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### ■ Warnings



The Danfoss harmonic filters AHF 005 and AHF 010 contain dangerous voltages when connected to line voltages. Only a competent electrician should carry out the electrical installation. Improper installation of the filter module or the connected adjustable frequency drive may cause equipment failure, serious injury, or death. Follow this manual and National Electrical Codes and local safety codes. Operation of the harmonic filter is only allowed with a closed cover of the housing!

### ■ Symbols used in this manual

When you read this manual, you will come across different symbols that require special attention. The symbols used are the following:



Warning of hazardous electrical voltage



Warning of a general danger



#### NOTE

This designates general, useful notes. If you observe them, handling of the filter module / drive system is made easier.

### ■ Operator's safety



After line disconnection, the power terminals X1.1, X1.2, X1.3, X3.1, X3.2, X3.3, X4.1, X4.2, and X4.3 remain live for minimum 15 minutes.



The filter modules must be installed in such a way that they fulfill their function and do not expose persons to danger. They must be mounted correctly and used in accordance with their purpose.

### ■ Avoid filter module damage

1. The filter modules are to be used only with Danfoss adjustable frequency drives. Usage with other electrical loads is not permitted and may damage the devices.
2. Do not use the drive system (adjustable frequency drive, motor load, and filter module) if the equipment has been damaged.
3. Modifications of the filter modules are not allowed.

### ■ DC-link resonance

To avoid resonances in the DC link, it is possible to disable the dynamic DC link compensation.

#### 483 Dynamic DC link compensation (DC LINK COMP.)

##### Value:

Off	[0]
★On	[1]

##### Function:

The VLT 5000, 6000, and 8000 series include a feature which ensures that the output voltage is independent of any voltage fluctuation in the DC link, e.g. caused by fast fluctuation in the line supply voltage. The benefit is a very steady torque on motor shaft (low torque ripple) under most line conditions.

##### Description of choice:

In some cases, this very dynamic compensation can cause resonances in the DC link and should then be disabled. Typical cases are where a line choke or a passive harmonic filter (e.g. filters AHF005/010) is mounted in the line supply to the adjustable frequency drive to suppress harmonics. Can also occur on line power supplies with low short circuit ratio.

### ■ Description

The Danfoss harmonic filters AHF 005 and AHF 010 ensure near-sinusoidal line current minimizing the harmonic current emission into the line supply. The Danfoss AHF 005 and AHF 010 are advanced harmonic filters not to be compared with traditional harmonic trap filters. The Danfoss harmonic filters have been specially designed to match all the Danfoss adjustable frequency drives. The filters AHF 010 and AHF 005 are available in four voltage ratings.

- 380 - 415 V AC, 50 Hz
- 440 - 480 V AC, 60 Hz
- 500 V AC, 50 Hz
- 690 V AC, 50 Hz

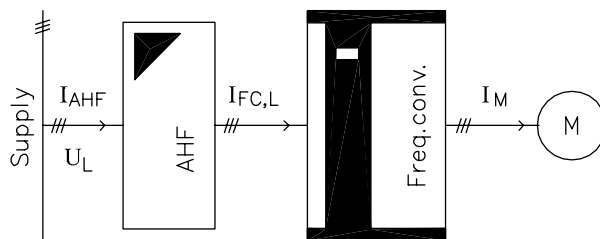
The Danfoss AHF 010 and AHF 005 have the following characteristics:

- Small compact housing that fits into a panel
- Easy to use in retrofit applications
- AHF 010 reduces the total harmonic current distortion to 10%\*
- AHF 005 reduces the total harmonic current distortion to 5%\*
- Current rating from 10A - 370A
- For higher power, modules can be paralleled
- One filter module can be used for several adjustable frequency drives
- High efficiency (> 0.98)
- User-friendly commissioning - no adjustment necessary
- No routine maintenance required

\* THiD of 10% or 5% will be achieved when the following conditions are met:

- THvD of the system without the drive operating is less than 2%
- Filter is operating at nominal load

If these conditions are not fulfilled, a significant reduction of the harmonic components can still be achieved, but the rated THiD values may not be achieved.



**Principle connection diagram of the Danfoss harmonic filter.**

Legends (as used throughout this manual):

$U_L$ :	Line voltage
$I_{AHF}$ :	Input current of the filter AHF
$I_{FC,L}$ :	Input current to the adjustable frequency drive
$I_M$ :	Motor current

**■ Ordering numbers, 380 - 415 V, 50 Hz**
**AHF 005 and AHF 010, 380V - 415V, 50Hz**

I <sub>AHF,N</sub>	Typical Motor Used [kW]	Danfoss ordering number		Typical Danfoss adjustable frequency drive series *		
		AHF 005	AHF 010	VLT 5000	VLT 6000 HVAC	VLT 8000 AQUA
10 A	4, 5.5	175G6600	175G6622	5006, 5008	6006, 6008	8006, 8008
19 A	7.5	175G6601	175G6623	5011	6011	8011
26 A	11	175G6602	175G6624	5016	6016	8016
35 A	15, 18.5	175G6603	175G6625	5022, 5027	6022, 6027	8022, 8027
43 A	22	175G6604	175G6626	5032	6032	8032
72 A	30, 37	175G6605	175G6627	5042, 5052	6042, 6052	8042, 8052
101 A	45, 55	175G6606	175G6628	5062, 5072	6062, 6072	8062, 8072
144 A	75	175G6607	175G6629	5102	6102	8102
180 A	90	175G6608	175G6630	5122	6122	8122
217 A	110	175G6609	175G6631	5152	6152	8152
289 A	132, 160	175G6610	175G6632	5202, 5252	6172, 6222	8202, 8252
324 A		175G6611	175G6633			
370 A	200	175G6688	175G6691	5302	6272	8302
Higher ratings can be achieved by paralleling the filter units						
434 A	250	Two 217A units		5352	6352	8352
578 A	315	Two 289 A units		5452	6402	8452
613 A	355	289 A and 324 A units		5502	6502	8502
648 A	400	Two 324 A units			6552	8602

\* Please note that the matching of the typical Danfoss adjustable frequency drive and filter is pre-calculated based on 400V and assuming typical motor load (4- or 2-pole motor). VLT 5000 series is based on a max. 160 % torque application, while VLT 6000 and 8000 series are based on a max. 110% torque application. The pre-calculated filter current may be different than the input current ratings of the VLT 5000, VLT 6000, and VLT 8000 series as stated in the respective instruction manuals, as these numbers are based on different operating conditions.

