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## General warning

The voltage of the frequency converter is dangerous whenever the converter is connected to mains. Incorrect fitting of the motor or frequency converter may cause damage to the equipment, serious injury or death. Consequently, it is essential to comply with the instructions in this manual as well as local and national rules and safety regulations

- The VLT frequency converter must be disconnected from mains if repair work is to be carried out. Check that the mains supply has been disconnected and that the necessary time has passed before removing motor and mains plugs.
- 2. The [STOP/RESET] or [OFF/STOP] key on the control panel of the VLT frequency converter does <u>not</u> disconnect the equipment from mains and is thus <u>not to be used as a safety switch.</u>
- Correct protective earthing of the equipment must be established, the user must be protected against supply voltage, and the motor must be protected against overload in accordance with applicable national and local regulations.
- 4. The earth leakage currents are higher than 3.5 mA.
- 5. Protection against motor overload is <u>not</u> included in the factory setting. If this function is desired, set parameter 128 to data value *ETR trip* or data value *ETR warning*. On VLT 6000, set parameter 117 to data value *ETR trip* or data value *ETR warning*.

<u>Note:</u> The function is initialised at 1.16 x rated motor current and rated motor frequency (see Operating manual).

- For the North American market: The ETR functions provide class 20 motor overload protection in accordance with NEC.
- Do <u>not</u> remove the plugs for the motor and mains supply while the VLT frequency converter is connected to mains. Check that the mains supply has been disconnected and that the necessary time has passed before removing motor and mains plugs.
- 7. Please note that the VLT frequency converter has more voltage inputs than L1, L2 and L3, when loadsharing (linking of DC intermediate circuit) and external 24 V DC have been installed. Check that all voltage inputs have been disconnected and that the necessary time has passed before repair work is commenced.

## Warning against unintended start

- The motor can be brought to a stop by means of digital commands, bus commands, references or a local stop, while the frequency converter is connected to mains. If personal safety considerations make it necessary to ensure that no unintended start occurs, these stop functions are not sufficient.
- While parameters are being changed, the motor may start. Consequently, the stop key [STOP/RE-SET] or [OFF/STOP] must always be activated, following which data can be modified.
- 3. A motor that has been stopped may start if faults occur in the electronics of the frequency converter, or if a temporary overload or a fault in the supply mains or the motor connection ceases.

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Touching the electrical parts may be fatal - even after the equipment has been disconnected from mains. Also make sure that other voltage inputs have been disconnected, such as external 24 V DC, load-sharing (linkage of DC intermediate circuit), as well as the motor connection for kinetic back-up.

Using VLT 5300-5500 / 6350-6550: wait at least 15 minutes



## VLT® 5000/6000 Series

## Introduction

#### Manual objectives

The purpose of this manual is to provide the user with the necessary information to install, program and start up the Danfoss VLT 5300-5500 and VLT 6350-6550 frequency converters. This manual should be read thoroughly before operating, servicing or initializing the drives. This manual is intended for use along with the Danfoss Operating Instructions Manual for the VLT 5000/6000 frequency converters for detailed information.

### Who should use this manual

This manual is intended for qualified service personnel responsible for setting up and servicing the Danfoss VLT 5300-5500 and VLT 6350-6550 frequency converters. Qualified personnel have previous experience with the frequency converters and understand electrical fundamentals, programming procedures, required equipment and safety precautions.

### Organization of the manual

This manual is arranged in equipment installation and connection sequence. The order of tasks are arranged as follows:

- Safety instructions
- Transportation and unpacking
- Technical data
- Mechanical installation
- Pre-installation
- Electrical installation guidelines
- Control cable routing
- Connection examples
- Electrical installation procedures
- Motor start

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### Transportation and unpacking

To lessen the possibility of damage it is recommended that the crated VLT frequency converter is located as close to the final installation site as possible before uncrating.

Door and ceiling clearances must be considered when moving and installing the VLT frequency converter. See below table for the crate dimensions:

### Dimensions [mm]:

	Н	W	D
IP 00	2096	1219	699
IP 20 / 54	2324	1321	724

## Weight [kg]:

	VLT	VLT	VLT	VLT
	5300/	5350/	5450/	5500/
	6350	6400	6500	6550
IP 00	548	583	628	653
IP 20	654	689	734	759
IP 54	664	699	744	769

A qualified person with a forklift or other similar lifting device will be needed to remove the VLT frequency converter from the crate.

To open the crate:

• Remove the metal locking tabs that secure the top panel of the crate, this will give access to the lifting rings on the top of the VLT frequency converter.



- On IP 00 versions remove the supporting brace bolted to the lifting rings.
- A forklift or similar lifting device should be used at this time to ensure the stability of the VLT frequency converter while the rest of the crate is removed. Position the lifting device to the front side of the crate.
- The VLT frequency converter should be lifted using a spreader bar or other similar lifting device. Lift the VLT frequency converter slightly, using all four lifting rings, distributing the weight as evenly as possible.



## VLT® 5000/6000 Series

## Do not lift in this manner.



Proper lifting method.



