■ Introduction

The built-in load sharing in VLT 5000 series gives the possibility to connect more VLT frequency converters over the DC-bus.
The built-in load sharing option is only available in Extended units (EB) in VLT Series 5000.

The aim of load sharing is briefly spoken to connect several VLT frequency converters to the same DC-bus with the following benefits:

- **Energy savings:**
  Energy released from motors running in regenerative mode, is supplied to the other VLT frequency converters which are running in motoring mode. The alternative is to use a brake resistor on each single drive, to consume the energy when the motor runs in regenerative mode.
- **Brake resistor:**
  In dynamic applications use of brake resistors is often necessary. When using load sharing only One common brake resistor is needed, instead of a brake resistor for each drive.
- **Power back-up:**
  At mains failure a backup can be supplied through the DC-bus. The customer can now close down his process in a controlled way or keep the process running.

■ General

The number of VLT frequency convertes which can be connected together is in principle infinite, but the VLT frequency converters which are connected should be of the same voltage (200-240V or 380-500V).

VLT 5000 in the ranges 5001-5052 (380-500 V) or 5001-5027 (200-240 V) can be connected. When connecting VLT 5060-VLT 5500 (380-500 V), VLT 5032-5052 (200-240 V) or VLT 2800 please contact Danfoss for further information.

Depending on how the VLT frequency converters are connected to eachother, it is neccesary with a line reactor in the mains supply and fuses in the DC-bus.

NB!:
When VLT frequency converters are connected to a common DC-bus, there must always be fuses mounted in the + and - DC connection to the common bus to comply with relevant regulations.

This instruction shows 5 configurations with principle diagrams:

A. Connection of VLT frequency converters to an external DC supply
B. One large drive used as common supply
C. All VLT frequency converters are connected to mains and connected to the common DC-bus
D. All VLT frequency converters are connected to mains and with DC-bus back-up
E. All VLT frequency converters are connected to mains and a common DC-bus. A brake resistor connected to one drive.

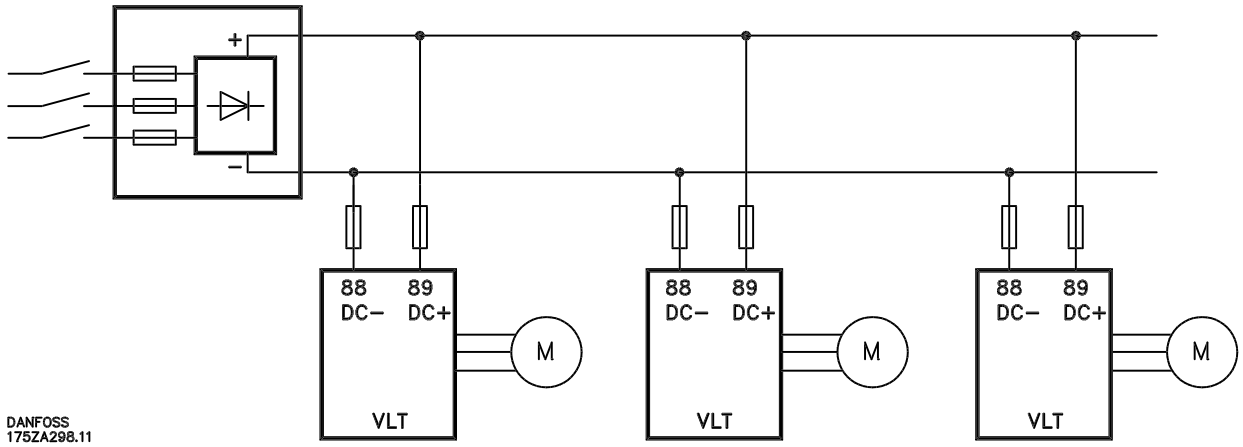
■ Connection of VLT frequency converters to an external DC supply

It is possible to supply all VLT frequency converters from one common DC-bus. No line reactors are necessary, as the intermediate voltage is the same for all VLT frequency converters.

To comply with relevant regulation, it is necessary with fuses in the DC-bus.

The DC-coils in the units will limit the ripple current and minimize the harmonic current to the common DC-supply. The inrush current will be limited by the PTC resistors in the VLT frequency converter.

