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Appendix

CDS803 18.5/22/30kW drive for VZH088-117-170CG

R410A

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Content

General Information

This document is an appendix for VZH088-117-170 Gen3 application guideline, more details for compressor application please refer to the main document(AB300034185311en).

CDS803 18.5/22/30kW drives for VZH088CG/117CG/170CG are certified against UL60730-1 and EN 60730-1.

Satisfy A2L requirements to electronic components in UL60335-1/UL60335-2-34 / UL60335-2-40

Compressor nomenclature

V Z H 117 C G A N A

- **Variable speed**
- **Family** VZH scroll
- **Lubricant** POE lubricant, R410A refrigerant
- **Swept volume** in cm^3/rev
- **Design pressure ratio** **C**: with IDV
- **Motor voltage code to CDS803 *** **G**: 380-480V/3~/50 & 60Hz
- **Equipement version** **A**: brazed connections, single version **D**: brazed connections, unified version

	Oil sight glass	Oil level switch
Single version	Threaded	None
Unified version	Threaded	Threaded

- **Motor protection type** **N**: no internal motor protection (protection by drive)
- **Evolution index**

* main supply voltage to frequency converter

Frequency converter nomenclature for CDS803

CDS 803 P18K T4 E20 H2

- **Dedicated compressor drive for VZH scroll**
- **Serie 803**
- **Output power** in kW
- **Main supply voltage** **T4:** 380-480V/3 ph/50-60 Hz
- **Enclosure protection** IP rating
- **RFI class**

Frequency converter specifications

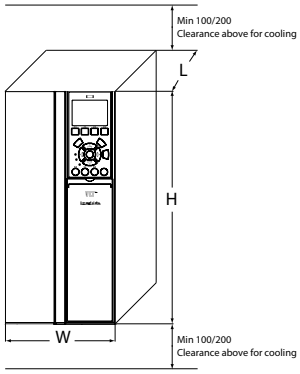
Mains supply voltage	T4: 380 - 480 V ±10% (3-phase)
Supply frequency	50 / 60 Hz
Output voltage	0 - 100 % of supply voltage
Inputs	4 digital (0-24V), 2 analog (0/±10V or 4-20mA, scalable)
Programmable outputs	2 analogue(0/4-20mA) or 2 digital(0-24V)
Protection functions	Over-current protection, low / high current handling
Compressor functions	Motor protection, compressor ramp up/down control
Static leakage current	CDS803 18.5/22kW: 2.5 mA, CDS803 30kw: 20mA

Oil injection

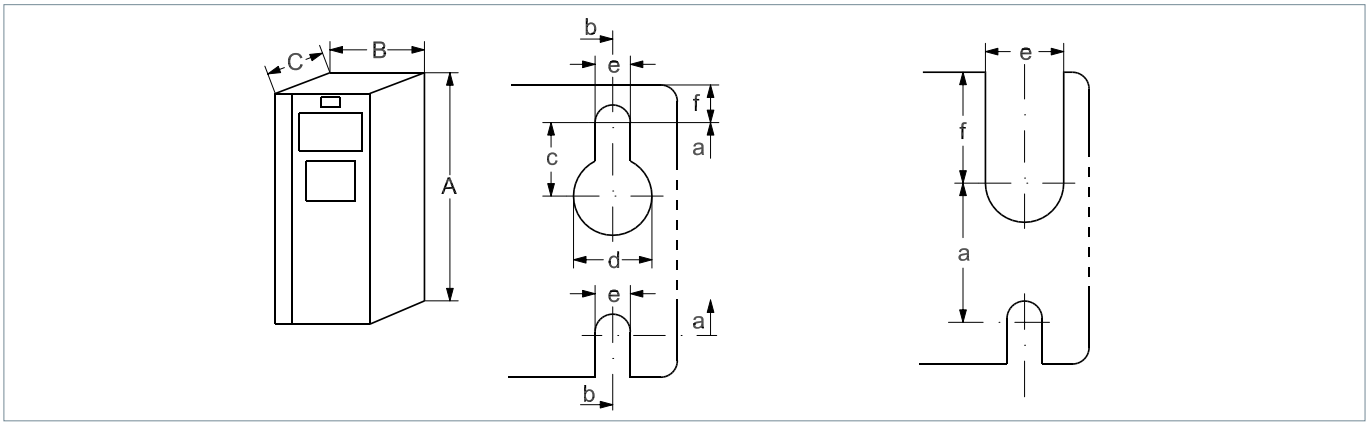
Refer to VZH Gen3+CDS303 package

CDS803 Frequency converter

Frequency converter dimensions depend on supply voltage, IP rating and power. The table below gives an overview of the overall dimensions and different drive enclosures (H5 and H6). Details for each drive enclosure are on the following pages.



