VACON® 100X
VACON® 100
AC DRIVES

MARINE INSTALLATION GUIDE

VACON®

PREFACE

Document ID: DPD01773A

Date: 25.1.2016

ABOUT THIS MANUAL

This manual is copyright of Vacon Ltd. All Rights Reserved. The manual is subject to change without prior notice.

ABOUT THE PRODUCT

This manual describes the Vacon 100, Vacon 100 FLOW, and Vacon 100 X drives in a marine environment, that is, in the marine and offshore industry. You can find all the other product-related data in the Installation Manual of your Vacon 100 product.

The marine option gives the drive a better vibration resistance. For enclosed drives, there is a handle on the cabinet door to hold on to, and a hook to keep the cabinet door open. The enclosed drives also have a cabinet heater as default.

The Vacon 100 and Vacon 100 FLOW are available in enclosure sizes MR4-MR12, and their enclosure class with the marine option is always IP54. The Vacon 100 X is available in enclosure sizes MM4-MM6, and its enclosure class is always IP66. The drives can be used in controlled electrical spaces in the special power distribution zone, the general power distribution zone, and the passenger accommodation zone.

The product fulfills the most common marine certificates.

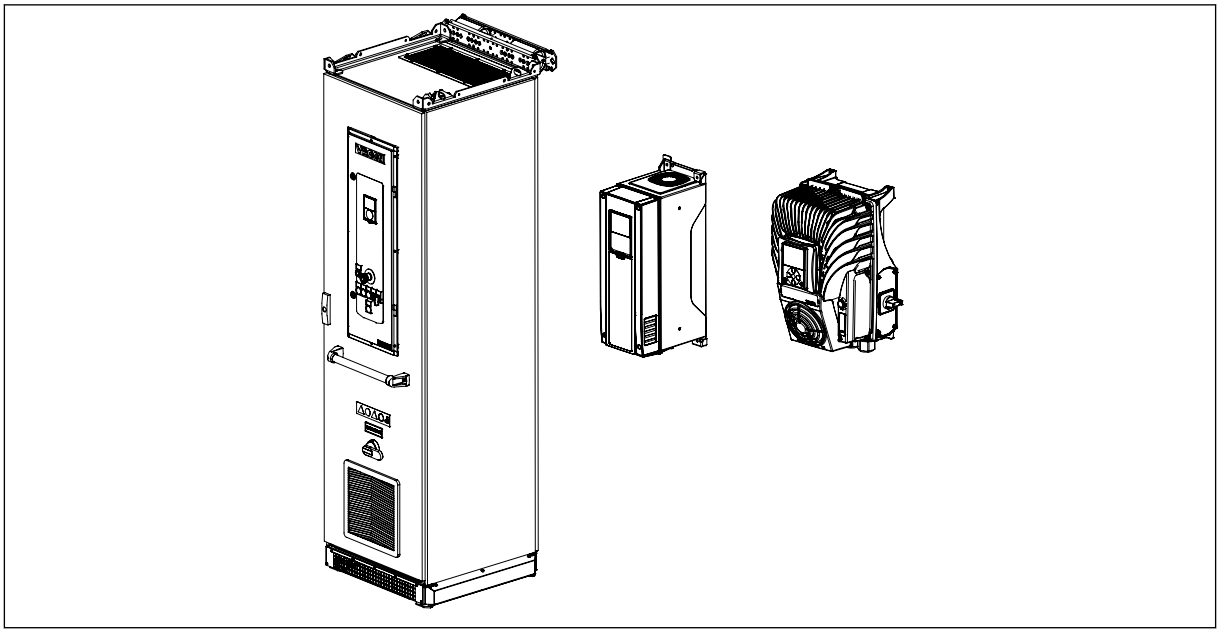


Fig. 1: A Vacon 100 enclosed drive, wall-mounted drive and a Vacon 100 X drive with the marine option

TEL. +358 (0)201 2121 · FAX +358 (0)201 212 205

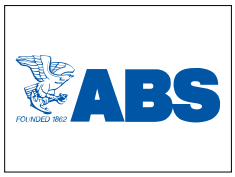
TABLE OF CONTENTS

Preface
About this manual ... 3
About the product ... 3
1 Approvals ... **6**
2 Safety ... **7**
2.1 The safety symbols used in the manual ... 7
3 Receiving the delivery ... **8**
3.1 Contents of the delivery ... 8
3.2 Removing the packaging and lifting the AC drive ... 8
3.2.1 Weight of the AC drive ... 8
3.2.2 Lifting the AC drive ... 9
4 Mounting ... **10**
4.1 Dimensions of the AC drive with the marine option ... 10
4.1.1 Dimensions of the wall-mounted drives ... 10
4.1.2 Dimensions of the enclosed drives ... 15
4.2 Installation requirements ... 20
4.2.1 The maximum vibration ... 21
4.2.2 Installation safety in a marine environment ... 21
4.3 EMC requirements ... 21
4.3.1 Installing a drive in an IT network ... 22
4.3.2 Installing a drive in a grounded network: maximum 500 V, enclosure sizes MM4-MM6 and MR4-MR9, not the enclosed drives ... 22
4.3.3 Installing a drive in a grounded network: 525-690 V, enclosure sizes MR10-MR12, and the enclosed drives ... 23
4.4 Installation procedure ... 24
4.4.1 Installation of wall-mounted drives in a marine environment ... 24
4.4.2 Installation of enclosed drives in a marine environment ... 25
5 Commissioning and additional instructions ... **28**
5.1 Maintenance ... 28

1 APPROVALS

These classification societies have granted a marine type approval for this Vacon product. You can find the general approvals in the Installation Manual of your Vacon 100 product.

- ABS (the American Bureau of Shipping)
- BV (Bureau Veritas)
- DNV GL (Det Norske Veritas - Germanischer Lloyd)
- LR (Lloyd's Register)
- RINA (RINA SERVICES S.p.A.)











TEL. +358 (0)201 2121 · FAX +358 (0)201 212 205

2 SAFETY

2.1 THE SAFETY SYMBOLS USED IN THE MANUAL

This manual contains warnings and cautions, which are identified with safety symbols. The warnings and cautions give important information on how to prevent injury and damage to the equipment or your system.

Read the warnings and cautions carefully and obey their instructions.

Table 1: The safety symbols

The safety symbol	Description
	WARNING!
	CAUTION!
	HOT SURFACE!

See the complete list of warnings in the Installation Manual of your Vacon 100 product.

NOTE! You can download the English and French product manuals with applicable safety, warning and caution information from http://drives.danfoss.com/knowledge-center/technical-documentation/.
REMARQUE Vous pouvez télécharger les versions anglaise et française des manuels produit contenant l'ensemble des informations de sécurité, avertissements et mises en garde applicables sur le site http://drives.danfoss.com/knowledge-center/technical-documentation/.

3 RECEIVING THE DELIVERY

3.1 CONTENTS OF THE DELIVERY

The contents of the delivery

- The AC drive and the options that you ordered
- An accessories bag
- The parts for the marine option
- Safety Instructions, and the manuals for the options that you ordered
- Installation Manual and Application Manual if you ordered them, or Quick Guide
- The Marine Installation Guide

3.2 REMOVING THE PACKAGING AND LIFTING THE AC DRIVE

3.2.1 WEIGHT OF THE AC DRIVE

Table 2: The weights of the wall-mounted drives with the marine option

Enclosure size	Weight [kg]	Weight [lb.]
Wall-mounted drive, MR4	6.1	13.4
Wall-mounted drive, MR5	10.1	22.3
Wall-mounted drive, MR6	20.1	44.3
Wall-mounted drive, MR7	37.6	82.9
Wall-mounted drive, MR8	76.2	168.0
Wall-mounted drive, MR9	134.6	296.7

Table 3: The weights of the enclosed drives with the marine option

Enclosure size	Weight [kg]	Weight [lb.]	Weight with the common mode and du/dt filters [kg]	Weight with the common mode and du/dt filters [lb.]
Enclosed drive, MR8	224	494	254	560
Enclosed drive, MR9	296	653	336	741
Enclosed drive, MR10	446	983	486	1071
Enclosed drive, MR12	2 x 446	2 x 983	2 x 486	2 x 1071

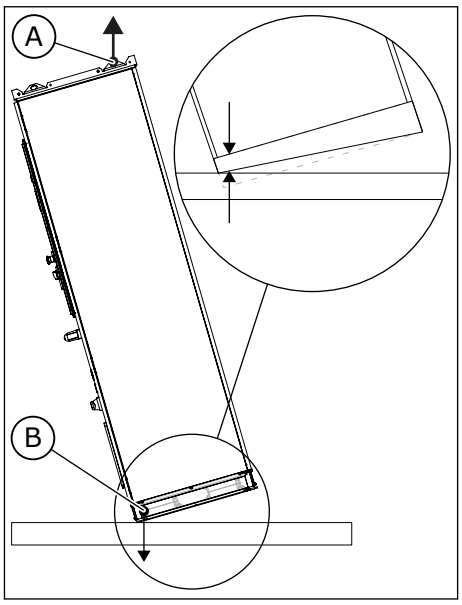
TEL. +358 (0)201 2121 · FAX +358 (0)201 212 205

3.2.2 LIFTING THE AC DRIVE

LIFTING THE ENCLOSED DRIVE

1 When you lift the enclosed drive to an upright position, be careful not to damage the springs at the bottom of the drive.