The external DC-supply is to be able to supply the connected VLT frequency converter, and should be equipped with the neccesary fuses, mains switch and RFI filter.

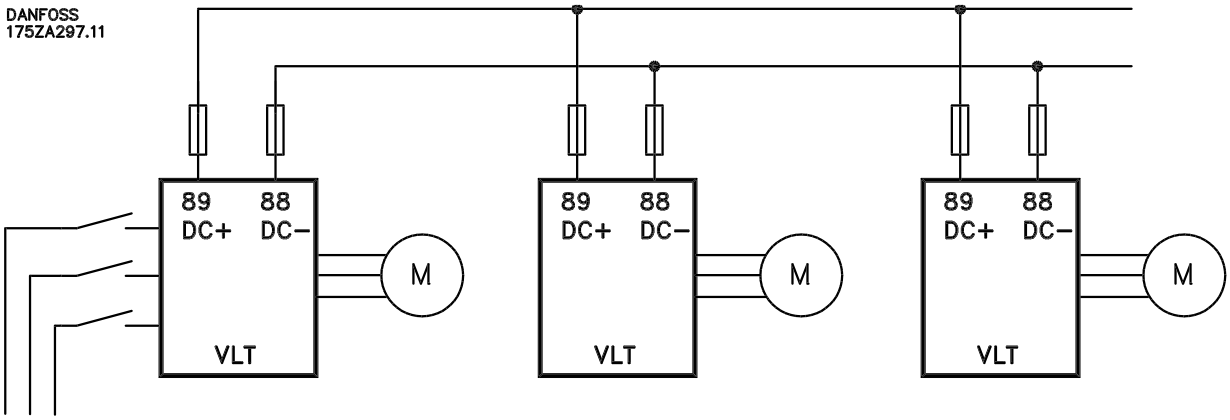


■ One large drive used as common supply

One VLT 5000 (large) connected to mains, and the other VLT frequency converters connected to the common DC-bus.

In this application only the large VLT frequency converter is connected to mains. The large VLT frequency converter has to be dimensioned so that it has capacity enough to supply the remaining VLT frequency converters. This means that the drive must be dimensioned to withstand the maximum motor power.
For example, the large VLT frequency converter could run a large flywheel and only provide power enough to overcome the friction after the start up; if the normal AC power should disappear, the mechanical inertia can be used to supply power via the common DC-bus to smaller VLT frequency converters. Possible application area is the textile industry.

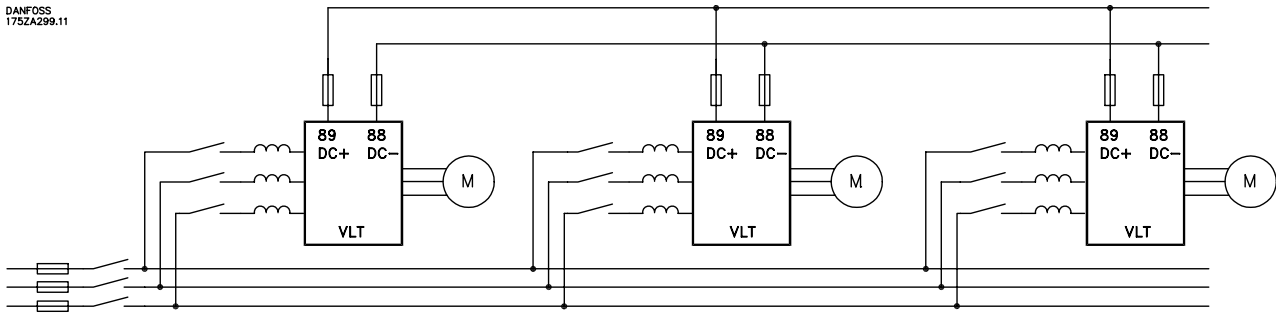
Another situation is one (large) VLT frequency converter with motor connected to the AC supply, and the remaining VLT frequency converter(s) connected to motor(s), which is only in regenerative mode. The large motor provides the power to the application and the smaller motor(s) provide braking torque for the application. This braking power is then “reused“ by the AC connected VLT frequency converter. Possible application area is a centrifuge with continuous supply of material and separation based on torque control. Because only one VLT frequency converter is connected to mains it is not neccesary with line reactors, but fuses in the DC-bus are still a must to comply with relevant legislation.