Drive supply voltage	Drive power kW	Compressor voltage code	Compressor model	IP20			
				Drive enclosure	Overall drive size [H x W x L] mm (inch)	Clearance above/below mm (inch)	bracket supplied (mm^2)
T4: 380-480/3/50-60	18.5	G	VZH088C	H5	402 × 150 × 255 (15.8 × 5.9 × 10)	100 (4)	1pcs, Φ2-11 1pcs, Φ3-18 1pcs, Φ6-23
	22		VZH117C	H5	402 × 150 × 255 (15.8 × 5.9 × 10)	100 (4)	1pcs, Φ2-11 1pcs, Φ3-18 1pcs, Φ6-23
	30		VZH170C	H6	595 × 239 × 242 (23.4 × 9.4 × 9.5)	200 (8)	1pcs, Φ24-28 28b 1pcs, Φ28-32 k32b



Enclosure		Height						Width				Depth		Mounting hole						Max. Weight	
Frame	IP Class	A		A[1]		a		B		b		C		d		e		f		kg	lb
		mm	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm	inch	mm	inch		
H5	IP20	334	13.1	402	15.8	314	12.4	150	5.9	120	4.7	255	10	12.6	0.5	7	0.28	8.5	0.33	9.5	20.9
H6	IP20	518	20.4	595	23.4	495	19.5	239	9.4	200	7.9	242	9.5	-	-	8.5	0.33	15	0.6	24.5	54

A[1] Including decoupling plate.

The dimensions are only for the physical units, but when installing in an application it is necessary to add space for free air passage both above and below the units. The amount of space for free air passage is listed in "frequency converter dimensions - Clearance above/below (mm/inch)".

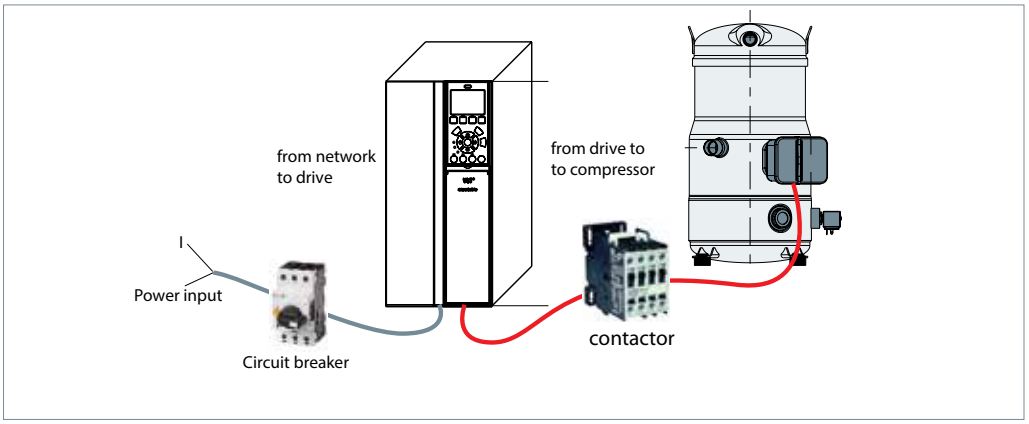
Fuses / circuit breakers

Danfoss recommends using the fuses/circuit breakers listed below to protect service personnel and property in case of component breakdown in the frequency converter. For circuit breakers, Moeller types have been tested and are recommended.

