reduce the motor speed to prevent overload, while continuing to supply water a lower speed.

### 1. End of curve detection
This feature is triggered if the pump runs without reaching a predefined setpoint, such as when a pipe leaks. The drive either sets off an alarm or performs another pre-programmed action.

### 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 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 setpoint, the drive starts automatically. Compared to continuous operation, this method reduces energy costs, equipment wear and helps extend the lifetime of the application.

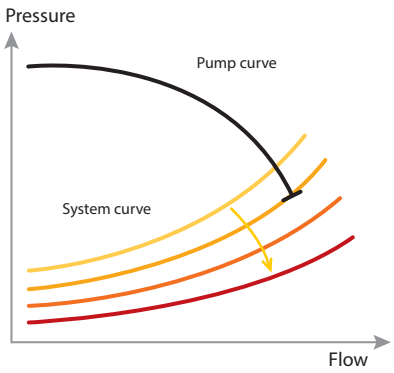
### 5. Deragging feature
This VLT® AQUA Drive software feature offers proactive pump protection. The deragging can be configured as either a preventative or reactive action. It optimizes the efficiency of the pump by constantly monitoring the motor shaft power consumption relative to flow. In the reactive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

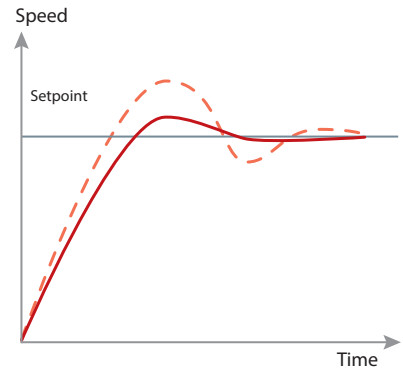
### 7. Initial/final ramp
The initial ramp provides fast acceleration of pumps to minimum speed, from where the normal ramp takes over. This prevents damage to the thrust bearings on the pump. The final ramp decelerates pumps from the minimum speed to stop.

*Continued on next page*

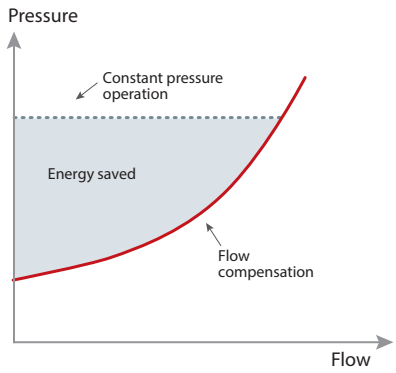
1


Pressure
Pump curve
System curve
Flow

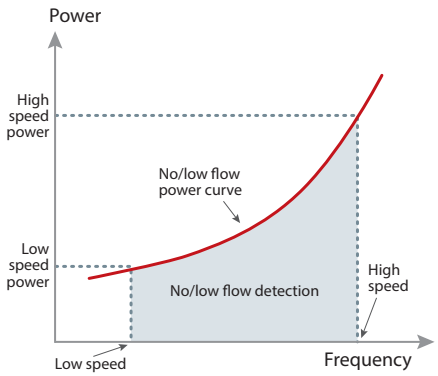
2


Speed
Setpoint
Time

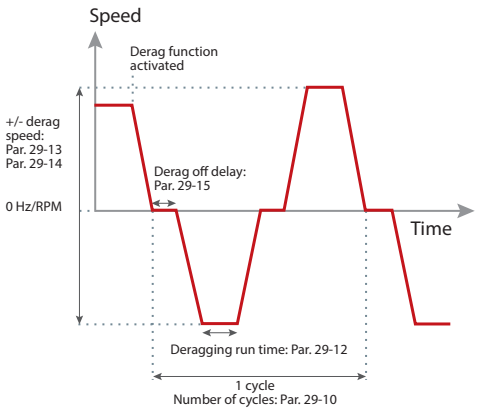
3


Pressure
Constant pressure operation
Energy saved
Flow compensation
Flow

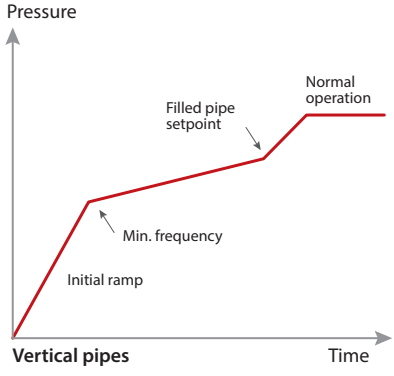
4

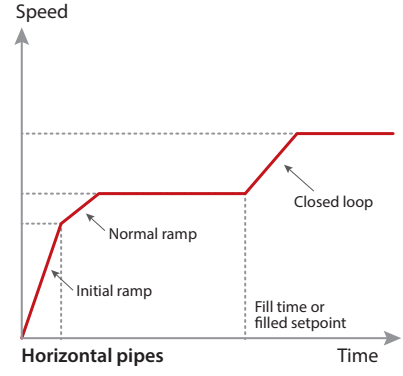

Power
High speed power
No/low flow power curve
Low speed power
No/low flow detection
High speed
Low speed
Frequency

5

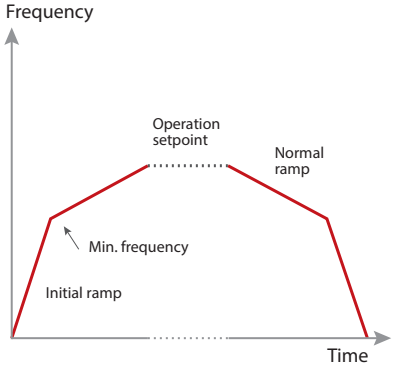

Speed
Derag function activated
+/- derag speed: Par. 29-13 Par. 29-14
Derag off delay: Par. 29-15
0 Hz/RPM
Time
Deragging run time: Par. 29-12
1 cycle
Number of cycles: Par. 29-10

6

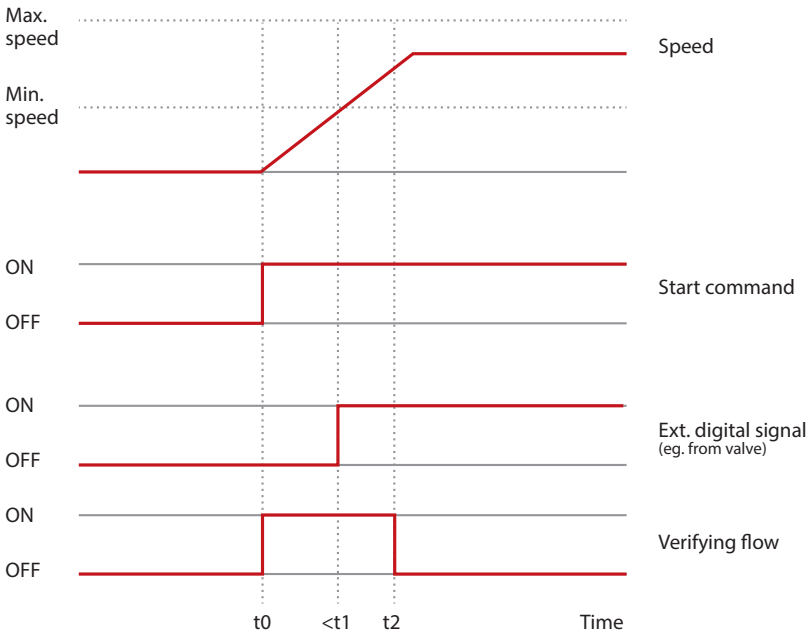

Pressure
Normal operation
Filled pipe setpoint
Min. frequency
Initial ramp
Vertical pipes
Time


Speed
Closed loop
Normal ramp
Initial ramp
Fill time or filled setpoint
Horizontal pipes
Time

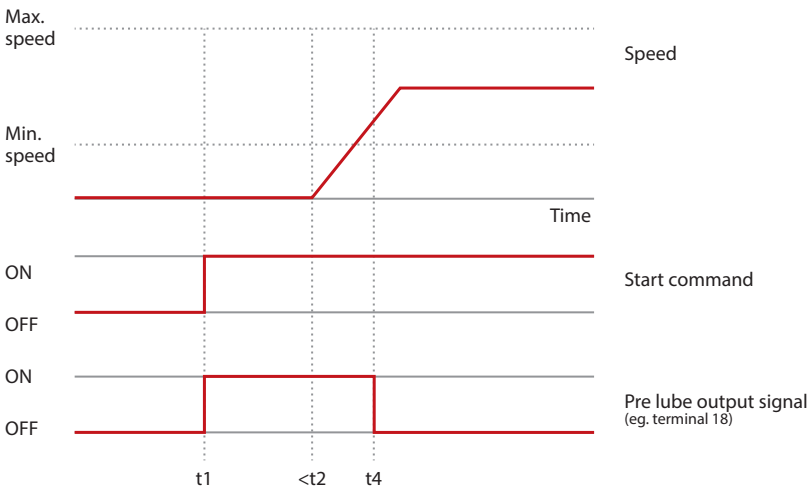
7


Frequency
Operation setpoint
Normal ramp
Min. frequency
Initial ramp
Time

8




9




## 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 AC drive.

## 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, such as exhaust fans, must remain active. 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. Available configurations: "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. With no need for external monitoring equipment, downtime for maintenance is minimized.

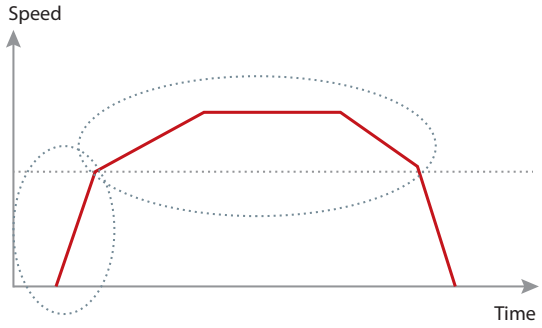
## 12. High/normal overload

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.

11

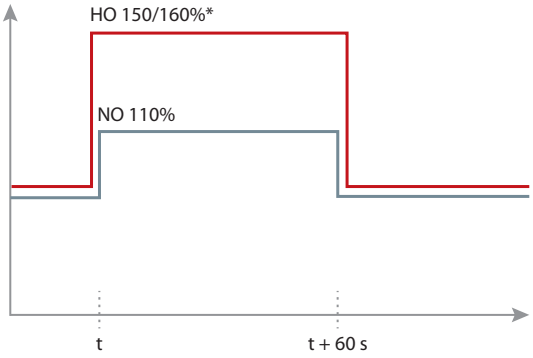



During normal operation (after ramping up) P1-86/1-87

(1-86/1-87) Trip speed low [RPM, Hz]

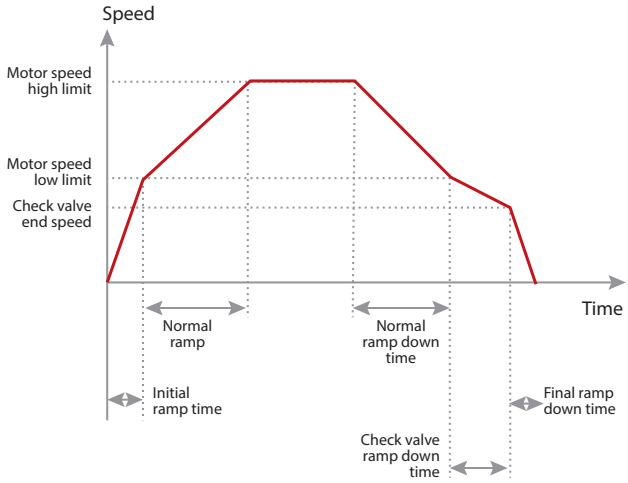
(1-79) Start max. time to trip

12

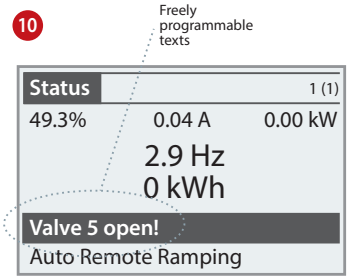



* depending on power size

13




10



# Fan features

## Velocity-to-flow conversion

The VLT® HVAC Drive is able to convert velocity pressure sensor values into flow values. This provides operators with the opportunity to set the drive up to provide a fixed flow or fixed differential flow. Regardless of method, the advantages are the same, as energy consumption is optimized while improving comfort. An added benefit is that this built-in setting eliminates the need for a flow sensor.

## Fire override mode

This safety feature prevents the drive from stopping to protect itself. Instead, it will continue vital fan operation regardless of control signals, warnings or alarms.

## Drive bypass

If a drive bypass is available, the VLT® HVAC Drive will not only sacrifice itself, it will also bypass itself and connect the motor directly to mains. Fan functionality will be maintained after the drive fails, as long as there is power and the motor is functioning.
(only available in the USA)

## Extend BMS capacity

Easy integration into building management systems provides managers with detailed information about the current state of the infrastructure in the building. By integrating the drive into the building management network, all the I/O points in the drive are available as remote I/O to extend the capacity of the BMS.

For example: by installing room temperature sensors (PT 100/PT 1000) and monitoring them with the VLT® Sensor Input Card, the motor is protected from overheating in the bearings and windings. Monitoring of sensor temperature is visible as a readout on the display or via fieldbus.

## Resonance monitoring

Avoid unwanted noise by setting the drive to avoid the frequency bands that cause fans to create resonances. Not only does this increase comfort, it also reduces wear on the equipment.

## Stairwell pressurization

If there is a fire, the VLT® HVAC Drive will continue to control the motor, even beyond its standard shutoff parameters. By maintaining a higher level of air in the stairwells than in other parts of the building, stairwells remain smoke free.

