

TYPE APPROVAL CERTIFICATE

This is to certify:

That the Frequency Converter

with type designation(s)
PENTA MARINE,

Issued to

ELETTRONICA SANTERNO S.P.A.
Castel Guelfo di Bologna BO, Italy

is found to comply with
Det Norske Veritas' Rules for Classification of Ships, High Speed & Light Craft and Det Norske Veritas' Offshore Standards

Application :

Frequency Converter for Asynchronous and Synchronous Motors PENTA MARINE series.
Range: 7A to 850 A 200 - 690 VAC supply.

This Certificate is valid until **2017-12-31**.

Issued at **Høvik** on **2014-11-10**

DNV GL local station: **Venice**

Approval Engineer: **Nicolay Horn**

for **DNV GL**

.....
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. If any person suffers loss or damage which is proven to have been caused by any negligent act or omission of the Society, then the Society shall pay compensation to such person for his proven direct loss or damage. However, the compensation shall not exceed an amount equal to ten times the fee charged for the service in question. The maximum compensation shall never exceed USD 2 million. In this provision the "Society" shall mean DNV GL AS as well as all its direct and indirect owners, affiliates, subsidiaries, directors, officers, employees, agents and any other person or entity acting on behalf of DNV GL AS.

Certificate No: **E-13611**
 File No: **822.21**
 Job Id: **262.1-013495-2**

Product description

Penta Marine: Variable speed controller for asynchronous and synchronous motors. Constant / variable torque applications. Air cooled only.

1.1 Nomenclature description:

PENTA MARINE 0005 4 T B A2 X 2
 1 2 3 4 5 6 7 8 9

| | |
|---|---|
| 1 Product line: | PENTA MARINE inverter stand alone PENTA MARINE BOX inverter in BOX PENTA MARINE Cabinet |
| 2 PENTA control type with 5 on board softwares available: | -IFD (Inverter Frequency Drive – V/f) -VTC (Vector Torque Control) -SYN (Synchronous) -FOC (Field Oriented Control) -RGN (Regenerative) |
| 6 Braking chopper: | X = 0 no braking chopper B = Built in braking chopper |
| 7 EMC filter type: | I = no filter A1 = integrated filter in accordance with IEC 61800-3 category C2 A2 = integrated filter in accordance with IEC 61800-3 category C3 B = integrated filter in accordance with IEC 61800-3 category C1 |
| 8 Programming panel: | X = without programming panel K = complete with programming panel |
| 9 Protection degree: | 0 = IP00 2 = IP20 5 = IP54 |

Models covered by the type approval

| | Size | Model | Voltage |
|--------------------------------|------|-------------------------------|-----------------|
| 2T/4T IP00 Product Range | S41 | PENTA MARINE 0180 2T/4T XA2K0 | 200÷240/380÷500 |
| | | PENTA MARINE 0202 2T/4T XA2K0 | 200÷240/380÷500 |
| | | PENTA MARINE 0217 2T/4T XA2K0 | 200÷240/380÷500 |
| | | PENTA MARINE 0260 2T/4T XA2K0 | 200÷240/380÷500 |
| | S51 | PENTA MARINE 0313 2T/4T XA2K0 | 200÷240/380÷500 |
| | | PENTA MARINE 0367 2T/4T XA2K0 | 200÷240/380÷500 |
| | | PENTA MARINE 0402 2T/4T XA2K0 | 200÷240/380÷500 |
| 5T/6T IP00 Product Range | S42 | PENTA MARINE 0181 5T/6T XA2K0 | 500÷600/575÷690 |
| | | PENTA MARINE 0206 5T/6T XA2K0 | 500÷600/575÷690 |
| | | PENTA MARINE 0218 5T/6T XA2K0 | 500÷600/575÷690 |
| | | PENTA MARINE 0259 5T/6T XA2K0 | 500÷600/575÷690 |
| | S52 | PENTA MARINE 0290 5T/6T XA2K0 | 500÷600/575÷690 |
| | | PENTA MARINE 0314 5T/6T XA2K0 | 500÷600/575÷690 |
| | | PENTA MARINE 0368 5T/6T XA2K0 | 500÷600/575÷690 |
| | | PENTA MARINE 0401 5T/6T XA2K0 | 500÷600/575÷690 |