	Model	Power (kW)	UL Compliant fuses				Non -UL	Recommended circuit breaker
			Bussmann				Maximum fuse	IP20
			Type RK5	Type RK1	Type J	Type T	Type G	Moeller type
3 × 380-480 V	13 TR/VZH088	18.5	FRS-R-80	KTS-R80	JKS-80	JJS-80	63	PKZM4-50
	17 TR/VZH117	22	FRS-R-80	KTS-R80	JKS-80	JJS-80	63	NZMB1-A100
	26 TR/VZH170	30	FRS-R-125	KTS-R125	JKS-R125	JJS-R125	80	NZMB1-A100

Wire sizes

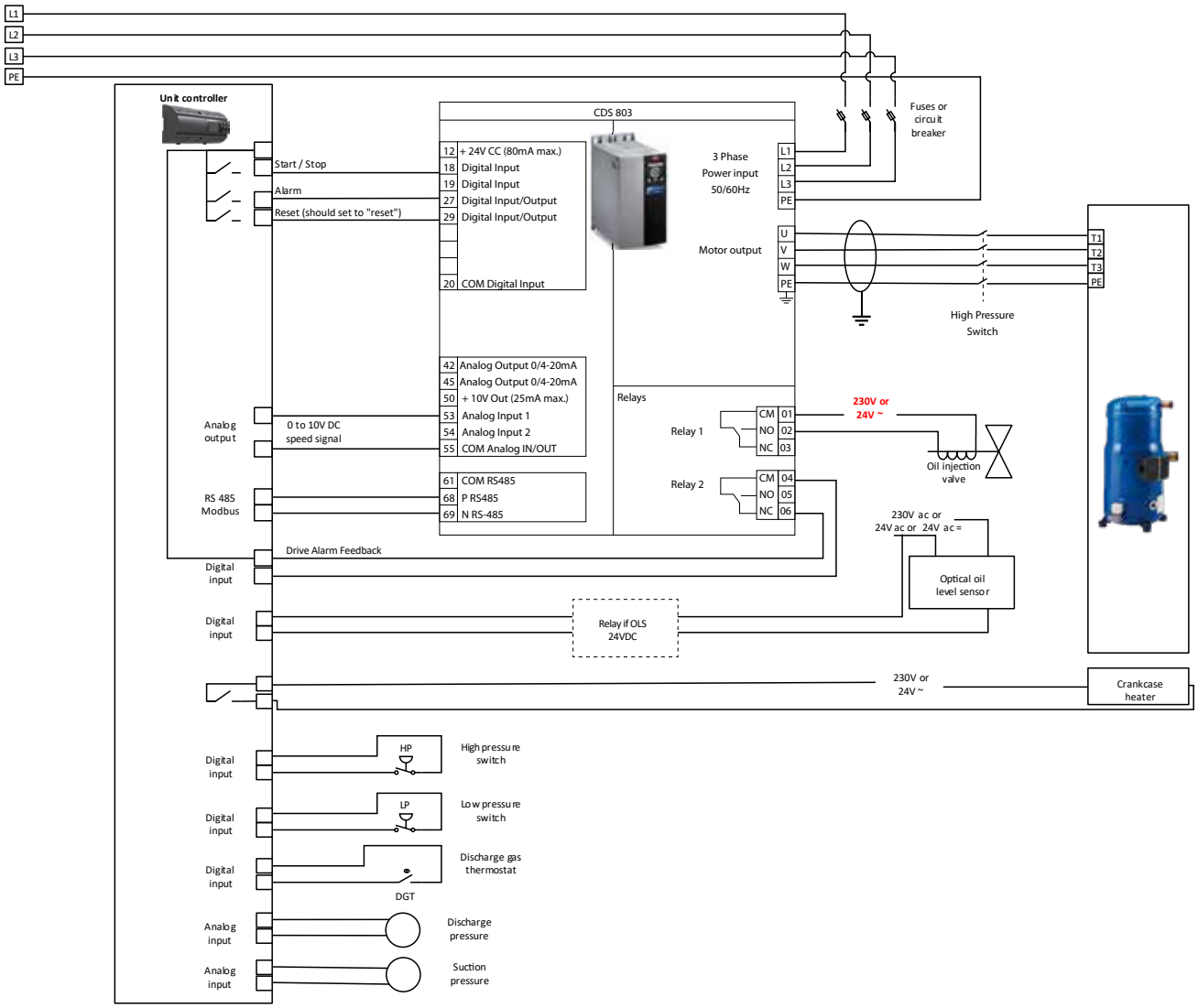
Below table lists maximum wiring sizes for the motor compressor power supply cables.



	From network to frequency converter			From frequency converter to compressor		
	Type	mm²	AWG	Type	mm²	AWG
380 - 480 V	CDS803-18.5kw	6	10	VZH088-G	6	10
	CDS803-22kw	10	8	VZH117-G	10	8
	CDS803-30kw	16	6	VZH170-G	16	6

Note: The wire size values are the maximum size the converter can accept. The required cable size should be specified by the OEM depending on the unit design, ambient temperature, the wire material, current, etc...