**■ Ordering numbers, 440 - 480 V, 60 Hz**

I <sub>AHF,N</sub>	Typical Motor Used [HP]	Danfoss ordering number		Typical Danfoss adjustable frequency drive series *		
		AHF 005	AHF 010	VLT 5000	VLT 6000 HVAC	VLT 8000 AQUA
19 A	10, 15	175G6612	175G6634	5011, 5016	6011, 6016	8011, 8016
26 A	20	175G6613	175G6635	5022	6022	8022
35 A	25, 30	175G6614	175G6636	5027, 5032	6027, 6032	8027, 8032
43 A	40	175G6615	175G6637	5042	6042	8042
72 A	50, 60	175G6616	175G6638	5052, 5062	6052, 6062	8052, 8062
101 A	75	175G6617	175G6639	5072	6072	8072
144 A	100, 125	175G6618	175G6640	5102, 5122	6102, 6122	8102, 8122
180 A	150	175G6619	175G6641	5152	6152	8152
217 A	200	175G6620	175G6642	5202	6172	8202
289 A	250	175G6621	175G6643	5252	6222	8252
324 A	300	175G6689	175G6692	5302	6272	8302
370 A	350	175G6690	175G6693	5352	6352	8352
Higher ratings can be achieved by paralleling the filter units						
506 A	450	217 A and 289 A units		5452	6402	8452
578 A	500	Two 289 A units		5502	6502	8502
648 A	600	Two 324 A units		-	6552	8602

\* Please note that the matching of the typical Danfoss adjustable frequency drive and filter is pre-calculated based on 480V and assuming typical motor load. VLT 5000 series is based on a 160 % torque application, while VLT 6000 and 8000 series are based on 110% torque application.

The pre-calculated filter current may vary from the input current ratings of the VLT 5000, VLT 6000, and VLT 8000 series as stated in the respective instruction manuals, as these numbers are based on different operating conditions.

**■ Ordering numbers, 500 V, 50 Hz**

I <sub>AHF,N</sub>	Typical Motor Used [kW]	Danfoss ordering number		Typical Danfoss adjustable frequency drive series *		
		AHF 005	AHF 010	VLT 5000	VLT 6000 HVAC	VLT 8000 AQUA
10 A	4, 5.5	175G6644	175G6656	5006, 5008	6006, 6008	8006, 8008
19 A	7.5, 11	175G6645	175G6657	5011, 5016	6011, 6016	8011, 8016
26 A	15, 18.5	175G6646	175G6658	5022, 5027	6022, 6027	8022, 8027
35 A	22	175G6647	175G6659	5032	6032	8032
43 A	30	175G6648	175G6660	5042	6042	8042
72 A	37, 45	175G6649	175G6661	5052, 5062	6052, 6062	8052, 8062
101 A	55, 75	175G6650	175G6662	5062, 5072	6062, 6072	8062, 8072
144 A	90, 110	175G6651	175G6663	5102, 5122	6102, 6122	8102, 8122
180 A	132	175G6652	175G6664	5152	6152	8152
217 A	160	175G6653	175G6665	5202	6172	8202
289 A	200	175G6654	175G6666	5252	6222	8252
324 A	250	175G6655	175G6667	5302	6302	8302
Higher ratings can be achieved by paralleling the filter units						
434 A	315	Two 217 A units		5352	6352	8352
469 A	355	180 A and 289 A units		5452	6402	8452
578 A	400	Two 289 A units		5502	6502	8502

\* Please note that the matching of the typical Danfoss adjustable frequency drive and filter is pre-calculated based on 500V and assuming typical motor load. VLT 5000 series is based on a 160 % torque application, while VLT 6000 and 8000 series are based on 110% torque application.

The pre-calculated filter current may vary from the input current ratings of the VLT 5000, VLT 6000, and VLT 8000 series as stated in the respective instruction manuals, as these numbers are based on different operating conditions.

**■ Ordering numbers, 690 V 50 Hz**

I <sub>AHF,N</sub>	Typical Motor Used [kW]	Danfoss ordering number		Typical Danfoss adjustable frequency drive series *	
		AHF 005	AHF 010	VLT 5000 160 %	VLT 8000 HVAC
43 A	37, 45	130B2328	130B2293	5042, 5052	8052
72 A	55, 75	130B2330	130B2295	5062, 5072	8062, 8072
101 A	90	130B2331	130B2296	5102	8102
144 A	110, 132	130B2333	130B2298	5122, 5152	8122, 8152
180 A	160	130B2334	130B2299	5202	8202
217 A	200	130B2335	130B2300	5252	8252
289 A	250	130B2331 & 130B2333	130B2301	5302	8302
324 A	315	130B2333 & 130B2334	130B2302	5352	8352
370 A	400	130B2334 & 130B2335	130B2304		8402

\* Please note that the matching of the typical Danfoss adjustable frequency drive and filter is pre-calculated based on 500V and assuming typical motor load. VLT 5000 series is based on a 160 % torque application, while the VLT 8000 series are based on 110% torque application.

The pre-calculated filter current may vary from the input current ratings of VLT 5000 and VLT 8000 series as stated in the respective instruction manuals, as these numbers are based on different operating conditions.

**■ Calculation of the exact filter size needed**

For optimal performance, the harmonic filter should be sized for the line input current to the adjustable frequency drive, i.e. the input current drawn based on the expected load of the adjustable frequency drive and not the size of the adjustable frequency drive itself!

The line input current to the adjustable frequency drive (I<sub>FC,L</sub>) can be calculated using the nominal motor current (I<sub>M,N</sub>) and displacement power factor (Cos φ) of the motor. Both data are normally printed on the nameplate of the motor. In the case where the nominal motor voltage (U<sub>M,N</sub>) is unequal to the actual line-line voltage (U<sub>L</sub>), the calculated current

must be corrected with the ratio between these voltages as shown in the equation below.

$$I_{FC,L} = 1.1 * I_{M,N} * \cos(\varphi) * ((U_{M,N}) / (U_L))$$

The harmonic filter chosen must have a nominal current (I<sub>AHF,N</sub>) equal to or larger than the calculated adjustable frequency drive line input current (I<sub>FC,L</sub>).

If several adjustable frequency drives are to be connected to the same filter, the harmonic filter must be sized according to the sum of the calculated line currents.



If the harmonic filter is sized for the load, and the motor of the corresponding adjustable frequency drive is changed, the current must be re-calculated to avoid overload of the harmonic filter.

