

## Type Approval Certificate

*This is to certify that the undernoted product(s) has/have been tested with satisfactory results in accordance with the relevant requirements of the Lloyd's Register Type Approval System.*

This certificate is issued to:

<b>PRODUCER</b>	VACON LTD RUNSORINTIE 7, 65380 VAASA, FINLAND
<b>PLACE OF PRODUCTION</b>	VACON (China) DRIVES Co. Ltd. HAIYAN BRANCH, BLOCK 6-7, No.339 North Xinqiao Road, Wuyuan Street, Haiyan Country, Jaxing, Zhejiang 314300 China  VACON LTD RUNSORINTIE 7, 65380 VAASA, FINLAND
<b>DESCRIPTION</b>	Fast current cutter/ DC bus-tie device based on standard VACON NXP inverter hardware and dedicated application software
<b>TYPE</b>	VACON® DCGuard (Peer to peer topology) VACON® DCGuard basic configuration consists of: - aR supply fuses in each DC supply line; - VACON NXP inverter (LR Type approval certificate No.11/ 60005(E2)); - di/ dt filter; - VACON® DCGuard application software, version ADFIF102.
<b>APPLICATION</b>	Marine and Offshore applications (ENV2 category)
<b>STANDARD</b>	LR Test Specification No.1:2018
<b>RATINGS</b>	Rated current (A): 3-4140 A Rated voltage (V): 465-1100 VDC Short-circuit current total clearance time (µs): 200-300 µs
<b>Certificate No.</b>	18/ 00076
<b>Issue Date</b>	1 November 2018
<b>Expiry Date</b>	31 October 2023
<b>Sheet</b>	1 of 8



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Input voltage UIN:	Voltage class 5: 380-500 V ( $\pm 10\%$ ) / DC Link voltage = 465 – 800 VDC ( $\pm 0\%$ ) Voltage class 6: 525-690 V ( $\pm 10\%$ ) / DC Link voltage = 640 – 1100 VDC ( $\pm 0\%$ )
Rated current:	Rated AC current = Rated DC current. Example: Rating for NXP 1500 690 V used as motor drive: 1500 A, 0-320 Hz. Rating for NXP 1500 690 V used as VACON® DCGuard: 1500 ADC
Distribution network	IT system, with appropriate insulation monitoring to PE
Output voltage	Normal operation: $U_{in} \approx U_{out}$ Charging: $0 \approx U_{in}$
Output frequency	Normal operation: DC voltage (directly connected to DC terminals). Charging: DC voltage (Pulse Width Modulation)
Output filter	di/ dt filter, recommended 2% inductance
Switching frequency	Normal operation: No switching / 0 kHz Charging: 1... 10 kHz; Factory default 5 kHz
Control method	Individual IGBT control
DC Short circuit current	Limited by the aR fuses in each DC supply line
Over voltage protection	500 V / Voltage class5: 911 VDC 690 V / Voltage class 6: 1258 VDC
IGBT hardware over current protection current	$\leq I_h * 3 \dots 5$ Unit dependent
IGBT hardware over current protection delay	Hardware circuit, instant without time delay

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VACON® DCGuard Air-cooled 500 V units.

Air cooled NX5 465-800 VDC		DCGuard Current	DC power @800V	Over current & Short circuit protection
Type code	Unit type      Frame	I [A]	PDC [kW]	Instant trip ≤ [A]
NXP00035A2T0SSS	NXP0003      FR4	3	2	10
NXP00045A2T0SSS	NXP0004      FR4	4	3	15
NXP00055A2T0SSS	NXP0005      FR4	5	4	19
NXP00075A2T0SSS	NXP0007      FR4	7	6	25
NXP00095A2T0SSS	NXP0009      FR4	9	7	33
NXP00125A2T0SSS	NXP0012      FR4	12	10	40
NXP00165A2T0SSS	NXP0016      FR5	16	13	53
NXP00225A2T0SSS	NXP0022      FR5	22	18	70
NXP00315A2T0SSS	NXP0031      FR5	31	25	101
NXP00385A2T0SSS	NXP0038      FR6	38	30	136
NXP00455A2T0SSS	NXP0045      FR6	45	36	167
NXP00615A2T0SSS	NXP0061      FR6	61	49	202
NXP00725A2T0SSS	NXP0072      FR7	72	58	268
NXP00875A2T0SSS	NXP0087      FR7	87	70	317
NXP01055A2T0SSS	NXP0105      FR7	105	84	383
NXP01405A2T0SSS	NXP0140      FR8	140	112	462
NXI01685A0T0ISF	NXP0168      FI9	168	134	616
NXI02055A0T0ISF	NXP0205      FI9	205	164	748
NXI02615A0T0ISF	NXP0261      FI9	261	209	902
NXI03005A0T0ISF	NXP0300      FI9	300	240	1 078
NXI03855A0T0ISF	NXP0385      FI10	385	308	1 320
NXI04605A0T0ISF	NXP0460      FI10	460	368	1 694
NXI05205A0T0ISF	NXP0520      FI10	520	416	2 024
NXI05905A0T0ISF	NXP0590      FI12(2xFI10)	590	472	2 288
NXI06505A0T0ISF	NXP0650      FI12(2xFI10)	650	520	2 596
NXI07305A0T0ISF	NXP0730      FI12(2xFI10)	730	584	2 860

