

TRABAJO FIN DE GRADO

15 105 P / BUQUE LNG DE MEMBRANA DE 145.000 m³

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CUADERNO 4

CÁLCULOS DE ARQUITECTURA NAVAL





DEPARTAMENTO DE INGENIERÍA NAVAL Y OCEÁNICA

TRABAJO FIN DE GRADO

CURSO 2014-2015

PROYECTO NÚMERO: 15 105 P

TIPO DE BUQUE: Buque tanque LNG de membrana

CLASIFICACIÓN, COTA Y REGLAMENTOS DE APLICACIÓN: DNV, SOLAS, MARPOL, CIG.

CARACTERÍSTICAS DE LA CARGA: gas natural licuado con capacidad para 145.000 m³.

VELOCIDAD Y AUTONOMÍA: 19,5 nudos a la velocidad de servicio, 85% MCR + 15% MM. 12.000 millas a la velocidad de servicio.

SISTEMAS Y EQUIPOS DE CARGA / DESCARGA: los habituales en este tipo de buque.

PROPULSIÓN: Propulsión Diesel eléctrico. Dos líneas de ejes

TRIPULACIÓN Y PASAJE: 35 tripulantes en camarotes individuales.

OTROS EQUIPOS E INSTALACIONES: Las habituales en este tipo de buque.

Ferrol, Abril de 2015

ALUMNO: D. Ismael Grandal Mouriz

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1-INTRODUCCIÓN

En el presente cuaderno vamos a realizar el compartimentado del buque, al mismo tiempo que obtendremos:

- Curvas hidrostáticas
- Curvas KN
- Capacidades y centros de gravedad de los tanques principales.

Las características principales de nuestro buque son las siguientes:

L	269,7
B	43,2
D	26,3
T	11,5
Volumen	145.000
Δ	105.379
V	19,5
Fn	0,1950
Cb	0,7673
Cm	0,9971
Cp	0,7905

Para realizar los cálculos del buque vamos a utilizar el Código Internacional para la construcción y el equipo de buques que transporten Gases licuados a granel (Código CIG).

En relación al tipo de carga que transportamos (gas metano), nuestro buque está dentro de la categoría 2G.

a	b	c	d	e	f	g	h	i
Product name	UN number	Ship type	Independent tank type C required	Control of vapour space within cargo tanks	Vapour detection	Gauging	MFAG table no.	Special requirements
Isoprene*	1218	2G/ 2PG	-	-	F	R	310	14.4.3, 17.8, 17.10, 17.12
Isopropylamine*	1221	2G/ 2PG	-	-	F+T	C	320	14.4.2, 14.4.3, 17.2.4, 17.10, 17.11, 17.12, 17.17
Methane (LNG)	1972	2G	-	-	F	C	620	
Methyl acetylene-propadiene mixtures	1060	2G/ 2PG	-	-	F	R	310	17.18
Methyl bromide	1062	1G	Yes	-	F+T	C	345	14.4, 17.2.3, 17.3.2, 17.4.1, 17.5, 17.9
Methyl chloride	1063	2G/ 2PG	-	-	F+T	C	340	17.2.3
Monoethylamine*	1036	2G/ 2PG	-	-	F+T	C	320	14.4.2, 14.4.3, 14.4.4, 17.2.1, 17.3.1, 17.10, 17.11, 17.12, 17.17
Nitrogen	2040	3G	-	-	O	C	620	17.19

2-ZONA ESTANCA

Definiremos zona estanca como aquella que no dispone de aberturas o, en caso de tenerlas, están protegidas con cierres estancos a la intemperie.

Nuestra zona estanca abarcará desde la línea base hasta la cubierta de francobordo, situada a 26,3 metros, así como lo que sobresalgan por encima de esta cubierta los tanques de carga. En la figura puede verse claramente la zona que estamos describiendo.



3-PUNTOS DE INUNDACIÓN PROGRESIVA

El punto de inundación progresiva será aquel punto de la estructura del barco que en el caso de estar sumergido en una condición de equilibrio pueda dar lugar a una inundación no restringida.

Los puntos de inundación progresiva son aberturas no estancas a la intemperie. Esto quiere decir, podrá soportar sin filtrar agua una situación de inmersión transitoria como un golpe de mar,... pero no una situación de inmersión permanente. Son puntos que provocarán una inundación progresiva si están sumergidos en el equilibrio y además limitarán el rango de la curva de estabilidad a su ángulo de inundación.

En nuestro caso se trata de las puertas en la cubierta 1 de habilitación. En la figura del apartado uno se puede ver claramente la localización de una de las puertas marcada en rojo. Hay una a cada banda.

Su localización exacta se muestra en la siguiente tabla:

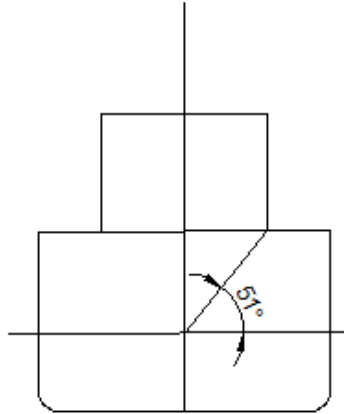
TIPO	X (m)	Y (m)	Z (m)
Puerta	48,96	-12	28,4
Puerta	48,96	12	28,4

Ángulo de inundación progresiva

El ángulo de inundación progresiva es la inclinación respecto de la horizontal (flotación en aguas tranquilas) que debe alcanzar el buque para que la superficie del agua alcance la parte más baja de la abertura más baja que pueda producir una inundación progresiva de los espacios bajo la cubierta de francobordo.

En el caso de nuestro buque, y teniendo en cuenta la situación de los puntos de inundación progresiva, el ángulo de inundación progresiva será:

$$\alpha_{ip} = 51^\circ$$



4-DISPOSICIÓN INTERNA

La disposición de nuestro buque se detalla más en profundidad en el cuaderno 8. Pero a modo podemos decir que:

- Longitudinalmente: situaremos mamparos intentando hacerlos coincidir con los anillos resistentes del casco.
- Transversalmente: situaremos mamparos de acuerdo a la normativa vigente (doble casco).
- Verticalmente: situaremos una cubierta de doble fondo a instancias de la normativa.

5-DOBLE FONDO, DOBLE CASCO Y COFERDAMS

Doble fondo

Utilizando las normas de nuestra Sociedad de Clasificación (DNV Pt.3 Ch.1 Sec.6 D101) aplicamos la expresión siguiente para calcular la altura mínima de doble fondo que debemos tener:

$$250 + 20 \cdot B + 50 \cdot T = 1.689 \text{ mm}$$

D. Arrangement of Double Bottom

D 100 General

101 The height of centre girder and floors at centre line is not to be less than:

$$250 + 20 B + 50 T \text{ (mm), minimum 650 mm}$$

The height is to be sufficient to give good access to all parts of the double bottom. For ships with a great rise of floors, the minimum height may have to be increased after special consideration.

La norma dice que como mínimo debemos tener una altura de doble fondo de 650 mm.

Para este tipo de buques y utilizando como referencia un buque base, vamos a proyectar un doble fondo de 2.500 mm, es decir, 2,5 m.

Definiremos doble fondo en toda la zona de carga, en cámara de máquinas y en la zona del tanque almacén de fuel oil.

Doble casco

Debido a las características de este buque y a modo de protección hemos puesto un doble casco de 2,5 metros. Tendremos doble casco en toda la zona de carga. Así también podemos facilitar el mantenimiento y la exploración de los tanques de carga de una forma cómoda. Con ello cumplimos las exigencias del CIG que establece que la manga del doble casco de nuestro buque no ha de ser inferior a 760 mm:

2.6.1 Los tanques de carga estarán situados a las siguientes distancias, medidas hacia el interior del buque desde el forro:

.1 Buques de tipo

IG (...)

.2 Buques de tipos 2G/2PG y 3G: desde la línea de trazado de la chapa del forro del fondo, en el eje longitudinal, una distancia no menor que la extensión vertical de la avería especificada en 2.5.1.2.3; en ningún punto será de menos de 760 mm desde la chapa del forro.

Coferdams

Se proyectan coferdams a ambos lados de los tanques. Estos espacios no solo nos proporcionan protección y pueden ser utilizados como tanques de lastre sino que además nos permiten supervisar las zonas adyacentes a los tanques a fin de realizar un correcto mantenimiento de los mismos. A la hora de realizar la distribución tenemos en cuenta el CIG:

3.1.1 Los espacios de bodega estarán separados de los espacios de máquinas y de calderas, de alojamiento y de servicio, puestos de control, cajas de cadenas, tanques de agua potable y de agua destinada a usos domésticos, y pañoles. Los espacios de bodega estarán situados a proa de los espacios de categoría A para máquinas, excepto de aquellos que la Administración juzgue necesarios para la seguridad o la navegación del buque.

3.1.2 Cuando se transporte carga en un sistema de contención que no necesite barrera secundaria, para separar los espacios de bodega de los espacios de los espacios a que se hace referencia en 3.1.1. o de los situados debajo de dichos espacios de bodega o fuera de estos y hacia el costado, en los que haya una fuente de ignición o riesgo de incendio, se utilizarán coferdanes o tanques de combustible líquido. Si en el espacio adyacente no hay riesgo de ignición ni de incendio se podrá utilizar una sola división de clase A-0 hermética.

3.1.4 Cuando se transporte carga en un sistema de contención que necesite una barrera secundaria:

.1 (...)

.2 a temperaturas inferiores a -55-C, el buque llevará también un mamparo longitudinal que forme tanques laterales.

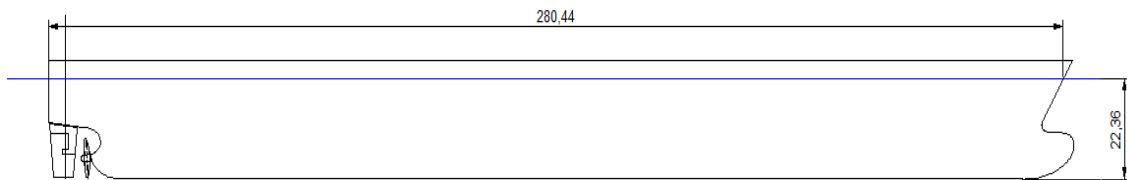
6-MAMPARO DE COLISIÓN

Mamparo de colisión de proa

Para situar el mamparo de colisión deberemos seguir lo dispuesto por el SOLAS en el capítulo II.