- When the drive tilts, the springs are squeezed. To prevent damage to the springs, do not keep the drive tilted for an unnecessary long time.
- When the springs are squeezed, they can bounce suddenly and cause damage to the equipment.



A. The lifting hole
B. The springs at the bottom

WARNING!

Be careful when you lift the enclosed drive to an upright position. If the springs are squeezed for too long, they can become damaged. Also, the springs can bounce suddenly and cause injury to the personnel and/or damage to the equipment.

4 MOUNTING

4.1 DIMENSIONS OF THE AC DRIVE WITH THE MARINE OPTION

Other dimensions can be found in the Installation Manual of your Vacon 100 product.

For the dimensions of the Vacon 100 X product, see its Installation Manual.

4.1.1 DIMENSIONS OF THE WALL-MOUNTED DRIVES

4.1.1.1 Dimensions of the wall-mounted drive with the marine option, MR4

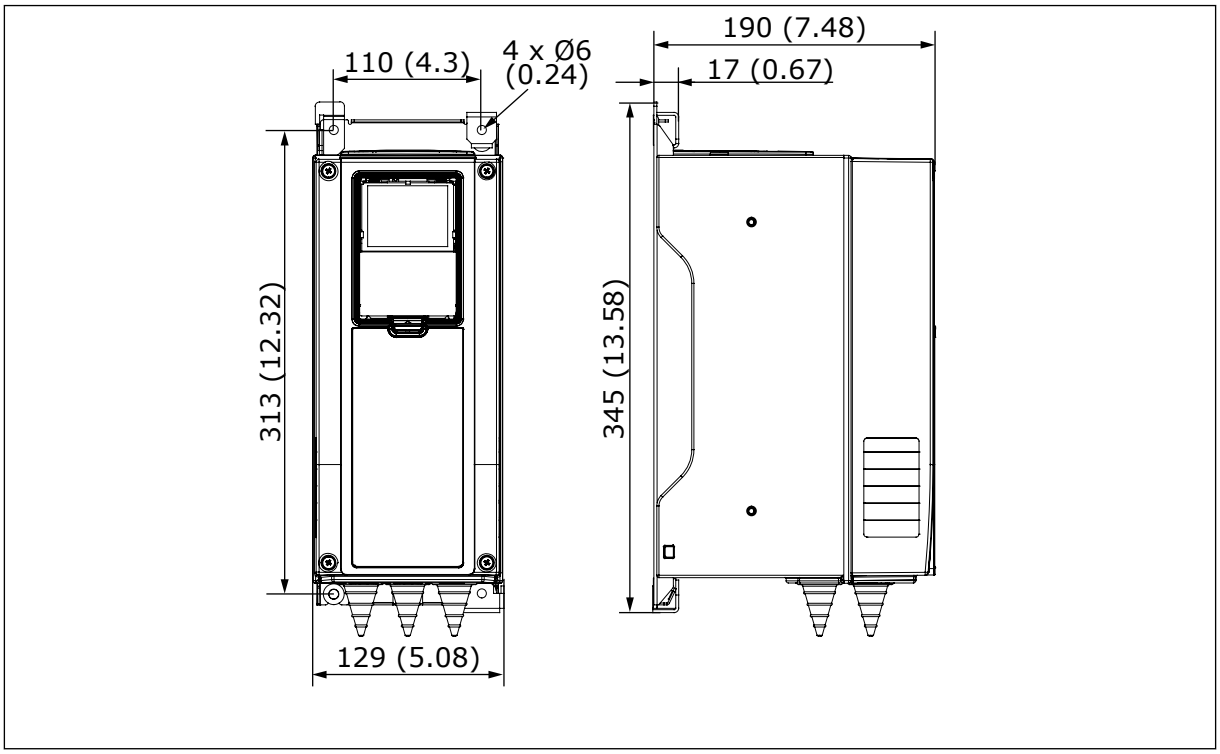


Fig. 2: Dimensions of the wall-mounted drive with the marine option, MR4, [mm (in)]

TEL. +358 (0)201 2121 · FAX +358 (0)201 212 205

4.1.1.2 Dimensions of the the wall-mounted drive with the marine option, MR5

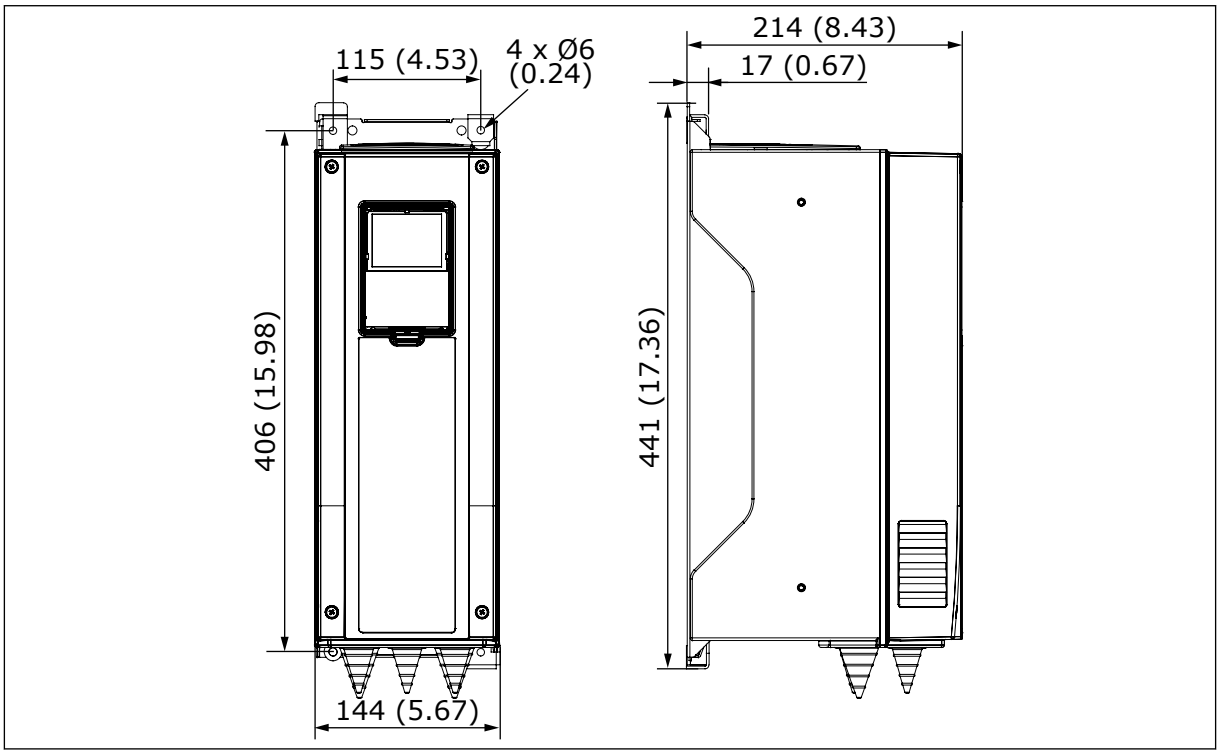


Fig. 3: Dimensions of the wall-mounted drive with the marine option, MR5, [mm (in)]