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NXI08205A0TOISF	NXP0820	FI12(2xFI10)	820	656	3 212
NXI09205A0TOISF	NXP0920	FI12(2xFI10)	920	736	3 608
NXI103005A0TOISF	NXP1030	FI12(2xFI10)	1030	824	4 048
NXI11505A0TOISF	NXP1150	FI13	1150	920	4 532
NXI13005A0TOISF	NXP1300	FI13	1300	1040	5 060
NXI145005A0TOISF	NXP1450	FI13	1450	1160	5 720
NXI177005A0TOISF	NXP1770	FI14	1770	1416	7 040
NXI21505A0TOISF	NXP2150	FI14	2150	1720	8 536
NXI27005A0TOISF	NXP2700	FI14	2700	2160	10 120

VACON® DCGuard Air-cooled 690 V units

Air cooled NX6 640-1100 VDC			DCGuard current	DC power @1100V	Over current & Short circuit protection
Type code	Unit type	Frame	I [A]	PDC [kW]	Instant trip ≤ [A]
NXP00046A2T0SSS	NXP0004	FR6	4,5	4	14
NXP00056A2T0SSS	NXP0005	FR6	5,5	4	20
NXP00076A2T0SSS	NXP0007	FR6	8	6	24
NXP00106A2T0SSS	NXP0010	FR6	10	8	33
NXP00136A2T0SSS	NXP0013	FR6	13,5	11	44
NXP00186A2T0SSS	NXP0018	FR6	18	14	59
NXP00226A2T0SSS	NXP0022	FR6	22	18	79
NXP00276A2T0SSS	NXP0027	FR6	27	22	97
NXP00346A2T0SSS	NXP0034	FR6	34	27	119
NXP00416A2T0SSS	NXP0041	FR7	41	33	150
NXP00526A2T0SSS	NXP0052	FR7	52	42	180
NXP00526A2T0SSS	NXP0062	FR8	62	50	229
NXP00526A2T0SSS	NXP0080	FR8	80	64	273
NXP00526A2T0SSS	NXP0100	FR8	100	80	352
NXP01256A2TOISF	NXP0125	FI9	125	100	440
NXP01446A2TOISF	NXP0144	FI9	144	115	550

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NXP01706A2TOISF	NXP0170	FI9	170	136	634
NXP02056A2TOISF	NXP0208	FI9	208	166	748
NXP02616A2TOISF	NXP0261	FI10	261	209	915
NXP03256A2TOISF	NXP0325	FI10	325	260	1 148
NXP03856A2TOISF	NXP0385	FI10	385	308	1 430
NXP04166A2TOISF	NXP0416	FI10	416	333	1 430
NXP04606A2TOISF	NXP0460	FI12(2xFI10)	460	368	1 694
NXP05026A2TOISF	NXP0502	FI12(2xFI10)	502	402	2 024
NXP05906A2TOISF	NXP0590	FI12(2xFI10)	590	472	2 209
NXP06506A2TOISF	NXP0650	FI12(2xFI10)	650	520	2 596
NXP07506A2TOISF	NXP0750	FI12(2xFI10)	750	600	2 860
NXP08206A2TOISF	NXP0820	FI12(2xFI10)	820	656	2 860
NXP09206A2TOISF	NXP0920	FI13	920	736	3 608
NXP10306A2TOISF	NXP1030	FI13	1030	824	4 048
NXP11806A2TOISF	NXP1180	FI13	1180	944	4 532
NXP15006A2TOISF	NXP1500	FI14(2xFI13)	1500	1200	5 720
NXP19006A2TOISF	NXP1900	FI14(2xFI13)	1900	1520	6 600
NXP22506A2TOISF	NXP2250	FI14(2xFI13)	2250	1800	8 360

