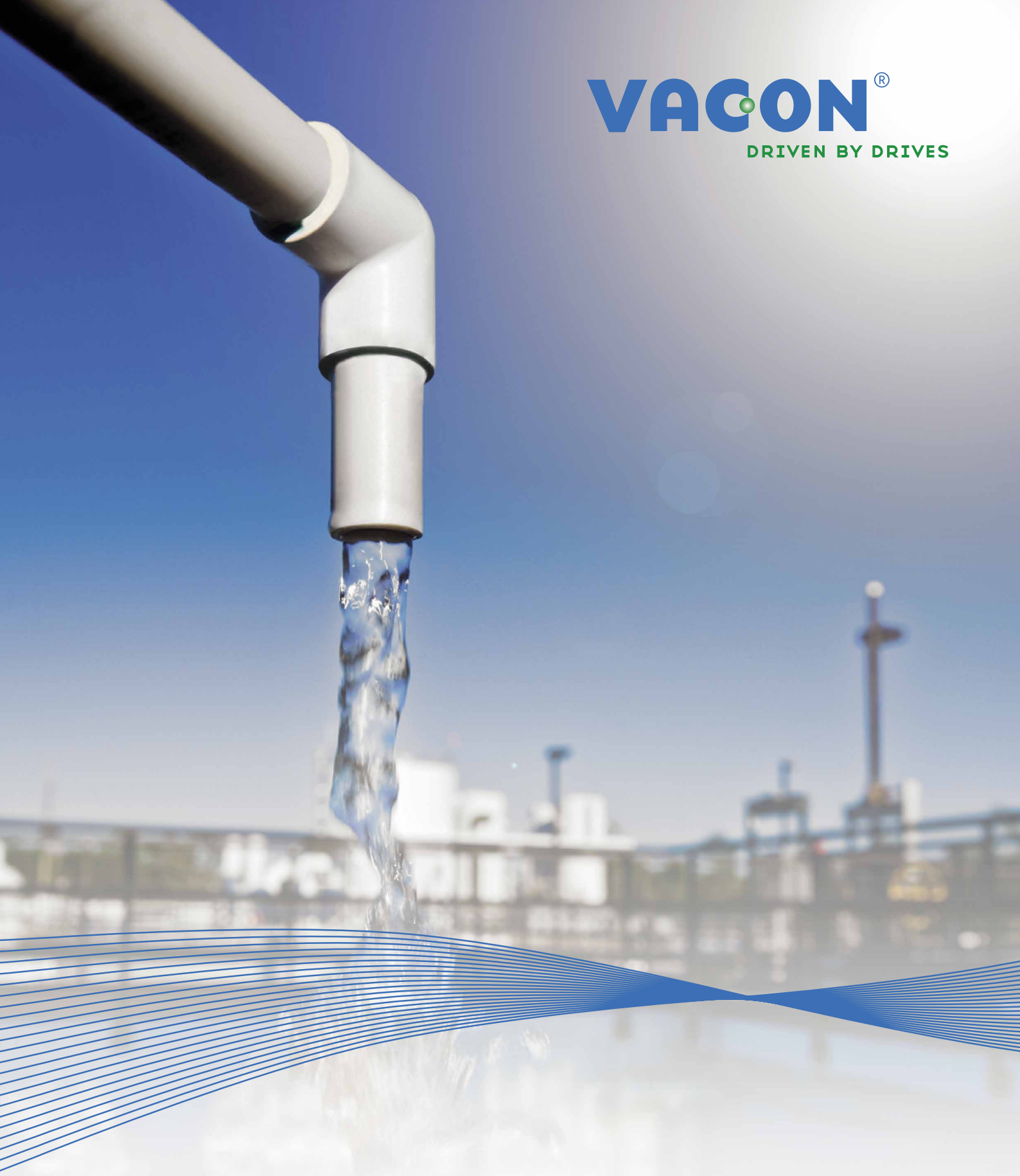
VACON®

DRIVEN BY DRIVES



VACON® LOW HARMONIC PRODUCTS

CLEAN POWER SOLUTIONS

WHAT BUSINESSES DREAM OF

Businesses are always looking for ways in which production processes can be streamlined, energy usage reduced and costs minimized. Their goal is to achieve optimal efficiency levels by ensuring that all aspects of their production flow smoothly and without disturbance.