Primeramente debemos definir la eslora que utilizaremos en los cálculos sucesivos que nos llevarán al posicionamiento del mamparo de colisión. Tomaremos el mayor valor de L entre:

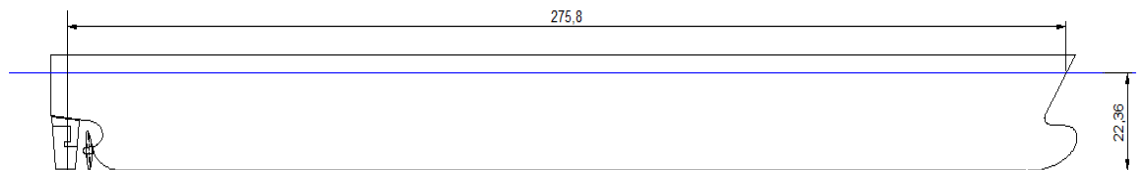
- 96 % de la eslora total desde el extremo de la roda hasta el extremo del codaste en una flotación al 85 % del puntal mínimo de trazado:



$$T_{85\%D} = 0,85 \cdot 26,3 = 22,36 \text{ m.}$$

$$L = 0,96 \cdot 280,44 = 269,22 \text{ m.}$$

- Eslora desde el extremo de la roda hasta el eje de la mecha del timón en la misma flotación:



$$L = 275,8 \text{ m.}$$

Por tanto tomaremos $L = 275,8 \text{ m.}$

Según lo dispuesto por el SOLAS en el Capítulo II-1-Regla 11, la situación del mamparo de colisión deberá cumplir:

- *Se instalará un mamparo de colisión que será estanco hasta la cubierta de francobordo. Dicho mamparo estará situado a una distancia de la perpendicular de proa no inferior al 5% de la eslora o a 10 metros si esta segunda magnitud es menor y salvo cuando la Administración permita otra cosa, dicha distancia no será superior al 8% de la eslora.*

$$5 \% L = 0,05 * 275,8 = 13,79 \text{ m.}$$

En nuestro caso 10 metros es la menor

- *Cuando cualquier parte del buque que quede por debajo de la flotación se prolongue delante de la perpendicular de proa , como por ejemplo ocurre con una proa de bulbo, las distancias estipuladas en el párrafo anterior se medirán desde un punto situado:*
 - *A 1,5 % L a partir de la Ppr.*
 - *A mitad de dicha prolongación*
 - *A una distancia de 3 metros por delante de la Ppr*

De estas medidas se tomará la menor

$$1,5 \% L = 4,14 \text{ m.}$$

$$\text{Protuberancia del bulbo } 8,76/2 = 4,38 \text{ m.}$$

Luego tomaremos 3 metros, por ser el menor de estos valores.

Luego al valor obtenido anteriormente de 10 metros de distancia mínima, teniendo en cuenta que tiene bulbo, hemos de restarle 3:

$$10 - 3 = 7 \text{ m.}$$

A nuestra eslora le restamos el valor antes calculado como distancia mínima para situar nuestro mamparo de proa:

$$275,8 - 7 = 268,8 \text{ m. como mínimo.}$$

Además, calcularemos el 8 % de L:

$$0,08 \cdot 275,8 = 22,06 \text{ m.}$$

Como nuestro buque tiene bulbo deberemos restarle también los 3 metros calculados anteriormente:

$$22,06 - 3 = 19,06 \text{ m.}$$

Luego $275,8 - 19,04 = 256,74 \text{ m.}$ como máximo

Por tanto, deberemos situar el mamparo de proa en el intervalo entre 256,74 y 268,8 metros.

Escogemos 264,685 metros, coincidiendo con la cuaderna 311.

Mamparo de colisión de popa

El mamparo de colisión de popa se suele tomar, como mínimo un 4 % de L, en nuestro caso, esto es, aproximadamente: 11,03 m.

Tomando como referencia nuestro buque base, estableceremos la longitud del pique de popa en 16 m. (11,36 desde la perpendicular de popa), coincidiendo con la cuaderna 20.

Cámara de máquinas

Tomando como referencia nuestro buque base estableceremos una eslora de cámara de máquinas de 40 m., yendo ésta de la cuaderna 20 a la 70 (de 11,36 m. a 51,36 m.).

7-CLARA DE CUADERNAS

La separación entre cuadernas en las distintas zonas del buque la hemos hecho analizando los buques de referencia, nuestro buque base y las limitaciones establecidas por la Sociedad de Clasificación, que establece que la separación en nuestro caso no puede ser mayor que:

$$S = 2,08 \cdot L + 438 = 998 \text{ mm.}$$

Donde:

L: eslora de escantillonado (aproximadamente el 96 % de L al 85 % de D). Este valor es 269,22 m.

Podemos distinguir tres zonas:

- Zona de cámara de máquinas: con una separación entre cuadernas de 800 mm.
- Zona de carga: con una separación entre cuadernas de 925 mm.
- Zona de proa: con una separación entre cuadernas de 800 mm.

8-HIPÓTESIS DE AVERÍA

A la hora de situar nuestros tanques hemos de tener en cuenta los requerimientos del CIG en cuanto a averías.

Según el CIG, las dimensiones máximas de averías supuestas serán las siguientes:

1-En el costado

1.1-Extensión longitudinal: $1/3 L^{2/3}$ o bien 14,5 metros, si este valor es menor.

1.2-Extensión transversal medida hacia el interior del buque, desde el costado, perpendicularmente al eje longitudinal, al nivel de la línea de carga de verano: $B/5$ o bien 11,5 metros, si este valor es menor.

1.3-Extensión vertical: hacia arriba, sin límite desde la línea de trazado de la chapa del forro del fondo en el eje longitudinal.

2-En el fondo

a) A $0,3 L$ de la perpendicular de proa del buque

b) En cualquier otra parte del buque

2.1-Extensión longitudinal:

$1/3 L^{2/3}$ o bien 14,5 metros, si este valor es menor (a)

- $1/3 L^{2/3}$ o bien 5 metros, si este valor es menor (b)

2.2-Extensión transversal:

-B/6 o bien 10 metros, si este valor es menor (a).

-B/6 o bien 5 metros, si este valor es menor (b).

2.3-Extensión vertical:

-B/15 o bien 2 metros, si este valor es menor, midiendo desde la línea de trazado de la chapa del forro del fondo en el eje longitudinal (a).

-B/15 o bien 2 metros, si este valor es menor, midiendo desde la línea de trazado de la chapa del forro del fondo en el eje longitudinal (b).

9-COMPARTIMENTADO DE LOS TANQUES DE CARGA

Para diseñar la disposición interna de nuestro buque debemos tener en cuenta varios factores, tres de ellos fundamentales:

-La capacidad de los tanques de carga ha de ser de 145.000 m³.

-Cumplimiento del Código CIG.

-Las características geométricas de nuestros tanques (membrana).

A la hora de diseñar nuestros tanques de carga hemos de tener en cuenta que el volumen neto que necesitamos transportar no se corresponde con el volumen neto para el que debemos diseñar.

Primeramente hemos de tener en cuenta la permeabilidad (μ) de los tanques. Según el CIG tenemos:

ESPACIOS	PERMEABILIDAD
Asignados a pertrechos	0,6
Ocupados como alojamientos	0,95
Ocupados por maquinaria	0,85
Espacios perdidos	0,95
Destinados a líquidos consumibles	0 a 0,95
Destinados a otros líquidos	0 a 0,95

Puesto que nuestros tanques no tienen mucho espacio perdido de su volumen real, tomamos un valor de 0,97. Lo que nos puede quitar volumen de carga son las bombas, el trípode y algún que otro equipo instalado.

Debemos dividir nuestro volumen de las RPA entre la permeabilidad en tanto por ciento:

$$Volumen\ carga = \frac{145.000}{0,97} \approx 149.500m^3$$

Pero además el CIG en su capítulo 15 establece que dichos tanques deberán ir cargados como máximo al 98 % de su capacidad:

15.1.1. Ningún tanque de carga se llenará tanto que el líquido ocupe más del 98% de su capacidad, a la temperatura de referencia.

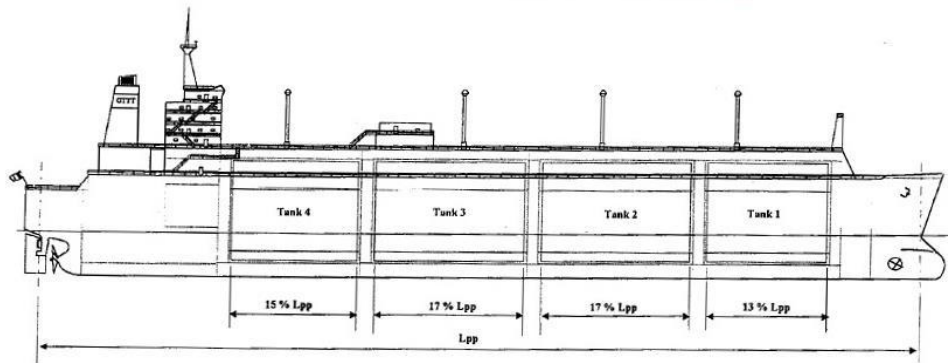
Por lo tanto dividiremos el volumen anteriormente calculado por 0,98.

$$Volumen\ carga_{FINAL} = \frac{149.500}{0,98} \approx 152.550\ m^3$$

Sin tener en cuenta la permeabilidad necesitamos 147.960 m³.

Tomaremos una densidad del gas natural licuado de 0,43 t/m³.

Cada uno de los tanques de carga debe representar aproximadamente el siguiente porcentaje de la eslora:



Teniendo en cuenta también la estructura de nuestro buque base tenemos que:

Lpp = 269,7 m.	L(tanque)	≈ % de Lpp
Tanque 4	46,25	17
Tanque 3	46,25	17
Tanque 2	46,25	17
Tanque 1	40,7	15

El porcentaje es aproximado, puesto que tenemos que hacer coincidir el inicio y el final de los tanques con una cuaderna.

Por tanto, finalmente tenemos una distribución como sigue:

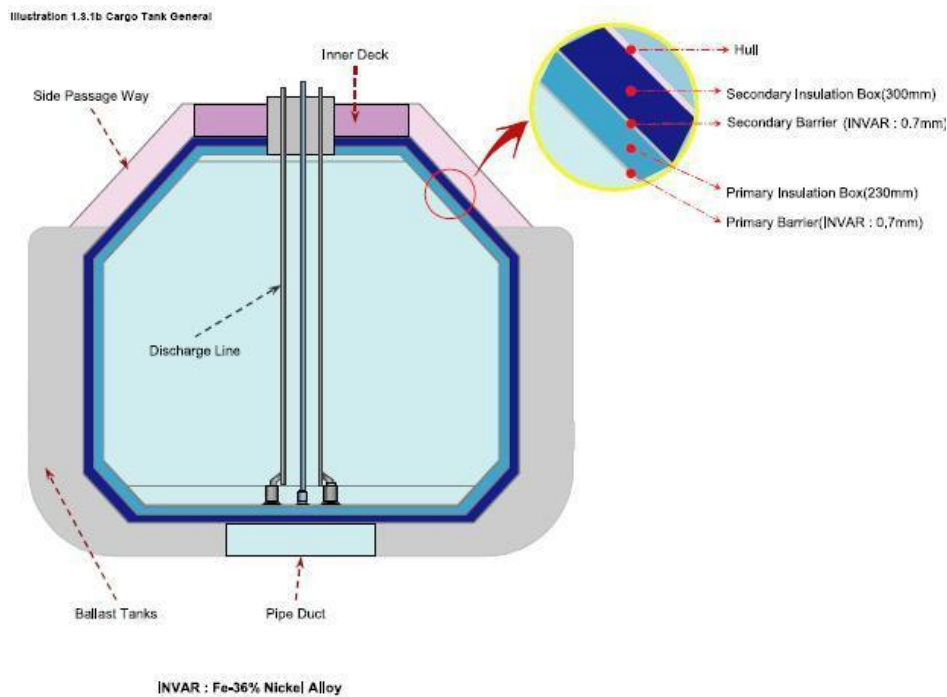
	Cuaderna inicial	Cuaderna final	Lcompartimentado (m)	Pos. Long. (m)
Cofferdam 5	70	73	2,775	51,36-54,135
Tanque 4	73	123	46,25	54,135-100,385
Cofferdam 4	123	126	2,775	100,385-103,16
Tanque 3	126	176	46,25	103,16-149,41
Cofferdam 3	156	179	2,775	149,41-152,185
Tanque 2	179	229	46,25	152-185-198,435
Cofferdam 2	229	232	2,775	198,435-201,21
Tanque 1	232	282	46,25	201,21-241,91
Cofferdam 1	282	286	2,775	241,91-244,685

