

„Research for the Parameters of the Damage Stability Rules Including
the Calculation of Water on Deck of Ro-Ro Passenger Vessels, for the
amendment of the Directives 2003/25/EC and 98/18/EC“



FSG Report

Flensburg, June 23rd 2009

Responsible Project Leader

Dipl. Ing. Rolf Nagel

Content

1. General.....	3
2. EMSA I (Ro Pax 80 m 300 Passengers).....	3
2.1 Design Description EMSA I	3
2.2 Damage Stability Calculations for EMSA I.....	5
3. EMSA II (Ro Pax 200m / 600 Persons)	7
3.1 Design Description EMSA II.....	7
3.2 Damage Stability Calculations for EMSA II.....	9
4. Summary	10

1. General

In the course of the project „Research for the Parameters of the Damage Stability Rules Including the Calculation of Water on Deck of Ro-Ro Passenger Vessels, for the amendment of the Directives 2003/25/EC and 98/18/EC“, initiated by the European Maritime Safety Agency (EMSA), flooding scenarios for Ro-Pax vessels of different size had to be investigated.

Hence two Ro-Pax vessels had to be designed by Flensburger Schiffbau-Gesellschaft (FSG). FSG carried out the standard intact and damage stability calculations during the design phase. In the next step, Water-On-Deck scenarios have been calculated by the Technical University of Hamburg (TUHH). Parallel the Hamburgische Schiffbau-Versuchsanstalt (HSVA) made numerical simulations of the ship's Water-On-deck characteristics in damaged condition. This simulations have been evaluated by model tank tests, also done by HSVA.

Both vessels have been designed strictly in accordance to the new probabilistic damage stability rules (SOLAS 2009) for passenger ships built from 1 January 2009. The small vessel is 80 meters long, having a Ro-Ro-cargo space on main deck with stern access and a passenger capacity of 300, called EMSA I in the following. The second vessel, a 200 meters long Ro-Pax ferry with a total of 600 persons on board ,called EMSA II in the following, has a significant larger cargo capacity incl. a lower hold and an increased number of persons on board. Due to the size, the ships have a different compartment status and value of the required index “R”.

The focus of the research project laid on the investigation of flooding scenarios caused by damages. The new safe return to port regulations, entering into force 1st July 2010, have been kept out of the design focus and have not been considered.

2. EMSA I (Ro Pax 80 m 300 Passengers)

2.1 Design Description EMSA I

The only parameter which was fixed by EMSA for the EMSA I design was an overall length of abt. 80 m. Typically, Ro-Pax vessels of this size are operated on very short distance routes like e.g. on island connections. Based on the nature of such routes, it has been decided not to foresee any overnight accommodation for passengers. Adequate day passenger capacity was found to be 300. The corresponding crew comprises 22 persons, for which overnight accommodation was considered to be necessary. The design developed is characterized by the following main parameters :

Main Dimensions:

Length over all	79.20 m
Length between Perpendiculars	73.60 m
Breadth moulded	16.00 m
Depth moulded to Main Deck	5.50 m
Draught (designed)	4.00 m
Draught (summer load)	4.10 m
Service Speed (design draught)	14.5 kn
Car lane metres	165 lm
Passenger Capacity	300
Crew:	22
Deadweight (on design draught)	389 t

Based on the above mentioned basic prerequisite the aim was to design a vessel which fulfills SOLAS 2009 damage stability requirements with little or even no margin left. The final design is shown in the attached General Arrangement Plan and stretches out over a total of six decks.

Below Deck 1, a 1.4 m high double bottom extends from amidships towards the bow and consists mainly of void spaces, with some smaller tanks arranged close to the engine room area. Trim compensation capability is provided by a forward and aft trim tank.

Deck 1 is the tank top and accommodates all technical spaces including one large engine room with two main engines plus two auxiliary diesel generators. The steering gear room at the very aft is separated from the engine room by two void spaces. Forward of the engine room, technical spaces like main switchboard room, pump room, engine control room, sewage plant & A/C chillers room and fresh water equipment room is arranged. Forward of these rooms, two fresh water tanks are arranged, followed by two void spaces and the bow thruster compartment.

The hull is subdivided into 11 zones. None of the spaces below the bulkhead deck are protected by any kind of longitudinal bulkhead, such as e.g. B/10 or B/5 bulkheads. Instead of that, they all stretch from one ship side to the other, also with the intention to ignore damage extends as to be considered for the Stockholm Agreement. Longitudinal bulkheads are partly arranged, but without being watertight. Originally, the hull was planned to be 15 m wide, but needed to be widened by 1 m after the first design loop due to insufficient intact stability.

Deck 2 is the Main Deck which also forms the bulkhead deck. The aft part of Deck 2 features the car deck, with a total of four lanes arranged next to each other. Wide side-casings along the car deck provide required space for technical spaces, stairs, the funnel and car deck ventilation ducts. The free height on the car deck is 4.75 m, allowing for commercial vehicles and busses to be carried. Forward of the car deck, some crew accommodation spaces are foreseen, as well as a provision area on the portside. A central casing houses further staircases, a lift and supply ducts.

Deck 3 is designated as Mezzanine Deck. In the aft part, the car deck stretches up to this deck level. Forward of the car deck, most of the crew accommodation, as well as the crew mess is arranged. In the central casing, stairs coming from the Main Deck and Deck 1 are merged, complying with SOLAS requirement for a minimum 2.5 m sill height for spaces leading from the bulkhead deck down to spaces below the bulkhead deck.

Deck 4 is the 1st House Deck and comprises all public spaces for the 300 day passengers. The deckhouse does not stretch over the entire length of the hull, but gives space for a combined embarkation and sun deck aft of the superstructure. Two combined life/rescue boats are stowed here in two davits, one at each ship side.

Deck 5 is the 2nd House Deck. All officer accommodation is arranged here, as well as a First Aid Room and A/C plant. In the aft part of Deck 5 there is the funnel on the port side, and emergency diesel generator on the opposite side of the funnel.

On the top of the superstructure, a 360° view wheelhouse is located on Deck 6

2.2 Damage Stability Calculations for EMSA I

As input data for the damage stability calculation the drafts and intact stability values were calculated, the intermediate results are shown below:

Subdivision Length	78.78 m
Depl. on Deepest Subdivision	2573 t
Draft	
Corresponding moulded Draft	4.089 m
Corresponding KG max	7.780 m
Corresponding GM req.	1.640 m

Determination of the Lightest Seagoing Condition

Light Ship Weight		2100 t
Passengers & Crew	100 %	20 t
Stores	50 %	2 t
Diesel Oil	10 %	6 t
Freshwater	10 %	6 t
Trimm Water	100 %	42 t
Ballast Water		24 t
Sum	Lightest	Seagoing
Condition		2200 t
Corresponding moulded Draft		3.675 m
Corresponding KG max		7.780 m
Corresponding GM req.		1.370 m

Determination of the Partial Draft

Depl. on Partial Draft	2420 t
Corresponding moulded Draft	3.923 m
Corresponding KG max	7.787 m
Corresponding GM req.	1.600 m

The stability limiting values KG max (resp GM req.) were determined for the intact stability criteria including the weather criterion acc to IMO Res A749, the calculations were based on the assumption of fixed. This assumption of fixed trim was agreed at the kick-off meeting in Hamburg on October 29th 2008. FSG pointed out that the yard usually calculates the righting lever curves on free trimming basis, but as the preliminary calculations already had shown that the required index could be reached with the lower GM values, the stability limits were calculated on fixed trim.

