VACON NXP LIQUID COOLED POWERDRIVES FOR EXTREME CONDITIONS

VACON
DRIVEN BY DRIVES

ULTIMATE PERFORMANCE

The Vacon NXP liquid cooled drive is the most space-saving AC drive in the market, well suited for locations where air cooling would be difficult, expensive or impractical or where the installation space is at a premium.

As no air ducts are required, the liquid cooled drives are extremely compact and suitable for different kinds of industries, e.g. the marine and offshore, the pulp and paper, as well as for the mining and metal industries. The Vacon NXP liquid cooled drive is today available from 7.5 kW up to 5000 kW at 380 to 690 VAC supply voltages. The Vacon NXP liquid cooled drive is an advanced AC drive for induction and permanent magnet motors.

Designed reliability

- Proven technology, high-quality electrical components
- Modularity
- No galvanic contact between coolant and live parts
- Fulfils international safety and functionality standards, as well as classification requirements
- Liquid cooling guarantees more stable conditions
- Uninfluenced by variations in the environment
- Enclosure temperature level can be high without risk of overheating
- Adequate sizing sustains long life
- Extensive and full power final testing on motor for whole drive system
- All IGBTs are protected against overtemperature and overload
- Double-shielded cooling circuitry

Wide application area

All applications for the air cooled Vacon NXP are also available for the Vacon NX liquid cooled drives. As a high degree of protection (IP54 or higher) can easily be achieved with these drives, they can be installed almost anywhere in the production area. This also reduces the load on the air-conditioning system in the electrical rooms – in many retrofit applications this is an important consideration. As the liquid cooled drives do not require large cooling fans, they are also quiet.

Vacon DriveSynch, fully redundant control of high-power drives

The Vacon DriveSynch, Vacon's new control concept for high-power drives, provides a high degree of redundancy in processes controlled by AC drives. It allows the control of one motor by means of 2, 3 or 4 power units of 100 - 2,500 kW each. The Vacon DriveSynch is suited for the control of single- and multi-winding AC motors.

The Vacon DriveSynch brings major benefits especially for system integrators that design and deliver systems to demanding environments where redundancy is of utmost importance.

VACON NXP LIQUID COOLED
CH5

VACON NXP LIQUID COOLED
CH61/CH62

VACON NXP LIQUID COOLED
CH72

OPTIMIZED, ULTRA COMPACT SOLUTION

Customer-oriented

- High power density, e.g, a 12-pulse CH74 is the smallest in the world; the rectifier, inverter and optional brake chopper in the same package.
- Extensive operating conditions, temperatures up to 50°C without derating, RH 5...96%, vibrations up to 1 G
- Less investments in infrastructure
- No need for filtered cooling air or for a large air conditioning system
- Substantial energy savings on the cooling arrangement
- Takes less floor space
- The most silent AC drive in the market, no large fans
- High IP rating possible for severe and harsh environments
- Heat losses to air less than 0.1...0.15%
- Separated motor cabling stands
- High switching frequency reduces current ripple for motor, improving motor loadability in AC drive applications

Exclusively designed for liquid cooling

The Vacon NXP dissipates less than 5% of its total heat losses to air, only 0.1...0.15% of drive the rated load. A high-tech cooling heatsink enables better cooling efficiency and makes the cooling utilization ratio of the components higher than ever. The majority of other liquid cooled drives in the market is based on modifications to an air cooled drive.

Total lifetime costs

- Compact size, less material and labour required
- Space savings up to 70%
- Smaller enclosure footprint
- Efficiency >98%
- Heat losses to air < 0.1...0.15% of output power
- Electrical energy savings between air cooled and liquid cooled drives
- Power factor of 0.99 with Active Front-End
- Modularity
- Serviceability

VACON NXP LIQUID COOLED
CH63

VACON NXP LIQUID COOLED
CH64

VACON NXP LIQUID COOLED
CH74

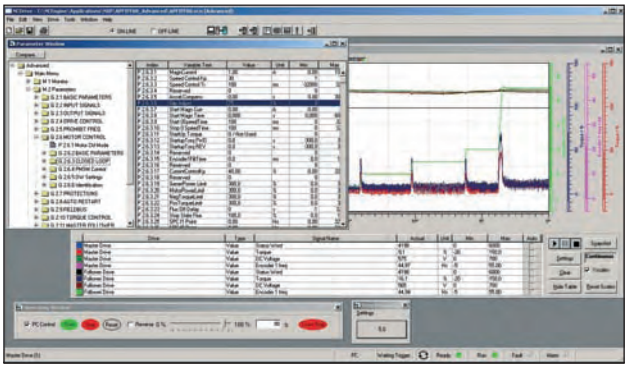
COMPLETE CONTROL PLATFORM

A robust modular design makes the Vacon NXP a suitable platform for all drive needs in different segments and applications, e.g. marine and offshore, renewable energy, mining and minerals as well as water and wastewater.

The core of the Vacon NXP is a fast micro controller, providing high dynamic performance for applications where good motor handling and reliability is required. It can be used both in open loop applications as well as in applications requiring encoder feedback.

The Vacon NXP supports fast drive-to-drive communication. It also offers an integrated data logger functionality for analysis of dynamic events without the need of additional hardware. Fast monitoring of several drives can be done simultaneously by using the NCDrive tool and CAN communication.

In applications where reliability and quality are words that are close to the heart the Vacon NXP is the logical choice.



Encoder options

- Normal pulse encoder
- Absolute encoder ENDAT
- Resolver
- SSI
- Sine cos.

Fieldbus options

- Ethernet –Modbus TCP
- Profibus
- Modbus
- CAN Open
- DeviceNet
- BACnet
- LonWorks

CAN Open I/O

Applications can be developed with third-party I/O modules of CAN Open, where a large number of I/Os are to be integrated into the drive.

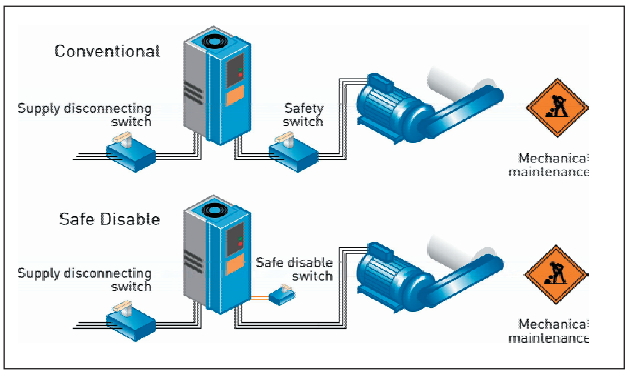
ATEX

Overtemperature detection using a thermistor can be used as a tripping device for ATEX certified motors. The thermistor tripping function is certified by VTT according to the ATEX directive 94/9/EC, for group II, category (2) in the 'G' area (areas where potentially explosive gas, vapor, mist or air mixtures are present) and the 'D' area (area with combustible dust).