**■ General technical data**

		AHF 0xx	AHF 0xx	AHF 0xx	AHF 0xx
Nominal supply voltage	$U_{L,N}$ [V]	$380 \leq U_{L,N} \leq 415$	$440 \leq U_{L,N} \leq 480$	500 V	690 V
Tolerance of the actual supply voltage	$U_L$ [V]	$342 \leq U_L \leq 456$	$396 \leq U_L \leq 528$	$450 \leq U_L \leq 550$	$621 \leq U_L \leq 759$
Supply frequency	$f_{L,N}$ [Hz]	$50 \pm 5 \%$	$60 \pm 5 \%$	$50 \pm 5 \%$	$50 \pm 5 \%$
Overload capability		1.6 for 60s			
Efficiency	$\eta$ [%]	~ 98.8 %			
THiD	[%]	AHF 005 < 5% AHF 010 < 10%			
cos $\phi$ of $I_L$		0.5 cap 0.8 cap 0.85 cap 0.99 cap 1.00	at 25% $I_{AHF,N}$ at 50% $I_{AHF,N}$ at 75% $I_{AHF,N}$ at 100% $I_{AHF,N}$ at 150% $I_{AHF,N}$		
Power derating	$[\%/C]$ $[\%/m]$	$104^\circ F < T_a < 131^\circ F \Rightarrow 1.5\%/F$ ( $40^\circ C < T_a < 55^\circ C \Rightarrow 3\%/C$ ) 3280 ft altitude above sea level < $h \leq 13,100$ ft altitude above sea level $\Rightarrow 5\% / 3280$ ft (1000m altitude above sea level. < $h \leq 4000$ m altitude above sea level $\Rightarrow 5\%/1000$ m)			


**NOTE**

The reduction of the low harmonic current emission to the rated THiD implies that the THvD of the non-influenced line voltage is lower than 2% and the ratio of short circuit power to installed load ( $R_{SCE}$ ) is at least 66. Under these conditions, the THiD of the line current of the adjustable frequency drive is reduced to 10% or 5% (typical values at nominal load). If these conditions are not or only partially fulfilled, a significant reduction of the harmonic components can still be achieved, but the rated THiD values may not be achieved.

**■ Environmental data**

Permissible temperature range*	During transport of the unit: -13°F...+158°F (-25°C...+70°C) (to VDE 0160) During storage of the unit: During operation of the unit: -13°F...+131°F (-25°C...+55°C) (to VDE 0160) 41°F...+104°F (5°C...+40°C) without power derating 41°F...+131°F (5°C...+55°C) with power derating
Humidity class*	Humidity class F without condensation ( 5% - 85% relative humidity)
Installation height h*	H ≤ 3280 m altitude above sea level without power derating 3280 ft (1000 m) altitude above sea level with power derating level < h ≤ 13,100 ft (4000 m) altitude above sea level
Degree of pollution	VDE 0110 Part 2 degree 2
Insulation strength	Overvoltage category III according to VDE 0110
Packaging	DIN 55468 for transport packaging materials
Type of protection	IP 20
Approvals	CE: Low-Voltage Directive; UL; C-tick

\*climatic conditions according to class 3K3 (EN 50178 Part 6.1)



**■ Dimensions/weight**

The AHF modules are available in seven frame sizes (size B to H).  
For dimensions, see the drawings on the following pages

AHF 005, 380 - 415 V AC, 50Hz			AHF 010, 380- 415 V AC, 50Hz		
I <sub>AHF,N</sub>	Frame size	Weight	I <sub>AHF,N</sub>	Frame size	Weight
10 A	B	20 Kg (44 lbs)	10 A	B	15 Kg (33 lbs)
19 A	C	31 Kg (68 lbs)	19 A	B	19 Kg (42 lbs)
26 A	C	31 Kg (68 lbs)	26 A	B	24 Kg (53 lbs)
35 A	C	49 Kg (108 lbs)	35 A	C	38 Kg (84 lbs)
43 A	D	60 Kg (132 lbs)	43 A	C	45 Kg (99 lbs)
72 A	D	81 Kg (179 lbs)	72 A	D	64 Kg (141 lbs)
101 A	E	128 Kg (282 lbs)	101 A	D	80 Kg (176 lbs)
144 A	E	165 Kg (364 lbs)	144 A	D	101 Kg (223 lbs)
180 A	F	197 Kg (434 lbs)	180 A	E	134 Kg (295 lbs)
217 A	F	228 Kg (503 lbs)	217 A	E	159 Kg (351 lbs)
289 A	G	269 Kg (593 lbs)	289 A	F	180 Kg (397 lbs)
324 A	G	309 Kg (681 lbs)	324 A	F	233 Kg (514 lbs)
370 A	H	345 Kg (761 lbs)	370 A	G	252 Kg (556 lbs)

AHF 005, 440 - 480 V AC, 60Hz			AHF 010, 440 - 480 V AC, 60Hz		
I <sub>AHF,N</sub>	Frame size	Weight	I <sub>AHF,N</sub>	Frame size	Weight
19 A	B	32 kg (71 lbs)	19 A	B	20 kg (44 lbs)
26 A	B	43 kg (95 lbs)	26 A	B	25 kg (55 lbs)
35 A	C	50 kg (110 lbs)	35 A	C	38 kg (84 lbs)
43 A	C	60 kg (132 lbs)	43 A	C	45 kg (99 lbs)
72 A	D	82 kg (181 lbs)	72 A	D	64 kg (141 lbs)
101 A	D	129 kg (284 lbs)	101 A	D	81 kg (179 lbs)
144 A	D	167 kg (368 lbs)	144 A	E	103 kg (227 lbs)
180 A	E	200 kg (441 lbs)	180 A	E	135 kg (298 lbs)
217 A	E	230 kg (507 lbs)	217 A	E	161 kg (355 lbs)
289 A	F	272 kg (600 lbs)	289 A	F	191 kg (421 lbs)
324 A	F	306 kg (675 lbs)	324 A	F	232 kg (511 lbs)
370 A	G	348 kg (767 lbs)	370 A	G	245 kg (540 lbs)