Una vez definida la geometría tenemos que definir la membrana de nuestros tanques. Debemos tener en cuenta los espesores de cada barrera y de cada aislante térmico:

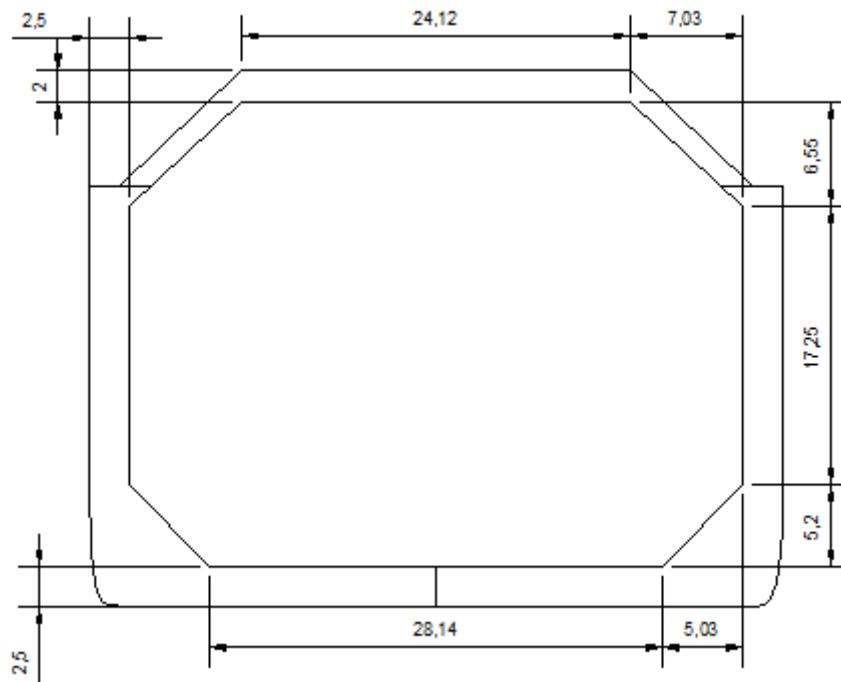
- Barrera primaria invar: 0,7 mm.
- Primera capa de aislante térmico: 230 mm.
- Barrera secundaria invar: 0,7 mm.
- Segunda capa de aislante térmico: 300 mm.

Por tanto, tendremos un espesor de 531,4 mm. Esto debemos sumárselo al doble casco y al doble fondo.

En la siguiente imagen podemos ver un esquema de un tanque de membrana.



Una vista de la estructura transversal en la cuaderna maestra de los tanques:



En la imagen anterior podemos ver el escantillonado

A continuación podemos ver la forma de los tanques en Maxsurf.

10-DOMOS

El CIG nos obliga a colocar nos obliga a poner domos en la parte superior de los tanques como medida de protección. Pueden llenarse de agua de lastre. En nuestro buque irán vacíos, puesto que añadir pesos a tanta altura puede perjudicarnos la estabilidad. Fijamos un espacio de 2 metros entre la parte superior de los tanques y la del domo.

Los podemos ver en el esquema anterior de la sección transversal del buque

11-CONSUMOS Y JUSTIFICACIÓN DE LA AUTONOMÍA. FUEL, DIESEL, ACEITE, AGUA DULCE, LODOS Y LASTRE.

Autonomía

Según las RPA debemos tener 12.000 millas de autonomía a 19,5 knot. Señalar que un nudo (knot) es igual a una milla marina (mn) por hora.

$$t_{navegación} = \frac{Autonomía}{Velocidad} = 615,38 \approx 25 \text{ días}$$

Fuel Oil

El buque lleva instalados cuatro motores dual-fuel como generadores para suministrar energía a toda la planta eléctrica del buque. En ninguna condición de carga eléctrica funcionan los cuatro motores de manera simultánea, uno siempre estará en stand-by.

El dimensionamiento de los tanques de combustible lo realizaremos teniendo en cuenta la situación de mayor consumo, es decir estando parado uno de los motores 16V50DF.

Los consumos del fuel oil se pueden determinar de la forma:

$$Consumo_{FO} = c_e \cdot PS \cdot t_{nav} \cdot 10^{-6}$$

Donde:

c_e : consumo específico del motor (189 g/kWh), sacado del catálogo que adjuntamos como anexo.

PS: potencia del motor en kW

La potencia del motor en condiciones de servicio será:

$$PS = MCR \cdot Margen = 17.700 \cdot 0,85 = 14.535 \text{ kW}$$

$$PS = MCR \cdot Margen = 15.200 \cdot 0,85 = 12.920 \text{ kW}$$

T_{nav} : tiempo de navegación ininterrumpida (615,38 h.)

Por lo que el consumo de fuel será:

$$Consumo_{FO} 18V50DF = 1.690,52 \text{ t}$$

$$Consumo_{FO} 16V50DF = 1.502,68 \text{ t}$$

Por lo tanto, teniendo en cuenta que de manera simultánea trabajan dos motores 18V50DF y un motor 16V50DF, el consumo de fuel oil de los motores principales es:

$$Consumo_{FO} = 2 \cdot 1.690,52 + 1 \cdot 1.502,68 = 4.883,72 \text{ t}$$

Y por consiguiente el volumen necesario de los tanques de combustible será:

$$Volumen_{FO} = \frac{Consumo \text{ total}}{\rho_{FO}} = 5.426,35 \approx 5.427 \text{ m}^3$$

Donde:

ρ_{FO} : densidad del fuel oil (0,9 t/m³).

Volumen de los tanques almacén

Se instalarán dos tanques almacén en la parte de proa del buque que tendrán una capacidad conjunta igual al volumen total de combustible necesario menos tres días y medio de consumo.

$$Volumen_{TA} = V_{TOTAL} - 84 \text{ h} =$$

$$Volumen_{TA} = 5.427 - \left(\frac{189 \cdot (2 \cdot 14.535 + 1 \cdot 12.920) \cdot 84 \cdot 10^{-6}}{0,97} \right) \approx 4.687 \text{ m}^3$$

Sin tener en cuenta la permeabilidad necesitamos 4.547,39 m³.

Volumen del tanque de sedimentación

Instalaremos dos tanques de sedimentación a cada banda en cámara de máquinas.

$$Volumen_{TS} = \frac{189 \cdot (2 \cdot 14.535 + 1 \cdot 12.920) \cdot 36 \cdot 10^{-6}}{0,97} = 294,53 \approx 295 \text{ m}^3$$

Sin tener en cuenta la permeabilidad necesitamos 286,15 m³

Volumen de los tanques de uso diario

Se instalarán dos tanques de uso diario a cada banda en cámara de máquinas. En cada tanque debe haber volumen suficiente para propulsar el buque un día entero.

$$Volumen_{TUD} = \frac{189 \cdot (2 \cdot 14.535 + 1 \cdot 12.920) \cdot 24 \cdot 10^{-6}}{0,97} = 196,35 \approx 197 \text{ m}^3$$

Sin tener en cuenta la permeabilidad necesitamos 191,09 m³.

Diesel Oil

En nuestro buque debemos llevar también diesel oil necesario para la propulsión del buque al navegar cerca de puerto, la costa o zonas protegidas (ECA). Estimaremos que será suficiente llevar combustible en los tanques para 4 días de navegación

$$Volumen_{T.DO} = \frac{189 \cdot (2 \cdot 14.535 + 1 \cdot 12.920) \cdot 96 \cdot 10^{-6}}{0,9} = 846,51 \approx 847 \text{ m}^3$$

Donde la densidad del diesel oil es igual a 0,9 t/m³.

Con la permeabilidad:

$$Volumen_{TDO} = \frac{847}{0,97} = 873 \text{ m}^3$$

Instalaremos dos tanques de diesel oil a cada banda en cámara de máquinas.

Aceite

Del catálogo de los motores Wärtsilä, vemos que el consumo específico de aceite lubricante por parte del motor es de 0,5 g/kWh

Por tanto, y teniendo en cuenta las potencias calculadas anteriormente:

$$Consumo_{AC} = c_e \cdot PS \cdot t_{nav} \cdot 10^{-6}$$

$$Consumo_{AC18V50DF} = 2 \cdot 0,5 \cdot 14.535 \cdot 615,38 \cdot 10^{-6} = 8,94 \text{ t}$$

$$Consumo_{AC16V50DF} = 1 \cdot 0,5 \cdot 12.920 \cdot 615,38 \cdot 10^{-6} = 3,97 \text{ t}$$

Volumen de los tanques de aceite de lubricación:

$$Volumen_{AC} = \frac{Consumo_{total}}{\rho_{Ac.Lub.}} = 14,34 \text{ m}^3$$

Donde:

$\rho_{ac.lub.}$: densidad del aceite de lubricación (0,9 t/m³)

Del catálogo del fabricante obtenemos que cada motor 18V50DF necesita un volumen de 25 m³ de aceite, y cada motor 16V50DF un volumen de 22 m³. Necesitaremos, por tanto un volumen total de aceite de:

$$Volumen_{totalAC} = 108,34 \approx 109 \text{ m}^3$$

Teniendo en cuenta la permeabilidad:

$$Volumen_{totalAC} = \frac{109}{0,97} = 113 \text{ m}^3$$

Instalaremos dos tanques de aceite a cada banda en cámara de máquinas.

Agua dulce

Para los cálculos de capacidad de agua dulce recurrimos a la norma UNE EN ISO 15748, Embarcaciones y tecnología marina. Suministror de agua potable en buques y estructuras marinas.

Tabla A.1
Valores guía para el consumo de agua potable en litros por persona/cama y día

Tipo de buque		Grupo de personas embarcado	Consumo de agua cuando esté equipado con	
			sistema de aseos de gravedad	sistema de aseos de vacío
Buque de alta mar	Carguero	Tripulante/cama	220 l	175 l

Se considera un consumo diario de 175 l. por persona y día. Por lo tanto, el consumo de agua dulce del buque es:

$$\text{Consumo}_{AD} = 175 \cdot 35 \cdot 25 = 153.125 \text{ l.}$$

Teniendo en cuenta una permeabilidad del tanque de 0,97, la capacidad del tanque de agua dulce debe ser:

$$\text{Volumen}_{AD} = \frac{153.125}{1000} \cdot 1,03 = 157,72 \approx 158 \text{ m}^3.$$

Instalaremos dos tanques de agua dulce en el pique de popa centrados en crujía.