The internal watertight subdivision of the vessel and the downflooding - points as modelled in the yard's E4-naval architecture system are shown in the appended "Internal Watertight Integrity Plan".

The results of the probabilistic part of the damage stability calculation are shown below:

Required Index "R"	0.70003804	
Attained Index "A"	0.71308998	A > R
Att. Index A Deepest PS	0.65974314	
Att. Index A Deepest SB	0.64966582	
Att. Index A Deepest	0.65470448	A Deepest > 0.9 R
Att. Index A Partial PS	0.72453665	
Att. Index A Partial SB	0.71456744	
Att. Index A Partial	0.71955204	A Partial > 0.9 R
Att. Index A Lightest PS	0.81538009	
Att. Index A Lightest SB	0.81829367	
Att. Index A Lightest	0.81683688	A Lightest > 0.9 R

The deterministic one - compartment - side damages were calculated for the abovementioned initial conditions.

There are some side damage cases where the attained s_i value is slightly less than 1.0 (from 0.98 upwards, the required s_i -value is 0.9).

The deterministic bottom damages were calculated using a Monte – Carlo – Generator for the damage extents. The attained s_i -values for bottom damages were 1.0 for all three drafts.

3. EMSA II (Ro Pax 200m / 600 Persons)

3.1 Design Description EMSA II

As a result of the kick-off meeting held at HSVA on October 29th 2008, all partners agreed to develop a Ro-Pax vessel for short international voyages. A lower cargo hold, a stern access as well as a bow access were defined as mandatory requirements to be considered for the design. The maximum number of persons on board has been specified to 600. This was to investigate a ship having two compartment status and a relatively low value of the required index "R".

Main Dimensions:

Length over all	199.90 m
Length between perp.	190.25 m
Breadth moulded	30.80 m
Depth moulded to main deck	9.20 m
Depth to upper deck	15.95 m
Draught (designed)	6.50 m
Deadweight (design)	8350 t
Service Speed (design draught)	25.0 kn
Main Engine MCR	28800 kW
Persons on board (total)	600 persons

The main deck (9200 mm above base line) has been considered as freeboard deck.

The ship is able to carry wheeled cargo in different cargo compartments on four decks. In particular the different areas foreseen for stowage of cargo are: tank top cargo hold, main deck cargo hold, upper deck cargo hold and the aft part of the weather deck. In addition private cars can be stowed in a separate garage located in the forward part of the weather deck below deckhouse.

The bigger the main cargo hold, the higher is the risk to damage such a cargo hold in case of a collision. A cargo hold extending over the whole length of the ship has the highest probability to be damaged in a collision. Against that background, it has been decided to design the vessel with a stern and bow access for the main cargo hold. In addition, from an operators point of view the drive-through concept provides a higher degree of flexibility and allows people and cargo to enter the ship either via stern ramp or via bow ramp and leave it across the ramp hinged at the opposite end of the main deck. Two stern ramps are hinged to the main deck. Both ramps are acting as watertight closure, being in closed and secured position. The bow is closed by a pair of side-hinged shell doors. A foldable bow ramp act as interface between ship and shore. The inner part of the bow ramp is designed to form the weathertight extension of the collision bulkhead in seagoing condition.

Access to the large lower hold on tank top will be provided via a fixed ramp on starboard-side. In sea condition the ramp is closed by a flush ramp cover fitted on main deck. In closed and locked position the ramp cover acts as a watertight closure of the lower cargo hold. The lower hold has been considered for stowage of unaccompanied cargo units only.

Access to the upper deck is possible in two different ways, depending which shore interface is used for loading the ship. Entering via stern ramp, all cargo to be stowed on upper or weather deck has to cross the hoistable ramp to upper deck fitted on portside aft. Using the bow access, all cargo has to cross the hoistable ramp placed on starboard-side forward.

Cars can reach the garage using a combination of a short hoistable ramp and a fixed ramp on portside.

The aft part of the weather deck can be loaded over a hoistable ramp on starboard-side. As the lower hold, the weather deck also has been considered for stowage of unaccompanied cargo only.

All public spaces have been placed on the 1st House Deck. Cabins for 420 passengers and crew are located at the 2nd and 3rd House Deck. The deckhouse is divided into two main vertical zones.

Space for necessary staircases, exhaust pipes, ducts for pipes, cables, ventilation and air conditioning has been provided in two center casings. Having the casing in center line in combination with the hoistable ramp on portside allows vehicles to enter the lower hold even when the ship is loading / unloading using the bow access. Most parts of the side shell structure on main deck initially have been designed as open web construction, except in way of emergency exits, ventilation ducts etc. Not anticipating the results of the simulations and model tests carried out for the large Ro-Pax vessel, it has to be mentioned, that due to the water on deck scenarios a double hull structure in the forward part of the main deck had to be included.

In accordance to the SOLAS 2009 regulations, a double bottom of 3m height has been considered below the lower cargo hold. In way of the lower cargo hold a watertight double side shell with a depth of B/10 is foreseen.

Watertight sliding doors have been placed to ensure watertight subdivision between the main engine room and the following adjacent spaces: auxiliary engine room, store room 1 and 2, purifier plant 1 and 2. Even the aft emergency exit on portside of the lower hold is protected by a watertight sliding door.

At a level of 3.4 meters above main deck the access to the engine room is connected to the main staircase aft. A similar arrangement has been chosen for the access to the forward service aggregate room, connected to the main staircase forward.

The layout of the propulsion system is based on a twin-screw concept, combining hydrodynamic efficiency with a high degree of redundancy and manoeuvrability. The two medium speed main engines are coupled to a reduction gear box. Via the gear box each main engine drives a controllable pitch propeller.

According to SOLAS regulations for short international voyages, the ship has been equipped with one lifeboat having a capacity of 100 persons on each side. In addition two rescue boats (one of them being a fast rescue boat) and the required number of life rafts are foreseen. The lifeboat capacity in combination with the number of persons on board is essential for the size of the required index “R” of the probabilistic approach for the damage stability calculations. Details on the damage stability calculations, calculation of the required and attained index will be given in one of the following sections.

3.2 Damage Stability Calculations for EMSA II

In this part of the report, the results of the abovementioned damage stability calculations are described in more detail.

As input data for the damage stability calculation the drafts and intact stability values were calculated, the intermediate results are shown below:

Subdivision Length	199.90 m
Depl. on Deepest Subdivision Draft	22875 t
Corresponding Draft	6.80 m
Corresponding KG max	14.20 m
Corresponding GM req.	4.50 m

Determination of the Lightest Seagoing Condition

Light Ship Weight		13085 t
Passengers & Crew		70 t
Stores + Lashing		110 t
Diesel Oil	10 %	27 t
Freshwater	10 %	38 t
Heavy Fuel Oil	10 %	385 t
Other Tanks	10 %	46 t
Ballast Water		2309 t
Sum Lightest Seagoing Condition		16070 t
Corresponding moulded Draft at Lpp		5.22 m
Corresponding KG max		15.08 m
Corresponding GM req.		4.10 m

Determination of the Partial Draft

Depl. on Partial Draft	19934 t
Corresponding Draft	6.17 m
Corresponding KG max	15.29 m
Corresponding GM req.	4.10 m

The stability limiting values KG max (resp GM req.) were determined for the intact stability criteria including the weather criterion acc to IMO Res A749, the calculations were based on the assumption of free trimming basis. The internal watertight subdivision of the vessel and the downflooding - points as modelled in the yard's E4- naval architecture system are shown in the appended "Internal Watertight Integrity Plan".