One potential source of unwanted problems is distortion in the energy supply, which is caused by the presence of harmonic currents and voltages. These distortions can cause disturbances for equipment connected to the same energy supply and create additional losses. Vacon offers solutions with active front-end (AFE) drives and active dynamic filters (ADF) which are designed to eliminate the disruption harmonics can cause to production processes. Studies have indicated that clean power, using low harmonic technology, will continue to grow in the near future, with more and more AC drives featuring it as businesses become aware of its benefits.

CLEAN ENERGY TO THE CORE

Vacon is a Cleantech company which means we're dedicated to including green values in everything we do. This includes constantly striving to improve our customers' processes so that they have as little impact on the surrounding environment as possible. Our range of low harmonic products offer some of the most effective ways in which we can achieve these goals: Low harmonic solutions eliminate the source of harmonics while active filters can clean previously dirty supply systems.

MAKING WAVES IN APPLICATION PROCESSES

AC drives have been instrumental in cutting costs and improving efficiency in numerous applications in all industries, but one issue that is sometimes present is the negative impact the harmonic currents they produce have on the power supply quality. All power supply systems are designed to handle sinusoidal currents but the diode rectifiers in power drive systems create non-sinusoidal currents containing harmonics. These currents have the potential to cause overheating in cables

and transformers, voltage distortion, even breakdowns and malfunctions in other equipment connected to the same supply.

An active front end (AFE) system eliminates the source of harmonic currents by replacing the diode rectifier with a controlled rectifier bridge, which creates a sinusoidal current with very low harmonic content. The load power factor can also be controlled. AFE reduces the THDi to less than 5% and, depending on process requirements, allows for energy to flow to and from the supply. This Vacon Low Harmonic solution can be used in applications where the load needs to be braked – such as elevators and cranes – allowing the brake energy to be fed into the mains for use elsewhere.

An active dynamic filter (ADF) eliminates the effect of harmonics by constantly monitoring the network and, at its point of connection, injecting currents into the supply to dynamically eliminate the harmonic currents created by other loads. This process often takes place at a central location, usually the transformer terminals. The filters also help in adjusting the system power factor and eliminating power system resonances. Active filters are particularly useful for larger installations and systems in helping compensate the harmonics created by large loads.

REACTIVE TO NETWORK REQUIREMENTS

Low-harmonic (AFE) technology reduces the supply current's total harmonic distortion (THDi) to less than 5%, which is low enough to avoid any problems. This decreases the RMS value of the current and minimizes losses in cables and transformers. This approach is already used in the water & waste water sector and heavy process industries such as oil & gas, mining, marine and power generation. The same basic technology is also used to produce clean energy from solar cells, fuel cells and the wind

VACON AT YOUR SERVICE

Vacon drives are sold in over 100 countries, with production and R&D on 3 continents, sales offices in 27 countries and service centers in nearly 90 locations worldwide. Whether you are an original equipment manufacturer (OEM), system integrator, brand label customer, distributor or end user, Vacon provides services to help you meet your business targets. Our global service solutions are available 24/7 throughout the product lifecycle with the intention of minimizing the total cost of ownership and environmental load. Vacon has been a pioneer in the AC drives market ever since it was founded in Vaasa, Finland in 1993.

VACON LOW HARMONIC SOLUTION

VACON® NXC low harmonic drive is the perfect choice for applications where low harmonics solutions are required. Not only does it meet the most demanding requirements for clean power but also provides other important benefits, such as regenerative braking and voltage boosting for maximum output power.

CLEAN POWER SAVES MONEY

The low harmonic enclosed drive offers an excellent comprehensive solution for the most demanding power quality requirements. The drive complies with the IEEE-519/1993, G5/4 and the relevant IEC harmonic standards.

