

Danfoss



Drives and Soft Starters For water and wastewater

VLT[®]
THE REAL DRIVE

Four decades of VFD technology evolution...

VLT® **40**
1968 • 2008



1968-1982



1982-1989



1989-1992



1992-1997



1997-2007



2007...

Danfoss introduced the world's first mass-produced VFD in 1968. Our VLT® brand name has set the standard for quality drives ever since.

Here's a quick history (left to right):

VLT 5 1968-1982
1-20 HP, 380 VAC (5 HP shown), Oil-cooled design (5.3 gal.capacity) Weight: 141 lbs.
First mass-produced AC drive ever made. Most popular in Europe, many units are still in use. Utilized PAM analog control principle.

VLT 200 1982-1989
1-30 HP, 220-460 VAC (5 HP shown) Weight: 77 lbs.
Analog control using PWM control principle. Modules for feature and performance enhancements included PID, ramp functions and isolation.

VLT 3500 1989-1992
1-75 HP, 220-500 VAC (5 HP shown) Weight: 36 lbs.
First digital drive with VVC control technology. LED control panel. UL approved.

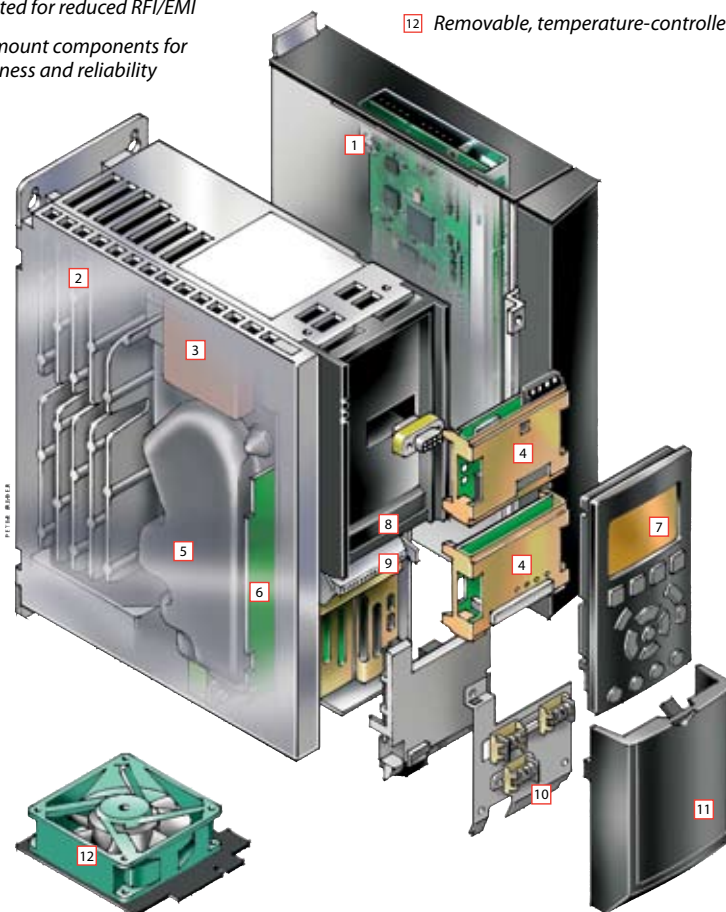
VLT 3500 1992-1997
1-300 HP, 220-500 VAC (5 HP shown) Weight: 29 lbs.
2nd generation VLT 3500 featured new LCD control panel with increased software capabilities. Serial communication protocols offered.

VLT 8000 1997 – 2007
1-600 HP, 200-600 VAC (5 HP shown) Weight: 19 lbs.
Enhanced VVC^{PLUS}, substantial size and weight reduction, many standard performance features that cost extra from other manufacturers.

Welcome to the new generation Danfoss VLT® drive technology:

VLT® AQUA Drive

- 1 Provision for electronically controlled bypass or advanced controller options
- 2 Unique cold plate and back channel cooling technology
- 3 Balanced DC-link reactors for reduced harmonics
- 4 Field-installable or factory installed and tested option cards provide additional functionality
- 5 Constructed for reduced RFI/EMI
- 6 Surface mount components for compactness and reliability
- 7 Hot-pluggable keypad with on-board memory and award-winning ergonomic design
- 8 USB interface for easy connection to PC software suite
- 9 Removable terminal strips, angled for easy access
- 10 All power and control wires enter at the bottom of the enclosure
- 11 Easy access to control terminals
- 12 Removable, temperature-controlled fan for easy servicing



... and focus on our customers' success

VLT® Drives Increase Productivity

Since 1933, Danfoss has mastered advanced technology and provided their customers with competitive advantages and increased productivity. Being a market leader, Danfoss can offer you the tools to move forward and stay ahead in your field.

Advanced Technology That is Easy to Use

Variable frequency drives—which allow standard AC motors to vary speed and torque in a very controlled way—are the core of our business. They increase the efficiency of automation systems, create energy savings and improve process control in a cost-effective way.

Dedicated to Drives Solutions

When considering drives, ask an expert's opinion. Danfoss has focused on providing drives and accessories for more than 40 years. We have accumulated a deep understanding of drives technologies, applications and customer needs.

- Danfoss has been mass producing AC drives longer than any other drive manufacturer
- We are an ISO 9001 certified manufacturer and our EMS (Environmental Management System) is ISO 14001 certified
- We are world renowned for superior quality, helpful service, and competitive pricing
- Danfoss products are a superior design—our products offer many design “extras” as standard built-in features, instead of extra cost, extra space add-ons
- Danfoss Drives is an exclusive drives manufacturer– it's all we do
- We provide fast turnaround on orders
- Application and technical information is available anywhere, anytime

Dependable People; Dependable Solutions

Danfoss shares the common Danfoss core values:

- Our business is trust
- A very safe and reliable choice
- Passionate about technology
- Global culture, local representation
- Environmentally and socially responsible

Our entire business organization is built on a straightforward approach to customers and applications, vouching for every step from design, manufacturing, sales and delivery to commissioning and after-sale services.

It Takes Innovation to Stay Ahead

Customers are actively involved in the development and design of VLT drives. Our newest VLT platform is a case in point. Future demands on drives technology and performance are explored through dialogue, studies and field tests. The results are user-friendly and reliable operation, along with useful new features and sophisticated technology.

We regard our customers as long-term business associates. We work with them to solve their problems. Their success is our success.

We look forward to the opportunity to work with you.

*DeviceNet® is a trademark of Open DeviceNet Vendor Association, Inc.
LonWorks® is a registered tradename of Echelon Corp.
Profibus® is a trademark of Profibus International
VLT® is a registered trademark of Danfoss Inc.*

Contents

Drives/Soft Starters Comparisons and Overviews	2
VLT® Micro Drive	6
VLT® 2800 Drive	18
VLT® AQUA Drive.....	38
MCD 200 Soft Starter	142
MCD 3000 Soft Starter	152

Drives/Soft Starters Comparison

Danfoss provides a wide range of VLT Series drives and MCD Soft Starters to control three-phase induction motors. The control requirements of your application should determine the selection. The tables below and on the following pages are designed to aid your selection.



VLT Series Drives



MCD Soft Starters

Feature	VLT Series Drives	MCD Soft Starters
Motor Speed/Torque Control	Infinitely variable	Fixed speed/soft start
Slip Compensation	Yes	No
Remote Start/Stop Available	Yes	Yes
Hand Start/Stop Available	Yes	Yes
Ramped Starting Available	Yes	Yes
Starting Ramp Time	to 3,600 sec.	to 60 sec.
Starting Method	Controlled voltage and frequency	Controlled motor current (and voltage) at a line frequency
Typical Maximum Starting Current (as a % of Motor Full Load Current)	150%	300 to 450%
Typical Maximum Starting Torque (as a % of Motor Full Load Torque)	160%	35 to 85%
Stopping Method	Selectable: coast to stop or frequency and voltage ramped deceleration	Selectable: coast to stop or ramped voltage during stop
Motor Overload Protection	Yes	Yes
Accepts Motor Thermistor for Additional Motor Thermal Protection	Yes	Yes
Controller Overtemperature Protection	Yes	Yes
Undervoltage Protection	Yes	Yes
Input Phase Imbalance/Phase Loss Protection	Yes	Yes
Number of Parameter Setups	Four	Two
Reversing	Electronic	Requires a separate reversing contactor
Fault Log	Yes	Yes
Fault Reset	Most faults automatically reset	Fault reset action can be selected based on the type of fault

Drives/Soft Starters Overview

VLT® Micro Drive

Available in 1/4 to 3 HP (230 VAC, 1 phase); 1/3 to 5 HP (230 VAC, 3 phase); 1/2 to 10 HP (480 VAC, 3 phase). The VLT Micro Drive provides a small, easy to use package to address the confines of panels and allow simple startup and operation.

VLT® 2800 Drive

The VLT 2800 Drive is offered in 1/2 to 5 HP, 1 or 3 phase, 230 VAC; 3/4 to 25 HP, 3 phase, 460 VAC. The VLT 2800 Drive provides general purpose performance, enhanced software features specifically aimed at demanding packaging applications, and standard protection features for reliable operation. Factory installed options for Dynamic Braking, RFI Filter and Fieldbus Communication are available.

VLT® AQUA Drive

This new generation drive is tailored to the specific needs of water and wastewater applications. The VLT AQUA Drive series addresses applications as high as 1,350 HP operating in variable torque mode with 110% overload. The units are offered in several configurations to simplify installation: chassis for panels, NEMA/UL Type 1 for control rooms, NEMA/UL Type 12 packages which offers the most compact standard solution on the market in this power range, and IP66 for units exposed to harsh environmental conditions. These units are available with a wide range of factory installed options, such as: RFI Filters, Serial Communication in the most popular protocols, Application Options and more.

Engineered Panel Solutions (EPS) Program

The EPS design gives the installer and drive user a centralized drive system featuring main supply disconnect convenience to help ensure operator safety and system protection.

Engineered panels are available in a variety of configurations with user-specified options to best match individual application requirements. Options include pilot lights, analog meters, switches, dual motor operation, contactor motor selection, line reactors and bypass fuses. These options can be incorporated into any panel and wired into the control circuitry specific to the application. Engineered panels are available for VLT 2800 and VLT AutomationDrive, and MCD Series soft starters.

MCD Soft Starters

Soft starters are typically used on motor applications where a smooth start and/or stop is advantageous, such as conveyor systems, fans, pumps, compressors, and high inertia loads. Danfoss soft starters are also a good replacement for star/delta starters.

MCD 200 Series

The MCD 200 Series is offered in 200 – 440 or 200 – 575 VAC 50/60 Hz supply voltages, for power ranges up to 200 HP. Internal SCR bypass contactors allow installation within motor control enclosures with no need for extra ventilation of external bypass contactors. The MCD 200 Series is smaller than most comparable soft starters, and optionally available with Modbus serial communication, remote operation, and MCD PC software which can be used for networks of up to 99 soft starters.

MCD 3000 Series

MCD 3000 Series electronic soft starters control motor current to provide a smooth start. For applications with high starting current, shock load on gear and other transmission elements, fast acceleration and deceleration, or utility regulations prohibiting line-starting of motors, the Danfoss MCD 3000 soft starter is the optimum solution. Models are available for AC motors ranging from 10 – 1,000 HP.

Drives Functional Comparison

	VLT® Micro Drive	VLT® 2800 Drive	VLT® AQUA Drive	
Page	6	18	38	
Input Voltage	200-240 VAC 1 phase	1/4 – 3 HP	1/2 – 5 HP	7-1/2 – 30 HP
	200-240 VAC 3 phase	1/3 – 5 HP	1/2 – 5 HP	1/3 – 60 HP
	380-480 VAC 3 phase	1/2 – 10 HP	3/4 - 25 HP	1/2 – 1350 HP
	525-600 VAC 3 phase			1 – 125 HP
	525-690 VAC 3 phase			50 – 1350 HP
Control Method	V/Hz	•		
	Enhanced V/Hz (VVC)		•	
	Sensorless Vector (VVC ^{PLUS})			•
Inputs and Outputs	Digital Inputs	6	5	6
	Pulse/Encoder Inputs	1	1	2/1
	Analog Inputs	1	2	2
	Safe Stop Input			•
	Digital/Pulse Outputs	1, photocoupler	1	2
	Relay Outputs	1	1	2
	Analog Outputs	1	1	1
Enclosure Types	Chassis (IP00)			•
	Protected Chassis (IP20)	•	•	•
	NEMA / UL Type 1 (IP21)		•	•
	NEMA / UL Type 12 (IP54/55)			•
	IP66			•
Mounting	Side by Side	•	•	•
	Vertical or Horizontal	•	•	•
	DIN rail	•		
Functions	Engineered Panel Solution		•	•
	RFI Filter	•	Built-in	•
	Motor Coils		•	•
	dV/dt		•	•
	Remote Mounting Keypad	•	•	•
	Graphic Display			•
	Numeric Display	•	•	
	Fuse/Fuse Disconnect			•
	NEMA / UL Type 1 Kit	•	•	•
	Through Panel Mounting Kit			•
	PI	•		
	PID		•	•
	Automatic Motor Tuning/Adaptation	•	•	•
Auto Energy Optimization	•		•	
Smart Logic Controller	•		•	
H-O-A Function		•		
H-O-A Keypad			•	
Certification	CE, cUL, UL	CE, cUL, UL	CE, cUL, UL	

Soft Starters Functional Comparison

	MCD 200		MCD 3000
Page	142		152
Type	MCD 201: Compact unit providing basic soft start and stop functionality MCD 202: Compact unit with current limit start, soft stop with motor protection		Complete motor starter solution, providing control of starting and stopping as well as protection of both motor and application
Range	10 - 150HP @ 480V 15 - 200HP @ 575V 200 - 575V mains voltage 110 - 400V AC or 24V AC/DC control supply		10 - 1250HP @ 480V 15 - 1500HP @ 575V 200 - 690V mains voltage 110 - 400V AC control supply
Start/Stop	MCD 201: Timed voltage ramp-up Adjustable initial torque	MCD 202: Current limit start Initial current ramp-up	Current limit start Initial current ramp-up Kick start Torque boost Dual parameter function
	Timed voltage ramp-down		Linear voltage ramp-down Three auto-adjustable voltage ramps DC brake function Soft brake function
Protection	MCD 202 only: Motor overload (adjustable trip class) Excess start time Reverse phase rotation Motor thermistor input Shorted SCR—no start Supply fault—no start		As MCD 202 + Undercurrent Shearpin Starter overtemperature Restart delay Warning before trips Adjustable phase Imbalance sensitivity
Outputs	MCD 201 one output relay: • Line contactor control MCD 202 two output relays: • Line contactor control • Run contactor or trip function		Three output relays: Line contactor control Run contactor or trip function DC brake contactor
Control	Two- or three-wire control Programmable via rotary switches (3 on MCD 201; 8 on MCD 202) Reset push button Optional: Modules for serial communication Remote operator kit PC software		Local keypad Buttons for start, stop, reset and remote control Inputs for two- or three-wire control Optional: Modules for serial communication Remote operator kit PC software
Other Features	Integral SCR bypass for minimum physical size and heat dissipation during nominal operation LED status indication		Built-in bars for easy connection of bypass contactor All motor protection functions are retained in bypass mode Inside delta wiring kit (175 - 1000HP @ 480V) Automatic reset function Password parameter protection Trip log function LED status indication
Enclosure Types	IP20 (Up to 100 Amps) IP00 (Above 100 Amps)		IP21 (Up to 250 Amps) IP20 (Above 250 Amps)

VLT® Micro Drive

Despite its compact size and ease of installation, the VLT Micro Drive can deliver exceptional performance even in complex applications.



- 1 Well protected IP20 enclosure with NEMA/UL Type 1 optional; no forced airflow through electronics
- 2 High quality capacitors
- 3 RFI Filter
- 4 Hot-pluggable LCP
- 5 LCD display
- 6 I/O terminals
- 7 EIA-485 connection
- 8 Customer relay screw terminals; wire inlet from the bottom
- 9 Potentiometer
- 10 Removable cover for convenient access to control terminals
- 11 Mains screw terminals
- 12 DC-link access
- 13 Safety ground; min. 10 AWG accessible from front
- 14 Motor screw terminals



Manufactured to the highest quality standards

The VLT® Micro Drive is a UL-listed product made in an ISO 9001-2000 certified facility.



Ready—Set—Go!

The VLT Micro Drive offers unsurpassed reliability, user-friendliness and condensed functionality that is extremely easy to commission. Connect motor and power cables, turn the control knob, and watch the motor speed change. Approximately 100 parameters are available to optimize energy efficiency and operation.

Features

Small drive—high performance

- Process PI controller – Removes need for external controller
- Automatic Energy Optimization (AEO) – Lowers energy consumption
- Automatic Motor Tuning (AMT) – Utilizes motor's full potential
- 150% motor torque up to 1 minute – Removes need for bigger drive
- Flying start (catch a spinning motor) – Provides smooth starts without tripping
- Electronic Thermal Relay (ETR) – Replaces external motor protection
- Smart Logic Controller – Helps automate application
- Built-in RFI filter – Minimizes radio frequency disturbances

User friendly

- Plug-and-play – Streamlined installation
- Minimal commissioning requirements – Quicker startup
- Settings can be copied via the local control panel – Easy setup of multiple drives
- Intuitive parameter structure – Minimal manual reading
- Compatible with MCT 10 Setup Software – Faster startup and greater control of large installations

Reliable

- Optimal heat dissipation – Longer lifetime
- High quality electronics/capacitors – Low lifetime cost
- All drives full-load tested from factory – High reliability
- Ground fault, temperature and short circuit protection – High level of protection without the need for external devices
- Circuit boards well protected and coated – Increased robustness

Inputs and outputs

- 5 programmable digital inputs
- Activation based on switching high or sinking low (0-24 VDC)
- Pulse input 20–5000 Hz
- 1 analog input (0–10 V or 0–20 mA)
- 1 analog input 0–20 mA
- Thermistor input (analog/digital)
- 1 analog output 0–20 mA
- 1 Relay 240 VAC, 2 A
- EIA-485 port with FC or Modbus RTU protocol

Compact general purpose drive

The VLT Micro Drive is a general purpose drive designed to control AC motors up to 10 HP.



VLT® Micro Drive

Ensured reliability and maximum uptime



True side-by-side mounting

A compact bookstyle design allows space-saving mounting without derating.

Built-in brake functions

With built-in DC and AC brake functions, the VLT® Micro Drive can transform kinetic energy in the application into braking power to slow the motor. A brake chopper is built into all VLT Micro drives 2 HP and up.

Minimal penetration of dust

The VLT Micro Drive is designed to separate forced ventilation air from the electronics. Printed circuit boards are well protected inside the drive.

Built-in RFI protection

A built-in RFI filter limits radio disturbance from motor cables, allowing for 50' motor cables (shielded).

Built-in smart logic controller

The smart logic controller is a simple yet very clever way to enable the drive, motor and application to work together.

The smart logic controller is able to monitor any parameter that can be characterized as "true" or "false." This includes digital commands and also logic expressions, which allows even sensor outputs to influence the operation. For example, temperature, pressure, flow, time, load, frequency, voltage and other parameters can be combined with the operators ">," "<," "=", "and" and "or" form logic expressions that are false or true.

That is why Danfoss calls it a "logic" controller. As a result, you can program the controller to react to most any event.

Designed for robust operation in a variety of applications

Coated electronics are standard

All VLT Micro Drives come with conformally coated circuit boards for greater longevity and reliability in harsh operating environments.

Energy efficiency 98%

High-quality VLT power modules ensure low power losses, resulting in cooler operation.

Intelligent heat management

Heat from the power semiconductors is transferred through the heatsink to the external airflow, which is routed through the cooling fins. This minimizes the air exchange inside the enclosure and protects the control circuitry from dirt and other contaminants.



122° F (50° C) ambient temperature

Highly efficient cooling allows for operation in high ambient temperatures. At 100% load, ambient temperature is rated at 104° F (40° C).

Features

Hot-pluggable display

Packed with features

- LCP copy function—transfer parameter settings from one drive to another
- Parameter numbers and values visible simultaneously
- Unit indications (A., V, Hz, RPM, %, s, HP and kW)
- Rotation direction indication
- Setup and status indications
- Removable during operation
- Hand-Off-Auto (H-O-A) buttons for ease of operation

Quick Menus

- Easy access to parameters commonly used in startup procedures
- PI controller parameters grouped for easy access

Large, bright display

- Easy to read from a distance
- H-O-A operation buttons illuminated when active

User-friendly menu structure

- Uses the same familiar and proven format as other VLT® Series drives
- Easy shortcuts for the experienced user
- Edit and operate in different setups simultaneously

Remote mountable

Illuminated LCD display

Navigation buttons

Indicators

H-O-A operation buttons



Control panels shown actual size: 3.3"H x 2.6"W x 0.8"D (D = 1.1" with potentiometer)

Control Panel Options

Two control panels are available for either local or remote mounting:

- LCP 11 with UP/DOWN buttons for speed setting (NEMA/UL Type 12 protection when remotely mounted)
- LCP 12 with rotary potentiometer for speed setting (NEMA/UL Type 1 protection)

Mains Supply (L1, L2, L3):

Supply voltage	1 x 200–240 V ±10%
	3 x 200–240 V ±10%
	3 x 380–480 V ±10%

Output Data (U, V, W):

Output voltage.....	0–100% of supply voltage
Output frequency.....	0–200 Hz (VVC+ mode) 0–400 Hz (V/Hz mode)
Switching on output	Unlimited
Ramp times.....	0.05–3600 sec.

Digital Inputs:

Programmable inputs.....	5
Logic.....	Selectable sourcing high (24 V) or sinking low (0 V)
Voltage level.....	0–24 V
Maximum voltage on input.....	28 VDC
Input Resistance	Approx. 4 kΩ

Pulse Inputs:

Programmable pulse inputs.....	1
Voltage level.....	0–24 VDC (PNP positive logic)
Pulse input accuracy (0.1–110 kHz)	Max. error: 0.1% of full scale
Pulse input frequency.....	20–5000 Hz

Analog Input:

Analog inputs	2
Modes.....	1 current/1 voltage or current
Voltage level.....	0–10 V (scaleable)
Current level.....	0/4–20 mA (scaleable)

Analog Output:

Programmable analog outputs.....	1
Current range at analog output.....	0/4–20 mA
Max. load to common at analog output.....	500 Ω
Accuracy on analog output.....	Max. error: 1% of full scale

On-Board Power Supply:

Output voltage.....	10.5 ± 0.5 V
Max. load	
10 V.....	25 mA
24 V.....	200 mA

Relay Outputs:

Programmable relay outputs.....	1
Max. terminal load	
Resistive	240 VAC, 2 A
Inductive.....	250 VAC, 0.2 A

Cable Lengths:

Max. motor cable length	
Shielded.....	50 ft (15 m)
Unshielded.....	165 ft (50 m)

Environmental Operating Conditions:

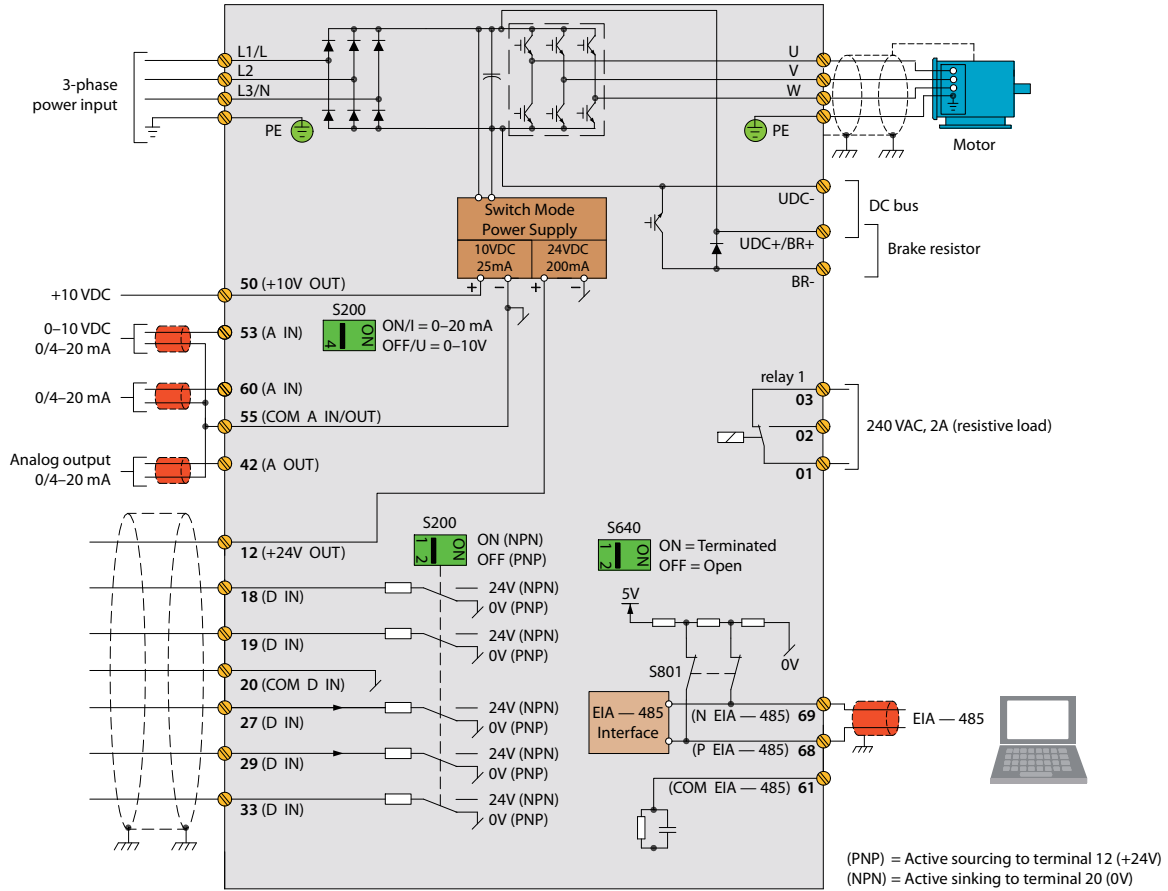
Enclosure	IP20 standard; NEMA/UL Type 1 and IP21 optional
Vibration test.....	0.7 g
Max. relative humidity.....	5%–95% (IEC 721-3-3; Class 3K3 (non-condensing) during operation
Aggressive environment.....	(IEC 721-3-3), coated class 3C3
Ambient operating temperature.....	Max. 122° F
24-hour average operating temperature	Max. 104° F
Min. ambient temperature	
During full-scale operation.....	32° F
At reduced performance	14° F
Temperature during storage/transport.....	-13 – 149/158° F

Protection and Features:

- Electronic thermal motor protection against overload
- Temperature monitoring of the heat sink protects the drive from overheating
- The drive is protected against short-circuits on motor terminals U, V, W
- The drive is protected against ground fault on motor terminals U, V, W

General Specifications

Connections

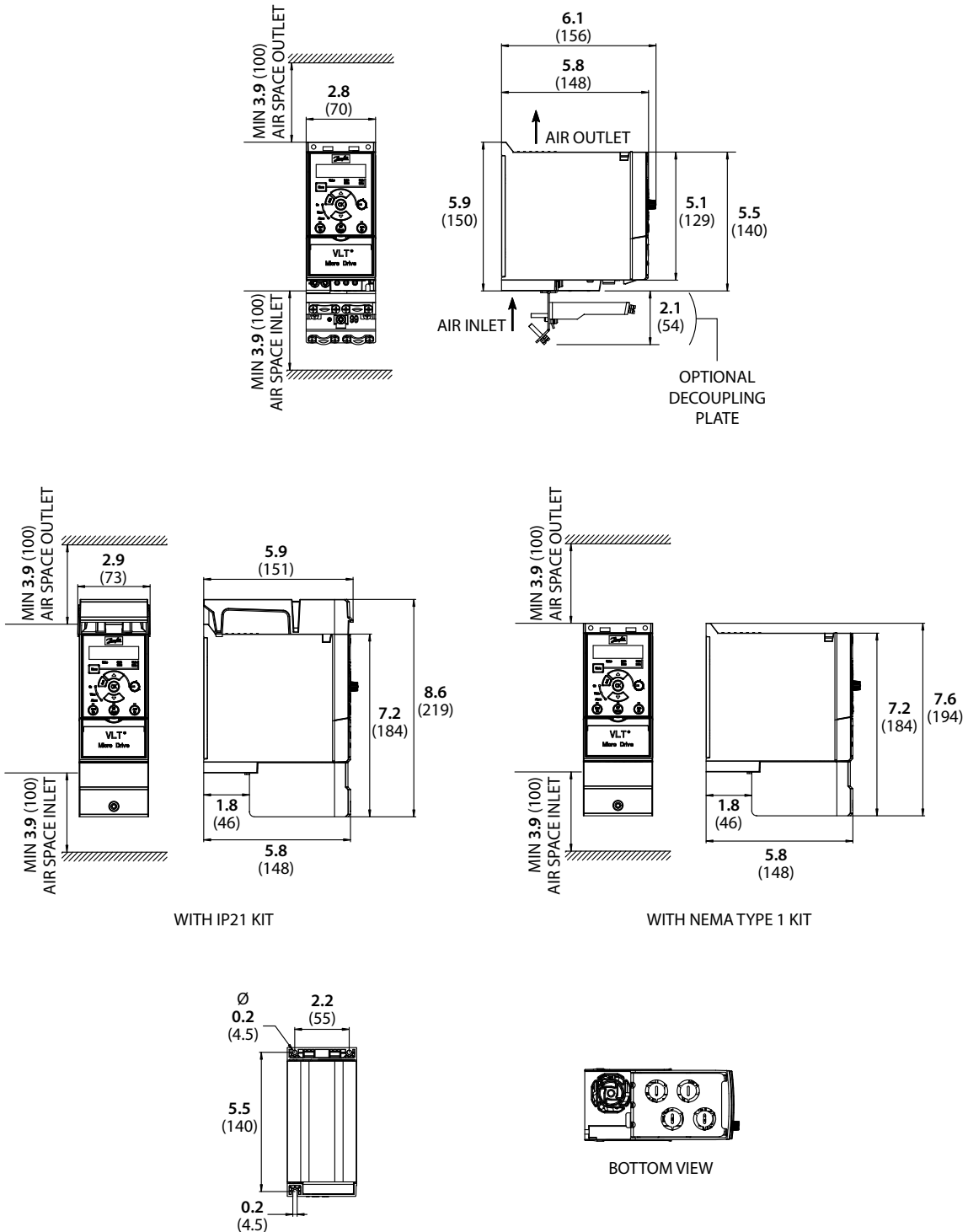


VLT® Micro Drive

Dimensions

in (mm)

M1 Frame Size

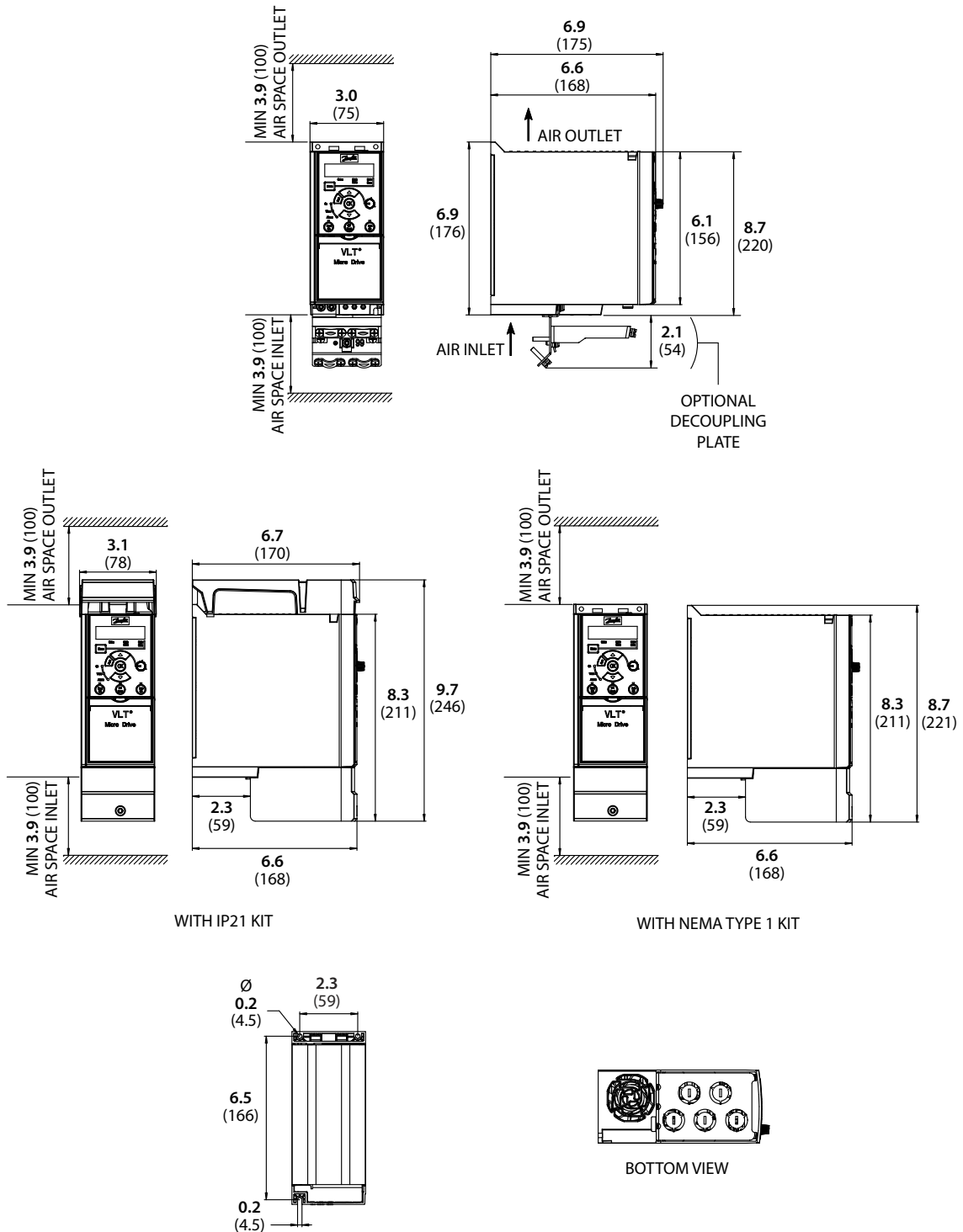


General Specifications

Dimensions

in (mm)

M2 Frame Size

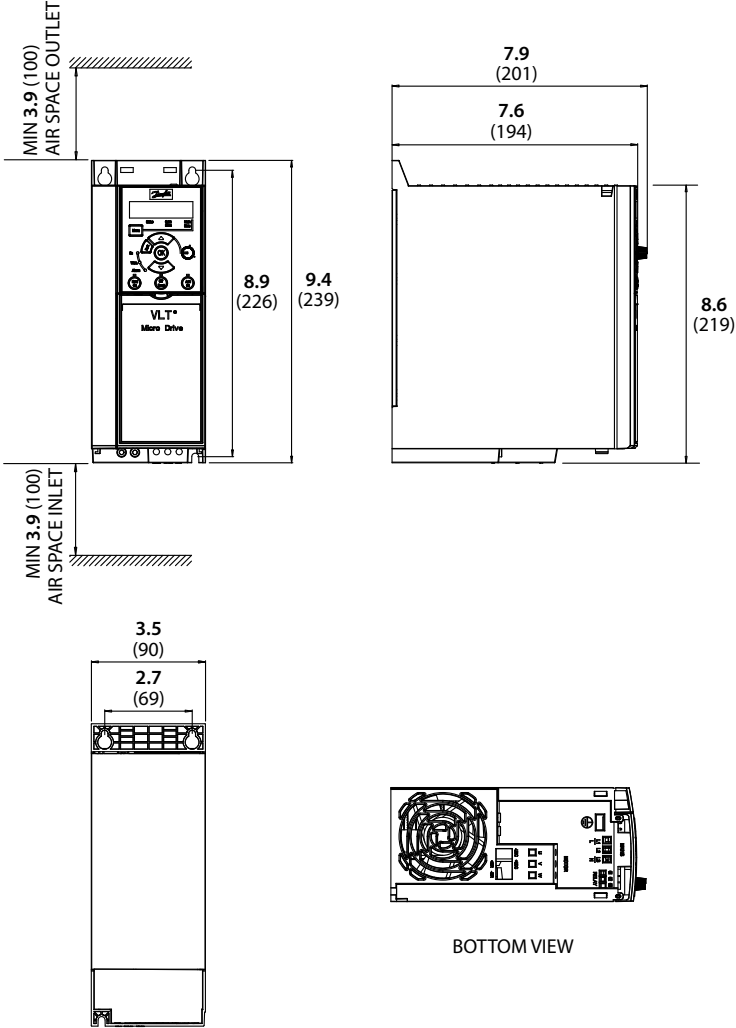


VLT® Micro Drive

Dimensions

in (mm)

M3 Frame Size



Contact Danfoss for M3 NEMA 1/IP21 dimensions.

Accessories



MCT 10 (Motion Control Tools)

Offering advanced programming functionality for all Danfoss drive products, MCT 10 greatly reduces programming and commissioning times.

Drives are managed in a standard folder-based user interface that's familiar and easy to understand. Parameter settings for each drive are contained in a single file, simplifying setup and the duplication of parameter sets between drives.

MCT 10 Basic version is available free of charge from the Danfoss web site. The Advanced edition, which offers a higher level of functionality, is available from your Danfoss sales partner. Both versions require an RS485 converter.

- On-line and off-line commissioning
- On-board help files for each drive parameter
- Logging of alarms and warnings for improved system performance and documentation
- MCT 10 Conversion Wizards simplify drive conversion projects
- Real-time data collection using the MCT 10 Scope function
- Access to the VLT® Micro's internal data buffer, providing up to four channels of high speed (down to 1 millisecond) data collection
- Simplified programming of the VLT® Micro's Smart Logic Controller using graphical programming tools
- Drive upgrade tools

Part Number 130B1000



Brake Resistors

Brake resistor(s) must be used in conjunction with the dynamic brake to dissipate the heat/power regenerated by the motor during deceleration or overhauling load. Braking energy is only absorbed into the brake resistor. Brake resistors must be ordered separately and field installed by the customer.

Contact Danfoss if brake resistors are required for your application.

Accessories



Remote Mounting Kit

A dedicated mounting kit is available for mounting the local control panel (LCP) in a cabinet door. Includes 10' cable.

Part Number 132B0102

VLT® Control Panels

LCP 11 w/o potentiometer 132B0100
LCP 12 with potentiometer 132B0101

NEMA/UL Type 1 Kits

For M1 frame 132B0103
For M2 frame 132B0104
For M3 frame 132B0105

Decoupling Plate Kit

For M1 and M2 frames 132B0106
For M3 frame 132B0107

IP21 Kit

For M1 frame 132B0108
For M2 frame 132B0109
For M3 frame 132B0110

DIN Rail Mounting Kit

For M1 frame 132B0111

VLT® Micro Drive Ordering Information

230 VAC, Single Phase

HP	Current [I-nom.]	Frame Size	Single-Phase Ordering #
0.25	1.2	M1	132F0001
0.5	2.2	M1	132F0002
1	4.2	M1	132F0003
2*	6.8	M2	132F0005
3*	9.6	M3	132F0007

230 VAC, Three Phase

HP	Current [I-nom.]	Frame Size	Three-Phase Ordering #
0.33	1.5	M1	132F0008
0.5	2.2	M1	132F0009
1	4.2	M1	132F0010
2*	6.8	M2	132F0012
3*	9.6	M3	132F0014
5*	15.2	M3	132F0016

460 VAC, Three Phase

HP	Current [I-nom.]	Frame Size	Three-Phase Ordering #
0.5	1.2	M1	132F0017
1	2.2	M1	132F0018
2*	3.7	M2	132F0020
3*	5.3	M2	132F0022
4*	7.2	M3	132F0024
6*	9	M3	132F0026
7.5*	12	M3	132F0028
10*	15.5	M3	132F0030



* VLT Micro Drives 2 HP and up have built-in brake chopper

VLT® 2800 Drive



Exceptional performance has made the VLT® 2800 the one to beat among general purpose drives. Over the years, the VLT 2800 has proven to be dependable, versatile and easy to operate and commission. Packed with functionality at an attractive price, the VLT 2800 can be a reliable asset in many applications.

Value-packed

Over one million sold worldwide:

- Compact
- No side clearance required
- Cold plate cooling technology
- Built-in DC-link reactor for harmonics reduction
- PID Controller

Easy to operate

- Quick Menu includes parameters needed for quick startup
- Hot-pluggable display with copy function available as option
- MCT 10 setup software can greatly simplify installation and startup

Compact general purpose drive

The VLT® 2800 Drive is a general purpose drive designed to control AC motors through 25 HP.

Intelligent

- Bus communication options include DeviceNet, Profibus DP, and built-in Modbus RTU and Metasys N2
- Precise stop
- Pump functions
- Wobble functions

Rugged and reliable

- Robust, with die-cast chassis and efficient heat dissipation
- Protected against line transients
- 24-hour support, local service
- 100% ground fault protection
- Protected from switching on input and output
- Galvanic isolation
- Output short circuit protection – survives even short circuit of motor cables and short circuit of signal cables
- No derating – operates at full load and full speed in temperatures up to 104° F (40° C)
- Complies with the EMC norm EN 55011 Class 1A and 1B (with RFI filter)



Manufactured to the highest quality standards

The VLT® 2800 Drive is a UL-listed product made in ISO 9001-2000 and ISO 14000 certified facilities.

Features

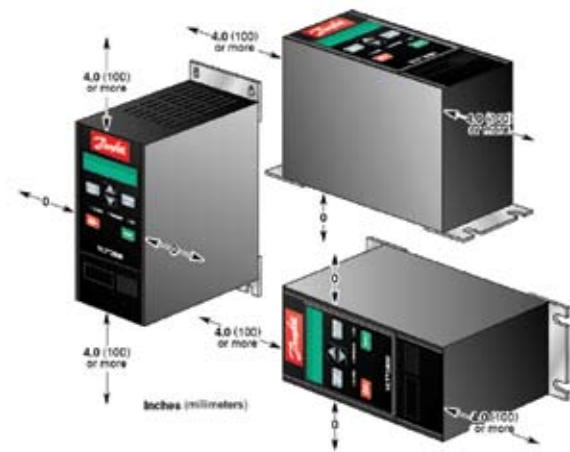
Plug-and-play simplicity

Single-phase line supply

Now available up to 5 HP, single-phase VLT® 2800 Series drives can be wired to plug into a standard single-phase outlet. These drives can then be connected to three-phase pumps, fans, blowers, and more. It's just like getting three-phase power from a standard 220–240V power socket.

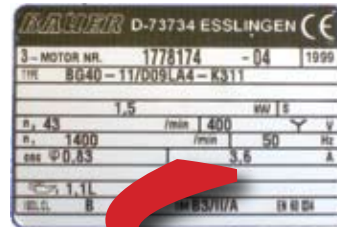
Flexible mounting

The VLT 2800 is designed for flexible mounting. A ventilated heatsink allows drive units to be mounted side-by-side or even horizontally.



User friendly

Entering motor data in the Quick Menu via the control panel is often all it takes to get up and running.



Hand-Off-Auto

This software function is actually three functions in one, all operated as a one-button control:

Auto (normal mode)

The drive is controlled by external or local reference signals, analog, digital inputs or fieldbus reference (e.g., current or voltage, such as 0 – 10 V or 4 – 20 mA).

Hand

In this mode, the application can be controlled manually from the keypad, temporarily ignoring external reference signals. The hand mode is useful for commissioning or in case of error in an external controller/sensor. Transition from Auto to Hand is smooth. Up/down arrows provide speed reference control on the LCP (Local Control Panel).

Off

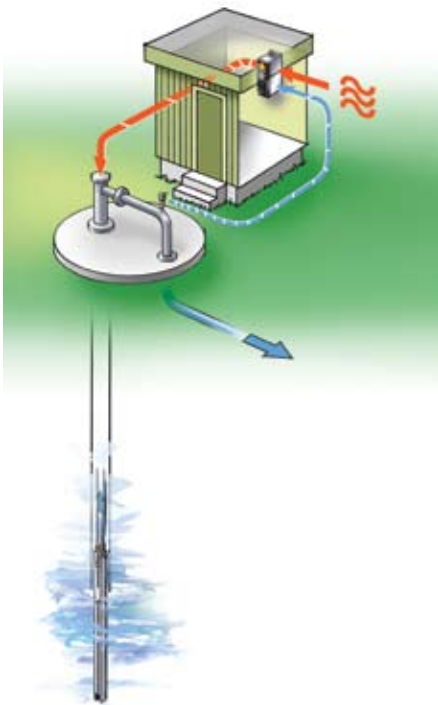
The stop button allows the application to be stopped locally for servicing of the drive (e.g., for changing parameters).

Dry pump detection

New features improve pump operation significantly, offering improved energy savings and greater pump protection.

VLT® 2800 Series drives can detect when the pump has run dry and shut it down before damage can occur.

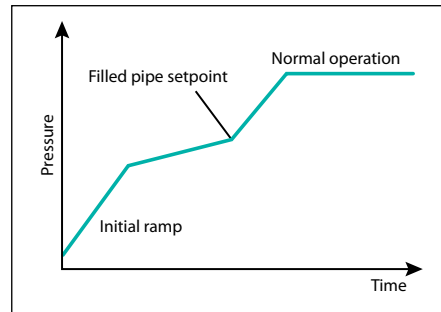
- Automatic or manual restart
- Programmable restart delay up to one hour
- Shutdown at low or no flow
- Operates in open or closed loop



Pipe fill mode

Provides controlled filling of pipes, preventing water hammer, burst water pipes and damage to sprinkler heads.

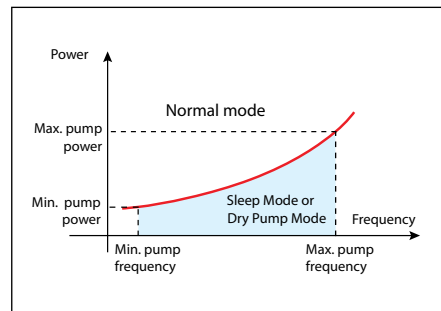
Pipe fill mode is particularly valuable in applications that are vulnerable to these types of damage, such as irrigation or water supply systems. Once up to speed, the drive's PID loop utilizes an input signal to match the desired line pressure in the system.



Enhanced sleep mode

When using pumps with flat pump curves or when the suction pressure varies, this feature provides excellent control for shutting down the pump at low flow, thus saving energy.

- Automatic restart after shutdown based on pressure
- Boost function increases pressure prior to shutdown
- Operates in closed loop



General Specifications

Mains Supply (L1, L2, L3):

Supply voltage	
VLT 2803-2840	
220 – 240 V (N, L1)	1 x 220/230/240 V ±10%
200 – 240 V	3 x 200/208/220/230/240 V ±10%
VLT 2805-2882	
380-480 V	3 x 380/400/415/440/480 V ±10%
VLT 2805-2840 (R5)	380/400 V +10%
Supply frequency	50/60 Hz ±3 Hz
Max. imbalance on supply voltage	±2.0% of rated supply voltage
True Power Factor (λ)	0.90 nominal at rated load
Displacement Power Factor (cos φ)	near unity (>0.98)
Number of connections at supply input L1, L2, L3	2 times/min.
Max. short-circuit value	100,000 A

See Design Guide section on Special Conditions.

Output Data (U, V, W):

Output voltage	0 – 100% of supply voltage
Output frequency	0.2 – 132 Hz, 1 – 1000 Hz
Rated motor voltage	
200 – 240 V units	200/208/220/230/240 V
380 – 480 V units	380/400/415/440/460/480 V
Rated motor frequency	50/60 Hz
Switching on output	Unlimited
Ramp times	0.02 – 3600 sec.

Torque Characteristics:

Starting torque (parameter 101)	
Torque characteristic = Constant torque).....	160% in 1 min.*
Starting torque (parameter 101)	
Torque characteristics = Variable torque).....	160% in 1 min.*
Starting torque (parameter 119)	
High starting torque)	180% for 0.5 sec.
Overload torque (parameter 101)	
Torque characteristic = Constant torque).....	160%*
Overload torque (parameter 101)	
Torque characteristic = Variable torque).....	160%*

Percentage relates to VFD's nominal current.

* VLT 2822 & 2840 1Ø 220 V only 110% in 1 min.

Control Card, Digital Inputs:

Number of programmable digital inputs	5
Terminal number	18, 19, 27, 29, 33
Voltage level	0 – 24 VDC (PNP positive logic)
Voltage level, logic '0'	<5 VDC
Voltage level, logic '1'	>10 VDC
Maximum voltage on input	28 VDC
Input resistance (terminals 18, 19, 27, 29)	approx. 4 kΩ
Input resistance (terminal 33)	approx. 2 kΩ

All digital inputs are galvanically isolated from the supply voltage (PELV) and other high-voltage terminals. See Design Guide section on Galvanic Isolation.

Control Card, Analog Inputs:

Number of analog voltage inputs	1 pcs.
Terminal number	53
Voltage level	0 – 10 VDC (scaleable)
Input resistance	approx. 10 kΩ
Max. voltage	20 V
Number of analog current inputs	1 pcs.
Terminal number	60
Current level	0/4 – 20 mA (scaleable)
Input resistance	approx. 300 Ω
Max. current	30 mA
Resolution for analog inputs	10 bit
Accuracy of analog inputs	Max. error 1% of full scale
Scan interval	13.3 msec

The analog inputs are galvanically isolated from the supply voltage (PELV) and other high-voltage terminals. See Design Guide section on Galvanic Isolation.

Control Card, Pulse Inputs:

Number of programmable pulse inputs	1
Terminal number	33
Max. frequency at terminal 33	67.6 kHz (Push-pull) 5 kHz (open collector)
Min. frequency at terminal 33	4 Hz
Voltage level	0 – 24 VDC (PNP positive logic)
Logic '0'	<5 VDC
Logic '1'	>10 VDC
Maximum voltage on input	28 VDC
Input resistance	approx. 2 kΩ
Scan interval	13.3 msec
Resolution	10 bit
Accuracy	
100 Hz – 1 kHz) terminal 33	Max. error: 0.5% of full scale
1 kHz – 67.6 kHz) terminal 33	Max. error: 0.1% of full scale

The pulse input (terminal 33) is galvanically isolated from the supply voltage (PELV) and other high-voltage terminals. See Design Guide section on Galvanic Isolation.

Control Card, Digital/Frequency Output:

Number of programmable digital/pulse outputs	1 pcs.
Terminal number	46
Voltage level at digital/frequency output.....	0 – 24 VDC (O.C PNP)
Max. output current at digital/frequency output.....	25 mA.
Max. load at digital/frequency output.....	1 kΩ
Max. capacity at frequency output.....	10 nF
Minimum output frequency at frequency output	16 Hz
Maximum output frequency at frequency output.....	10 kHz
Accuracy on frequency output.... Max. error: 0.2 % of full scale	
Resolution on frequency output	10 bit

The digital output is galvanically isolated from the supply voltage (PELV) and other high-voltage terminals. See Design Guide section on Galvanic Isolation.

Control Card, Analog Output:

Number of programmable analog outputs	1
Terminal number	42
Current range at analog output.....	0/4 – 20 mA
Max. load to common at analog output.....	500 Ω
Accuracy on analog output	Max. error: 1.5 % of full scale
Resolution on analog output.....	10 bit

The analog output is galvanically isolated from the supply voltage (PELV) and other high-voltage terminals. See Design Guide section on Galvanic Isolation.

Control Card, 24 VDC Output:

Terminal number	12
Max. load	130 mA

The 24 VDC supply is galvanically isolated from the supply voltage (PELV), but has the same potential as the analog and digital inputs and outputs. See Design Guide section on Galvanic Isolation.

Control Card, 10 VDC Output:

Terminal number	50
Output voltage.....	10.5 V ±0.5 V
Max. load	15 mA

The 10 VDC supply is galvanically isolated from the supply voltage (PELV) and other high-voltage terminals. See Design Guide section on Galvanic Isolation.

Control Card, RS 485 Serial Communication:

Terminal number	68 (TX+, RX+), 69 (TX-, RX-)
Terminal number 67	+5 V
Terminal number 70....	Common for terminals 67, 68 and 69

Full galvanic isolation. See Design Guide section on Galvanic Isolation.

For DeviceNet units, see VLT 2800 DeviceNet manual, MG.90.BX.YY.

Relay Outputs:¹⁾

Number of programmable relay outputs	1
Terminal number, control card (resistive and inductive load).....	1-3 (break), 1-2 (make)
Max. terminal load (AC1) on 1-3, 1-2, control card	250 VAC, 2 A, 500 VA
Max. terminal load (DC1 (IEC 947) on 1-3, 1-2, control card	25 VDC, 2 A /50 VDC, 1A, 50 W
Min. terminal load (AC/DC) on 1-3, 1-2, control card	24 VDC 10 mA, 24 VAC 100 mA

The relay contact is separated from the rest of the circuit by strengthened isolation.

Note: Rated values resistive load - $\cos\phi > 0.8$ for up to 300,000 operations.

Inductive loads at $\cos\phi 0.25$ approximately 50% load or 50% life time.

Cable Lengths and Cross Sections:

Max. motor cable length	
Shielded cable	130 ft (40 m)
Unshielded cable.....	250 ft (75 m)
Shielded cable and motor coil.....	330 ft (100 m)
Unshielded cable and motor coil	660 ft (200 m)
Shielded cable and RFI/1B filter	200 V, 330 ft (100 m)
	400 V, 80 ft (25 m)
Shielded cable and RFI 1B/LC filter	400 V, 80 ft (25 m)

Max. cross section to:

Motor	see next section.
Control wires, rigid wire	1.5 mm ² /16 AWG (2 x 0.75 mm ²)
Control cables	
Flexible cable	1 mm ² /18 AWG
Cable with enclosed core	0.5 mm ² /20 AWG

When complying with EN 55011 1A and EN 55011 1B the motor cable must in certain instances be reduced. See Design Guide section on EMC Emission.

General Specifications

Control Characteristics:

Frequency range.....	0.2 – 132 Hz, 1 – 1000 Hz
Resolution of output frequency.....	0.013 Hz, 0.2 – 1000 Hz
Repeat accuracy of Precise start/stop(terminal 18, 19)	±0.5 msec
System response time (terminal 18, 19, 27, 29, 33)	26.6 msec
Speed control range	
Open loop.....	1:10 of synchronous speed
Closed loop.....	1:120 of synchronous speed
Speed accuracy	
Open loop.....	150 – 3600 rpm: Max. error of ±23 rpm
Closed loop.....	30 – 3600 rpm: Max. error of ±7.5 rpm

All control characteristics are based on a 4-pole asynchronous motor.

Surroundings:

Enclosure	IP20
Enclosure with options.....	NEMA 1
Vibration test.....	0.7 g
Max. relative humidity	5% – 93% during operation
Ambient temperature.....	Max. 113° F (45° C) 24-hour average max. 104° F (40° C)

Derating for high ambient temperature

See special conditions in the Design Guide

Min. ambient temperature	
During full-scale operation.....	32° F (0° C)
At reduced performance	14° F (-10° C)

Temperature during storage/transport..... -13° F (-25° C) to 149/158° F (65/70° C)

Max. altitude above sea level

1000 m

Derating for high air pressure..... see special conditions in the Design Guide

EMC standards

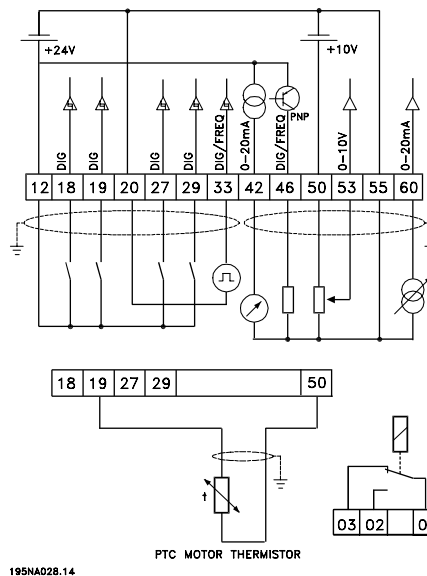
Emission.....	EN 61081-2, EN 61800-3, EN 55011
Immunity.....	EN 50082-1/2, EN 61000-4-2, EN 61000-4-3, EN 61000-4-4, EN 61000-4-5, EN 61000-4-6, EN 61800-3

See Design Guide section on Special Conditions.

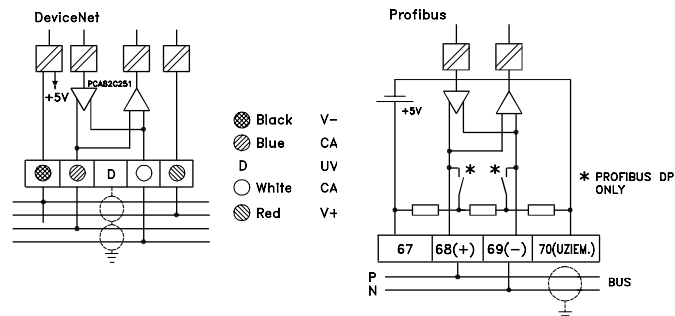
Protection and Features:

- Electronic thermal motor protection against overload.
- Temperature monitoring of the power module ensures that the drive cuts out if the temperature reaches 212° F (100° C). An overload temperature cannot be reset until the temperature of the power module is below 158° F (70° C).
- The drive is protected against short-circuits on motor terminals U, V, W.
- If a mains phase is missing, the drive will cut out.
- Monitoring of the intermediate circuit voltage ensures that the drive cuts out if the intermediate circuit voltage is too low or too high.
- The drive is protected against earth fault on motor terminals U, V, W.

Input/output connections



195NA028.14



VLT® 2800 Drive

1Ø 220 – 240 VAC; 3Ø 200 – 240 VAC

VLT Type		2803	2805	2807	2811	2815
Typical Shaft Output	[HP]	0.5	0.75	1.0	1.5	2.0
Output Current						
Continuous	[A]	2.2	3.2	4.2	6.0	6.8
Intermittent (60 sec)	[A]	3.5	5.1	6.7	9.6	10.8
Max. Input Current						
Continuous	1Ø, 220 – 240 VAC [A]	5.9	8.3	10.6	14.5	15.2
	3Ø, 200 – 240 VAC [A]	2.9	4.0	5.1	7.0	7.6
Intermittent (60 sec)	1Ø, 220 – 240 VAC [A]	9.4	13.3	16.7	23.2	24.3
	3Ø, 200 – 240 VAC [A]	4.6	6.4	8.2	11.2	12.2
Environment						
Estimated Power Loss at Rated Max. Load	240 VAC [W]	24	35	48	69	94
Enclosure		Protected Chassis/IP20 (NEMA/UL Type 1 opt)				
Weight	[lbs.]	4.4	4.4	4.4	4.4	4.4

VLT Type		2822	2822 (T2*)	2840	2840 (T2*)
Typical Shaft Output	[HP]	3.0	3.0	5.0	5.0
Output Current					
Continuous	[A]	9.6	9.6	16.0	16.0
Intermittent (60 sec)	[A]	10.6	15.3	17.6	25.6
Max. Input Current					
Continuous	1Ø, 220 – 240 VAC [A]	22.0	—	31.0	—
	3Ø, 200 – 240 VAC [A]	8.8	8.8	14.7	14.7
Intermittent (60 sec)	1Ø, 220 – 240 VAC [A]	24.3	—	34.5	—
	3Ø, 200 – 240 VAC [A]	9.7	14.1	16.2	23.5
Environment					
Estimated Power Loss at Rated Max. Load	[W]	125	125	231	231
Enclosure	1Ø, 220 – 240 VAC	Protected chassis/IP20 (NEMA/UL Type 1 opt) (NEMA 1 std on 2840 T2 only)			
Weight	[lbs.]	13.2	8.2	40.7	13.2

*2822 and 2840 T2 versions are 3Ø only.