Typical control architecture



Modbus protocol

To physically establish and configure communication between the Danfoss CDS drives and a controller, Please refer to modbus RTU operating instructions: MG92B102

Oil injection control

Oil injection solenoid valve is controlled by CDS803 drive through pre-configured Relay 1.

More details refer to the same topic in VZH Gen3 application guideline.

Function differences between CDS803 and CDS303

item	Difference	Comments
1*	Different LCP	CDS803 use “Alpha numeric LCP” and CDS303 use “Graphic LCP”. Drive has different setting in "0-xx Operation and Display" due to two kind of LCP.
2	UL60730 require hide motor related parameters in CDS803 drive.	Motor related parameters are hidden in "Group 1-xx Load and Motor" are hidden in CDS803 only
3*	CDS803 show parameter unit by [Hz], not by [rpm]. So, 9 parameters by[rpm] are not included in CDS803 .	1-77 Compressor Start Max Speed [rpm] in CDS303 only
		1-81 Speed limit for stop function (rpm) in CDS303 only
		1-86 Compressor Min. Speed for Trip [rpm] in CDS303 only
		4-11 Motor speed low limit (rpm) in CDS303 only
		4-13 Motor speed high limit (rpm) in CDS303 only
		4-60 Bypass Speed From [RPM] in CDS303 only
		4-62 Bypass Speed To [RPM] in CDS303 only
		28-14 ORM Min Speed Limit (RPM) in CDS303 only
		28-16 ORM Boost Speed (RPM) in CDS303 only
4	CDS803 and CDS303 has same behaviors by default setting of those funciton. But those parameters can not be seen in CDS803.They are coded in to software logic.	3-00 Reference Range
		3-04 Reference Function
		3-40 Ramp 1 Type
		3-50 Ramp 2 Type
		13-12 Comparator Value
5*	CDS803 show parameter unit by [Hz] but CDS303 show [rpm] for same parameter.	3-02 Min reference[rpm] in CDS303 vs 3-02 Min reference[Hz] in CDS803
		3-03 Max reference[rpm] in CDS303 vs 3-03 Max reference[Hz] in CDS803
		4-52 Warning Freq.Low[rpm] in CDS303 vs 4-40 Warning Freq.Low[Hz] in CDS803
		4-53 Warning Freq.High[rpm] in CDS303 vs 4-41 Warning Freq.High[Hz] in CDS803
		5-52 Term. 29 Low Ref./Feedb. Value [rpm] in CDS303 vs 5-52 Term. 29 Low Ref./Feedb. Value [Hz] in CDS803
		5-53 Term. 29 High Ref./Feedb. Value [rpm] in CDS303 vs 5-53 Term. 29 High Ref./Feedb. Value [Hz] in CDS803
		13-12 Comparator Value [rpm] in CDS303 vs 13-12 Comparator Value [rpm] in CDS803
6*	CDS803 does not have STO function.	STO in CDS303 only.
7	Close loop control	CDS303 has close loop control in "7-** controller". CDS803 has similar close loop control function in " 20-xx Drive Closed Loop".
8	Motor control algorithm	CDS803 motor control is VVC+, CDS303 motor control is flux. Drive parameter default values in "Group 14-xx Special Functions" are based on control algorithm. So Some parameters and default values are not fully same for CDS303 and CDS803 .
9	Four parameters in Data Readout of Group 16-xx are not included by CDS803	16-80Fieldbus CTW 1 in CDS303 only
		16-82Fieldbus REF 1 in CDS303 only
		16-84Comm. Option STW in CDS303 only
		16-85FC Port CTW 1 in CDS303 only
10	CDS803 does not have "Cascade Controller"	25-** Cascade controller in CDS303 only
11	CDS803 does not have "Discharge temperature monitor"	"28-2* Discharge Temp. Monitor" in CDS303 only
12	CDS803 does not have "Load profile (logging / Graph)"	"28-5* Load Profile" in CDS303 only.
13	CDS803 does not have "Defrost cycle function"	"28-6* defrost" in CDS303 only .
14	CDS803 does not have "Day/night setting"	"28-3* day night setting" in CDS303 only
15*	CDS803 does not have "USB Port"	"USB port" in CDS303 only
16	CDS803 does not have "CSIV file"	"CSIV file" in CDS303 only
17	CDS803 does not have "Relay card option"	"Relay card option" in CDS303 only
18	CDS803 does not have "Pressure to temperatature conversation"	"Pressure to temperatature conversation" in CDS303 only
19	CDS803 doest not have "Len protocol"	"Len protocol for carrier" in CDS303 only
20*	CDS803 doest not have "Power grid auto selection" function. Power grid must be selected in "P0-06 Grid type"	"Power grid type in CDS803: Normal which is used for TN-S / TN-C system. IT system:between the power supply equipment and ground, it is no ground connection/floating and between supplied device and ground/network connect to ground directly. Deta system(A corner-grounded network): A corner-grounded network is a system in which one corner of the transformer's delta-connected secondary is grounded"
21	Crankcase heating function	Both CDS803 has crankcase heating function. But this function is not recommended to use. Suggest customer use crankcase heater as CDS303 instead. Crankcase heater is more efficiency.
22	Main failure	Both CDS803 and CDS303 has main failure function. Suggest customer do not disable this function. Since this function is used to protect drive.
23*	There is no compressor downsize selection in CDS803.	UL requires that motor related parameters should be fixed and certified into drive firmware. CDS803 18.5/22/30kw drive should be matched with compressor exactly.