## Smart logic reduces costs

The drive's built-in Smart Logic Controller and four auto-tuning PID controllers can control air handling functions with fans, valves and dampers. This reduces DDC tasks in the building management system and frees valuable data points for other use.

## Intelligent AHU functions

The ability to handle logical rules and inputs from sensors, real-time functionality, and time-related actions enables the HVAC Drive to control a wide range of functions:

- Weekend and working-day operations
- Cascaded P-PI for temperature control
- Multi-zone "3" control
- Flow balancing between fresh and outlet air
- Belt monitoring

# Condenser and evaporator features

## Floating condensing temperature optimizes COP

VLT® Refrigeration Drive FC 103 intelligently controls evaporative condensers or air-cooled condensers to optimize refrigeration system performance (COP) at lower energy consumption. The drive adapts condensing temperature set point as the outdoor temperature drops, lowering the set point to a new stable level. This functionality provides:

- Increased cooling capacity at lower power consumption
- Ability to run on fewer compressors, thereby reducing wear and tear

## Intelligent functions

The FC 103 handles logical rules and inputs from sensors, real time functionality and time-related actions. This enables the FC 103 to control a wide range of functions, including:

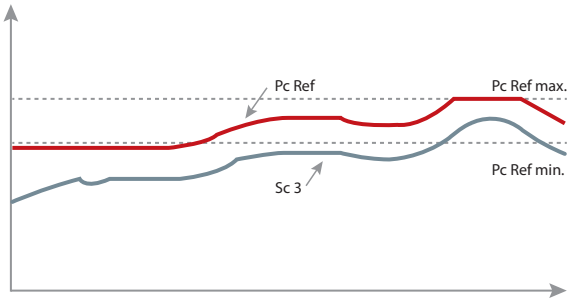
- Weekend and working-day operations
- Cascaded P-PI for temperature control
- Belt monitoring

## Resonance monitoring

By pressing a few buttons on the Local Control Panel, the drive can be set to avoid frequency bands at which connected fans create resonances in the in condensers or evaporators.
This reduces vibration noise and equipment wear.

## Auto tuning of the PI controllers

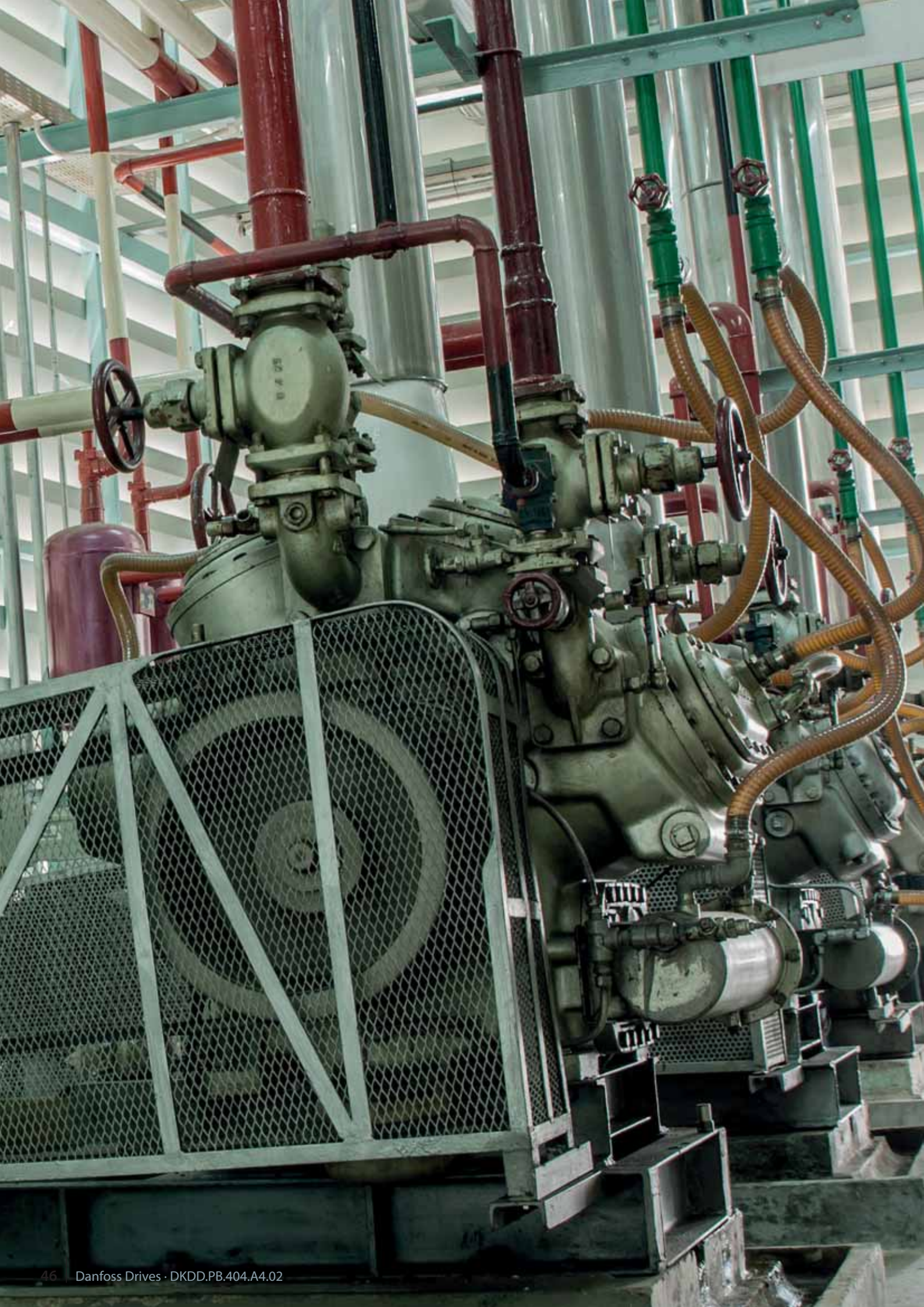
With auto tuning of the PI controllers, the drive monitors how the system reacts on corrections made by the drive – and learns from it.




*Floating condensing temperature set point control by VLT® Refrigeration Drive FC 103.*

## Extended I/O capacity

When operated by an external controller, all the FC 103 I/O points are available as remote I/O to extend the capacity of the controller. For example, room temperature sensors (Pt1000/Ni1000) can be directly connected.



# Compressor features

## Day/night control
Compressors usually operate with different setpoints depending on the time of day. This in turn results in different evaporator fan speeds, resulting in reduced energy consumption. This function can be easily programmed with day/night control.

## Neutral zone
The FC 103 continues to control fixed speed compressors in situations where the variable speed compressor fails. Neutral zone is in a fail situation set by a special parameter "Fixed speed neutral zone". This gives the opportunity to have fewer starts by expanding the neutral zone and longer duration of safe operation even under challenging situations.

## Oil Return Management
If compressors run at low speed for longer periods of time, lubrication oil will end up in the refrigerant and pipelines. Lack of oil in crankcase causes insufficient lubrication. Built-in oil return management in the FC 103 ensures oil is returned to crankcase thus significantly improving system reliability. Oil management functionality increases the compressor speed up to its maximum value for the user-defined interval of time and brings the oil back to the compressor.

- Oil boost functionality activates at fixed time intervals
- Or when the compressor speed has been lower than nominal speed for too long time
- Improves lubrication and system reliability

## Condensing temperature monitoring
The AC drive can monitor the Floating Head Pressure high pressure levels using connected temperature sensors. Speed is reduced before the head pressure reaches a critical value. This allows safe operation of system for longer duration thus enhancing food safety and process control.

## Single compressor or pack
The user has the choice of operating the system with a single large compressor or using the pack controller to operate the system with several smaller compressors that are activated as the demand for cooling capacity increases. The built-in Pack Controller can distribute running hours evenly across all compressors, keeping wear on individual compressors to a minimum and ensuring that all compressors are in great shape.

## Direct entry of evaporator temperature
The user can enter the desired evaporator temperature directly in the control panel of the FC 103. The AC drive also takes the properties of the refrigerant into account. Tables for the most commonly used refrigerants are preloaded in the drive. User-defined entry of the refrigerant used in the system is also possible. This feature simplifies commissioning.

## Inject ON
When all connected compressors on the FC 103 are stopped due to a missing safety circuit, this will be registered by the system unit which will close all valves connected to the case controllers. This prevents liquid flow to the compressor when FC 103 starts the compressor again. As soon as a compressor starts running again, the valves will reopen.

## Fewer starts and stops
Start-up is the critical phase of compressor operation. The FC 103 minimizes the number of required starts and stops by varying the speed of the compressor to match the capacity to the cooling demand. This ensures maximum run time and minimum number of starts and stops. In addition, the maximum number of start/stop cycles in a given period can be configured using the control panel.

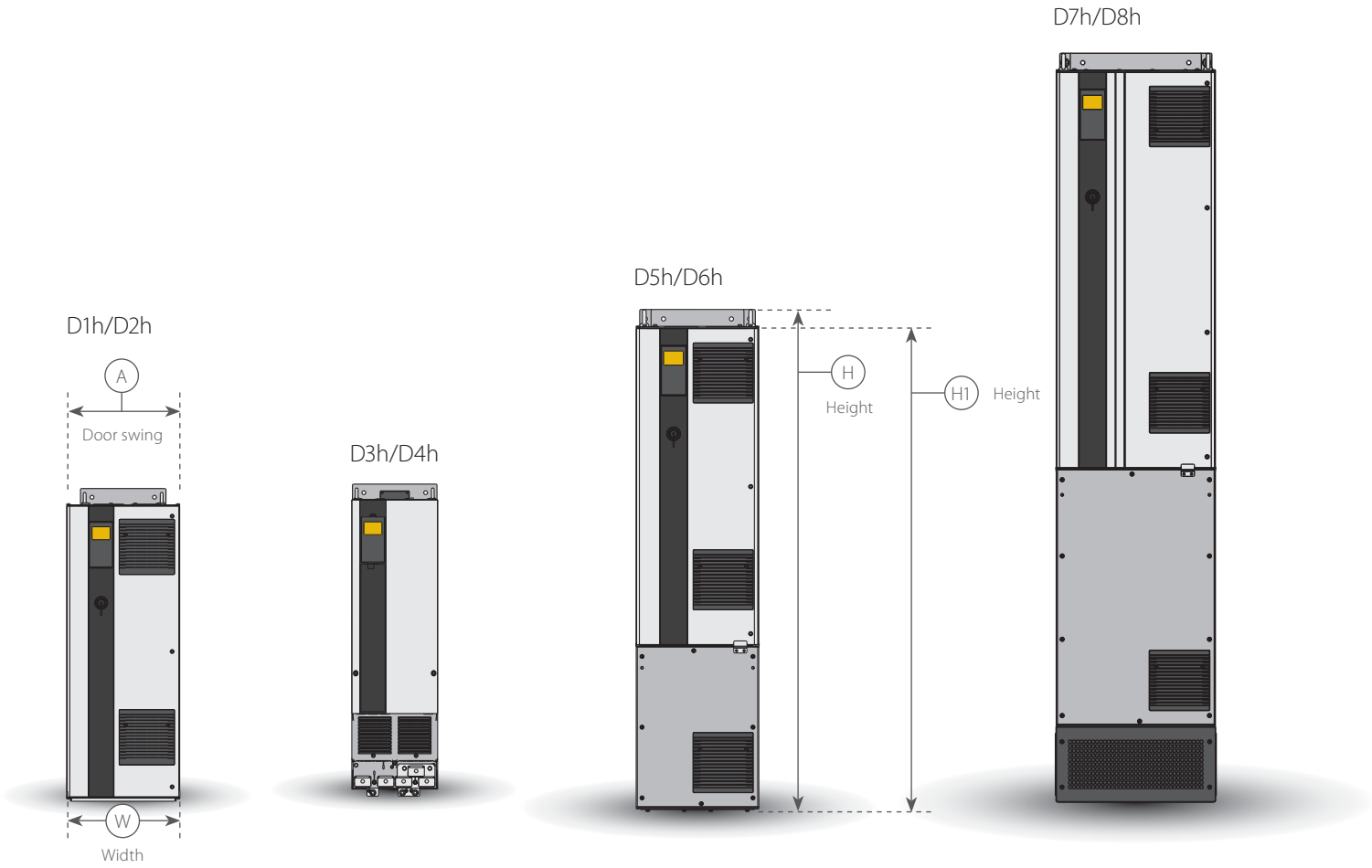
## Unloaded start
To further extend the lifetime of the FC 103 a pressure relief valve can be opened to allow the compressor to start up quickly with no load.