Performance Data

3Ø 380 – 480 VAC

VLT Type		2805	2807	2811	2815	2822	2830
Typical Shaft Output	[HP]	0.75	1.0	1.5	2.0	3.0	4.0
Output Current							
Continuous	[A]	1.7	2.1	3.0	3.7	5.2	7.0
Intermittent (60 sec)	[A]	2.7	3.3	4.8	5.9	8.3	11.2
Max. Input Current							
Continuous	[A]	1.6	1.9	2.6	3.2	4.7	6.1
Intermittent	[A]	2.6	3.0	4.2	5.1	7.5	9.8
Environment							
Estimated Power Loss at Rated Max. Load	460 VAC [W]	28	38	55	75	110	150
Enclosure	Protected chassis/IP20 (NEMA/UL Type 1 opt)						
Weight	[lbs.]	4.6	4.6	4.6	4.6	8.2	8.2

VLT Type		2840	2855	2875	2880	2881	2882
Typical Shaft Output	[HP]	5.0	7.5	10	15	20	25
Output Current							
Continuous	[A]	9.1	12.0	16.0	24.0	32.0	37.5
Intermittent	[A]	14.5	19.2	25.6	38.4	51.2	60.0
Max. Input Current							
Continuous	[A]	8.1	10.6	14.9	24.0	32.0	37.5
Intermittent	[A]	13.0	17.0	23.8	38.4	51.2	60.0
Environment							
Estimated Power Loss at Rated Max. Load	[W]	200	275	372	412	562	693
Enclosure	Protected chassis/IP20 (NEMA/UL Type 1 opt)			Protected chassis/IP20 NEMA/UL Type 1			
Weight	[lbs.]	8.2	13.2	13.2	40.7	40.7	40.7

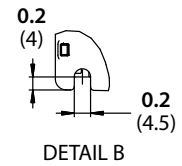
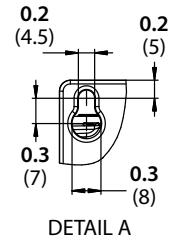
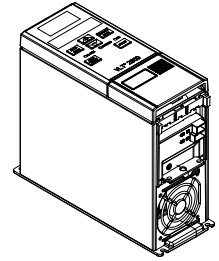
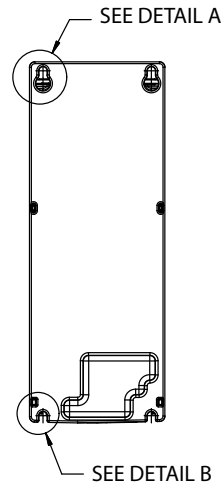
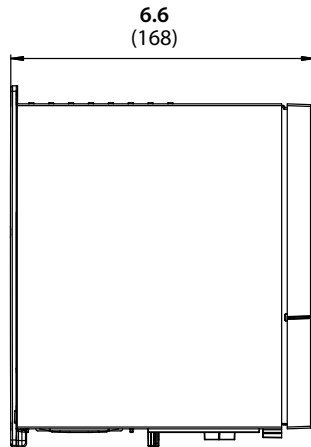
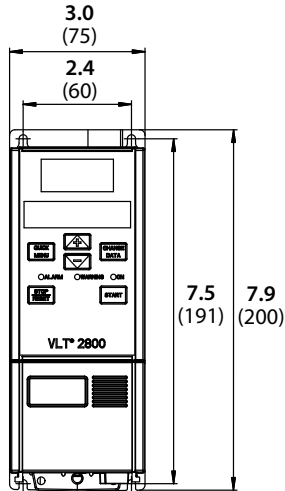
VLT® 2800 Drive

Protected Chassis/IP20

in (mm)

VLT 2803 – 2815 (1/2 – 2 HP) 200 – 240 VAC

VLT 2805 – 2815 (3/4 – 2 HP) 380 – 480 VAC

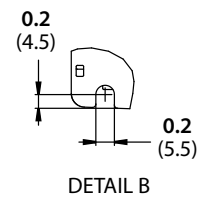
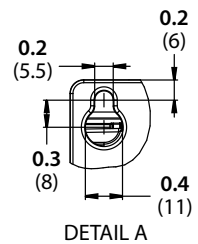
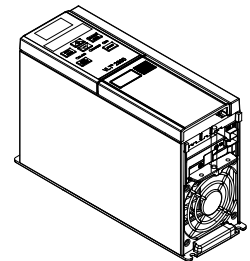
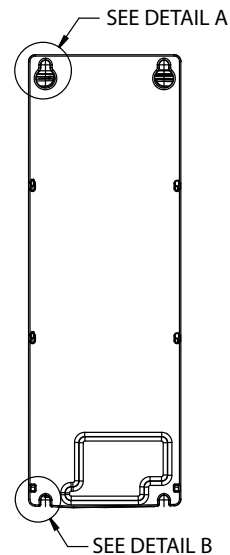
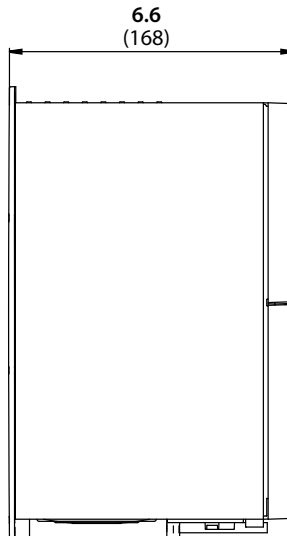
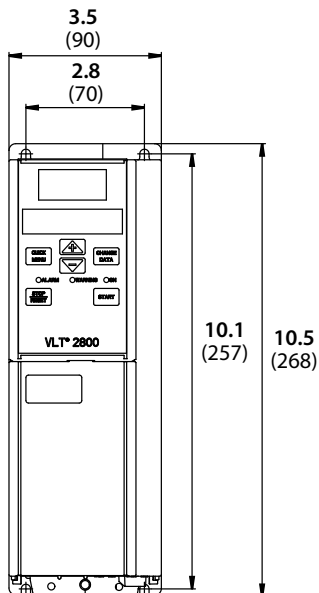


Protected Chassis/IP20

in (mm)

VLT 2822 (T2) (3 HP) 3Ø 200 – 240 VAC

VLT 2822 – 2840 (3 – 5 HP) 380 – 480 VAC

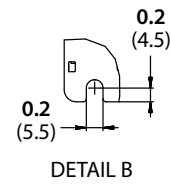
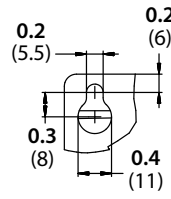
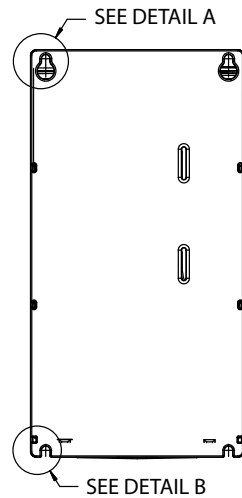
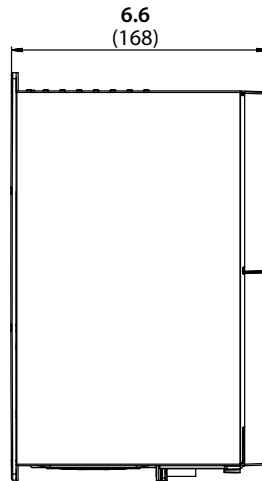
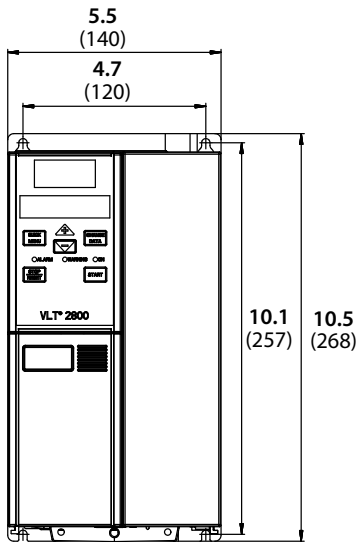
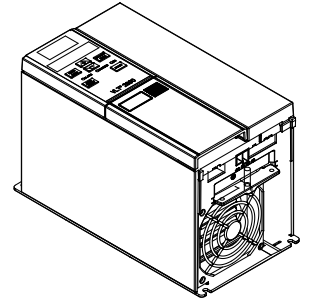


Dimensions

Protected Chassis/IP20

in (mm)

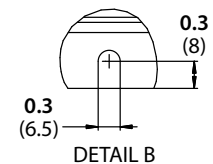
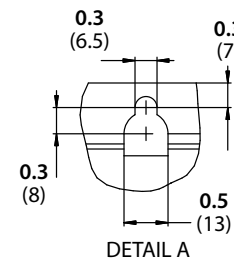
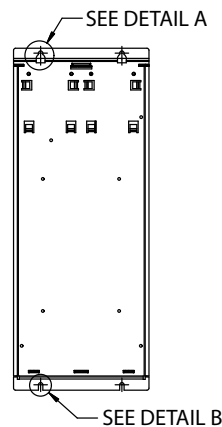
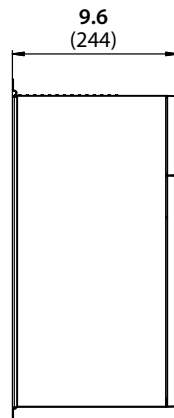
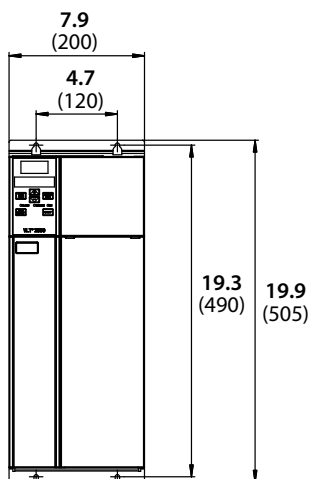
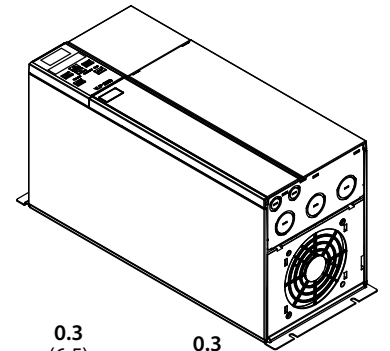
VLT 2822 (3 HP) 1Ø/3Ø 220 – 240 VAC
 VLT 2840 (T2) (5 HP) 3Ø 200 – 240 VAC
 VLT 2855 – 2875 (7.5 – 10 HP) 380 – 480 VAC



NEMA 1/IP21

in (mm)

VLT 2840 (5 HP) 1Ø/3Ø 220 – 240 VAC
 VLT 2880 – 2882 (15 – 25 HP) 380 – 480 VAC



Fieldbus Options

Profibus Control Card Option

Profibus is a fieldbus system, which can be used for linking automation devices such as sensors and actuators with the controls by means of a two-conductor cable.

Using the Profibus option, the Danfoss drive always acts as a follower to the master PC or PLC. It exchanges information and commands such as “speed reference,” “start/stop” of motor, “reverse” operation, etc. The drive acknowledges receipt by transmitting status signals, such as “running,” “on reference,” “motor stopped” and so on to the PC/PLC. The VLT 2800 Series drive may also transmit fault indications, alarms and warnings to the PC/PLC.

The Profibus option card communicates according to the Profibus Protocol Standard DIN 19245 parts 1, 2 and 3. This means that it can communicate with all PC/PLCs that comply with this standard, but it does not necessarily mean that all services available in the Profibus standard are supported. The VDI/VDE 3689 Profibus Profile for Variable Speed Drives is a subset of Profibus part 2 - FMS - which only supports the services relevant to speed control applications. PROFIDRIVE is an implementation of VDI/VDE 3689 profile created by Danfoss and a number of other companies.

Option Order Code

F10	With Profibus DP (3 MB)
F12	With Profibus DP (12 MB)

DeviceNet Control Card Option

DeviceNet fieldbus systems can be used for linking automation devices such as sensors and actuators with the controls by means of a four-wire conductor cable.

DeviceNet is a factory installed option available on all VLT 2800 Series drive models. This option supports a ± 10 VDC reference signal and provides inputs for quadrature encoder signal. The baud rate and address are set in the VLT 2800 parameter menu.

Option Order Code

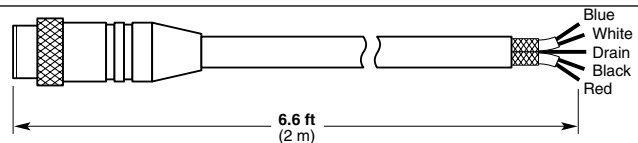
F30	With DeviceNet
-----	----------------

ODVA Approved Drop Cable Accessory

An ODVA approved 6.6 foot (2 meter) drop cable is available as a separate accessory for use with the DeviceNet Control Card option.

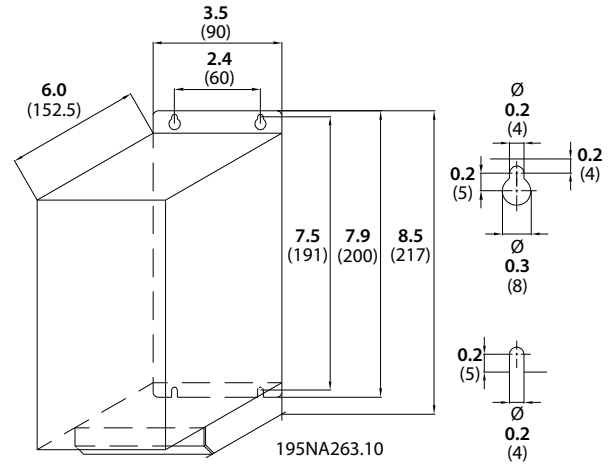
Part Number

195N3113



Options and Accessories

Motor Coil Accessory



The use of motor coils allows unlimited switching on the output. Typically, this is an essential feature for applications utilizing multiple motors or switchgear in the motor line for items such as bypass circuits.

An added benefit of the motor coil is that it permits the use of motor cable up to 650 ft. (The standard VLT 2800 drive allows cables up to 130 ft.) Motor coils do not meet RFI emission requirements.

Motor coils come in IP20 enclosures, mounted directly beside the drive. The motor coil accessory is available on all VLT 2800 models.

Max. motor cable length	650 ft. (200 m) unshielded; 300 ft. (100 m) shielded
Enclosure	IP20
Min. distance between VLT and module	Side by side
Min. space above and below	4 in (100 mm)
Max. nominal input current	16 A RMS
Max. voltage	480 VAC
Approvals	VDE, UL/cUL

Part Number	195N3110
--------------------	----------

RFI Options and Accessories

The switching of a variable frequency drive's power components causes deviations in the voltage and current of the AC line. These deviations contain elements of high frequencies that may disturb equipment sharing the power line or radiate to nearby equipment. High frequencies in the 150 kHz to 30 MHz range are identified as RFI (radio frequency interference).

When properly used, RFI filters prevent interference currents from transmitting back onto the AC power lines in accordance to the European Community (CE) requirements.

As a built-in option, both RFI Class 1, Group A and Group B filters are available.

The Class 1, Group B filter or the RFI 1B/LC filter accessories are ordered separately and are mounted directly alongside of the drive (see illustrations). The RFI 1B/LC filter is a dual purpose filter which serves to meet stringent Class 1, Group B RFI requirements as well as reducing acoustic motor noise.

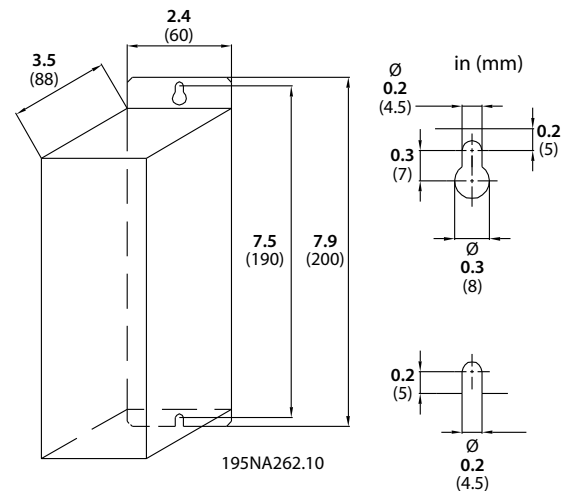
Built-in RFI 1A and 1B Filter Options

The built-in RFI options comply with the EMC norm EN 55011 Class 1A and 1B.

Option Order Code

R1	With built-in 1A filter (VLT 2803 – 2875)
R3	With built-in 1B filter (VLT 2880 – 2882)

RFI 1B Filter Accessory



Max. motor cable length:

VLT 2800 200-240 V	300 ft. (100 m) shielded
VLT 2800 380-480 V	25 ft. (25 m) shielded

Enclosure	IP20
Min. distance between VLT and module	Side by side
Min. space above and below	4 in. (100 mm)
Max. nominal input current	16 A RMS
Max. voltage	480 VAC
Max. voltage to ground	380 VAC
Approvals	VDE, UL/cUL

Part Number 195N3103

Options and Accessories

RFI 1B/LC Filter Accessory



Power Rating	4.0 A	9.1 A
Max. motor cable length	1000 ft. (300 m) unshielded	500 ft. (150 m) shielded
Enclosure	IP20	IP20
Min. distance between VLT and module	Side by side	Side by side
Min. space above and below	4 in. (100 mm)	4 in. (100 mm)
Dimensions – H x W x D	7.87 x 2.95 x 6.61 in. (200 x 75 x 168)	10.12 x 3.54 x 6.61 in. (257 x 90 x 168 mm)
Max. nominal input current	16 A RMS	16 A RMS
Max. voltage	480 VAC	480 VAC
Max. voltage to ground	380 VAC	380 VAC
Approvals	VDE, UL/cUL	VDE, UL/cUL
Part Number	195N3100	195N3101

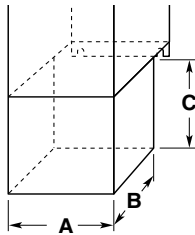
NEMA UL Type 1 Terminal Cover Accessory



All models up to 5 HP (200 – 240 VAC) and 10 HP (380 – 480 VAC) can be fitted with an optional protective attachment to the base of the drive to convert the unit to a NEMA UL Type 1 rating. The NEMA 1 Kit option is ordered as a separate order number, and is specifically designed as a field upgrade kit.

VLT 2880-2882 drives meet NEMA 1 requirements as standard.

Part Number	Dimensions – in (mm)		
	A	B	C
195N1900	3.0 (75)	3.4 (86)	2.3 (59)
195N1901	3.5 (90)	3.5 (90)	2.4 (60)
195N1902	5.5 (140)	3.4 (86)	3.1 (79)



Model	HP	VAC	Part Number
VLT 2803	0.5	200 – 240	195N1900
VLT 2805	0.75	All	195N1900
VLT 2807	1	All	195N1900
VLT 2811	1.5	All	195N1900
VLT 2815	2	All	195N1900
VLT 2822	3	All	195N1901
VLT 2830	4	380 – 480	195N1901
VLT 2840	5	380 – 480	195N1901
VLT 2840	5	200 – 240	195N1902
VLT 2855	7.5	380 – 480	195N1902
VLT 2875	10	380 – 480	195N1902

Brake Resistor Accessories

Brake resistor(s) must be used in conjunction with the dynamic brake to dissipate the heat/power regenerated by the motor during deceleration or overhauling load.

Braking energy is only absorbed into the brake resistor. Brake resistors must be ordered separately and field installed by the customer.

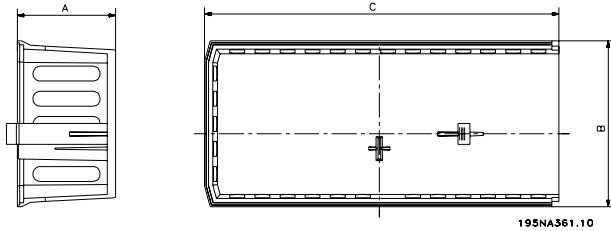
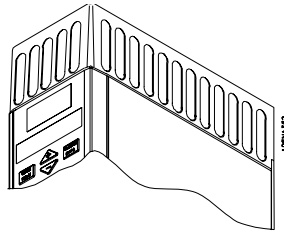
Contact Danfoss if brake resistors are required for your application.



Options and Accessories

IP21 Cover Accessory

Allows the VLT 2800 to meet IP21 enclosure requirements.



Part Number	Dimensions – in (mm)		
	A	B	C
195N2179	1.85 (47)	3.15 (80)	6.69 (170)
195N2180	1.85 (47)	3.74 (95)	6.69 (170)
195N2181	1.85 (47)	5.71 (145)	6.69 (170)
195N2182	1.85 (47)	8.07 (205)	9.65 (245)

Model	HP	VAC	Part Number
VLT 2803	0.5	200 – 240	195N2179
VLT 2805	0.75	All	195N2179
VLT 2807	1	All	195N2179
VLT 2811	1.5	All	195N2179
VLT 2815	2	All	195N2179
VLT 2822 (T2)	3	200 – 240	195N2180
VLT 2822	3	200 – 240	195N2181
VLT 2822	3	380 – 480	195N2180
VLT 2830	4	380 – 480	195N2180
VLT 2840 (T2)	5	200 – 240	195N2181
VLT 2840	5	200 – 240	195N2182
VLT 2840	5	380 – 480	195N2180
VLT 2855	7.5	380 – 480	195N2181
VLT 2875	10	380 – 480	195N2181
VLT 2880	15	380 – 480	195N2182
VLT 2881	20	380 – 480	195N2182
VLT 2882	25	380 – 480	195N2182

Cold Plate Technology Heat Dissipation

Electronic components generate heat that must be removed. The conventional solution is to use natural convection or forced cooling. Natural convection is not the optimum solution for today's small drives; so forced cooling with built-in fans has become the preferred solution at present. Now, Danfoss introduces solution number three: Cold Plate Technology.

Cold plate technology makes it possible to remove 50-75% of the heat through the rear wall of the unit.

VLT 2800 Series cold plate technology supports the increasing use of automation components that are either placed directly on the machine or in control cabinets close to the application, thus reducing costs of cabling and installation. Such modularized machine automation provides flexibility with standard components and maximizes use of standard components.

The robust enclosure makes the drive suited for damp and dusty environments. The VLT 2800 cold plate can be used together with a standard cabinet. Other automation components can be mounted in the panel as well, making this a flexible solution, especially for decentralized installations. Cabinet material, surface finish, and enclosure rating can be chosen from the wide range of standard products available.

For further information on sizing cold plate technology for your application, refer to VLT 2800 Cold Plate Instruction MI.28.DX.02.

Part Number	Recommended Maximum Output
195N3111	3 HP
195N3112	7.5 HP



Typical maximum recommended operating conditions

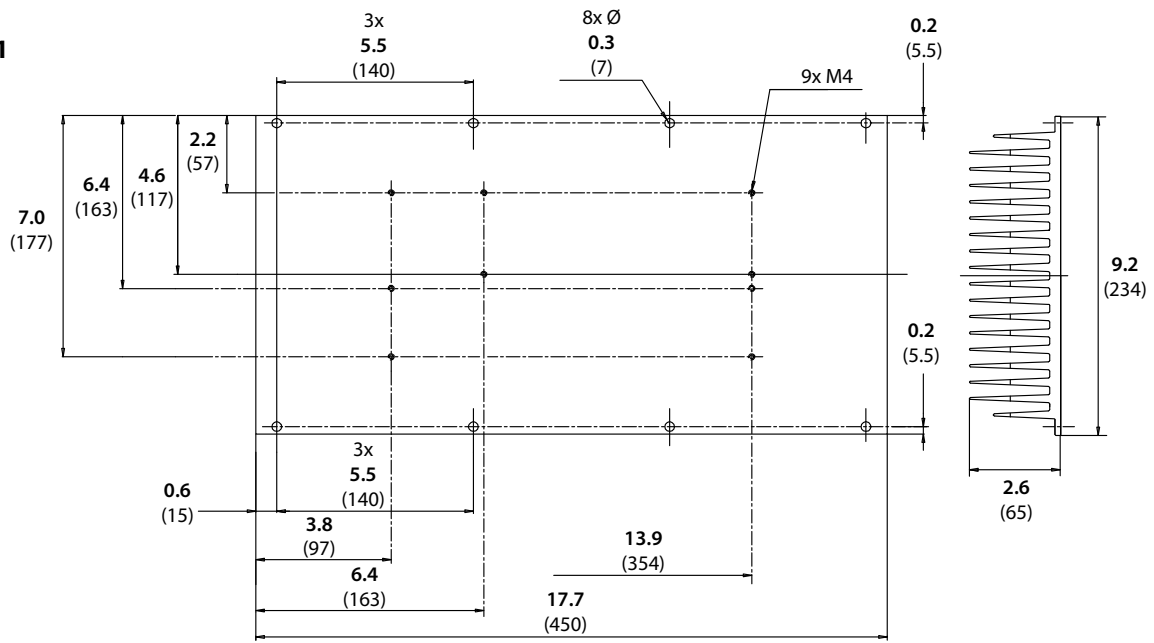
Min. cabinet size	20" H x 16" W x 8-1/4" D
Max. cable length	50 ft
Max. switching frequency	4.5 kHz
Max. input voltage	400 V
Max. load	100%
Max. ambient temperature	104° F (40° C)

Options and Accessories

Dimensions

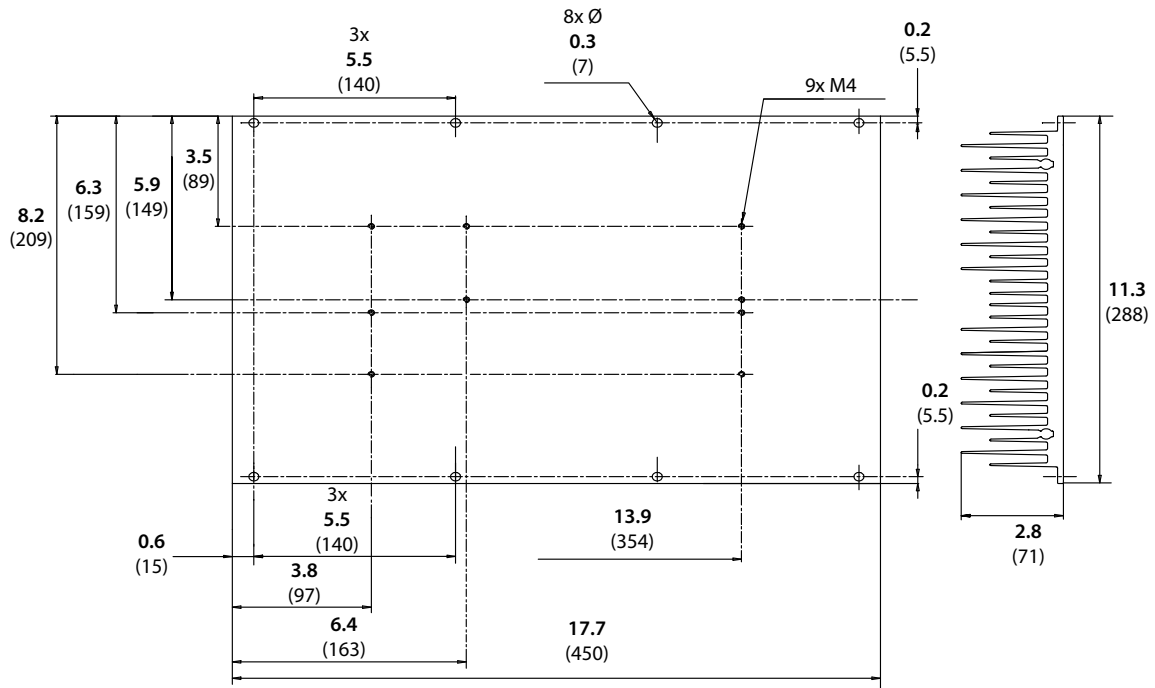
in (mm)

195N3111



195N3112

in (mm)



Control Accessories



LCP-2 Remote Control Panel Kit

The VLT 2800 Series has an optional LCP-2 keypad available for remote programming/commissioning and operation, mountable up to 10 ft.(3 m) from the unit. The LCP-2 keypad is a full alphanumeric display that provides concise programming and clear monitoring of drive and application parameters during operation. The separate mounting kit includes all the necessary hardware to mount the LCP-2 to satisfy NEMA 12 requirements.

Description	Part Number
LCP 2 control unit for programming	175N0131
Remote mounting kit (incl. 3 m cable, excl. LCP 2)	175Z0850
Cable for LCP 2 control unit to drive	175Z0929



MCT 10 (Motion Control Tools)

Offering advanced programming functionality for all Danfoss drive products, MCT 10 greatly reduces programming and commissioning times.

Drives are managed in a standard folder-based user interface that's familiar and easy to understand. Parameter settings for each drive are contained in a single file, simplifying setup and the duplication of parameter sets between drives.

MCT 10 Basic version is available free of charge from the Danfoss web site. The Advanced edition, which offers a higher level of functionality, is available from your Danfoss sales partner. Both versions require an RS485 converter.

- On-line and off-line commissioning
- On-board help files for each drive parameter
- Logging of alarms and warnings for improved system performance and documentation
- MCT 10 Conversion Wizards simplify drive conversion projects
- Real-time data collection using the MCT 10 Scope function
- Access to the VLT® 2800's internal data buffer, providing up to four channels of high speed (down to 1 millisecond) data collection
- Simplified programming of the VLT® 2800's Smart Logic Controller using graphical programming tools
- Drive upgrade tools

Part Number	130B1000
--------------------	----------

VLT® 2800 Drive Ordering Information

Use the information from the charts below to build a complete part number.

Example:

[1]	[2]	[3]	[4]	[5]
VLT 2880	-P-	T4	- B20 -	ST - R0 - DB - F00

[1] Power Size*

2803	0.5 HP
2805	0.75 HP
2807	1 HP
2811	1.5 HP
2815	2 HP
2822	3 HP
2830	4 HP
2840	5 HP
2855	7.5 HP
2875	10 HP
2880	15 HP
2881	20 HP
2882	25 HP

[2] AC Line Voltage

D2**	230 VAC, 1Ø or 3Ø (0.5 – 5 HP only)
S2†	230 VAC, 1Ø (0.5 – 3 HP only)
T2	200 – 240 VAC, 3Ø (3 – 5 HP only)
T4	380 – 480 VAC, 3Ø (0.75 – 25 HP)

[3] Hardware

ST	Standard
SB	Standard with Brake

[4] RFI Filter

R0	Without Filter
R1	With Built-in 1A Filter
R3	With Built-in 1B Filter

[5] Fieldbus Options

F00	Without Fieldbus
F10	With Profibus DP (3 MB)
F12	With Profibus DP (12 MB)
F30	With DeviceNet

* Power sizes 2803 – 2875 provided in a protected chassis (IP20); 2880 – 2882 are NEMA 1

** Cannot be ordered with RFI Filter

† Must be ordered with RFI Filter

VLT® AQUA Drive

The modular VLT® AQUA Drive is engineered for design simplicity and high performance.

Unique cooling concept

- Improves efficiency
- Reduces contaminants in electronics

Fieldbus options (A-option)

- Select any of the common fieldbus protocols

Local Control Panel (LCP)

- Six-line graphical LCP display

I/O, relay or safety (B-option)

- I/O, Cascade Controller and relay functions

Advanced cascade controller option

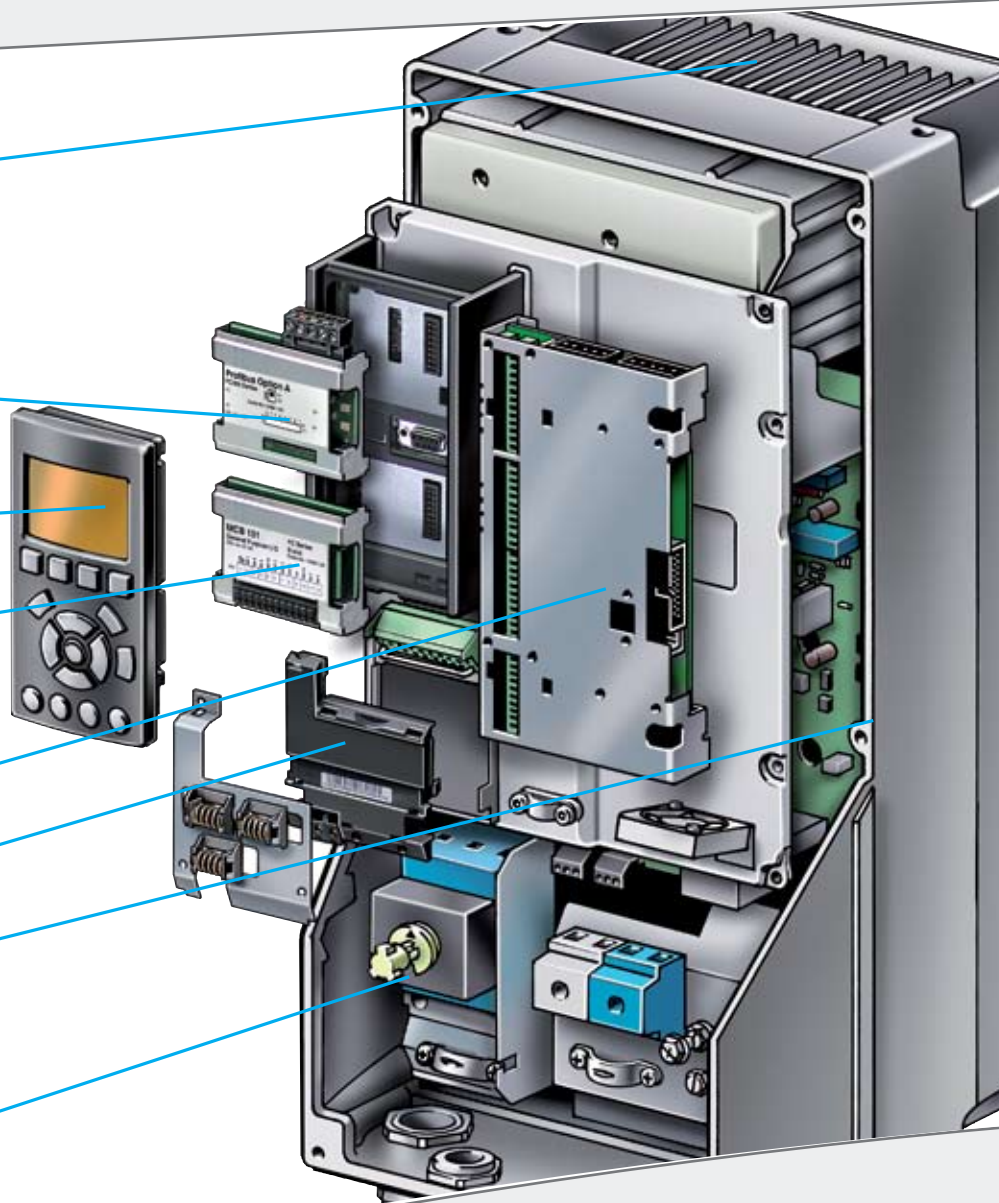
- (C-option)

24V supply option (D-option)

Conformally coated PCBs

- Durable in aggressive environments
- Additional higher level of conformal coating optional

AC mains disconnect and fusing (optional)



Manufactured to the highest quality standards

The VLT® AQUA Drive is a UL-listed product made in ISO 9001-2000 and ISO 14000 certified facilities.

Defining new standards for the water/wastewater market.

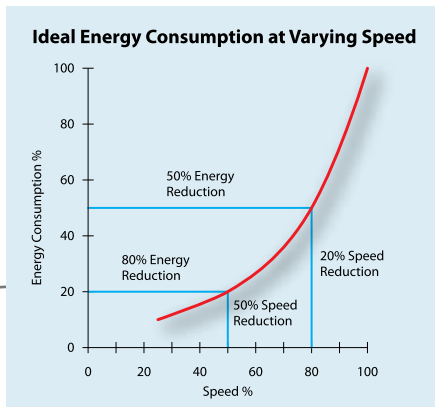
Features

VLT AQUA Drive built-in intelligence increases performance in all water and wastewater applications

Water and wastewater is a global business for Danfoss Drives. Our unequalled experience makes the VLT AQUA Drive the perfect match for pumps and blowers in water and wastewater systems. With a wide range of powerful standard and optional features designed specifically for water and wastewater applications, the VLT® AQUA Drive provides the lowest overall cost of ownership of any drive available.

Save energy

- High efficiency (>98%)
- Sleep Mode shuts off pumps when demand is low
- Automatic Motor Adaptation
- Automatic Energy Optimization produces typical savings of 3–5% (up to 15% possible)
- Flow compensation of setpoint
- Unique cooling concept



Energy savings using a VLT AQUA Drive are achieved with even a modest reduction in speed.

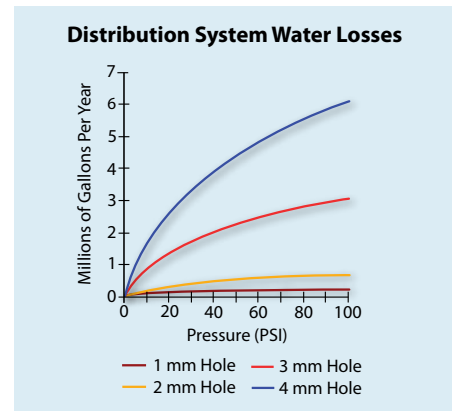
Save space

- Compact, modular design
- Built-in DC-link reactors for harmonic suppression—no need for external AC input line reactors
- Optional, integrated RFI filters throughout the power range
- Integrated disconnects and fusing

Save costs

Protect your system with a series of pump-specific features:

- Cascade controller
- Sensorless control
- Dry pump detection
- End of curve detection
- Motor alternation
- 2-step ramps (initial ramp)
- Safe stop
- Pipe fill mode
- Real-time clock
- Password protection
- Overload trip protection
- Smart logic controller
- User-selectable variable or constant torque operation
- NEMA/UL Type 12 (IP54/55) and IP66 outdoor-rated enclosures eliminate the need for separate enclosures



Reducing water losses by lowering system pressure becomes increasingly effective as the size of line breaks increase.

Save time

- Intuitive user interface with the new, award-winning local control panel (LCP)
- One drive type for the full power range
- Modular VLT design enables fast installation of options
- Auto-tuning of PI controllers
- Robust design and efficient monitoring significantly reduce maintenance requirements.

Designed for all water and wastewater applications



Desalination plants

Desalination plants are used to provide clean drinking water from the ocean. The process uses high pressure pumps, which must be accurately controlled. With its built-in PID controller, the VLT® AQUA Drive ensures reliable and precise pressure control, maximizing process control and efficiency.



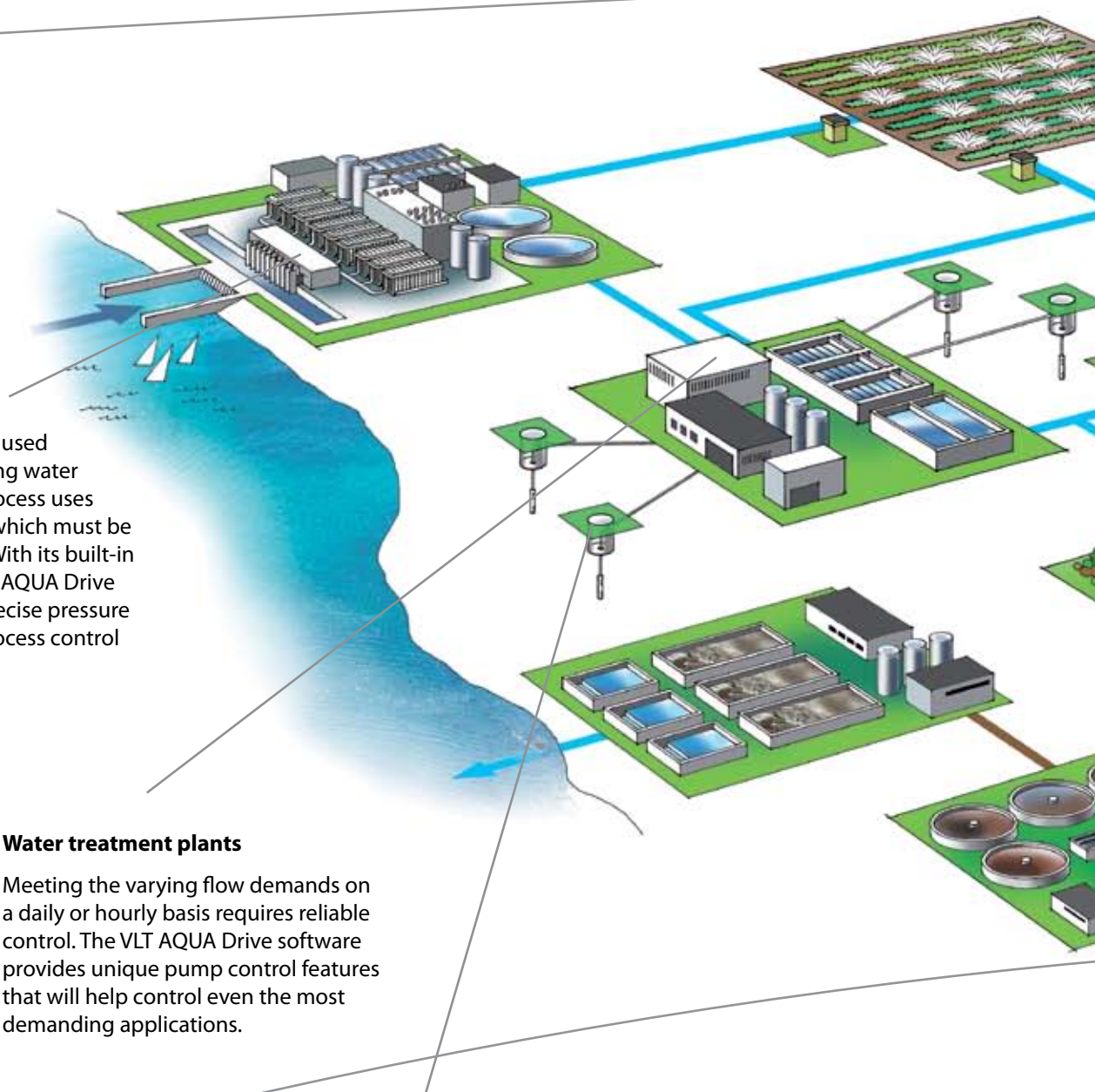
Water treatment plants

Meeting the varying flow demands on a daily or hourly basis requires reliable control. The VLT AQUA Drive software provides unique pump control features that will help control even the most demanding applications.

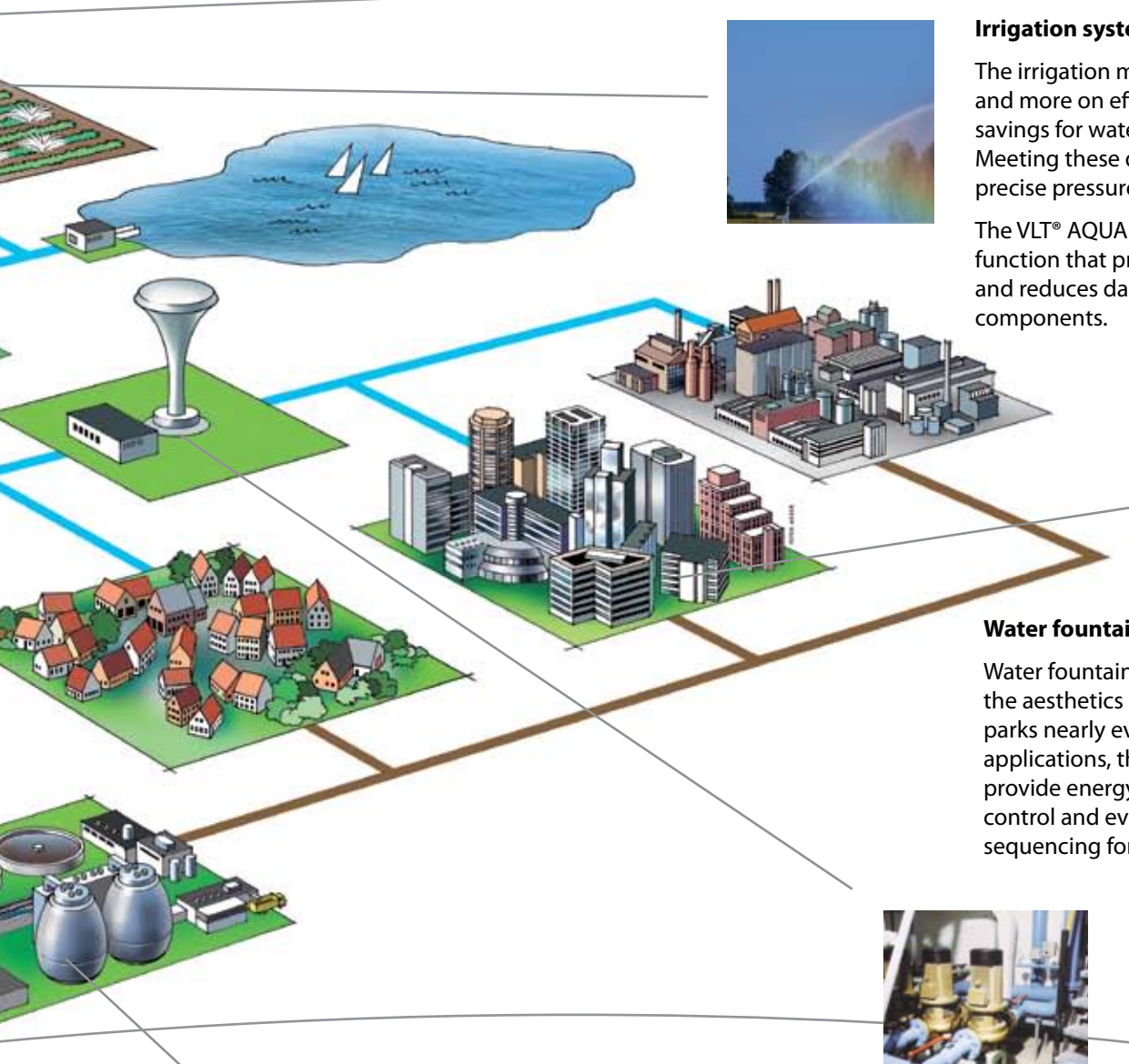


Groundwater pumps

Submersible deep well pumps need rapid start capability, precise control and protection against running dry. The built-in dry pump detection, initial ramp and multiple parameter input make the VLT AQUA Drive the perfect choice for these applications.



Features



Irrigation systems

The irrigation market is focusing more and more on efficiency and energy savings for water management. Meeting these demands requires precise pressure and flow control.

The VLT® AQUA Drive offers a pipe fill function that prevents water hammer and reduces damage to pipes and components.



Water fountains and pools

Water fountains are used to enhance the aesthetics of buildings and parks nearly everywhere. In these applications, the VLT AQUA Drive can provide energy efficiency, accurate control and even meticulously timed sequencing for a dramatic effect.



Wastewater plants

Fluctuations in flow can disrupt efficient process control, increase costs and equipment wear due to a higher number of starts and stops, and adversely affect effluent quality.

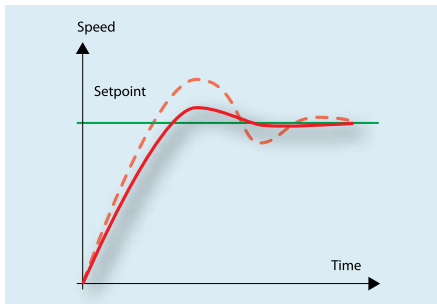
Using the VLT AQUA Drive on pumps, blowers and other equipment will lead to better process control and reduce energy consumption. The AQUA Drive can also provide tighter control of chemical feed pumps, mixers and other equipment.



Distribution

As areas become more populated, the increasing demand for reliable and precise pressure control becomes a challenge to many communities. The VLT AQUA Drive has innovative pumping functions to assist in maintaining precise pressure and flow while reducing system leakage and energy consumption. In many cases, it can also provide a cost-effective alternative to unsightly water towers.

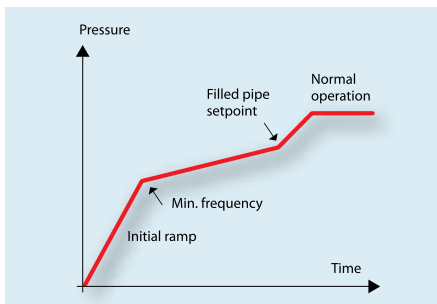
Dedicated features for water and wastewater applications



Automatic tuning of PI controllers

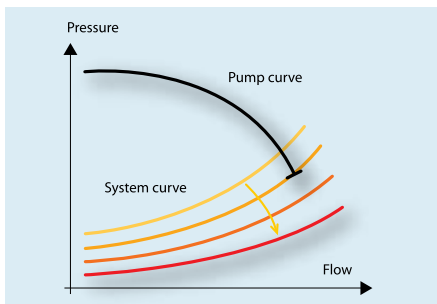
The VLT® AQUA Drive offers up to four separate PID loops for controlling multiple processes, each of which is automatically tuned to provide optimal performance.

The drive monitors how the system reacts to corrections and learns from this data to quickly achieve precise and stable operation. Gain factors for PI are continuously adjusted to compensate for changing characteristics of the loads. Knowing the exact P and I settings at startup is not necessary, making commissioning easier.



Pipe Fill Mode

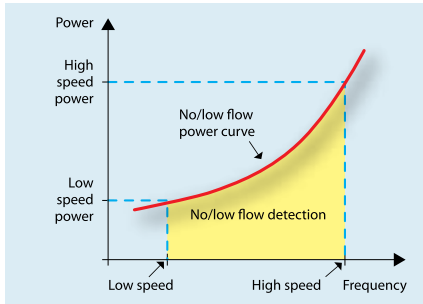
The VLT AQUA Drive can provide controlled (closed loop) filling of pipes, preventing water hammer, burst water pipes and damage to sprinkler heads. This feature is particularly valuable in applications that are vulnerable to these types of damage, such as irrigation systems and water supply systems.



End of Pump Curve Detection

The VLT AQUA Drive can detect breaks and leakage in supply lines by comparing pump speed with the system pressure. The drive can be set to trigger an alarm, shut off the pump, or perform some other programmed action whenever a pump is found running at full speed without creating the desired pressure—a situation that usually indicates a break in the system.

Features

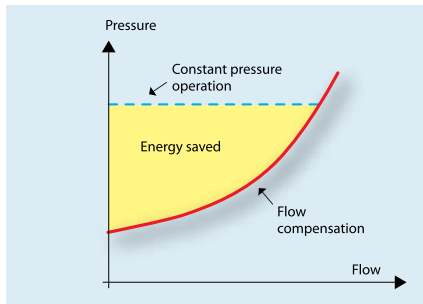


Dry Pump Protection

The VLT® AQUA Drive constantly evaluates the condition of the pump, based on internal frequency/power measurements. When power consumption drops too low—indicating a no or low flow situation—the VLT AQUA Drive will shut down the pump.

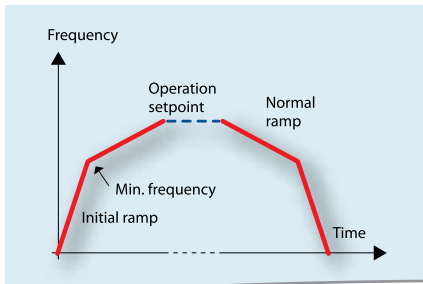
Sleep Mode

Sleep Mode keeps pump wear and power consumption to an absolute minimum. In low flow situations, the VLT AQUA Drive will boost the system pressure and then shut down the pump. It will continue to monitor the system pressure and restart when the pressure falls below the required level.



Flow compensation

The flow compensation feature of the VLT AQUA Drive takes advantage of the fact that flow resistance decreases with reduced flow. Using this information, the pressure setpoint is reduced as necessary, thereby saving energy.



Initial/Final Ramp

Initial ramp provides rapid acceleration of pumps to a desired minimum speed, at which time the normal ramp takes over. This prevents damage to thrust bearings and overheating of the pump.

The final ramp decelerates pumps to avoid unintended closure of check valves and water hammer.

Single-phase line supply

Single-phase VLT AQUA Drives can be wired to plug into a standard single-phase outlet. These drives can then be connected to three-phase pumps, fans, blowers, and more. It's just like getting three-phase power from a standard 220–240V power socket.

Payback time indication

One of the main reasons for using a VLT Series drive is the minimal payback time due to energy savings. The VLT AQUA Drive comes with a unique feature that continuously displays the time remaining before the drive pays for itself.

Motor Alternation

This built-in logic controls alternation between two pumps in duty/stand-by applications. Running the stand-by pump prevents sticking and lubricates the seals.

An internal timer assures equal usage of the pumps.

Designed with the user in mind

The VLT® AQUA Drive maximizes system reliability with built-in protection against:

- System overloads
- Motor failures
- Motor and drive overheating
- Voltage disturbances
- Power surges
- Loss of phase
- Phase-to-phase and phase-to-ground short circuit
- Ground fault
- Switching on input/output
- Electrical disturbances
- Overvoltage
- Overcurrent
- Undervoltage
- External fault
- Overtemperature

Minimize motor noise and heating with ASFM

With the ASFM (Adjustable Switching Frequency Modulation) function, the switching frequency is adjusted automatically in relation to the speed of the motor. As speed is reduced, the switching frequency increases to ensure optimally low motor noise and reduce motor heating.



Input line protection from extreme running conditions

Minimal harmonic distortion/maximum power factor

DC-link reactors reduce the harmonic distortion currents that a variable frequency drive injects back into the AC line. The properly sized reactors in a VLT AQUA Drive can reduce line harmonic currents by up to 40% of the fundamental current. This eliminates the need and cost of additional AC line reactors and their resultant line voltage reduction.

Line disturbances and transients

To protect itself from AC line voltage disturbances, the drive monitors all three phases and interrupts drive operation in the event of phase loss or imbalance. Transients on the AC line are suppressed by MOVs as well as zener diodes for extreme transients. Danfoss VLT AQUA Drives meet VDE 0160 (European standard—2.3 x line voltage for 1.3 msec) for transient protection.

Voltage sags and surges

The VLT AQUA Drive is designed for a wide range of operating conditions. The 480 volt drive will operate from 342–528 VAC. The 230 volt drives will operate on 180–264 VAC. 575 volt drives will operate on 495–660 VAC and 690 volt drives will operate on 472–759 VAC. Full rated motor voltage and torque can be delivered with voltage dips down to 10% under nominal AC line voltage. During an AC line drop-out, the VLT AQUA Drive continues until the intermediate circuit voltage drops below the minimum stop level, which is typically 15% below the VLT AQUA Drive's lowest rated supply voltage.

Ground fault

The VLT AQUA Drive provides complete protection from potentially damaging ground fault conditions on both the supply side and the motor side.

Features

Output protection for longer motor life

VLT® AQUA Drives incorporate both DC-link reactors and motor output protection as standard design features. This provides short circuit protection and allows unlimited switching on the output without damage to the drive, eliminating the need for additional output reactors or switch interlocks.

The DC-link reactors improve overall efficiency by increasing the power factor and lowering the ripple current in the bus voltage providing an almost threefold increase in capacitor and drive life. As a result, motor operation is smooth and quiet and longer motor life can be expected.

Hall effect current transducers measure current flowing on all three motor phases. This provides highly responsive and accurate feedback to the VLT control circuit for optimum motor protection and performance.

VVC^{PLUS} output switching pattern

Unique digital VVC^{PLUS} voltage vector control provides:

- A nearly perfect output sine wave that reduces the overshooting and undershooting of voltage and current generated by standard PWM drives
- Fully rated motor voltage at rated frequency
- Increased efficiency for both drive and motor
- Full motor performance without derating; no additional heating of motor windings
- Motor cable lengths up to 1000' standard

Reduced installation cost

Dual DC-link reactors reduce the input RMS current to less than or equal to the output current. This greatly reduces the cable size requirement and the subsequent cost of installation.

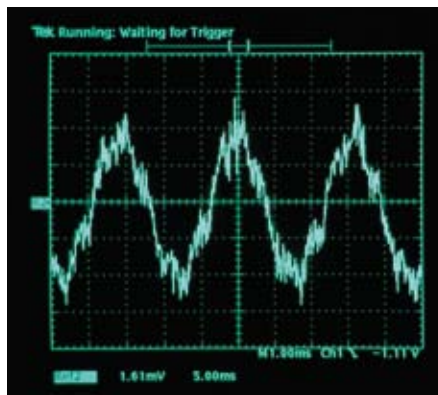
Short circuit

The VLT AQUA Drive is protected against short circuits by measuring the current in each of the three motor phases. A short circuit between two output phases will shut down the drive as soon as the current exceeds the maximum value.

Thermal protection for the drive and motor

The ETR (Electronic Thermal Relay) is an open loop method built into the VLT AQUA Drive software to guard against motor overheating, requiring no additional sensors or wiring. This function is UL recognized (Class 20) as an effective guard against motor thermal overload.

The VLT AQUA Drive has built-in thermal protection and also accepts thermistor signal input from the motor to create closed loop thermal protection for the entire system.



Brand "X" PWM scope trace (left) compared to smoother VVC^{PLUS} scope trace (right).

Award-winning control panel

Input from our extensive user group significantly influenced the design and function of the new generation Local Control Panel. The removable LCP now comes with an improved user interface. Choose between eight built-in languages or have it customized with any language you like. Two of the languages can be changed by the user. The info button accesses virtually all information contained in the printed operation manual.

The Automatic Motor Adaptation (AMA), Quick Setup menu and large graphic display make commissioning and operation convenient and easy.

The LCP also comes with a choice of numerical display, graphical display or blind cover.



Graphical display

- Informative overview
- Six lines of display
- Graphical or numerical display of information
- Readout in user-selectable engineering units
- Select from up to 27 languages
- Backlit for increased visibility

Quick Menus

- Danfoss-defined Quick Menu
- User-personalized Quick Menu
- Changes Made Menu displays the parameters to which changes have been made
- Function Setup Menu provides quick setup for specific applications
- Logging Menu provides access to operation history

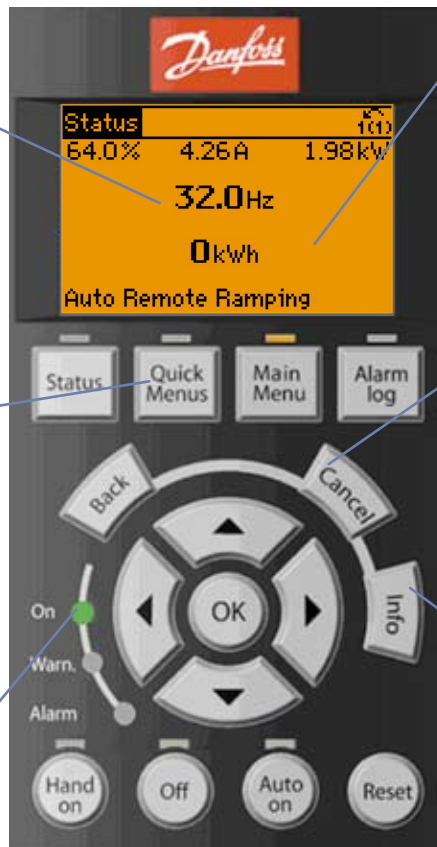
Illumination

- Illuminated LEDs indicate which function is active



design award
winner

The VLT® AQUA Drive Local Control Panel won the international iF design award. The Danfoss LCP beat out 1000 entries from 34 countries in the "interface in communication" category.



Menu structure

- Based on the field-proven matrix system used in previous VLT® Series drives
- Menu shortcuts access specific function
- Edit and operate in different setups simultaneously

Other benefits

- The keypad is removable during operation
- Upload/download setups between drives using the keypad
- Remote mounting kit available for panel installation

Additional buttons

- Info: an "onboard manual" that provides specific information about each parameter
- Cancel: exits the current parameter without saving changes
- Alarm log: easy access to a list of all previous alarm conditions



Features

Setup and display

The VLT AQUA Drive makes setup and operation easy. With a remarkably user-friendly interface, intuitive menu structures and powerful tools that streamline installation and troubleshooting, the VLT AQUA Drive saves valuable time, resulting in a lower overall cost of ownership.

- **Transfer of parameters**—Parameters can be programmed into one drive and downloaded to other drives via the drive's keypad or MCT 10 software.
- **Remote mounting kit available**— An optional kit allows remote mounting of the VLT AQUA Drive keypad up to 10 feet away. Removal of the keypad does not affect the drive's NEMA/UL Type 1 or NEMA/UL Type 12 rating, and the gasketed keypad itself carries a NEMA/UL Type 12 and NEMA/UL Type 3R rating.
- **Continuous monitoring with or without the keypad**—With or without a keypad, the VLT AQUA Drive's ON, WARNING and ALARM status lights are always visible.
- **Plain language alarms and warnings**—Alarms and warnings are displayed in easy-to-understand form, eliminating the need for decoding or referring to long tables in manuals.
- **Complete programmability of display**—The keypad's four line, backlit, alphanumeric display can be programmed to display four different measurements at a time. Choose from many options, including: °F, °C, %, Pa, bar, RPM, frequency, gallons/min., ft.³/sec., or p.s.i.

PC software programming tools

MCT 10 Motion Control Tool

MCT 10 facilitates programming by enabling control of entire parameter sets, including copying from one drive to another within the interface.

Based on the familiar Windows technology and format, MCT 10 is intuitive and easy to use. Project drive folders can be named and organized to closely match system layout. Word, Notepad, and other file types can be placed into the project folders where they are most relevant.

- Supports current Danfoss product line as well as legacy drive models

MCT 31 Harmonics Calculation Tool

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

- Project-oriented for simplified calculations on several transformers
- Easy to compare different harmonic solutions within the same project
- Supports current Danfoss product line as well as legacy drive models



USB Connectivity

The VLT AQUA Drive can be remotely commissioned and monitored through a USB connection.

Protective features

With an unmatched combination of drive, motor, and system protection features, the VLT AQUA Drive is the most cost-effective overall solution on the market. Designed and built for long-term, worry-free operation without the need for external devices to protect driven equipment, the VLT AQUA Drive provides secure, reliable results, right out of the box.

System Protection

No Flow Detection

Operation under dead head conditions provides no flow to the system and may damage the pump. Differential pressure switches or flow sensors to monitor flow increase the installation costs and add complexity. The VLT AQUA Drive can automatically detect no flow situations and take the appropriate corrective action.

End of Curve Protection

The VLT AQUA Drive can automatically detect over-flow conditions that indicate operation off the end of the pump curve. Its response can be customized to trigger an alarm and stop the pump, issue a warning while maintaining operation, or perform a variety of other functions to protect both the pump and the system.

Automated Vibration Avoidance

Fan and pump systems often have resonant speeds that must be avoided to reduce vibration and noise. The VLT AQUA Drive automates the process of setting up frequency avoidance bands, minimizing system commissioning time.

VLT AQUA Drives provide the lowest overall cost of ownership by including as standard DC-link reactors, which minimize harmonic current distortion without the need for external reactors.

Drive Protection

Metal oxide varistors (MOVs) and capacitor snubbers in both the AC and DC input circuitry reduce the impact of voltage spikes on the input. In addition, a balanced pair of DC-link reactors between the input rectifier and the bank of DC-bus capacitors reduces the severity of any current surge resulting from abrupt changes in the AC supply line.

Conformal coating is standard to protect electronic components in aggressive environments.

Motor Protection

The VLT AQUA Drive's built-in I²T motor overload, thermistor input and motor preheat functions increase the life of the controlled motor without the added cost of separately supplied protection. The drive's built-in I²T motor overload is UL-listed as a true overload device, eliminating the need for external motor protection hardware.

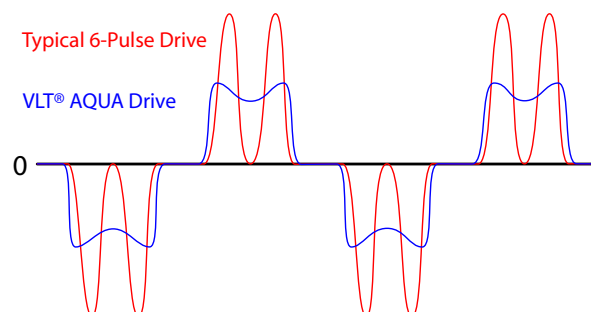
Motor Preheating Function

The VLT AQUA Drive can be programmed to introduce a small amount of current to the motor whenever it is at rest. This prevents condensation inside the motor, extending its life without the need for space heaters or other external equipment.

Harmonic Mitigation

DC-link reactors limit harmonic distortion on the power line, reducing RMS input current by more than 40% compared to drives without input reactors.

Other drive manufacturers address harmonics with AC line reactors, usually external to the drive. Often, these optional AC line reactors are 50% larger than the DC-link reactors standard on the VLT AQUA Drive. This results in significant additional heat generation and reduced efficiency. The harmonic performance of the DC-link reactors in the VLT AQUA Drive is equal to that of a 5% AC line reactor, but without the associated voltage drop and efficiency losses.



Features

Intelligent heat management

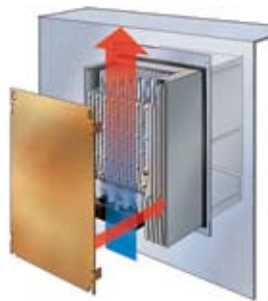
Total separation between cooling air and electronics circulation air keeps electronics clean and cool, and provides a solution where heat needs to be removed outside the cabinets. A Through-Panel Mounting Kit is available for mounting the drive in the backplate of a cabinet.

Forced convection cooling

A fan blows cold air through the cooling ribs of the aluminum base. The channel is easily cleaned without touching electronics. All drives are equipped with forced convection cooling.



Wall mounted with forced cooling through the heatsink.



Through-panel mounting

Cold plate cooling

External cooling is possible through the back side of the aluminum base. The solid aluminum base is integrated with the back panel to provide high mechanical stability, efficient cooling and the option of cold plate operation. Cold plate cooling is available on all A frame size drives.

Back-channel cooling

The intelligent heat management of VLT® high power drives removes 85% of the heat losses via finned heat sinks, which transfer the heat to the back channel cooling air. This back channel is separated from the electronics area by an IP54 seal. This method of cooling greatly reduces contamination of the control electronics area, resulting in longer life and higher reliability. The remaining 15% of heat losses are removed from the control electronics area using lower-volume door fans.

The excess heat from the back channel is either dispersed into the control room or it can be directly removed from the building. An optional back-channel cooling duct kit is available to aid in the installation of IP00/Chassis drives into Rittal TS8 enclosures. Back channel cooling is available on all D, E and F frame size drives.

Outdoor-rated VLT® AQUA Drives

Built to withstand harsh environments, an outdoor-rated enclosure and standard 1000-foot motor cable runs mean the VLT AQUA Drive provides maximum mounting flexibility

Suitable for outdoor or indoor installations that require protection against windblown dust and rain or splashing water, IP66-rated drives (available up to 125 HP) can be installed directly at the equipment location without a protective enclosure. All cast aluminium parts are powder coated with a durable epoxy that can stand up to most corrosive chemicals.

IP66 rated drives are the perfect solution for demanding applications, such as lift stations, pump stations, irrigation, and other outdoor applications.

Small footprint

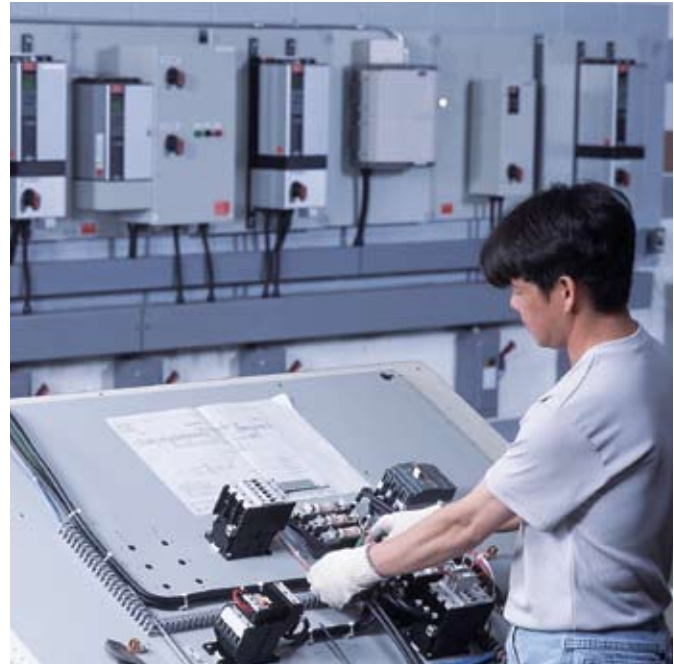
Throughout the entire power range, all sizes of VLT® AQUA Drives are even smaller than comparable previous drives. No dimension has increased, and volumes are typically 20% smaller.



