

**EUROPÄISCHES PATENT | EUROPEAN PATENT  
BREVET EUROPÉEN**

Hiermit wird bescheinigt, dass für die in der Patentschrift beschriebene Erfindung ein europäisches Patent für die in der Patentschrift bezeichneten Vertragsstaaten erteilt worden ist. It is hereby certified that a European patent has been granted in respect of the invention described in the patent specification for the Contracting States designated in the specification. Il est certifié par la présente qu'un brevet européen a été délivré pour l'invention décrite dans le fascicule de brevet, pour les États contractants désignés dans le fascicule.

Europäisches Patent Nr.  
European patent No.  
Brevet européen N°
Tag der Bekanntmachung des Hinweis auf die Erteilung des europäischen Patents  
Date of publication of the mention of the grant of the European patent  
Date de publication de la mention de la délivrance du brevet européen

**EP3847091** **30.08.2023**

**SCHIFFSRUMPF MIT EINER ERHÖHUNG IM BEREICH EINER  
UNTERSEITE DES SCHIFFSRUMPF**

Patentinhaber / Proprietor(s) of the patent / Titulaire(s) du brevet

LR-Shipdesign AG  
Neuhofstrasse 5a  
6340 Baar  
CH

Antonio Campinos  
Präsident des Europäischen Patentamts / President of the European Patent Office / Président de l'Office européen  
München, (den) / Munich, le / 30.08.2023

URKUNDE | CERTIFICATE | CERTIFICAT

(English translation)  
**CERTIFICATE OF PATENT**

**Patent Number 10-2510333**

Application No. 10-2021-7009023  
 Filing Date March 25, 2021  
 Registration Date March 10, 2023

**Title of the Invention**  
SHIP HULL HAVING A RAISED PORTION IN THE REGION OF AN UNDERSIDE OF THE SHIP HULL

**Owner of the Patent right**  
LR-SHIPDESIGN AG  
Neuhofstrasse 5a, 6340 Baar, Switzerland

**Inventor(s) of the Patent**  
LINDINGER, Roland  
Mettenfeld 5, 5642 Muhlau, Kanton Aargau, Switzerland

This is to certify that, in accordance with the Patent Act, a patent for the invention has been registered at the Korean Intellectual Property Office.

March 10, 2023

  
**특허청장**  
COMMISSIONER,  
KOREAN INTELLECTUAL PROPERTY OFFICE

**CERTIFICATE OF GRANT  
STANDARD PATENT**

Patent number: 2019334419

The Commissioner of Patents has granted the above patent on 8 December 2022, and certifies that the below particulars have been registered in the Register of Patents.

**Name and address of patentee(s):**  
LR-Shipdesign AG of Neuhofstrasse 5a 6340 Baar Switzerland

**Title of invention:**  
Ship hull having a raised portion in the region of an underside of the ship hull

**Name of inventor(s):**  
LINDINGER, Roland

**Term of Patent:**  
Twenty years from 2 September 2019

**Priority details:**

Number	Date	Filed with
10/2018 121 4148	3 September 2018	DE

**特許証**  
特許第7287706号  
(CERTIFICATE OF PATENT)

発明の名称 (TITLE OF THE INVENTION) 船体の底面の領域に隆起部を有する船体

特許権者 (PATENTEE) スイス国・6340・パール・ノイホフシュトラーセ・5ア  
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エルアルーシップデザイン・アーゲー

発明者 (INVENTOR) リンディンガー、ローラント

出願番号 (APPLICATION NUMBER) 特願2021-636161  
 出願日 (FILING DATE) 令和 1年 9月 2日 (September 2, 2019)  
 登録日 (REGISTRATION DATE) 令和 5年 5月29日 (May 29, 2023)

この発明は、特許するものと確定し、特許原簿に登録されたことを証する。  
(THIS IS TO CERTIFY THAT THE PATENT IS REGISTERED ON THE REGISTER OF THE JAPAN PATENT OFFICE.)

令和 5年 5月29日 (May 29, 2023)

特許庁長官 (COMMISSIONER, JAPAN PATENT OFFICE)  
濱野 幸

(12) NACH DEM VERTRAG ÜBER DIE INTERNATIONALE ZUSAMMENARBEIT AUF DEM GEBIET DES PATENTWESENS (PCT) VERÖFFENTLICHTE INTERNATIONALE ANMELDUNG

(19) Weiterorganisation für geübten Eigentum Internationalen Erfindung

(43) Internationale Veröffentlichungsdatum 12. März 2020 (12.03.2020)

WIPO/PCT WO 2020/048933 A1

(5) Internationale Patentklassifikation: B63H 1/04 (2006.01)  
 B63H 5/08 (2006.01)  
 B63H 5/09 (2006.01)

(21) Internationale Anmeldedaten: PCT/EP2019037514

(22) Internationales Anmeldedatum: 02. September 2019 (02.09.2019)