The low THDi reduces supply currents and allows supply transformers, protection devices and power cables to be sized according to the actual active power. It creates savings for both new and retrofit projects as there is no need to invest in expensive 12- or 18-pulse transformers, two classical solutions for low harmonic needs.

FEATURES

- Clean power with total current harmonics THDi < 5 %
- Over-dimensioning of power transformer or input cables is not required
- Regenerative function available
- Reduces system complexity
- Total power factor correction
- No need for special 12-pulse transformers
- Well-suited for retrofit projects
- Increased flexibility with a wide range of standard options
- Can be tailored to fit specific problems e.g. compensating different harmonics, many options in the application

BENEFITS

- 4-quadrant design allows braking energy to be fed to network
- Over-dimensioning of input components is not needed, reducing the total costs
- Voltage boost function for maximum output power
- Full motor voltage available (lower motor current, smaller sizing motor unit IGBTs, lower motor losses)
- Power factor can be controlled
- Can strengthen weak networks
- Constant DC voltage extends life time of components
- Smaller, more compact for normal power size 250-1500 kW.

TYPICAL APPLICATIONS

- Pumps & fans
- Extruders
- Main propulsion & bow thrusters
- Wood handling machines
- Conveyors & crushers
- Feeders & mixers
- Test benches
- Water treatment
- Winches
- Compressors
- Static power supply
- Industrial elevators

LOW HARMONIC SOLUTION IN ACTION

▲ VACON® NXC LOW HARMONIC

RWE GASSPEICHER GMBH, GRONAU-EPE, GERMANY

In 2011, a VACON Low harmonic solution helped RWE Gasspeicher GmbH to replace a conventional current source inverter (CSI) with voltage source inverters (VSI) using VACON® NXP Low harmonic AC drives using VACON DriveSynch technology.

Due to the age of many of the CSI drives, the project had to be a retrofit. RWE's specifications required a 12-pulse current source inverter for the large motor in the underground reservoir in Epe, along with an active voltage conditioner (AVC) to reduce harmonic distortion in the medium voltage grid.

Since the motor would then be considerably older and less advanced than the electrics, the chances of system failure rose exponentially. Due to successful projects in the past, RWE Power requested a quote from Vacon, but the results were not what they had expected. "We achieved the objective using a configuration that was completely different from what was requested in the quotation", explains Friedhelm Harf of Vacon GmbH. Four VACON NXP Low harmonic AC drives were connected in parallel to control the motor and ensure reliability and system availability. The active front-end drives meant RWE did not have to invest in the AVC filters they had expected to require, saving the company around EUR 450,000 while still reducing current harmonic distortion (THDi) to below 5%.

VACON ACTIVE FILTER SOLUTION

Vacon has partnered with a third party to provide an industrial modular active filter with a twist. It's the first time Vacon has offered a solution which features cutting-edge Active Dynamic Filter technology to create a low harmonic solution. ADF filters are able to react to almost any problem or change in load by removing unnecessary losses and restoring a smooth sine wave without disturbances.

PRECISELY THE POWER REQUIRED

These unique low harmonic solutions are fully customizable, and multiple ADFs can be combined to accommodate higher power as required. They automatically track the changes in load and only supply the necessary amount of compensation. Not only are problems reduced but costs and energy consumption are kept to a bare minimum without any compromise in productivity. These ADF filters are modular constructions that can be paralleled for future expansion if necessary and are particularly suitable for use in heavy process industry and marine applications, often in conjunction with larger drive systems. By measuring voltage and current at the point of common coupling, the filter ensures optimum efficiency and eliminates the chances of issues with harmonics, flicker or voltage variations.