The results of the probabilistic part of the damage stability calculation are shown below:

Required Index "R"	0.721	
Attained Index "A"	0.722	A > R
Att. Index A Deepest PS	0.722	
Att. Index A Deepest SB	0.689	
Att. Index A Deepest	0.705	A Deepest > 0.9 R
Att. Index A Partial PS	0.751	
Att. Index A Partial SB	0.719	
Att. Index A Partial	0.735	A Partial > 0.9 R
Att. Index A Lightest PS	0.750	
Att. Index A Lightest SB	0.709	
Att. Index A Lightest	0.729	A Lightest > 0.9 R

The deterministic two - compartment - side damages were calculated for the abovementioned initial conditions.

The side damage cases were calculated as in regulation 8, where s_i -values must be 1, in a passenger ship carrying more than 400 persons.

The deterministic bottom damages were calculated using a Monte – Carlo – Generator for the damage extents. The attained s_i -values for bottom damages were 1.0 for all three drafts.

4. Summary

Flensburger Schiffbau-Gesellschaft has designed two state of the art Ro-Pax vessels according to basic criteria as defined by EMSA. The vessels fulfill the latest intact and probabilistic damage stability criteria without no or only little margin. For further consideration of safety level of the vessels incl. water on deck calculations and model testing see separate reports established by HSVA and TU Hamburg Harburg.

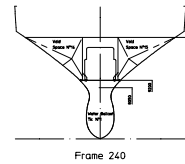
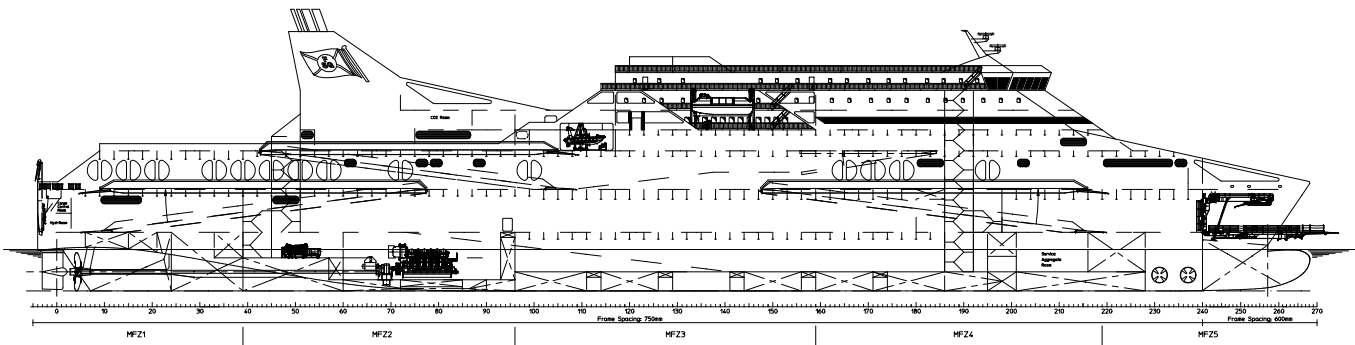
Appendices:

GA Plan of EMSA I

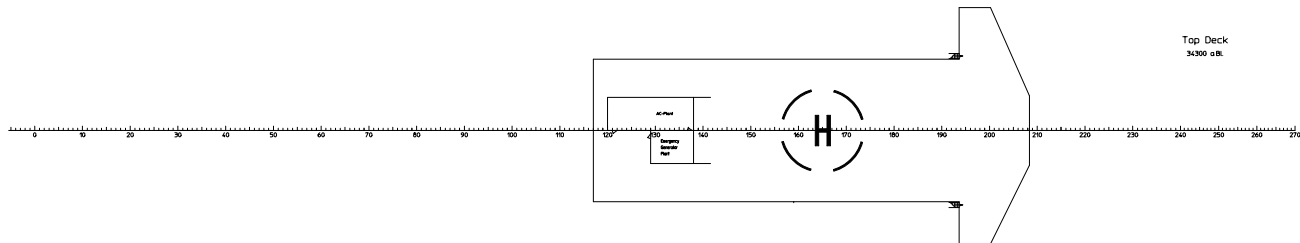
Internal watertight integrity plan of EMSA I

GA Plan of EMSA II

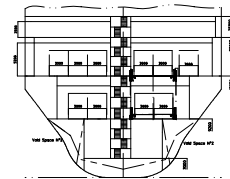
Internal watertight integrity Plan of EMSA II



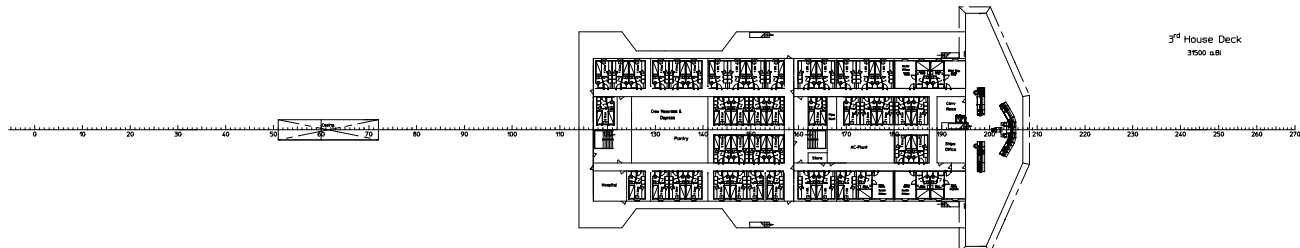
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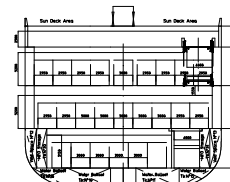
Top Deck
34300 a.B.



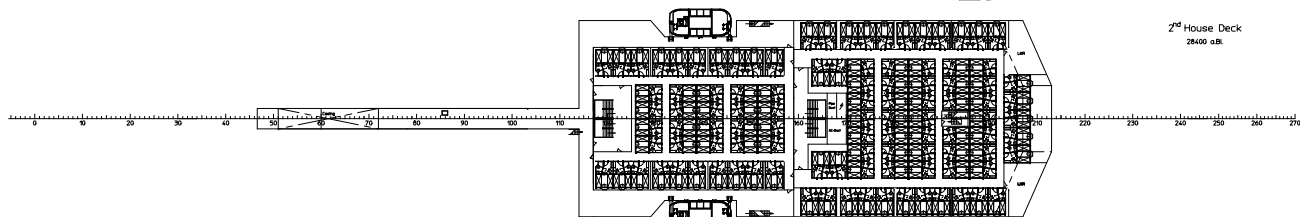
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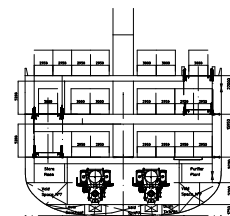
3rd House Deck
35000 a.B.



