TYPE APPROVAL CERTIFICATE

Certificate No:
TAE000008A

This is to certify:

That the Frequency Converter

with type designation(s)
FC102 series,

Issued to
Danfoss Drives A/S
GRAASTEN, Denmark

is found to comply with
DNV GL rules for classification – Ships and offshore units

Application :

Frequency Converter for Asyncronous Motors Range: 1,1 kW to 1400 kW
200-240 / 380-480 / 525-690 VAC supply.

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

This Certificate is valid until **2017-06-30**.

Issued at **Høvik** on **2015-11-16**

for **DNV GL**

DNV GL local station: **Fredericia**

Approval Engineer: **Nicolay Horn**

Marit Laumann
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.

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Name and place of manufacturer

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

Product description

Product: Frequency converter 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 (T2)				
Power rating	**Enclosure type**			
[kW]	**IP20** (*1)	**IP21** (*2)	**IP55** (*3)	**IP66** (*4)
1,1	A2	A2 (*5)	A4+A5	A4+A5
1,5				
2,2				
3,0	A3	A3 (*5)		
3,7			A5	A5
5,5	B3	B1	B1	B1
7,5				
11				
15	B4	B2	B2	B2
18,5		C1	C1	C1
22	C3			
30				
37	C4	C2	C2	C2
45				

FC-102: 380-480V (T4)				
Power rating	**Enclosure type**			
[kW]	**IP20** (*1)	**IP21** (*2)	**IP55** (*3)	**IP66** (*4)
1,1	A2	A2 (*5)	A4+A5	A4+A5
1,5				
2,2				
3,0				
4,0	A2	A2 (*5)	A4+A5	A4+A5
5,5	A3	A3 (*5)	A5	A5
7,5				
11	B3	B1	B1	B1
15				
18,5	B3	B1	B1	B1
22	B4	B2	B2	B2
30				
37		C1	C1	C1
45	C3			
55				
75	C4	C2	C2	C2

FC-102: 380-480V (T4)				
Power rating	**Enclosure type**			
[kW]	**IP20** (*1)	**IP21** (*2)	**IP55** (*3)	**IP66** (*4)
90			N/A	
45	C3			
55				
75	D3h			
90				

FC-102: 380-480V (T4)				
Power rating [kW]	**Enclosure type**			
	IP20 (*1)	**IP00** (*1)	**IP21** (*2)	**IP54** (*3)
110	D3h	NA	D1h/D5h/D6h	D1h/D5h/D6h
132				
160				
200	D4h	NA	D2h/D7h/D8h	D2h/D7h/D8h
250				
315				
110	NA	D3	D1	D1
132				
160	NA	D4	D2	D2
200				
250				
315	NA	E2	E1	E1
355				
400				
450				
500	NA	NA	F1/F3	F1/F3
560				
630				
710				
800	NA	NA	F2/F4	F2/F4
1000	NA	NA	F2/F4	F2/F4

FC-102: 525-690V (T7)				
Power rating	**Enclosure type**			
[kW]	**IP20** (*1)	**IP21** (*2)	**IP55** (*3)	**IP66** (*4)
1,1	A3	N/A		
1,5				
2,2		B2	B2	B2
3,0				
3,7		N/A		
4,0		B2	B2	B2
5,5				
7,5				
11	B4			
15				
18,5				

FC-102: 525-690V (T7)				
Power rating	**Enclosure type**			
[kW]	**IP20** (*1)	**IP21** (*2)	**IP55** (*3)	**IP66** (*4)
22				
30				
37		C2	C2	C2
45	C3			
55				
75	D3h			
90				

FC-102 525-690V (T7)				
Power rating	**Enclosure type**			
[kW]	**IP20 (*1)**	**IP00** (*1)	**IP21** (*2)	**IP54** (*3)
75	D3h	NA	D1h/D5h/D6h	D1h/D5h/D6h
90				
110				
132				
160				
200	D4h	NA	D2h/D7h/D8h	D2h/D7h/D8h
250				
315				
400				
45	NA	D3	D1	D1
55				
75				
90				
110				
132				
160				
200	NA	D4	D2	D2
250				
315				
400				
450	NA	E2	E1	E1
500				
560				
630				
710	NA	NA	F1/F3	F1/F3
800				
900				
1000	NA	NA	F2/F4	F2/F4
1200				
1400				

