



DET NORSKE VERITAS

TYPE APPROVAL CERTIFICATE

CERTIFICATE NO. **E-13293**

This is to certify that the
Frequency Converter

with type designation(s)
SPX & LCX

Issued to
Eaton Industries GmbH
Bonn, Germany

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 Motors SPX (aircooled) and LCX (water-cooled) series.
Range: 0,55 kW to 2750 kW 208 - 690 VAC supply.

This Certificate is valid until **2018-06-30**.

Issued at **Høvik** on **2014-05-16**

DNV local station: **Vaasa**

Approval Engineer: **Nicolay Horn**

for **Det Norske Veritas AS**

.....
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 proved to have been caused by any negligent act or omission of Det Norske Veritas, then Det Norske Veritas shall pay compensation to such person for his proved direct loss or damage. However, the compensation shall not exceed an amount equal to ten times the fee charged for the service in question, provided that the maximum compensation shall never exceed USD 2 million. In this provision "Det Norske Veritas" shall mean the Foundation Det Norske Veritas as well as all its subsidiaries, directors, officers, employees, agents and any other acting on behalf of Det Norske Veritas.

Name and place of manufacturer

Vacon Oyj
 VAASA, Finland

Vacon (China) Drives Co Ltd
 Suzhou 215125, China

Product description

Variable speed controller for asynchronous motor. Constant / variable torque applications.
 Air and liquid cooled. SPX = Air cooled, LCX = liquid cooled

| Type designation | Frame size | Mains supply (V) | Number of phases | Motor shaft power (kW) ^{1) 2)} |
|------------------|------------|------------------|------------------|---|
| SPXF07A- | FR4 | 208 - 240 | 3 | 0,55 /- |
| SPX001A- | FR4 | 208 - 240 | 3 | 0,75 /- |
| SPXF15A- | FR4 | 208 - 240 | 3 | 1,1 /- |
| SPX002A- | FR4 | 208 - 240 | 3 | 1,5 /- |
| SPX003A- | FR4 | 208 - 240 | 3 | 2,2 /- |
| SPX004A- | FR5 | 208 - 240 | 3 | 3 /- |
| SPX005A- | FR5 | 208 - 240 | 3 | 4 /- |
| SPX007A- | FR5 | 208 - 240 | 3 | 5,5 /- |
| SPX010A- | FR6 | 208 - 240 | 3 | 7,5 /- |
| SPX015A- | FR6 | 208 - 240 | 3 | 11 /- |
| SPX020A- | FR7 | 208 - 240 | 3 | 15 /- |
| SPX025A- | FR7 | 208 - 240 | 3 | 18,5 /- |
| SPX030A- | FR7 | 208 - 240 | 3 | 22 /- |
| SPX040A- | FR8 | 208 - 240 | 3 | 30 /- |
| SPX050A- | FR8 | 208 - 240 | 3 | 37 /- |
| SPX060A- | FR8 | 208 - 240 | 3 | 45 /- |
| SPX075A- | FR9 | 208 - 240 | 3 | 55 /- |
| SPX100A- | FR9 | 208 - 240 | 3 | 75 /- |
| | | | | |
| SPX001A- | FR4 | 380 - 500 | 3 | 1,1 /- |
| SPXF15A- | FR4 | 380 - 500 | 3 | 1,5 /- |
| SPX002A- | FR4 | 380 - 500 | 3 | 2,2 /- |
| SPX003A- | FR4 | 380 - 500 | 3 | 3 /- |
| SPX005A- | FR4 | 380 - 500 | 3 | 4 /- |
| SPX006A- | FR4 | 380 - 500 | 3 | 5,5 /- |
| SPX007A- | FR5 | 380 - 500 | 3 | 7,5 / 11 |
| SPX010A- | FR5 | 380 - 500 | 3 | 11 / 15 |
| SPX015A- | FR5 | 380 - 500 | 3 | 15 / 18,5 |
| SPX020A- | FR6 | 380 - 500 | 3 | 18,5 / 22 |
| SPX025A- | FR6 | 380 - 500 | 3 | 22 / 30 |
| SPX030A- | FR6 | 380 - 500 | 3 | 30 / 37 |
| SPX040A- | FR7 | 380 - 500 | 3 | 37 / 45 |
| SPX050A- | FR7 | 380 - 500 | 3 | 45 / 55 |
| SPX060A- | FR7 | 380 - 500 | 3 | 55 / 75 |
| SPX075A- | FR8 | 380 - 500 | 3 | 75 / 90 |
| SPX100A- | FR8 | 380 - 500 | 3 | 90 / 110 |
| SPX125A- | FR8 | 380 - 500 | 3 | 110 / 132 |
| SPX150A- | FR9 | 380 - 500 | 3 | 132 / 160 |
| | | | | |