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| | Size | Model | Voltage |
|--------------------------------|-------------------------------|-------------------------------|-----------------|
| 2T/4T IP20 Product Range | S05 | PENTA MARINE 0007 2T BA1K2 | 200÷240 |
| | | PENTA MARINE 0008 2T BA1K2 | 200÷240 |
| | | PENTA MARINE 0010 2T BA1K2 | 200÷240 |
| | | PENTA MARINE 0013 2T BA1K2 | 200÷240 |
| | | PENTA MARINE 0015 2T BA1K2 | 200÷240 |
| | | PENTA MARINE 0016 2T BA1K2 | 200÷240 |
| | | PENTA MARINE 0020 2T BA1K2 | 200÷240 |
| | S12 | PENTA MARINE 0023 2T BA2K2 | 200÷240 |
| | | PENTA MARINE 0033 2T BA2K2 | 200÷240 |
| | | PENTA MARINE 0037 2T BA2K2 | 200÷240 |
| | S05 | PENTA MARINE 0005 4T BA1K2 | 380÷500 |
| | | PENTA MARINE 0007 4T BA1K2 | 380÷500 |
| | | PENTA MARINE 0009 4T BA1K2 | 380÷500 |
| | | PENTA MARINE 0011 4T BA1K2 | 380÷500 |
| | | PENTA MARINE 0014 4T BA1K2 | 380÷500 |
| | S12 | PENTA MARINE 0016 4T BA1K2 | 380÷500 |
| | | PENTA MARINE 0017 4T BA1K2 | 380÷500 |
| | | PENTA MARINE 0020 4T BA1K2 | 380÷500 |
| | | PENTA MARINE 0025 4T BA1K2 | 380÷500 |
| | | PENTA MARINE 0030 4T BA1K2 | 380÷500 |
| | | PENTA MARINE 0034 4T BA2K2 | 380÷500 |
| | | PENTA MARINE 0036 4T BA2K2 | 380÷500 |
| | S15 | PENTA MARINE 0040 2T/4T BA2K2 | 200÷240/380÷500 |
| | | PENTA MARINE 0049 2T/4T BA2K2 | 200÷240/380÷500 |
| | S20 | PENTA MARINE 0060 2T/4T BA2K2 | 200÷240/380÷500 |
| | | PENTA MARINE 0067 2T/4T BA2K2 | 200÷240/380÷500 |
| | | PENTA MARINE 0074 2T/4T BA2K2 | 200÷240/380÷500 |
| | | PENTA MARINE 0086 2T/4T BA2K2 | 200÷240/380÷500 |
| S30 | PENTA MARINE 0113 2T/4T BA2K2 | 200÷240/380÷500 | |
| | PENTA MARINE 0129 2T/4T BA2K2 | 200÷240/380÷500 | |
| | PENTA MARINE 0150 2T/4T BA2K2 | 200÷240/380÷500 | |
| | PENTA MARINE 0162 2T/4T BA2K2 | 200÷240/380÷500 | |
| 5T/6T IP20 Product Range | S12 | PENTA MARINE 0003 5T XA2K2 | 500÷600 |
| | | PENTA MARINE 0004 5T XA2K2 | 500÷600 |
| | | PENTA MARINE 0006 5T XA2K2 | 500÷600 |
| | | PENTA MARINE 0012 5T XA2K2 | 500÷600 |
| | | PENTA MARINE 0018 5T XA2K2 | 500÷600 |
| | S14 | PENTA MARINE 0003 6T XA2K2 | 575÷690 |
| | | PENTA MARINE 0004 6T XA2K2 | 575÷690 |
| | | PENTA MARINE 0006 6T XA2K2 | 575÷690 |
| | | PENTA MARINE 0012 6T XA2K2 | 575÷690 |
| | | PENTA MARINE 0018 6T XA2K2 | 575÷690 |
| | | PENTA MARINE 0019 5T/6T *A2K2 | 500÷600/575÷690 |
| | | PENTA MARINE 0021 5T/6T *A2K2 | 500÷600/575÷690 |
| | | PENTA MARINE 0022 5T/6T *A2K2 | 500÷600/575÷690 |
| | | PENTA MARINE 0024 5T/6T *A2K2 | 500÷600/575÷690 |
| | | PENTA MARINE 0032 5T/6T *A2K2 | 500÷600/575÷690 |
| | S22 | PENTA MARINE 0042 5T/6T *A2K2 | 500÷600/575÷690 |
| | | PENTA MARINE 0051 5T/6T *A2K2 | 500÷600/575÷690 |
| | | PENTA MARINE 0062 5T/6T *A2K2 | 500÷600/575÷690 |
| | | PENTA MARINE 0069 5T/6T *A2K2 | 500÷600/575÷690 |

