

# TYPE APPROVAL CERTIFICATE

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**This is to certify:**

**That the Frequency Converter**

with type designation(s)  
**FC-102 series,**

Issued to

**Danfoss Drives A/S**  
**GRAASTEN, Denmark**

is found to comply with  
**DNV GL 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 GL.**

This Certificate is valid until **2022-06-30**.

Issued at **Høvik** on **2017-06-23**

DNV GL local station: **Fredericia**

Approval Engineer: **Nicolay Horn**

for **DNV GL**

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**Andreas Kristoffersen**  
**Head of Section**

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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.

Job Id: **262.1-004066-7**  
 Certificate No: **TAE000008A**  
 Revision No: **2**

### Name and place of manufacturer

Danfoss Drives A/S GRAASTEN Denmark	Danfoss LLC LOVES PARK IL, United States
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### Product description

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

**Model:** VLT® HVAC Drive series FC-102

### FC-102 power rating vs. enclosure type and IP rating

FC-102: 200-240V				
Power rating [kW]	Enclosure type			
FC-102	IP20 (*1)	IP21 (*2)	IP55 (*3)	IP66 (*4)
-	A2	A2 (*5)	A4+A5	A4+A5
-				
-				
-				
1,1				
1,5	A3	A3 (*5)	A5	A5
2,2				
3,0				
3,7				
5,5				
7,5	B3	B1	B1	B1
11				
15				
18,5	B4	B2	B2	B2
22		C3	C1	C1
30				
37				
45	C4	C2	C2	C2

FC-102: 380-480/500V				
Power rating [kW]	Enclosure type			
FC-102	IP20 (*1)	IP21 (*2)	IP55 (*3)	IP66 (*4)
-	A2	A2 (*5)	A4+A5	A4+A5
-				
-				
1,1				
1,5				
2,2	A3	A3 (*5)	A5	A5
3,0				
4,0				
5,5				
7,5				
11	B3	B1	B1	B1

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<b>FC-102: 380-480/500V</b>				
<b>Power rating [kW]</b>	<b>Enclosure type</b>			
<b>FC-102</b>	<b>IP20 (*1)</b>	<b>IP21 (*2)</b>	<b>IP55 (*3)</b>	<b>IP66 (*4)</b>
15	B4	B2	B2	B2
18,5				
22				
30				
37	C3	C1	C1	C1
45				
55	C4	C2	C2	C2
75				
90				

<b>FC-102: 525-690V</b>				
<b>Power rating [kW]</b>	<b>Enclosure type</b>			
<b>FC-102</b>	<b>IP20 (*1)</b>	<b>IP21 (*2)</b>	<b>IP55 (*3)</b>	<b>IP66 (*4)</b>
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	C3	C2	C2	C2
30				
37				
45	D3h	C2	C2	C2
55				
75				
90				

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<b>FC-102: 380-480/500V</b>					
<b>Power rating [kW]</b>	<b>Enclosure type</b>				
	<b>6-pulse</b>			<b>12-pulse</b>	<b>Low Harmonic Drive (LHD)</b>
<b>FC-102</b>	<b>IP20 (*1)</b>	<b>IP00 (*1)</b>	<b>IP21/IP54 (*2)</b>		
110	D3h	N/A	D1h/D5h/D6h	N/A	N/A
132					D1n
160					D2n
200	D4h	N/A	D2h/D7h/D8h	N/A	N/A
250					
315	E3h	E2	E1/E1h	F8/F9	E9
355					
400					
450	E4h	N/A	F1/F3/E2h	F10/F11	F18
500	E4h		F1/F3/E2h		
560	N/A		F1/F3		
630	N/A		F1/F3		
710	N/A	N/A	F2/F4	F12/F13	N/A
800	N/A	N/A	F2/F4	F12/F13	N/A
1M0					

<b>FC-102: 525-690V</b>				
<b>Power rating [kW]</b>	<b>Enclosure type</b>			
	<b>6-pulse</b>			<b>12-pulse</b>
<b>FC-102</b>	<b>IP20 (*1)</b>	<b>IP00 (*1)</b>	<b>IP21/IP54 (*2)</b>	
75	D3h	N/A	D1h/D5h/D6h	N/A
90				
110				
132				
160	D4h	N/A	D2h/D7h/D8h	N/A
200				
250				
315				
400				
450	E3h	E2	E1/E1h	F8/F9
500				
560				
630	E4h	N/A	F1/F3/E2h	F10/F11
710	E4h		F1/F3/E2h	
800	N/A		F1/F3	
900	N/A	N/A	F2/F4	F12/F13
1M0				
1M2				
1M4	N/A	N/A	F2/F4	F12/F13

(\*1) IP20/Panel mount. All IP20 versions can be upgraded to IP21 with optional kit

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- (\*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 A29.

## Application/Limitation

Supply voltage range:	200 - 240 V / 380 - 480 V / 525 - 690 V, 50/60 Hz
Voltage variation:	± 10 %, -15% reduced power rating
Frequency variation:	A, B and C frames: ± 10% 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 of 1.5 %/°C.
Temperature class:	A
Vibration class:	A
Humidity class:	B*
EMC class:	A**
Protection class:	IP00 / 20 / 21 / 54 / 55 / 66 & E4X***

The FC-102 shall be regarded as a component. The actual installation is to be designed according to Danfoss design guide MG11BC02 & MG16C202 and according to the applicable DNV Rules for the actual application.

Documents for the actual application are to be submitted for approval in each case in accordance with DNV Rules Pt.4, Ch.8, Sec.1 Table B2. A Product Certificate is required for converters ≥ 100 kW.

\* 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.

The 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”:

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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

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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 tests 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