Aguas negras y grises

Para los cálculos de capacidad de aguas negras y grises recurriremos a la norma UNE EN ISO 15749, Embarcaciones y tecnología marina. Sistemas de desagüe en barcos y estructuras marinas.

Tabla 2
Cantidad mínima de agua de desecho

Tipo de buque	Cantidad mínima de agua de desecho por persona y día en litros			
	Planta sin vacío		Planta con vacío	
	Aguas negras	Aguas negras y grises	Aguas negras	Aguas negras y grises
Buques de pasaje	70	230	25	185
Buques de alta mar exceptuando los de pasaje	70	180	25	135
Los buques costeros pueden conservar los valores recomendados por las autoridades responsables.				
NOTA - Estos valores son los recomendados. Hay que considerar las posibles variaciones debidas a los reglamentos nacionales o a las recomendaciones de las sociedades de clasificación				

Se considera una cantidad mínima de aguas negras y grises es de 180 l. por persona y día. Por tanto, el volumen total de agua de aguas negras es:

$$Consumo_{ANG} = 180 \cdot 35 \cdot 25 = 157.500 \text{ l.}$$

Teniendo en cuenta una permeabilidad del tanque del 0,98, la capacidad del tanque de aguas negras y grises del buque será:

$$Volumen_{ANG} = \frac{157.500}{1000} \cdot 1,03 = 162,225 \approx 163 \text{ m}^3.$$

Instalaremos un tanque de aguas negras y grises en el doble fondo de la cámara de máquinas.

Lodos

El tanque de lodos lo dimensionaremos de acuerdo con el convenio MARPOL. En el Anexo I, Regla 17 se indica, a modo de orientación la capacidad adecuada del tanque de lodos. De todas formas, la capacidad del tanque de lodos podrá calcularse en función de cualquier otra hipótesis.

Para construidos con posterioridad al 31 de diciembre de 1990, y que no lleven agua de lastre en los tanques de Fuel Oil, la capacidad mínima de los tanques de lodos se calcula mediante la siguiente expresión.

$$V_{LODOS} = K_1 \cdot C \cdot D \approx 72 \text{ m}^3$$

Donde:

K_1 : 0,015 para los buques en los que se purifique el fueloil pesado destinado a la máquina principal.

C: consumo diario de Fuel Oil en m^3 (191,09)

D: duración máxima, en días, del viaje entre puertos en el que los fangos pueden descargarse en tierra. (25 días).

Teniendo en cuenta una permeabilidad del 0,97 en el tanque, nuestro tanque de lodos deberá tener una capacidad de:

$$V_{Lodos} = \frac{72}{0,97} \approx 75 m^3$$

Instalaremos un tanque de lodos en el doble fondo de la cámara de máquinas.

Tanques de lastre

Tomando como referencia nuestro buque base, definiermos como tanques de lastre el pique de popa, el pique de proa, los cofferdams entre tanques de carga y el doble fondo y doble casco a lo largo de la eslora de carga, cuyos tanques tendrán forma de “L”.

12-RESUMEN DE VOLÚMENES DE TANQUES

En la siguiente tabla podemos ver un resumen de las capacidades requeridas en los tanques de nuestro buque. Comprobamos que cumplimos con todos los volúmenes. Es conveniente señalar que extraemos los datos de Maxsurf, donde ya hemos supuesto una permeabilidad del 0,97, por tanto, en nuestros volúmenes requeridos no debemos tenerla en cuenta.

Tanques	Volumen requerido (m ³)	Volumen real (m ³)
Carga	147.960	148.871
FO Almacén	4.548	2.394,494 x 2 = 4.788,988
Diesel	847	425,414 x 2 = 850,828
FO Sed.	286,15	143,855 x 2 = 287,71
FO UD	191	95,653 x 2 = 191,306
Aceite	109	54,908 x 2 = 109,816
Agua dulce	153,125	76,795 x 2 = 153,59
Aguas grises	157,5	158,979
Lodos	72	75,439

En concreto, para nuestras RPA, y lo que más nos interesa en nuestro buque, cumplimos con la capacidad de carga. Debemos llevar 147.960 m³ para cumplir con los requerimientos, y llevamos 148.871 m³. Tenemos un volumen a mayores de 911 m³.

En los anexos adjuntamos las tablas de capacidades así como las gráficas de todos los tanques del buque, incluidos los de lastre y cofferdams.

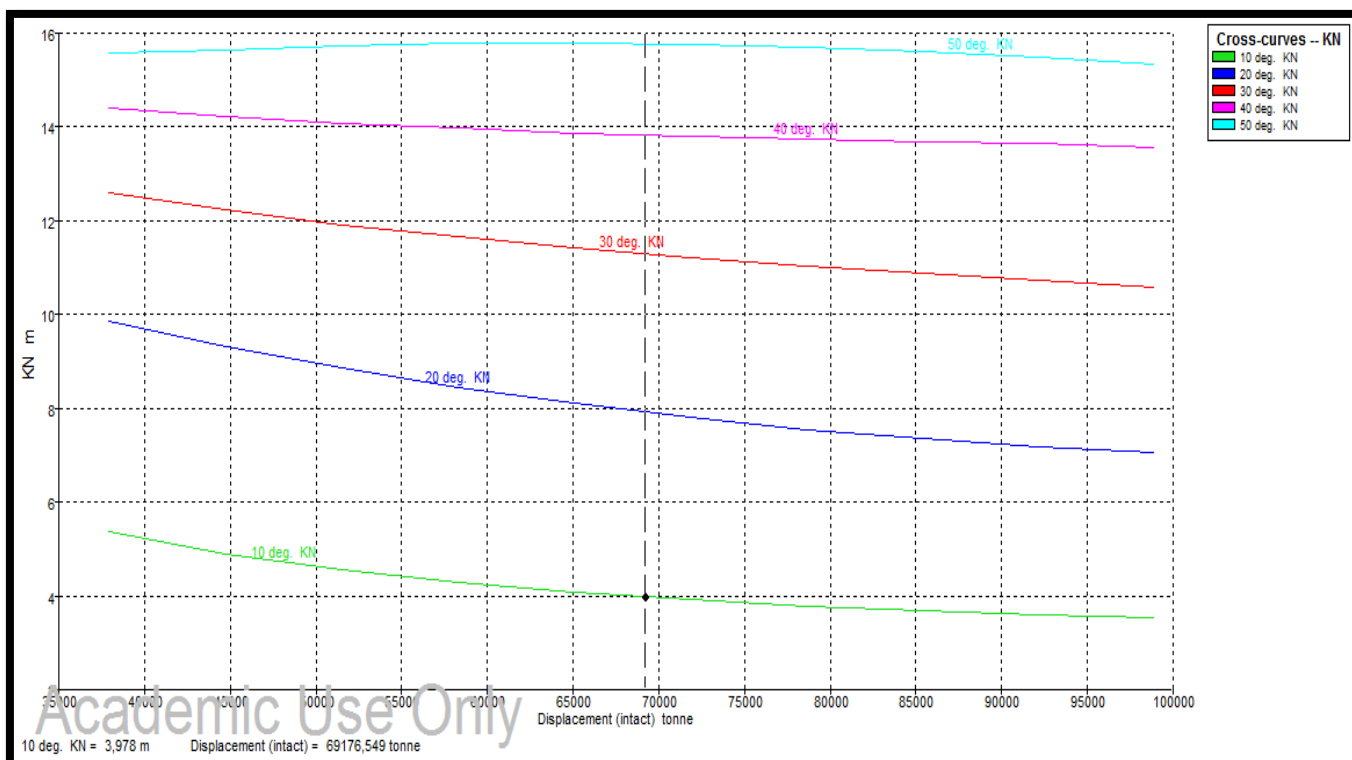
13-CURVAS DE KN (BRAZOS ADRIZANTES)

Vamos a calcular nuestras curvas de KN o curvas de brazos de adrizamiento desde nuestro desplazamiento inicial (rosca) hasta nuestro desplazamiento final con un incremento en intervalos de 10 desplazamientos y para ángulos de escora de 10° a 50°.

Haremos el cálculo para distintos asientos (aproantes y apopantes), desde asiento 0 hasta un 1,5 % de Lpp (4,05) con incrementos de 0,5.

A continuación se muestran tanto la tabla de valores como la gráfica de curvas hidrostáticas para asiento 0. El resto de cálculos los ajuntamos en el anexo.

	Displacement (intact) tonne	Draft Amidships m	Trim (+ve by stern) m	LCG m	TCG m	Assumed VCG m	KN 10,0 deg. Starb.	KN 20,0 deg. Starb.	KN 30,0 deg. Starb.	KN 40,0 deg. Starb.	KN 50,0 deg. Starb.
1	37944	5,058	0,000	138,346	0,000	-11,500	5,373	9,860	12,589	14,392	15,572
2	44721	5,833	0,000	138,120	0,000	-11,500	4,897	9,326	12,227	14,227	15,652
3	51498	6,591	0,000	137,850	0,000	-11,500	4,547	8,861	11,919	14,086	15,728
4	58275	7,334	0,000	137,529	0,000	-11,500	4,281	8,453	11,654	13,969	15,784
5	65052	8,064	0,000	137,160	0,000	-11,500	4,076	8,098	11,423	13,873	15,801
6	71829	8,780	0,000	136,749	0,000	-11,500	3,915	7,798	11,218	13,796	15,769
7	78606	9,486	0,000	136,301	0,000	-11,500	3,788	7,553	11,034	13,737	15,699
8	85383	10,181	0,000	135,829	0,000	-11,500	3,685	7,353	10,868	13,692	15,600
9	92160	10,867	0,000	135,341	0,000	-11,500	3,600	7,190	10,718	13,642	15,480
10	98937	11,546	0,000	134,846	0,000	-11,500	3,530	7,058	10,583	13,573	15,345