12-Pulse Drives				
FC-202: 525-690V (T7)				
Power rating [kW]	**Enclosure type**			
	IP00 (*1)	**IP21** (*2)	**IP54** (*3)	
450	NA	F8/F9	F8/F9	
500				
560				
630				
710	NA	F10/F11	F10/F11	
800				
900				
1M0	NA	F12/F13	F12/F13	
1M2				
1M4				

Low Harmonic Drives				
FC-102: 380-480V (T4)				
Power rating [kW]	**Enclosure type**			
	IP00 (*1)	**IP21** (*2)	**IP54** (*3)	
160	NA	D11/D13	D11/D13	
200				
250				
315	NA	E7/E9	E7/E9	
355				
400				
450				
500	NA	F17/F18	F17/F18	
560				
630				
710				

(*1) IP00/IP20/Panel mount.
(*2) IP21/NEMA Type 1
(*3) IP54/NEMA Type 12
(*4) IP66/NEMA Type 4X.
(*5) IP20/Panel with IP21 upgrade kit

H1, H2, H3, H4, H5, B2, L2 and N2 RFI comply with IACS E10 requirements except radiated and conducted emissions.

Ruggedized boards, selection "R" in character 20, must be selected for D1h – D8h.

Selection types for Type Codes for FC-102

_ (character 24 – 39 software + options)
1 4 7 10 11 23

Basic string definitions:

Product Group (character 1-3)

FC- : Adjustable Frequency Converters

VLT series (character 4-6)
102 VLT HVAC Drive – Advanced version

Power size (character 7-10)
P110: 110 kW / 150 HP
N110: 110 kW/ 150 HP

Voltage: (character 11-12)
T2: Three phase 200-240 VAC
T4 : Three phase 380-480 VAC
T7 : Three Phase 525-690 VAC

Enclosure (character 13-15)
E00: IP00 / Chassis
E20: IP20 / Chassis
E2S: IP20 / Chassis (medium power D-Frame)
E21: IP21 / Type 1
E2D: IP21 / Type 1 (medium power D-Frame)
H21: IP21 / Type 1 with heater
E54: IP54/ Type 12
E55: IP55/ Type 12
H54: IP54 / Type 12 with heater
E5H: Hybrid IP54
E2M: IP20 / Type 1 with mains shield
E5M: IP54 / Type 12 with mains shield
E5D: IP54 / Type 12 (medium power D-Frame)
E66: IP66 / Type 4X

Hardware (character 16-23)
Hardware, RFI filter (character 16-17)
H2: 6 Pulse Drive RFI for Maritime (complies with IACS E10 requirements except radiated and conducted emissions)
H4: 6 Pulse Drive RFI for Maritime (complies with IACS E10 requirements except radiated and conducted emissions)
H5: 6 Pulse Drive RFI for Maritime (complies with IACS E10 requirements except radiated and conducted emissions)
H6: 6 Pulse Drive RFI for Maritime (complies with IACS E10 requirements)
B2: 12 Pulse Drive with RFI for Maritime (complies with IACS E10 requirements except radiated and conducted emissions)
L2: Low Harmonic Drive with RFI for Maritime (complies with IACS E10 requirements except radiated and conducted emissions)
N2: Low Harmonic Drive with RFI for Maritime (complies with IACS E10 requirements except radiated and conducted emissions)

Hardware, Brake & Stop (character 18)
Hardware, Display (character 19)
Hardware, Coating (character 20)
Hardware, Mains options (character 21)
Hardware, adaptation A (character 22)
Hardware, adaptation B (character 23)

Software (character 24-28)
Options – A (character 29-30)
Options – B (character 31-32)
Options – C (character 33-37)
Options – D (character 38-39)

Brand labelling and customer specific definitions

Brand labelling and customer specific drives are following the type codes except the characters 1-6 for product group and VLT series. Character 1-6 are used for customer specific definitions.

Basic string definitions for brand labelling and customer specific drives:

Product Group and VLT series (character 1-6)

AF-600	Equals to FC-102
AKD102	Equals to FC-102
ADS102	Equals to FC-102
IVS102	Equals to FC-102
TR-200	Equals to FC-102
ITT102	Equals to FC-102
FC -103	Equals to FC-102

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

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 is complied with and that no alterations are made to the product design or choice of materials.

The main elements of the survey are:
- Inspection on factory samples, selected at random from the production line (where practicable)
- Results from Production Sample Tests (PST) and Routines (RT) checked (if not available tests according to PST and 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.

Survey to be performed at least every second year.

END OF CERTIFICATE