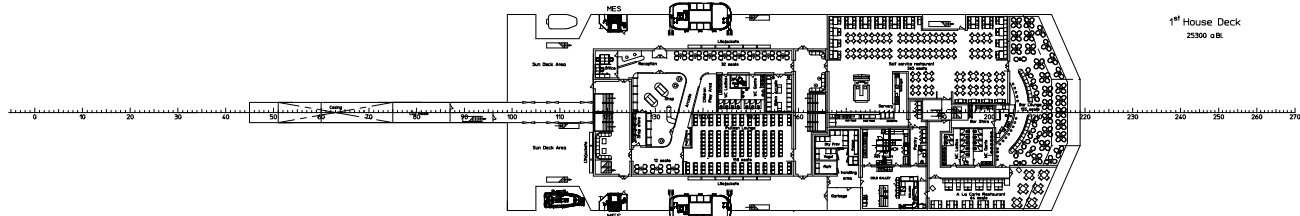
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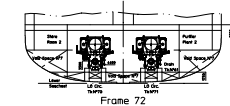
2nd House Deck
28400 a.B.



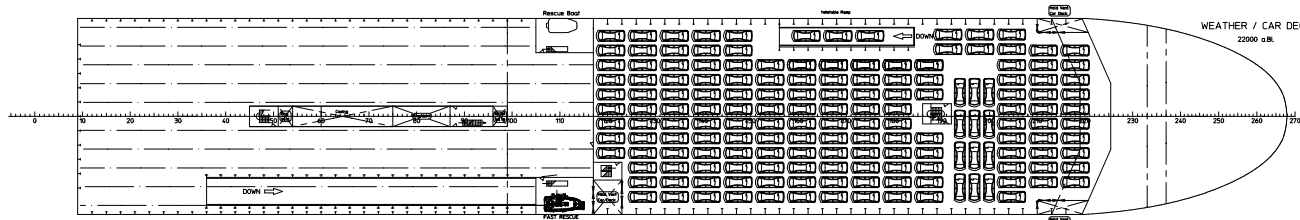
Frame 78



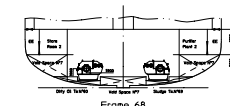
1st House Deck
25300 a.B.



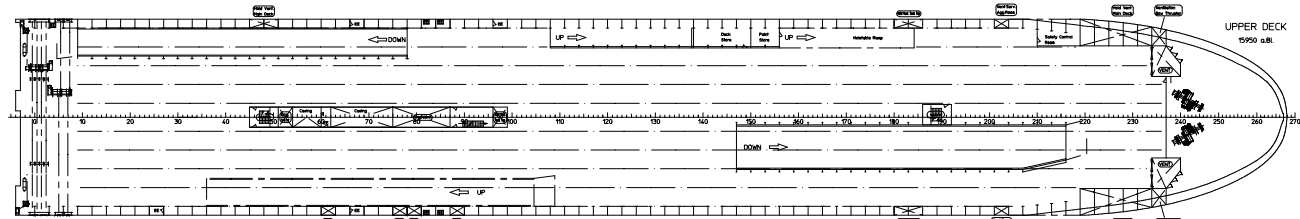
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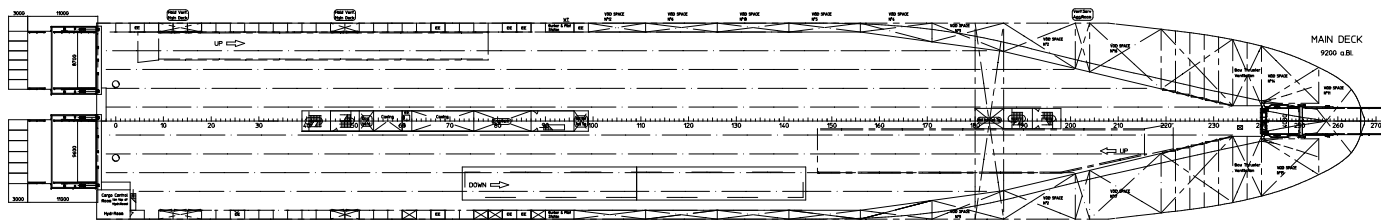
WEATHER / CAR DECK
22000 a.B.



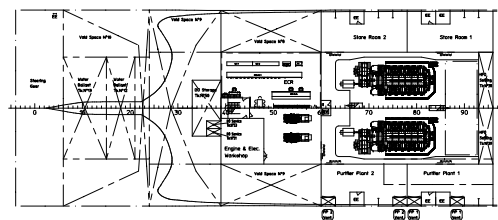
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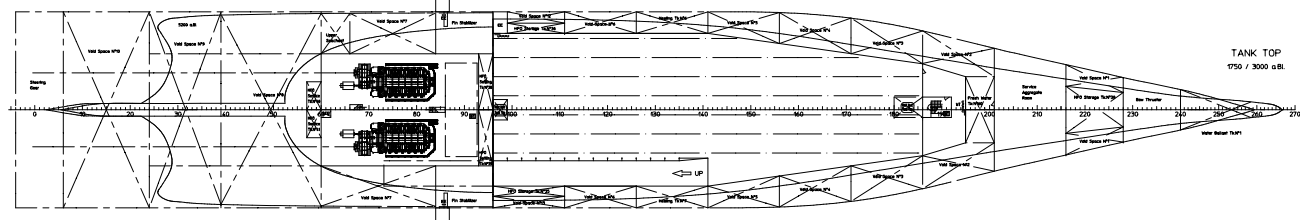
UPPER DECK
19950 a.B.



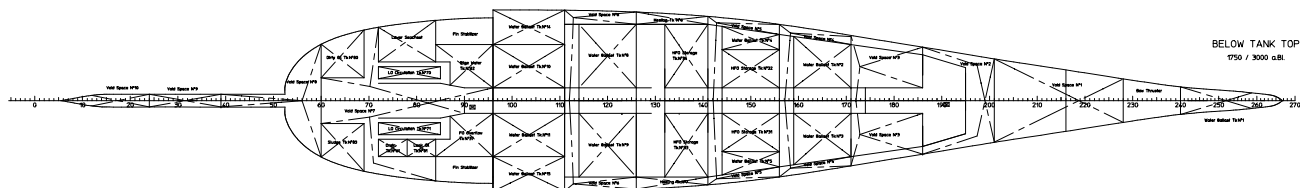
MAIN DECK
9200 a.B.



1st Platform Deck
5200 a.B.



TANK TOP
1750 / 3000 a.B.



BELOW TANK TOP
1750 / 3000 a.B.

