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An 18680 dwt Multipurpose/ Heavy Lift Cargo Vessel, *Part I*

Professional paper

In this article the first part of the design of an 18 680 dwt multipurpose/heavy lift cargo vessel is presented. It comprises the description of the design task with the given requirements, technical description as well as classification rules and other regulations that had to be fulfilled. It also includes the stability analysis for five heavy cargo loading cases, and the calculation of the bulkhead and opening position for satisfying the ship damage stability. In the next journal's issue the remaining part of the design will be presented.

Keywords: *damage stability, design features, heavy lift cargo cranes, survival conditions*

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Višenamjenski brod za dizanje teških tereta nosivosti 18680 dwt, I dio

Stručni rad

U članku je prikazan prvi dio projekta višenamjenskog broda za dizanje i prijevoz teških tereta nosivosti 18 680 dwt. Ovaj dio obuhvaća opis projektnog zadatka sa zadanim zahtjevima, tehničkim opisom kao i s klasifikacijskim pravilima i drugim propisima koje je projekt trebao zadovoljiti, zatim analizu stabiliteta za pet slučajeva dizanja teškog tereta, i na kraju proračun položaja poprečnih pregrada i otvora u svrhu zadovoljenja stabiliteta oštećenog broda. U sljedećem broju časopisa prikazat će se drugi dio projekta.

Ključne riječi: dizalice za teške terete, projektne značajke, stabilitet oštećenog broda, uvjeti preživljavanja

1 Introduction

Heavy lift cargo vessels are specialised multipurpose ships for lifting and transporting heavy cargo. Their market is limited, and the order book contains only several ships per year.

According to present analyses of broker's companies, this limited ship market has a growing tendency due to the growth in the sea and underwater exploitation, although it is very small and protected by a limited number of big operators which practically have the monopoly on the market.

The most significant European shipyards for this ship type are the *Damen Shipyards Group* in the Netherlands and *Sietas KG Shiffwerft* in Germany.

The owners with the largest number of heavy lift cargo vessels are: Jumbo, SAL, BigLift and COSCO.

There are only four heavy lift cargo vessels ordered to be built in Europe and partially in India.

The price of this type of new-builds is very high because it is commanded by specific requirements of ship-owners; therefore, the added value per CGT is much higher than for other ship types.

In the period of the following few years, the tendency of the price growth for these ships is also expected because the Far East Shipyards show no interest in this market, and this is what could eventually lower the prices.

The multipurpose heavy lift cargo ship is an example of a vessel that, according to the analyses carried out in the shipyard *3. maj*, would not incur any losses; therefore, it is considered that this ship type and similar specialised ships should be a niche market for the shipyard *3. maj* in the very near future.

2 Contract Particulars

The shipyard *3. maj* and the shipping company *BigLift* opened their technical/commercial negotiations on building a multipurpose heavy lift cargo ship at the end of the summer of 2005.

When the negotiations started, the client initially demanded from the shipyard to give three optional offers for:

- a ship without installed cranes which should be installed later in the company *Huisman-Itrec,*
- a ship with installed structural elements of the crane power station and with partially completed crane foundations that should be finally equipped in the company *Huisman-Itrec*,
- a complete ship with cranes installed in the shipyard *3. maj*, with the cranes delivered by the client based on the *Owner supply* principle.

During the negotiations, the last option of the complete ship was chosen, see Figures 1 and 2.

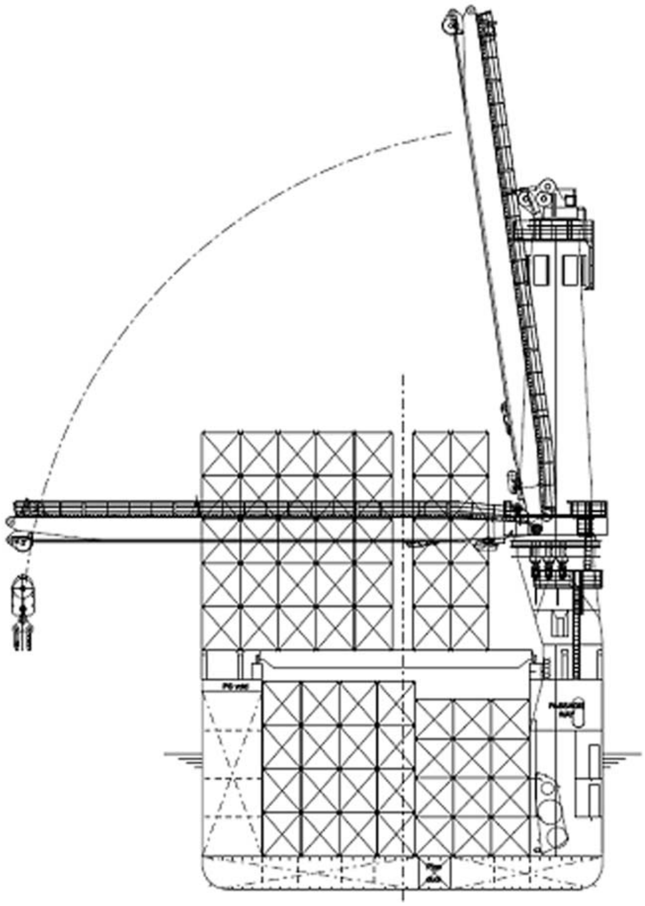


Figure 1 **The ship side-view with installed cranes**
Slika 1 **Poprečni presjek broda s ugrađenim dizalicama**

- Accommodation arrangement,
- Capacity plan – preliminary,
- Trim and stability book – preliminary,
- Engine room arrangement,
- Electric load analysis,
- Mid-ship section – geometry,
- Supplier's list.

Appendix F consisted of *Cost presumed items* for the following equipment:

- Main engine,
- Gearbox,
- CP propeller,
- Deck and twin-deck hatch covers.

Before the final signing of the contract, the shipyard had commercially and technically operated the offers of the mentioned equipment, see Table 1, and signed the Protocols of option.

