

TYPE APPROVAL CERTIFICATE

This is to certify:

That the EPL / ShaPoLi arrangement

with type designation(s)

Lemag Shaftpower - ShaPoLi, SP A1 Display, SP A2.a Stationary Shaft Unit Cabinet, SP A2.b Main Connection Point, SP A14.1 and SP A14.2 Receiving Antennas, SP Stator and Rotor

Issued to

**Chris-Marine Germany GmbH
Rellingen, Germany**

is found to comply with

**IACS Recommendation No. 172 (June 2022) EEXI Implementation Guidelines
DNV rules for classification – Ships**

Application :

Product(s) approved by this certificate is/are accepted for installation on all vessels classed by DNV.

Location classes:

Type	Temperature	Humidity	Vibration	EMC	Enclosure
Lemag Shaftpower - ShaPoLi	D	B	A	B	
SP A1 Display	D	B	A	B	B / IP65 (front), A / IP20 (back)
SP A2.a Stationary Shaft Unit Cabinet	D	B	A	A	B / IP44
SP A2.b Main Connection Point	D	B	A	A	A / IP20
SP A14.1 and SP A14.2 Receiving Antennas	D	B	A	A	B / IP55
SP Stator and Rotor	D	B	A	A	B / IP55

Issued at **Høvik** on **2022-11-17**

This Certificate is valid until **2024-11-16**.

DNV local unit: **Hamburg – CMC North/East**

Approval Engineer: **Thorbjørn Hansen**



for **DNV**

Digitally Signed By: Sneen, Ståle

Location: DNV Høvik, Norway

on behalf of

**Jan Tore Grimsrud
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

The Chris-Marine ShaPoLi solution is designed to comply with the ShaPoLi approach as outlined in IACS Rec.172 (section 6.6, first bullet) of June 2022. The complete Chris-Marine ShaPoLi solution comprises the following main parts.

1. HW for measuring the torque and rotational speed delivered to the propeller of the ship.
2. A control unit (master) installed on the bridge for calculation and monitoring of the power transmitted by the shaft to the propeller.
3. A control unit (slave) installed in ECR.

A separate digital contact intended for communicating system error alarm to the vessels main alarm system is provided.

Functionality specified by MEPC.335(76) concerning EPL/ShaPoLi are listed in Table 1. Which of these functions that are covered by the subject Type Approval Certificate are identified in column no. 3. When the system shall be used onboard DNV classed vessels, the vessel-specific configuration shall be reflected in Annex 1.

Table 1: Functions defined in MEPC.335(76)

No	Function	Covered by the subject TAC	SW No	DNV HW TAC
1	Power limitation			
1a	EPL - Power limitation	N/A		
1b	ShaPoLi - Power limitation	Yes ^{Note 1}		
2	Override			
2a	Override power limitation	Yes ^{Note 1}		
3	Alarming			
3a	Alarming relevant failures on bridge	Yes		
4	Indication (on the bridge)			
4a	Activation of un-limiting mode	Yes ^{Note 1}		
4b	Power limit exceeded (visual and audible)	Yes		
4c	Indication of shaft speed, -torque and -power ^{Note 2}	Yes		
5	Recording			
5a	Shaft speed, -torque and -power recorded in un-limiting mode ^{Note 1}	Yes		
5b	Power limit exceeded	Yes		
5c	Activation of override ^{Note 3}	N/A		
6	Tamper-proofing			
6a	<p>The following measures are established to arrange the Chris-Marine system tamper proof:</p> <p>The system configuration is stored on each display in an encrypted parameter file. This parameter file can only be changed by Chris-Marine. In addition to general system configuration, the following EEXI related data is stored in the encrypted parameter files:</p> <ul style="list-style-type: none"> • A static EEXI maximum shaft power value (in kW) • A warning limit relative (in percent) to the static EEXI maximum shaft power value • A moving average filter for the measured shaft power value to avoid short fluctuations • A delay before an alarm is generated following a EEXI shaft power limit violation is detected • Password for overriding a EEXI shaft power limit violation • Password for changing offset1 and offset3 values • Limits for normal sensor1 and sensor3 values • Limits for port stay/stand still detection <p>Events related to static EEXI maximum shaft power value are stored in encrypted event log files. The event log files are created on the display on the bridge SLO/SPO A1.a and are automatically backed-up on the display in the engine control room SLO/SPO A1.</p> <p>A detailed log with</p> <ul style="list-style-type: none"> - Timestamp (UTC) - Shaft rotational speed - Shaft torque - Shaft power <p>is recorded when the shaft power limit is exceeded.</p>	Yes		
^{Note 1}	<p>The subject system shall primarily be arranged independent of the engine automation system and provides alarm, indication and recording necessary for the navigator to manually limit the power as specified in IACS Rec. 172, Section 6.6.</p> <p>However, if the subject system shall be applied in ShaPoLi-arrangements with automatic power limitation as specified MEPC.335(76), such use is not covered by this Type Approval certificate and is subject to case-by-case approval.</p>			
^{Note 2}	Required when power limitation is arranged as specified in 1b.			
^{Note 3}	Required when power limitation is arranged as specified in 1a.			

