CERTIFICATE NUMBER	23-2443672-PDA
EFFECTIVE DATE	15-Dec-2023
EXPIRY DATE	14-Dec-2028
ABS TECHNICAL OFFICE	Houston ESD - Electrical

CERTIFICATE OF

Product Design Assessment

This is to certify that a representative of this Bureau did, at the request of

DANFOSS POWER ELECTRONICS A/S

located at

ULSNAES 1, , DK-6300 GRAASTEN, Denmark

assess design plans and data for the below listed product. This assessment is a representation by the Bureau as to the degree of compliance the design exhibits with applicable sections of the Rules. This assessment does not waive unit certification or classification procedures required by ABS Rules for products to be installed in ABS classed vessels or facilities. This certificate, by itself, does not reflect that the product is Type Approved. The scope and limitations of this assessment are detailed on the pages attached to this certificate.

Product:	**Frequency Converter**
Model:	**Series FC-102, FC-202, FC-301, FC-302**
Endorsements:	
Tier:	**5 - Unit Certification Required**

This Product Design Assessment (PDA) Certificate remains valid until 14/Dec/2028 or until the Rules and/or Standards used in the assessment are revised or until there is a design modification warranting design reassessment (whichever occurs first).

Acceptance of product is limited to the "Intended Service" details prescribed in the certificate and as per applicable Rules and Standards.

This Certificate is valid for installation of the listed product on ABS units which exist or are under contract for construction on or previous to the effective date of the ABS Rules and standards applied at the time of PDA issuance. Use of the Product for non-ABS units is subject to agreement between the manufacturer and intended client.

American Bureau Of Shipping

Soheni Haque

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Tier: 5 - Unit Certification Required

Product: **Frequency Converter**
Model: **Series FC-102, FC-202, FC-301, FC-302**
Endorsements:

Intended Service:
Marine and Offshore Installations - Air-cooled adjustable frequency converters for variable speed control of AC motors

Description:
Frequency Converters with Frame sizes A, B, C, D, E and F Frame (Enclosure Type) used to control motor drives having rated power 0.25KW to 1400KW, including Series FC-102, FC-202, FC-301 & FC-302 with Radio Frequency Interference (RFI) filter.

FC-102: VLT HVAC Drive - Advanced version
FC-202: VLT AQUA Drive - Advanced version
FC-301: VLT Automation Drive - Standard version
FC-302: VLT Automation Drive - Advanced version

* Refer to "Products List" attached for details of configurations of each series.

Rating:
Rated power: 0.25-1400 KW
Input voltage: 200-240 VAC (A, B & C Frame)
380-480 VAC, 380-500 VAC, 525-690 VAC (A, B, C, D, E and F Frame)
Input frequency: 50/60 Hz
Output voltage: 0-100% of input voltage
Output frequency: 0-590 Hz
Input/Output Phase: 3
Degree of ingress protection (enclosure): IP20, IP21, IP55, IP66 (A, B and C Frame)
IP00, IP20, IP21, IP54 (D, E and F Frame)
Design Ambient Temperature: 0°C-45°C; Maximum 55°C (with current derating)
Relative humidity: 5-95% (non-condensing)

* Refer to "Products List" attached for details of design ratings based on Type Codes.

Service Restriction:
1) Unit Certification is required for the frequency converters used to control motor drives having a rated power of 100 kW and over intended for essential services defined in Marine Vessel Rules 4-8-1/7.3.3 and Mobile Offshore Units Rules 4-1-1/3.5 or for services indicated in Marine Vessel Rules 4-8-3/TABLE 7 or related to additional optional notations requested for the ship and offshore unit.
2) If the manufacturer or purchaser request an ABS Certificate for compliance with a specification or standard, the specification or standard, including inspection standards and tolerances, must be clearly defined.
3) The products are not to be installed in the bridge and deck zone.
4) The converters are not intended for the service in hazardous areas.