Table 1 **Comparison of offers for different equipment**
Tablica 1 **Usporedba ponuda različite opreme**

No.	Equipment	Suppliers		
1	Main Engine	* Wärtsilä 8L46 8775 kW	MaK 9M43C 9000 kW	MAN 8L48B 9600 kW
2	Gearbox	RENK, type HSU 1120	*RENK type RSV-1060	Reintjes, type SVA 1200
3	CP propeller	Schottel	* Wärtsilä – Lips	Rolls-Royce
4	Hatch Cover	* Radež-MacGregor	TTS	

*chosen by the client

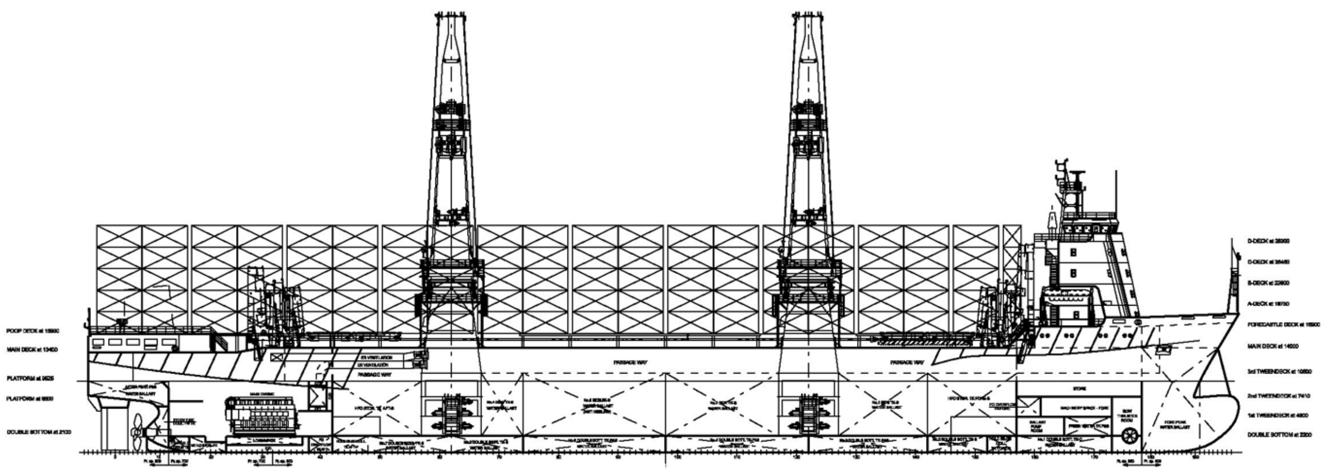


Figure 2 **The ship longitudinal view with installed cranes**
Slika 2 **Uzdužni presjek broda s ugrađenim dizalicama**

The technical part of the contract was given in appendices A and F.

Appendix A contained the following documents:

- Technical specification,
- General arrangement plan,

The particularity of the contract consists in the client's commitment to delivering and installing the cargo cranes in a way that the shipyard provides for the installer, i.e. the crane producer and the client, the manpower and technical resources in the shipyard according to the following agreed schedule:

- the client is responsible for the assembling of cranes in accordance with the shipbuilding technological concepts, such as the investigation of individual installing phases, the final crane verification by a classification society and the issuing of all necessary certificates;
- the shipyard provides the manpower, the assembling equipment and the necessary "standard" assembling material.

The mutual commitments of the shipyard and the client are defined by the contract technical description.

The assembling of the cranes is divided into three phases:

- the lower part of the crane power unit and the foundation part above the main deck on the building berth;
- the upper part of the crane power unit and the foundation on the fitting-out quay;
- the cranes on the fitting-out quay.

The contract was signed on June 21, 2006 and should have been executed by September 30, 2006. Unfortunately, without the necessary state and bank guaranties for the payment of the 1st client's instalment, the contract, even with two prolongations, has never been carried out.

The client ordered the building of the same ships in the Indian shipyard *Toubro Limited*, and the shipyard *3. maj* has delivered them the design and classification documentation.

3 Ship Design

3.1 Basic concept

Due to its specifics, this project presented an extra challenge for the *3. maj* designers. Due to the fact that *3. maj* took in charge also the preparation of the classification documentation; this was also a challenge for the Technical office.

The fact that the contract documentation for a similar project, made by the shipyard *Merwede* in the Netherlands and recommended by the *Big-Lift* ship owners, should have been used as a base, has not diminished this challenge.

The experience and professional skill of the *BigLift* team as well as competence of the *3. maj* designers have contributed to the excellence of this design, which can be offered today also to other ship owners.

The design represents the state-of-the-art in his category, fulfilling all requirements for modern heavy lift vessels, which are:

- powerful and reliable cranes (2 x 900 t SWL),
- capability of entering small ports and confined seaways (enhanced manoeuvrability and low draught),
- box shaped hold,
- weather deck, weather deck hatch covers and other structures on the weather deck in the same level,
- lift away twindeck hatch cover panels with numberless possible positions (12 horizontal levels, at one position watertight bulkhead and at twelve positions sand/grain bulkhead),
- distinct capability of ballasting including the correction of heel (24 ballast tanks generally divided into double bottom tanks and double side P&S tanks including one pair of antiheeling tanks with a dedicated pump),
- capability of controlling acceleration forces (disposition of cargo and ballast tanks).