- Remove the metal locking tabs and the remaining crate panels.
- On IP 00 versions remove the clear plastic safety barrier from the front of the unit to prevent the possibility of breaking during positioning of the VLT frequency converter.
- The VLT frequency converter is now ready to be lifted and positioned in the installation site.
   NOTE: On IP 00 versions there are inductors bolted to the bottom of the crate. Lift the VLT frequency converter high enough to allow clearance over these inductors.
- Observe cooling and ventilation requirements given in the "Installation Site" section of this manual.
- Secure to the floor using the four holes provided in the bottom of the unit. On IP 00 versions secure to the panel using the four mounting holes provided in the back. Refer to the dimensional drawings in this instruction manual.





1200



600

All dimensions are in mm.

 $\mathbf{x}$ 



## ■ Key diagram forVLT 5300-5500 380-500 V and VLT 6350-6550 380-460 V



Brake terminals 81, 82 and 104-106 are not available in VLT 6000 HVAC.



## ■ Mains supply 3 x 380-500 V

ments	, -	VLT type	5300	5350	5450	5500
	Normal overload	torque (110 %):				
	Output current	I <sub>VIT.N</sub> [A] (380-440 V)	480	600	658	745
	·	IVIT. MAX (60 s)[A](380-440 V)	528	660	724	820
		I <sub>VLT.N</sub> [A] (441-500 V)	443	540	590	678
		I <sub>VLT. MAX</sub> (60 s)[A](441-500 V)	487	594	649	746
	Output	S <sub>VLT,N</sub> [kVA] (380-440 V)	333	416	456	516
		S <sub>VLT,N</sub> [kVA] (441-500 V)	384	468	511	587
	Typical shaft outp	out (380-440 V) P <sub>VLT.N</sub> [kW]	250	315	355	400
	Typical shaft outp	out (380-440 V) P <sub>VLT,N</sub> [HP]	300	350	450	500
	Typical shaft outp	out (441-500 V) P <sub>VLT,N</sub> [kW]	315	355	400	500
	Typical shaft outp	out (441-500 V) P <sub>VLT.N</sub> [HP]	350	450	500	600
	High overload to	orque (150 %):				
	Output current	I <sub>VLT,N</sub> [A] (380-440 V)	395	480	600	658
		I <sub>VLT, MAX</sub> (60 s)[A](380-440 V)	593	720	900	987
		I <sub>VLT,N</sub> [A] (441-500 V)	361	443	540	590
		IVLT, MAX (60 s)[A](441-500 V)	542	665	810	885
	Output	S <sub>VLT,N</sub> [kVA] (380-440 V)	274	333	416	456
		S <sub>VLT,N</sub> [kVA] (441-500 V)	313	384	468	511
	Typical shaft outp	out (380-440 V) P <sub>VLT,N</sub> [kW]	200	250	315	355
	Typical shaft outp	out (380-440 V) P <sub>VLT,N</sub> [HP]	300	350	450	500
	Typical shaft outp	out (441-500 V) P <sub>VLT,N</sub> [kW]	250	315	355	400
<u></u>	Typical shaft outp	out (441-500 V) P <sub>VLT,N</sub> [HP]	350	450	500	600
	Max. cross-section	on of copper cable to motor,	2 x 150	2 x 185	2 x 240	2 x 300
	and loadsharing	(380-440 V) [mm²] <sup>5)</sup>	3 x 70	3 x 95	3 x 120	3 x 150
	Max. cross-section	Max. cross-section of copper cable to motor		2 x 150	2 x 185	2 x 300
	and loadsharing	(441-500 V) [mm²] <sup>5)</sup>	3 x 70	3 x 95	3 x 95	3 x 120
	Max. cross-section	on of aluminium cable to motor	2 x 185	2 x 240	2 x 300	
	and loadsharing	(380-440 V) [mm²] <sup>5)</sup>	3 x 120	3 x 150	3 x 185	3 x 185
	Max. cross-section	on of aluminium cable to motor	2 x 150	2 x 185	2 x 240	
	and loadsharing	(441-500) [mm <sup>2</sup> ] <sup>5)</sup>	3 x 95	3 x 120	3 x 150	3 x 185
	Max. cross-section	on of copper cable to motor	2x250mcm	2x350mcm	2x400mcm	2x500mcm
	and loadsharing	(380-440 V) AWG] <sup>2) 5)</sup>	3 x 2/0	3 x3/0	3 x 4/0	3x250mcm
	Max. cross-section	on of copper cable to motor	2 x 4/0	2x300mcm	2x350mcm	2x500mcm
	and loadsharing	(441-500 V) AWG] <sup>2) 5)</sup>	3 x 1/0	3 x 3/0	3 x 3/0	3 x 4/0
	Max. cross-section	on of aluminium cable to motor	2x350mcm	2x500mcm	2x600mcm	2x700mcm
	and loadsharing	(380-440 V) AWG] <sup>2) 5)</sup>	3 x 4/0	3x250mcm	3x300mcm	3x350mcm
	Max. cross-section	on of aluminium cable to motor	2x300mcm	2x400mcm	2x500mcm	2x600mcm
	and loadsharing	(441-500 V) AWG] <sup>2) 5)</sup>	3 x 3/0	3 x 4/0	3x250mcm	3x300mcm