■ All VLT frequency converters are connected to mains

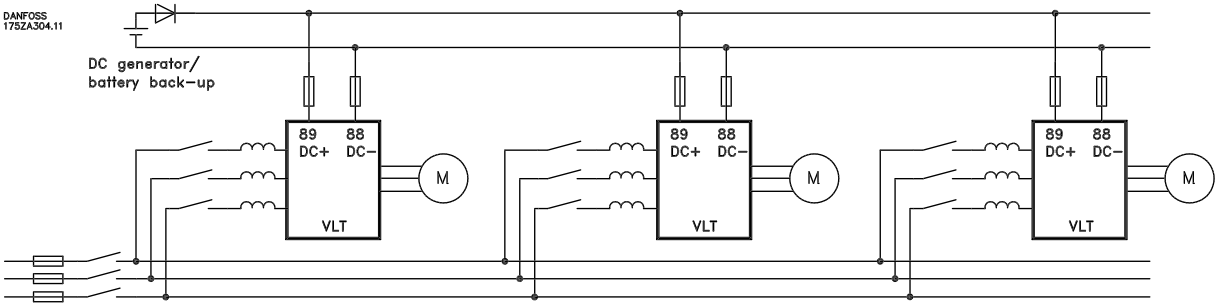
This installation is a typical “load sharing“ application, in which each VLT frequency converter supplies normally power to a motor via the AC supply line; but if one or more motors are driven into regenerative mode, they deliver power to the common DC-bus. This power is then used by other VLT frequency converters, and in this way the installation is more economical. But first of all because in many situations brake resistors can be omitted.

In this situation the DC voltage (intermediate voltage) can be slightly different from converter to converter. This is due to minor differences in the rectifiers, different temperature, etc. This small difference in DC voltage makes is necessary with line reactors in the mains supply. Furthermore, it is also necessary with fuses in the DC-bus.



■ All VLT frequency converters are connected to mains and with DC-bus back-up.

This installation is almost the same as *All VLT frequency converters are connected to mains and connected to the common DC-bus*.
In this situation the DC voltage (intermediate voltage) is used as an emergency back-up. The DC-voltage is made by a DC-generator or a battery backup, and will be turned on when AC supply line to the VLT frequency converters should break down.