Vessels having existing torque meter(s) supplied by Chris-Marine may be reused for ShaPoLi purpose. The following two options are hence available:

- Option 1: The complete ShaPoLi system
 (-as pr. Chris-Marine drawing no. SPL-02-04-06-0300-00)
- Option 2: Reuse existing torque meter and install new display in ECR and on the bridge
 (-as pr. Chris-Marine drawing no. SPL-02-04-06-0300-01)

Table 2 shows the SW numbering structure and the type approved SW revision.

Table 3 provides a complete list of HW that are covered by the subject TA certificate.

Table 2: Chris-Marine's SW version number allocation

x	:	Major modifications	0-99
y	:	Major – Minor modifications	0-9
z	:	Minor modifications	0-99
Type approved SW version no. (Vx.yz):			V3.6z

Table 3: Chris-Marine ShaPoLi system, HW overview

Component		Included in option 1 or 2	Physical location
Name	Description		
	Shaft-installed HW, comprising:	1	
SP A3	• Power Receiving Coil	1	ER
SP A4, A5	• Shaft Clamp Ring	1	ER
SP A9, A10	• Torque Sensor	1	ER
SP A11	• Rotating shaft unit	1	ER
SP A12	• Speed sensor pickup plate	1	ER
SP A13	• RF transmitter antenna	1	ER
SP A2.a	Stationary shaft unit, interfacing:	1	ER
SP A14.1	• Receiver antenna 1	1	ER
SP A14.2	• Receiver antenna 2	1	ER
SP A6	• Power transmitter coil	1	ER
SP A7, A8	• Speed pickup sensor	1	ER
N/A	• RS232 (to SP A2.b)	1	
SLO/SPO A1	Display SPEAT/Shaftpower Display ECR	1, 2	ECR/ER
SP A2.b	Main connection point, optionally interfacing:	1	ECR/ER
SL Cb.3	• Digital Output	1	ECR/ER
	o System error	1	
	o Overload warning	1	
	o Overload alarm	1	
SP Cb. 4	• Analog Output	1	ECR/ER
	o RPM, Torque, Power	1	
SP Cb.5	• Serial Output	1	ECR/ER
	o RPM, Torque, Power	1	
	o Main engine fuel oil data	1, 2	
	o Aux engine(s) fuel oil data	1, 2	
	o Aux boiler(s) fuel oil data	1, 2	
SPO A1.a	Shaftpower Display Bridge	1, 2	WH
SL A28	Connection point, optionally interfacing:	1, 2	WH
	• GPS	1, 2	WH
	• Speedlog	1, 2	WH
	• Anemometer	1, 2	WH

Radio specification

No. of RF transceivers: 1 transmitter, 2 receivers
 Centre frequency: 433.92 MHz
 RF power: 10 dBm (10 mW)
 Data rate: 64 kbps
 Number of channels: 1
 Channel bandwidth: 65 kHz (- 3 dB)

Approval conditions

This Type Approval certificate covers all HW and SW in Chris-Marine's ShaPoLi solution.