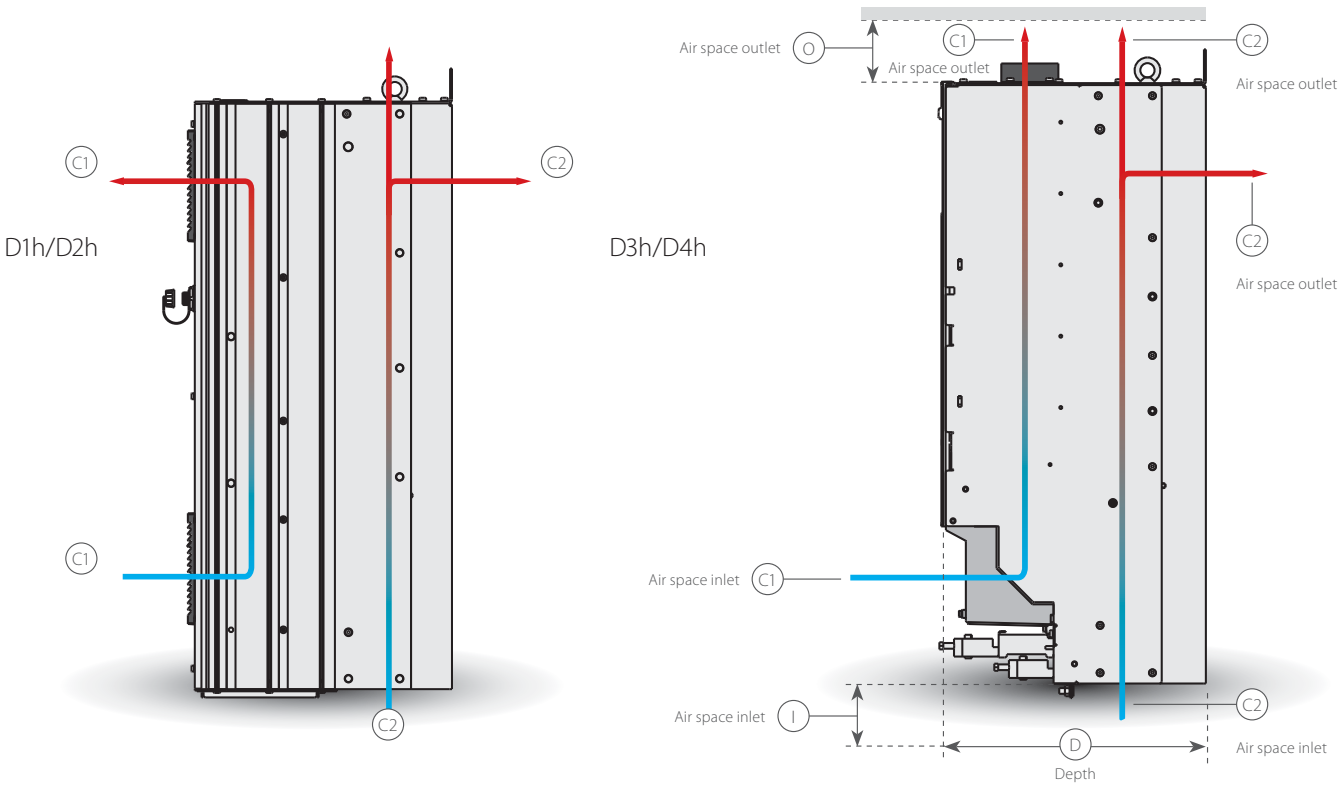
## 135% starting torque
The FC 103 delivers 135% of the rated starting torque for 0.5 second. In normal operation, 110% of the rated torque is available for 60 seconds.

## Smaller compressors with the same peak load
The operator can configure the system with a smaller compressor for a given peak load. Provided that the compressor is designed for over-speed operation, the FC 103 can run it at up to 90 Hz. This may allow brief peak loads to be handled without necessarily requiring a larger compressor.

## P0 optimization
The FC 103 supports connection of an ADAP-KOOL® LonWorks control for P0 optimization.

# Dimensions and air flow for 6-pulse drives



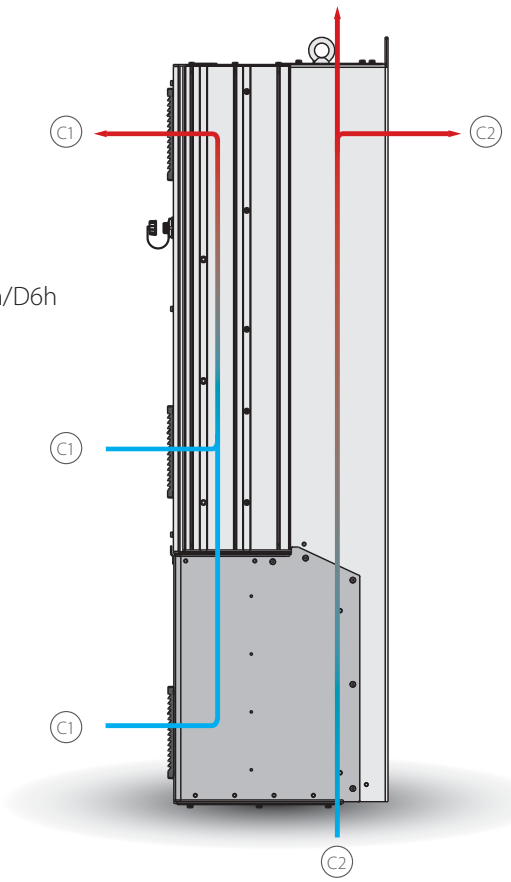




*Please see the VLT® High Power Design Guide for other enclosure sizes, available at http://vlt-drives.danfoss.com/Support/Technical-Documentation-Database/.*

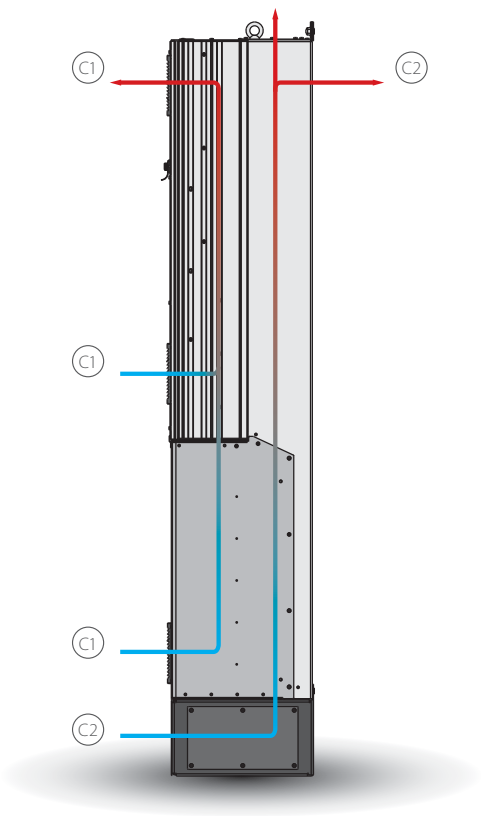
# Enclosure size D

| | | VLT® drive | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **Enclosure size** | | **D1h** | **D2h** | **D3h** | **D4h** | **D5h** | **D6h** | **D7h** | **D8h** |
| **Ingress protection rating** | | **IP21/IP54** | | **IP20** | | **IP21/IP54** | | | |
| **H mm** Height of backplate | | 901 (36) | 1107 (44) | 909 (36) | 1122 (44) | 1324 (52) | 1665 (66) | 1978 (78) | 2284 (90) |
| **H1 mm** Height of product | | 844 (33) | 1050 (41) | 844 (33) | 1050 (41) | 1277 (50) | 1617 (64) | 1931 (76) | 2236 (88) |
| **W mm** | | 325 (13) | 420 (17) | 250 (10) | 350 (14) | 325 (13) | 325 (13) | 420 (17) | 420 (17) |
| **D mm** | | 378 (15) | 378 (15) | 375 (15) | 375 (15) | 381 (15) | 381 (15) | 384 (15) | 402 |
| **D1 mm** With mains disconnect | | – | – | – | – | 426 | 426 | 429 | 447 |
| **Door swing A mm** | | 298 (12) | 395 (15.6) | n/a | n/a | 298 (12) | 298 (12) | 395 (16) | 395 (16) |
| **Air cooling** | **I (air space inlet) mm** | 225 (9) | 225 (9) | 225 (9) | 225 (9) | 225 (9) | 225 (9) | 225 (9) | 225 (9) |
| | **O (air space outlet) mm** | 225 (9) | 225 (9) | 225 (9) | 225 (9) | 225 (9) | 225 (9) | 225 (9) | 225 (9) |
| | **C1** | 102 m³/hr (60 cfm) | 204 m³/hr (120 cfm) | 102 m³/hr (60 cfm) | 204 m³/hr (120 cfm) | 102 m³/hr (60 cfm) | | 204 m³/hr (120 cfm) | |
| | **C2** | 420 m³/hr (250 cfm) | 840 m³/hr (500 cfm) | 420 m³/hr (250 cfm) | 840 m³/hr (500 cfm) | 420 m³/hr (250 cfm) | | 840 m³/hr (500 cfm) | |
| **Efficiency** | | 0.98 | | | | | | | |
| **Max. cable cross-section to motor output terminals (per phase) – mm² (AWG)**<br>**Max. cable cross-section to load sharing terminals (per -DC/+DC)**<br>**Max. cable cross-section to regeneration terminals (per-DC/+DC)**<br>**Max. cable cross-section to brake resistor terminals (per -R/+R)**<br>**Max. cable cross-section to input mains terminals (per phase)** | | 2 x 95 (2 x 3/0) | 2 x 185 (2 x 350 mcm) | 2 x 95 (2 x 3/0) | 2 x 185 (2 x 350 mcm) | 2 x 95 (2 x 3/0) | | 2 x 185 (2 x 350 mcm) | |

D5h/D6h

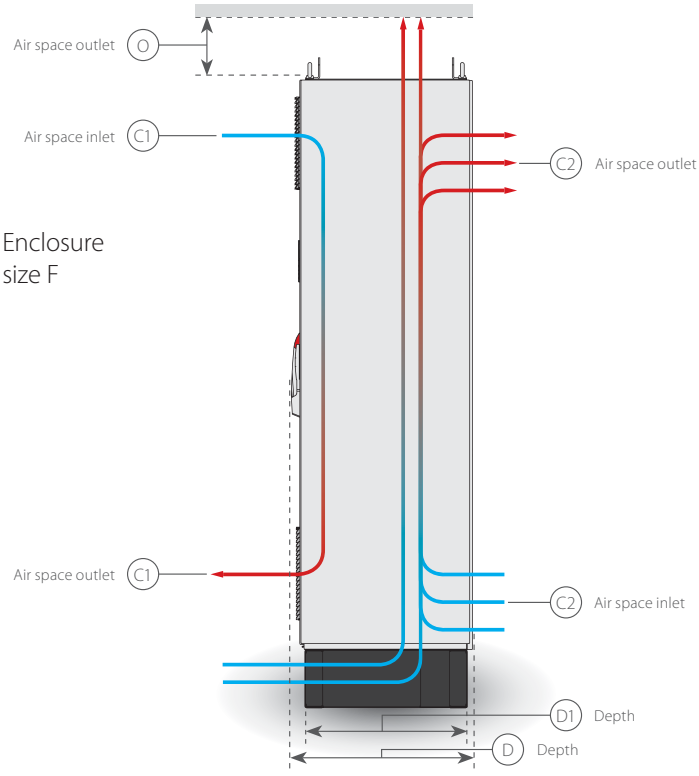



D7h/D8h

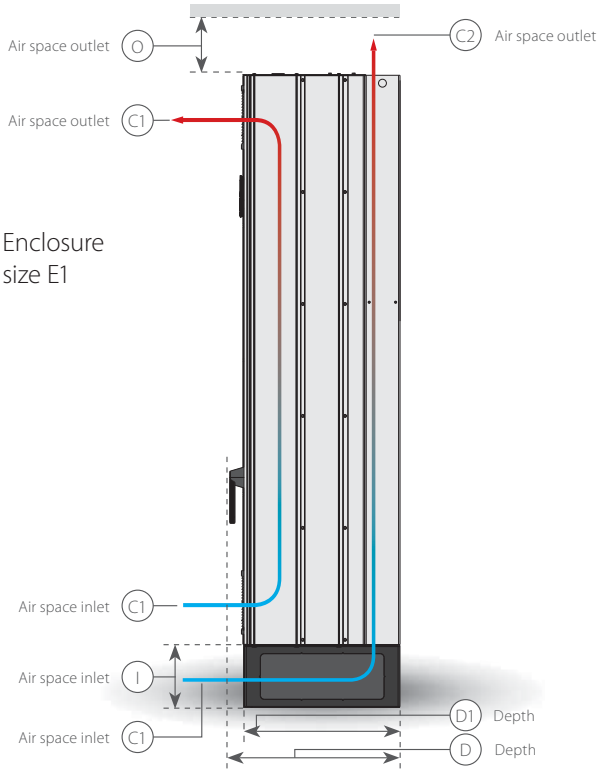


# Dimensions and air flow for 6-pulse drives


Enclosure size F



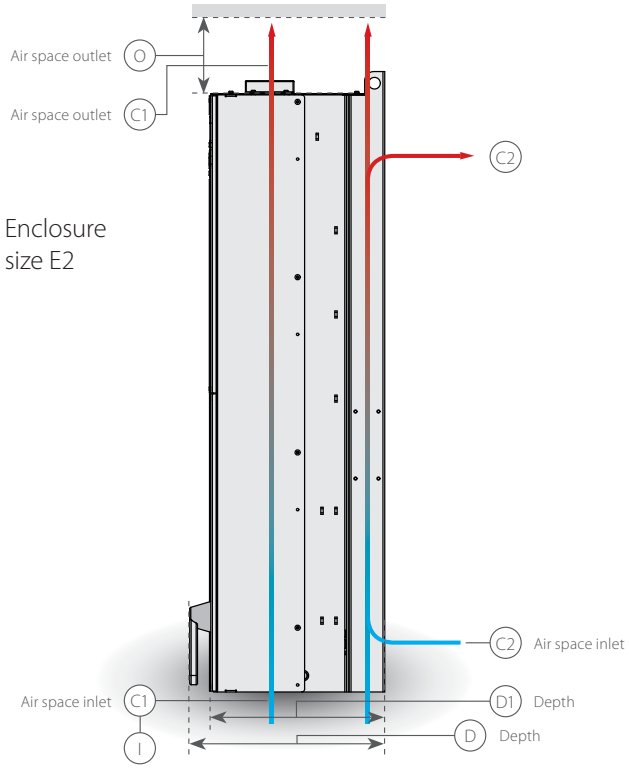

Enclosure size E1




*Please see the VLT® High Power Design Guide for other enclosure sizes, available at http://vlt-drives.danfoss.com/Support/Technical-Documentation-Database/.*