ments	lional require-	VLT type	5300	5350	5450	5500
	Rated input	I <sub>VLT,N</sub> [A] (400 V)	389	467	584	648
		I <sub>VLT, N</sub> (460 V)	431	431	526	581
	Max. cross-section	of copper cable to power	2 x 150	2 x 185	2 x 240	2 x 300
	(380-440 V) [mm <sup>2</sup> ] <sup>5</sup>		3 x 70	3 x 95	3 x 120	3 x 150
	Max. cross-section of copper cable to power		2 x 120	2 x 150	2 x 185	2 x 300
	(441-500 V) [mm <sup>2</sup> ] <sup>5)</sup>		3 x 70	3 x 95	3 x 95	3 x 120
	Max. cross-section	of aluminium cable to	2 x 185	2 x 240	2 x 300	
	power (380-440 V)	[mm <sup>2</sup> ] <sup>5)</sup>	3 x 120	3 x 150	3 x 185	3 x 185
	Max. cross-section	of aluminium cable to	2 x 150	2 x 185	2 x 240	
	power (441-500 V)	[mm <sup>2</sup> ] <sup>5)</sup>	3 x 95	3 x 120	3 x 150	3 x 185
	Max. cross-section	of copper cable to power	2x250mcm	2x350mcm	2x400mcm	2x500mcm
	(380-440 V) AWG] <sup>2)</sup>	5)	3 x 2/0	3 x3/0	3 x 4/0	3x250mcm
	Max. cross-section	of copper cable to power	2 x 4/0	2x300mcm	2x350mcm	2x500mcm
	(441-500 V) AWG] <sup>2)</sup>	5)	3 x 1/0	3 x 3/0	3 x 3/0	3 x 4/0
	Max. cross-section	of aluminium cable to	2x350mcm	2x500mcm	2x600mcm	2x700mcm
	power (380-440 V)	AWG] <sup>2) 5)</sup>	3 x 4/0	3x250mcm	3x300mcm	3x350mcm
	Max. cross-section	of aluminium cable to	2x300mcm	2x400mcm	2x500mcm	2x600mcm
	power (441-500 V)	AWG] <sup>2) 5)</sup>	3 x 3/0	3 x 4/0	3x250mcm	3x300mcm
	Max. pre-fuses (ma	ins)	630/600	700/700	800/800	800/800
	Integral pre-fuses (s	softcharge circuit)	15/15	15/15	15/15	30/30
	Integral pre-fuses (s	softcharge resistors)	12/12	12/12	12/12	12/12
	Integral pre-fuses (S	SMPS)	5.0/5.0			
	Efficiency		0.97			
	Weight IP 00		480	515	560	585
	Weight IP 20		595	630	675	700
	Weight IP 54		605	640	685	710
	Power loss at max.	load	7500	9450	10650	12000
	Enclosure		IP 00 / IP 2	20 / IP 54		

- If UL/cUL is to be complied with, pre-fuses type Bussmann FWH and FWX or similar must be used. Pre-fuses type gR must be used for VLT 5300 - 5500 380-500 V. Fuses must be designed for protection in a circuit capable of supplying a maximum of 100,000 Amps ms (symmetrical), 500 V maximum.
- 3. Measured using 30 m screened motor cables at rated load and rated frequency.
- 4. Min. cable cross-section is the smallest cable cross-section allowed to be fitted on the terminals. Always comply with national and local regulations on min. cable cross-section.
- 5. Connection stud 2 x M12 / 3 x M12.

2. American Wire Gauge.

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#### ■ Mains supply 3x 380-500 V

According to interna	ational require-							
ments		VLT type	6350	6450	6500	6550		
	Normal overload torque (110 %):							
	Output cur- rent	I <sub>VLT,N</sub> [A] (380-415 V)	480	600	658	745		
		I <sub>VLT, MAX</sub> (60 s)[A](380-415 V)	528	660	724	820		
		I <sub>VLT,N</sub> [A] (440-460 V)	443	540	590	678		
		I <sub>VLT, MAX</sub> (60 s)[A](440-460 V)	487	594	649	746		
	Output	S <sub>VLT,N</sub> [kVA] (380-415 V)	333	416	456	516		
		S <sub>VLT,N</sub> [kVA] (440-460 V)	384	468	511	587		
	Typical shaft o	utput (380-415 V) P <sub>VLT,N</sub> [kW]	250	315	355	400		
	Typical shaft o	utput (380-415 V) P <sub>VLT,N</sub> [HP]	300	350	450	500		
	Typical shaft o	315	355	400	500			
	Typical shaft output (440-460 V) PvLT,N [HP]		350	450	500	600		
	Max. cross-section of copper cable to motor,		2 x 150	2 x 185	2 x 240	2 x 300		
	brake and loadsharing (380-415 V) $[mm^2]^{5)}$		3 x 70	3 x 95	3 x 120	3 x 150		
	Max. cross-section of copper cable to motor		2 x 120	2 x 150	2 x 185	2 x 300		
	and loadsharin	3 x 70	3 x 95	3 x 95	3 x 120			
<del>مم</del> ا	Max. cross-se	2 x 185	2 x 240	2 x 300				
	motor and load	3 x 120	3 x 150	3 x 185	3 x 185			
	Max. cross-se	2 x 150	2 x 185	2 x 240				
	motor and loadsharing (440-460) [mm <sup>2</sup> ] <sup>5</sup> )		3 x 95	3 x 120	3 x 150	3 x 185		
	Max. cross-se	ction of copper cable to motor	2x250mcm	2x350mcm	2x400mcm	2x500mcm		
	and loadsharin	g (380-415 V) AWG] <sup>2) 5)</sup>	3 x 2/0	3 x3/0	3 x 4/0	3x250mcm		
	Max. cross-se	ction of copper cable to motor	2 x 4/0	2x300mcm	2x350mcm	2x500mcm		
	and loadsharin	g (440-460 V) AWG] <sup>2) 5)</sup>	3 x 1/0	3 x 3/0	3 x 3/0	3 x 4/0		
	Max. cross-se	ction of aluminium cable to	2x350mcm	2x500mcm	2x600mcm	2x700mcm		
	motor and load	dsharing (380-415 V) AWG] <sup>2) 5)</sup>	3 x 4/0	3x250mcm	3x300mcm	3x350mcm		
	Max. cross-se	ction of aluminium cable to	2x300mcm	2x400mcm	2x500mcm	2x600mcm		
	motor and load	dsharing (440-460 V) AWG] <sup>2) 5)</sup>	3 x 3/0	3 x 4/0	3x250mcm	3x300mcm		

