

VACON NX
AC DRIVES

LIQUID-COOLED DRIVES USER MANUAL

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AT LEAST THE FOLLOWING STEPS OF THE *START-UP QUICK GUIDE* MUST BE PERFORMED DURING THE INSTALLATION AND COMMISSIONING.

IF ANY PROBLEMS OCCUR, PLEASE CONTACT YOUR LOCAL DISTRIBUTOR.

Start-up Quick Guide

1. Check that the delivery corresponds to your order, see Chapter 3.
2. Before taking any commissioning actions read carefully the safety instructions in Chapter 1.
3. Check the size of the motor cable, mains cable, mains fuses and check the cable connections, read Chapters 6.1.1.1 – 6.1.2.
4. Follow the installation instructions.
5. Control connections are explained in Chapter 6.2.2.
6. Ensure the adequate pressure and flow of the cooling agent you are using. See Chapter 5.2.
7. If the Start-Up wizard is active, select the language of the keypad and the application you want to use and confirm by pressing the *Enter button*. If the Start-Up wizard is not active, follow the instructions 7a and 7b.
 - 7a. Select the language of the keypad from the Menu M6, page 6.1. Instructions on using the keypad are given in Chapter 7.
 - 7b. Select the application you want to use from the Menu M6, page 6.2. Instructions on using the keypad are given in Chapter 7.
8. All parameters have factory default values. In order to ensure proper operation, check the rating plate data for the values below and the corresponding parameters of parameter group G2.1.
 - nominal voltage of the motor
 - nominal frequency of the motor
 - nominal speed of the motor
 - nominal current of the motor
 - motor cos ϕAll parameters are explained in the All in One Application Manual.
9. Follow the commissioning instructions, see Chapter 8.
10. The Vacon NX Liquid-Cooled Frequency Converter is now ready for use.

Vacon Plc is not responsible for the use of its products against instructions.

ABOUT THE VACON NX LIQUID-COOLED FREQUENCY CONVERTERS AND INVERTERS USER'S MANUAL

Congratulations for choosing the Smooth Control provided by Vacon NX_W Liquid Cooled drives!

The User's Manual will provide you with the necessary information about the installation, commissioning and operation of Vacon NX Liquid-Cooled drives. We recommend that you carefully study these instructions before powering up the frequency converter for the first time.

This manual is available in both paper and electronic editions. We recommend you to use the electronic version if possible. If you have the electronic version at your disposal you will be able to benefit from the following features:



The manual contains several links and cross-references to other locations in the manual which makes it easier for the reader to move around in the manual, to check and find things faster.

The manual also contains hyperlinks to web pages. To visit these web pages through the links you must have an internet browser installed on your computer.

1. SAFETY



ONLY A COMPETENT ELECTRICIAN MAY CARRY OUT THE ELECTRICAL INSTALLATION!

	= DANGEROUS VOLTAGE!
	= GENERAL WARNING

1.1 DANGER



The components of the power unit of the frequency converter are live when Vacon NX Liquid-Cooled drive is connected to mains potential. Coming into contact with this voltage is extremely dangerous and may cause death or severe injury.



The motor terminals U, V, W and the DC-link/brake resistor terminals are live when Vacon NX Liquid-Cooled drive is connected to mains, even if the motor is not running.



After disconnecting the frequency converter from the mains, wait until the indicators on the keypad go out (if no keypad is attached see the indicators on the cover). Wait 5 more minutes before doing any work on Vacon NX Liquid-Cooled drive connections. Do not touch the enclosure before this time has expired. Always ensure absence of voltage before starting any electrical work!



The control I/O-terminals are isolated from the mains potential. However, the relay outputs and other I/O-terminals may have a dangerous control voltage present even when Vacon NX Liquid-Cooled drive is disconnected from mains.



Before connecting the NX Liquid-Cooled drive to mains, ensure the functionality of the coolant circulation and check the circulation for possible leaks.



Before connecting the drive to mains make sure that the enclosure door is closed.



If Vacon NX_ is disconnected from mains while running the motor, it remains live if the motor is energized by the process. In this case the motor functions as a generator feeding energy to the frequency converter.

1.2 WARNINGS



The Vacon NX Liquid-Cooled drive is meant for fixed installations only.



Do not perform any measurements when the frequency converter is connected to the mains. Prior to measurements on the motor or the motor cable, disconnect the motor cable from the frequency converter.



The earth leakage current of Vacon NX_ frequency converters exceeds 3.5mA AC. According to standard EN61800-5-1, a reinforced protective ground connection must be ensured. See chapter 1.4.



If the frequency converter is used as a part of a machine, the machine manufacturer is responsible for providing the machine with a main switch (EN 61800-5-1).



Only spare parts delivered by Vacon can be used.





After the power-up, power brake or fault reset the motor will start immediately if the start signal is active, unless the pulse control for Start/Stop logic has been selected. Furthermore, the I/O functionalities (including start inputs) may change if parameters, applications or software are changed. Disconnect, therefore, the motor if and unexpected start can cause danger.




Prior to measurements on the motor or the motor cable, disconnect the motor cable from the frequency converter.

1.3 CAUTIONS

	<p>Do not perform any voltage withstand tests on any part of Vacon NX_. There is a certain procedure according to which the tests shall be performed. Ignoring this procedure may result in damaged product.</p> <p>Do not touch the components on the circuit boards. Static voltage discharge may damage the components.</p>
	<p>If a fault protection relay is used, it must be of at least type B, preferably B+ (according to EN 50178), with a trip level of 300 mA. This is for fire protection, not for touch protection in grounded systems.</p>

1.4 EARTHING AND EARTH FAULT PROTECTION

The Vacon NX Liquid-Cooled frequency converter must always be earthed with an earthing conductor connected to the earthing terminal . See page 80.

The earth leakage current of Vacon NX_ exceeds 3.5mA AC. According to EN61800-5-1, one or more of the following conditions for the associated protective circuit shall be satisfied:

- The protective conductor shall have a cross-sectional area of at least 10 mm² Cu or 16 mm² Al, through its total run.
- Where the protective conductor has a cross-sectional area of less than 10 mm² Cu or 16 mm² Al, a second protective conductor of at least the same cross-sectional area shall be provided up to a point where the protective conductor has a cross-sectional area not less than 10 mm² Cu or 16 mm² Al.
- Automatic disconnection of the supply in case of loss of continuity of the protective conductor.

The cross-sectional area of every protective earthing conductor which does not form part of the supply cable or cable enclosure shall, in any case, be not less than:

- 2,5mm² if mechanical protection is provided or
- 4mm² if mechanical protection is not provided.




The earth fault protection inside the frequency converter protects only the converter itself against earth faults in the motor or the motor cable. It is not intended for personal safety.

Due to the high capacitive currents present in the frequency converter, fault current protective switches may not function properly.

1.5 RUNNING THE MOTOR

Warning symbols

For your own safety, please pay special attention to the instructions marked with the following symbols:

	= <i>Dangerous voltage</i>
	= <i>General warning</i>
	= <i>Hot surface – Risk of burn</i>

Motor run check list



Before starting the motor, check that it is mounted properly and ensure that the machine connected to the motor allows the motor to be started.



Set the maximum motor speed (frequency) on the frequency converter according to the motor and the machine connected to it.



Before reversing the motor make sure that this can be done safely.



Make sure that no power correction capacitors are connected to the motor cable.



Make sure that the motor terminals are not connected to mains potential.



Before the NX_W Liquid Cooled drive can be used to control the motor, the proper functioning of the liquid-cooling system must be ensured.

2. EU DIRECTIVE

2.1 CE MARKING

The CE marking on the product guarantees the free movement of the product within the EEA (European Economic Area).

Vacon NX frequency converters carry the CE label as a proof of compliance with the Low Voltage Directive and the Electro Magnetic Compatibility Directive (EMC). The company SGS FIMKO has acted as the Competent Body.

2.2 EMC DIRECTIVE

2.2.1 GENERAL

The EMC Directive provides that the electrical apparatus must not excessively disturb the environment it is used in, and, on the other hand, it shall have an adequate level of immunity toward other disturbances from the same environment.

The compliance of Vacon NX Liquid-Cooled frequency converters with the EMC directive is verified with Technical Construction Files (TCF) checked and approved by SGS FIMKO, which is a Competent Body. The Technical Construction Files are used to authenticate the conformity of Vacon frequency converters with the Directive because such a large-sized product family is impossible to be tested in a laboratory environment and because the combinations of installation vary greatly.

2.2.2 TECHNICAL CRITERIA

Our basic idea was to develop a range of frequency converters offering the best possible usability and cost-efficiency. EMC compliance was a major consideration from the outset of the design.

Vacon NX Liquid-Cooled frequency converters are marketed throughout the world, a fact which makes the EMC requirements of customers different. As far as the immunity is concerned, all Vacon NX Liquid-Cooled frequency converters are designed to fulfil even the strictest requirements.

2.2.3 VACON FREQUENCY CONVERTER EMC CLASSIFICATION

Vacon NX Liquid-Cooled frequency converter and inverter modules delivered from factory fulfil all EMC immunity requirements (standard EN 61800-3).

The basic liquid cooled modules do not have any inherent emission filtering. If filtering is needed and a certain EMC emission level is required, external RFI filters must be used.

Class N:

The NX Liquid-Cooled drives of this class do not provide EMC emission protection. This kind of drives are mounted in enclosures. External EMC filtering is usually required to fulfil the EMC emission requirements.

Class T:

The T-class converters have a smaller earth leakage current and are intended to be used with IT supplies only. If they are used with other supplies no EMC requirements are complied with.


Warning: This is a product of the restricted sales distribution class according to IEC 61800-3. In a domestic environment this product may cause radio interference in which case the user may be required to take adequate measures.

2.2.3.1 IT networks

The grounding of input capacitors made by default with the grounding screw at terminal X41 of the bus board in all drives is imperative in all variations of TN/TT networks. Should a drive originally purchased for TN/TT networks be used in an IT network, the screw at X41 must be removed. It is strongly recommended that this be done by Vacon personnel. Ask you local distributor for more information.

2.2.4 MANUFACTURER'S DECLARATION OF CONFORMITY

The following pages present the Manufacturer's Declarations of Conformity assuring the compliance of Vacon frequency converters with the EMC-directives.



EC DECLARATION OF CONFORMITY

We

Manufacturer's name: Vacon Oyj

Manufacturer's address: P.O.Box 25
Runsorintie 7
FIN-65381 Vaasa
Finland

hereby declare that the product

Product name: Vacon NX Liquid-Cooled Frequency converter

Model designation: Vacon NX Liquid-Cooled 0016 5.... to 4140 5....
Vacon NX Liquid-Cooled 0170 6.... to 3100 6....

has been designed and manufactured in accordance with the following standards:

Safety: EN 60204-1:2006+A1:2009 (as relevant)
EN 61800-5-1:2007


EMC (immunity): EN61800-3:2004 (only immunity)

and conforms to the relevant safety provisions of the Low Voltage Directive (2006/95/EC) and EMC Directive 2004/108/EC.

It is ensured through internal measures and quality control that the product conforms at all times to the requirements of the current Directive and the relevant standards.

In Vaasa, 24th of March, 2011

The year the CE marking was affixed: 2002


Vesa Laihi
President

VANXPLC_1000_INS_uk

3. RECEIPT OF DELIVERY

The standard delivery of Vacon liquid-cooled drives includes all or part of the following components:

- power unit
- control unit
- main line connecting hoses and conduits (1.5m) + aluminium adapters for Ch5-Ch74
- Tema 1300 series fast connectors for Ch3-Ch4
- choke (not DC-fed inverters, type code I)
- control unit mounting kit
- optic fibre & cable set (1.5m) for control unit; Optic sets in different lengths also available
- optic fibre cable set for 2*CH64/CH74: 1.8m/11 fibres (Power module 1) and 3.8m/8 fibres (Power module 2)

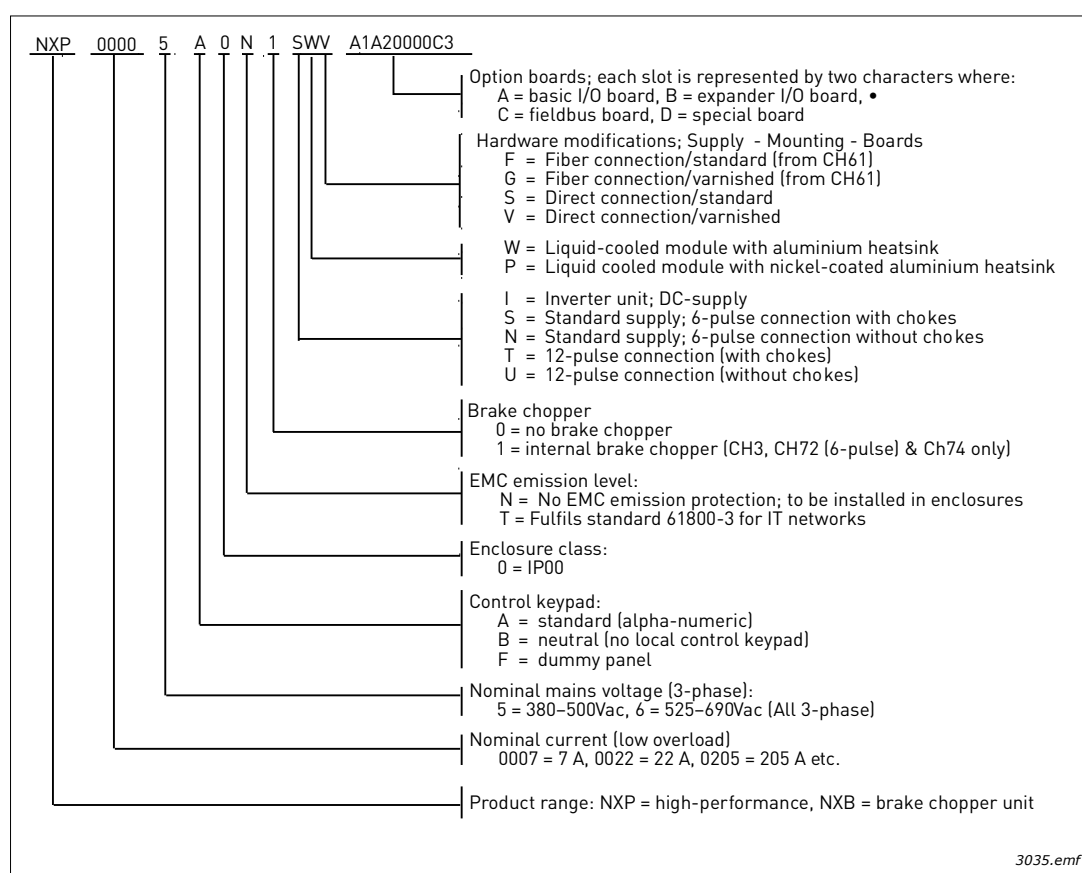
Vacon liquid-cooled frequency converters have undergone scrupulous tests and quality checks at the factory before they are delivered to the customer. However, after unpacking the product, check that no signs of transport damages are to be found on the product and that the delivery is complete [compare the type designation of the product to the code].

Should the drive have been damaged during the shipping, please contact primarily the cargo insurance company or the carrier.

If the delivery does not correspond to your order, contact the supplier immediately.

3.1 TYPE DESIGNATION CODE

The type designation code for the NX Liquid-Cooled drives is presented below.



3035.emf

3.2 STORAGE AND SHIPPING

If the frequency converter is to be kept in store before use make sure that the ambient conditions are acceptable:

Storing temperature	-40...+70°C (no cooling liquid inside cooling element allowed below 0°)
Relative humidity	<96%, no condensation

If the storage time exceeds 12 months the electrolytic DC capacitors need to be charged with caution. Therefore, such a long storage time is not recommended. See chapter 9.3 and the NX Liquid-Cooled Drives Service Manual for instructions on charging. See also chapter 3.3.

Warning: Always remove all cooling agent from the cooling element(s) before shipping to avoid damage caused by freezing.

3.3 MAINTENANCE

In normal conditions, Vacon NX Liquid-Cooled frequency converters are maintenance-free. However, if the frequency converter is used in conditions with temperatures below the freezing point and the liquid used for cooling is likely to freeze, be sure to empty the cooling element if the converter must be moved or if it is taken out of use for a longer time. See also chapter 3.2.

It may also be necessary to clean up the coolant ducts in the cooling element. Contact the factory for more information.

The instructions for the cooling system provided by its manufacturer shall be followed.

Change the glycol coolant every 2 years or add inhibitor.

3.4 WARRANTY

Only manufacturing defects are covered by the warranty. The manufacturer assumes no responsibility for damages caused during or resulting from transport, receipt of the delivery, installation, commissioning or use.

The manufacturer shall in no event and under no circumstances be held responsible for damages and failures resulting from misuse, wrong installation, unacceptable ambient temperature, running motor with lower coolant flow than minimum flow, condensation, dust, corrosive substances or operation outside the rated specifications.

Neither can the manufacturer be held responsible for consequential damages.

NOTE! Vacon NX Liquid-Cooled drives must not be run with the liquid cooling system disconnected. Furthermore, the requirements of the liquid cooling specifications, e.g. minimum flow rate (see chapter 5.2 and Table 15) must be satisfied. Ignoring this will render the warranty null and void.

The Manufacturer's time of warranty is 18 months from the delivery or 12 months from the commissioning whichever expires first (Vacon Warranty Terms).

The local distributor may grant a warranty time different from the above. This warranty time shall be specified in the distributor's sales and warranty terms. Vacon assumes no responsibility for any other warranties than that granted by Vacon itself.

In all matters concerning the warranty, please contact first your distributor.

4. TECHNICAL DATA

4.1 INTRODUCTION

The Vacon NX_W liquid-cooled product range consists of both inverters and frequency converters. Figure 2 presents the block diagram of the Vacon NX Liquid-Cooled inverter and frequency converter. Mechanically, the product consists of two units, the Power Unit and the Control Unit. The power unit can contain one to six modules (cooling plates), depending on the drive size. Instead of air, Vacon NX Liquid-Cooled inverters and frequency converters use liquid for cooling. A charging circuit is embodied in the frequency converters but not in inverters.

An external three-phase AC-choke (1) at the mains input together with the DC-link capacitor (2) form an LC-filter. In frequency converters, the LC-filter together with the diode bridge produce the DC-voltage supply to the IGBT Inverter Bridge (3) block. The AC-choke also functions as a filter against High Frequency disturbances from the mains as well as against those caused by the frequency converter to the mains. In addition, it enhances the waveform of the input current to the frequency converter. In chasses with multiple parallel line-rectifiers (CH74) AC-chokes are required to balance the line current between the rectifiers.

The power drawn by the frequency converter from the mains is mostly active power.

The IGBT Inverter Bridge produces a symmetrical, 3-phase Pulse Width Modulated AC-voltage to the motor.