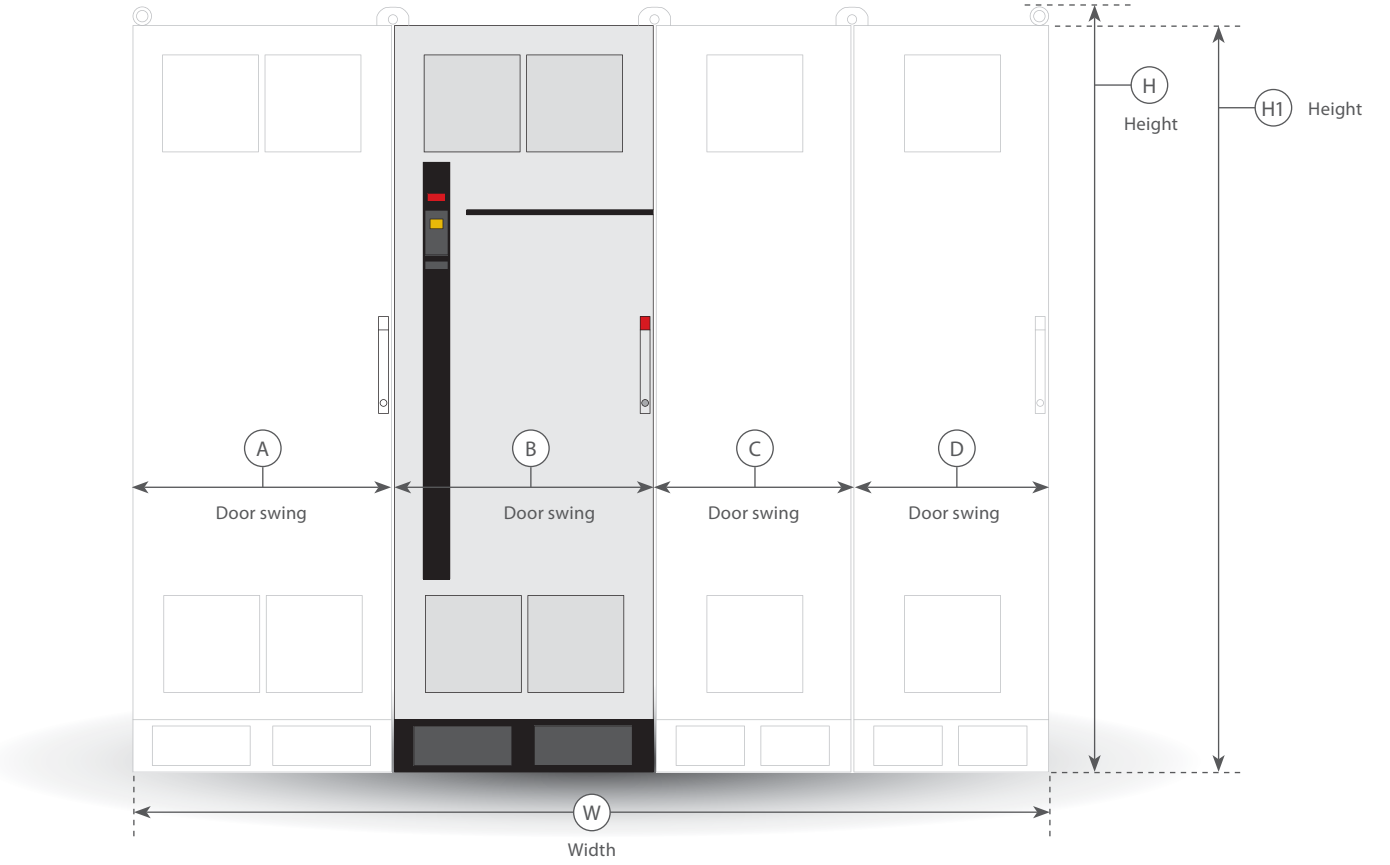
# Enclosure sizes E and F

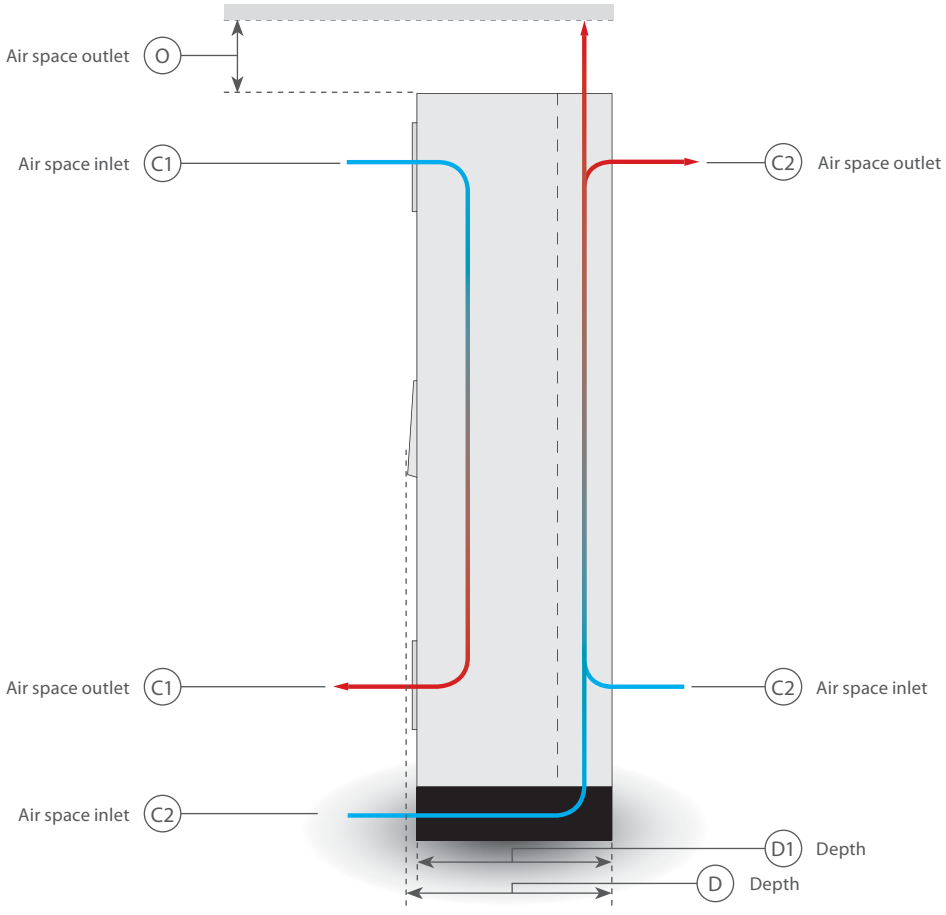
| | | VLT® 6-pulse | | | | | |
|---|---|---|---|---|---|---|---|
| **Enclosure size** | | **E1** | **E2** | **F1** | **F3** | **F2** | **F4** |
| **Ingress protection rating** | | **IP21/IP54** | **IP00** | | **(F1 + options cabinet)** | | **(F2 + options cabinet)** |
| **H mm (inches)** | | 2000 (79) | 1547 (61) | 2280 (90) | 2280 (90) | 2280 (90) | 2280 (90) |
| **H1 mm (inches)** | | n/a | n/a | 2205 (87) | 2205 (87) | 2205 (87) | 2205 (87) |
| **W mm (inches)** | | 600 (24) | 585 (23) | 1400 (55) | 1997 (79) | 1804 (71) | 2401 (94) |
| **D mm (inches)** | | 538 (21) | 539 (21) | n/a | n/a | n/a | n/a |
| **D1 mm (inches)** | | 494 (19) | 498 (20) | 607 (24) | 607 (24) | 607 (24) | 607 (24) |
| **Door swing A mm (inches)** | | 579 (23) | 579 (23) | 578 (23) | 578 (23) | 578 (23) | 578 (23) |
| **Door swing B mm (inches)** | | n/a | n/a | 778 (31) | 578 (23) | 624 (25) | 578 (23) |
| **Door swing C mm (inches)** | | n/a | n/a | n/a | 778 (31) | 579 (23) | 624 (25) |
| **Door swing D mm (inches)** | | n/a | n/a | n/a | n/a | n/a | 578 (23) |
| **Air cooling** | **I (air space inlet) mm (inches)** | 225 (9) | 225 (9) | n/a | n/a | n/a | n/a |
| | **O (air space outlet) mm (inches)** | 225 (9) | 225 (9) | 225 (9) | 225 (9) | 225 (9) | 225 (9) |
| | **C1** | 340 m³/hr (200 cfm) | 255 m³/hr (150 cfm) | IP21/NEMA 1 700 m³/hr (412 cfm) IP54/NEMA 12 525 m³/hr (309 cfm) | | | |
| | **C2** | 1105 m³/hr (650 cfm) or 1444 m³/hr (850 cfm) | 1105 m³/hr (650 cfm) or 1444 m³/hr (850 cfm) | 985 m³/hr (580 cfm) | | | |
| **Efficiency** | | 0.98 | | | | | |
| **Max. cable cross-section to motor output terminals (per phase) – mm² (AWG)** | | 4 x 240 (4 x 500 mcm) | | 8 x 150 (8 x 300 mcm) | 8 x 150 (8 x 300 mcm) | 12 x 150 (12 x 300 mcm) | 12 x 150 (12 x 300 mcm) |
| **Max. cable cross-section to load sharing terminals (per -DC/+DC)** | | | | 4 x 120 (4 x 250 mcm) | | | |
| **Max. cable cross-section to regeneration terminals (per-DC/+DC)** | | | | 2 x 150 (2 x 300 mcm) | | | |
| **Max. cable cross-section to brake resistor terminals (per -R/+R)** | | 2 x 185 (2 x 350 mcm) | | 4 x 185 (4 x 350 mcm) | 4 x 185 (4 x 350 mcm) | 6 x 185 (6 x 350 mcm) | 6 x 185 (6 x 350 mcm) |
| **Max. cable cross-section to input mains terminals (per phase)** | | 4 x 240 (4 x 500 mcm) | | 8 x 240 (8 x 500 mcm) | | | |




*Dimension and air flow for VLT® Low Harmonic Drive and VLT® 12-pulse*
*Please see the VLT® High Power Drive Selection Guide.*

