TYPE APPROVAL CERTIFICATE

Certificate No:
TAE000008C
Revision No:
4

This is to certify:

That the Frequency Converter

with type designation(s)
FC-302 series,

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 :

Products approved by this certificate are accepted for installation on all vessels classed by DNV.

Issued at **Høvik** on **2022-11-08**

This Certificate is valid until **2027-06-30**.
DNV local station: **Denmark CMC**

Approval Engineer: **Nicolay Horn**

for **DNV**

Digitally Signed By: Elter, Frederik Tore
Location: DNV Høvik, Norway

Frederik Tore Elter
Head of Section

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.

Name and place of manufacturer

Danfoss Drives A/S GRAASTEN Denmark	Danfoss LLC LOVES PARK IL, United States
Zhejiang Holip Electronic Technology Co., Ltd Haiyan county, Jiaxing city, Zhejiang province, China	

Product description

Product: Frequency converter for asynchronous motors for use in various marine applications.

Model: VLT® Automation Drive series FC-302

FC-302 power rating vs. enclosure type and IP rating

FC-302: 200-240V				
Power rating [kW]	**Enclosure type**			
FC-302	**IP20** (*1)	**IP21** (*2)	**IP55** (*3)	**IP66** (*4)
0,25	A2	A2 (*5)	A4+A5	A4+A5
0,37				
0,55				
0,75				
1,1				
1,5				
2,2				
3,0	A3	A3 (*5)	A5	A5
3,7				
5,5	B3	B1	B1	B1
7.5				
-				
11	B4	B2	B2	B2
15		C1	C1	C1
18.5	C3			
22				
30	C4	C2	C2	C2
37				

FC-302: 380-480/500V				
Power rating [kW]	**Enclosure type**			
FC-302	**IP20** (*1)	**IP21** (*2)	**IP55** (*3)	**IP66** (*4)
0,37	A2	A2 (*5)	A4+A5	A4+A5
0,55				
0,75				
1,1				
1,5				
2,2				
3,0				
4,0				
5,5	A3	A3 (*5)	A5	A5
7,5				
-	B3	B1	B1	B1

FC-302: 380-480/500V				
Power rating [kW]	**Enclosure type**			
FC-302	**IP20** (*1)	**IP21** (*2)	**IP55** (*3)	**IP66** (*4)
11				
15				
18.5	B4	B2	B2	B2
22				
30		C1	C1	C1
37	C3			
45				
55	C4	C2	C2	C2
75				

FC-302: 525-690V				
Power rating [kW]	**Enclosure type**			
FC-302	**IP20** (*1)	**IP21** (*2)	**IP55** (*3)	**IP66** (*4)
1,1	A3	N/A	N/A	N/A
1,5				
2,2				
3,0				
4,0				
5,5				
7,5				
-	B4	B2	B2	B2
11				
15				
18				
22				
30		C2	C2	C2
37	C3			
45				
55	D3h			
75				

FC-302: 380-480/500V					
Power rating [kW]	**Enclosure type**				
	6-pulse			**12-pulse**	**Low Harmonic Drive (LHD)**
FC-302	**IP20 (*1)**	**IP00** (*1)	**IP21/IP54** (*2)		
90	D3h	N/A	D1h/D5h/D6h	N/A	N/A
110					
132					D1n
160	D4h		D2h/D7h/D8h		D2n
200					
250				F8/F9	E9
315	E3h	E2/E3h	E1/E1h		
355					
400					
450	E4h	E4h	F1/F3/E2h	F10/F11	F18
500	E4h	E4h	F1/F3/E2h		
560	N/A	N/A	F1/F3		
630	N/A	N/A	F1/F3		
710	N/A	N/A	F2/F4	F12/F13	N/A
800					

FC-302: 525-690V				
Power rating [kW]	**Enclosure type**			
	6-pulse			**12-pulse**
FC-302	**IP20 (*1)**	**IP00** (*1)	**IP21/IP54** (*2)	
55	D3h	N/A	D1h/D5h/D6h	N/A
75				
90				
110				
132				
160	D4h	N/A	D2h/D7h/D8h	N/A
200				
250				
315				
355	E3h	E2/ E3h	E1/E1h	F8/F9
400				
500				
560				
630	E4h	E4h	F1/F3/E2h	F10/F11
710	E4h	E4h	F1/F3/E2h	
800	N/A	N/A	F1/F3	
900	N/A	N/A	F2/F4	F12/F13
1M0				
1M2				

(*1) IP20/Panel mount. All IP20 versions can be upgraded to IP21 with optional kit
(*2) IP21/NEMA Type 1
(*3) IP55/NEMA Type 12
(*4) IP66/NEMA Type 4X
(*5) IP20/Panel with IP21 upgrade kit

For more detailed information: See Product Overview Document ID 00714813 version A33.