Features

- Speed error < 0.01%, depending on the encoder
- Incremental or absolute encoder support
- Encoder voltages of 5 V (RS422), 15 V or 24 V, depending on the option card
- Full torque control at all speeds
- Torque accuracy < 2%; < 5% down to zero speed
- Full capability for master/follower configurations
- Integrated data logger for system analysis
- Fast multiple drive monitoring with PC
- High-speed bus (12 Mbit/s) for fast drive-to-drive communication
- High-speed applications (up to 7200 Hz) possible
- Supports asynchronous induction as well as permanent magnet synchronous motors
- The core of the Vacon NXP is a fast micro controller, providing high dynamic performance and a large memory for developing versatile applications.

Safe Disable



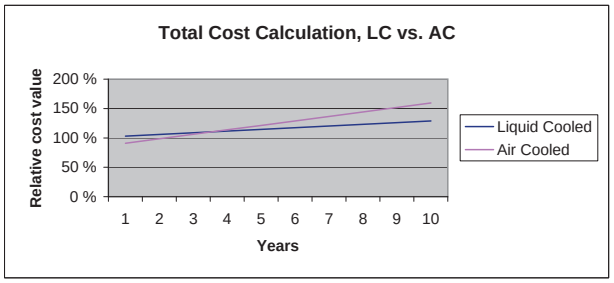
A hardware-based Safe Disable function is designed to prevent any torque on the motor shaft. The Safe Disable function is certified according to EN954-1, Cat 3. The Safe Disable function has been certified by BGIA.

THE ADVANTAGES OF THE COOLING TECHNOLOGY

When comparing the cooling technology solutions, it is important to understand the effects on the infrastructure of the electrical room, and electrical room requirements. Additional comparison parameters are the geographical location, the customer segment and the customer process.

400 kW, 690 VAC liquid cooled drive is:

- 32 % of the volume of the air cooled drive
- 50 % of the width of the air cooled drive
- 70 % of the weight of the air cooled drive
- 20 dBA more silent than the air cooled drive



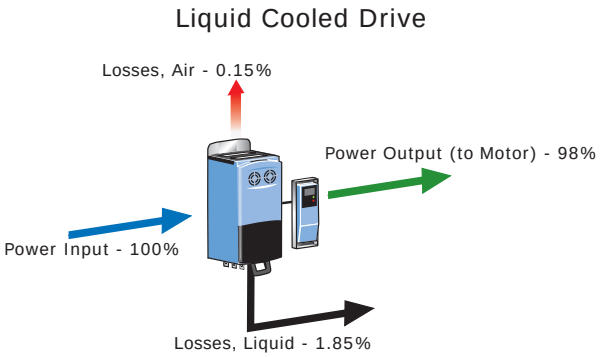
In warm climates it is extremely important to observe the amount of heat load transferred to the electrical room because it is in a direct relationship to the electrical energy consumption.

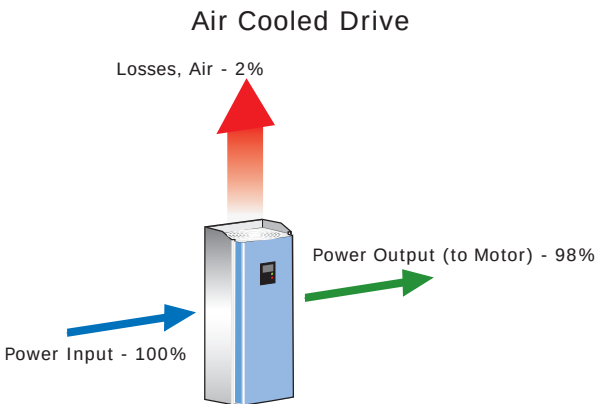
The type-tested switchgears standard EN 60439-1 specifies that the electrical room's 24-hour average temperature should be below +35°C and the maximum temporary temperature cannot exceed +40°C. Due to this, the cooling system in electrical rooms is typically based on air conditioning chillers, which are dimensioned by the maximum heat load, the inside temperature of the electrical room and the outdoor maximum temperature.

The normal electrical energy consumption of air conditioning is 25...33% of the cooling power. Therefore, high-power drives are creating huge energy consumption, based on the heat load produced.

The initial investments in the liquid cooled AC drives technology are slightly more expensive than those in the air cooled AC drives technology because of the technology used, cooling piping arrangements and heat exchanger systems. It is significant to understand that a heat exchanger needs also be compared to ventilation and air condition systems with ventilation ducts, ventilation machine and ventilation automation system.

The non-evaluated features remarkably decrease the payback time of the liquid cooled drives. The payback time of a single 650-kW liquid cooled drive is 3 years. The payback time of >1 MW high power drives or drive groups reduces significantly and the initial investment difference can be compensated during the first operating year. The electrical energy cost trend supports a wider use of the liquid cooled drives technology, and the number of on-shore installations is growing rapidly.