# Dimensions and air flow for 12-pulse drives



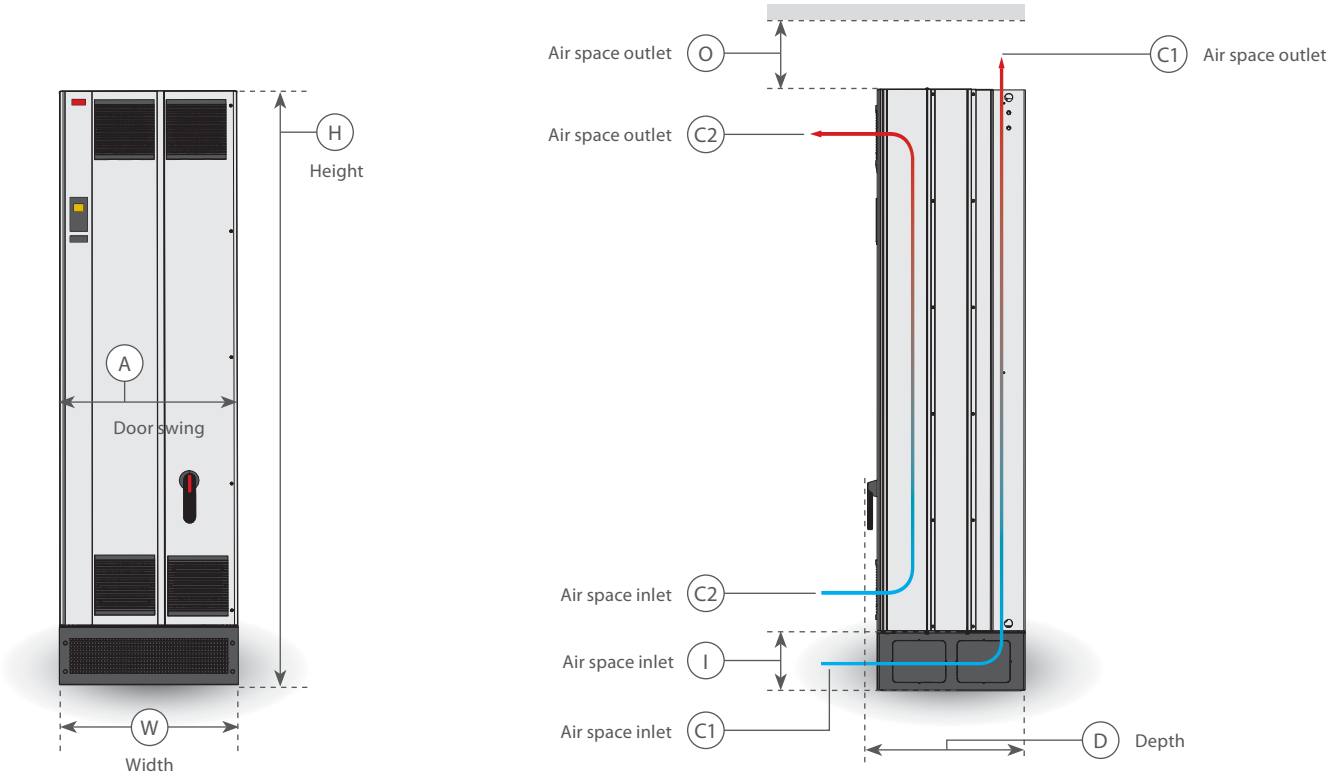



# Enclosure size F

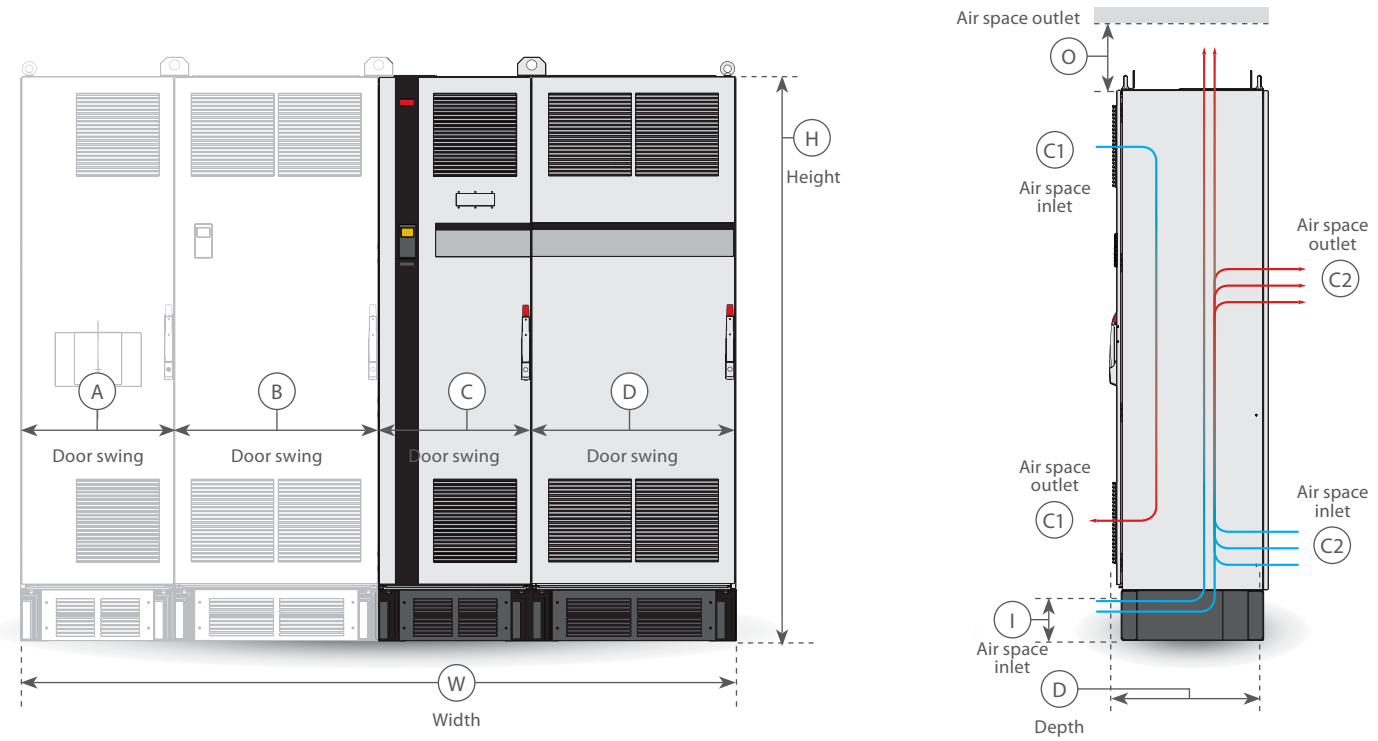
| | | VLT® 12-pulse | | | | | |
|---|---|---|---|---|---|---|---|
| Enclosure size | | F8 | F9 (F8 + options cabinet) | F10 | F11 (F10 + options cabinet) | F12 | F13 (F12 + options cabinet) |
| H mm (inches) | | 2280 (90) | 2280 (90) | 2280 (90) | 2280 (90) | 2280 (90) | 2280 (90) |
| H1 mm (inches) | | 2205 (87) | 2205 (87) | 2205 (87) | 2205 (87) | 2205 (87) | 2205 (87) |
| W mm (inches) | | 806 (32) | 1404 (55) | 1606 (32) | 2401 (95) | 2006 (79) | 2802 (110) |
| D mm (inches) | | 607 (24) | 607 (24) | 607 (24) | 607 (24) | 607 (24) | 607 (24) |
| Door swing A mm (inches) | | 776 (30) | 593 (23) | 776 (30) | 776 (30) | 776 (30) | 776 (30) |
| Door swing B mm (inches) | | n/a | 776 (30) | 776 (30) | 776 (30) | 592 (23) | 776 (30) |
| Door swing C mm (inches) | | n/a | n/a | n/a | 776 (30) | 592 (23) | 592 (23) |
| Door swing D mm (inches) | | n/a | n/a | n/a | n/a | n/a | 592 (23) |
| Air cooling | O (air space outlet) mm (inches) | 225 (9) | 225 (9) | 225 (9) | 225 (9) | 225 (9) | 225 (9) |
| Air cooling | C1 | IP21/NEMA 1 1400 m³/hr (824 CFM)<br>IP54/NEMA 12 1050 m³/hr (618 CFM) | IP21/NEMA 1 2100 m³/hr (1236 CFM)<br>IP54/NEMA 12 1575 m³/hr (927 CFM) | IP21/NEMA 1 2800 m³/hr (1648 CFM)<br>IP54/NEMA 12 2100 m³/hr (1236 CFM) | IP21/NEMA 1 4200 m³/hr (2472 CFM)<br>IP54/NEMA 12 3150 m³/hr (1854 CFM) | IP21/NEMA 1 2800 m³/hr (1648 CFM)<br>IP54/NEMA 12 3150 m³/hr (1854 CFM) | IP21/NEMA 1 4200 m³/hr (2472 CFM)<br>IP54/NEMA 12 3150 m³/hr (1854 CFM) |
| Air cooling | C2 | 1970 m³/hr (1160 CFM) | 1970 m³/hr (1160 CFM) | 3940 m³/hr (2320 CFM) | 3940 m³/hr (2320 CFM) | 4925 m³/hr (2900 CFM) | 4925 m³/hr (2900 CFM) |
| Weight | IP21 / NEMA 1 kg (lbs)<br>IP54 / NEMA 12 kg (lbs) | 440 (880) | 656 (1443) | 880 (1936) | 1096 (2411) | 1022 (2248) | 1238 (2724) |
| Efficiency | | 0.98 | | | | | |
| Max. cable cross-section to motor output terminals (per phase) – mm² (AWG) | | 8 x 150 (8 x 300 mcm) | | 8 x 150 (8 x 300mcm) | | 12 x 150 (12 x 300 mcm) | |
| Max. cable cross-section to regeneration terminals (per-DC/+DC) | | 4 x 120 (4 x 250 mcm) | | | | | |
| Max. cable cross-section to brake resistor terminals (per -R/+R) | | 2 x 185 (2 x 350 mcm) | | 4 x 185 (4 x 350 mcm) | | | |
| Max. cable cross-section to input mains terminals (per phase) | | 8 x 250 (8 x 500 mcm) | | | | | |
| Max. external input mains fuses [A] | | 630 | 630 | 900 | 900 | 2000 | 2000 |

# Dimensions and air flow for VLT® Advanced Active Filter AAF 006 and VLT® Low Harmonic Drive

VLT® Advanced Active Filter




VLT® Low Harmonic Drive



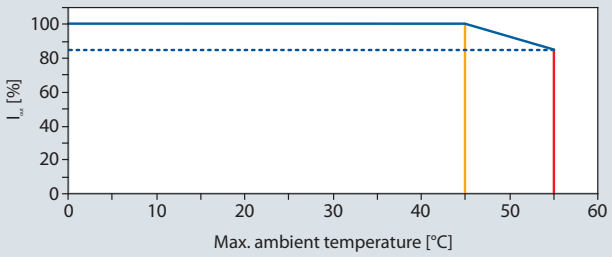
# Enclosures

| | | VLT® Advanced Active Filter AAF 006 | | VLT® Low Harmonic Drive | | | |
|---|---|---|---|---|---|---|---|
| **Enclosure size** | | **D14** | **E1** | **D1n** | **D2n** | **E9** | **F18** |
| **H mm (inches)** | | 1780 (70) | 2000 (79) | 1780 (70) | 1780 (70) | 2000 (79) | 2277 (90) |
| **W mm (inches)** | | 600 (24) | 600 (24) | 915 (36) | 1020 (40) | 1200 (47) | 2800 (110) |
| **D mm (inches)** | | 378 (15) | 494 (20) | 380 (15) | 380 (15) | 500 (19) | 600 (24) |
| **Door swing A mm (inches)** | | 574 (23) | 577 (23) | 577 (23) | 577 (23) | 577 (23) | 590 (23) |
| **Door swing B mm (inches)** | | n/a | n/a | 298 (12) | 395 (15.6) | 577 (23) | 784 (31) |
| **Door swing C mm (inches)** | | n/a | n/a | n/a | n/a | n/a | 590 (23) |
| **Door swing D mm (inches)** | | n/a | n/a | n/a | n/a | n/a | 784 (31) |
| **Air cooling** | **O (air space outlet) mm (inches)** | 225 (9) | 225 (9) | 225 (9) | | 225 (9) | 225 (9) |
| | **C1** | 340 m³/hr (200 CFM) | 765 m³/hr (450 CFM) | 442 m³/hr (260 CFM) | 544 m³/hr (320 CFM) | 680 m³/hr (400 CFM) | 3150 m³/hr (1855 CFM) |
| | **C2** | 765 m³/hr (450 CFM) | 1230 m³/hr (724 CFM) | 1185 m³/hr (700 CFM) | 1605 m³/hr (945 CFM) | 2635 m³/hr (1550 CFM) | 4485 m³/hr (2640 CFM) |
| **Weight** | **IP21 / NEMA 1 kg (lbs)** | 238 (525) | AAF 250/310 429 (945) AAF 400 453 (998) | 353 (777) | 413 (910) | 676 (1491) | 1899 (4187) |
| | **IP54 / NEMA 12 kg (lbs)** | | | | | | |
| **Efficiency** | | | | 0.96 | | | |
| **Max. cable cross-section to motor output terminals (per phase) – mm² (AWG)** | | n/a | | | | 4 x 240 (4 x 500 mcm) | 8 x 150 (8 x 300 mcm) |
| **Max. cable cross-section to brake resistor terminals (per -R/+R)** | | n/a | | Motor: 2 x 95 (2 x 3/0) Brake: 2 x 95 (2 x 3/0) Input: 2 x 185 (2 x 350) | Motor: 2 x 185 (2 x 350) Brake: 2 x 185 (2 x 350) Input: 2 x 185 (2 x 350) | 2 x 185 (2 x 300 mcm) | 4 x 185 (4 x 350 mcm) |
| **Max. cable cross-section to input mains terminals (per phase)** | | 2 x 150 (2 x 300 mcm) | 4 x 240 (4 x 500 mcm) | | | 4 x 240 (4 x 500 mcm) | 8 x 240 (8 x 500 mcm) |
| **Max. external input mains fuses [A] *(Typical shaft output @ high overload)*** | | 190 A: 350 | 250/310 A: 700 400 A: 900 | 132 kW @ 400 V: 400 | 160 kW @ 400 V: 550 200 kW @ 400 V: 630 | 250 kW @ 400 V: 700 315 kW @ 400 V: 900 355 kW @ 400 V: 900 400 kW @ 400 V: 900 | 450 kW @ 400 V: 1600 500 kW @ 400 V: 1600 560 kW @ 400 V: 2000 630 kW @ 400 V: 2000 |
| **Estimated power loss at max load [W] *(Typical shaft output @ high overload)*** | | 190 A: 7200 | 250 A: 8700 310 A: 11800 400 A: 13400 | 132 kW @ 400 V: 7428 | 160 kW @ 400 V: 8048 200 kW @ 400 V: 9753 | 250 kW @ 400 V: 13311 315 kW @ 400 V: 14577 355 kW @ 400 V: 16396 400 kW @ 400 V: 17703 | 450 kW @ 400 V: 22401 500 kW @ 400 V: 25110 560 kW @ 400 V: 27323 630 kW @ 400 V: 31268 |


Up to
50°C
ambient
temperature
without derating

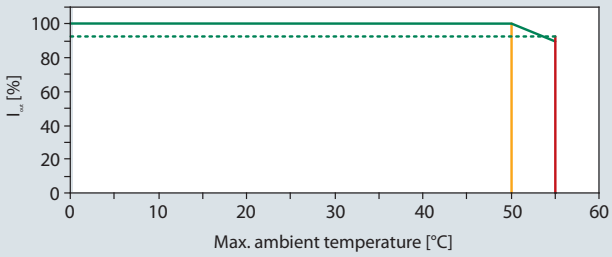
# Special conditions

### Normal overload drives for VLT® HVAC Drive and VLT® AQUA Drive




*Derating curve based on 60 AVM switching pattern. Curve shows a derating of 1.5%/°C above 45 °C. Please see Design Guide for further information.*

### High overload drives for VLT® AutomationDrive




*Derating curve based on 60 AVM switching pattern. Curve shows 1.5%/°C above 50 °C. For 6-pulse and 12-pulse drives. Please see the design guide for detailed information.*

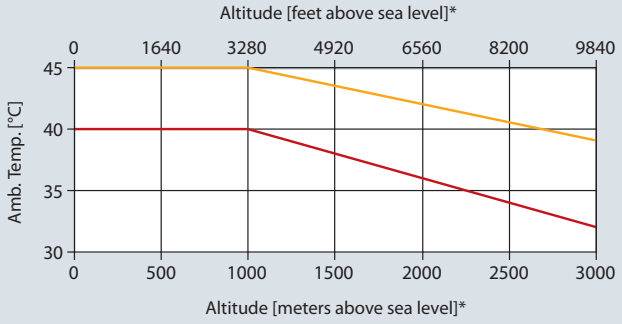
## Derating in high ambient temperatures

VLT® series drives can provide 100% of their rated output current in environments with ambient temperatures of up to 50 °C for high overload applications and 45 °C for normal overload applications without any derating. In environments with higher ambient temperatures, VLT® series drives can still operate by reducing the output current in accordance with the derating curves in the design guides with an overview of these represented by the charts to the left.