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| 2T/4T IP20 | Size | Model | Voltage |
|------------|------|-------------------------------|-----------------|
| | S32 | PENTA MARINE 0076 5T/6T *A2K2 | 500÷600/575÷690 |
| | | PENTA MARINE 0088 5T/6T *A2K2 | 500÷600/575÷690 |
| | | PENTA MARINE 0131 5T/6T *A2K2 | 500÷600/575÷690 |
| | | PENTA MARINE 0164 5T/6T *A2K2 | 500÷600/575÷690 |

| 5T/6T IP20 Product Range | Size | Model | Voltage |
|--------------------------------|------|-------------------------------|-----------------|
| | S14 | PENTA MARINE 0003 5T/6T BA2K2 | 500÷600/575÷690 |
| | | PENTA MARINE 0004 5T/6T BA2K2 | 500÷600/575÷690 |
| | | PENTA MARINE 0006 5T/6T BA2K2 | 500÷600/575÷690 |
| | | PENTA MARINE 0012 5T/6T BA2K2 | 500÷600/575÷690 |
| | | PENTA MARINE 0018 5T/6T BA2K2 | 500÷600/575÷690 |

| 2T/4T IP54 Product Range | Size | Model | Voltage |
|--------------------------------|------|-------------------------------|-----------------|
| | S05 | PENTA MARINE 0007 2T BA1K5 | 200÷240 |
| | | PENTA MARINE 0008 2T BA1K5 | 200÷240 |
| | | PENTA MARINE 0010 2T BA1K5 | 200÷240 |
| | | PENTA MARINE 0013 2T BA1K5 | 200÷240 |
| | | PENTA MARINE 0015 2T BA1K5 | 200÷240 |
| | | PENTA MARINE 0016 2T BA1K5 | 200÷240 |
| | | PENTAMARINE 0020 2T BA1K5 | 200÷240 |
| | S12 | PENTA MARINE 0023 2T BA2K5 | 200÷240 |
| | | PENTA MARINE 0033 2T BA2K5 | 200÷240 |
| | | PENTA MARINE 0037 2T BA2K5 | 200÷240 |
| | S05 | PENTA MARINE 0005 4T BA1K5 | 380÷500 |
| | | PENTA MARINE 0007 4T BA1K5 | 380÷500 |
| | | PENTA MARINE 0009 4T BA1K5 | 380÷500 |
| | | PENTA MARINE 0011 4T BA1K5 | 380÷500 |
| | | PENTA MARINE 0014 4T BA1K5 | 380÷500 |
| | S12 | PENTA MARINE 0016 4T BA1K5 | 380÷500 |
| | | PENTA MARINE 0017 4T BA1K5 | 380÷500 |
| | | PENTA MARINE 0020 4T BA1K5 | 380÷500 |
| | | PENTA MARINE 0025 4T BA1K5 | 380÷500 |
| | | PENTA MARINE 0030 4T BA1K5 | 380÷500 |
| | | PENTA MARINE 0034 4T BA2K5 | 380÷500 |
| | S15 | PENTA MARINE 0040 2T/4T BA2K5 | 200÷240/380÷500 |
| | | PENTA MARINE 0049 2T/4T BA2K5 | 200÷240/380÷500 |
| | S20 | PENTA MARINE 0060 2T/4T BA2K5 | 200÷240/380÷500 |
| | | PENTA MARINE 0067 2T/4T BA2K5 | 200÷240/380÷500 |
| | | PENTA MARINE 0074 2T/4T BA2K5 | 200÷240/380÷500 |
| | | PENTA MARINE 0086 2T/4T BA2K5 | 200÷240/380÷500 |
| | | PENTA MARINE 0113 2T/4T BA2K5 | 200÷240/380÷500 |
| | S30 | PENTA MARINE 0129 2T/4T BA2K5 | 200÷240/380÷500 |
| | | PENTA MARINE 0150 2T/4T BA2K5 | 200÷240/380÷500 |
| PENTA MARINE 0162 2T/4T BA2K5 | | 200÷240/380÷500 | |