Vacon NXP liquid cooled frequency converters – Mains voltage 400—500 VAC

Converter type 6-pulse	Converter type 12-pulse	Drive/Current			Electrical output power		Power loss	Chassis
		Thermal I_{TH} [A]	Rated continuous I_L [A]	Rated continuous I_H [A]	Optimum motor at I_{TH} (400 V) [kW]	Optimum motor at I_{TH} (500 V) [kW]	c/a/T*) [kW]	
0016_5		16	15	11	7,5	11	0.4/0.2/0.6	CH3
0022_5		22	20	15	11	15	0.5/0.2/0.7	CH3
0031_5		31	28	21	15	18,5	0.7/0.2/0.9	CH3
0038_5		38	35	25	18,5	22	0.8/0.2/1.0	CH3
0045_5		45	41	30	22	30	1.0/0.3/1.3	CH3
0061_5		61	55	41	30	37	1.3/0.3/1.5	CH3
0072_5		72	65	48	37	45	1.2/0.3/1.5	CH4
0087_5		87	79	58	45	55	1.5/0.3/1.8	CH4
0105_5		105	95	70	55	75	1.8/0.3/2.1	CH4
0140_5		140	127	93	75	90	2.3/0.3/2.6	CH4
0168_5		168	153	112	90	110	4.0/0.4/4.4	CH5
0205_5		205	186	137	110	132	5.0/0.5/5.5	CH5
0261_5		261	237	174	132	160	6.0/0.5/6.5	CH5
0300_5		300	273	200	160	200	4.5/0.5/5.0	CH61
0385_5		385	350	257	200	250	6.0/0.5/6.5	CH61
0460_5	0460_5	460	418	307	250	315	6.5/0.5/7.0	CH72
0520_5	0520_5	520	473	347	250	355	7.5/0.6/8.1	CH72
0590_5	0590_5	590	536	393	315	400	9.0/0.7/9.7	CH72
0650_5	0650_5	650	591	433	355	450	10.0/0.7/10.7	CH72
0730_5	0730_5	730	664	487	400	500	12.0/0.8/12.8	CH72
0820_5		820	745	547	450	560	12.5/0.8/13.3	CH63
0920_5		920	836	613	500	600	14.4/0.9/15.3	CH63
1030_5		1030	936	687	560	700	16.5/1.0/17.5	CH63
1150_5		1045	766	600	750	750	18.5/1.2/19.7	CH63
1370_5	1370_5	1370	1245	913	700	900	19.0/1.2/20.2	CH74
1640_5	1640_5	1640	1491	1093	900	1100	24.0/1.4/25.4	CH74
2060_5	2060_5	2060	1873	1373	1100	1400	32.5/1.8/34.3	CH74
2300_5		2300	2091	1533	1200	1500	36.3/2.0/38.3	CH74
2470_5	2470_5	2470	2245	1647	1300	1600	38.8/2.2/41.0	2xCH74
2950_5	2950_5	2950	2681	1967	1550	1950	46.3/2.6/48.9	2xCH74
3710_5	3710_5	3710	3372	2473	1950	2450	58.2/3.0/61.2	2xCH74
4140_5	4140_5	4140	3763	2760	2150	2700	65.0/3.6/68.6	2xCH74
2x2470_5	2x2470_5	4700	4300	3100	2450	3050	73.7/4.2/77.9	4xCH74
2x2950_5	2x2950_5	5600	5100	3700	2900	3600	88/5/93	4xCH74
2x3710_5	2x3710_5	7000	6400	4700	3600	4500	110.6/5.7/116.3	4xCH74
2x4140_5	2x4140_5	7900	7200	5300	4100	5150	123.5/6.9/130.4	4xCH74

Explanations of the currents

I_{TH} = Thermal maximum continuous RMS current. Dimensioning can be done according to this current if the process does not require any overloadability or the process does not include any torque ripple or margin for overloadability.

I_L = Low overloadability current. Allows +10% torque ripple. 10% exceeding can be continuous
I_H = High overloadability current. Allows +50% torque ripple. 50% exceeding can be continuous.
All values with cosφ = 0.83 and efficiency = 97%

*) c = power loss into coolant; a = power loss into air; **T = total power loss**; power losses of input chokes not included. All power losses obtained using max. supply voltage, I_{TH} and switching frequency of 3.6 kHz and closed loop control mode. All power losses are worst-case losses. If some other mains voltage is used, apply the formula P = $\sqrt{3}$ U_N x In x cosφ x eff% to calculate the output power of the Vacon NX liquid cooled drive.

The enclosure class for all Vacon NX liquid cooled frequency converters is IP00, suitable for wall-mounted in a cabinet.

If the motor is continuously (besides start and stop ramps) run at frequencies below 5 Hz, pay attention to the drive dimensioning for low frequencies, or choose drive according to I_H. It is recommended to check the rating with your distributor or Vacon. Drive overrating may also be necessary if the process requires a high starting torque.

Vacon NXP liquid cooled frequency converters – Mains voltage 525—690 VAC

Converter type 6-pulse	Converter type 12-pulse	Drive/Current			Electrical output power		Power loss c/a/T*) [kW]	Chassis
		Thermal I_{TH} [A]	Rated continuous I_L [A]	Rated continuous I_H [A]	Optimum motor at I_{TH} (525 VAC) [kW]	Optimum motor at I_{TH} (690 VAC) [kW]		
0170_6		170	155	113	110	160	5.5/0.2/5.7	CH61
0208_6		208	189	139	132	200	6.5/0.3/6.8	CH61
0261_6		261	237	174	160	250	6.5/0.3/6.8	CH61
0325_6	0325_6	325	295	217	200	300	7.5/0.4/7.9	CH72
0385_6	0385_6	385	350	257	250	355	9.0/0.5/9.5	CH72
0416_6	0416_6	416	378	277	250	355	9.4/0.5/9.9	CH72
0460_6	0460_6	460	418	307	300	400	10.0/0.5/10.5	CH72
0502_6	0502_6	502	456	335	355	450	12.0/0.6/12.6	CH72
0590_6		590	536	393	400	560	13.0/0.7/13.7	CH63
0650_6		650	591	433	450	600	16.0/0.8/16.8	CH63
0750_6		750	682	500	500	700	18.0/0.9/18.9	CH63
0820_6	0820_6	820	745	547	560	800	19.0/1.0/20.0	CH74
0920_6	0920_6	920	836	613	650	850	21.3/1.2/22.5	CH74
1030_6	1030_6	1030	936	687	700	1000	22.0/1.1/23.1	CH74
1180_6	1180_6	1180	1073	787	800	1100	25.0/1.3/26.3	CH74
1300_6	1300_6	1300	1182	867	900	1200	31.0/1.6/32.6	CH74
1500_6	1500_6	1500	1364	1000	1000	1400	38.0/1.9/39.9	CH74
1700_6	1700_6	1700	1545	1133	1150	1550	38.0/1.9/39.9	CH74
1850_6	1850_6	1850	1682	1233	1250	1650	39.6/2.0/41.6	2xCH74
2120_6	2120_6	2120	1927	1413	1450	1900	45.0/2.4/47.4	2xCH74
2340_6	2340_6	2340	2127	1560	1600	2100	55.8/2.9/58.7	2xCH74
2700_6	2700_6	2700	2455	1800	1850	2450	68.4/3.4/71.8	2xCH74
3100_6	3100_6	3100	2818	2066	2150	2800	68.4/3.4/71.8	2xCH74
2x1850_6	2x1850_6	3500	3200	2300	2400	3150	75,2/3,8/79	4xCH74
2x2120_6	2x2120_6	4000	3600	2700	2750	3600	85,5/4,6/90,1	4xCH74
2x2340_6	2x2340_6	4400	4000	2900	3050	3950	106/5,5/111,5	4xCH74
2x2700_6	2x2700_6	5100	4600	3400	3500	4600	130/6,5/136,5	4xCH74
2x3100_6	2x3100_6	5900	5400	3900	4050	5300	130/6,5/136,5	4xCH74

Vacon NXP liquid cooled dimensions: Drives consisting of one module

Chassis	Width (mm)	Height (mm)	Depth (mm)	Weight (kg)
CH3	160	431	246	30
CH4	193	493	257	35
CH5	246	553	264	40
CH61/62	246	658	372	55
CH63	505	923	375	120
CH64	746	923	375	180
CH72	246	1076	372	90
CH74	746	1175	385	280

One-module drive dimensions (mounting base included)
Please note that AC chokes are not included.