FEATURES

- Clean power with total current harmonics THDi < 5 % at the point of common coupling
- Compensates the harmonics as required
- Total power factor correction
- Rated voltage up to 480V or 690V
- Eliminates resonances in the supply
- Dynamic VAR compensation up to several MVA
- Air-cooled
- Several units can be paralleled for greater power needs

BENEFITS

- ADF eliminates extra losses in cables and transformers
- Able to handle changes in network conditions
- High performance and reliability
- Modular construction makes expansion possible

TYPICAL APPLICATIONS

- Fans and pumps
- Industrial and commercial elevators
- Marine applications
- Common DC bus system compensation

ACTIVE FILTER SOLUTION IN ACTION

VACON® ADF

PETROVIETNAM, SOUTH CHINA SEA

A LeTourneau 160E jack-up drilling platform in the South China Sea, not far from the Vietnamese coast, serves as the perfect example of how active filter technology can be the perfect solution for keeping processes running smoothly in potentially disruptive conditions. The rig was commissioned by PetroVietnam, Vietnam's national oil and gas group.

Offshore drilling rigs have large non-linear loads compared to the installed generator capacity. This has the potential to affect other equipment onboard. Norwegian system integrator TTS Sense installed 10 VACON® NXP liquid cooled (CH74) AC drives. This system has the potential to use 8 MW of power. Such a large amount of power being used in the system means there are a large amount of harmonics present, which in turn raises the potential for complications. With this in mind, a set of 4 VACON ADF active filters were installed in order to reduce the effect of harmonics, with resounding success – they helped reduce the THD(i) from a potentially hazardous 22% to just 5%.

TECHNICAL DATA

VACON® NXC LOW HARMONIC

Mains voltage	Low-harmonic drive type	Loadability					Motor shaft power		Frame size	Dimensions & weight W x H x D (mm)/ kg
		Low (+40°C)		High (+40°C)			400 V / 690 V			
		Rated continuous current I_L (A)	10% overload current (A)	Rated continuous current I_H (A)	50% overload current (A)	Maximum current I_S (A)	10% overload P (kW)	50% overload P (kW)		
380-500 V 50/60 Hz	NXC 0261 5 A 2 L 0 RSF	261	287	205	308	349	132	110	AF9	1006 x 2275 x 605/680
	NXC 0300 5 A 2 L 0 RSF	300	330	245	368	444	160	132		
	NXC 0385 5 A 2 L 0 RSF	385	424	300	450	540	200	160	AF10	1006 x 2275 x 605/700
	NXC 0460 5 A 2 L 0 RSF	460	506	385	578	693	250	200		
	NXC 0520 5 A 2 L 0 RSF	520	572	460	690	828	250	250		
	NXC 0650 5 A 2 L 0 RSF	650	715	590	885	1062	355	315	AF12	2006 x 2275 x 605/1400
	NXC 0730 5 A 2 L 0 RSF	730	803	650	975	1170	400	355		
	NXC 0820 5 A 2 L 0 RSF	820	902	730	1095	1314	450	400		
	NXC 0920 5 A 2 L 0 RSF	920	1012	820	1230	1476	500	450		
	NXC 1030 5 A 2 L 0 RSF	1030	1133	920	1380	1656	560	500		
	NXC 1150 5 A 2 L 0 RSF	1150	1265	1030	1545	1854	630	560	AF13	2206 x 2275 x 605/1950
	NXC 1300 5 A 2 L 0 RSF	1300	1430	1150	1725	2070	710	630		
	NXC 1450 5 A 2 L 0 RSF	1450	1595	1300	1950	2340	800	710		
	NXC 1770 5 A 2 L 0 RSF	1770	1947	1600	2400	2880	1000	900	AF14	4406 x 2275 x 605/3900
	NXC 2150 5 A 2 L 0 RSF	2150	2365	1940	2910	3492	1200	1100		
	NXC 2700 5 A 2 L 0 RSF	2700	2970	2300	3278	3933	1500	1200		
525-690 V 50/60 Hz	NXC 0125 6 A 2 L 0 RSF	125	138	100	150	200	110	90	AF9	1006 x 2275 x 605/680
	NXC 0144 6 A 2 L 0 RSF	144	158	125	188	213	132	110		
	NXC 0170 6 A 2 L 0 RSF	170	187	144	216	245	160	132		
	NXC 0208 6 A 2 L 0 RSF*	208	229	170	255	289	200	160		
	NXC 0261 6 A 2 L 0 RSF	261	287	208	312	375	250	200	AF10	1006 x 2275 x 605/700
	NXC 0325 6 A 2 L 0 RSF	325	358	261	392	470	315	250		
	NXC 0385 6 A 2 L 0 RSF	385	424	325	488	585	355	315		
	NXC 0416 6 A 2 L 0 RSF*	416	416	325	488	585	400	315		
	NXC 0460 6 A 2 L 0 RSF	460	506	385	578	693	450	355	AF12	2006 x 2275 x 605/1400
	NXC 0502 6 A 2 L 0 RSF	502	552	460	690	828	500	450		
	NXC 0590 6 A 2 L 0 RSF	590	649	502	753	904	560	500		
	NXC 0650 6 A 2 L 0 RSF	650	715	590	885	1062	630	560		
	NXC 0750 6 A 2 L 0 RSF	750	825	650	975	1170	710	630		
	NXC 0820 6 A 2 L 0 RSF*	820	902	650	975	1170	750	650		
	NXC 0920 6 A 2 L 0 RSF	920	1012	820	1230	1476	900	800	AF13	2206 x 2275 x 605/1950
	NXC 1030 6 A 2 L 0 RSF	1030	1133	920	1380	1656	1000	900		
	NXC 1180 6 A 2 L 0 RSF*	1180	1298	1030	1463	1755	1150	1000		
	NXC 1500 6 A 2 L 0 RSF	1500	1650	1300	1950	2340	1500	1300	AF14	4406 x 2275 x 605/3900
	NXC 1900 6 A 2 L 0 RSF	1900	2090	1500	2250	2700	1800	1500		
	NXC 2250 6 A 2 L 0 RSF*	2250	2475	1900	2782	3335	2000	1800		