14-CURVAS HIDROSTÁTICAS

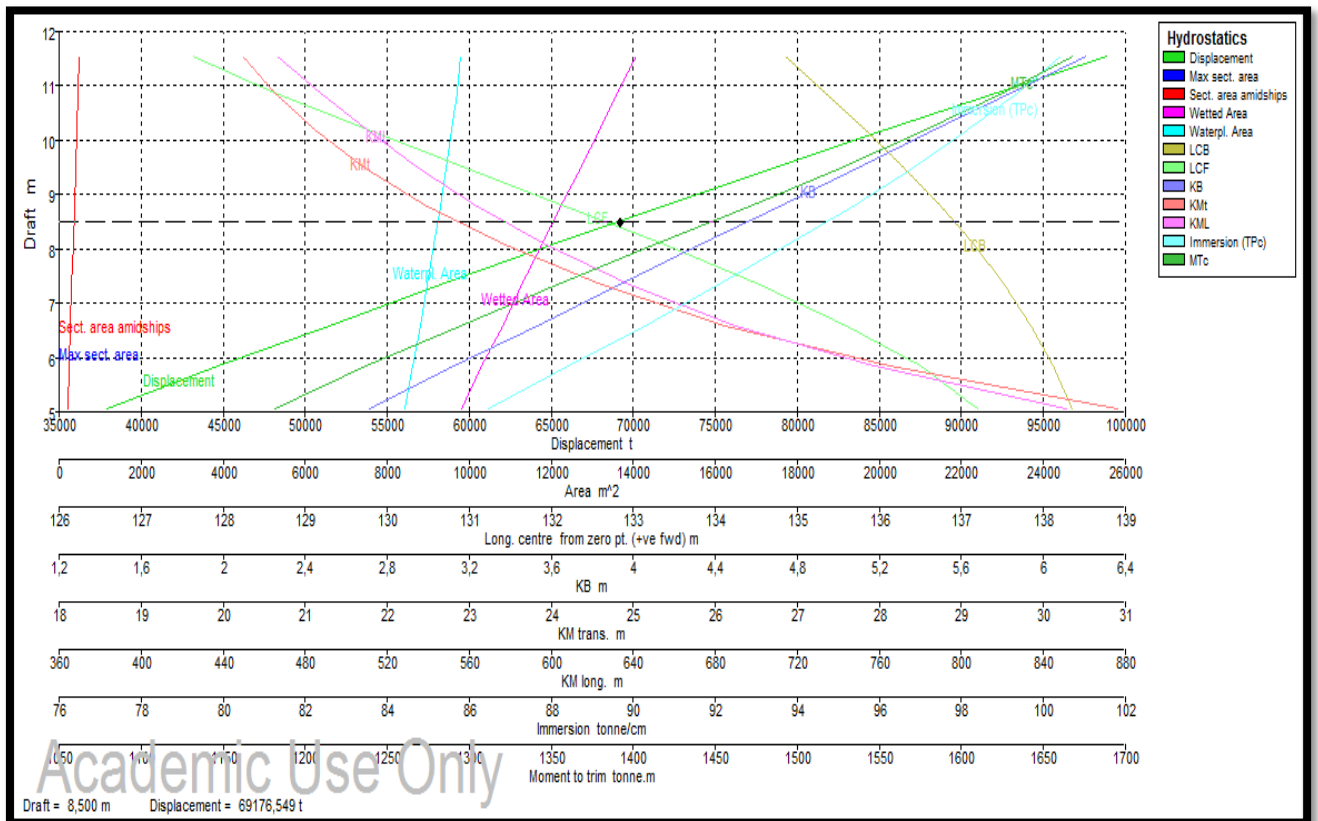
Las curvas hidrostáticas o curvas de carenas rectas son las curvas que reflejan el compartimiento de la carena del buque para distintos calados.

Vamos a calcular nuestras curvas hidrostáticas desde nuestro desplazamiento inicial (rosca) hasta nuestro desplazamiento final con un incremento en intervalos de 10 desplazamientos.

Haremos el cálculo para distintos asientos (aproantes y apopantes), desde asiento 0 hasta un 1,5 % de Lpp (4,05) con incrementos de 0,5.

A continuación se muestran tanto la tabla de valores como la gráfica de curvas hidrostáticas para asiento 0. El resto de cálculos los ajuntamos en el anexo.

	Draft Amidships m	5,058	5,833	6,591	7,334	8,064	8,781	9,486	10,181	10,867	11,546
1	Displacement t	37944	44721	51498	58275	65052	71829	78606	85383	92160	98937
2	Heel deg	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0
3	Draft at FP m	5,058	5,833	6,591	7,334	8,064	8,781	9,486	10,181	10,867	11,546
4	Draft at AP m	5,058	5,833	6,591	7,334	8,064	8,781	9,486	10,181	10,867	11,546
5	Draft at LCF m	5,058	5,833	6,591	7,334	8,064	8,781	9,486	10,181	10,867	11,546
6	Trim (+ve by stern) m	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000
7	WL Length m	270,006	270,762	271,433	272,033	272,531	272,924	273,150	272,965	272,060	271,295
8	Beam max extents on	43,113	43,141	43,163	43,173	43,182	43,186	43,189	43,192	43,194	43,196
9	Wetted Area m²	9815,91	10312,6	10805,3	11289,4	11765,8	12238,7	12705,8	13165,6	13618,0	14059,0
10	Waterpl. Area m²	8436,21	8626,89	8808,73	8982,31	9146,71	9301,87	9444,78	9575,84	9693,38	9797,42
11	Prismatic coeff. (Cp)	0,643	0,653	0,662	0,671	0,679	0,687	0,694	0,702	0,712	0,721
12	Block coeff. (Cb)	0,630	0,641	0,651	0,661	0,669	0,678	0,686	0,694	0,705	0,714
13	Max Sect. area coeff. (0,987	0,988	0,989	0,990	0,991	0,991	0,992	0,993	0,993	0,993
14	Waterpl. area coeff. (C	0,725	0,739	0,752	0,765	0,777	0,789	0,801	0,812	0,825	0,836
15	LCB from zero pt. (+ve	138,346	138,120	137,850	137,529	137,160	136,749	136,301	135,829	135,341	134,846
16	LCF from zero pt. (+ve	137,192	136,505	135,599	134,546	133,391	132,174	130,959	129,768	128,628	127,625
17	KB m	2,713	3,127	3,533	3,932	4,325	4,712	5,093	5,469	5,841	6,208
18	KG m	11,500	11,500	11,500	11,500	11,500	11,500	11,500	11,500	11,500	11,500
19	BMT m	28,185	24,993	22,584	20,679	19,107	17,775	16,638	15,654	14,792	14,026
20	BML m	848,499	754,359	686,087	634,113	592,916	559,204	530,098	504,551	481,405	460,098
21	GMT m	19,398	16,621	14,617	13,111	11,932	10,987	10,231	9,623	9,133	8,735
22	GML m	839,712	745,987	678,121	626,546	585,740	552,415	523,690	498,520	475,746	454,806
23	KMt m	30,898	28,121	26,117	24,611	23,432	22,487	21,731	21,123	20,633	20,235
24	KML m	851,212	757,487	689,621	638,046	597,240	563,915	535,190	510,020	487,246	466,306
25	Immersion (TPc) tonne/	86,471	88,426	90,290	92,069	93,754	95,344	96,809	98,152	99,357	100,424
26	MTc tonne.m	1181,38	1236,97	1294,83	1353,79	1412,81	1471,24	1526,33	1578,23	1625,68	1668,41
27	RM at 1deg = GMT Disp.	12845,8	12972,2	13137,2	13334,2	13546,1	13773,0	14035,0	14339,8	14689,9	15082,1
28	Max deck inclination de	0,0000	0,0000	0,0000	0,0000	0,0000	0,0000	0,0000	0,0000	0,0000	0,0000
29	Trim angle (+ve by ster	0,0000	0,0000	0,0000	0,0000	0,0000	0,0000	0,0000	0,0000	0,0000	0,0000



15-BIBLIOGRAFÍA

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-“Proyectos de Buques y Artefactos”, Fernando Junco Ocampo.

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-Reglamento Sociedad de Clasificación DNV

-CIG

-Diverso material web

ANEXO I

Catálogo del motor

3.6 Wärtsilä 16V50DF

Wärtsilä 16V50DF		DE IMO Tier 2		DE IMO Tier 2		ME IMO Tier 2	
		Gas mode	Diesel mode	Gas mode	Diesel mode	Gas mode	Diesel mode
Cylinder output	kW	950		975		975	
Engine speed	rpm	500		514		514	
Engine output	kW	15200		15600		15600	
Mean effective pressure	MPa	2.0		2.0		2.0	
Combustion air system (Note 1)							
Flow at 100% load	kg/s	24.5	30.1	24.4	30.0	24.4	29.1
Temperature at turbocharger intake, max.	°C	45		45		45	
Temperature after air cooler, nom. (TE 601)	°C	45	50	45	50	45	50
Exhaust gas system							
Flow at 100% load	kg/s	25.1	30.9	25.1	30.9	25.1	30.0
Flow at 75% load	kg/s	18.9	23.9	18.9	23.9	19.2	22.3
Flow at 50% load	kg/s	14.4	16.9	14.4	16.9	14.1	16.2
Temperature after turbocharger at 100% load (TE 517)	°C	373	343	373	343	369	350
Temperature after turbocharger at 75% load (TE 517)	°C	424	351	424	351	388	380
Temperature after turbocharger at 50% load (TE 517)	°C	426	385	426	385	390	370
Backpressure, max.	kPa	4		4		4	
Calculated exhaust diameter for 35 m/s	mm	1289	1397	1289	1397	1285	1384
Heat balance at 100% load (Note 2)							
Jacket water, HT-circuit	kW	1760	2723	1760	2723	1707	2880
Charge air, HT-circuit	kW	2240	3360	2240	3360	2293	3307
Charge air, LT-circuit	kW	1333	1680	1333	1680	1333	1627
Lubricating oil, LT-circuit	kW	1253	2080	1253	2080	1253	2187
Radiation	kW	427	480	427	480	560	613
Fuel consumption (Note 3)							
Total energy consumption at 100% load	kJ/kWh	7300	-	7300	-	7300	-
Total energy consumption at 75% load	kJ/kWh	7620	-	7620	-	7490	-
Total energy consumption at 50% load	kJ/kWh	8260	-	8260	-	7830	-
Fuel gas consumption at 100% load	kJ/kWh	7258	-	7258	-	7258	-
Fuel gas consumption at 75% load	kJ/kWh	7562	-	7562	-	7429	-
Fuel gas consumption at 50% load	kJ/kWh	8153	-	8153	-	7734	-
Fuel oil consumption at 100% load	g/kWh	1.0	189	1.0	189	1.0	190
Fuel oil consumption at 75% load	g/kWh	1.5	192	1.5	192	1.5	196
Fuel oil consumption 50% load	g/kWh	2.4	204	2.4	204	2.3	200
Fuel gas system (Note 4)							
Gas pressure at engine inlet, min (PT901)	kPa (a)	472	-	472	-	472	-
Gas pressure to Gas Valve unit, min	kPa (a)	592	-	592	-	592	-
Gas temperature before Gas Valve Unit	°C	0...60	-	0...60	-	0...60	-
Fuel oil system							
Pressure before injection pumps (PT 101)	kPa	800±50		800±50		800±50	
Fuel oil flow to engine, approx	m³/h	16.2		16.6		16.7	
HFO viscosity before the engine	cSt	-	16...24	-	16...24	-	16...24
Max. HFO temperature before engine (TE 101)	°C	-	140	-	140	-	140
MDF viscosity, min.	cSt	2.0		2.0		2.0	
Max. MDF temperature before engine (TE 101)	°C	45		45		45	
Leak fuel quantity (HFO), clean fuel at 100% load	kg/h	-	12.1	-	12.1	-	12.4
Leak fuel quantity (MDF), clean fuel at 100% load	kg/h	32.1	60.3	32.1	60.3	31.1	62.2
Pilot fuel (MDF) viscosity before the engine	cSt	2...11		2...11		2...11	
Pilot fuel pressure at engine inlet (PT 112)	kPa	400...800		400...800		400...800	
Pilot fuel pressure drop after engine, max	kPa	150		150		150	
Pilot fuel return flow at 100% load	kg/h	317		317		317	
Lubricating oil system (Note 5)							
Pressure before bearings, nom. (PT 201)	kPa	400		400		400	
Pressure after pump, max.	kPa	800		800		800	
Suction ability, including pipe loss, max.	kPa	40		40		40	
Priming pressure, nom. (PT 201)	kPa	80		80		80	
Temperature before bearings, nom. (TE 201)	°C	63		63		63	
Temperature after engine, approx.	°C	78		78		78	
Pump capacity (main), engine driven	m³/h	263		272		279	