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|----------------------------|--------------------------------|-------------------------------|----------------------------|
| | 5T/6T IP54 Product Range | S12 | PENTA MARINE 0003 5T XA2K5 |
| PENTA MARINE 0004 5T XA2K5 | | | 500÷600 |
| PENTA MARINE 0006 5T XA2K5 | | | 500÷600 |
| PENTA MARINE 0012 5T XA2K5 | | | 500÷600 |
| PENTA MARINE 0018 5T XA2K5 | | | 500÷600 |
| S14 | | PENTA MARINE 0003 6T XA2K5 | 500÷600/575÷690 |
| | | PENTA MARINE 0004 6T XA2K5 | 500÷600/575÷690 |
| | | PENTA MARINE 0006 6T XA2K5 | 500÷600/575÷690 |
| | | PENTA MARINE 0012 6T XA2K5 | 500÷600/575÷690 |
| | | PENTA MARINE 0018 6T XA2K5 | 500÷600/575÷690 |
| | | PENTA MARINE 0019 5T/6T *A2K5 | 500÷600/575÷690 |
| | | PENTA MARINE 0021 5T/6T *A2K5 | 500÷600/575÷690 |
| | | PENTA MARINE 0022 5T/6T *A2K5 | 500÷600/575÷690 |
| | | PENTA MARINE 0024 5T/6T *A2K5 | 500÷600/575÷690 |
| | | PENTA MARINE 0032 5T/6T *A2K5 | 500÷600/575÷690 |
| | | PENTA MARINE 0003 5T/6T BA2K5 | 500÷600/575÷690 |
| | | PENTA MARINE 0004 5T/6T BA2K5 | 500÷600/575÷690 |
| | | PENTA MARINE 0006 5T/6T BA2K5 | 500÷600/575÷690 |
| | | PENTA MARINE 0012 5T/6T BA2K5 | 500÷600/575÷690 |
| | | PENTA MARINE 0018 5T/6T BA2K5 | 500÷600/575÷690 |
| S22 | | PENTAMARINE 0042 5T/6T *A2K5 | 500÷600/575÷690 |
| | | PENTAMARINE 0051 5T/6T *A2K5 | 500÷600/575÷690 |
| | | PENTA MARINE 0062 5T/6T *A2K5 | 500÷600/575÷690 |
| | | PENTA MARINE 0069 5T/6T *A2K5 | 500÷600/575÷690 |
| S32 | | PENTA MARINE 0076 5T/6T *A2K5 | 500÷600/575÷690 |
| | | PENTA MARINE 0088 5T/6T *A2K5 | 500÷600/575÷690 |
| | | PENTA MARINE 0131 5T/6T *A2K5 | 500÷600/575÷690 |
| | | PENTA MARINE 0164 5T/6T *A2K5 | 500÷600/575÷690 |

Options: Inductors & EMI/RFI filters; DC inductors; braking units

Application/Limitation

Range : 7A to 850A
 Supply voltage range: 200 - 690 V, 50/60 Hz
 Voltage variation: - 15 %, + 10 %
 Frequency variation: ± 5 %
 Output frequency: 0 - 1000Hz
 Temperature range in operation: -10 to +55 °C (derating 2,0%/°C above 40 °C may apply to selected models; for details see SINUS PENTA Installation Guide)

Temperature class: A
 Vibration class: A
 Humidity class: B
 EMC class*: A / IEC 61800-3*
 To be used on EMC class A locations
 IP Class**: IP00 / 20 / 54**

The PENTA MARINE shall be regarded as a component. The actual installation to be designed according to 15P0102BX SINUS PENTA Installation Guide and according to the applicable DNV Rules for the actual application. The selection of size shall be based on an ambient temperature of 45 °C.

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.

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* 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:

"Modello per Certificazione DNV-Marine" Spread sheet rev. 3 dated 2013-03-04.

Test reports:

TÜV test reports nos. VIBR 13_174 dated 2013-06-17. REi test report No. SANT02280313 dated 2013-05-20, INTEK test report no RP 2013-052-00, EUROTTEST test report no CLM01 16521-130146 dated 2013-05-29 NEMKO Test report no. 234512TRFEMC dated 2013-06-12. Santerno test report "Compliance DNV Marine STD 2.4_SINUS PENTA_S51_04T_PTC_605.pdf dated 2013-04-23.. DNV SURVEY REPORT dated 2013-04-23.

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 CN2.4/ 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

PENTA MARINE – Type designation – Current – 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