* max. ambient temperature of +35°C

HARDWARE CONFIGURATIONS

Active front-end	Enclosure		EMC		Brake chopper	Cabling		Input device	Output filters		
380-500 V	IP21	IP54	L	T		Bottom	Top +CIT/+COT	+ILS & +ICB	+OCM/ +OCH	+ODU	+OSI
AF9	S	O (H: +130)	S	O	* (W: +400)	S	O (W: +400)	S	O	O (W:+400)	O (W: +600)
AF10	S	O (H: +130)	S	O	* (W: +400)	S	O (W: +400)	S	O	O (W:+400)	O (W: +600)
AF12	S	O (H: +130)	S	O	* (W: +400)	S	O (W: +400)	S	O	O (W:+400)	O (W: +1200)
AF13	S	O (H: +170)	S	O	* (W: +400)	S	O (W: +400)	S	O	O	O (W: +800)
AF14	S	O (H: +170)	S	O	* (W: +400)	S	O (W: +600)	S	O	S	O (W: +1600)
525-690 V											
AF9	S	O (H: +130)	S	O	* (W: +400)	S	O (W: +400)	S	O	O (W:+400)	O (W: +600)
AF10	S	O (H: +130)	S	O	* (W: +400)	S	O (W: +400)	S	O	O (W:+400)	O (W: +600)
AF12	S	O (H: +130)	S	O	* (W: +400)	S	O (W: +400)	S	O	O (W:+400)	O (W: +1200)
AF13	S	O (H: +170)	S	O	* z(W: +400)	S	O (W: +400)	S	O	O	O (W: +800)
AF14	S	O (H: +170)	S	O	* (W: +400)	S	O (W: +600)	S	O	S	O (W: +1600)

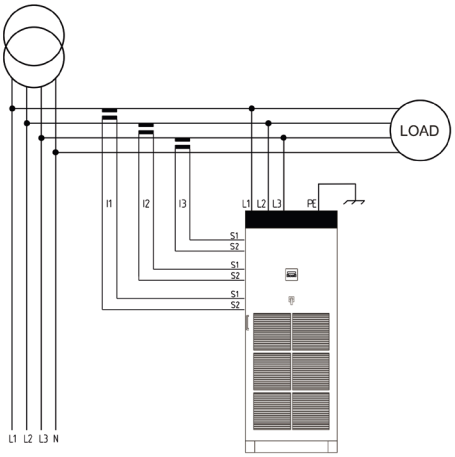
* Contact factory **S** = Standard **O** = Optional