Any deviations from the preferred choices in Annex 1 in this TA certificate are subject to separate approval. In such case, a complete set of ShaPoLi system documents shall be submitted to DNV for approval. Certification may in such case be required.

The following documents, holding vessel specific information shall be available onboard and be presented to the DNV surveyor upon request:

- Annex 1 in this TA certificate
- Chris-Marine's "Internal Workshop Test Certificate"
- Chris-Marine's "Service/Commissioning Report", document no. ATD-SHP-3-E

The adjustable delay timer for power exceedance alarm shall be set to max 15 seconds.

When the type approved software is revised (affecting all future deliveries) DNV is to be informed by forwarding updated software version documentation. If the changes are judged to affect functionality for which rule requirements apply a new functional type test may be required and the certificate may have to be renewed to identify the new software version.

Application/Limitation

The Chris-Marine ShaPoLi solution is approved for use in DNV classed vessels subject to EEXI overridable power limitation provided the vessel's Flag Administration have accepted the ShaPoLi approach as outlined in IACS Rec.172 (section 6.6, first bullet) of June 2022.

Except from the recording functionality, this TA certificate does not cover use in ShaPoLi systems with functionality for automatic power limitation. Such use will be subject to case-by-case approval.

Equipment installed in the wheelhouse shall not be placed nearer than 0.65 m to the standard compass and 0.50 m to the steering compass.

Use of radio frequency bands

This type approval does not cover the different administrations requirements for use of the radio frequency bands. The applied frequency band 433.05-434.79 MHz is defined by ITU-R Radio Regulations (2020) as an ISM-band that may be subject to special authorization by the administration concerned. Any use of the radio frequency band has to be in line with the requirements of the administration concerned.

Radio frequency susceptibility

The sensor system applies wireless communication at 433.92 MHz with a channel bandwidth of 65 kHz. Co-existence with other wireless systems communicating on this frequency is not guaranteed and needs to be tested at commissioning of the system.

Type Approval documentation

Document Title	Document No	Rev/date	DNV No
How to handle SW releases, Specification	D-251	1.2/2022-11-09	32
Compass safe distance for STIF A4D162.5 and STIF A2D8/2,5	530	-/2007-08-08	31
Compass safe distance for 6NEMAt06-E	1073	-/2020-08-24	30
Compass safe distance for Panel-PC and Power supply	P116642	-/2022-11-10	29
Chris-Marine's ShaPoLi Solution, System Test Specification	TS-SHAPOLI-1	01/2022-11-02	28
System Description, Chris-Marine's ShaPoLi Solution	SD-SHAPOLI-1	02/2022-10-31	27
Chris-Marine SPEAT/Shaftpower ShaPoLi, Upgrade overview	SPL-02-04-06-0300-01	03/28.10.2022	26
Chris-Marine SPEAT/Shaftpower ShaPoLi System Overview	SPL-02-04-06-0300-00	03/28.10.2022	25
Connection point Bridge display, NMEA Signal collector SL A28	SM-LS-02-02-05-5560-01	01/27.10.2022	24
Main Connection Point SP A2.b, Mechanical construction (1/4)	SP-02-02-05-2040-00	-/23.06.2016	20
Main Connection Point SP A2.b, Int. wiring 24VDC (2/4)	SP-02-01-01-2040-00	-/23.06.2016	20
Main Connection Point SP A2.b, Ext. wiring SP Cb.46 (3/4)	SP-02-01-02-2040-00	-/23.06.2016	20
Main Connection Point SP A2.b, Ext. wiring SP Cb.47 (4/4)	SP-02-01-02-2040-01	-/23.06.2016	20
Radiometrix BIM2G-433-64-CD-5V Datasheet	-	2/2013-03-07	15
Lemag Shaftpower – Radio Communication Description	-	00/2022-09-16	14
LEMAG Shaftpower – Test Report IACS UR E10 Rev.7	S259A-2022	-/2022-09-28	13
LEMAG Shaftpower – Type Test Program (DNV-CG-0339 Tests)	-	00/2022-02-28	11
LEMAG Shaftpower – Drawings (28 pages)	multiple drawings	-	2
Test case Digital output Wago System	-	-	34
LEMAG Shaftpower – Internal Workshop Test Certificate	-	-	9
Service/commissioning report	ATD-SHP-3-E	01/2022-11-11	33