- If UL/cUL is to be complied with, pre-fuses type Bussmann FWH and FWX or similar must be used. Pre-fuses type gR must be used for VLT 6350 - 6550 380-460 V. Fuses must be designed for protection in a circuit capable of supplying a maximum of 100,000 Amps ms (symmetrical), 500 V maximum.
- 2. American Wire Gauge.

- 3. Measured using 30 m screened motor cables at rated load and rated frequency.
- 4. Min. cable cross-section is the smallest cable cross-section allowed to be fitted on the terminals. Always comply with national and local regulations on min. cable cross-section.
- 5. Connection stud 2 x M12 / 3 x M12.



According to interna	ational require-					
ments		VLT type	6350	6450	6500	6550
	Rated input current	I <sub>VLT,N</sub> [A] (400 V)	389	467	584	648
		I <sub>VLT, N</sub> (460 V)	431	431	526	581
	Max. cross-secti	on of copper cable to power	2 x 150	2 x 185	2 x 240	2 x 300
	(380-415 V) [mm	<sup>1</sup> <sup>2</sup> ] <sup>5</sup> )	3 x 70	3 x 95	3 x 120	3 x 150
	Max. cross-secti	on of copper cable to power	2 x 120	2 x 150	2 x 185	2 x 300
	(440-460 V) [mm	1 <sup>2</sup> ] <sup>5</sup> )	3 x 70	3 x 95	3 x 95	3 x 120
	Max. cross-secti	on of aluminium cable to	2 x 185	2 x 240	2 x 300	
	power (380-415	V) [mm²] <sup>5)</sup>	3 x 120	3 x 150	3 x 185	3 x 185
	Max. cross-secti	on of aluminium cable to	2 x 150	2 x 185	2 x 240	
	power (440-460	V) [mm²] <sup>5)</sup>	3 x 95	3 x 120	3 x 150	3 x 185
	Max. cross-secti	on of copper cable to power	2x250mcm	2x350mcm	2x400mcm	2x500mcm
	(380-415 V) AWO	G] <sup>2) 5)</sup>	3 x 2/0	3 x3/0	3 x 4/0	3x250mcm
	Max. cross-secti	on of copper cable to power	2 x 4/0	2x300mcm	2x350mcm	2x500mcm
	(440-460 V) AWO	G] <sup>2) 5)</sup>	3 x 1/0	3 x 3/0	3 x 3/0	3 x 4/0
	Max. cross-secti	on of aluminium cable to	2x350mcm	2x500mcm	2x600mcm	2x700mcm
	power (380-415	V) AWG] <sup>2) 5)</sup>	3 x 4/0	3x250mcm	3x300mcm	3x350mcm
n	Max. cross-secti	on of aluminium cable to	2x300mcm	2x400mcm	2x500mcm	2x600mcm
	power (440-460	V) AWG] <sup>2) 5)</sup>	3 x 3/0	3 x 4/0	3x250mcm	3x300mcm
	Max. pre-fuses (	mains)	630/600	700/700	800/800	800/800
	Integral pre-fuses	s (softcharge circuit)	15/15	15/15	15/15	30/30
	Integral pre-fuses	s (softcharge resistors)	12/12	12/12	12/12	12/12
	Integral pre-fuses	s (SMPS)	5.0/5.0			
	Efficiency		0.97			
	Weight IP 00		480	515	560	585
	Weight IP 20		595	630	675	700
	Weight IP 54		605	640	685	710
	Power loss at ma	ax. load	7500	9450	10650	12000
	Enclosure		IP 00 / IP 2	20 / IP 54		

- If UL/cUL is to be complied with, pre-fuses type Bussmann FWH and FWX or similar must be used. Pre-fuses type gR must be used for VLT 6350 - 6550 380-460 V. Fuses must be designed for protection in a circuit capable of supplying a maximum of 100,000 Amps ms (symmetrical), 500 V maximum.
- 2. American Wire Gauge.
- 3. Measured using 30 m screened motor cables at rated load and rated frequency.
- 4. Min. cable cross-section is the smallest cable cross-section allowed to be fitted on the terminals. Always comply with national and local regulations on min. cable cross-section.
- 5. Connection stud 2 x M12 / 3 x M12.