Application/Limitation

Supply voltage range:	200 - 240 V / 380 - 480 V / 525 - 690 V, 50/60 Hz
Voltage variation:	± 10 %, -15% with reduced power rating
Frequency variation:	A, B and C frames: ± 10%, -15% for maintaining functions after start up. D, E and F frames: ± 5% In accordance with Danfoss design guide
Output frequency:	A, B and C frames: 0 – 590 Hz D, E and F frames: 0 – 590 Hz In accordance with Danfoss design guide
Temperature range in operation:	In accordance with Danfoss design guide
Temperature range in operation:	0 - 45°C, 46-55 °C with current derating in according to relevant design guide.
Temperature class:	A
Vibration class:	A
Humidity class:	B*
EMC class:	A**
Protection class:	IP00 / 20 / 21 / 54 / 55 / 66 & E4X***

The FC-302 shall be regarded as a component. The actual installation is to be designed according to Danfoss design guide MG11BC02, MG34S302 & MG38C202 and according to the applicable DNV Rules for the actual application.

Frequency converters rated equal or larger than 100 kW serving essential or important functions as defined in DNV rules Pt.4 Ch.8 shall have a product certificate according to DNV Pt.4 Ch.8 Sec.1 Table 3 for each delivery to DNV classed vessels.

For product certification / plan approval, the following documents of the semiconductor assembly should be submitted for approval, Ref. to DNV Pt.4 Ch.8 Sec.1 Table 2 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 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.

* Relative humidity 5 to 95%, no condensation allowed.

** Converters EMC classed C3 according to IEC 61800-3 can be installed in "special distribution zone" and "general power distribution zone" in accordance with IEC 60533 provided precautions are taken to attenuate these effects on the distribution system, so the safe operation is assured.

*** To be installed in an enclosure with an IP degree in accordance with DNV Rules w.r.t. location.

Te Type Approval covers hardware and software for the basic controller.

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.

Type Approval documentation

Technical info:
Product overview complete Marine approval document no. 00714813 Ref sequence A29, dated 2017-03-23.

Test reports:
In accordance with Tech Doc numbers 45 to 86.
P720 Test Report Package v1, included in email dated 2016-05-04.

Part of CD: P424 _LHD & AAF" :

Danfoss test report no. 00708868, & 00708869 & 00708874 dated 2013-10-30. NTS test report nos CTR-11-0127 dated 2011-04-11 CTR-11-0145 & CTR-11-0125 dated 2011-08-24, CTR-1-0155 dated 2012. Danfoss doc. Nos 00703862, 00703684 dated 2011-09-25, 00705156 dated 2012-04-01. NTS Report: Danfoss Drives A10116 dated

2010-06-14, NTS Report: Danfoss Drives A11198 Report dated 2011-06-27. Danfoss report nos. 00596396 dated 2010-07-19, 00207667 dated 2013-03-01. Danfoss test reports 00709736, 00709737 & 00707738 dated 2012-08-07-

Part of CD 1 & 2 " Danfoss Loves Park Type Approval Submittal Package"

Danfoss test reports P454 Marine Vibration Report doc no. 00707038 dated 2012-03-06 and P454 Dry Heat Justification report doc. no. 00712217 dated 2012-12-26. UL test reports no. File E70524 V2 Project 05NK19968 dated Aug 18 2005, File E70524 V2 Project 05NK31571 dated Jan 05 2006, File E70524 V2 Project 07NK16874 dated Sept 10 2007, File E70524 V2 Project 08NK16638 dated July 29 2008, File E70524 V2 Project 09NK08421 dated May 21 2006, File E70524 V2 Project 09CA48648 dated Oct 06 2009. NTS test report no. A8366-500B0432 dated Dec 05 2008. DELTA EMC test report no.19K0441, dated 2007-03-02, Danak Report 19K0227-1, Danfoss test reports Tr100903 dated 2010-09-03, P401-151, -152, & -154 dated 2007-03-09, P404-363, -449, -682, -683, -684, -685, -686, -688, -689, -691, -692, -697, -698, & -699, Document version 1.00a, P407-16 and P407-142.