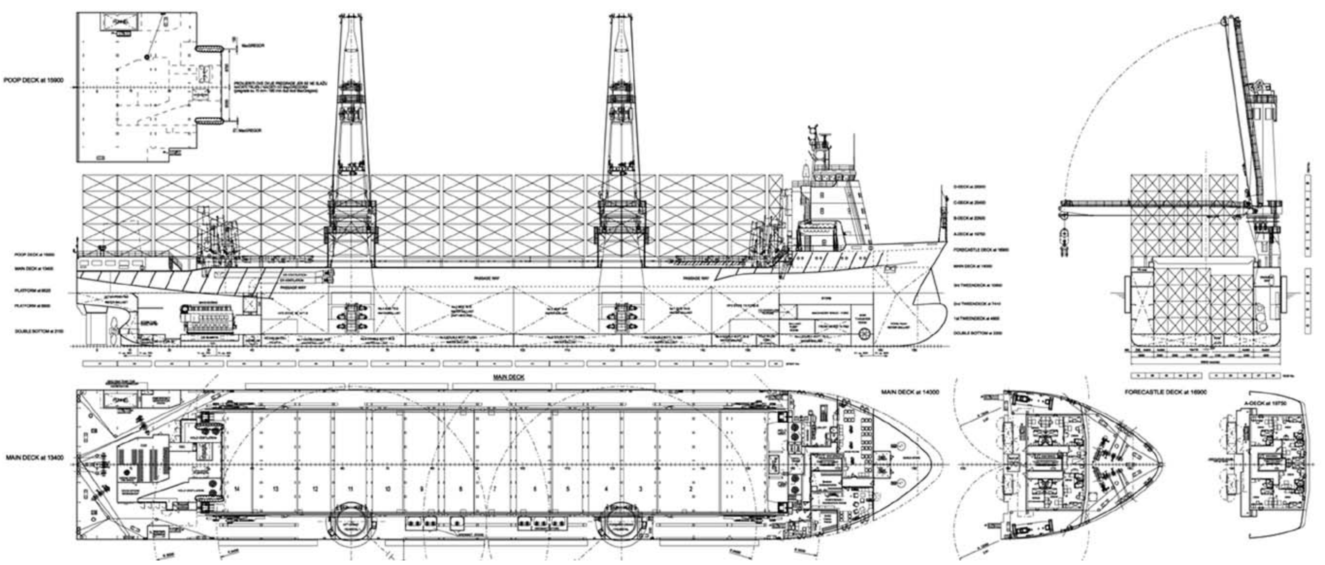
The contract documentation made by the shipyard *Merwede* from the Netherlands for a similar ship from the *BigLift* fleet, i.e. the ship 2784, was used as a base for the design. Table 2 gives a comparison of the main dimensions for the *BigLift* ship 2784 and for the present contract.

Table 2 **Comparison of main particulars, ship 2784 (*BigLift*) and the present contract (3. maj)**
Tablica 2 **Usporedba glavnih značajki: brod 2784 (*BigLift*) i ugovoreni projekt (*3. maj*)**

	L_{oa} [m]	L_{pp} [m]	B [m]	D [m]	d_{scan} [m]
BigLift	154.85	144.6	25.65	14.0	9.5
3. maj	154.80	145.20	26.5	14.0	9.5

Figure 3 presents the general arrangement of the present design.

Figure 3 **General arrangement of the present design**
Slika 3 **Opći plan prikazanog projekta**



3.2 Technical description

The vessel shall be designed and built for unrestricted service notation as a multipurpose cargo vessel suitable for the carrying and lifting of heavy cargo, timber, containers, paper, general cargoes, bulk cargo such as coal and grain (grab discharge) and certain dangerous cargoes as per SOLAS, in accordance with the description and vessel capabilities as specified here.

The considered environmental conditions by the design were: the temperature of the sea water of +32 °C in the summer and of 0 °C in the winter, and the temperature of the outside air of +35 °C (humidity 70%) in the summer and of -35 °C in the winter.

The temperature of -35 °C in the winter shall not be considered as the design temperature for the hull construction material. The temperature of -35 °C in the winter shall be considered as the main engine room intake air design temperature.

Main particulars

• Length overall	abt 154.80	m
• Length b.p.	145.20	m
• Breadth, moulded	26.50	m
• Depth, to upper deck	14.00	m
• Design draught, moulded	7.00	m
• Scantling draught, moulded	9.50	m
• Deadweight at scantling draught	18680	t
• Main engine output (CMCR)	8775 kW/500	min^{-1}
• Trial speed at 7460 kW at 7.0 m draught	16.60	knots

Equipment for cargo

Two (2) heavy lift cranes (SWL 900 t each) will be installed on the starboard side of the vessel as shown on the general arrangement plan (GAP) and shall be Owner's supply. Upper deck hatch covers shall be of box folding type made of steel, operated by hydraulic cylinders, six (6) panels at each end, and two (2) middle panels shall be of lift away rolling type. In the open position, hatch covers shall be stowed for and aft and can be kept in the stowage position also when the vessel is at sea. Twindeck hatch covers shall be of the lift away box type.

Pillars

Pillars designed as load spreaders between the weather deck and the twin deck (24 pcs of abt 5050 mm in length) and between the twin deck and the tank top (24 pcs of abt 6300 mm in length) with ladders inside and adequate ISO-fittings shall be provided. Five (5) pillars shall be used also as support elements of twindeck hatch cover panels as stability pontoons.

Ship equipment

Steering gear shall be of electro-hydraulic four cylinder ram type. Windlasses and mooring winches shall be hydraulically driven (number and arrangement as per GAP). One (1) bow thruster of 1000 kW, CPP, dia. abt 2 m, S2-30 duty, and a stainless steel ring in way of a propeller shall be provided.

Equipment for crew

Accommodation shall be provided in a deck house above the forecastle deck for 34 persons as per GAP. Safety equipment shall be provided for 34 persons.

Machinery main components

The ship's propelling machinery shall consist of a non-reversible four stroke diesel-engine; I-coupled through the reduction gear to a four (4) bladed controllable pitch propeller. The contract maximum continuous output of the engine shall be abt 8775 kW at a speed up to 500 min^{-1}.

Electric power production

Electric power plant shall consist of:

- one PTO generator 1560 kVA/1800 min^{-1} (power factor abt 0.8)
- three diesel generator sets of abt 1200 kVA/900 rpm (power factor abt 0.8)
- one emergency/harbour diesel generator set of abt 375 kVA/ 1800 min^{-1} (power factor abt 0.8).

The power and lighting distribution system shall be 3×440 V and 3×220 V, 60 Hz.