## Mechanical installation

## Mechanical dimensions

VLT 5300-5500 380-500 Volt and VLT 6350-6550 380-460 Volt					
VIT type	$\Delta$ (mm)	B (mm)	C. (mm)	ab	l/r
VET type			0 (1111)	(mm)	(mm)
5300-5500/6350-6550 IP 00	1896	1099	494	400	0
5300-5500/6350-6550 IP 20	2010	1200	600	400	0
5300-5500/6350-6550 IP 54	2010	1200	600	400	0

ab: Min. space above enclosure.

I/r: Min. distance between VLT frequency converter and other plant components, left and right sides.



VLT 5300-5500 and VLT 6350-6550 must be fastened to the floor with bolts. The drawing shows the dimensions.





### Pre-installation

The most important part of the mechanical installation is the pre-installation planning. Neglecting this planning may very well result in extra work during and after the installation

Before you install your VLT frequency converter you should select the best possible operational site. Consider the following in the pre-installation plan:

- Ambient operating temperature.
- Installation method.
- The position of the VLT frequency converter.
- The cable routing.
- Ensure that the power source supplies the correct voltage and necessary current.
- If the VLT frequency converter is without built-in mains disconnector and fuses, ensure that the external disconnector or fuses have the correct current rating.

### Installation site

The VLT frequency converter must be installed vertically.

The VLT frequency converter is cooled by means of air circulation. For the unit to be able to release its cooling air, the minimum distance over the unit must be as shown in the table under Mechanical Dimension.

To protect the unit from overheating, it must be ensured that the ambient temperature does not rise above the max. temperature stated for the VLT frequency converter and that the 24-hour average temperature is not exceeded. The max. temperature and 24-hour average can be seen from the General Technical Data in the Operating Instructions. If the ambient temperature is in the range of  $45^{\circ}$  -55°C, derating of the VLT frequency converter will become relevant, see Derating for ambient temperature.

The service life of the VLT frequency converter will be reduced if derating for ambient temperature is not taken into account.

### Installation of VLT 5300-5500 380-500 V and VLT 6350-6550380-460 V IP 00, IP 20 and IP 54 Cooling



All units in the above-mentioned series require a minimum space of 400 mm above the enclosure and must be installed on a plane floor. This applies to both IP 00, IP 20 and IP 54 units.



## Side-by-side

IP 00, IP 20 and IP 54

All IP 00, IP 20 and IP 54 units in the abovementioned series can be installed side by side without any space between them, since these units do not require cooling on the sides.



#### ■ Cable site



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The drawing and table show the mechanical setup of the cable which can be done before the VLT frequency converter is installed.

VLT type	Mains terminal
VLT 5300-5500/6350-6550	969 mm
VLT 5300-5500/6350-6550 with RFI	516 mm
VLT 5300/6350 with RFI/Disconnec- tor	626 mm
VLT 5350-5500/6400-6550 with RFI/ Disconnector	516 mm

#### Derating for high altitude

Below 1000 m altitude no derating is necessary for VLT 5300-5500 or VLT 6350-6550.

Above 1000 m the ambient temperature ( $T_{AMB}$ ) or max. output current ( $I_{VLT,MAX}$ ) must be derated in accordance with the diagram below:

- 1. Derating of output current versus altitude at T<sub>AMB</sub> = max. 45  $^{\circ}C$
- 2. Derating of max.  $T_{AMB}$  versus altitude at 100% output current.



#### Derating for ambient temperature

The ambient temperature ( $T_{AMB,MAX}$ ) is the maximum temperature allowed. The average ( $T_{AMB,AVG}$ ) measured over 24 hours must be at least 5°C lower. If VLT 5300-5500 or VLT 6350-6550 is operated at

temperatures above 45 °C, a derating of the continuous output current is necessary.





## Electrical installation



The voltage

on the frequency converter is dangerous when the unit is connected to mains. Incorrect installation of the motor or VLT

frequency converter may lead to material damage or serious injury or it may be fatal.

Consequently, the instructions in this manual as well as national and local rules and safety regulations must be complied with.

Touching the electrical parts may be fatal, even after the mains supply has been disconnected. Wait at least 15 minutes if using VLT 5300-5500 or VLT 6350-6550.

## NB!:

It is the user's or certified electrician's responsibility to ensure correct earthing and protection in accordance with applicable national and local norms and standards.

All terminals for the control cables and power cables are located behind the protective cover of the VLT frequency converter. The protective cover can be removed by means of a screwdriver.

Once the protective cover has been removed, the actual EMC-correct installation can start.

## Pre-fuses

For VLT type 5300-5500 380-500 V and VLT type 6350-6550 380-460 V, external pre-fuses must be installed in the mains supply to the VLT frequency converter.