| Type designation | Frame size | Mains supply (V) | Number of phases | Motor shaft power (kW) ^{1) 2)} |
|------------------|------------|------------------|------------------|---|
| SPX250A- | FR10 | 380 - 500 | 3 | 200 / 250 |
| SPX300A- | FR10 | 380 - 500 | 3 | 250 / 315 |
| SPX350A- | FR10 | 380 - 500 | 3 | 250 / 355 |
| SPX400A- | FR11 | 380 - 500 | 3 | 315 / 400 |
| SPX500A- | FR11 | 380 - 500 | 3 | 355 / 450 |
| SPX550A- | FR11 | 380 - 500 | 3 | 400 / 500 |
| SPX600A- | FR12 | 380 - 500 | 3 | 450 / 560 |
| SPX650A- | FR12 | 380 - 500 | 3 | 500 / 600 |
| SPX700A- | FR12 | 380 - 500 | 3 | 560 / 700 |
| SPX800A- | FR13 | 380 - 500 | 3 | 630 / 750 |
| SPX900A- | FR13 | 380 - 500 | 3 | 710 / - |
| SPXH10A- | FR13 | 380 - 500 | 3 | 800 / - |
| SPXH12A- | FR14 | 380 - 500 | 3 | 900 / - |
| SPXH16A- | FR14 | 380 - 500 | 3 | 1100 / - |
| | | | | |
| SPX002A- | FR6 | 525 - 690 | 3 | 3 / - |
| SPX003A- | FR6 | 525 - 690 | 3 | 4 / - |
| SPX004A- | FR6 | 525 - 690 | 3 | 5,5 / - |
| SPX005A- | FR6 | 525 - 690 | 3 | 7,5 / - |
| SPX007A- | FR6 | 525 - 690 | 3 | 11 / - |
| SPX010A- | FR6 | 525 - 690 | 3 | 15 / - |
| SPX015A- | FR6 | 525 - 690 | 3 | 18,5 / - |
| SPX020A- | FR6 | 525 - 690 | 3 | 22 / - |
| SPX025A- | FR6 | 525 - 690 | 3 | 30 / - |
| SPX030A- | FR7 | 525 - 690 | 3 | 37,5 / - |
| SPX040A- | FR7 | 525 - 690 | 3 | 45 / - |
| SPX050A- | FR8 | 525 - 690 | 3 | 55 / - |
| SPX060A- | FR8 | 525 - 690 | 3 | 75 / - |
| SPX075A- | FR8 | 525 - 690 | 3 | 90 / - |
| SPX100A- | FR9 | 525 - 690 | 3 | 110 / - |
| SPX125A- | FR9 | 525 - 690 | 3 | 132 / - |
| SPX150A- | FR9 | 525 - 690 | 3 | 160 |
| SPX175A- | FR9 | 525 - 690 | 3 | 200 |
| SPX200A | FR10 | 525 - 690 | 3 | 200 |
| SPX250A- | FR10 | 525 - 690 | 3 | 315 |
| SPX300A- | FR10 | 525 - 690 | 3 | 355 |
| N/A | FR10 | 525 - 690 | 3 | 400 |
| SPX400A- | FR10 | 525 - 690 | 3 | 450 |
| SPX450A- | FR10 | 525 - 690 | 3 | 500 |
| SPX500A- | FR10 | 525 - 690 | 3 | 560 |
| SPX550A- | FR11 | 525 - 690 | 3 | 630 |
| SPX600A- | FR11 | 525 - 690 | 3 | 710 |
| SPX700A- | FR11 | 525 - 690 | 3 | 800 |
| SPX800A- | FR11 | 525 - 690 | 3 | 900 |
| SPX900A- | FR12 | 525 - 690 | 3 | 1000 |
| SPXH10A- | FR13 | 525 - 690 | 3 | 1150 |
| SPXH13A- | FR13 | 525 - 690 | 3 | 1500 |
| SPXH15A- | FR13 | 525 - 690 | 3 | 1800 |
| SPXH20A- | FR14 | 525 - 690 | 3 | 2000 |