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**AHF 005/010**

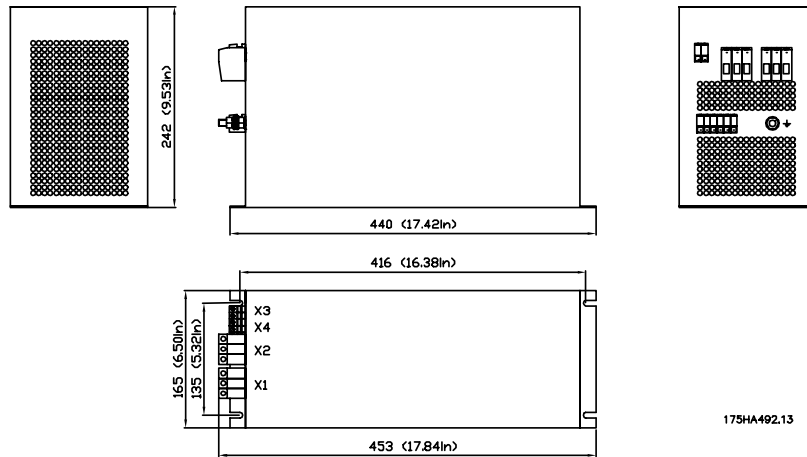

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AHF 005, 500 V AC, 50Hz			AHF 010, 500 V AC, 50Hz		
I <sub>AHF,N</sub>	Frame size	Weight	I <sub>AHF,N</sub>	Frame size	Weight
10 A	B	22 Kg (49 lbs)	10 A	B	17 Kg (37 lbs)
19 A	C	35 Kg (77 lbs)	19 A	B	21 Kg (46 lbs)
26 A	C	49 Kg (108 lbs)	26 A	B	28 Kg (62 lbs)
35 A	C	55 Kg (121 lbs)	35 A	C	42 Kg (93 lbs)
43 A	D	67 Kg (148 lbs)	43 A	C	47 Kg (104 lbs)
72 A	D	82 Kg (181 lbs)	72 A	D	69 Kg (152 lbs)
101 A	E	144 Kg (317 lbs)	101 A	D	91 Kg (201 lbs)
144 A	E	187 Kg (412 lbs)	144 A	E	131 Kg (289 lbs)
180 A	F	226 Kg (498 lbs)	180 A	E	147 Kg (324 lbs)
217 A	F	262 Kg (578 lbs)	217 A	F	185 Kg (408 lbs)
289 A	G	309 Kg (681 lbs)	289 A	F	209 Kg (461 lbs)
324 A	G	348 Kg (767 lbs)	324 A	F	256 Kg (564 lbs)

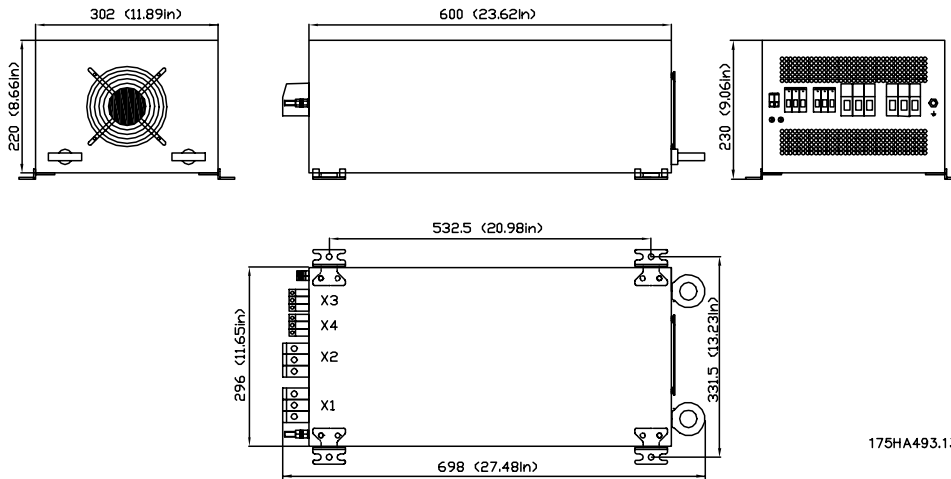
AHF 005, 690V AC, 50Hz			AHF 010, 690 V AC, 50Hz		
I <sub>AHF,N</sub>	Frame size	Weight	I <sub>AHF,N</sub>	Frame size	Weight
43 A	D	85 kg (187 lbs)	43 A	D	65 kg (143 lbs)
72 A	E	100 kg (220 lbs)	72 A	D	75 kg (165 lbs)
101 A	F	130 kg (287 lbs)	101 A	E	95 kg (209 lbs)
144 A	G	160 kg (353 lbs)	144 A	E	125 kg (276 lbs)
180 A	G	200 kg (441 lbs)	180 A	F	140 kg (309 lbs)
217 A	H	300 kg (661 lbs)	217 A	G	180 kg (397 lbs)
			289 A	G	200 kg (441 lbs)
			324 A	H	250 kg (551 lbs)
			370 A	H	300 kg (661 lbs)

