HAMBURGISCHE SCHIFFBAU-VERSUCHSANSTALT GMBH

THE HAMBURG SHIP MODEL BASIN

Report RP-2022-073

Aft Body Optimisation for a 76,000 DWT Bulk Carrier - Summary Report -

HSVA Model No. 5557

Customer:
LR-Shipdesign AG

HSVA

Document Control Sheet

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Summary: On behalf of *LR-Shipdesign AG (LRS)* a comprehensive calm water model test campaign has been carried out for a 76,000 DWT Bulk Carrier. The aim of the tests was to verify the reduction of the vessel's power consumption by optimising the aft body arrangement.

Subject to the optimisation have been the hull form, the propeller and the rudder.

In this report the results of the various test series are summarised.

The detailed results of the various tests performed are presented in the HSVA reports nos. RP-2021-078, RP-2021-079, RP-2021-100, RP-2022-043, RP-2022-066, WM-2021-024, WM-2021-025, WM-2021-031, OW-2021-037, OW-2022-008, OW-2022-022.

The results of the calm water tests performed are summarised as follows:

(1) The optimised Lindinger design reduces the power consumption by about 6.7% at a full scale ship speed of 13.0 kts.

(2) Due to the reduced propeller speed an additional fuel oil saving is expected as the corresponding main engine with lower engine speed has a lower specific fuel consumption.

Keywords: Propulsion test, Resistance test, 3D Wake Measurement, Bulker

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HSVA Model No. 5557

Hamburg, August 2022

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1.1 Introduction and Description of the Model

On behalf of *LR-Shipdesign AG (LRS)* a comprehensive calm water model test campaign has been carried out for a 76,000 DWT Bulk Carrier. The aim of the tests was to verify the reduction of the vessel's power consumption by optimising the aft body arrangement.

Subject to the optimisation have been the hull form, the propeller and the rudder.

In this report the results of the various test series are summarised.

The detailed results of the various tests performed are presented in the following HSVA reports:

Resistance and propulsion tests:

- RP-2021-078 (original design)
- RP-2021-079 (1st optimisation step)
- RP-2021-100 (2nd optimisation step)
- RP-2022-043 (3rd optimisation step)
- RP-2022-066 (4th optimisation step)

3D wake measurements:

- WM-2021-024 (original hull form)
- WM-2021-025 (1st Lindinger hull form)
- WM-2021-031 (2nd Lindinger hull form)

Propeller open water tests:

- OW-2021-037 (original propeller)
- OW-2022-008 (1st design propeller)
- OW-2022-022 (2nd design propeller)

The HSVA models nos. 5556 and 5557 are built from wood to a scale ratio of 30.7317. The principal dimensions of the ship and the models are given by the following tables:

Original Design			
	Ship		**Model**
Number	—		5556
Index	—		00010
Rudder	—		2176
Propeller	—		8729
L_{PP}	221.50 m		7207.5 mm
B_{WL}	36.50 m		1187.7 mm
T_{Design}	12.50 m		406.7 mm
$C_{B,Design}$		0.8432	
∇_{Design} (excl. appendages)	85215 m^3		2.9360 m^3

Optimised Lindinger Design			
	Ship		**Model**
Number	—		5557
Index	—		01120
Rudder	—		2231
Propeller	—		8757
L_{PP}	221.50 m		7207.5 mm
B_{WL}	36.50 m		1187.7 mm
T	12.50 m		406.7 mm
C_B		0.8433	
∇_{Design} (excl. appendages)	85226 m^3		2.9364 m^3

Photographs of the ship models are given on the pages P1 and P2.

The figures F1 and F2 show three-dimensional views of the initial hull form (F1) and the optimised Lindinger hull form (F2).

1.2 Test Program

All tests were carried out in HSVA's large towing tank which is described in appendix Z. The following table gives an overview of the tests performed:

Week	Kind of Tests	Remark
42/2021	• Resistance test • Propulsion test • 3D wake measurement • Propeller open water test	Original design
42/2021	• Resistance test • Propulsion test • 3D wake measurement	Initial Lindinger hull form
51/2021	• Resistance test • Propulsion test • 3D wake measurement	Optimised Lindinger hull form
17/2022	• Propulsion tests • Propeller open water test	Intermediate Propeller & Rudder Optimisation
25/2022	• Propulsion tests • Propeller open water test	Optimised Lindinger design

1.3 Test Analysis

The test results were analysed according to the HSVA Standard Correlation Method.