| Type designation | Frame size | Mains supply (V) | Number of phases | Motor shaft power (kW) 1) 2) |
|------------------|------------|------------------|------------------|------------------------------|
| LCX016A- | CH3 | 400 - 500 | 3 | 10 / 9 |
| LCX022A- | CH3 | 400 - 500 | 3 | 14 / 12 |
| LCX031A- | CH3 | 400 - 500 | 3 | 20 / 18 |
| LCX038A- | CH3 | 400 - 500 | 3 | 24 / 22 |
| LCX045A- | CH3 | 400 - 500 | 3 | 29 / 26 |
| LCX061A- | CH3/ | 400 - 500 | 3 | 39 / 36 |
| LCX072A- | CH4 | 400 - 500 | 3 | 46 / 42 |
| LCX087A- | CH4 | 400 - 500 | 3 | 56 / 51 |
| LCX105A- | CH4 | 400 - 500 | 3 | 68 / 62 |
| LCX105A- | CH4 | 400 - 500 | 3 | 90 / 82 |
| LCX140A- | CH5 | 400 - 500 | 3 | 110 / 90 |
| LCX170A- | CH5 | 400 - 500 | 3 | 125 / 110 |
| LCX208A- | CH5 | 400 - 500 | 3 | 175 / 150 |
| LCX300A- | CH61 | 400 - 500 | 3 | 200 / 175 |
| LCX385A- | CH61 | 400 - 500 | 3 | 250 / 225 |
| LCX460A- | CH72 | 400 - 500 | 3 | 300 / 275 |
| LCX520A- | CH72 | 400 - 500 | 3 | 325 / 300 |
| LCX590A- | CH72 | 400 - 500 | 3 | 375 / 350 |
| LCX650A- | CH72 | 400 - 500 | 3 | 425 / 375 |
| LCX730A- | CH72 | 400 - 500 | 3 | 475 / 425 |
| LCX820A- | CH63 | 400 - 500 | 3 | 525 / 475 |
| LCX920A- | CH63 | 400 - 500 | 3 | 600 / 525 |
| LCXH10A- | CH63 | 400 - 500 | 3 | 650 / 600 |
| LCXH11A- | CH63/ | 400 - 500 | 3 | 750 / 675 |
| LCXH13A- | CH74 | 400 - 500 | 3 | 875 / 800 |
| LCXH16A- | CH74 | 400 - 500 | 3 | 1050 / 950 |
| LCXH20A- | CH74 | 400 - 500 | 3 | 1325 / 1200 |
| LCXH23A- | CH74 | 400 - 500 | 3 | 1475 / 1350 |
| LCXH24A- | 2xCH74 | 400 - 500 | 3 | 1600 / 1450 |
| LCXH29A- | 2xCH74 | 400 - 500 | 3 | 1900 / 1725 |
| LCXH37A- | 2xCH74 | 400 - 500 | 3 | 2400 / 2175 |
| LCXH41A- | 2xCH74 | 400 - 500 | 3 | 2650 / 2425 |
| LCX170A- | CH61 | 525 - 690 | 3 | 150 / 125 |
| LCX208A- | CH61 | 525 - 690 | 3 | 175 / 150 |
| LCX261A- | CH61 | 525 - 690 | 3 | 225 / 200 |
| LCX325A- | CH72 | 525 - 690 | 3 | 275 / 250 |
| LCX385A- | CH72 | 525 - 690 | 3 | 350 / 300 |
| LCX416A- | CH72 | 525 - 690 | 3 | 375 / 325 |
| LCX460A- | CH72 | 525 - 690 | 3 | 400 / 350 |
| LCX502A- | CH72 | 525 - 690 | 3 | 450 / 400 |
| LCX590A- | CH63 | 525 - 690 | 3 | 525 / 475 |
| LCX650A- | CH63 | 525 - 690 | 3 | 575 / 525 |
| LCX750A- | CH63 | 525 - 690 | 3 | 675 / 600 |
| LCX820A- | CH74 | 525 - 690 | 3 | 725 / 650 |
| LCX920A- | CH74 | 525 - 690 | 3 | 825 / 750 |
| LCXH10A- | CH74/IP00 | 525 - 690 | 3 | 925 / 825 |
| LCXH11A- | CH74/IP00 | 525 - 690 | 3 | 1050 / 950 |