Deadweight and draught

Expected deadweight at scantling draught of 9.5 m shall be 18680 t.

Speed and cruising range

The guaranteed trial speed of the ship running at the design draught of 7.0 m, in deep and smooth water in calm weather with the wind not exceeding 2 degrees Beaufort scale, with clean bottom and at the engine output of 85% CMCR (7460 kW) shall be 16.60 knots. The trials shall be performed at the design draught. The estimated service speed (20% sea margin) at the design draught with the main engine developing 7460 kW (85% CMCR) with PTO taking 350 kW shall be abt 15.7 knots. The propeller shall be optimized for the ship in trial condition at the draught of 7.0 m to absorb 7460 kW at abt 140 min^{-1}. The propeller strength shall be designed for the ME output of 8775 kW.

3.3 Classification and regulations

The ship, including the hull machinery and equipment shall be built under the survey of the Classification Society in accordance with their Rules and Regulations for the class as follows:

Lloyd's Register of Shipping for the class:

- 100 A1, Ice class 1A (Finish), "Strengthened for Heavy Cargoes", Timber Deck Cargoes, "Container Cargoes in Hold on Deck and on Upper Deck Hatch Covers", LA
- LMC, UMS, IWS, PCWBT, SCM, NAV 1

Rules and Regulations

The ship shall be built in compliance with the following Conventions, Rules and Regulations as in force at the date of signing the Contract:

- Classification Society Rules and Regulations according to class notations;
- Finnish - Swedish Ice Class Rules (FMA Bulletin No. 13/1.10.2002) - timber load line shall not be considered for Ice class;
- International Convention for the Safety of Life at Sea, 1974, including the December 2002 amendments;

- International Convention of Tonnage Measurements, 1969;
- Convention on the International Regulation for Preventing Pollution from Ships, 1973, as modified by the Protocol of 1978 relating thereto (MARPOL 73/78) including Annexes I, III, IV, V and VI, including the April 2004 amendments
- International Convention on Load Lines, 1966, as amended in 2003 (Consolidated edition, 2005) Convention on the International Regulations for Preventing Collisions at Sea, 1972, and revisions of 1981 and 1987 including the 2001 amendments;
- ITU Radio Regulations, Geneva 1990, including the 1992 amendments;
- Suez Canal navigation rule, 1981, including the latest amendments;
- Panama Canal navigation rule, 1984, including the latest amendments;
- USCG Regulations for Foreign Flag Vessels Operating in the Navigable Waters of the USA;
- Maritime rules of the Netherlands (IVW-DS). Including noise regulations (*);
- ARBO regulations (Netherlands Health Regulations) (*);
- Rule of Australian Waterside Worker's Federation (AWWF/AMSA Marine orders-MO32) for hold and crane pedestal access ladders;
- Reg. 54 of Solas 1981 for the carriage of dangerous goods DHI (Partial application) (*) → SOLAS Ch. II-2 Reg. 19;
- INF CODE (International Code for the Safe Carriage of Packaged Irradiated Nuclear Fuel, Plutonium and High-level Radioactive Wastes on Board Ships) for Class INF 1 ship;
- International Life Saving Appliance (LSA) Code, 1996;
- ILO Conventions:
  - o C 68 Food and Catering (Ship's Crews) Convention, 1946,
  - o C 92 Accommodation of Crews Convention (Revised), 1949,
  - o C 133 Accommodation of Crews (Supplementary Provisions) Convention, 1970,
  - o C 148 Working Environment (Air Pollution, Noise and Vibration) Convention, 1977,
  - o C 152 Occupational Safety and Health (Dock Work) Convention, 1979;
- Lloyd's Register of Shipping Code for Lifting Appliances in Marine Environment, January;
- IMO Res. MSC. 137(76) - Standards for ship manoeuvrability;
- IMO MSC/Circ. 608/Rev. 1 - Interim Guidelines for Open-Top Containerships with interpretation of Dutch authorities for survival condition (0.5 m water on tank top and twindeck) (*);
- International Maritime Pilots Association Recommendations ;
- Council Directive 96/98/EC of 20 December 1996 on marine equipment, as amended;
- International Ship and Port Facility Security (ISPS) Code (for fixed equipment as specified herein after);
- Rules and Regulations to enable the ship to be registered under the Netherlands flag (*).

(*) In accordance with the description and vessel's capabilities as specified herein. Items/procedures not described but found to be in excess or in contradiction with the listed International Rules and Regulations shall be subjected to a separate agreement between the client and the builder.

3.4 Some design features

In order to meet all the requirements listed in the technical description, numerous calculations and model tests were carried out.