(25) Einreichungssprache: Deutsch

(35) Angaben zur Priorität: 01. September 2018 (01.09.2018) DE 10 2018 121 414 6

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(84) Bestimmungsstaaten (sofern nicht anders angegeben, für jede vorliegende regionale Schutzrechtsart): AR, BF, BW, BY, CH, CN, CO, DE, DK, EC, EE, ES, FI, FR, GB, GR, GU, HK, HM, IL, IN, IR, IT, JP, KE, KG, KH, KR, KZ, LI, LU, MC, MG, MK, MN, MW, MY, NZ, PA, PE, PG, PH, PL, PT, RO, RU, SA, SC, SD, SE, SG, SI, SK, SL, SV, TH, TN, TR, TT, UA, UG, US, UZ, VC, ZA, ZM, ZW

(84) Bestimmungsstaaten (sofern nicht anders angegeben, für jede vorliegende regionale Schutzrechtsart): AR, BF, BW, BY, CH, CN, CO, DE, DK, EC, EE, ES, FI, FR, GB, GR, GU, HK, HM, IL, IN, IR, IT, JP, KE, KG, KH, KR, KZ, LI, LU, MC, MG, MK, MN, MW, MY, NZ, PA, PE, PG, PH, PL, PT, RO, RU, SA, SC, SD, SE, SG, SI, SK, SL, SV, TH, TN, TR, TT, UA, UG, US, UZ, VC, ZA, ZM, ZW

(84) Titel: SHIP HULL HAVING A RAISED PORTION IN THE REGION OF AN UNDERSIDE OF THE SHIP HULL

(84) Bezeichnung: SCHIFFSRUMPF MIT EINER ERHÖHUNG IM BEREICH EINER UNTERSEITE DES SCHIFFSRUMPF

(87) Zusammenfassung: Die vorliegende Erfindung betrifft einen Schiffsrumpf (10) insbesondere für ein Containerschiff, einen Bulkcarrier und einen Tanker. Der Schiffsrumpf (10) weist eine Erhöhung (L) einer Außenwand (AK) des Schiffsrumpfs (10) in Bezug auf eine nach oben gerichtete Vertikalachsrichtung (Z) des Schiffsrumpfs (10) im Bereich einer ersten und zweiten Spantenlinie (SP1, SP2) gegenüber einem an die Erhöhung (L) unmittelbar angrenzenden Oberflächenelement (OF) auf. Dabei ist die Erhöhung (L) in einem Bereich zwischen einer Mitte und einem Heck (H) des Schiffsrumpfs (10) angeordnet.

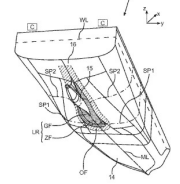


Fig.1



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September 8, 2022

**APPROVAL IN PRINCIPLE**

**Subject: LR-Shipdesign AG - Aft Body Optimization for a 76,000 DWT Bulk Carrier**

This is to certify that this Administration has conducted a technical examination of the documentation listed in appendix 1 for the subject project with a view to awarding an Approval in Principle.

The examination has been made to verify the performance of LR-Shipdesign AG's aft body hull form optimization and methodology applied for the purpose of subsequent EEDI calculation in accordance with the following guidelines:

- 2018 Guidelines on the Method of Calculation of the Attained Energy Efficiency Design Index (EEDI) for new Ships, IMO Resolution MEPC.308(73), as amended by resolutions MEPC.322(74) and MEPC.332(76)
- 2014 Guidelines on Survey and Certification of the Energy Efficiency Design Index (EEDI) as amended, IMO MEPC.1.Circ.855/Rev.2

The methodology and data to be applied for the EEDI calculation has been verified through model tank tests of a 76k DWT Bulk Carrier design as referenced in appendix 1.

This Administration considers the efficiency of Aft Body Optimization (incl. optimized propeller and rudder) has been satisfactorily validated to demonstrate an efficiency improvement of about 6.7% with about 400 kW less main engine power (equal to about 3 rpm), and an Approval in Principle is awarded.

Final approval will be based upon the items detailed in ClassNK's Statement of Fact listed in appendix 1 being satisfactorily addressed to ensure compliance with above guidelines and applicable statutory rules and regulations.

Sincerely,

Thomas Klenum  
 Executive Vice President, Innovation & Regulatory Affairs  
 LISCR, LLC  
 For the Deputy Commissioner of Maritime Affairs  
 Republic of Liberia



**STATEMENT OF FACT**

Statement M-CH-P, July 16, 2023

THIS IS TO CERTIFY that, at the request of the applicant Messrs. LR-Shipdesign AG, Landis+Gyr Str. 1 CH 6300 Zug (in the following LRSD), and CIMC Ocean Engineering Design & Research Institute (in the following CIMC CRIC), this society reviewed the documents relating to propeller design optimization and calm water model tests performed for a 2,900 TEU Container Vessel (191 m) and provides statement as below.

