INDUSTRY PROCESS
AND AUTOMATION SOLUTIONS

BONFIGLIOLI VECTRON

Operating instructions Part 1

General information and power section

Frequency inverter 400 V

4.0 kW ... 355.0 kW

VCB

GB

BONFIGLIOLI

Operating instructions Part 1
General information and power section for static frequency inverters VECTRON

VCB 400-010	—	4 kW
VCB 400-014	—	5.5 kW
VCB 400-018	—	7.5 kW
VCB 400-025	—	11 kW
VCB 400-034	—	15 kW
VCB 400-045	—	22 kW
VCB 400-060	—	30 kW
VCB 400-075	—	37 kW
VCB 400-090	—	45 kW
VCB 400-115	—	55 kW
VCB 400-135	—	65 kW
VCB 400-150	—	75 kW
VCB 400-180	—	90 kW
VCB 400-210	—	110 kW
VCB 400-250	—	132 kW
VCB 400-300	—	160 kW
VCB 400-370	—	200 kW
VCB 400-460	—	250 kW
VCB 400-570	—	315 kW
VCB 400-610	—	355 kW

Item No. of operating instructions 051 001 114
Version: June 2005

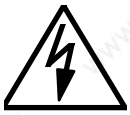
A IMPORTANT INFORMATION ON THESE OPERATING INSTRUCTIONS

These operating instructions are valid for the frequency inverter range **VCB 400**.

A **list** with the relevant control connections and gives information on the handling of the control unit **KP 100**, the individual equipment parameters and their parameterisation.

According to the customised request of the frequency inverter, there are also device versions with special functions. The **supplements to the operating instructions E1, E2 ...** describe equipment options and expansion modules. Among other things the extended control connections with the relevant parameters and setting possibilities are described.

For more clarity the following pictograms are used in the operating instructions for warnings and notes.



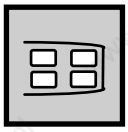
⇒ Caution! Lethal risk from high direct contact voltage.

⇒ Caution! Instruction must be observed.

⇒ Caution! Disconnect the unit from the mains before performing any operation and wait few minutes until the DC – link capacitors have discharged to a safe residual voltage.

⇒ Prohibited! Wrong handling may lead to damaging the equipment.

⇒ Useful note, tip.



⇒ Setting can be changed using the control unit KP 100.

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A.1 FURTHER INFORMATION

These operating instructions have been drawn up with the greatest care and have been extensively checked several times. For reasons of clarity not all detailed information on all product models and also not every conceivable case of installation, operation or maintenance could be taken into account. Should you require further information or if particular problems should occur which are not treated in enough detail in the operating instructions you may request the necessary information from the local agent of the company BONFIGLIOLI.
We should like to indicate moreover that the contents of these operating instructions are not part of a previous or current agreement, confirmation of legal relationship nor should they amend this. All the manufacturer's obligations ensue from the relevant sales contract which also includes the complete and solely valid guarantee regulation. These contractual guarantee conditions are neither extended nor restricted by implementation of these operating instructions.

The manufacturer retains the right to correct or alter the contents and product details as well as omissions without previous notice and accepts no liability for damage, injuries or expenses resulting from the above named reasons.

1 GENERAL INFORMATION

1.1 SAFETY INSTRUCTIONS

While operating inverters can have live parts appropriate to their protection class as well as hot surfaces. A frequency inverter drive is thus potentially lethal.

To avoid serious injury or severe damage only qualified persons are allowed to work on the equipment. Persons are qualified who are acquainted with mounting, commissioning and operation of inverters and have a qualification relevant to their work. These persons must read the operating instructions carefully before installation and commissioning and follow the safety instructions.

In this context the norms IEC 364 or CENELEC HD 384 or DIN VDE 0100 and IEC report 664 or EN 50 178 and VBG 4 and other national regulations must be complied with.

Repairs in the unit may only be carried out by the manufacturer or repair services authorised by him. Unauthorised opening and improper intervention can lead to injury or damage.

1.2 COMPLIANCE WITH STATUTORY REGULATIONS

The frequency inverters of the construction range VCB 400 are electrical operating appliances for the installation in electrical cabinets of industrial plants. They are designed for the speed adjustment of 3-phase motors.

The frequency inverters are not stand-alone devices. However, they are subject to the Law with respect to the electromagnetic compatibility of devices (EMVG, from 18 September, 1998, 2nd re-enactment).
According to this, apparatus, systems and components which are manufactured and planned exclusively as vendor or spare parts for further processing by companies and persons with specialist knowledge in the field of electromagnetic compatibility do not have to meet the protective requirements of the EMC Law. The device which is ready for work and which contains apparatus, systems or components must comply with the rules of the law.

The frequency inverters are integrated in a drive system consisting of a number of components. The electromagnetic compatibility (EMC) only has to be assessed for the overall system. This is why compliance with the EMC Guideline and EMC Law can only be achieved through the EMC-compatible design as shown in Chapter 4.4.

A typical drive system which fulfils EMC requirements consists of the following components:

- frequency inverter
- line choke
- radio interference suppression filter
- mains cable - perhaps shielded
- shielded motor cable
- shielded control cables
- standard 3-phase induction motor
- metal mounting plate

These operating instructions (Part 1) present measures by which compliance with the EMC Guideline 89/336/EWG and the EMC Law can be ensured in typical installations. The responsibility for compliance with the EMC Guideline during the machine's use rests with the user of the frequency inverter.
We declare that the frequency inverters listed in these operating instructions are planned as control components for 3-phase motors for installation in a machine or system in the intendment of the EC Directive 89/392/EWG (Machine Directive).
The machine may not be commissioned until it has been determined that it complies with the requirements of the EC Directive 89/392/EWG.
The frequency inverters listed in these operating instructions comply with the regulations of the Commission's Directive from 19 February 1973 on the harmonisation of the legislative provisions of the member countries as regards electrical resources for use within certain voltage limits (73/23/EWG Low Voltage Directive).
The technical data and information on the connection and ambient conditions can be found on the ratings plate and in these operating instructions and must be observed.

1.3 STANDARDS AND TEST SYMBOLS

STANDARDS, TEST SYMBOLS	TITEL
EN 50178 (Oct. 1997) Classification VDE 0160	Equipping power installations with electronic resources
EN 61800-3 (Oct. 1996) Classification VDE 0160 Part 100	Change-speed electric drives Part 3: EMC product standard including special test method (IEC 1800-3:1996)
UL test symbol acc. to UL508c	UL Standard for Safety for Power conversion equipment (see chapter 6)

The UL test symbol also indicates that the requirements of the CSA Standard C22.2-No.14-95 have been met. This is shown on the devices by the combination test symbol.

1.4 TRANSPORT, STORAGE AND MECHANICAL HANDLING

Frequency inverters in the VCB 400 series are packed for transportation in boxes or crates with inlays (acc. to UPS standard) depending on their weight to protect them against external damage. They should be stored in dry rooms, which are free of dust and moisture with low temperature fluctuations. They may not be stacked!

Max. permissible ambient conditions at the place of storage acc. to EN 50178:

- Storage temp.: - 25 °C ... +55 °C
- rel.humidity: 15 ... 85%, no condensation

They may not be stored for longer than 1 year. The VCB 400 frequency inverter must be connected to a power supply before the end of one year. It can then be stored for a further year.

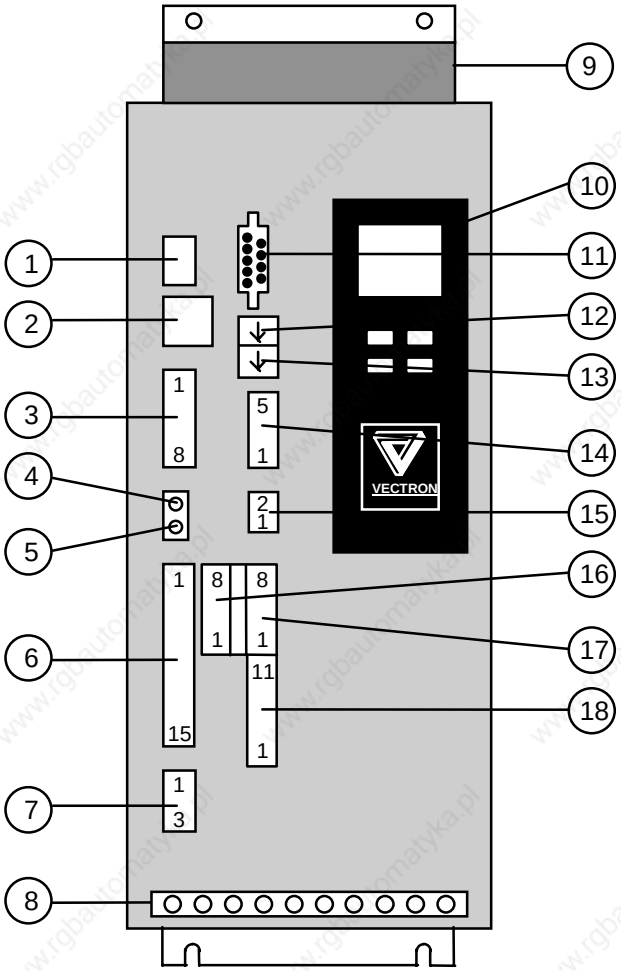
Note: Please check the quality, quantity and type of all incoming goods. Obvious defects such as external damage to the packaging or the device must be reported to the sender with seven days for insurance reasons.

2 EQUIPMENT DATA

2.1 CONSTRUCTION AND LAYOUT DRAWING

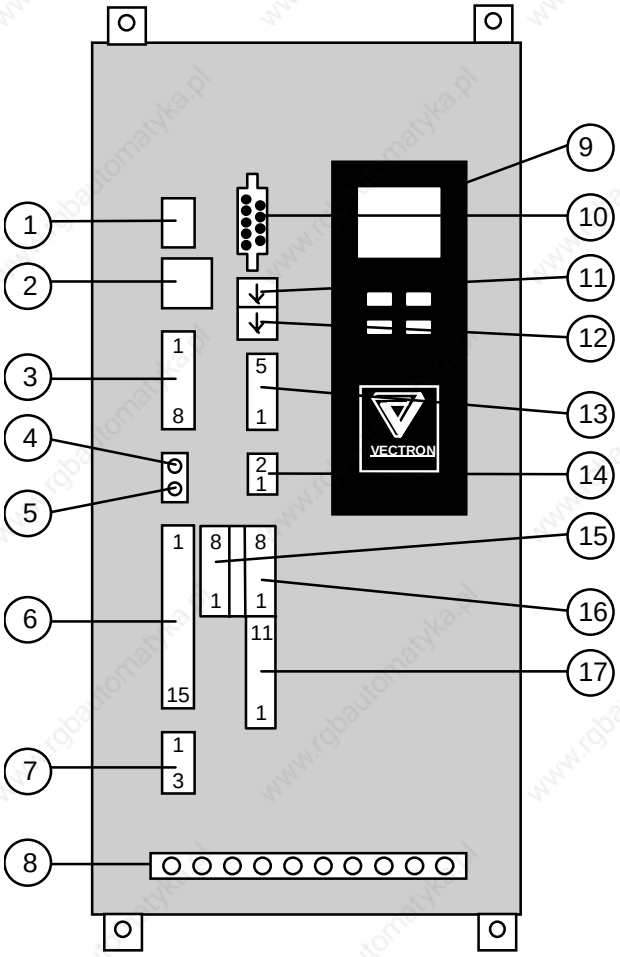
Note: The following construction and layout drawings show the standard model with option assemblies.

2.1.1 CONSTRUCTION SIZE 1 (VCB 400–010 TO –034)



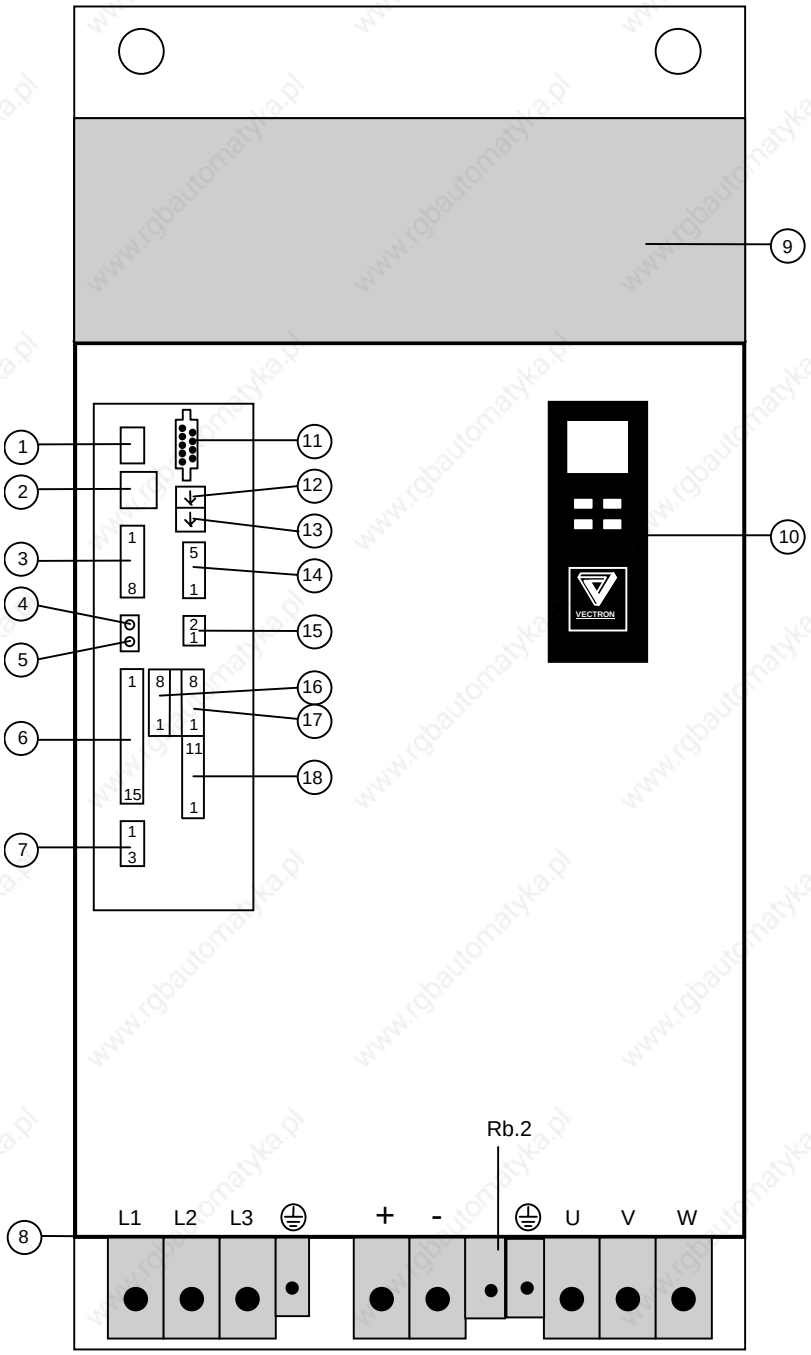
Item	Designation	Item	Designation
1	Service interface X214	**7**	Terminal strip X209, relay output
2	Plug connection for the control unit KP 100 / serial interface X215	**8**	Terminal X1, power connections
3	Terminal strip X211, analogue inputs and outputs	**9**	Fan
4	LED H2 (red) fault message	**10**	Control unit KP 100
5	LED H1 (green) operation mes-sage	**11 to 18**	Option, see supplements to the operating instructions.
6	Terminal strip X210, digital inputs and outputs		