4.1.1.3 Dimensions of the the wall-mounted drive with the marine option, MR6

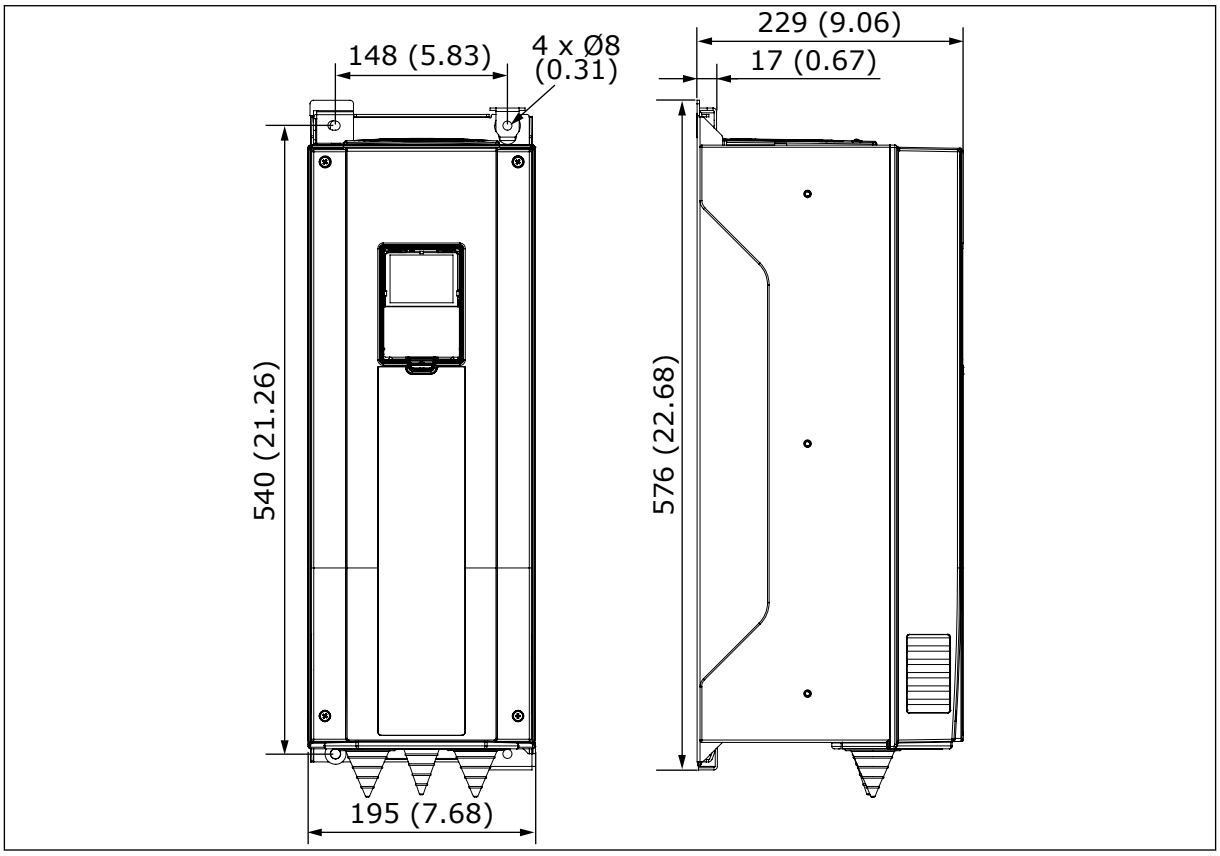


Fig. 4: Dimensions of the wall-mounted drive with the marine option, MR6, [mm (in)]

TEL. +358 (0)201 2121 · FAX +358 (0)201 212 205

4.1.1.4 Dimensions of the the wall-mounted drive with the marine option, MR7

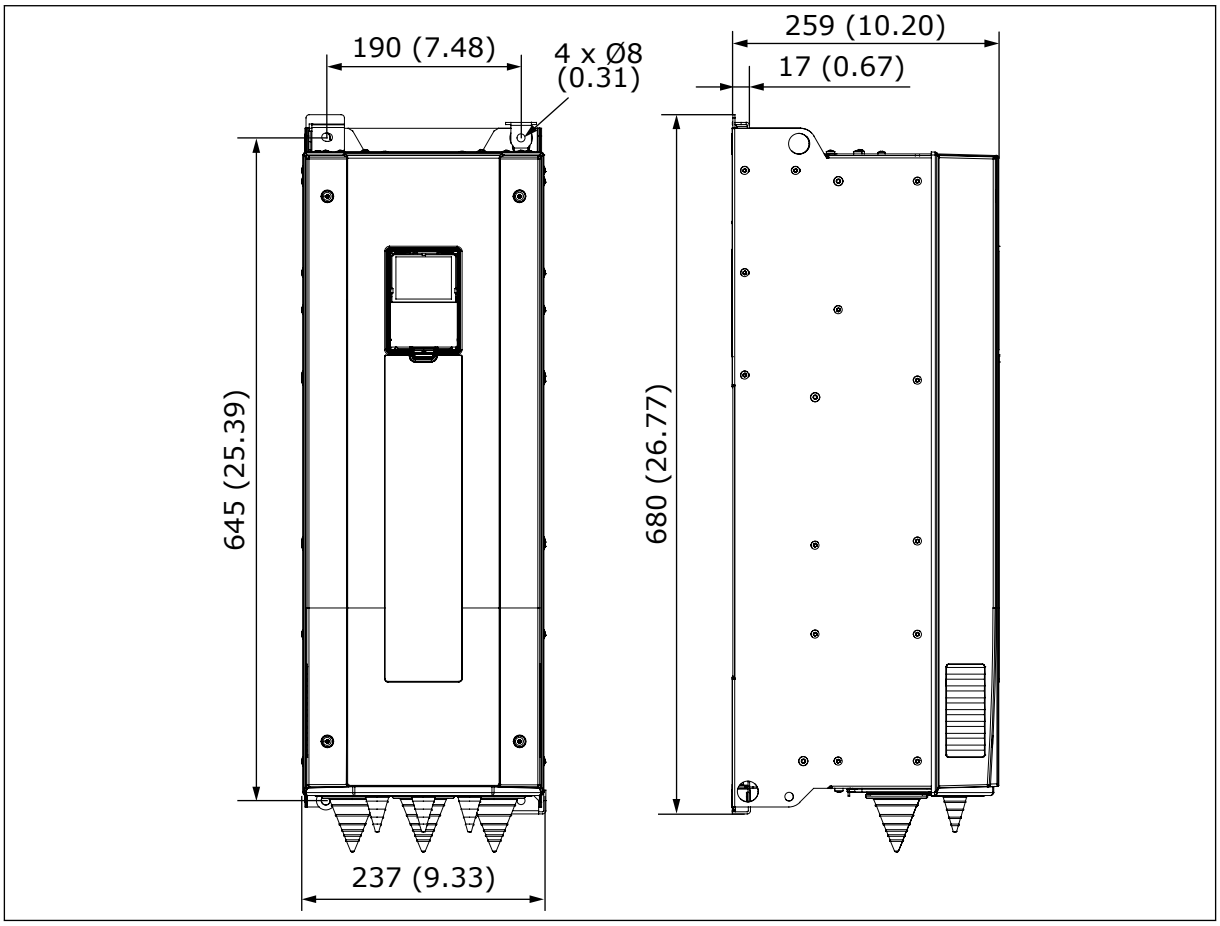


Fig. 5: Dimensions of the wall-mounted drive with the marine option, MR7, [mm (in)]