Back-channel cooling: A smart, dedicated kit allows chassis/IP00 enclosures to be mounted in Rittal cabinets so cool air removes 85% of excess heat without contact with the electronics.

Packaged Panel Solutions

Flexibility is the key to Danfoss packaged drive solutions. From our unique feature-rich standard packages to our Engineered Drive Systems, Danfoss supplies the package to meet the application. Our packaged solutions are all manufactured in our own UL-certified facilities, without outsourcing, and supported by the same stringent manufacturing standards and warranties as VLT Series drive products. Being your single source supplier of both VFDs and packaged solutions is just one more way that Danfoss reduces your total cost of ownership.



Danfoss packaged panel solutions are built in Milwaukee, Wisconsin.

Typical Package Options

- Two-contactor bypass
- Three-contactor bypass
- Contactor motor selection
- Multiple motor operation
- Main input disconnect
- Main input fusing
- Drive fusing
- Input AC line reactors
- Output dV/dt filters
- 100,000 amp short circuit current rated package
- Common start/stop
- Control switches
- Indicator lights
- Meters
- System communications
- Auxiliary enclosure for customer-supplied equipment
- Multiple drives in a single enclosure
- NEMA/UL Type 1, 12, 3R, or 4X to meet customer requirements

Packaged Panel Solutions

Integrated Fused Disconnect Package

- Why supply separate drives and fused disconnects when you can get them in the smallest, easiest package possible?
- Reduced installation cost & time
- Can be ordered with or without drive input fusing

Engineered Drive Systems

Custom enclosures, soft start bypass panel, custom wiring and pilot devices, or NEMA/UL Type 1, 12, 4 and 4X panels. You name the package and we can engineer and build the unit in our in-house UL panel shop.

Enhanced Packages

VLT AQUA Drives through 75 HP at 460 or 600 volts and 30 HP at 208 or 230 volts may also be supplied with a UL-listed Type 3R enclosure suitable for outdoor use. These weather-resistant enclosures allow the versatile VLT AQUA Drive to be located with all of its options on a rooftop or other outdoor location.

Enclosure fans help keep the drive within its temperature limits in high ambient temperatures, and a thermostatically controlled heater helps prevent condensation in cool, damp environments.



NEMA Type 3R enclosures are available for locations exposed to weather.

Panel solution products are packaged according to the functional requirements of the system, commonly referred to as Tier 1, 2 and 3. Examples of Tier 1, 2 and 3 enclosure are shown below.

Tier 1: Drive or drive with fuse and/or disconnect

Tier 2: Drive with bypass or non-bypass drive with input AC line reactor, output LC filter and/or contactor motor selection

Tier 3: Drive with bypass and input AC line reactor, output LC filter and/or contactor motor selection.



Electronically Controlled Bypass (ECB)

Danfoss ECB is Electronically Controlled Bypass done right. With the highest level of performance and protection, and the easiest operator interface on the market, our ECB offers the best solution for even the most critical of applications.

Enhanced Performance and Protection

Motor Protection

- Phase loss / imbalance protection
- Overload motor protection in bypass
- Overload reset from drive keypad, drive digital input or over BAS

24 VDC Switch Mode Power Supply

- Operates off of any two of the three input phases
- Continued drive operation at a reduced load when any input phase is lost
- Eliminates contactor dropout on voltage conditions as low as 70% of nominal voltage
- Separate power source for drive logic
- Eliminates the need for an undervoltage relay

Additional Protection Features

- Drive input fuses supplied with every panel
- Bypass run-time hour meter
- Password protection prevents unauthorized bypass operation
- Manual bypass initiation override ensures operation
- Bypass control through the drive Smart Logic Controller and Real-Time clock
- Bypass fault logging and time stamping



Bypass-specific keypad provides one-touch access to bypass operation



Packaged Panel Solutions

Electro-Mechanical Bypass (EMB)

For users who prefer the traditional bypass control methods of relay logic and selector switches, Danfoss offers a standard drive and bypass package.

Door Mounted Operators

- Drive-Off-Bypass selector
- Bypass pilot light indication
- Test selection added with three contactor bypass units

24 VDC Switch Mode Power Supply

- Operates off of any two of the three input phases
- Continued drive operation at a reduced load when any input phase is lost
- Eliminates contactor dropout on voltage conditions as low as 70% of nominal voltage
- Eliminates the need for an undervoltage relay



Traditional Doesn't Have to be Featureless

- The same flexible power configurations as the ECB
- Common start/stop available
- Run permissive available
- Automatic bypass with adjustable time delay is available
- Class 20 overload

Main Fusing/Drive Fusing

Danfoss can supply fuses in conjunction with other options built into the standard drive enclosure, resulting in a compact solution with no increase in footprint size.

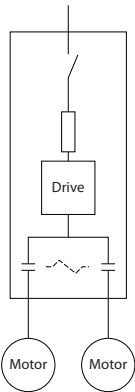
Drive Fuses

Drive fuses are located ahead of the drive and are a fast-acting type. Drive fuses are standard in two-contactor and three-contactor bypasses, so there is no need to add them for bypass units. If drive fuses are required for any non-bypass configuration, order an Input Disconnect Switch and Input Fuse (see right).

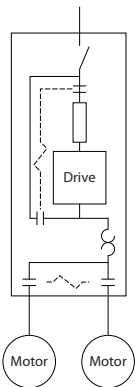
Main Fuses

Main fuses are used in panels containing a bypass. They are located ahead of the drive, the drive fuses, and the bypass. Main fuses are designed to protect the circuitry within the panel, but are not adequate to protect the drive. Main fuses are dual-element time delay type. These fuses mount within the bypass enclosure.

Contactor Motor Selection.



Allows selection between two motors, either manually, or automatically from a remote signal. (Remote signal source not included.) A door-mounted Motor 1 -- Auto -- Motor 2 selector switch is provided. In the Auto mode, the motor is selected via two external, normally open contacts. Interlocking is provided to ensure soft-start if switching occurs while the drive is running. For proper motor overload protection, both motors must be the same size. Bypass can also be supplied, if required.

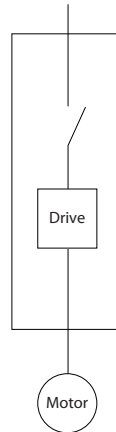


Contactor Motor Selection without Bypass requires a drive with Input Fuses and Disconnect. Contactor Motor Selection with Bypass requires a drive with bypass

Fuse/Disconnect

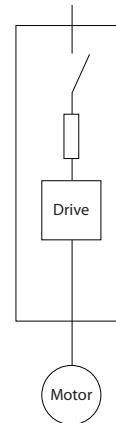
Includes back plate if required and graphical control panel.

Input Disconnect Switch



A padlockable, defeatable, two-position rotary switch that allows the input line to the drive to be disconnected. For safety, the switch must be in the OFF position before the enclosure cover can be removed. Includes drive and disconnect switch. Disconnect switch mounts below the drive in an extended drive enclosure for 10 HP @ 460V and 3 HP @ 208V and smaller units. No increase in enclosure size for all larger units. For single motor applications only.

Input Disconnect Switch and Input Fuse



Includes drive, drive fuses, and disconnect switch. Disconnect switch and fuses mount below the drive in an extended drive enclosure for 10 HP @ 460V and 3 HP @ 208V and smaller units. No increase in enclosure size for all larger units. For single motor applications only.

Short Circuit Current Rating

All VLT AQUA Drives and drives with drive fuses and/or input disconnect switches are rated at 100,000 amps short circuit current rating. (100kA SCCR).

All other standard panels consisting of a VLT AQUA Drive and options are labeled for 5kA SCCR.

Most requirements for a higher SCCR can be satisfied by a 100kA SCCR. We can optionally supply a bypass panel labeled for 100k SCCR. Main fuses (not circuit breaker) are always required for 100kA SCCR.

Please note that the SCCR is what is required to ensure that the panel's rating is sufficient for the source current available. This is not the same as amp interrupting capacity (AIC). AIC is a component rating, and cannot be used as the SCCR, which is a complete drive or panel rating.

Packaged Panel Solutions

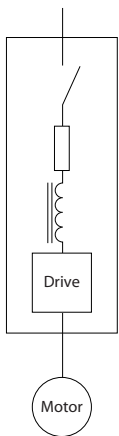
Input Line Reactor/Output LC Filter

Reactors and filters are in a UL Type 1 option enclosure only. This enclosure is identical in size to the option enclosure that can house a bypass. If a reactor and filter are both required, they will both be mounted in the same enclosure.

Drives without a bypass must have the input disconnect option.

For drives with bypass, neither input line reactors nor output LC Filters can be mounted in the same option panel as the bypass. A total of two option panels will be supplied for drives including both a bypass and an input line reactor or output LC filter.

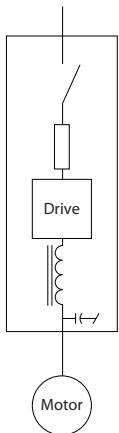
AC Input Line Reactor



AC input line reactors are used in the input to the drive to filter line noise from the drive and drive noise from the line. An internal 5% dual DC-link reactor is standard on all drives, eliminating the need for AC line reactors in many applications. Available with Contactor Motor Selection on bypass units only.

Drive with Disconnect Switch, Drive Fuses, and Input Line Reactor

Output LC Filter



This low-pass filter allow the use of longer motor leads, and reduces insulation stress, especially on low horsepower motors without interphase insulation. Available with Contactor Motor Section on both bypass and drive only units.

Drive with Disconnect Switch, Drive Fuses, and Output LC Filter

Input EMI Filter

All VLT AQUA Drives are designed to contain and control EMI and RFI to stringent European standard EN 61800-3.

Additional optional filtering is available for even the most sensitive installations.

Optional filters attenuate radio frequencies (150 Hz to 30 MHz) conducted to the AC power line and radiated emissions (30 MHz to 1 GHz).

Drives equipped with this optional filter have been tested to the product norm EN 61800-3 and meet the following standards. The test system included a drive with a motor and shielded motor cables, and a control box with a potentiometer and shielded control cable. When tested in this configuration, these drives are within the EN 55011 test limits for Class A1, A2, and B as shown below using the Danfoss H1 filter for drives less than 150 HP or H4 filter for drives 150 HP and up.

- This filter mounts inside the standard drive enclosure
- Available for both UL Type 1 and UL Type 12 drives
- Must be ordered as part of the drive; field retrofitting is not possible

EN 55011 Compliance

Models	Conducted Emissions			Radiated Emissions
	Class A2	Class A1	Class B	Class A1
1/2 HP through 60 HP @ 208V	500 ft (150 m)	500 ft (150 m)	165 ft (50 m)	Yes
1/2 HP through 125 HP @ 480 V	500 ft (150 m)	500 ft (150 m)	165 ft (50 m)	Yes

VLT® AQUA Drive

Mains Supply (L1, L2, L3):

Supply voltage	200 – 240 V ±10% (180 – 264 V)
	380 – 480 V ±10% (342 – 528 V)
	525 – 600 V ±10% (472 – 660 V)
	525 – 690 V ±10% (472 – 759 V)

Supply frequency50/60 Hz

Max. imbalance temporary

between mains phases..... 3.0 % of rated supply voltage

True Power Factor (λ)..... ≥ 0.9 nominal at rated load

Displacement Power Factor ($\cos\phi$)near unity (> 0.98)

Switching on input supply

L1, L2, L3 (power-ups) ≤ 10 HPmaximum 2 times/min.

L1, L2, L3 (power-ups) ≥ 15 HPmaximum 1 time/min.

Environment according to

EN60664-1..... overvoltage category III/pollution degree 2.

The unit is suitable for use on a circuit capable of delivering not more than 100.000 RMS symmetrical Amperes, 240/480/600 V maximum.

Motor Output (U, V, W):

Output voltage..... 0 - 100% of supply voltage

Output frequency.....0 – 120 Hz

Switching on output Unlimited

Ramp times..... 1 – 3600 sec.

Torque Characteristics:

Starting torque

(Constant torque)maximum 110% for 60 sec.*

Starting torque..... maximum 135% up to 0.5 sec.*

Overload torque

(Constant torque)maximum 110% for 60 sec.*

**Percentage relates to the nominal torque.*

Cable Lengths and Cross Sections:

Max. motor cable length, shielded500 ft (150 m)

Max. motor cable length, unshielded..... 1000 ft (300 m)

Maximum cross section

To motor, mains, load sharing and brake*

To control terminals,

Rigid wire: 16 AWG /1.5 mm² (2 x 0.75 mm²)

Flexible cable 18 AWG/1 mm²

Cable with enclosed core 20 AWG/0.5 mm²

Minimum cross section

To control terminals.....24 AWG/0.25 mm²

**See Mains Supply table for more information.*

Protection and Features:

- Electronic thermal motor protection against overload.
- Temperature monitoring of the heatsink ensures that the drive trips if the temperature reaches 203° F (95° C) $\pm 5^\circ$ C. An overload temperature cannot be reset until the temperature of the heatsink is below 158° F $\pm 9^\circ$ (70° C $\pm 5^\circ$) (Guideline - these temperatures may vary for different power sizes, enclosures etc.). VLT AQUA Drive has an auto derating function to avoid it's heatsink reaching 203° F (95° C).
- The drive is protected against short-circuits on motor terminals U, V, W.
- If a mains phase is missing, the drive trips or issues a warning (depending on the load).
- Monitoring of the intermediate circuit voltage ensures that the drive trips if the intermediate circuit voltage is too low or too high.
- The drive is protected against earth faults on motor terminals U, V, W.

Digital Inputs:

Programmable digital inputs4 (6)

Additional digital inputs available with

MCB 101 general purpose I/O option card3

Terminal number 18, 19, 27¹⁾, 29, 32, 33,

Logic..... PNP or NPN

Voltage level..... 0 – 24 VDC

Voltage level, logic '0' PNP..... <5 VDC

Voltage level, logic '1' PNP..... >10 VDC

Voltage level, logic '0' NPN²⁾>19 VDC

Voltage level, logic '1' NPN²⁾<14 VDC

Maximum voltage on input.....28 VDC

Input resistance..... approx. 4 k Ω

All digital inputs are galvanically isolated from the supply voltage (PELV) and other high-voltage terminals.

1) Terminals 27 and 29 can also be programmed as output.

General Specifications

Analog Inputs:

Number of analog inputs	2
Additional analog inputs available with:	
MCB 101 general purpose I/O option card	2
MCB 109 advanced analog I/O option card.....	3
Terminal number	53, 54
Modes	Voltage or current
Mode select	Switch S201 and switch S202
Voltage mode	Switch S201/switch S202 = OFF (U)
Voltage level	0 to +10 (scaleable)
Input resistance	approx. 10 k Ω
Max. voltage	± 20 V
Current mode	Switch S201/switch S202 = ON (I)
Current level	0/4 to 20 mA (scaleable)
Input resistance	approx. 200 Ω
Max. current	30 mA
Resolution for analog inputs	10 bit (+ sign)
Accuracy of analog inputs.....	Max. error 0.5% of full scale
Bandwidth.....	200 Hz

The analog inputs are galvanically isolated from the supply voltage (PELV) and other high-voltage terminals.

Pulse Inputs:

Programmable pulse inputs	2
Additional pulse inputs available with:	
MCB 101 general purpose I/O option card	3
Terminal number pulse/encoder	29, 33
Max. frequency at terminal 29, 33.....	110 kHz (Push-pull driven)
	5 kHz (open collector)
Min. frequency at terminal 29, 33.....	4 Hz
Voltage level.....	see section on Digital input
Maximum voltage on input	28 VDC
Input resistance.....	approx. 4 k Ω
Pulse input accuracy (0.1 - 1 kHz)	Max. error: 0.1% of full scale

The pulse and encoder inputs (terminals 29, 32, 33) are galvanically isolated from the supply voltage (PELV) and other high-voltage terminals.

Analog Output:

Number of programmable analog outputs	1
Additional analog outputs available with:	
MCB 101 general purpose I/O option card	1
MCB 109 advanced analog I/O option card.....	3
Terminal number	42
Current range at analog output	0/4 – 20 mA
Max. load to common at analog output	500 Ω
Accuracy on analog output	Max. error: 0.5 % of full scale
Resolution on analog output	8 bit

The analog output is galvanically isolated from the supply voltage (PELV) and other high voltage terminals.

Control Card, RS 485 Serial Communication:

Terminal number	68 (P,TX+, RX+), 69 (N,TX-, RX-)
Terminal number	61 Common for terminals 68 and 69

The RS 485 serial communication circuit is functionally separated from other central circuits and galvanically isolated from the supply voltage (PELV).

Digital Output:

Programmable digital/pulse outputs	2
Additional digital outputs available with:	
MCB 101 general purpose I/O option card	2
Terminal number	27, 29 ¹⁾
Voltage level at digital/frequency output	0 – 24 V
Max. output current (sink or source)	40 mA
Max. load at frequency output	1 k Ω
Max. capacitive load at frequency output.....	10 nF
Minimum output frequency at frequency output	0 Hz
Maximum output frequency at frequency output.....	32 kHz
Accuracy of frequency output..	Max. error: 0.1 % of full scale
Resolution of frequency outputs.....	12 bit

1) Terminal 27 and 29 can also be programmed as input.

The digital output is galvanically isolated from the supply voltage (PELV) and other high-voltage terminals.

Control Card, 24 VDC Output:

Terminal number	12, 13
Max. load	200 mA

The 24 VDC supply is galvanically isolated from the supply voltage (PELV), but has the same potential as the analog and digital inputs and outputs.

Relay Outputs:

Programmable relay outputs	2
Additional relay outputs available with:	
MCB 105 relay option card	3
Relay 01 Terminal number	1-3 (break), 1-2 (make)
Max. terminal load (AC-1) ¹⁾	
on 1-3 (NC), 1-2 (NO) (Resistive load)	240 VAC, 2 A
Max. terminal load (AC-15) ¹⁾	
(Inductive load @ cosφ 0.4)	240 VAC, 0.2 A
Max. terminal load (DC-1) ¹⁾	
on 1-2 (NO), 1-3 (NC) (Resistive load)	60 VDC, 1 A
Max. terminal load (DC-13) ¹⁾	
(Inductive load)	24 VDC, 0.1 A
Relay 02 Terminal number	4-6 (break), 4-5 (make)
Max. terminal load (AC-1) ¹⁾ on 4-5 (NO)	
(Resistive load)	400 VAC, 2 A
Max. terminal load (AC-15) ¹⁾ on 4-5 (NO)	
(Inductive load @ cosφ 0.4)	240 VAC, 0.2 A
Max. terminal load (DC-1) ¹⁾ on 4-5 (NO)	
(Resistive load)	80 VDC, 2 A
Max. terminal load (DC-13) ¹⁾ on 4-5 (NO)	
(Inductive load)	24 VDC, 0.1 A
Max. terminal load (AC-1) ¹⁾ on 4-6 (NC)	
(Resistive load)	240 VAC, 2 A
Max. terminal load (AC-15) ¹⁾ on 4-6 (NC)	
(Inductive load @ cosφ 0.4)	240 VAC, 0.2 A
Max. terminal load (DC-1) ¹⁾ on 4-6 (NC)	
(Resistive load)	50 VDC, 2 A
Max. terminal load (DC-13) ¹⁾ on 4-6 (NC)	
(Inductive load)	24 VDC, 0.1 A
Min. terminal load on 1-3 (NC), 1-2 (NO),	
4-6 (NC), 4-5 (NO)	24 VDC 10 mA, 24 VAC 20 mA

Environment according
to EN 60664-1 ... overvoltage category III/pollution degree 2

1) IEC 60947 part 4 and 5

The relay contacts are galvanically isolated from the rest of the circuit by reinforced isolation (PELV).

Control Card, 10 VDC Output:

Terminal number	50
Output voltage	10.5 V ±0.5 V
Max. load	25 mA

The 10 VDC supply is galvanically isolated from the supply voltage (PELV) and other high-voltage terminals.

Control Characteristics:

Resolution of output frequency	
at 0 - 1000 Hz	+/- 0.003 Hz
System response time	
(terminals 18, 19, 27, 29, 32, 33)	≤2 ms
Speed control range	
Open loop	1:100 of synchronous speed
Speed accuracy	
Open loop	30 – 4000 rpm: error ±8 rpm

All control characteristics are based on a 4-pole asynchronous motor

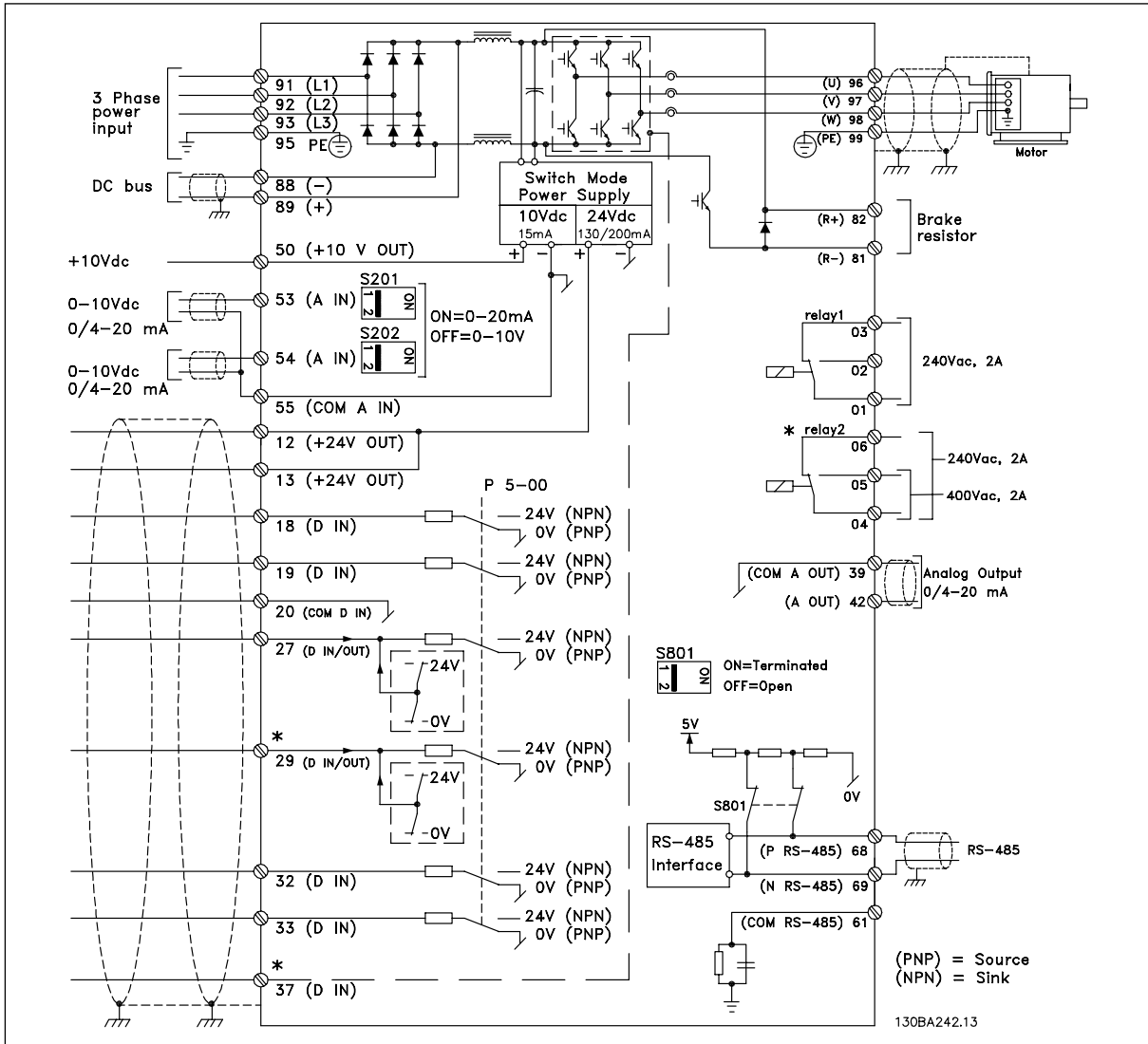
Surroundings:

Enclosure ≤10 HP	Protected Chassis/IP20, NEMA Type 12/IP55, IP66
Enclosure 15 HP – 125 HP	Protected Chassis/IP20, NEMA Type 1/IP21, NEMA Type 12/IP55, IP66
Enclosure ≥150 HP	Chassis/IP00, NEMA Type 1/IP21, NEMA Type 12/IP54
Enclosure kit available ≤125 HP	NEMA Type 1/IP21
Vibration test	1.0 g RMS
Max. relative humidity	5% - 95% (IEC 60 721-3-3; Class 3K3 (non-condensing) during operation
Aggressive environment (IEC 721-3-3), uncoated ...	class 3C2
Aggressive environment (IEC 721-3-3), coated	class 3C3
Test method according to IEC 60068-2-43 H2S (10 days)	
Ambient temperature	122° F (50° C)
<i>Derating for high ambient temperature, see Design Guide section on special conditions</i>	
Minimum ambient temperature	
During full-scale operation	32° F (0° C)
At reduced performance	-14° F (-10° C)
Temperature during storage/transport	-13° F (-25° C) to 149/158° F (65/70° C)
Maximum altitude above sea level	1000 m
<i>Derating for high altitude, see Design Guide section on Special Conditions</i>	
EMC standards	
Emission	EN 61800-3, EN 61000-6-3/4, EN 55011, IEC 61800-3
Immunity	EN 61800-3, EN 61000-6-1/2, EN 61000-4-2, EN 61000-4-3, EN 61000-4-4, EN 61000-4-5, EN 61000-4-6

General Specifications

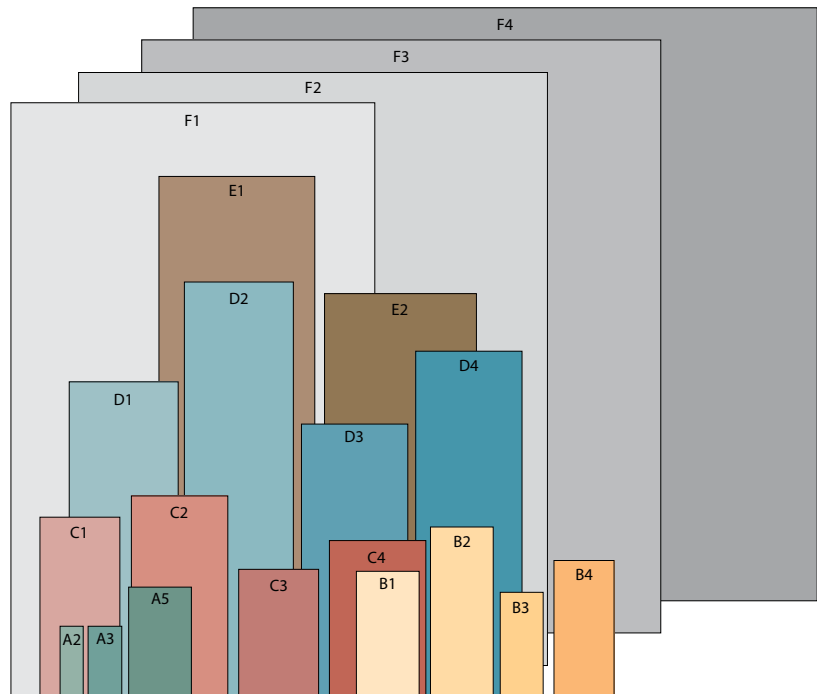
Connection example

This diagram shows a typical installation of the VLT® AQUA Drive. The numbers represent the terminals on the drive.



VLT® AQUA Drive

VLT AQUA Drives are available in numerous enclosure frame sizes illustrated at right and in several power ranges shown in the charts on the following pages.



200 – 240 VAC 1Ø

HP	Current [A]				Est. Power Loss @ Rated Max. Load (W)	Enclosure Rating/Frame Size ⁽¹⁾		
	Output		Input			NEMA 1 IP21	NEMA 12 IP55	IP66
	Cont.	Int.	Cont.	Int.				
7-1/2	24.2	26.6	46.0	50.6	110	B1	B1	B1
10	30.8	33.4	59.0	64.9	150	B2	B2	B2
20	59.4	65.3	111.0	122.1	300	C1	C1	C1
30	88.0	96.8	172.0	189.2	440	C2	C2	C2

200 – 240 VAC 3Ø

HP	Current [A]				Est. Power Loss @ Rated Max. Load (W)	Enclosure Rating/Frame Size ⁽¹⁾			
	Output		Input			Protected Chassis IP20	NEMA 1 IP21	NEMA 12 IP55	IP66
	Cont.	Int.	Cont.	Int.					
1/3	1.8	2.9	1.6	2.6	21				
1/2	2.4	3.8	2.2	3.5	29				
3/4	3.5	5.6	3.2	5.1	42				
1	4.6	7.4	4.1	6.6	54	A2	A2	A5	
1-1/2	6.6	7.3	5.9	6.5	63				
2	7.5	8.3	6.8	7.5	82				
3	10.6	11.7	9.5	10.5	116				
4	12.5	13.8	11.3	12.4	155	A3	A3	A5	
5	16.7	18.4	15.0	16.5	185				
7-1/2	24.2	26.6	22.0	24.2	269				
10	30.8	33.9	28.0	30.8	310	B3	B1	B1	
15	46.2	50.8	42.0	46.2	447				
20	59.4	65.3	54.0	59.4	602	B4	B2	B2	
25	74.8	82.3	68.0	74.8	737				
30	88.0	96.8	88.0	88.0	845	C3	C1	C1	
40	115	127	104	114	1140				
50	143	157	130	143	1353	C4	C2	C2	
60	170	187	154	169	1636				

Note: 110% Torque Overload is rated for 60 seconds.

⁽¹⁾ See page 63 for the index to dimension drawings.

Performance Data

380 – 480 VAC 3Ø

HP	Current [A]				Est. Power Loss @ Rated Max. Load (W)	Enclosure Rating/Frame Size ⁽¹⁾			
	Output		Input			Protected Chassis IP20	NEMA 1 IP21	NEMA 12 IP55	IP66
	Cont.	Int.	Cont.	Int.					
1/2	1.2	1.9	1.0	1.6	35				
3/4	1.6	2.6	1.4	2.2	42				
1	2.1	3.4	1.9	3.0	46				
1-1/2	2.7	3.0	2.7	4.1	58	A2	A2	A5	A5
2	3.4	3.7	3.1	3.4	62				
3	4.8	5.3	4.3	4.7	88				
4	6.3	6.9	5.7	6.3	116				
5	8.2	9.0	7.4	8.1	124				
7-1/2	11.0	12.1	9.9	10.9	187	A3	A3	A5	A5
10	14.5	15.4	13.0	14.3	255				
15	21	23.1	19	20.9	278				
20	27	29.7	25	27.5	392	B3	B1	B1	B1
25	34	37.4	31	34.1	465				
30	40	44	36	39.6	525				
40	52	61.6	47	51.7	739	B4	B2	B2	B2
50	65	71.5	59	64.9	698				
60	80	88	73	80.3	843	C3	C1	C1	C1
75	105	116	95	105	1083				
100	130	143	118	130	1384	C4	C2	C2	C2
125	160	176	145	160	1474				

HP	Current [A]				Est. Power Loss @ Rated Max. Load (W)	Enclosure Rating/Frame Size ⁽¹⁾		
	Output		Input			Chassis IP00	NEMA 1 IP21	NEMA 12 IP54
	Cont.	Int.	Cont.	Int.				
150	190	209	185	3234	D3	D1	D1	
200	240	264	231	3782				
250	302	332	291	4213				
300	361	397	348	5119	D4	D2	D2	
350	443	487	427	5893				
450	540	594	531	7630				
500	590	649	580	7701	E2	E1	E1	
550	678	746	667	8879				
600	730	803	718	9428				
650	780	858	759	⁽²⁾				
750	890	979	867	⁽²⁾				
900	1050	1155	1022	⁽²⁾	—	F1 or F3	F1 or F3	
1000	1160	1276	1129	⁽²⁾				
1200	1380	1518	1344	⁽²⁾				
1350	1530	1683	1490	⁽²⁾	—	F2 or F4	F2 or F4	

Note: 110% Torque Overload is rated for 60 seconds.

⁽¹⁾ See page 63 for the index to dimension drawings.

⁽²⁾ Contact Danfoss.

VLT® AQUA Drive

525 – 600 VAC 3Ø

HP	Current [A]				Est. Power Loss @ Rated Max. Load (W)	Enclosure Rating/Frame Size ⁽¹⁾			
	Output		Input			Protected Chassis IP20	NEMA 1 IP21	NEMA 12 IP55	IP66
	Cont.	Int.	Cont.	Int.					
1	1.7		1.7		35				
1-1/2	2.4	2.6	2.4	2.7	50				
2	2.7	3.0	2.7	3.0	65	A2	A2	A5	A5
3	3.9	4.3	4.1	4.5	92				
4	4.9	5.4	5.2	5.7	122				
5	6.1	6.7	5.8	6.4	145				
7-1/2	9.0	9.9	8.6	9.5	195	A3	A3	A5	A5
10	11.0	12.1	10.4	11.5	261				
15	18	20	17.2	19	300				
20	22	24	20.9	23	400	B3	B1	B1	B1
25	27	30	25.4	28	475				
30	34	37	32.7	36	525	B4	B2	B2	B2
40	41	45	39	43	700				
50	52	57	49	54	750				
60	62	68	59	65	850	C3	C1	C1	C1
75	83	91	78.9	87	1100				
100	100	110	95.3	105	1400	C4	C2	C2	C2
125	131	144	124.3	137	1500				

Note: 110% Torque Overload is rated for 60 seconds.

⁽¹⁾ See page 63 for the index to dimension drawings.

Mechanical Specifications

525 – 690 VAC 3Ø

HP	kW	Current [A] (@ 575V Nominal)			Est. Power Loss @ Rated Max. Load (W)	Enclosure Rating/Frame Size ⁽²⁾		
		Output		Input		Chassis IP00	NEMA 1 IP21	NEMA 12 IP54
		Cont.	Int.	Cont.				
50	37	54	59	58	1458			
60	45	73	80	74	1717			
75	55	86	95	87	1913			
100	75	108	119	106	2262	D3	D1	D1
125	90	144	131	124	2662			
150	110	155	171	151	3114			
200	132	192	211	189	3612			
250	160	242	266	234	4292			
300	200	290	319	286	5156	D4	D2	D2
350	250	344	378	339	5821			
400	315	400	440	390	6149			
450	355	450	495	434	6449			
500	400	500	550	482	7249	E2	E1	E1
600	500	570	627	549	8727			
650	560	630	693	607	9673			
750	560	730	803	711	⁽³⁾			
950	670	850	935	828	⁽³⁾	F1 or F3	F1 or F3	F1 or F3
1050	750	945	1040	920	⁽³⁾			
1150	850	1060	1166	1032	⁽³⁾	F2 or F4	F2 or F4	F2 or F4
1350	1000	1260	1386	1227	⁽³⁾			

Note: 110% Torque Overload is rated for 60 seconds.

⁽¹⁾ See below for the index to dimension drawings.

⁽²⁾ Contact Danfoss.

Index of Dimensions

Frame Size	Enclosure Rating	Page
A2	Protected Chassis/IP20	64-67
	NEMA 1/ IP21	68-71
	Tier 2	72-73
	Tier 3	74-75
A3	Protected Chassis/IP20	76-79
	NEMA 1/ IP21	80-83
	Tier 2	84-85
	Tier 3	86-87
A5	NEMA 12/ IP55/IP66	88
	Tier 2	89
	Tier 3	90
B1	NEMA 12/ IP55/IP66	91
	Tier 2	92
	Tier 3	93
B2	NEMA 12/ IP55/IP66	94
	Tier 2	95
	Tier 3	96
B3	Protected Chassis/IP20	97-100
B4	Protected Chassis/IP20	101

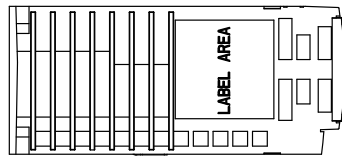
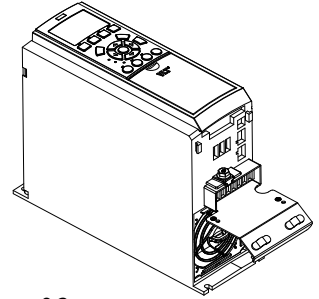
Frame Size	Enclosure Rating	Page
C1	NEMA 12/ IP55/IP66	102
	Tier 2	103
	Tier 3	104
C2	NEMA 12/ IP55/IP66	105
	Tier 2	106
	Tier 3	107
C3	Protected Chassis/IP20	108
C4	Protected Chassis/IP20	109
D1	NEMA 12/ IP54	110
	Tier 2	111
	Tier 3	112
D2	NEMA 12/ IP54	113
	Tier 2	114
	Tier 3	115
D3	Chassis/IP00	116
D4	Chassis/IP00	117
E1	NEMA 12/ IP54	118
E2	Chassis/IP00	119
F1	NEMA 12/ IP54	120
F2	NEMA 12/ IP54	121
F3	NEMA 12/ IP54	122
F4	NEMA 12/ IP54	123

VLT® AQUA Drive

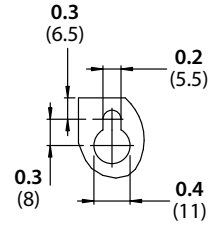
A2 Frame Size

Protected Chassis/IP20 No option card; bottom cable entry

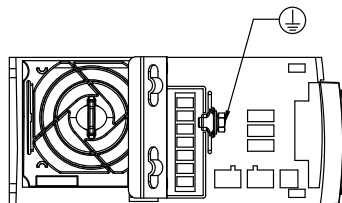
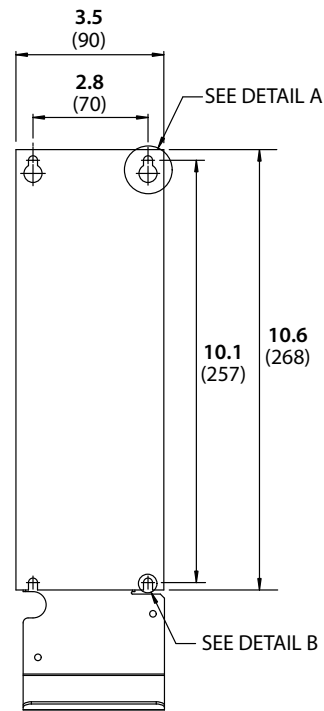
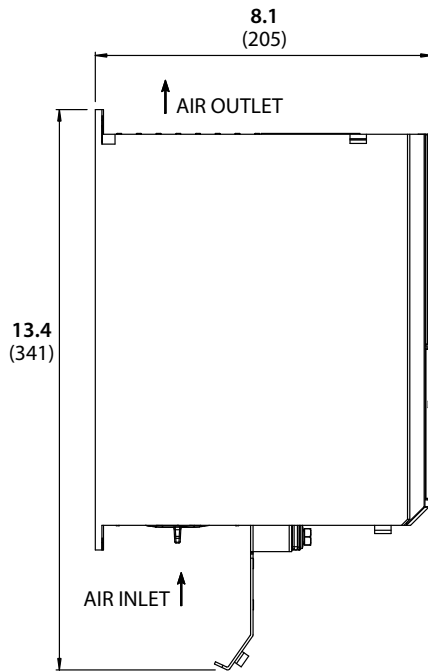
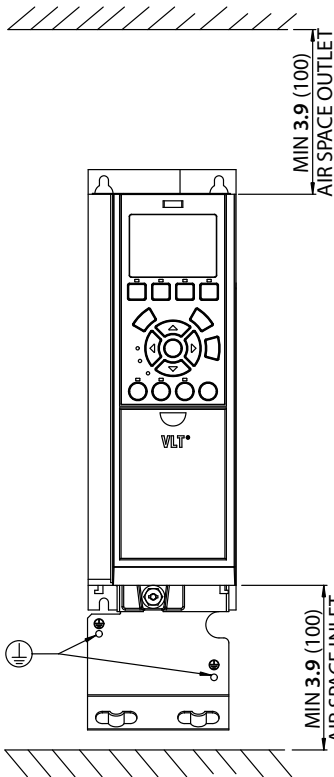
Dimensions: in (mm) **Weight: 10.4 – 10.8 lbs (4.7 – 4.9 kg)**



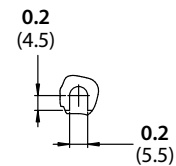
TOP VIEW



DETAIL A



BOTTOM VIEW



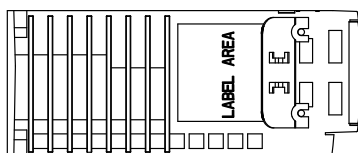
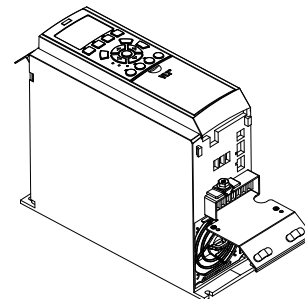
DETAIL B

Mechanical Specifications

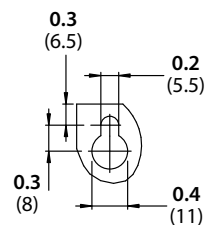
A2 Frame Size

Protected Chassis/IP20 A and/or B option card; top cable entry

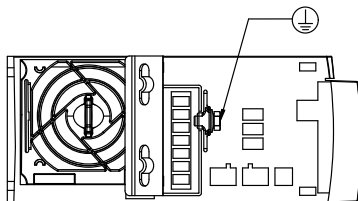
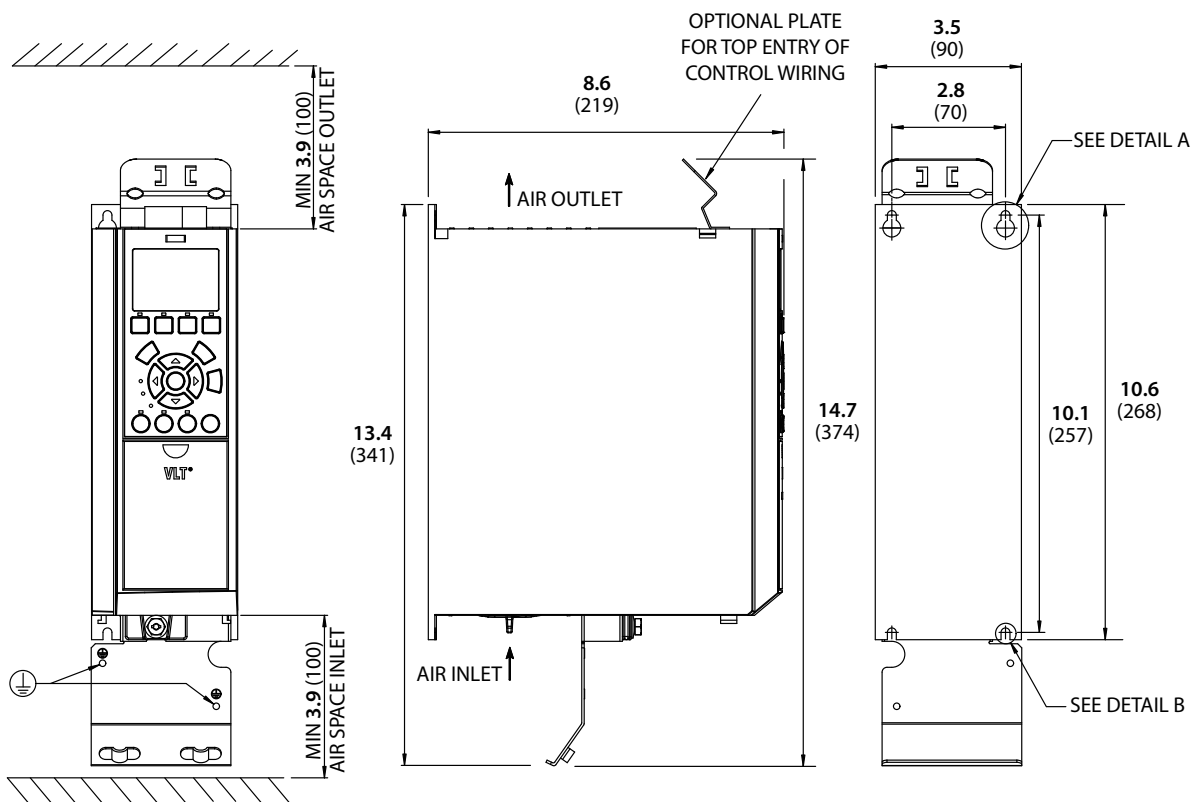
Dimensions: in (mm) **Weight: 10.4 – 10.8 lbs (4.7 – 4.9 kg)**



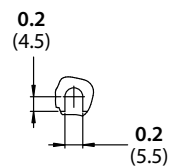
TOP VIEW



DETAIL A



BOTTOM VIEW



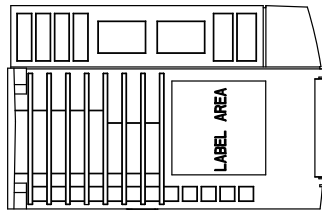
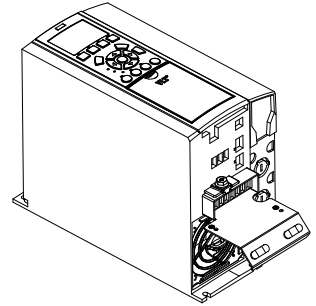
DETAIL B

VLT® AQUA Drive

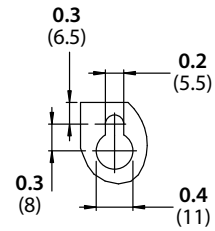
A2 Frame Size

Protected Chassis/IP20 C option card; bottom cable entry

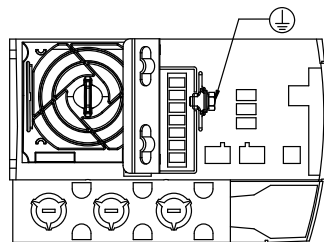
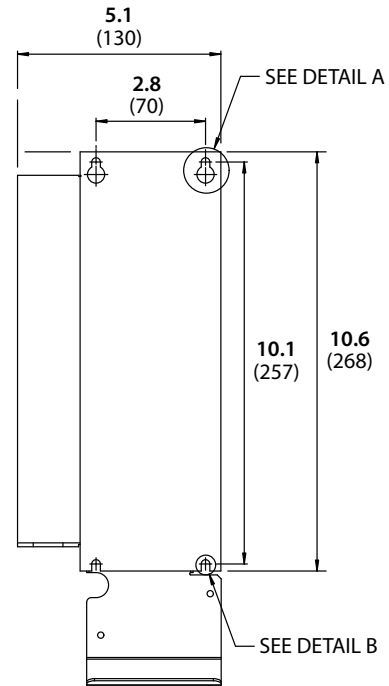
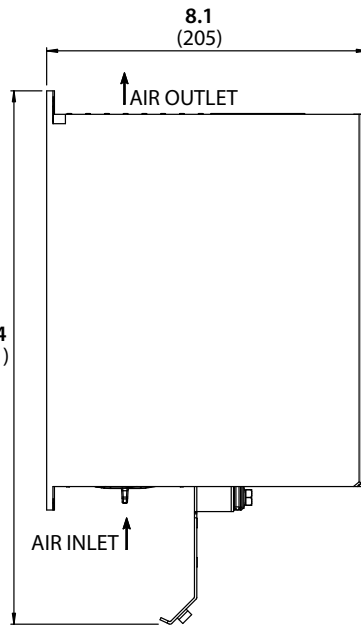
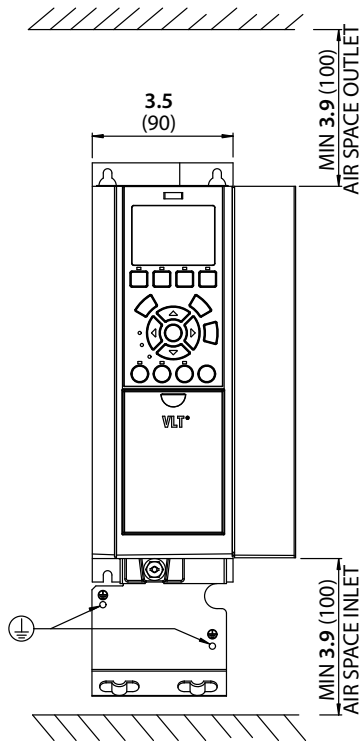
Dimensions: in (mm) **Weight: 10.4 – 10.8 lbs (4.7 – 4.9 kg)**



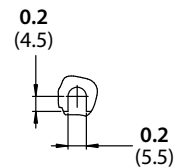
TOP VIEW



DETAIL A



BOTTOM VIEW



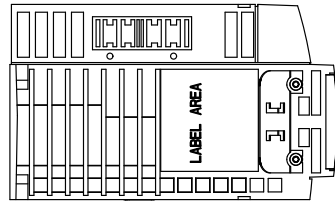
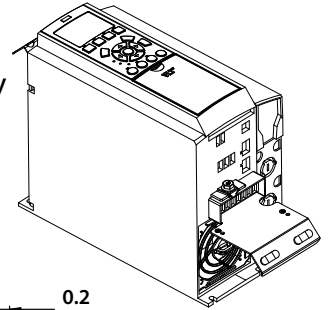
DETAIL B

Mechanical Specifications

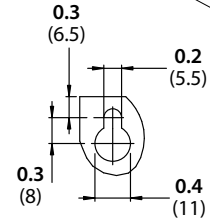
A2 Frame Size

Protected Chassis/IP20 A and/or B option card; C option card; top cable entry

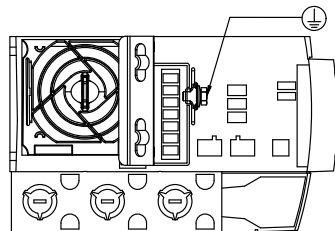
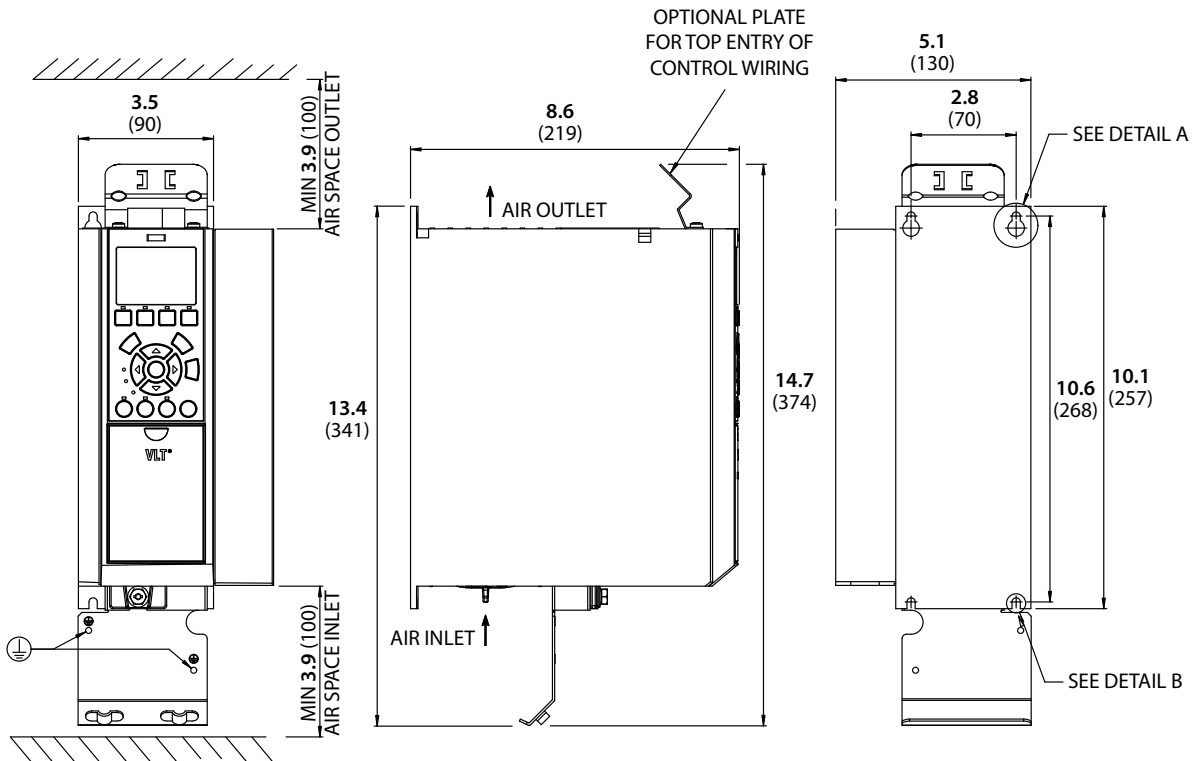
Dimensions: in (mm) **Weight: 10.4 – 10.8 lbs (4.7 – 4.9 kg)**



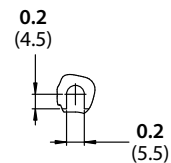
TOP VIEW



DETAIL A



BOTTOM VIEW



DETAIL B

VLT® AQUA Drive

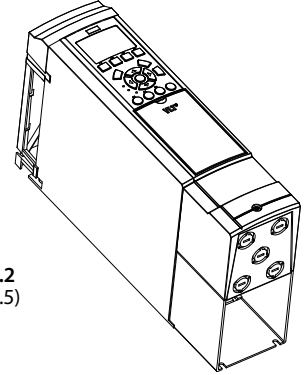
A2 Frame Size

NEMA 1/IP21 No option card; bottom cable entry

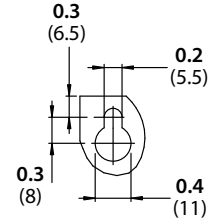
Dimensions: in (mm)

Weight: 10.4 – 10.8 lbs (4.7 – 4.9 kg)

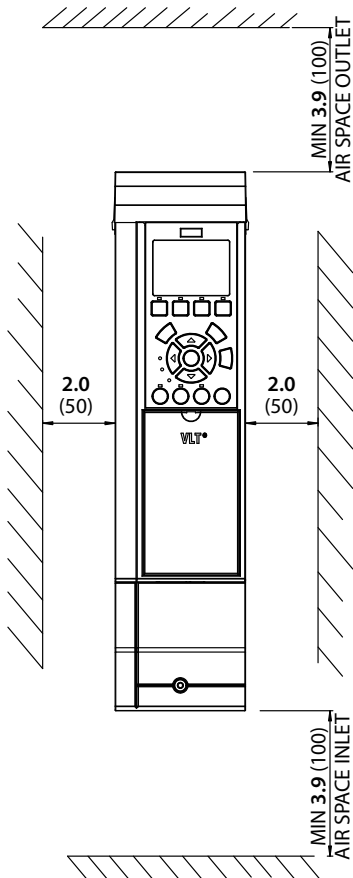
NEMA 1 Kit: 1.3 lbs (0.6 kg)



TOP VIEW



DETAIL A



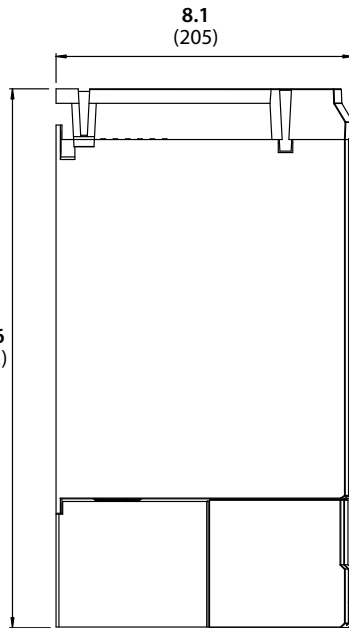
MIN 3.9 (100)
AIR SPACE OUTLET

2.0 (50)

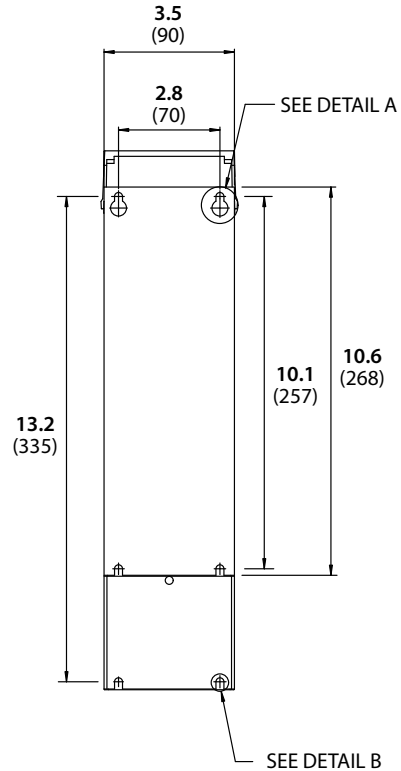
2.0 (50)

14.6 (372)

MIN 3.9 (100)
AIR SPACE INLET

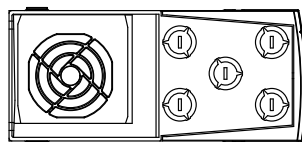


8.1 (205)

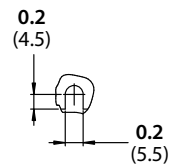


13.2 (335)

SEE DETAIL B



BOTTOM VIEW



DETAIL B

Mechanical Specifications

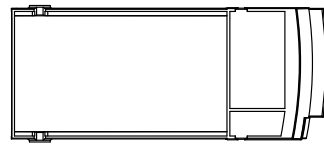
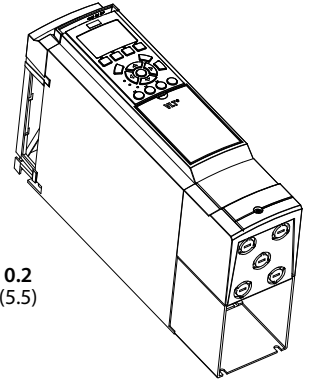
A2 Frame Size

NEMA 1/IP21 A and/or B option card; bottom cable entry

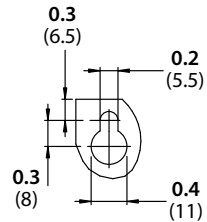
Dimensions: in (mm)

Weight: 10.4 – 10.8 lbs (4.7 – 4.9 kg)

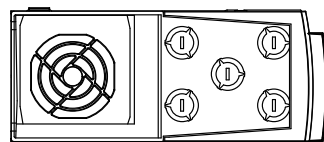
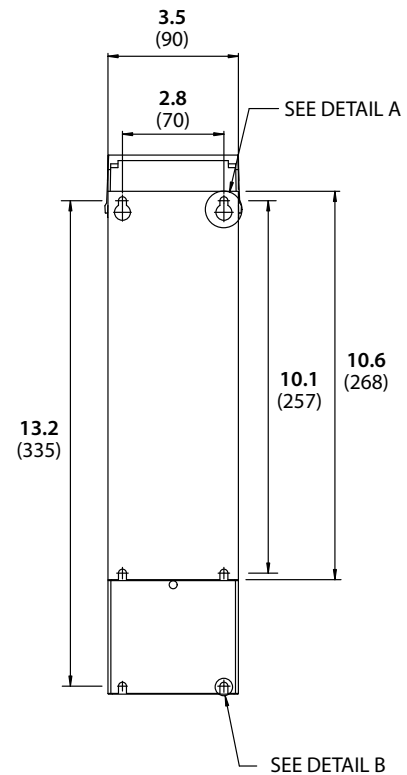
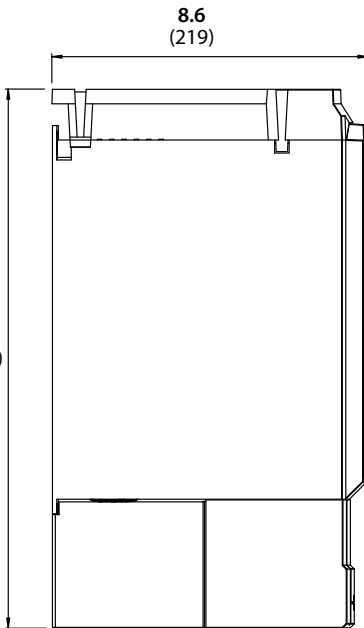
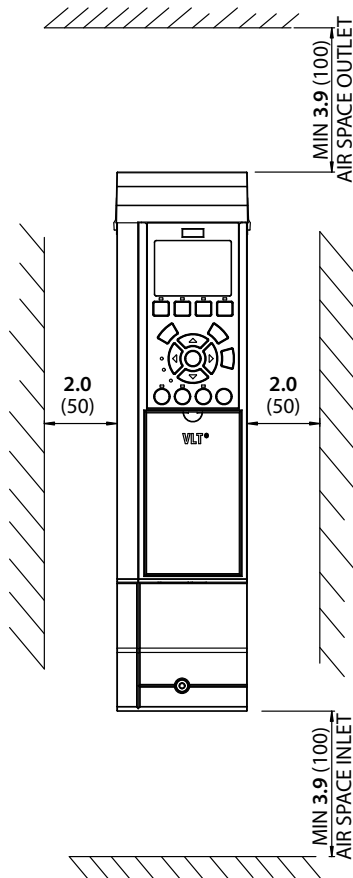
NEMA 1 Kit: 1.3 lbs (0.6 kg)



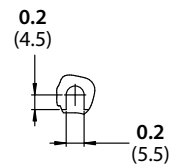
TOP VIEW



DETAIL A



BOTTOM VIEW



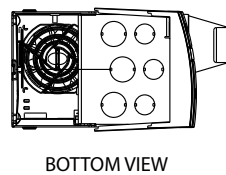
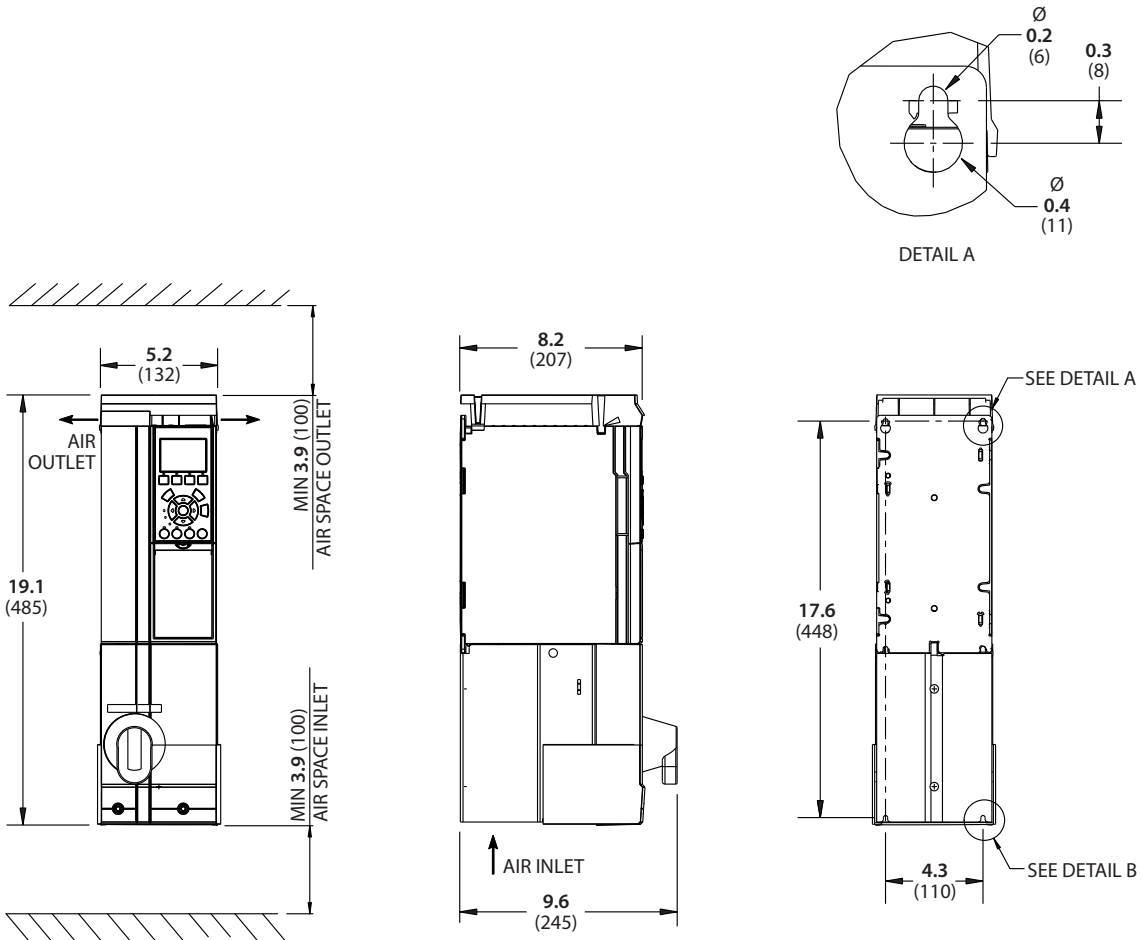
DETAIL B