VACON® DCGuard Liquid-cooled 500 V units

Liq. cooled NX5 465-800 VDC			DCGuard current	DC power @800V	Over current & Short circuit protection
Type code	Unit type	Frame	I [A]	PDC [kW]	Instant trip ≤ [A]
NXP00165A0TOIWF	NXP0016	CH3	16	13	61
NXP00225A0TOIWF	NXP0022	CH3	22	18	83
NXP00315A0TOIWF	NXP0031	CH3	31	25	116
NXP00385A0TOIWF	NXP0038	CH3	38	30	138
NXP00455A0TOIWF	NXP0045	CH3	45	36	165
NXP00615A0TOIWF	NXP0061	CH3	61	49	226
NXP00725A0TOIWF	NXP0072	CH4	72	58	264

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NXP00875A0T0IWF	NXP0087	CH4	87	70	319
NXP01055A0T0IWF	NXP0105	CH4	105	84	385
NXP01405A0T0IWF	NXP0140	CH4	140	112	512
NXP01685A0T0IWF	NXP0168	CH5	168	134	616
NXP02055A0T0IWF	NXP0205	CH5	205	164	754
NXP02615A0T0IWF	NXP0261	CH5	261	209	957
NXP03005A0T0IWF	NXP0300	CH61	300	240	616
NXP03855A0T0IWF	NXP0385	CH61	385	308	792
NXP04605A0T0IWF	NXP0460	CH62	460	368	946
NXP05205A0T0IWF	NXP0520	CH62	520	416	1 069
NXP05905A0T0IWF	NXP0590	CH62	590	472	1 210
NXP06505A0T0IWF	NXP0650	CH62	650	520	1 334
NXP07305A0T0IWF	NXP0730	CH62	730	584	1 500
NXP08205A0T0IWF	NXP0820	CH63	820	656	1 685
NXP09205A0T0IWF	NXP0920	CH63	920	736	1 888
NXP10305A0T0IWF	NXP1030	CH63	1030	824	2 116
NXP11505A0T0IWF	NXP1150	CH63	1150	920	2 359
NXP13705A0T0IWF	NXP1370	CH64	1370	1096	2 812
NXP16405A0T0IWF	NXP1640	CH64	1640	1312	3 366
NXP20605A0T0IWF	NXP2060	CH64	2060	1648	4 229
NXP230005A0T0IWF	NXP2300	CH64	2300	1840	4 722
NXP24705A0T0IWF	NXP2470	2xCH64	2470	1976	5 073
NXP29505A0T0IWF	NXP2950	2xCH64	2950	2360	6 058
NXP37105A0T0IWF	NXP3710	2xCH64	3710	2968	7 617
NXP41405A0T0IWF	NXP4140	2xCH64	4140	3312	8 501

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VACON® DCGuard Liquid-cooled 690V units.

Liq. cooled NX6 640-1100 VDC			DCGuard current	DC power @1100V	Over current & Short circuit
Type code	Unit type	Frame	I [A]	PDC [kW]	Instant trip ≤ [A]
NXP01706A0TOIWF	NXP0170	CH61	170	187	524
NXP02086A0TOIWF	NXP0208	CH61	208	229	641
NXP02616A0TOIWF	NXP0261	CH61	261	287	804
NXP03256A0TOIWF	NXP0325	CH62	325	358	1 001
NXP03856A0TOIWF	NXP0385	CH62	385	424	1 186
NXP04166A0TOIWF	NXP0416	CH62	416	458	1 281
NXP04606A0TOIWF	NXP0460	CH62	460	506	1 417
NXP05026A0TOIWF	NXP0502	CH62	502	552	1 546
NXP05906A0TOIWF	NXP0590	CH63	590	649	1 817
NXP06506A0TOIWF	NXP0650	CH63	650	715	2 002
NXP07506A0TOIWF	NXP0750	CH63	750	825	2 310
NXP08156A0TOIWF	NXP0815	CH63	815	897	2 510
NXP08206A0TOIWF	NXP0820	CH64	820	902	2 526
NXP09206A0TOIWF	NXP0920	CH64	920	101	2 834
NXP10306A0TOIWF	NXP1030	CH64	1030	113	3 172
NXP11806A0TOIWF	NXP1180	CH64	1180	129	3 634
NXP13006A0TOIWF	NXP1300	CH64	1300	143	4 004
NXP15006A0TOIWF	NXP1500	CH64	1500	165	4 620
NXP17006A0TOIWF	NXP1700	CH64	1700	187	5 236
NXP18506A0TOIWF	NXP1850	2xCH64	1850	203	5 698
NXP212006A0TOIWF	NXP2120	2xCH64	2120	233	6 530
NXP234006A0TOIWF	NXP2340	2xCH64	2340	257	7 207
NXP27006A0TOIWF	NXP2700	2xCH64	2700	297	8 316
NXP31006A0TOIWF	NXP3100	2xCH64	3100	341	9 548

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**CONDITIONS AND LIMITATIONS**

- upstream mechanical disconnect for isolation/ switching is to be provided for VACON® DCGuard;
- DC supply aR fuses are to be rated based on short-circuit current calculations and selectivity study on a case by case basis for DC distribution system;
- earth fault monitoring device of DC distribution system is not part of this type approval certificate;
- a system integrator is to ensure that a fault/ trip in one peer VACON® DCGuard leads to the opening of the other peer VACON® DCGuard;
- VACON NXP converter has hardware based short-circuit and overload protections as required by IEC 61800-5-1.