4.1.1.5 Dimensions of the wall-mounted drive with the marine option, MR8

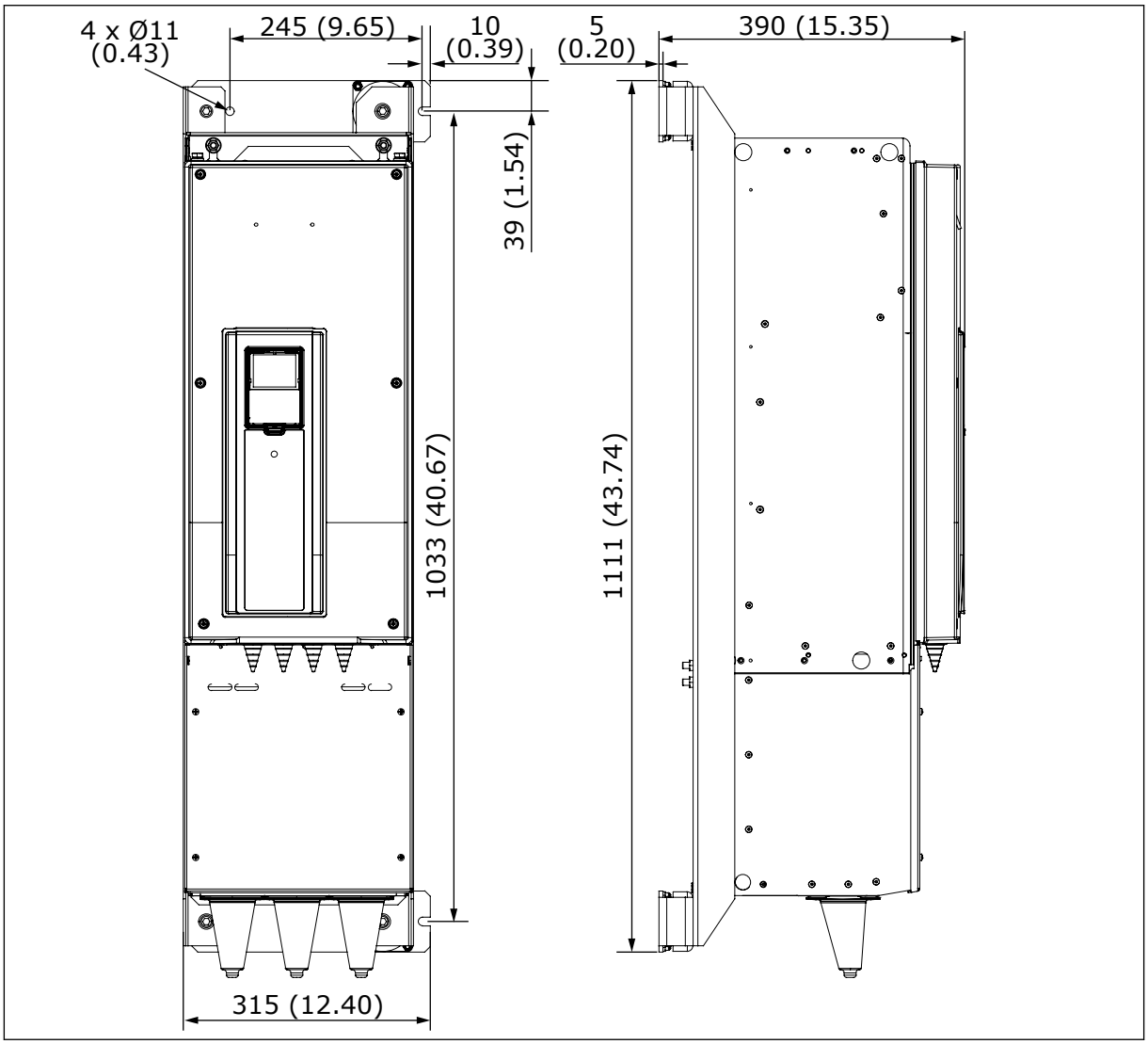


Fig. 6: Dimensions of the wall-mounted drive with the marine option, MR8, [mm (in)]

TEL. +358 (0)201 2121 · FAX +358 (0)201 212 205

4.1.1.6 Dimensions of the wall-mounted drive with the marine option, MR9

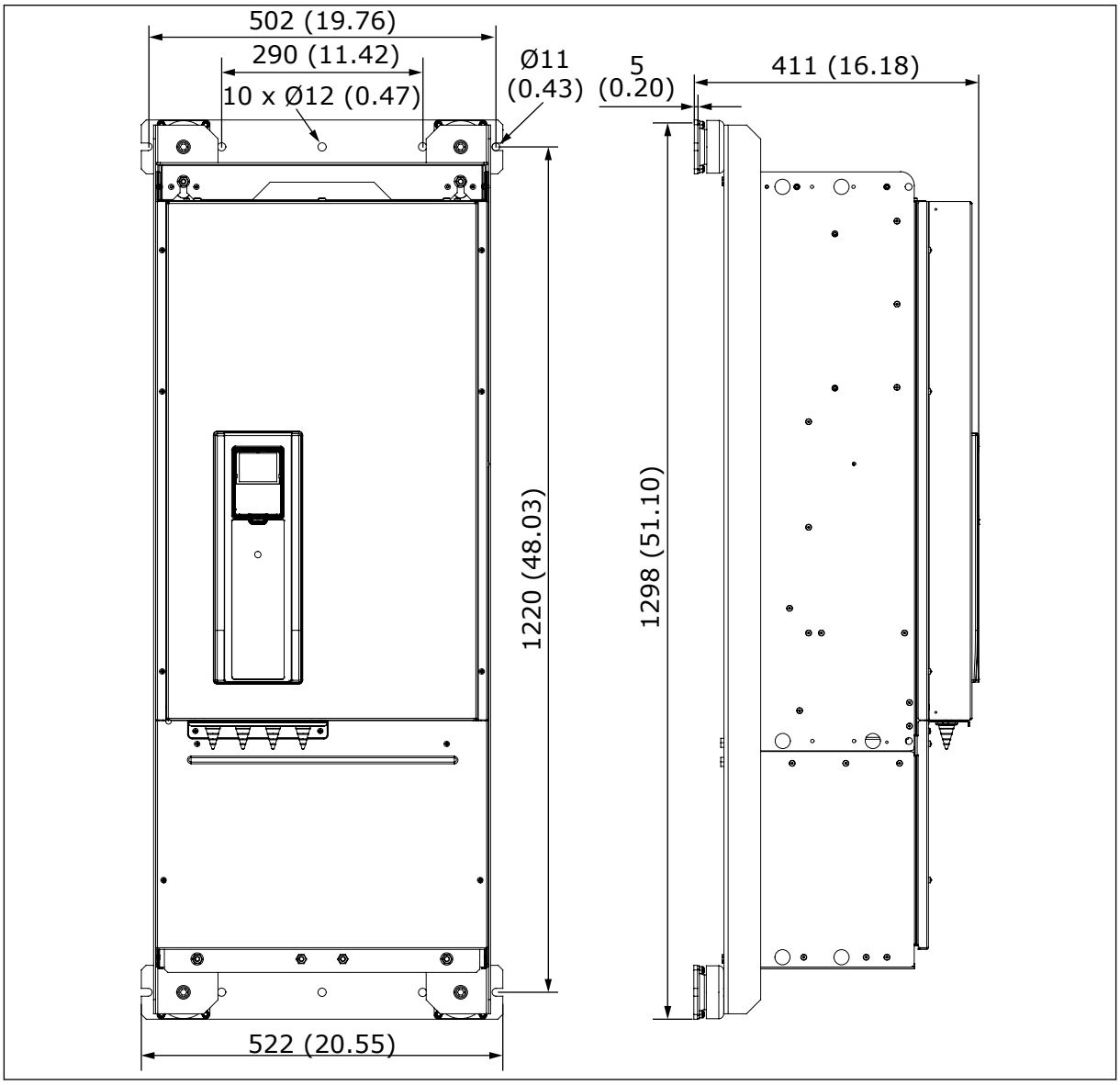


Fig. 7: Dimensions of the wall-mounted drive with the marine option, MR9, [mm (in)]

4.1.2 DIMENSIONS OF THE ENCLOSED DRIVES

Some options of the enclosed drives require additional cabinets. For more information, see the Vacon 100 Enclosed Drives Installation Manual.

