Certificate no.:
TAE00004U8

TYPE APPROVAL CERTIFICATE

This is to certify:

that the Frequency Converter

with type designation(s)
VACON 3000

issued to
Danfoss Power Electronics A/S
Gråsten, **Denmark**

is found to comply with
DNV rules for classification – Ships, offshore units, and high speed and light craft

Application:

Product(s) approved by this certificate is/are accepted for installation on all vessels classed by DNV.

Issued at **Høvik** on **2024-02-05**

This Certificate is valid until **2029-02-04**.
DNV local unit: **Certification & Inspection Services**

Approval Engineer: **Thomas Hartmann**

for **DNV**

Digitally Signed By: Schaarmann, Arne
Location: DNV SE Hamburg, Germany
Signing Date: 2024-02-05

This Certificate is subject to terms and conditions overleaf. Any significant change in design or construction may render this Certificate invalid.
The validity date relates to the Type Approval Certificate and not to the approval of equipment/systems installed.

Product description

General characteristics of VACON 3000 series converters

Voltage variation:	U_N ± 10 %
Frequency variation:	± 5 %
Output frequency:	0- 120 Hz
Temperature range in operation:	0 – 45 °C
Degree of protection	IP54
Cooling	Liquid cooled

12-pulse DFE drives

A VACON 3000 diode front-end unit (DFE) is a liquid-cooled power conversion unit (PCU). The DFE unit is a power converter, which converts the supplied AC voltage to DC voltage. The inverter converts the DC voltage to the AC voltage and frequency supplied to the motor.

Type designation	Mains supply [V]	Output [kVA]	Rated output current [A]
VACON3000-ED-12-0425-03	3300	2430	425
VACON3000-ED-12-0640-03	3300	3660	640
VACON3000-ED-12-0820-03	3300	4690	820
VACON3000-ED-12-1230-03	3300	7030	1230
VACON3000-ED-12-0340-04	4160	2450	340
VACON3000-ED-12-0510-04	4160	3670	510
VACON3000-ED-12-0650-04	4160	4680	650
VACON3000-ED-12-0980-04	4160	7060	980

Active Front End drives

The AFE unit is a power converter, which enables continuous 4-quadrant operation. The AFE converts the supplied AC voltage to DC voltage. When the motor is braking, the AFE can supply power back to the supply side. The inverter converts the DC voltage to the AC voltage and frequency supplied to the motor.

Type designation	Mains supply [V]	Output [kVA]	Rated output current [A]
VACON3000-ED-4Q-0425-03	3300	2430	425
VACON3000-ED-4Q-0640-03	3300	3660	640
VACON3000-ED-4Q-0820-03	3300	4690	820
VACON3000-ED-4Q-1230-03	3300	7030	1230
VACON3000-ED-4Q-0340-04	4160	2450	340
VACON3000-ED-4Q-0510-04	4160	3670	510
VACON3000-ED-4Q-0650-04	4160	4680	650
VACON3000-ED-4Q-0980-04	4160	7060	980

Application/Limitation

Temperature class:	A
Vibration class:	A
Humidity class:	B
EMC class:	A[1)]

The VACON 3000 converter must be regarded as a component. The actual installation to be designed according to VACON Operating Manual and according to the applicable DNV GL Rules for the actual application.

[1)]Converters with conducted and radiated emission above the DNV required limits can be installed in "special distribution zone" and "general power distribution zone", in accordance with IEC 60533 provided measures are taken to attenuate these effects on the distribution system, so the safe operation is assured. Planned EMC measures shall be submitted for approval prior to installation onboard.
The EMC measures should be derived from an EMC analysis and plan in accordance with IEC 60533 Annex B and /or IEC 61800-3 Annex E. EMC-Filter configuration as per manufacturer instruction for vessel applications.