■ Dimension diagrams

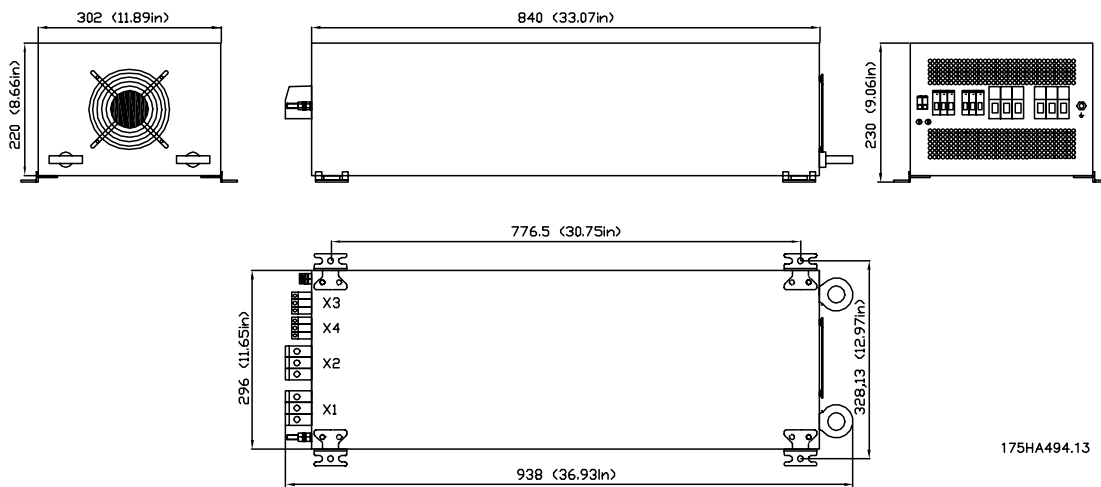
Frame size B



Frame size C

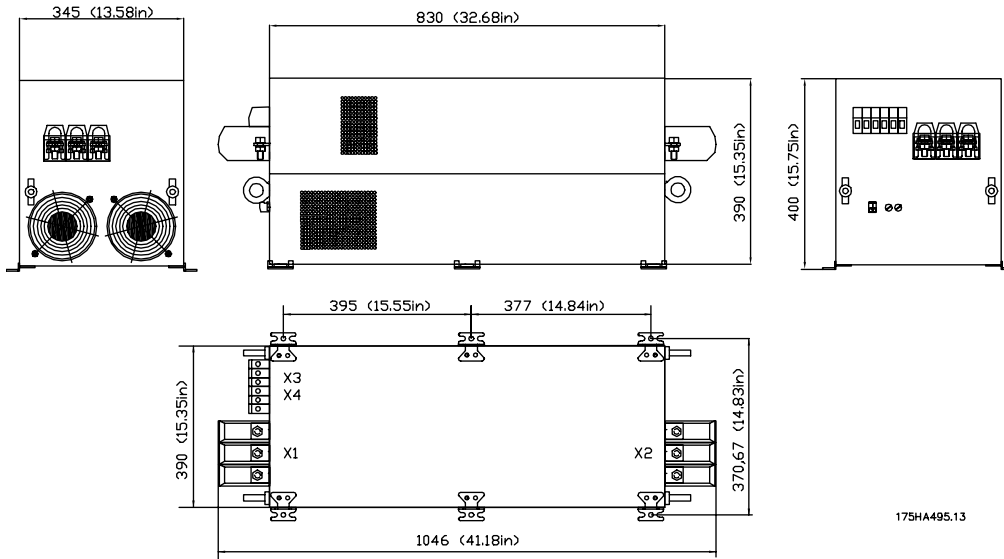


Frame size D

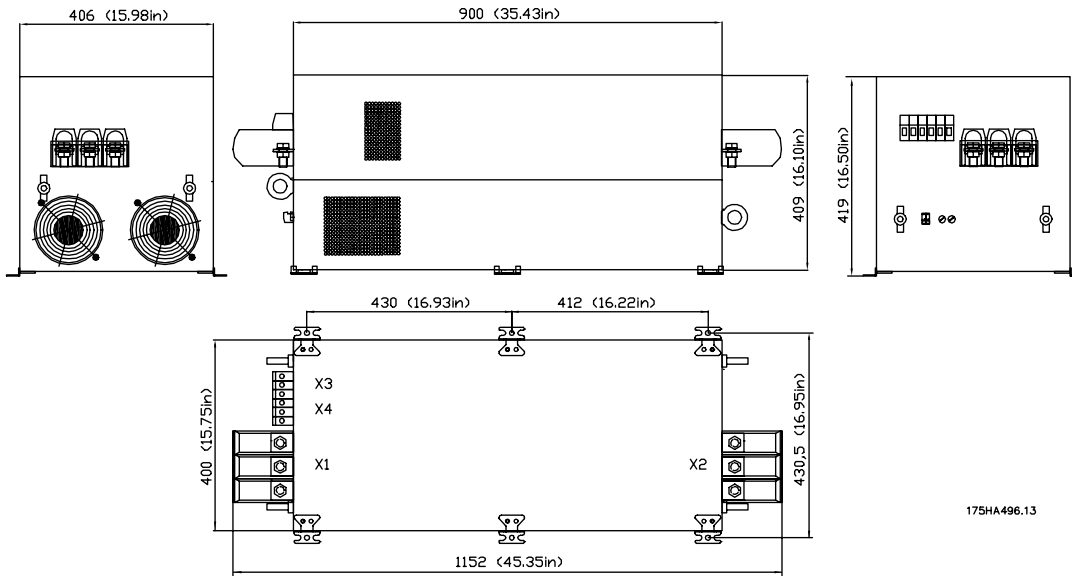


Programming

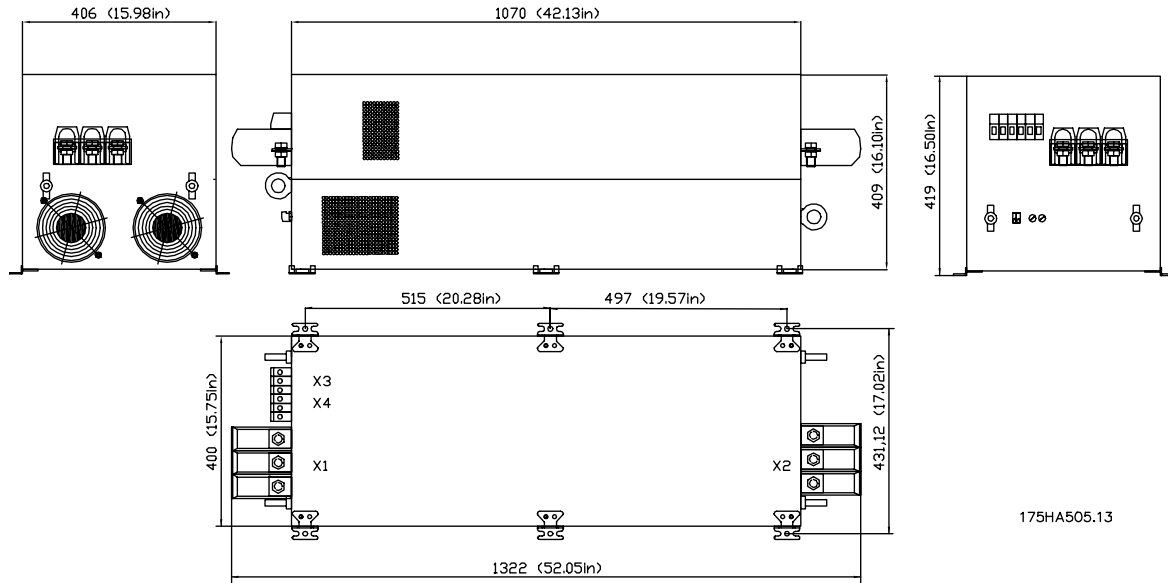
Frame size E



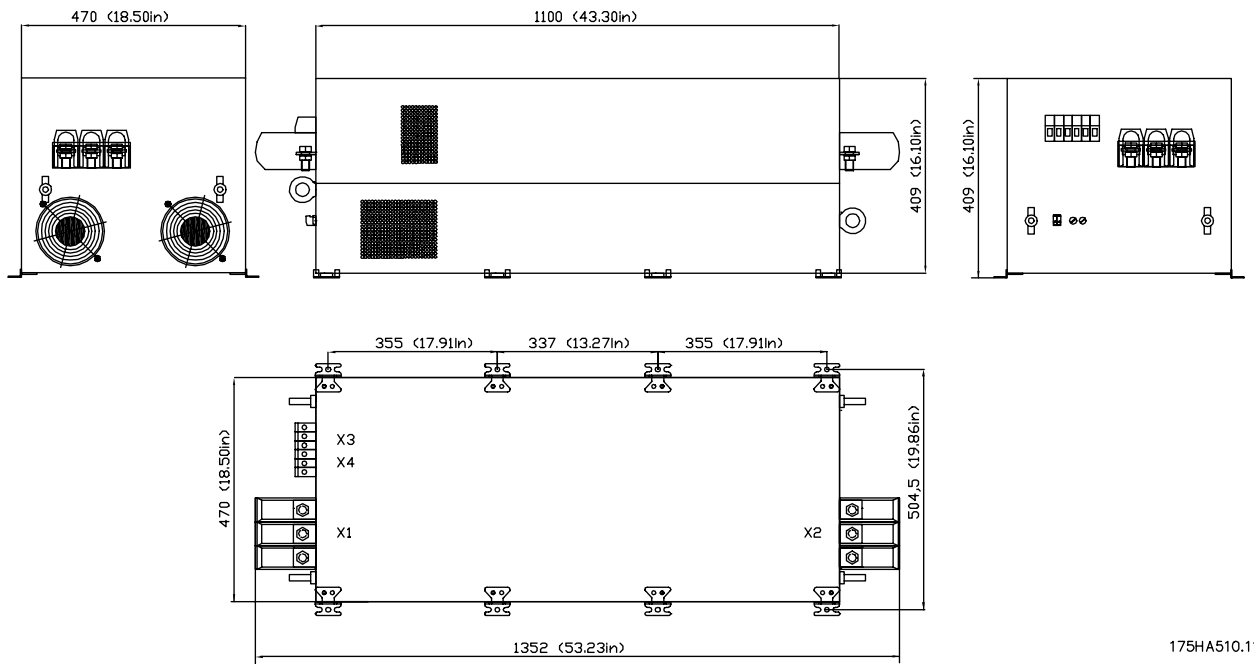
Frame size F



### Frame size G



### Frame size H



**NOTE**  
 Please allow an additional 1.18 in (30 mm) of depth of the filter for the mounting feet.

**NOTE**  
 For frames E-H, only transport the filter vertically, i.e. use lifting hooks on both ends.

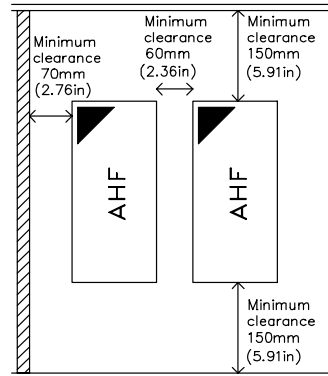
Programming

### ■ Mechanical installation

The encapsulation of the filters has an IP 20 rating. The modules can be mounted side-by-side with 2.36 in. (60mm) clearance.

To other components and to the cabinet walls, maintain a horizontal clearance of at least 2.76 in. (70mm) and a vertical clearance of at least 5.91 in. (150mm).

Only vertical installation is allowed (line terminal at bottom).



175HA500.10



For versions with bus bars (frame size E - H), it is necessary to mount the added covers to the connectors in order to achieve the protection type IP 20.

### ■ Ventilation

The filters are cooled by means of air circulation. Consequently, the air needs to be able to move freely above and below the filter module. The efficiency

of the filter modules is greater than 0.98. When installing a filter module in a panel or another enclosure, ensure there is sufficient airflow through the enclosure to limit heat rise in the enclosure.