TECHNICAL DATA

Vacon NXP liquid cooled inverter units – Mains voltage 465—800 VDC

Inverter type	Drive/Current			Motor output power		Power loss c/a/T*) [kW]	Chassis
	Thermal I_{TH} [A]	Rated continuous I_L [A]	Rated continuous I_H [A]	Optimum motor at I_{TH} (540 VDC) [kW]	Optimum motor at I_{TH} (675 VDC) [kW]		
0016_5	16	15	11	7,5	11	0.4/0.2/0.6	CH3
0022_5	22	20	15	11	15	0.5/0.2/0.7	CH3
0031_5	31	28	21	15	18,5	0.7/0.2/0.9	CH3
0038_5	38	35	25	18,5	22	0.8/0.2/1.0	CH3
0045_5	45	41	30	22	30	1.0/0.3/1.3	CH3
0061_5	61	55	41	30	37	1.3/0.3/1.5	CH3
0072_5	72	65	48	37	45	1.2/0.3/1.5	CH4
0087_5	87	79	58	45	55	1.5/0.3/1.8	CH4
0105_5	105	95	70	55	75	1.8/0.3/2.1	CH4
0140_5	140	127	93	75	90	2.3/0.3/2.6	CH4
0168_5	168	153	112	90	110	2.5/0.3/2.8	CH5
0205_5	205	186	137	110	132	3.0/0.4/3.4	CH5
0261_5	261	237	174	132	160	4.0/0.4/4.4	CH5
0300_5	300	273	200	160	200	4.5/0.4/4.9	CH61
0385_5	385	350	257	200	250	5.5/0.5/6.0	CH61
0460_5	460	418	307	250	315	5.5/0.5/6.0	CH62
0520_5	520	473	347	250	355	6.5/0.5/7.0	CH62
0590_5	590	536	393	315	400	7.5/0.6/8.1	CH62
0650_5	650	591	433	355	450	8.5/0.6/9.1	CH62
0730_5	730	664	487	400	500	10.0/0.7/10.7	CH62
0820_5	820	745	547	450	560	12.5/0.8/13.3	CH63
0920_5	920	836	613	500	600	14.4/0.9/15.3	CH63
1030_5	1030	936	687	560	700	16.5/1.0/17.5	CH63
1150_5	1150	1045	766	600	750	18.4/1.1/19.5	CH63
1370_5	1370	1245	913	700	900	15.5/1.0/16.5	CH64
1640_5	1640	1491	1093	900	1100	19.5/1.2/20.7	CH64
2060_5	2060	1873	1373	1100	1400	26.5/1.5/28.0	CH64
2300_5	2300	2091	1533	1200	1500	29.6/1.7/31.3	CH64
2470_5	2470	2245	1647	1300	1600	36.0/2.0/38.0	2xCH64
2950_5	2950	2681	1967	1550	1950	39.0/2.4/41.4	2xCH64
3710_5	3710	3372	2473	1950	2450	48.0/2.7/50.7	2xCH64
4140_5	4140	3763	2760	2150	2700	53.0/3.0/56.0	2xCH64
2x2470_5	4700	4300	3100	2450	3050	69.1/3.9/73	4xCH64
2x2950_5	5600	5100	3700	2900	3600	74.4/4.6/79	4xCH64
2x3710_5	7000	6400	4700	3600	4500	90.8/5.2/96	4xCH64
2x4140_5	7900	7200	5300	4100	5150	101.2/5.8/107	4xCH64

Vacon NXP liquid cooled inverter units – Mains voltage 640—1100 VDC

Inverter type	Drive/Current			Motor output power		Power loss c/a/T*) [kW]	Chassis
	Thermal I_{TH} [A]	Rated continuous I_L [A]	Rated continuous I_H [A]	Optimum motor at I_{TH} (710 VDC) [kW]	Optimum motor at I_{TH} (930 VDC) [kW]		
0170_6	170	155	113	110	160	4.5/0.2/4.7	CH61
0208_6	208	189	139	132	200	5.5/0.3/5.8	CH61
0261_6	261	237	174	160	250	5.5/0.3/5.8	CH61
0325_6	325	295	217	200	300	6.5/0.3/6.8	CH62
0385_6	385	350	257	250	355	7.5/0.4/7.9	CH62
0416_6	416	378	277	250	355	8.0/0.4/8.4	CH62
0460_6	460	418	307	300	400	8.5/0.4/8.9	CH62
0502_6	502	456	335	355	450	10.0/0.5/10.5	CH62
0590_6	590	536	393	400	560	10.0/0.5/10.5	CH63
0650_6	650	591	433	450	600	13.5/0.7/14.2	CH63
0750_6	750	682	500	500	700	16.0/0.8/16.8	CH63
0820_6	820	745	547	560	800	16.0/0.8/16.8	CH64
0920_6	920	836	613	650	850	18.0/0.9/18.9	CH64
1030_6	1030	936	687	700	1000	19.0/1.0/20.0	CH64
1180_6	1180	1073	787	800	1100	21.0/1.1/22.1	CH64
1300_6	1300	1182	867	900	1200	27.0/1.4/28.4	CH64
1500_6	1500	1364	1000	1050	1400	32.0/1.6/33.6	CH64
1700_6	1700	1545	1133	1150	1550	38.0/1.9/39.9	CH64
1850_6	1850	1682	1233	1250	1650	34.2/1.8/36.0	2xCH64
2120_6	2120	1927	1413	1450	1900	37.8/2.0/39.8	2xCH64
2340_6	2340	2127	1560	1600	2100	48.6/2.5/51.1	2xCH64
2700_6	2700	2455	1800	1850	2450	57.6/3.0/60.6	2xCH64
3100_6	3100	2818	2066	2150	2800	68.4/3.4/71.8	2xCH64
2x1850_6	3500	3200	2300	2400	3150	75.2/3.8/79	4xCH64
2x2120_6	4000	3600	2700	2750	3600	85.5/4.6/90.1	4xCH64
2x2340_6	4400	4000	2900	3050	3950	106/5.5/111.5	4xCH64
2x2700_6	5100	4600	3400	3500	4600	130/6.5/136.5	4xCH64
2x3100_6	5900	5400	3900	4050	5300	130/6.5/136.5	4xCH64

* More details for exlanations of the currents on page 6.