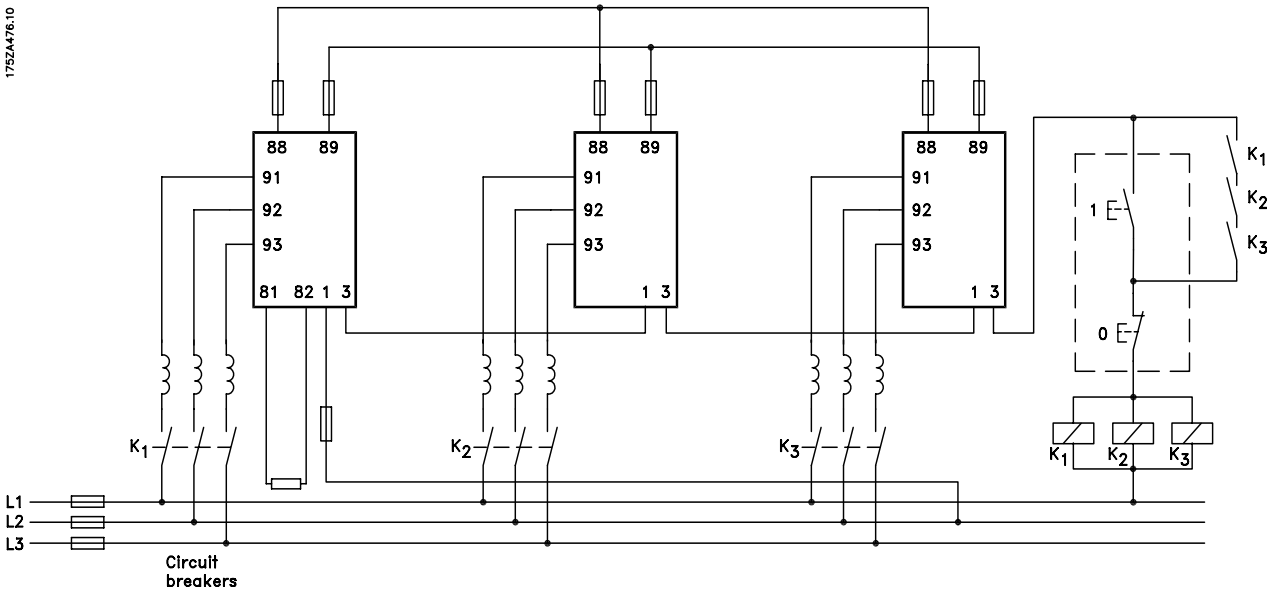


■ **All VLT frequency converters are connected to mains and a common DC-bus. A brake resistor connected to one drive.**

The installation is almost the same as all VLT frequency converters are connected to mains and connected to the common DC-bus. In this example the extra energy from motors running in regenerative mode, is consumed by a brake resistor. As the DC-bus is connected together, it is possible to use only one brake resistor to dissipate the energy.
The brake resistor must be dimensioned to dissipate the maximum energy from braking of the motors and connected to a VLT frequency converter in the system which can withstand the brake power.
The settings of a VLT 5000 must be as follows:

- Drive connected to brake resistor:
Parameter 400: Resistor brake
Parameter 401: Actual ohmic resistance of brake resistor
Parameter 402: The maximum monitoring limit of the actual brake resistor. Calculation see manual.
Parameter 403: Must be set to the appropriate function (Off, Warning or Trip)
Parameter 404: Must be set to the appropriate function (Off, warning or Trip)

- Drive not connected to a brake resistor:
Parameter 400: Resistor brake
Parameter 401: Set the value to the highest possible value
Parameter 402: Set the value to the maximum possible value
Parameter 403: OFF
Parameter 404: OFF



■ Dimension of fuses and line reactors

When 380-500V VLT frequency converters are connected to a common DC-bus, the voltage in the range of 850V is present on the DC terminals, cable and fuses. The electrical installation must be made in accordance with this voltage.

If a short circuit should occur in one of the VLT frequency converters connected to a common DC-bus, the power behind all the parallelly connected capacitors is available. Should short circuit occur to ground, all VLT frequency converters can deliver power to this ground fault. Both of these situations can give severe material damage and lead to a potential dangerous situation.

NB!:
When VLT frequency converters are connected to a common DC-bus, there must always be fuses mounted in the + and - DC connection to the common bus to comply with relevant legislation.

The table below shows the dimensions on the fuses and the line reactors to each unit. The line reactors are calculated to give a voltage drop of 1% or 1.7% depending on the supply.
Fuses must be used to comply with relevant legislation.

Table 1

200-240V units

VLT type	Nominal Power at CT [kW]	Mains voltage [V]	Input current [A]	DC bus fuse [A]	Voltage drop] [%]	Inductivity [mH]	Max. cable cross section [mm²]	Ordering number	Encl. type
5001	0.75	200-240	3.4	4-6	1.7	1.934	4	175U0021	A
5002	1.1	200-240	4.8	6-8	1.7	1.387	4	175U0024	A
5003	1.5	200-240	7.1	8-12	1.7	1.050	4	175U0025	B
5004	2.2	200-240	9.5	10-16	1.7	0.808	4	175U0026	B
5005	3	200-240	11.5	16-20	1.7	0.603	4	175U0028	C
5006	4	200-240	14.5	20-25	1.7	0.490	4	175U0029	C
5008	5.5	200-240	32.0	40-63	1.7	0.230	16	175U0030	D
5011	7.5	200-240	46.0	50-80	1.7	0.167	35	175U0032	F
5016	11	200-240	61.0	80-125	1.7	0.123	35	175U0034	G
5022	15	200-240	73.0	100-160	1.7	0.102	35	175U0036	H
5027	18.5	200-240	88.0	100-160	1.7	0.083	50	175U0047	H