The resistance of the appendages and openings such as bilge keels, bow thruster tunnels etc., which are not fitted on the model, is considered theoretically by adding an additional frictional resistance component for the trial and service predictions.

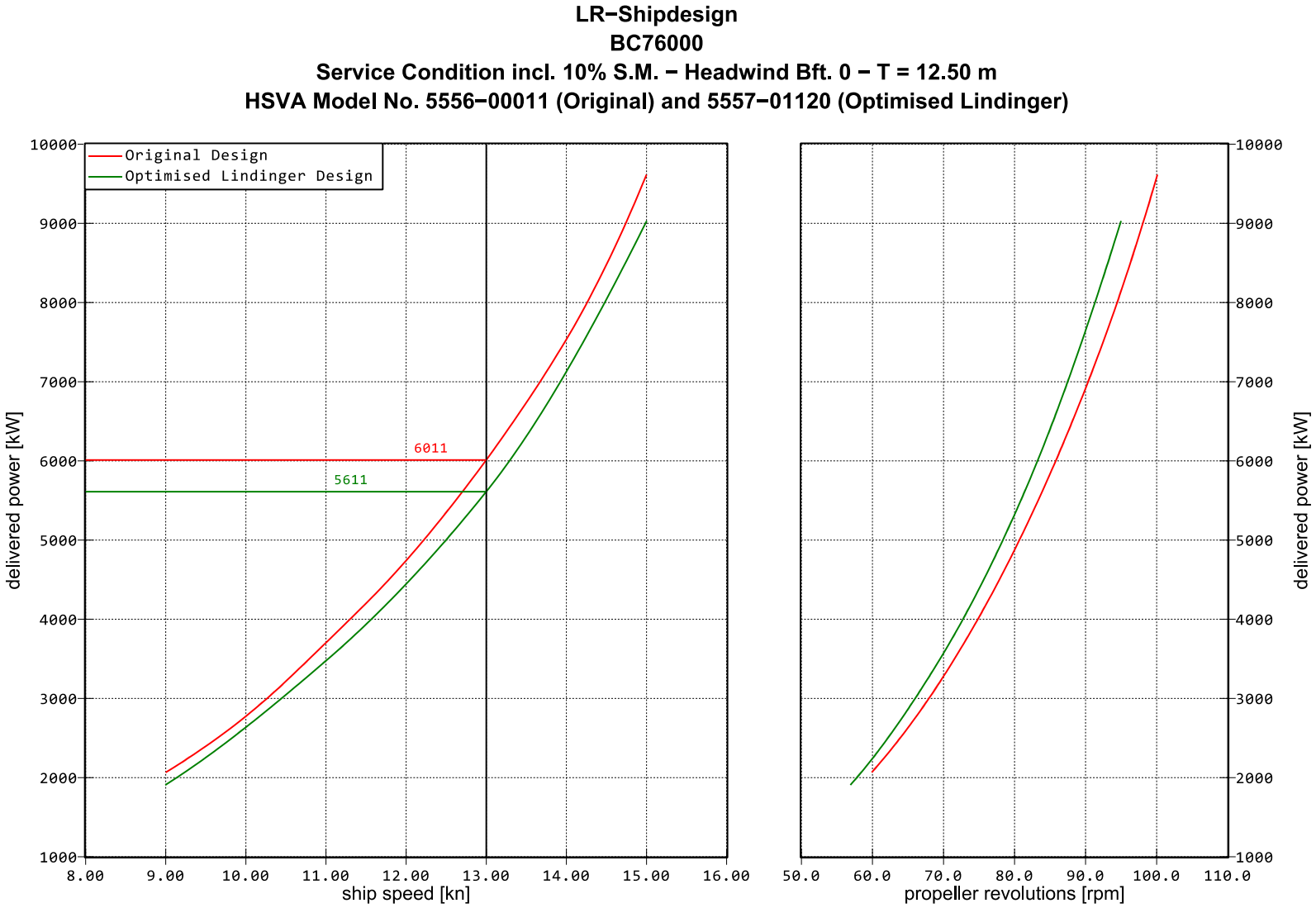
1.4 Test Results

The results of the calm water tests performed are summarised as follows:

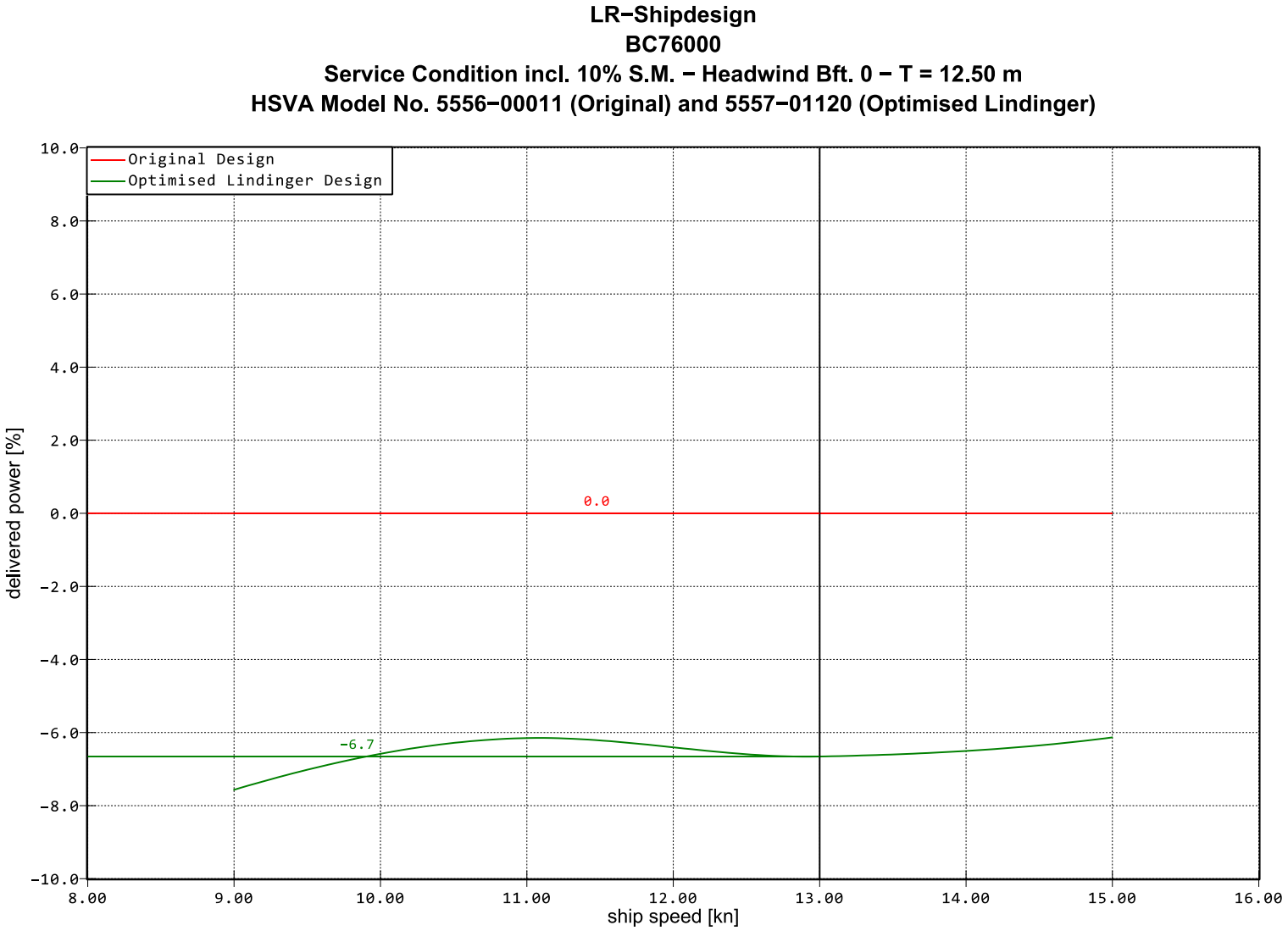
(1) The optimised Lindinger design reduces the power consumption by about 6.7% at a full scale ship speed of 13.0 kts.

(2) Due to the reduced propeller speed an additional fuel oil saving is expected as the corresponding main engine with lower engine speed has a lower specific fuel consumption.

2.1 Power Prediction for Service Conditions incl. 15% S.M.



2.2 Reduction of the Power Consumption by Lindinger Optimisation



4.2 Photographs of Model 5557-01120 (Optimised Lindinger Design)