Figure 4 **Prediction diagram**
Slika 4 **Prognozni dijagram**

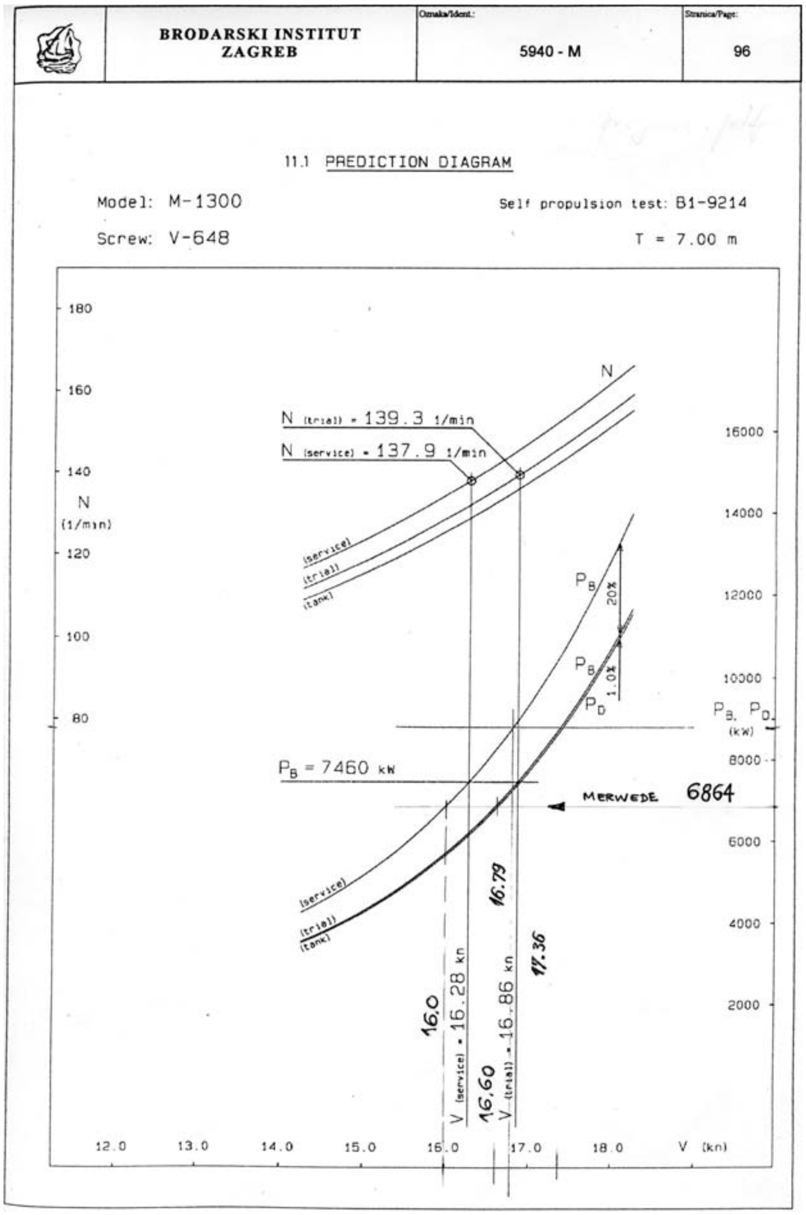


Figure 4 presents a prediction diagram from the model self-propulsion test.

Figure 5 shows the righting lever from the ship stability calculation in the survival condition for the "open ship".

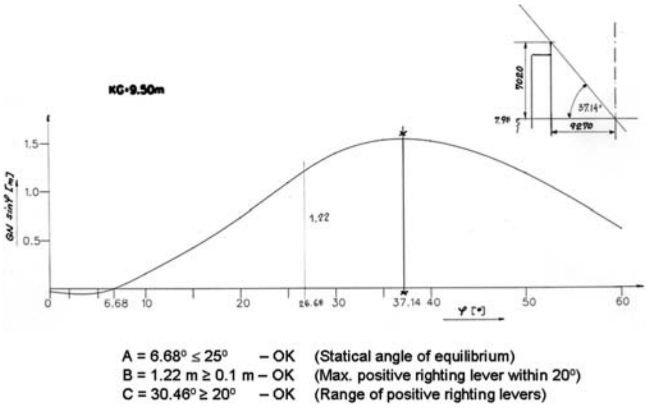


Figure 5 **Righting lever curve for survival conditions**
Slika 5 **Krivulja poluge stabiliteta u uvjetima preživljavanja**

The survival condition came out as a result of combined efforts of the Netherlands' Authority and IMO officials to find the way of implementing IMO MSC/Circ. 608/Rev. 1 „Interim Guidelines for Open Top Containerships" to vessels which are not exclusively container ships.

Additional stability criteria were worked out, as listed above. The righting lever curve is calculated with 0.5 m of entrained water on twindeck hatch covers and 0.5 m of entrained water on the tank top for a chosen *KG* (ship's centre of gravity). Seakeeping tests were executed at 7.5 m draught with *KG* = 11.0 m in the open ship condition with the result of a negligible amount of entrained water.

Finally, the results from the manoeuvrability tests are shown in Table 3.

Table 3 **Results from manoeuvrability tests**
Tablica 3 **Rezultati testa upravljivosti**