2.1.2 CONSTRUCTION SIZE 2 (VCB 400–045 TO –075)



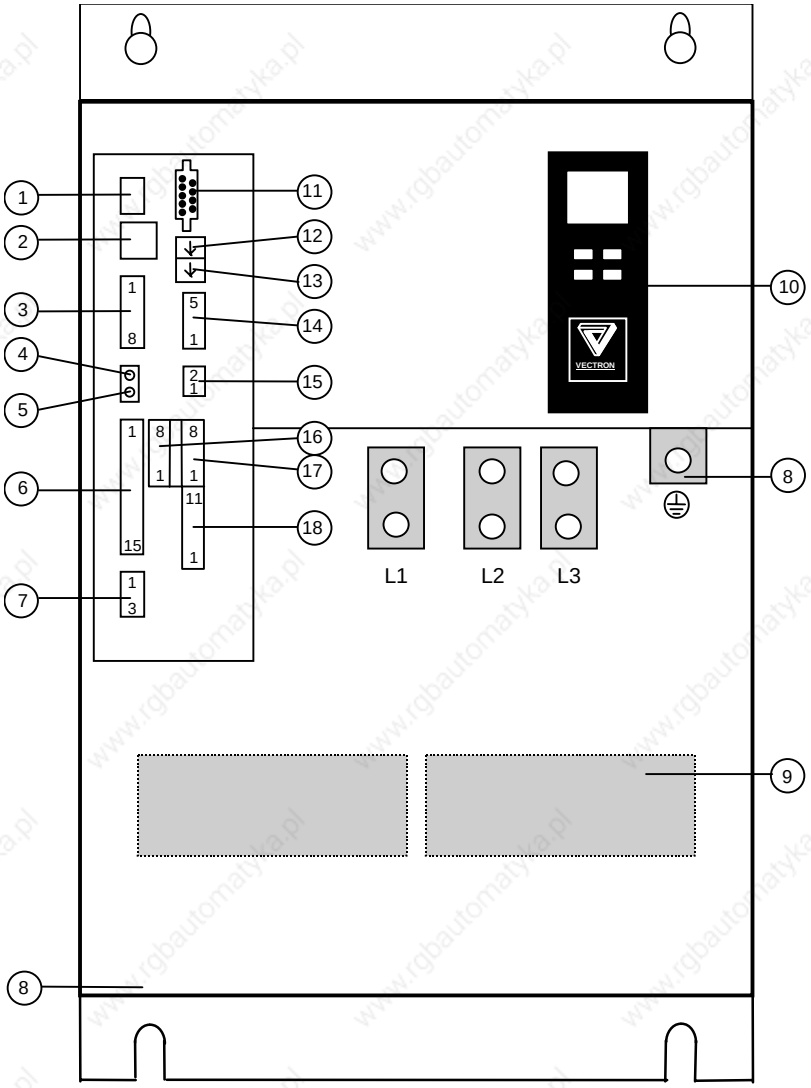
Item	Designation	Item	Designation
1	Service interface X214	**7**	Terminal strip X209, relay output
2	Plug connection for the control unit KP 100 / serial interface X215	**8**	Terminal X1, power connections
3	Terminal strip X211, analogue inputs and outputs	**9**	Fan
4	LED H2 (red) fault message	**10**	Control unit KP 100
5	LED H1 (green) operation mes-sage	**11 to 18**	Option, see supplements to the operating instructions.
6	Terminal strip X210, digital inputs and outputs		

2.1.3 CONSTRUCTION SIZE 3 (VCB 400–090 TO –135)



Item	Designation	Item	Designation
1	Service interface X214	**7**	Terminal strip X209, relay output
2	Plug connection for the control unit KP 100 / serial interface X215	**8**	Terminal X1, power connections
3	Terminal strip X211, analogue inputs and outputs	**9**	Fan
4	LED H2 (red) fault message	**10**	Control unit KP 100
5	LED H1 (green) operation mes-sage	**11 to 18**	Option, see supplements to the operating instructions.
6	Terminal strip X210, digital inputs and outputs		

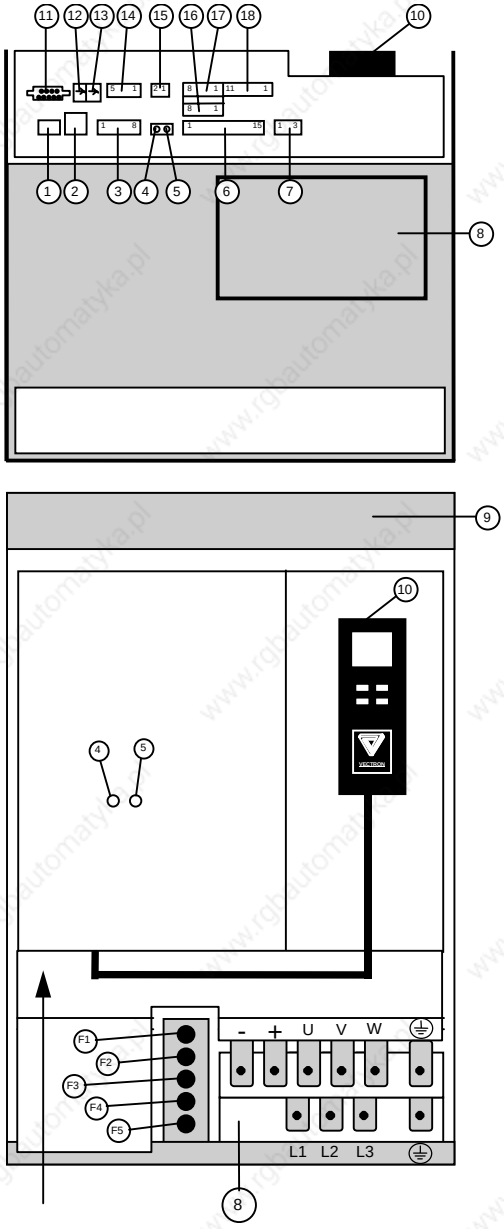
2.1.4 CONSTRUCTION SIZE 4 (VCB 400–150 TO –210)



Item	Designation	Item	Designation
1	Service interface X214	**7**	Terminal strip X209, relay output
2	Plug connection for the control unit KP 100 / serial interface X215	**8**	Terminal X1, power connections
3	Terminal strip X211, analogue inputs and outputs	**9**	Fan
4	LED H2 (red) fault message	**10**	Control unit KP 100
5	LED H1 (green) operation message	**11 to 18**	Option, see supplements to the operating instructions.
6	Terminal strip X210, digital inputs and outputs		

2.1.5 CONSTRUCTION SIZE 5 (VCB 400–250 TO –610)

Underneath view



Underneath view

Item	Designation	Item	Designation
1	Service interface X214	**7**	Terminal strip X209, relay output
2	Plug connection for the control unit KP 100 / serial interface X215	**8**	Terminal X1, power connections
3	Terminal strip X211, analogue inputs and outputs	**9**	Fan
4	LED H2 (red) fault message	**10**	Control unit KP 100
5	LED H1 (green) operation mes-sage	**11 to 18**	Option, see supplements to the operating instructions.
6	Terminal strip X210, digital inputs and outputs		

2.2 TECHNICAL DATA

2.2.1 CONSTRUCTION SIZE 1 (VCB 400–010 TO –034)

			VCB 400-010	VCB 400-014	VCB 400-018	VCB 400-025	VCB 400-034
Output motor side, at 400 V connecting voltage							
Recommended rated motor output	P	kW	until 4	5.5	7.5	11	15
Equipment continuous output	S	kVA	6.9	9.7	12.5	17.3	23.6
Output current, effective	I	A	10	14	18	25	34
Output voltage, effective	U	V	3 x 0 ... mains voltage input				
Overload capacity	-		1.2 / 1.5 for 60 s, according to model				
Protection			short circuit / earth fault				
Rotary field frequency	f	Hz	0 ... 400, according to switching frequency				
Switching frequency	f	kHz	1 ... 8				1 ... 8 [1]
Connection terminal	A	mm^2	0.50 ... 10.00				
Input mains side							
Recommended wiring cross section	A	mm^2	1.5	2.5	4	6	10
Voltage	U	V	3 x 400 (-20%) ... 460 (+10%)				
Frequency	f	Hz	50 (-10%) ... 60 (+10%)				
Power factor	cos φ	-	~1 (Power factor of the fundamental)				
Efficiency (approx.)	η	%	98, at 2 kHz switching frequency				
Line fuses	-	-	external				
Mechanical							
Dimensions: Standard model Feed-through model	WxHxD	mm	124x406x262 124x382x262			124x426x264 124x382x262	124x426x274 124x382x272
Weight (approx.)	m	kg	6			6.5	
Protection class	-	-	IP 20				
Installation type	-	-	Vertical wall mounting				
Environmental conditions							
Dissipation, at 2 kHz switching freq.	P	W	164	202	250	320	411
Min. air consumption	Q	m^3/h	90				150
Coolant temperature	T_n	°C	0 ... 40, forced ventilation				
Storage temperature	T_L	°C	-25 ... +55				
Transport temperature	T_T	°C	-25 ... +70				
Relative humidity	-	%	15 ... 85, no condensation				
Power reduction see Chapter 3.3.1	ΔP	%	2.5%/K above 40 °C; Tmax=50 °C; 5%/1000 m above 1000 m above sea level; hmax=4000 m				
Options and accessories							
Line choke (u_k=4%)	-	-	external, optional internal DC – link choke			external	
EMC filter	-	-	external				
Brake chopper	-	-	optional internal				external
Digital control unit	-	-	optional				

[1] From 5kHz switching frequency the output current must be reduced

Internal fuses used
Fuse for switching power supply 1 pc. 2 A/ 600V super-quick-acting, 10 x 38 mm

2.2.2 CONSTRUCTION SIZE 2 (VCB 400–045 TO –075)

			VCB 400-045	VCB 400-060	VCB 400-075
Output motor side, at 400 V connecting voltage					
Recommended rated motor output	P	kW	22	30	37
Equipment continuous output	S	kVA	31.2	41.6	52
Output current, effective	I	A	45	60	75
Output voltage, effective	U	V	3 x 0 ... mains voltage input		
Overload capacity	-		1.2 / 1.5 for 60 s, according to model		
Protection			short circuit / earth fault		
Rotary field frequency	f	Hz	0 ... 400, according to switching frequency		
Switching frequency	f	kHz	1 ... 8		1 ... 8 [1)]
Connection terminal	A	mm^2	16 ... 50		
Input mains side					
Recommended wiring cross section	A	mm^2	16	25	35
Voltage	U	V	3 x 400 (-20%) ... 460 (+10%)		
Frequency	f	Hz	50 (-10%) ... 60 (+10%)		
Power factor	cos φ	-	~1 (Power factor of the fundamental)		
Efficiency (approx.)	η	%	98, at 2 kHz switching frequency		
Line fuses	-	-	external		
Mechanical					
Dimensions: Standard model Feed-through model	WxHxD	mm	250 x 376 x 317 284 x 428 x 317		
Weight (approx.)	m	kg	17	18	19
Protection class	-	-	IP 20		
Installation type	-	-	Vertical wall mounting		
Environmental conditions					
Dissipation, at 2 kHz switching freq.	P	W	527	680	852
Min. air consumption	Q	m^3/h	300		350
Coolant temperature	T_n	°C	0 ... 40 , forced ventilation		
Storage temperature	T_L	°C	-25 ... +55		
Transport temperature	T_T	°C	-25 ... +70		
Relative humidity	-	%	15 ... 85, no condensation		
Power reduction see Chapter 3.3.1	ΔP	%	2.5%/K above 40 °C; Tmax=50 °C; 5%/1000 m above 1000m above sea level; hmax=4000m		
Options and accessories					
Line choke (u_k=4%)	-	-	external		
EMC filter	-	-	external		
Brake chopper	-	-	optional internal		
Digital control unit	-	-	optional		

[1)] From 5kHz switching frequency the output current must be reduced.

Internal fuses used

Fuse for switching power supply 1 pc. 2A / 600V super-quick-acting, 10 x 38 mm

2.2.3 CONSTRUCTION SIZE 3 (VCB 400–090 TO –135)

			VCB 400-090	VCB 400-115	VCB 400-135
Output motor side, at 400 V connecting voltage					
Recommended rated motor output	P	kW	45	55	65
Equipment continuous output	S	kVA	62.4	79.7	93.5
Output current, effective	I	A	90	115	135
Output voltage, effective	U	V	3 x 0 ... mains voltage input		
Overload capacity	-		1.2 / 1.5 for 60 s, according to model		
Protection			short circuit / earth fault		
Rotary field frequency	f	Hz	0 ... 400, according to switching frequency		
Switching frequency	f	kHz	1 ... 8		1 ... 4
Connection terminal	A	mm^2	35 ... 95		
Input mains side					
Recommended wiring cross section	A	mm^2	50	70	95
Voltage	U	V	3 x 400 (-20%) ... 460 (+10%)		
Frequency	f	Hz	50 (-10%) ... 60 (+10%)		
Power factor	cos φ	-	~1 (Power factor of the fundamental)		
Efficiency (approx.)	η	%	98, at 2 kHz switching frequency		
Line fuses	-	-	external		
Mechanical					
Dimensions: Standard model Feed-through model	WxHxD	mm	300 x 602 x 298 300 x 475 x 298		
Weight (approx.)	m	kg	31.5	32.5	
Protection class	-	-	IP 20		
Installation type	-	-	Vertical wall mounting		
Environmental conditions					
Dissipation, at 2 kHz switching freq.	P	W	1011	1255	1463
Min. air consumption	Q	m^3/h	400		
Coolant temperature	T_n	°C	0 ... 40, forced ventilation		
Storage temperature	T_L	°C	-25 ... +55		
Transport temperature	T_T	°C	-25 ... +70		
Relative humidity	-	%	15 ... 85, no condensation		
Power reduction see Chapter 3.3.1	ΔP	%	2.5%/K above 40 °C; Tmax=50 °C; 5%/1000 m above 1000 m above sea level; hmax=4000m		
Options and accessories					
Line choke (u_k=4%)	-	-	external		
EMC filter	-	-	external		
Brake chopper	-	-	optional internal		
Digital control unit	-	-	optional		

Internal fuses used

Fuse for switching power supply 1 pc. 2A / 600V super-quick-acting, 10 x 38 mm
Fuse protection fan 3 pcs. 1.6A / 500V quick-acting, 6.3 x 32 mm

2.2.4 CONSTRUCTION SIZE 4 (VCB 400–150 TO –250)

			VCB 400-150	VCB 400-180	VCB 400-210	VCB 400-250
Output motor side, at 400 V connecting voltage						
Recommended rated motor output	P	kW	75	90	110	132
Equipment continuous output	S	kVA	103.9	124.7	145.5	173,2
Output current, effective	I	A	150	180	210	250
Output voltage, effective	U	V	3 x 0 ... mains voltage input			
Overload capacity	-		1.2 / 1.5 for 60 s, according to model			1.2 for 60 s
Protection			short circuit / earth fault			
Rotary field frequency	f	Hz	0 ... 400, according to switching frequency			
Switching frequency	f	kHz	1 ... 8	1 ... 8 [1)]	1 ... 4	
Connection bolt	-	-	M8			
Input mains side						
Recommended wiring cross section	A	mm^2	95	120	150	185
Voltage	U	V	3 x 400 (-20%) ... 460 (+10%)			
Frequency	f	Hz	50 (-10%) ... 60 (+10%)			
Power factor	cos φ	-	~1 (Power factor of the fundamental)			
Efficiency (approx.)	η	%	98, at 2 kHz switching frequency			
Line fuses	-	-	external			
Mechanical						
Dimensions: Standard model Feed-through model	WxHxD	mm	412 x 510 x 362 412 x 580 x 362			
Weight (approx.)	m	kg	50			
Protection class	-	-	IP 20			
Installation type	-	-	Vertical wall mounting			
Environmental conditions						
Dissipation, at 2 kHz switching freq.	P	W	1619	1931	2242	2658
Min. air consumption	Q	m^3/h	500			
Coolant temperature	T_n	°C	0 ... 40 , forced ventilation			
Storage temperature	T_L	°C	-25 ... +55			
Transport temperature	T_T	°C	-25 ... +70			
Relative humidity	-	%	15 ... 85, no condensation			
Power reduction see Chapter 3.3.1	ΔP	%	2.5%/K above 40 °C; Tmax=50 °C; 5%/1000 m above 1000 m above sea level; hmax=4000m			
Options and accessories						
Line choke (u_k=4%)	-	-	external			
EMC filter	-	-	external			
Brake chopper	-	-	optional internal			
Digital control unit	-	-	optional			