VLT® AQUA Drive

A2 Frame Size

NEMA 1/IP21 Optional mains disconnect; no option card; bottom cable entry

Dimensions: in (mm) **Weight: 10.4 – 10.8 lbs (4.7 – 4.9 kg)**

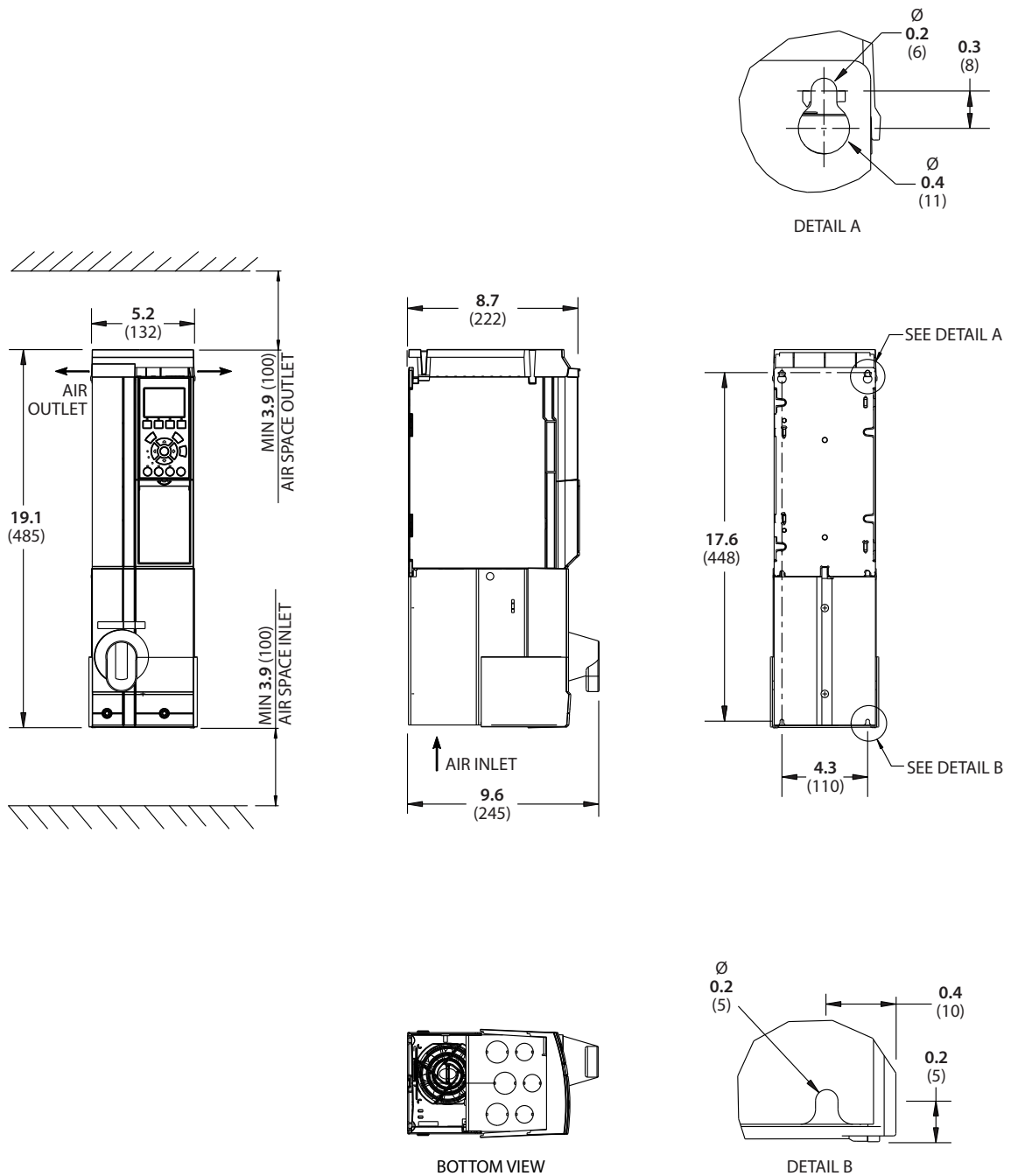


Mechanical Specifications

A2 Frame Size

NEMA 1/IP21 Optional mains disconnect; A and/or B option card; bottom cable entry

Dimensions: in (mm) Weight: 10.4 – 10.8 lbs (4.7 – 4.9 kg)

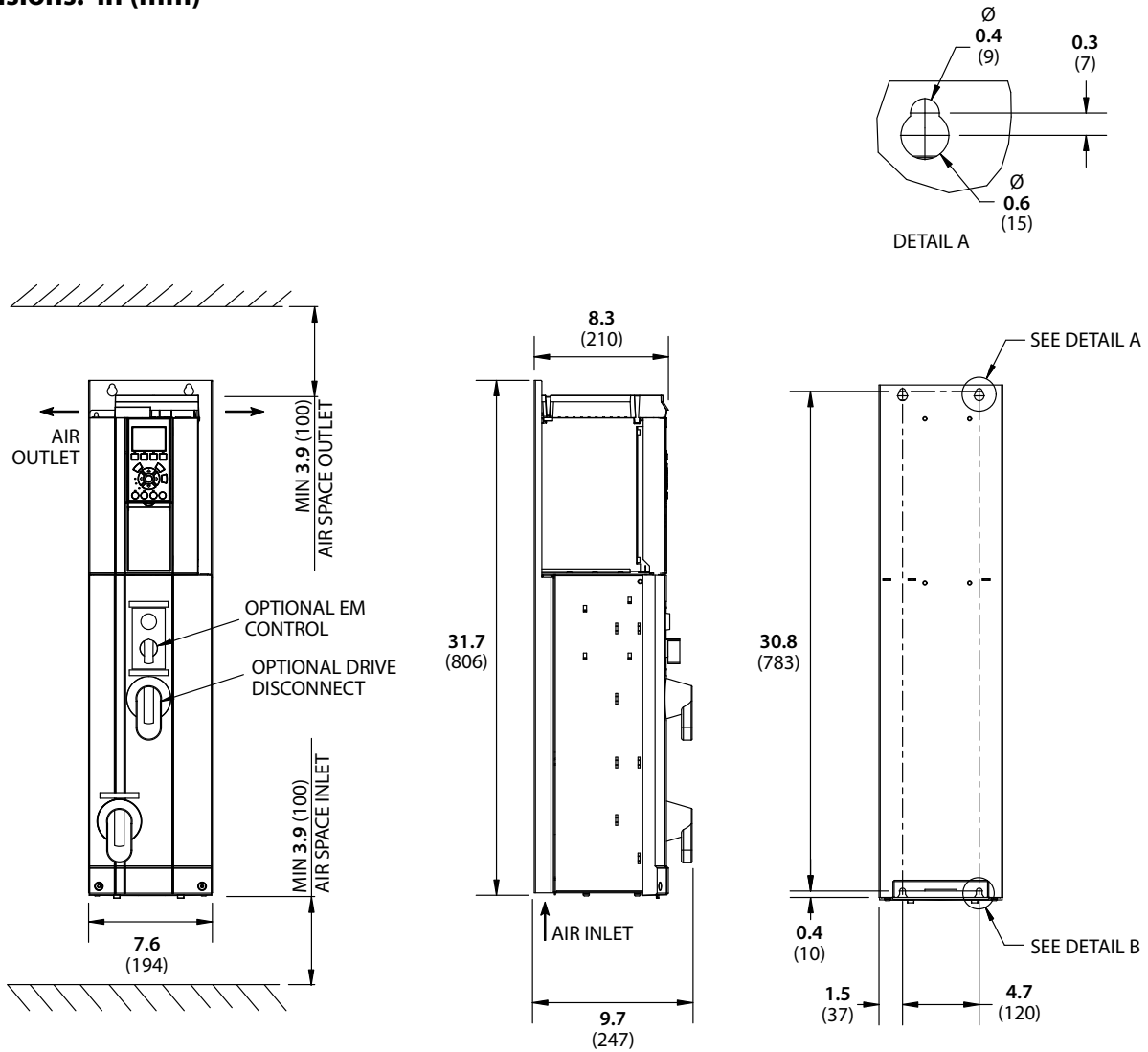


VLT® AQUA Drive

A2 Frame Size Tier 2*

NEMA 1/IP21 With optional mains disconnect; no option card; bottom cable entry

Dimensions: in (mm)



BOTTOM VIEW

DETAIL B

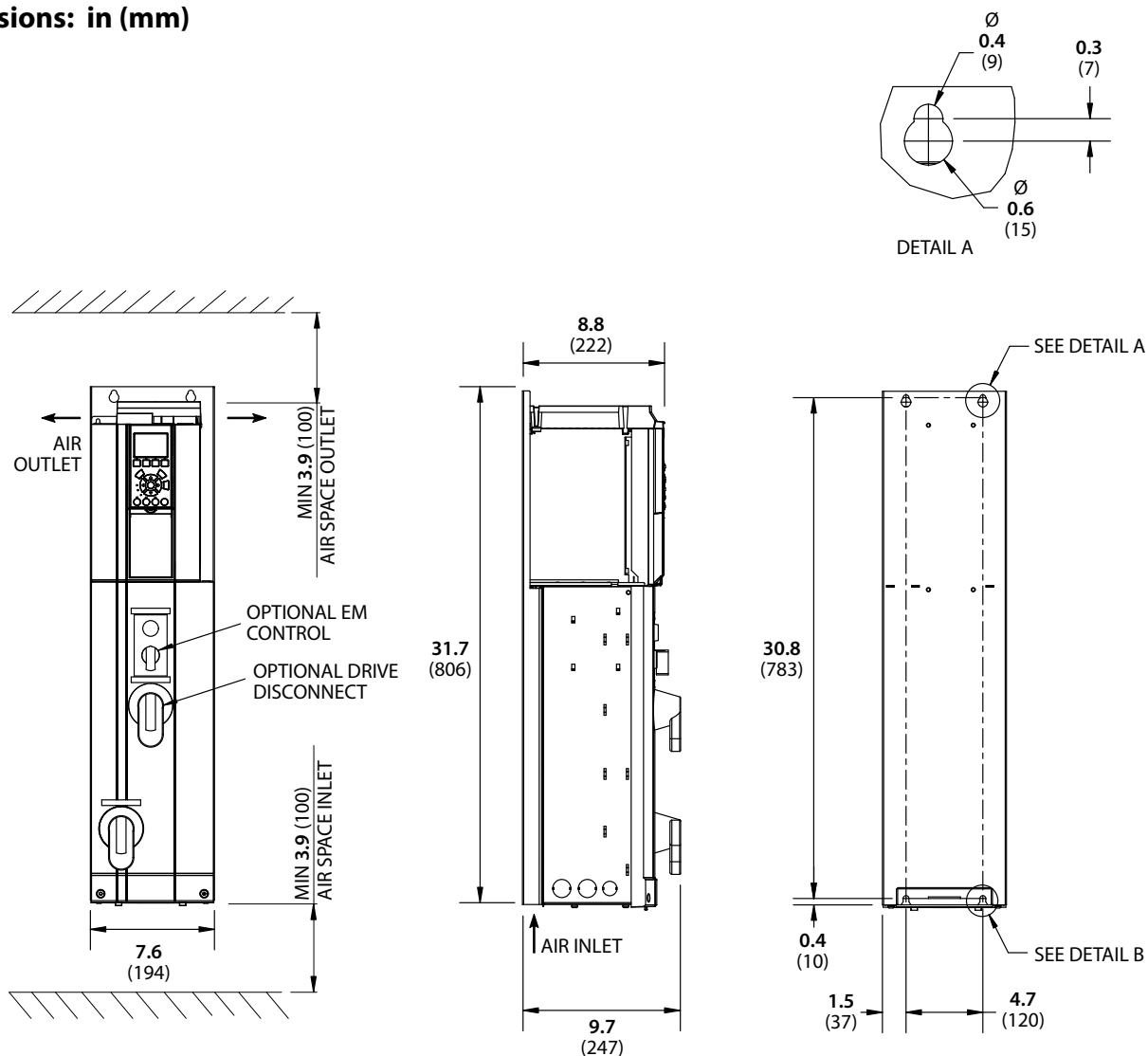
* Tier 2 Panel Solution products include drive with bypass or non-bypass drive with input AC line reactor, output LC filter and/or contactor motor selection See page 51 for more information.

Mechanical Specifications

A2 Frame Size Tier 2*

NEMA 1/IP21 With optional mains disconnect and A and/or B option card; bottom cable entry

Dimensions: in (mm)



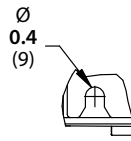
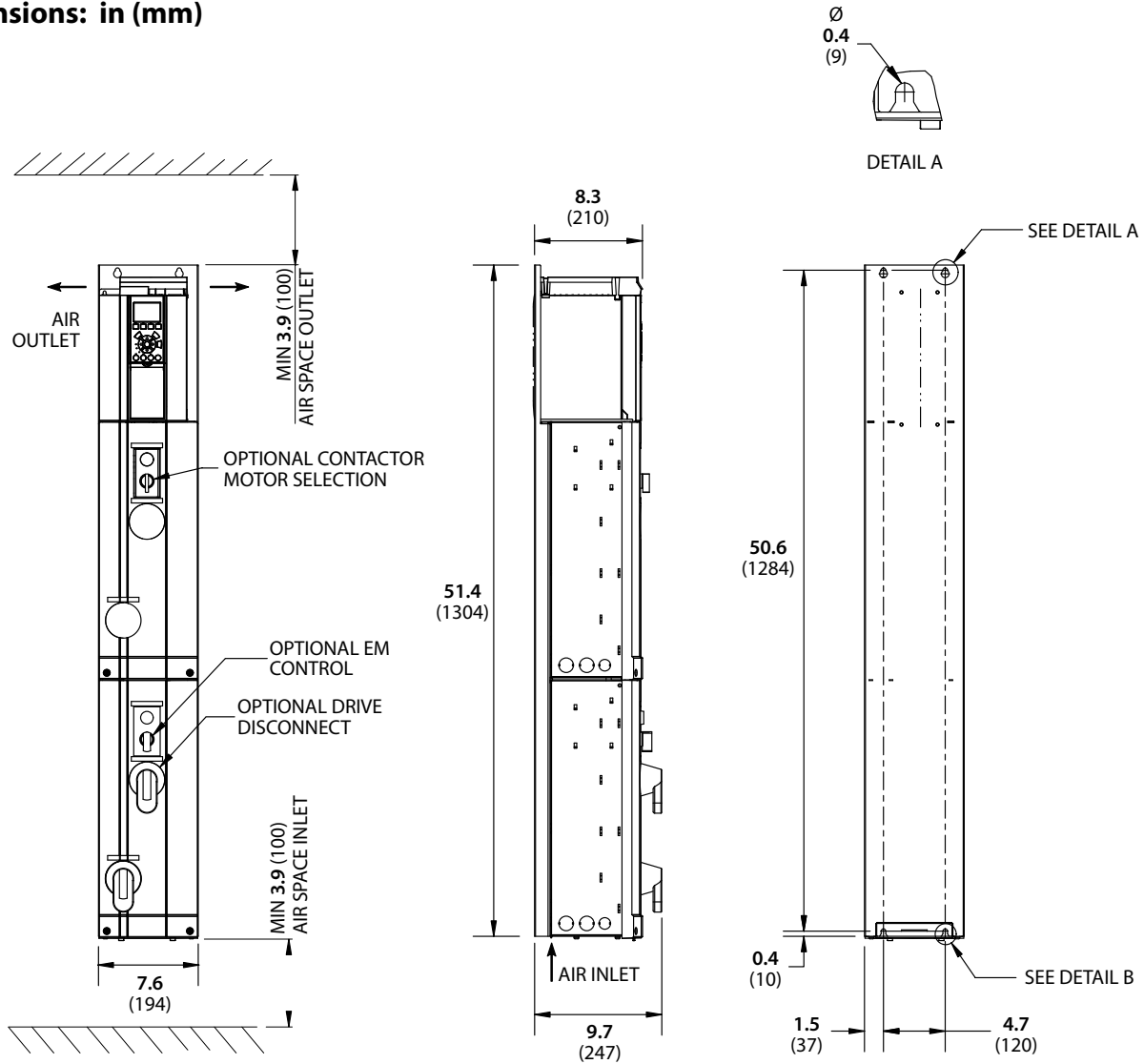
* Tier 2 Panel Solution products include drive with bypass or non-bypass drive with input AC line reactor, output LC filter and/or contactor motor selection See page 51 for more information.

VLT® AQUA Drive

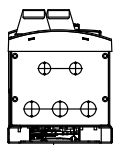
A2 Frame Size Tier 3*

NEMA 1/IP21 With optional mains disconnect; no option card; bottom cable entry

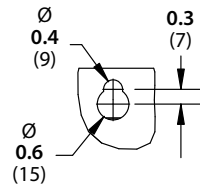
Dimensions: in (mm)



DETAIL A



BOTTOM VIEW



DETAIL B

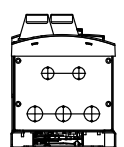
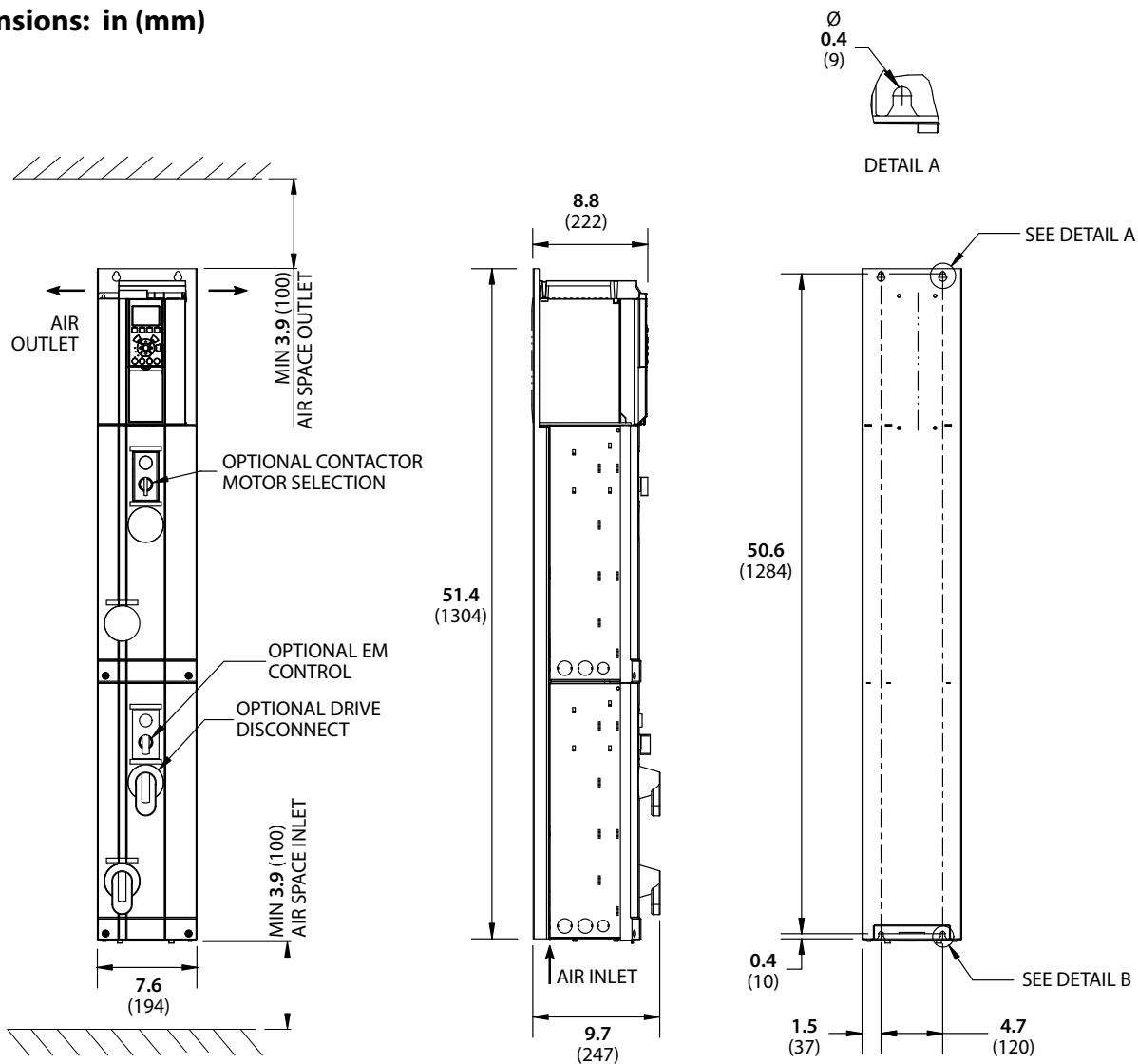
* Tier 3 Panel Solution products include drive with bypass and input AC line reactor, output LC filter and/or contactor motor selection. See page 51 for more information.

Mechanical Specifications

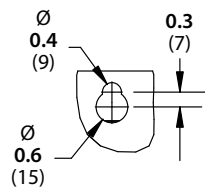
A2 Frame Size Tier 3*

NEMA 1/IP21 With optional mains disconnect and A and/or B option card; bottom cable entry

Dimensions: in (mm)



BOTTOM VIEW



DETAIL B

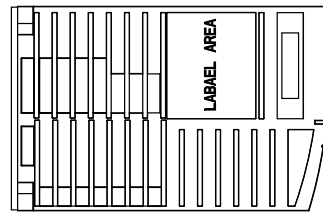
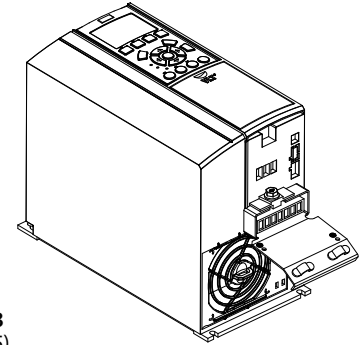
* Tier 3 Panel Solution products include drive with bypass and input AC line reactor, output LC filter and/or contactor motor selection. See page 51 for more information.

VLT® AQUA Drive

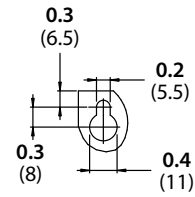
A3 Frame Size

Protected Chassis/IP20 No option card; bottom cable entry

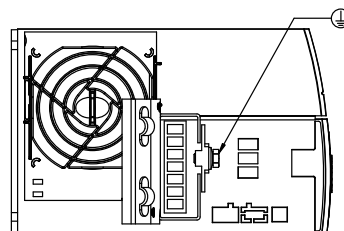
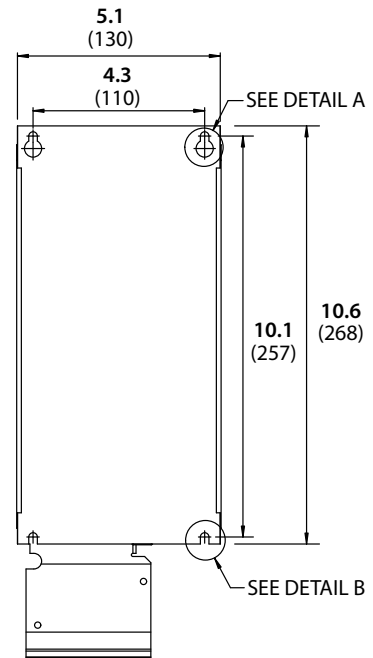
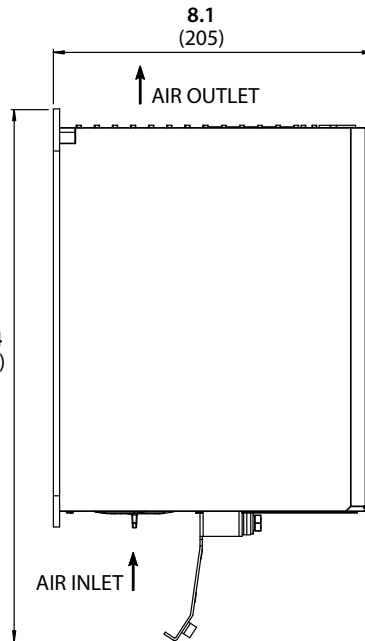
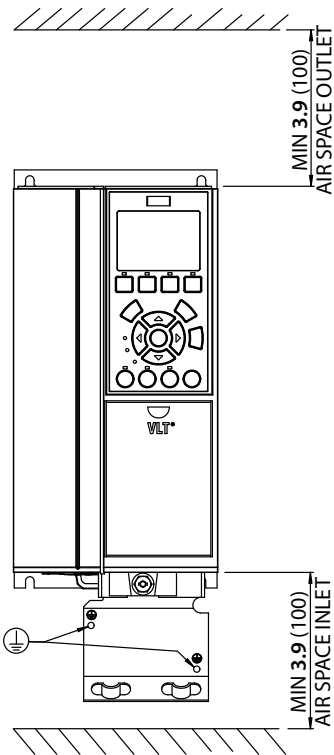
Dimensions: in (mm) **Weight: 14.3 – 14.6 lbs (6.5 – 6.6 kg)**



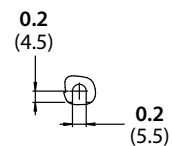
TOP VIEW



DETAIL A



BOTTOM VIEW



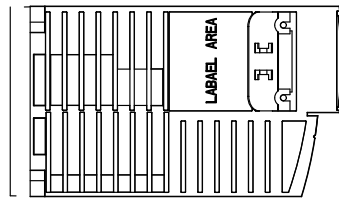
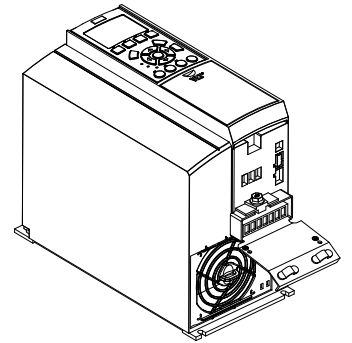
DETAIL B

Mechanical Specifications

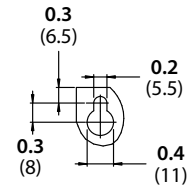
A3 Frame Size

Protected Chassis/IP20 A and/or B option card; top cable entry

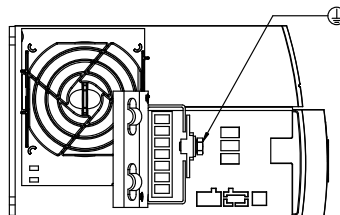
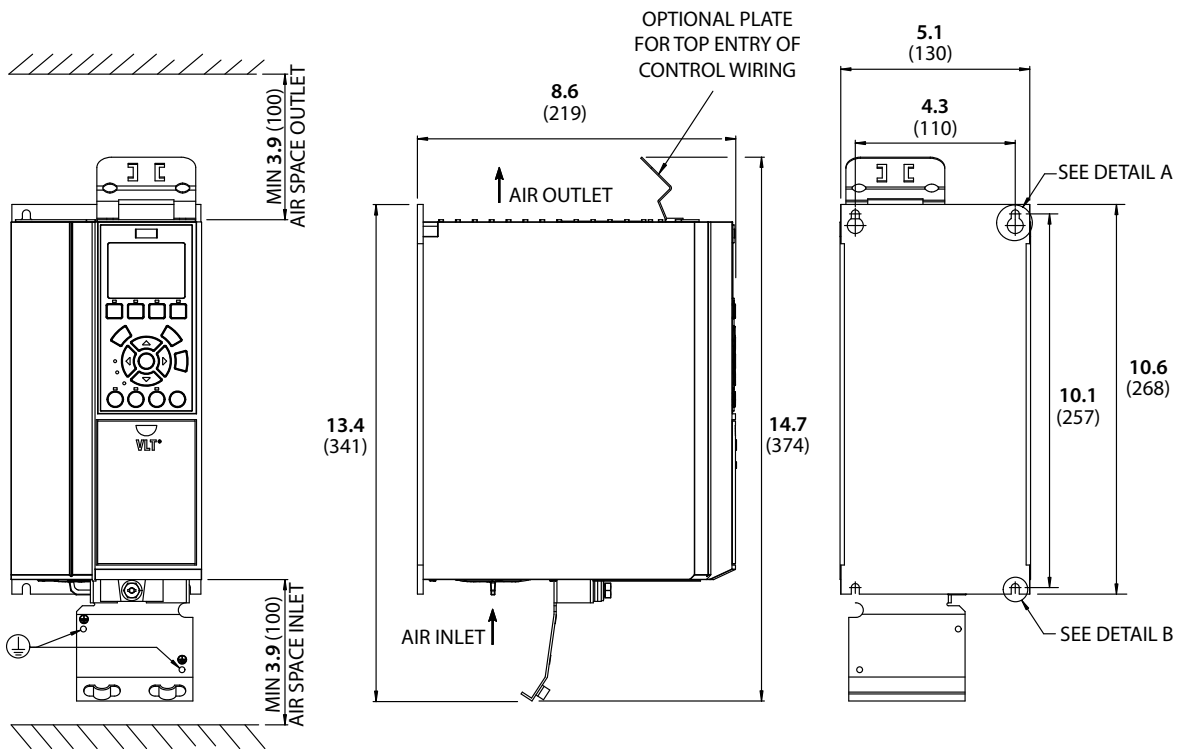
Dimensions: in (mm) **Weight: 14.3 – 14.6 lbs (6.5 – 6.6 kg)**



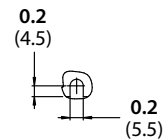
TOP VIEW



DETAIL A



BOTTOM VIEW



DETAIL B

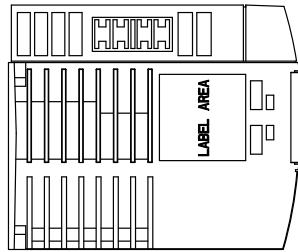
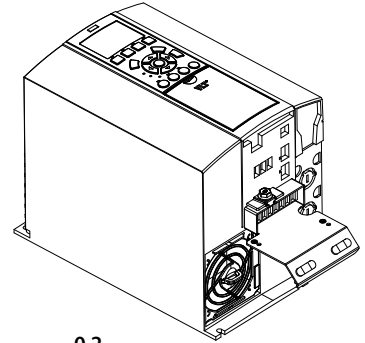
VLT® AQUA Drive

A3 Frame Size

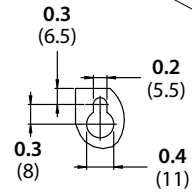
Protected Chassis/IP20 C option card; bottom cable entry

Dimensions: in (mm)

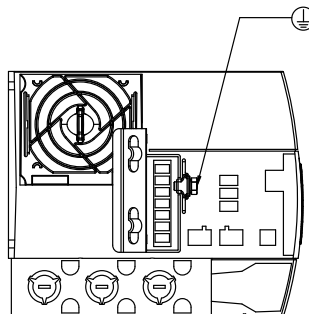
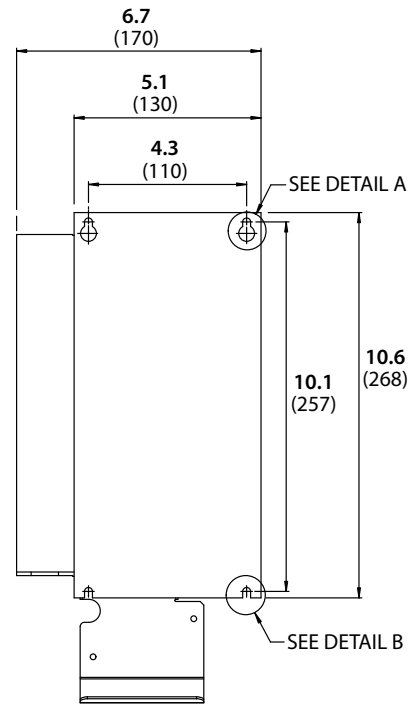
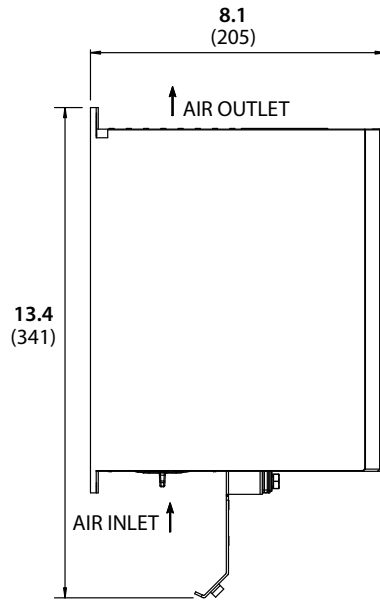
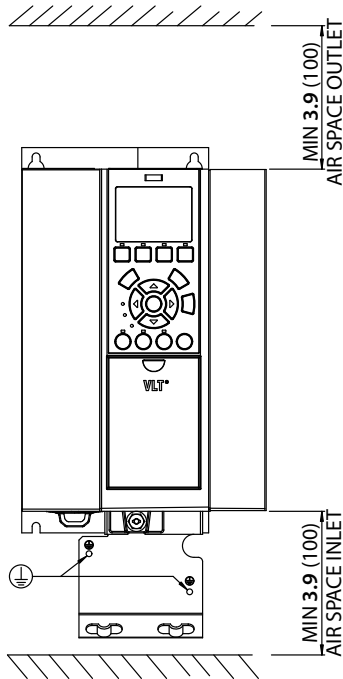
Weight: 14.3 – 14.6 lbs (6.5 – 6.6 kg)



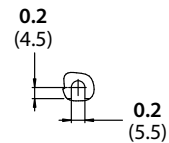
TOP VIEW



DETAIL A



BOTTOM VIEW



DETAIL B

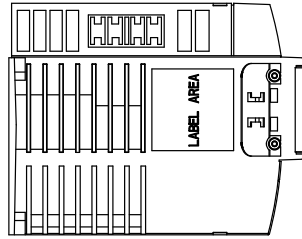
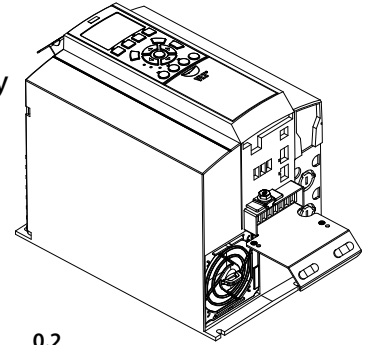
Mechanical Specifications

A3 Frame Size

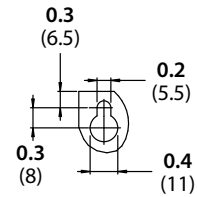
Protected Chassis/IP20 A and/or B option card; C option card; top cable entry

Dimensions: in (mm)

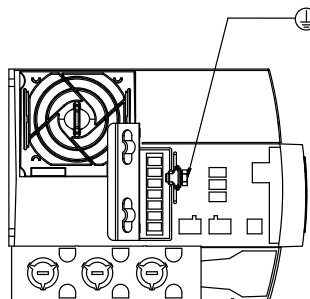
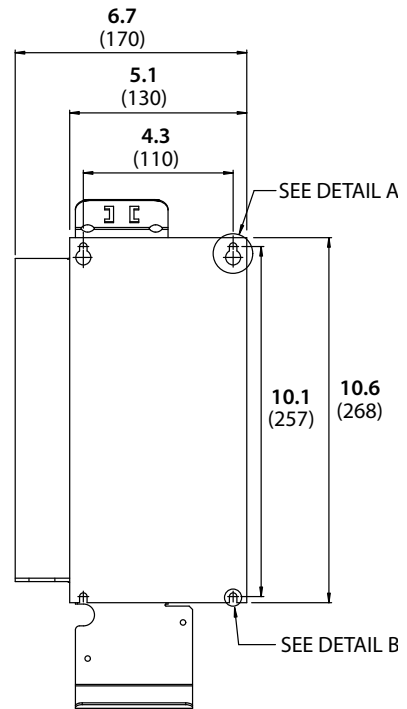
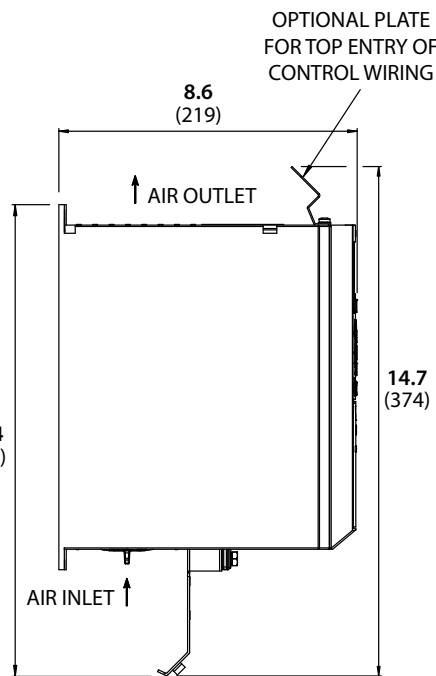
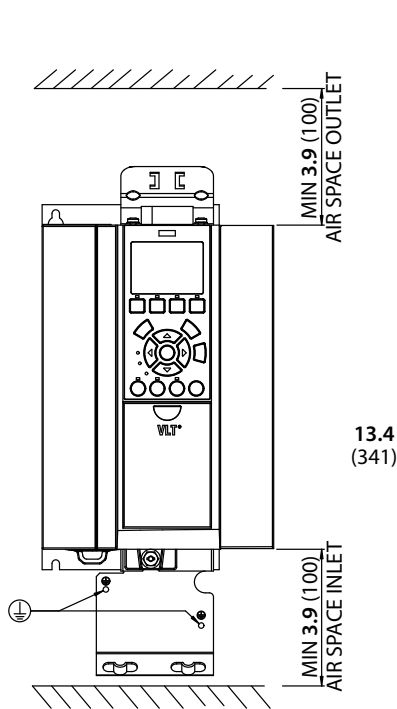
Weight: 14.3 – 14.6 lbs (6.5 – 6.6 kg)



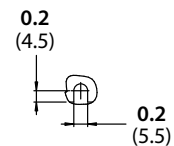
TOP VIEW



DETAIL A



BOTTOM VIEW



DETAIL B

VLT® AQUA Drive

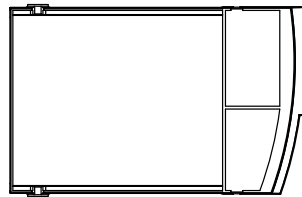
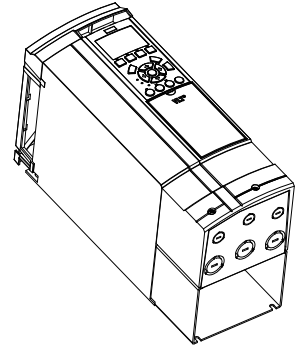
A3 Frame Size

NEMA 1/IP21 No option card; bottom cable entry

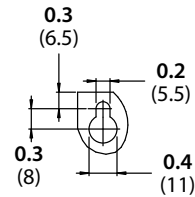
Dimensions: in (mm)

Weight: 14.3 – 14.6 lbs (6.5 – 6.6 kg)

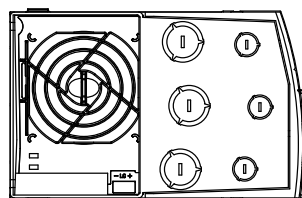
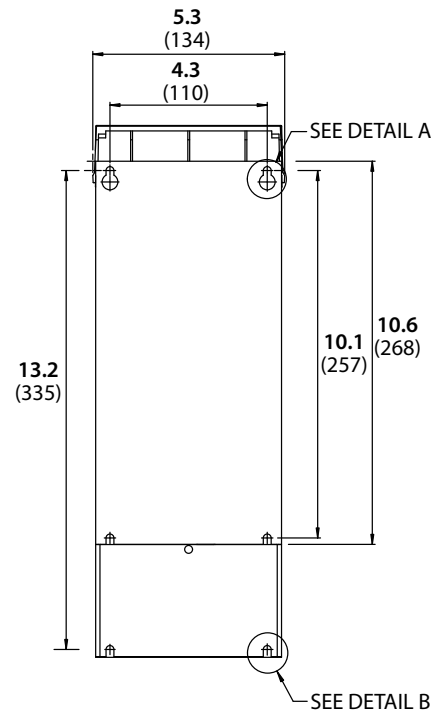
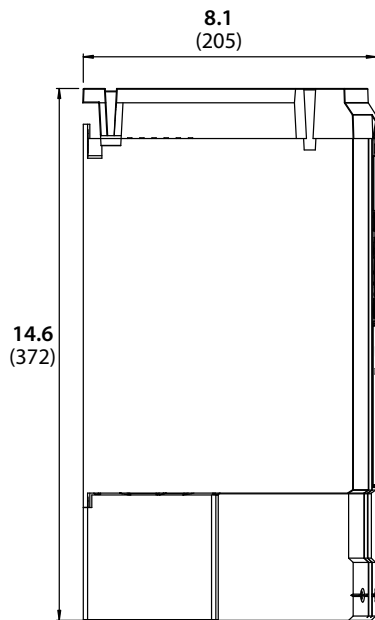
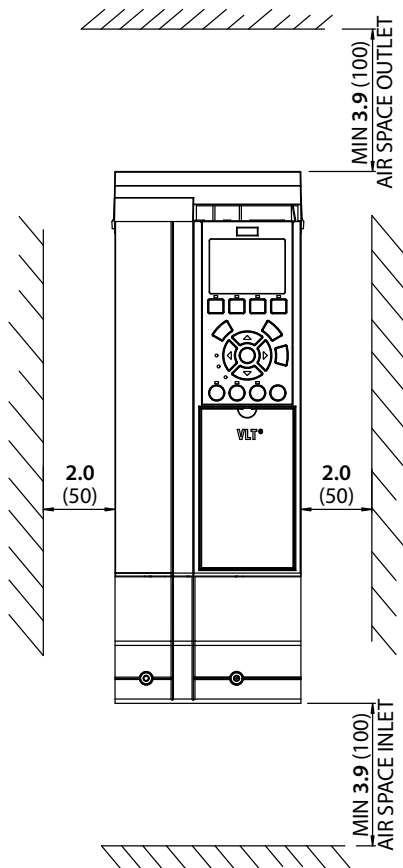
NEMA 1 Kit: 2 lbs (0.9 kg)



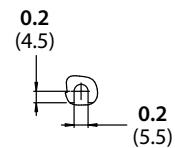
TOP VIEW



DETAIL A



BOTTOM VIEW



DETAIL B

Mechanical Specifications

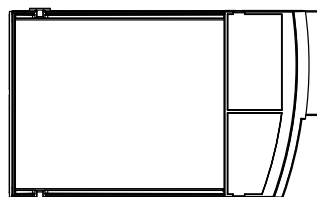
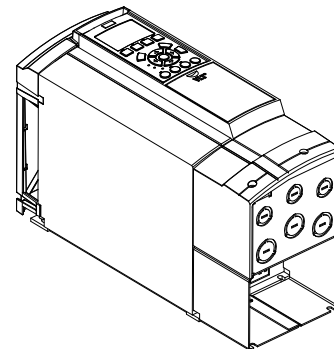
A3 Frame Size

NEMA 1/IP21 A and/or B option card; bottom cable entry

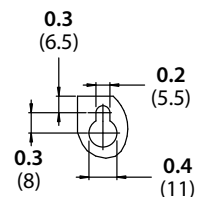
Dimensions: in (mm)

Weight: 14.3 – 14.6 lbs (6.5 – 6.6 kg)

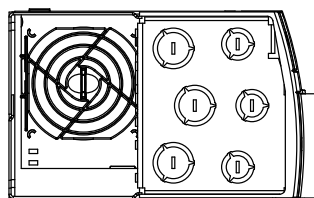
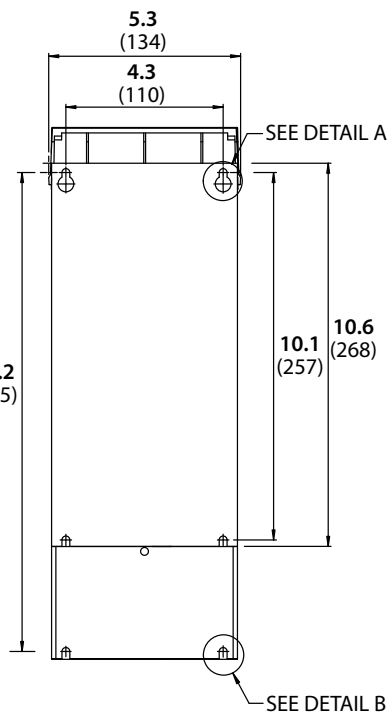
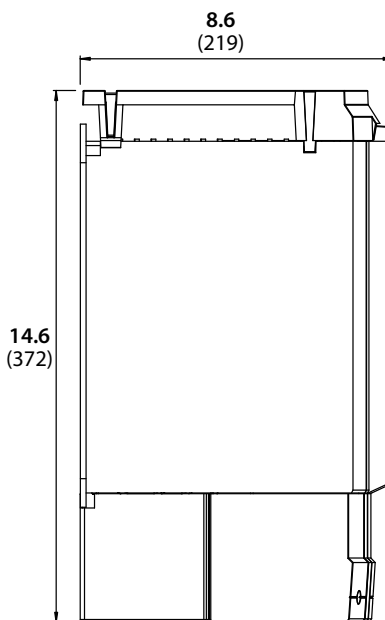
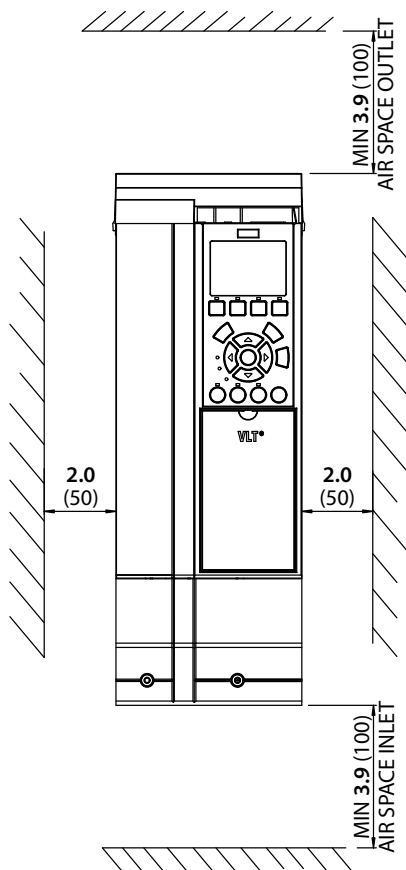
NEMA 1 Kit: 2 lbs (0.9 kg)



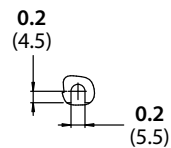
TOP VIEW



DETAIL A



BOTTOM VIEW



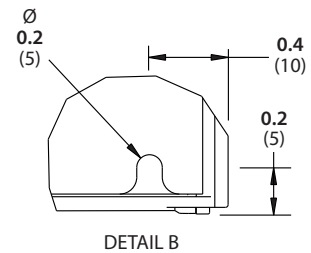
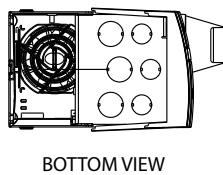
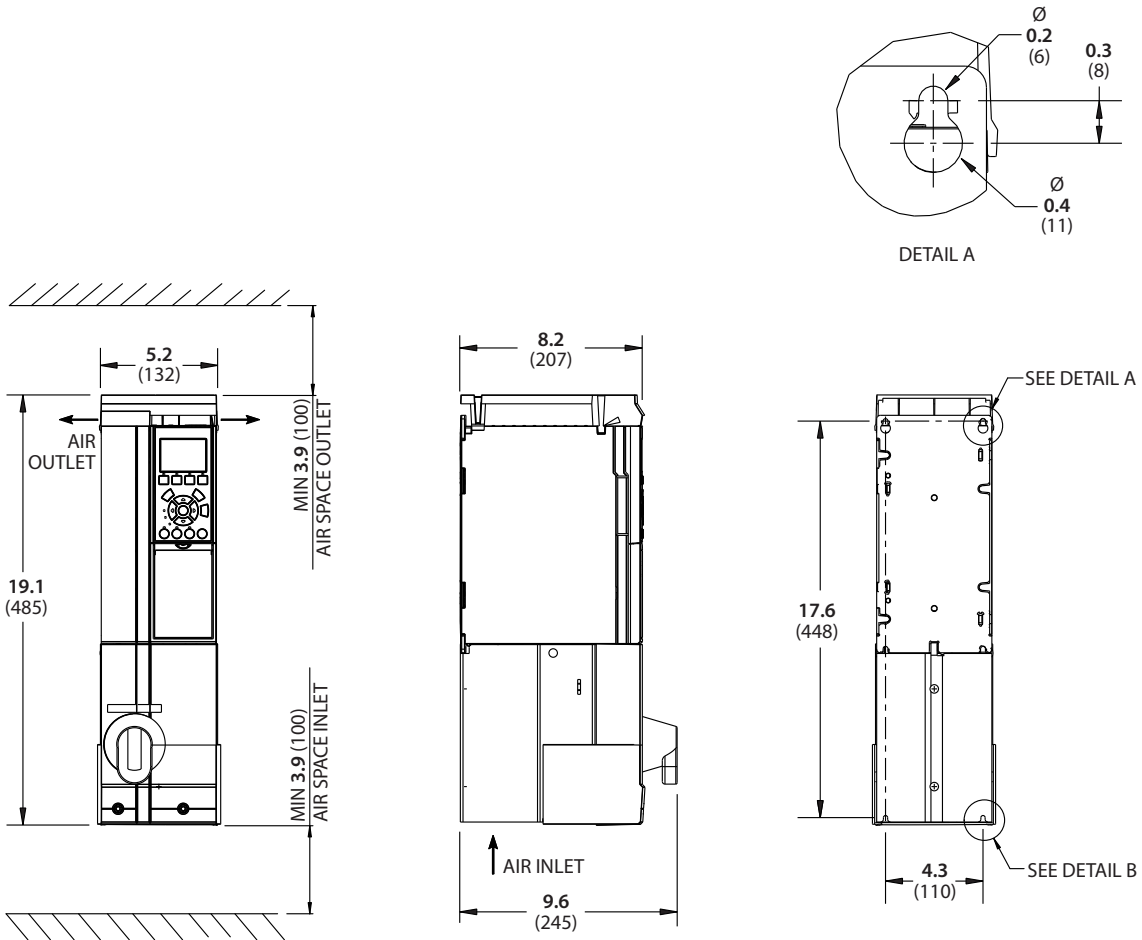
DETAIL B

VLT® AQUA Drive

A3 Frame Size

NEMA 1/IP21 Optional mains disconnect; no option card; bottom cable entry

Dimensions: in (mm) **Weight: 14.3 – 14.6 lbs (6.5 – 6.6 kg)**

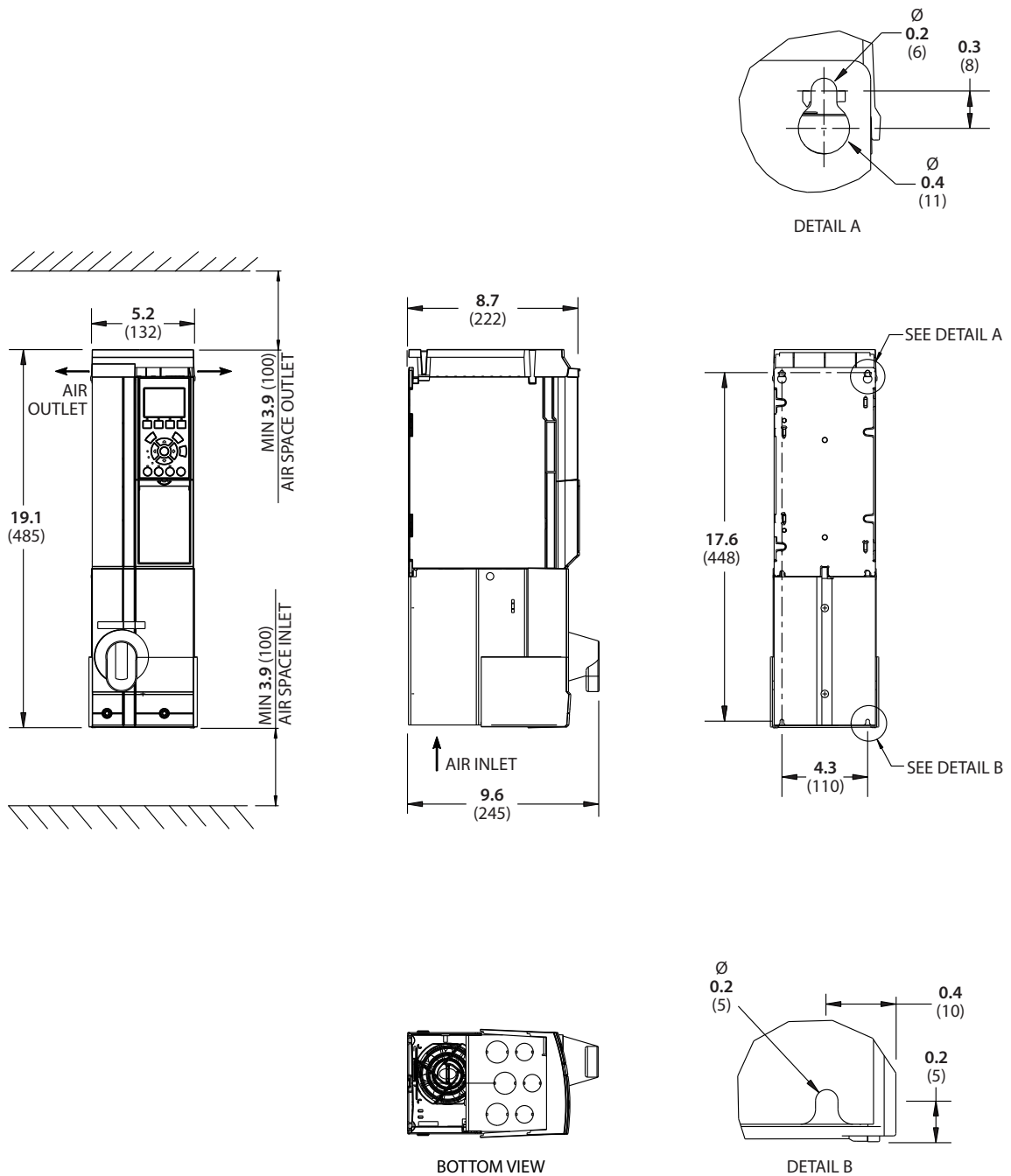


Mechanical Specifications

A3 Frame Size

NEMA 1/IP21 Optional mains disconnect; A and/or B option card; bottom cable entry

Dimensions: in (mm) Weight: 14.3 – 14.6 lbs (6.5 – 6.6 kg)

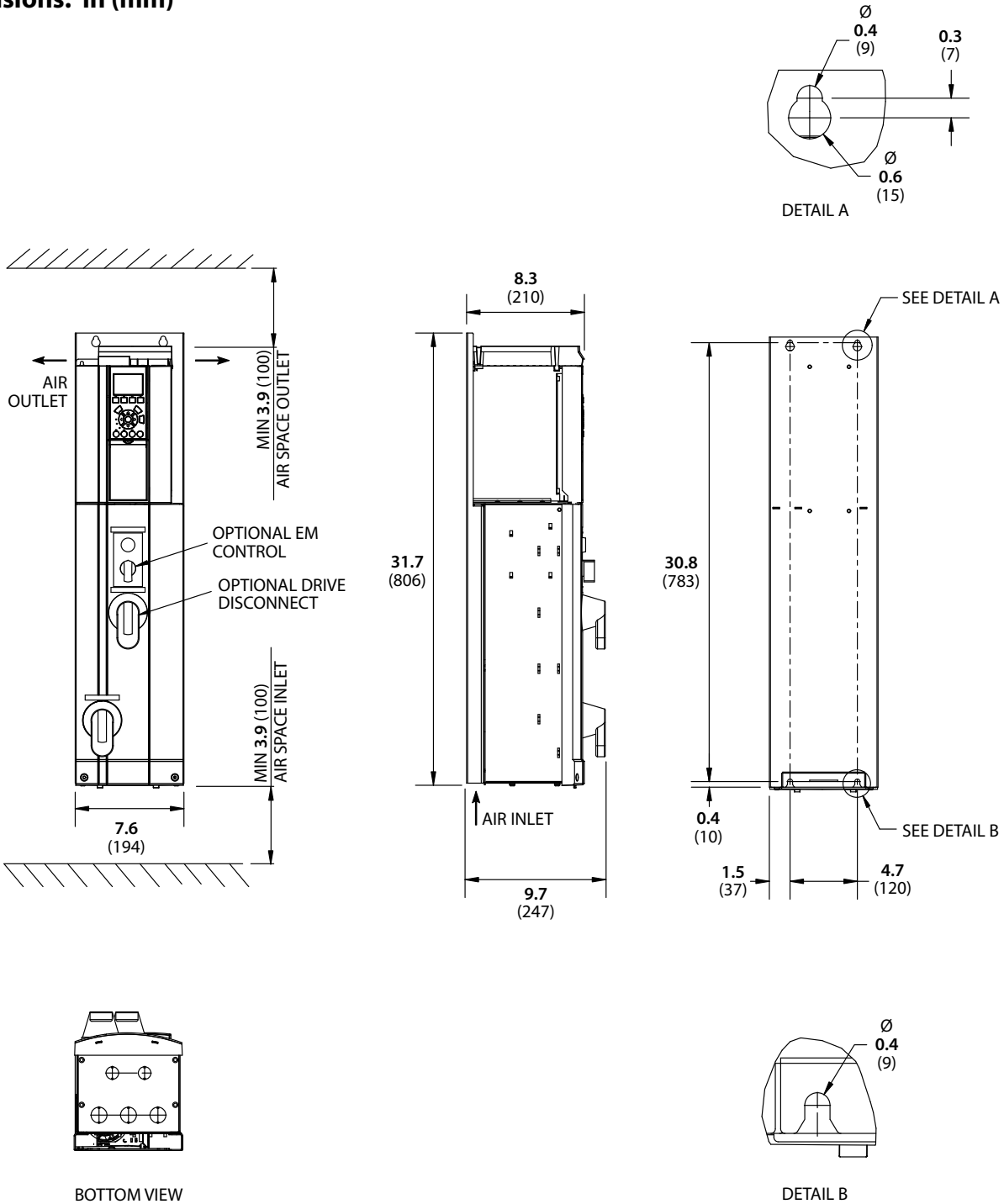


VLT® AQUA Drive

A3 Frame Size Tier 2*

NEMA 1/IP21 With optional mains disconnect; no option card; bottom cable entry

Dimensions: in (mm)



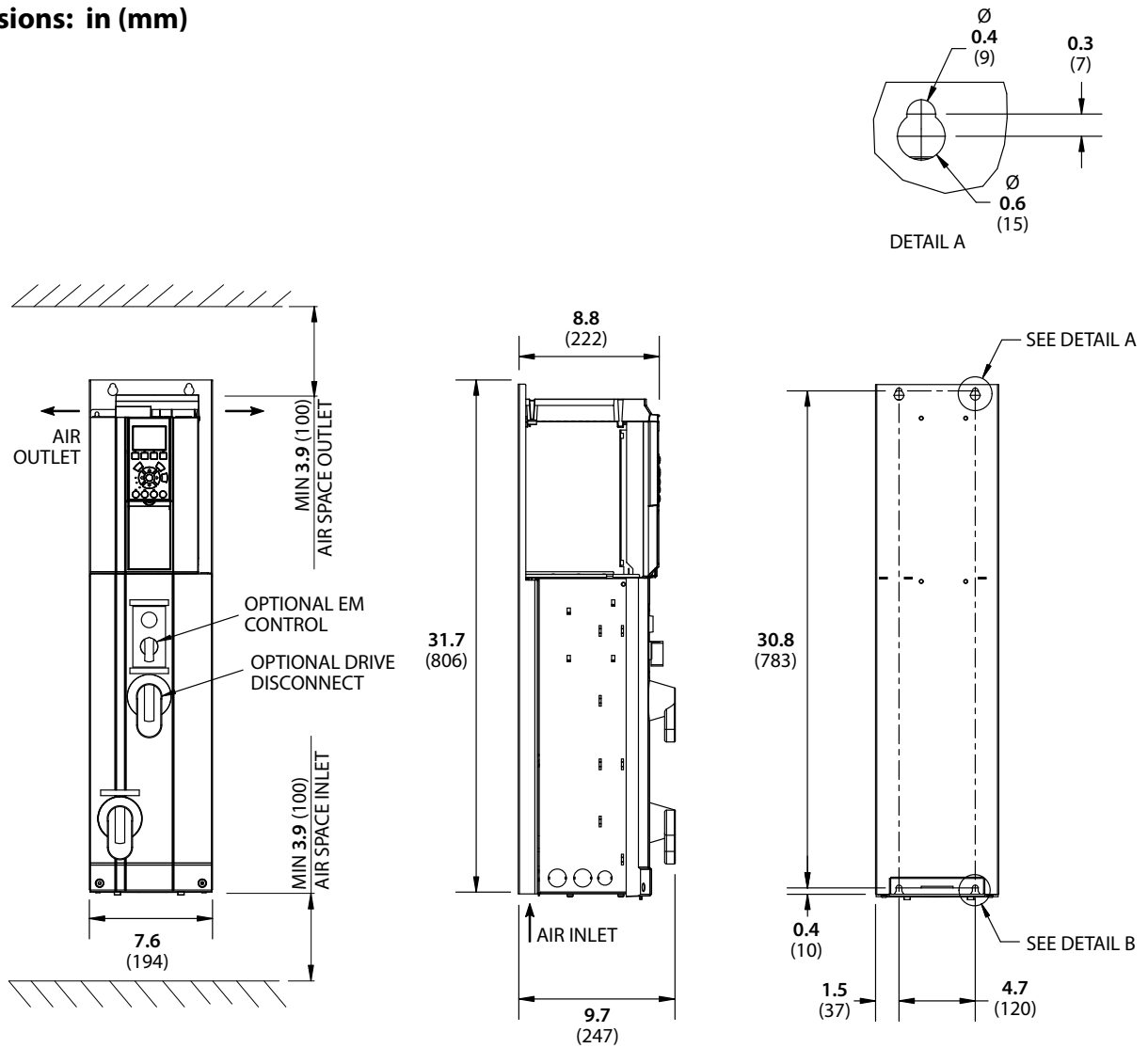
* Tier 2 Panel Solution products include drive with bypass or non-bypass drive with input AC line reactor, output LC filter and/or contactor motor selection See page 51 for more information.