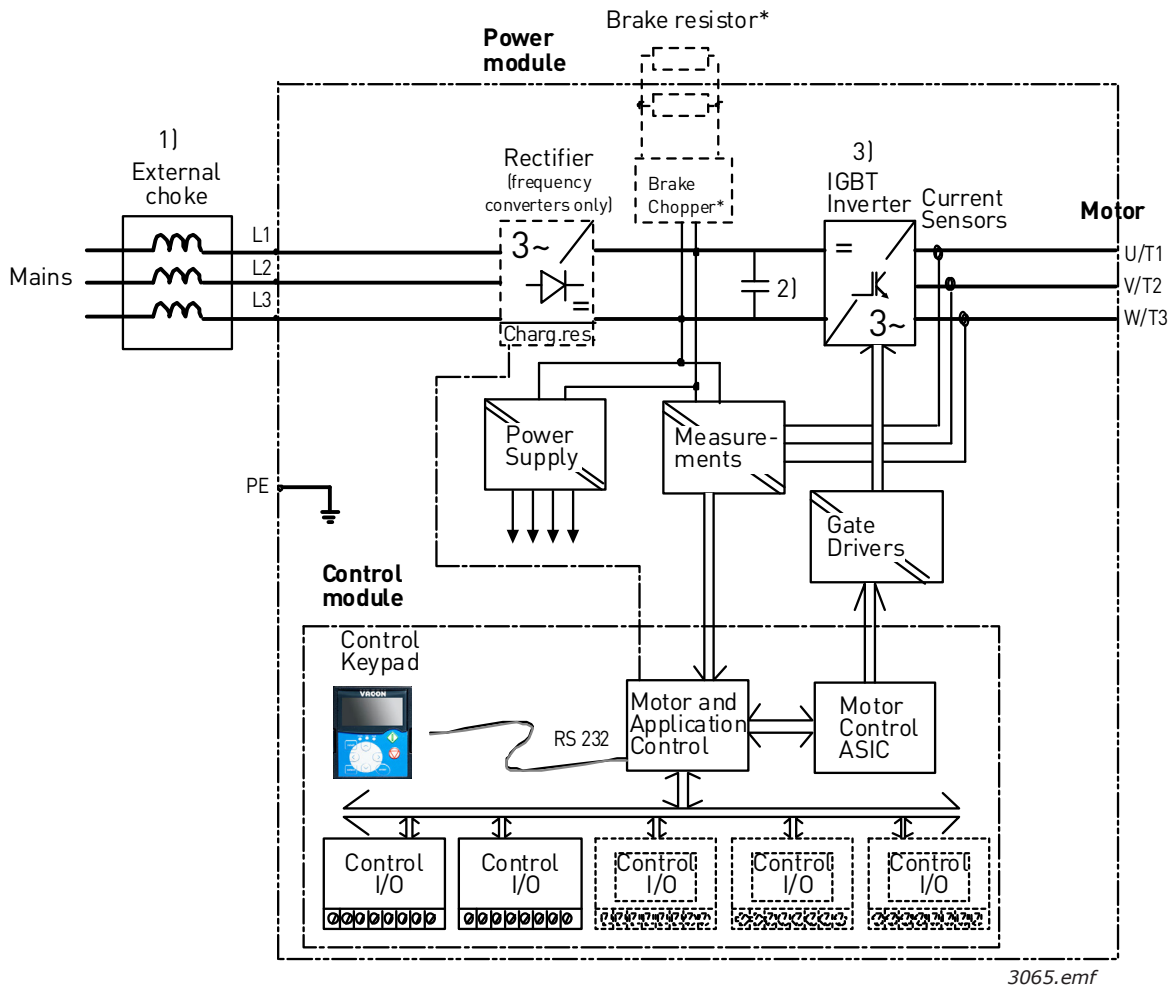
The Motor and Application Control Block is based on microprocessor software. The microprocessor controls the motor basing on the information it receives through measurements, parameter settings, control I/O and control keypad. The motor and application control block controls the motor control ASIC which, in turn, calculates the IGBT positions. Gate drivers amplify these signals for driving the IGBT inverter bridge.

The control keypad constitutes a link between the user and the frequency converter. The control keypad is used for parameter setting, reading status data and giving control commands. It is detachable and can be operated externally and connected via a cable to the frequency converter. Instead of the control keypad, a PC can also be used to control the frequency converter if connected through a similar cable ($\pm 12V$).

You can have your frequency converter equipped with a control I/O board which is either isolated (OPT-A8) or not isolated (OPT-A1) from the frame. Optional I/O expander boards that increase the number of inputs and outputs to be used are also available. For closer information, contact the Manufacturer or your local distributor (see back cover).

The basic control interface and the parameters (the Basic Application) are easy to use. If a more versatile interface or parameters are required, a more suitable application can be chosen from the "All in One" Application Package. See the "All in One" Application Manual for more information on the different applications.

An internal brake chopper is available as standard for chassis CH3. For Ch72 (only 6-pulse) and Ch74, it is available as internal option while in all other sizes the brake chopper is available as option and installed externally. The standard product does not include a brake resistor. It should be acquired separately.



*Brake resistor is available for all sizes (CH3 to CH7). An internal brake chopper belongs to standard equipment in sizes CH3. For Ch72 (only 6-pulse) and Ch74, it is available as internal option while in all other sizes it is optional but installed externally.

Figure 1. Vacon NX Liquid-Cooled converter principal block diagram

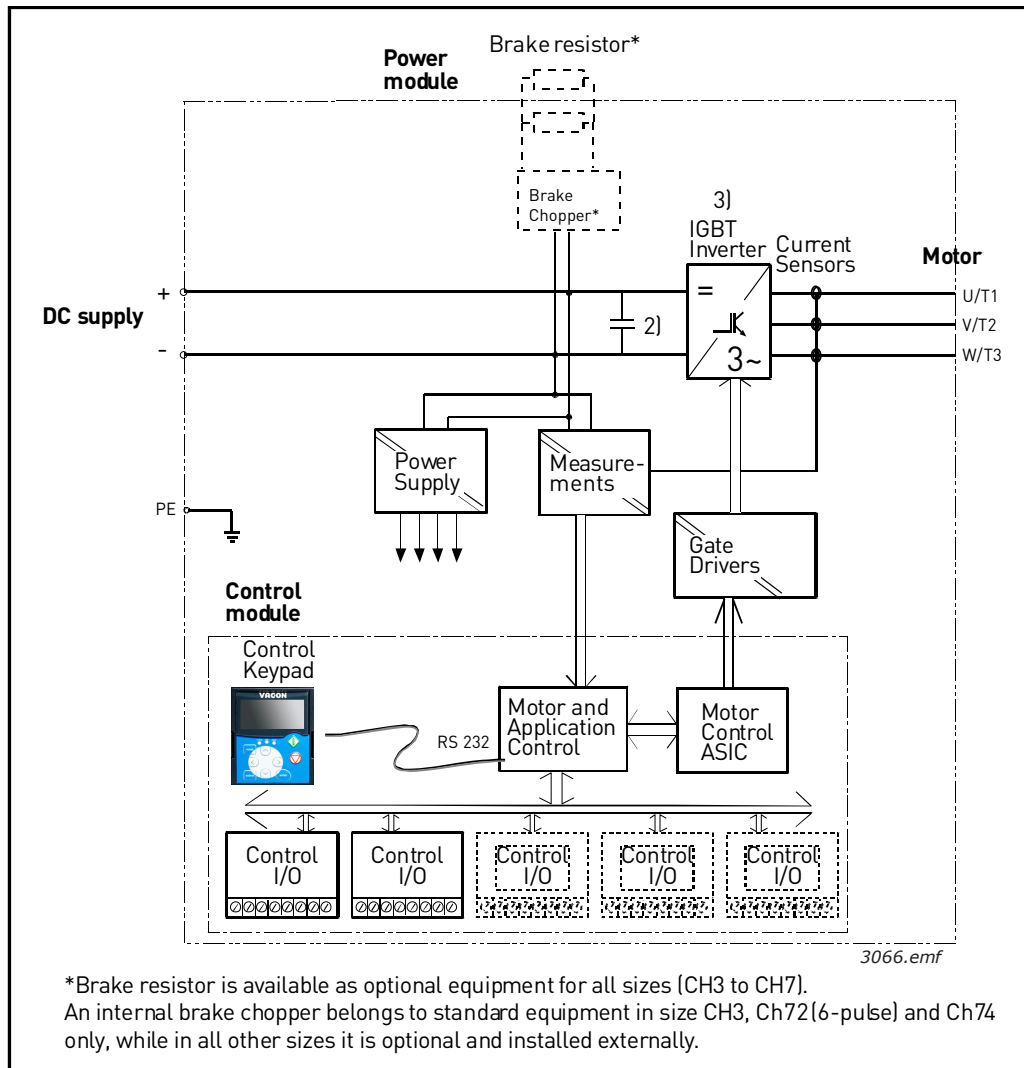


Figure 2. Vacon NX Liquid-Cooled inverter principal block diagram

4.2 POWER RATINGS

Vacon Liquid-Cooled product range consists of both frequency converters (AC input, AC output) and inverter units (DC input, AC output). The following tables present the drive output values for both and an indication of motor shaft power at I_{th} and I_L at different mains voltages as well as the drive losses and mechanical sizes. The power achieved is given as per the supply voltage.

4.2.1 FREQUENCY CONVERTERS

4.2.1.1 *Vacon NX Liquid-Cooled Frequency Converter – Mains voltage 400–500 VAC*

Table 1. Power ratings and dimensions of NX Liquid-Cooled frequency converter (6-pulse), supply voltage 400-500VAC

Mains voltage 400-500 VAC, 50/60 Hz, 3~, 6-pulse drives							
Converter type	Drive output					Power loss c/a/T*) [kW]	Chassis
	Current			Motor output power			
	Thermal I _{th} [A]	Rated cont. I _L [A]	Rated contin. I _H [A]	Optimum motor at I _{th} (400V) [kW]	Optimum motor at I _{th} (500V) [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	460	418	307	250	315	6.5/0.5/7.0	CH72
0520_5	520	473	347	250	355	7.5/0.6/8.1	CH72
0590_5	590	536	393	315	400	9.0/0.7/9.7	CH72
0650_5	650	591	433	355	450	10.0/0.7/10.7	CH72
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	1150	1045	766	600	750	18.5/1.2/19.7	CH63
1370_5	1370	1245	913	700	900	19.0/1.2/20.2	CH74
1640_5	1640	1491	1093	900	1100	24.0/1.4/25.4	CH74
2060_5	2060	1873	1373	1100	1400	32.5/1.8/34.3	CH74
2300_5	2300	2091	1533	1250	1500	36.3/2.0/38.3	CH74
2470_5	2470	2245	1647	1300	1600	38.8/2.2/41.0	2*CH74
2950_5	2950	2681	1967	1550	1950	46.3/2.6/48.9	2*CH74

Table 1. Power ratings and dimensions of NX Liquid-Cooled frequency converter (6-pulse), supply voltage 400-500VAC

Mains voltage 400-500 VAC, 50/60 Hz, 3~, 6-pulse drives							
3710_5	3710	3372	2473	1950	2450	58.2/3.0/61.2	2*CH74
4140_5	4140	3763	2760	2150	2700	65.0/3.6/68.6	2*CH74

Table 2. Power ratings and dimensions of NX Liquid-Cooled frequency converter (12-pulse), supply voltage 400-500VAC

Mains voltage 400-500 VAC, 50/60 Hz, 3~, 12-pulse drives							
Converter type	Drive output					Power loss c/a/T*) [kW]	Chassis
	Current			Motor output power			
	Thermal I _{th} [A]	Rated cont. I _L [A]	Rated contin. I _H [A]	Optimum motor at I _{th} (400V) [kW]	Optimum motor at I _{th} (500V) [kW]		
0460_5	460	418	307	250	315	6.5/0.5/7.0	CH72
0520_5	520	473	347	250	355	7.5/0.6/8.1	CH72
0590_5	590	536	393	315	400	9.0/0.7/9.7	CH72
0650_5	650	591	433	355	400	10.0/0.7/10.7	CH72
0730_5	730	664	487	400	450	12.0/0.8/12.8	CH72
1370_5	1370	1245	913	700	900	19.0/1.2/20.2	CH74
1640_5	1640	1491	1093	850	1050	24.0/1.4/25.4	CH74
2060_5	2060	1873	1373	1050	1350	32.5/1.8/34.3	CH74
2470_5	2470	2245	1647	1300	1600	38.8/2.2/41.0	2*CH74
2950_5	2950	2681	1967	1550	1950	46.3/2.6/48.9	2*CH74
3710_5	3710	3372	2473	1950	2450	58.2/3.0/61.2	2*CH74
4140_5	4140	3763	2760	2150	2700	65.0/3.6/68.6	2*CH74

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 load variation or margin for overloadability.

I_L = Low overloadability current. Allows +10% load variation. 10% exceeding can be continuous.

I_H = High overloadability current. Allows +50% load variation. 50% exceeding can be continuous.

All values with $\cos\phi = 0,83$ 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 ClosedLoop control mode. All power losses are worst case losses.

If some other mains voltage is used, apply the formula $P = U_n \times I_n \times \cos\phi \times \text{eff}\%$ to calculate the NX Liquid-Cooled drive output power.

The enclosure class for all NX Liquid-Cooled frequency converters is IP00.

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, i.e. maximum $I_H = 0.66 \times I_{th}$ 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 high starting torque.

Table 3. Internal brake chopper unit (BCU) ratings, braking voltage 460-800VDC

Internal brake chopper ratings, braking voltage 600-800 Vdc						
Converter type	Loadability	Braking capacity @ 600 Vdc		Braking capacity @ 800 Vdc		Chassis
	Rated min resistance [Ω]	Rated cont. braking power [kW]	BCU rated cont. braking current, I_{br} [A]	Rated cont. braking power @ 800VDC [kW]	BCU rated cont. braking current, I_{br} [A]	
NX_460 5 ¹⁾	1,3	276	461	492	615	CH72
NX_520 5 ¹⁾	1,3	276	461	492	615	CH72
NX_590 5 ¹⁾	1,3	276	461	492	615	CH72
NX_650 5 ¹⁾	1,3	276	461	492	615	CH72
NX_730 5 ¹⁾	1,3	276	461	492	615	CH72
NX_1370 5	1,3	276	461	492	615	CH74
NX_1640 5	1,3	276	461	492	615	CH74
NX_2060 5	1,3	276	461	492	615	CH74
NX_2300 5	1,3	276	461	492	615	CH74

NOTE: Braking power: $P_{brake} = U_{brake}^2 / R_{brake}$

NOTE: Braking DC current: $I_{in_max} = P_{brake_max} / U_{brake}$

¹⁾ Only 6 pulse drives

The internal brake chopper can also be used in motor application where 2...4 x Ch7x drives are used for a single motor, but in this case the DC connections of the power modules must be connected together. The break choppers are working independently of each other and because of this the DC connections must be connected together otherwise there can be unbalance between the power modules.

4.2.1.2 Vacon NX Liquid-Cooled Frequency Converter – Mains voltage 525–690 VAC

Table 4. Power ratings and dimensions of NX Liquid-Cooled frequency converter (6-pulse), supply voltage 525–690VAC

Mains voltage 525-690 VAC, 50/60 Hz, 3~, 6-pulse drives							
Converter type	Drive output					Power loss c/a/T*) [kW]	Chassis
	Current			Motor output power			
	Thermal I _{th} [A]	Rated contin. I _L [A]	Rated contin. I _H [A]	Optimum motor at I _{th} [525V] [kW]	Optimum motor at I _{th} [690V] [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	325	295	217	200	300	7.5/0.4/7.9	CH72
0385_6	385	350	257	250	355	9.0/0.5/9.5	CH72
0416_6	416	378	277	250	355	9.4/0.5/9.9	CH72
0460_6	460	418	307	300	400	10.0/0.5/10.5	CH72
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	820	745	547	560	800	19.0/1.0/20.0	CH74

Table 4. Power ratings and dimensions of NX Liquid-Cooled frequency converter (6-pulse), supply voltage 525–690VAC

Mains voltage 525-690 VAC, 50/60 Hz, 3~, 6-pulse drives							
0920_6	920	836	613	650	850	21.3/1.2/22.5	CH74
1030_6	1030	936	687	700	1000	22.0/1.1/23.1	CH74
1180_6	1180	1073	787	800	1100	25.0/1.3/26.3	CH74
1300_6	1300	1182	867	900	1200	31.0/1.6/32.6	CH74
1500_6	1500	1364	1000	1050	1400	38.0/1.9/39.9	CH74
1700_6	1700	1545	1133	1150	1550	38.0/1.9/39.9	CH74
1850_6	1850	1682	1233	1250	1650	39.6/2.0/41.6	2*CH74
2120_6	2120	1927	1413	1450	1900	45.0/2.4/47.4	2*CH74
2340_6	2340	2127	1560	1600	2100	55.8/2.9/58.7	2*CH74
2700_6	2700	2455	1800	1850	2450	68.4/3.4/71.8	2*CH74
3100_6	3100	2818	2066	2150	2800	68.4/3.4/71.8	2*CH74

Table 5. Power ratings and dimensions of NX Liquid-Cooled frequency converter (12-pulse), supply voltage 525–690VAC

Mains voltage 525-690 VAC, 50/60 Hz, 3~, 12-pulse drives							
Converter type	Drive output					Power loss c/a/T*) [kW]	Chassis
	Current			Motor output power			
	Thermal I _{th} [A]	Rated contin. I _L [A]	Rated contin. I _H [A]	Optimum motor at I _{th} (525V) [kW]	Optimum motor at I _{th} (690V) [kW]		
0325_6	325	295	217	200	250	7.5/0.4/7.9	CH72
0385_6	385	350	257	250	355	9.0/0.5/9.5	CH72
0416_6	416	378	277	250	355	9.4/0.5/9.9	CH72
0460_6	460	418	307	315	400	10.0/0.5/10.5	CH72
0502_6	502	456	335	355	450	12.0/0.6/12.6	CH72
0820_6	820	745	547	600	750	19.0/1.0/20.0	CH74
0920_6	920	836	613	650	850	21.3/1.2/22.5	CH74
1030_6	1030	936	687	750	950	22.0/1.1/23.1	CH74
1180_6	1180	1073	787	800	1100	25.0/1.3/26.3	CH74
1300_6	1300	1182	867	950	1200	31.0/1.6/32.6	CH74
1500_6	1500	1364	1000	1050	1400	38.0/1.9/39.9	CH74
1850_6	1850	1682	1233	1250	1650	39.6/2.0/41.6	2*CH74
2120_6	2120	1927	1413	1450	1900	45.0/2.4/47.4	2*CH74
2340_6	2340	2127	1560	1600	2100	55.8/2.9/58.7	2*CH74
2700_6	2700	2455	1800	1850	2450	68.4/3.4/71.8	2*CH74
3100_6	3100	2818	2067	2150	2800	68.4/3.4/71.8	2*CH74

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 load variation

I_L = Low overloadability current. Allows +10% load variation. 10% exceeding can be continuous.

I_H = High overloadability current. Allows +50% load variation. 50% exceeding can be continuous.

All values with $\cos\phi = 0,83$ 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 ClosedLoop control mode. All power losses are worst case losses.

If some other mains voltage is used, apply the formula $P = \sqrt{3} \times U_n \times I_n \times \cos\phi \times \text{eff}\%$ to calculate the NX Liquid-Cooled drive output power.

The enclosure class for all NX Liquid-Cooled frequency converters is IP00.

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, i.e. maximum $I_H = 0.66 \times I_{th}$ 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 high starting torque.

Table 6. Internal brake chopper unit (BCU) ratings, braking voltage 840-1100VDC

Internal brake chopper ratings, braking voltage 840-1100 Vdc						
Converter Type	Loadability	Braking capacity @ 840 Vdc		Braking capacity @ 1100 Vdc		Chassis
	Rated min resistance [Ω]	Rated cont. braking power [kW]	BCU rated cont. braking current, I_{br} [A]	Rated cont. braking power [kW]	BCU rated cont. braking current, I_{br} [A]	
NX_325 6 ¹⁾	2,8	252	300	432	392	Ch72
NX_385 6 ¹⁾	2,8	252	300	432	392	Ch72
NX_416 6 ¹⁾	2,8	252	300	432	392	Ch72
NX_460 6 ¹⁾	2,8	252	300	432	392	Ch72
NX_502 6 ¹⁾	2,8	252	300	432	392	Ch72
NX_820 6	2,8	252	300	432	392	Ch74
NX_920 6	2,8	252	300	432	392	Ch74
NX_1030 6	2,8	252	300	432	392	Ch74
NX_1180 6	2,8	252	300	432	392	Ch74
NX_1300 6	2,8	252	300	432	392	Ch74
NX_1500 6	2,8	252	300	432	392	Ch74

NOTE: Braking power: $P_{brake} = U_{brake}^2 / R_{brake}$

NOTE: Braking DC current: $I_{in_max} = P_{brake_max} / U_{brake}$

¹⁾ Only 6 pulse drives

The internal brake chopper can also be used in motor application where 2...4 x Ch7x drives are used for a single motor, but in this case the DC connections of the power modules must be connected together. The break choppers are working independently of each other and because of this the DC connections must be connected together otherwise there can be unbalance between the power modules.

