Certificate No: LR2446207TA
Issue Date: 14/05/2024
Expiry Date: 13/05/2029

Type Approval Certificate

This is to certify that the undernoted product(s) has/have been tested with satisfactory results in accordance with the relevant requirements of the Lloyd's Register Type Approval System.

Manufacturer	**Danfoss Drives Oy**
Address	Runsorintie 7, Vaasa, 65380, Finland
Place of Production	Danfoss Drives Oy Runsorintie 7, Vaasa, 65380, Finland
Type	Electronic Frequency Convertor
Description	Danfoss iC7-60SL liquid cooled drive modules are used as building blocks for larger power systems. The system modules can be configured to different product functions like inverter units (INU), active front end units (AFE), brake chopper units (BCU), grid converter units (GC) and DC/DC units (DC). The units share the same system module building block with AC/DC terminals, IGBTs, DC-capacitors and PCBAs. Application software and options (e.g. input/output filter) defines the final product function. The product can be configured as basic system modules and loose filters or with integration units. Integration units improves serviceability and allows input and output filters to be integrated to the same mechanical construction. iC7-60SL system modules can be equipped for example with following options: L filter, LC filter, Sin filter, Du/dt filter, common mode filter, DC filter, pre-charging circuit and cooling modules (heat exchanger). For detailed product description, pls. refer to appendix.

Matthias Karg

Electrical & Control - Specialist to Lloyd's Register EMEA
A member of the Lloyd's Register group

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Trade Name	iC7-60SL
Application	Marine, Offshore and Industrial applications for use in environmental categories ENV1, ENV2 and ENV3, as defined in Lloyd's Register Type Approval System, Test Specification Number 1 – December 2021. Suitable for installation in *"Special Power Distribution Zones"* in accordance with IEC 60533 only.
Specified Standard	IEC 61800-3: 2017 IEC 61800-5-1: 2007 +AMD1: 2016 IEC 62477-1: 2012 +AMD1: 2016 IACS UR E10 Rev. 8: 2021 (EMC, partial)
Ratings	Input voltage: 3 x 380…500 VAC (-15…+10%), 400…800 VDC(-0…+0%) 3 x 525…690 VAC (–15…+10%), 640…1200 VDC (–0…+0%) Input frequency: 45 -66 Hz Output voltage: 0 – Uin, 3-phase Output frequency: 0 – 599 Hz Ambient temperature range: 5 – 60 °C IP00 for iC7-60SL (System module liquid cooled) IP55 for Power module (power module, IGBT, PCBA) For detailed ratings, pls. refer to appendix.
Other Conditions	For systems consisting of the listed components the final functional arrangement and application software are to comply with appropriate Lloyd's Register Rules and Regulations and shall be subject to project related Plan Approval Process, when installed on LR classed vessels. Documents and drawings for the actual application are to be provided according relevant LR Rules and Regulations. All software changes must be recorded as long as the system is in operation on board. The change records must be accessible on request. Major software

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changes must be authorised by LR before installation in the converter.

iC7-60SL drive modules are only to be installed in SPECIAL POWER DISTRIBUTION ZONES in accordance with IEC 60533.

It must be observed that the ingress protection of the system modules complies with IEC 60092-201 when indented to be installed on LR classed vessels.

Manufacturer’s derating table is to be observed.

Type Approval does not eliminate the need for normal inspection and survey procedures required by the Rules and Regulations.

If the specified standards are amended during the validity of this certificate, the product is to be re-approved prior to it being supplied to vessels to which the amended standards apply.

This certificate is not valid for equipment, the design, ratings or operating parameters of which have been varied from the specimen tested. The manufacturer should notify Lloyd's Register EMEA of any modification or changes to the equipment in order to obtain a valid Certificate.

The Design Appraisal Document HPC2362047-24/MK and its supplementary Type Approval Terms and Conditions form part of this Certificate.