DD-DS3 P420 - Marine test overview version 1.00

P462-91_R0132T02v200c dated 2012-07-03
P462-120_R0101T02v200a dated 2012-11-20
P462-122_R0102T01v300b dated 2013-04-30
P462-159_R0132T04v100d dated 2013-05-28
P462-164_R0134T05v210a dated 2013-11-18
P462-308 _R0132T02v200c dated 2013-11-18
P462-321_R0123T03v110a dated 2013-04-30
P462-329_R0101T02v200a dated 2012-11-20
P462-308_R0132T02v200c dated 2012-07-03
P462-355_R0134T05v210c dated 2013-11-18
P462-91_R0132T02v200c dated 2012-07-03
P462-362_R0102T01v300b dated 2013-04-30
P462-367_R0123T03v110a dated 2013-04-30
P462-391_R0102T01v300b dated 2013-04-30
P462-395_R0101T02v200a dated 2012-11-20
P462-451_R0124T02v110a dated 2013-07-03
P462-454_R0123T03v110a dated 2013-04-30
P462-456_R0132T02v200c dated 2013-07-03
P462-459_R0134T05v210 dated 2013-11-18
P462-473_R0122T01v110a dated 2013-09-18
P420-541_R0123T04v110a dated 2007-12-19
P420-321_R0123T03v110a dated 2007-12-19
P420-367_R0123T03v110a dated 2007-12-19
P420-368_R0123T04v110a dated 2007-12-19
P420-454_R0123T03v110a dated 2007-12-19

P429 -58_R0101T01v220a "Visual inspection, dated 2009-12-19
P429 -81_R0111T01v201a "Temperature test" dated 2008-06-02
P429 -151_R0126T02v100a "Burst – fast transient" dated 2008-11-25
P429 -162_R0126T02v100a "Burst – fast transient" dated 2008-11-25
P429 -150_R0126T02v100a "Electrostatic discharge" dated 2008-11-25
P429 -161_R0126T02v100a "Electrostatic discharge" dated 2008-11-25
P429 -159_R0127T02v100b "Conducted emission" dated 2008-11-25
P429 -231_R0127T02v100c "Conducted emission" dated 2008-11-25
P429 -165_R0122T01v110a "Power supply variation and interruptions" dated 2008-11-25
P429 -154_R0122T02v110a "Power supply variation and interruptions" dated 2008-11-25
P429 -144_R0123T01v110a "Dry heat test" dated 2008-11-25
P429 -155_R0123T01v110a "Dry heat test" dated 2008-11-25
P429 -163_R0124T01v100a "Wide band random" dated 2008-11-26
P429 -164_R0124T01v100a "Wide band random" dated 2008-12-22

DocCM 00708685, DocCM 00709825, DocCM 0071489
CTR 13-0120 dated 2013-05-17

130R0319 – Marine test overview FC302PK25T5 – FC302P7K5T5
130R0320 – Marine test overview FC302P11KT5 – FC302P75KT5
DANAK EMC test report no.19K0123, dated 2004-05-26
DANAK EMC test report no.19K0337, dated 2006-04-11
DANAK EMC test report no.19K0351, dated 2006-04-11
Danfoss test reports P401-749, -758,--1093, -1094,-1095,-1096, -1098 & -1129, Document version 1.00a
Danfoss test reports P404-363, -682, -683, -684, -685, -686, -688, -689, -698, -691, -692, -697, & -699, Document version 1.00a.

Tests carried out

Visual inspection, Performance, Power supply failure, Power supply variations, Voltage/frequency variation, Vibration/shock, Dry heat, Damp heat, Insulation resistance, High voltage.
EMC: 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

Danfoss – 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 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.

Assessment to be performed at 2, 3.5 year and at renewal.

END OF CERTIFICATE