4.2.2 INVERTER UNITS

4.2.2.1 Vacon NX Liquid-Cooled Inverter Unit – Mains voltage 465–800 VDC

Table 7. Power ratings and dimensions of NX Liquid-Cooled inverter unit, supply voltage 540–675VDC

Mains voltage 465-800 VDC							
Converter type	Drive output					Power loss c/a/T*) [kW]	Chassis
	Current			Motor output power			
	Thermal I _{th} [A]	Rated cont. I _L [A]	Rated cont. I _H [A]	Optimum motor at I _{th} (540VDC) [kW]	Optimum motor at I _{th} (675VDC) [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	1250	1500	29,6/1,7/31,3	CH64
2470_5	2470	2245	1647	1300	1600	36,0/2,0/38,0	2*CH64
2950_5	2950	2681	1967	1550	1950	39,0/2,4/41,4	2*CH64
3710_5	3710	3372	2473	1950	2450	48,0/2,7/50,7	2*CH64
4140_5	4140	3763	2760	2150	2700	53,0/3,0/56,0	2*CH64

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 load variation

I_L = Low overloadability current. Allows +10% load variation. 10% exceeding can be continuous.

I_H = High overloadability current. Allows +50% load variation. 50% exceeding can be continuous.

All values with $\cos\phi = 0,83$ and efficiency = 97%

*) c = power loss into coolant; a = power loss into air; T = total power loss

All power losses obtained using max. supply voltage, I_{th} and switching frequency of 3.6 kHz and ClosedLoop control mode. All power losses are worst case losses.

If some other mains voltage is used, apply the formula $DC P = (U_{DC}/1.35) * \sqrt{3} * I_n * \cos\phi * eff\%$ to calculate the NX Liquid-Cooled drive electrical output power.

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, i.e. maximum $I_H = 0.66 * I_{th}$ 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 high starting torque.

The voltage classes for the inverter units used in the tables above have been defined as follows:

Input 540VDC = Rectified 400VAC supply

Input 675VDC = Rectified 500VAC supply

The enclosure class of all inverter units is IP00. For more information, see chapter 10.

4.2.2.2 Vacon NX Liquid-Cooled Inverter Unit – Mains voltage 640–1100 VDC

Table 8. Power ratings and dimensions of NX Liquid-Cooled inverter unit, supply voltage 710–930VDC

Mains voltage 640-1100 VDC							
Inverter type	Drive output					Power loss c/a/T*) [kW]	Chassis
	Current			Motor output power			
	Thermal I _{th} [A]	Rated cont. I _L [A]	Rated cont. I _H [A]	Optimum motor at I _{th} (710VDC) [kW]	Optimum motor at I _{th} (930VDC) [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	2*CH64
2120_6	2120	1927	1413	1450	1900	37,8/2,0/39,8	2*CH64
2340_6	2340	2127	1560	1600	2100	48,6/2,5/51,1	2*CH64
2700_6	2700	2455	1800	1850	2450	57,6/3,0/60,6	2*CH64
3100_6	3100	2818	2066	2150	2800	68,4/3,4/71,8	2*CH64

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 load variation

I_L = Low overloadability current. Allows +10% load variation. 10% exceeding can be continuous.

I_H = High overloadability current. Allows +50% load variation. 50% exceeding can be continuous.

All values with $\cos\varphi = 0,83$ and efficiency = 97%

*) c = power loss into coolant; a = power loss into air; T = total power loss

All power losses obtained using max. supply voltage, I_{th} and switching frequency of 3.6 kHz and ClosedLoop control mode. All power losses are worst case losses.

If some other mains voltage is used, apply the formula $DC P = (U_{DC}/1.35) * \sqrt{3} * I_n * \cos\varphi * eff\%$ to calculate the NX Liquid-Cooled drive output power.

The voltage classes for the inverter units used in the tables above have been defined as follows:

Input 710VDC = Rectified 525VAC supply

Input 930VDC = Rectified 690VAC supply

The enclosure class of all inverter units is IP00.

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, i.e. maximum $I_H = 0.66 * I_{th}$ 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 high starting torque.

For more information, see chapter 10.

4.3 TECHNICAL DATA

Table 9. Technical data

Mains connection	Input voltage U_{in}	400...500VAC; 525...690VAC; (-10%...+10%) 465...800VDC; 640...1100VDC (-0%...+0%)	
	Input frequency	45...66 Hz	
	Connection to mains	Once per minute or less	
	DC bank capacitance	Voltage class 500V: Voltage class 690V:	Ch3 (16-31A units): 410 μ F Ch3 (38-61A units): 600 μ F CH4: 2400 μ F CH5: 7200 μ F CH61: 10800 μ F CH62/CH72: 10800 μ F CH63: 21600 μ F CH64/CH74: 32400 μ F 2*CH64/2*CH74: 64800 μ F CH61: 4800 μ F CH62/CH72: 4800 μ F CH63: 9600 μ F CH64/CH74: 14400 μ F 2*CH64/2*CH74: 28800 μ F
Motor connection	Output voltage	0— U_{in}	
	Continuous output current	Rated current at nominal inflow cooling water temperature according to dimensioning charts	
	Output frequency	0...320 Hz (standard); 7200 Hz (Special software)	
	Frequency resolution	Application dependent	
Control characteristics	Control method	Frequency control U/f Open Loop Sensorless Vector Control Closed Loop Vector Control	
	Switching frequency (see parameter 2.6.9)	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 Note! Derating required if higher switching frequency than the default is used!	
	Frequency reference		
	Analogue input	Resolution 0.1% (10-bit), accuracy $\pm 1\%$	
	Panel reference	Resolution 0.01 Hz	
	Field weakening point	8...320 Hz	
	Acceleration time	0.1...3000 sec	
	Deceleration time	0.1...3000 sec	
	Braking torque	DC brake: 30% * T_N (without brake option)	

Table 9. Technical data

Ambient conditions	Ambient operating temperature	–10°C (no frost)...+50°C (at I_{th}) The NX liquid cooled drives must be used in an heated indoor controlled environment
	Installation temperature	0...+70°C
	Storage temperature	–40°C...+70°C; No liquid in heatsink under 0°C
	Relative humidity	5 to 96% RH, non-condensing, no dripping water
	Air quality: • chemical vapours • mechanical particles	IEC 60721-3-3, unit in operation, class 3C2 IEC 60721-3-3, unit in operation, class 3S2 (no conductive dust allowed) No corrosive gases
	Altitude	NX_5 (380...500 V): max. 3000 m (in case network is not corner grounded) NX_6: max. 2000 m. For further requirements, contact factory 100-% load capacity (no derating) up to 1,000 m; above 1,000 m derating of maximum ambient operating temperature by 0,5°C per each 100 m is required
	Vibration EN50178/EN60068-2-6	5...150Hz 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)
EMC	Enclosure class	IP00/Open Frame standard in entire kW/HP range
	Immunity	Fulfil all EMC immunity requirements
	Emissions	EMC level N for TN/TT networks EMC level T for IT networks
Safety		EN50178, EN61800-5-1, CE, UL, CUL, GOST R, (see unit nameplate for more detailed approvals)
	Safe Torque Off (STO) board	The drive is equipped with Vacon OPTAF board for prevention of torque on motor shaft. Standards: prEN ISO 13849-1 (2004), EN ISO 13849-2 (2003), EN 60079-14 (1997), EN 954-1 (1996), cat. 3 (hardware disable); IEC 61508-3(2001), prEN 50495 (2006). See Vacon manual ud01066 for detailed information.

Table 9. Technical data

Control connections (apply to boards OPT-A1, OPT-A2 and OPT-A3)	Analogue input voltage	0...+10V, $R_i = 200k\Omega$, (–10V...+10V joystick control) Resolution 0.1%, accuracy $\pm 1\%$
	Analogue input current	0(4)...20 mA, $R_i = 250\Omega$ differential
	Digital inputs (6)	Positive or negative logic; 18...24VDC
	Auxiliary voltage	+24V, $\pm 10\%$, max volt. ripple < 100mVrms; max. 250mA Dimensioning: max. 1000mA/control box 1A external fuse required (no internal short-circuit protection on the control board)
	Output reference voltage	+10V, +3%, max. load 10mA
	Analogue output	0(4)...20mA; R_L max. 500 Ω ; Resolution 10 bit; Accuracy $\pm 2\%$
	Digital outputs	Open collector output, 50mA/48V
	Relay outputs	2 programmable change-over relay outputs Switching capacity: 24VDC/8A, 250VAC/8A, 125VDC/0.4A Min. switching load: 5V/10mA
Protections	Overvoltage trip limit Undervoltage trip limit	NX_5: 911V; NX_6 (CH62, CH63 & CH64): 1258V; NX_6 (Other chassis): 1200V (all VDC) NX_5: 333V; NX_6: 461V (all VDC)
	Earth fault protection	In case of earth fault in motor or motor cable, only the frequency converter is protected
	Mains supervision	Trips if any of the input phases is missing (frequency converters only)
	Motor phase supervision	Trips if any of the output phases is missing
	Unit overtemperature protection	Alarm limit: 65°C (heatsink); 70°C (circuit boards) Trip limit: 70°C (heatsink); 85°C (circuit boards)
	Overcurrent protection	Yes
	Motor overload protection	Yes
	Motor stall protection	Yes
	Motor underload protection	Yes
	Short-circuit protection of +24V and +10V reference voltages	Yes

Table 9. Technical data

Liquid cooling	Allowed cooling agents	Drinking water (see specification on page 49) Water-glycol mixture See derating specifications, chapter 5.3
	Volume	See page 51.
	Temperature of cooling agent	0...35°C (I_{th})(input); 35...55°C: derating required, see Chapter 5.3 Max. temperature rise during circulation max. 5°C No condensation allowed. See Chapter 5.2.1.
	Cooling agent flow rates	See Table 15.
	System max. working pressure	6 bar
	System max. peak pressure	40 bar
	Pressure loss (at nom. flow)	Varies according to size. See Table 16.

5. INSTALLATION

5.1 MOUNTING

Vacon NX Liquid-Cooled Drive modules must be installed into an enclosure. The drives consisting of one module will be mounted on the mounting plate. The drives that include two or three modules are mounted inside a mounting bracket (see) which will then be installed in the enclosure.

NOTE: If any other than vertical installation position is required, please contact your distributor!

NOTE: The allowed installation temperature is 0...+70°C.

In chapter 5.1.2 you will find the dimensions of Vacon NX Liquid-Cooled drives installed on mounting bases (plates and brackets).

5.1.1 LIFTING THE DRIVE

We recommend you to always use a jib crane or similar elevating device to lift the frequency converter/ inverter unit. See figures below for correct lifting points.

For units with no mounting bracket (see chapter 5.1.2.2), the best place for hoisting is the hole(s) in the middle of the mounting plate (Lifting point 1). Vacon NX Liquid-Cooled drives consisting of several modules can the most safely and easily be lifted by the holes in the mounting bracket (Lifting point 2) using a screw pin shackle. Pay also attention to the recommended dimensions of the hoisting belt and the beam. See Figure 3.

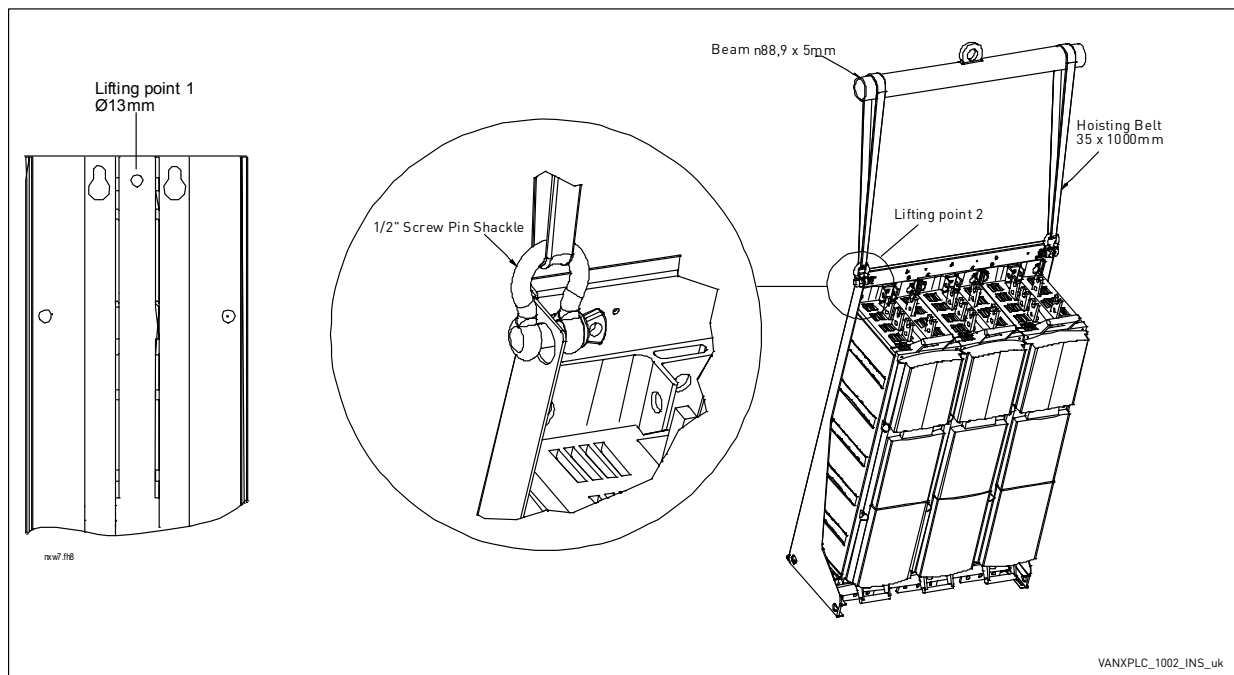


Figure 1. Lifting points for drives consisting of one module (left) and several modules

In cabinet installation, the hoisting procedure described above right may, however, become difficult or even impossible if the cabinet width does not allow the use of the screw pin shackle in Lifting point 2 (see above).

In such case, follow the lifting procedure described in Figure 4. The mounting becomes easier and safer if the drive can be laid on a *supporting girder* fixed on the cabinet frame. We also recommend to use an *aligning stud* to guarantee an easy and safe mounting.

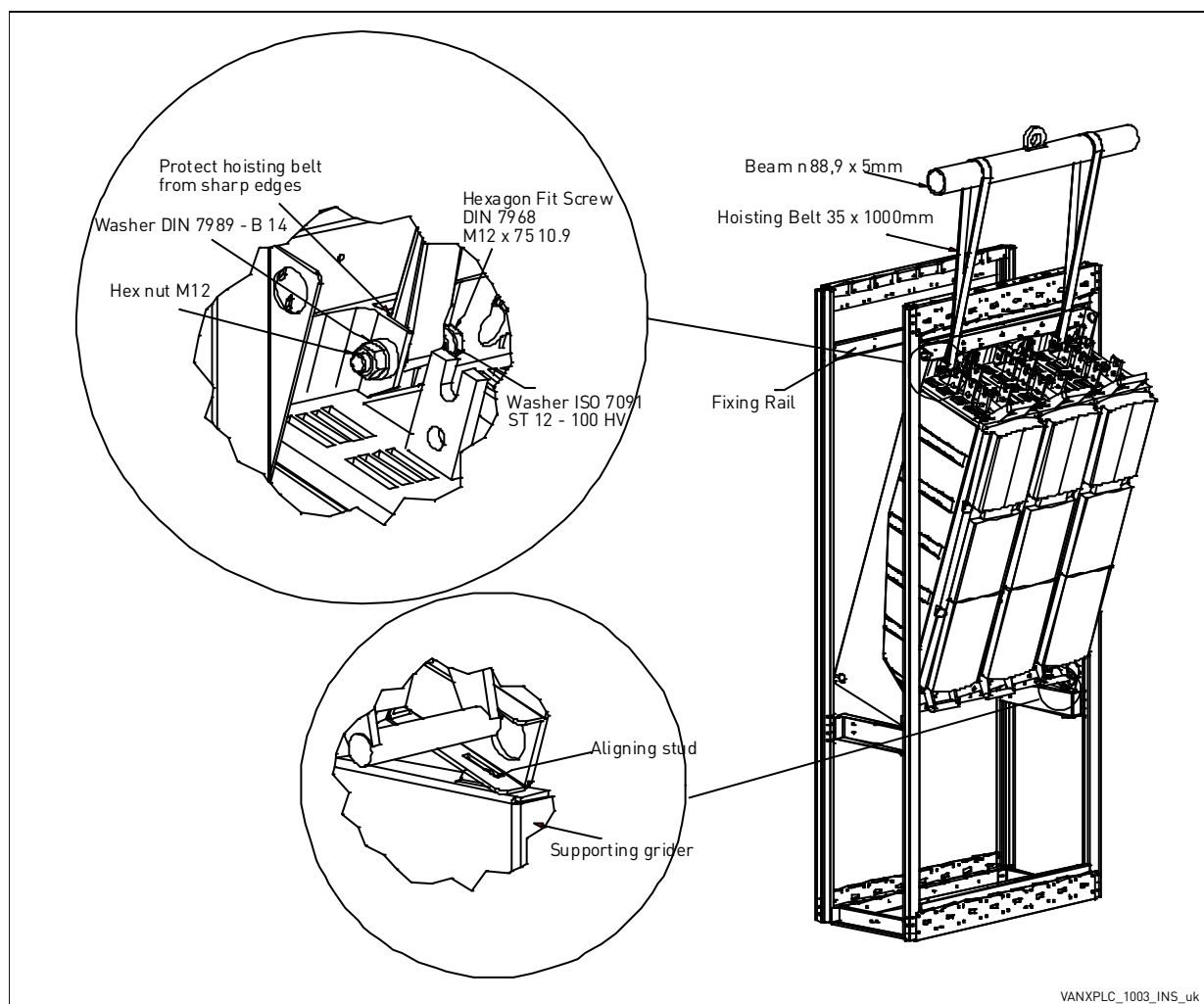


Figure 2. Lifting of drive into a narrow mounting space

To additionally stabilize the cabinet with the drive, we recommend to mount a fixing rail on the back of the cabinet, to which the top of the drive can be fastened with 5 or 6 M5 screws. The cut-out is compatible with Rittal or Veda cabinets. Also secure the drive with M8 nuts and studs to the supporting girder. See Figure 4 and Figure 5.

The NX liquid cooled drives are equipped with plastic handles and these handles can be used to lift drives consisting of one power module (CH61, CH62, & CH72). Recommended lifting point is mounting plate shown in Figure 3.

Note: A drive that includes two or three modules (CH63, CH64, & CH74) shall not and is never allowed to be lifted from one plastic handle. Recommended lifting procedure for these units are as described in Figure 3 and Figure 4.