[1)] Equipment variant with 6 kHz maximal switching frequency

Internal fuses used

Fuse for switching power supply 1 pc. 2A / 600V super-quick-acting, 10 x 38 mm

2.2.5 CONSTRUCTION SIZE 5 (VCB 400–250 TO –370)

			VCB 400-250	VCB 400-300	VCB 400-370
Output motor side, at 400 V connecting voltage					
Recommended rated motor output	P	kW	132	160	200
Equipment continuous output	S	kVA	173.2	207.8	256.3
Output current, effective	I	A	250	300	370
Output voltage, effective	U	V	3 x 0 ... mains voltage input		
Overload capacity	-		1.5 for 60 s	1.2 / 1.5 for 60 s, according to model	
Protection			short circuit / earth fault		
Rotary field frequency	f	Hz	0 ... 400, according to switching frequency		
Switching frequency	f	kHz	1 ... 4		
Connection bolt	-	-	M12		
Input mains side					
Recommended wiring cross section	A	mm^2	185	240	2 x 120
Voltage	U	V	3 x 400 (-20%) ... 460 (+10%)		
Frequency	f	Hz	50 (-10%) ... 60 (+10%)		
Power factor	cos φ	-	~1 (Power factor of the fundamental)		
Efficiency (approx.)	η	%	98, at 2 kHz switching frequency		
Line fuses	-	-	external		
Mechanical					
Dimensions	WxHxD	mm	518x820x406		
Weight (approx.)	m	kg	105	110	
Protection class	-	-	IP 20		
Installation type	-	-	Vertical wall mounting		
Environmental conditions					
Dissipation, at 2 kHz switching freq.	P	W	2658	3178	3905
Min. air consumption	Q	m^3/h	700		
Coolant temperature	T_n	°C	0 ... 40, forced ventilation		
Storage temperature	T_L	°C	-25 ... +55		
Transport temperature	T_T	°C	-25 ... +70		
Relative humidity	-	%	15 ... 85, no condensation		
Power reduction see Chapter 3.3.1	ΔP	%	2.5%/K above 40 °C; Tmax=50 °C; 5%/1000 m above 1000 m above sea level; hmax=4000m		
Options and accessories					
Line choke (u_k=4%)	-	-	external		
EMC filter	-	-	external		
Brake chopper	-	-	optional internal		
Digital control unit	-	-	optional		

Internal fuses used

Fuse for switching power supply 2 pcs. 1A6 / 500V super-quick-acting, 6.3x32 mm
Fuse protection power supply cables 5 pcs. 10A / 500V semi-time-lag, 6.3 x 32 mm

2.2.6 CONSTRUCTION SIZE 5 (VCB 400–460 TO –610)

			VCB 400-460	VCB 400-570	VCB 400-610
Output motor side, at 400 V connecting voltage					
Recommended rated motor output	P	kW	250	315	355
Equipment continuous output	S	kVA	318.7	395	422.6
Output current, effective	I	A	460	570	610
Output voltage, effective	U	V	3 x 0 ... mains voltage input		
Overload capacity	-		1.2 / 1.5 for 60 s, according to model	1.2 for 60 s	
Protection			short circuit / earth fault		
Rotary field frequency	f	Hz	0 ... 400, according to switching frequency		
Switching frequency	f	kHz	1 ... 4		
Connection bolt	-	-	M12		
Input mains side					
Recommended wiring cross section	A	mm^2	2 x 185	2 x 240	
Voltage	U	V	3 x 400 (-20%) ... 460 (+10%)		
Frequency	f	Hz	50 (-10%) ... 60 (+10%)		
Power factor	cos φ	-	~1 (Power factor of the fundamental)		
Efficiency (approx.)	η	%	98, at 2 kHz switching frequency		
Line fuses	-	-	external		
Mechanical					
Dimensions	WxHxD	mm	518x820x406 [1] 518x1095x406 [2]	518x1095x406	
Weight (approx.)	m	kg	110 [2] 120 [3]	120	
Protection class	-	-	IP 20		
Installation type	-	-	Vertical wall mounting		
Environmental conditions					
Dissipation, at 2 kHz switching freq.	P	W	4840	5984	6399
Min. air consumption	Q	m^3/h	700 [1], 1200 [2]	1200	
Coolant temperature	T_n	°C	0 ... 40, forced ventilation		
Storage temperature	T_L	°C	-25 ... +55		
Transport temperature	T_T	°C	-25 ... +70		
Relative humidity	-	%	15 ... 85, no condensation		
Power reduction see Chapter 3.3.1	ΔP	%	2.5%/K above 40 °C; Tmax=50 °C; 5%/1000 m above 1000 m above sea level; hmax=4000m		
Options and accessories					
Line choke (u_k=4%)	-	-	external		
EMC filter	-	-	external		
Brake chopper	-	-	optional internal		
Digital control unit	-	-	optional		

[1] overload capacity 1.2, [2] overload capacity 1.5

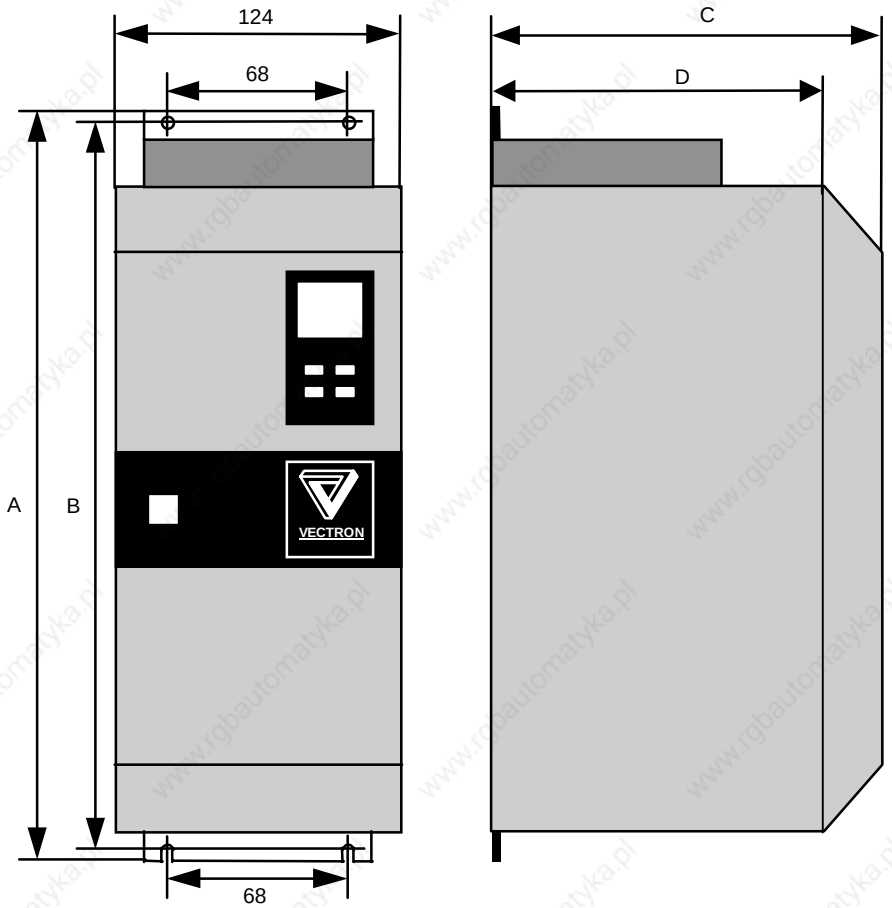
Internal fuses used

Fuse for switching power supply 2 pcs. 1A6 / 500V super-quick-acting, 6.3 x 32 mm
Fuse protection power supply cables and fan 5 pcs. 10A / 500V semi-time-lag, 6.3 x 32 mm

3 INSTRUCTIONS FOR MECHANICAL INSTALLATION

3.1 DIMENSIONAL DRAWINGS OF EQUIPMENT

3.1.1 CONSTRUCTION SIZE 1, STANDARD MODELS (VCB 400–010 TO –034)



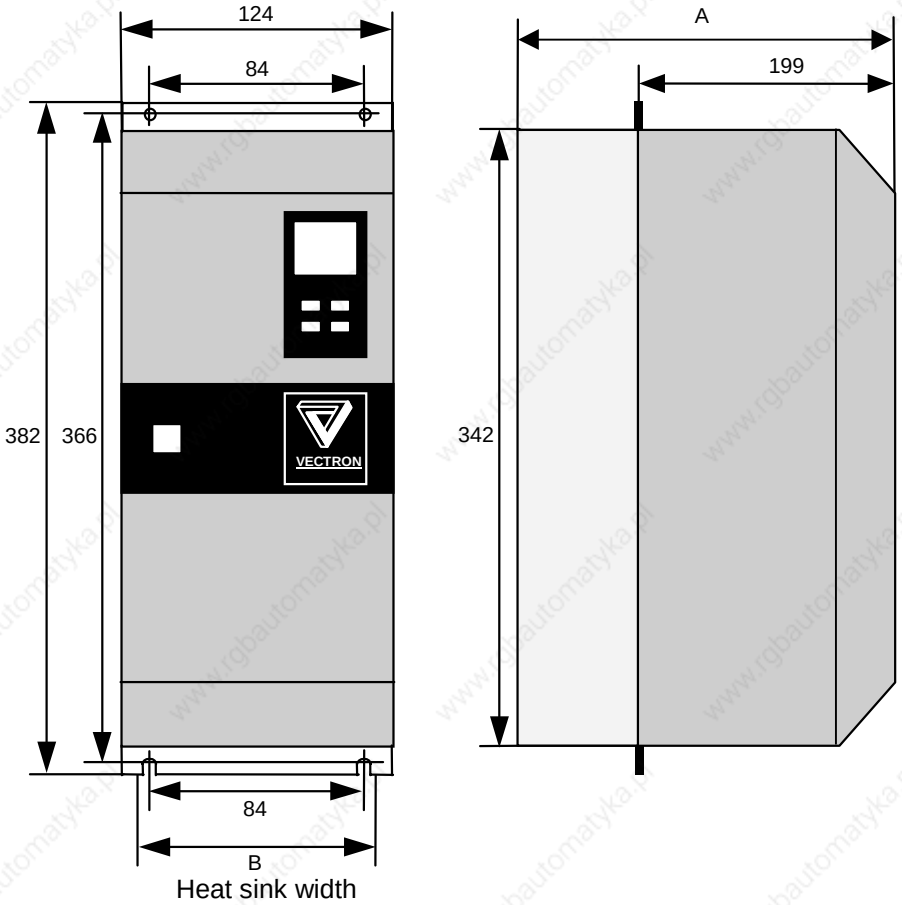
Diameter of the fixing holes 7 mm

Dimension table

Unit type	A	B	C	D
VCB 400-010 to -018	406 mm	390 mm	262 mm	222 mm
VCB 400-025	426 mm	410 mm	264 mm	224 mm
VCB 400-034	426 mm	410 mm	274 mm	234 mm

Caution:. The air flow direction through the heat sink passes from bottom to top. The turning direction of the device fan must be noted

3.1.2 CONSTRUCTION SIZE 1, FEED-THROUGH MODEL (VCB 400–010 TO –034)

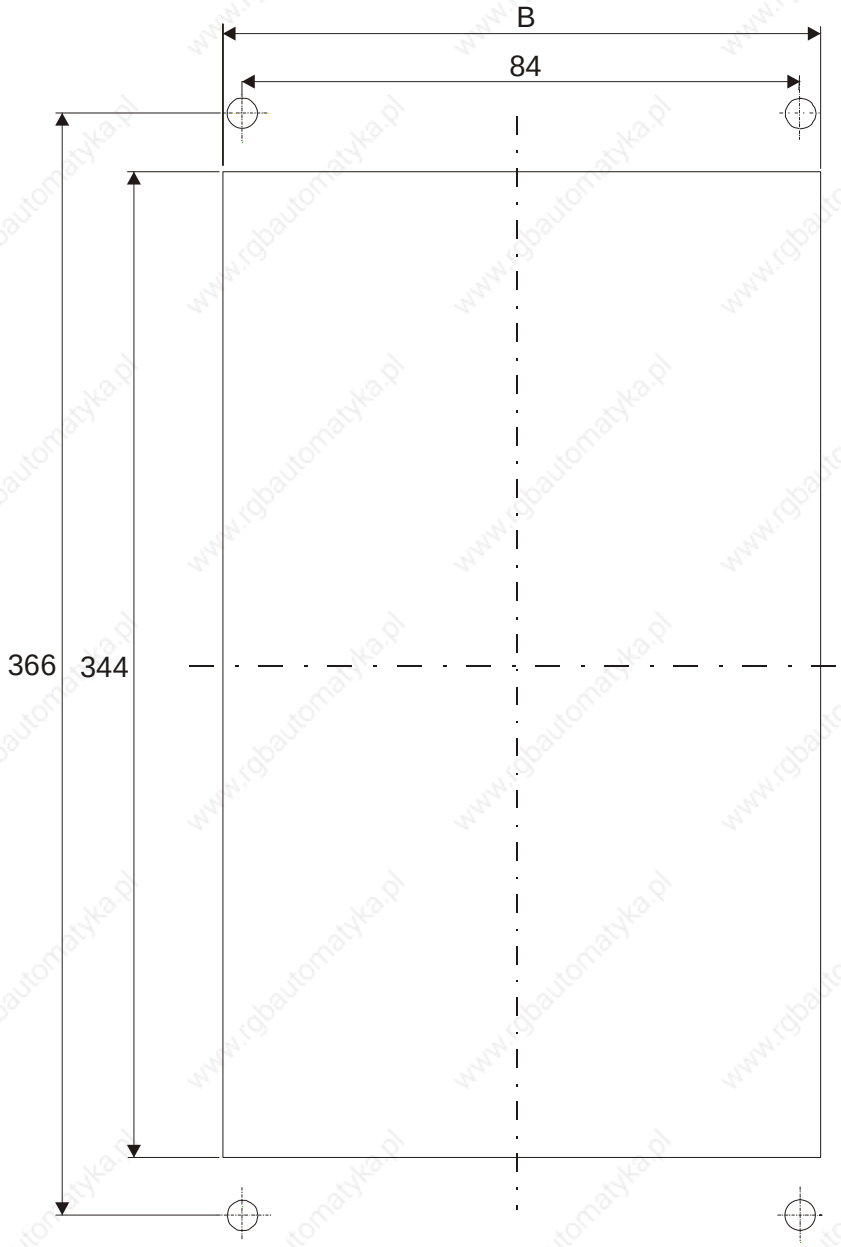


Diameter of the fixing holes 7 mm

Dimension table

Unit type	A	B
VCB 400-010 to -018	262 mm	96 mm
VCB 400-025	264 mm	96 mm
VCB 400-034	274 mm	108 mm

Drill pattern for feed-through model VCB 400-010 to -034

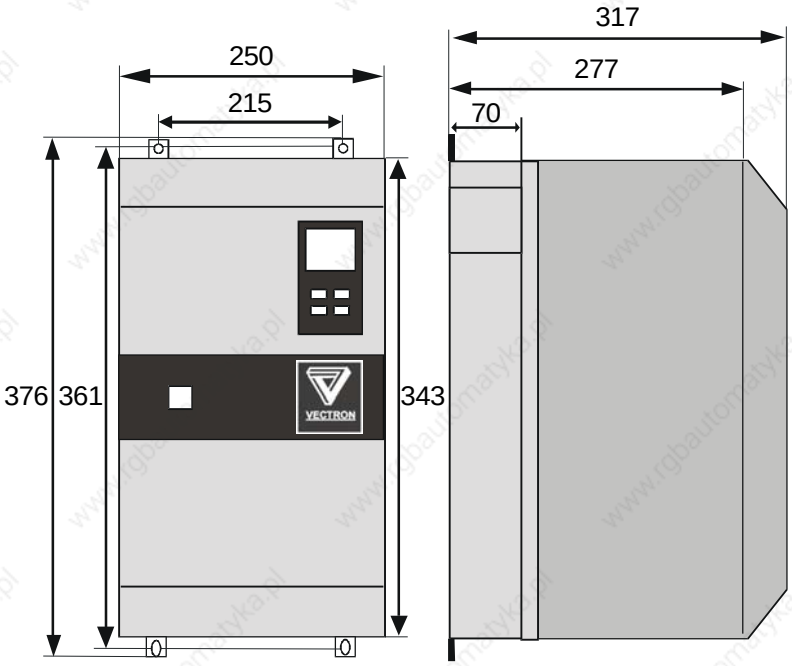


Diameter of the fixing holes 7mm

Unit type	B
VCB 400-010 to -025	98 mm
VCB 400-034	110 mm

Assembling kit	
Number of pieces	**Designation**
2	**brackets**
4	**screws**

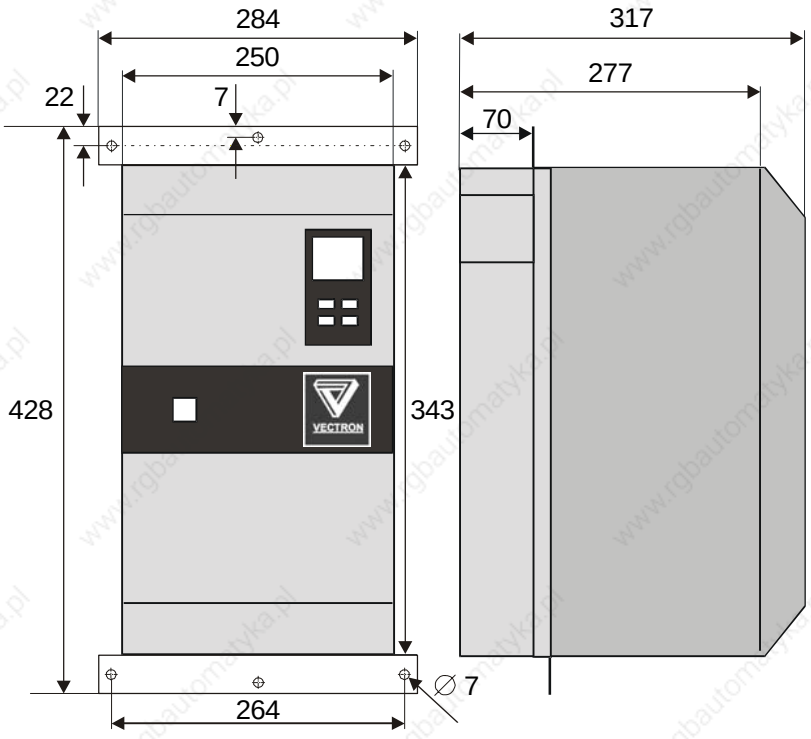
3.1.3 CONSTRUCTION SIZE 2, STANDARD MODEL (VCB400–045 TO –075)



Diameter of the fixing holes 6.6 mm

Caution: The airflow direction through the heat sink passes from top to bottom. The turning direction of the device fan must be noted.