4.1.2.1 Dimensions of the enclosed drive with the marine option, MR8

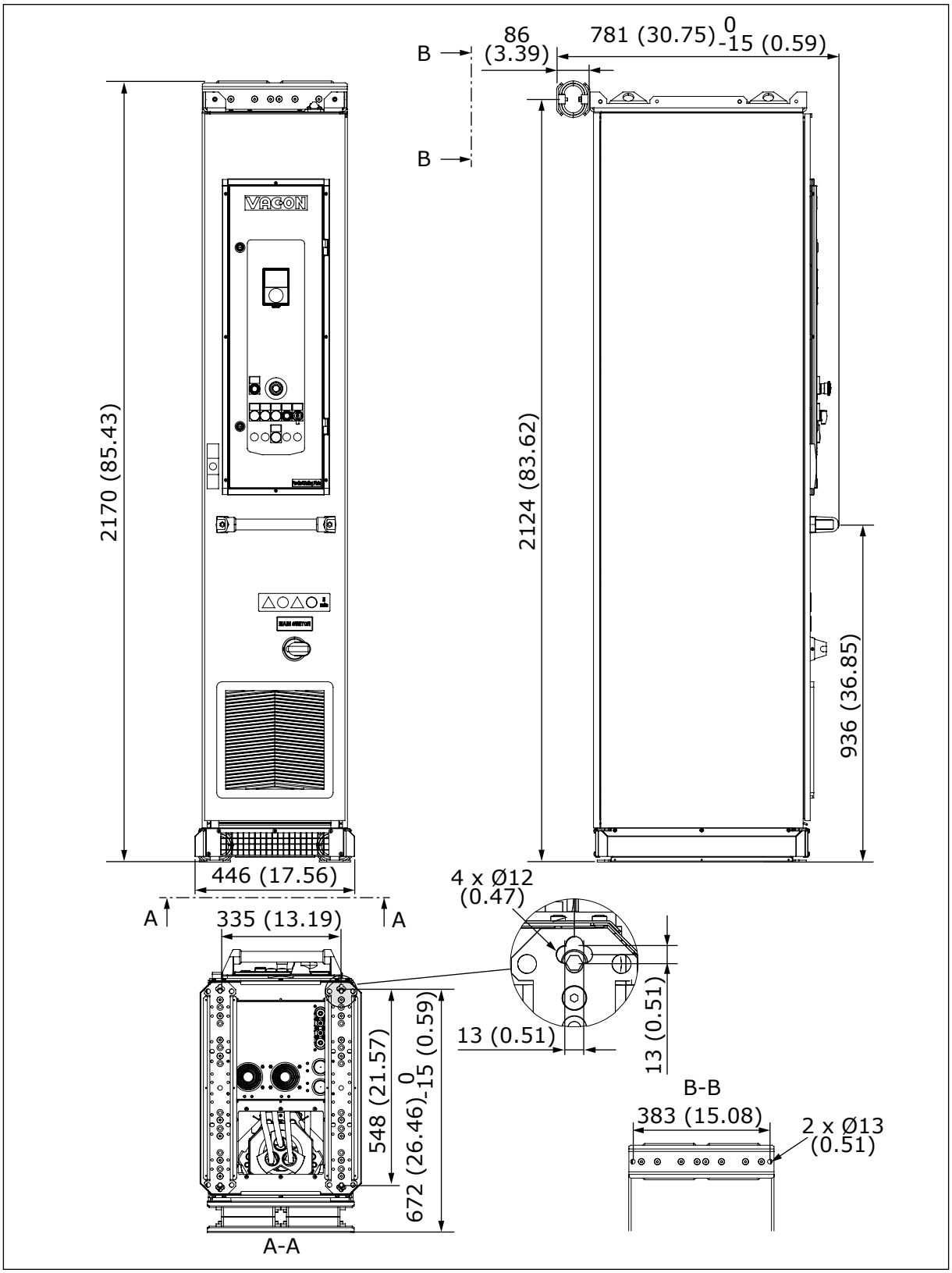


Fig. 8: Dimensions of the enclosed drive with the marine option, MR8, [mm (in)]

TEL. +358 (0)201 2121 · FAX +358 (0)201 212 205

4.1.2.2 Dimensions of the enclosed drive with the marine option, MR9

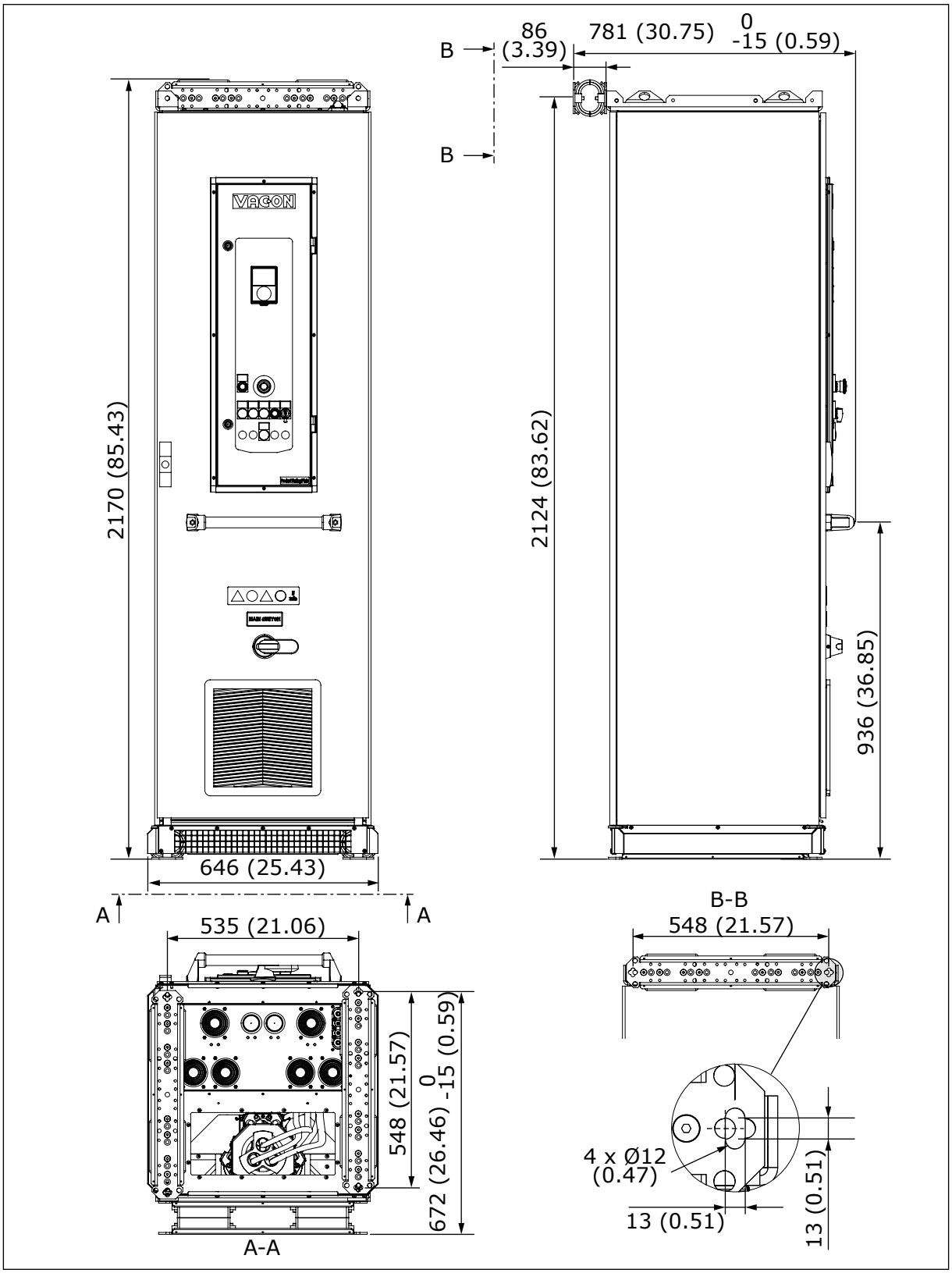


Fig. 9: Dimensions of the enclosed drive with the marine option, MR9, [mm (in)]