Mains connection	Input voltage U_{in}	400...500 VAC; 525...690 VAC; (–10%...+10%) 465...800 VDC; 640...1100 VDC (–0%...+0%)
	Input frequency	45...66 Hz
Control characteristics	Control method	Frequency control U/f Open loop sensorless vector control Closed loop frequency control Closed loop vector control
	Switching frequency	NX_5: Up to and including NX_0061: 1...16 kHz; Factory default 10 kHz From NX_0072: 1...12 kHz; Factory default 3.6 kHz NX_6: 1...6 kHz; Factory default 1.5 kHz
Ambient conditions	Ambient operating temperature	–10°C (no frost)...+50°C (at I_{th})
	Installation temperature	0...+70C
	Storage temperature	–40°C...+70°C; no liquid in heatsink under 0ºC
	Relative humidity	5 to 96% RH, non-condensing, no dripping water
	Air quality	No corrosive gases
	- chemical vapours	IEC 60721-3-3, unit in operation, class 3C2
	- mechanical particles	IEC 60721-3-3, unit in operation, class 3S2 (no conductive dust allowed)
	Altitude	NX_5 (380...500 V): 3000 m; in case network is not corner grounded NX_6: 2000 m. For further requirements, please contact factory
	Vibration	5...150 Hz
	EN50178/EN60068-2-6	Displacement amplitude 0.25 mm (peak) at 3...31 Hz Max acceleration amplitude 1 G at 31...150 Hz
	Shock EN50178, EN60068-2-27	UPS Drop Test (for applicable UPS weights) Storage and shipping: max 15 G, 11 ms (in package)
	Enclosure class	IP00/Open Frame standard in entire kW/HP range
EMC	Immunity	Fulfils all EMC immunity requirements
	Emissions	EMC level N, T (IT networks)
Safety		EN50178, IEC 60204-1, CE, UL, CUL, IEC 61800-5-1 (see unit nameplate for more detailed approvals)
Approvals	Type tested	UL, DNV, BV, SGS Fimko CE
	Factory acceptance tested (FAT)	Lloyd's Register, ABS, GL
	Approvals our partners have	Ex, SIRA
Liquid cooling	Allowed cooling agents	Drinking water Water-glycol mixture
	Temperature of cooling agent	0...35°C (I_{th})(input); 35...55ºC, please see manual for further details Temperature rise during circulation max. 5°C No condensation allowed
	System max. working pressure	6 bar/ 40 bar peak
	Pressure loss (at nominal flow)	Varies according to size, please see manual for further details

TECHNICAL DATA

Vacon NXB line 465–800 VDC, IP00, EMC level T, liquid cooled external brake chopper

Order type code	Drive output					Power loss	Size/prot.	Dimensions	Weight
	Current			Electrical braking power					
	I_{TH} [A]	Minimum resistance		600 VDC*) (kW)	800 VDC*) (kW)	c/a/T*) (kW)	CH/IP	WxHxD	kg
		600 VDC (Ohm)	800 VDC (Ohm)						
NXB00315A0T0 8WSA1A2	2x31	19.5	25.7	37	49	0.7/0.2/0.9	CH3/IP00	160x431x244	30
NXB00615A0T0 8WSA1A2	2x61	9.9	13.1	73	97	1.3/0.3/1.5	CH3/IP00	160x431x244	30
NXB00875A0T0 8WSA1A2	2x87	7	9.2	105	138	1.5/0.3/1.8	CH4/IP00	208x493x258	35
NXB01055A0T0 8WSA1A2	2x105	5.8	7.6	127	167	1.8/0.3/2.1	CH4/IP00	208x493x258	35
NXB01405A0T0 8WSA1A2	2x140	4.3	5.7	169	223	2.3/0.3/2.6	CH4/IP00	208x493x258	35
NXB01685A0T0 8WSA1A2	2x168	3.6	4.7	203	267	2.5/0.3/2.8	CH5/IP00	246x553x264	40
NXB02055A0T0 8WSA1A2	2x205	3	3.9	248	326	3.0/0.4/3.4	CH5/IP00	246x553x264	40
NXB02615A0T0 8WSA1A2	2x261	2.3	3.1	316	415	4.0/0.4/4.4	CH5/IP00	246x553x264	40
NXB03005A0T0 8WFA1A2	2x300	2	2.7	363	477	4.5/0.4/4.9	CH61/IP00	246x553x232	40
NXB03855A0T0 8WFA1A2	2x385	1.6	2.1	466	613	5.5/0.5/6.0	CH61/IP00	246x658x374	55
NXB04605A0T0 8WFA1A2	2x460	1.3	1.7	556	732	5.5/0.5/6.0	CH62/IP00	246x658x374	55
NXB05205A0T0 8WFA1A2	2x520	1.2	1.5	629	828	6.5/0.5/7.0	CH62/IP00	246x658x374	55
NXB05905A0T0 8WFA1A2	2x590	1.1	1.4	714	939	7.5/0.6/8.1	CH62/IP00	246x658x374	55
NXB06505A0T0 8WFA1A2	2x650	1	1.2	786	1035	8.5/0.6/9.1	CH62/IP00	246x658x374	55
NXB07305A0T0 8WFA1A2	2x730	0.9	1.1	883	1162	10.0/0.7/10.7	CH62/IP00	246x658x374	55

Vacon NXB line 640–1100 VDC, IP00, EMC level T, liquid cooled external brake chopper

Order type code	Drive output					Power loss	Size/prot.	Dimensions	Weight
	Current			Electrical braking power					
	I_{TH} [A]	Minimum resistance		840 VDC*) (kW)	1100 VDC*) (kW)	c/a/T*) (kW)	CH/IP	WxHxD	kg
		840 VDC (Ohm)	1100 VDC (Ohm)						
NXB01706A0T0 8WFA1A2	2x170	4.9	6.5	282	372	4.5/0.2/4.7	CH61/IP00	246x658x374	55
NXB02086A0T0 8WFA1A2	2x208	4	5.3	346	456	5.5/0.3/5.8	CH61/IP00	246x658x374	55
NXB02616A0T0 8WFA1A2	2x261	3.2	4.2	435	572	5.5/0.3/5.8	CH61/IP00	246x658x374	55
NXB03256A0T0 8WFA1A2	2x325	2.6	3.4	542	713	6.5/0.3/6.8	CH62/IP00	246x658x374	55
NXB03856A0T0 8WFA1A2	2x385	2.2	2.9	643	845	7.5/0.4/7.9	CH62/IP00	246x658x374	55
NXB04166A0T0 8WFA1A2	2x416	2	2.6	693	913	8.1/0.4/8.4	CH62/IP00	246x658x374	55
NXB04606A0T0 8WFA1A2	2x460	1.8	2.4	767	1010	8.5/0.4/8.9	CH62/IP00	246x658x374	55
NXB05026A0T0 8WFA1A2	2x502	1.7	2.2	838	1100	10.0/0.5/10.5	CH62/IP00	246x658x374	55

*) Braking power with two resistors.