	<b>AHF 0xx, 380 – 415V Max. Heat</b>	<b>AHF 0xx, 440 – 480V Max. Heat</b>	<b>AHF 0xx, 500V Max. Heat</b>	<b>AHF 0xx, 690V Max. Heat</b>
10 A	283 Btu/hr (83 W)		355 Btu/hr (104 W)	
19 A	540 Btu/hr (158 W)	649 Btu/hr (190 W)	672 Btu/hr (197 W)	
26 A	738 Btu/hr (216 W)	884 Btu/hr (259 W)	922 Btu/hr (270 W)	
35 A	990 Btu/hr (290 W)	1192 Btu/hr (349 W)	1243 Btu/hr (364 W)	
43 A	1223 Btu/hr (358 W)	1465 Btu/hr (429 W)	1526 Btu/hr (447 W)	2107 Btu/hr (617 W)
72 A	2046 Btu/hr (599 W)	2452 Btu/hr (718 W)	2554 Btu/hr (748 W)	3528 Btu/hr (1033 W)
101 A	2869 Btu/hr (840 W)	3442 Btu/hr (1008 W)	3586 Btu/hr (1050 W)	4945 Btu/hr (1448 W)
144 A	4088 Btu/hr (1197 W)	4907 Btu/hr (1437 W)	5109 Btu/hr (1496 W)	7052 Btu/hr (2065 W)
180 A	5109 Btu/hr (1496 W)	6133 Btu/hr (1796 W)	6389 Btu/hr (1871 W)	8814 Btu/hr (2581 W)
217 A	6161 Btu/hr (1804 W)	7393 Btu/hr (2165 W)	7701 Btu/hr (2255 W)	10,627 Btu/hr (3112 W)
289 A	8206 Btu/hr (2403 W)	9845 Btu/hr (2883 W)	10,255 Btu/hr (3003 W)	14,155 Btu/hr (4145 W)
324 A	9200 Btu/hr (2694 W)	11,037 Btu/hr (3232 W)	11,498 Btu/hr (3367 W)	15,866 Btu/hr (4646 W)
370 A	10,504 Btu/hr (3076 W)	12,605 Btu/hr (3691 W)		18,120 Btu/hr (5306 W)



#### NOTE

If other heat sources (e.g. Danfoss adjustable frequency drives) are installed in an enclosure with the harmonic filter AHF 0xx, this heat generation must also be considered when calculating required airflow



#### NOTE

If the cooling air is polluted (dust, dirt swirl, grease, aggressive gas), the function of the filter module may be impeded. Ensure sufficient countermeasures, e.g. separate cooling air, mounting of air filters, periodical cleaning.