Note that by VLT type 5300-5500 and VLT type 6350-6550 you can built-in the pre-fuses and a mains disconnector.

If UL/cUL is to be complied with, pre-fuses type Bussmann FWH and FWX or similar must be used. If UL/cUL not is to complied with pre-fuses type gR can be used for VLT 5300-5500, 380-500 V and VLT 6350-6550 380-460 V. Fuses must be designed for protection in a circuit capable of supplying a maximum of 100,000 Amps ms (symmetrical), 500 V maximum.

See Technical data for correct sizing of pre-fuses.

## Earthing

The following basic issues need to be considered when installing a frequency converter, so as to obtain electromagnetic compatibility (EMC).

- Safety earthing: Please note that the frequency converter has a high leakage current and must be earthed appropriately for safety reasons. Apply local safety regulations.
- High-frequency earthing: Keep the earth wire connections as short as possible.

Connect the different earth systems at the lowest possible conductor impedance. The lowest possible conductor impedance is obtained by keeping the conductor as short as possible and by using the greatest possible surface area.

The metal cabinets of the different devices are mounted on the cabinet rear plate using the lowest possible HF impedance. This avoids having different HF voltages for the individual devices and avoids the risk of radio interference currents running in connection cables that may be used between the devices. The radio interference will have been reduced. In order to obtain a low HF impedance, use the fastening bolts of the devices as HF connection to the rear plate. It is necessary to remove insulating paint or similar from the fastening points.

## RFI switch

Mains supply isolated from earth:

If the VLT frequency converter is supplied from an isolated mains source (IT mains), the RFI switch can be turned off (OFF). In OFF position, the internal RFI capacities (filter capacitors) between the chassis and the intermediate circuit are cut off to avoid damage to the intermediate circuit and to reduce the earth capacity currents (according to IEC 1800-3). See position of RFI switch by Electrical installation, enclosures.



# NB!: The RFI switch is not to be operated with

mains connected to the unit. Check that the mains supply has been disconnected before operating the RFI switch.



## Open RFI switch is only

allowed at factory set switching frequencies.



The RFI switch disconnects the capacitors galvanically; however, transients higher than approx. 1,000 V will be bypassed by a spark gap.

## Mains supply connected to earth:

The RFI switch must be in ON position in order for the frequency converter to comply with the EMCstandard.

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#### Electrical installation, power cables



able in VLT 6000 HVAC.





## ■ Electrical installation, enclosure

Compact IP 20 / IP 54 VLT 5300-5500, 380-500 V VLT 6350-6550, 380-460 V

Brake terminals 81, 82 and 104-106 are not available in VLT 6000 HVAC.



#### Terminal adapter kit



#### 176FA036.10

The terminal adapter kit is an optional kit for VLT 5300-5500 and VLT 6350-6650.

The terminal adapter kit makes it possible to connect the power wires with the power terminals i.e. the mains-, motor-, load sharing and brake terminals.

The ordering numbers of the terminal adapter kit are:

VLT 5	5300-5500/6350-6550 EX, E	- XC	176F1815
VLT 5	5300-5500 EB, DE	-	176F1816

### ■ Tightening-up torques

The table shows the torque required when fitting terminals to the VLT frequency converter.

For VLT 5300-5500 and VLT 6350-6550 the cables must be fastened with bolts or the terminal adapter kit. These figures apply to the following terminals:

Mains terminals	Nos	R, L1, 91
		S, L2, 92
		T, L3, 93
Motor terminals	Nos	U, T1, 96
		V, T2, 97
		W, T3, 98
Earth terminal	No	95
Brake resistor		R- 81
terminals		R+ 82
Loadsharing		DC- 88
		DC+ 89

VLT type	LT type Tightening-up	
	torque	size
VLT 5300-5500 1)	42 Nm	M12
VLT 6350-6550	42 Nm	M12

<sup>1)</sup> For the brake terminals, the tightening-up torque is 11.3 Nm and the bolt size M8.

## Installation of 24 Volt external DCsupply

Torque: 0.5 - 0.6 Nm Screw size: M3

No.	Function	
35, 36	24 V external DC supply	

24 V external DC supply can be used as low-voltage supply to the control card and any option cards installed. This enables full operation of the LCP (incl. parameter setting) without connection to mains. Please note that a warning of low voltage will be given when 24 V DC has been connected; however, there will be no tripping. If 24 V external DC supply is connected or switched on at the same time as the mains supply, a time of min. 200 msec. must be set in parameter 120 Start delay.

A pre-fuse of min. 6 Amp, slow-blow, can be fitted to protect the external 24 V DC supply. The power consumption is 15-50 W, depending on the load on the control card.



NB!: Use 24 V DC supply of type PELV to ensure correct galvanic isolation (type PELV) on the control terminals of the VLT frequency converter.

## Installation of brake resistortemperature switch

Toraue: 0.5-0.6 Nm Screw size: M3

No.	Function
106, 104, 105	Brake resistor temperature
105	Switch.