Note: The rated currents in given ambient temperatures (+50°C) and coolant temperatures (+30°C) are achieved only when the switching frequency is equal to or less than the factory default.

Braking power: $P_{break} = 2 \times U_{break} / R_{break}$

Max. input DC current: $I_{in\_max} = P_{break\_max} / U_{break}$

Vacon NX options liquid cooled regenerative line filters IP00, (LCL)

Order type code	Suitability	Description
RLC-0385-6-0	CH62/690 V: 325, 385 AAC	LCL filter, 2-p
RLC-0520-6-0	CH62/500-690 V	LCL filter, 3-p
RLC-0750-6-0	CH62/500, CH63/690 V	LCL filter, 3-p
RLC-0920-6-0	CH63/500, CH64/690 V	LCL filter, 3-p
RLC-1180-6-0	CH63/500, CH64/690 V	LCL filter, 3-p
RLC-1640-6-0	CH64/500-690 V	LCL filter, 3-p
RLC-2300-5-0	CH64/500 V: 2060, 2300 AAC	LCL filter, 2-p

Vacon NXA line 465–800 VDC, IP00, EMC level T, liquid cooled active front-end

Order type code	AFE input			AFE output to DC-link				Power loss	Size/prot.
	Current			Apparent power kVA		**Dimensioning power		c/a/T*) (kW)	CH/IP
	Thermal I_{TH} (A)	Rated I_L (A)	Rated I_H (A)	594 VDC I_L (kVA)	742 VDC I_L (kVA)	594 VDC I_{TH}/I_L (kW)	742 VDC I_{TH}/I_L (kW)		
NXA01685A0T0IWSA1A2	168	153	112	114	143	125 / 100	150 / 125	2.5/0.3/2.8	CH5/IP00
NXA02055A0T0IWSA1A2	205	186	137	139	174	150 / 125	175 / 150	3.0/0.4/3.4	CH5/IP00
NXA02615A0T0IWSA1A2	261	237	174	177	221	200 / 175	225 / 200	4.0/0.4/4.4	CH5/IP00
NXA03005A0T0IWFA1A2	300	273	200	204	255	225 / 200	275 / 250	4.5/0.4/4.9	CH61/IP00
NXA03855A0T0IWFA1A2	385	350	257	261	327	275 / 250	325 / 300	5.5/0.5/6.0	CH61/IP00
NXA04605A0T0IWFA1A2	460	418	307	312	390	325 / 300	400 / 375	5.5/0.5/6.0	CH62/IP00
NXA05205A0T0SWSA1A2	520	473	347	353	442	375 / 350	475 / 425	6.5/0.5/7.0	CH62/IP00
NXA05905A0T0IWFA1A2	590	536	393	400	500	425 / 375	525 / 475	7.5/0.6/8.1	CH62/IP00
NXA06505A0T0IWFA1A2	650	591	433	441	552	475 / 425	575 / 525	8.5/0.6/9.1	CH62/IP00
NXA07305A0T0IWFA1A2	730	664	487	496	620	525 / 475	650 / 600	10.0/0.7/10.7	CH62/IP00
NXA08205A0T0IWFA1A2	820	745	547	556	696	575 / 525	725 / 675	10.0/0.7/10.7	CH63/IP00
NXA09205A0T0IWFA1A2	920	836	613	624	780	650 / 600	825 / 750	12.4/0.8/12.4	CH63/IP00
NXA10305A0T0IWFA1A2	1030	936	687	699	874	750 / 675	925 / 850	13.5/0.9/14.4	CH63/IP00
NXA11505A0T0IWFA1A2	1150	1045	767	780	976	825 / 750	1025 / 950	16.0/1.0/17.0	CH63/IP00
NXA13705A0T0IWFA1A2	1370	1245	913	930	1162	975 / 900	1225 / 1125	15.5/1.0/16.5	CH64/IP00
NXA16405A0T0IWFA1A2	1640	1491	1093	1114	1392	1200 / 1100	1500 / 1375	19.5/1.2/20.7	CH64/IP00
NXA20605A0T0IWFA1A2	2060	1873	1373	1399	1749	1475 / 1350	1850 / 1700	26.5/1.5/28.0	CH64/IP00
NXA23005A0T0IWFA1A2	2300	2091	1533	1562	1952	1650 / 1500	2050 / 1900	34.0/1.8/35.8	CH64/IP00

Vacon NXA line 640–1100 VDC, IP00, EMC level T, liquid cooled active front-end

Order type code	AFE input			AFE output to DC-link				Power loss	Size/prot.
	Current			Apparent power kVA		**Dimensioning power		c/a/T*) (kW)	CH/IP
	Thermal I_{TH} (A)	Rated I_L (A)	Rated I_H (A)	780 VDC I_L (kVA)	1025 VDC I_L (kVA)	780 VDC I_{TH}/I_L (kW)	1025 VDC I_{TH}/I_L (kW)		
NXA01706A0T0IWFA1A2	170	155	113	152	200	175 / 150	200 / 175	4.5/0.2/4.7	CH61/IP00
NXA02086A0T0IWFA1A2	208	189	139	185	243	200 / 175	250 / 225	5.5/0.3/5.8	CH61/IP00
NXA02616A0T0IWFA1A2	261	237	174	232	305	250 / 225	325 / 300	5.5/0.3/5.8	CH61/IP00
NXA03256A0T0IWFA1A2	325	295	217	289	380	300 / 275	400 / 375	6.5/0.3/6.8	CH62/IP00
NXA03856A0T0IWFA1A2	385	350	257	343	451	350 / 325	475 / 450	7.5/0.4/7.9	CH62/IP00
NXA04166A0T0IWFA1A2	416	378	277	371	487	400 / 350	500 / 475	8.1/0.4/8.4	CH62/IP00
NXA04606A0T0IWFA1A2	460	418	307	410	539	450 / 400	575 / 525	8.5/0.4/8.9	CH62/IP00
NXA05026A0T0IWFA1A2	502	456	335	447	587	475 / 425	625 / 575	10.0/0.5/10.5	CH62/IP00
NXA05906A0T0IWFA1A2	590	536	393	525	691	575 / 525	725 / 675	10.0/0.5/10.5	CH63/IP00
NXA06506A0T0IWFA1A2	650	591	433	579	761	625 / 575	825 / 750	13.5/0.7/14.2	CH63/IP00
NXA07506A0T0IWFA1A2	750	682	500	669	879	700 / 650	675 / 600	16.0/0.8/16.8	CH63/IP00
NXA08206A0T0IWFA1A2	820	745	547	730	960	825 / 725	1000 / 925	16.0/0.8/16.8	CH64/IP00
NXA09206A0T0IWFA1A2	920	836	613	819	1077	875 / 800	1150 / 1050	17.8/1.0/18.4	CH64/IP00
NXA10306A0T0IWFA1A2	1030	936	687	918	1206	975 / 900	1275 / 1150	19.0/1.0/20.0	CH64/IP00
NXA11806A0T0IWFA1A2	1180	1073	787	1052	1382	1125 / 1025	1475 / 1350	21.0/1.1/22.1	CH64/IP00
NXA13006A0T0IWFA1A2	1300	1182	867	1159	1523	1225 / 1125	1650 / 1500	27.0/1.4/28.4	CH64/IP00
NXA15006A0T0IWFA1A2	1500	1364	1000	1337	1757	1450 / 1325	1900 / 1725	32.0/1.6/33.6	CH64/IP00