*As shown to the left, when the ambient temperature is 55 °C, high overload drives can provide 92.5 % of their rated output current, and normal overload drives can provide 85 % of their rated output current (based on 60 AVM switching pattern). For VLT® Low Harmonic Drive derating curves, please see the LHD Operating Instructions.*

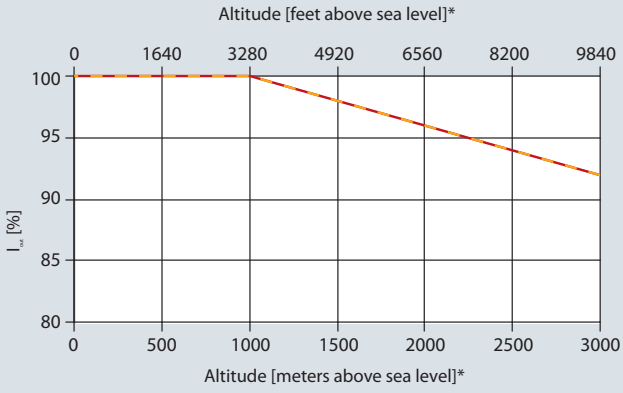
---

**Normal overload drives** **High overload drives**




## Derating in high altitudes

The thinner air at higher altitudes reduces the effective cooling capabilities of the drive. Reliable operation in higher altitudes can still be assured as long as the ambient temperature remains within the ranges specified in the chart to the left:




***Alternatively, the output current of the drive can be reduced to achieve the same objective:***

** 690 V drives are limited to 6560' (2000 m) above sea level based on PELV requirements.*

*For derating options related to switching frequency, see the VLT® HVAC Drive, VLT® AQUA Drive or VLT® AutomationDrive Design Guide.*

# Accessories and typecode position overview

| Enclosure size | Typecode position | D1h/ D2h | D3h/ D4h | D5h/ D7h | D6h/ D8h | D13 | E1 | E2 | E9 | F1, F2 | F3 and F4 (w/ options cabinet) | F8 | F9 (w/options cabinet) | F10, F12 | F11, F13 (w/ options cabinet) | F18 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Enclosure with corrosion-resistant back channel | 4 | ■ | ■ | ■ | ■ | | | ■ | | ■ | ■ | | | | | |
| Mains shielding | 4 | ■ | ■ | ■ | ■ | ■ | ■ | | ■ | | | | | | | ■ |
| Space heaters and thermostat | 4 | ■ | ■ | ■ | ■ | | | | | ■ | ■ | | | ■ | ■ | ■ |
| Cabinet indicator light with power outlet | 4 | | | | | | | | | ■ | ■ | | | ■ | ■ | ■ |
| Class A1 RFI Filters | 5 | ■ | ■ | ■ | ■ | ■ | ■ | ■ | | | ■ | | ■ | | ■ | ■ |
| NAMUR terminals | 5** | | | | | | | | | ■ | ■ | ■ | ■ | ■ | ■ | ■ |
| Insulation Resistance Monitor (IRM) | 5 | | | | | | | | | | ■ | | ■ | | ■ | |
| Residual Current Monitor (RCD) | 5* | | | | | | | | | | ■ | | ■ | | ■ | ■ |
| Brake chopper (IGBTs) | 6 | | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ |
| Safe Torque Off / 6*** | 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 | ■ | ■ | ■ | ■ | | | | | | | | | | | |
| LCP 101 numerical local control panel | 7 | ■ | ■ | ■ | ■ | | ■ | ■ | | | | | | | | |
| LCP 102 graphical local control panel | 7 | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ |
| Fuses | 9 | ■ | ■ | ■ | | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ |
| Load sharing terminals | 9 | | ■ | | | ■ | ■ | ■ | ■ | ■ | ■ | | | | | ■ |
| Fuses + load sharing terminals | 9 | | ■ | | | ■ | ■ | ■ | ■ | ■ | ■ | | | | | ■ |
| Disconnect | 9**** | | | ■ | ■ | ■ | ■ | ■ | ■ | | ■ | | ■ | | ■ | ■ |
| Circuit breakers | 9**** | | | | ■ | | | | | | ■ | | | | | ■ |
| Contactors | 9**** | | | | ■ | | | | | | ■ | | | | | ■ |
| Manual motor starters | 10 | | | | | | | | | ■ | ■ | | | ■ | ■ | ■ |
| 30 Amp, fuse-protected terminals | 10 | | | | | | | | | ■ | ■ | | | ■ | ■ | ■ |
| 24 V DC supply | 11 | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ |
| External temperature monitoring | 11 | | | | | | | | | ■ | ■ | | | ■ | ■ | ■ |
| Heat sink access panel | 11 | ■ | ■ | ■ | ■ | | | | | | | | | | | |
| NEMA 3R ready drive | 11 | ■ | | | | | | | | | | | | | | |

* *Requires an options cabinet*
** *Available only for the VLT® AutomationDrive FC 302*
*** *Standard on VLT® AutomationDrive FC 302, optional for VLT® HVAC Drive FC 102 and VLT® AQUA Drive FC 202*
**** *Options supplied with fuses for enclosure size D*
***** *Available for IP21/54*

## 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 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.

## NAMUR terminals

Selection of this option provides standardized terminal connection and associated functionality as defined by NAMUR NE37.
NAMUR is an international association of automation technology users in the process industries, primarily chemical and pharmaceutical industries in Germany.

Requires the selection of the VLT® Extended Relay Card MCB 113 and the VLT® PTC Thermistor Card MCB 112.

Available only for VLT® AutomationDrive FC 302.

## 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-stop 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-stop 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. The relay is used in the external temperature monitoring option. If PTC monitoring is required, VLT® PTC Thermistor Card MCB 112 must be ordered.

## 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-stop 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% 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 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-stop 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

## 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-stop 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, 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

# A options: Fieldbuses

*Available for the full product range*

| Fieldbus | Typecode position | FC 302 | FC 202 | FC 102 | FC 103 |
|---|---|---|---|---|---|
| **A** | | | | | |
| VLT® PROFIBUS DP MCA 101 | | ■ | ■ | ■ | ■ |
| VLT® DeviceNet MCA 104 | | ■ | ■ | ■ | |
| VLT® CANopen MCA 105 | | ■ | | | |
| VLT® AK-LonWorks MCA 107 | | | | | ■ |
| VLT® LonWorks MCA 108 | | | | ■ | |
| VLT® BACnet MCA 109 | | | | ■ | |
| VLT® 3000 PROFIBUS Converter MCA 113 | | ■ | | | |
| VLT® 5000 PROFIBUS Converter MCA 114 | **14** | ■ | | | |
| VLT® PROFINET MCA 120 | | ■ | ■ | ■ | ■ |
| VLT® EtherNet/IP MCA 121 | | ■ | ■ | ■ | |
| VLT® Modbus TCP MCA 122 | | ■ | ■ | ■ | |
| VLT® POWERLINK MCA 123 | | ■ | | | |
| VLT® EtherCAT MCA 124 | | ■ | | | |
| VLT® BACnet/IP MCA 125 | | | | ■ | |
| VLT® 5000 DeviceNet Converter MCA 194 | | ■ | | | |

## VLT® PROFIBUS DP MCA 101

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.

VLT® PROFIBUS DP MCA 101 provides:

- 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 profile state machines, PROFIBUS DP-V1, Master Class 1 and 2

**Ordering number**
130B1100 standard
130B1200 coated *(Class 3C3/IEC 60721-3-3)*

## VLT® DeviceNet MCA 104

VLT® DeviceNet MCA 104 offers robust, efficient data handling thanks to advanced Producer/Consumer technology.

- Support of ODVA's AC drive profile supported via I/O instance 20/70 and 21/71 secures compatibility to existing systems
- Benefit from ODVA's strong conformance testing policies, which ensure that products are interoperable

**Ordering number**
130B1102 standard
130B1202 coated *(Class 3C3/IEC 60721-3-3)*

## VLT® CANopen MCA 105

High flexibility and low cost are two of the "cornerstones" for CANopen.

The VLT® CANopen MCA 105 option for the VLT® AutomationDrive is fully equipped with both high-priority access to control and status of the drive (PDO Communication) and access all parameters through acyclic data (SDO Communication).

For interoperability, the option has implemented the DSP402 AC drive Profile.
These features all guarantees standardized handling, interoperability and low cost.

**Ordering number**
130B1103 standard
130B1205 coated *(Class 3C3/IEC 60721-3-3)*

## VLT® AK-LonWorks MCA 107

VLT® AK-LonWorks MCA 107 is a complete electronic refrigeration and control system for monitoring and controlling refrigeration plants.

Connecting this drive to a Danfoss ADAP-KOOL® Lon network is a simple process that needs only a network address.

**Ordering number**
130B1169 standard
130B1269 coated *(Class 3C3/IEC 60721-3-3)*

## VLT® LonWorks MCA 108

LonWorks is a fieldbus system developed for building automation. It enables communication between individual units in the same system (peer-to-peer) and thus supports decentralizing of control.

- No need for main station (master-follower)
- Units receive signals directly
- Supports echelon free-topology interface (flexible cabling and installation)
- Supports embedded I/O and I/O options (easy implementation of decentral I/O)
- Sensor signals can quickly be moved to another controller via bus cables
- Certified as compliant with LonMark ver. 3.4 specifications

**Ordering number**
130B1106 standard
130B1206 coated *(Class 3C3/IEC 60721-3-3)*

## VLT® BACnet MCA 109

The BACnet protocol is an international protocol that efficiently integrates all parts of building automation equipment from the actuator level to the building management system.

Via the BACnet option, it is possible to read all analog and digital inputs and control all analog and digital outputs of the VLT® HVAC Drive.

All inputs and outputs can be operated independently of the functions of the drive, and thus work as remote I/O:

- COV (Change of Value)
- Synchronization of RTC from BACnet
- Read/write property multiple
- Alarm/warning handling

**Ordering number**
130B1144 standard
130B1244 coated *(Class 3C3/IEC 60721-3-3)*

## VLT® PROFIBUS Converter MCA 113

The VLT® PROFIBUS Converter MCA 113 is a special version of the PROFIBUS options that emulates the VLT® 3000 commands in the VLT® AutomationDrive.

The VLT® 3000 can be replaced by the VLT® AutomationDrive, or an existing system can be expanded without costly change of the PLC program.

For upgrade to a different fieldbus, the installed converter is easily removed and replaced with a new option. This secures the investment without losing flexibility.

**Ordering number**
NA standard
130B1245 coated *(Class 3C3/IEC 60721-3-3)*

## VLT® PROFIBUS Converter MCA 114

The VLT® PROFIBUS Converter MCA 114 is a special version of the PROFIBUS options that emulates the VLT® 5000 commands in the VLT® AutomationDrive.

The VLT® 5000 can be replaced by the VLT® AutomationDrive, or an existing system can be expanded without costly change of the PLC program.

For upgrade to a different fieldbus, the installed converter is easily removed and replaced with a new option. This secures the investment without losing flexibility. The option supports DPV1.

**Ordering number**
NA standard
130B1246 coated *(Class 3C3/IEC 60721-3-3)*

## VLT® PROFINET MCA 120

VLT® PROFINET MCA 120 uniquely combines the highest performance with the highest degree of openness. The option is designed so that many of the features from the VLT® PROFIBUS MCA 101 can be reused, minimizing user effort to migrate PROFINET and securing the investment in a PLC program.

- Same PPO types as the MCA 101 PROFIBUS for easy migration to PROFINET
- Built-in web server for remote diagnosis and reading out of basic drive parameters
- 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
- Support of PROFISAFE when combined with MCB 152
- Implementation in accordance with Conformance Class B

**Ordering number**
130B1135 standard
130B1235 coated *(Class 3C3/IEC 60721-3-3)*

## VLT® EtherNet/IP MCA 121

Ethernet is the future standard for communication at the factory floor. The VLT® EtherNet/IP MCA 121 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 VLT® MCA 121 offers advanced features such as:

- Built-in high performance switch enabling line-topology, and eliminating the need for external switches
- DLR Ring (from October 2015)
- Advanced switch and diagnosis functions
- Built-in web server
- E-mail client for service notification
- Unicast and Multicast communication

**Ordering number**
130B1119 standard
130B1219 coated *(Class 3C3/IEC 60721-3-3)*

## VLT® Modbus TCP MCA 122

Modbus TCP is the first industrial Ethernet-based protocol for automation.
The VLT® Modbus TCP MCA 122 connects to Modbus TCP-based networks. It 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:

- Built-in web-server for remote diagnosis and reading out basic drive parameters
- Email notification can be configured to send an email message to one or more recipients when certain alarms or warnings occur, or are cleared
- Dual Master PLC connection for redundancy

**Ordering number**
130B1196 standard
130B1296 coated *(Class 3C3/IEC 60721-3-3)*

## VLT® POWERLINK MCA 123

VLT® POWERLINK MCA 123 represents the second generation of fieldbus. The high bit rate of industrial Ethernet can now be used to make the full power of IT technologies used in the automation world available for the factory world.

POWERLINK provides high performance real-time and time synchronization features. Due to its CANopen-based communication models, network management and device description model, it offers much more than just a fast communication network.