Mechanical Specifications

A3 Frame Size Tier 2*

NEMA 1/IP21 With optional mains disconnect and A and/or B option card; bottom cable entry

Dimensions: in (mm)



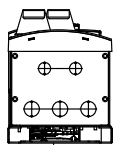
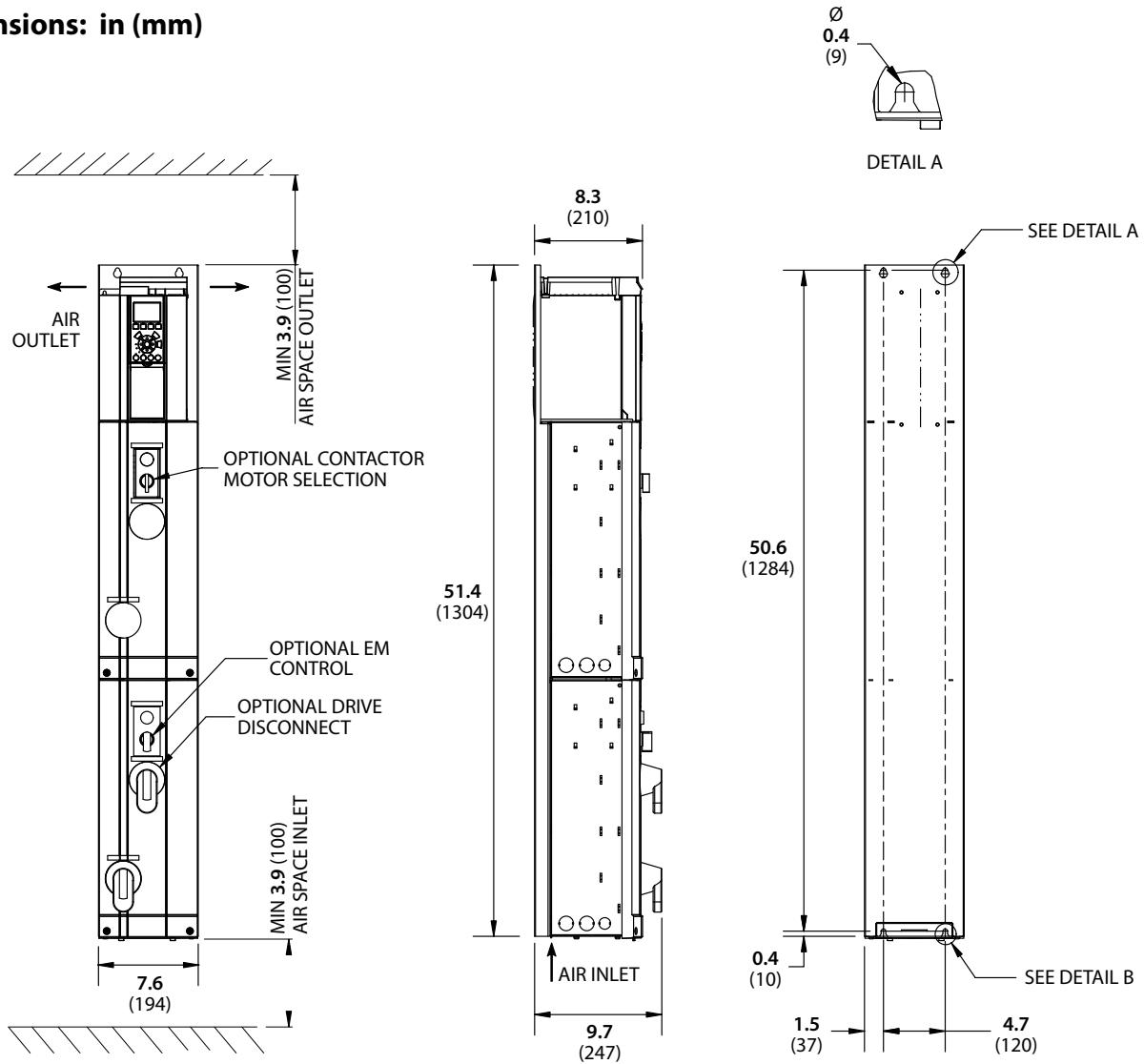
* Tier 2 Panel Solution products include drive with bypass or non-bypass drive with input AC line reactor, output LC filter and/or contactor motor selection See page 51 for more information.

VLT® AQUA Drive

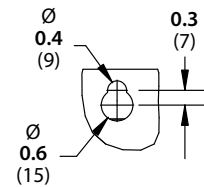
A3 Frame Size Tier 3*

NEMA 1/IP21 With optional mains disconnect; no option card; bottom cable entry

Dimensions: in (mm)



BOTTOM VIEW



DETAIL B

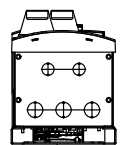
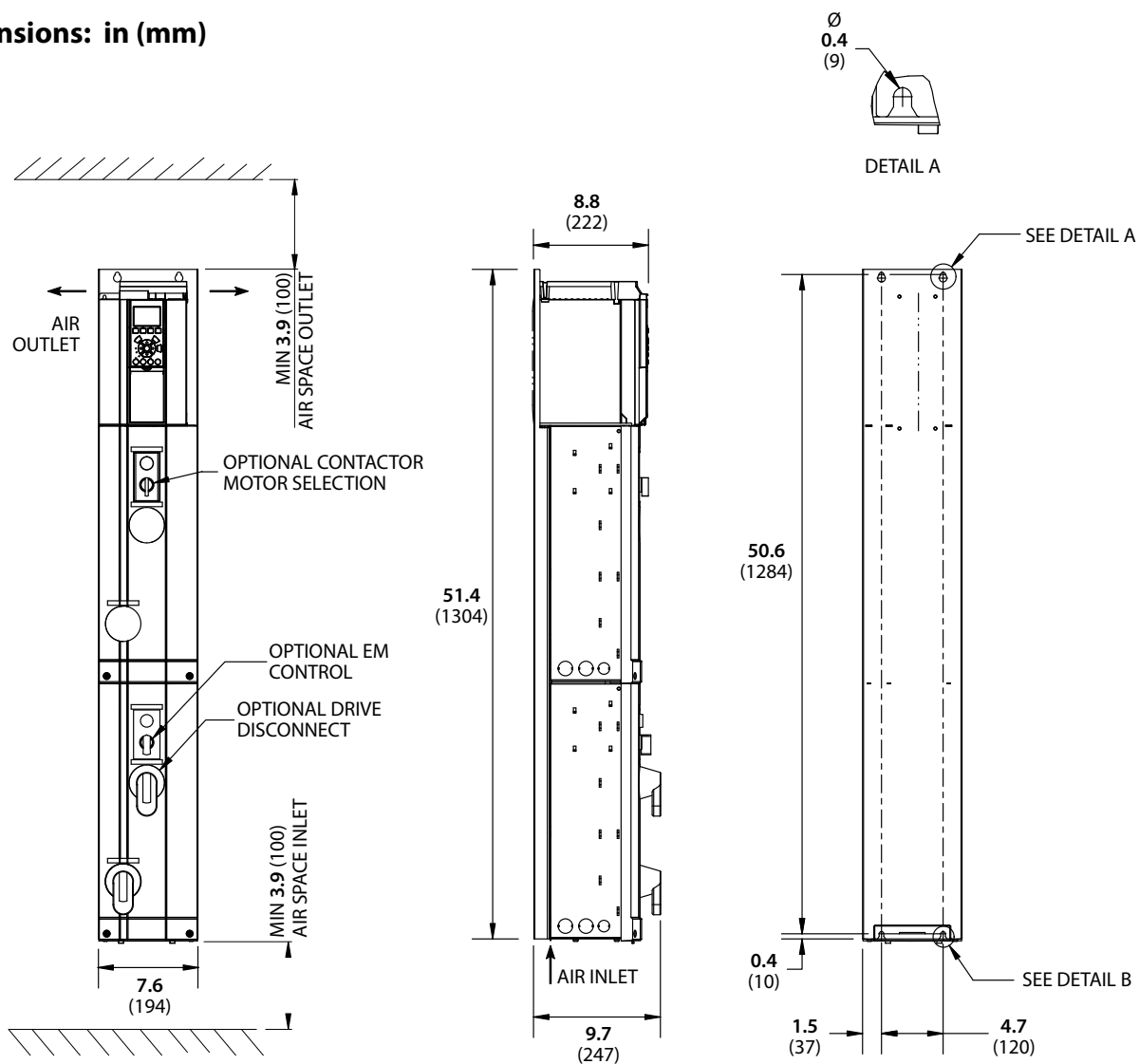
* Tier 3 Panel Solution products include drive with bypass and input AC line reactor, output LC filter and/or contactor motor selection. See page 51 for more information.

Mechanical Specifications

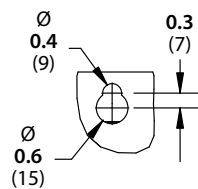
A3 Frame Size Tier 3*

NEMA 1/IP21 With optional mains disconnect and A and/or B option card; bottom cable entry

Dimensions: in (mm)



BOTTOM VIEW



DETAIL B

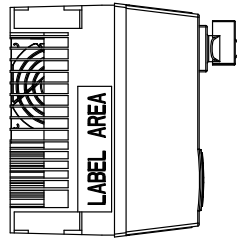
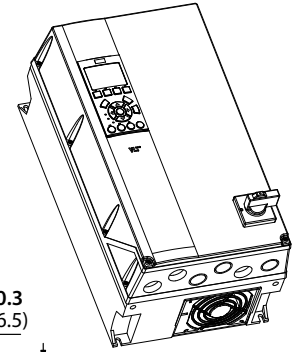
* Tier 3 Panel Solution products include drive with bypass and input AC line reactor, output LC filter and/or contactor motor selection. See page 51 for more information.

VLT® AQUA Drive

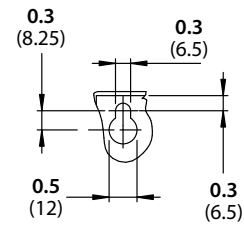
A5 Frame Size

NEMA 12/IP55 & IP66 (Optional mains disconnect lock-out switch shown)

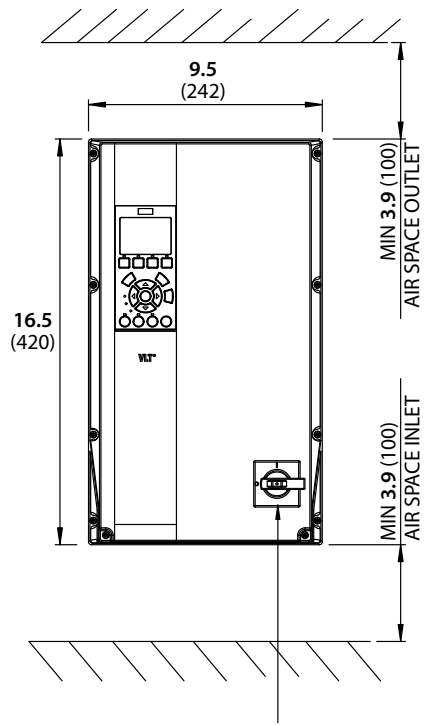
Dimensions: in (mm) Weight: 29.8 – 31.3 lbs (13.5 – 14.2 kg)



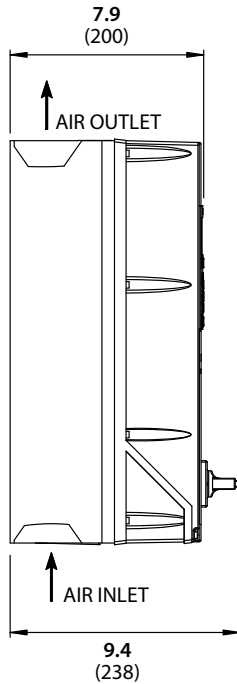
TOP VIEW



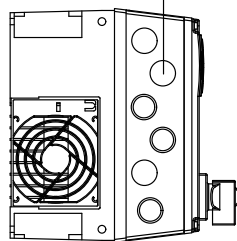
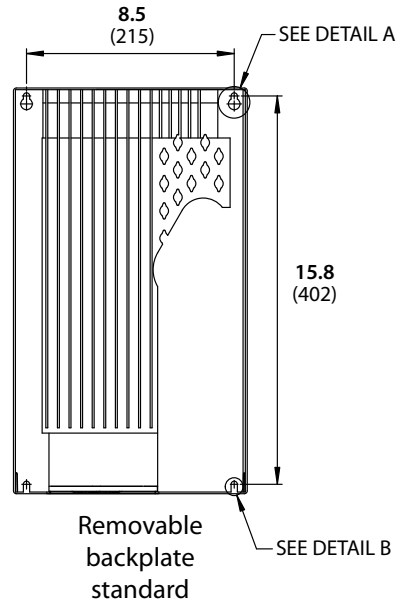
DETAIL A



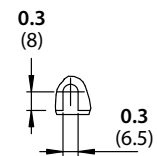
OPTIONAL MAINS DISCONNECT SWITCH



CABLE ENTRY KNOCKOUTS



BOTTOM VIEW



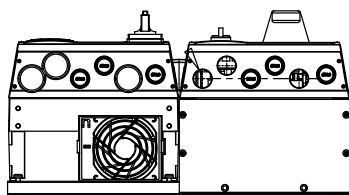
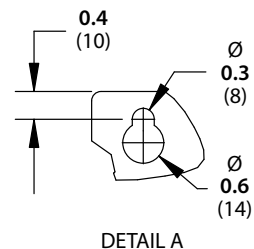
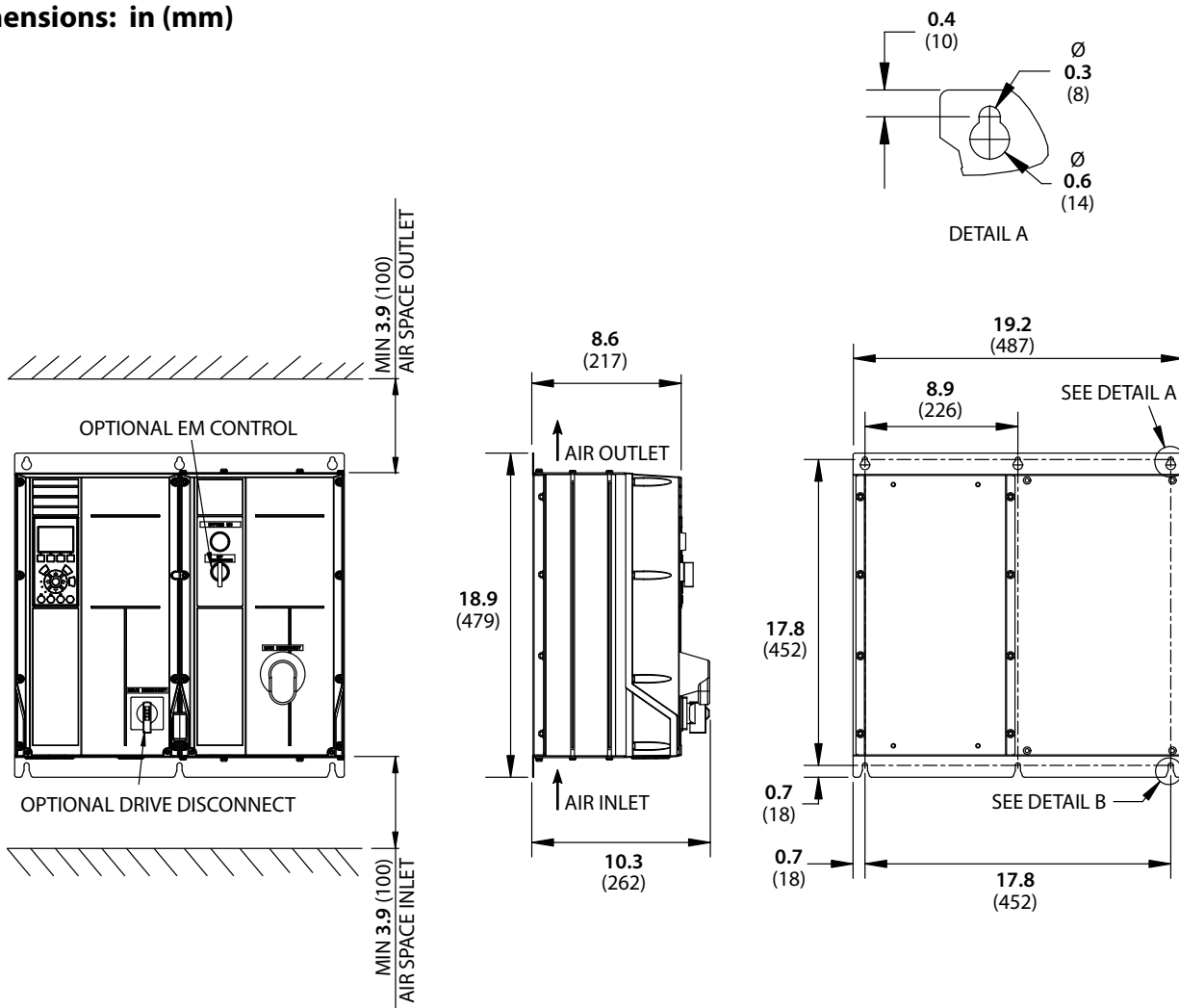
DETAIL B

Mechanical Specifications

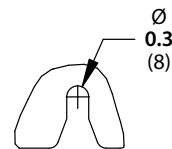
A5 Frame Size Tier 2*

NEMA 12/IP55 & IP66 With optional mains disconnect and A and/or B option card; bottom cable entry

Dimensions: in (mm)



BOTTOM VIEW



DETAIL B

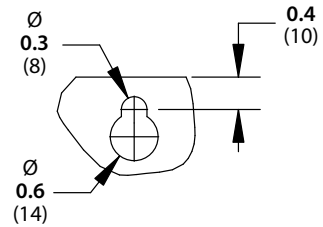
* Tier 2 Panel Solution products include drive with bypass or non-bypass drive with input AC line reactor, output LC filter and/or contactor motor selection See page 51 for more information.

VLT® AQUA Drive

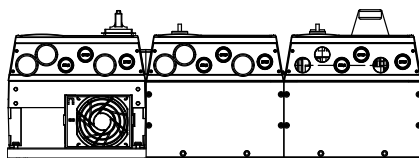
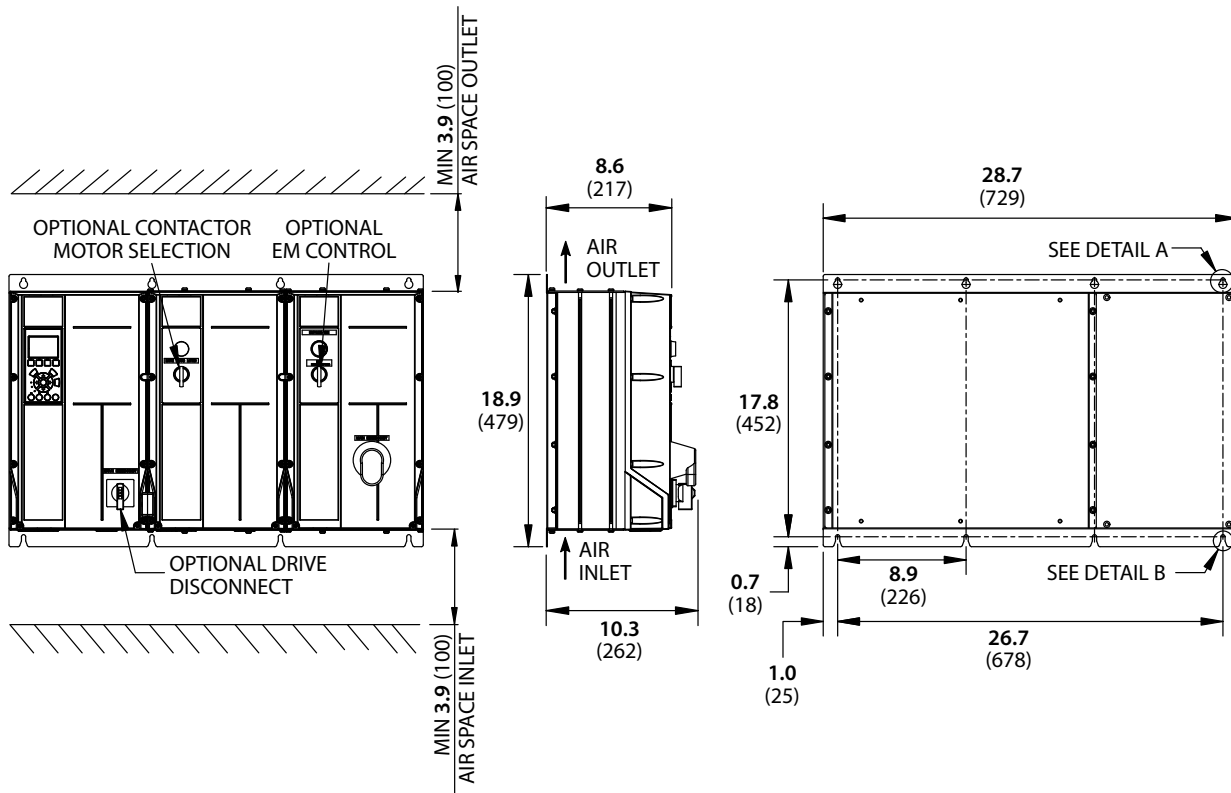
A5 Frame Size Tier 3*

NEMA 12/IP55 & IP66 With optional mains disconnect; no option card; bottom cable entry

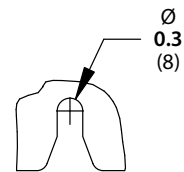
Dimensions: in (mm)



DETAIL A



BOTTOM VIEW



DETAIL B

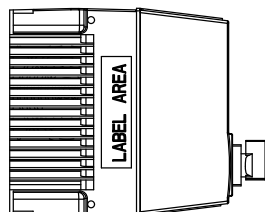
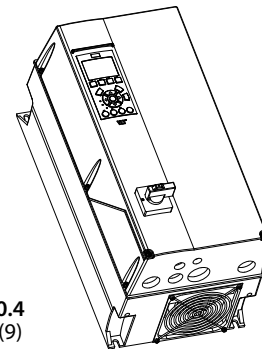
* Tier 3 Panel Solution products include drive with bypass and input AC line reactor, output LC filter and/or contactor motor selection. See page 51 for more information.

Mechanical Specifications

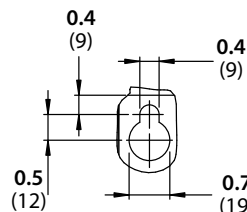
B1 Frame Size

NEMA 12/IP55 & IP66 (Optional mains disconnect lock-out switch shown)

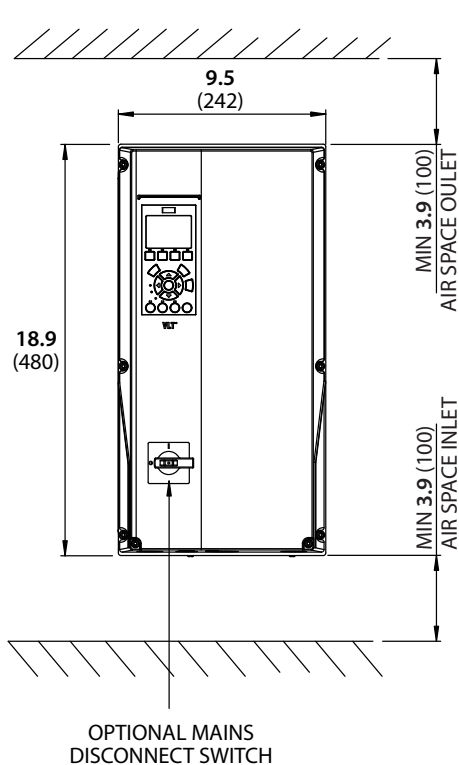
Dimensions: in (mm) **Weight: 51 lbs (23 kg)**



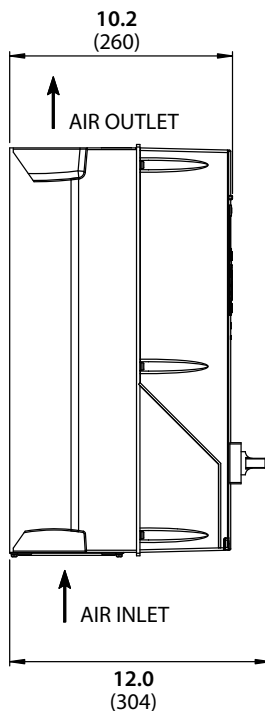
TOP VIEW



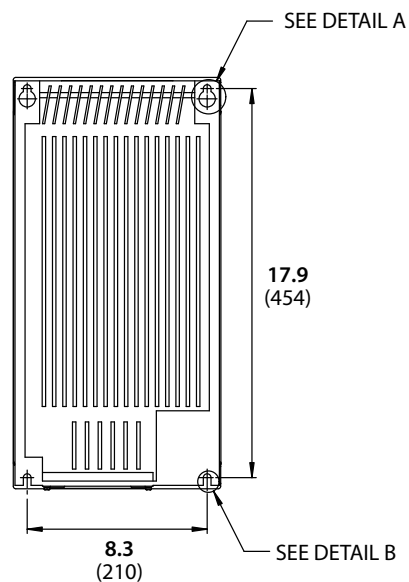
DETAIL A



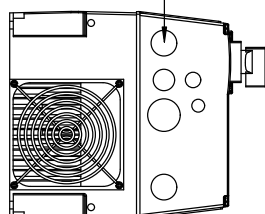
OPTIONAL MAINS DISCONNECT SWITCH



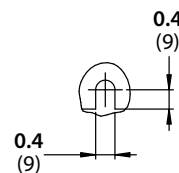
12.0 (304)



CABLE ENTRY KNOCKOUTS



BOTTOM VIEW



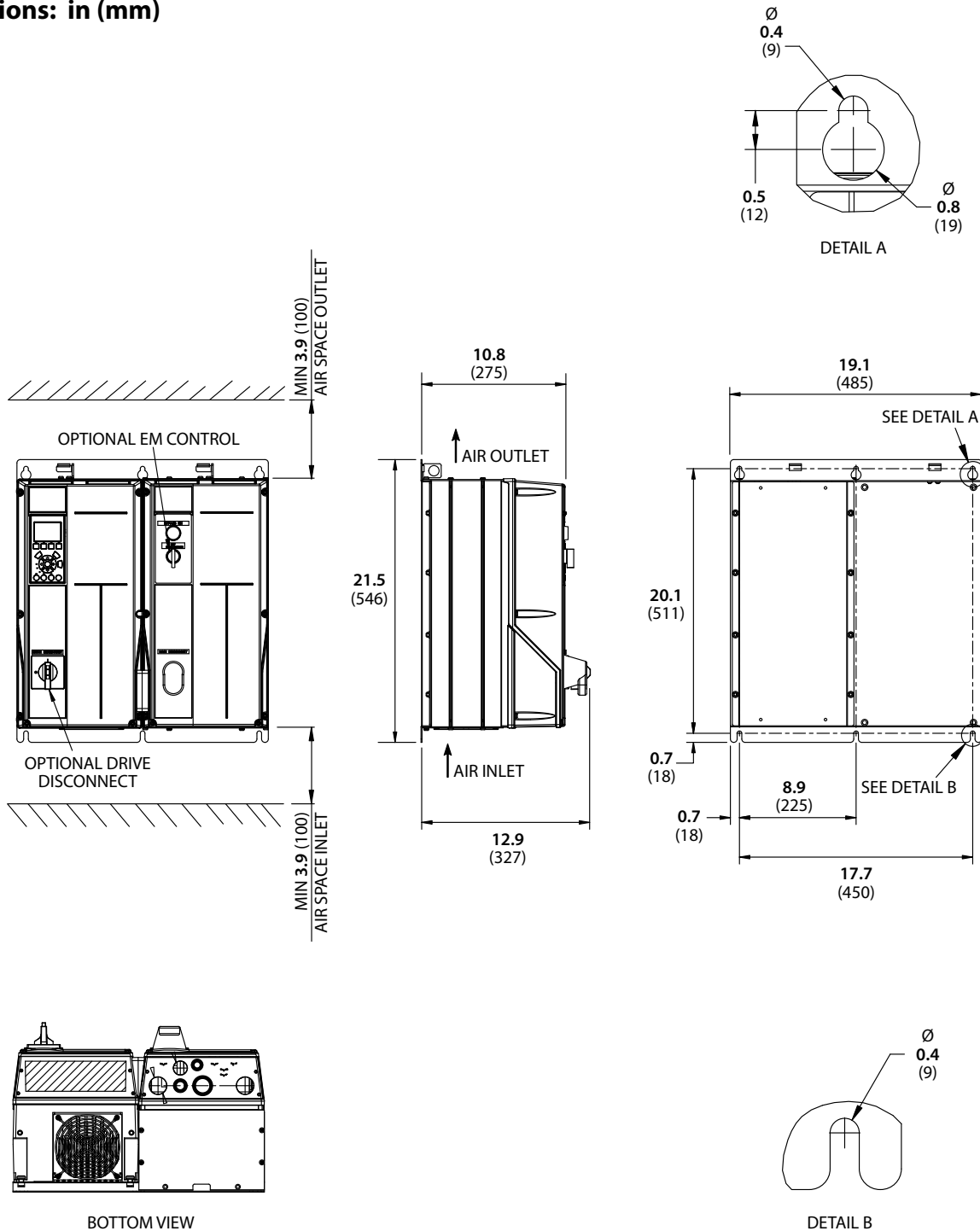
DETAIL B

VLT® AQUA Drive

B1 Frame Size Tier 2*

NEMA 12/IP55 & IP66 With optional mains disconnect; no option card; bottom cable entry

Dimensions: in (mm)



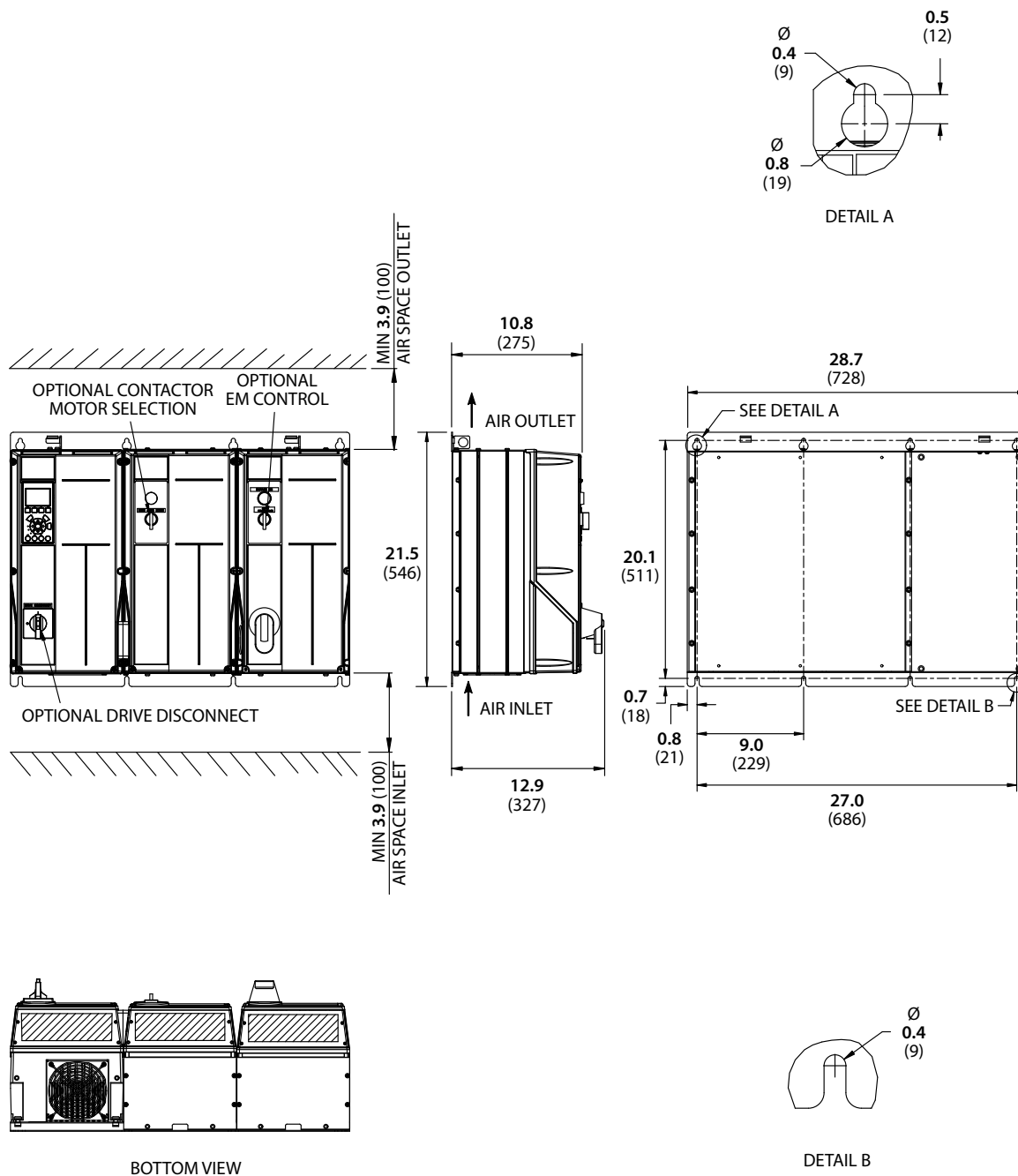
* Tier 2 Panel Solution products include drive with bypass or non-bypass drive with input AC line reactor, output LC filter and/or contactor motor selection See page 51 for more information.

Mechanical Specifications

B1 Frame Size Tier 3*

NEMA 12/IP55 & IP66 With optional mains disconnect; no option card; bottom cable entry

Dimensions: in (mm)



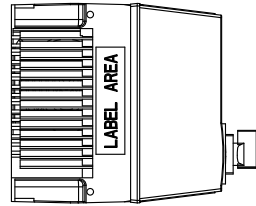
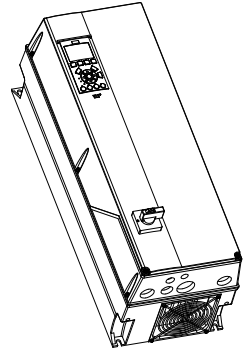
* Tier 3 Panel Solution products include drive with bypass and input AC line reactor, output LC filter and/or contactor motor selection. See page 51 for more information.

VLT® AQUA Drive

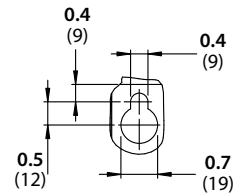
B2 Frame Size

NEMA 12/IP55 & IP66 (Optional mains disconnect lock-out switch shown)

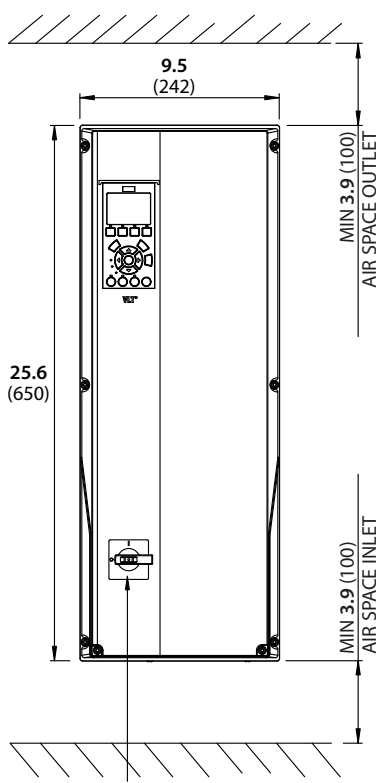
Dimensions: in (mm) **Weight: 60 lbs (27 kg)**



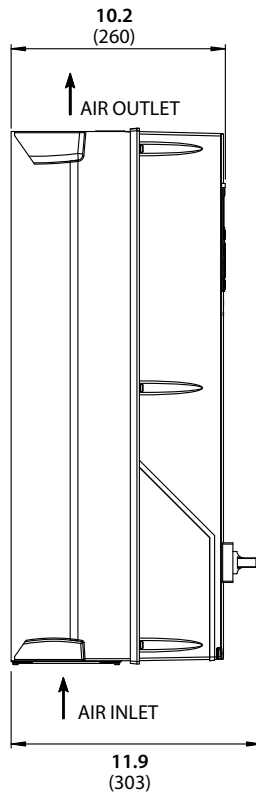
TOP VIEW



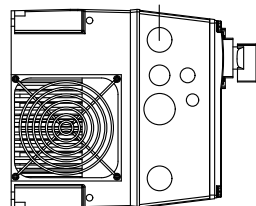
DETAIL A



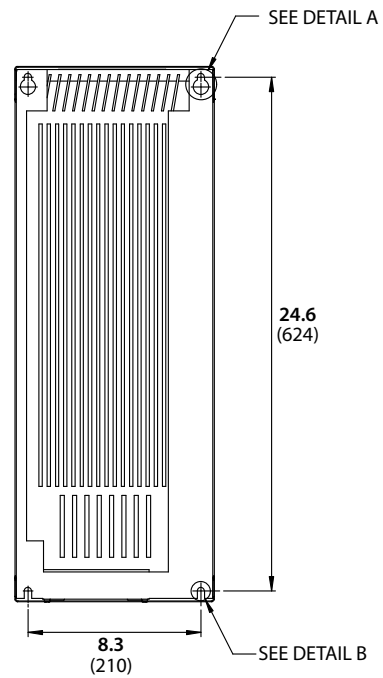
OPTIONAL MAINS DISCONNECT SWITCH



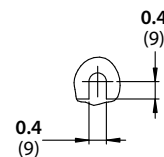
CABLE ENTRY KNOCKOUTS



BOTTOM VIEW



DETAIL B

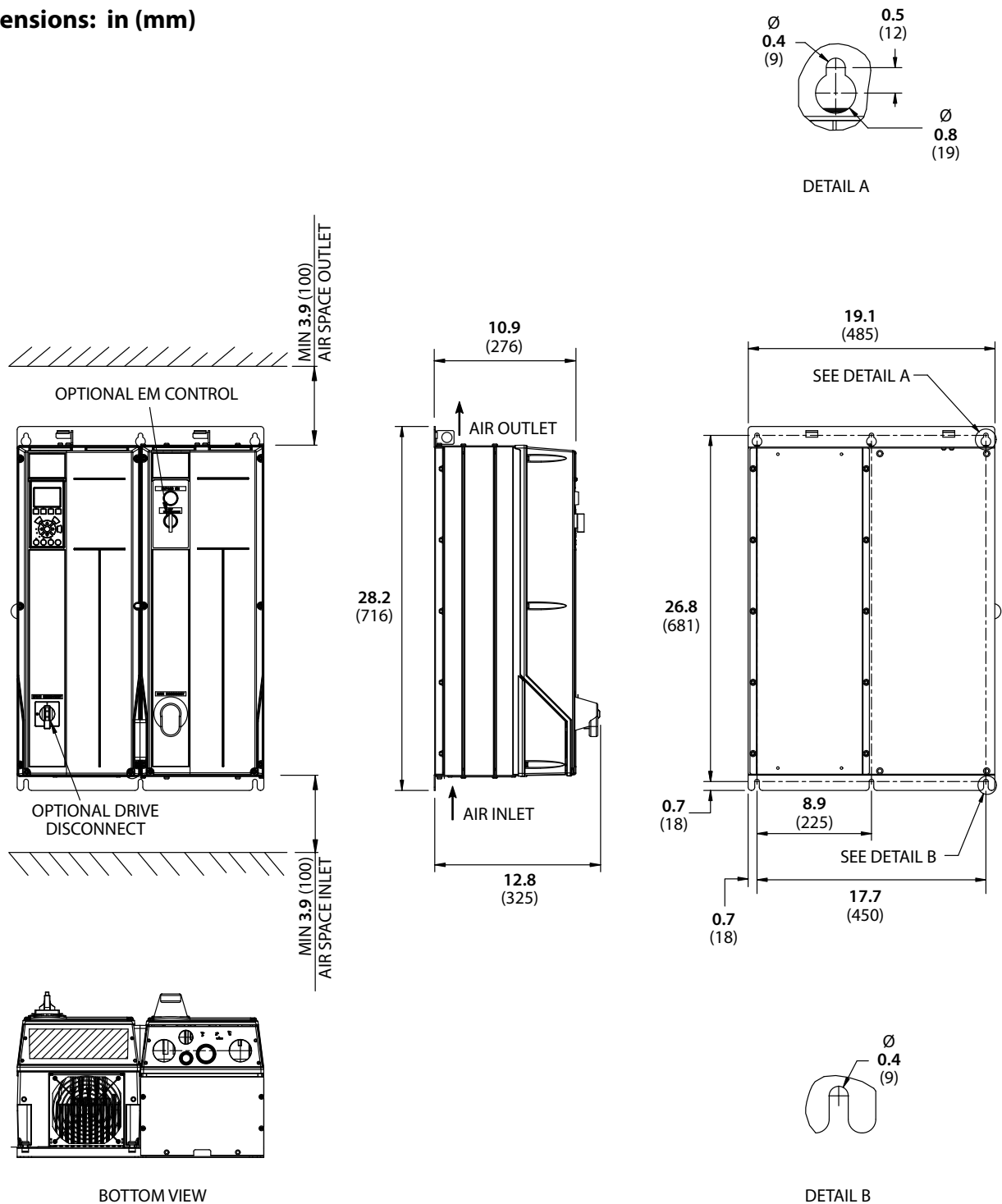


Mechanical Specifications

B2 Frame Size Tier 2*

NEMA 12/IP55 & IP66 With optional mains disconnect; no option card; bottom cable entry

Dimensions: in (mm)



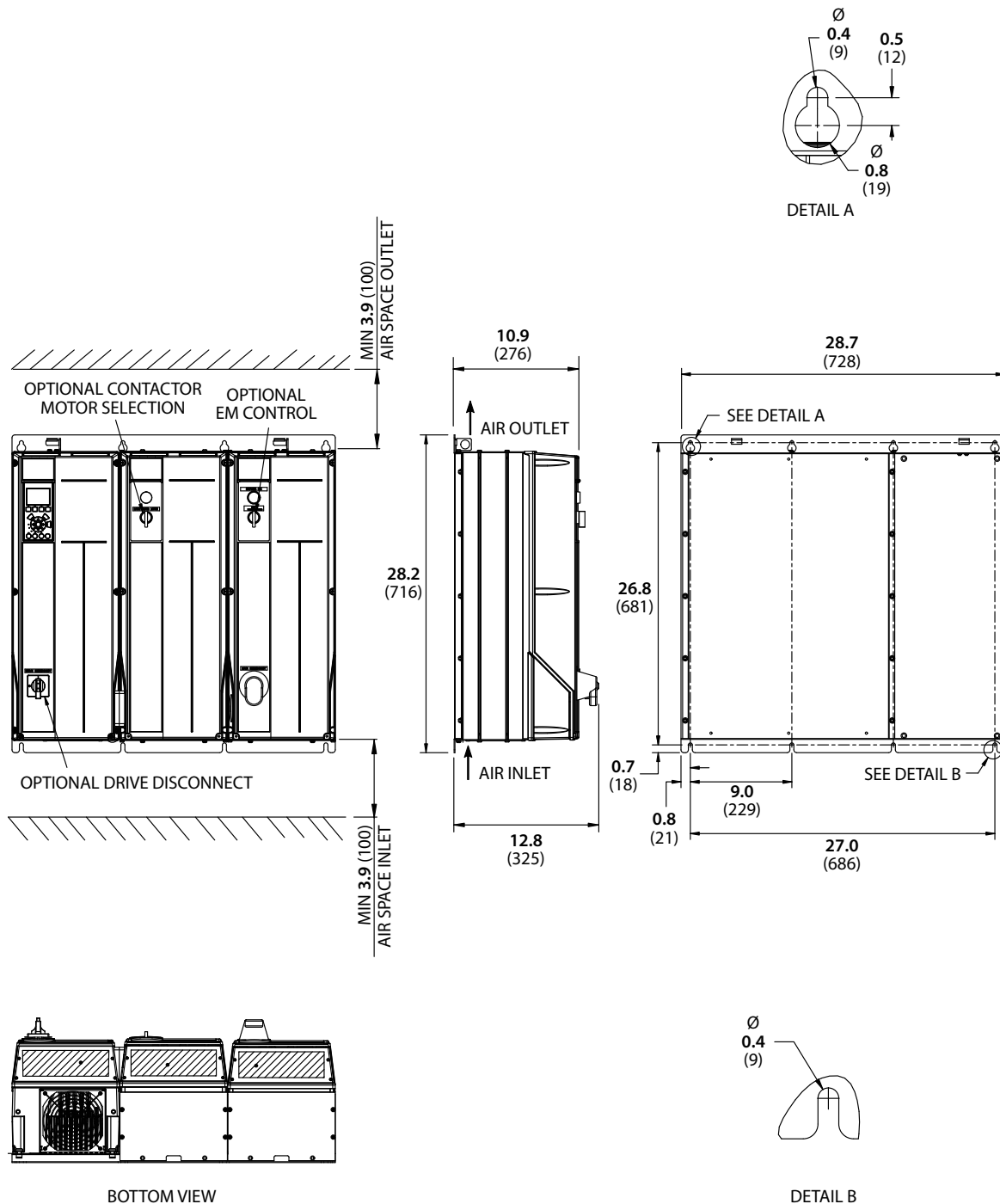
* Tier 2 Panel Solution products include drive with bypass or non-bypass drive with input AC line reactor, output LC filter and/or contactor motor selection See page 51 for more information.

VLT® AQUA Drive

B2 Frame Size Tier 3*

NEMA 12/IP55 & IP66 With optional mains disconnect; no option card; bottom cable entry

Dimensions: in (mm)



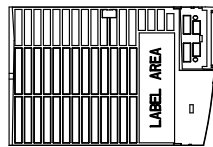
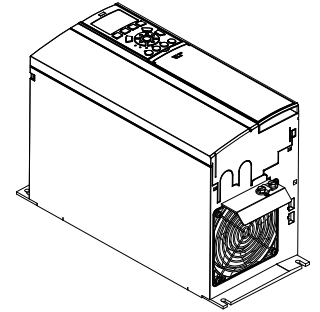
* Tier 3 Panel Solution products include drive with bypass and input AC line reactor, output LC filter and/or contactor motor selection. See page 51 for more information.

Mechanical Specifications

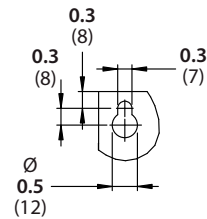
B3 Frame Size

Protected Chassis/IP20 No option card; bottom cable entry

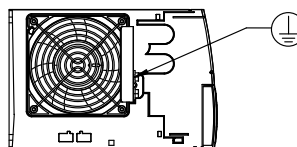
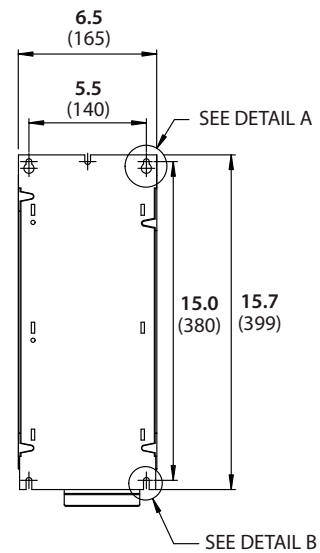
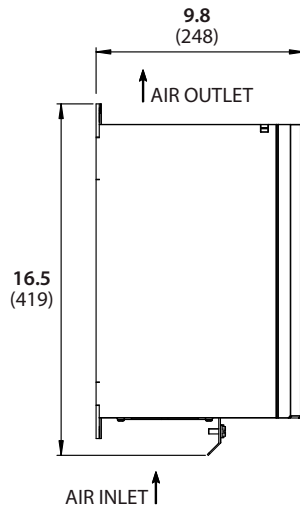
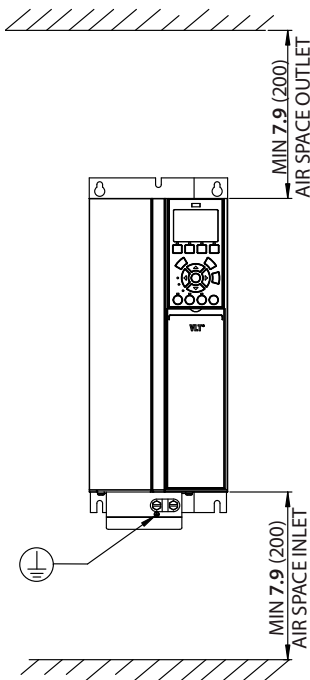
Dimensions: in (mm) **Weight: 26 – 30 lbs (12 – 14 kg)**



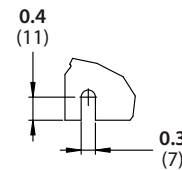
TOP VIEW



DETAIL A



BOTTOM VIEW



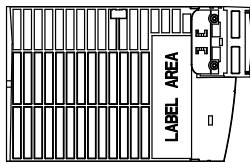
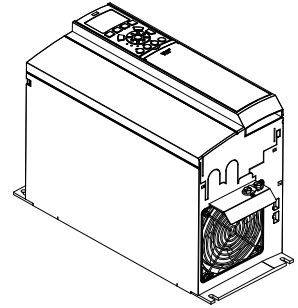
DETAIL B

VLT® AQUA Drive

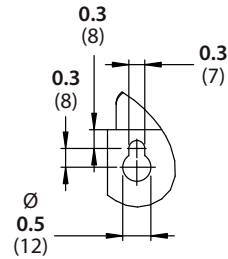
B3 Frame Size

Protected Chassis/IP20 A and/or B option card; top cable entry

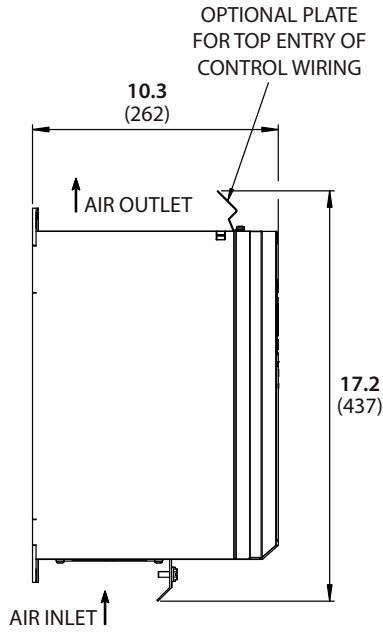
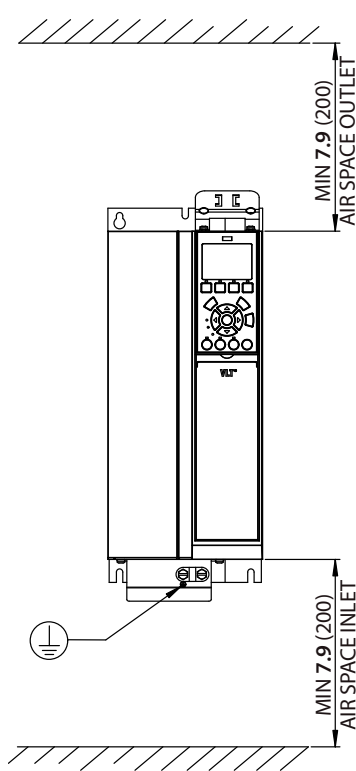
Dimensions: in (mm) **Weight: 26 – 30 lbs (12 – 14 kg)**



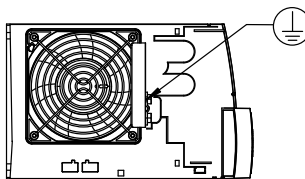
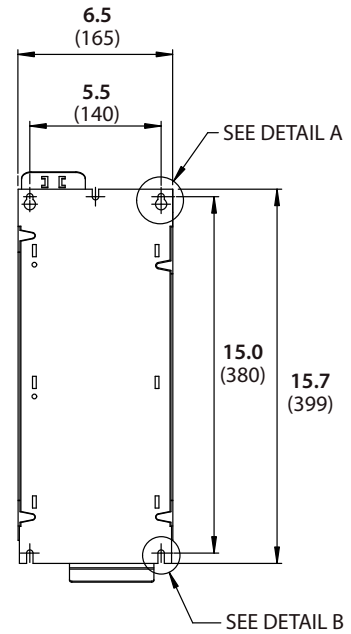
TOP VIEW



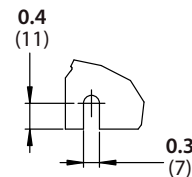
DETAIL A



AIR INLET ↑



BOTTOM VIEW



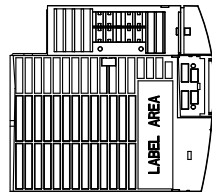
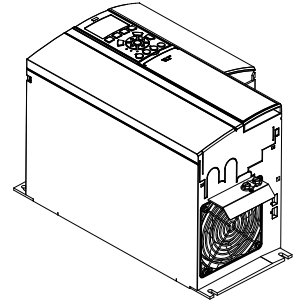
DETAIL B

Mechanical Specifications

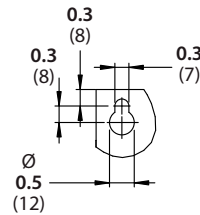
B3 Frame Size

Protected Chassis/IP20 C option card; bottom cable entry

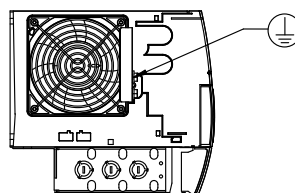
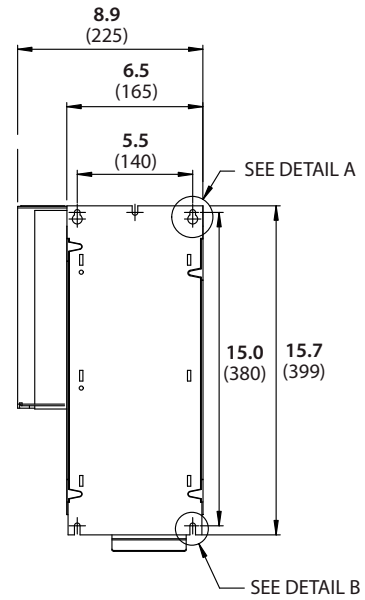
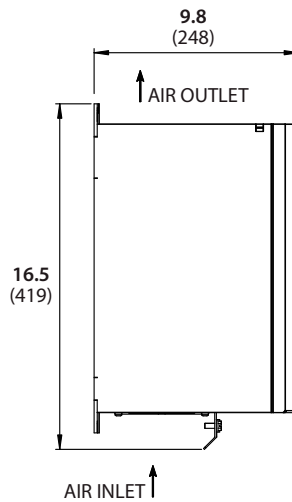
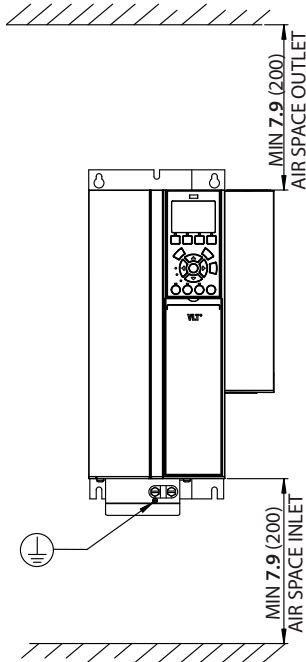
Dimensions: in (mm) **Weight: 26 – 30 lbs (12 – 14 kg)**



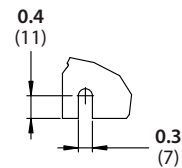
TOP VIEW



DETAIL A



BOTTOM VIEW



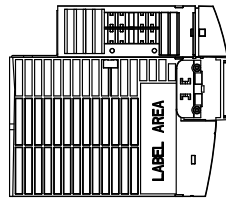
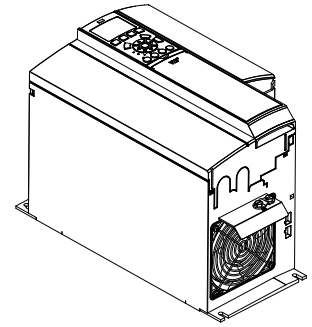
DETAIL B

VLT® AQUA Drive

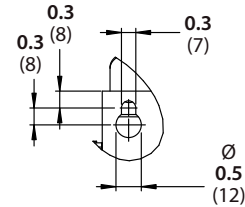
B3 Frame Size

Protected Chassis/IP20 A and/or B option card; C option card, top cable entry

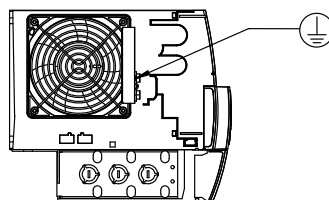
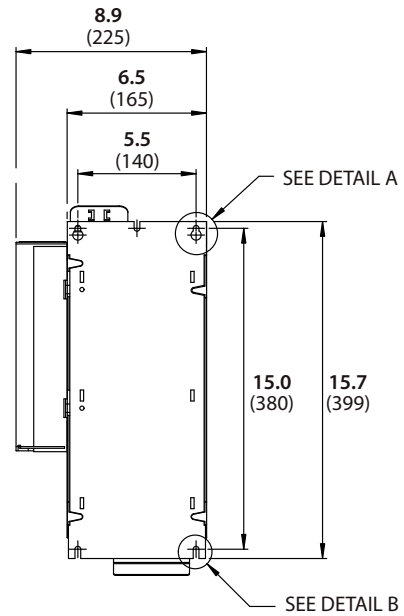
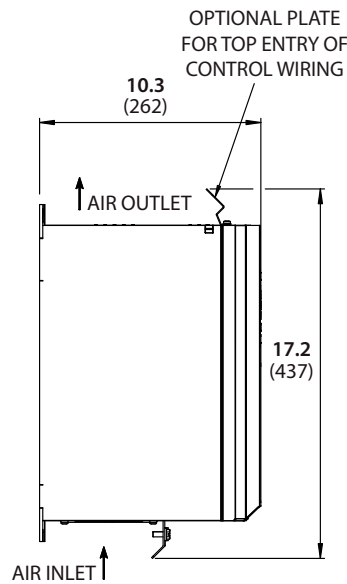
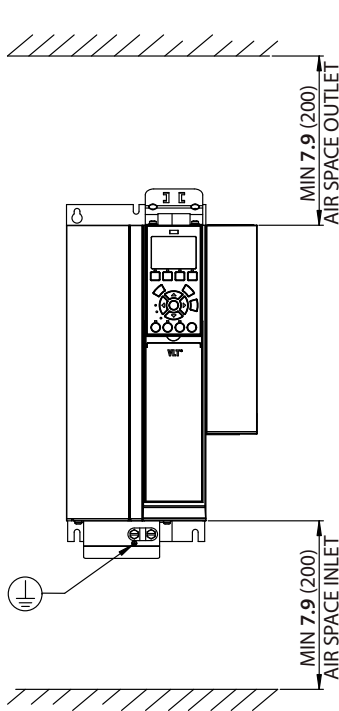
Dimensions: in (mm) **Weight: 26 – 30 lbs (12 – 14 kg)**



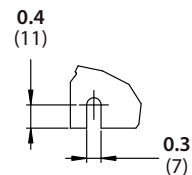
TOP VIEW



DETAIL A



BOTTOM VIEW



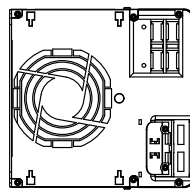
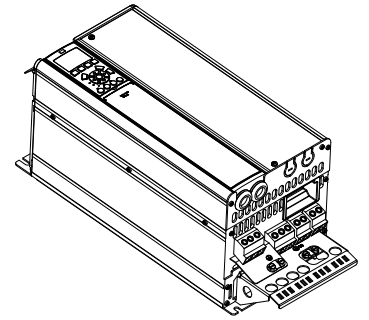
DETAIL B

Mechanical Specifications

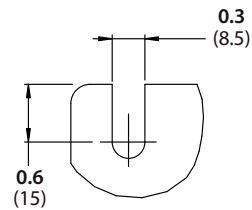
B4 Frame Size

Protected Chassis/IP20

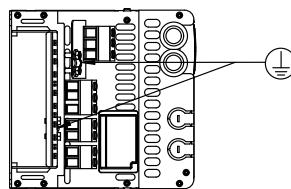
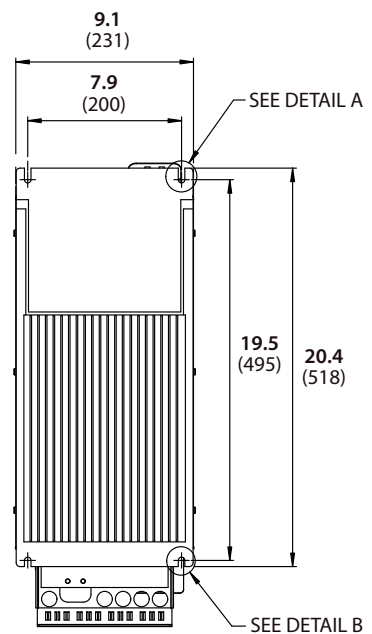
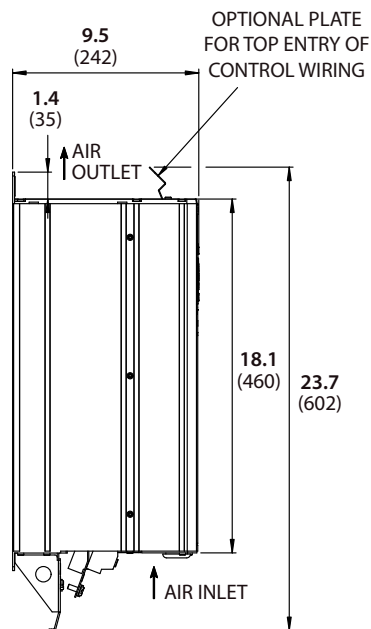
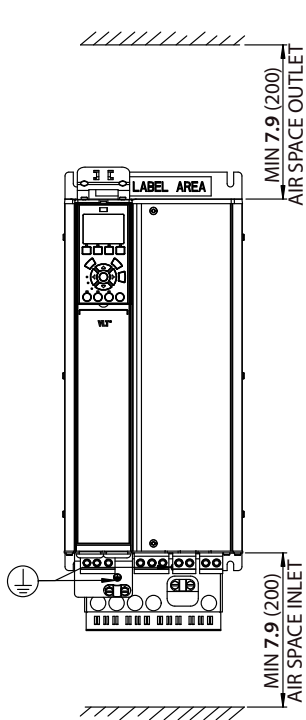
Dimensions: in (mm) **Weight: 53 lbs (24 kg)**



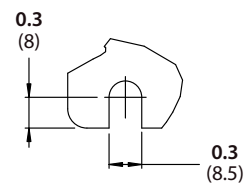
TOP VIEW



DETAIL A



BOTTOM VIEW



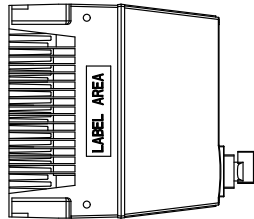
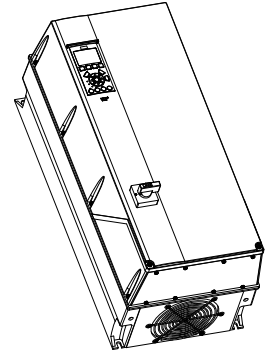
DETAIL B

VLT® AQUA Drive

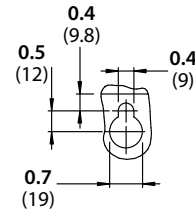
C1 Frame Size

NEMA 12/IP55 & IP66 (Optional mains disconnect lock-out switch shown)

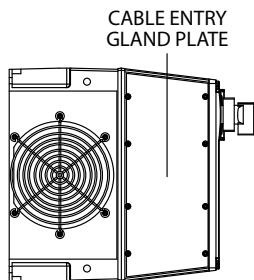
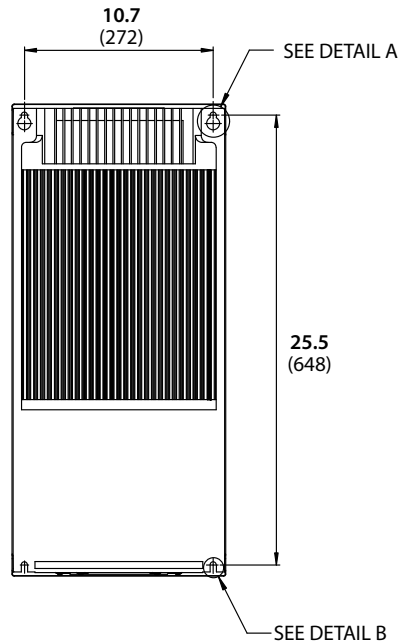
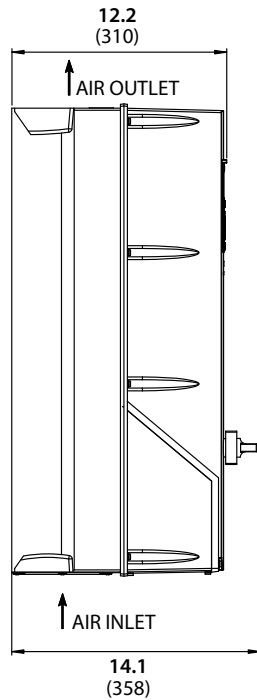
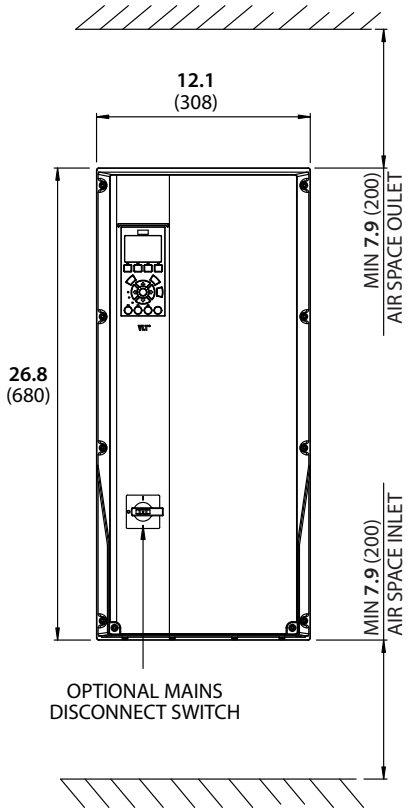
Dimensions: in (mm) **Weight: 95 – 99 lbs (43 – 45 kg)**



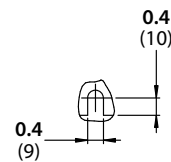
TOP VIEW



DETAIL A



BOTTOM VIEW



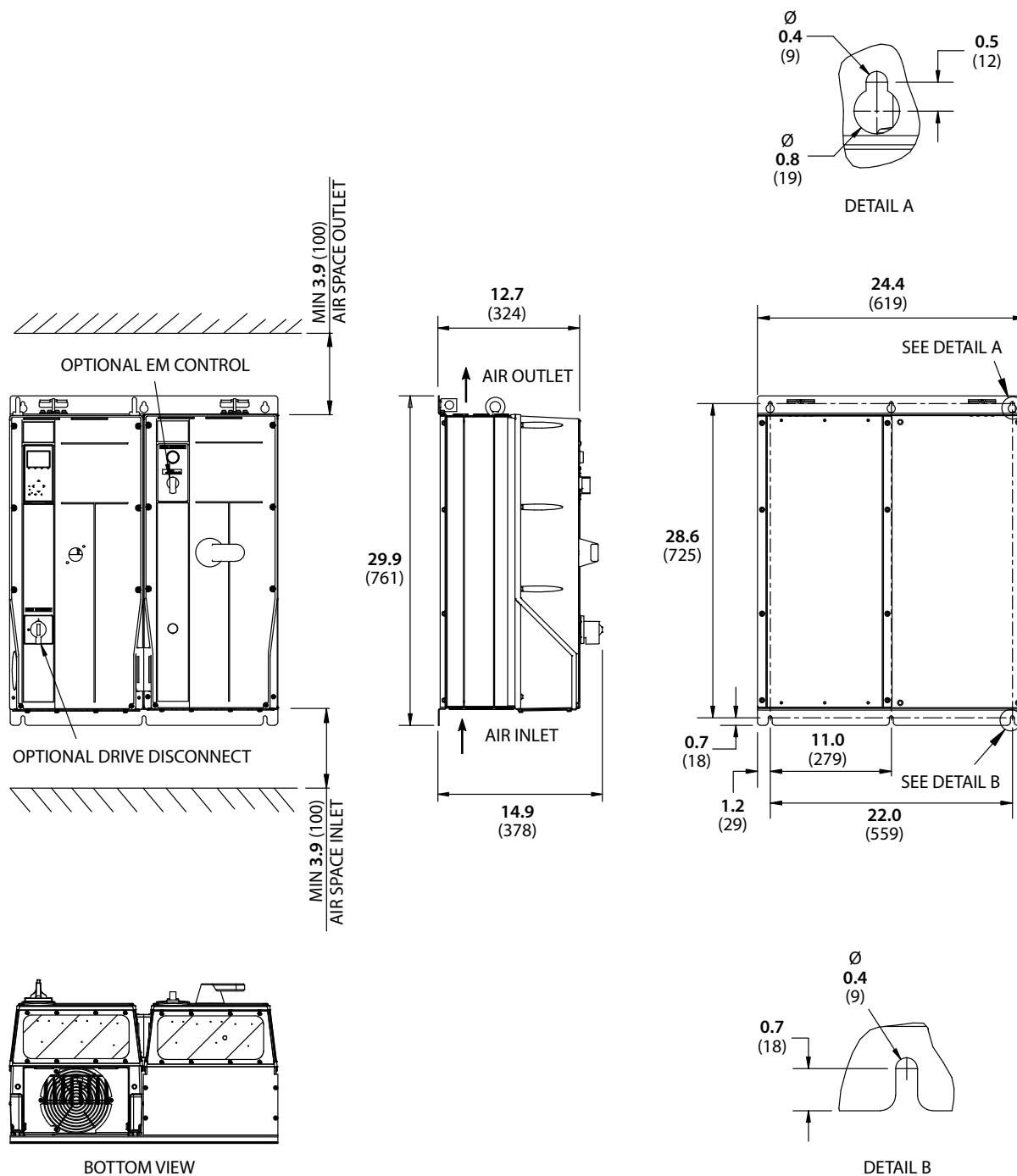
DETAIL B

Mechanical Specifications

C1 Frame Size Tier 2*

NEMA 12/IP55 & IP66 With optional mains disconnect; no option card; bottom cable entry

Dimensions: in (mm)



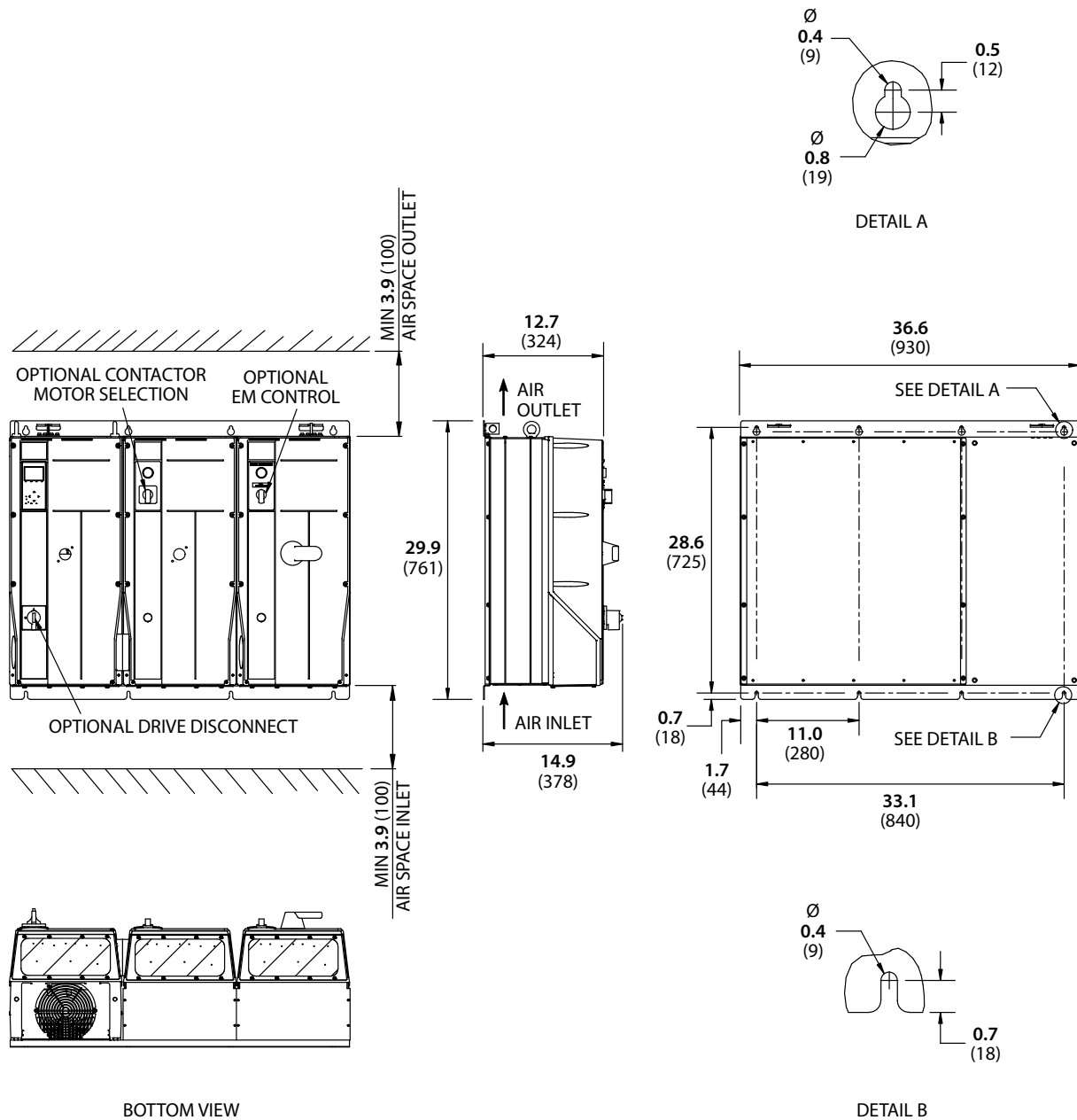
* Tier 2 Panel Solution products include drive with bypass or non-bypass drive with input AC line reactor, output LC filter and/or contactor motor selection See page 51 for more information.