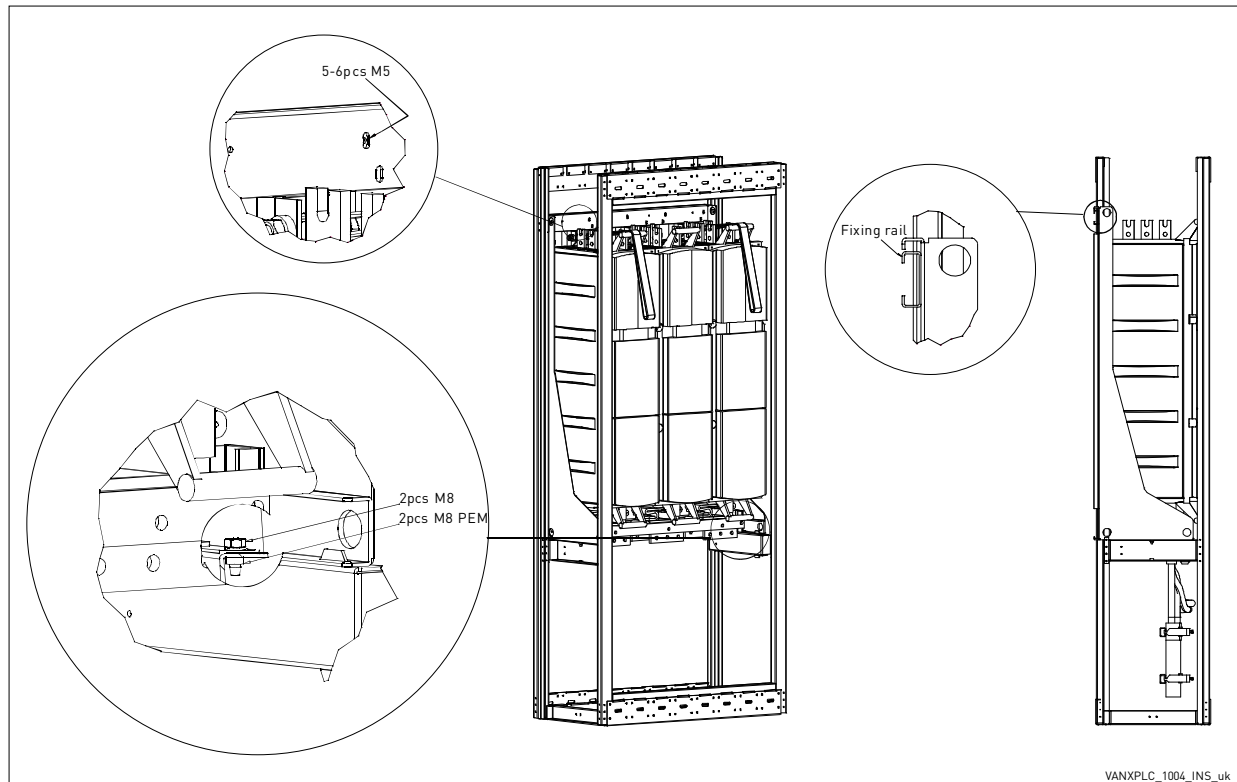


Figure 3. Securing the drive to the cabinet frame

5.1.2 NX LIQUID-COOLED DIMENSIONS

5.1.2.1 *Drives consisting of one module*

Table 1. One-module drive dimensions (mounting base included)

Chassis	Width	Height	Depth	Weight*
CH3	160	431	246	15
CH4	193	493	257	22
CH5	246	553	264	40
CH61/62	246	658	372	55
CH72	246	1076	372	90

*. AC choke excluded.

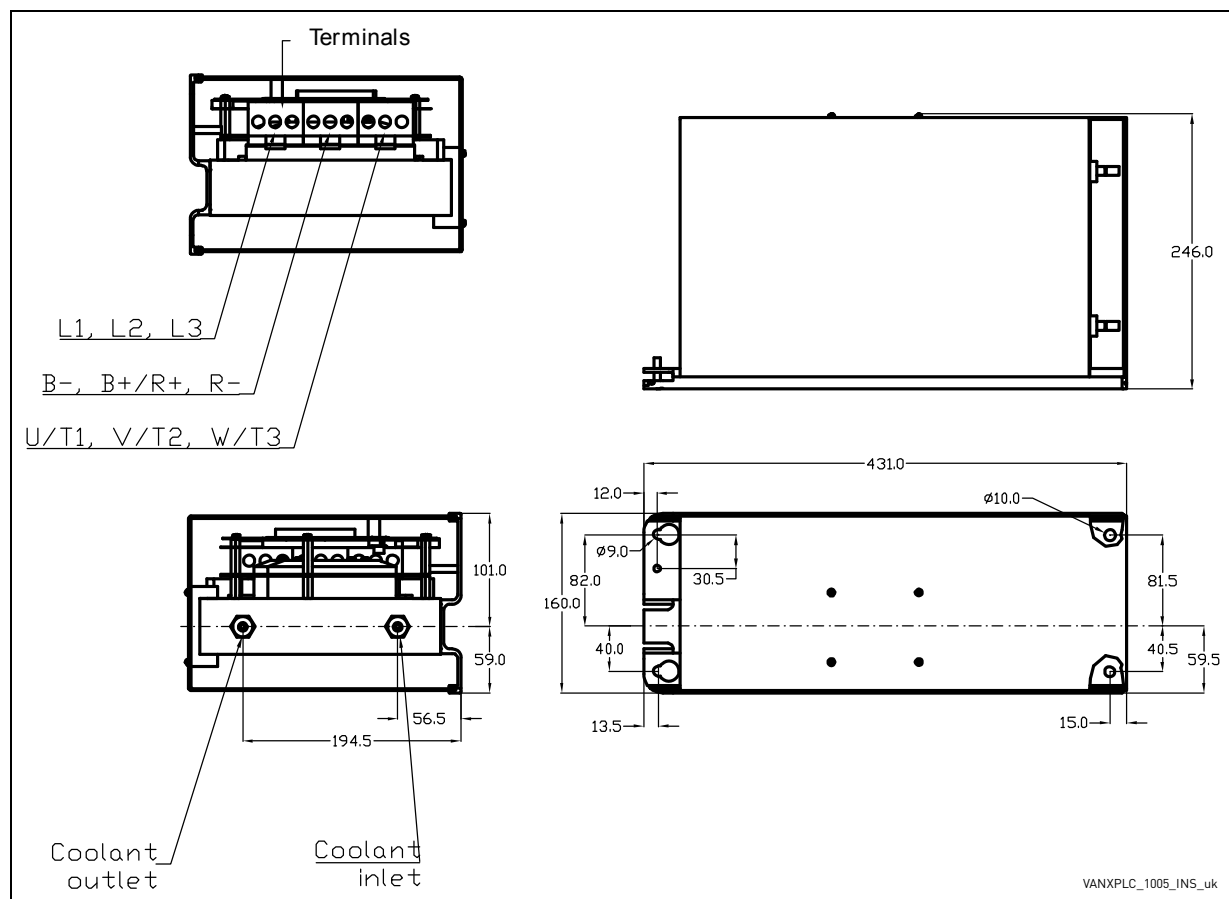


Figure 4. Vacon NX Liquid-Cooled drive dimensions, CH3

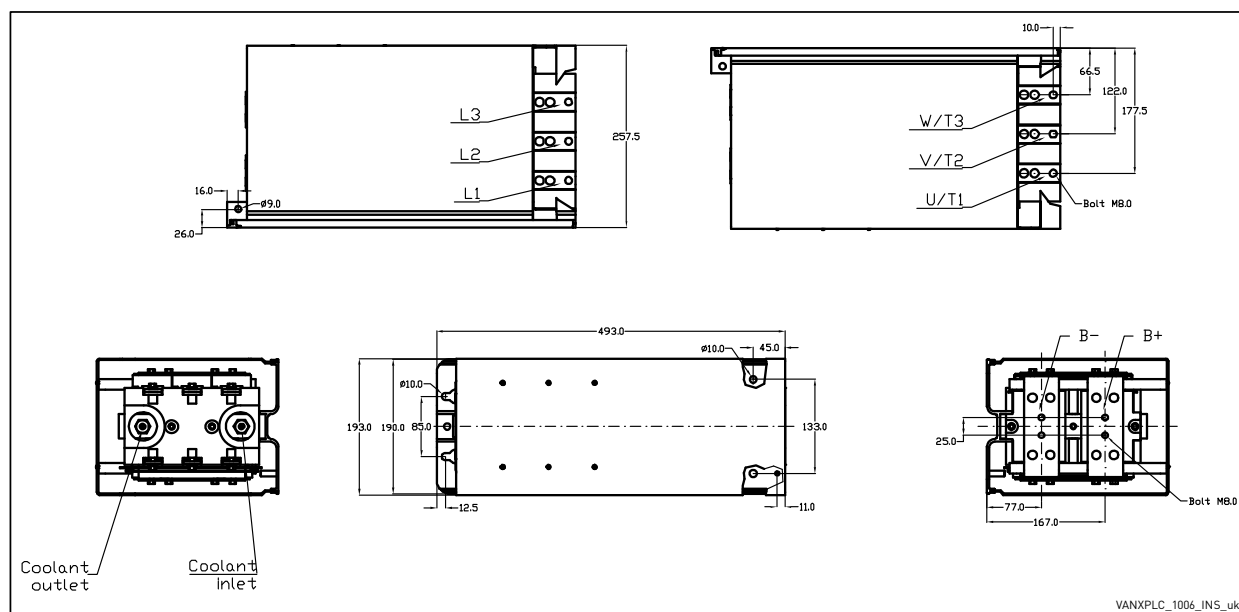


Figure 5. Vacon NX Liquid-Cooled drive dimensions (frequency converter), CH4

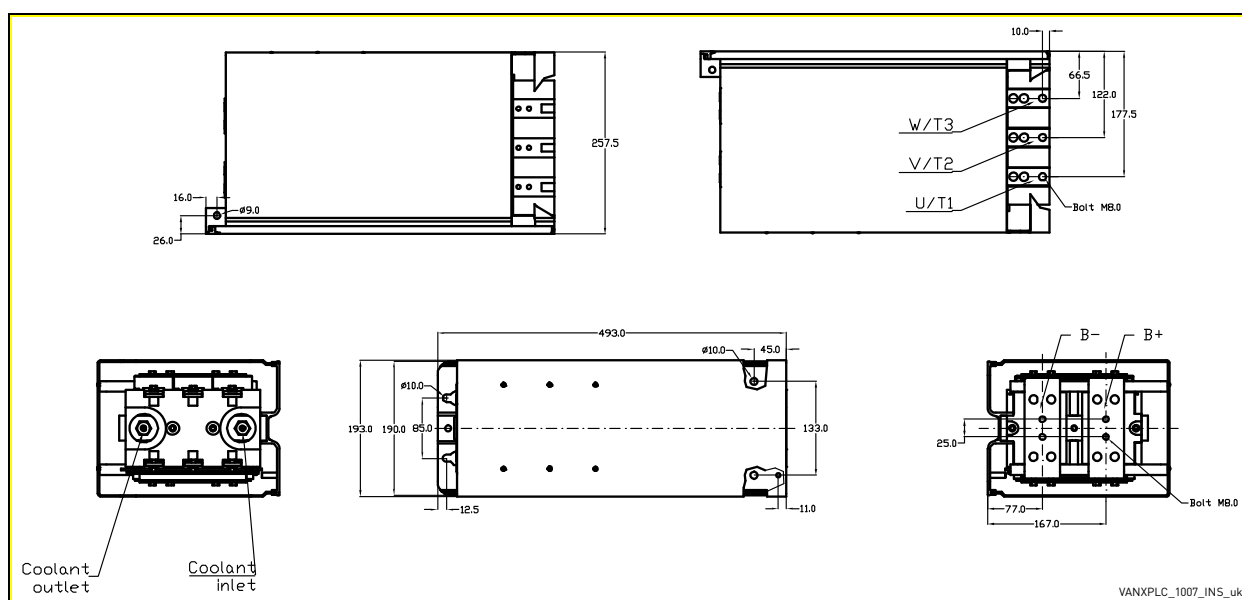


Figure 6. Vacon NX Liquid-Cooled drive dimensions (inverter), CH4

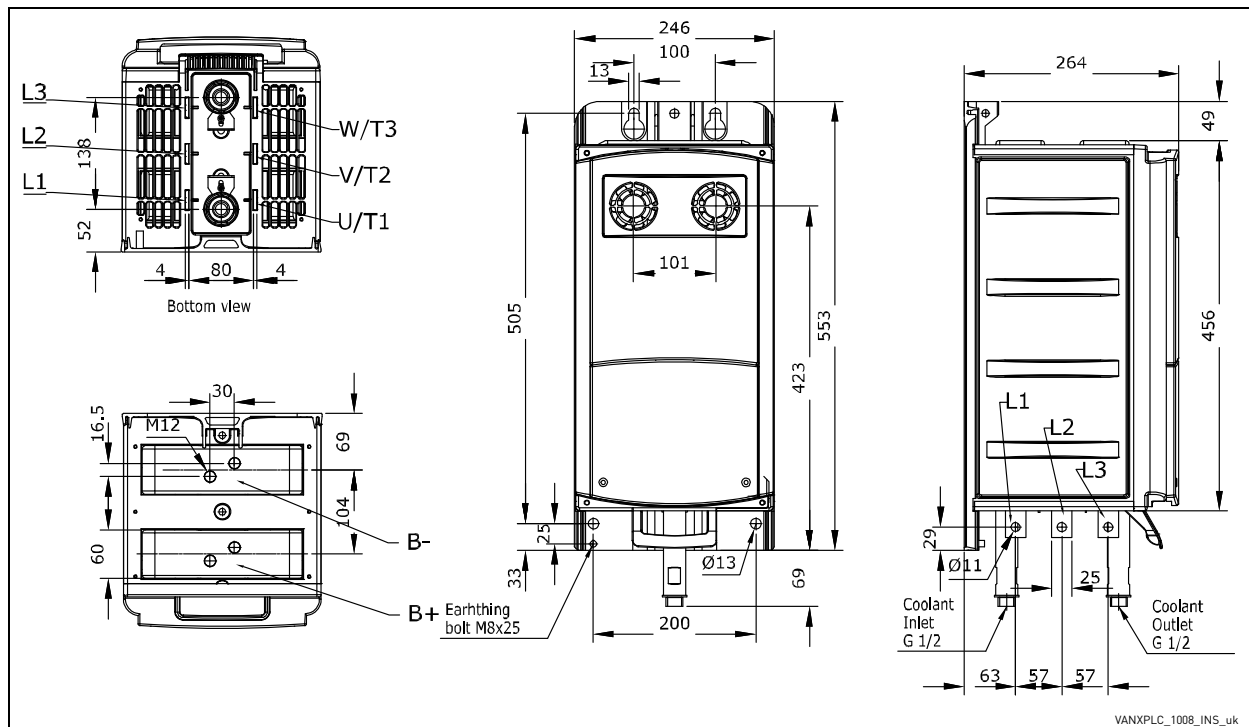


Figure 7. Vacon NX Liquid-Cooled dimensions, CH5 frequency converter

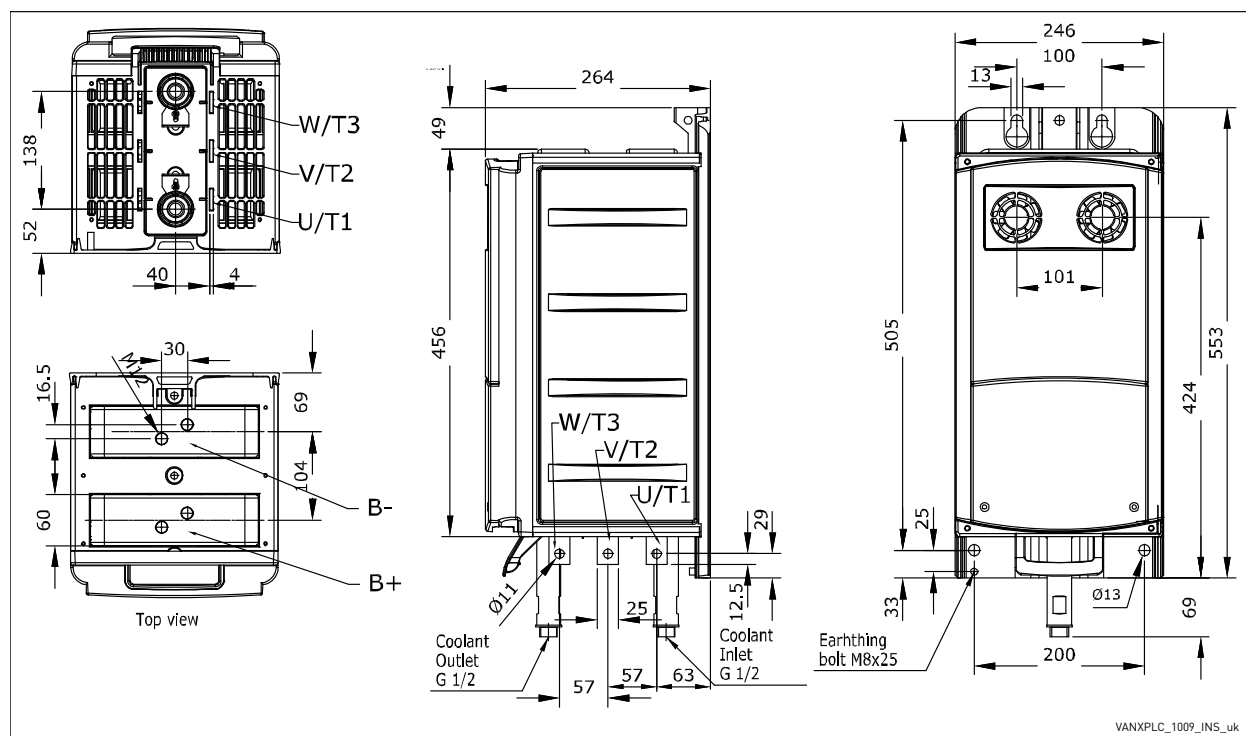
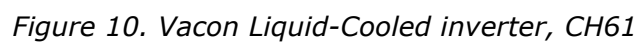