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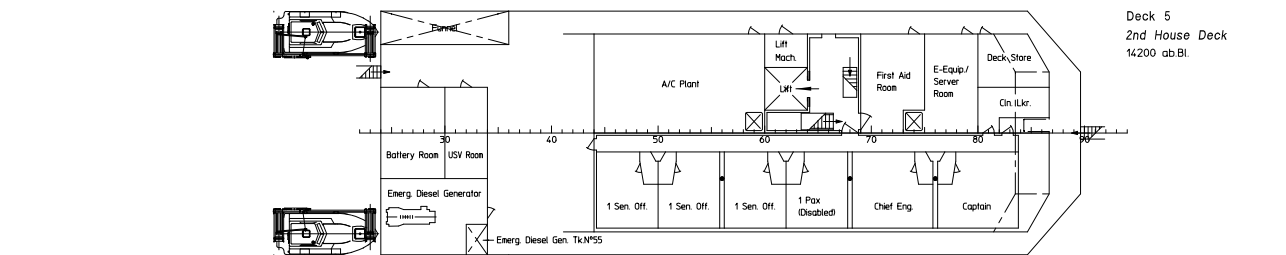
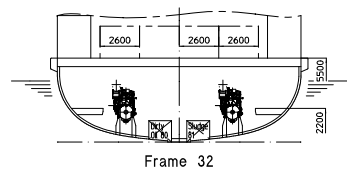
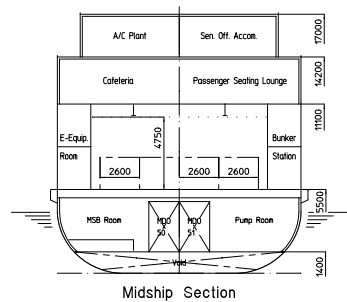
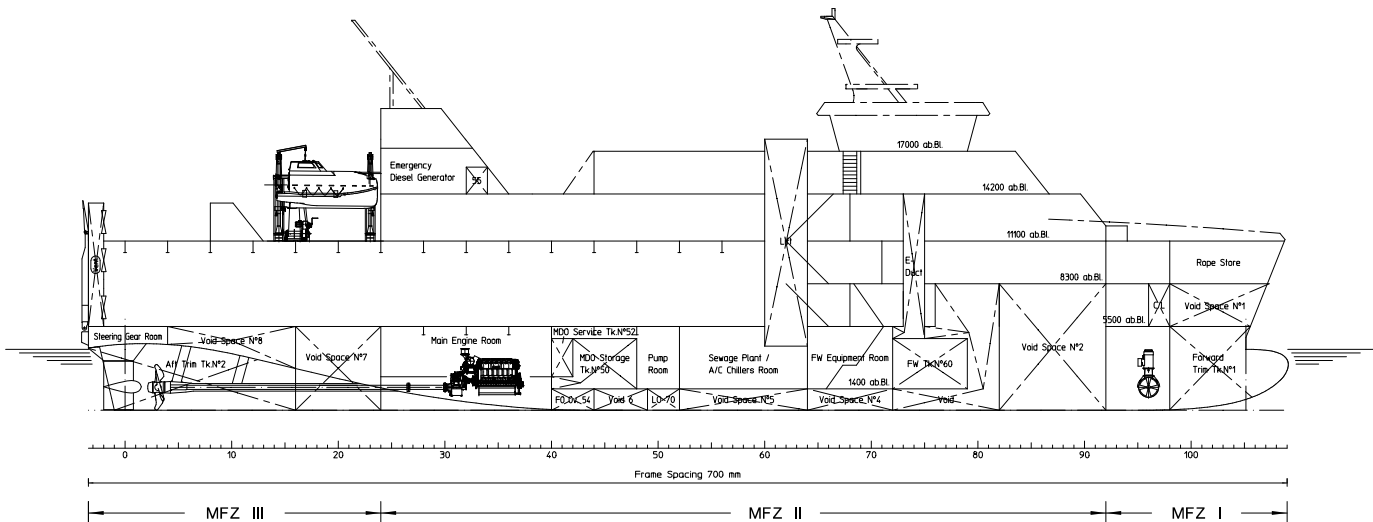
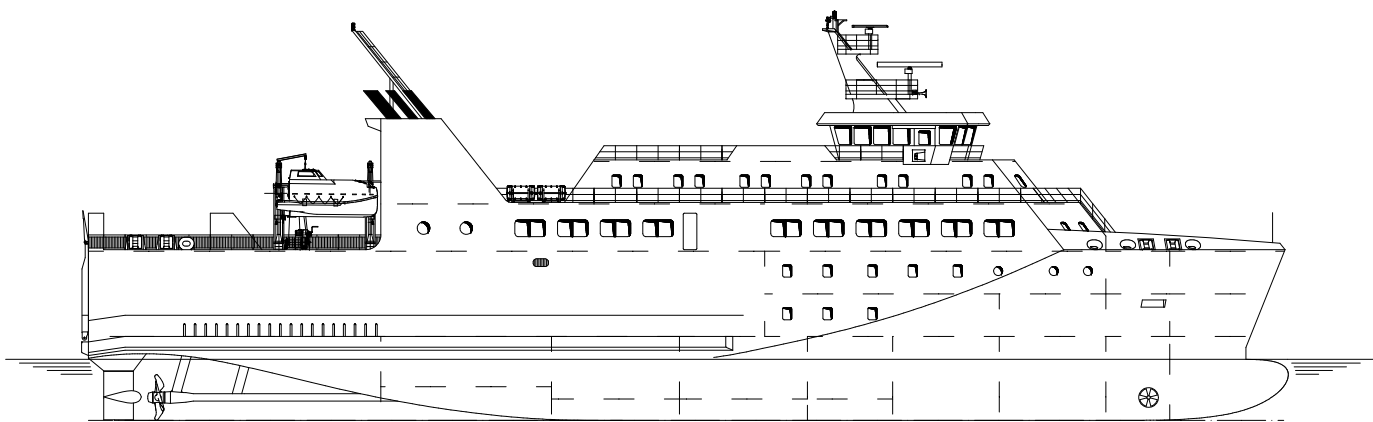
EMSA Damage Stability Study

200m Ro-Ro Passenger Ferry
Proj. N° 08-014

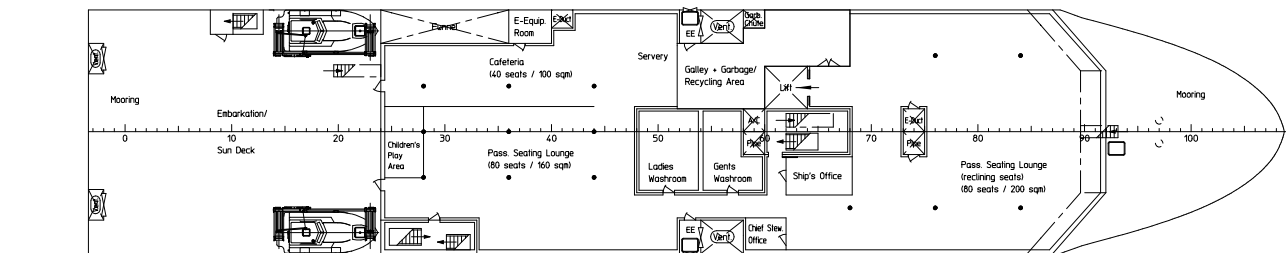
MAIN DIMENSIONS:	
LENGTH OVER ALL	199.90 m
LENGTH BETWEEN PERP.	190.25 m
BREADTH MOULDED	30.80 m
DEPTH MOULDED TO MAIN DECK	9.20 m
DEPTH TO UPPER DECK	15.95 m
DRAUGHT (DESIGNED)	6.50 m
DEADWEIGHT (DESIGN)	8350 t
SERVICE SPEED (DESIGN DRAUGHT)	25.00 kn
MAIN ENGINE	MCR 28800 kW

PASSENGERS IN CABINS (105 x 4)	420
PASSENGERS max.	542
CREW	58

04	partial double hull included on main deck	08-Jun-09	Heyer
03	value of LPP in field of main particulars modified	12-May-09	Heyer
02	EE's added, views updated	20-Jan-09	Heyer
01	ship lines modified	06-Jan-09	Heyer
Mod N°	Modification	Date	Name
FLENSBURGER SCHIFFBAU-GESELLSCHAFT	IMO N° XXX		
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GENERAL ARRANGEMENT PLAN			
Dr. N° 0210-0001	Rev. 04		
Des.: HEYER	Date: XX-XX-XX		
CHK.: TKX	Drawing 1:400		
Group: TKX	Scale		
HE'D CAD DRAWING - DO NOT CHANGE BY HAND			