| Type designation | Frame size | Mains supply (V) | Number of phases | Motor shaft power (kW) ^{1) 2)} |
|------------------|-------------|------------------|------------------|---|
| LCXH13A- | CH74/IP00 | 525 - 690 | 3 | 1150 / 1050 |
| LCXH15A- | CH74/IP00 | 525 - 690 | 3 | 1350 / 1225 |
| LCXH17A- | CH74/IP00 | 525 - 690 | 3 | 1500 / 1375 |
| LCXH18A- | 2xCH74/IP00 | 525 - 690 | 3 | 1650 / 1500 |
| LCXH21A- | 2xCH74/IP00 | 525 - 690 | 3 | 1900 / 1725 |
| LCXH23A- | 2xCH74/IP00 | 525 - 690 | 3 | 2100 / 1900 |
| LCXH27A- | 2xCH74/IP00 | 525 - 690 | 3 | 2400 / 2200 |
| LCXH31A- | 2xCH74/IP00 | 525 - 690 | 3 | 2750 / 2500 |

- 1) Values applicable for 40 °C, 10 % overload and highest voltage in each voltage class. To be modified for ships application at 45 °C. See under "Application / limitation".
- 2) Values applicable for 50 °C, 0 % overload and highest voltage in each voltage class.

In addition SPX can be substituted by SPI, Those units are exactly based on DC-fed Eaton SPX control and power electronics component platforms, excluding for rectifier units and charging circuitry, which are not used in these products. Variation is made by application selection.

SPX FR10-FR14 and all LCXCH units will include external chokes.

SPX & LCX units can also be accompanied with following L/LCL filters

| Choke types |
|-------------|
| CHK0261 |
| CHK0400 |
| CHK0520 |
| CHK0650 |
| CHK0750 |
| CHK0820 |
| CHK1030 |
| CHK1150 |

| L/LCL Filters |
|---------------|
| LCL 0261 5 |
| LCL 0460 5 |
| LCL 1300 5 |
| LCL 0170 6 |
| LCL 0325 6 |
| LCL 1030 6 |
| L 0300 5 |
| L 0520 5 |
| L 1450 5 |
| L 0208 6 |
| L 0416 6 |
| L 1180 6 |

LCX_ Liquid cooled (CHxx) units can be accompanied with hoses attached to the modules.

LCX Liquid cooled (CHxx) units can be accompanied with following options: Heat Exchangers, Air-cooled Regenerative LCL filters IP00 (Naturally convected) and Liquid-cooled Regenerative LCL filters IP00. For details see Eaton documentation.

Application/Limitation

Supply voltage range: 208 - 690 V, 50/60 Hz
 Voltage variation: - 10 % , + 10 %
 Frequency variation: ± 10 %
 Output frequency: 0 - 320 Hz
 Temperature range in operation: Air cooled: 0 - 40 °C (40 - 50 °C when derated 1,5% /°C, 50 - 55 when derated 2,5% /°C)
 Liquid cooled: 0 - 50 °C (CH6x series 50 – 55 °C when derated 2,5% /°C)
 Temperature class: A
 Vibration class: A
 Humidity class: A
 Protection class: IP00, IP21 & IP54
 EMC class*: DNV CN 2,4 / IEC 61800-3
 To be used on EMC class A locations

The SPX - LCX must be regarded as a component. The actual installation shall be designed according to Eaton Users Manual and according to the applicable DNV Rules for the actual application. Documentation 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.

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.

For marine applications size of drive to be derated with respect to an ambient temperature of 40°C (1,5% per deg. C for ambient above 40 - 50 °C) or chosen acc. to 50 °C rating. See manual.

Type Approval documentation

Technical info:

"Vacon request for update" Part of email from Vacon to DNV dated 2010-09-23.

"Eaton User's manual LCX dated January 2007 & User manual _SVX-SPX issued May 2011.

Test reports:

"Classification documentation of frequency converters – Air cooled Fr4-14, Liq. Cooled Ch3-7, dated 2006.

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

Eaton SPX / LCX – 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