**Reference**

MARITIME RESEARCH INSTITUTE NETHERLANDS (MARIN), NL-Wageningen (certified model test basin)  
 2,900 TEU container vessel (191 m). Calm water model tests with design propeller  
 Report No. : 34608-4-DT  
 Date: July 2023  
 Version: 1.0, Final Report  
 2,900 TEU container vessel (191 m). Computational propeller design optimization  
 Report No. : 34608-5-DT  
 Date: June 2023  
 Version: 0.2, Draft Report

**Introduction**

The investigations of which the results are provided in the MARIN report nos. 34608-4-DT and 34608-5-DT concern a 2,900 TEU container vessel (191 m) with an AFT OPT10 hull form designed by LR-Shipdesign (LRSD). The propulsion arrangement of this vessel consists of a single fixed pitch propeller. At this stage, a dedicated MARIN-LRSD design propeller is being tested.

The model test results of the LRSD hull form with dedicated MARIN-LRSD design propeller are compared with the results of an optimized conventional hull provided by CIMC CRIC. According to CIMC CRIC the conventional hull was fully optimized by MARIN. The conventional hull was tested with a MARIN stock propeller.

The objective of the tests is to determine whether the LRSD hull form with dedicated design propeller can lower the required trial power at 19 knots by at least 6% in power. A light running margin of at least 8% at full power had to be demonstrated.

**General description**

- The main particulars of the ship are:
- Length between perpendiculars 191.00 m
  - Breadth moulded 32.20 m
  - Design draught moulded 8.00 m
- The main propulsion data of the ship are:
- 1 fixed pitch propeller, diameter 7.125 m
  - Available brake power at 100% MCR 11,700 kW
  - Rotation rate at 100% MCR 96.5 rpm
  - Light running margin ± 6 %

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2023-07-26 09:57 for CIMC LR-Shipdesign AG (LRSD)



NIPPON KAJI KYOKAI

Page 1 of 2

**STATEMENT OF FACT**

Statement No. 22WE07200

THIS IS TO CERTIFY that, at the request of the applicant Messrs. LR-Shipdesign AG, Landis+Gyr Str. 1 CH- 6300 Zug, this society reviewed the documents relating to calm water model test which were reported between 8 December 2021 and 11 August 2022, and provides statement as below.

1. (Efficiency of Hull)

1.1 The Hamburg Ship reduction of a 76,000 TEU Energy Saving Device

Original design  
 Un-conventional

1.2 The ship performance

1.3 As the result in the reduces the power

1.4 It is recommended method in accordance reasons:

- slow blunt ship hull optimization
- small diameter optimized hull
- design stage 1

2. (Efficiency of Two)

2.1 In addition to the a 76,000 DWT Bulk Energy Saving Device

Original design  
 Un-conventional

2.2 As the result in new ESD reduces kts.

This Report is issued subject to the conditions of the circumstances whatever to be held in entry in the Record or other publications  
 97. 11. 10000 (K)

Electronically published by ABS Houston, Reference T2443507, dated 18-AUG-2023.



**Task – T2443507  
 Model Test Review for LRSD AFT OPT Design**

**Attention:**

Mr. Roland Lindinger  
 LR-Shipdesign AG (WCN: 484537)

The model test reports in the attached list were mainly reviewed based on the applicable recommendations of the following:

- ITTC Quality System Manual Recommended Procedures and Guidelines Procedure - 1978 ITTC Performance Prediction Method

The following observations were made.

Calm water model tests for two 2900 TEU containerships were carried out by MARIN (Maritime Research Institute Netherlands).

- MARIN Report 34608-2-DT (excerpt) presents the model test results for Hull No. 10433, which is an optimized conventional hull.
- MARIN Report 34608-4-DT presents the model test results for Hull No. 10470, which is similar to Hull No. 10433 but with LR-Shipdesign's AFT OPT10 technology, also referred to as the "AFT OPT" hull.

The model tests were conducted at MARIN's Deep Water Towing Tank following the test procedures and data processing methods as described in the above test reports.

Two different values of the model-ship correlation allowance (CA) factor were used for predicting the full-scale trial power performance. In total, five different sets of full-scale power prediction were provided at the draft of 8.0 m.

- Case 1: Original optimized hull (Hull No. 10433) + Propeller No. 7775R + Rudder I with CA = 0.0001
- Case 2: AFT OPT hull (Hull No. 10470) + Propeller No. 8310R + Rudder II with CA = 0.0002
- Case 3: AFT OPT hull (Hull No. 10470) + Propeller No. 8312R + Rudder II with CA = 0.0002
- Case 4: AFT OPT hull (Hull No. 10470) + Propeller No. 8310R + Rudder II with CA = 0.0001
- Case 5: AFT OPT hull (Hull No. 10470) + Propeller No. 8312R + Rudder II with CA = 0.0001

The extrapolated full-scale trial performances of these five different cases were compared in MARIN Report 34608-4-DT.

ABS, Corporate Technology  
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