3.1.4 CONSTRUCTION SIZE 2, FEED-THROUGH MODEL (VCB 400–045 TO –075)

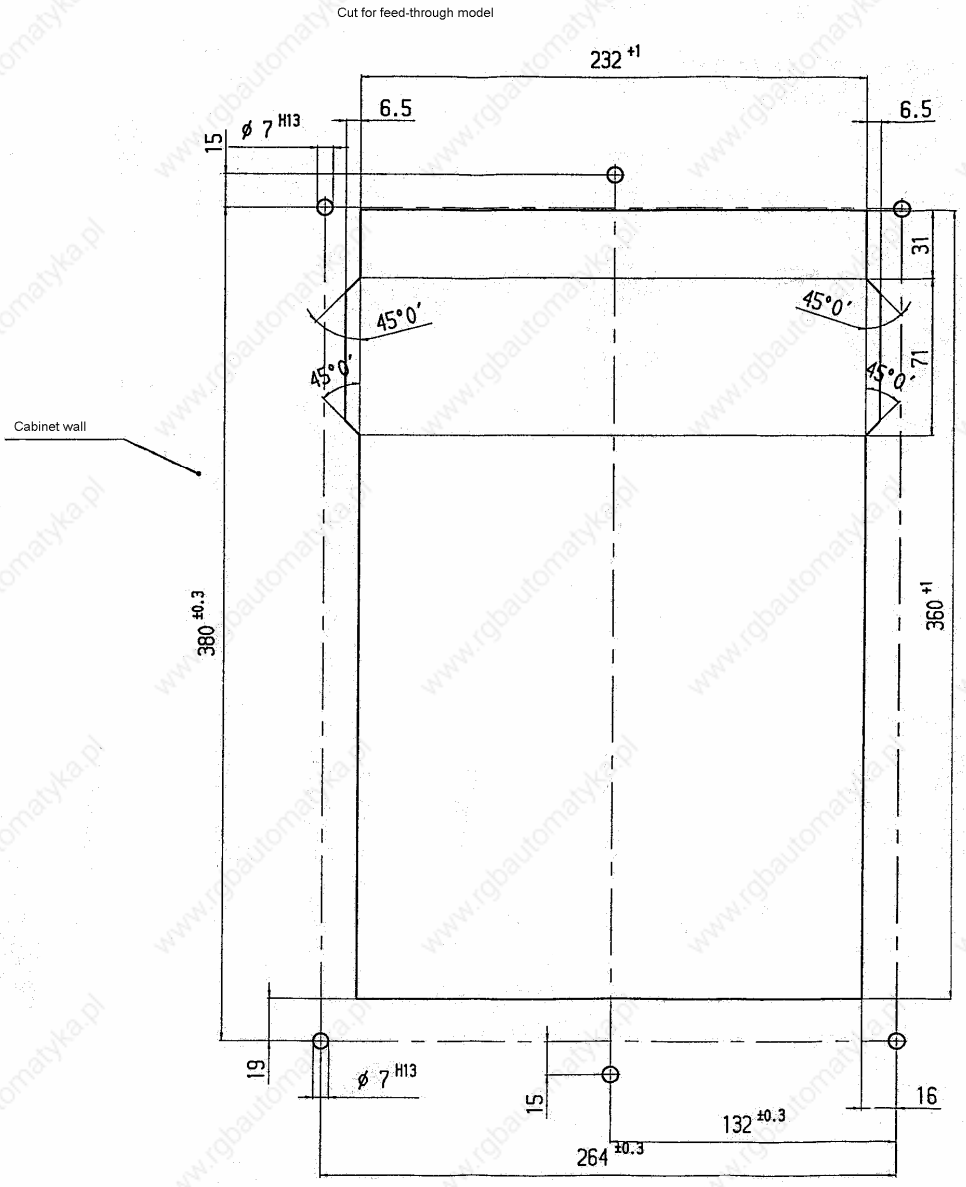


For assembling in a cabinet there will be required two brackets and one heat conducting sheet metal for the backside.

The feed-through deep of the heat sink is 70 mm.

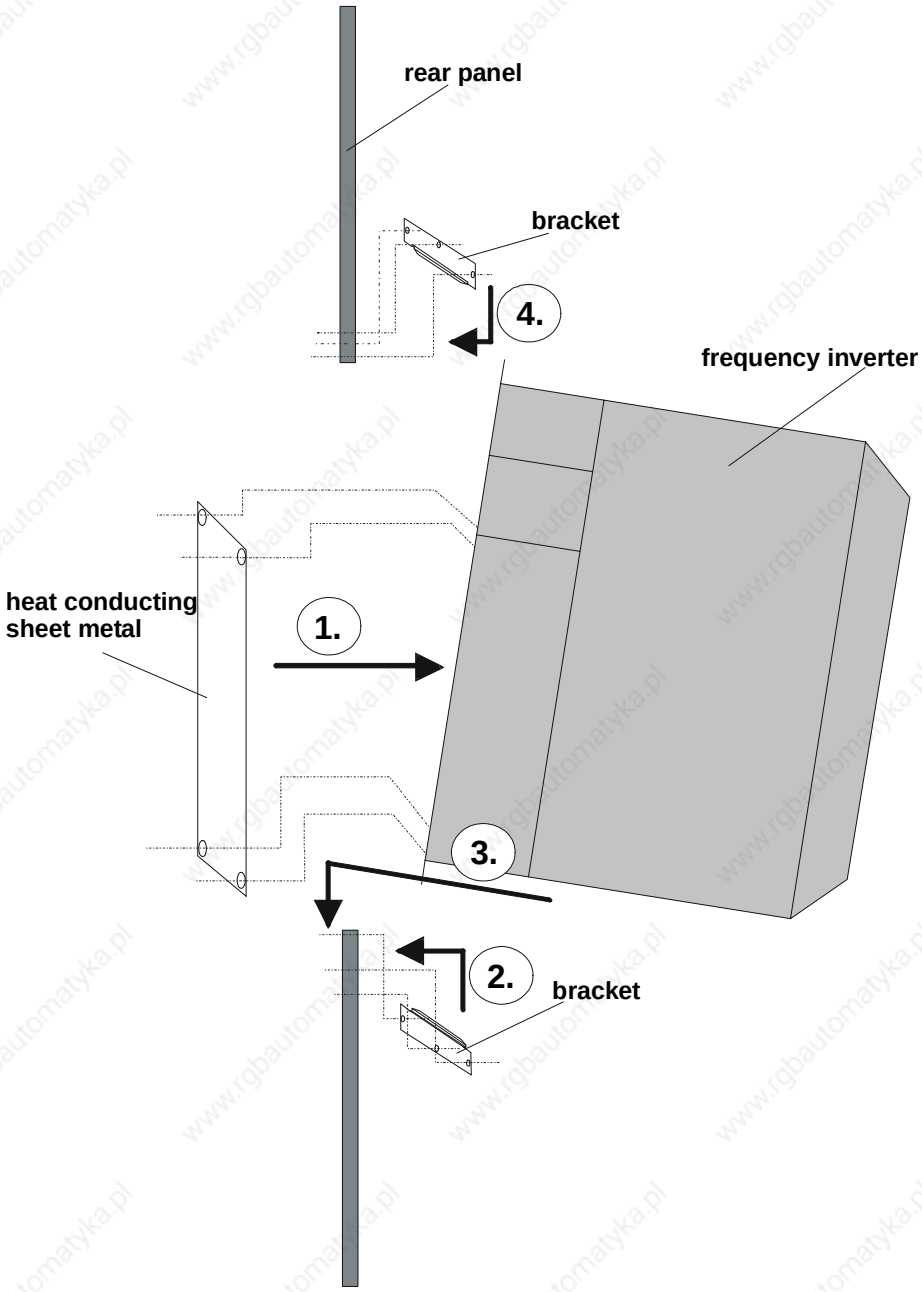
Assembling kit	
Number of pieces	**Designation**
1	heat conducting sheet metal
2	brackets
1	screw set

Drill pattern for feed-through model VCB 400-045 to -075 in construction size 2



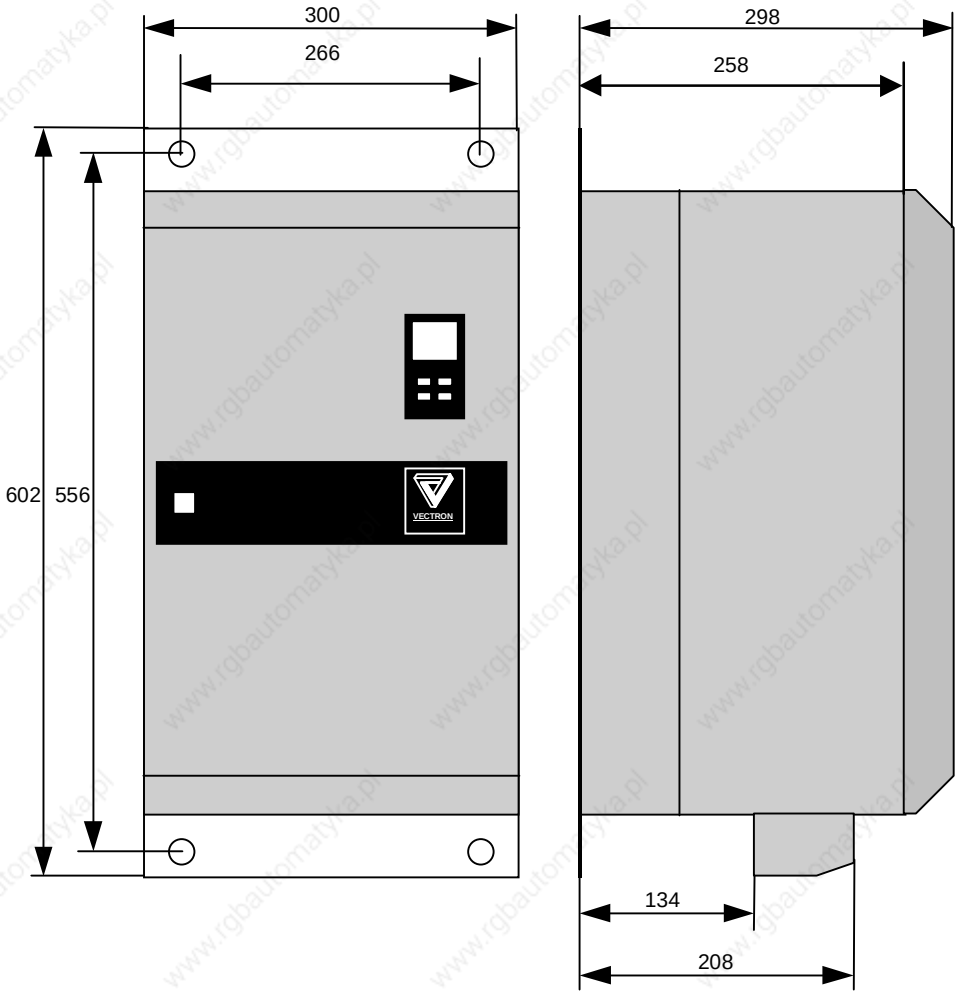
Attention: The cut in the cabinet has to be 20 mm bigger (see drill pattern) than the height of the frequency inverter housing; otherwise it is impossible to pass the device through the cut.

Assembling instruction feed-through model VCB 400-045 to -075 in construction size 2



1. Screw the heat conducting sheet metal on the backside of the heat sink of the frequency inverter.
2. Screw one bracket on the underside of the cut of the cabinet rear panel.
3. Pass the frequency inverter with the heat sink through the cut and engage the slot at the underside to the bracket.
4. Engage the 2nd bracket at the slot on the upper side and screw the bracket at the cabinet.

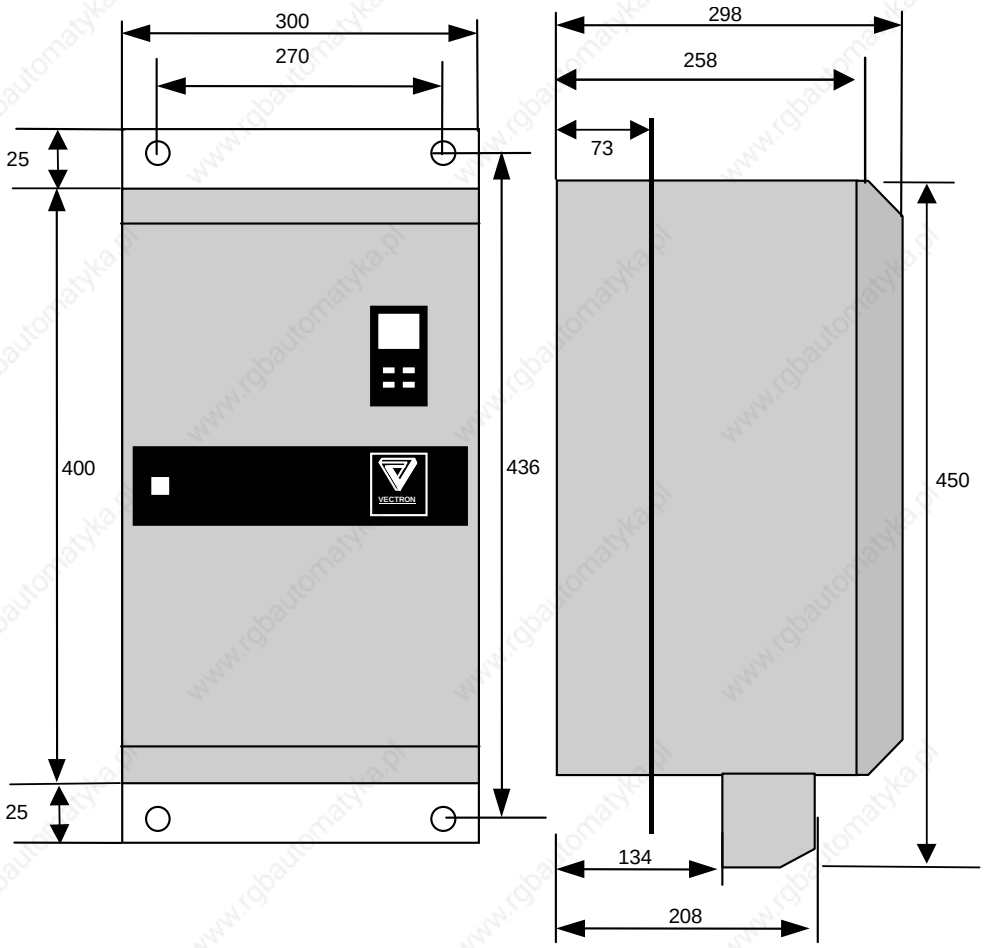
3.1.5 CONSTRUCTION SIZE 3, STANDARD MODELS (VCB 400–090 TO –135)