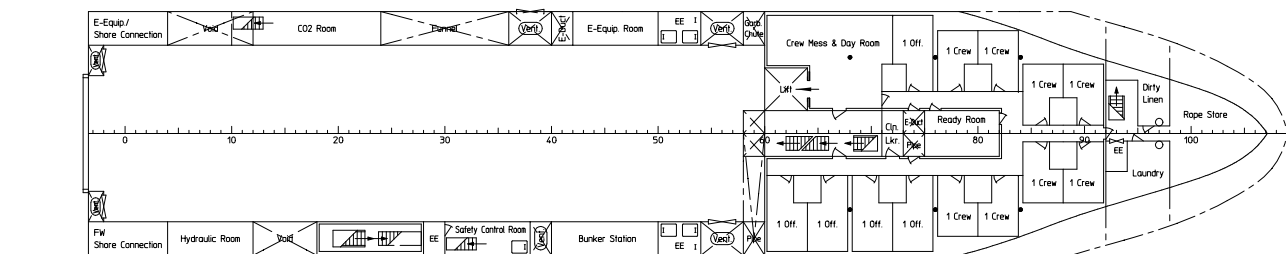
Deck 4
1st House Deck
1100 ab.BI.



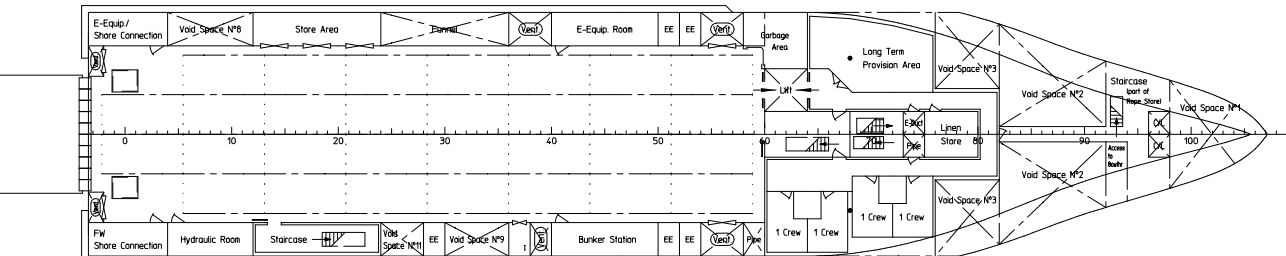
Deck 3
Mezzanine Deck
8300 ab.BI.

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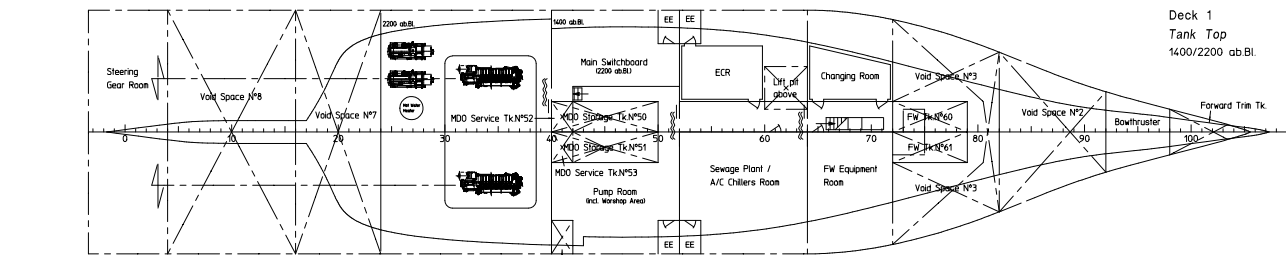
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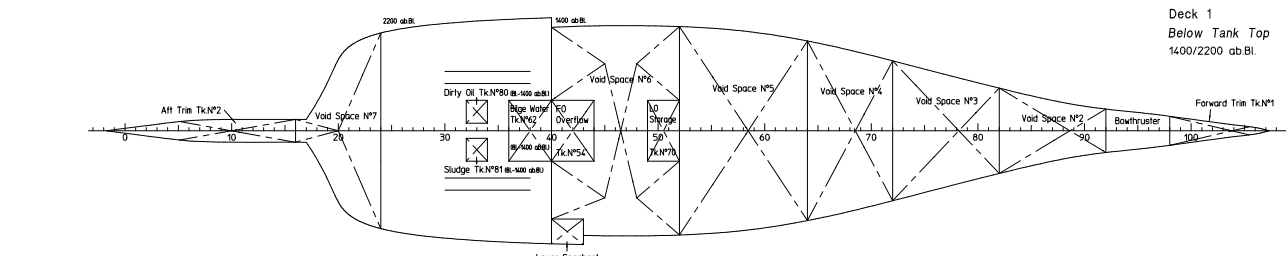
Deck 2
Main Deck
5500 ab.BI.
abt. 165 lm
h = 4.75 m



Deck 1
Tank Top
1400/2200 ab.BI.



Deck 1
Below Tank Top
1400/2200 ab.BI.

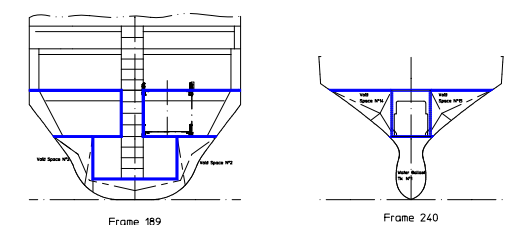
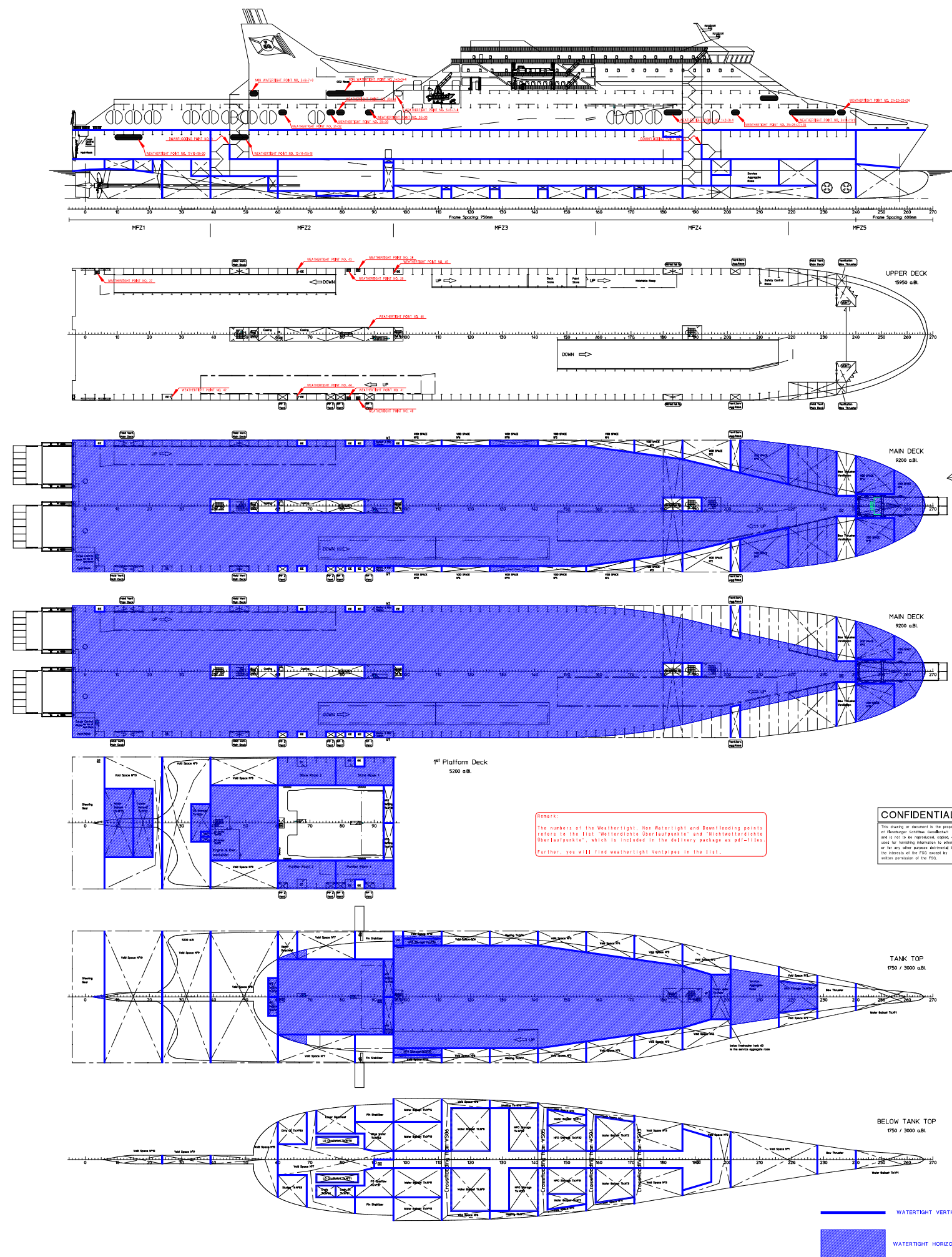