4.1.2.3 Dimensions of the enclosed drive with the marine option, MR10

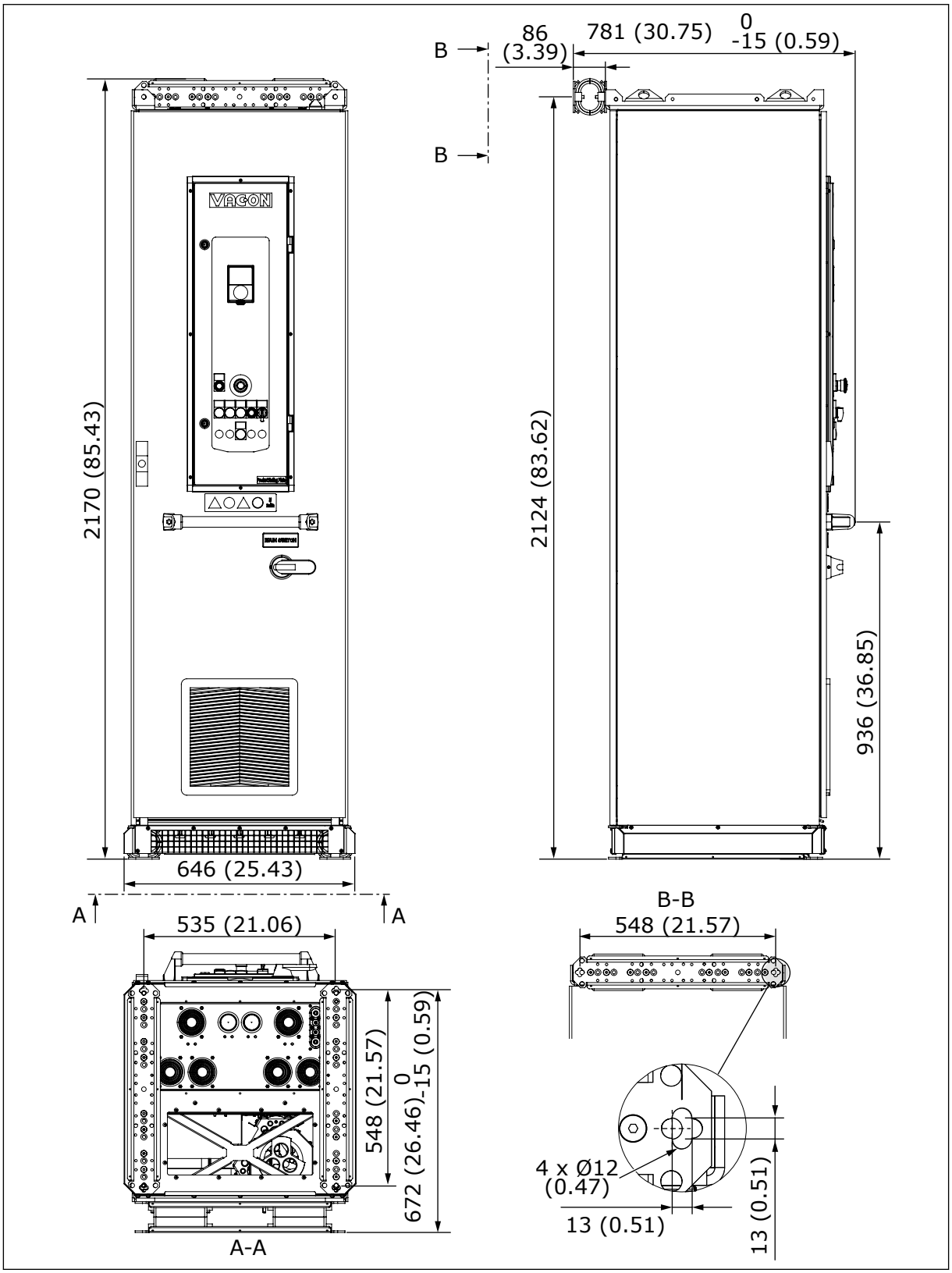


Fig. 10: Dimensions of the enclosed drive with the marine option, MR10, [mm (in)]

TEL. +358 (0)201 2121 · FAX +358 (0)201 212 205

4.1.2.4 Dimensions of the enclosed drive with the marine option, MR12

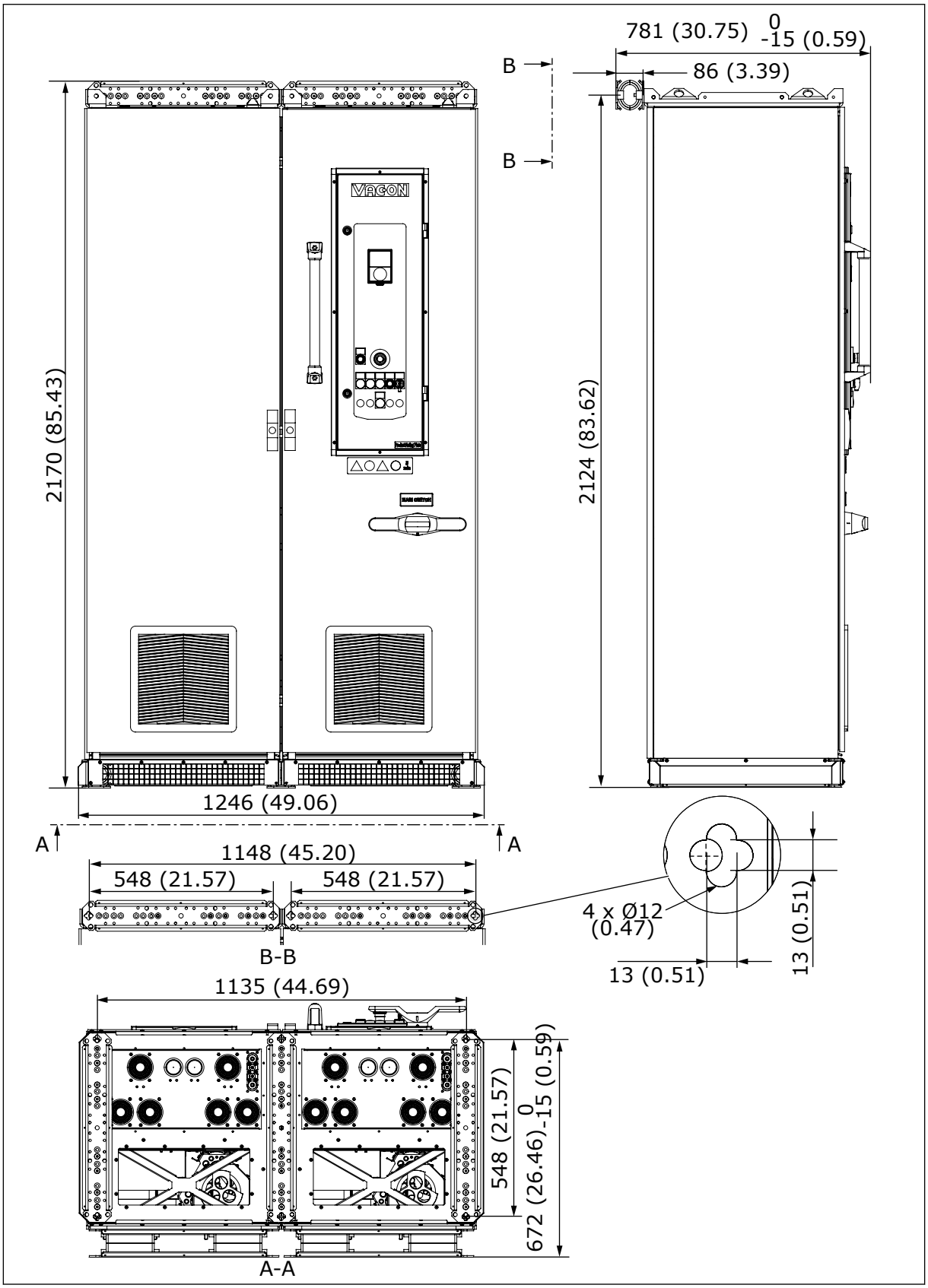


Fig. 11: Dimensions of the enclosed drive with the marine option, MR12, [mm (in)]

4.2 INSTALLATION REQUIREMENTS

In the marine environment, the power distribution system is normally divided into 3 zones. The Vacon 100 drives are type-approved in these zones.

- Special power distribution zone
- General power distribution zone
- Passenger accommodation zone

The Vacon 100 drives are not type-approved in bridge or deck zones.