Comments:
1) The Manufacturer has provided a declaration about the control of, or the lack of Asbestos in this product.
2) Where the converters with (RFI) filter, which exceeds the limits for radiated and conducted emissions required by Marine Vessel Rules 4-9-9/Table 1, are to be installed in the general power distribution zone, measures shall be taken per Danfoss Operating Guides / Instructions for the relevant Series for EMC-compliant installation to attenuate the emission effects on the distribution system. Planned EMC measures shall be assessed and communicated with the user in accordance with Marine Vessel Rules 4-8-3/8.5.14.
3) The converters are to be selected to have a degree of ingress protection suitable for intended installation locations in

accordance with Marine Vessel Rules 4-8-3/Table 2 and Mobile Offshore Units Rules 4-3-3/Table 1, or to be installed in an enclosure with an IP degree complying with the Rules aforementioned.
4) The current derating of the converters under ambient temperature 46°C-55°C is according to relevant Danfoss Design Guide for the associated series.
5) The alarm functions of converters, as a minimum, as specified per Marine Vessel Rules 4-8-3/8.5.12 are to be tested, as applicable at the plant of the manufacturer.
6) Assessment is for hardware only.
7) External cables of the subject converters are not covered by this PDA certificate.

Notes/Drawing/Documentation:
00714813, Product overview complete Marine approval Note, Revision: A,33
Drawing No. 177R0433, Block Diagram D-frame, Revision: 006
Drawing No. 177R0659, Block Diagram E-frame, P4001, Revision: 004
Drawing No. 177R0704, Installation drawing, E1h, IP21/54, Revision: 001
Drawing No. 177R0705, Installation drawing, E2h, IP21/54, Revision: 001
Drawing No. 177R0706, Installation drawing, E3h, IP00/20, Revision: 001
Drawing No. 177R0707, Installation drawing, E4h, IP00/20, Revision: 001
OJ L 96, 29.3.2014 (p. 79-106), Summary of references of harmonised standards published in the Official Journal – Directive 2014/30/EU, Date: 19.9.2022.
UL Bulletin, UL 61800-5-1 Effective Date Reminder and Update on Implementation, Date: April 23, 2018
00730213, FC-102 EU Declaration of Conformity, Revision: A,7
00730215, FC-202 EU Declaration of Conformity, Revision: A,7
00730216, FC-301 EU Declaration of Conformity, Revision: A,7
00730217, FC-302 EU Declaration of Conformity, Revision: A,7
UL File E70524, Vol. 2, Index, Issued: 2006-01-11, Revised: 2023-02-28
Drawing No. 134H1451, D1h Bill of Materials, Date: 2023.10.31
Drawing No. 177R0374, INSTALLATION DRAWING, D1H, IP21/54, Revision: 005
Drawing No. 134H3073, D2h Bill of Materials, Date: 2023.10.31
Drawing No. 177R0375, INSTALLATION DRAWING, D2H, IP21/54, Revision: 004
Drawing No. 136L9248, D3 Bill of Materials, Date: 2023.10.31
Drawing No. 177R0339, INSTALLATION DRAWING, D3H, IP20/CHASSIS, Revision: 004
Drawing No. 136N3304, D4h Bill of Materials, Date: 2023.10.31
Drawing No. 177R0340, INSTALLATION DRAWING, D4H, IP20/CHASSIS, Revision: 003
Drawing No. 137G5387, D5h Bill of Materials, Date: 2023.10.31
Drawing No. 177R0490, INSTALLATION DRAWING, D5H, IP21/54, Revision: 006
Drawing No. 136l8761, D6h Bill of Materials, Date: 2023.10.31
Drawing No. 177R0491, INSTALLATION DRAWING, D6H, IP21/54, Revision: 002
Drawing No. 134X5648, D7h Bill of Materials, Date: 2023.10.31
Drawing No. 177R0492, INSTALLATION DRAWING, D7H, IP21/54, Revision: 006
Drawing No. 136n0748, D8h Bill of Materials, Date: 2023.10.31
Drawing No. 177R0493, INSTALLATION DRAWING, D8H, IP21/54, Revision: 002
UL-US-L70524-1212-20202102-7, UL CERTIFICATE OF COMPLIANCE, NMMS - Power Conversion Equipment, Date: 3-Mar-2023
Drawing No. 132N0351, E1h Bill of Materials, Date: 2023.10.31
Drawing No. 136U9981, E2h Bill of Materials, Date: 2023.10.31
Drawing No. 132N3420, E3h Bill of Materials, Date: 2023.10.31
Drawing No. 137H6958, E4h Bill of Materials, Date: 2023.10.31
Compare Submittal drawings, E-Frame drives
UL-US-L70524-1215-13107102-4, UL CERTIFICATE OF COMPLIANCE, NMMS - Power Conversion Equipment, Date: 31-May-2022
FM5F9078a, 2MBI800XNE120-50 Fuji IGBT Modules Datasheet, Date: 2018/09
UL File E134261, Vol. 1, Index, Issued: 2006-01-27, Revised: 2021-03-05
MG21A502, Operating Guide, VLT AQUA Drive FC 202, 110–400 kW, Enclosure Sizes D1h–D8h, Date: 09/2018
MG34U502, Operating Guide, VLT Automation Drive FC 302, 90–315 kW, Enclosure Size D1h–D8h, Date: 09/2018

