

TYPE APPROVAL CERTIFICATE

This is to certify:

That the Frequency Converter

with type designation(s)
Emotron FDUL / FDUG

Issued to

CG Drives & Automation Sweden AB
Helsingborg, Sweden

is found to comply with

DNV rules for classification – Ships, offshore units, and high speed and light craft

Application :

Frequency Converter for Asynchronous Motors Emotron FDUL / FDUG series.
Range: 55 / 45 kW to 4000 / 3200 kW, 380 - 690 VAC supply.

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

Issued at **Høvik** on **2023-03-21**

for **DNV**

This Certificate is valid until **2028-03-20**.

DNV local station: **Sweden CMC**

Approval Engineer: **Nicolay Horn**

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.

LEGAL DISCLAIMER: Unless otherwise stated in the applicable contract with the holder of this document, or following from mandatory law, the liability of DNV AS, its parent companies and their subsidiaries as well as their officers, directors and employees ("DNV") arising from or in connection with the services rendered for the purpose of the issuance of this document or reliance thereon, whether in contract or in tort (including negligence), shall be limited to direct losses and under any circumstance be limited to 300,000 USD.



Product description

FDUL / FDUG: Variable speed controller for asynchronous / PM motors . Variable torque applications. Air and liquid cooled.

460 V Series:

Model	FDUL/FDUG model includes the following modules	Normal duty (120%, 1 min. every 10 min)	
		Rated current [A]	Power 400 V [kW]**
46-109-CL-xx	FDUL: AFR46-109-CL-xx + FDU48-109-CL-VSI-xx FDUG: AFG46-109-CL-xx + FDU48-109-CL-VSI-xx	109	55
46-175-CL-xx	FDUL: AFR46-175-CL-xx + FDU48-175-CL-VSI-xx FDUG: AFG46-146-CL-xx + FDU48-175-CL-VSI-xx	175	90
46-210-CL-xx	FDUL: AFR46-175-CL-xx + FDU48-210-CL-VSI-xx FDUG: AFG46-175-CL-xx + FDU48-210-CL-VSI-xx	210	110
46-250-CL-xx	FDUL: AFR46-250-CL-xx + FDU48-250-CL-VSI-xx FDUG: AFG46-210-CL-xx + FDU48-250-CL-VSI-xx	250	132
46-295-CL-xx	FDUL: AFR46-250-CL-xx + FDU48-295-CL-VSI-xx FDUG: AFG46-259-CL-xx + FDU48-295-CL-VSI-xx	295	160
46-365-CL-xx	FDUL: AFR46-365-CL-xx + FDU48-365-CL-VSI-xx FDUG: AFG46-321-CL-xx + FDU48-365-CL-VSI-xx	365	200
46-590-CL-xx	FDUL: AFR46-500-CL-xx + FDU48-590-CL-VSI-xx FDUG: AFG46-518-CL-xx + FDU48-590-CL-VSI-xx	590	315
46-730-CL-xx	FDUL: AFR46-700-CL-xx + FDU48-730-CL-VSI-xx FDUG: AFG46-642-CL-xx + FDU48-730-CL-VSI-xx	730	400
46-810-CL-xx	FDUL: AFR46-700-CL-xx + FDU48-810-CL-VSI-xx FDUG: AFG46-777-CL-xx + FDU48-810-CL-VSI-xx	810	450
46-1010-CL-xx	FDUL: AFR46-885-CL-xx + FDU48-1010-CL-VSI-xx FDUG: AFG46-963-CL-xx + FDU48-1010-CL-VSI-xx	1010	560
46-1100-CL-xx	FDUL: AFR46-1050-CL-xx + FDU48-1100-CL-VSI-xx FDUG: AFG46-1036-CL-xx + FDU48-1100-CL-VSI-xx	1100	630
46-1250-CL-xx	FDUL: AFR46-1050-CL-xx + FDU48-1250-CL-VSI-xx FDUG: AFG46-1284-CL-xx + FDU48-1250-CL-VSI-xx	1250	710
46-1460-CL-xx	FDUL: AFR46-1400-CL-xx + FDU48-1460-CL-VSI-xx FDUG: AFG46-1284-CL-xx + FDU48-1460-CL-VSI-xx	1460	800
46-1710-CL-xx	FDUL: AFR46-1400-CL-xx + FDU48-1710-CL-VSI-xx FDUG: AFG46-1554-CL-xx + FDU48-1710-CL-VSI-xx	1710	900
46-2200-CL-xx	FDUL: AFR46-1770-CL-xx + FDU48-2200-CL-VSI-xx FDUG: AFG46-1926-CL-xx + FDU48-2200-CL-VSI-xx	2200	1250
46-2500-CL-xx	FDUL: AFR46-2100-CL-xx + FDU48-2500-CL-VSI-xx	2500	1350