Figure 8. Vacon NX Liquid-Cooled dimensions, CH5 inverter



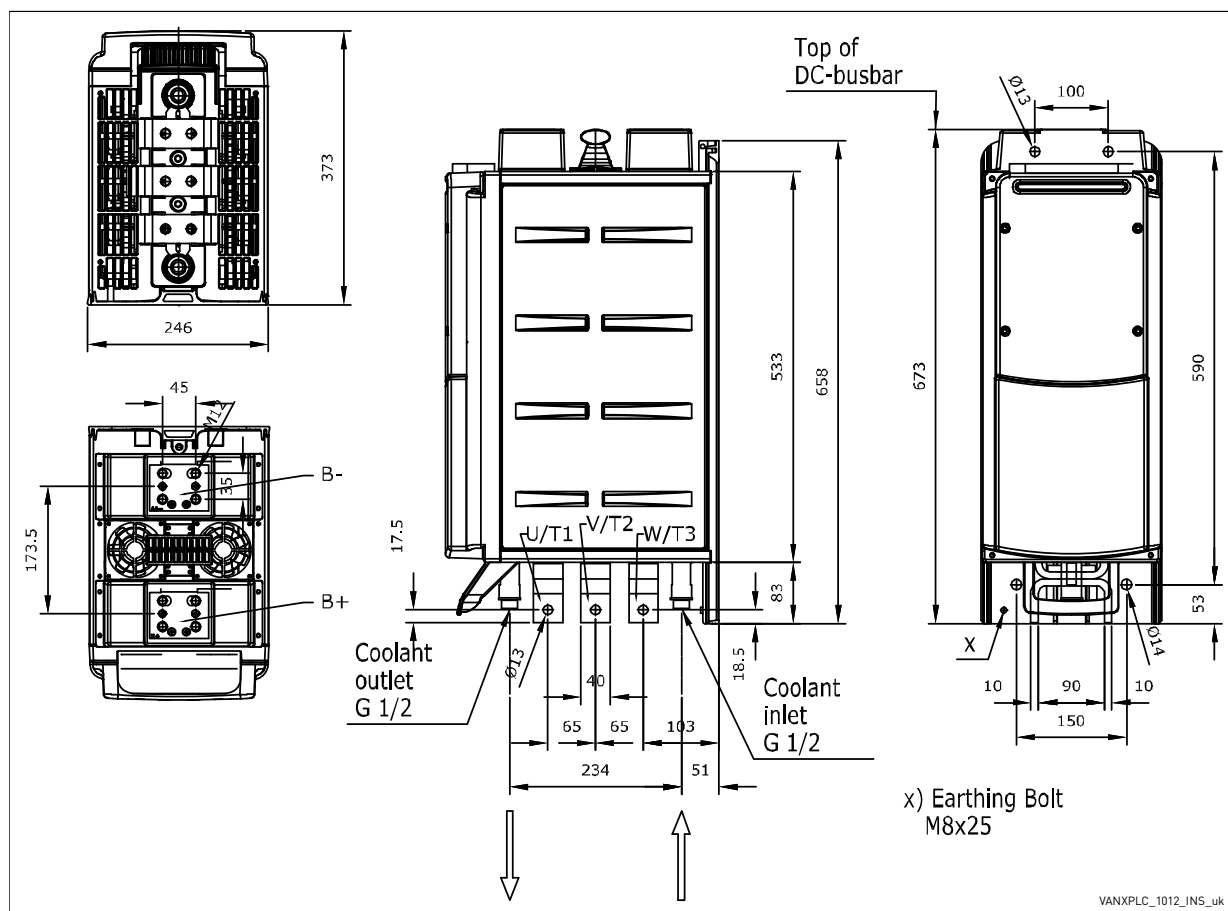


Figure 11. Vacon Liquid-Cooled inverter, CH62

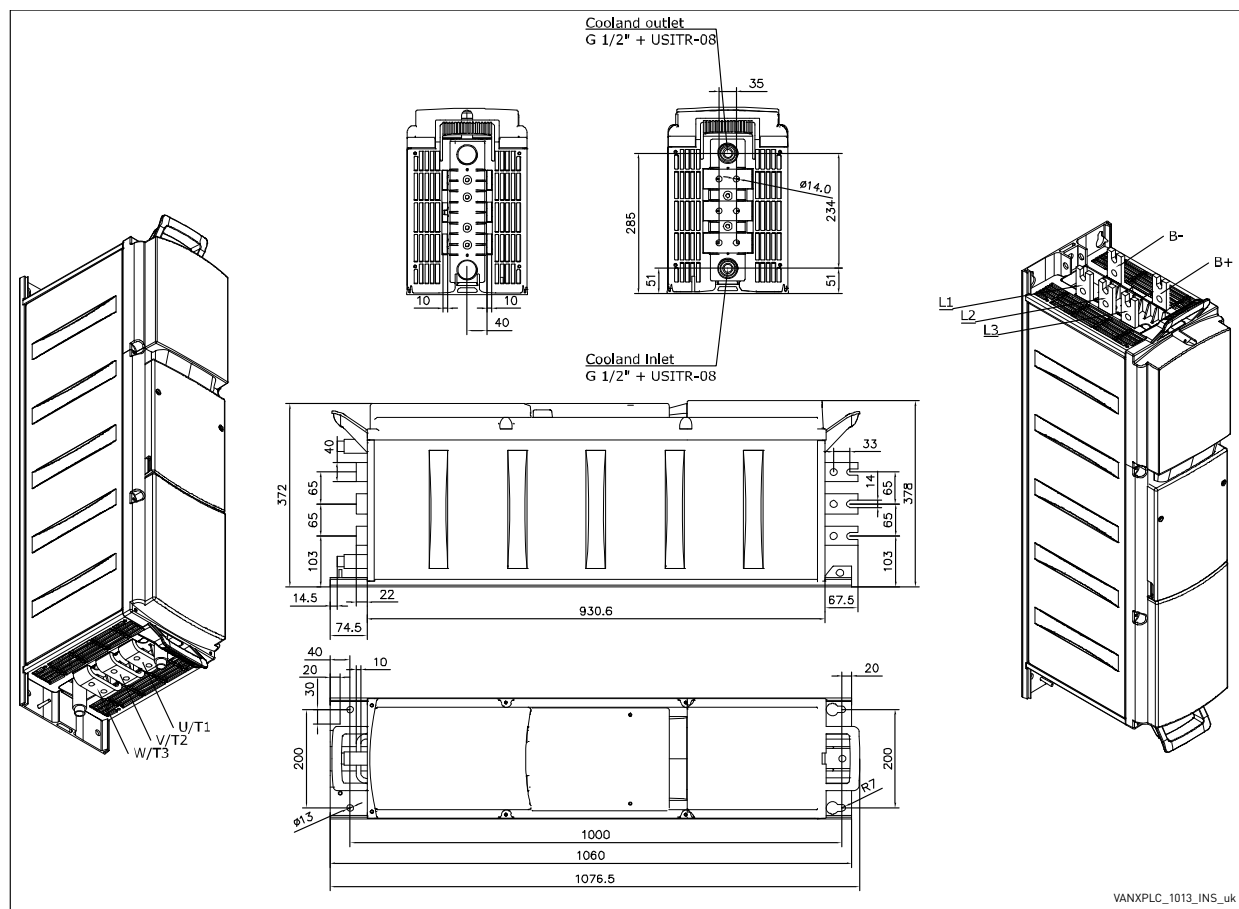


Figure 12. Vacon Liquid-Cooled frequency converter (6-pulse), CH72

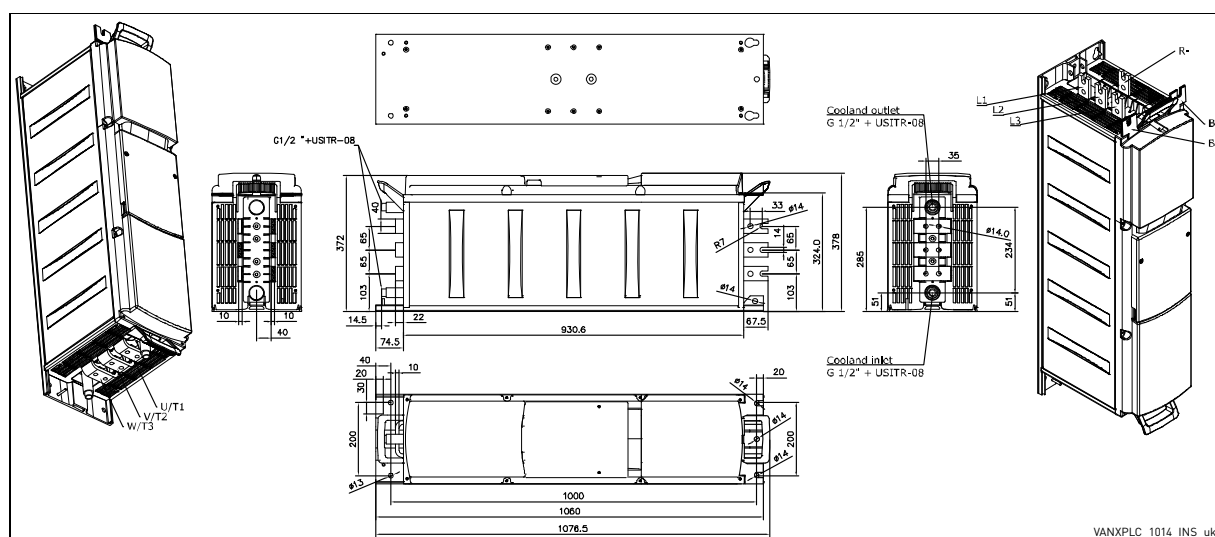


Figure 13. Vacon Liquid-Cooled frequency converter (6-pulse) with internal brake chopper

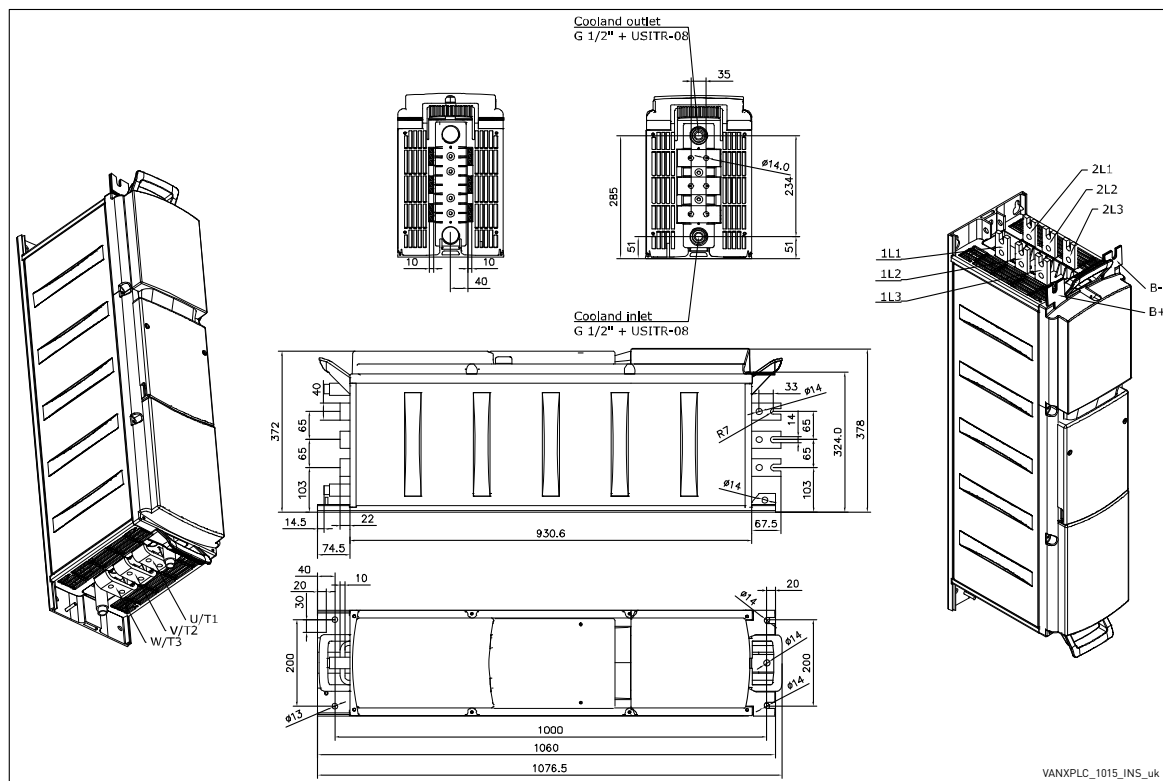
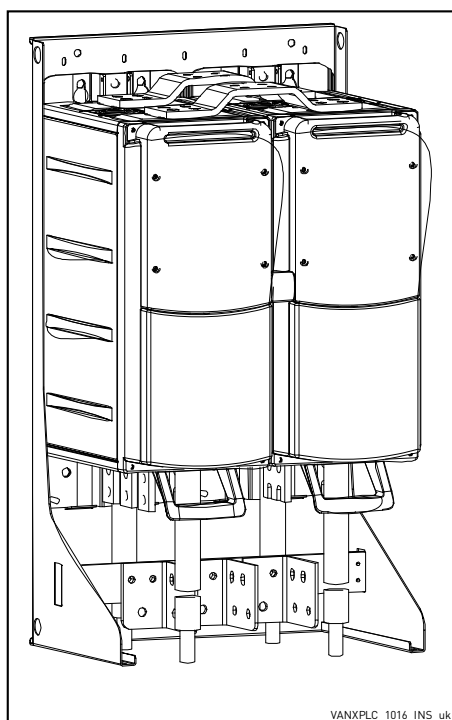


Figure 14. Vacon Liquid-Cooled frequency converter (12-pulse), CH72

5.1.2.2 Drives consisting of several modules

Vacon NX Liquid-Cooled drives consisting of several modules are mounted in a mounting bracket as presented in Figure 17.



*Table 2. Several-module drive dimensions
(mounting bracket incl.)*

Chassis	Width	Height	Depth	Weight
CH63	505	924	375	120
CH64	746	924	375	180
CH74	746	1175	385	280

Figure 15. Drive mounted inside mounting bracket

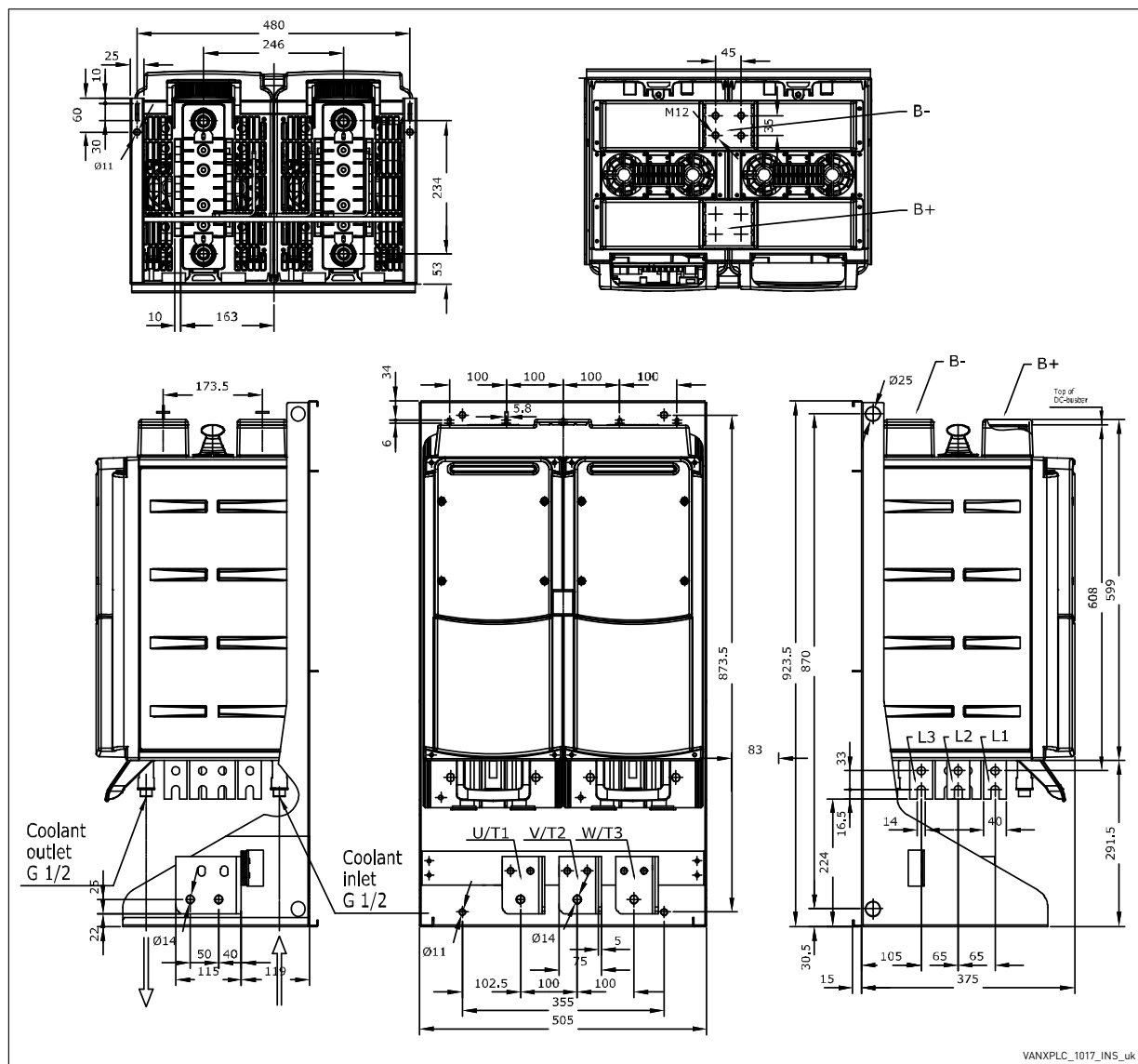
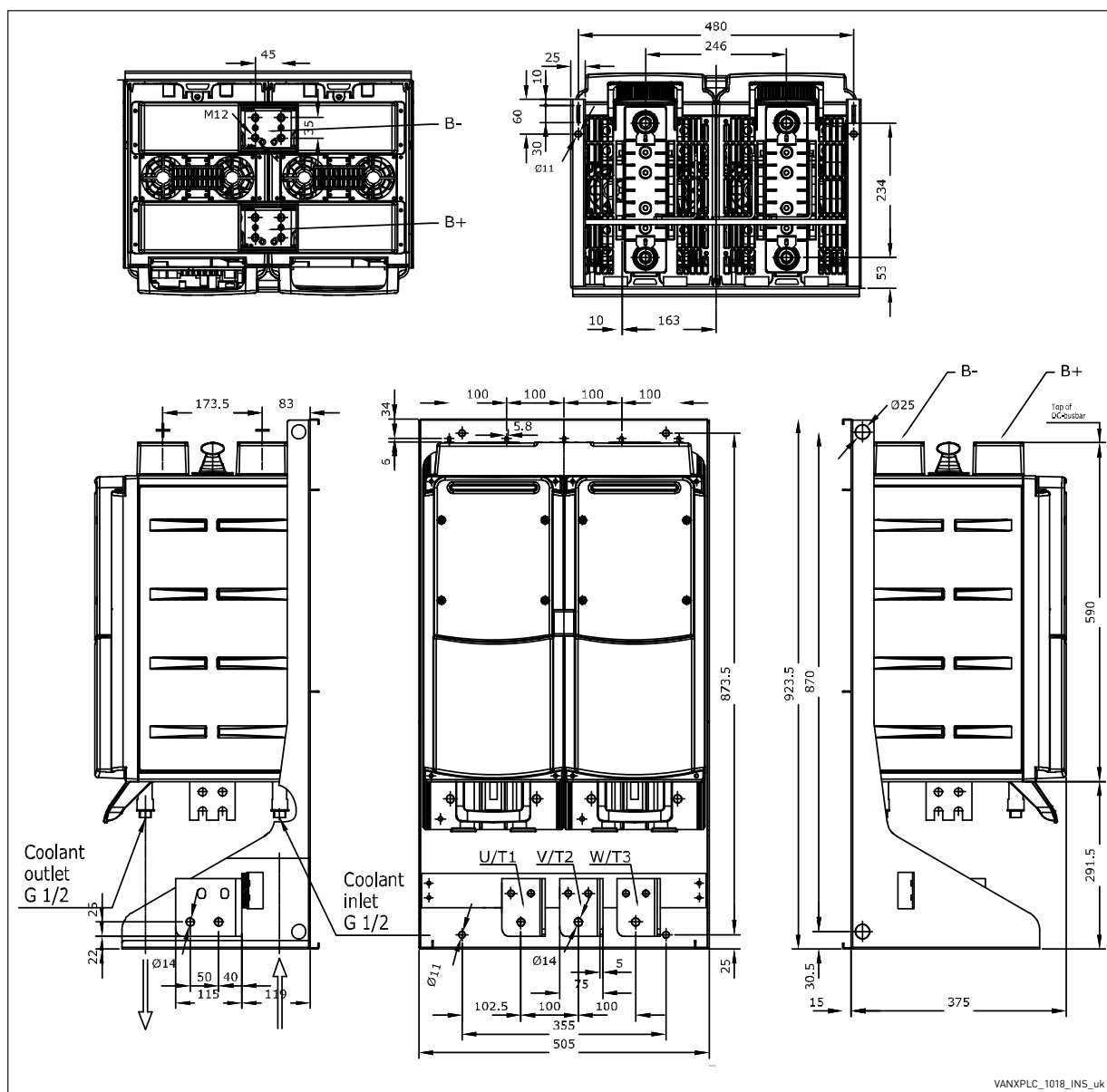