**Power wiring**
**Standard connection**

Supply voltage must be connected to the terminals X1.1, X1.2 and X1.3. The adjustable frequency drive supply terminals L1, L2, and L3 must be connected to the filter module terminals X2.1, X2.2, and X2.3.

**Paralleling of AFDs**

If several adjustable frequency drives are to be connected to the harmonic filter, the connection is similar to the standard connection - The supply terminals L1, L2 and L3 of several adjustable frequency drives must be connected to the filter module terminals X2.1, X2.2 and X2.3.

**NOTE**

If several AFDs are to be connected to the same filter, the harmonic filter must be sized according to the sum of the calculated input current to the AFDs.

**Paralleling of filters**

If the line input current of the adjustable frequency drive exceeds the nominal current of the largest harmonic filter, several harmonic filters can be paralleled to achieve the necessary rating. Supply voltage must be connected to the terminals X1.1, X1.2 and X1.3 of the filters. The adjustable frequency drive supply terminals L1, L2 and L3 must be connected to the filter modules terminals X2.1, X2.2 and X2.3.

**NOTE**

Filters of different current ratings can be paralleled. The rating of the filter becomes the sum of the individual current ratings.

**Capacitor disconnect**

The power factor of the harmonic filter AHF 005/010 decreases with decreasing load. At zero load, the power factor becomes zero and the capacitors produce approximately 30% leading current compared to the rated current of the filter. The reactive current generated by the filter at partial load is normally not of any concern, mainly because of the small current compared to the system capacity (max 30%) as well as the fact that other load normally compensates the capacitive current.

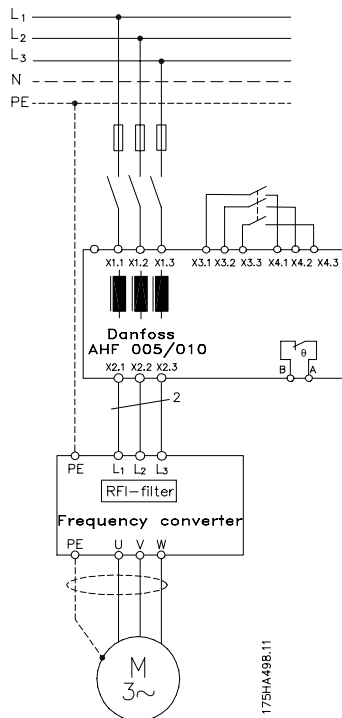
In applications where this reactive current may not be accepted, Terminals X3.1, X3.2, X3.3 and X4.1, X4.2, X4.3 give access to the filter capacitors. By default (on delivery), the wiring will shorten Terminal X3.1 with X4.1, X3.2 with X4.2 and X3.3 with X4.3. In the case that no capacitor disconnect is required, no changes should be made. If capacitor disconnect is required, a three-phase contactor should be placed between terminals X3 and X4. Size the contactor and wiring to 50% of the nominal current and use the AC3 rating of the contactor


**NOTE**

Only switch the contactor at less than 20% load. Allow minimum 5 minutes for the capacitors to discharge before turning on again.

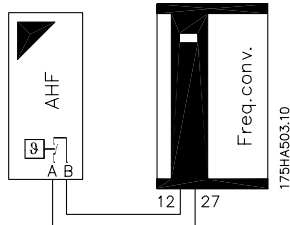


Use cables complying with local regulations.



### ■ Overtemperature contactor

The Danfoss harmonic filter AHF 005 and AHF 010 is equipped with a galvanically isolated contactor that is closed under normal operating conditions and open if the filter is overheated. This contactor must be used to prevent damages to the filter caused by overtemperature as shown in the following example.



Example: Connect terminal A of the harmonic filter to terminal 12 or 13 (voltage supply digital input, 24V) of the Danfoss adjustable frequency drive and terminal B to terminal 27 (digital input "Coast Inverse"); the adjustable frequency drive will let go of the motor (coasting) and thereby unload the filter if an overtemperature is detected.



### NOTE

The maximum rating of the overtemperature contactor is 250V AC and 10A.



■ Power wiring size

Power wiring size

Enclosure	Max. cable size, in <sup>2</sup> (mm <sup>2</sup> )	Type	Nom. Fix Torque
B	0.025 (16)	Connector	1.5 ft-lb (2 Nm)
C and D	0.078 (50)	Connector	4.4 ft-lb (6 Nm)
E, F, G and H	*	Bus Bars	18 ft-lb (25 Nm)

Overheat contactor (copper)

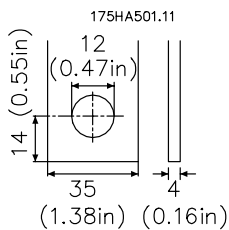
Enclosure	Max. cable size, in <sup>2</sup> (mm <sup>2</sup> )	Type	Nom. Fix Torque
	0.0062 (4)	Connector	0.4 ft-lb (0.6 Nm)

Capacitor disconnect (copper)

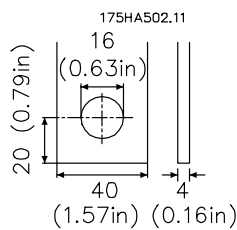
Enclosure	Max. cable size, in <sup>2</sup> (mm <sup>2</sup> )	Type	Nom. Fix Torque
B	0.0062 (4)	Connector	0.4 ft-lb (0.6 Nm)
C and D	0.025 (16)	Connector	1.5 ft-lb (2 Nm)
E, F, G and H	0.078 (50)	Connector	4.4 ft-lb (6 Nm)

\*Power wiring used for connecting the filter AHF 005 and AHF 010 in enclosure size E, F and G must be terminated with cable lugs that can be attached to the input and output bus bars terminals. This

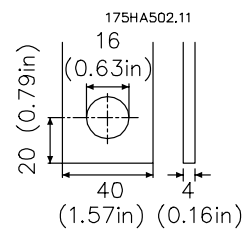
type of termination imposes no specifications on the minimum and maximum cable size suitable for connection. Power terminal details regarding the bus bars can be found in the figures below.



Frame E



Frame F



Frame G, Frame H



**NOTE**

For UL approval, use copper conductor only.