Fuses must be at least type aR, 660V AC

Table 2

380-500V units

VLT type	Nominal Power at CT [kW]	Mains voltage [V]	Input current [A]	DC bus fuse [A]	Voltage drop] [%]	Inductivity [mH]	Max. cable cross section [mm²]	Ordering number	Encl. type
5001	0.75	380-500	2.3	4-6	1	3.196	4	175U0015	A
5002	1.1	380-500	2.6	4-6	1	2.827	4	175U0017	A
5003	1.5	380-500	3.8	4-6	1	1.934	4	175U0021	A
5004	2.2	380-500	5.3	6-8	1	1.387	4	175U0024	A
5005	3	380-500	7.0	8-12	1	1.050	4	175U0025	B
5006	4	380-500	9.1	10-16	1	0.808	4	175U0026	B
5008	5.5	380-500	12.2	16-20	1	0.603	4	175U0028	C
5011	7.5	380-500	15.0	20-25	1	0.490	4	175U0029	C
5016	11	380-500	32.0	40-50	1	0.230	16	175U0030	D
5022	15	380-500	37.5	40-50	1	0.196	16	175U0031	E
5027	18.5	380-500	44.0	63-80	1	0.167	35	175U0032	F
5032	22	380-500	60.0	80-100	1	0.123	35	175U0034	G
5042	30	380-500	72.0	100-160	1	0.102	35	175U0036	H
5052	37	380-500	89.0	100-160	1	0.083	50	175U0047	H

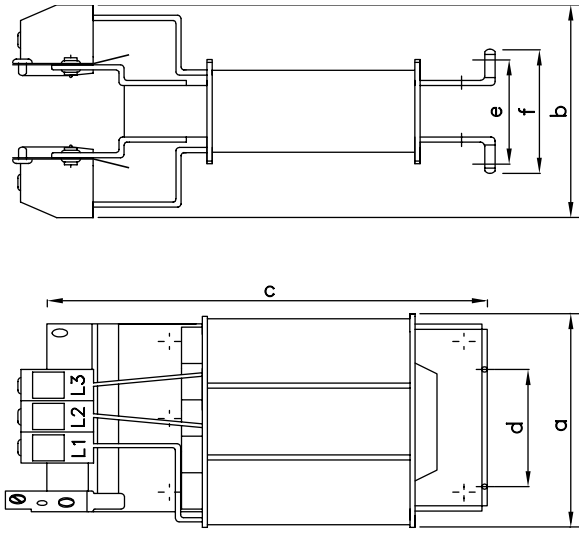
Fuses must be at least type aR, 660V AC

Table 3

Mechanical dimensions

Encl.	a	b	c	d	e	f	Drawing
A	77	64	98	50	31	45	1
B	77	64	98	50	31	52	1
C	95	82	115	56	35	48	1
D	119	104	153	90	39	53	1
E	119	114	153	90	49	63	1
F	119	90	170	90	49	63	2
G	148	90	195	113	49	66	2
H	148	90	195	113	65	82	2

All measurements in mm.



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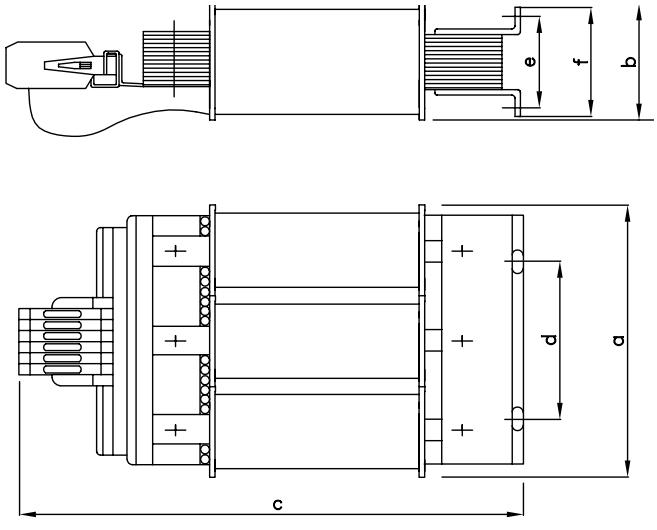
Drawing 1



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Drawing 2

■ Installation example

Below a dimensioning of the prefuses and line reactors to a load sharing installation with three VLT frequency converters is shown.

The example shows a load sharing installation with a VLT 5016 380-500V, VLT 5006 380-500V and a VLT 5003 380-500V.