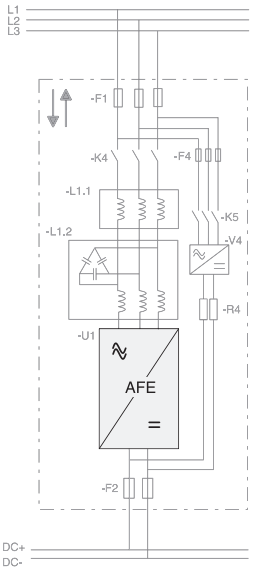
*) C = power loss into coolant, A = power loss into air, T = total power loss

**) kW/KkVA values with input parameters TPF=0.98 (Note! On AFE DC-supply terminals)

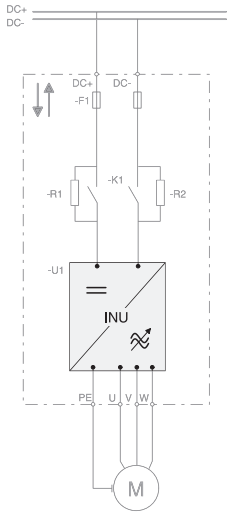
If some other mains voltage is used, apply the formula $P = \sqrt{3} \times U_N \times I_L$ to calculate the output apparent power [kVA] of the Vacon NX liquid cooled drive.

The enclosure class for all Vacon NX liquid cooled frequency converters is IP00.

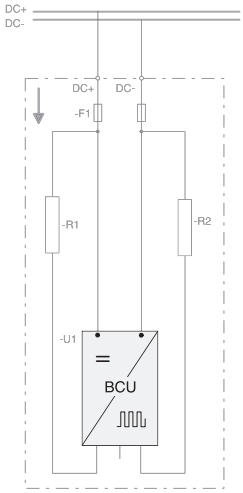
TYPICAL DEVICE CONFIGURATIONS



ACTIVE FRONT-END
(CH5, CH61, CH62, CH63, CH64)



INVERTER UNIT
(CH3, CH4, CH5, CH61, CH62, CH63, CH64)



BRAKE CHOPPER UNIT
(CH3, CH4, CH5, CH61, CH62)

NXA, Active Front-End

The Active Front-End (AFE) unit is bi-directional (regenerative) power converter (supply unit) for the front-end of a common DC bus drive line-up. An external LCL filter is used at the input. This unit is suitable in applications where a low level of mains harmonics and high power factor are required.

- LCL filter guarantees that harmonics are not an issue in any network
- Power factor is better than 0.99 which, together with low harmonics, means that supply chain transformers, generators, etc. can be sized very accurately without reserving margins for the reactive power. This can mean a saving of 10 % in supply chain investments
- Faster payback time, regenerative energy feeding back to the grid
- Power management system interface for backpower control, power limit

Fuses, LCL filters, pre-charging rectifiers and resistors need to be ordered and specified separately.

NXI, Inverter unit

The INU (Inverter unit) is a bidirectional DC-fed power inverter for the supply and control of AC motors. The INU is supplied from a common DC bus drive line-up. A charging circuit is needed in case a connection to a live DC bus is required. The DC-side charging circuit is external for inverter types.

Pre-charging resistors and switches or fuses are not included in an NXI delivery. They need to be specified and ordered separately.

NXB, Brake chopper unit

The Brake Chopper Unit (BCU) is unidirectional power converter for the supply of excessive energy from a common DC bus drive line-up or big single drive to resistors where the energy is dissipated as heat. External resistors are needed.

- Improves drive dynamic performance in a load regenerative operating point
- Protects common DC bus voltage level from overvoltage
- Saves AFE investments in some cases

Resistors or fuses are not included in an NXB delivery. They need to be specified and ordered separately.

LIQUID TO LIQUID HEAT EXCHANGERS

In cooperation with HVAC professionals, Vacon has designed a range of liquid-to-liquid heat exchangers (HX), which improve the availability and usability of AC drive systems. The heat exchangers added to the liquid cooled Vacon NXP range offer a reliable and cost-effective cooling without ventilation concerns.

Built with high-quality components, Vacon's standardized heat exchanger makes the use of liquid cooled drives easier, because a well-planned and sized unit is easier to apply than a project solution. In addition, a standard heat exchanger solution offers proven reliability.

To minimize the risk of possible leaks, splitting the cooling circuit into segments is worthwhile, because even in a large group of AC drives the volume of the liquid stays under 100 litres. An additional advantage of separated cooling segments is the possibility to use inhibitors and glycol against the corrosion, freezing and micro organisms.

The Vacon heat exchanger has versatile protection and control functions. The whole system is supervised by the drive's control application software, which meets the standards of even the most demanding customers. The operation of the unit can be monitored by an upper level automation system. The system controls the cooling conditions of the drives and supervises the flow and detects possible leaks in the cooling system.

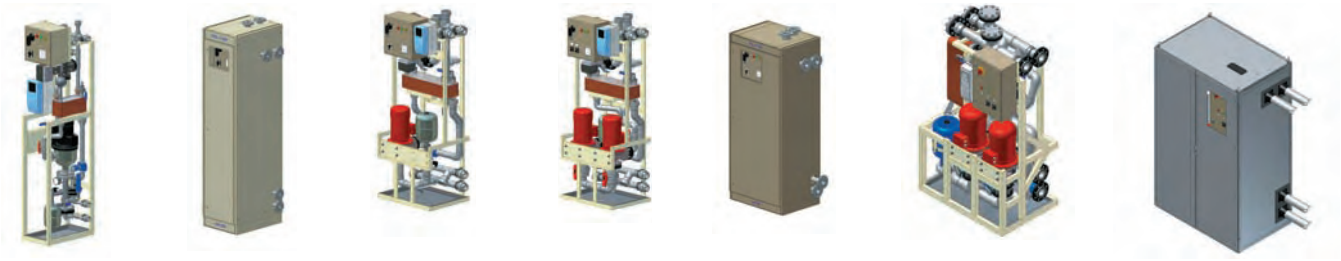
The Vacon heat exhanger can be used in different kinds of electrical networks, where frequencies and voltages may vary, because the cooling pump is controlled by an AC drive. Such networks are typically used in the marine industry and other electrical island networks using diesel generators. This kind of solution brings an extra advantage because the flow capacity can be adjusted to the demand. Pressure losses that are higher than expected within the cooling circuit may be easily compensated by changing the speed of the pump and thus raising the pressure and flow.