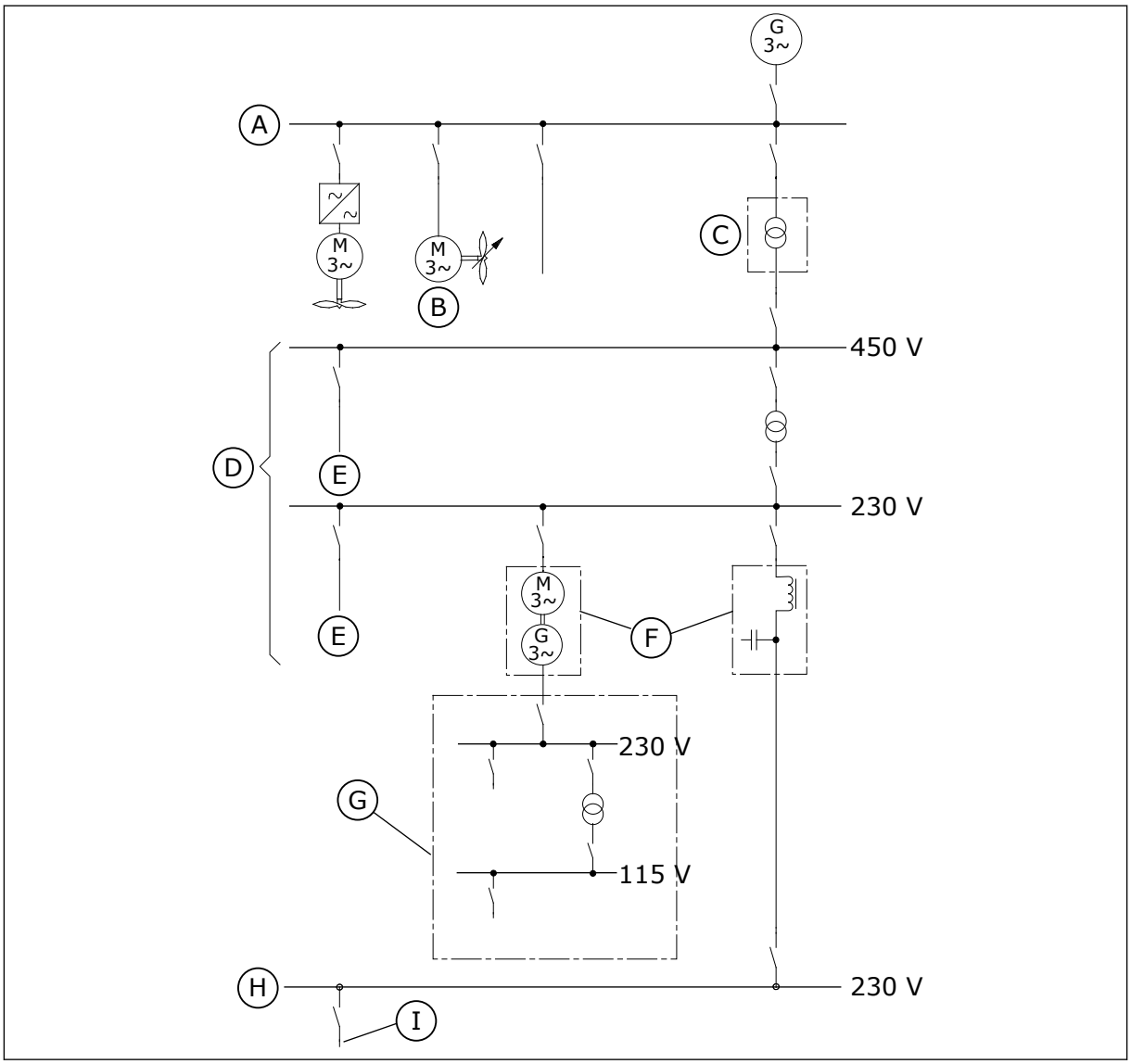


Fig. 12: The installation zones in a marine environment

A. Special power distribution zone
B. Propulsion systems, bow thruster, etc.
C. Transformer or other way of decoupling
D. General power distribution zone
E. Normal consumers
F. Transformer or other way of decoupling
G. Passenger accommodation zone
H. Bridge and deck zone
I. Radiocommunication and navigation, intercommunication, etc.

TEL. +358 (0)201 2121 · FAX +358 (0)201 212 205

4.2.1 THE MAXIMUM VIBRATION

The manufacturer has made a vibration test on the AC drive with these values. Refer to the test standard IEC 60068-2-6 for more information. The vibration of the drive must not exceed these values.

- 2-13.2 Hz, amplitude ±1mm
- 13.2-100 Hz, acceleration ± 0.7 g

You must also obey the requirements in the Installation Manual of your Vacon 100 product.

4.2.2 INSTALLATION SAFETY IN A MARINE ENVIRONMENT

NOTE!

We recommend you to install the AC drive with screws, but you can also use welding. You can use welding to install MR8 and MR9 wall-mounted drives and the enclosed drives.

CAUTION!

If you install the AC drive by welding, connect the return conductor of the welding equipment to the bottom of the drive frame within 50 cm of the welding point. The welding current must not go through the drive. If the return conductor is not connected correctly, the welding current can cause damage to the electric circuits of the drive.

CAUTION!

If you install the AC drive during shipbuilding, make sure that you prevent contamination and condensation on the drive. Before commissioning, make sure that the product is clean and dry, and that it fulfills the requirements of the Installation Manual of your Vacon 100 product. Doing otherwise can cause damage to the product.

CAUTION!

When you install an enclosed drive, activate the cabinet heater. The cabinet heater prevents moisture that can cause damage to the drive.

CAUTION!

Using cables that have a smaller cross-sectional area than what is recommended in the Installation Manual of your Vacon 100 product causes power losses. The power losses decrease the performance and shorten the lifetime of the AC drive.

4.3 EMC REQUIREMENTS

Make sure that the AC drive installation fulfills the requirements of IEC 60533: Electrical and electronic installations in ships – Electromagnetic compatibility (marine requirements), and IEC 61800-3: Adjustable-speed electrical power drive systems – Part 3: EMC requirements and specific test methods.

The classification societies can also have other requirements. For more information, contact the classification society that you are consulting.

Instead of mitigating the high-frequency emissions locally, in high-power or special installations it is more economical to make a system-wide high-frequency compatibility analysis. In the analysis you can find the problems and then do the necessary mitigation actions. This is called EMC planning.

For Vacon 100 drives, there are 3 different EMC cases.

1. Installing a drive in an IT network
2. Installing a drive in a grounded network: maximum 500 V, enclosure sizes MM4-MM6 and MR4-MR9, not the enclosed drives
3. Installing a drive in a grounded network: 525-690 V, enclosure sizes MR10-MR12, and the enclosed drives

To make your system compatible with the marine EMC requirements, obey the instructions below.

4.3.1 INSTALLING A DRIVE IN AN IT NETWORK

If the drive is installed in an IT (that is, floating ground) or HRG (that is, high resistance ground) network, disconnect the ground capacitors of the EMC filter. See the Installation Manual of your Vacon 100 product for the disconnection instructions. The disconnection changes the EMC class of the drive to level C4 of the IEC 61800-3 standard.

The drive fulfills the requirements of the special power distribution and passenger accommodation zones of the IEC 60533 standard. To fulfill the requirements in a general power distribution zone, you must make an EMC plan (refer to IEC 61800-3, Annex E). The nature of the IT network minimizes the disturbance currents that circulate in the ground potential. Thus, you can achieve compatibility with simpler procedures than in grounded networks.

CONDUCTED EMISSIONS

When the drive is in Run state, a high-frequency common mode voltage is present in the network. To prevent compatibility problems, obey the common engineering practice for IT and HRG networks. In the practice, the ground capacitance of connected devices is minimized, and thus EMC issues that are caused by circulating currents are minimized in the area of the supply transformer.

RADIATED EMISSIONS

To get the best compatibility on radiated emissions that are lower than 100 MHz, use a motor cable with low-impedance shield. Make a 360° grounding of the shield at both the drive and motor end. If there is a high risk of interference emission from the mains cable, use a shielded cable and make a 360° grounding at both ends of the mains cable.

No special procedures for emissions that are higher than 100 MHz are necessary, because the choice of grounding of the mains cable does not have an effect on these emissions.

4.3.2 INSTALLING A DRIVE IN A GROUNDED NETWORK: MAXIMUM 500 V, ENCLOSURE SIZES MM4-MM6 AND MR4-MR9, NOT THE ENCLOSED DRIVES

In this class, the drives comply with the requirements for marine installations in the allowed installation zones.

TEL. +358 (0)201 2121 · FAX +358 (0)201 212 205

4.3.3 INSTALLING A DRIVE IN A GROUNDED NETWORK: 525-690 V, ENCLOSURE SIZES MR10-MR12, AND THE ENCLOSED DRIVES

The 525-690 V drives, enclosure sizes MR10-MR12, and enclosed drives are targeted to installations in machine rooms or other similar locations. Because the immunity level of devices that are installed in these locations is higher than usual, the filtering of the drives is level C3 of the IEC 61800-3 standard.

- Without actions, the installation complies with the requirements of the special power distribution and passenger accommodation zones of IEC 60533. However, for the passenger accommodation zone, we recommend similar compatibility procedures as in the general power distribution zone.
- To make a compatible installation in the general power distribution zone, you must make an EMC plan (refer to IEC 61800-3, Annex E). In the EMC plan, assess the required amount of high-frequency filtering. See the recommended amount of filtering in *Table 4*.

You can use this table as a reference when you discuss the correct filtering with your filter or isolation transformer provider, and with the manufacturers of other devices intended to be used on the same supply.

Table 4: The recommended amount of emission filtering for the general power distribution zone

Drive	Emission frequency 10 kHz – 500 kHz	Emission frequency 500 kHz – 5 MHz	Emission frequency 5 MHz - 30 MHz	Emission frequency 30 MHz – 300 MHz
Vacon 100 MR10-MR12, 500 V	54 dB	55 dB	45 dB	10 dB
Vacon 100 MR4-MR8, 690 V	24 dB	16 dB	20 dB - 0 dB *	10 dB
Vacon 100 MR9-MR12, 690 V	54 dB	55 dB	45 dB	10 dB
Vacon 100 enclosed drives	54 dB	55 dB	45 dB	10 dB with distance or separate electrical room

* The value decreases logarithmically with frequency.