Figure 16. Vacon Liquid-Cooled frequency converter with mounting bracket, CH63



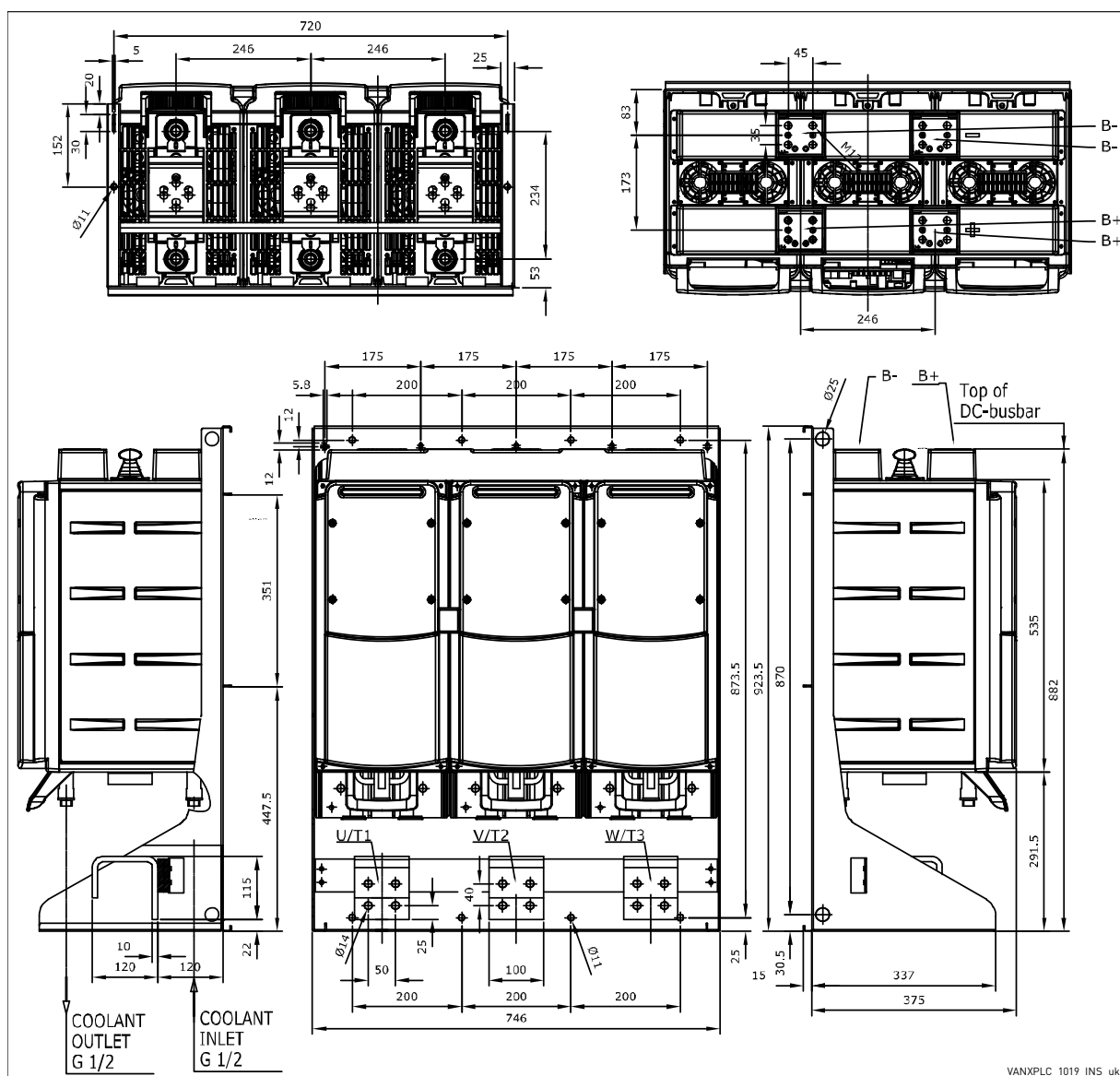


Figure 18. Vacon NX Liquid-Cooled inverter dimensions, CH64, IP00

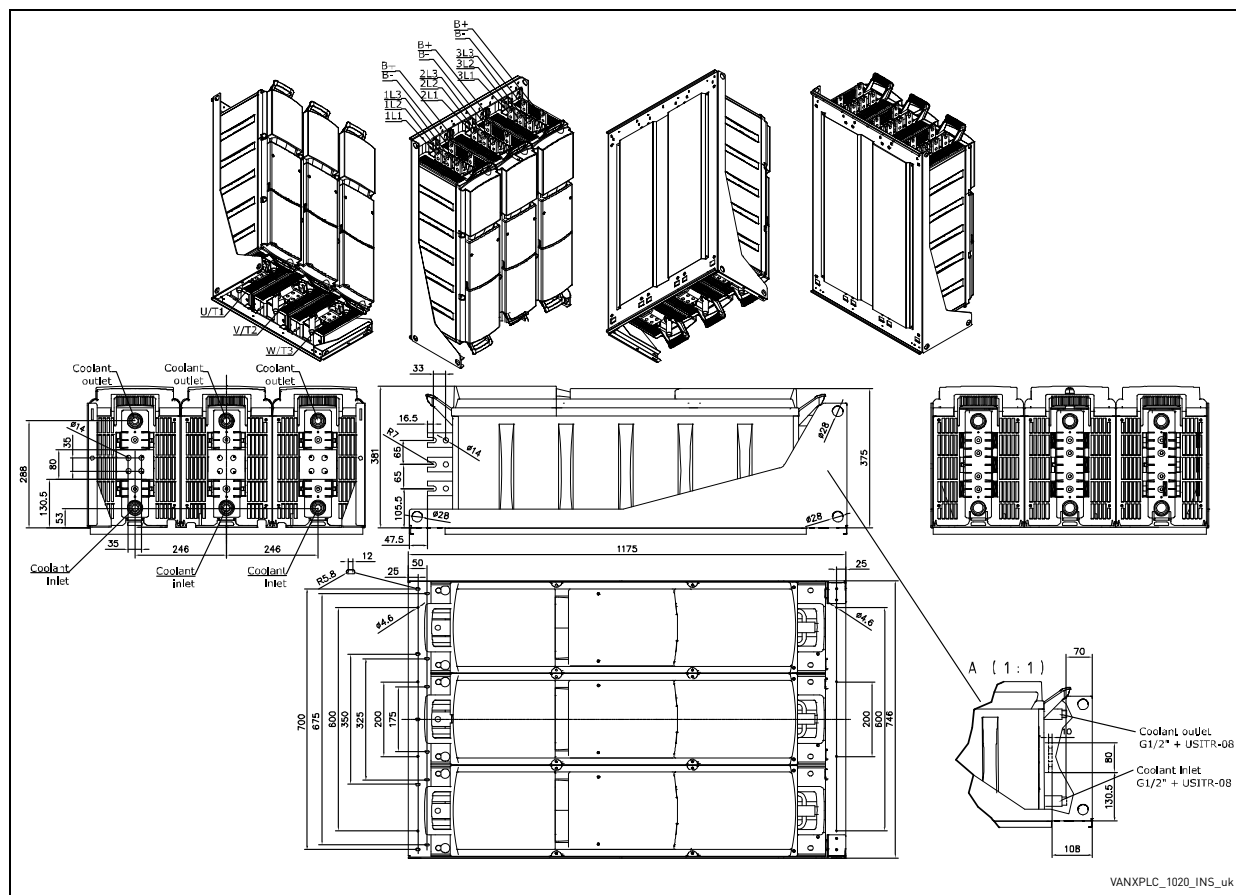


Figure 19. Vacon NX Liquid-Cooled frequency converter (6-pulse) dimensions, CH74, IP00

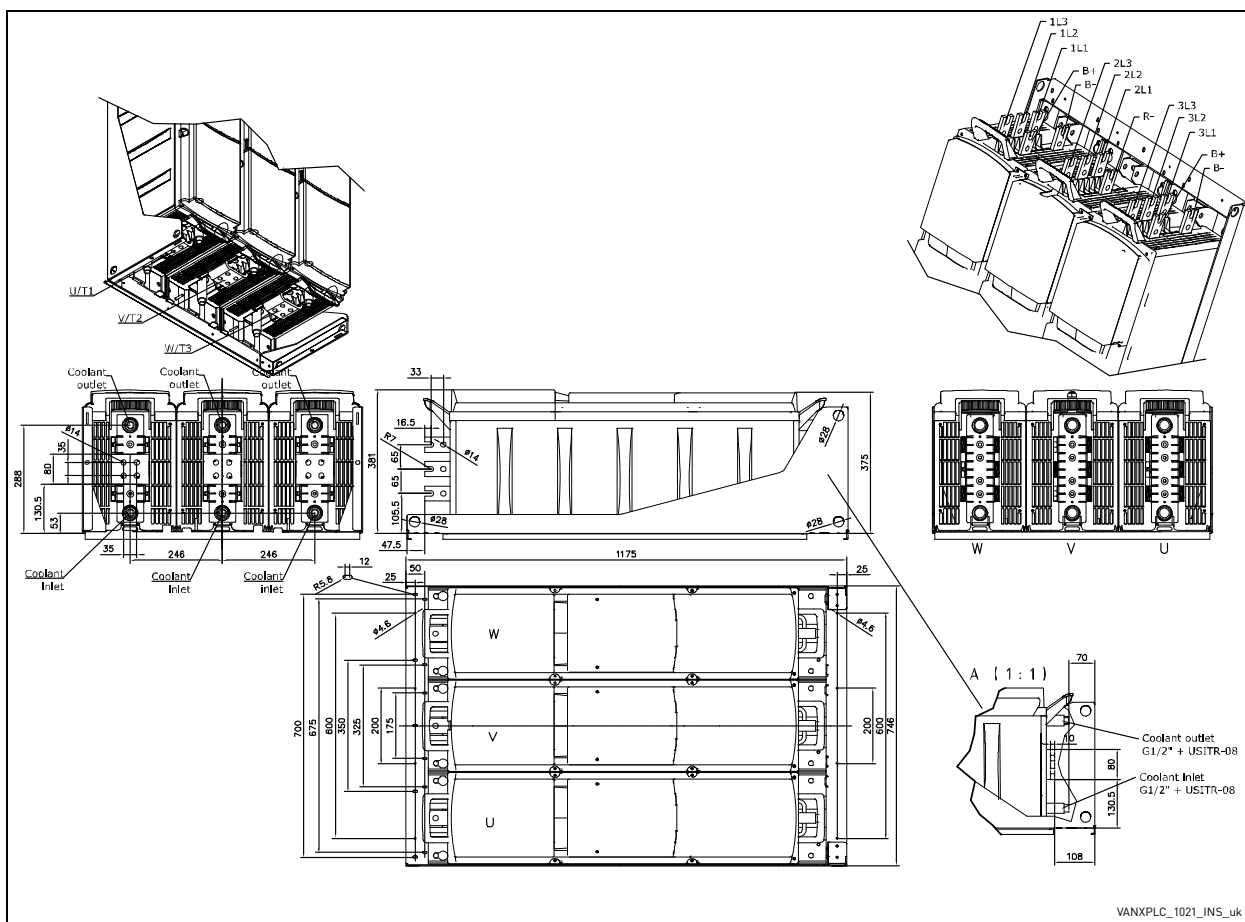


Figure 20. Vacon NX Liquid-Cooled frequency converter (6-pulse) with internal brake chopper dimensions, CH74, IP00

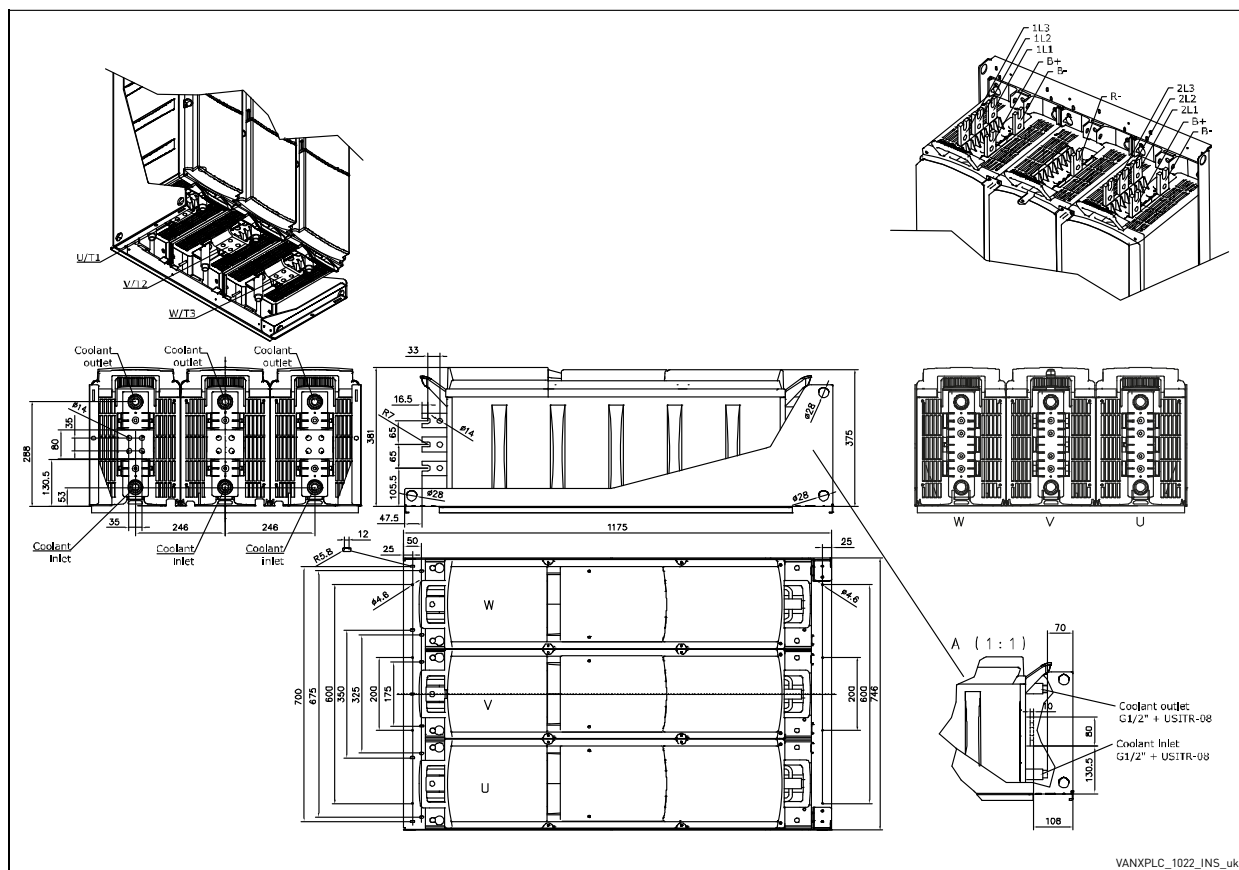


Figure 21. Vacon NX Liquid-Cooled frequency converter (12-pulse) with internal brake chopper dimensions, CH74, IP00

5.2 COOLING

Instead of using air for cooling, Vacon NX Liquid-Cooled drives are cooled with liquid. The liquid circulation of the drive is usually connected to a heat-exchanger (liquid-liquid/liquid-air) which cools down the liquid circulating in the cooling elements of the drive. Because the cooling elements are made of aluminium, the cooling agents allowed to be used are drinking water, demineralized water or a mixture of water and glycol.

There are two types of circulation system: open systems and closed systems.

An open system has no pressure, and allows free contact with air.

In a closed system, the piping is completely air-tight and there is pressure inside the pipes. The pipes must be made of metal, or specific plastic or rubber that includes an oxygen barrier. Preventing of oxygen diffusion in the coolant diminishes the risk of electrochemical corrosion of the metal parts, and generation of rust deposits. Always use a closed system with Vacon NX Liquid Cooled drives.

In case there is no other option than using an open system, you must take several precautions.

1. Use glycol or inhibitor in the coolant.
2. Examine the water quality regularly, and add inhibitor accordingly.
3. Yearly check that the properties of the cooling liquid are in accordance with the specification in this manual.

In a closed circulation system, the following figures are recommended reference values. To avoid electrochemical corrosion, it is necessary to add an inhibitor (e.g. Cortec VpCI-649) in the cooling agent.

The heat-exchanger delivered by Vacon (HX) consists of stainless steel materials. The good corrosion performance of stainless steel in district water systems is utilized and no disadvantage of divergent metal filler is included. Nevertheless, some precautions must be taken to reduce the corrosion risk on the stainless steel in high chloride waters, see Table 14. We recommend to use a Vacon HX heat exchanger whenever possible.

NOTE: If no heat-exchanger is used, actions must be taken to avoid electrochemical corrosion. Specifically no brass or copper elements may be used in the liquid circulation of the drive.

Copper and brass may be used in the liquid circulation in case the liquid-cooled drive is equipped with a nickel coated aluminum heatsink.

Specification: Drinking water

The attached table gives the chemical requirements for drinking water provided for by the Finnish Ministry of Social Affairs and Health. These values are indicative.

Table 3. Drinking water chemical specification

Quality	Unit	Value
Acrylamide	µg/l	0.10
Antimony	µg/l	5.0
Arsenic	µg/l	10
Benzene	µg/l	1.0
Benzopyrene	µg/l	0.010
Boron	mg/l	1.0
Bromate	µg/l	10
Cadmium	µg/l	5.0
Chromium	µg/l	50

Table 3. Drinking water chemical specification

Quality	Unit	Value
Copper	mg/l	2.0
Cyanides	µg/l	50
1,2-Dichloroethane	µg/l	3.0
Epichlorohydrin	µg/l	0.10
Fluoride	mg/l	1.5
Lead	µg/l	10
Mercury	µg/l	1.0
Nickel	µg/l	20
Nitrate (NO ₃ ⁻)	mg/l	50
Nitrate-Nitrogen (NO ₃ -N)	mg/l	11.0
Nitrite (NO ₂ ⁻)	mg/l	0.5
Nitrite-Nitrogen (NO ₂ -N)	mg/l	0.15
Bactericides	µg/l	0.10
Bactericides, total	µg/l	0.50
Polynuclear aromatic hydrocarbons	µg/l	0.10
Selenium	µg/l	10
Tetrachloroethylene and trichloroethylene tot.	µg/l	10
Trihalomethanes tot.	µg/l	100
Vinyl chloride	µg/l	0.50
Chlorophenols total	µg/l	10

Table 4. Drinking water quality recommendations

Quality	Unit	Max. value
Aluminium	µg/l	200
Ammonium (NH ₄ ⁺)	mg/l	0.50
Ammonium (NH ₄ -N)	mg/l	0.40
Chloride ¹⁾	mg/l	<100
Manganese	µg/l	50
Iron	µg/l	<0.5
Sulphate ^{1) 2)}	mg/l	250
Sodium	mg/l	200
Oxidizability (COD _{Mn} -O ₂)	mg/l	5,0
Quality	Unit	Desired value
<i>Clostridium perfringens</i> (including spores)	pmy/100 ml	0
Coliform bacteria	pmy/100 ml	0
Bacterial count (22°C)		No unusual changes
pH ¹⁾	pH	6...8
Electrical conductivity ¹⁾	µS/cm	<100
Turbidity		To be approved by user and no unusual changes
Colour		No unusual changes
Smell and taste		No unusual changes
Total organic carbon (TOC)		No unusual changes
Tritium	beq/l	100
Indicative total dose	mSv/year	0.10
Water hardness	°dH	3...10
Max. particle size in coolant	µm	300

Notes:

1) No aggressive water allowed

2) To avoid corrosion of piping, the sulphate content must not exceed 150 mg/l.

The cleanness of the heat exchanger, and therefore the heat exchanging capacity, depend on the purity of the process water. The more impure the water, the more frequently the heat exchanger needs cleaning. The following figures are reference values required of cooling circuit process water:

Specification: Process water*Table 5. Process water specification*

Quality	Unit	Value
pH		6...9
Water hardness	°dH	<20
Electrical conductivity	µS/cm	<100
Chlorides (Cl) *	mg/l	<100
Iron (Fe)	mg/l	<0.5

*. The allowed concentration of chloride ions (Cl⁻): <1000 ppm at 20°C, <300 ppm at 50°C and <100 ppm at 80°C; the values are given as guidance to reduce the corrosion risk on stainless steel. The values are valid for pH=7. Lower pH value increases the risk.