Tests carried out

Applicable tests according to class guideline DNV-CG-0339, August 2021.
Compass safe distance measured according to IEC 60945:2002 Sec.11.2 for the bridge mounted equipment.
Function tests according to document TS-SHAPOLI-1, 2022-11-02 – Rev 01.

Marking of product

As applicable:

- Chris-Marine
- Component names as pr. Table 2
- Compass safe distance
- Serial number
- 100-240 VAC, 50/60 Hz
- Radio transceiver power & frequency

Periodical assessment

The scope of the periodical assessment is to verify that the conditions stipulated for the type are complied with, and that no alterations are made to the product design or choice of systems, software versions, components and/or materials.

The main elements of the assessment are:

- Ensure that type approved documentation is available
- Inspection of factory samples, selected at random from the production line (where practicable)
- Review of production and inspection routines, including test records from product sample tests and control routines
- Ensuring that systems, software versions, components and/or materials used comply with type approved documents and/or referenced system, software, component and material specifications
- Review of possible changes in design of systems, software versions, components, materials and/or performance, and make sure that such changes do not affect the type approval given
- Ensuring traceability between manufacturer's product type marking and the type approval certificate

Periodical assessment is to be performed at least every second year and at renewal of this certificate.

END OF CERTIFICATE



Annex 1: Ship specific configuration

A signed project specific copy of Annex 1 shall be available onboard and be presented to the DNV surveyor upon request.

The default choices are indicated in **bold**. Any deviations from the default choices may be subject to separate approval. Vessel specific documentation shall in such case be submitted to DNV for approval.

No	Item	Actual configuration
1	Vessel's propulsion shaft arrangement:	
1.1	No of propulsion shafts (1 / 2 ) .....	.....
2	ShaPoLi option no:	
2.1	Shapoli option no. 1 or no.2 delivered (1 / 2 ) .....	.....
3	Installed SW / system configuration:	
3.1	SW version no. V3.6z is implemented in the system installed onboard (Y / N ) .....	.....
3.2	Adjustable time delay for power exceeded alarm set to max 15 seconds (Y / N ) .....	.....
3.3	The vessel specific configuration is reflected in "internal workshop test certificate" (Y / N ) .....	.....
4	Power limitation:	
4.1	The subject system is used for <u>automatic</u> power limitation (Y / N ) .....	.....
5	Shaft power limitation arranged as per IACS Rec. 172, section 6.6, including	
5.1	Alarm is activated on the bridge when the EEXI power limit is exceeded (Y / N ) .....	.....
5.2	Continuously recording of the following parameters when power limit is exceeded:	
5.2.1	- Shaft rotational speed (Y / N ) .....	.....
5.2.2	- Shaft torque (Y / N ) .....	.....
5.2.3	- Shaft power (Y / N ) .....	.....
5.2.4	Continuously indication of "EEXI power limit exceeded" (Y / N ) .....	.....
6	Interface to external systems	
6.1	GPS position (Y / N) ^{Note 1} .....	.....
6.1.1	Speedlog (Y / N ) .....	.....
6.1.2	Anemometer (Y / N ) .....	.....
6.1.3	System fail output interfaced to external alarm system (Y / N ) .....	.....
7	Installation record:	
7.1	The system will be installed and tested onboard as pr. document ATD-SHP-3-E (Y / N ) ....	.....

Note 1 Interface to the ships GPS shall be through a communication port approved for external use

The above, IDENTICAL configuration applies to the following vessels:

IMO No	Flag Admin.	IMO No	Flag Admin.	IMO No	Flag Admin.

Comments:

 Manufacturer's signature, date & stamp