Diameter of the fixing holes 10 mm

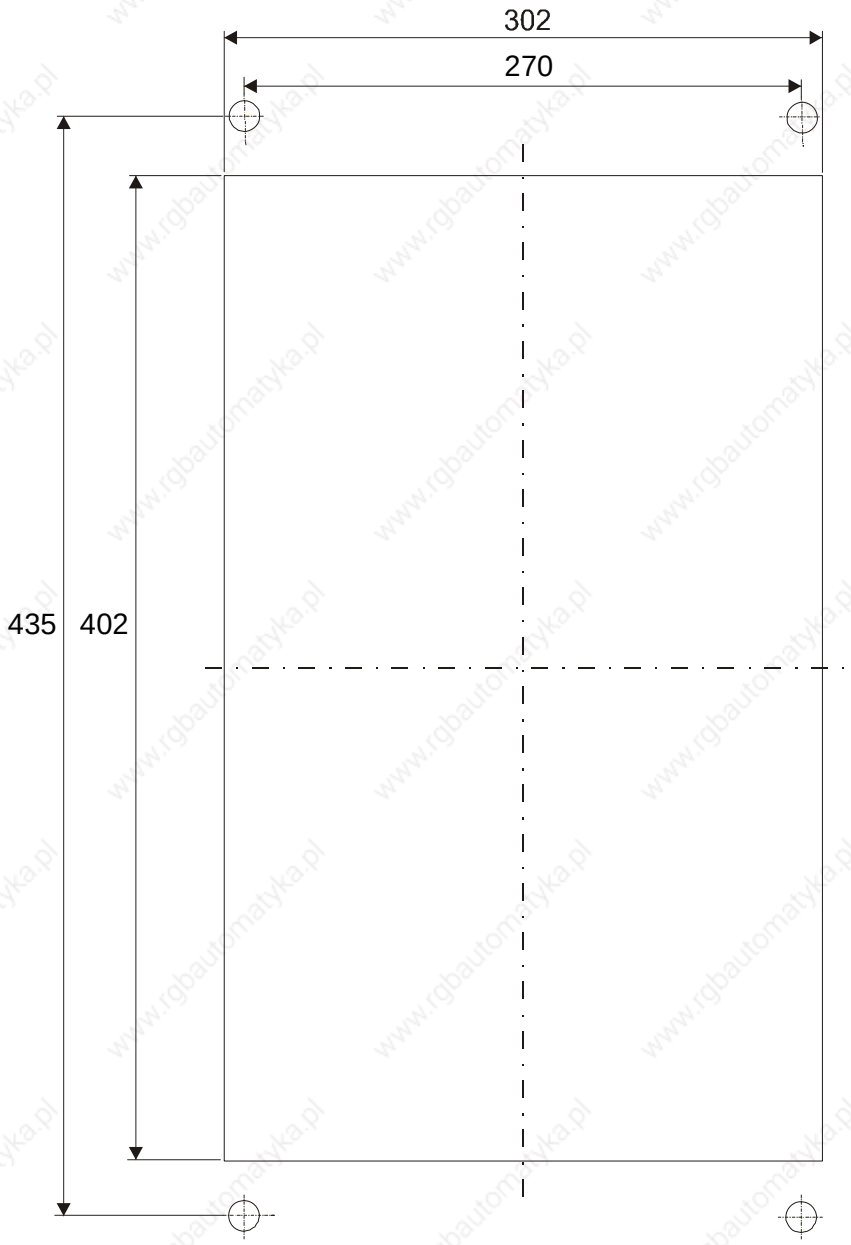
Caution: The airflow direction through the heat sink passes from bottom to top. The turning direction of the device fan must be noted.

3.1.6 CONSTRUCTION SIZE 3, FEED-THROUGH MODEL (VCB 400-090 TO -135)



Diameter of the fixing holes 7 mm

Drill pattern for feed-through model VCB 400-090 to -135 in construction size 3



Diameter of the fixing holes 7 mm

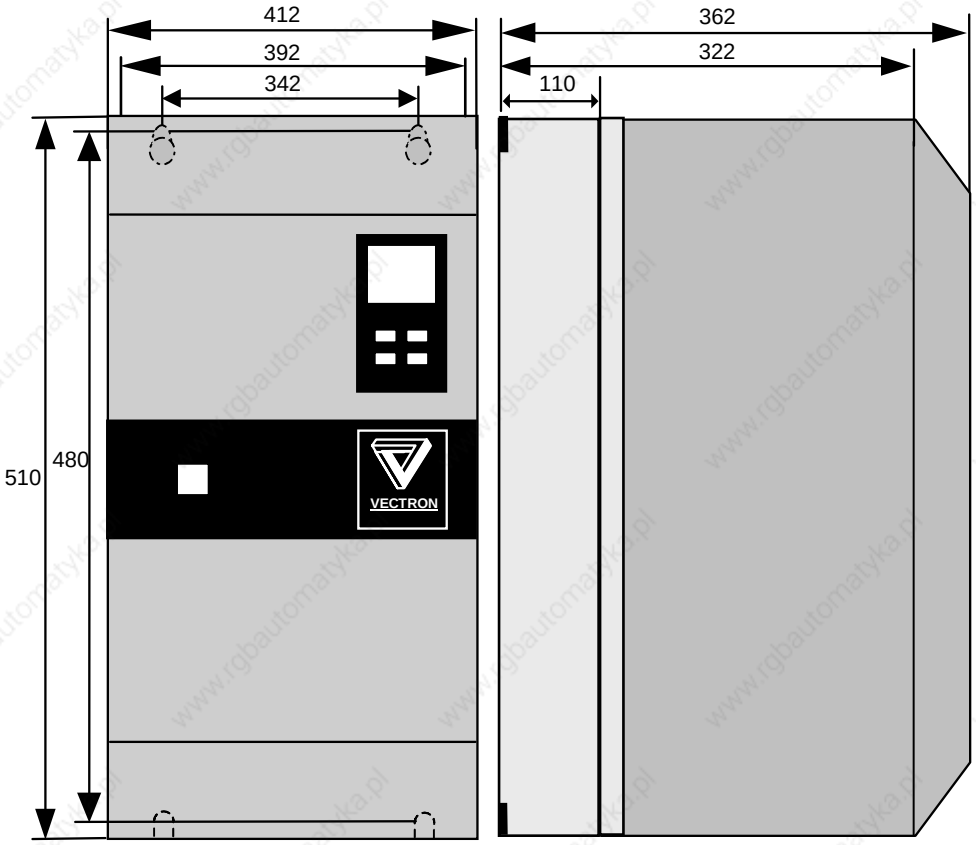
Assembling kit	
Number of pieces	**Designation**
2	**brackets**
4	**screws**

The feed-through depth of the heat sink is 73 mm. Two **brackets** and **two additional screws** are necessary for the installation into an electrical cabinet.

Fitting the plate:

1. Undo the fastening screws on the frequency inverter.
2. Fasten the plate onto the top and bottom sides with the three screws.
3. Push the frequency inverter with the heat sink through the opening.
4. Fit the frequency inverter to the rear wall of the control cabinet

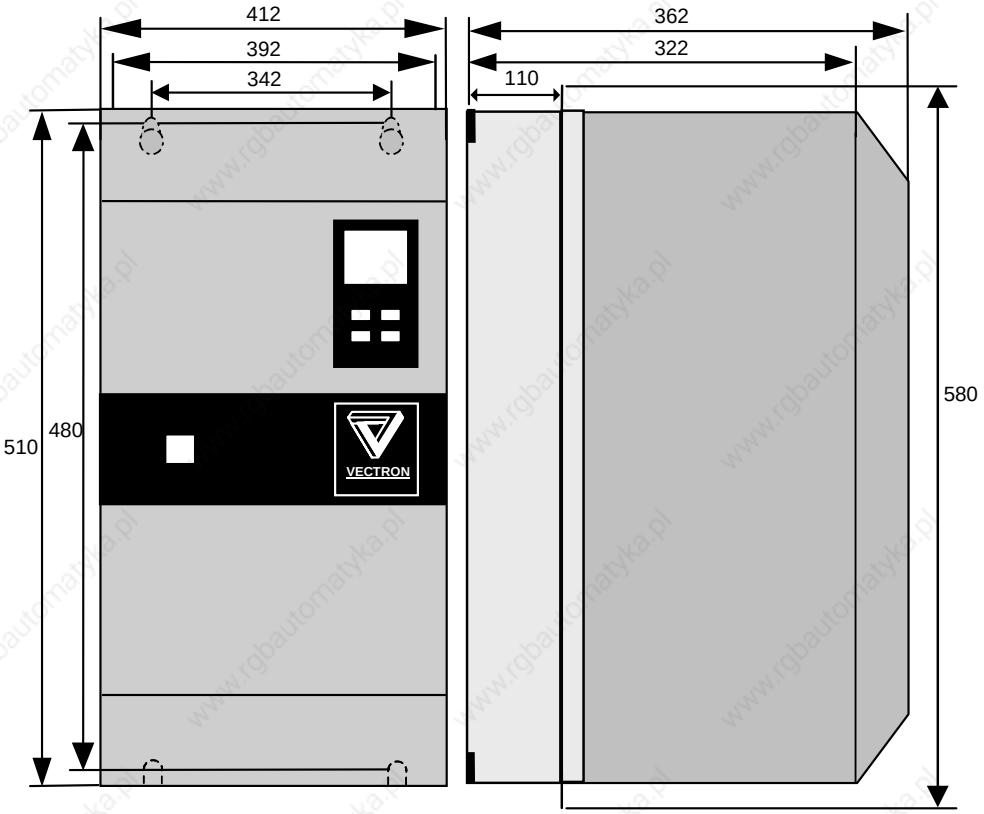
3.1.7 CONSTRUCTION SIZE 4, STANDARD MODELS (VCB 400–150 AND –250)



Diameter of the fixing holes 9 mm

Caution: The airflow direction through the heat sink passes from bottom to top. The turning direction of the device fan must be noted.

3.1.8 CONSTRUCTION SIZE 4, FEED-THROUGH MODEL (VCB 400-150 TO -250)

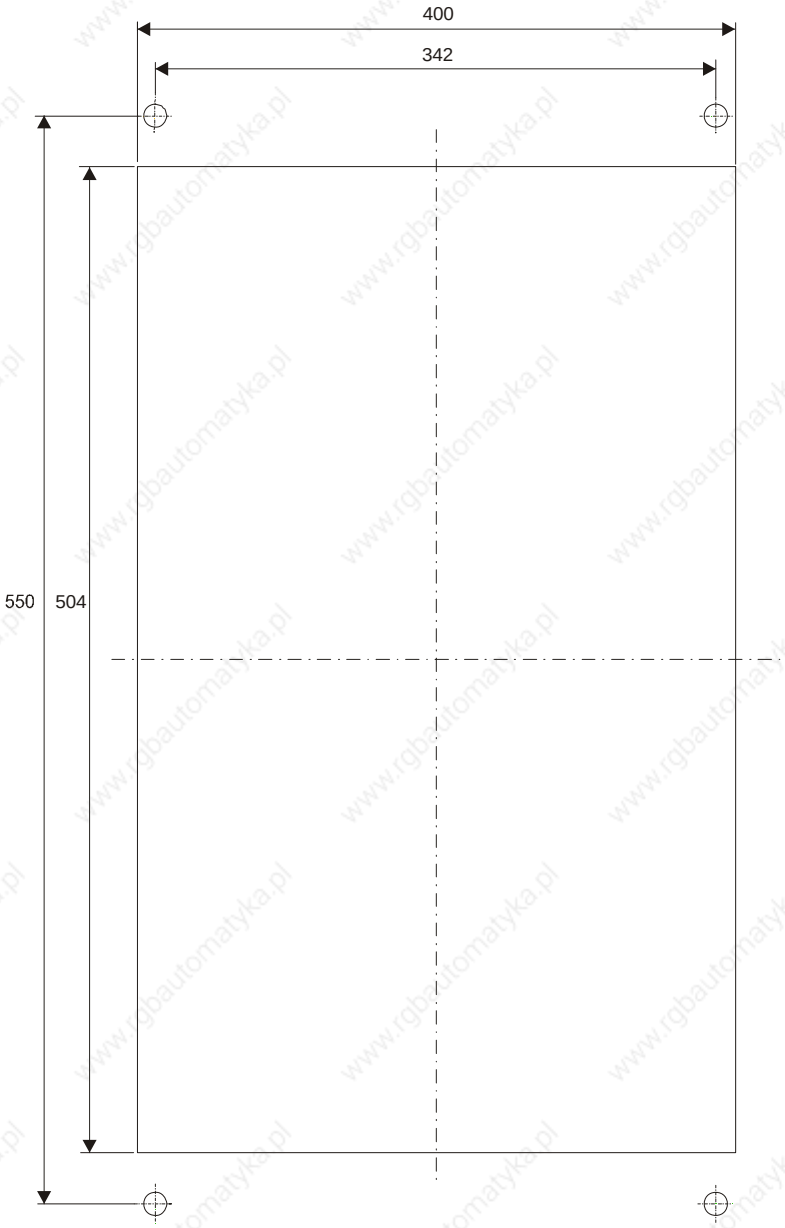


Diameter of the fixing holes 9 mm

Assembling kit	
Number of pieces	**Designation**
2	**brackets**
4	**screws**

Caution: The airflow direction through the heat sink passes from bottom to top. The turning direction of the device fan must be noted.

Drill pattern for feed-through model VCB 400-150 to -250



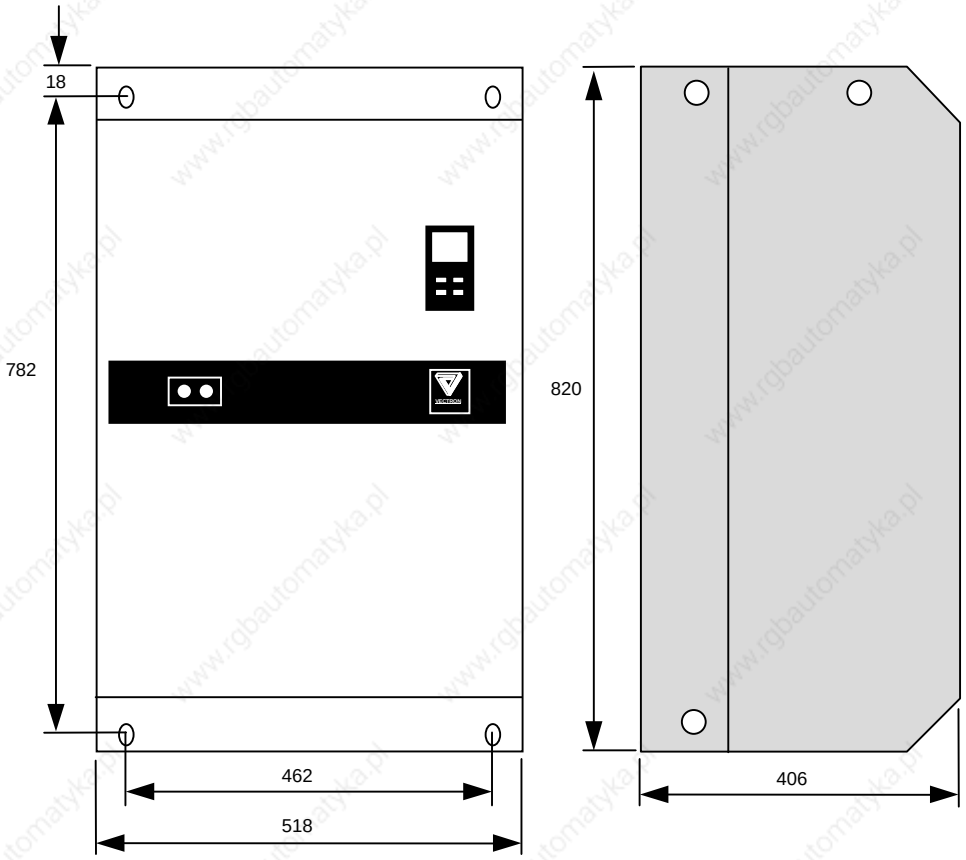
Diameter of the fixing holes 9 mm

The feed-through depth of the heat sink is 110 mm (see dimensional drawing of the standard model). Two brackets are necessary for the installation into an electrical cabinet.