VACON® ADF

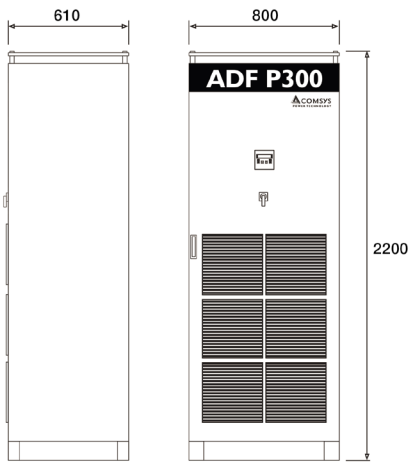
Model	ADF P300-100	ADF P300-200	ADF P300-300
Rated power *	70 kVA	140 kVA	210 kVA
Compensation current capacity	100 Arms	200 Arms	300 Arms
System voltage **		480 V (208 - 480 V), 690 V (480-690 V)	
Nominal frequency **		50/60 Hz ± 2%	
Number of phases		3 wire type	
Connection type		3 phase without neutral (TN, TT, IT)	
Harmonic current compensated		global compensation up to 50 th order	
Rate of harmonic reduction		better than 98%	
Current compensation of cos φ		up to 1.0	
Expandability		up to 8 ADF units in parallel	
Response time		<1 ms	
Power dissipation	< 1900 W	< 3800 W	< 5700 W
Maximum air flow requirement	600 m3/h	1200 m3/h	1800 m3/h
Noise level		< 60 dB	
Environment		0 to 95% RH non-condensing, max altitude 1000 m	
Operating temperature		0 to 40 °C continous, <25 °C recommended	
Dimensions		800 x 2200 x 610 mm (W x H x D)	
Weight	319 kg	445 kg	571 kg
Cabinet color		cabinet RAL 7035 (gray), base RAL 7022 (dark gray)	
Protection class		IP 20 according to IEC 529	
Environmental conditions		chemical 3C3, mechanical 3S3	
Electromagnetic compability		EN 61000-6-2, EN 61000-6-4	
Certificates		CE	

*** Compensation power at 400V nominal voltage**
**** Please state your system voltage and line frequency when ordering**

CONNECTION DIAGRAM



DIMENSIONS



TYPE CODE KEY

VACON® NXC LOW HARMONIC

NXC	0520	5	A	2	L	0	S	S	F	A1 A2 00 00 00	+	IFD

NXC — **Product Range**
NXC = cabinet

0520 — **Nominal current voltage**
0520 = 520 A

5 — **Nominal mains voltage**
5 = 380-500 V **6** = 525-690 V

A — **Control keypad**
A = standard alphanumeric **B** = no local keypad
F = dummy keypad **G** = graphic display

2 — **Enclosure class**
5 = IP 54, FR4-10; NXC FR9-FR14; AF9-14
2 = IP 21, FR4-11; NXC FR9-FR14; AF9-14

L — **EMC emission levels**
L = category C3, EN 61800-3 **T** = for IT networks

0 — **Brake chopper**
0 = no brake chopper
1 = integrated brake chopper

S — **Supply**
R = Low-harmonic

S — **Cooling**
S = standard air-cooled

F — **Control**
F = standard FR9 and NXC
N = standard IP00 > FR10 & NXC with IP54 control unit enclosure
G = as F, but varnished boards
O = as N, but varnished boards

A1 A2 00 00 00 — **Option boards; each slot is represented by two characters:**
Ax = basic I/O boards, **Bx** = expander I/O boards
Cx = fieldbus boards, **Dx** = special boards

+

IFD — **NXC options, see tables p. 22**

VACON® ADF

VACON ADF | P300 | 100 | 480

VACON ADF	VACON Active Dynamic Filter
P300	Product series number for air-cooled products
100	Current [A]
480	Supply Voltage

VACON ADF | P300 | 200 | 480

VACON ADF	VACON Active Dynamic Filter
P300	Product series number for air-cooled products
200	Current [A]
480	Supply Voltage