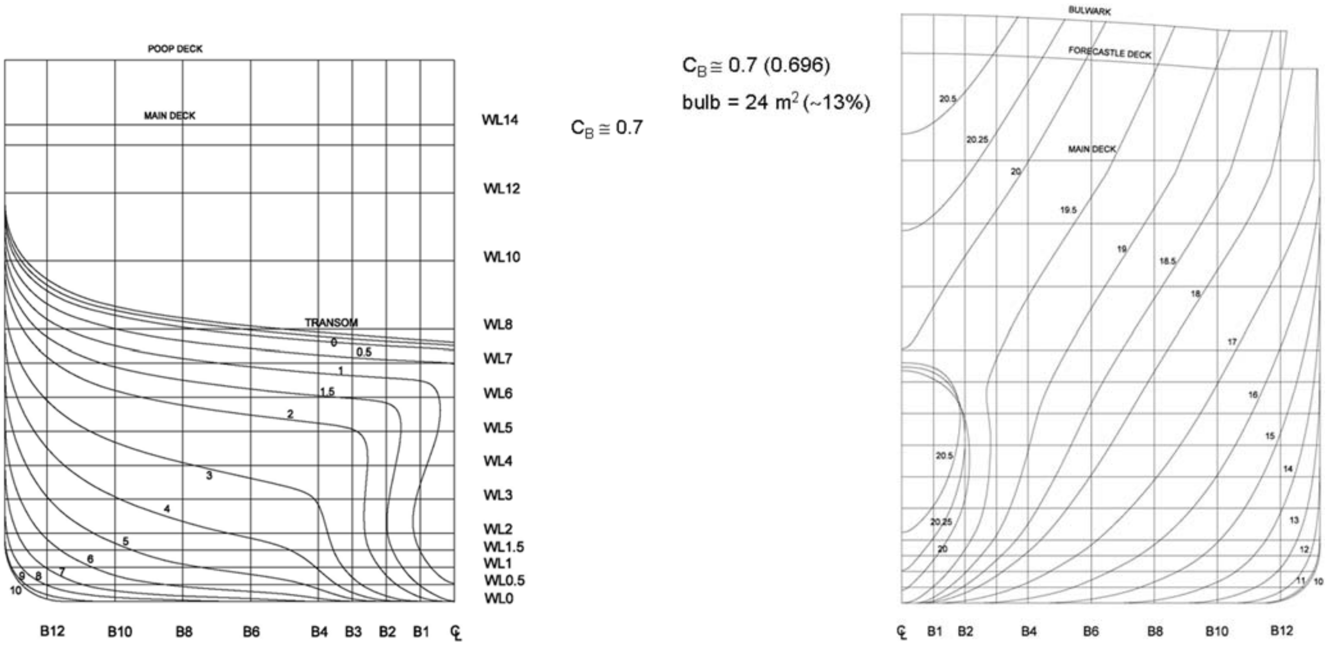
manoeuvrability tests

trim	skegplate	Becker rudder		zig - zag 10 - 10 psi -01	zig - zag 10 - 10 t-01 heading 0	zig - zag 10 - 10 psi-02	zig - zag 10 - 10 t-02 heading 0	zig - zag 20 - 20 psi-01	spiral l-delta
IMO standards MSC.137(76):				< 15.3		< 32.9		< 25.0	< 3.8
no	no	standard	SB PS	62,0 28,0	154,2 75,6	27,0 55,0	71,7 120,8	37,0 29,0	12,10
yes	no	standard	SB PS	34,5 22,2	90,3 57,0	30,1 50,9	65,8 98,2	34,3 34,2	7,79
yes	yes	standard	SB PS	22,6 13,6	62,9 43,2	23,7 34,9	59,0 80,6	30,2 21,6	4,22
yes	yes	enlarged	SB PS	15,2 15,1	44,2 42,2	25,3 31,7	60,9 65,8	25,8 23,8	3,95
no	yes	enlarged	SB PS	27,4 22,4	69,7 65,9	32,4 48,9	81,5 96,3	32,7 27,2	6,95

As it can be seen from the table above, the ship did not fulfil the IMO Res. Requirements, but the Owner was satisfied with the achieved results and did not insist on further investigations.

As a result of all those actions, the body lines were defined as presented in Figure 6.

Figure 6 **Body lines**
Slika 6 **Plan rebara**



4 Heavy Cargo Loading Cases

Figure 7 gives the crane general arrangement.

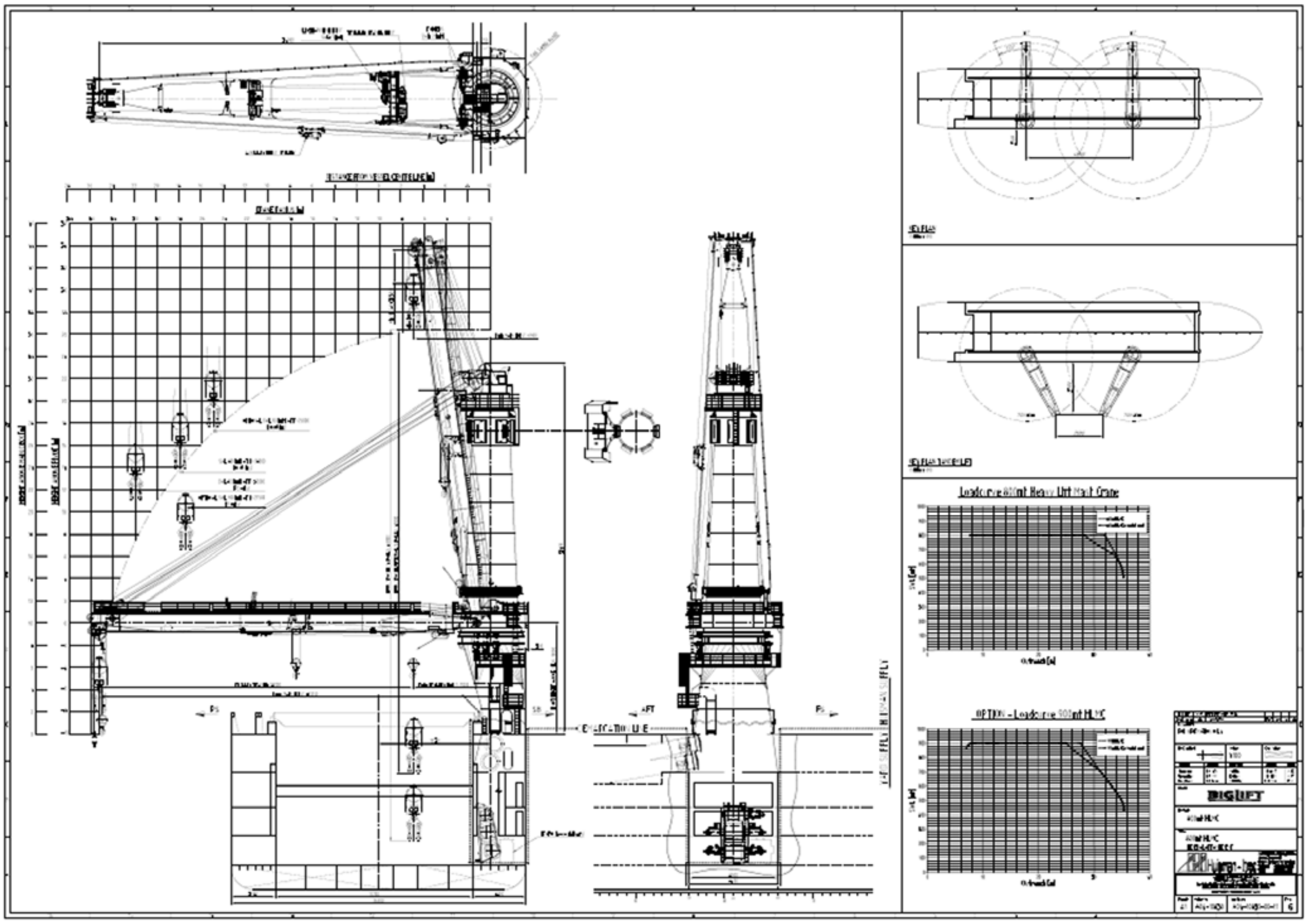


Figure 7 **The crane general arrangement**
Slika 7 **Opći plan dizalica**

4.1 Crane technical particulars

Crane type: Huisman Heavy Lift Mast Crane (HLMC)
Crane arm type: box-type girder
Permissible carrying capacity: 900 t
Power system: entirely electrical system
Crane equipment: main hoist (capacity 900 t)
auxiliary/trolley hoist (capacity 37,5 t)
auxiliary/sling hoist (capacity 10 t)
tugger (2 pieces) - maximum tugging force 25 t
- maximum continuous force 15 t

Figure 8 presents the position of the crane hoists.