* Key change point

Temperature during storage/transport

-30 to +65/70 °C (-22 to +149/158 °F)

Direct and indirect exposure of drive to water

IP20 drives are intended for indoor or cabinet mounting. Application example: drive fitted in a machine room, basement or in an electrical cabinet together with other electric / electronic components such as the unit controller or contactors.

For outdoor use the electrical cabinet must be IP54 or the drive itself must be IP54 at least. Application example: rooftop units or condensing units.

If IP54 with LCP make sure that the gasket is applied to ensure tightness.

It is recommended to place drive at least 30cm (11.81 inches) from ground to protect against floods.

Dust Exposure

Avoid dust from depositing on the drive surface, circuit boards and other electric components. These deposits act as insulation layers and hamper heat transfer to the ambient air, reducing the cooling capacity. The increased heat load causes an accelerated aging of the electrical components, thus decreasing the service life. Dust deposits that accumulate on the heat sink located on the back of the VFD will also decrease the service life of the unit.

The drive cooling fans have small bearings into which dust can penetrate and act as an abrasive. This leads to bearing damage and fan failure.

Under the conditions described above, it is advisable to clean the frequency converter during periodic maintenance. Remove dust off the heat sink and fans and clean the filter mats.

Mechanical Mounting

For optimal cooling conditions, mount the drive on vertical position. Allow a free air passage above and below the frequency converter. See Table below:

Enclosure type*	H5	H6
a(mm/inch)	100/3.94	200/7.87
b(mm/inch)	100/3.94	200/7.87

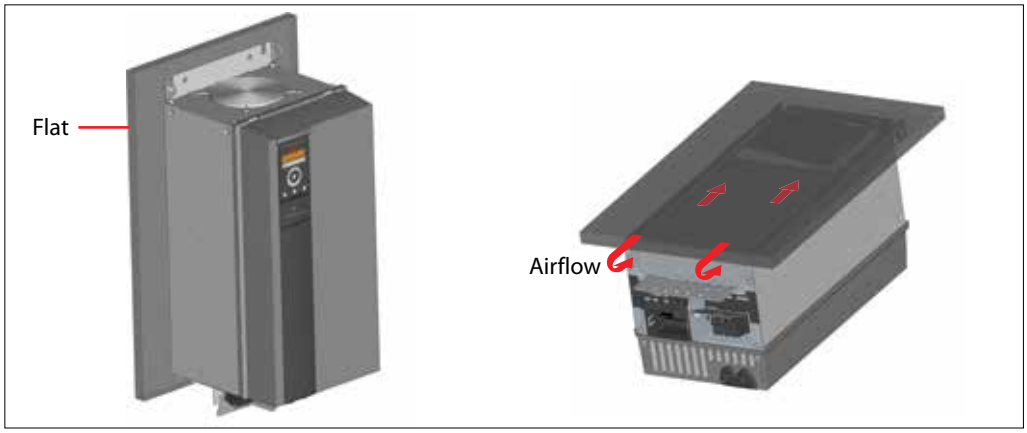
*: Enclosure please refer to drive enclosure table in section "CDS803 Frequency converter".