VLT® AQUA Drive

C1 Frame Size Tier 3*

NEMA 12/IP55 & IP66 With optional mains disconnect; no option card; bottom cable entry

Dimensions: in (mm)



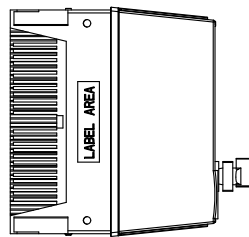
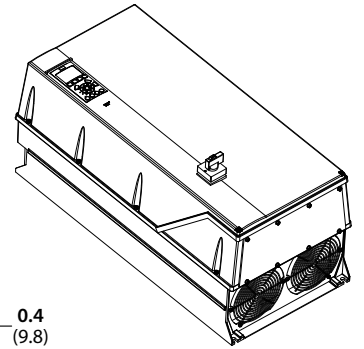
* Tier 3 Panel Solution products include drive with bypass and input AC line reactor, output LC filter and/or contactor motor selection. See page 51 for more information.

Mechanical Specifications

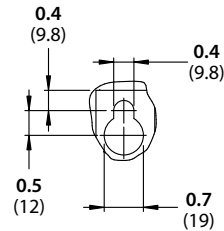
C2 Frame Size

NEMA 12/IP55 & IP66 (Optional mains disconnect lock-out switch shown)

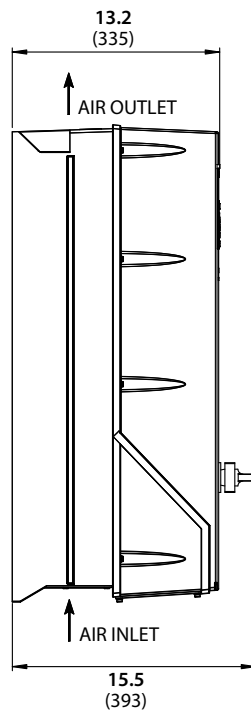
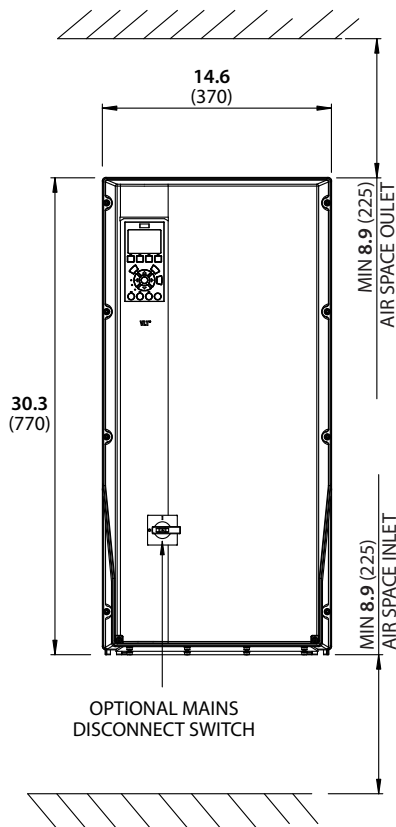
Dimensions: in (mm) **Weight: 134 – 143 lbs (61 – 65 kg)**



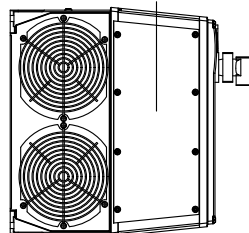
TOP VIEW



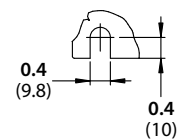
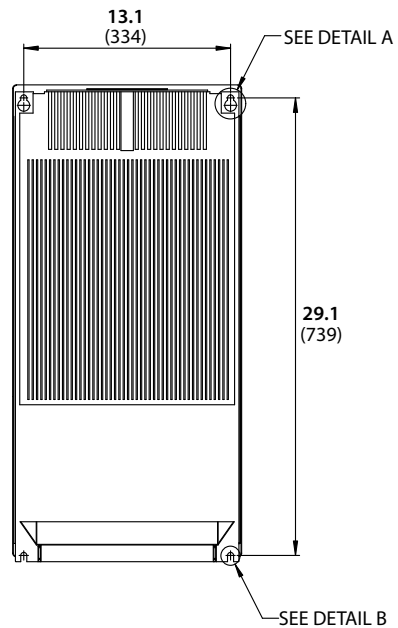
DETAIL A



CABLE ENTRY GLAND PLATE



BOTTOM VIEW



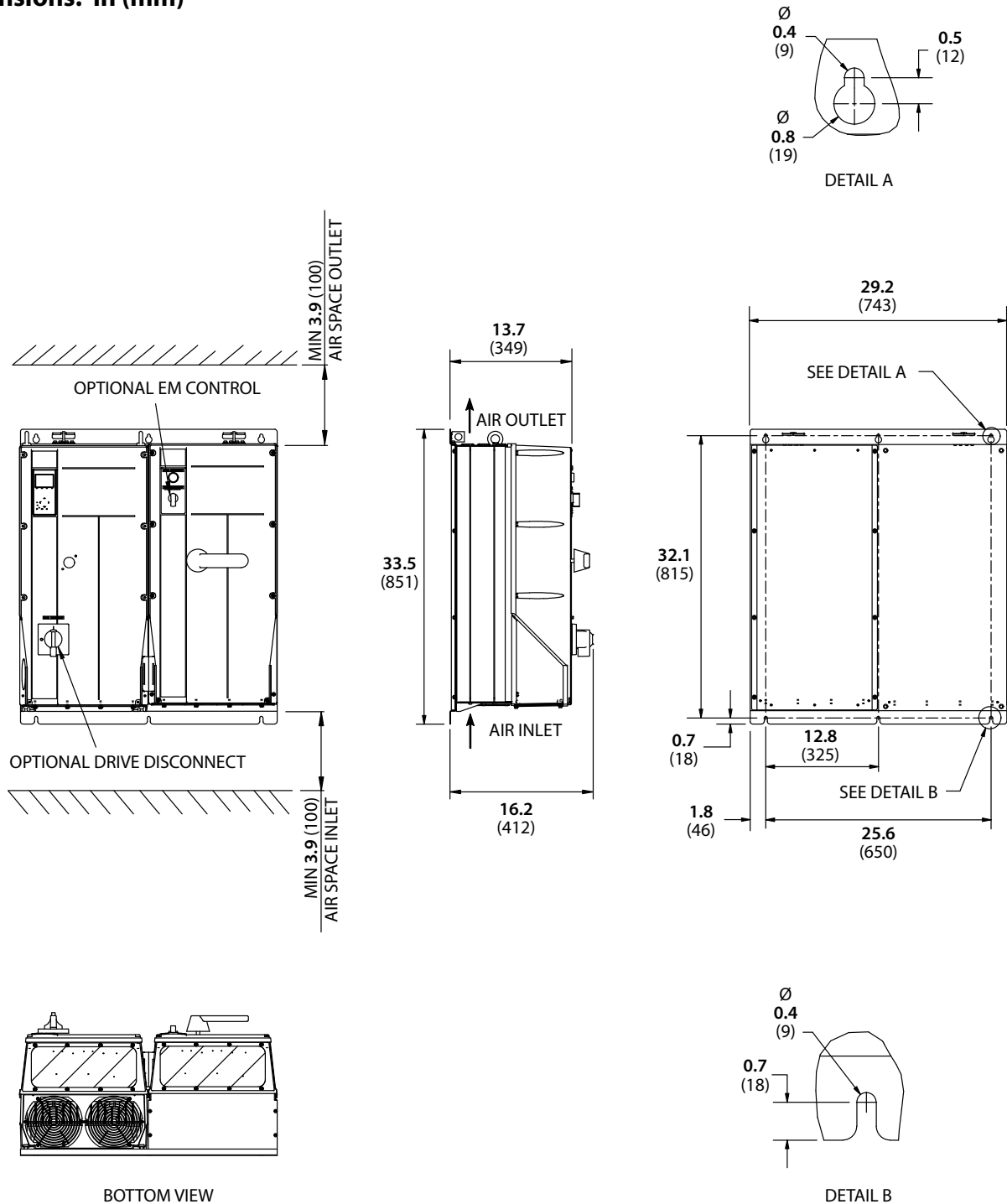
DETAIL B

VLT® AQUA Drive

C2 Frame Size Tier 2*

NEMA 12/IP55 & IP66 With optional mains disconnect; no option card; bottom cable entry

Dimensions: in (mm)



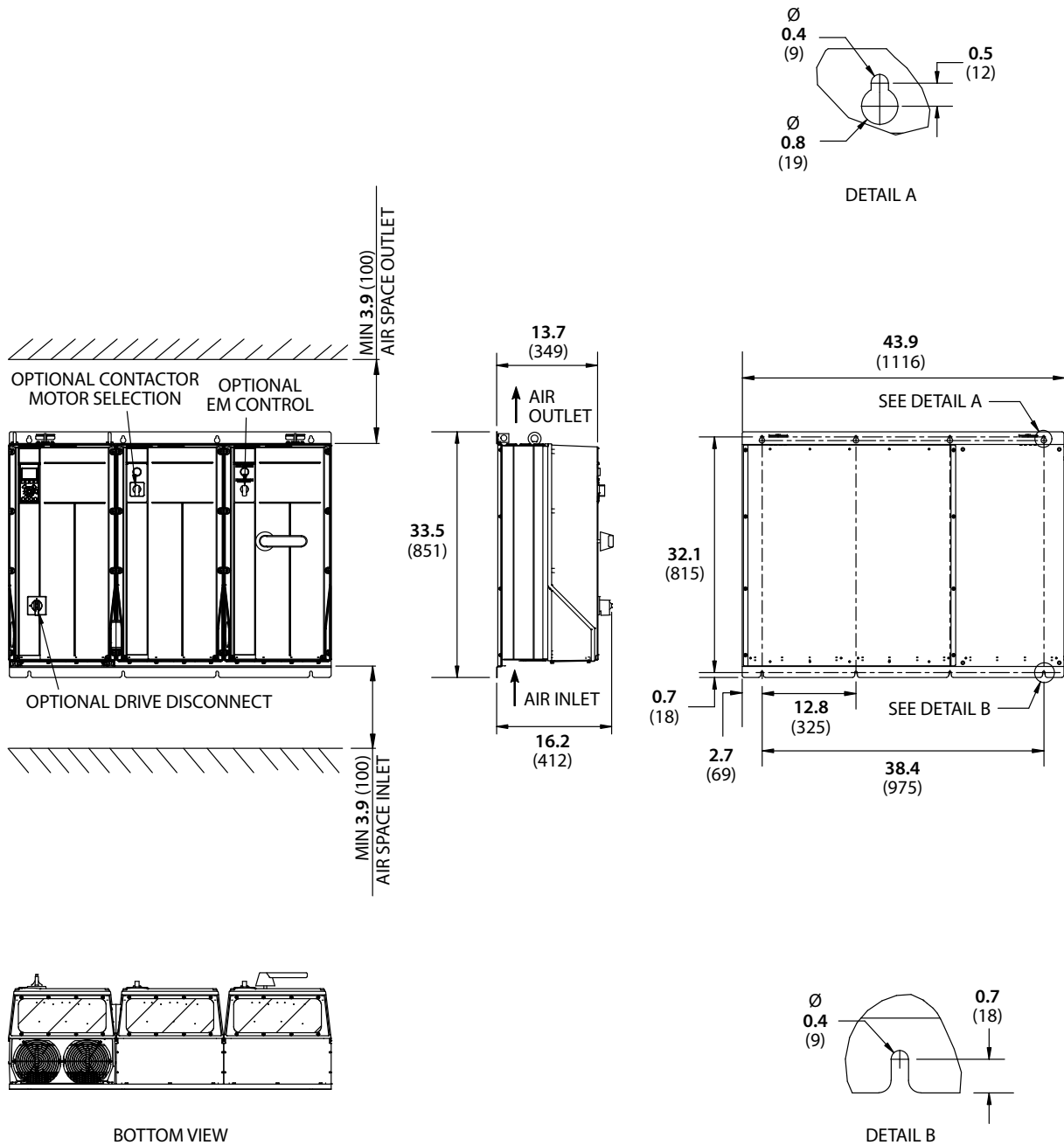
* Tier 2 Panel Solution products include drive with bypass or non-bypass drive with input AC line reactor, output LC filter and/or contactor motor selection See page 51 for more information.

Mechanical Specifications

C2 Frame Size Tier 3*

NEMA 12/IP55 & IP66 With optional mains disconnect; no option card; bottom cable entry

Dimensions: in (mm)



* Tier 3 Panel Solution products include drive with bypass and input AC line reactor, output LC filter and/or contactor motor selection. See page 51 for more information.

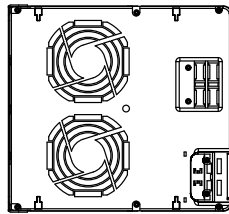
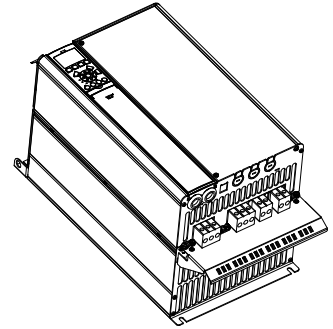
VLT® AQUA Drive

C3 Frame Size

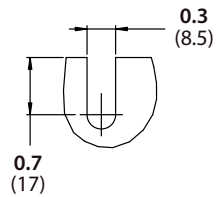
Protected Chassis/IP20

Dimensions: in (mm)

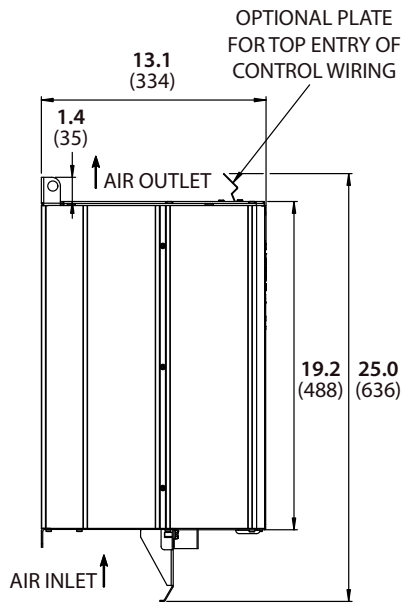
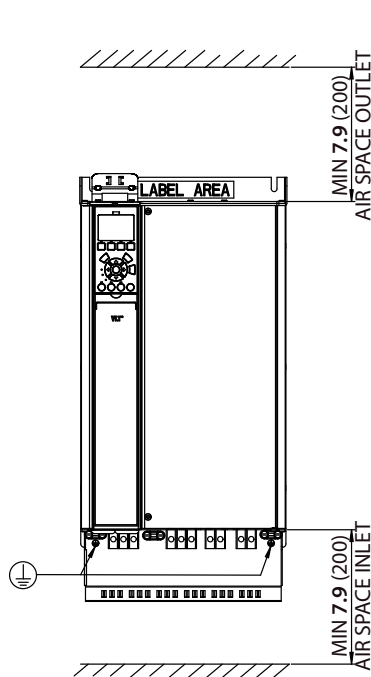
Weight: 77 lbs (35 kg)



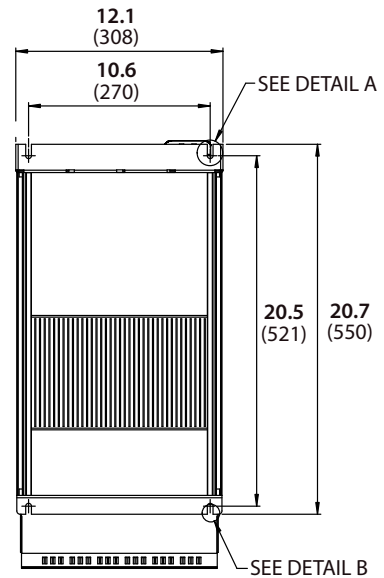
TOP VIEW



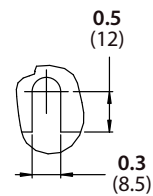
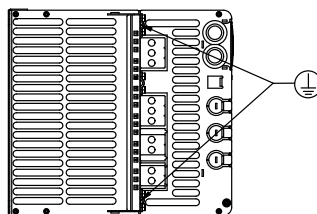
DETAIL A



BOTTOM VIEW



DETAIL B



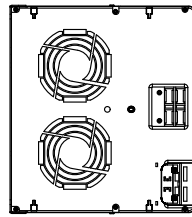
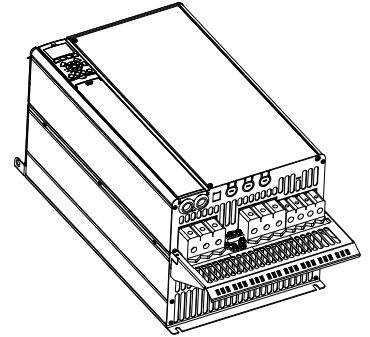
Mechanical Specifications

C4 Frame Size

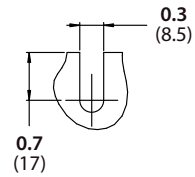
Protected Chassis/IP20

Dimensions: in (mm)

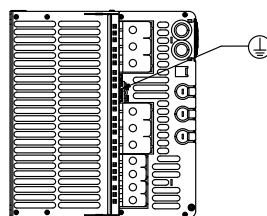
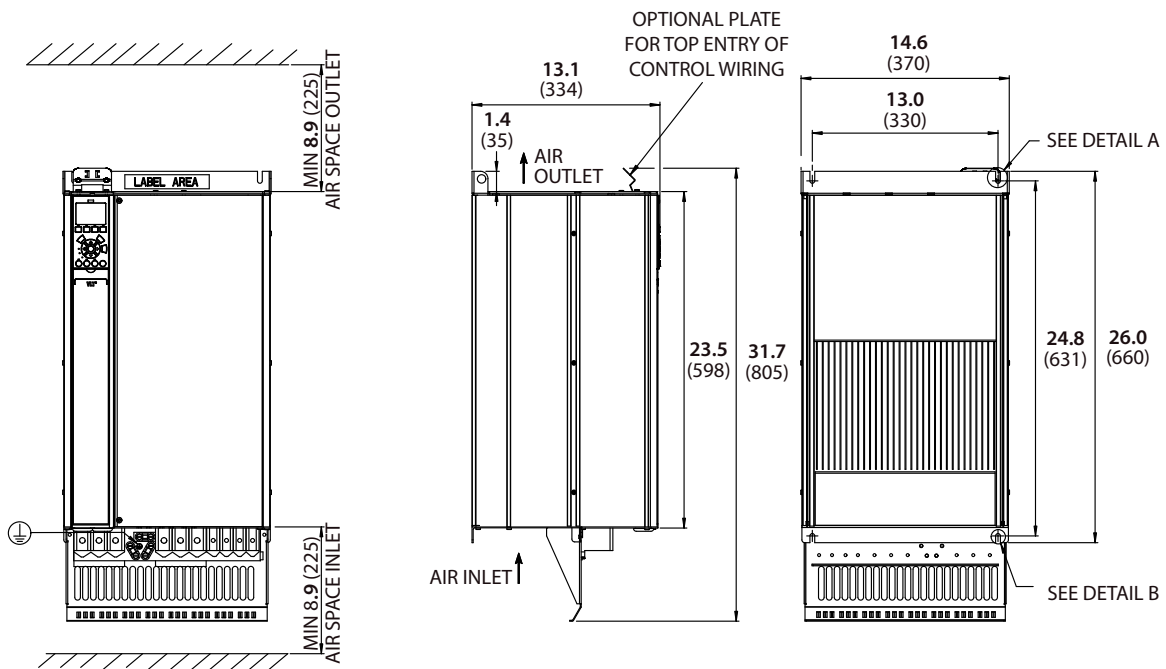
Weight: 110 lbs (50 kg)



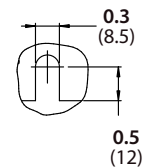
TOP VIEW



DETAIL A



BOTTOM VIEW



DETAIL B

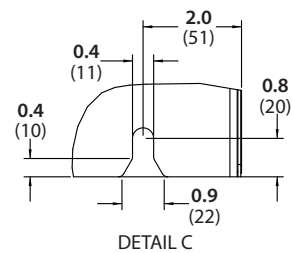
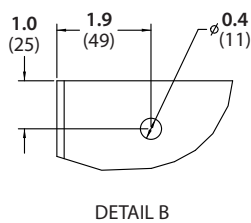
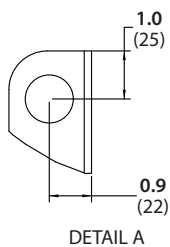
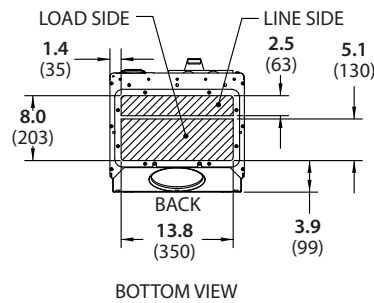
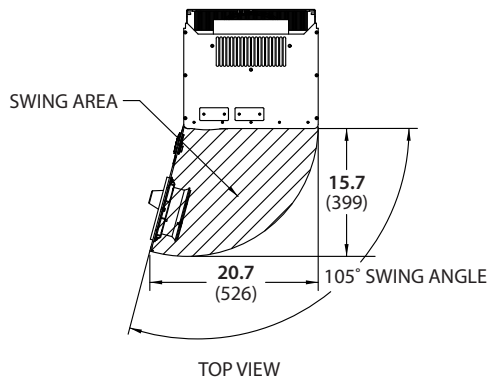
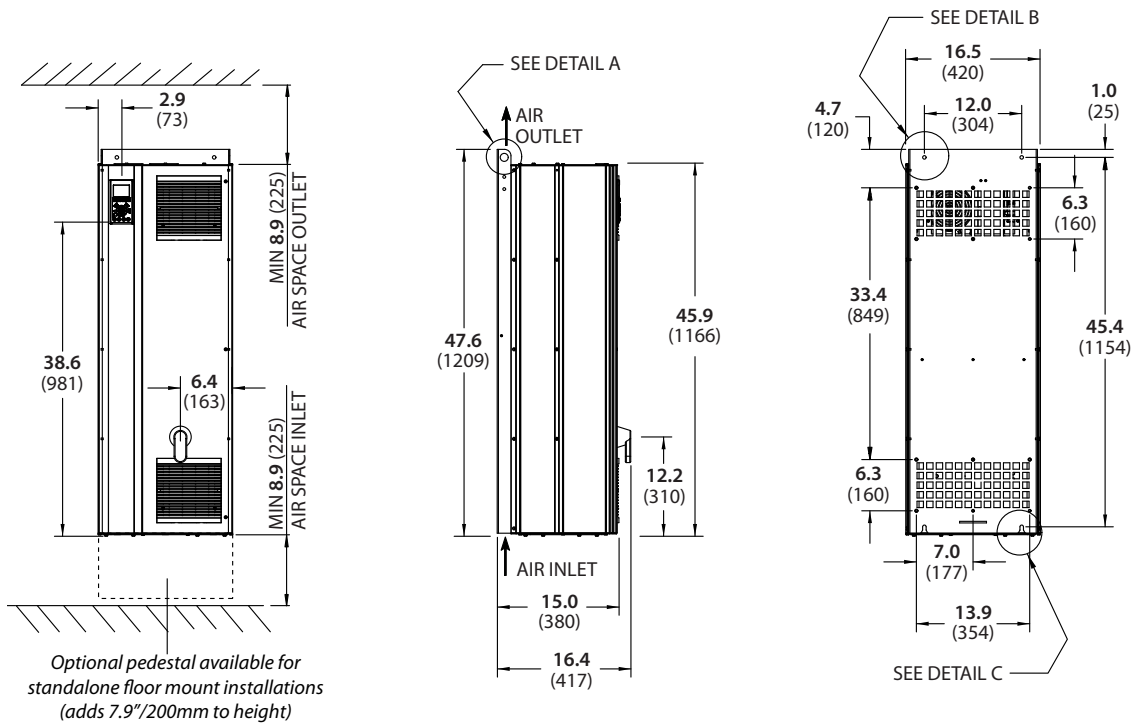
VLT® AQUA Drive

D1 Frame Size

NEMA 12/IP54 Floor or wall mount (Optional mains disconnect lock-out switch shown)

Dimensions: in (mm) Weight: 211 – 229 lbs (96 – 104 kg)

Optional Pedestal Accessory Ordered Separately– Part Number: 176F1827

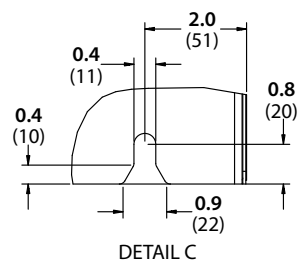
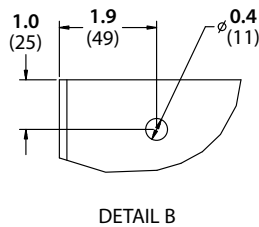
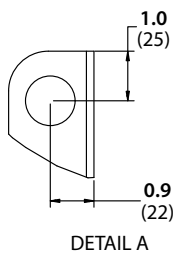
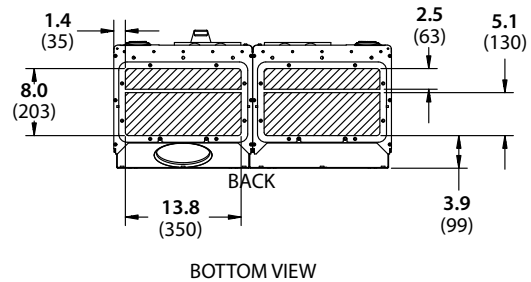
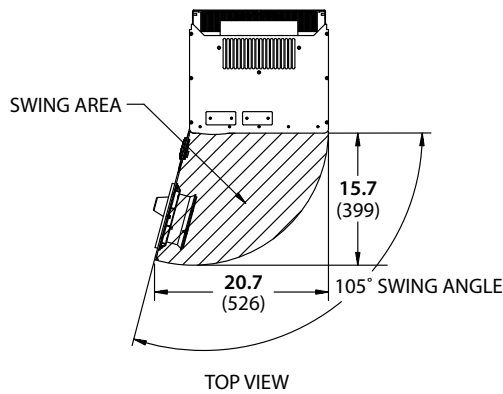
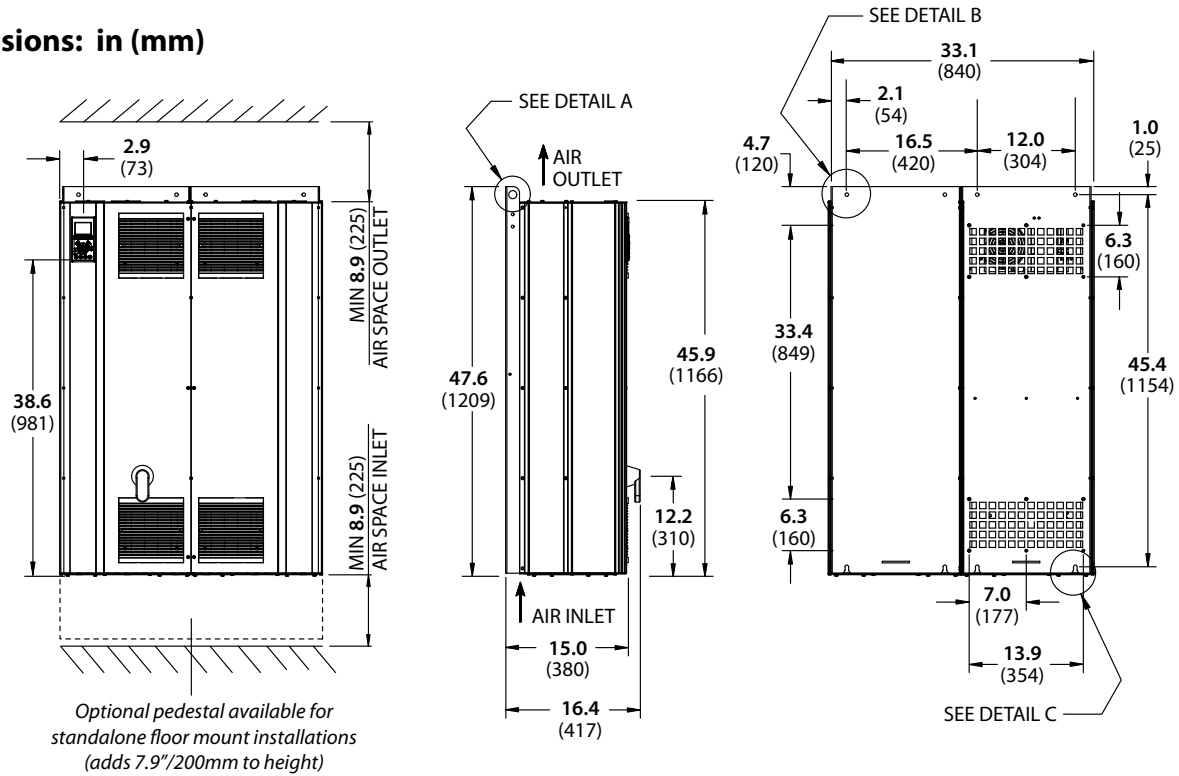


Mechanical Specifications

D1 Frame Size Tier 2*

NEMA 12/IP54 With optional mains disconnect; no option card; bottom cable entry

Dimensions: in (mm)



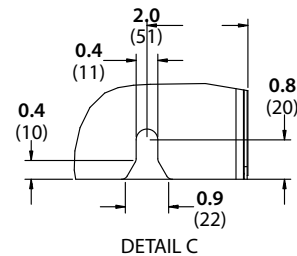
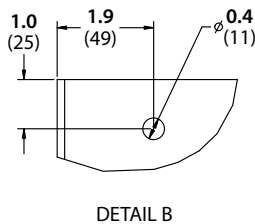
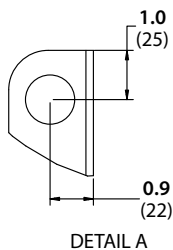
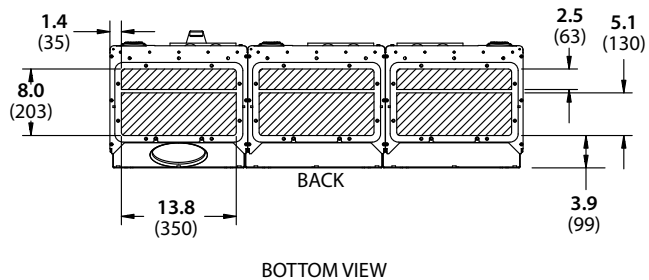
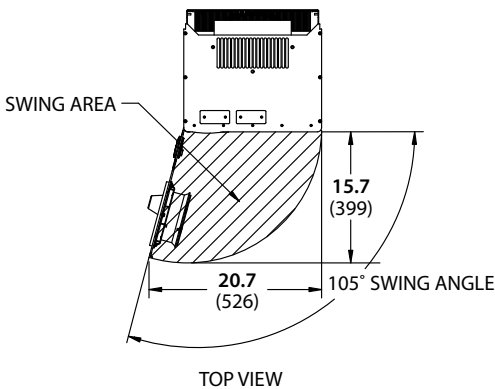
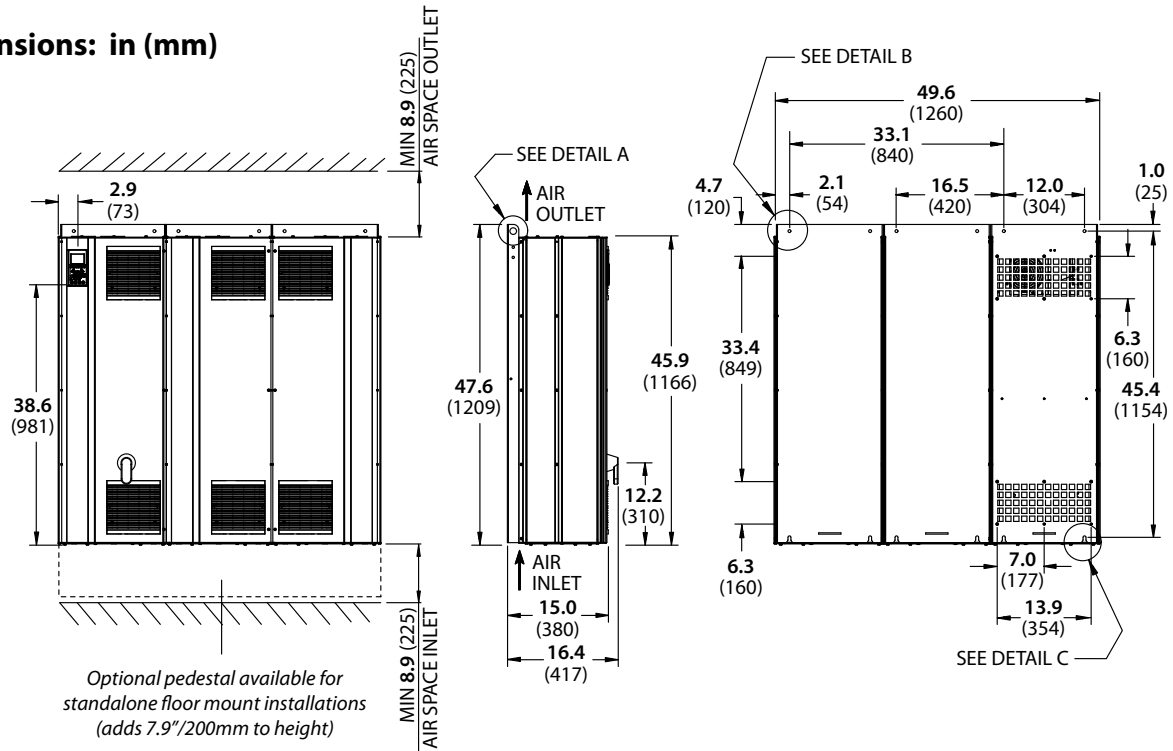
* Tier 2 Panel Solution products include drive with bypass or non-bypass drive with input AC line reactor, output LC filter and/or contactor motor selection See page 51 for more information.

VLT® AQUA Drive

D1 Frame Size Tier 3*

NEMA 12/IP54 With optional mains disconnect; no option card; bottom cable entry

Dimensions: in (mm)



* Tier 3 Panel Solution products include drive with bypass and input AC line reactor, output LC filter and/or contactor motor selection. See page 51 for more information.

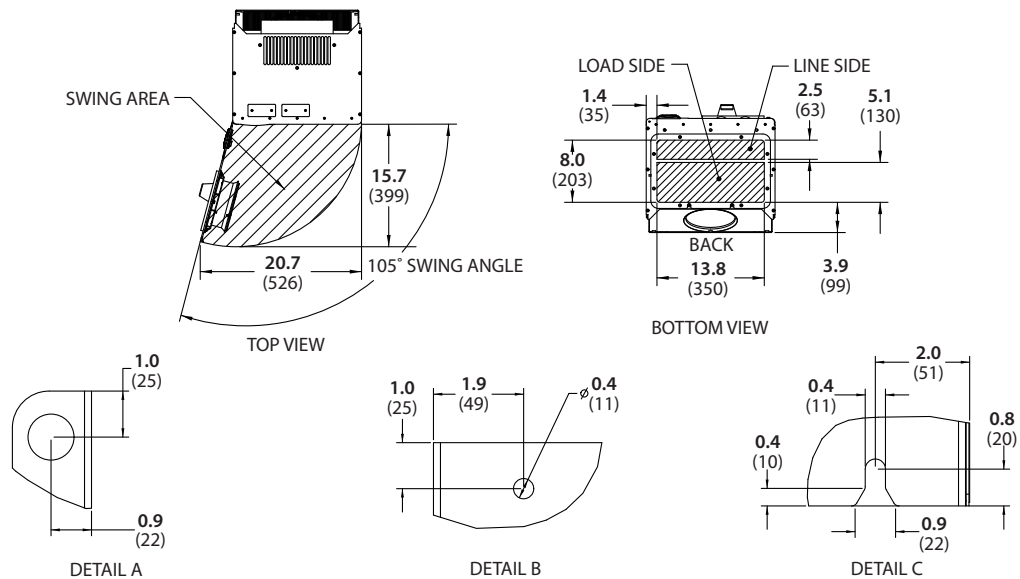
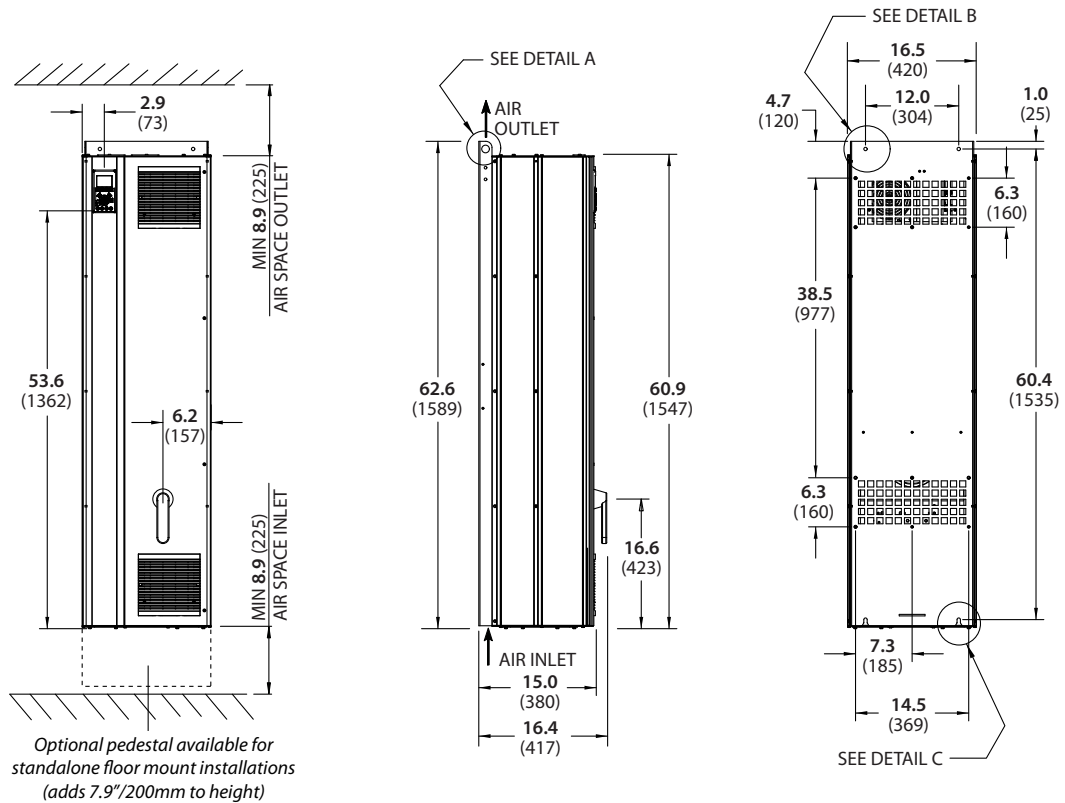
Mechanical Specifications

D2 Frame Size

NEMA 12/IP54 Floor or wall mount (Optional mains disconnect lock-out switch shown)

Dimensions: in (mm) Weight: 276– 333 lbs (125 – 151 kg)

Optional Pedestal Accessory Ordered Separately– Part Number: 176F1827

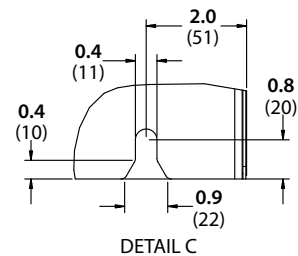
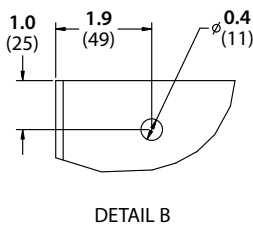
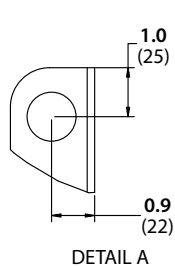
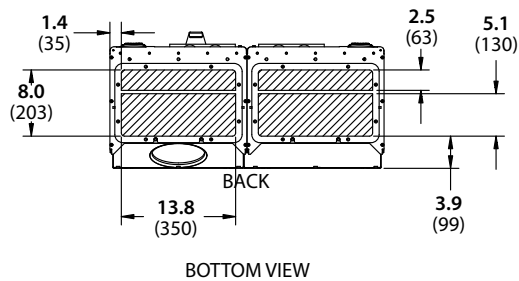
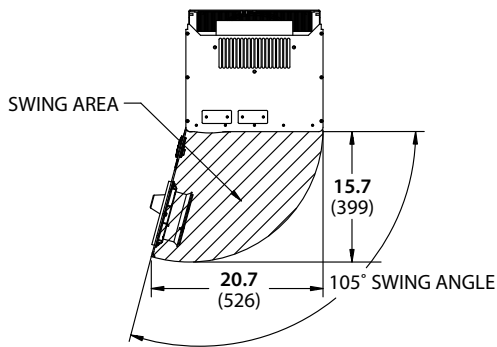
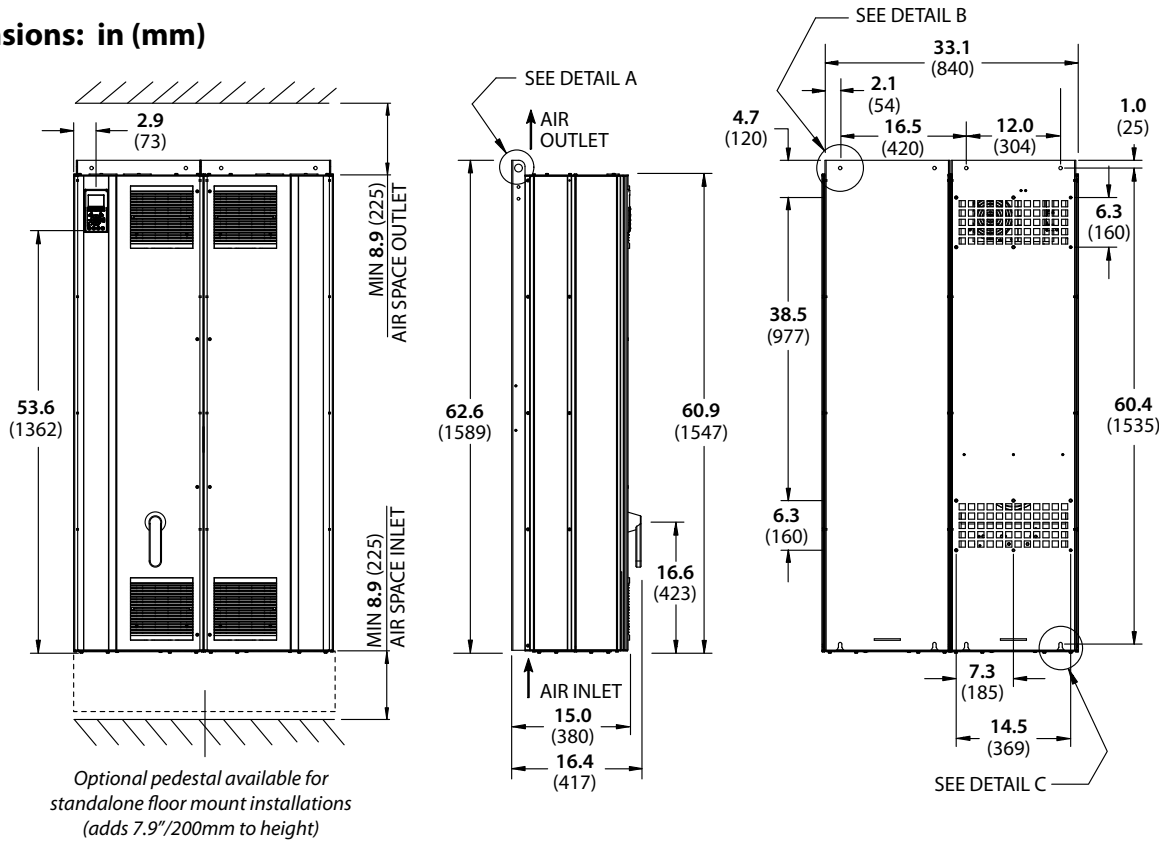


VLT® AQUA Drive

D2 Frame Size Tier 2*

NEMA 12/IP54 With optional mains disconnect; no option card; bottom cable entry

Dimensions: in (mm)



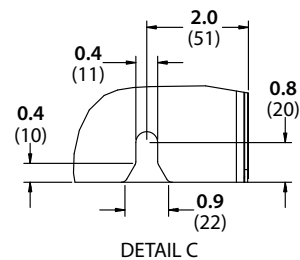
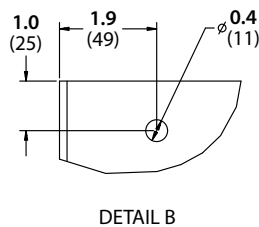
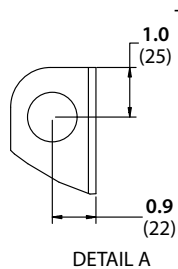
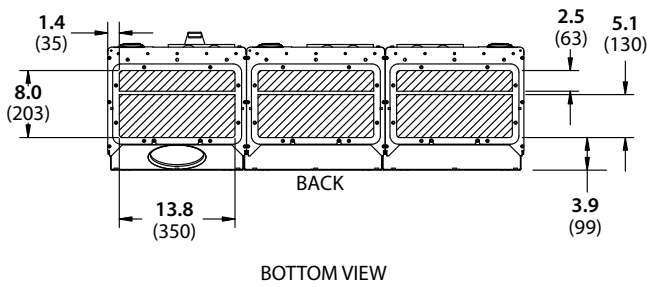
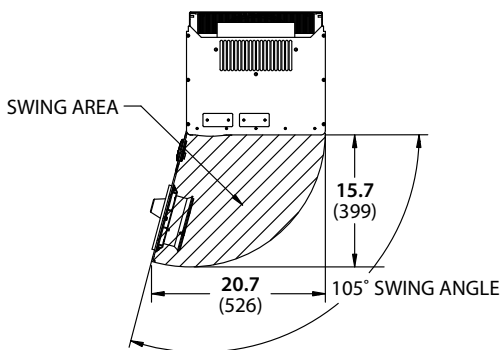
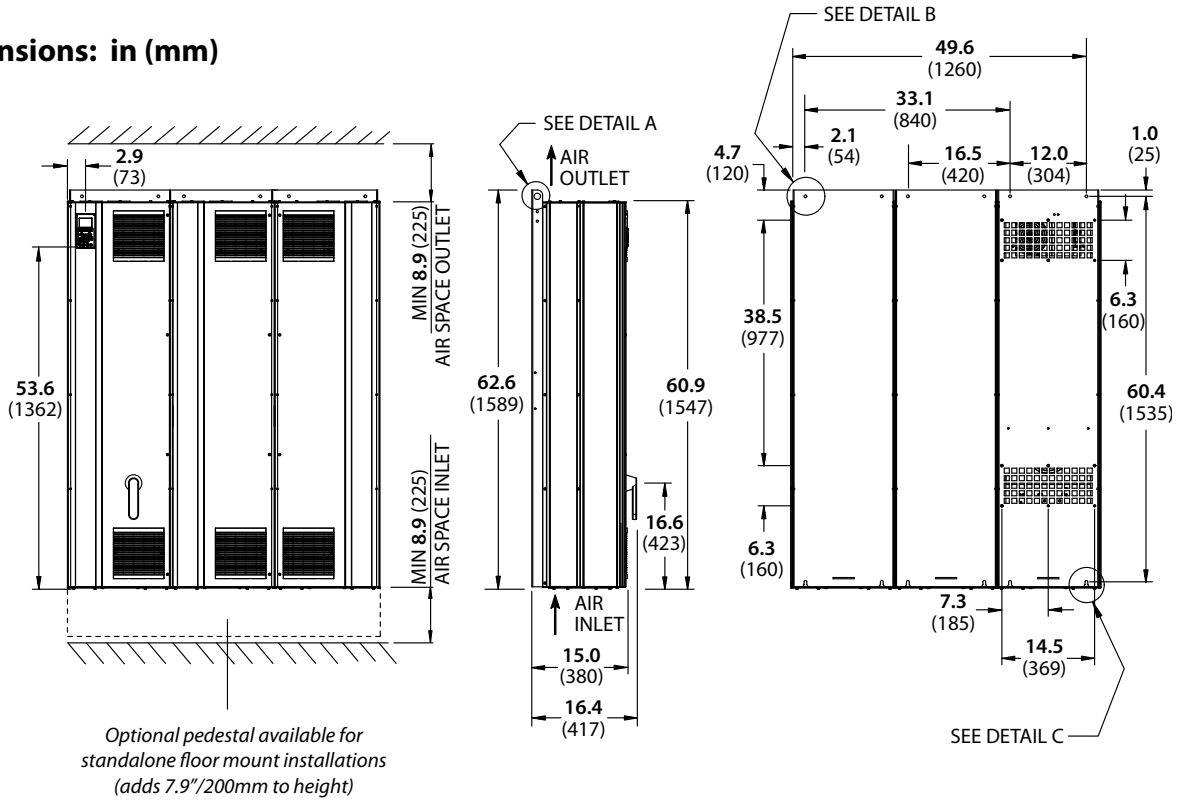
*Tier 2 Panel Solution products include drive with bypass or non-bypass drive with input AC line reactor, output LC filter and/or contactor motor selection See page 51 for more information.

Mechanical Specifications

D2 Frame Size Tier 3*

NEMA 12/IP54 With optional mains disconnect; no option card; bottom cable entry

Dimensions: in (mm)



* Tier 3 Panel Solution products include drive with bypass and input AC line reactor, output LC filter and/or contactor motor selection. See page 51 for more information.