This function is only available on VLT 5032-5052 200-240 V and VLT 5060-5500 380-500

If the temperature of the brake resistor gets too high and the KLIXON switch drops out, the VLT frequency converter will stop braking. The motor will start coasting.

A KLIXON switch must be installed that can either be 'normally closed' or 'normally open'. If this function is not used, 106 and 104 must be shortcircuited together.





## ■ Cable cross-sectionand length

See *Technical data* for correct sizing of motor cable and mains cable cross-section. Always comply with national and local regulations on cable crosssections. It is important to keep the motor cable as short as possible so as to reduce the noise level and leakage currents to a minimum.

Max. motor cable length for screened cable is 150 m. Max. motor cable length for unscreened cable is 300 m.

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#### Mains connection

Mains must be connected to terminals R/L1/91, S/ L2/92, T/L3/93.



NB!:

Check the name plate to ensure that the mains voltage of the VLT frequency converter matches the power supply of your plant.

Ensure that the power supply can supply the necessary current to the VLT frequency converter, see Technical data.

If the unit is without built-in mains disconnector and fuses, ensure that the appropriate disconnector or fuses have the correct current rating.

See Technical data for correct sizing of cable crosssections.

See Electrical installation prodedures for how install the mains connections to the VLT frequency converter.



Mains connection from the side without built-in disconnector and fuses







Mains connection from the side with built-in disconnector and fuses





Mains connection from the bottom with built-in disconnector and fuses

## Motor connection

The motor must be connected to terminals U/T1/96, V/T2/97, W/T3/98. Earth to terminal 99.

All types of three-phase asynchronous standard motors can be used with a VLT frequency converter unit.

The factory setting is for clockwise rotation with the VLT frequency transformer output connected as follows.



Terminal U/T1/96 connected to U-phase Terminal V/T2/97 connected to V-phase Terminal W/T3/98 connected to W-phase

The direction of rotation can be changed by switching two phases in the motor cable.

See *Technical data* for correct sizing of cable cross-sections.

See *Electrical installation prodedures* for how install the motor connections to the VLT frequency converter.



Motor connection from the side



Motor connection from the bottom



#### Brake connection

NB!:

The connection cable to the brake resistor must be screened. Connect the screen by means of cable clamps to the conductive back plate at the VLT frequency converter and to the metal cabinet of the brake resistor. Size the brake cable cross-section to match the brake torque.



Please note that voltages up to 850 V DC may occur on the terminals.

See *Electrical installation prodedures* for how install the brake connections to the VLT frequency converter.



Brake connection from the side



Brake connection from the bottom

### Load sharing connection

The connection cable must be screened and the max. length from the VLT frequency converter to the DC bar is 25 metres. Load sharing enables linking of the DC intermediate circuits of several VLT frequency converters.



Please note that voltages up to 850 V DC will occur on the terminals.

Load sharing calls for extra equipment. For further information please consult Loadsharing Instructions MI.50.NX.XX.

See *Electrical installation prodedures* for how install the load sharing connections to the VLT frequency converter.



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## ■ Motor and DC coils connections on IP 00

Motor and DC coils must be installed by the customer by VLT 5300-5500 or VLT 6350-6550 with an IP 00 enclosure. Minimum length of cables are supplied with the VLT frequency converter. See below drawing for the connection between DC coils and the VLT frequency converter and motor coils and the VLT frequency converter.



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## VLT® 5000/6000 Series

## ■ Control cable routing

The drawing below shows how to route your control cable in the VLT frequency converter.





## VLT® 5000/6000 Series

#### ■ Connection example

The diagram below gives an example of a typical installation of a VLT frequency converter.

The mains supply is connected to terminals R/L1/91, S/L2/92 and T/L3/93, while the motor is connected to U/T1/96, V/T2/97 and W/T3/98. These numbers can also be seen from the terminals of the VLT frequency converter.

An external DC supply (load sharing) can be connected to terminals 88 and 89.

Analogue inputs can be connected to terminals 53 [V], 54 [V] and 60 [mA]. These inputs can be programmed for either reference, feedback or thermistor. See *Analogue inputs* in parameter group 300.

There are 8 digital inputs, which can be connected to terminals 16-19, 27, 29, 32, 33. These inputs can be programmed in accordance with the table in the Operating instruction. See *Digital inputs* in parameter group 300.

There are two analogue/digital outputs (terminals 42 and 45), which can be programmed to show the present status or a process value, such as  $0-f_{max}$ . Relay outputs 1 and 2 can be used for giving the present status or a warning.

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



# Brake terminals 81, 82 and 104-106 are not available in VLT 6000 HVAC.



#### Electrical installation procedures

The following procedure will guide you through a correct electrical installation of your VLT frequency converter.

Before you start, please read the safety instructions on the first page of this instruction.

Note that the user is responsible, that the VLT frequency converter, motor and other units are installed according to recognized local regulations. Pay special attention to cable dimensioning, pre-fuses, earthing and over-current protection.

### 1. Mechanical installation check

Check the following before the electrical installation:

- 1. Check for proper ambient operating conditions. See *Derating for ambient temperature*.
- 2. Check for free flow of cooling air.
- 3. Check for proper mechanical installation.

## 2. Before electrical installation

Remove the protective cover to get access to terminals for control and power cables. The protective cover can be removed by means of a screwdriver.