Horizontal mounting is NOT the preferred position, however if unavoidable, lay PCB on the left side (270°) to avoid condensation accumulation on the electronics.

All of CDS803 drive have backplate except 30kW.

The backplate is covering the heatsink on the mounting surface and to make sure the airflow is guided through the heatsink, it can be disregarded if customer are sure to mount the drive up against a wall.

Only 30kW drive is without backplate, so it is mandatory to be mounted on a flat or inside a cabinet.



Drive ambient temperature

R CDS803 18.5/22 kW drive can operate at 52˚C with maximum load; 30kW drive can operate at 45 ˚C with maximum load, between 45 ˚C and 52 ˚C with 80% maximum load. Do not exceed the maximum temperature limit.

The drive could operate lower to -10˚C (14˚F) with proper operation, such as inside the cabinet, install the space heater. LCP operating temperature is -10 - 50 ˚C.

High Ambient Temperature

Test at the unit's at highest ambient maximum load is recommended. Look for over temperature alarms.

Guidelines that support high ambient temperature:

- Ensure clearance limits above and below the drive for air circulation are respected.
- The drive must be installed on a panel wall or on a back plate to ensure proper cooling
- Do not place the drive under direct sunlight.
- Insulation inside the electrical panel can reduce impact of sun radiation.
- Additional air conditioning of the cabinet o may be required.

The frequency converter has built-in temperature sensors and reacts immediately to critical values via hard-coded limits. In case of over-temperature inside the frequency converter, it automatically derates the switching frequency and the maximum allowed output current to reduce the internal heat. This can cause the compressor to trip due to insufficient current to drive the compressor.

EMC

Frequency converter (and other electrical devices) generate electronic or magnetic fields that may interfere with their environment. The electromagnetic compatibility (EMC) of these effects depends on the power and the harmonic characteristics of the devices.

The EMC product standard for frequency converters defines 4 categories (C1, C2, C3, and C4) with specified requirements for emission and immunity. Table below states the definition of the 4 categories and the equivalent classification from EN 55011.

Category	Definition	Equivalent emission class in EN 55011
C1	Frequency converters installed in the first environment (home and office) with a supply voltage less than 1000 V.	Class B
C2	Frequency converters installed in the first environment (home and office) with a supply voltage less than 1000 V, which are not plug-in and not movable, and must be installed and commissioned by a professional.	Class A Group 1
C3	Frequency converters installed in the second environment (industrial) with a supply voltage lower than 1000 V.	Class A Group 2
C4	Frequency converters installed in the second environment with a supply voltage equal to or above 1000 V or rated current equal to or above 400 A or intended for use in complex systems.	No limit line. Make an EMC plan

VZH compressor with drive package achieve EMC Class A Group 1 emission and immunity requirements.