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Appendix

DESCRIPTION

Danfoss iC7-60SL liquid cooled drive modules:

Neutral base unit (NBU) consisting of (e.g.):

- AC/DC terminals
- IGBTs
- DC-capacitors
- PWBs

Standard modules consisting of (e.g.):

- IM10L
  - inverter unit (INU 416A)
  - 1x NBU
- IM12L
  - inverter unit (INU 820A)
  - 2x NBU
- AM10L
  - active front end unit (AFE 380A)
  - 1x NBU
- AM12L
  - active front end unit (AFE 750A)
  - 2x NBU
- DM10
  - DC/DC converter unit (570A)
  - 1x NBU
- DM12L
  - 2x DC/DC converter unit (1200 A)
  - 2x NBU

Filter options for standard modules:

- dU/dt and dU/dt + common mode assembly for IM10L
- dU/dt assembly for IM12L
- SIN-filter assembly for IM10L
- SIN-filter assembly for IM12L
- LC-filter assembly for AM10L
- LC-filter assembly for AM12L
- L-filter for AM10L
- L-filter for AM12L
- DC-filter for DM10L
- DC-filter for DM12L

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DESCRIPTION (continued)

Module integration units (MIU) consisting of (e.g.):

- IR10L
  - inverter unit (INU 416A),
  - 1x NBU with rack foot terminal (AC busbar construction)
  - dU/dt-filter + common mode filter or SIN-filter
- IR12L
  - inverter unit (INU 820A)
  - 2x NBU with rack foot terminals (AC busbar construction)
  - dU/dt-filter or SIN-filter
- AR10L:
  - active front end unit (AFE 380A)
  - 1x NBU with rack foot terminal (AC busbar construction)
  - LC-filter
- AR12L:
  - active front end unit (AFE 750A)
  - 2x NBU with rack foot terminals (AC busbar construction)
  - LC-filter
- AR10L:
  - active front end unit (AFE 380A)
  - 1x NBU with rack foot terminal (AC busbar construction)
  - LC-filter and grid side L-filters (to be installed separately inside cabinet)
- AR12L:
  - active front end unit (AFE 750A)
  - 2x NBU with rack foot terminals (AC busbar construction)
  - LC-filter and grid side L-filters (to be installed separately inside cabinet)
- DR10L
  - DC-DC converter unit (DC 570A)
  - 1x NBU with rack foot terminal (DC busbar construction)
  - DC-filter
- DR12L
  - DC-DC Converter unit (DC 1200A)
  - 2x NBU with rack foot terminal (DC busbar construction)
  - DC-filter

Options:

- DC semiconductor fuses, option code +AKFX

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RATINGS

Code example	Description
iC7-60	**Product group**
SL	**Product category** SL = system module, liquid-cooled
IN	**Product type** 3A = 3-phase active front end, AFE 3H = 3-phase low harmonic, AFE BR = Brake chopper, BCU DC = DCDC Converter, DC GC = Grid Converter, GC IN = Inverter, INU
07	**Voltage rating** 07 = 525-690 VAC, 640-1100VDC A7 = 525-690 VAC, 640-1200 VDC B5 = 380-500 VAC, 400-800 VDC
-300A	**Current rating, $I_{L(1/5)}$** 170A, 206A, 208A, 236A, 245A, 261A, 300A, 302A, 325A, 334A, 360A, 365A, 380A, 385A, 416A, 420A, 425A, 465A, 475A, 480A, 510A, 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	**Protection rating** F3 = C3 Industry Environment F4 = C4 System Component

Software packages:

- iC7_Marine-2024.4.4 (19.04.2024)
  - Firmware product 5.x.x
  - Propulsion and Machinery 5.x.x
  - Active front end 5.x.x
- iC7_Hybrid-2024.4.3 (19.04.2024)
  - Firmware product 5.x.x
  - Grid converter 5.x.x
  - DC/DC converter 5.x.x

x = minor changes (e.g. bug fixes)

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