The design temperature of the cooling agent entering the drive module(s) is 35°C. While circulating inside the cooling element, the liquid transfers the heat produced by the power semiconductors (and the capacitors). The design temperature rise of the cooling agent during the circulation is less than 5°C. Typically, 95% of the power losses is dissipated in the liquid. We advise you to equip the cooling agent circulation with temperature supervision.

The heat exchanging equipment can be located outside the electrical room in which the frequency converters are. The connections between these two are made on site. In order to minimize the pressure drops, the pipings shall be made as straight as possible. We further recommend that a regulating valve equipped with a measurement point is mounted. This makes the measurement and regulation of liquid circulation possible in the commissioning phase.

In order to prevent dirt particles from accumulating in the connections and thus gradually weakening the cooling effect, installation of filters is also recommended.

The highest point of the piping must be equipped with either an automatic or a manual venting device. The material of the piping must comply with at least AISI 304 (AISI 316 is recommended).

Prior to the actual connection of the pipes, the bores shall be cleaned thoroughly. If cleaning with water is not possible, although recommended, pressured air must be used to remove all loose particles and dust.

To facilitate the cleaning and venting of the coolant circulation, we recommend you to install a bypass valve in the main line and valves at each frequency converter inlet. Open the bypass valve and shut the valves to the frequency converter when cleaning and airing the system. On commissioning the system, the bypass valve shall be closed and the valves to the converters opened.

Below you will find a simplified example of the cooling system as well as an example of the connections between the frequency converters and the cooling system.

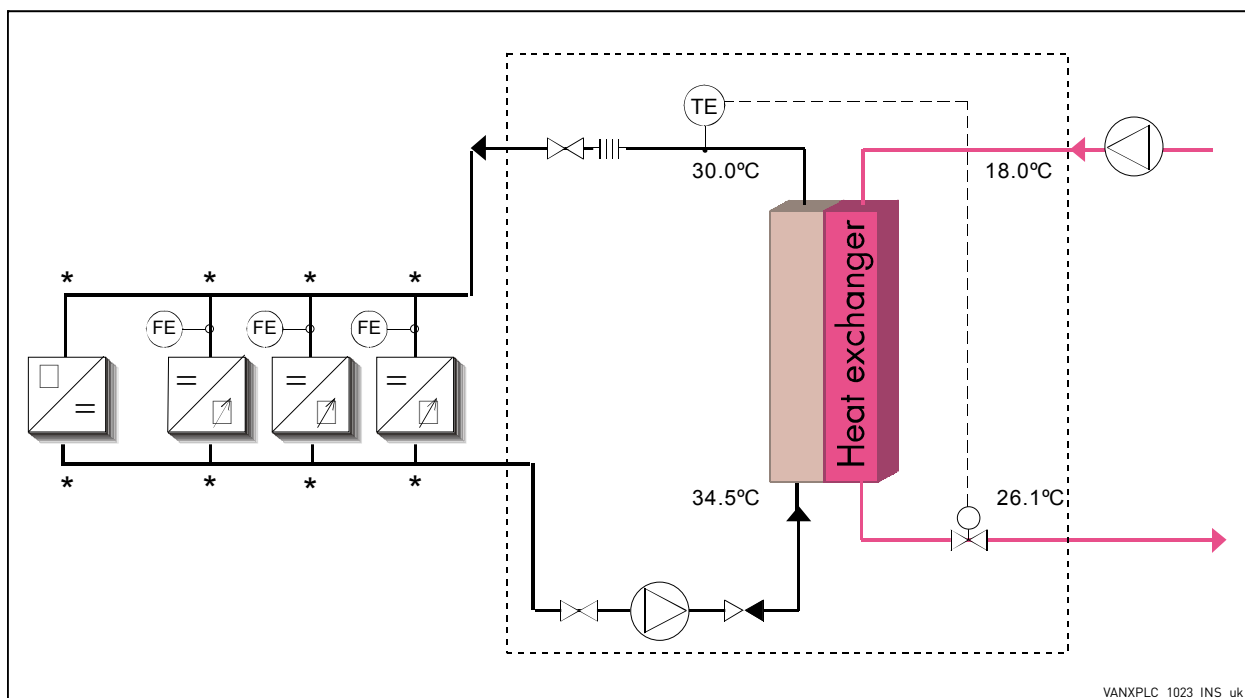


Figure 22. Example of cooling system

Vacon recommends to equip the cooling system with pressure and flow supervision (FE). The flow supervision can be connected to digital input function *External fault*. If the coolant flow is found too low, the frequency converter will be stopped.

The flow supervision and other actuators, e.g. a constant flow valve, are available as options. The options shall be mounted at the junction of the main line and the branching line to the element, indicated with an asterisk (*) in the figure above.

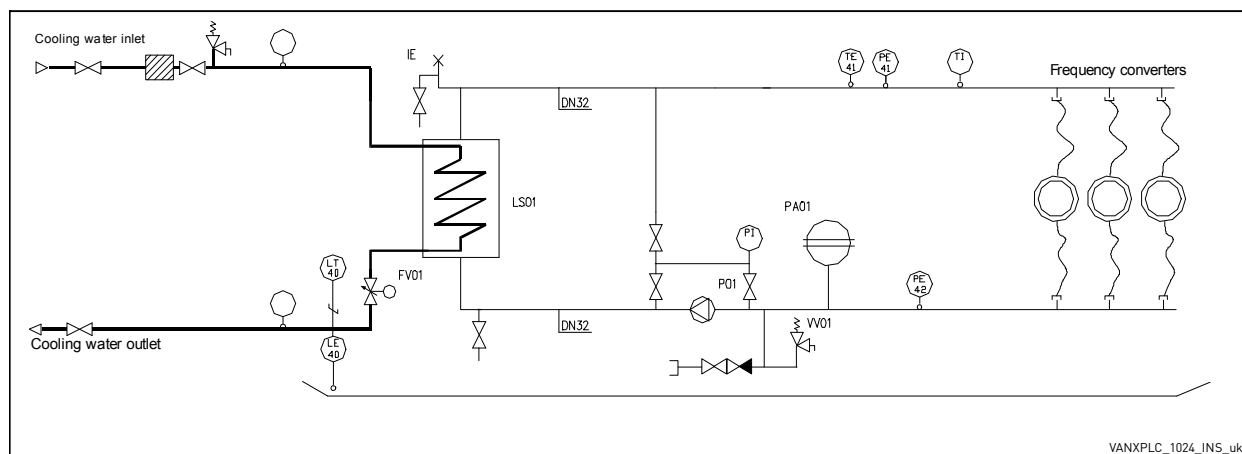


Figure 23. Example: PI-diagram of the cooling system and the connections

In tables below you will find the specifications related to the cooling agent and its circulation. See also Table 9 on page 26.

Table 6. Information about cooling agent and its circulation

Chassis	Min. liquid flow per element (drive) [dm ³ /min]	Nom. liquid flow per element (drive) [dm ³ /min]			Max. liquid flow per element (drive) [dm ³ /min]	Liquid volume/element [l]
	A	A	B	C	A	A
CH3	3 (3)	5 (5)	5,4 (5,4)	5,8 (5,8)	20 (20)	0.11
CH4	8 (8)	10 (10)	11 (11)	12 (12)	20 (20)	0.15
CH5	10 (10)	15 (15)	16 (16)	17 (17)	40 (40)	0.22
CH61	15 (15)	25 (25)	27 (27)	29 (29)	40 (40)	0.38
CH62	15 (15)	25 (25)	27 (27)	29 (29)	40 (40)	0.38
CH63	15 (30)	25 (50)	27 (54)	29 (58)	40 (80)	0.38
CH64	15 (45)	25 (75)	27 (80)	29 (86)	40 (120)	0.38
CH72	20 (20)	35 (35)	37 (37)	40 (40)	40 (40)	1.58
CH74	20 (60)	35 (105)	37 (112)	40 (121)	40 (120)	1.58

A = 100% water; B = Water/Glycol mixture 80:20; C = Water/Glycol mixture (60:40)

Definitions: Min liquid flow = Minimum flow rate to ensure of total venting of the cooling element

Nom liquid flow = Flow rate that allows running the drive at lth

Max liquid flow = If flow rate exceeds max liquid flow, risk of cooling element erosion increases

Liquid ref temperature, input: 30°C

Max temperature rise during circulation: 5°C

NOTE: Unless minimum liquid flow rate is ensured, air pockets may develop in the cooling elements. Automatic or manual de-airing of the cooling system must also be ensured.

The following table will help you to determine the appropriate flows of cooling agent (l/min) with given power losses (see chapter 4.2).

Figure 24. Cooling agent flow rates (l/min) in relation to power loss at certain glycol/water mixture

Power loss [kW]	Glycol/Water ratio					
	100/0	80/20	60/40	40/60	20/80	0/100
1	4,41	3,94	3,58	3,29	3,06	2,87
2	8,82	7,88	7,15	6,58	6,12	5,74
3	13,23	11,82	10,73	9,87	9,18	8,61
4	17,64	15,75	14,31	13,16	12,24	11,48
5	22,05	19,69	17,88	16,45	15,30	14,35
6	26,46	23,63	21,46	19,74	18,36	17,22
7	30,86	27,57	25,03	23,03	21,42	20,10
8	35,27	31,51	28,61	26,32	24,48	22,97

Figure 24. Cooling agent flow rates (l/min) in relation to power loss at certain glycol/water mixture

Power loss [kW]	Glycol/Water ratio					
	100/0	80/20	60/40	40/60	20/80	0/100
9	39,68	35,45	32,19	29,61	27,54	25,84
10	44,09	39,38	35,76	32,90	30,60	28,71

5.2.1 CONDENSATION

Condensation on the cooling plate of the NX Liquid-Cooled drive must be avoided. Therefore, the temperature of the cooling liquid must be kept higher than the temperature of the electrical room. Use the graph below to determine if the drive operating conditions (combination of room temperature, humidity and cooling liquid temperature) are safe, or, to choose the allowed temperature for the cooling liquid.

The conditions are safe when the point is below the respective curve. If not, take adequate precautions by decreasing the room temperature and/or the relative humidity or increase the cooling liquid temperature. Note that increasing the temperature of the cooling liquid above figures in loadability charts decreases the nominal output current of the drive. The below curves are valid at sea level altitude (1013 mbar).

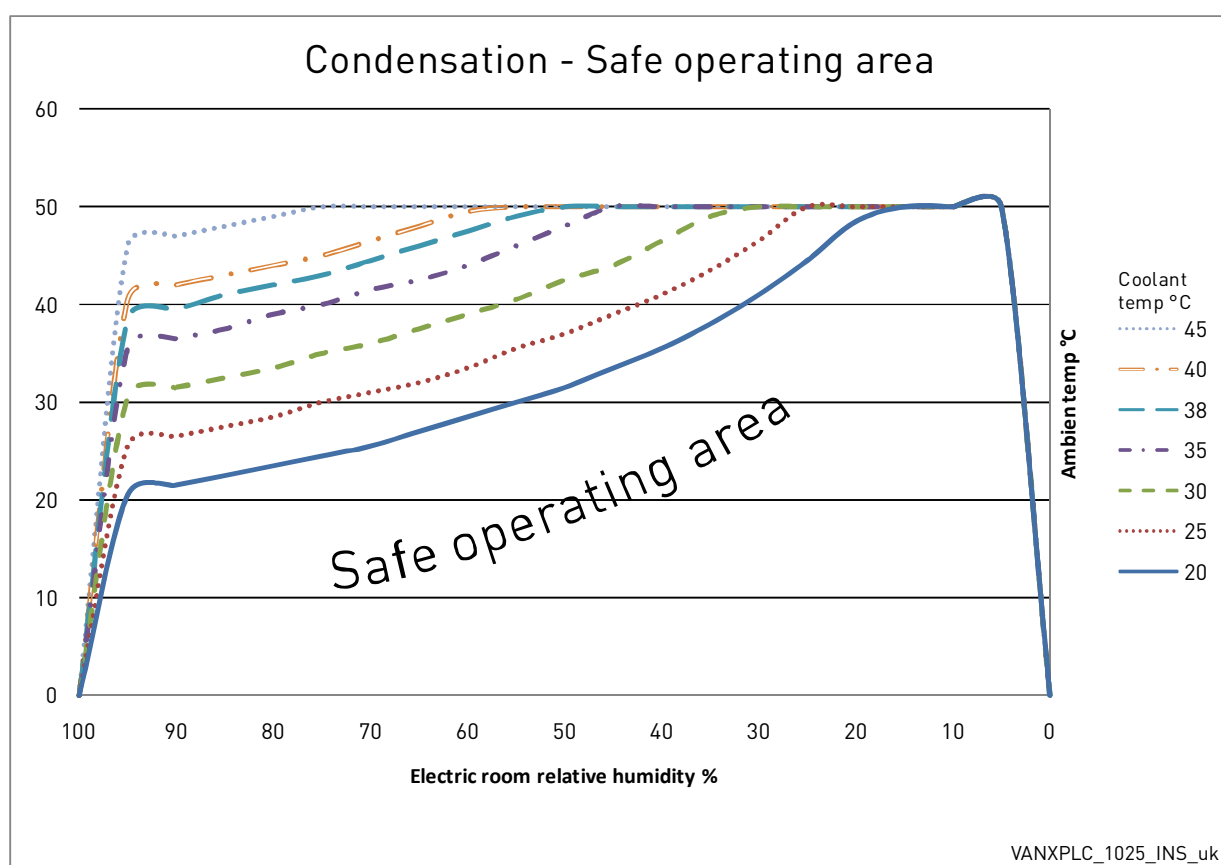


Figure 25. Safe operating conditions in relation to condensation

Example:

If the temperature of the electric room is 30°C, the relative humidity is 40% and the temperature of the cooling liquid is 20°C (the lowest curve in Figure 27), then the drive operating conditions are safe.

However, if the room temperature were to rise to 35°C and the relative humidity to 60%, then the operating conditions of the drive would no longer be safe. In this case, to reach safe operating con-

ditions, the air temperature should be cooled to 28°C or lower. If it is not possible to lower the room temperature, then the temperature of the cooling liquid should be raised to at least 25°C.

5.2.2 COOLING SYSTEM CONNECTIONS

The external cooling system shall be connected to each one of the cooling elements of the inverter or frequency converter.

NOTE: It is forbidden to connect the cooling elements in series.

The delivery comprises hoses (Technobel Noir Tricoflex, Art.no 135855) 1.5m in length and 16mm in diameter (CH5, CH6, CH7). The hoses are inserted in 1400-mm UL94V0 approved conduits (type HFX40). These hoses have screw type connectors with internal thread. The connection of the hoses is made on the aluminium adapter (external thread) of the cooling element. The customer end thread of the cooling hose is G1/2" male fixed including a Usit-R sealing. The connection of the line hose shall be made avoiding any twisting of the hose on the element.

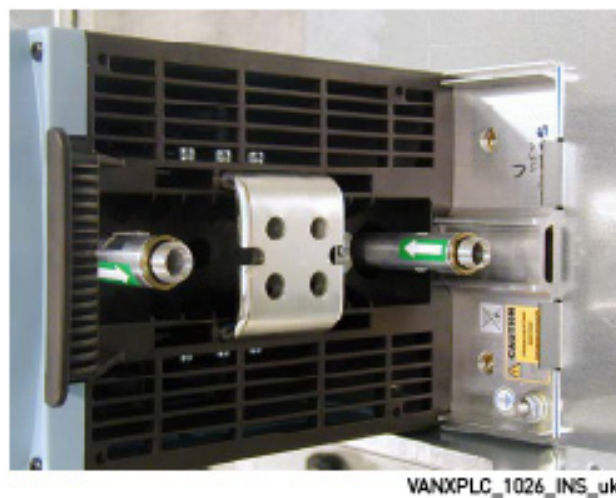


Figure 26. Aluminium hose adapters



Figure 27. External thread of hose adapter

For all other classes (CH3, CH4), the standard delivery includes fast connectors of type 'Tema', series 1300 or 1900. The fast connectors are available as option also for CH5, CH6, CH7.

Table 7. Liquid connector types (all pressure values at nominal flow)

Chassis	Thread on element (internal) BSPP ^{*)}	Connector type or hose type	Thread (cust.) BSPP ^{**)}	Max. pressure (entire system)	Pressure loss, (fast connector + element)	Pressure loss, (hoses + element)
CH3	G3/8"	1300NE2 1/4"		6 bar	0.25 bar	
CH4	G3/8"	1300NE2 1/4"		6 bar	0.25 bar	
CH5	G3/4"	Technobel 16*23.5	G1/2"	6 bar		0.2 bar
CH6	G3/4"	Technobel 16*23.5	G1/2"	6 bar	See table below	See table below
CH7	G3/4"	Technobel 16*23.5	G1/2"	6 bar	See table below	See table below

^{*)} Use sealing (e.g. Usit-R Metal washer-rubber sealing) for this type of connection according to ISO standard 228-1

^{**)} Use sealant or sealing tape for this type of connection

5.2.2.1 Pressure losses

Table 8. Pressure losses; CH6x

CH6x with standard 1.5m hoses and optional fast connectors TEMA							
Volume flow rate (l/min)	Pressure loss; Tema, inflow (bar)	Pressure loss; inflow hose (bar)	Pressure loss; element (bar)	Pressure loss; outflow hose: (bar)	Pressure loss; Tema, outflow (bar)	Pressure loss total (inflow hose, element and outflow hose) (bar)	Pressure loss total (Tema, inflow and outflow hoses and element) (bar)
40,0	0,59	0,30	0,28	0,29	0,51	0,87	1,96
30,0	0,30	0,17	0,16	0,16	0,25	0,49	1,04
20,0	0,10	0,09	0,08	0,07	0,09	0,24	0,43
17,0	0,06	0,07	0,06	0,03	0,07	0,16	0,29

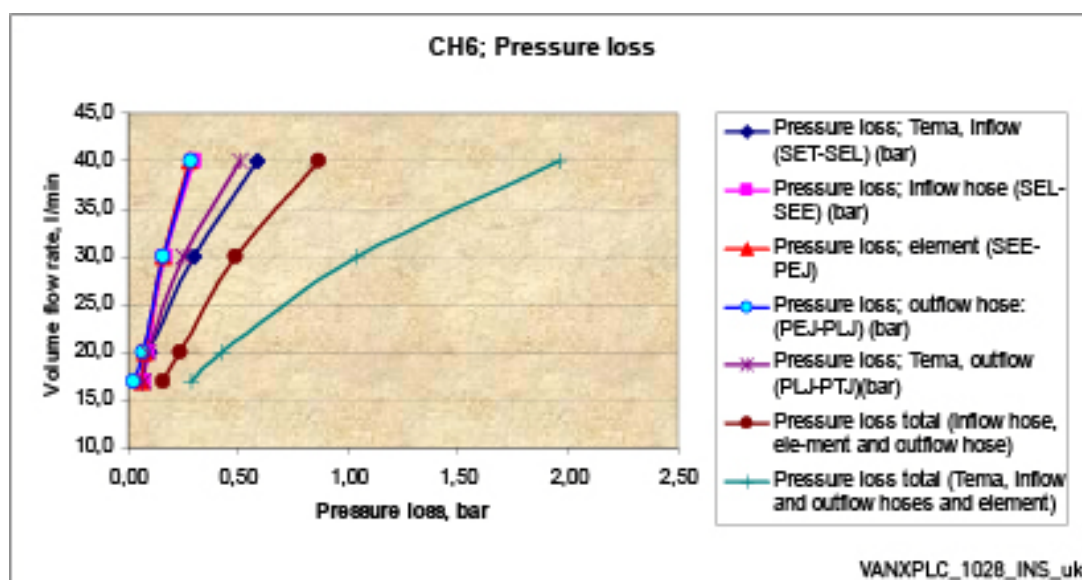


Figure 28. Pressure loss, CH6x

Table 9. Pressure losses; CH7x

CH7x (16) with standard 1.5m hoses and optional fast connectors TEMA							
Volume flow rate (l/min)	Pressure loss; Tema, inflow (bar)	Pressure loss; inflow hose (bar)	Pressure loss; element (bar)	Pressure loss; outflow hose: (bar)	Pressure loss; Tema, outflow (bar)	Pressure loss total (inflow hose, element and outflow hose) (bar)	Pressure loss total (Tema, inflow and outflow hoses and element) (bar)
40,0	0,61	0,30	0,28	0,28	0,50	0,87	1,97
30,0	0,31	0,17	0,17	0,16	0,26	0,50	1,07