■ Operation on different line type

Line type		Operation of the filter module
TN	Directly grounded star point	Allowed
TN	Indirectly grounded star point	Allowed
IT	Isolated star point	Allowed

All about VLT 8000 AQUA

The filter module has been designed completely symmetrically for three-phase operation and without reference to the star point or protective ground.

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### ■ Typical installation in a panel or other enclosures

To avoid high frequency noise coupling, keep a minimum distance of 5.91 in. (150 mm) to:

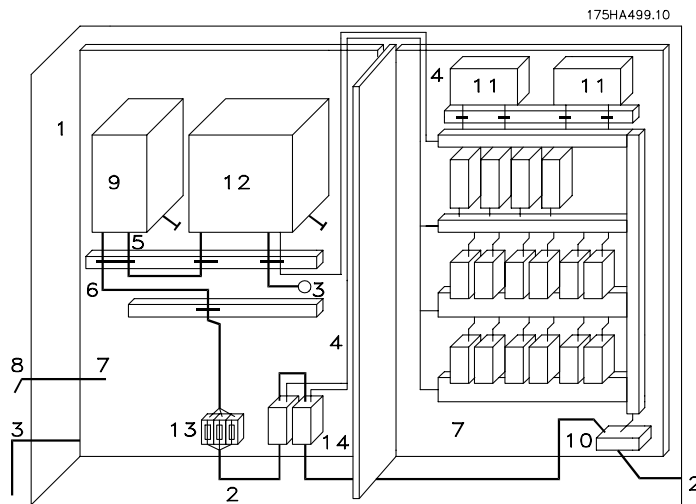
- a) AC line/supply wires
- b) motor wires of adjustable frequency drive
- c) control and signal wires (voltage range < 48 V)

To obtain low resistive HF connections, grounding, shielding, and other metallic connections (e. g. mounting plates, mounted units) should have a surface as large as possible to metallic ground. Use grounding and potential equalization wires with

as large a cross-section as possible (min. 0.015 in.<sup>2</sup> /10mm<sup>2</sup>) or thick grounding tapes.

Use copper or tinned copper shielded wires only, as steel shielded wires are not suitable for high frequency applications. Connect the shield with metal clamps or metal glands to the equalization bars or PE connections.

Inductive switching units (relay, magnetic contactor, etc.) must always be equipped with varistors, RC circuits, or suppressor diodes.



1. Panel
2. Line supply wire
3. Motor wiring
4. Control wiring
5. Wiring between harmonic filter and adjustable frequency drive
6. Lines supply wire of filter module
7. Mounting plate (common star point)
8. Potential equalization
9. Filter module AHF 0xx
10. Line connection
11. PLC
12. Adjustable frequency drive
13. Line fuses
14. Line circuit breaker

**■ Commissioning**

Prior to initial switch-on of the filter module, check the wiring for completeness, short circuit, and ground fault.



If the wiring is not correct, an unintentional operation of controller and/or filter module is possible.

**Initial power-up**

1. Switch on line supply :
  - The filter module is ready for operation at once.
2. Check the readiness of the adjustable frequency drive:
  - Proceed in accordance with the instruction manual of the adjustable frequency drive.

**1. General**

During operation, filter module units may have, according to their type of protection, live, bare, in some cases also movable or rotating parts as well as hot surfaces.

Unauthorized removal of the required cover, inappropriate use, or incorrect installation or operation creates the risk of severe injury to persons or damage to material assets.

Further information can be obtained from the documentation.

All operations concerning transport, installation, and commissioning as well as maintenance must be carried out by qualified, skilled personnel (IEC 364 and CENELEC HD 384 or DIN VDE 0100 and IEC-Report 664 or DIN VDE 0110 and national regulations for the preventions of accidents must be observed).

According to this basic safety information, qualified skilled personnel are persons who are familiar with the erection, assembly, commissioning, and operation of the product and who have the qualifications necessary for their occupation.

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**2. Application as directed**

Filter modules are components designed for installation in electrical systems or machinery.

When installing in machines, commissioning of the filter modules (i.e. the starting of operation as directed) is prohibited until it is verified that the machine corresponds to the regulations of the EC Directive 83/392/EEC (Machinery Directive); EN 60204 must be observed.

Commissioning (i.e. starting operation as directed) is only allowed when there is compliance with the EMC-Directive 89/336/EEC.

The filter modules meet the requirements of the Low-Voltage Directive 73/23/EEC. The technical data and information on the connection conditions must be obtained from the nameplate and the documentation and must be observed in all cases.

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**3. Transport, Storage**

Notes on transport, storage, and appropriate handling must be observed.

The filter modules must be protected from inadmissible stress. In particular, during transport and handling no components may be bent, and isolating distances may not be altered. The units are equipped with electrostatic-sensitive devices, which may be damaged by improper handling. Therefore contact with electronic components must be avoided. If electronic components are damaged mechanically, the unit must not be put into operation, as it cannot be ensured that all relevant standards are observed. Climatic conditions must be observed according to prEN 50178.

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**4. Installation**

The devices must be erected and cooled according to the regulations of the corresponding documentation.

The filter modules must be protected against inappropriate loads. Particularly during transport and handling, components must not be bent and / or isolating distances must not be changed. Touching of electronic components and contacts must be avoided.

Filter modules contain electrostatic-sensitive components, which can easily be damaged by inappropriate handling. Electrical components must not be damaged or destroyed mechanically (health risk are possible!).

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**5. Electrical Installation**

When working on live filter modules, the valid national regulations for the prevention of accidents (e.g. VBG 4) must be observed. Before any installation or connection works, the plant must be switched off and secured properly.

The electrical installation must be carried out according to the appropriate regulations (e.g. cable cross-sections, fuses, PE-connection). More detailed information is included in the documentation. When using the filter module with adjustable frequency drives without safe separation from the supply line (to VDE 0100), all control wiring must be included in further protective measures (e.g. double insulated or shielded, grounded and insulated).

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## **6. Operation**

Systems where filter modules are installed, if applicable, must be equipped with additional monitoring and protective devices according to the valid safety regulations e.g. law on technical tools, regulations for the prevention of accidents, etc.

After disconnecting the filter module from the supply voltage, live parts of the filter module and power connections must not be touched immediately, because of the possibility of charged capacitors.

During operation, all covers and doors must be closed.

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## **7. Maintenance and service**

The manufacturer's documentation must be observed.

### **This safety information must be kept!**

The product-specific safety and application notes in this Instruction Manual must also be observed!

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