A standard heat exchanger delivery consists of

- Self-supporting module rack construction, which can be integrated into generic switchgear and cabinet solutions
- Cooling circuit equipped with threaded joints or flanges
- Heavy industry PVC-C pipework; excellent, because it is light and prevents corrosion
- Industrial water heat exchanger, three-way-valve, pump, AC drive

Typical options of the heat exchangers available

- Stainless steel AISI piping
- Customer circuitry insulation for condensation prevention, typically needed when the process water is below 15°C
- Two-way-valve capable of optimizing the quantity of the cooling water, when the temperature of the process liquid is low
- Heat exhanger can be delivered installed inside a Rittal TS8 or VSG VEDA cabinet
- Double pumps can be selected for marine class requirements, types 120 kW and 300 kW
- Titanium heat exchanger is used in sea water circuits. The structure and performance differs from the fresh water models.



	HXL-M/V/R-040-N-P	HXL/M-M/V/R-120-N-P	HXS/T-M/V/R-070-N-P	HXL/M-M/R-300-N-P
Cooling power	0...40 kW	0...120 kW	0...69 kW	0...300 kW
Mains supply	380...420 VAC	380...420 VAC	380...420 VAC	380...500 VAC
Flow	40...120 l/min	120...360 l/min	120...200 l/min	360...900 l/min
Distribution pressure	0.3 bar / l=10 m, DN32*	HXL: 1 bar / l = 40 m, DN50 HXM: 0.7 bar / l = 30 m, DN50	HXS: 1 bar / l = 40 m, DN50 HXT: 0.7 bar / l = 25 m, DN50	HXL: 1 bar / l = 40 m, DN80 HXM: 0.7 bar / l = 25 m, DN80
Double pump		HXM	HXT	HXM
Cabinets	VEDA, Rittal	VEDA, Rittal	VEDA, Rittal	Rittal

* l = maximum distribution distance with specific DN diameter

REFERENCE STORIES

Helsinki Energy district cooling plant

Helsinki Energy (Finland) uses liquid cooled technology for their pump applications at their Salmisaari power plant site. The scope of delivery covered 16 liquid cooled Vacon NXP drives (CH61-CH74, 690 V) installed in cabinets.

District cooling means centralized production and distribution of the cooling agent, which requires a lot of electricity. Contrary to the cooling agents used in compressor cooling, no harmful substances evaporate in the process of producing district cooling. At the Salmisaari district cooling plant, district cooling is produced by absorption technology, using energy from the district heat that would otherwise remain unused. With the liquid cooling technology the plant saves not just energy, but also a lot of space. Air conditioning is also more economical with the use of liquid cooled Vacon NX drives.

Cranes, grabber crane

The Vacon liquid cooled drives technology is used in the Corus IJmuiden steel and aluminium company in the Netherlands. A huge crane with the capacity of 40,000 kg has a hoist including two 820 kW AFE-supplied liquid cooled AC drives and a trolley travel, including a 485 kW AFE supplied liquid cooled AC drive.

Vacon liquid cooled AC drives were chosen because they are very compact and liquid cooling gives the possibility to have cabinets with a high protection class. The AFE filters are also liquid cooled. The size of the Vacon solution in the electrical room was considerably small and highly appreciated.

Corus is an international company, providing steel and aluminium products and services to customers worldwide.

Electroproject Aandrijftechniek is a system integrator and is responsible for designing and commissioning the drive system, including the water cooling system and grabber crane logic.

Wind turbines

The world's biggest wind turbine system uses a gearless permanent magnet generator. The technology has been developed by Arctic Wind Power, a consortium which consists of highly skilled experts from The Switch Oy, Verteco Oy and Vaasa Engineering Oy.

The gearless wind turbine is based on using full-size inverter technology instead of double-fed generators, which are still the most commonly used technology for controlling wind turbines today. The new inverter technology makes old conventional solutions obsolete, since it can utilize all available wind speeds, from very weak to very strong. The Vacon CH64 liquid cooled NXP inverters, coupled to permanent magnet generators, put less mechanical stress on the system and provide high-quality 690 V electricity that is supplied via a transformer to a 20-kV network.

Through hard rock with tunnel boring machines

The Robbins Company, a USA-based company, is engaged in the design, manufacture, sale and rental of custom-made equipment for the underground excavation industry. Since 1990s, the Robbins company only uses liquid cooled drives to control their tunnel boring machines (TMBs), each of which includes 4-15 drives to control one cutterhead. Typical Robbins TBM applications include road, railway, cable, water and sewerage tunnels. TBMs are used to excavate circular cross-section tunnels through a wide variety of geology, from soils to hard rock.

The main advantage of liquid cooling compared to air cooled drives in tunnel boring is space saving. Liquid cooled drives are also more suitable for severe and demanding conditions such as dust and humidity.

Oil drilling at sea

National Oilwell Varco, a world leader in supplying systems and components used in oil and gas drilling and production, chose Vacon as its supplier of liquid cooled drives. In addition to their high performance and reliability, the liquid cooled Vacon NX drives also bring many other benefits to the drilling process.

Liquid cooled Vacon NX drives are controlling the active heave drawworks and top drive on the SC Lancer drill ship. The drawworks with a lifting capacity of 500 tons is run by four 850 kW motors, which are controlled by four liquid cooled Vacon NX drives and four brake choppers, each with the power of one megawatt.

Motor speed control enables smooth operation of the drawworks. It also impoves reliability, efficiency and work safety. Speed control also decreases electromechanical stress for the electrical system and provides flexibility in power generation and distribution.

Outokumpu steel plant

Vacon delivered more than one hundred drives to the melting shop at the Outokumpu steel plant in Tornio, Finland. Outokumpu is the world's second largest producer of stainless steel. The drives were liquid cooled NX units in the power range of 5...1200 kW (400 V and 690 V). The melting shop includes, for example, an electric arc furnace, an AOD converter and a continuous casting machine. The AOD converter is used to tilt the bucket when pouring the melted metal. The process is extremely demanding due to continuous changes in energy consumption, depending on whether the motor is consuming or generating electrical energy.