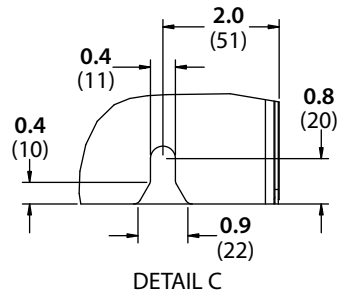
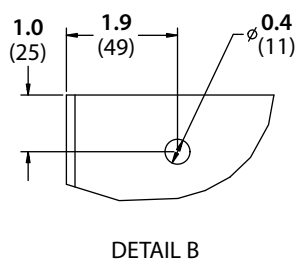
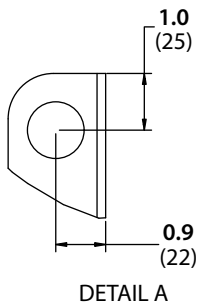
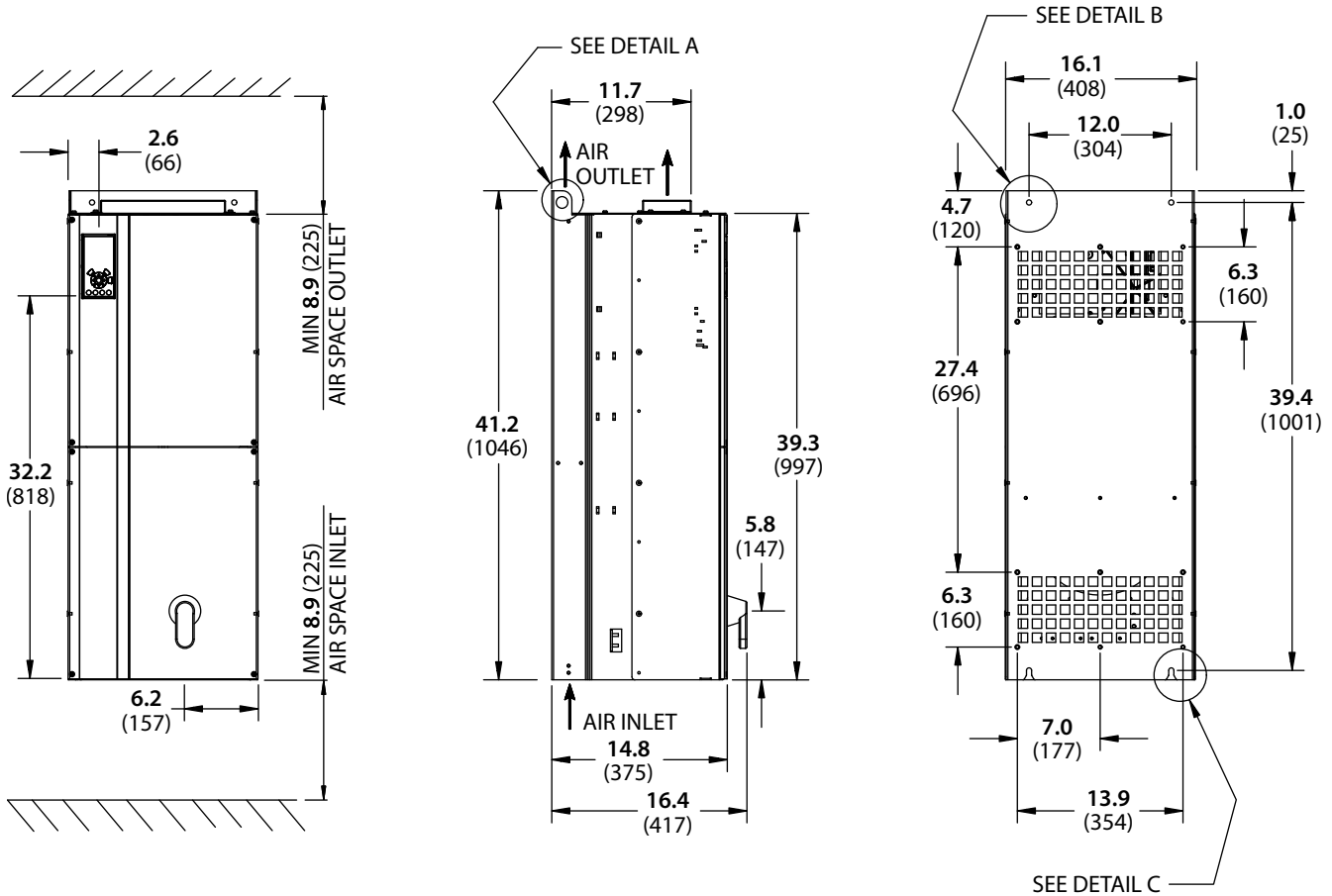
VLT® AQUA Drive

D3 Frame Size

Chassis/IP20 (Optional mains disconnect lock-out switch shown)

Dimensions: in (mm)

Weight: 181 – 201 lbs (82 – 91 kg)



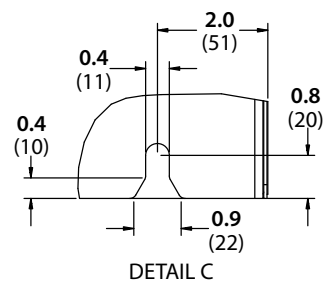
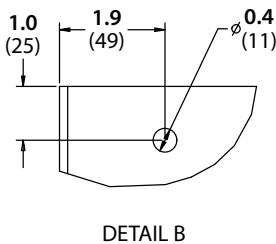
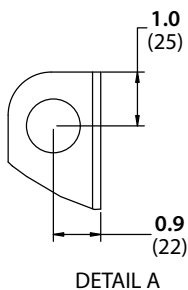
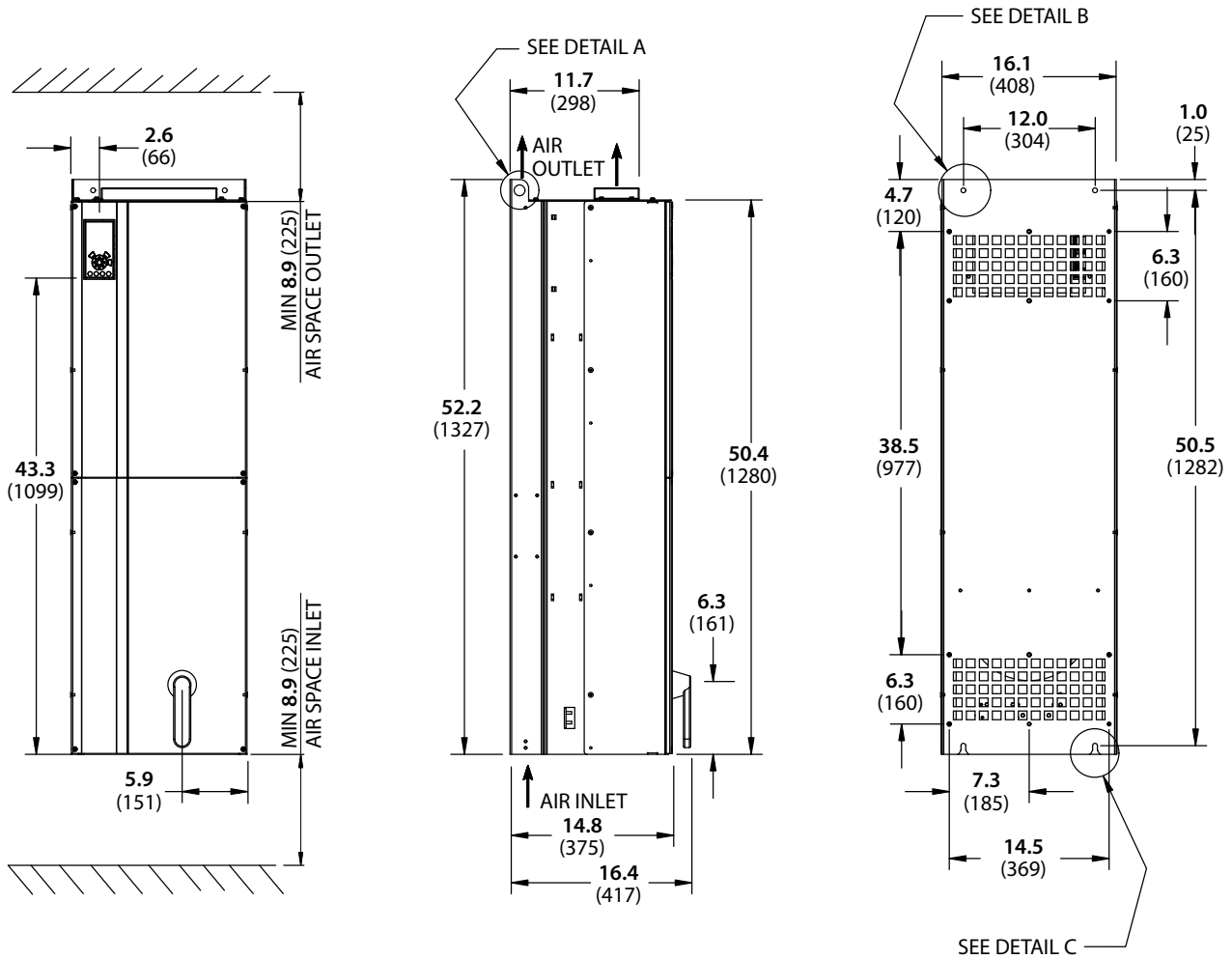
Mechanical Specifications

D4 Frame Size

Chassis/IP20 (Optional mains disconnect lock-out switch shown)

Dimensions: in (mm)

Weight: 247 – 304 lbs (112 – 138 kg)



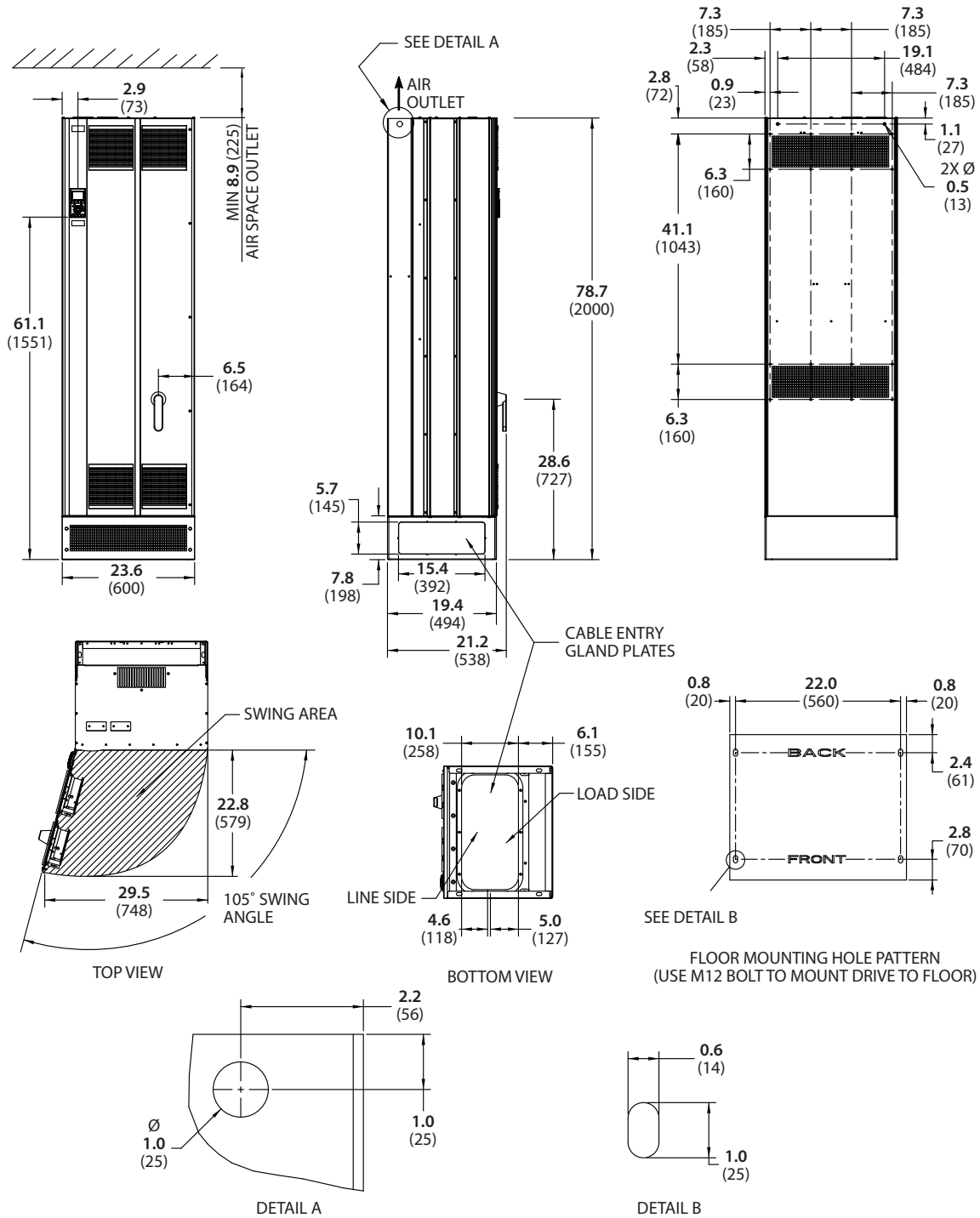
VLT® AQUA Drive

E1 Frame Size

NEMA 12/IP54 (Optional mains disconnect lock-out switch shown)

Dimensions: in (mm)

Weight: 580 – 690 lbs (263 – 313 kg)

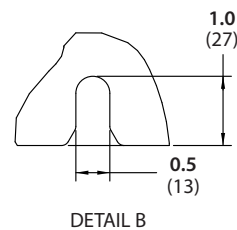
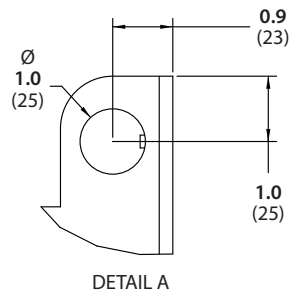
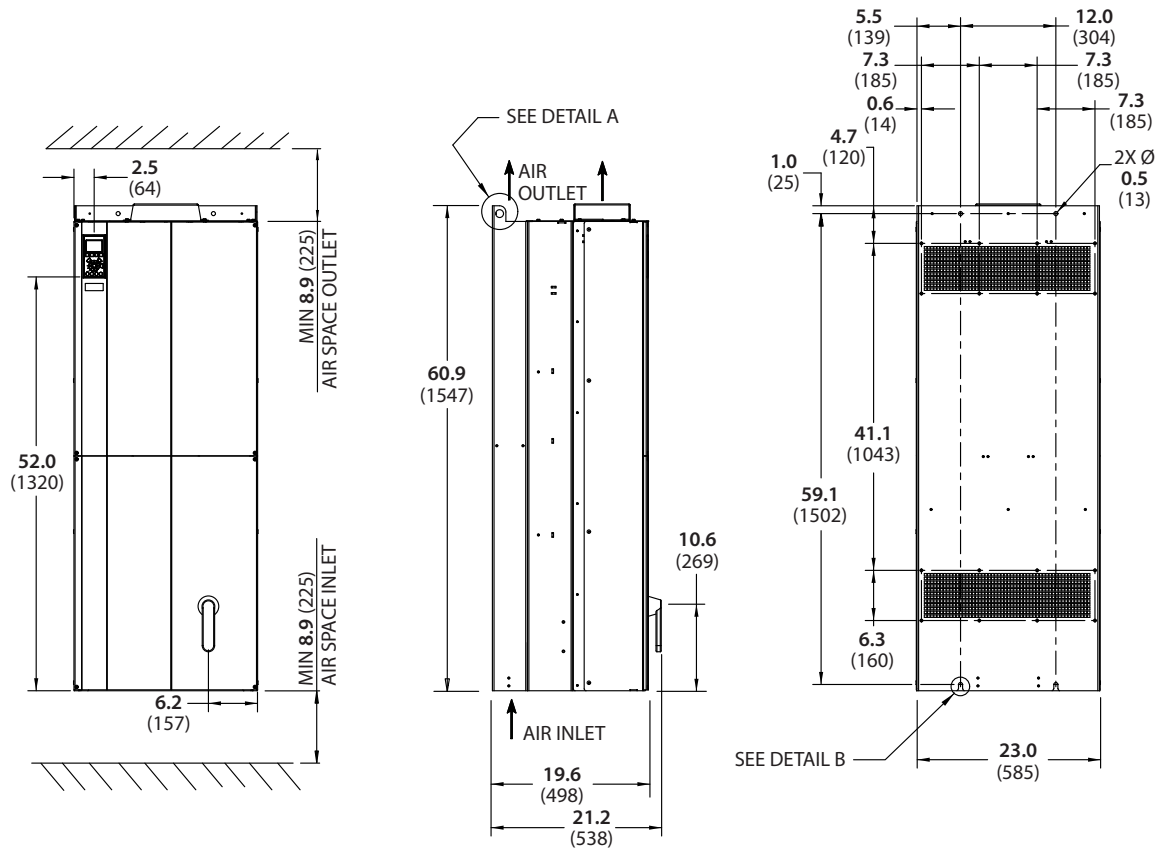


Mechanical Specifications

E2 Frame Size

Chassis/IP20 (Optional mains disconnect lock-out switch shown)

Dimensions: in (mm) **Weight: 487 – 611 lbs (221 – 277 kg)**

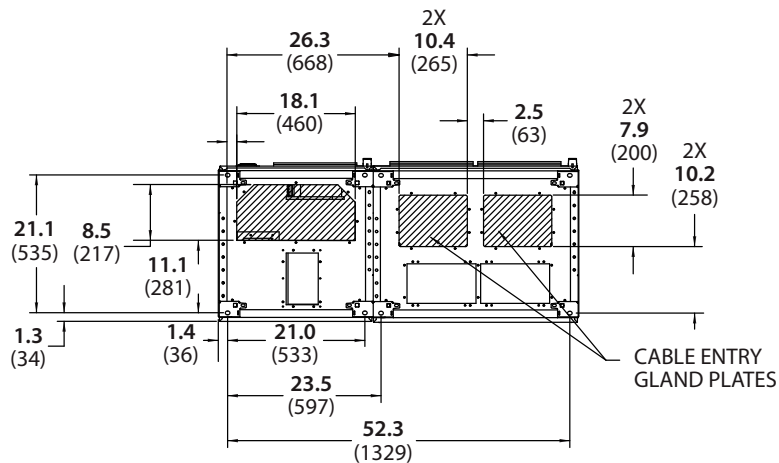
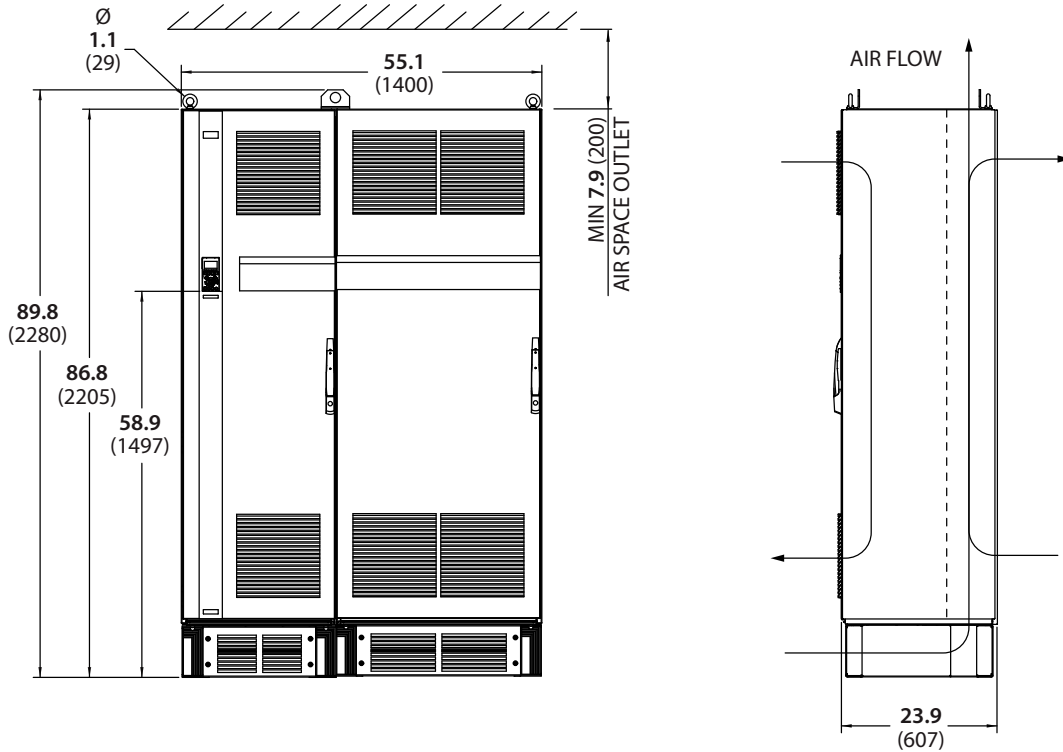


VLT® AQUA Drive

F1 Frame Size

NEMA 12/IP54 (Optional mains disconnect lock-out switch shown)

Dimensions: in (mm) Weight: 2,214 lbs (1,004 kg)



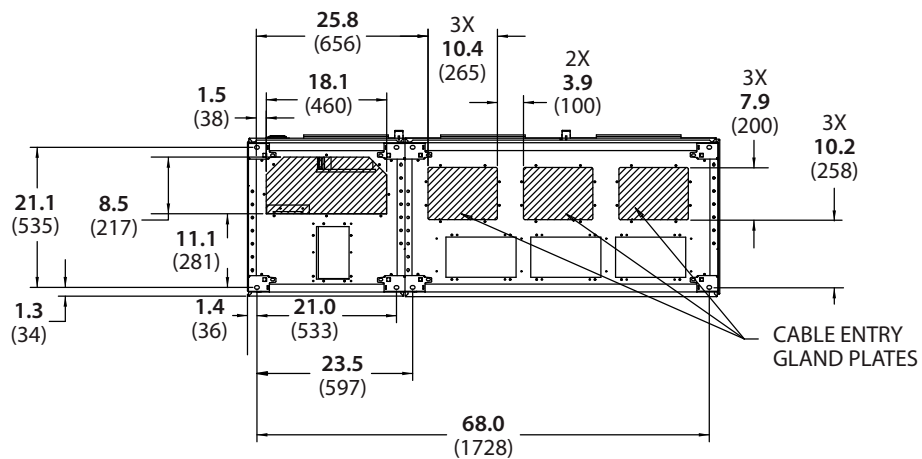
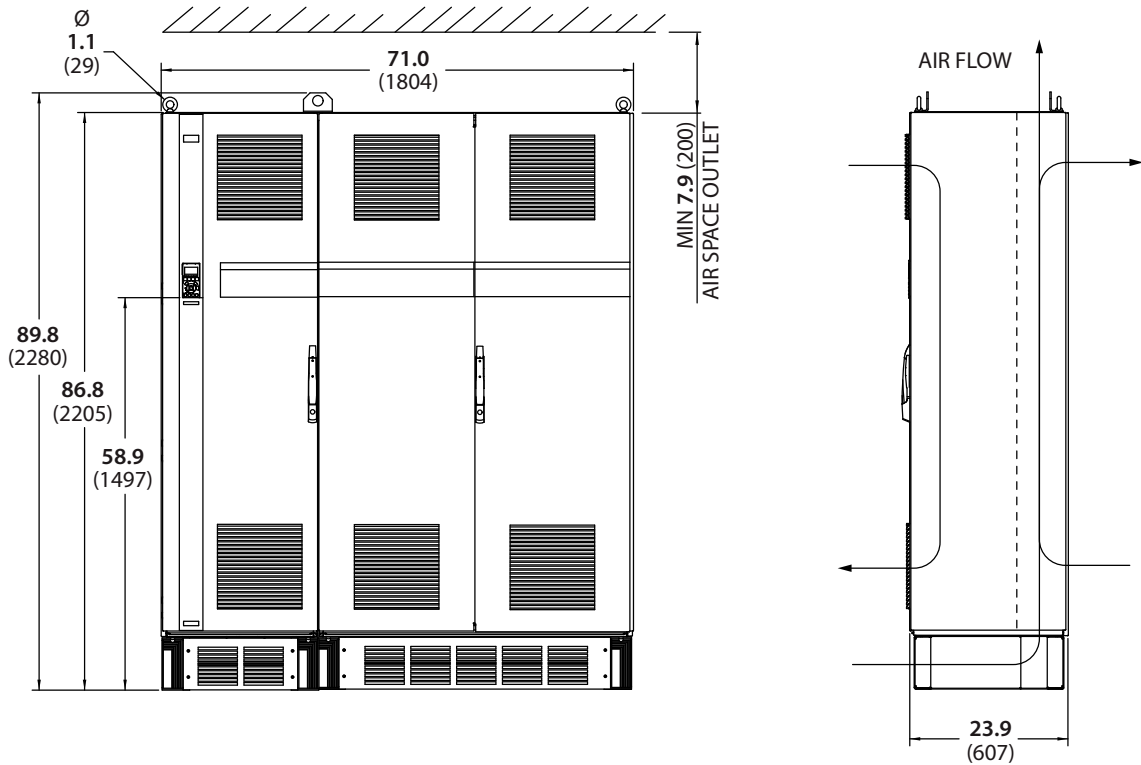
BOTTOM VIEW

Mechanical Specifications

F2 Frame Size

NEMA 12/IP54 (Optional mains disconnect lock-out switch shown)

Dimensions: in (mm) Weight: 2,748 lbs (1,246 kg)



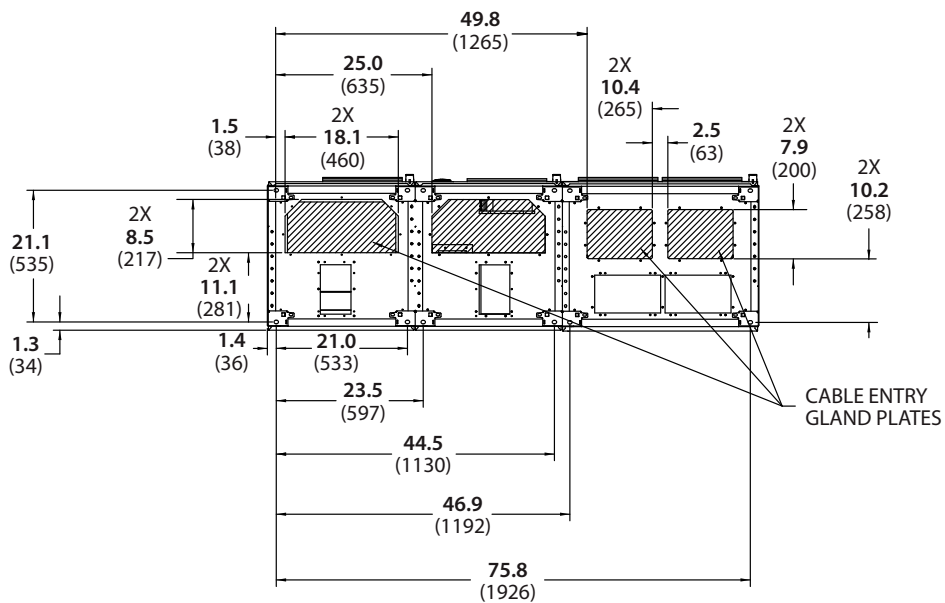
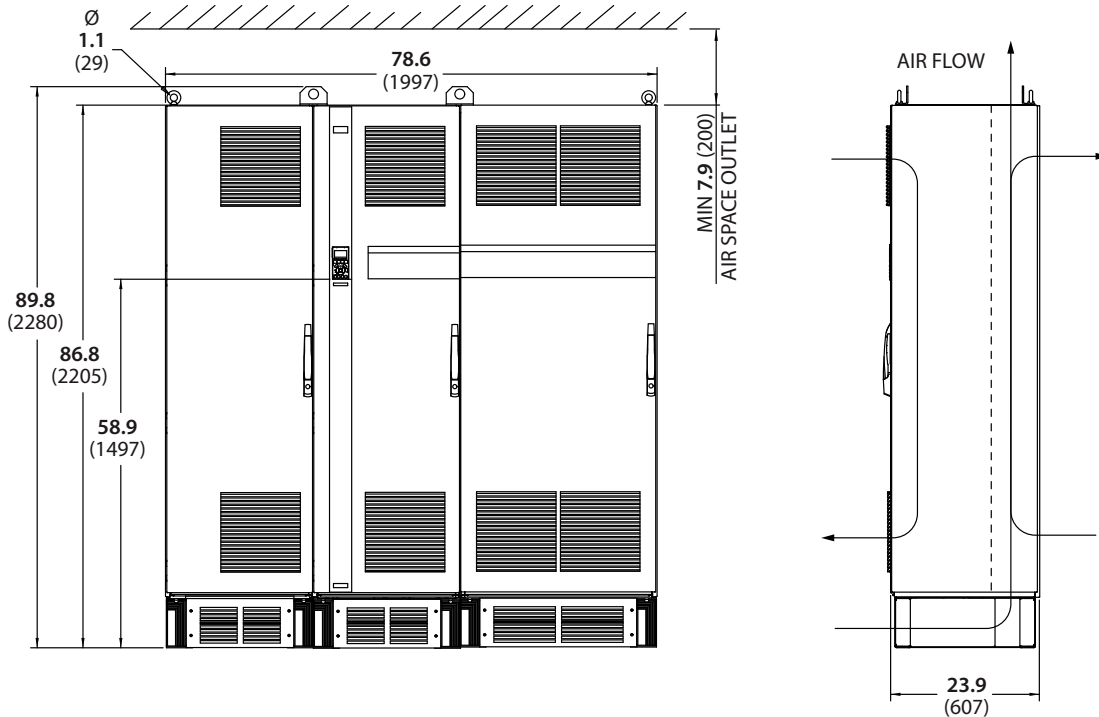
BOTTOM VIEW

VLT® AQUA Drive

F3 Frame Size

NEMA 12/IP54 (Optional mains disconnect lock-out switch shown)

Dimensions: in (mm) Weight: 2,214 lbs (1,004 kg)



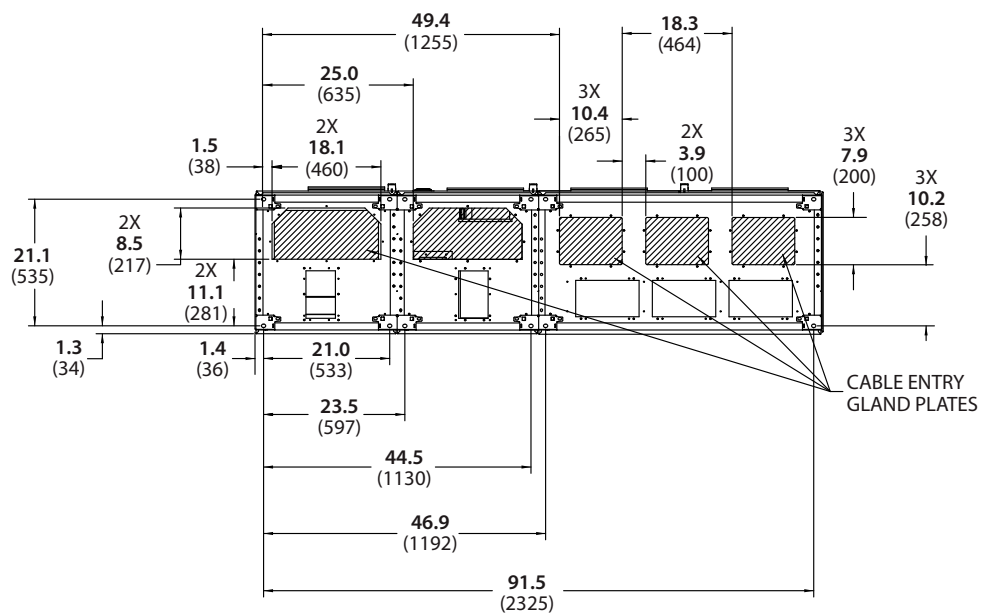
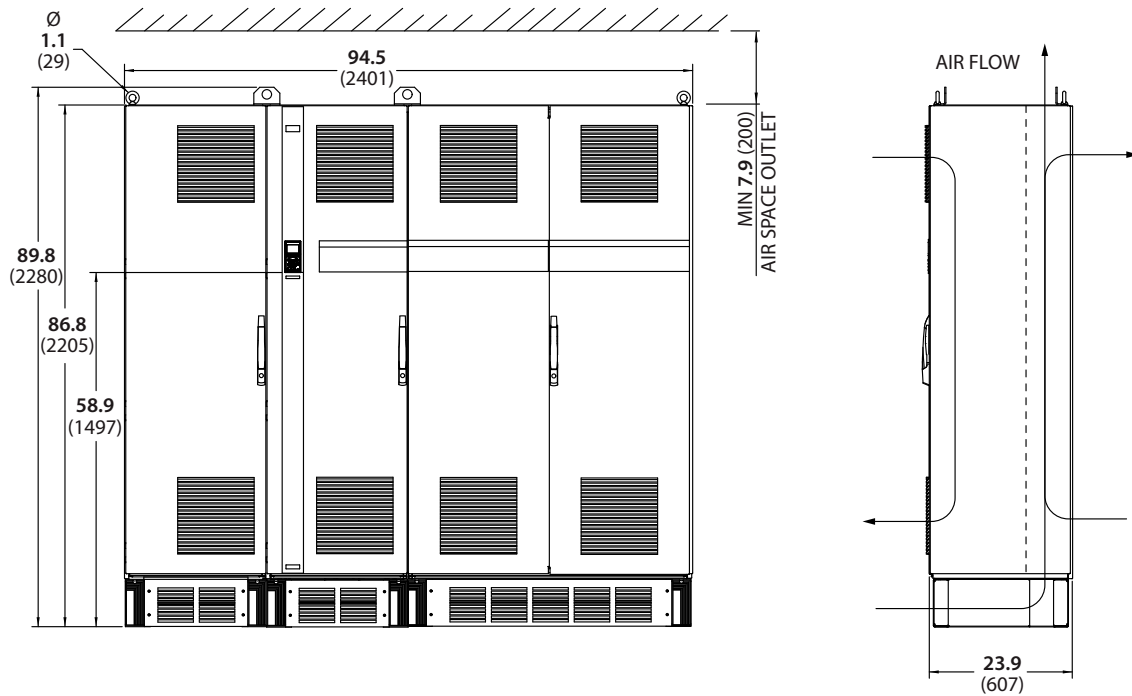
BOTTOM VIEW

Mechanical Specifications

F4 Frame Size

NEMA 12/IP54 (Optional mains disconnect lock-out switch shown)

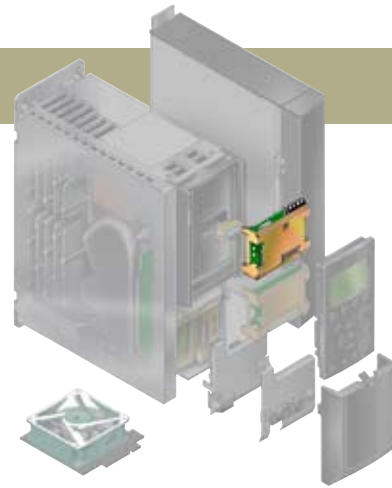
Dimensions: in (mm) Weight: 2,748 lbs (1,246 kg)



BOTTOM VIEW

Fieldbus Options/Accessories (A-Card)

The VLT AQUA Drive is available with a variety of fieldbus products which are available as factory-installed options or as field-installed accessories.



MCA 101 Profibus

Supported by all major PLC vendors, PROFIBUS DP V1 gives you a high level of availability and compatibility with future versions.

- Fast and efficient communication, advanced diagnosis and autoconfiguration of process data via GSD files
- Acyclic parameterization using PROFIBUS DP V1, PROFIdrive or Danfoss FC profile state machines, PROFIBUS DP V1, Master Class 1 and 2



MCA 108 LonWorks

Allows the drive to communicate on a LonWorks Free Topology network.

- Certified compliant with LonWorks 3.4 specifications
- Designed to communicate with any system complying with the FTT and 78Kbps LonWorks standard
- Equipped with two termination switches enabling double termination when using bus topology



MCA 104 DeviceNet

Based on Producer/Consumer technology, DeviceNet offers robust, efficient data handling.

- Allows the user to select the nature and timing of reported information
- ODVA's strong conformance testing policies ensure that products are interoperable



MCA 121 Ethernet

Provides the network tools to deploy standard Ethernet technology for manufacturing applications while enabling Internet and enterprise connectivity.

- Built-in advanced switch with diagnostic functions and two ports for line topology
- Built-in web server and e-mail client for service notification
- Transparent socket channel



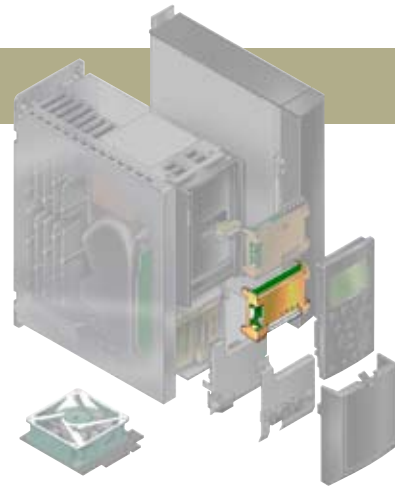
	Option Order Code*	Accessory Part Number	
		Uncoated	Coated
MCA 101 Profibus	A0	130B1100	130B1200
MCA 101 Profibus (with top entry for B and C frame enclosures)	A1		
MCA 104 DeviceNet	A4	130B1102	130B1202
MCA 104 DeviceNet (with top entry for B and C frame enclosures)	A5		
MCA 108 LonWorks	AG	130B1106	130B1206
MCA 121 Ethernet	AN	130B1119	130B1219

* Factory installed at time of drive purchase. See order configuration code on page 141.

Options and Accessories

Application Options/Accessories (B-Card)

The VLT AQUA Drive is available with several added-functionality application products which are available as factory-installed options or as field-installed accessories.



MCB 101 General Purpose I/O

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
- Separate parameter settings



MCB 109 Analog I/O

- Provides battery back-up of clock function on control card
- Extension of analog I/O selection
- Turning drive into decentral I/O block supporting Building Management System
- Support Extended PID controllers



MCB 105 Relay

Extend the relay functions of the VLT® AQUA Drive with 3 extra relay outputs.

Max. terminal load:

- AC-1 Resistive load 240V AC: 2A
- AC-15 Inductive @ $\cos \phi$ 0.4: 0.2A
- DC-1 Resistive load 240V AC: 1A
- DC-13 Inductive @ $\cos \phi$ 0.4: 0.1A

Min. terminal load:

- DC 5 V: 10 mA
- Max. switch rate at rated load/min. load: 6 min⁻¹/20 sec⁻¹
- Protected control cable connection
- Spring-loaded connection of control wires
- Selection of relay functions in parameter settings



MCO 101 Extended Cascade Controller

Extends the capabilities of the standard Cascade Controller built into VLT® Series drives:

- Provides 3 additional relays for staging of additional motors
- Provides accurate flow, pressure, and level control for optimizing the efficiency of systems that use multiple pumps or blowers
- Master/Follower mode runs all blowers/pumps at the same speed, potentially reducing the energy consumption to less than half that of valve throttling or traditional, across-the-line on/off cycling
- Lead pump alternation assures that pumps or blowers are used equally



	Option Order Code*	Accessory Part Number	
		Uncoated	Coated
MCB 101 I/O	BK	130B1125	130B1212
MCB 105 Relay	BP	130B1110	130B1210
MCB 109 Analog I/O	AO	130B1143	130B1243
MCO 101 Extended Cascade Controller	BY	130B1118	130B1218

* Factory installed at time of drive purchase. See order configuration code on page 141.

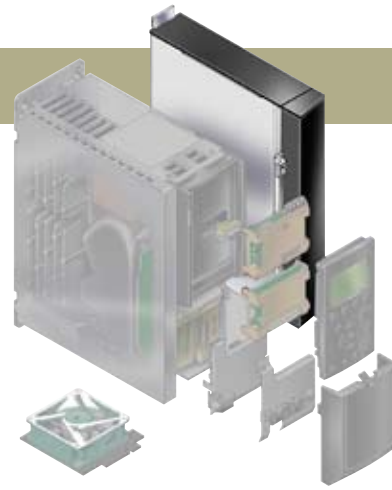
Cascade Controller (C-Card)

MCO 102 Advanced Cascade Controller

The Advanced Cascade Controller option provides the capability to control multiple pumps configured in parallel in a way that makes them appear as a single larger pump.

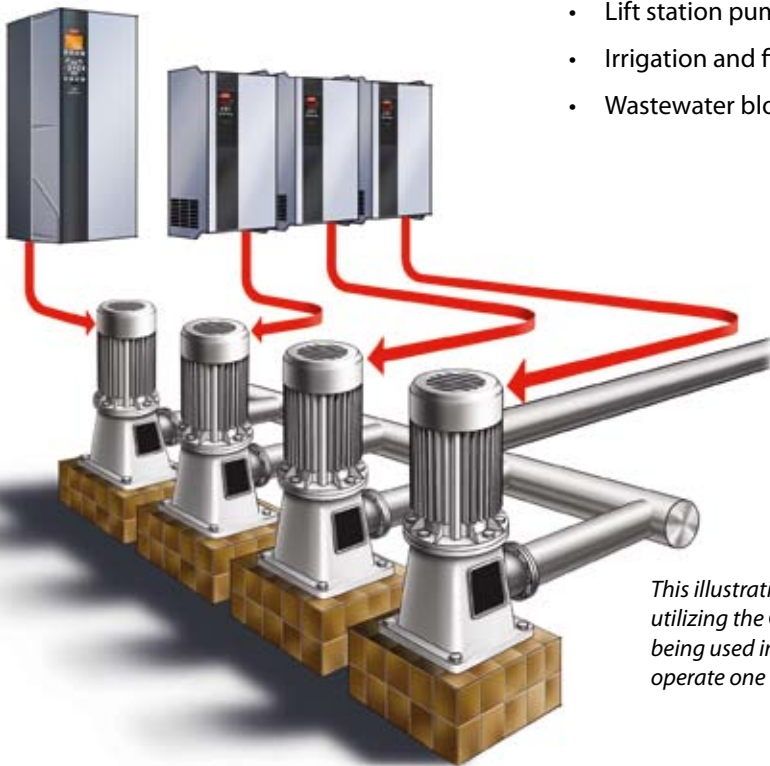
Using the Advanced Cascade Controller individual pumps are automatically turned on (staged) and turned off (destaged) as needed to satisfy the required system output for flow or pressure. The speed of the pumps connected to the VLT AQUA Drives is also controlled to provide a continuous range of system output.

The Advanced Cascade Controller option card controls up to five parallel pumps. The controller provides constant pressure or level control in such systems, and reduces water hammer and energy consumption. The controller also eliminates the need for PLCs and external controllers.



The Advanced Cascade Controller is available as a factory-installed option or as field-installed accessory, and is designed for a variety of applications including:

- Pressure booster pump systems
- Tank level control
- Pressure control
- Lift station pump control
- Irrigation and fire pump systems
- Wastewater blower systems



This illustration depicts a typical VLT AQUA Drive installation utilizing the Cascade Controller option. The controller is being used in conjunction with MCD Series Soft Starters to operate one to four pumps as demand requires.

	Option Order Code*	Accessory Part Number	
		Uncoated	Coated
MCO 102 Advanced Cascade Controller	C5	130B1154	130B1254

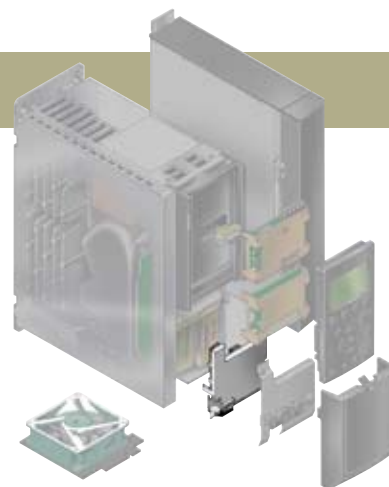
* Factory installed at time of drive purchase. See order configuration code on page 141.

Options and Accessories

DC Input Option/Accessory (D-Card)

MCB 107 External 24 VDC Supply

Enables connection of external DC supply to keep the control section and any option installed active despite interruption of AC power.



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

	Option Order Code*	Accessory Part Number	
		Uncoated	Coated
MCB 107 External 24 VDC Supply	D0	130B1108	130B1208

* Factory installed at time of drive purchase. See order configuration code on page 141.

Faceplate Options/Accessories

VLT® AQUA Drives can be configured with three different HMI (faceplate) configurations:

- Graphic (far left)
- Numeric (center)
- Blank (right)

Faceplate configurations are available as a factory-installed option or as a field-installed accessory.



LCP 102 Graphical Local Control Panel

- Multi-language display
- VLT® AQUA Drive status messages
- Quick menu for easy commissioning
- Parameter setting and explanation of parameter function
- Full parameter backup and copy function
- Alarm logging
- Info button explains the function of the selected item on display
- Hand operated start-stop or selection of Automatic mode
- Reset function
- Trend graphing



LCP 101 Numerical Local Control Panel

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



MCF 102 LCP Panel Mounting Kits

The LCP mounting kit enables the LCP to be mounted in an IP 65 cabinet front.

- 3m cable
- Gasket for sealing
- Finger screws for easy fitting
- Supports LCP 101 and LCP 102



	Option Order Code*	Accessory Part Number
LCP 101 Numerical Faceplate	N	130B1124
LCP 102 Graphical Faceplate	G	130B1107
LCP 103 Blank Faceplate	X	130B1077
MCF 102 Panel Mounting Kit (Includes fastener, 10 ft (3 m) cable, and gasket)	—	130B1117
MCF 102 Panel Mounting Kit with Numerical Faceplate	—	130B1113
Panel Mounting Kit with Graphical Faceplate	—	130B1114
LCP cable 10 ft. (3 m)	—	175Z0929
Hardened USB Cable Extension for IP66	—	130B1155
for A5, B1 Enclosures	—	130B1156
For B2, C1, C2 Enclosures		

* Factory installed at time of drive purchase. See order configuration code on page 141.

Options and Accessories

Danfoss Advanced Harmonic Solutions: A Clear Advantage

Danfoss offers several harmonic solutions which offer a critically important performance advantages over other technologies:

- Meet or exceeds IEEE 519-1992 guidelines for current distortion limits for drive installations
- Equal or superior performance and cost competitive compared to 12- and 18-pulse rectifiers
- Engineered drive, harmonic reduction, bypass, and disconnect in one compact NEMA 1 or 12 enclosure
- Flexible installation configurations with dramatic size and weight advantages over other harmonic filtering solutions

Advanced Harmonic Filters and Active Harmonic Filters specifications are listed on the following pages.

Determining whether harmonics are an issue for your application

Current distortion relates specifically to the individual drive and equipment. Voltage distortion calculations require an understanding of the harmonic currents of the non-linear load and the system short-circuit impedance. It is not possible to predict the voltage distortion knowing only the drive's performance. Voltage distortion is a system performance parameter.

So how do you determine whether harmonics are or will be an issue?

Danfoss has the experience and knowledge to provide you with practical and realistic advice when it comes to your installation. Using the Danfoss MCT-31 Harmonics Calculation Tool, we can quickly, completely and accurately estimate the harmonics in any facility.

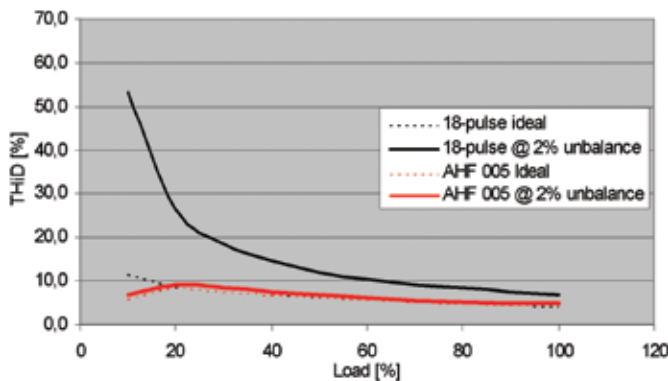
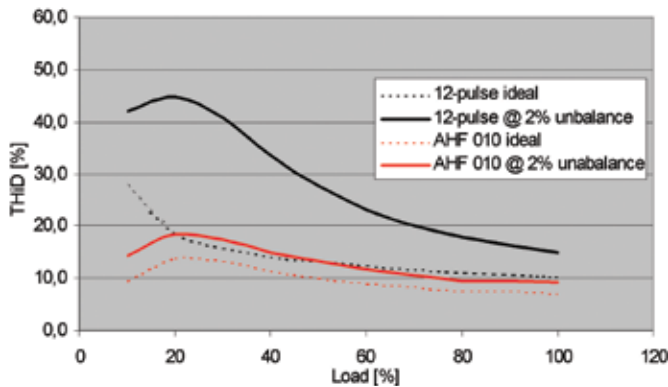
The MCT-31 Harmonics Calculation Tool can save you time and money by forecasting how changes in your configuration will impact the overall system. Along with our application engineering staff, MCT-31 will help you specify the right VFD system the first time, and avoid costly mistakes and unnecessary equipment changes.



AHF Advanced Harmonic Filters

As a cost-effective total solution, Danfoss Advanced Harmonic Solutions packages combine the reliability and performance of VLT® Series drives with the innovative technology of AHF Series Filters.

- Designed for matched performance with Danfoss VLT® Series drives
- User-friendly startup; no adjustment necessary
- Requires no routine maintenance
- Protects multiple drives with one filter
- Designed to address the current distortion limit guidelines of IEEE 519-1992
- AHF 10 has THiD < 10%; equal or superior performance and cost competitive compared to 12-pulse rectifiers
- AHF 05 has THiD < 5%; equal or superior performance and cost competitive compared to 18-pulse rectifiers



Specifications

Line Voltage	380–415 VAC (50 Hz), ±10%
	440–480 VAC (60 Hz), ±10%
	500–525 VAC (50 Hz), ±10%
	690 VAC (50 Hz), ±10%
Frequency	±5%
Enclosure Rating	Chassis (IP00)
Overload Current	160% for 60 seconds
Efficiency	>0.98
True Power Factor	0.85 @ 50% load; 0.99 @ 100% load
Ambient Temperature	41°–104° F (5°–40°C) without derating

Options and Accessories

Selection

Power Rating	Current (A)	Watts	AHF 010 (10% Filter)		AHF 005 (5% Filter)	
			Frame	Ordering Number	Frame Size	Ordering Number
For 40 HP / 30 kW	43	718	C	175G6637	D	175G6615
For 50 HP / 37 kW	72	718	D	175G6638	D	175G6616
For 60 HP / 45 kW		1,008				
For 75 HP / 55 kW	101	1,008	D	175G6639	E	175G6617
For 100 HP / 75 kW	144	1,437	D	175G6640	E	175G6618
For 125 HP / 90 kW						
For 150 HP / 110 kW	180	1,796	E	175G6641	F	175G6619
For 200 HP / 132 kW	217	2,165	E	175G6642	F	175G6620
For 250 HP / 160 kW	289	2,883	F	175G6643	G	175G6621
For 300 HP / 200 kW	324	3,232	F	175G6692	G	175G6689
For 350 HP / 250 kW	370	3,691	G	175G6693	H	175G6690
For 400 HP / 300 kW	434	4,330	Use two 200 HP Filters			
For 450 HP / 315 kW	506	5,048	Use one 200 HP and one 250 HP Filter			
For 500 HP / 355 kW	578	5,766	Use two 250 HP Filters			
For 600 HP / 450 kW	648	6,464	Use two 300 HP Filters			
For 700 HP / 525 kW	740	7,382	Use two 350 HP Filters			

Frame Size	Dimensions — in (mm)		
	H	W	D
C	23.6 (600)	11.9 (300)	5.7 (145)
D	33.1 (840)	11.9 (300)	8.7 (220)
E	32.7 (830)	13.6 (345)	15.4 (390)
F	35.4 (900)	16.0 (405)	16.1 (410)
G	42.1 (1070)	16.0 (405)	16.1 (410)
H	43.3 (1100)	20.9 (530)	16.5 (420)

AAF Advanced Active Filters

The perfect solution for:

- Restoring weak networks
- Increasing network capacity
- Increasing generator power
- Meeting compact retrofit demands
- Securing sensitive environments

Danfoss Active filters identify harmonic distortion from non-linear loads and inject counter-phased harmonic and reactive currents into the AC line to cancel out the distortion. The optimal sinusoidal waveform of the AC power is restored and the power factor of the system is reestablished at 1.

The modular design offers the same benefits as our High Power VLT® family, including high energy efficiency, user-friendly operation, back-channel cooling and high enclosure grades.

Danfoss Active Filters can compensate individual VLT® drives as a compact integrated solution or be installed as a compact, standalone solution at a common point of coupling to address several loads simultaneously.

With a step-down transformer, Danfoss Active Filters can also operate at medium voltage levels.

Contact Danfoss Application Engineering for sizing and selection assistance.



Frame		D1	E1	E2
Nominal current [A]	@ 400 V	190	310	500
	@ 690 V	140	230	365
Peak Current [A]	@ 400 V	475	775	1250
	@ 690 V	375	625	1000
Frame size — inches (mm)	Height	60.6 (1540)	78.7 (2000)	78.7 (2000) 86.6 (2200) with base
	Width	33.1 (840)	33.1 (840)	55.1 (1400)
	Depth	14.7 (373)	19.4 (494)	23.6 (600)
RMS overload [%]	120%, 60 seconds in 10 min.			

* Above 460V, derating of the active filter power for the harmonic mitigation will occur

Options and Accessories

Specifications

Line voltage	380–480 VAC, 50–60 Hz; 500–690 VAC 50–60 Hz
Enclosure rating	Chassis (IP00), NEMA Type 1 (IP21), and NEMA Type 12 (IP54)
Power range	190 A, 310 A, 500 A <i>Up to four units can be paralleled for higher power</i>
Current transformer (CT) requirements	Three standard CTs connected during installation at phases L1, L2 and L3
Operation modes	Mode 1: Harmonic mitigation Mode 2: Harmonic mitigation and power factor correction with options to program the task priorities
Harmonic mitigation performance	< 5% THD of the rated non-linear load current at the point of common coupling
Harmonics control	Individual harmonic control of 1st harmonic of the reactive current and the 2nd through at least the 25th harmonic (excluding the 3rd)
Compatibility	Compatible for field installation with existing active filters
Ambient temperature	14° F to 114° F (-10°C to 45° C), up to 1000 meters above sea level, with relative humidity of 5%–85% RH, class 3K3 (functions to be maintained up to 95% RH, non-condensing)
Power fuses	Optional
RFI filtering	Class A2 RFI required; Class A1 RFI optional
Cooling	Air-cooled, with primary cooling through back channel
Standard current transducer	Rated secondary current 1 A and 5 A
	Rated apparent power 0.5 VA
	Accuracy class 0.5 or better

Sine Wave Filters

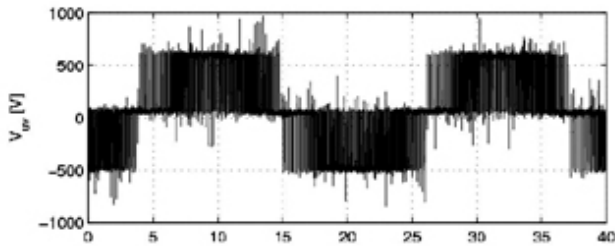
Positioned between the variable frequency drive and the motor, sine wave filters provide a sinusoidal phase-to-phase motor voltage. They reduce motor insulation stress and switching acoustic noise from the motor. Bearing currents are also reduced, especially in larger motors.

In addition to protecting the motor, sine wave filters also provide protection for the drive, because the lower pulse load is reflected in lower semiconductor losses.

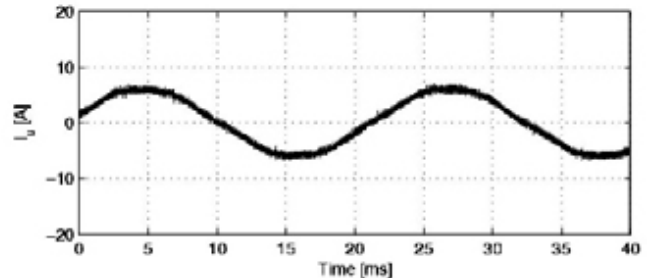
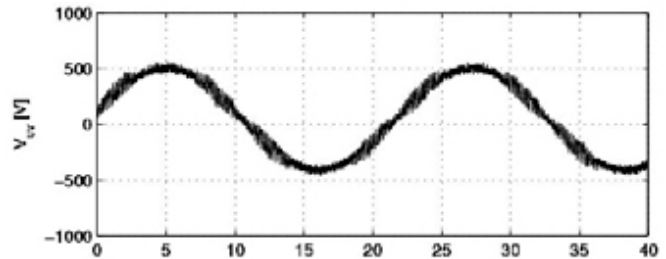
- Greater motor longevity through lower dV/dt stress
- Lower frequency-dependent losses in the motor, eddy current losses and stray flux losses
- Lower acoustic switching noise on the motor
- Reduced semiconductor losses in the drive when using longer motor cables
- Less EMI on unshielded motor cables
- Reduced voltage peaks
- Reduced electrical discharges in the motor, prolonging bearing life
- Prevent flashover in motor windings

Specifications

Voltage rating	380–500, 525–690 VAC
Nominal current I_N @ 50 Hz	2.5–1200 amp (modules can be paralleled for higher power)
Motor frequency	6–60 Hz without derating, 120 Hz with derating
Ambient temperature	-13° F to 104° F (-25° to 40°C) without derating
Min. switching frequency	f_{min} 1.5 kHz–5 kHz, depending on filter type
Max. switching frequency	f_{max} 8 kHz
Overload capacity	150% for 60 seconds every 10 minutes
Enclosure rating	Chassis (IP00) and NEMA Type 1 (IP20)
Mounting	Floor
Approvals	CE, UL508



Voltage and current without sine wave filter



Voltage and current with sine wave filter

Options and Accessories

Selection

	Current		Dimensions						Ordering Number
	@ 60Hz	@ 50Hz	Height		Width		Depth		
			inches	mm	inches	mm	inches	mm	
Chassis (IP00) Enclosures									
380-480V	171	180	15.9	402	17.8	450	20.7	524	130B2285
	247	260	20	506	17.8	450	21.2	536	130B2286
	390	410	26.6	675	18.9	480	22.1	560	130B2287
	456	480	25.6	650	23.7	600	24.9	630	130B2288
	627	660	29.3	742	24.5	620	24.7	626	130B2289
	712	750	27	684	34.7	880	26.2	664	130B2290
	836	880	35.2	893	30	760	28.4	720	130B2291
	1140	1200	36.3	920	29.2	740	26.1	661	130B2292
525-690V	42.5	45	14.9	378	12.3	310	14.6	370	130B2323
	72	76	17.4	440	14.2	360	16.2	410	130B2324
	109	115	18.9	480	17	430	17	430	130B2325
	157	165	21.4	542	18.9	480	19.3	490	130B2326
	247	260	19.5	493	21.7	550	21.3	540	130B2327
	287	303	25.3	641	21.3	540	26	660	130B2329
	408	430	25.4	643	23.3	590	26.8	680	130B2241
	503	530	31.3	794	26.8	680	24.5	620	130B2242
	627	660	31.3	794	27.2	690	22.7	576	130B2337
	726	765	35	888	35.5	900	27	684	130B2338
	893	940	36.6	928	44.9	1140	22.1	560	130B2339
	1250	1320	38.2	968	33.5	850	29.2	740	130B2340
NEMA 1 (IP20) Enclosures									
380-480V	171	180	30.8	782	37.1	940	25.6	650	130B2311
	247	260	30.8	782	37.1	940	25.6	650	130B2312
	390	410	30.8	782	37.1	940	25.6	650	130B2313
	456	480	29.3	742	41.4	1050	30	760	130B2314
	627	660	45.4	1152	50.8	1290	31.5	800	130B2315
	712	750	43.9	1115	50.8	1290	31.5	800	130B2316
	836	880	45.4	1152	50.8	1290	31.5	800	130B2317
	1140	1200	45.4	1152	50.8	1290	31.5	800	130B2318
525-690V	42.5	45	20.6	522	26.4	670	19.7	500	130B2343
	72	76	20.6	522	26.4	670	19.7	500	130B2344
	109	115	20.6	522	25.2	640	19.7	500	130B2345
	157	165	30.8	782	35.9	910	25.6	650	130B2346
	247	260	30.8	782	37.1	940	25.6	650	130B2347
	287	303	45.4	1152	50.8	1290	31.5	800	130B2348
	408	430	45.4	1152	50.8	1290	31.5	800	130B2270
	503	530	45.4	1152	50.8	1290	31.5	800	130B2271
	627	660	45.4	1152	50.8	1290	31.2	790	130B2381
	726	765	45.4	1152	50.8	1290	31.5	800	130B2382
	893	940	45.4	1152	50.8	1290	31.5	800	130B2383
	1320	1250	51.6	1310	51.3	1302	33.9	860	130B2384

dV/dt Filters

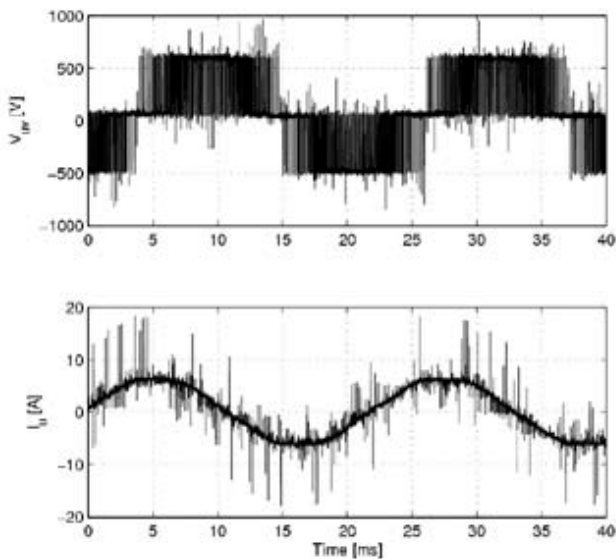
dV/dt filters provide a slower voltage rise rate on the motor terminal phase-to-phase voltage, which is particularly important when using shorter motor cables. The higher the level of inductance, the higher the voltage peaks, which can cause flashover, a condition that results in premature breakdown of the winding insulation of the connected motor.

Even in applications where motor cable length is substantial, dV/dt filters reduce the peak voltage, prolonging the life of the motor. They accomplish this by cutting off frequencies above the switching frequency. With small inductance and capacitance, dV/dt filters are a more cost-conscious solution than (but not a substitute for) sine wave filters.

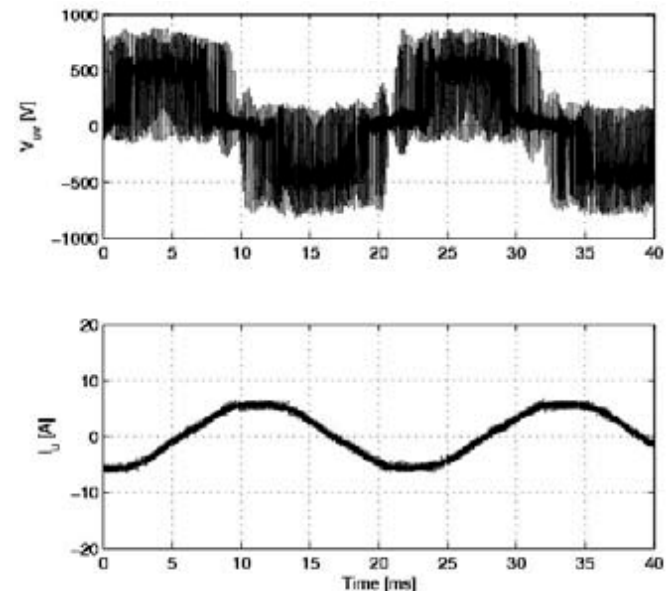
- Greater motor longevity through lower dV/dt stress
- Reduced transmission of electromagnetic interference to surrounding cables and equipment
- Trouble-free operation

Specifications

Voltage rating	3 x 380–500, 3 x 525–690 VAC
Nominal current I_N @ 50 Hz	11 – 1200 amp (modules can be paralleled for higher power)
Motor frequency	6–60 Hz without derating, 120 Hz with derating
Ambient temperature	-25° to 40°C without derating
Min. switching frequency	f_{min} 1.5 kHz–5 kHz, depending on filter type
Max. switching frequency	f_{max} 8 kHz
Overload capacity	150% for 60 seconds every 10 minutes
Enclosure rating	Chassis (IP00) and NEMA Type 1 (IP20)
Mounting	Floor except where noted as wall mounted
Approvals	CE, UL508



Voltage and current without dV/dt filter



Voltage and current with dV/dt filter

Options and Accessories

Selection

	Current		Dimensions						Ordering Number*
	@ 60Hz	@ 50Hz	Height		Width		Depth		
			inches	mm	inches	mm	inches	mm	
Chassis (IP00) Enclosures									
380-480V	173	182	10.7	270	9.7	245	13.8	350	130B2389
	266	280	11.8	298	9.5	240	15.8	400	130B2390
	380	400	15.4	390	8.9	226	18.2	460	130B2391
	475	500	16.2	410	9.7	246	16.6	420	130B2275
	712	750	17	430	11.9	300	19.3	490	130B2276
	864	910	17.4	440	11.9	300	19.3	490	130B2393
	1425	1500	30.4	770	15.4	390	19.3	490	130B2394
	2185	2300	30.5	774	15.4	390	19.3	490	130B2395
525-690V	26	28	10.3	260	4.8	120	10.3	260	130B2414*
	42	45	10.3	260	6.7	170	10.3	260	130B2415*
	71	75	10.3	260	6.7	170	10.3	260	130B2416*
	109	115	10.3	260	6.7	170	10.3	260	130B2417*
	157	165	12.2	308	10.5	265	16.2	410	130B2418
	247	260	15.8	400	10.5	265	15	380	130B2419
	294	310	15.8	400	10.5	265	14.6	370	130B2420
	408	430	17.3	437	10.5	265	16.6	420	130B2235
	503	530	21	533	10.6	268	16.8	425	130B2236
	598	630	17.2	436	10.5	265	16.4	415	130B2280
	726	765	28.9	734	17.6	446	20.5	520	130B2421
	1282	1350	29.6	750	18	455	19.9	503	130B2422
NEMA 1 (IP20) Enclosures									
380-480V	173	182	18.3	463	24.1	610	17.4	440	130B2400
	266	280	18.3	463	24.1	610	17.4	440	130B2401
	380	400	22.5	571	30.4	770	21.7	550	130B2402
	475	500	11.9	300	26.4	670	19.3	490	130B2277
	712	750	23.8	602	30.4	770	21.7	550	130B2278
	864	910	23.8	602	30.4	770	21.7	550	130B2405
	1425	1500	33.8	856	45.3	1150	33.9	860	130B2407
	2185	2300	33.8	856	45.3	1150	33.9	860	130B2410
525-690V	42	45	11.3	285	6.7	170	10.3	260	130B2424*
	71	75	11.3	285	6.7	170	10.3	260	130B2425*
	109	115	11.3	285	6.7	170	10.3	260	130B2426*
	157	165	20.6	522	26.4	670	19.7	500	130B2427
	247	260	20.6	522	25.2	640	19.7	500	130B2428
	294	310	20.6	522	26.4	670	19.7	500	130B2429
	408	430	20.6	522	26.4	670	19.7	500	130B2238
	503	530	23.8	602	30.4	770	21.7	550	130B2239
	598	630	20.6	522	26.4	670	19.7	500	130B2274
	726	765	33.8	856	45.3	1150	33.9	860	130B2430
	1282	1350	33.8	856	45.3	1150	33.9	860	130B2431

*Wall mounted. All other units are floor mounted.

Other Accessories

MCF 101 NEMA 1/IP21 Option/Accessory Kit

Used for installations in dry environments. The NEMA 1/IP21 kit is available as factory-installed option or as a field-installed accessory.

- Available for frame sizes A2 and A3 (0.33–10 HP)
- Can be used with or without mounted option modules
- IP21 on top side
- PG 16 and PG 21 holes for glands



MCF 104 Profibus Adaptor Sub-D9 Connector

Uses a Phoenix type connector to connect to the Profibus Fieldbus Option (MCA 101) and provides a Sub D plug-in connection in place of screw type termination.



Part Number	130B1112
-------------	----------

	Option Order Code*	Accessory Part Number
MCF 101 NEMA 1/IP21 Kit		
For A2 Enclosure	E21	130B1122
For A3 Enclosure	E21	130B1123

* Factory installed at time of drive purchase. See order configuration code on page 141.

Options and Accessories

Decoupling Plate for Fieldbus Cables

Makes fieldbus mounting robust.



Part Number	130B0524
--------------------	----------

Brake Resistors

Brake resistor(s) must be used in conjunction with the dynamic brake to dissipate the heat/power regenerated by the motor during deceleration or overhauling load. Braking energy is only absorbed into the brake resistor. Brake resistors must be ordered separately and field installed by the customer. Contact Danfoss application engineering if brake resistors are required for your application.



Options and Accessories

PC Software

MCT 10 (Motion Control Tools)

Offering advanced programming functionality for all Danfoss drive products, MCT 10 greatly reduces programming and commissioning times.