VACON ADF | P300 | 300 | 480

VACON ADF	VACON Active Dynamic Filter
P300	Product series number for air-cooled products
300	Current [A]
480	Supply Voltage

VACON ADF | P300 | 100 | 690

VACON ADF	VACON Active Dynamic Filter
P300	Product series number for air-cooled products
100	Current [A]
690	Supply Voltage

VACON ADF | P300 | 200 | 690

VACON ADF	VACON Active Dynamic Filter
P300	Product series number for air-cooled products
200	Current [A]
690	Supply Voltage

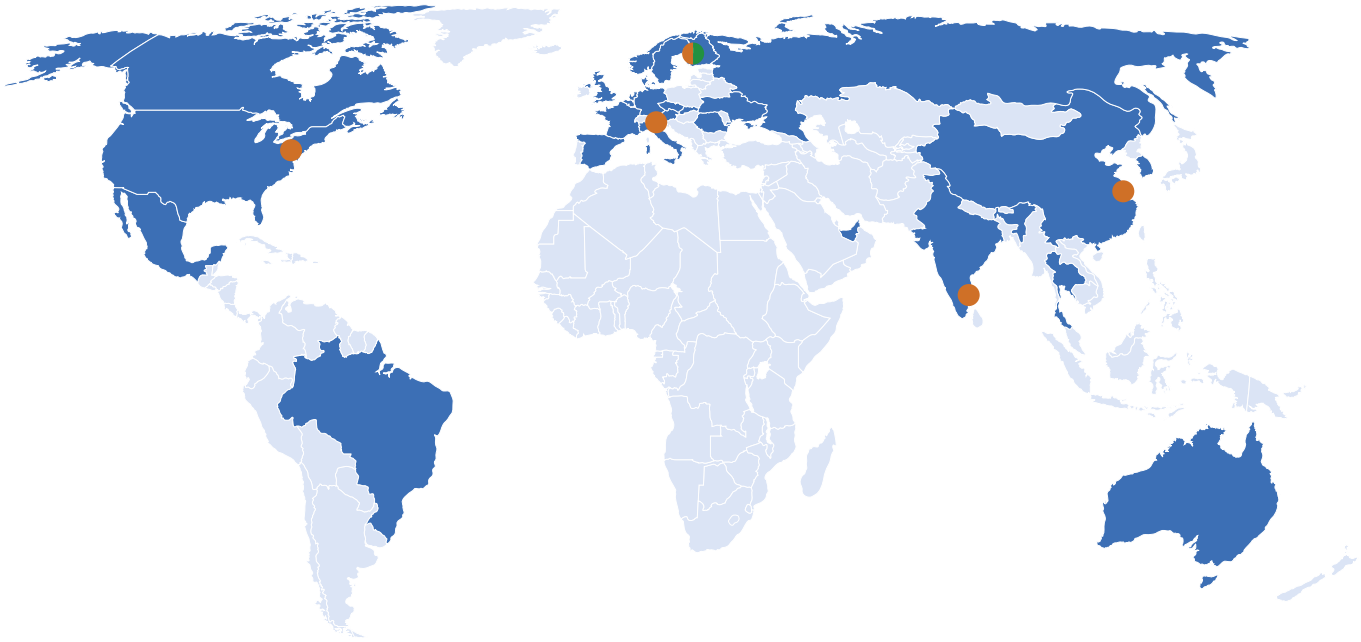
VACON ADF | P300 | 300 | 690

VACON ADF	VACON Active Dynamic Filter
P300	Product series number for air-cooled products
300	Current [A]
690	Supply Voltage

VACON AT YOUR SERVICE

Vacon is driven by a passion to develop, manufacture and sell the best AC drives and inverters in the world - and to provide customers with efficient product life-cycle services. Our AC drives offer optimum process control and energy efficiency for electric motors. Vacon inverters play a key role when energy is produced from renewable sources. Vacon has production and R&D facilities in Europe, Asia and North America, and sales and service operations in nearly 90 countries.

VACON – TRULY GLOBAL



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