80 m Ro-Ro Passenger Ferry EMSA Damage Stability Study FSG Proj.N°08-008

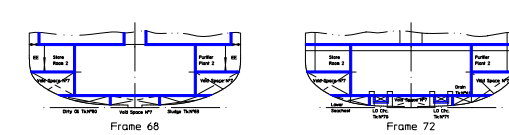
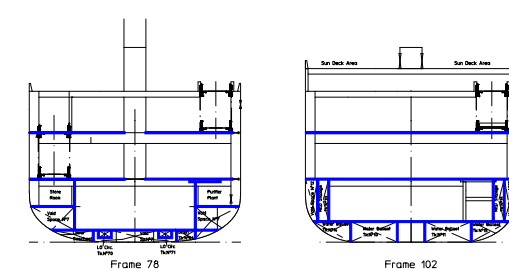
Main Particulars:	
Length over all:	abt. 79.20 m
Length between perpendiculars:	abt. 73.60 m
Breadth moulded:	abt. 16.00 m
Breadth over fenders:	16.90 m
Draught (design):	4.00 m
Draught (summer load):	max. 4.10 m
Depth to Main Deck:	5.50 m
Service speed:	abt. 14.5 kn
Main engines:	abt. 2x 1,020 kW
Car lane metres:	abt. 165 lm
Passenger capacity:	300
Crew:	22

Mod N°	Modification	Date	Name
FLENSBURGER SCHIFFBAU-GESELLSCHAFT			
IMO N°	XXX		
Yard N°	08-008	Pg 1 / 1	
Des.: ORTLOFF	Drw. N° 0210-0001	Rev.: 00	
Chk.: TKP	Date: 22-Oct-08		
Group: TKP	Drawing Scale	1:300	

ME10 CAD DRAWING - DO NOT CHANGE BY HAND



Variante Doppelhuelle



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Remark:
The numbers of the Watertight, Non Watertight and Downflooding points refers to the list "Wetterlichte Überlaufpunkte" and "Nichtwetterlichte Überlaufpunkte", which is included in the delivery package as pdf-File. Further, you will find watertight ventpipes in the list.

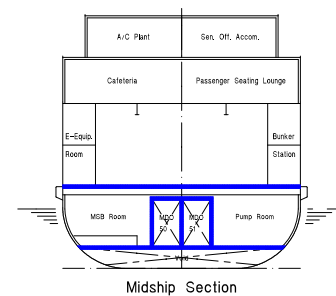
FLENSBURGER

EMSA Damage Stability Study
200m Ro-Ro Passenger Ferry
Proj. N°08-014

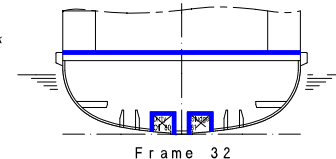
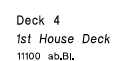
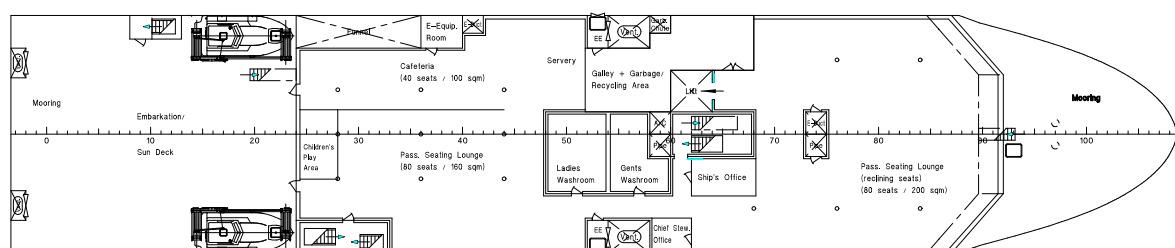
MAIN DIMENSIONS:	
LENGTH OVER ALL	199,90 m
LENGTH BETWEEN PERP.	188,79 m
BREADTH MOULDED	30,80 m
DEPTH MOULDED TO MAIN DECK	9,20 m
DEPTH TO UPPER DECK	15,95 m
DRAUGHT (DESIGNED)	6,50 m
DEADWEIGHT (DESIGN)	8350 t
SERVICE SPEED (DESIGN DRAUGHT)	25,00 kn
MAIN ENGINE	MCR 28800 kW

PASSENGERS IN CABINS (105 x 4)	420
PASSENGERS max.	542
CREW	58

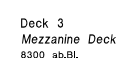
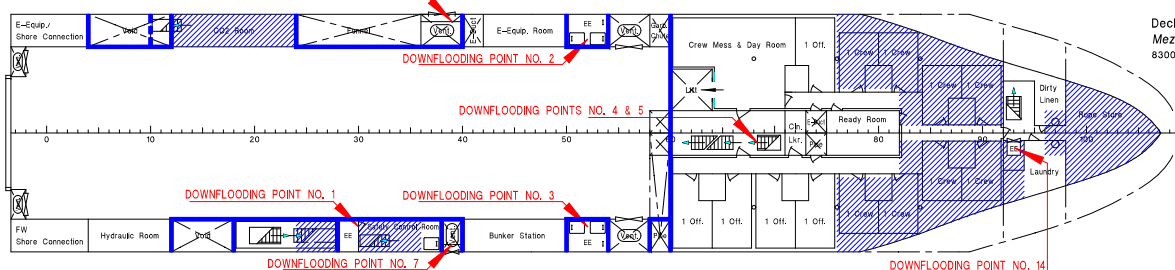
Mod N°	Modification	Date	Name
FLENSBURGER SCHIFFBAU-GESELLSCHAFT	FLENSBURGER SCHIFFBAU-GESELLSCHAFT	MO N° XXX	Yard N° 08-014 Pg 1 / 1
INTERNAL WATERTIGHT INTEGRITY PLAN	Drw. N° 0314-0002	Rev. 01	Date: 03-Mrz-09
NEIO CAD DRAWING - DO NOT CHANGE BY HAND	Chk:	Drawing Scale	1:400
	Group: TKP		