Table 9. Pressure losses; CH7x

CH7x (16) with standard 1.5m hoses and optional fast connectors TEMA							
Volume flow rate (l/min)	Pressure loss; Tema, inflow (bar)	Pressure loss; inflow hose (bar)	Pressure loss; element (bar)	Pressure loss; outflow hose (bar)	Pressure loss; Tema, outflow (bar)	Pressure loss total (inflow hose, element and outflow hose) (bar)	Pressure loss total (Tema, inflow and outflow hoses and element) (bar)
20,0	0,11	0,09	0,08	0,07	0,10	0,24	0,44

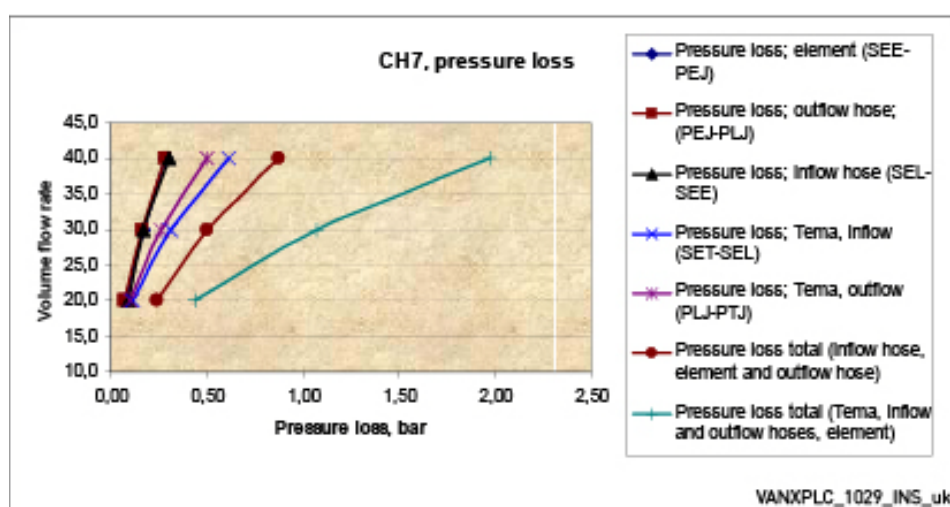


Figure 29. Pressure loss, CH7x

The liquid carrying hoses from the network to the cooling elements of the drive must not be electrically conductive. Risk of electrical shock and device damage! To avoid electrochemical corrosion, it is necessary to add an inhibitor (e.g. Cortec VpCI-649I in the cooling liquid).

The following main line hose materials are allowed for a liquid cooled drive including an aluminum heatsink:

- plastic (PVC)
- rubber (EPDM & NBR only)
- aluminium
- other stainless and acid-proof materials

The following main line hose materials are allowed for a liquid cooled drive including a nickel coated aluminum heatsink:

- plastic (PVC)
- rubber (EPDM & NBR only)
- copper
- aluminium
- brass
- other stainless and acid-proof material

The hoses must tolerate a peak pressure of 40 bar.

Connect the line hose to its counterpart (screw connector or fast connector) on the cooling element of the frequency converter/inverter. The coolant inlet connector is the one closer to the mounting plate and the outlet connector the one closer to the face of the drive, see Figure 33. Due to high pressure in the line hose, it is recommended to equip the liquid line with a shut-off valve, which makes the connection easier. In order to prevent water from spraying in the installation room we also recommend to wrap e.g. lintors around the connection on installing.

Vacon furthermore recommends to equip the pipe branches to the cooling elements with valves.

5.2.2.2 *Installation of flow switch*

As stated on page 50, Vacon recommends the installation of flow supervision in the liquid cooling system. If requested, Vacon delivers the flow switch as option. The specification of the flow switch as well as notes as concerns its installation are given below.

About the installation

Vacon recommends to mount the flow switch on the inflow side of the system (see Figure 24). Pay attention to the direction of flow. The switch reaches the highest accuracy when it is mounted in horizontal position. If mounted vertically, the mechanical sensor is affected by the Earth's gravity which reduces the accuracy according to the data given in Table 19.



Figure 30. Flow switch: Hose connection, fast connector (electrical), fast connector lock screw, cable seal and clamp

Table 10. Flow switch data

Hose connection	G1/2" female, internal thread ISO228-1
Closing	The switch closes if the flow exceeds 20 l/min.
Switching accuracy: Horizontal installation Vertical installation	–5...+15% (19...23 l/min) ±5% (19...21 l/min)

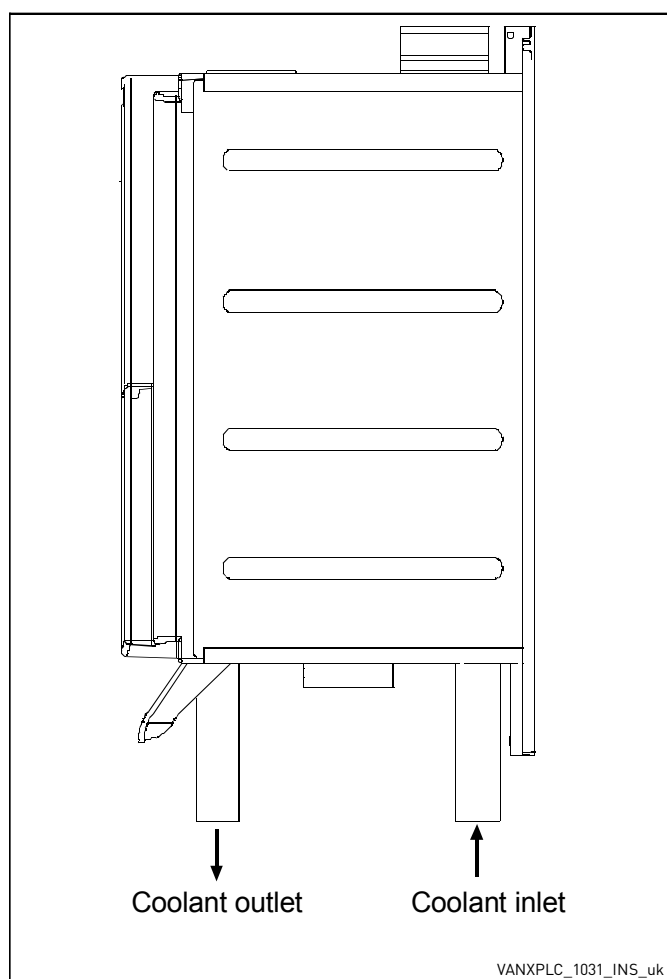


Figure 31. Direction of coolant circulation

5.3 DRIVE DERATING

The tables below state the maximum coolant temperatures for Vacon liquid-cooled drives at given switching frequencies. Drive derating is required if the maximum temperatures are exceeded.

NOTE: If the heatsink is nickel-coated you must allow for a 2-degree C derating of values in the tables below.¹⁾ (Temperatures given in parenthesis). This applies only to the two biggest drive sizes of each chassis!

Table 11. Max temperatures of coolant at switching frequency of 3.6 kHz

Supply voltage 400-500 VAC, switching frequency 3,6 kHz			
Chassis	Type	Max coolant temperature [°C] Supply voltage 400V	Max coolant temperature [°C] Supply voltage 500V
CH 61	NXP0385_5	47 (45) ¹⁾	43 (41) ¹⁾
CH62	NXP0730_5	40 (38) ¹⁾	37 (35) ¹⁾
CH63	NXP1150_5	38 (36) ¹⁾	36 (34) ¹⁾
CH64	NXP2060_5	37 (35) ¹⁾	34 (32) ¹⁾
CH64	NXP2300_5	42 (40) ¹⁾	40 (38) ¹⁾
CH72	NXP0730_5	42 (40) ¹⁾	40 (38) ¹⁾
CH74	NXP2060_5	37 (35) ¹⁾	34 (32) ¹⁾
CH74	NXP2300_5	37 (35) ¹⁾	34 (32) ¹⁾

Table 12. Max temperatures of coolant at switching frequency of 1.5 kHz

Supply voltage 400-500 VAC, switching frequency 1,5 kHz			
Chassis	Type	Max coolant temperature [°C] Supply voltage 400V	Max coolant temperature [°C] Supply voltage 500V
CH61	NXP0385_5	52 (50) ¹⁾	49 (47) ¹⁾
CH62	NXP0730_5	47 (45) ¹⁾	45 (43) ¹⁾
CH63	NXP1150_5	44 (42) ¹⁾	42 (40) ¹⁾
CH64	NXP2060_5	49 (47) ¹⁾	47 (45) ¹⁾
CH64	NXP2300_5	44 (42) ¹⁾	42 (40) ¹⁾
CH72	NXP0730_5	45 (43) ¹⁾	43 (41) ¹⁾
CH74	NXP2060_5	49 (47) ¹⁾	47 (45) ¹⁾
CH74	NXP2300_5	44 (42) ¹⁾	43 (41) ¹⁾

Table 13. Max temperatures of coolant at switching frequency of 3,6 kHz

Supply voltage 525-690 VAC, switching frequency 3,6 kHz			
Chassis	Type	Max coolant temperature [°C] Supply voltage 525V	Max coolant temperature [°C] Supply voltage 690V
CH61	NXP0261_6	45 (43) ¹⁾	39 (37) ¹⁾
CH62	NXP0502_6	41 (39) ¹⁾	33 (31) ¹⁾
CH63	NXP0750_6	42 (40) ¹⁾	36 (34) ¹⁾
CH64	NXP1500_6	41 (39) ¹⁾	34 (32) ¹⁾
CH72	NXP0502_6	38 (36) ¹⁾	32 (30) ¹⁾
CH74	NXP1500_6	41 (39) ¹⁾	34 (32) ¹⁾

Table 14. Max temperatures of coolant at switching frequency of 1,5 kHz

Supply voltage 525-690 VAC, switching frequency 1,5 kHz			
Chassis	Type	Max coolant temperature [°C] Supply voltage 525V	Max coolant temperature [°C] Supply voltage 690V
CH61	NXP0261_6	54 (52) ¹⁾	51 (49) ¹⁾
CH62	NXP0502_6	52 (50) ¹⁾	47 (45) ¹⁾
CH63	NXP0750_6	53 (51) ¹⁾	50 (48) ¹⁾
CH64	NXP1500_6	52 (50) ¹⁾	47 (45) ¹⁾
CH72	NXP0502_6	51 (49) ¹⁾	46 (44) ¹⁾
CH74	NXP1500_6	52 (50) ¹⁾	48 (46) ¹⁾

5.4 INPUT CHOKES

The input choke carries out several functions in the Vacon NX Liquid-Cooled frequency converter. Connection of the input choke is necessary except if you have a component in your system that performs the same tasks (e.g. a transformer). The input choke is needed as an essential component for motor control, to protect the input and DC-link components against abrupt changes of current and voltage as well as to function as a protection against harmonics. In chassis with multiple parallel line rectifiers (CH74) AC-chokes are required to balance the line current between the rectifiers.

The input chokes are included in the standard delivery of Vacon liquid-cooled frequency converters (not inverters). However, you can also order your frequency converter without the choke.

The Vacon chokes listed below are meant for supply voltages of 400-500 and 525-690V.

Table 15. Input choke dimensioning, 6-pulse supply

Converter types (400—500VAC)	Converter types (690VAC)	Choke type	Thermal current [A]	Nominal inductance [0H] A/B*	Calculated loss [W]
0016...0022	0012...0023	CHK0023N6A0	23	1900	145
0031...0038	0031...0038	CHK0038N6A0	38	1100	170

Table 15. Input choke dimensioning, 6-pulse supply

Converter types (400—500VAC)	Converter types (690VAC)	Choke type	Thermal current [A]	Nominal inductance [0H] A/B*	Calculated loss [W]
0045...0061	0046...0062	CHK0062N6A0	62	700	210
0072...0087	0072...0087	CHK0087N6A0	87	480	250
0105...0140	0105...0140	CHK0145N6A0	145	290	380
0168...0261	0170...0261	CHK0261N6A0	261	139/187	460
0300...0385	0325...0385 <i>0820...1180</i> <i>1850...2340</i>	CHK0400N6A0	400	90/126	610
0460...0520 <i>1370 (CH74)</i>	0416...0502 <i>1300...1500</i> <i>2700...3100</i>	CHK0520N6A0	520	65/95	810
0590...0650 <i>1640</i>	0590...0650 <i>1700...1900</i>	CHK0650N6A0	650	51/71	890
0730 <i>2060</i>	0750	CHK0750N6A0	750	45/61	970
0820 <i>2300</i>	-	CHK0820N6A0	820	39/53	1020
0920...1030	-	CHK1030N6A0	1030	30/41	1170
1150	-	CHK1150N6A0	1150	26/36	1420
<i>2470...2950</i>		CHK0520N6A0	520	65/95	810
<i>3710</i>		CHK0650N6A0	650	51/71	890
<i>4140</i>		CHK0750N6A0	750	45/61	970
<i>Converter types written bold italic require three (3) chokes of the designated kind per unit with 6-pulse supply</i>					

Table 16. Input choke dimensioning, 12-pulse supply

Converter types (400—500VAC)	Converter types (690VAC)	Choke type (2 chokes needed)	Thermal current [A]	Nominal inductance [0H] A/B*	Calculated loss [W]
0460...0520	0325...0502	CHK0261N6A0	261	139/187	460
0590...0730	0590...0750	CHK0400N6A0	400	90/120	610
0820...1030	0820...1030 <i>1850</i>	CHK0520N6A0	520	65/95	810
1150 <i>2300</i> <i>2470</i>	1180...1300 <i>2120...2340</i>	CHK0650N6A0	650	51/71	890
1370 <i>2950</i>	1370 <i>2700</i>	CHK0750N6A0	750	45/61	970
1640	1500 <i>3100</i>	CHK0820N6A0	820	39/53	1020
2060 <i>3710</i>	1700...1900	CHK1030N6A0	1030	30/41	1170

Table 16. Input choke dimensioning, 12-pulse supply

Converter types (400—500VAC)	Converter types (690VAC)	Choke type (2 chokes needed)	Thermal current [A]	Nominal inductance [0H] A/B*	Calculated loss [W]
4140	-	CHK1150N6A0	1150	26/36	NA

Converter types written bold italic require two (2) chokes of the designated kind per unit (totally 4).
 *Inductances for different supply voltages; A = 400...480Vac, B = 500...690Vac. See page 63.

5.4.1 INSTALLATION OF INPUT CHOKES

There are two types of input choke connection in Vacon NX Liquid-Cooled drives. The two smallest sizes (CH31, CH32; up to 61A) have terminal block connection whereas bigger sizes use busbar connection. Examples of both connections and the choke dimensions below.

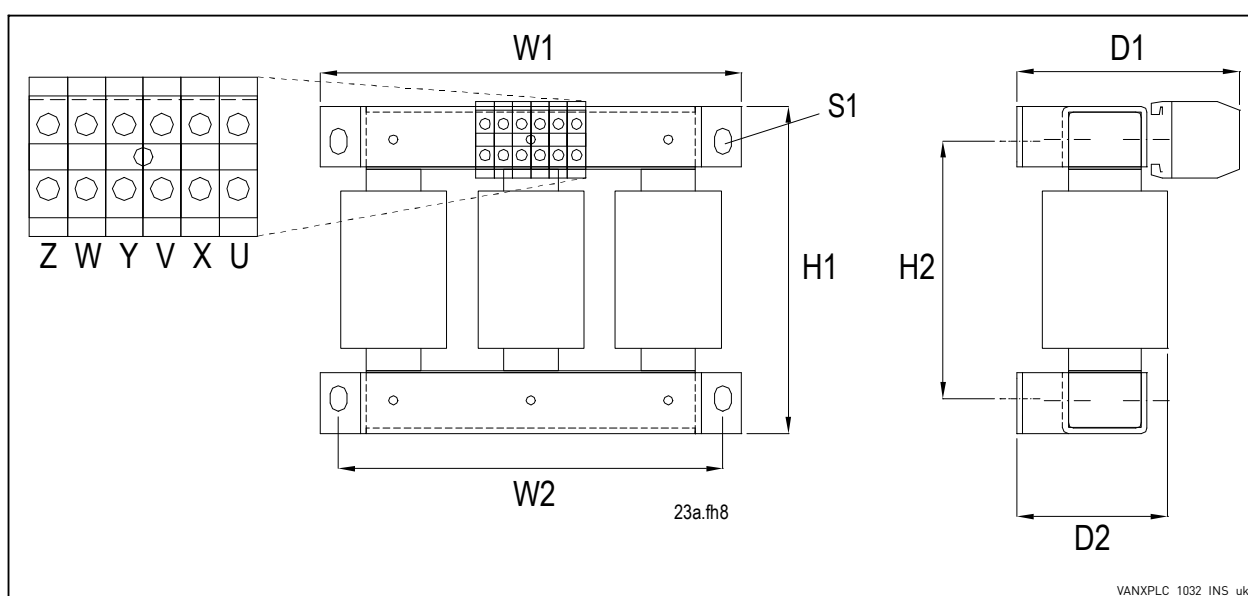


Figure 32. Example of input chokes for Vacon NX Liquid-Cooled. Sizes up to 62A

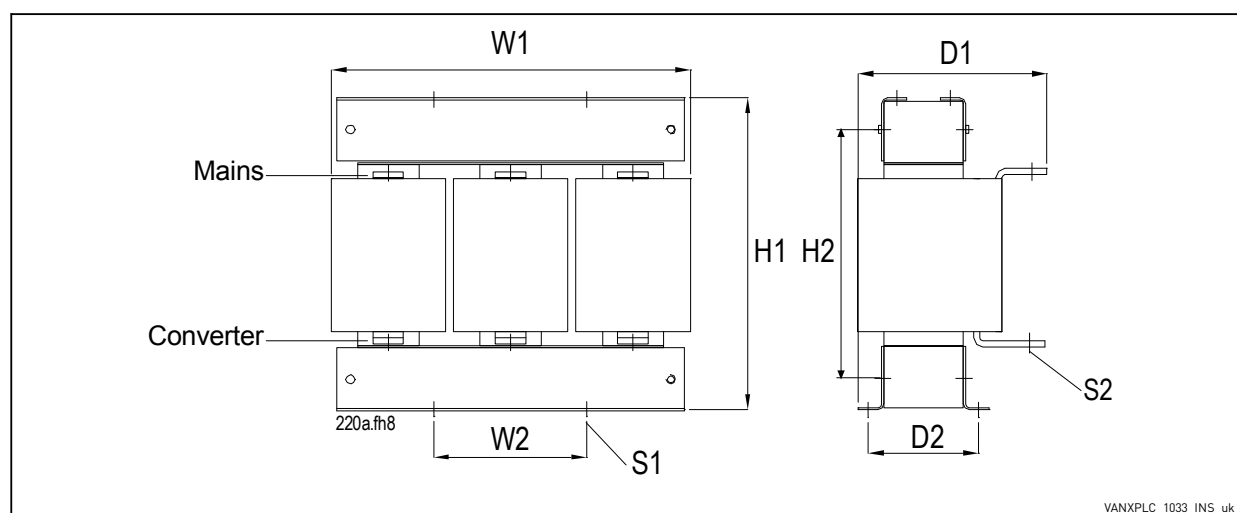


Figure 33. Example of input chokes for Vacon NX Liquid-Cooled. Sizes 87A...145A and 590A