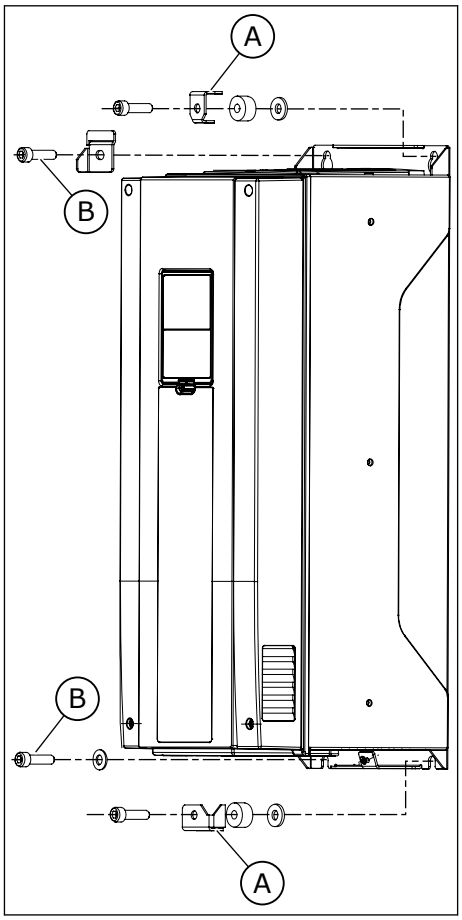
4.4 INSTALLATION PROCEDURE

4.4.1 INSTALLATION OF WALL-MOUNTED DRIVES IN A MARINE ENVIRONMENT

INSTALLATION PROCEDURE, MR4-MR9

1 MR4-MR7: Attach the components of the marine option. Use 4 pcs of Ø 8 mm / 0.31 in screws.

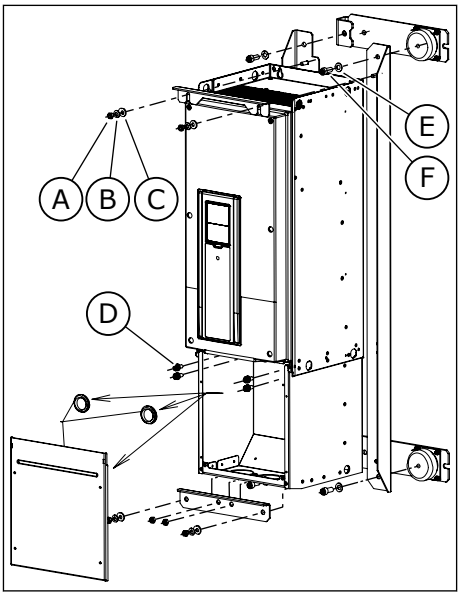
- Tighten the screw so that it is tight, but so that the bracket (A) does not deform. For the other 2 screws (B), use a tightening torque of 12 Nm.



A. The bracket
B. The screw tightened to 12 Nm

TEL. +358 (0)201 2121 · FAX +358 (0)201 212 205

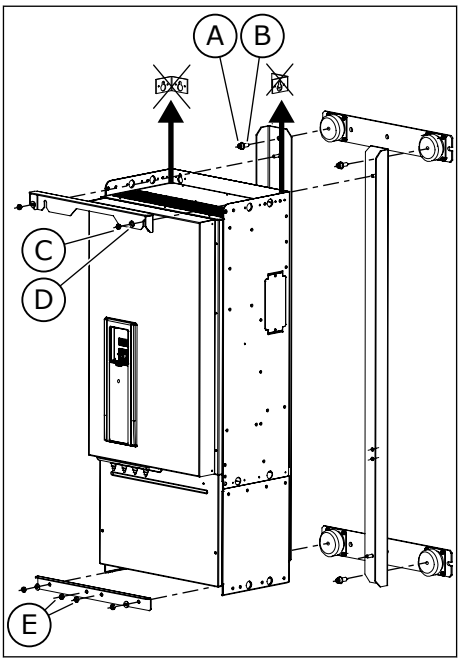
2 MR8: Attach the installation frame to the wall. You can use screws or welding. Attach the drive to the installation frame. Use:



A) 6 pcs of M8 nuts tightened to a minimum torque of 20 Nm
B) 4 pcs of 8 mm spring washers
C) 4 pcs of 8 mm washers
D) 4 pcs of M8 x 20 mm combi screws tightened to a minimum torque of 20 Nm
E) 4 pcs of 10 mm washers
F) 4 pcs of M10 x 25 mm screws with a minimum torque of 40 Nm

To have access to the installation holes, remove the protective cover.

3 MR9: Attach the installation frame to the wall. You can use screws or welding. Attach the drive to the installation frame. Use:



A) 4 pcs of M10 x 25 mm screws tightened to a minimum torque of 40 Nm
B) 4 pcs of 10 mm washers
C) 6 pcs of M8 nuts tightened to a minimum torque of 20 Nm
D) 4 pcs of 8 mm spring washers
E) The plinth of the AC drive

Remove the 2 brackets from the top of the AC drive. Attach the grounding cables to the plinth of the AC drive.

4.4.2 INSTALLATION OF ENCLOSED DRIVES IN A MARINE ENVIRONMENT

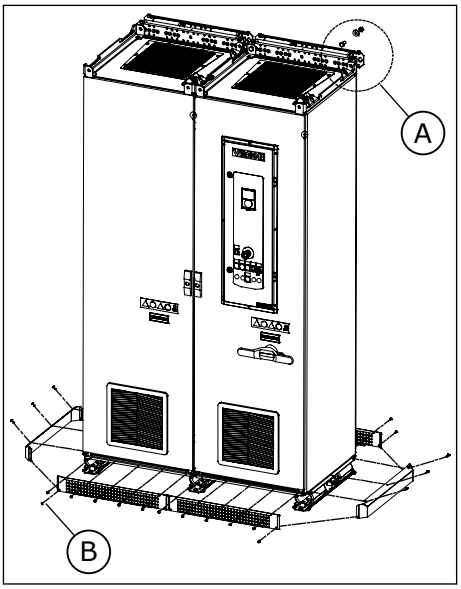
INSTALLATION PROCEDURE, MR8-MR12

The bottom dampers are installed at the factory. You must install the upper dampers and plinths on site.

1 MR8-MR12: Attach the upper damper to the wall. You can use screws or welding. Attach the protection grilles of the cabinet with M5 x 12 mm screws.
Attach the handle that you can find in the accessories bag to the holes in the cabinet door with M8 x 40 mm bolts and M8 nuts.

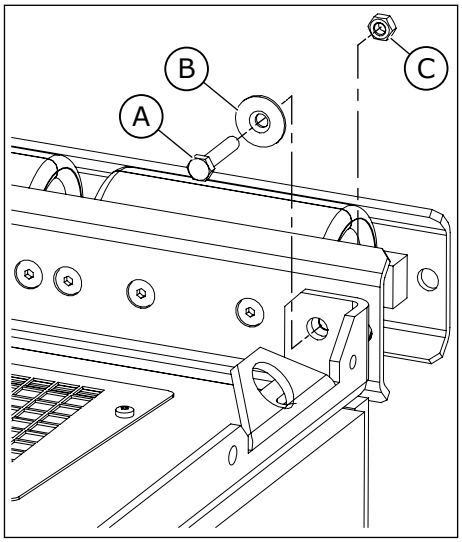
A) The upper damper
B) M5 x 12 mm screws

The picture shows an MR12 drive.



2 MR8: To attach the upper damper, use:

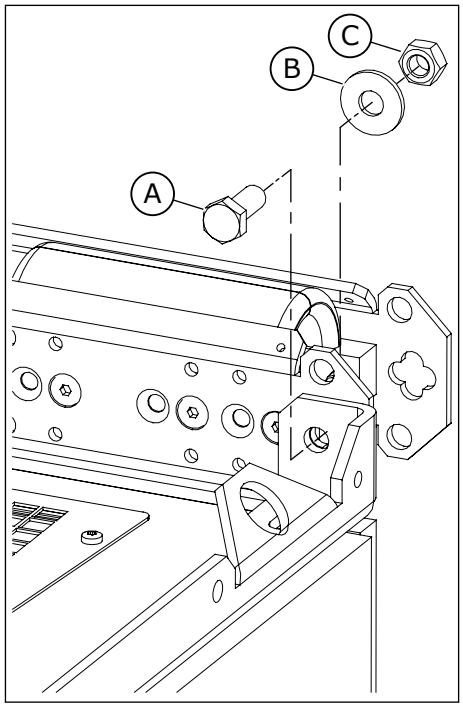
A) An M8 x 40 mm bolt tightened to a 20-25 Nm torque
B) An 8 mm washer with a formed hole
C) An M8 nut tightened to a 20-25 Nm torque



TEL. +358 (0)201 2121 · FAX +358 (0)201 212 205

3 MR9-MR12: To attach the upper damper, use:

A) An M12 x 30 mm bolt tightened to a 60-70 Nm torque
B) A 12 mm plain washer
C) An M12 nut tightened to a 60-70 Nm torque



5 COMMISSIONING AND ADDITIONAL INSTRUCTIONS

5.1 MAINTENANCE

See the complete list of maintenance tasks in the Installation Manual of your Vacon 100 product.

Table 5: The maintenance intervals and tasks for the marine option

Maintenance interval	Maintenance task
Regularly	Do a check of the installation bolts of the marine option.

TEL. +358 (0)201 2121 · FAX +358 (0)201 212 205

VACON®

www.danfoss.com

Document ID:

DPD01773A

Rev. A

Vacon Ltd
Member of the Danfoss Group
Runsorintie 7
65380 Vaasa
Finland

Sales code: DOC-INS100MA+DLUK