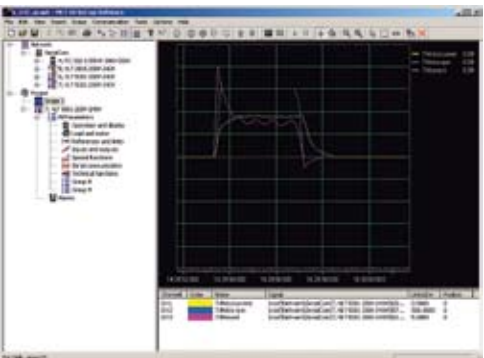
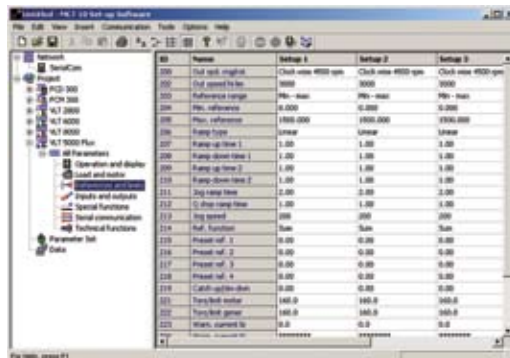
Drives are managed in a standard folder-based user interface that's familiar and easy to understand. Parameter settings for each drive are contained in a single file, simplifying setup and the duplication of parameter sets between drives.



MCT-10 Basic version is available free of charge from the Danfoss web site. The Advanced edition, which offers a higher level of functionality, is available from your Danfoss sales partner.

- SyncPos programming
- On-line and off-line commissioning
- On-board help files for each drive parameter
- Logging of alarms and warnings for improved system performance and documentation
- MCT-10 Conversion Wizards simplify drive conversion projects
- Real-time data collection using the MCT-10 Scope function
- Access to the VLT® AQUA Drive's internal data buffer, providing up to four channels of high speed (down to 1 millisecond) data collection
- Simplified programming of the VLT® AQUA Drive's Smart Logic Controller using graphical programming tools
- Drive upgrade tools

MCT 10 allows setting of parameters in an easy-to-navigate interface (right) and provides graphical data collection and programming tools (far right).



MCT 31 (Harmonics Calculation Tool)

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

- Project oriented for simplified calculations on several transformers
- Easy to compare different harmonic solutions within the same project
- Supports current Danfoss product line as well as legacy drive models

Custom Configured Drive Ordering Information

There are literally thousands of ways to configure a VLT® AQUA Drive. (Below is a partial listing of just some of the selection choices that are available for the VLT AQUA Drive.) Choosing between options, you configure a unique drive order type code to describe your custom configured drive. Once the order and typecode are received by Danfoss, an eight-digit number is assigned to the your configuration. Future orders for the same drive configuration can be made using the eight digit number. This eight-digit number can be viewed on any VLT AQUA Drive by displaying parameter 15-46 on the LCP or with MCT 10 software.

Performance Level

202 Enhanced performance AQUA Drive

Power Size

- 1/3 – 1200 HP

AC Line Voltage

T2 3Ø 200/240 VAC
T4 3Ø 380/480 VAC
T6 3Ø 525/600 VAC
T7 3Ø 525/690 VAC

Enclosure

- Chassis/IP00
- Protected chassis/IP20
- NEMA 1/IP21
- NEMA 12/IP54
- NEMA 12/IP55
- IP66

RFI Filter

- Integral 2A filter
- Integral 1A and 1B filter
- Maritime-use RFI filter
- RCD
- IRM
- Namur terminals

Drive Selection Made Easy

Option availability and ordering information varies greatly between different power sizes, line voltages, and enclosure frame sizes. To make the selection of a drive to your exact application requirements fast, easy and accurate, use our on-line configurator at:

<https://drivewebsales.danfoss.com>

– choose "Online Configurator".

If you have any questions about the on-line configurator or for assistance with sizing a drive for your application, please feel free to contact our application engineers.

LCP

G Graphic LCP
N Numeric LCP
X Blank faceplate

Other Features

- Conformal coating on all PCBs
- Mains disconnect
- Fuses
- Loadsharing
- 30 A, fuse-protected power terminals
- 2.5 – 16 A manual motor starters
- 5 A, 24 V power supply
- External temperature monitoring
- Fieldbus options including Profibus, DeviceNet, LonWorks, Profibus Conveter, Ethernet IP
- Application options for PTC thermistor, general purpose I/O, relay expansion, safety PLC interface
- Advanced Cascade Controller option for controlling multiple pumps in a master/follower configuration

MCD 200 Series Soft Starters



AC motors often cause one or more serious problems during startup acceleration. MCD 200 Series electronic soft starters control motor current to provide a smooth start. When is the MCD 200 the correct fit for your application? Anytime one or more of the following apply:

- High starting current, often causing an unacceptable load on the AC line
- Shock load on gear and other transmission elements, causing unnecessary wear on mechanical parts
- Fast acceleration and deceleration, causing unstable process conditions (e.g., in conveyors)
- Utility regulations prohibit line-starting of motors

The Danfoss MCD 201 and 202 soft starters are the optimum solution to all these problems for AC motors ranging from 10-200 HP.

Unlike traditional solutions, the MCD 200 soft starters offers a wide range of benefits for motor and equipment operation as a whole, including:

- Flexible control of starting current and torque
- Smooth control of current and voltage without any steps or transients
- Frequent start/stop operation without mechanical damage
- Flexibility to changes in the start conditions, increasing flexibility in the application
- Soft stop control for extending the motor deceleration time

Easy-to-Use Interface

The built-in potentiometers allow setting of parameters for simplified setup and easy operation. The dedicated remote operator kit accessory provides remote access to parameters, LED display, and monitoring of motor current.

Working Principle

Motor voltage is controlled by means of a phase cut principle. Two thyristors in each phase perform the power switching, enabling the starter to handle high starting torque and frequent starts/stops. Current transformers measure the motor current, providing feedback for constant current control of motor starting and also for numerous motor and application protection functions.

MCD 201 and MCD 202 soft starters share a common power and mechanical design, but offer different levels of functionality. MCD 201 soft starters provide TVR (Timed Voltage Ramp) starting and stopping control and are designed for use with an external motor protection device. MCD 202 soft starters provide Current Limit starting control, TVR soft stop and include a range of motor protection functions.

MCD 200 Series soft starters include an integral bypass function that bypasses the soft starter SCRs during run. This minimizes heat dissipation during run and makes the MCD 200 suitable for installation within non-ventilated enclosures without the need for an external bypass contactor.

Common Functionality and Features

- 200 – 440 or 200 – 575 VAC 50/60 Hz supply voltage
- 10 – 150 HP @ 480 VAC; 15 – 200 HP @ 575 VAC
- Internal SCR bypass contactors allow installation within motor control enclosures with no need for extra ventilation of external bypass contactors
- Cover larger HP motors
- IP20 (up to 100 amps); IP00 (above 100 amps)
- Smaller than most comparable soft starters
- Equal functionality to market leaders, but with superior communication options
- Easy DIN rail mount for sizes up to 40 HP
- 2-wire or 3-wire start/stop control; programmable via 3 rotary switches
- Reset push button
- Ready and run (on, off or flashing) LED status indicators

Options:

- Modbus module for serial communication
- Remote operator kit
- MCD PC software can be used for networks of up to 99 soft starters (each soft starter connected to the network requires a Modbus module or a remote operator kit)

Features

	MCD 201	MCD 202
Concept	<ul style="list-style-type: none"> Physically compact starter providing basic soft start and stop functionality 	<ul style="list-style-type: none"> Physically similar to MCD 201, but provides enhanced soft start and motor protection functionality in addition to all the most common soft start and soft stop features
Start/stop Adjustments	3 adjustments: <ul style="list-style-type: none"> Timed voltage ramp-up Adjustable initial torque Timed voltage ramp-down 	8 adjustments: <ul style="list-style-type: none"> Current limit (250 – 450%) Current ramp-up (2 – 25 seconds) plus initial current (150 – 250%) Ramp down (1 – 20 seconds) Motor FLC (50 – 100%) Motor trip class (10, 15, 20) Maximum start time (0 – 20 seconds) Phase rotation protection Auxiliary relay function (trip, run)
Protection		<ul style="list-style-type: none"> Motor overload (adjustable trip class) Excess start time Reverse phase rotation Motor thermistor input Shorted SCR – no start Supply fault – no start
Outputs	1 output relay: <ul style="list-style-type: none"> Line contactor control 	2 output relays: <ul style="list-style-type: none"> Line contactor control Run contactor or trip function
Optional Remote Operator	<ul style="list-style-type: none"> Pushbutton control Starter status LED Trip code display 	<ul style="list-style-type: none"> Pushbutton control Starter status LED Trip code display Motor current Motor current display Motor temperature display
Optional Network Functionality	<ul style="list-style-type: none"> Operational control Status monitoring 	<ul style="list-style-type: none"> Operational control Status monitoring Performance monitoring

MCD 200 Series Soft Starters

Line Supply (L1, L2, L3):

MCD 200-xxx-T4-xxx.. 3 x 200 VAC ~ 440 VAC (+10% / - 15%)
MCD 200-xxx-T6-xxx. 3 x 200 VAC ~ 575 VAC (+10% / - 15%)
Supply frequency (at start) 45 Hz - 66 Hz

Control Supply (A1, A2, A3):

MCD 200-xxx-xx-CV1.....24 VAC/VDC ($\pm 20\%$)
MCD 200- xxx-xx-CV3 110 – 240 VAC (+10% / - 15%) or
.....380 – 440 VAC (+10% / - 15%)

Control Inputs:

Start Terminal N1Normally Open, 300 VAC max.
Stop Terminal N..... Normally Closed, 300 VAC max.

Relay Outputs:

Main Contactor
Terminals 13 & 14Normally Open
6 A, 30 VDC resistive / 2 A, 400 VAC, AC11
Programmable Relay
Terminals 23 & 24 Normally Open
6 A, 30 VDC resistive / 2 A, 400 VAC, AC11

Environmental:

Degree of protection
MCD 200-007 to MCD 200-055IP20
MCD 200-075 to MCD 200-110IP00
Operating Temperatures 14° F – 140° F (-10° C – +60° C)
Humidity..... 5% to 95% Relative Humidity
Pollution Degree..... Pollution Degree 3
VibrationIEC 60068 Test Fc Sinusoidal
4 Hz – 13.2 Hz: ± 0.04 in (± 1 mm) displacement
13.2 Hz – 100 Hz: ± 0.0015 lb (± 0.7 g)

EMC Emission:

Equipment class (EMC)..... Class A
Conducted radio
frequency emission0.15 MHz – 0.5 MHz: <90 dB (μ V)
0.5 MHz – 5 MHz: <76 dB (μ V)
5 MHz – 30 MHz: 80 – 60 dB (μ V)
Radiated radio
frequency emission 30 MHz – 230 MHz: <30 dB (μ V/m)
230 MHz – 1000 MHz: <37 dB (μ V/m)

This product has been designed for Class A equipment. Use of the product in domestic environments may cause radio interference, in which case the user may be required to employ additional mitigation methods.

EMC Immunity:

Electrostatic discharge4 kV contact discharge, 8 kV air discharge
Radio frequency
electromagnetic field.....0.15 MHz – 1000 MHz: 140 dB (μ V)
Rated impulse withstand voltage
(Fast transients 5/50 ns) 2 kV line to ground
Rated insulation voltage
(Surges 1.2/50 μ s - 8/20 ms) 2 kV line to ground,
1 kV line to line
Voltage dip and
short time interruption 100 ms (at 40% nominal voltage)

Short Circuit:

Rated short circuit current
MCD 200-007 to MCD 200-037.....5 kA
MCD 200-045 to MCD 200-110..... 10 kA

Heat Dissipation:

During Start..... 10 Btu/hr / ampere (3 watts / ampere)
During Run..... <13.7 Btu/hr (4 watts)

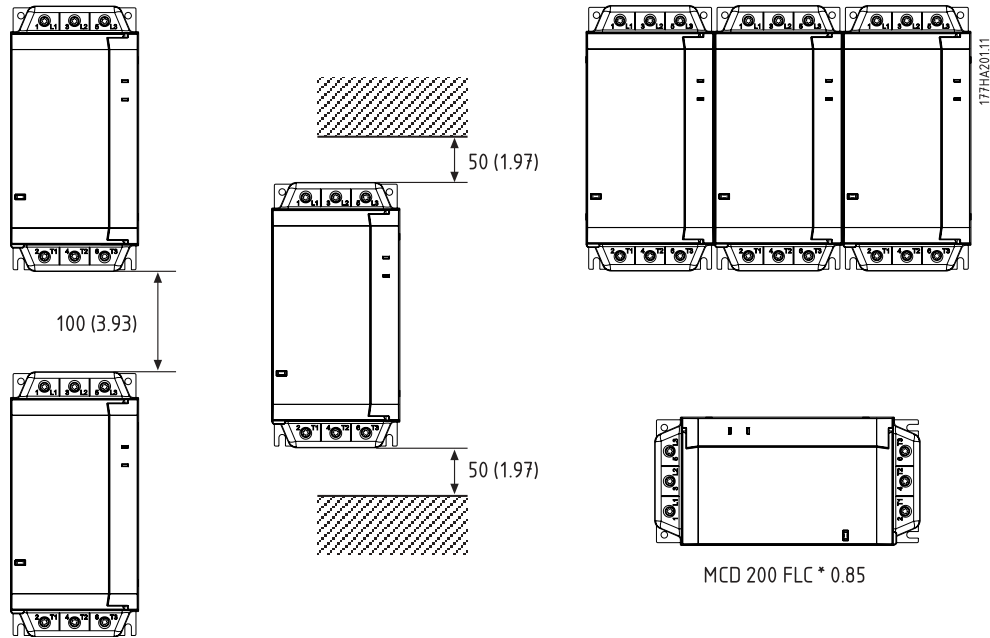
Standards Approvals:

CIEC 60947-4-2
UL / C-UL.....UL508
CEIEC 60947-4-2
CCCGB 14048.6

General Specifications

Mechanical Installation

mm (in)



MCD 201/202	Din Rail	Foot Mounting
MCD 20x-007 ~ MCD 200-030	1.18 in. (30 mm)	Yes
MCD 20x-037 ~ MCD 200-110	Not available	Yes

Cable Size

	mm ² (AWG)				mm ² (AWG)	
	MCD 200-007 ~ MCD 200-030	MCD 200-037 ~ MCD 200-055	MCD 200-075 ~ MCD 200-110	MCD 200-007 ~ MCD 200-110	MCD 200-007 ~ MCD 200-110	
	10 - 35 (8 - 2)	25 - 50 (4 - 1/0)	N.A.	0.14 - 1.5 (26 - 16)		
	10 - 35 (8 - 2)	25 - 50 (4 - 1/0)	N.A.	0.14 - 1.5 (26 - 16)		
	Torx (T20) 3 - 5 Nm. 2.2 - 3.7 ft-lb.	Torx (T20) 4 - 6 Nm. 2.9 - 4.4 ft-lb.	N.A.	N.A.		
	7 mm 3 - 5 Nm 2.2 - 3.7 ft-lb	7 mm 4 - 6 Nm 2.9 - 4.4 ft-lb	N.A.	3.5 mm 0.5 Nm max. 4.4 lb-in max.		

177HA245.11

Ventilation

The MCD 201/202 Soft Starter includes an integral bypass function that bypasses the soft starter's SCRs during run.

This minimizes heat dissipation during run and makes the MCD 200 suitable for installations within non-ventilated enclosures, with no need for an external bypass contactor.

MCD 200 Series Soft Starters

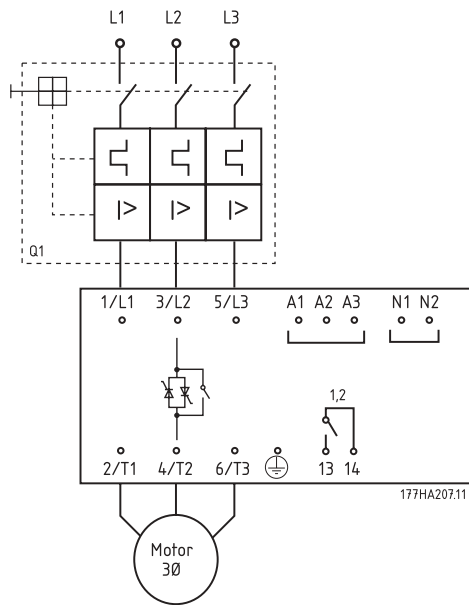
MCD 201 Wiring Schematics

Range

MCD 201 soft starters provide TVR (Timed Voltage Ramp) starting and stopping control and are designed for use with an external motor protection device.

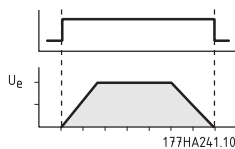
Example 1

MCD 201 installed with motor protection circuit breaker



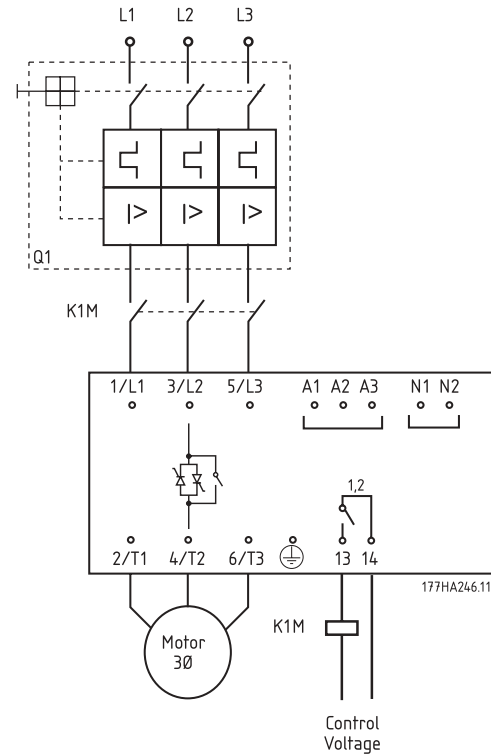
1 6 A @ 30 VDC resistive / 2 A 400 VAC AC11

2 Main Contactor



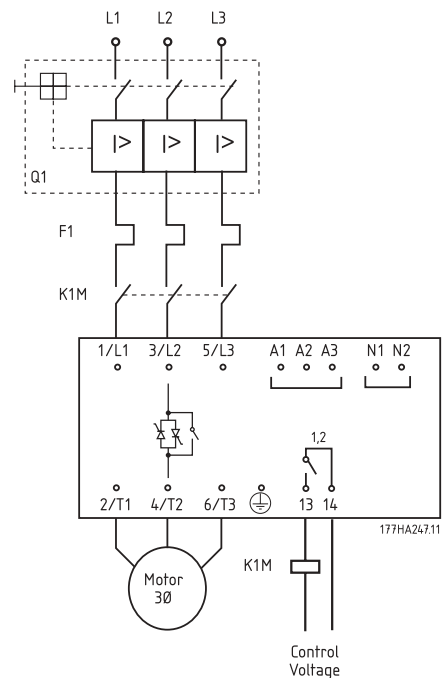
Example 2

MCD 201 installed with motor protection circuit breaker and line contactor



Example 3

MCD 201 installed with circuit breaker, overload and line contactor



General Specifications

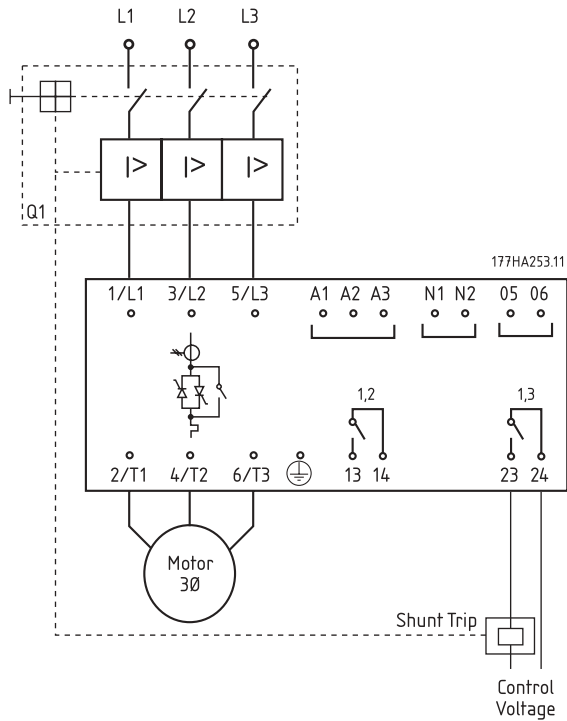
MCD 202 Wiring Schematics

Range

MCD 202 soft starters provide current limiting control and TVR (Timed Voltage Ramp) soft stop, and include a range of motor protection features.

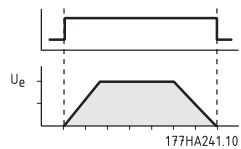
Example 1

MCD 202 installed with system protection circuit breaker complete with shunt trip device



¹ 6 A @ 30 VDC resistive / 2 A 400 VAC AC11

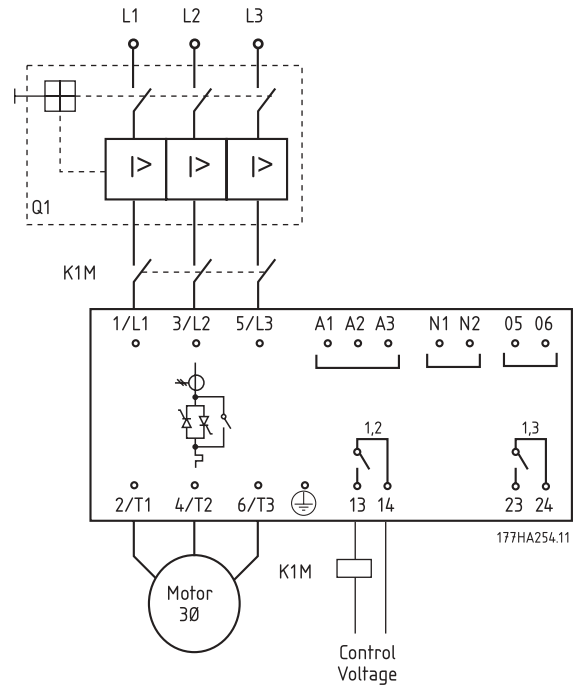
² Main Contactor



³ Auxiliary Relay Function = Trip (see parameter 8)

Example 2

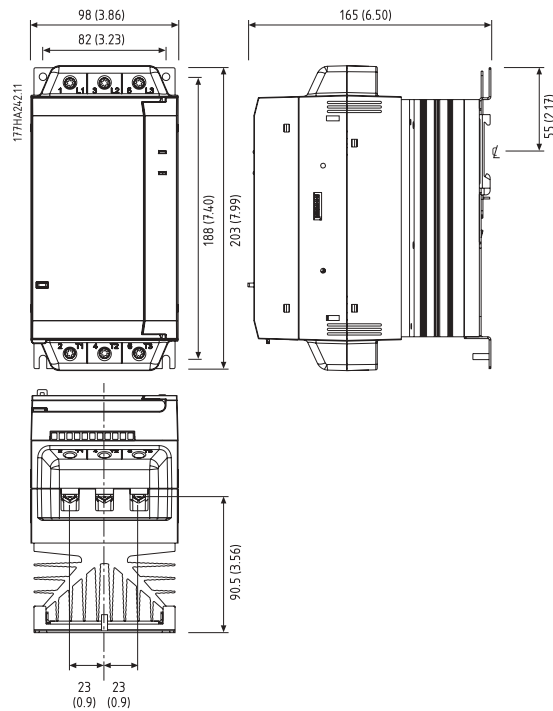
MCD 202 installed with system protection circuit breaker and line contactor



MCD 200 Series Soft Starters

MCD 201-007 ~ MCD 201-030
4.8 lb (2.2 kg)

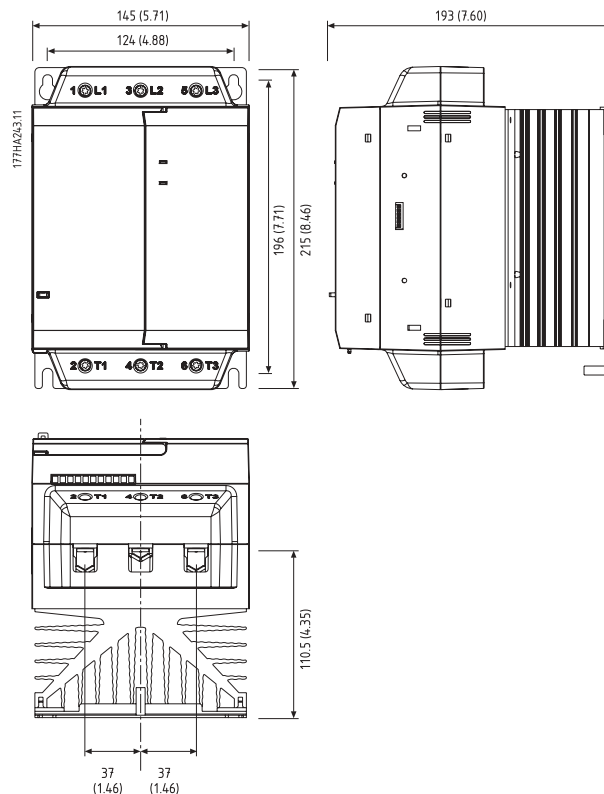
MCD 202-007 ~ MCD 202-030
5.3 lb (2.4 kg)



mm (in)

MCD 201-037 ~ MCD 201-055
8.8 lb (4.0 kg)

MCD 202-037 ~ MCD 202-055
9.5 lb (4.3 kg)



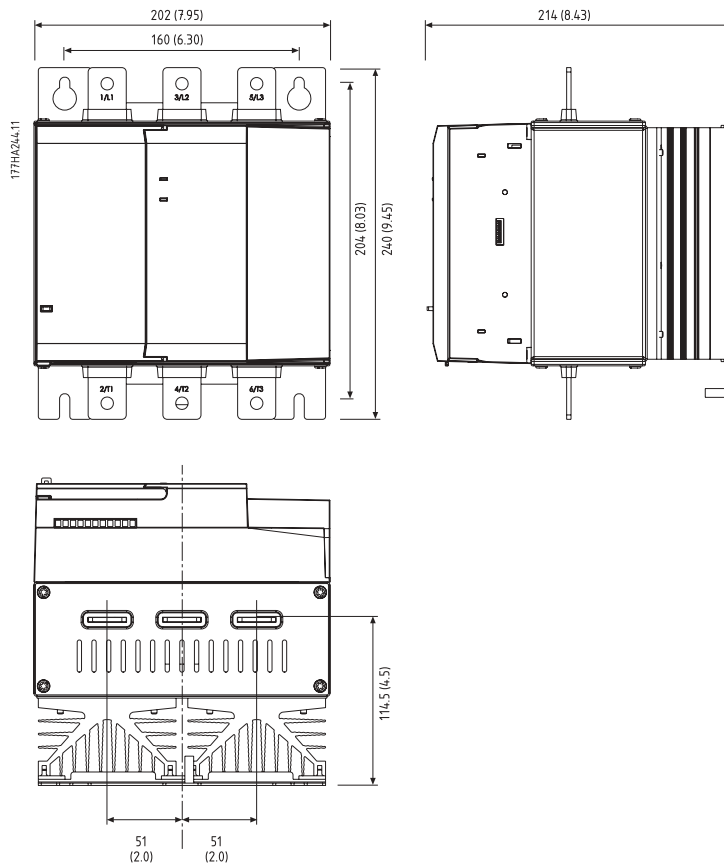
mm (in)

Dimensions

MCD 201-075 ~ MCD 201-110
13.5 lb (6.1 kg)

mm (in)

MCD 202-075 ~ MCD 202-110
15.0 lb (6.8 kg)



MCD 200 Series Soft Starters Options



Serial Communication

The RS485 serial link can be used to control operation when the starter is in either local or remote mode.

MCD 201 and MCD 202 come with optional plug-in modules for serial communication.

Description	Part Number
AS-i	175G9003
DeviceNet	175G9002
Modbus RTU	175G9000
Profibus	175G9001

Remote Operation

Remote operation of MCD Soft Starters is facilitated by the dedicated remote operator kit. The operator (IP54/NEMA12) is mounted on the cabinet front and allows remote control, status indication and motor monitoring of an individual MCD Soft Starter using RS485 serial communication. It incorporates the following features:

	MCD 201	MCD 202
Start/stop/quick stop, reset	•	•
LED for start, run, trip	•	•
Trip codes	•	•
Current display		•
Motor temp. display		•
4 – 20 mA output		•

Description	Part Number
Remote Keypad	175G9004

MCD 200 Series Ordering Information

MCD 201/202 (T4) 200 – 440 VAC

Model Size	Encl.	HP Rating @ Designated VAC and Normal Current					Order Number			
					Current Rating*		MCD 201		MCD 202	
		208	230	440	Normal	Heavy	T4-CV1	T4-CV3	T4-CV1	T4-CV3
MCD 20x-007	IP20	5	5	10	18	17	175G5176	175G5165	175G5220	175G5209
MCD 20x-015	IP20	10	10	25	34	30	175G5177	175G5166	175G5221	175G5210
MCD 20x-018	IP20	—	—	30	42	36	175G5178	175G5167	175G5222	175G5211
MCD 20x-022	IP20	15	15	—	48	40	175G5179	175G5168	175G5223	175G5212
MCD 20x-030	IP20	20	20	40	60	49	175G5180	175G5169	175G5224	175G5213
MCD 20x-037	IP20	25	25	50	75	65	175G5181	175G5170	175G5225	175G5214
MCD 20x-045	IP20	—	30	60	85	73	175G5182	175G5171	175G5226	175G5215
MCD 20x-055	IP20	30	40	75	100	96	175G5183	175G5172	175G5227	175G5216
MCD 20x-075	IP00	40	50	100	140	120	175G5184	175G5173	175G5228	175G5217
MCD 20x-090	IP00	60	60	125	170	142	175G5185	175G5174	175G5229	175G5218
MCD 20x-110	IP00	—	75	150	200	165	175G5186	175G5175	175G5230	175G5219

MCD 201/202 (T6) 200 – 575 VAC

Model Size	Encl.	HP Rating @ Designated VAC and Normal Current				Current Rating*		Order Number			
								MCD 201		MCD 202	
		208	230	480	575	Normal	Heavy	T6-CV1	T6-CV3	T6-CV1	T6-CV3
MCD 20x-007	IP20	5	5	10	15	18	17	175G5198	175G5187	175G5242	175G5231
MCD 20x-015	IP20	7 ^{1/2} /10	7 ^{1/2} /10	25	30	34	30	175G5199	175G5188	175G5243	175G5232
MCD 20x-018	IP20	—	—	30	40	42	36	175G5200	175G5189	175G5244	175G5233
MCD 20x-022	IP20	15	15	—	40	48	40	175G5201	175G5190	175G5245	175G5234
MCD 20x-030	IP20	20	20	40	50	60	49	175G5202	175G5191	175G5246	175G5235
MCD 20x-037	IP20	25	25	50	60	75	65	175G5203	175G5192	175G5247	175G5236
MCD 20x-045	IP20	—	30	60	75	85	73	175G5204	175G5193	175G5248	175G5237
MCD 20x-055	IP20	30	40	75	100	100	96	175G5205	175G5194	175G5249	175G5238
MCD 20x-075	IP00	40/50	50	100	125	140	120	175G5206	175G5195	175G5250	175G5239
MCD 20x-090	IP00	60	60	125	150	170	142	175G5207	175G5196	175G5251	175G5240
MCD 20x-110	IP00	—	75	150	200	200	165	175G5208	175G5197	175G5252	175G5241

* Normal duty rating is 104° F (40° C) ambient, 3000 ft, 6 seconds ramp time, 400%
Heavy duty rating is 104° F (40° C) ambient, 3000 ft, 20 seconds ramp time, 400%

MCD 3000 Series Soft Starters

AC motors often cause one or more serious problems during startup acceleration. MCD 3000 Series electronic soft starters control motor current to provide a smooth start. When is the MCD 3000 the correct fit for your application? Anytime one or more of the following apply:

- High starting current, often causing an unacceptable load on the AC line
- Shock load on gear and other transmission elements, causing unnecessary wear on mechanical parts
- Fast acceleration and deceleration, causing unstable process conditions (e.g., in conveyors)
- Utility regulations prohibit line-starting of motors

The Danfoss MCD 3000 soft starter is the optimum solution to all these problems for AC motors ranging from 10 – 1,000 HP.

Unlike traditional solutions, the MCD 3000 soft starter offers a wide range of benefits for motor and equipment operation as a whole, including:

- Flexible control of starting current and torque
- Smooth control of current and voltage without any steps or transients
- Frequent start/stop operation without mechanical damage
- Flexibility to changes in the start conditions, increasing flexibility in the application
- Soft stop control for extending the motor deceleration time
- Braking control to reduce motor deceleration time



Programmable Features

- Three programmable relay outputs allow external indications of a run command, presence of a fault, or a broken belt (low current warning)
- An auto restart time delay can be set
- Phase imbalance sensitivity can be set to eliminate nuisance faults
- Password protection locks the parameters from unauthorized changes

Principle of Operation

Motor voltage is controlled by means of a phase cut principle. Two thyristors in each phase perform the power switching, enabling the starter to handle high starting torque and frequent starts/stops. Current transformers measure the motor current, providing feedback for constant current control of motor starting and also for numerous motor and application protection functions.

Features

MCD 3000 is Fully Electronic and Fully Controllable

The smooth, electronic, current-controlled starts provided by the MCD 3000 eliminate undesired torque pulsations and power line current transients. The MCD 3000 provides smooth, controlled acceleration to a degree not possible with wye/delta, auto transformer, or partial winding motor starters.

The MCD 3000 uses three-phase, closed loop current control to constantly monitor current. Current transducers continuously measure the current supplied to the motor. A rugged, full-wave, fully-controlled SCR bridge directly controls current to all three phases of the motor.

The fully interchangeable control card uses the current information from the transducers to construct the ideal switching algorithms to control the SCRs at all times, precisely maintaining the desired current, controlling acceleration, and minimizing motor heating.

The user sets the desired acceleration current. The soft starter smoothly accelerates the load to full speed. Current draw is minimized and stress on the motor and driven equipment is reduced.

The MCD 3000 provides a wide range of control and protection features, including:

- Overload protection for the motor
- Overload protection for the soft starter
- Adjustable calculated motor thermal protection
- Provision for a motor thermistor
- Overtemperature protection for the soft starter
- Phase imbalance protection
- Phase loss protection
- Phase rotation protection
- Undervoltage protection
- Selectable automatic or manual fault reset
- Line frequency monitoring to detect unstable operation of emergency power generators
- A fault log for troubleshooting

Cabling

- AC line, motor and bypass connectors: Bar type with thread for fastening bolts for cable shoes
- Control cable connections: Terminal block for 0.14 m²~1.5 m²/26~16 AWG
- Control card supply connection: Terminal block for 2.5~4 mm²/14~12 AWG
- The bottom plates are removable and include a drilling template for cable entries

Short Circuit Protection

For proper protection, semiconductor fuses must be installed in front of the starter.

Control Inputs

- Start/stop: Can be configured for either two-wire or pulse (three-wire) start/stop commands
- Reset
- Parameter set: For selection between two unique motor parameter sets

Signal Outputs

Three relay outputs (programmable) for control of:

- Line, Bypass and DC brake contactors
- Run, Trip, Output on, and High/low current indication

Bypass

If the soft starter is mounted in a cabinet without ventilation, a bypass contactor should be applied to prevent heat dissipation during operation. The starter has built-in bars for connection of a bypass contactor. This allows the MCD 3000 Soft Starter to measure motor current and retain all motor protection functions even when the bypass contactor is closed.

MCD 3000 Series Soft Starters

Mains supply (L1, L2, L3):

Supply voltage MCD 3000 – T5 3 x 200 VAC – 525 VAC
 Supply frequency
 At start) 50 Hz (± 2 Hz) / 60 Hz (± 2 Hz)
 During start) >45Hz (50 Hz supply) or >55 Hz (60Hz supply)
 During run) >48Hz (50 Hz supply) or >58 Hz (60Hz supply)
 Electronics control voltage 230 VAC (+ 10%/-15%) or
 400 VAC (+10%/-15%)

Control Inputs:

Start (Terminals 15 & 16) Normally Open, Active 24 VDC,
 8mA approx.
 Stop (Terminals 17 & 18) Normally Closed, Active 24 VDC,
 8mA approx.
 Reset (Terminals 25 & 26) ... Normally Closed, Active 24 VDC,
 8mA approx.
 Parameter Set (Terminals 27 & 28) Normally Open, Active 24
 VDC, 8mA approx.

Relay Outputs:

Programmable Output A⁽¹⁾
 (Terminals 13 & 14) Normally Open,
 5 A @ 250 VAC/360 VA,
 5 A @ 30 VDC resistive
 Programmable Output B⁽²⁾
 (Terminals 21, 22 & 24) Changeover,
 5 A @ 250 VAC/360 VA,
 5 A @ 30 VDC resistive
 Output C⁽³⁾ (Terminals 33 & 34) Changeover,
 5 A @ 250 VAC/360 VA,
 5 A @ 30 VDC resistive

- (1) Programmable functions: Line contactor, Run
 (2) Programmable functions: Tripped, output on, High current flag,
 Low current flag, Line contactor
 (3) Programmable functions: Run, D.C.Brake Contactor Control, Off

Standards Approvals:

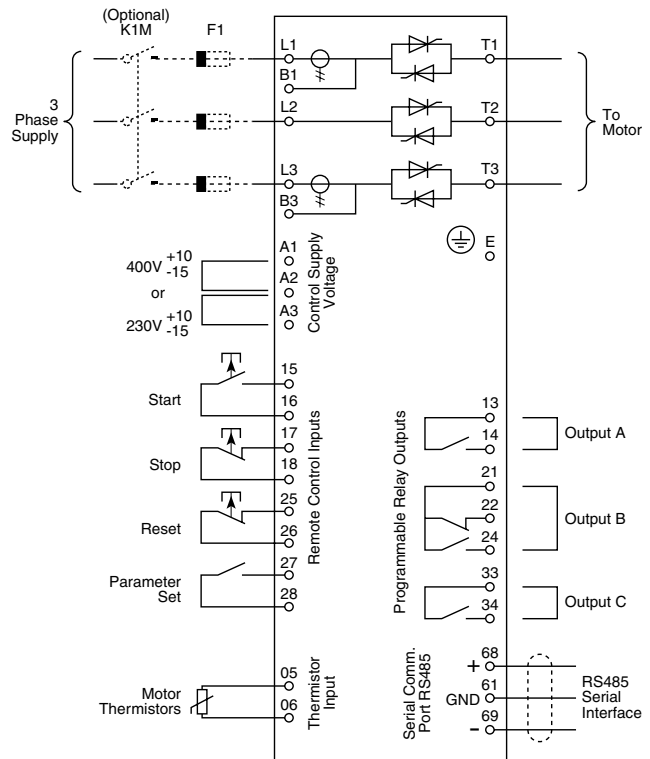
C \checkmark CISPR-11
 UL UL508
 CSA CSA 22.2 No. 14
 CE IEC 60947-4-2

Environmental:

Degree of protection
 MCD 3007 to MCD 3132 IP21
 MCD 3185 to MCD 3800 IP20
 Rated short-circuit current
 (with semi-conductor fuses) 100kA
 Rated insulation voltage
 (Surges) 2 kV line to earth, 1 kV line to line
 Rated impulse withstand
 voltage (Fast transients) 2 kV
 Pollution Degree Pollution Degree 3
 Electro static discharge 4 kV contact discharge,
 8 kV air discharge
 Equipment class (EMC) Class A
 Radio-frequency
 electromagnetic field* 0.15 MHz – 80 MHz;
 140dB μ V; 80 MHz – 1 GHz; 10 V/m

**This product has been designed for Class A equipment. Use of the product in domestic environments may cause radio interference, in which case the user may be required to employ additional mitigation methods.*

Wiring Schematic



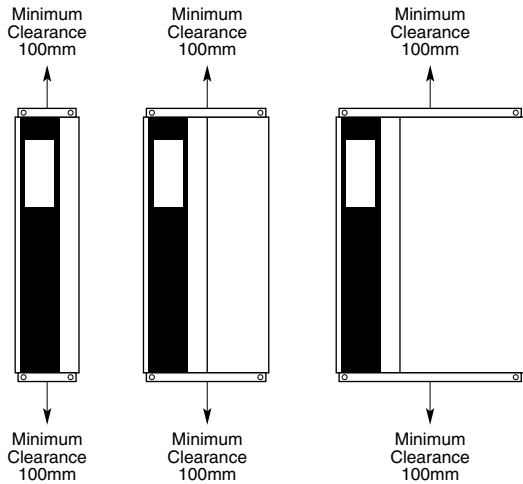
Legend

F1 Semiconducter Fuses (customer supplied)
 K1M | Line Contactor (optional)

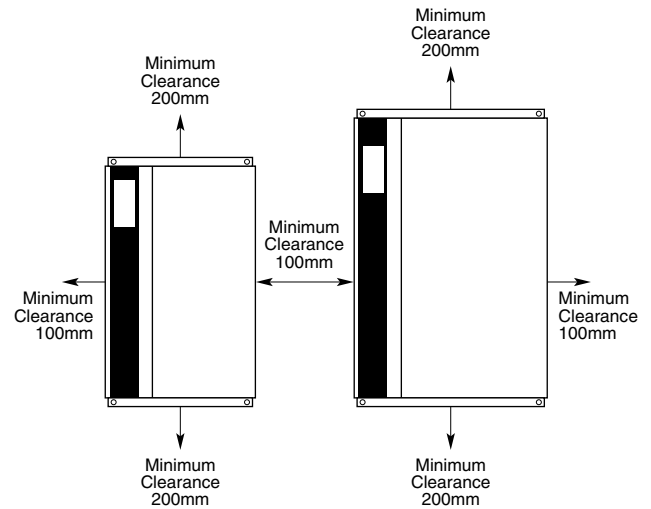
General Specifications

Mechanical Installation

Models MCD 3007 – 3132 have a NEMA 1 (IP21) rating and can be wall mounted or installed inside another enclosure. These models can be mounted side by side with no clearance.



Models MCD 3185 – 3800 have an IP20 rating and must be mounted in another enclosure. These models must have a clearance of 100mm on either side.



Ventilation

MCD 3000 cooling is by means of air circulation. Consequently, the air needs to be able to move freely above and below the soft starter.

Soft starters dissipate approximately 4.5 watts per amp. When installing a soft starter in a control panel or other enclosure, ensure there is sufficient airflow through the enclosure to limit heat rise in the enclosure.

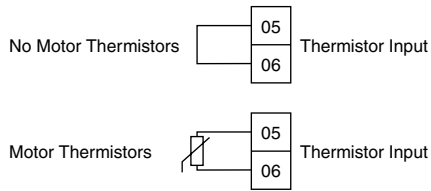
MCD 3000 Series Soft Starters

MCD 3000 Control Wiring Examples

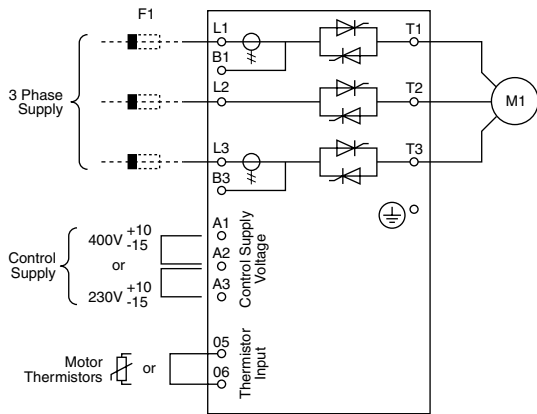
Motor Thermistors

If the motor is fitted with thermistors, these may be connected directly to the MCD 3000. A trip will occur if the thermistor circuit resistance is above approximately 2.8 kΩ.

If thermistors are not connected to the MCD 3000, there must be a link across the thermistor input terminals.

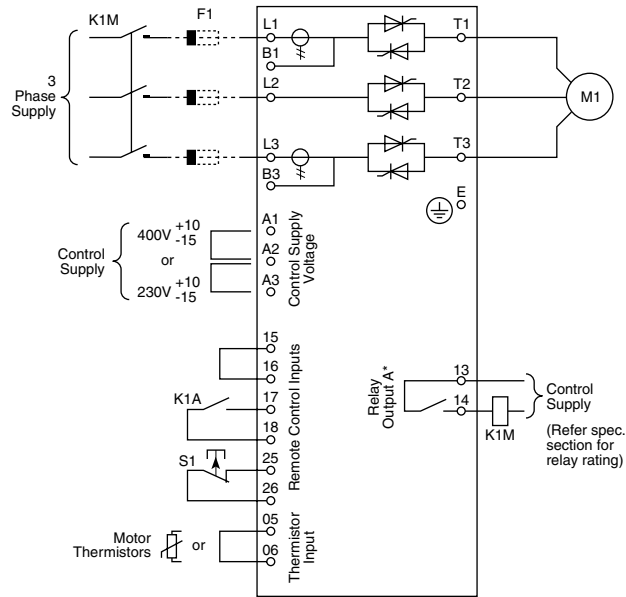


Example 1. A basic installation where motor operation is controlled using the MCD 3000 Local Control Panel. The MCD 3000 must be in local mode to function with this circuit.



Legend
F1 | Semiconductor Fuses (customer supplied)

Example 2. MCD 3000 installed with a line contactor and operated via a remote two-wire start circuit with reset pushbutton. The MCD 3000 must be in remote mode to function with this circuit. Relay Output A must be programmed for the Line contactor function.

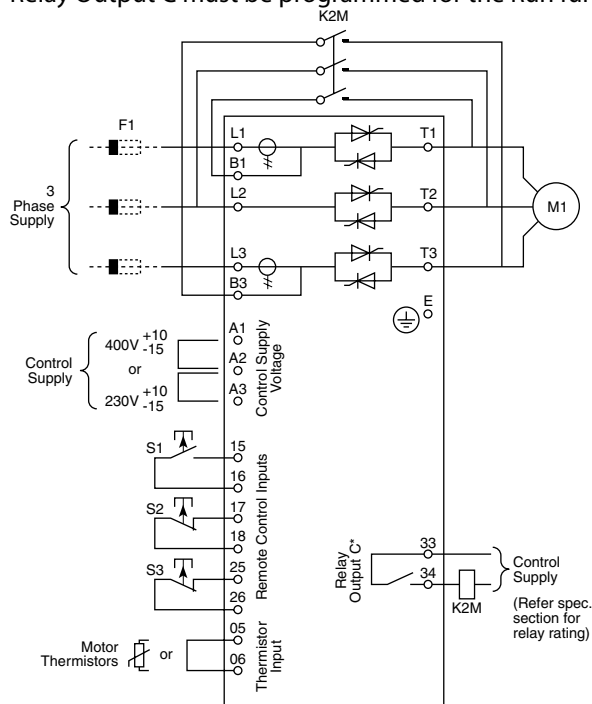


* Par. 36 = O (Line Contactor)

Legend
F1 | Semiconductor Fuses (customer supplied)
K1A | Start/Stop Control Relay
K1M | Line Contactor
S1 | Reset Pushbutton

General Specifications

Example 3. MCD 3000 installed with a bypass contactor and controlled via a remote pushbutton circuit. The MCD 3000 must be in remote mode to function with this circuit. Relay Output C must be programmed for the Run function.

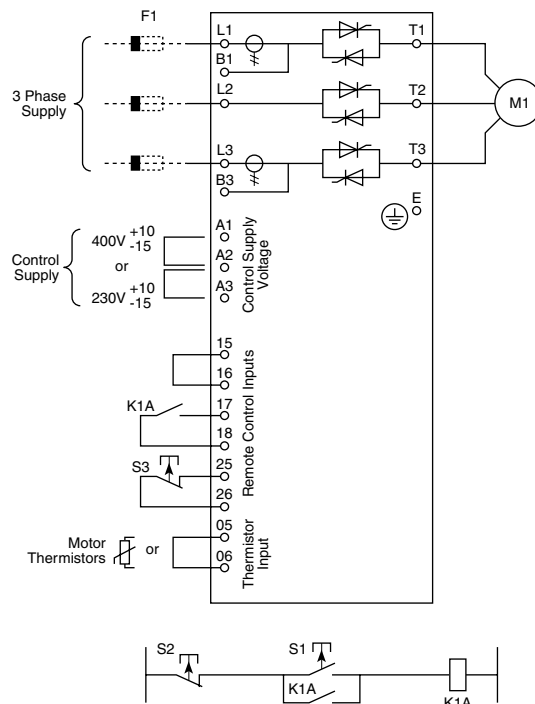


* Par. 38 = O (Run)

Legend

F1	Semiconductor Fuses (customer supplied)
K2M	Bypass Contactor
S1	Start Pushbutton
S2	Stop Pushbutton
S3	Reset Pushbutton

Example 4. MCD 3000 controlled by remote 3-wire pushbutton circuit. The MCD 3000 must be in remote mode to function with this circuit.



Legend

F1	Semiconductor Fuses (customer supplied)
K1A	Start/Stop Control Relay
S1	Start Pushbutton
S2	Stop Pushbutton
S3	Reset Pushbutton

MCD 3000 Series Soft Starters

Dimensions

NEMA 1 (IP21)

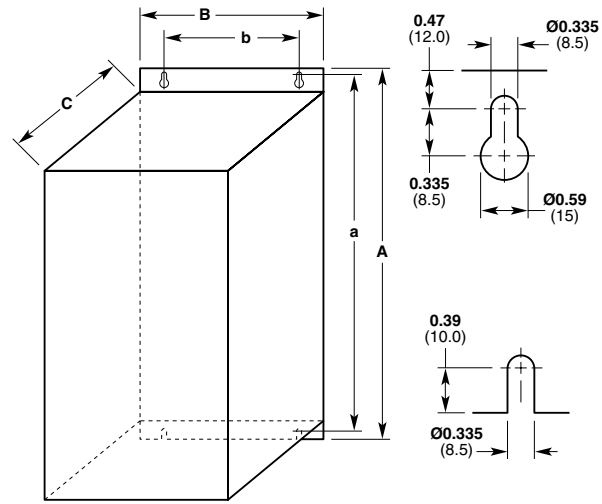
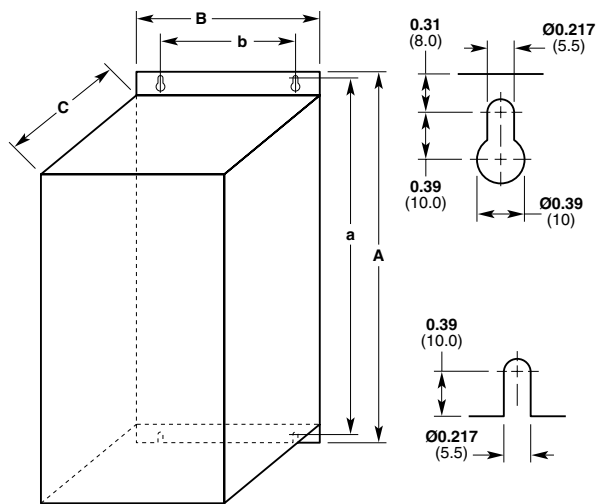
MCD 3007 – MCD 3132

in (mm)

Chassis (IP20)

MCD 3185 – MCD 3800

in (mm)



NEMA 1 (IP21)

MCD Model	A	B	C	a	b	Weight lbs (kg)
3007 – 3022	20.87 (530)	5.20 (132)	10.63 (270)	20.16 (512)	3.54 (90)	25 (11)
3030 – 3055	20.87 (530)	5.20 (132)	10.63 (270)	20.16 (512)	3.54 (90)	26 (11.5)
3075 – 3110	20.87 (530)	10.40 (264)	10.63 (270)	20.16 (512)	8.74 (222)	43 (19.5)
3132	20.87 (530)	15.60 (396)	10.63 (270)	20.16 (512)	13.94 (354)	60 (27)

Chassis (IP20)

MCD Model	A	B	C	a	b	Weight lbs (kg)
3185 – 3500	33.46 (850)	16.93 (430)	11.02 (280)	32.59 (828)	14.57 (370)	109 (49.5)
3600 – 3800	39.37 (1000)	22.05 (560)	12.40 (315)	38.49 (978)	19.69 (500)	232 (105)

Selection and Accessories

MCD 3000 Soft Starter Selection

Motor horsepower ratings are given for reference only. Soft starters must always be sized for the full load current rating of the connected load.

Nominal current ratings given are the continuous full load current that the soft starter can deliver.

The typical starter current ratings are based on:

- Maximum 104° F (40° C) operating temperature
- Maximum 3000 feet elevation
- Maximum of 10 starts per hour
- Minimum 50% on load duty cycle

Example of starts per hour and on load duty cycle:

The starter starts 10 times an hour or once every 6 minutes. During that 6 minutes the starter runs at least 3 or more of those minutes, or at least 50% of the cycle time.

Many applications will not require as high of a cycle rate. If the cycle rate were greater or the on load duty cycle shorter, the starter may have to be oversized to handle the application.

The list at right shows the typical multipliers assigned to the full load current requirements of various applications. Based on experience, the required start current ratings are given. For high inertia or heavy load applications, consult the factory for sizing assistance. Consult the Operating Instructions manual for more application information.

The soft starter decreases the starting current by reducing, but controlling, the starting voltage. In doing so, the starting torque available from the motor is also reduced. Typical starting torque reductions are approximately the square of the current reduction obtained from soft start control.

Application	Typical Start Current
General and Water	
Agitator	4.0 X FLA
Centrifugal Pump	3.5 X FLA
Conveyor	4.0 X FLA
Fan w/Damper Control	3.5 X FLA
Fan w/o Damper Control	4.5 X FLA
Positive Displacement Pump	4.0 X FLA
Metals and Mining	
Hammer Mill	4.5 X FLA
Roller Mill	4.5 X FLA
Grinder	3.0 X FLA
Food Processing	
Bottle Washer	3.0 X FLA
Centrifuge	4.0 X FLA
Palletizer	4.5 X FLA
Petrochemical	
Ball Mill	4.5 X FLA
Extruder	5.0 X FLA
Screw Conveyor	4.0 X FLA
Transport and Machine Tool	
Ball Mill	4.5 X FLA
Press	3.5 X FLA
Rotary Table	4.0 X FLA
Lumber and Wood	
Bandsaw	4.5 X FLA
Chipper	4.5 X FLA
Planer	3.5 X FLA
Sander	4.0 X FLA

Accessories

Description	Model Number	Voltage	Ordering Number
Remote Keypad			175G3061
Control Voltage Transformer	MCD 3007 – 3055	110 – 460 VAC	175G5084
(Allows the use of other control voltages for the MCD 3000)		24 – 110 VAC	175G5087
	MCD 3075 – 3800	110 – 460 VAC	175G5144
		24 – 110 VAC	175G5146

MCD 3000 Series Ordering Information

MCD Soft Starter Selection Guide and Ordering Information

When ordering, use the ordering number that corresponds to the appropriate MCD 3000 model number.

Automatic detection and calibration for supply voltage and frequency eliminates the need for special models. MCD 3000 soft starters are available with two maximum voltage ratings:

- 200 VAC – 525 VAC
- 200 VAC – 690 VAC

The power circuit uses reverse parallel connected thyristors to provide full wave control on all three phases. The MCD 3000 can be used with or, if local regulations permit, without a line contactor.

Overload Conditions:

Starting Current–30 sec. start, 10 starts/hr.; 50% duty cycle

Enclosure

- B21 Bookstyle NEMA 1 (IP21)
- C20 Compact Protected Chassis (IP20)
- C21 Compact NEMA 1 (IP21)

Control Voltage

- CV2 110/230 VAC
- CV4 230/400 VAC

Power Size	Overload Conditions			Enclosure			Ordering Number			
	Continuous Amps ⁽¹⁾						200 – 525 VAC		200 – 690 VAC ⁽²⁾	
	3x	3.5x	4x	B21	C20	C21	CV2	CV4	CV2	CV4
MCD 3007	20	18	16	•			175G5000	175G5002	175G5001	175G5003
MCD 3015	34	32	29	•			175G5004	175G5006	175G5005	175G5007
MCD 3018	39	38	34	•			175G5008	175G5010	175G5009	175G5011
MCD 3022	47	46	42	•			175G5012	175G5014	175G5013	175G5015
MCD 3030	67	60	54	•			175G5016	175G5018	175G5017	175G5019
MCD 3037	86	77	69	•			175G5020	175G5022	175G5021	175G5023
MCD 3045	92	84	75	•			175G5024	175G5026	175G5025	175G5027
MCD 3055	121	111	99	•			175G5028	175G5030	175G5029	175G5031
MCD 3075	138	123	110			•	175G5032	175G5034	175G5033	175G5035
MCD 3090	196	177	158			•	175G5036	175G5038	175G5037	175G5039
MCD 3110	231	210	187			•	175G5040	175G5042	175G5041	175G5043
MCD 3132	247	221	197			•	175G5044	175G5046	175G5045	175G5047
MCD 3185	363	323	287		•		175G5048	175G5050	175G5049	175G5051
MCD 3220	430	382	339		•		175G5052	175G5054	175G5053	175G5055
MCD 3300	545	487	433		•		175G5056	175G5058	175G5057	175G5059
MCD 3315	630	564	502		•		175G5060	175G5062	175G5061	175G5063
MCD 3400	775	701	623		•		175G5064	175G5066	175G5065	175G5067
MCD 3500	897	816	727		•		175G5068	175G5070	175G5069	175G5071
MCD 3600	1,153	1,074	958		•		175G5072	175G5074	175G5073	175G5075
MCD 3700 ⁽³⁾	1,403	1,327	1,186		•		175G5076	175G5078	175G5077	175G5079
MCD 3800 ⁽³⁾	1,564	1,498	1,339		•		175G5080	175G5082	175G5081	175G5083

⁽¹⁾ Current ratings are listed for starters without an external bypass circuit. Consult the factory for other current ratings for different starting currents, starting times, starts per hour, and duty cycles.

⁽²⁾ UL Listed up to 600 VAC

⁽³⁾ Not UL/cUL Listed



DrivePro™

Professional Drive Support



The best drives deserve the best protection

Danfoss has been producing drives and supporting customers longer than any other VFD manufacturer in the world. VLT® Drives produced by Danfoss are known for reliable, dependable performance. To ensure ongoing customer satisfaction, Danfoss has developed the Danfoss DrivePro™ Extended Warranty program.

DrivePro Service Plans

DrivePro Service Plans provide a complete service solution, freeing customers' time and resources to focus on their core business activities, resulting in increased efficiency and improved return on investment. Customers are ensured the highest system reliability with comprehensive professional drive support with DrivePro Service Plans. DrivePro provides a fixed cost solution against unforeseen risks, and the quickest response in the event of a malfunction.

Service Delivery

DrivePro service provides all the advantages of professional service management and delivery without the hassles. Managing today's rapidly changing technology is a tremendous challenge. A Danfoss Service Manager takes responsibility for overseeing the many complexities involved in the complete service delivery process. Our nationwide support network and the DrivePro escalation process ensures rapid involvement of specialized experts when needed.

Call Center

DrivePro customers can take full advantage of the Danfoss call center. One toll free call provides direct access to our technical support center, 8:00 to 5:00 CST with emergency support available 24 hours per day, 365 days a year. Service Managers for each area ensure quick and reliable resolution for on-site service support to maximize system integrity for DrivePro customers.

DrivePro Service Plans provide "no-risk" service solutions to everyday concerns of equipment maintenance. DrivePro's unparalleled partnership of drive professionals ensures affordable high quality service for a growing mix of equipment. DrivePro offerings are designed to put customers in control of unexpected expenditures and their maintenance budget.

DrivePro-SU Start-Up ensures customer's maximum utilization and efficiency from their drive system.

DrivePro- Extended Warranty purchased with the drive provides the industry's longest coverage, up to six years

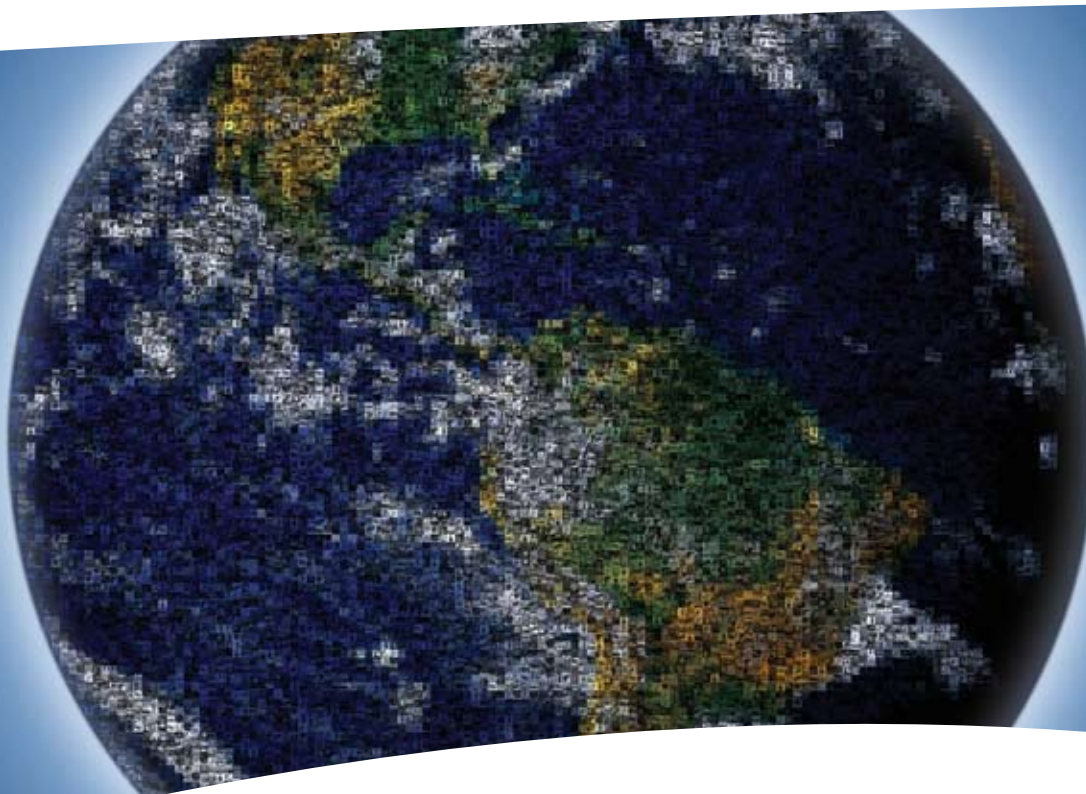
DrivePro-SC Service Contract ensure long-term service coverage beyond the warranty period.

DrivePro-SW Service Warranty provides fixed price, service support security to keep drive equipment running.

DrivePro™ Plus drive replacement contracts provide a quick, turn-key solution for replacing aging drives that are no longer economical to repair. DrivePro™ Plus packages streamline the upgrade process with minimal change to the existing installation and re-use existing bypass options and enclosures where possible to minimize the costs of replacement.

DrivePro™ SmartStep provides a comprehensive and affordable migration program for customers with large numbers of legacy model or multiple brand drives. This program combines the benefits of the latest technology Danfoss drives with professional installation, startup and support for a fixed annual fee. SmartStep is a very flexible and sensible way to upgrade drive systems on a budget.

DrivePro-PM Preventive Maintenance is structured specifically to make certain that customers receive recommended preventive maintenance inspections.



EnVisioneering

As a world leader in components and solutions, Danfoss meets our customers' challenges through "EnVisioneering." This approach expresses our views on engineering innovation, energy efficiency, environmental responsibility and sustainable business growth that create strong customer partnerships. This vision is realized through a global production, sales, and service network focused on refrigeration, air conditioning, heating and water, and motion control. Through EnVisioneering, Danfoss is Making Modern Living Possible.

Danfoss "EnVisioneering":

- Engineered solutions to improve performance and profitability
- Energy efficiency to meet higher standards and to lower operating costs
- Environmental sustainability to provide a financial and social payback
- Engaged partnerships to foster trust, reliability, and technological superiority

www.danfossdrives.com

Danfoss can accept no responsibility for possible errors in catalogs, brochures and other printed material. Danfoss reserves the right to alter its products without notice. This also applies to products already on order provided that such alterations can be made without subsequent changes being necessary in specifications already agreed. All trademarks in this material are property of the respective companies. Danfoss and the Danfoss logotype are trademarks of Danfoss A/S. All rights reserved.

Danfoss Drives

8800 W. Bradley Road
Milwaukee, WI 53224 USA
Phone: 1.800.621.8806
1.414.355.8800
Fax: 1.414.355.6117

For Orders & Customer Service:
Phone: 1.800.432.6367
Fax: 1.815.639.8802