Figure 8 **Position of the crane hoists**
Slika 8 **Položaj vitala dizalice**

Huisman

4.2 Stability analysis for heavy cargo loading cases

The analysis was carried out for several heavy cargo loading cases in accordance with the client's and USCG requirements. The 1600 t heavy cargo was applied.

The client's requirements were:

- initial metacentre height corrected for the free surface influence GM_0 must not be less than 1.0 m for all loading cases;
- ship heeling angle φ in all loading cases must be equal to 0.

The USCG requirements were concerned with:

- a comparison of the cargo action moment and the heeling moment;
- the stability during the cargo lifting;
- the stability in the case of cargo falling down from the hoist.

Five loading cases with the parallel crane action "tandem load" were analysed. They are presented in Figure 9.

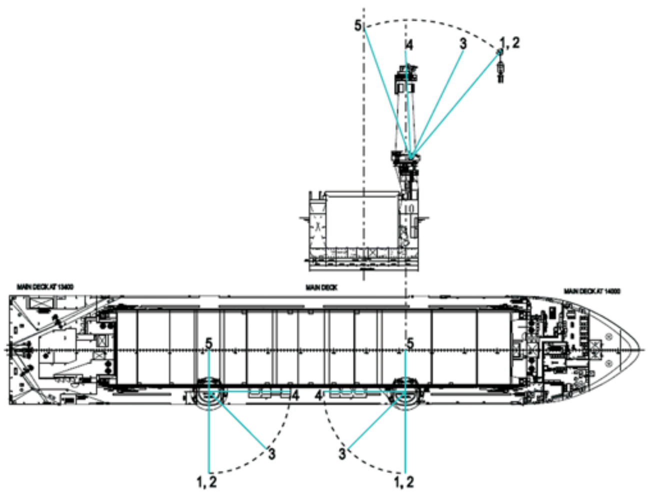


Figure 9 **Position of crane arms at five loading cases**
Slika 9 **Položaj krakova dizalica za pet stanja krcanja**

Loading case 1 comprises the ship ready for loading a 1600 t cargo. The client's requirements are satisfied: (GM_0 = 4.558 m > 1m, ϕ = 0.011^0 ≈ 0^0), mean draught d_{sr} = 7.135 m, liquid ballast 2222 t (2168 m^3), solid ballast (stone) 5500 t.

Loading case 2 comprises crane arms with the cargo perpendicular to CL, starboard side. The clients requirements are satisfied: (GM_0 = 1.659 m > 1m, ϕ = 0^0), mean draught d_{sr} = 8.630 m, liquid ballast 5939 t (5794 m^3), solid ballast (stone) 5500 t.

Loading case 3 comprises crane arms with the cargo at 45° to CL. The client's requirements are satisfied: (GM_0 = 2.004 m > 1m, ϕ = 0^0), mean draught d_{sr} = 8.661 m, liquid ballast 6108 t (5959 m^3), solid ballast (stone) 5500 t.

Loading case 4 comprises crane arms with the cargo parallel with CL. The client's requirements are satisfied: (GM_0 = 2.123 m > 1m, ϕ = 0^0), mean draught d_{sr} = 8.657 m, liquid ballast 6071 t (5923 m^3), solid ballast (stone) 5500 t.

Loading case 5 comprises crane arms with the cargo perpendicular to CL, port side. The client's requirements are satisfied: (GM_0 = 1.719 m > 1m, ϕ = 0^0), mean draught d_{sr} = 8.701 m, liquid ballast 6228 t (6076 m^3), solid ballast (stone) 5500 t.

In all cases the stability meets the clients requirements, i.e. GM_0 > 1.0 m and φ =0°. Concerning the USCG requirements, the stability during the cargo lifting is satisfactory. In the case of cargo falling down from the hoist, a sufficient reserve of dynamic stability prevents the ship from capsizing, i.e. it enables the ship to return back into the position of the static equilibrium angle.

5 Bulkhead and Opening Position for Satisfying Ship Damage Stability

5. 1 Introduction

The calculation of the ship damage stability was carried out in accordance with the SOLAS 1974 rules (Chapter II-1, Part B-1, Reg. 25-1 to 25-10 - Subdivision and damage stability of cargo ships). Also, recommendations of the IMO resolution A.684 (17) including amendments MSC.75 (69) were used.

The ship is equipped with a removable watertight bulkhead (positioned on frame 122) so that she can navigate as follows: with bulkhead in hold, without bulkhead and with open hatch openings on the main deck. For all three cases it was necessary to carry out the calculation of the ship damage stability - probability method.

Due to the fact that the ship is non-symmetrically subdivided, each of the three mentioned calculations was carried out twice, i.e. separately for the port and for the starboard side.

The calculations were performed by means of the computer programming package NAPA (Naval Architecture Package, version 2007.1, Finland).

5.2 Calculation procedure

The calculations were carried out according to the anticipated plan of inner water tightness, for two draughts:

d_1 - deepest WL

d_2 - partial WL

The required subdivision index (R) according to SOLAS reg. 25-2 for a ship length greater than 100 m yields

R = $(0.002 + 0.0009 \times L_s)^{1/3}$, L_s = 154.635 m

R = 0.52069 m

The minimum metacentre heights MG_{min}, i.e. the maximum permissible vertical gravity centre KG_{max}, on the basis of which acceptable results of the attained subdivision index are obtained, are taken as margin values for a damaged ship.