Wärtsilä 16V50DF		DE		DE		ME	
		IMO Tier 2		IMO Tier 2		IMO Tier 2	
		Gas mode	Diesel mode	Gas mode	Diesel mode	Gas mode	Diesel mode
Cylinder output	kW	950		975		975	
Engine speed	rpm	500		514		514	
Pump capacity (main), electrically driven	m ³ /h	260		260		260	
Oil flow through engine	m ³ /h	230		230		230	
Priming pump capacity (50/60Hz)	m ³ /h	85.0 / 85.0		85.0 / 85.0		85.0 / 85.0	
Oil volume in separate system oil tank	m ³	22		22		22	
Oil consumption at 100% load, approx.	g/kWh	0.5		0.5		0.5	
Crankcase ventilation flow rate at full load	l/min	3600		3600		3600	
Crankcase volume	m ³	39.4		39.4		39.4	
Crankcase ventilation backpressure, max.	Pa	500		500		500	
Oil volume in turning device	l	68.0...70.0		68.0...70.0		68.0...70.0	
Oil volume in speed governor	l	6.2		6.2		6.2	
HT cooling water system							
Pressure at engine, after pump, nom. (PT 401)	kPa	250 + static		250 + static		250 + static	
Pressure at engine, after pump, max. (PT 401)	kPa	480		480		480	
Temperature before cylinders, approx. (TE 401)	°C	74		74		74	
Temperature after charge air cooler, nom.	°C	91		91		91	
Capacity of engine driven pump, nom.	m ³ /h	355		355		355	
Pressure drop over engine, total	kPa	50		50		50	
Pressure drop in external system, max.	kPa	150		150		150	
Pressure from expansion tank	kPa	70...150		70...150		70...150	
Water volume in engine	m ³	2.1		2.1		2.1	
LT cooling water system							
Pressure at engine, after pump, nom. (PT 471)	kPa	250+ static		250+ static		250+ static	
Pressure at engine, after pump, max. (PT 471)	kPa	440		440		440	
Temperature before engine, max. (TE 471)	°C	38		38		38	
Temperature before engine, min. (TE 471)	°C	25		25		25	
Capacity of engine driven pump, nom.	m ³ /h	355		355		355	
Pressure drop over charge air cooler	kPa	30		30		30	
Pressure drop in external system, max.	kPa	200		200		200	
Pressure from expansion tank	kPa	70...150		70...150		70...150	
Starting air system (Note 6)							
Pressure, nom. (PT 301)	kPa	3000		3000		3000	
Pressure at engine during start, min. (20 °C)	kPa	1000		1000		1000	
Pressure, max. (PT 301)	kPa	3000		3000		3000	
Low pressure limit in starting air vessel	kPa	1800		1800		1800	
Consumption per start at 20 °C (successful start)	Nm ³	7.8		7.8		7.8	
Consumption per start at 20 °C (with slowturn)	Nm ³	9.4		9.4		9.4	

Notes:

- Note 1 At Gas LHV 49620kJ/kg
- Note 2 At 100% output and nominal speed. The figures are valid for ambient conditions according to ISO 15550, except for LT-water temperature, which is 35°C in gas operation and 45°C in back-up fuel operation. And with engine driven water, lube oil and pilot fuel pumps.
- Note 3 According to ISO 15550, lower calorific value 42700 kJ/kg, with engine driven pumps (two cooling water + one lubricating oil pumps). Tolerance 5%. Gas Lower heating value >28 MJ/m³N and Methane Number High (>80). The fuel consumption BSEC and SFOC are guaranteed at 100% load and the values at other loads are given for indication only.
- Note 4 Fuel gas pressure given at LHV ≥ 36MJ/m³N. Required fuel gas pressure depends on fuel gas LHV and need to be increased for lower LHV's. Pressure drop in external fuel gas system to be considered. See chapter Fuel system for further information.
- Note 5 Lubricating oil treatment losses and oil changes are not included in oil consumption. The lubricating oil volume of the governor is depending of the governor type.
- Note 6 At manual starting the consumption may be 2...3 times lower.

ME = Engine driving propeller, variable speed

DE = Diesel-Electric engine driving generator

Subject to revision without notice.

3.7 Wärtsilä 18V50DF

Wärtsilä 18V50DF		DE IMO Tier 2		DE IMO Tier 2	
		Gas mode	Diesel mode	Gas mode	Diesel mode
Cylinder output	kW	950		975	
Engine speed	rpm	500		514	
Engine output	kW	17100		17550	
Mean effective pressure	MPa	2.0		2.0	
Combustion air system (Note 1)					
Flow at 100% load	kg/s	27.5	33.8	27.5	33.7
Temperature at turbocharger intake, max.	°C	45		45	
Temperature after air cooler, nom. (TE 601)	°C	45	50	45	50
Exhaust gas system					
Flow at 100% load	kg/s	28.2	34.7	28.2	34.7
Flow at 75% load	kg/s	21.3	26.9	21.3	26.9
Flow at 50% load	kg/s	16.2	19.0	16.2	19.0
Temperature after turbocharger at 100% load (TE 517)	°C	373	343	373	343
Temperature after turbocharger at 75% load (TE 517)	°C	424	351	424	351
Temperature after turbocharger at 50% load (TE 517)	°C	426	385	426	385
Backpressure, max.	kPa	4		4	
Calculated exhaust diameter for 35 m/s	mm	1366	1480	1366	1480
Heat balance at 100% load (Note 2)					
Jacket water, HT-circuit	kW	1980	3120	1980	3120
Charge air, HT-circuit	kW	2520	3780	2520	3780
Charge air, LT-circuit	kW	1500	1890	1500	1890
Lubricating oil, LT-circuit	kW	1410	2340	1410	2340
Radiation	kW	480	540	480	540
Fuel consumption (Note 3)					
Total energy consumption at 100% load	kJ/kWh	7300	-	7300	-
Total energy consumption at 75% load	kJ/kWh	7620	-	7620	-
Total energy consumption at 50% load	kJ/kWh	8260	-	8260	-
Fuel gas consumption at 100% load	kJ/kWh	7258	-	7258	-
Fuel gas consumption at 75% load	kJ/kWh	7562	-	7562	-
Fuel gas consumption at 50% load	kJ/kWh	8153	-	8153	-
Fuel oil consumption at 100% load	g/kWh	1.0	189	1.0	189
Fuel oil consumption at 75% load	g/kWh	1.5	192	1.5	192
Fuel oil consumption 50% load	g/kWh	2.4	204	2.4	204
Fuel gas system (Note 4)					
Gas pressure at engine inlet, min (PT901)	kPa (a)	472	-	472	-
Gas pressure to Gas Valve unit, min	kPa (a)	592	-	592	-
Gas temperature before Gas Valve Unit	°C	0...60	-	0...60	-
Fuel oil system					
Pressure before injection pumps (PT 101)	kPa	800±50		800±50	
Fuel oil flow to engine, approx	m³/h	18.2		18.7	
HFO viscosity before the engine	cSt	-	16...24	-	16...24
Max. HFO temperature before engine (TE 101)	°C	-	140	-	140
MDF viscosity, min.	cSt	2.0		2.0	
Max. MDF temperature before engine (TE 101)	°C	45		45	
Leak fuel quantity (HFO), clean fuel at 100% load	kg/h	-	13.6	-	13.6
Leak fuel quantity (MDF), clean fuel at 100% load	kg/h	36.1	68.0	36.1	68.0
Pilot fuel (MDF) viscosity before the engine	cSt	2...11		2...11	
Pilot fuel pressure at engine inlet (PT 112)	kPa	400...800		400...800	
Pilot fuel pressure drop after engine, max	kPa	150		150	
Pilot fuel return flow at 100% load	kg/h	325		325	
Lubricating oil system (Note 5)					
Pressure before bearings, nom. (PT 201)	kPa	400		400	
Pressure after pump, max.	kPa	800		800	
Suction ability, including pipe loss, max.	kPa	40		40	
Priming pressure, nom. (PT 201)	kPa	80		80	
Temperature before bearings, nom. (TE 201)	°C	63		63	
Temperature after engine, approx.	°C	78		78	
Pump capacity (main), engine-driven	m³/h	335		345	

Wärtsilä 18V50DF		DE IMO Tier 2		DE IMO Tier 2	
		Gas mode	Diesel mode	Gas mode	Diesel mode
Cylinder output	kW	950		975	
Engine speed	rpm	500		514	
Pump capacity (main), electrically driven	m ³ /h	335		335	
Oil flow through engine	m ³ /h	260		260	
Priming pump capacity (50/60Hz)	m ³ /h	100.0 / 100.0		100.0 / 100.0	
Oil volume in separate system oil tank	m ³	25		25	
Oil consumption at 100% load, approx.	g/kWh	0.5		0.5	
Crankcase ventilation flow rate at full load	l/min	4200		4200	
Crankcase volume	m ³	44.3		44.3	
Crankcase ventilation backpressure, max.	Pa	500		500	
Oil volume in turning device	l	68.0...70.0		68.0...70.0	
Oil volume in speed governor	l	6.2		6.2	
HT cooling water system					
Pressure at engine, after pump, nom. (PT 401)	kPa	250 + static		250 + static	
Pressure at engine, after pump, max. (PT 401)	kPa	480		480	
Temperature before cylinders, approx. (TE 401)	°C	74		74	
Temperature after charge air cooler, nom.	°C	91		91	
Capacity of engine driven pump, nom.	m ³ /h	400		400	
Pressure drop over engine, total	kPa	50		50	
Pressure drop in external system, max.	kPa	150		150	
Pressure from expansion tank	kPa	70...150		70...150	
Water volume in engine	m ³	2.6		2.6	
LT cooling water system					
Pressure at engine, after pump, nom. (PT 471)	kPa	250+ static		250+ static	
Pressure at engine, after pump, max. (PT 471)	kPa	440		440	
Temperature before engine, max. (TE 471)	°C	45		45	
Temperature before engine, min. (TE 471)	°C	25		25	
Capacity of engine driven pump, nom.	m ³ /h	400		200	
Pressure drop over charge air cooler	kPa	30		30	
Pressure drop in external system, max.	kPa	200		200	
Pressure from expansion tank	kPa	70...150		70...150	
Starting air system (Note 6)					
Pressure, nom. (PT 301)	kPa	3000		3000	
Pressure at engine during start, min. (20 °C)	kPa	1000		1000	
Pressure, max. (PT 301)	kPa	3000		3000	
Low pressure limit in starting air vessel	kPa	1800		1800	
Consumption per start at 20 °C (successful start)	Nm ³	9.0		9.0	
Consumption per start at 20 °C (with slowturn)	Nm ³	10.8		10.8	

Notes:

- Note 1 At Gas LHV 49620kJ/kg
- Note 2 At 100% output and nominal speed. The figures are valid for ambient conditions according to ISO 15550, except for LT-water temperature, which is 35°C in gas operation and 45°C in back-up fuel operation. And with engine driven water, lube oil and pilot fuel pumps.
- Note 3 According to ISO 15550, lower calorific value 42700 kJ/kg, with engine driven pumps (two cooling water + one lubricating oil pumps). Tolerance 5%. Gas Lower heating value >28 MJ/m³N and Methane Number High (>80). The fuel consumption BSEC and SFOC are guaranteed at 100% load and the values at other loads are given for indication only.
- Note 4 Fuel gas pressure given at LHV ≥ 36MJ/m³N. Required fuel gas pressure depends on fuel gas LHV and need to be increased for lower LHV's. Pressure drop in external fuel gas system to be considered. See chapter Fuel system for further information.
- Note 5 Lubricating oil treatment losses and oil changes are not included in oil consumption. The lubricating oil volume of the governor is depending of the governor type.
- Note 6 At manual starting the consumption may be 2...3 times lower.