*“This Certificate is not valid for equipment, the design, ratings or operating parameters of which have been varied from the specimen tested. The manufacturer should notify Lloyd's Register EMEA of any modification or changes to the equipment in order to obtain a valid certificate.”*

*The Design Appraisal Document No.18/ and its supplementary Type Approval Terms and Conditions form part of this Certificate*

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**Southampton Office**  
**Lloyd's Register EMEA**

LR030.2016.06

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### DESIGN APPRAISAL DOCUMENT

Date 1 November 2018	Quote this reference on all future communications UKITSO/ETS/TA/AAP/WP32151004
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## LLOYD'S REGISTER TYPE APPROVAL SYSTEM, 2017.

Issued to: VACON LTD

For: VACON® DCGuard (Peer to peer topology)  
TYPE APPROVAL CERTIFICATE No. 18/

The undernoted documents have been reviewed for compliance with the requirements of the Lloyd's Register Type Approval System, 2017 and this Design Appraisal Document forms part of the Certificate.

### APPROVAL DOCUMENTATION

LR Type Approval certificate No.11/60005(E2)	01/10/2018
ISO 9001:2008 certificate No.CN07/00402	09/09/2016
ISO 9001:2008 certificate No.CNBJ312468-UK	29/11/2017
LR PQA audit report No.WO4588712	13/10/2016
DNVGL Type Approval certificate No.TAE00002G2	09/03/2018
ISO 9001:2008 certificate No.DK008428	14/12/2017
NX Software Process and Quality Plan v7	12/03/2018
VACON NXI Inverters FI4-FI8 User Manual No.DPD00908C, rev. C	22/03/2018
VACON NXI Inverters FI9-FI14 User Manual No.DPD00909C, rev. C	28/03/2018
VACON® DCGuard™ Application software and interface test plan, rev. 0.0	26/10/2017
VACON® DCGuard Peer to Peer Topology Functional description, rev. C,1	08/10/2018
VACON® DCGuard Peer to Peer Topology Technical data, rev.C,2	27/11/2017
VACON NX AC Drives Liquid-Cooled Drives User Manual No. DPD00887E, rev. E	25/10/2016
VACON NX AC Drives ADFIF102 DCGuard Application Manual No. DPD01971A, rev. A	28/11/2017
Memorandum of Meeting at Lloyd's Register office in Southampton, 12th June 2018, rev.2	22/06/2018
VACON® DCGuard Test plan, rev.1.1	14/06/2017
DANFOSS Drives DCGuard FMEA, v.2	05/07/2018
DCGuard double earth fault Simulation report	07/09/2018

### TEST REPORTS

VACON® DCGuard DNV-GL Type Approval Tests Rev. Sequence: A, 2 Test Report	27/11/2017
VACON® DCGuard LR Type Approval Tests Rev. Sequence: A, 1 Test Report	12/07/2018
VACON DCGuard double earth fault test report, rev.1.0	26/10/2018



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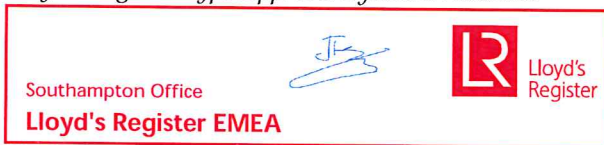
#### Supplementary Type Approval Terms and Conditions

*Type Approval certifies that a representative sample of the product(s) referred to herein has/have been found to meet the applicable design criteria for the use specified herein. It does not mean or imply approval for any other use, nor approval of any product(s) designed or manufactured otherwise than in strict conformity with the said representative sample.*

*Type Approval is based on the understanding that the manufacturer's recommendations and instructions and any relevant requirements of the Rules and Regulations are complied with.*

*Type Approval does not eliminate the need for normal inspection and survey procedures required by the Rules and Regulations.*

*Lloyd's Register EMEA reserves the right to cancel or withdraw this Type Approval Certificate in accordance with the Lloyd's Register Type Approval System Procedure.*



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