690 V Series:

Model	FDUL/FDUG model includes the following modules	Normal duty (120%, 1 min. every 10 min)	
		Rated current [A]	Power 690 V [kW]**
69-109-CL-xx	FDUL: AFR69-109-CL-xx + FDU69-109-CL-VSI-xx FDUG: AFG69-109-CL-xx + FDU69-109-CL-VSI-xx	109	110
69-175-CL-xx	FDUG: AFG69-149-CL-xx + FDU69-175-CL-VSI-xx	175	160
69-200-CL-xx	FDUL: AFR69-175-CL-xx + FDU69-200-CL-VSI-xx FDUG: AFG69-200-CL-xx + FDU69-200-CL-VSI-xx	200	200
69-250-CL-xx	FDUL: AFR69-233-CL-xx + FDU69-250-CL-VSI-xx FDUG: AFG69-298-CL-xx + FDU69-250-CL-VSI-xx	250	250

Model	FDUL/FDUG model includes the following modules	Normal duty (120%, 1 min. every 10 min)	
		Rated current [A]	Power 690 V [kW]**
69-400-CL-xx	FDUG: AFG69-400-CL-xx + FDU69-400-CL-VSI-xx	400	400
69-500-CL-xx	FDUL: AFR69-466-CL-xx + FDU69-500-CL-VSI-xx FDUG: AFG69-600-CL-xx + FDU69-500-CL-VSI-xx	500	500
69-750-CL-xx	FDUL: AFR69-700-CL-xx + FDU69-750-CL-VSI-xx FDUG: AFG69-800-CL-xx + FDU69-750-CL-VSI-xx	750	710
69-1000-CL-xx	FDUL: AFR69-900-CL-xx + FDU69-1000-CL-VSI-xx FDUG: AFG69-1200-CL-xx + FDU69-1000-CL-VSI-xx	1000	1000
69-1250-CL-xx	FDUL: AFR69-1400-CL-xx + FDU69-1250-CL-VSI-xx FDUG: AFG69-1200-CL-xx + FDU69-1250-CL-VSI-xx	1250	1250
69-1500-CL-xx	FDUL: AFR69-1400-CL-xx + FDU69-1500-CL-VSI-xx FDUG: AFG69-1600-CL-xx + FDU69-1500-CL-VSI-xx	1500	1500
69-2000-CL-xx	FDUL: AFR69-1800-CL-xx + FDU69-2000-CL-VSI-xx FDUG: AFG69-2400-CL-xx + FDU69-2000-CL-VSI-xx	2000	2000
69-2500-CL-xx	FDUG: AFG69-2400-CL-xx + FDU69-2500-CL-VSI-xx	2500	2500
69-3000-CL-xx	FDUL: AFR69-2700-CL-xx + FDU69-3000-CL-VSI-xx	3000	3000
69-4000-CL-xx	FDUL: AFR69-3600-CL-xx + FDU69-4000-CL-VSI-xx	4000	4000

xx: 20 (IP20 modules) or 54 (IP54 cabinet)

* Ratings for heavy duty 150% /10 min see technical info

**Values applicable for 40 °C, to be modified for ships application at 45 °C. See under "Application / limitation".

Application/Limitation

Supply voltage range:	230 - 460 or 500 - 690 V, 50/60 Hz
Voltage variation:	±15 % + 10 % (steady state) at U ≥ 380V ±10 % + 10 % (steady state) at U = 230V
Frequency range:	45 - 65 Hz
Output frequency:	0 - 599 Hz
Temperature range in operation:	0 - 40 °C (40 - 45 °C when derated 1 %/°C)
Temperature class:	A
Vibration class:	A
Humidity class:	A
EMC class:	IEC 61800-3 To be used on EMC class A locations

The FDUL / FDUG must be regarded as a component. The actual installation shall be designed according to CG Drives & Automation Sweden AB Users Manual and according to the applicable DNV Rules for the actual application.

Product certificate:

Frequency converters rated equal or larger than 100kW 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, the following documents should be submitted for approval, Ref. to DNV Pt.4 Ch.8 Sec.1 Table 2:

- 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.

All drives are to be installed in an enclosure with an IP degree in accordance with DNV Rules w.r.t. location.

*Converters with conducted and radiated emission above the DNV required limits can be installed in "special distribution zone" and "general power distribution zone", in accordance with IEC 60533 provided measures are taken to attenuate

these effects on the distribution system, so the safe operation is assured. Planned EMC measures shall be submitted for approval prior to installation onboard. The EMC measures should be derived from an EMC analysis and plan in accordance with IEC 60533 Annex B and /or IEC 61800-3 Annex E.

Type Approval documentation

Technical info:

Compact liquid cooled AFE for optimal power density, brochure from CG Drives.

Test reports:

FORCE Test Report no. 121-25743-1 dated 2020-07-28.

CG Drives & Automation Type Test Reports dated 2022-09-09 and 2022-10-11.

CG Drives & Automation Test reports Frame size 365 LVD and EMC

Tests carried out

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

EMC: The following tests are in accordance with the DNV-CG-0339 / IEC 61800-3: Electrical fast transient (Burst), electrical slow transient (Surge), RF-common mode Voltage, radiated RF-electromagnetic fields, electric discharge (ESD), radiated and conducted emission. (See under application limitation).

Marking of product

Type designation – Voltage – Current

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 according to 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.

Periodical assessment is to be performed after 2 years and after 3.5 years. A renewal assessment will be performed at renewal of the certificate.

END OF CERTIFICATE