For product certification / plan approval, the following documents of the semiconductor assembly should be submitted for approval, Ref. to DNV Pt.4 Ch.8 [2023] Sec.1 Table 7 by the end user / final product integrator:

- Reference to this Type Approval Certificate
- (E180) A drawing showing external location of instruments and devices for operation (panel layout)
- (E240) Functional description for the intended use, configuration and interface (e.g. alarms, monitoring and auxiliary power supplies)
- (Z252) Test program at manufacturer for routine tests and functional tests as per DNV Pt.4 Ch.8 [2023] Sec.7, 2.1.1
- Single line diagram (only applicable for multi drive configuration)
- If additional components to the type approved frequency converter are delivered, documentation according to DNV rules Pt.4 Ch.8 Sec.1 table 2 shall be submitted for review.
- For propulsion converter application the requirements of RU-Ship Pt.4 Ch.8 [2023] Sec.12 shall be observed

During product survey the following routine tests as per DNV RU-SHIP Pt.4 Ch.8 [2023] Sec.7 Table 5 shall be performed:

- No.1 Visual Inspection
- No.2 Light load and function test
- No.5 High voltage test
- No.6 Insulation tests
- No.9 Control and monitoring system
- No.11 Cooling failure test
- No.12 Pressure test of coolant piping/hoses

Clause for software control:
All changes in software are to be recorded as long as the system is in use on board. The records of all changes are to be forwarded to DNV for evaluation and approval. Major changes in the software are to be approved before being installed in the converter.

Place of manufacture

Danfoss Drives
12 TW Alexander Dr, Bldg 200 A,
Research Triangle Park,
27709 North Carolina, USA

Harju Elekter UAB
Tinklu g. 35R, Panevezys,
LT-35115, Lithuania

VEO Oy
Runsorintie 5
Vaasa 65380, Finland

Type Approval documentation

DNVGL Witness test report Danfoss2020-VS-1 & Danfoss2020-VS-2; ETL 15890B; TR-PR109101, Rev.#1; ETR1904231-01A; ETR18242DAN01.DGS; ETR20142DAN01.IWS; 24513029 – KEMA; E506467- 20221219-TestRecord (UL test record summary sheet); DanfossMV_AFE_PowerSupplyVariation_Simulation; DFE_Vib_DNV_16226B_cert.final rev1; DanfossMV_DFE_PowerSupplyVariation_Simulation; DFE_HumdCyclic_16234B-Rev-1_cert.final; DFE_IEC_DampHeat_16234-Rev-1_cert.final; DFE_LowTemp_16234A-Rev-1_cert.final; ETR21096DAN01.IWS; ETR1904231-01A; Final 24513070, Danfoss NC(Report); A0577803-210722_Site Visit Report_2021; D_DANFOSS TAC MV_VSD_Survey 2021-07-2_Vacon3000_DFE_DNVGL_ TestReport_Danfoss2021-VS_Signed_DNV; E506467-20230411-TestRecord; E517540-20230303-TestRecord (UL test record summary sheet);
AFEVacon3000_Agency_TestPlan_Sequence_DNVGL_R5_THH2023_12;
DFE Vacon3000_DFE_System_TestPlan_R2_DNVGL_THH2023_12

Tests carried out

Visual inspection, Performance, Power supply failure, Power supply variations, Vibration, Dry heat, Damp heat, Insulation resistance, High voltage.
EMC: The following tests are in accordance with the EMC directive / IEC 601800-3: Electrical fast transient (Burst), electrical slow transient (Surge), RF-common mode Voltage, radiated RF-electromagnetic fields, electric discharge (ESD), radiated and conducted emission.

Marking of product

VACON – Type designation – Power – Voltage

Periodical assessment

The scope of the periodical assessment is to verify that the conditions stipulated for the Type approval are complied with and that no alterations are made to the product design or choice of materials.
The main elements of the assessment are:

- Inspection on factory samples, selected at random from the production line (where practicable)
- Results from Routine Tests (RT) checked (if not available tests according to RT to be carried out)
- Review of type approval documentation
- Review of possible change in design, materials and performance
- Ensuring traceability between manufacturer's product type marking and Type Approval Certificate.

Periodical assessment is to be performed after 2 years and after 3.5 years. A renewal assessment will be performed at renewal of the certificate.

END OF CERTIFICATE