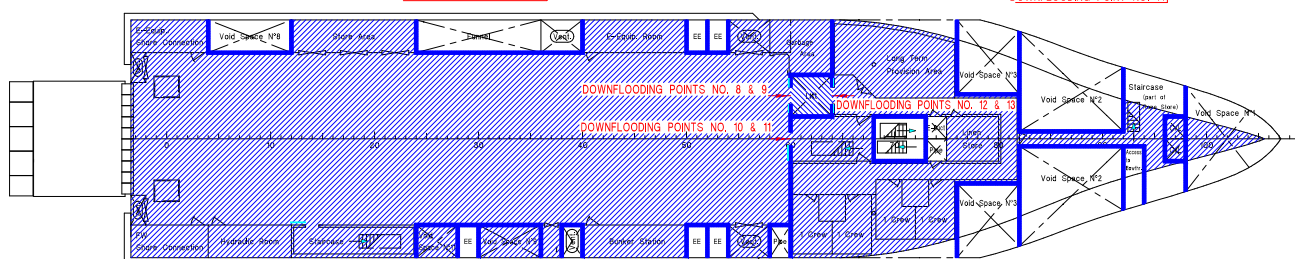
Midship Section



Frame 32

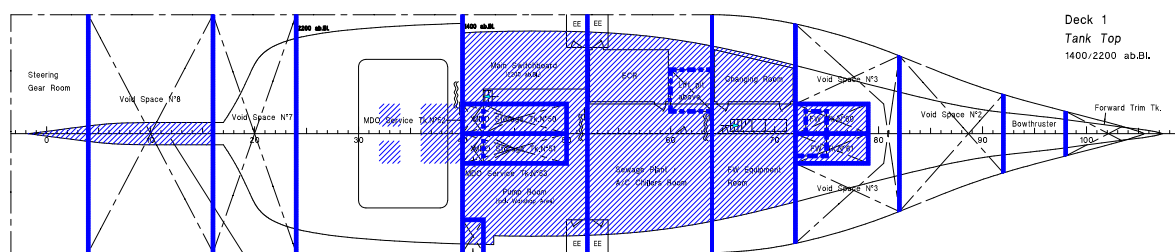


- Remarks:
- The following nonwatertight openings have been considered in the Damage Stability Calculations:
- 1) Emergency Exit Frame 30 stbd ($x = 21.06$ m, $y = 0.75$ m stbd, $z = 8.30$ m)
Internal opening, connecting the ACCOMMODATION with the BOWTHRUST ROOM
 - 2) Emergency Exit Frame 54 port ($x = 37.85$ m, $y = 0.75$ m port, $z = 8.30$ m)
Internal opening, connecting the ACCOMMODATION with the BOWTHRUST ROOM
 - 3) Emergency Exit Frame 54 stbd ($x = 37.80$ m, $y = 0.75$ m stbd, $z = 8.30$ m)
Internal opening, connecting the PUMP/ELECTRIC ROOM and the ECR/SEA-AC ROOM
 - 4) Staircase Frame 88 mid ($x = 47.55$ m, $y = 0.15$ m stbd, $z = 6.30$ m)
Staircase Frame 68 stbd ($x = 47.55$ m, $y = 1.15$ m stbd, $z = 6.30$ m)
Internal opening, connecting the FREQU-EQUIPMENT/CHANGING ROOM and the ACCOMMODATION
 - 5) Engine/ventilation port ($x = 27.30$ m, $y = 7.50$ m port, $z = 16.50$ m)
Engine/ventilation stbd ($x = 27.30$ m, $y = 7.50$ m stbd, $z = 16.50$ m)
external opening, connecting the ENGINE ROOM with the OUTSIDE
 - 6) Hold to Lift (port edge) ($x = 42.00$ m, $y = 3.475$ m port, $z = 5.50$ m)
Hold to Lift (stbd edge) ($x = 42.00$ m, $y = 3.475$ m stbd, $z = 5.50$ m)
Internal opening, connecting the RO-RO CARGO HOLD with the LIFTINGSTAC
 - 7) Hold to Accommodation port ($x = 42.00$ m, $y = 0.45$ m port, $z = 6.50$ m)
7) Hold to Accommodation stbd ($x = 42.00$ m, $y = 0.45$ m stbd, $z = 6.50$ m)
Internal opening, connecting the RO-RO CARGO HOLD with the ACCOMMODATION
 - 12) Lift to Accommodation port ($x = 44.80$ m, $y = 3.475$ m port, $z = 5.50$ m)
12) Lift to Accommodation stbd ($x = 44.80$ m, $y = 2.425$ m stbd, $z = 5.50$ m)
Internal opening, connecting the LIFTINGSTAC with the ACCOMMODATION
 - 14) Accommodation to Bowthr. R ($x = 65.00$ m, $y = 1.50$ m stbd, $z = 8.30$ m)
Internal opening connecting the ACCOMMODATION with the BOWTHRUST-ROOM

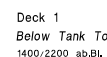
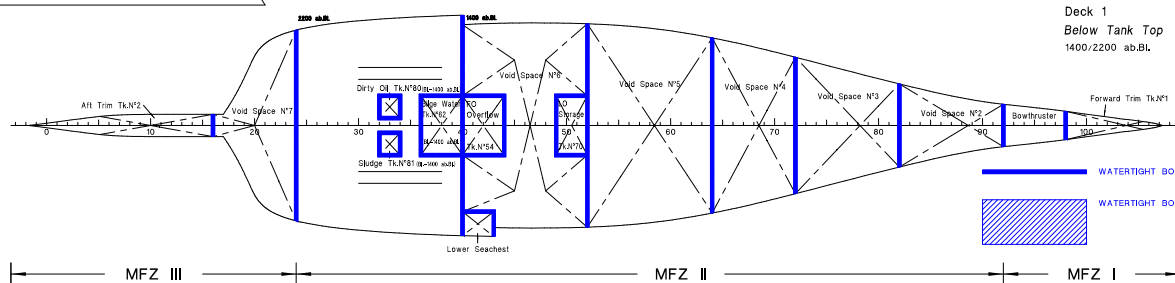


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Slanted Tanktop, Heights: 4150 at Frame -2 / 4000 at Frame 4 / 2200 at Frame 16



80 m Ro-Ro Passenger Ferry

EMSA Damage Stability Study

FSG Proj.N°08-012

Main particulars:		
Length over all:	abt.	79.20 m
Length between perpendiculars:	abt.	73.60 m
Breadth moulded:	abt.	16.00 m
Breadth over fenders:		16.90 m
Draught (design):		4.00 m
Draught (summer load):	max.	4.10 m
Depth to Main Deck:		5.50 m
Service speed:	abt.	14.5 kn
Main engines:	abt. 2x	1,020 kW
Car lane metres:	abt.	165 lm
Passenger capacity:		300
Crew:		22

[illegible]