The calculations of MG_{min} and KG_{max} for the ship intact stability, according to IMO criteria, are carried out for the ship without cargo on the deck and for the ship with 5 rows of containers on the deck.

5.3 Calculation results

Although six calculations were carried out, only the results of the case "the ship with watertight bulkhead in hold" are presented here.

Figure 10 presents the MG_{min} and KG_{max} curves.

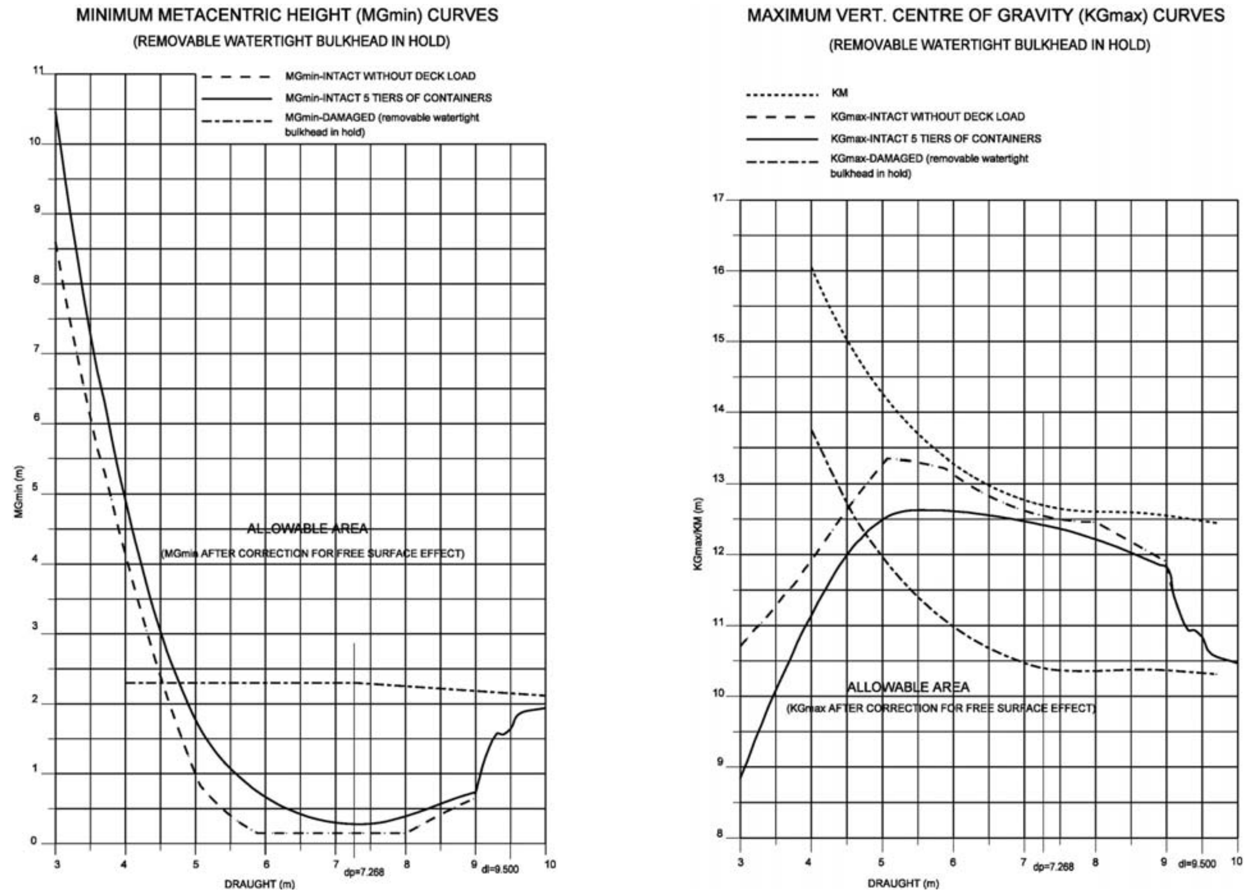


Figure 10 **MG_{min} and KG_{max} curves (removable watertight bulkhead in hold)**
Slika 10 **Krivulje MG_{min} i KG_{max} (pomična vodonepropusna pregrada u skladištu)**

From there, it can be seen that

d_1 = 9.50 m, KM = 12.477 m, MG_{min} = 2.15 m, K_{max} = 10.327 m

d_2 = 7.268 m, KM = 12.695 m, MG_{min} = 2.3 m, K_{max} = 10.395 m

Table 4 gives the calculation results of the attained subdivision index.

Table 4 **Attained subdivision index (removable watertight bulkhead in hold)**
Tablica 4 **Dobiveni indeks pregrađivanja (pomična vodonepropusna pregrada u skladištu)**

	Damage - left side	Damage - right side	Average value
Attained index for d_1	0.24016	0.15367	
Attained index for d_2	0.40672	0.33217	
Average attained index	0.64688	0.48584	0.56636

5.4 Summary

Table 5 gives the final results for all three cases. The notation in the table is as follows:

I - ship with watertight bulkhead in hold,
II - ship without watertight bulkhead in hold,
III - ship with open deck hatch covers,
R - required subdivision index,
A - attained subdivision index.

Table 5 **Subdivision index**
Tablica 5 **Indeks pregrađivanja**

	R	A
I	0.52069	0.56636
II	0.52069	0.58037
III	0.52069	0.58064

According to the results presented in Table 5, the ship fulfils the SOLAS 1974 regulations, Chapter II-1, Part B-1, and Regulation 25-1 to 25-10.

6 Instead of a Conclusion

Due to the fact that this is only *Part I* of this presentation, the final conclusions will be given at the end of *Part II*. Here, it can be announced that *Part II* will present the ship structure design, the propulsion and main engine systems, the electricity loading system and the engine room modelling.

At the end of this part, we would like to express our gratitude to all members of the *3. maj* design office. Their contributions have created this article.

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