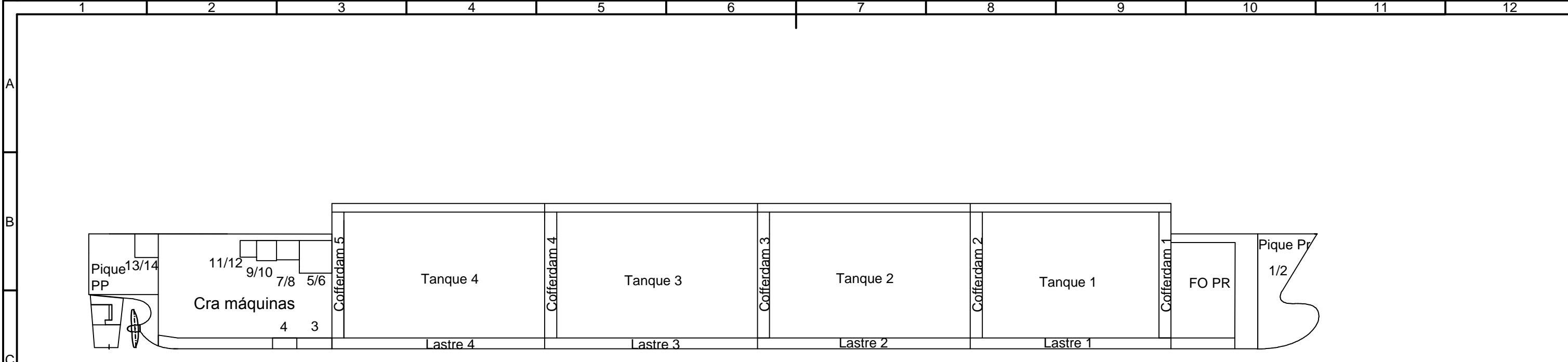
ME = Engine driving propeller, variable speed

DE = Diesel-Electric engine driving generator

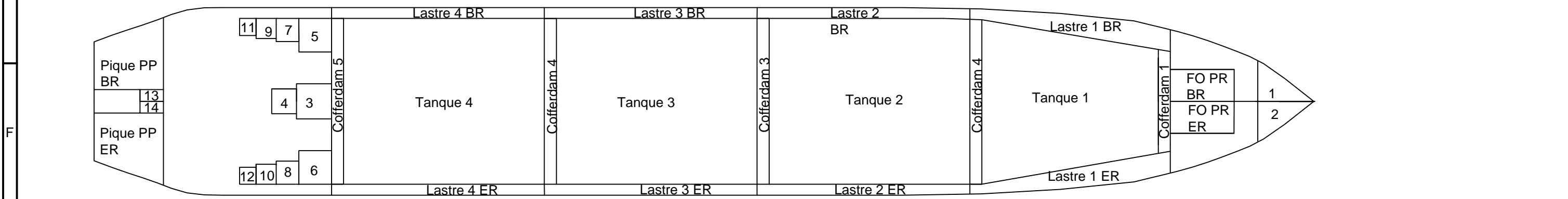
Subject to revision without notice.

ANEXO II

Plano de compartimentado



- 1-Pique PR BR
- 2-Pique PR ER
- 3-Aguas grises
- 4-Lodos
- 5-Diesel BR
- 6-Diesel ER
- 7-FO Sed. BR
- 8-FO Sed. ER
- 9-FO UD BR
- 10-FO UD ER
- 11-Aceite BR
- 12-Aceite ER
- 13-Agua dulce BR
- 14-Agua dulce ER



 UNIVERSIDADE DA CORUÑA ESCOLA POLITÉCNICA SUPERIOR	PROYECTO: 15 105 P	
	PLANO DE COMPARTIMENTADO	
AUTOR: ISMAEL GRANDAL MOURIZ		ESCALA 1:900

PRODUCIDO POR UN PRODUCTO EDUCATIVO DE AUTODESK

PRODUCIDO POR UN PRODUCTO EDUCATIVO DE AUTODESK

ANEXO III

Tablas de capacidades tanques

Tank Calibrations - TANQUES BUENOS

Stability 20.00.04.9, build: 9

Tank Calibrations - Pique PP BR

Fluid Type = Water Ballast Specific gravity = 1,025

Permeability = 97 %

Trim = 0 m (+ve by stern); Heel = 0 deg to starboard

Tank Name	Sounding m	Ullage m	% Full	Capacity m ³	Capacity tonne	LCG m	TCG m	VCG m	FSM tonne.m
Pique PP BR	14,450	0,000	100,000	2638,019	2703,969	3,809	-8,973	19,875	0,000
	14,250	0,200	98,409	2596,038	2660,939	3,815	-8,967	19,773	3317,248
	14,199	0,251	98,000	2585,258	2649,890	3,816	-8,965	19,746	3317,167
	14,186	0,264	97,900	2582,620	2647,186	3,817	-8,965	19,740	3317,147
	13,500	0,950	92,441	2438,622	2499,587	3,838	-8,942	19,388	3316,070
	12,750	1,700	86,475	2281,233	2338,264	3,864	-8,915	19,003	3313,936
	12,000	2,450	80,512	2123,912	2177,010	3,893	-8,883	18,616	3309,051
	11,250	3,200	74,552	1966,694	2015,862	3,928	-8,846	18,228	3302,542
	10,500	3,950	68,598	1809,637	1854,878	3,968	-8,804	17,838	3291,589
	9,750	4,700	62,653	1652,807	1694,127	4,015	-8,754	17,445	3277,675
	9,000	5,450	56,720	1496,296	1533,703	4,070	-8,696	17,050	3257,120
	8,250	6,200	50,804	1340,218	1373,724	4,138	-8,626	16,651	3230,194
	7,500	6,950	44,912	1184,774	1214,394	4,222	-8,541	16,247	3193,885
	6,750	7,700	39,054	1030,258	1056,014	4,326	-8,437	15,838	3140,348
	6,000	8,450	33,256	877,291	899,223	4,460	-8,308	15,422	3029,729
	5,250	9,200	27,564	727,156	745,334	4,637	-8,151	14,997	2859,517
	4,500	9,950	22,038	581,358	595,892	4,877	-7,962	14,563	2642,074
	3,750	10,700	16,757	442,047	453,099	5,211	-7,737	14,118	2376,546
	3,000	11,450	11,842	312,401	320,211	5,691	-7,477	13,656	2068,990
	2,250	12,200	7,513	198,199	203,153	6,399	-7,229	13,177	1658,511
	1,500	12,950	4,048	106,779	109,449	7,351	-7,070	12,693	1274,048
	0,750	13,700	1,655	43,648	44,740	7,907	-6,787	12,250	705,703
	0,487	13,963	1,000	26,380	27,040	8,033	-6,649	12,105	564,546
	0,000	14,450	0,000	0,000	0,000	8,257	-6,379	11,850	0,000

Tank Calibrations - Pique PP ER

Fluid Type = Water Ballast Specific gravity = 1,025
 Permeability = 97 %
 Trim = 0 m (+ve by stern); Heel = 0 deg to starboard

Tank Name	Sounding m	Ullage m	% Full	Capacity m ³	Capacity tonne	LCG m	TCG m	VCG m	FSM tonne.m
Pique PP ER	14,450	0,000	100,000	2638,050	2704,001	3,809	8,973	19,875	0,000
	14,250	0,200	98,409	2596,068	2660,970	3,815	8,967	19,773	3317,420
	14,199	0,251	98,000	2585,289	2649,921	3,816	8,966	19,746	3317,339
	14,186	0,264	97,900	2582,651	2647,217	3,817	8,965	19,740	3317,319
	13,500	0,950	92,441	2438,650	2499,616	3,838	8,943	19,388	3316,241
	12,750	1,700	86,475	2281,259	2338,290	3,864	8,915	19,003	3314,108
	12,000	2,450	80,512	2123,935	2177,034	3,893	8,883	18,616	3309,223
	11,250	3,200	74,552	1966,716	2015,883	3,928	8,846	18,228	3302,714
	10,500	3,950	68,598	1809,656	1854,898	3,968	8,804	17,838	3291,762
	9,750	4,700	62,653	1652,824	1694,144	4,015	8,754	17,445	3277,848
	9,000	5,450	56,720	1496,310	1533,718	4,070	8,696	17,050	3257,294
	8,250	6,200	50,804	1340,230	1373,736	4,138	8,626	16,651	3230,368
	7,500	6,950	44,911	1184,784	1214,404	4,222	8,541	16,247	3194,061
	6,750	7,700	39,054	1030,265	1056,022	4,326	8,437	15,838	3140,526
	6,000	8,450	33,256	877,297	899,229	4,460	8,308	15,422	3029,834
	5,250	9,200	27,564	727,160	745,339	4,637	8,151	14,997	2859,625
	4,500	9,950	22,038	581,361	595,895	4,877	7,962	14,563	2642,188
	3,750	10,700	16,757	442,049	453,101	5,211	7,737	14,118	2376,668
	3,000	11,450	11,842	312,402	320,212	5,691	7,477	13,656	2069,030
	2,250	12,200	7,513	198,199	203,154	6,399	7,229	13,177	1658,557
	1,500	12,950	4,048	106,779	109,449	7,351	7,070	12,693	1274,097
	0,750	13,700	1,655	43,648	44,740	7,907	6,787	12,250	705,703
	0,487	13,963	1,000	26,381	27,040	8,033	6,649	12,105	564,549
	0,000	14,450	0,000	0,000	0,000	8,257	6,379	11,850	0,000

Tank Calibrations - Agua dulce BR

Fluid Type = Fresh Water Specific gravity = 1
 Permeability = 97 %
 Trim = 0 m (+ve by stern); Heel = 0 deg to starboard