The perfect solution for:

- Dynamic motion control applications
- Material handling
- Synchronization and positioning applications

**Ordering number**
130B1489 standard
130B1490 coated *(Class 3C3/IEC 60721-3-3)*

## VLT® EtherCAT MCA 124

The VLT® EtherCAT MCA 124 offers connectivity to EtherCAT® based networks via the EtherCAT Protocol.

The option handles the EtherCAT line communication in full speed, and connection towards the drive with an interval down to 4 ms in both directions. This allows the MCA 124 to participate in networks ranging from low performance up to servo applications.

- EoE Ethernet over EtherCAT support
- HTTP (Hypertext Transfer Protocol) for diagnosis via built-in web server
- CoE (CAN Over Ethernet) for access to drive parameters
- SMTP (Simple Mail Transfer Protocol) for e-mail notification
- TCP/IP for easy access to drive configuration data from MCT 10

**Ordering number**
130B5546 standard
130B5646 coated *(Class 3C3/IEC 60721-3-3)*

## VLT® BACnet/IP MCA 125

The VLT® BACnet/IP MCA 125 option optimizes the use of VLT® HVAC Drive together with building management systems (BMS) using the BACnet/IP protocol or running BACnet on Ethernet. The option has two Ethernet connectors, enabling daisy-chain configuration with no need for external switches. The VLT® BACnet/IP MCA 125 makes it easy to control or to monitor points required in typical HVAC applications, reducing overall cost of ownership.

Besides standard functionality, the option provides:

- COV, Change Of Value
- Read/WritePropertyMultiple
- Alarm/Warning notifications
- PID Loop object
- Segmented data transfer
- Trending

**Ordering number**
134B1586 coated *(Class 3C3/IEC 60721-3-3)*

## VLT® DeviceNet Converter MCA 194

The VLT® DeviceNet Converter MCA 194 emulates VLT® 5000 commands in the VLT® AutomationDrive.

This means that a VLT® 5000 drive can be replaced by the VLT® AutomationDrive, or a system can be expanded without costly change of the PLC program.

For a later upgrade to a different fieldbus, the installed converter can easily be removed and replaced with a different option. This secures the investment without losing flexibility. The option emulates I/O instances and explicit messages of a VLT® 5000.

**Ordering number**
NA standard
130B5601 coated *(Class 3C3/IEC 60721-3-3)*

# B options: Functional extensions

*Available for the full product range*

| Functional extensions | Typecode position | FC 302 | FC 202 | FC 102 | FC 103 |
|---|---|---|---|---|---|
| **B** | | | | | |
| VLT® General Purpose MCB 101 | 15 | ■ | ■ | ■ | ■ |
| VLT® Encoder Input MCB 102 | | ■ | | | |
| VLT® Resolver Input MCB 103 | | ■ | | | |
| VLT® Relay Option MCB 105 | | ■ | ■ | ■ | ■ |
| VLT® Safe PLC I/O MCB 108 | | ■ | | | |
| VLT® Analog I/O Option MCB 109 | | | ■ | ■ | ■ |
| VLT® PTC Thermistor Card MCB 112 | | ■ | ■ | ■ | |
| VLT® Sensor Input Card MCB 114 | | ■ | ■ | ■ | |
| VLT® Safety Option MCB 140 | | ■ | | ■ | |
| VLT® Safety Option MCB 150 TTL | | ■ | | | |
| VLT® Safety Option MCB 151 HTL | | ■ | | | |
| VLT® Safety Option MCB 152 PROFIsafe STO | | ■ | | | |
| 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® Encoder Input MCB 102

This option offers the possibility to connect various types of incremental and absolute encoders. The connected encoder can be used for closed loop speed control as well as closed loop flux motor control.

The following encoder types are supported:
- 5V TTL (RS 422)
- 1VPP SinCos
- SSI
- Hiperface
- EnDat

**Ordering number**
130B1115 standard
130B1203 coated *(Class 3C3/IEC 60721-3-3)*

## VLT® Resolver Input MCB 103

This option enables connection of a resolver to provide speed feedback from the motor.

- Primary voltage ..... 2-8 Vrms
- Primary frequency ..... 2.0-15 kHz
- Primary current max ..... 50 mA rms
- Secondary input voltage ..... 4 Vrms
- Spring loaded connection

**Ordering number**
130B1127 standard
130B1227 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 $min^{-1}$/20 $sec^{-1}$
- 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® Safe PLC I/O MCB 108

The VLT® AutomationDrive FC 302 provides a safety input based on a single-pole 24 V DC input.

- For the majority of applications, this input enables the user to implement safety in a cost-effective way. For applications that work with more advanced products like Safety PLC and light curtains, the Safe PLC interface enables the connection of a two-wire safety link
- The Safe PLC Interface allows the Safe PLC to interrupt on the plus or the minus link without interfering the sense signal of the Safe PLC

**Ordering number**
130B1120 standard
130B1220 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 (EX e only FC 302)
- Uses Safe Stop function, which is approved in accordance with SIL 2 IEC 61508

**Ordering number**
NA standard
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® Safety Option MCB 140 and MCB 141

VLT® Safety Option MCB 140 and MCB 141 comprise safety options with Safe Stop 1 (SS1), Safely Limited Speed (SLS) and Safe Speed Monitor (SSM) functionality.

The options can be used up to PL e according to ISO 13849-1.

MCB 140 is a standard B-Option. MCB 141 offers the same functionality in an external 45 mm housing. MCB 141 enables the user to use MCB 140 functionality also if another B-Option is used.

Different operating modes can be configured easily by using the on board display and buttons. The options provide only a limited set of parameters for fast parameterization.

- MCB 140 standard B-Option
- MCB 141 external option
- Single-channel or dual-channel operation possible
- Proximity switch as speed feedback
- SS1, SLS and SMS functionality
- Easy and fast parameterization

**Ordering number**
130B6443 MCB 140, 130B6447 MCB 141

## VLT® Safety Option MCB 150 and MCB 151

The VLT ® Safety Options MCB 150 and MCB 151 expand the Safe Torque Off (STO) function, which is integrated in a standard VLT® AutomationDrive. Use the Safe Stop 1 (SS1) function to perform a controlled stop before removing torque. Use the Safely-Limited Speed SLS function to monitor whether a specified speed is exceeded.

The functions can be used up to PL d according to ISO 13849-1 and SIL 2 according to IEC 61508.

- Additional standards-compliant safety functions
- Replacement of external safety equipment
- Reduced space requirements
- 2 safe programmable inputs
- 1 safe output (for T37)
- Easier machine certification
- Drive can be powered continuously
- Safe LCP Copy
- Dynamic commissioning report
- TTL (MCB 150) or HTL (MCB 151) encoder as speed feedback

**Ordering number**
130B3280 MCB 150, 130B3290 MCB 151

## VLT® Safety Option MCB 152

The VLT ® Safety Option MCB 152 enables activation of Safe Torque Off (STO) via the PROFIsafe fieldbus in combination with VLT ® PROFINET MCA 120 fieldbus option. It improves flexibility by connecting safety devices within a plant.

The safety functions of the MCB 152 are implemented according to EN IEC 61800-5-2. The MCB 152 supports PROFIsafe functionality to activate integrated safety functions of the VLT AutomationDrive from any PROFIsafe host, up to Safety Integrity Level SIL 2 according to EN IEC 61508 and EN IEC 62061, Performance Level PL d, Category 3 according to EN ISO 13849-1.

- PROFIsafe device (in combination with MCA 120)
- Replacement of external safety equipment
- 2 safe programmable inputs
- Safe LCP copy
- Dynamic commissioning report

**Ordering number**
130B9860 coated *(Class 3C3/IEC 60721-3-3)*

## VLT® Extended Cascade Controller MCO 101

The MCO 101 upgrades the built-in cascade controller to operate more pumps and provide more advanced pump control in master/follower mode.

- Up to 6 pumps in standard cascade set-up
- Up to 5 pumps in master/follower set-up
- 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*

| Option slot | Typecode position | FC 302 | FC 202 | FC 102 | FC 103 |
|---|---|---|---|---|---|
| **C** | | | | | |
| VLT® Advanced Cascade Controller MCO 102 | **17** | ■ | ■ | | |
| VLT® Motion Control MCO 305 | **16** | ■ | | | |
| VLT® Synchronizing Control MCO 350 | **16 and 18** | ■ | | | |
| VLT® Positioning Controller MCO 351 | | ■ | | | |
| VLT® Extended Relay Card MCB 113 | **17** | ■ | ■ | | ■ |

## 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 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)*

## VLT® Motion Control MCO 305

An integrated programmable motion controller adding extra functionality for VLT® AutomationDrive FC 301 and FC 302.

VLT ® Motion Control Option MCO 305 offers easy-to-use motion functions combined with programmability – an ideal solution for positioning and synchronizing applications.

- Synchronization (electronic shaft), positioning and electronic cam control
- 2 separate interfaces supporting both incremental and absolute encoders
- 1 encoder output (virtual master function)
- 10 digital inputs
- 8 digital outputs
- Support of CANopen motion bus, encoders and I/O modules
- Sends and receives data via fieldbus interface (requires fieldbus option)
- PC software tools for debugging and commissioning: Program and Cam editor
- Structured programming language with both cyclic and event-driven execution

**Ordering number**
130B1134 standard
130B1234 coated *(Class 3C3/IEC 60721-3-3)*

## VLT® Synchronizing Controller MCO 350

The VLT® Synchronizing Controller MCO 350 for VLT ® AutomationDrive expands the functional properties of the AC drive in synchronizing applications, and replaces traditional mechanical solutions.

- Speed synchronizing
- Position (angle) synchronizing with or without marker correction
- On-line adjustable gear ratio
- On-line adjustable position (angle) offset
- Encoder output with virtual master function for synchronization of multiple followers
- Control via I/Os or fieldbus
- Home function
- Configuration as well as read-out of status and data via the LCP

**Ordering number**
130B1152 standard
130B1252 coated *(Class 3C3/IEC 60721-3-3)*

## VLT® Positioning Controller MCO 351

The VLT® Positioning Controller MCO 351 offers a host of user-friendly benefits for positioning applications in many industries.

Features:
- Relative positioning
- Absolute positioning
- Touch-probe positioning
- End-limit handling (software and hardware)
- Control via I/Os or fieldbus
- Mechanical brake handling (programmable hold delay)
- Error handling
- Jog speed/manual operation
- Marker related positioning
- Home function
- Configuration as well as read-out of status and data via the LCP

**Ordering number**
130B1153 standard
130B1253 coated *(Class 3C3/IEC 60721-3-3)*

# D option: 24 V back-up power supply

*Available for the full product range*

| Option slot | Typecode position | FC 302 | FC 202 | FC 102 | FC 103 |
|---|---|---|---|---|---|
| **D** | | | | | |
| VLT® 24 V DC Supply Option MCB 107 | **19** | ■ | ■ | ■ | ■ |

## 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 uF
- Power-up delay .....< 0.6 s

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

# Kits to fit your application

| 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, E1, 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, E2 |
| NEMA 3R Rittal and welded enclosures | D3h, D4h, E2 |
| Back-channel cooling kits for non-Rittal enclosures | D3h, D4h |
| Back-channel cooling kit (in-bottom/out-top) | D1h, D2h, D3h, D4h, E2 |
| Back-channel cooling kit (in-back/out-back) | D1h, D2h, D3h, D4h, E, F |
| Pedestal kit with in-back/out-back cooling | D1h, D2h |
| Pedestal kit | D1h, D2h, D5h, D6h, D7h, D8h, E1, E2 |
| Input-plate option kit | D, E |
| IP20 conversion kit | E2 |
| Top entry of fieldbus cables | D3, D4, D1h-D8h, E2 |

## 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.

**IP20**
D1h, D2h, D3h, D4h, D5h, D6h, D7h and D8h.

**IP21/IP54**
D1h, D2h, D3h, D4h, D5h, D6h, D7h, D8h, E1 and F.

## 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 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 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, D4h and E2.

**Ordering number top and bottom**

| | |
|---|---|
| D3h kit 1800 mm | 176F3627 |
| D4h kit 1800 mm | 176F3628 |
| D3h Kit 2000 mm | 176F3629 |
| D4h Kit 2000 mm | 176F3630 |
| E2 2000 mm | 176F1850 |
| E2 2200 mm | 176F0299 |

**Ordering number top only**

| | |
|---|---|
| E2 | 176F1776 |

## 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 |
| E2 kit | 176F0298 |

**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 |
| E2 kit | 176F1852 |

## 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 top and base covers**

| | |
|---|---|
| E2 – IP00 (welded enclosures) | 176F1861 |
| E1 – IP21/54 | 176F1946 |
| E1 – IP00 (Rittal enclosures) | 176F1783 |

**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 |
| E1 | 176F3537 |

## 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 |
| E pedestal kit | 176F6739 |

## 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.

## IP20 conversion kit

This kit is for use with enclosure size E2 (IP00). After installation, the drive will have an ingress protection rating of IP20.

**Ordering number**

| | |
|---|---|
| E2 – terminal cover height 254 mm (10 inch.) | 176F1884 |

## 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**

| | |
|---|---|
| D3/D4/E2 | 176F1742 |
| D1h-D8h | 176F3594 |

## LCP 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

# True system independence

## System independence

When it comes to optimizing system efficiency to meet your needs exactly, the right components are vital. Whether it's a particular vendor, certain motor technology or a standardized way to communicate, Danfoss Drives can provide the right AC drive to meet your specific needs. You'll always get the most flexible VLT® or VACON® drive adapted to:

- Meet the unique requirements of your applications
- Operate at peak performance
- Optimize efficiency

When you have the freedom to select the optimal components for your system, a potential energy saving of up to 60% is possible.