Fitting the plate:

1. Undo the fastening screws on the frequency inverter.
2. Fasten the plate onto the top and bottom sides with the three screws.
3. Push the frequency inverter with the heat sink through the opening.
4. Fit the frequency inverter to the rear wall of the control cabinet

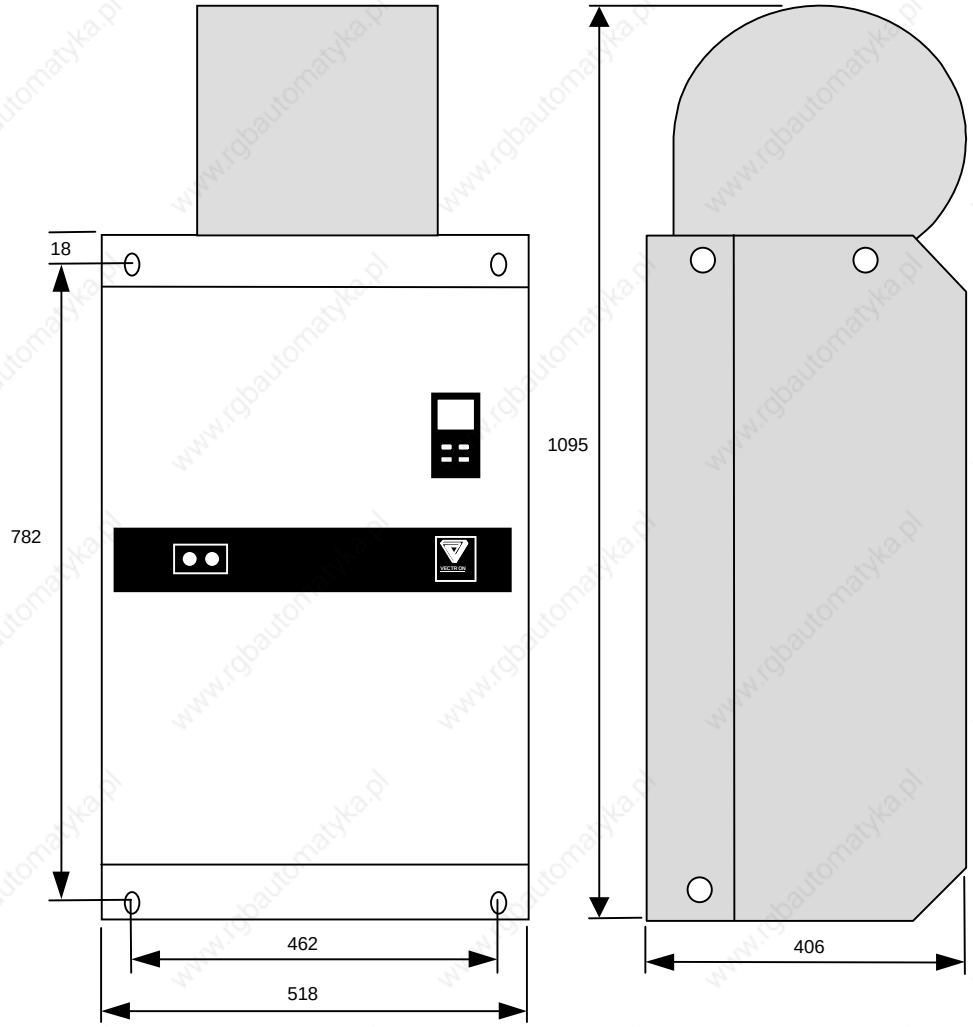
3.1.9 CONSTRUCTION SIZE 5, STANDARD MODELS (VCB 400–250 TO –370)



Diameter of the fixing holes 9 mm

Caution: The airflow direction through the heat sink passes from bottom to top. The turning direction of the device fan must be noted.

3.1.10 CONSTRUCTION SIZE 5, STANDARD MODELS (VCB 400–460 TO –610)



Diameter of the fixing holes 9 mm

Caution: The airflow direction through the heat sink passes from top to bottom. Look at the arrow indicated on the side to check the turning direction of the device fan.

3.2 HOUSING PROTECTION CLASS

The housing protection class is IP 20 according to EN60529. The accident prevention regulation VBG4 is fulfilled (contact protection).

3.3 INSTRUCTIONS FOR INSTALLATION OF THE UNIT

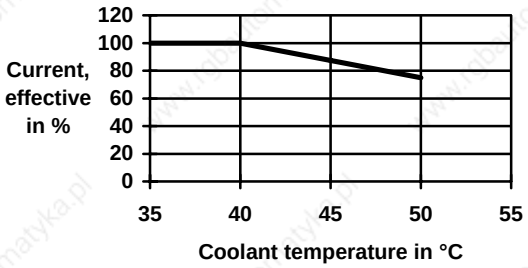
The frequency inverters are normally supplied for installation in electrical cabinets with external air flow-through ventilation. The inverters are secured to a mounting plate with 4 bolts. The inverters must be installed vertically.

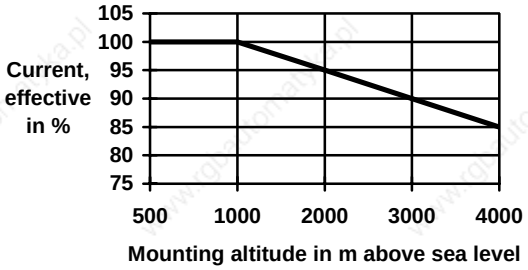
Caution: Care must be taken that no foreign bodies like borings or screws fall into the unit during installation.

Caution, following conditions are required at the installation site:

- max. cooling air inlet temperature: 50 °C
  the power must be reduced acc. to the diagrams above 40 °C.
- relative air humidity: 15...85%, no condensation
- max. installation altitude: 4000 m (from 1000 m reduce power)
- the installation site must be free from conductive and aggressive substances as well as from dampness

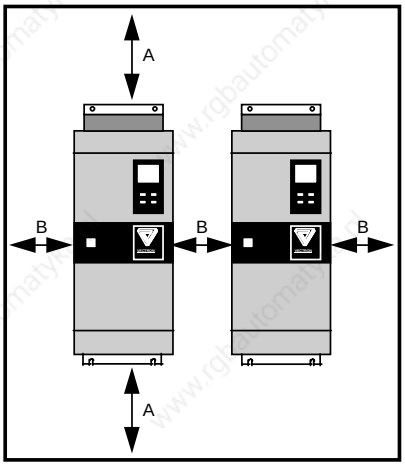
3.3.1 REDUCTION DIAGRAMS





3.4 MOUNTING DISTANCES

To avoid a build-up of heat the mounting distances must not be fallen below. The ventilation openings on the top surface must not on any condition be covered or closed.



Inverter type	A	B
VCB 400-010 to -034	100 mm	0 mm
VCB 400-045 to -135	100 mm	50 mm
VCB 400-150 to -210	300 mm	50 mm
VCB 400-250 to -610	300 mm	50 mm [1)]

[1)] The frequency inverters VCB 400-570 to -610 are to be separated by a sufficiently large plate in the area of the device fans. Min. distance to plate 50 mm.

3.5 TIGHTENING TORQUES OF THE CONNECTION TERMINALS

The frequency inverter range VCB 400 differs according to the output in the housing shape and dimensioning of the connection terminals which depend on the output.

In the following table the torques to be observed when connecting are listed.

Tightening torque	
Description	**Tightening torque**
Control terminals of all construction size (Phoenix Combicon)	0.22 – 0.25 Nm 38.5 – 43.7 lb in
Output terminals of construction size 1 (Weidmüller LU10.16)	1.2 Nm 210.1 lb in
Output terminals of construction size 2 (Phoenix HDFK 50)	6 – 8 Nm 1051.7 – 1400 lb in
Output terminals of construction size 3 (Phoenix HDFK 95)	15 – 20 Nm 2626.9 – 3502.5 lb in
PE terminal of construction size 3 (Phoenix HDFK 50)	6 – 8 Nm 1051.7 – 1400 lb in
Output terminals of construction size 4 (insulating bolts)	10 Nm 1751.2 lb in
Output terminals of construction size 5 (set nut in bar)	35 – 40 Nm 6129.4 – 7005 lb in

4 INSTRUCTIONS FOR ELECTRICAL INSTALLATION

4.1 STANDARDS AND REGULATIONS TO BE OBSERVED

The general standards and regulations should be observed during electrical installation:

EN 60204 Part 1 (Oct. 1992) Classification VDE 0113 Part 1
Electrical equipment of machines.
Part 1: General requirements.

EN 50178 (Oct. 1997) Classification VDE 0160 Part 100
Equipping power installations with electronic resources
Since the leakage current of frequency inverters can be >3.5 mA, a permanent connection must be provided according to the standard. The **PE cross-section** must be at least **10 mm²** or a second PE must be laid electrically parallel to the first. In this case the cross-section has to comply with the recommended cable cross-section of the cable connection.

Safety instructions:
Do not perform any operations, do not touch any connections and before using measuring and test equipment wait until the DC - link capacitors have discharged to less than 50 V residual voltage.
Do not try to check the dielectric strength of the inverter and disconnect its connection before carrying out any insulation test on the unit. All control inputs and outputs are isolated from the mains potential!

Caution, danger from high contact voltage:
The device must be safely disconnected from the mains before any intervention. Wait a few minutes before starting work on the device to allow the DC-link capacitors to discharge to less than 50 V residual voltage.

Further regulations may have to be observed in the event of special fields of application.

4.2 SAFETY MEASURES

The following may be used according to the regulations of the local electricity supply company:

- fault current protection circuit
- fault voltage protection circuit
- protective earth
- neutral
- safety earth conductor system

Note: Fault current protection circuits may be used subject to restrictions in conjunction with frequency inverters. A universal fault current relay with leakage current separation has to be used. In some countries this is forbidden.
There are two reasons for this:

a) All rectifier loads (therefore not only frequency inverters) can cause a DC current in the mains power supply lines, which can reduce the sensitivity of the safety switch.
b) Because of an increased leakage current when using a radio interference suppression filter the fault current safety switch can trip early which would result in an undesirable failure of the drive system.

4.3 CONTROL EQUIPMENT

According to VDE regulations the inverters must be connected to the mains in such a way that they can be disconnected from the mains supply by means of appropriate devices (e g main switch, contactor, circuit breaker). The motor connected to the inverter may, when loaded, be isolated by a contactor or motor protection switch.

Note: The inverter may be switched to the mains supply only every 60 s. This means that jogging operation of a mains contactor is not permissible. For the commissioning phase or after an emergency shutdown it is permitted to switch the unit on directly once only. Connection of excited motors or pole-switching in the case of pole-switchable motors as well as the reversal of the direction of rotation of the motor with a reversing contactor are not permissible during operation.

4.4 INSTRUCTIONS FOR EMC SAFE INSTALLATION

For the EMC safe mounting and installation of the drive system the instructions listed below are to be observed.
In case of deviations in the installation e g use of unshielded cables, use of collective suppressors for several machines instead of an individual suppressor or not using a power choke the system builder must in each case prove the observance of the limit values of the drive system separately.

The system builder bears the responsibility for the observance of the limit values for the EMC of the drive system.

Basic rules for the installation of frequency inverters in electrical cabinet

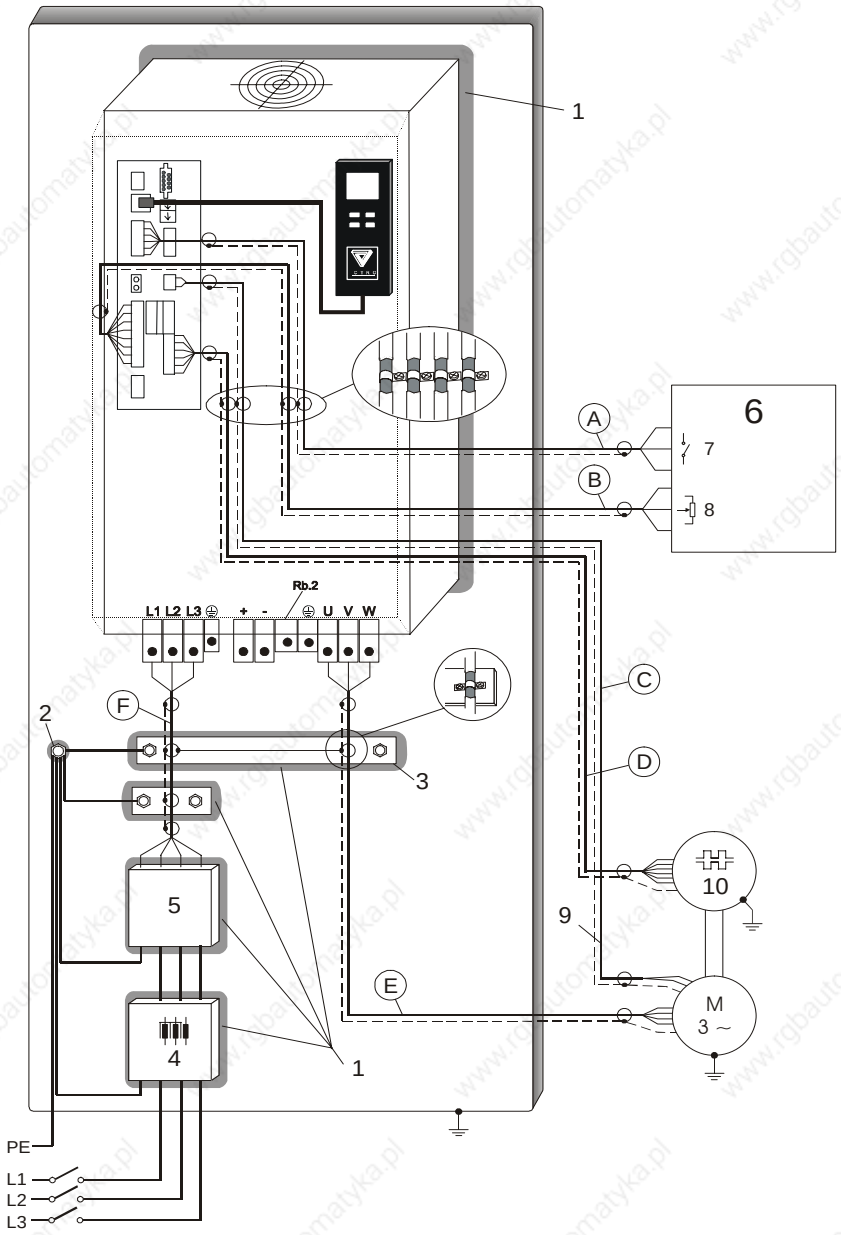
Some basic rules for installation, which can be used for all electrical cabinet installations, are listed below.

- Ensure a **good equipotential bonding** within the system or plant. System components such as switch cabinets, regulation desks, machine frames, etc. are to be connected by PE – cables of at least 10 mm².
- **All metal parts of the electrical cabinet** are to be joined to one another on a plane and highly conductive, not paint on paint. If necessary scraper discs are to be used. The cabinet door must be connected as closely as possible with the cabinet case with several ground cables.
- **Signal cables and power cables** are to be routed with a minimum distance of 20cm.
- The feed and return wires of **unshielded cables** should be **twisted** wherever possible.
- **Contactors, relays and magnetic valves** in the cabinet must be equipped with suppressor components: RC combinations, varistors and protective diodes.
- The **shields of digital cables** are to be connected with the earth on both sides over a wide area and highly conductive. In the case of poor equipotential bonding between the shield connections an additional equalizing line of at least 10mm² must be routed parallel to the shield to reduce the shield current.
- **The shields of analogue signal cables** may only be earthed on one side but over a wide area and highly conductive. The one-sided shielding prevents cases of low-frequency, capacitive interference (e g 50 Hz humming). The shield connection must be effected in the electrical cabinet.
- The braiding-out of **shields** and the bonding over long single strands (so-called pig tails) are to be avoided.
- **Plug connectors** of control cables must be selected so that the connector shell facilitates a good shield contact.
- Do not route **cabling** exposed in the cabinet but as close as possible to the electrical cabinet case (mounting plate) or earth potential.
- **Unnecessary lengths of cable** must be avoided. Coupling capacities and coupling inductances are thus kept low.
- If an **electrical cabinet** consists of the areas power range and control area the mounting of a metal screen between these areas is recommended. In this case encircling bonding over a wide area is necessary. This can only be achieved by removing the painted surface between the frame and the dividing wall and by screwing down using sheet metal screws. No cables should be routed through the screen wall. All components for the control of the installation as well as contactors, which do not lie in the power cables, are to be outside of the area of power electronics.