EMC Emission Test Results CDS803 + VZH088/117/170

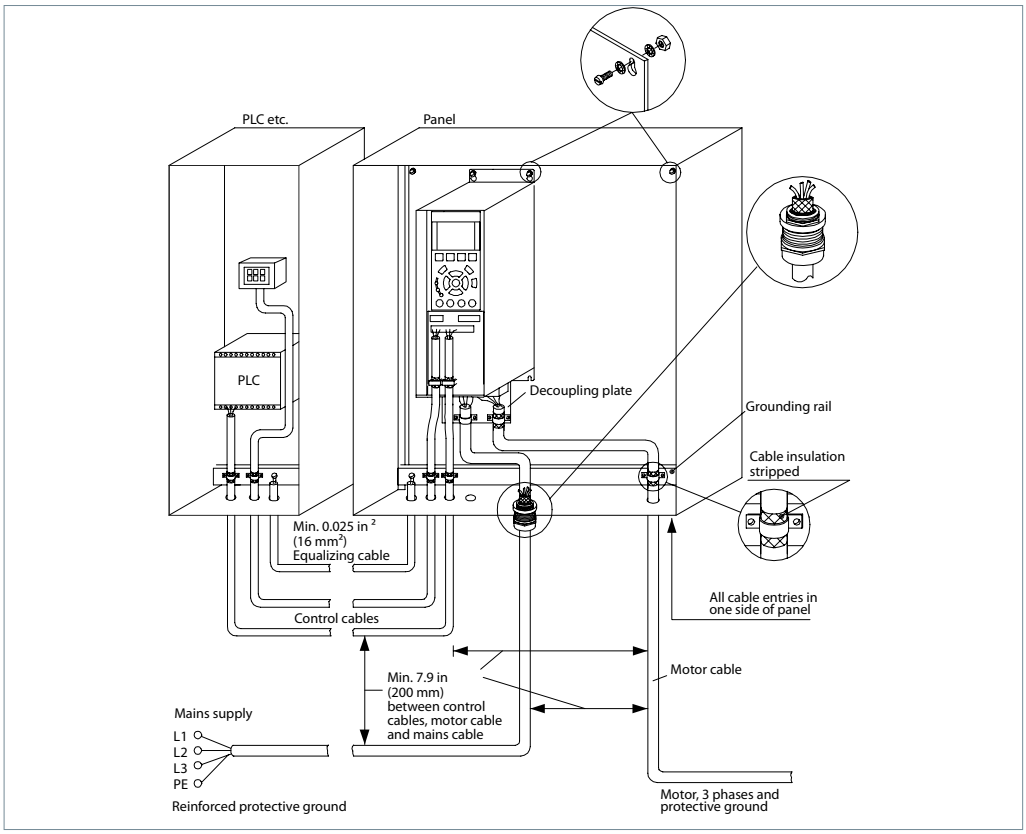
RFI Filter type	Conducted emission		Radiated emission
EN 55011	**Class A Group 1** Industrial environment		Class A Group 1 Industrial environment
EN/IEC 61800-3	**Category C2** First environment Home and office		Category C2 First environment Home and office
H2 RFI filter (EN 55011 A2, EN/IEC 61800-3 C3)	Input cable test setup		Output cable test setup
3x380–480 V IP20	Without external filter	With external filter	Without external filter
18.5kW	2m with ferrite core	-	5m with ferrite core
22kW	2m with ferrite core	-	5m with ferrite core
30kW	1.5m	5m	5m

EMC best practices

- Use screened (shielded) cables for motor, control wiring and communication.
- Separate cables for input power, motor wiring and control wiring. Failure to isolate power, motor, control and communication cables can result in unintended behavior or reduced performance. Minimum 200 mm (7.9 in) clearance between power, motor and control cables is required.
- Ensure VFD proper grounding
- Motor cables should be as short as possible to reduce noise level and leakage currents.
- Use the decoupling plate to fix and terminate cables(Refer to EMC correct installation of an frequency drive CDS803).

EMC correct installation of an frequency drive CDS803

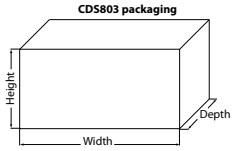
EMC qualification reports are available upon request to Danfoss technical support.



Packaging and ordering codes

Packaging

Frequency converter single pack



Drive supply voltage	Drive power (kW)	IP20			
		Height (mm)	Width (mm)	Depth (mm)	Weight (kg)
T4: Code G	18.5-22	395	233	380	9.5
	30	850	370	460	24.5

Ordering codes

VZH voltage code G-380-480 Volt

Compressor model	Frequency converter			
	Model & power	IP class	RFI class	Code n° for ordering
VZH088-G	CDS803 18.5kW	IP20	H2	136U4910
VZH117-G	CDS803 22kW	IP20	H2	136U4911
VZH170-G	CDS803 30kW	IP20	H2	136U4254

LCP: user interface 120Z0581(accessory)

LCP's

Spare parts frequency converter

Type	Code n°	Description	Application	Packaging	Pack size
	120Z0581	LCP	Frequency converter 803/VZH028-044 code G & codeJ, VZH088-170 code G	Single pack	1
	120Z0617	LCP kit for remote mounting contains rubber sealing, 3m cable, bracket and screws	Frequency converter 803/VZH028-044 code G & codeJ, VZH088-170 code G	Single pack	1
	132B0132	LCP 31 cable, 3m	Frequency converter 803/VZH028-044 code G & codeJ, VZH088-170 code G	Single pack	1

Decoupling Plate

Frame	Compressor	Decoupling plate	Packaging	Pack size
H5	VZH088/117CG	120Z0583	Single pack	1
H6	VZH170CG	132B0207	Single pack	1

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Danfoss Turbocor Compressors

Danfoss Inverter Scrolls

Danfoss Scrolls

Danfoss Optyma™ Condensing Units

Danfoss Maneurop Reciprocating Compressors

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