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Tier: 5 - Unit Certification Required

MG33AT22, Operating Guide, VLT Automation Drive FC 301/302, 0.25–75 kW, Date: 05/2018
MG16D502, Operating Guide, VLT HVAC Drive FC 102, 110–400 kW, Enclosure Sizes D1h–D8h, Date: 09/2018
MG38A202, Operating Guide, VLT Automation Drive FC 302,315–710 kW, Enclosure Sizes E1h–E4h, Date:04/2018
MG33U402, Operating Instructions, VLT Automation Drive FC 302, 90–1200 kW, Date: 2013-12-16
MG22A202, Operating Guide, VLT AQUA Drive FC 202, 355–800 kW, Enclosure Sizes E1h–E4h, Date: 04/2018
MG20P402, Operating Instructions, VLT AQUA Drive FC 202, 110–1400 kW, Date: 2013-12-16
MG16O202, Operating Guide, VLT HVAC Drive FC 102, 355–800 kW, Enclosure Sizes E1h–E4h, Date: 04/2018
MG11F502, Operating Instructions, VLT HVAC Drive FC 102, 315-1400 kW, Date: 08/2014
E70524, UL Product IQ, NMMS.E70524 - Power Conversion Equipment, Last Updated on 2023-09-20
UL File E70524, Project no. 4791065942, LABORATORY DATA PACKAGE, Fuji IGBT test report, Date: 11-02-2023
UL File E134261 Vol.1 Sec. 13, Project 03NK27228 USL, CNL AC motor controllers, Issued: 2004-01-08, Revised: 2023-01-13
00720010, EMC measures in IT-Grid on ships GUIDELINE, Rev. A,8
NMMS.E1324261 Power Conversion Equipment, Last Updated: 2023-11-23

* Refer to Documentation List attached for the drawings/documents included in the previous approvals.

Terms of Validity:
This Product Design Assessment (PDA) Certificate remains valid until 14/Dec/2028 or until the Rules and/or Standards used in the assessment are revised or until there is a design modification warranting design reassessment (whichever occurs first).

Acceptance of product is limited to the "Intended Service" details prescribed in the certificate and as per applicable Rules and Standards.

This Certificate is valid for installation of the listed product on ABS units which exist or are under contract for construction on or previous to the effective date of the ABS Rules and standards applied at the time of PDA issuance. Use of the Product for non-ABS units is subject to agreement between the manufacturer and intended client.

STANDARDS

ABS Rules:
2023 Rules for Conditions of Classification, Part 1, 1-1-4/7.7, 1-1-A3, 1-1-A4, which covers the following:
2023 Marine Vessel Rules 4-1-1/7.11, 4-8-1/7.3.3, 4-8-3/1.11, 4-8-3/1.17, 4-8-3/8, 4-8-3/Table 2, 4-8-3/Table 7, 4-8-4/1.3, 4-9-9/Table 1 & Table 2

2023 Rules for Conditions of Classification, Part 1, Offshore Units and Structures 1-1-4/9.7, 1-1-A2, 1-1-A3, which covers the following:
2023 Mobile Offshore Units Rules 4-1-1/3.5, 4-1-1/7.7, 4-3-3/3.1, 4-3-3/Table 1, 6-1-7/12, 6-1-7/13.5, 6-1-7/19.1

National:
UL 61800-5-1 Edition 1, Adjustable Speed Electrical Power Drive Systems - Part 5-1: Safety Requirements - Electrical, Thermal and Energy
UL 508C Edition 4, Power Conversion Equipment

International:
EN61800-5-1:2007+A1:2017+A11:2021 Adjustable speed electrical power drive systems – Part 5-1: Safety requirements – Electrical, thermal and energy
EN61800-3:2004 + A1:2012 Adjustable speed electrical power drive systems – Part 3: EMC requirements and specific test methods

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Tier: 5 - Unit Certification Required

Government:
NA

EUMED:
NA

OTHERS:
None