Installation of a drive system fulfilling EMC requirements

Components of the drive system given fulfilling EMC requirements:	
radio interference suppression filter	see chapter 5.1.2
line choke	see chapter 5.1.1
motor cable	Shielded cable with tinned E-CU-braid with 85% coverage Terminal voltage, compliance with limit class B acc. to the table in Chap. 5.2 (maximum length of cable without output filter for shielded lines)
power cable between radio interference suppression filter and frequency inverter	> 300 mm length of cable, shielded power line with tinned E-CU-harness with 85% cover
signal cable	shielded signal lead: type: LIYCY or NYSLYCYÖ-O

Installation of a drive system fulfilling EMC requirements:



Cable shields: Fasten control and power cable shields in or on device with the enclosed clips

Construction size 4 and 5: Also connect motor and power cable shields to the mounting plate near the device

Position	
1	Paint-free metallic mounting surface
2	Ground reference point
3	PE-bar
4	Choke
5	Mains filter
6	Control unit
7	Digital control inputs
8	Analogue inputs
9	Motor PTC resistor monitoring
10	Speed encoder

Cable definitions		
A	Control cable	NYSLYCYÖ – O or LIYCY
B	Reference value cable	
C	Encoder cable	
D	PTC resistor monitoring	
E	Drive cable	e.g. Ölflex–100 CY
F	Power cable	e.g. Ölflex–100 CY

Explanations on the EMC safe installation of a drive system:

1. **Radio interference suppression filter, line choke, frequency inverter and PE-bars** are to be mounted on the mounting plate over a wide contact area. Either the mounting points are to be made paint-free or a galvanised mounting plate is to be used. The above mentioned components are to be mounted on the same mounting plate.
2. Use only those line chokes and radio interference suppression filters approved by VECTRON. Both components have been specially selected for these frequency inverters. They are effective in different frequency ranges.
3. The ground reference point on the **mounting plate** is the common star point for the earth potential. All metal conductive drive components are to be connected through ground lines separately with this ground point. Equipotential busbars or shield bars can be fitted on the mounting plate, onto which all cable shields can be connected by use of cable clips. The mounting plate is attached to the cabinet wall so that it is highly conductive, HF effective (fan discs, HF litz wire, unpainted connections).
4. The **radio interference suppression filter** must be installed in the immediate vicinity of the frequency inverter (max. 50cm). The cable between the **radio interference suppression filter** and frequency inverter must be laid with a shield if longer than 300 mm. Otherwise cross coupling may occur with the unfiltered input cable of the radio interference suppression filter. The shield must be connected by clips over a wide area to a PE rail in the vicinity of both the device and the filter.
5. The **power cable** between mains and radio interference suppression filter (line choke) can be any length. However it must be routed separately from control cables, data cables and motor cable.
6. The shields of all cables between the motor and the frequency inverter must be connected over a wide area on both sides.
7. The **motor cable** is a shielded power cable. The shield consists of a tin-plated E-CU-harness with 85% cover. The motor cable shield should be connected to the motor with a metal PG joint on the casing of the terminal box. For this the terminal box must be made of metal and have a perfect metal conductive connection to the motor casing. If a PVC terminal box is used the cable shield should be connected to the unpainted motor housing or machine frame with a cable clip. For better shielding the motor cable can be routed down on the back of the mounting plate between cabinet rear panel and mounting plate. The motor cable should be routed without interruption directly from the frequency inverter to the motor. If the motor cable must be interrupted for contactors or motor protected switches then the line shield and the PE cable are not to be interrupted. The cable shield is to be connected with the mounting plate over a wide area.
8. **Line shields** are to be connected with earth clips on suitable equipotential busbars or on the unpainted galvanised mounting plate. Shields from signal and control cables can, if present, be connected with earth clips in the device.
9. **Control lines** must be laid separately from power lines. Signal lines should be kept separate from control lines for contactors or lines for the electronic power supplies and fan.
10. It must moreover be observed that the motor has a good PE-connection. The PE-potentials in the electrical cabinet, of the frequency inverter and of the motor must be identical. Otherwise a **potential equalising bar** must be routed between motor and cabinet/device. The cabinet must have a connection with the equipotential busbar of the building's earth.

Explanations on the EMC safe installation of a drive system:

11. If **filters** are fitted then the following points are to be observed: In general the **leakage current** increases through the use of filter elements. If this exceeds a limiting value of 3.5 mA then one of the following conditions must be fulfilled:
    - PE cross-section at least 10 mm²
    - Monitoring of the protective conductor by an appliance, which leads to an automatic switching off in the case of a defect.
    - Routing of a second cable, electric parallel to the PE via separate terminals. This must itself fulfil the requirements according to VDE 0100 Part 540 (e g minimum cross-section).
12. In order to achieve as low a load as possible of the supply net in general **line chokes** with a short circuit voltage of 4% are used. The **line choke** is to be placed between mains connection and radio interference suppression filter.

5 POWER CONNECTIONS

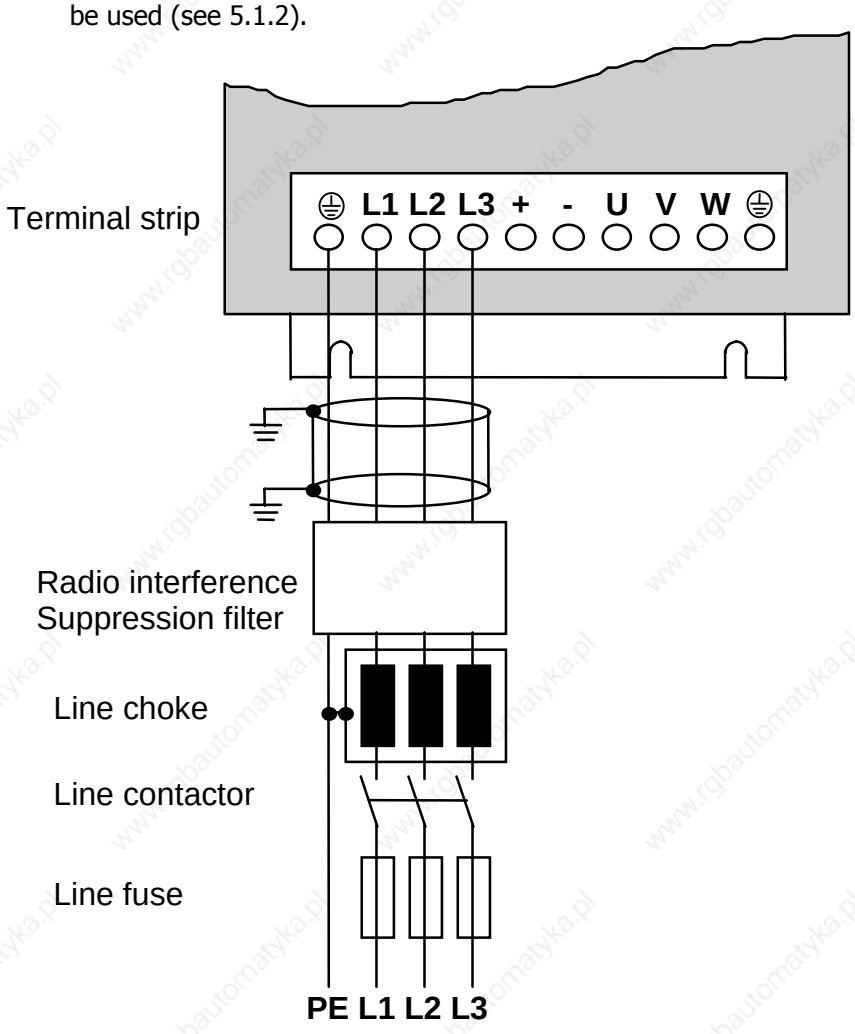
Note: To deal with the next chapters use the construction and layout drawing in chapter 2.1.

5.1 MAINS POWER CONNECTION

The mains power connection to the inverter uses the terminals or connection screws X1-PE, X1-L1, X1-L2 and X1-L3.

Caution: All devices of construction size 3 as well as device types VCB 400-570 and VCB 400-610 of construction size 5 include a device fan, which is directly connected internally to the mains connection. This means that the phase sequence must be observed and checked. Check the direction of rotation of the device fan using the air current.
The device fans in frequency inverters of construction size 3 draw the air out of the inverter whereas the air is forced into the inverter in device types VCB 400-570 and VCB 400-610.

Note: The following connection diagram also shows the schematic arrangement of the line choke and the radio interference suppression filter.
To reduce the mains feedback (mains vibrations) a line filter can be used (see chapter 5.1.1).
To suppress radio interference a radio interference suppression filter can be used (see 5.1.2).



Caution: Operation on unearthed mains (IT-mains) is not permissible with the frequency inverters VCB 400 in standard configuration.

(Further information on demand)

The mains fuses and the cable cross-sections must be rated according to the current carrying capacity of the permitted connection cable according to DIN VDE 0298 Part 4. As the leakage current with frequency inverters can be >3.5 mA a permanent connection must be provided in accordance with the standard. The **PE cross-section** in this case must measure at least **10 mm²** or a second PE must be routed electrically parallel to the first. In this case the cross-section has to comply with the recommended cable cross-section of the cable connection.

For VCB 400-010 to VCB 400-180 fuses e g NH fuses of the operating mode gL (VDE 636, Part 1) may be connected in series.
The mains supply must comply with the technical data
(see chapter. 2.2 Technical Data – Input mains side)

Rating example for PVC core cables in electrical installation pipes or channels at an ambient temperature of 40 °C.
If the routing types, ambient temperatures or insulating raw materials deviate the cable cross-sections must be selected according to DIN VDE 0298 Part 4.

Inverter Type	min. cable cross section at 40 °C (mm²)	line fuses gL (A)
VCB 400-010	1.5	10
VCB 400-014	2.5	16
VCB 400-018	4	20
VCB 400-025	6	25
VCB 400-034	10	35
VCB 400-045	16	50
VCB 400-060	25	63
VCB 400-075	35	80
VCB 400-090	50	100
VCB 400-115	70	125
VCB 400-135	95	160
VCB 400-150	95	160
VCB 400-180	120	200
VCB 400-210	150	250

For VCB 400-250 to VCB 400-610 the semi-conductor fuses given in the following table must be connected in series.

Frequency Inverter Type	min. cable cross-section at 40 °C (mm²)	line fuses Ferraz 6.6 URD
VCB 400-250	185	30 D . . A0400
VCB 400-300	240	31 D . . A0450
VCB 400-370	2 x 120	32 D . . A0550
VCB 400-460	2 x 185	33 D . . A0700
VCB 400-570	2 x 240	33 D . . A0900
VCB 400-610	2 x 240	33 D . . A1100

Note: Shielded cables are necessary to suppress radio interference (see chapter 5.1.2).

5.1.1 LINE CHOKE AND DC – LINK CHOKE

The line and DC – link circuit choke is needed to operate the frequency inverter. It reduces the commutation glitches and mains feedback.
The inverter types **VCB 400-010 to -018** can be supplied with an integrated DC – link choke as an option. For the unit types **VCB 400-025 and -610** line chokes with a short circuit voltage of u_k = 4% are available as accessories
The diagram in chapter 5.1 mains connection shows the schematic arrangement of the line choke.

5.1.2 RADIO INTERFERENCE SUPPRESSION FILTER

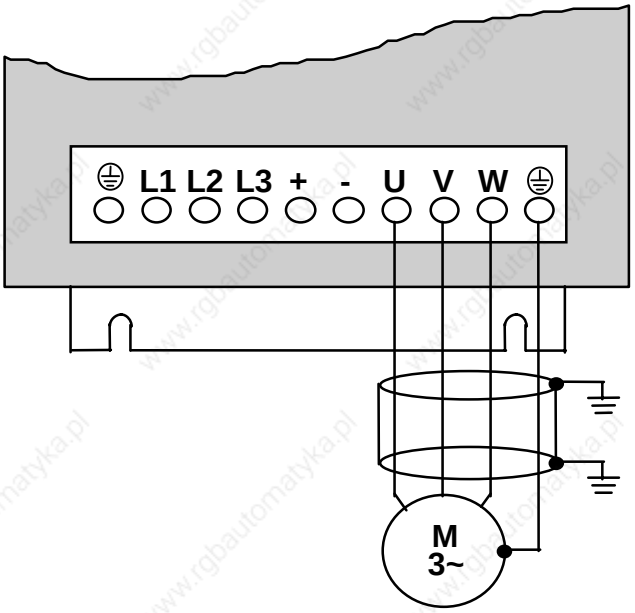
A radio interference suppression filter, available as an optional extra, must be used and installed in accordance with Chap. 4.4 to limit the terminal voltage on the power line.
(Radio interference level acc. to EN 61800-3 for use in living areas)
This complies with the limit class B acc. to EN 55011.

5.2 MOTOR CONNECTION

Caution, lethal risk of electric shock:
Before performing any operation the unit must be disconnected from the mains. Only after a waiting period of a few minutes, when the DC - link capacitors are discharged and have a residual voltage of less than 50 V, may work be carried out on the unit.

The motor connection of the inverter is via the terminals or connecting screws X1-U, -V, -W and protection switch.

Terminal strip



Caution: The cable cross-sections must be rated according to the current carrying capacity of the permissible connecting cable according to DIN VDE 0298 Part 4.

Rating example for the cable cross-sections according to DIN VDE 0298 Part 4 at an ambient temperature of 40 °C (electrical cabinet inside temperature):

Inverter Type	Max. continuous current (A)	Min. cable cross-section at 40 °C (mm²)
VCB 400-010	10	1.5
VCB 400-014	14	2.5
VCB 400-018	18	4
VCB 400-025	25	6
VCB 400-034	34	10
VCB 400-045	45	16
VCB 400-060	60	25
VCB 400-075	75	35
VCB 400-090	90	50
VCB 400-115	115	70
VCB 400-135	135	95
VCB 400-150	150	95
VCB 400-180	180	120
VCB 400-210	210	150
VCB 400-250	250	185
VCB 400-300	300	240
VCB 400-370	370	2 x 120
VCB 400-460	460	2 x 185
VCB 400-570	570	2 x 240
VCB 400-610	610	2 x 240

Note: Shielded cables are necessary for radio interference suppression. They should be installed in accordance with Chap. 4.4.
In the case of long motor cables an output filter, available as an accessory, must be used (see table below). An output filter must also be used if necessary when using special motors e g high frequency motors or old motors. A larger output of the frequency inverter may have to be selected due to the power loss of the filter. Further information is provided with the corresponding filters.

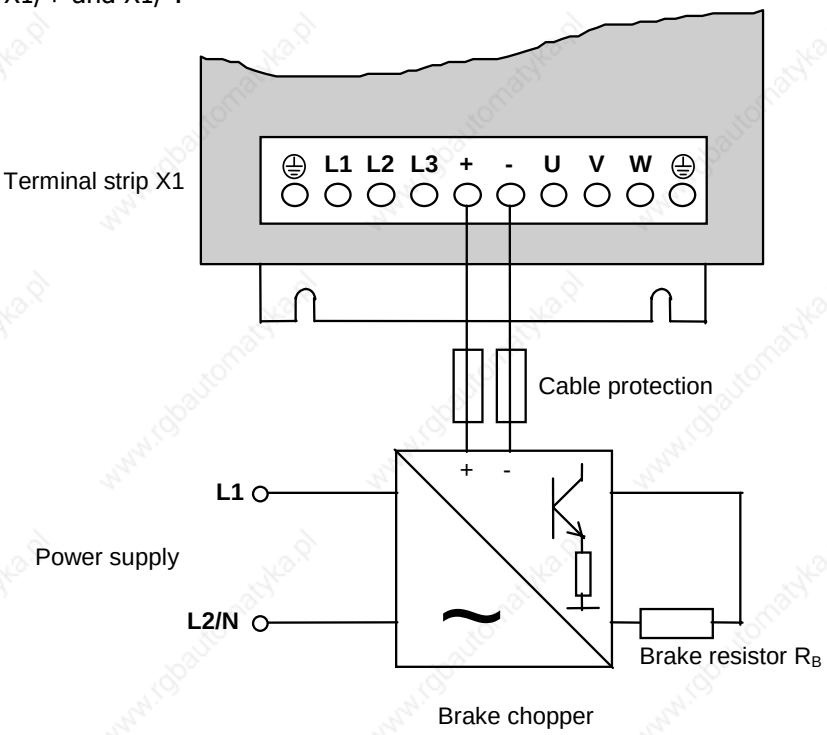
Caution: The frequency inverter must have an ohmic / inductive load; purely capacitive loads are not permissible.
Connection of excited motors or switching of the numbers of poles in the case of pole-switchable motors as well as changing the direction of rotation of the motor e g by means of a reversing contactor are not permissible during operation.
In the case of multi-motor drives care must be taken to ensure that the maximum current for the inverter is not exceeded. The sum total of the cable lengths for all motors may not exceed the maximum lengths listed in the table below. The cable lengths can be extended on request by corresponding technical measures.

