Type Approval Certificate

[Frequency Converter]

Initial Approval 24 October 2024

Manufacturer Danfoss Drives Oy
Runsorintie 7, 65380 Vaasa, Finland

Product Description Type : iC7-60SL

″ See Appendix 1 ″

Approval Condition ″ See Appendix 1 ″

THIS IS TO CERTIFY that the above-mentioned product has been approved in accordance with the relevant requirement of this Society's Rules and / or of the recognized standards as follows.

Pt. 6, Ch. 1, Sec. 12 of the Rules for Classification of Steel Ships.

This Certificate is valid until 23 October 2029

Issued at Busan, Korea on 24 October 2024

This certificate is signed electronically in accordance with IMO FAL.5/Circ.39/Rev.2. Validation and authentication of the certificate can be confirmed from "http://e-cert.krs.co.kr" by using the tracking No(ME24050619952) and certificate No.(HMB28683-AC004).

KOREAN REGISTER

General Manager of
Marine & Ocean Equipment Team

Note : *1. This certificate will be valid subject to complying with the approval conditions described on the certificate and/or on the Rules of this Society.*
2. This certificate will be invalid from the expiry date aforementioned unless the extension or renewal has been granted to the applicant or the manufacturer.
3. Any significant modifications or changes in design or construction to the above product without approval from this Society will render this certificate invalid.
4. Should the specified rules, regulations or standards be amended during the validity of this certificate, the product is to be re-approved by this Society in accordance with the requirements as amended.

Product Description and/or Approval Condition

Date of Issue : 24 October 2024

A. Product Description

1. Product Specification

Danfoss iC7-60SL drive modules are liquid-cooled units which serve as building blocks for larger power systems.

iC7-60SL drive modules can be used for inverter units (INU), active front end units (AFE), brake chopper units (BCU), grid converter units (GC) and DC/DC converter units (DC). These modules are available with loose or integrated filter options.

1) Specification

- Supply voltage : 525 ~ 690V AC (-15 ~ +10%), 640 ~ 1100V DC (-0 ~ 0%)
  525 ~ 690V AC (-15 ~ +10%), 640 ~ 1200V DC (-0 ~ 0%)
  380 ~ 500V AC (-15 ~ +10%), 465 ~ 800V DC (-0 ~ 0%)
- Input frequency : 45 ~ 66 Hz for AFE/GC, 25 ~ 70 Hz for GC with derating
- Output frequency : 0 ~ 599 Hz
- Operation temperature : -15 ~ +60℃ (power units), -15 ~ +55℃ (control units)

2) Type Designation

Code example	Description
iC7-60	Product group
SL	Product category SL = system module, liquid-cooled
IN	3A = 3-phase active front end, AFE GC = Grid converter module, GC IN = Inverter module, INU DC = DC/DC conveter, DC
07	Voltage rating 07 = 525 ~ 690V AC (640 ~ 1100V DC) A7 = 525 ~ 690V AC (640 ~ 1200V DC) B5 = 380 ~ 500V AC (465 ~ 800V DC)
-300A	Current rating 170A, 206A, 208A, 236A, 245A, 261A, 300A, 302A, 325A, 334A, 360A, 365A, 380A, 385A, 416A, 420A, 425A, 465A, 475A, 480A, 525A, 530A, 570A, 590A, 595A, 650A, 670A, 720A, 730A, 760A, 820A, 840A, 850A, 945A, 960A, 1040, 1060, 1080, 1200, 1230, 1325, 1400, 1440, 1500, 1640, 1680, 1700, 1795, 1800, 1920, 2000, 2080, 2160, 2250, 2300, 2400, 2500, 2650, 2830, 2880, 2940, 3050, 3120, 3240, 3260, 3500, 3600, 3900, 4035, 4320, 4400, 4750, 4850, 5040, 5300, 5400, 5600, 5750, 6100, 6400
E00	Protection rating E00 = IP00/Open type
F4	EMC level F3 = C3 industry environment F3 = C4 system component
+XXXX	Options

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2. Approved Drawings and Documents

1) Operating Guide for iC7 Series liquid-cooled system modules
   - AQ303746230368en-000101/139Z5997 dated 2021-06
2) Circuit Diagram
   - TED14189 Rev.2 dated 2019-10-28

3. Test Reports, etc.

1) Environmental / EMC Test Reports
   - 00775653 dated 2022-05-09, 00769622 dated 2020-12-07
     EUFI29-19004866-T2 dated 2020-01-08, EUFI29-19004589-T2 dated 2019-12-12,
     EUFI29-21002279-T1 dated 2021-10-06, EUFI29-19006315-T2 dated 2019-12-13,
     EUFI29-19004866-T2 dated 2020-01-18, EUFI29-19004589-T2, T4, T6 dated 2019-12-12
2) IEC 61800-5-1, IEC 62477-1 Test Reports
   - HELES2102000122-1 dated 2022-06-23, HELES2102000122-2 dated 2021-12-08,
     HELES2202000152-1 dated 2023-11-21, HELES2202000152-2 dated 2023-11-28
3) Additional Test Reports
   - Quick stop test 00782694 dated 2024-10-04
   - Short circuit test for grid converter 00782690 dated 2024-10-04
4) Software Documents
   - Software quality plan 00781700 dated 2024-04-24
5) Application Guides
   - Propulsion application AB426216167632en-000302/136R0306
   - Active front end application AB318753809018en-000201/136R0281
   - Grid converter application AB426216113631en-0002/136R0305

B. Approval Condition

1. Application & Limitation

1) This approval is granted on the basis of test reports and approved documentation.
2) Degree of protection is to be complied with Rule Pt.6 Ch.1 Sec.2 201.2.(5).
3) The manufacturer is to inform this Society of all kinds of revisions of the equipment including software. If the changes are recognized to affect functionality of the approved equipment, type test to confirm the reliability of the revised equipment may be performed in the presence of our surveyor.
4) Converters that exceed the KR required limits for conducted and radiated emissions may be installed in special distribution zone, in compliance with IEC 60533, provided that measures are taken to mitigate these emissions and ensure safe operation of the distribution system.
5) Unless specifically directed by the Administration, this approval is not to be interpreted as a replacement for approval from the flag Administration.

2. Individual Product Cert. and Drawing Approval Requirement

1) If the converters are used as parts of the motor controller which drive essential auxiliaries specified in KR Rule Pt. 5, Ch. 1, 102 and exceed the output 7.5 kW, or for electric propulsion, drawing approval for individual vessel, and/or individual product certification is required for the motor controller.
2) If the converters are used for electric propulsion unit, drawing approval for individual vessel, and individual product certification are required.

3. Marking

1) The product or packing is to be marked with manufacturer name and type designation on a suitable position.

4. Others

1) Test condition

Test	Condition	Remark
EMC	Special distribution zone in accordance with IEC 60533	-
Temperature	+5 ~ +70℃	-
Vibration	Acceleration ±0.7g	-

< End of Certificate >