### 3. Load sharing connection

Note

- 1. Tighten the load sharing terminals with a torque of 42 Nm.
- 2. Install the wire for DC+ to terminal 89.
- 3. Install the wire for DC- to terminal 88.



that voltages up to 850 V DC will occur on the terminals when power is connected.

## 4. Mains connection

- 1. Check that the mains voltage matches the VLT frequency converter nominal input voltage.
- 2. Ensure that the power supply can supply the necessary current to the VLT frequency converter, see *Technical data*.
- 3. Tighten the mains and earth terminals with a torque of 42 Nm.
- 4. Install earth from the power supply to the earth bus bar.
- 5. Install line 1 from the power supply to terminal R/L1/91.
- 6. Install line 2 from the power supply to terminal S/ L2/92.
- Install line 3 from the power supply to terminal T/ L3/93.

### 5. Brake resistor (only VLT 5000)

- 1. Tighten the brake resistor terminals with a torque of 11.3 Nm.
- 2. Install the wire for R+ to terminal 81.
- 3. Install the wire for R- to terminal 82.

#### 6. Motor connection

- 1. Tighten the motor and earth terminals with a torque of 42 Nm.
- 2. Install earth from the motor to the earth bus bar.
- 3. Install W from the motor to terminal W/T3/98.
- 4. Install V from the motor to terminal V/T2/97.
- 5. Install U from the motor to terminal U/T1/96.

### 7. Protective cover

Remount the protective cover.

### 8. Power up

Check the following before you power up the VLT frequency converter:

- 1. Check for proper mains fuses. See *Technical data*.
- 2. Check for a proper earthing.
- 3. Check for proper mains, load sharing, brake and motor connection.
- 4. Check that there are no tools in the enclosure.

Close the doors and connect the power to the VLT frequency converter. The green voltage indicator lamp (ON) on the control panel is activated when the VLT frequency converter receives voltage.

The VLT frequency converter can now be programmed via the control panel.

Note that in parameter 620 *Operating mode* you can select *Function with de-activated inverter* [1]. This means that without the motor shaft running you can control the influence of the control signal on the control card.



Wait at least 15 minutes before you open the doors, after the VLT frequency converter has been disconnected from mains



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## VLT<sup>®</sup> 5000/6000 Series

#### Electrical installation, control leads

Note: The terminals on the control card are detachable.

Connect a jumper between terminals 12 + 24 Volt and 27 Coast.

Mount screened cable to external start/stop of control terminals 12 + 24 Volt and 18 Start.



#### Programming the VLT 5000

The frequency converter is programmed over the control panel.

Press QUICK MENU □.

The Quick Menu appears in the display. You choose parameters by means of  $\uparrow$  and  $\downarrow$ .

Press CHANGE DATA 
to change parameter value. Data values are changed using  $\uparrow$  and  $\downarrow$ .

Press  $\rightarrow$  or  $\leftarrow$  to move the cursor. Press OK  $\Box$  to save your parameter setting.

Set the desired language in parameter 001. You have six possibilities: English, German, French, Danish, Spanish, Italian.

Set motor parameters according to the motor plate:

Parameter 102
Parameter 103
Parameter 104
Parameter 105
Parameter 106

Set frequency interval and ramp times.

Parameter	204
Parameter	205
Parameter	207
Parameter	208
	Parameter Parameter Parameter Parameter

Set Operation site, parameter 002 for Local.

### Programming the VLT 6000 HVAC

The frequency converter is programmed over the control panel.

#### Press QUICK MENU □.

The Quick Menu appears in the display. You choose parameters by means of  $\uparrow$  and  $\downarrow$ . Press CHANGE DATA I to change parameter value. Data values are changed using  $\uparrow$  and  $\downarrow$ . Press  $\rightarrow$  or  $\leftarrow$  to move the cursor. Press OK  $\Box$  to save your parameter setting.

Set the desired language in parameter 001. You have nine possibilities: English, German, French, Danish, Spanish, Italian, Swedish, Dutch and Portuguese.

Set motor parameters according to the motor plate:

Motor power	Parameter	102
Motor voltage	Parameter	103
Motor frequency	Parameter	104
Motor current	Parameter	105
Rated motor speed	Parameter	106

Set frequency interval and ramp times.

Vin. reference	Parameter	204
Max. reference	Parameter	205
Ramp up time	Parameter	207
Ramp down time	Parameter	208
Relay 1 function	Parameter	323
Relay 2 function	Parameter	326

#### Motor start

Press START 
on VLT 5000 to start the motor or HAND START on VLT 6000 HVAC to start the motor.

Set motor speed in parameter 003 by VLT 5000.

Set motor speed with the +/- keys by VLT 6000.



Check if the direction of rotation is as shown in the display. It can be changed by swapping two phases of the motor cable.

Press STOP  $\Box$  or OFF/STOP to stop the motor.

Select total or reduced Automatic Motor Adaption (AMA) in parameter 107. For further description of AMA, please see the manual.

Press START 
to start the Automatic Motor Adaption (AMA).

Press DISPLAY/STATUS □ to leave the Quick Menu.



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