## Motor independence

With increasingly stringent demands on motor efficiency, traditional induction motors cannot always comply. New motor technologies therefore continue to emerge, extending both full-load and part-load efficiency. The unique requirements of these newer motor technologies – such as permanent magnet (PM) motors and synchronous reluctance (SynRM) motors – also demand special motor control algorithms within the AC drive. Both VLT® and VACON® drives have the built-in capabilities to control whatever motor technology your application requires, at optimum efficiency. The required performance of your system is always available exactly when you need it.

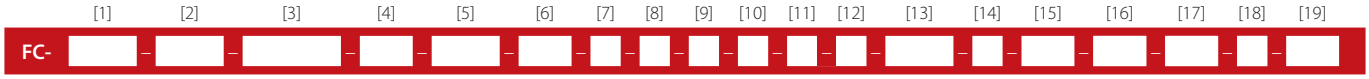
## Fieldbus independence

An important aspect of any system is the ability to communicate efficiently over various interfaces, such as PROFINET or EtherNet/IP in industrial applications, or BACnet/IP in building automation applications. Regardless of your application or your preferred communication protocol, both VLT® and VACON® drives have an extremely wide variety of communication protocols to select from. In this way, you can ensure that the AC drive integrates seamlessly into your chosen system. The control system attains optimal efficiency while also reducing costs related to training, commissioning and maintenance.

# Ordering typecode

| [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)* | |
|---|---|
| 102 | VLT® HVAC Drive |
| 202 | VLT® AQUA Drive |
| 302 | VLT® AutomationDrive |
| **[2] Power size** *(character 7-10)* | |
| N55K | 55 kW / 75 hp |
| 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 |
| P355 | 355 kW / 500 hp |
| P400 | 400 kW / 550 hp |
| P450 | 450 kW / 600 hp |
| P500 | 500 kW / 650 hp |
| P560 | 560 kW / 750 hp |
| P630 | 630 kW / 900 hp |
| P710 | 710 kW / 1000 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)* | |
| T4 | 3 x 380/480 V AC *(0.37 – 1000 kW)* |
| T6 | 3 x 525/600 V AC *(0.75 – 90 kW)* |
| T7 | 3 x 525/690 V AC *(11 – 1400 kW)*<br>*690 V kW. See manuals for 575 V hp* |
| **[4] Ingress protection rating** *(character 13-15)* | |
| ***For cabinet mounting:*** | |
| E00 | IP00/Chassis<br>*(Enclosure size E2 only)* |
| C00 | IP00/Chassis with stainless steel back channel *(Enclosure size E2 only)* |
| E20 | IP20/Chassis<br>*(Enclosure sizes D3h, D4h)* |
| ***Standalone:*** | |
| E21 | IP21 / Type 1 *(Enclosure sizes D1h, D2h, D5h, D6h, D7h, D8h, E1, F1, F2, F3, F4, VLT® Low Harmonic Drive D13, E9, F18)* |
| E5D | IP54 / Type 12 *(Enclosure size D1h only)* |
| E3R | NEMA 3R *(US only)* |
| E2D | IP21 / Type 1 *(Enclosure size D1h only)* |
| E2S | IP20 / Chassis *(Enclosure size D3h only)* |
| C20 | IP20 / Chassis |
| C21 | IP21/Type 1 corrosion resistant back channel *(Only available for enclosure sizes F1, F2, F3, F4)* |
| C2S | IP20 / Chassis + corrosion resistant<br>*(Enclosure size D3h only)* |
| C54 | IP54/Type 12 corrosion resistant back channel *(Only available for enclosure sizes F1, F2, F3, F4)* |
| P3R | NEMA 3R with backplate *(US only)* |
| E54 | IP54/Type 12 *(Enclosure size D1h, D2h, D5h, D6h, D7h, D8h, E1, F1, F2, F3, F4, VLT® Low Harmonic Drive D13, E9, F18)* |
| E5S | IP54/Type 12 NEMA 3R ready drive with heater |
| H21 | IP21 / Type 1 with space heater and thermostat *(Enclosure size F only)* |
| H54 | IP54 / Type 12 with space heater and thermostat *(Enclosure size F only)* |
| L2X | IP21 / Type 1 with cabinet light and IEC 230 V power outlet *(Enclosure size F only)* |
| L5X | IP54 / Type 12 with cabinet light and IEC 230 V power outlet *(Enclosure size F only)* |
| L2A | IP21 / Type 1 with cabinet light and NAM, 115 V power outlet *(Enclosure size F only)* |
| L5A | IP54 / Type 12 with cabinet light and NAM, 115 V power outlet *(Enclosure size F only)* |
| R2X | IP21 / Type 1 with space heater, thermostat, light and IEC 230 V power outlet *(Enclosure size F only)* |
| R5X | IP54 / Type 12 with space heater, thermostat, light and IEC 230 V power outlet *(Enclosure size F only)* |
| R2A | IP21 / Type 1 with space heater, thermostat, light and NAM, 115 V power outlet *(Enclosure size F only)* |
| R5A | IP54 / Type 12 with space heater, thermostat, light and NAM, 115 V power outlet *(Enclosure size F only)* |
| ***Special designs:*** | |
| E5S | NEMA 3R Ready IP54 – to be used with the NEMA 3R cover *(Enclosure size D1h and D2h)* |
| P20 | IP20 (frame B4, C3, C4 – with backplate) |
| E2M | IP21 / Type 1 with mains shield *(Enclosure size D1h, D2h, D5h, D6h, D7h, D8h, E1, VLT® Low Harmonic Drive D13 + E9)* |
| P21 | IP21 / Type 1<br>(Enclosure size as for E21 – with backplate) |
| E5M | IP54 / Type 12 with mains shield *(Enclosure size D1h, D2h, D5h, D6h, D7h, D8h, E1, VLT® Low Harmonic Drive D13 + E9)* |
| P55 | IP55<br>(Enclosure size as for E55 – with backplate) |
| Y55 | IP55<br>(Enclosure size as for Z55 – with backplate) |
| Y66 | IP66/NEMA 4X<br>(Enclosure size as for Z66 – with backplate) |
| **[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)<br>*(Enclosure sizes D and F only)* |
| H5 | RFI filter, Class A2 (C3)<br>Marine ruggedized |
| HG | IRM for IT mains with Class A2 RFI<br>*(Enclosure sizes F1, F2, F3, F4)* |
| HE | RCD for TN/TT mains with Class A2 RFI<br>*(Enclosure sizes F1, F2, F3, F4)* |
| HX | No RFI filter |
| HF | RCD for TN/TT mains and Class A1 RFI<br>*(Enclosure sizes F1, F2, F3, F4)* |
| HH | IRM for IT mains and Class A1 RFI<br>*(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<br>*(enclosure sizes F1, F2, F3, F4)* |
| D | Safe Torque Off with Pilz Safety Relay and brake IGBT<br>*(enclosure sizes F1, F2, F3, F4)* |
| E | Safe Torque Off with Pilz Safety Relay and regeneration terminals<br>*(enclosure sizes F1, F2, F3, F4)* |
| T | Safe Torque Off without brake<br>*(FC 102, FC 103 and FC 202; Safe Torque Off is standard on FC 302)* |
| R | Regeneration terminals *(enclosure sizes D & F)* |
| S | Regeneration terminals and brake chopper |
| U | Brake IGBT plus Safe Torque Off<br>*(FC 102, FC 103 and FC 202; Safe Torque Off is standard on FC 302)* |
| ***Enclosure sizes F3, F4*** | |
| M | IEC Emergency Stop Pushbutton<br>*(includes Pilz Relay)* |
| N | IEC Emergency Stop Pushbutton with brake IGBT and brake terminals<br>*(includes Pilz Safety Relay)* |
| P | IEC Emergency Stop Pushbutton with regeneration terminals<br>*(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, 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 |
| 8 | Mains disconnect and load sharing *(enclosure sizes B1, B2, C1 and C2 only)* |
| 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)* |
| 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 D only)* |
| W | Cable connection cabinet and fuse *(enclosure size D only)* |
| **[10] Hardware option A** *(character 22)* | |
| X | Standard cable entries |
| ***Enclosure sizes F1, F2, F3, F4, F10, F11, F12, F13, F18*** | |
| 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 |
| **[11] Hardware option B** *(character 23)* | |
| X | No adaptation |
| Q | Heat sink access panel *(enclosure size D only)* |
| ***Enclosure sizes F1, F2, F3, F4, F10, F11, F12, F13, F18*** | |
| 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 |

| [12] Special version *(character 24-27)* | |
|---|---|
| SXXX | Latest released standard software |
| **[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] Fieldbus *(character 29-30)* | | FC 302 | FC 202 | FC 102 | FC 103 |
|---|---|---|---|---|---|
| AX | No option | ■ | ■ | ■ | ■ |
| A0 | VLT® PROFIBUS DP MCA 101 | ■ | ■ | ■ | ■ |
| A4 | VLT® DeviceNet MCA 104 | ■ | ■ | ■ | |
| A6 | VLT® CANopen MCA 105 | ■ | | | |
| AZ | VLT® AK-LonWorks MCA 107 | | | | ■ |
| AG | VLT® LonWorks MCA 108 | | | ■ | |
| AJ | VLT® BACnet MCA 109 | | | ■ | |
| AT | VLT® 3000 PROFIBUS Converter MCA 113 | ■ | | | |
| AU | VLT® 5000 PROFIBUS Converter MCA 114 | ■ | | | |
| AL | VLT® PROFINET MCA 120 | ■ | ■ | ■ | ■ |
| AN | VLT® EtherNet/IP MCA 121 | ■ | ■ | ■ | |
| AQ | VLT® Modbus TCP MCA 122 | ■ | ■ | ■ | |
| AY | VLT® POWERLINK MCA 123 | ■ | | | |
| A8 | VLT® EtherCAT MCA 124 | ■ | | | |
| AK | VLT® BACnet/IP MCA 125 | | | ■ | |
| AV | VLT® 5000 DeviceNet Converter MCA 194 | ■ | | | |

| [15] Application 1 *(character 31-32)* | | FC 302 | FC 202 | FC 102 | FC 103 |
|---|---|---|---|---|---|
| BX | No application option | ■ | ■ | ■ | ■ |
| BK | VLT® General Purpose MCB 101 | ■ | ■ | ■ | ■ |
| BR | VLT® Encoder Input MCB 102 | ■ | | | |
| BU | VLT® Resolver Input MCB 103 | ■ | | | |
| BP | VLT® Relay Option MCB 105 | ■ | ■ | ■ | ■ |
| BZ | VLT® Safety PLC I/O MCB 108 | ■ | | ■ | |
| B0 | VLT® Analog I/O Option MCB 109 | | ■ | ■ | ■ |
| B2 | VLT® PTC Thermistor Card MCB 112 | ■ | ■ | ■ | |
| B4 | VLT® Sensor Input Card MCB 114 | ■ | ■ | ■ | |
| BY | VLT® Extended Cascade Controller MCO 101 | | ■ | | |
| B6 | VLT® Safety Option MCB 150 TTL | ■ | | | |
| B7 | VLT® Safety Option MCB 151 HTL | ■ | | | |
| B8 | VLT® Safety Option MCB 152 PROFIsafe STO | ■ | | | |

| [16] Motion control *(character 33-34)* | | FC 302 | FC 202 | FC 102 | FC 103 |
|---|---|---|---|---|---|
| CX | No motion control option | ■ | ■ | ■ | ■ |
| C4 | VLT® Motion Control MCO 305 | ■ | | | |

| [17] Extended relay *(character 35)* | | FC 302 | FC 202 | FC 102 | FC 103 |
|---|---|---|---|---|---|
| X | No option | ■ | ■ | ■ | ■ |
| 5 | VLT® Advanced Cascade Controller MCO 102 | | ■ | | |
| R | VLT® Extended Relay Card MCB 113 | ■ | ■ | | ■ |

| [18] Motion software *(character 35)* | | FC 302 | FC 202 | FC 102 | FC 103 |
|---|---|---|---|---|---|
| XX | No software option *Note: C4 option in [16] selected with no motion software in [18] will require programming by qualified individual* | ■ | ■ | ■ | ■ |
| 10 | VLT® Synchronizing Controller MCO 350 *(must select C4 in position [16])* | ■ | | | |
| 11 | VLT® Positioning Controller MCO 351 *(must select C4 in position [16])* | ■ | | | |

| [19] Control Power Back-up Input *(character 38-39)* | | FC 302 | FC 202 | FC 102 | FC 103 |
|---|---|---|---|---|---|
| DX | No DC input installed | ■ | ■ | ■ | ■ |
| D0 | VLT® 24 V DC Supply Option MCB 107 | ■ | ■ | ■ | ■ |

***1) reduced motor cable length***

***Please beware that not all combinations are possible. Find help configuring your drive with the online configurator found under: driveconfig.danfoss.com***

ENGINEERING
TOMORROW

# Danfoss Drives

Danfoss Drives is a world leader in variable speed control of electric motors. We aim to prove to you that a better tomorrow is driven by drives. It is as simple and as ambitious as that.

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

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

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

We draw on decades of experience within industries that include:

- Chemical
- Cranes and Hoists
- Food and Beverage
- HVAC
- Lifts and Escalators
- Marine and Offshore
- Material Handling
- Mining and Minerals
- Oil and Gas
- Packaging
- Pulp and Paper
- Refrigeration
- Water and Wastewater
- Wind

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

Since 1968, we have been pioneers in the drives business. In 2014, Vacon and Danfoss merged, forming one of the largest companies in the industry. Our AC drives can adapt to any motor technology, and we supply products in a power range from 0.18 kW to 5.3 MW.

VLT® | VACON®



DKDD.PB.404.A4.02