Maximum cable length without output filter		
Frequency Inverter Type	**unshielded cables (m)**	**shielded cables (m)**
VCB 400-010	50	35
VCB 400-014	70	50
VCB 400-018	100	67
VCB 400-025	110	75
VCB 400-034	125	85
VCB 400-045 to VCB 400-610	150	100

Maximum cable length with output filter		
Frequency Inverter Type	**unshielded cables (m)**	**shielded cables (m)**
VCB 400-010	150	100
VCB 400-014	200	100
VCB 400-018	225	100
VCB 400-025	240	100
VCB 400-034 to VCB 400-060	260	150
VCB 400-075 to VCB 400-610	300	200

5.3 BRAKE UNIT

Caution, lethal risk of electric shock:
Before any operation the unit is to be disconnected. Only after a waiting period of approximately a few minutes, when the DC - link capacitors are discharged and have less than 50 V residual voltage, may any work be carried out on the unit.
If the rotor speed is higher than the corresponding stator speed the motor feeds energy back to the inverter. In this mode of operation the motor is braked by the inverter. Depending on the amounts of energy it may become necessary to use an external brake unit. This converts the volume of energy into heat via a resistor.
The brake unit of the inverter is connected via the terminals or the connecting screws X1/+ and X1/-.



Caution: The cable cross-sections must be rated according to the current carrying capacity of the permissible connecting cable according to DIN VDE 0298 Part 4.

Note: The static frequency inverters in the construction sizes 1 to 5 have to be ordered with a brake chopper module for the control of an external brake resistor, which is integrated in the unit. In this configuration two terminals are available to connect the brake resistor.

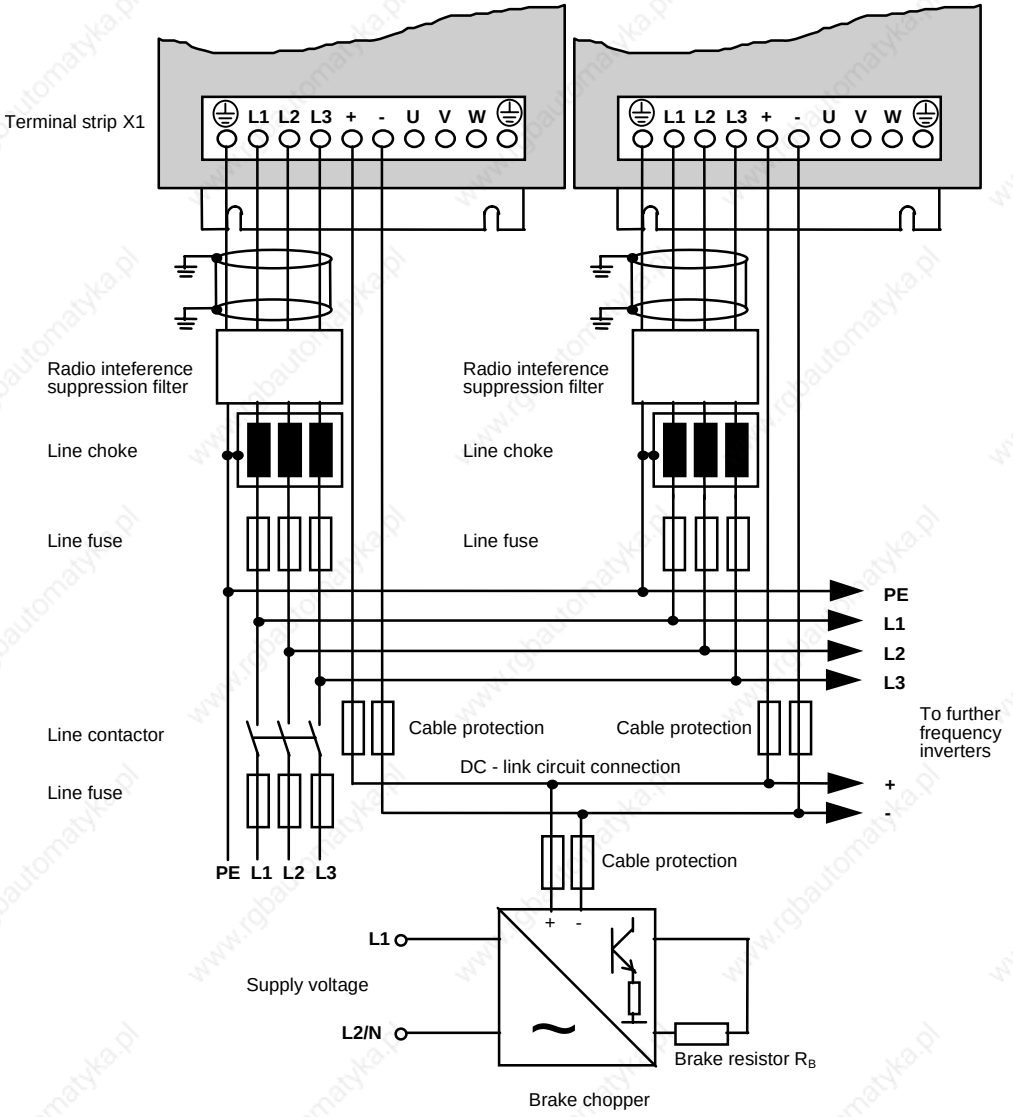
5.4 CONNECTION OF THE DC - LINK CIRCUITS

Caution, lethal risk of electric shock:

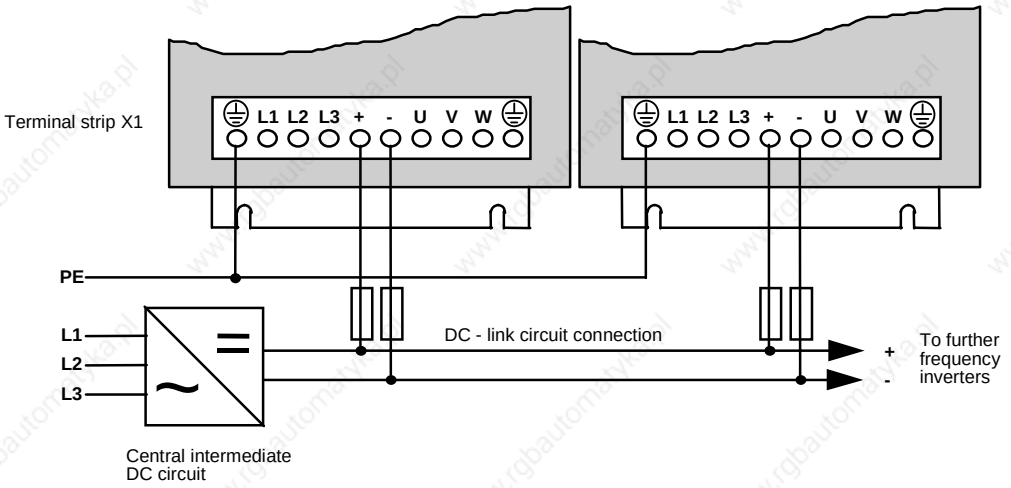
Before any operation the unit must be disconnected. Only after a waiting period of approximately a few minutes, when the DC - link capacitors are discharged and have less than 50 V residual voltage, may any work be carried out on the unit.

When several drives are working in a motor and generator mode they can be connected to one another in the DC-link circuit for the exchange of energy. In this case all inverters must be supplied simultaneously with the same mains voltage and connected with the recommended line choke or all inverters must be fed by a central DC - link circuit (DC voltage source). A brake unit is only necessary if for a certain time the generator energy should be more than the motor energy. The frequency inverters can optionally be ordered with integrated brake chopper or the VER power unit can be used.
The connection in the DC - link circuit of the inverters is via the terminals or connecting screws X1/+ and X1/-.

DC - link connection with supply via the mains input



DC – link connection with supply via a a central DC – link circuit



The central DC - link circuit can be fed via the VER power unit. Further information can be found in the corresponding documentation.

Note: Linking with a central DC – link circuit is possible with the present frequency inverters of all output classes.

It must be observed that a 3-phase fan is included in the units of construction size 3, VCB 400-570 and VCB 400-670. This must be supplied with voltage with the correct phase sequence at the optional terminals.

The **connecting terminals** for the 3-phase fan are **not** part of the basic equipment of the frequency inverters and must be given separately in the order for the named application.

6 GENERAL TECHNICAL DATA / LICENSING BY UL AND CSA

6.1 MARKING AND SPECIFICATION

The devices VCB 400-010 to VCB 400-135 are tested and licensed by UL as per UL508c (UL Standard for Safety for power conversion equipment). The requirements in CSA Standard C22.2 – No.14-95 for frequency inverters are therefore also met. This is indicated on the device by the combined examination mark.

83KA Listing mark for standard models

or

Recognized mark for feed-through models

6.2 NOTES FOR THE LICENSING OF THE DRIVE SYSTEM

The frequency inverter is part of a more complex drive system that, depending on the circumstances, must be licensed by UL or CSA. To determine if and which specification your drive system must meet according to UL or CSA, go to

www.UL.com or www.CSA.ca

to locate the appropriate adviser closest to you.

6.3 INSTALLATION NOTES

6.3.1 SUPER-ENCLOSURE

The frequency inverters VCB 400-010 to VCB 400-135 are categorized as „open type", where the device must be installed in a super-enclosure (control cabinet, machine frame, etc.). The super-enclosure must not have dimensions of less than 800mm x 500mm x 400mm.

6.3.2 INTENDED USE IN DRIVE SYSTEM

Standard models VCB 400-010 bis VCB 400-135 c UL us LISTED 83KA

These devices can be directly installed in the drive system. For UL/CSA licensing of the drive system, the electrical and thermal limit values (see Chapter 6.4.2) and the installation notes (see Chapter 6.4) must be complied with.

Feed-through models VCB 400-010 to VCB 400-135 c UL us

These devices are supplied without device fans and are therefore suitable for integration within the ventilation concept of the machine so that the device can be cooled or, alternatively, the actual dissipation power of the frequency inverter can be separated from the interior of the control cabinet.
For perfect operation of the frequency inverter, forced air cooling of the heat sink is necessary. The following minimum values must be evidenced for UL/CSA licensing of the drive system.

VCB 400-010 /-014 /-018	> 90 m^3/h
VCB 400-025 /-034	> 150 m^3/h
VCB 400-045 /-060 /-075	> 300 m^3/h
VCB 400-090 /-115 /-135	> 400 m^3/h

With the appropriate mechanical design, these values can be met using the fans used for standard devices by Vectron (inquire at factory).

In addition, the electrical and thermal limit values (see Chapter 6.4.2) and the installation notes (see Chapter 6.4) must be complied with.

6.4 INSTALLATION NOTES

6.4.1 MAINS CONNECTION

Connection to a power supply with a short circuit current greater than 18000Arms and rated voltage greater than 480 Vac is not permitted.

For mains and motor connections, only use UL/CSA approved copper lines with a 75 °C temperature range.

The following tables indicate the permissible fuses and minimum cross-sections for the mains and motor connections.

Frequency Inverter type	Over load	AWG (min.)	Line fuses type	Nominal fuse current
VCB 400-010	1.2	14	class K5 / min. 480 V	10 A
VCB 400-010	1.5	14	class K5 / min. 480 V	10 A
VCB 400-014	1.2	12	class K5 / min. 480 V	15 A
VCB 400-014	1.5	12	class K5 / min. 480 V	15 A
VCB 400-018	1.2	10	class K5 / min. 480 V	20 A
VCB 400-018	1.5	10	class K5 / min. 480 V	20 A
VCB 400-025	1.2	8	class K5 / min. 480 V	25 A
VCB 400-025	1.5	8	class K5 / min. 480 V	25 A
VCB 400-034	1.2	8	class K5 / min. 480 V	35 A
VCB 400-034	1.5	8	class K5 / min. 480 V	35 A
VCB 400-045	1.2	6	Semiconductor fuse *)/min. 480 V	80 A
VCB 400-045	1.5	6	Semiconductor fuse *)/min. 480 V	100 A
VCB 400-060	1.2	4	Semiconductor fuse *)/min. 480 V	100 A
VCB 400-060	1.5	4	Semiconductor fuse *)/min. 480 V	125 A
VCB 400-075	1.2	3	Semiconductor fuse *)/min. 480 V	125 A
VCB 400-075	1.5	3	Semiconductor fuse *)/min. 480 V	160 A
VCB 400-090	1.2	2	Semiconductor fuse *)/min. 480 V	160 A
VCB 400-090	1.5	2	Semiconductor fuse *)/min. 480 V	200 A
VCB 400-115	1.2	1/0	Semiconductor fuse *)/min. 480 V	200 A
VCB 400-115	1.5	1/0	Semiconductor fuse *)/min. 480 V	250 A
VCB 400-135	1.2	2/0	Semiconductor fuse *)/min. 480 V	250 A
VCB 400-135	1.5	2/0	Semiconductor fuse *)/min. 480 V	250 A

*) Applicable types are, e.g.: Ferraz Type URQ or equivalent (UL/CSA approval is required)

Note: Important note when supplying power through DC terminals:

In the frequency inverters VCB 400 010 to 025 with integrated retarding chopper and VCB 400 034 to 075, any transient overvoltages of the DC supply that occur must be limited to 4 kV (e.g. overvoltage protector).

This requirement is met when a Vectron frequency inverter, series VCB 400, is used for the power supply.

6.4.2 ELECTRICAL AND THERMAL LIMIT VALUES

Mains input at ambient temperature of 40 °C

Type (VCB -)	Nominal voltage	Frequency	Rated current	Phases
400-010	400 V (480 V max.) 540 Vdc (650 V max.)	50 – 60 Hz --	10 A 12 A	3 ph --
400-014	400 V (480 V max.) 540 Vdc (650 V max.)	50 – 60 Hz --	14 A 16 A	3 ph --
400-018	400 V (480 V max.) 540 Vdc (650 V max.)	50 – 60 Hz --	18 A 21 A	3 ph --
400-025	400 V (480 V max.) 540 Vdc (650 V max.)	50 – 60 Hz --	25 A 29 A	3 ph --
400-034	400 V (480 V max.) 540 Vdc (650 V max.)	50 – 60 Hz --	34 A 40 A	3 ph --
400-045	400 V (480 V max.) 540 Vdc (650 V max.)	50 – 60 Hz --	45 A 53 A	3 ph --
400-060	400 V (480 V max.) 540 Vdc (650 V max.)	50 – 60 Hz --	60 A 71 A	3 ph --
400-075	400 V (480 V max.) 540 Vdc (650 V max.)	50 – 60 Hz --	75 A 89 A	3 ph --
400-090	400 V (480 V max.) 540 Vdc (650 V max.)	50 – 60 Hz --	90 A 108 A	3 ph --
400-115	400 V (480 V max.) 540 Vdc (650 V max.)	50 – 60 Hz --	115 A 138 A	3 ph --
400-135	400 V (480 V max.) 540 Vdc (650 V max.)	50 – 60 Hz --	135 A 162 A	3 ph --

Output at ambient temperature of 40 °C

Type (VCB -)	Nominal voltage	Frequency	Power	Phases
400-010	0 – U input	0 – 400 Hz	6.6 hp (ac)	3 ph
400-014	0 – U input	0 – 400 Hz	9.0 hp (ac)	3 ph
400-018	0 – U input	0 – 400 Hz	12.0 hp (ac)	3 ph
400-025	0 – U input	0 – 400 Hz	17.0 hp (ac)	3 ph
400-034	0 – U input	0 – 400 Hz	23.4 hp (ac)	3 ph
400-045	0 – U input	0 – 400 Hz	33.6 hp (ac)	3 ph
400-060	0 – U input	0 – 400 Hz	45.3 hp (ac)	3 ph
400-075	0 – U input	0 – 400 Hz	55.9 hp (ac)	3 ph
400-090	0 – U input	0 – 400 Hz	67.3 hp (ac)	3 ph
400-115	0 – U input	0 – 400 Hz	82.2 hp (ac)	3 ph
400-135	0 – U input	0 – 400 Hz	97.1 hp (ac)	3 ph

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