Tank Name	Sounding m	Ullage m	% Full	Capacity m ³	Capacity tonne	LCG m	TCG m	VCG m	FSM tonne.m
Agua dulce BR	5,410	0,000	100,000	76,795	76,795	8,655	-1,352	23,595	0,000
	5,302	0,108	98,000	75,259	75,259	8,655	-1,352	23,541	8,923
	5,296	0,114	97,900	75,182	75,182	8,655	-1,352	23,538	8,923
	5,250	0,160	97,043	74,524	74,524	8,655	-1,352	23,515	8,923
	5,000	0,410	92,421	70,975	70,975	8,655	-1,352	23,390	8,923
	4,750	0,660	87,800	67,426	67,426	8,655	-1,352	23,265	8,923
	4,500	0,910	83,179	63,878	63,878	8,655	-1,352	23,140	8,923
	4,250	1,160	78,558	60,329	60,329	8,655	-1,352	23,015	8,923
	4,000	1,410	73,937	56,780	56,780	8,655	-1,352	22,890	8,923
	3,750	1,660	69,316	53,231	53,231	8,655	-1,352	22,765	8,923
	3,500	1,910	64,695	49,683	49,683	8,655	-1,352	22,640	8,923
	3,250	2,160	60,074	46,134	46,134	8,655	-1,352	22,515	8,923
	3,000	2,410	55,453	42,585	42,585	8,655	-1,352	22,390	8,923
	2,750	2,660	50,832	39,036	39,036	8,655	-1,352	22,265	8,923
	2,500	2,910	46,211	35,488	35,488	8,655	-1,352	22,140	8,923
	2,250	3,160	41,590	31,939	31,939	8,655	-1,352	22,015	8,923
	2,000	3,410	36,969	28,390	28,390	8,655	-1,352	21,890	8,923
	1,750	3,660	32,348	24,841	24,841	8,655	-1,352	21,765	8,923
	1,500	3,910	27,726	21,293	21,293	8,655	-1,352	21,640	8,923
	1,250	4,160	23,105	17,744	17,744	8,655	-1,352	21,515	8,923
	1,000	4,410	18,484	14,195	14,195	8,655	-1,352	21,390	8,923
	0,750	4,660	13,863	10,646	10,646	8,655	-1,352	21,265	8,923
	0,500	4,910	9,242	7,098	7,098	8,655	-1,352	21,140	8,923
	0,250	5,160	4,621	3,549	3,549	8,655	-1,352	21,015	8,923
	0,054	5,356	1,000	0,768	0,768	8,655	-1,352	20,917	8,923
	0,000	5,410	0,000	0,000	0,000	8,655	-1,352	20,890	0,000

Tank Calibrations - Agua dulce ER

Fluid Type = Fresh Water Specific gravity = 1
 Permeability = 97 %
 Trim = 0 m (+ve by stern); Heel = 0 deg to starboard

Tank Name	Sounding m	Ullage m	% Full	Capacity m ³	Capacity tonne	LCG m	TCG m	VCG m	FSM tonne.m
Agua dulce ER	5,410	0,000	100,000	76,795	76,795	8,655	1,352	23,595	0,000
	5,302	0,108	98,000	75,259	75,259	8,655	1,352	23,541	8,923
	5,296	0,114	97,900	75,182	75,182	8,655	1,352	23,538	8,923
	5,250	0,160	97,043	74,524	74,524	8,655	1,352	23,515	8,923
	5,000	0,410	92,421	70,975	70,975	8,655	1,352	23,390	8,923
	4,750	0,660	87,800	67,426	67,426	8,655	1,352	23,265	8,923
	4,500	0,910	83,179	63,878	63,878	8,655	1,352	23,140	8,923
	4,250	1,160	78,558	60,329	60,329	8,655	1,352	23,015	8,923
	4,000	1,410	73,937	56,780	56,780	8,655	1,352	22,890	8,923
	3,750	1,660	69,316	53,231	53,231	8,655	1,352	22,765	8,923
	3,500	1,910	64,695	49,683	49,683	8,655	1,352	22,640	8,923
	3,250	2,160	60,074	46,134	46,134	8,655	1,352	22,515	8,923
	3,000	2,410	55,453	42,585	42,585	8,655	1,352	22,390	8,923
	2,750	2,660	50,832	39,036	39,036	8,655	1,352	22,265	8,923
	2,500	2,910	46,211	35,488	35,488	8,655	1,352	22,140	8,923
	2,250	3,160	41,590	31,939	31,939	8,655	1,352	22,015	8,923
	2,000	3,410	36,969	28,390	28,390	8,655	1,352	21,890	8,923
	1,750	3,660	32,348	24,841	24,841	8,655	1,352	21,765	8,923
	1,500	3,910	27,726	21,293	21,293	8,655	1,352	21,640	8,923
	1,250	4,160	23,105	17,744	17,744	8,655	1,352	21,515	8,923
	1,000	4,410	18,484	14,195	14,195	8,655	1,352	21,390	8,923
	0,750	4,660	13,863	10,646	10,646	8,655	1,352	21,265	8,923
	0,500	4,910	9,242	7,098	7,098	8,655	1,352	21,140	8,923
	0,250	5,160	4,621	3,549	3,549	8,655	1,352	21,015	8,923
	0,054	5,356	1,000	0,768	0,768	8,655	1,352	20,917	8,923
	0,000	5,410	0,000	0,000	0,000	8,655	1,352	20,890	0,000

Tank Calibrations - Aceite BR

Fluid Type = Specific gravity = 0,9
 Permeability = 97 %
 Trim = 0 m (+ve by stern); Heel = 0 deg to starboard

Tank Name	Sounding m	Ullage m	% Full	Capacity m ³	Capacity tonne	LCG m	TCG m	VCG m	FSM tonne.m
Aceite BR	3,800	0,000	100,000	54,908	49,417	32,095	-17,140	22,900	0,000
	3,724	0,076	98,000	53,810	48,429	32,095	-17,140	22,862	17,168
	3,720	0,080	97,900	53,755	48,379	32,095	-17,140	22,860	17,168
	3,600	0,200	94,737	52,018	46,816	32,095	-17,140	22,800	17,168
	3,400	0,400	89,474	49,128	44,215	32,095	-17,140	22,700	17,168
	3,200	0,600	84,211	46,238	41,615	32,095	-17,140	22,600	17,168
	3,000	0,800	78,947	43,348	39,014	32,095	-17,140	22,500	17,168
	2,800	1,000	73,684	40,459	36,413	32,095	-17,140	22,400	17,168
	2,600	1,200	68,421	37,569	33,812	32,095	-17,140	22,300	17,168
	2,400	1,400	63,158	34,679	31,211	32,095	-17,140	22,200	17,168
	2,200	1,600	57,895	31,789	28,610	32,095	-17,140	22,100	17,168
	2,000	1,800	52,632	28,899	26,009	32,095	-17,140	22,000	17,168
	1,800	2,000	47,368	26,009	23,408	32,095	-17,140	21,900	17,168
	1,600	2,200	42,105	23,119	20,807	32,095	-17,140	21,800	17,168
	1,400	2,400	36,842	20,229	18,206	32,095	-17,140	21,700	17,168
	1,200	2,600	31,579	17,339	15,605	32,095	-17,140	21,600	17,168
	1,000	2,800	26,316	14,449	13,005	32,095	-17,140	21,500	17,168
	0,800	3,000	21,053	11,560	10,404	32,095	-17,140	21,400	17,168
	0,600	3,200	15,789	8,670	7,803	32,095	-17,140	21,300	17,168
	0,400	3,400	10,526	5,780	5,202	32,095	-17,140	21,200	17,168
	0,200	3,600	5,263	2,890	2,601	32,095	-17,140	21,100	17,168
	0,038	3,762	1,000	0,549	0,494	32,095	-17,140	21,019	17,168
	0,000	3,800	0,000	0,000	0,000	32,095	-17,140	21,000	0,000

Tank Calibrations - Aceite ER

Fluid Type = Specific gravity = 0,9
 Permeability = 97 %
 Trim = 0 m (+ve by stern); Heel = 0 deg to starboard

Tank Name	Sounding m	Ullage m	% Full	Capacity m ³	Capacity tonne	LCG m	TCG m	VCG m	FSM tonne.m
Aceite ER	3,800	0,000	100,000	54,908	49,417	32,095	17,140	22,900	0,000
	3,724	0,076	98,000	53,810	48,429	32,095	17,140	22,862	17,168
	3,720	0,080	97,900	53,755	48,379	32,095	17,140	22,860	17,168
	3,600	0,200	94,737	52,018	46,816	32,095	17,140	22,800	17,168
	3,400	0,400	89,474	49,128	44,215	32,095	17,140	22,700	17,168
	3,200	0,600	84,211	46,238	41,615	32,095	17,140	22,600	17,168
	3,000	0,800	78,947	43,348	39,014	32,095	17,140	22,500	17,168
	2,800	1,000	73,684	40,459	36,413	32,095	17,140	22,400	17,168
	2,600	1,200	68,421	37,569	33,812	32,095	17,140	22,300	17,168
	2,400	1,400	63,158	34,679	31,211	32,095	17,140	22,200	17,168
	2,200	1,600	57,895	31,789	28,610	32,095	17,140	22,100	17,168
	2,000	1,800	52,632	28,899	26,009	32,095	17,140	22,000	17,168
	1,800	2,000	47,368	26,009	23,408	32,095	17,140	21,900	17,168
	1,600	2,200	42,105	23,119	20,807	32,095	17,140	21,800	17,168
	1,400	2,400	36,842	20,229	18,206	32,095	17,140	21,700	17,168
	1,200	2,600	31,579	17,339	15,605	32,095	17,140	21,600	17,168
	1,000	2,800	26,316	14,449	13,005	32,095	17,140	21,500	17,168
	0,800	3,000	21,053	11,560	10,404	32,095	17,140	21,400	17,168
	0,600	3,200	15,789	8,670	7,803	32,095	17,140	21,300	17,168
	0,400	3,400	10,526	5,780	5,202	32,095	17,140	21,200	17,168
	0,200	3,600	5,263	2,890	2,601	32,095	17,140	21,100	17,168
	0,038	3,762	1,000	0,549	0,494	32,095	17,140	21,019	17,168
	0,000	3,800	0,000	0,000	0,000	32,095	17,140	21,000	0,000

Tank Calibrations - FO UD BR

Fluid Type = Specific gravity = 0,97
 Permeability = 97 %
 Trim = 0 m (+ve by stern); Heel = 0 deg to starboard

Tank Name	Sounding m	Ullage m	% Full	Capacity m ³	Capacity tonne	LCG m	TCG m	VCG m	FSM tonne.m
FO UD BR	4,620	0,000	100,000	95,653	92,783	36,305	-16,790	22,490	0,000
	4,600	0,020	99,567	95,239	92,382	36,305	-16,790	22,480	36,826
	4,528	0,092	98,000	93,740	90,928	36,305	-16,790	22,444	36,826
	4,523	0,097	97,900	93,644	90,835	36,305	-16,790	22,441	36,826
	4,400	0,220	95,238	91,098	88,365	36,305	-16,790	22,380	36,826
	4,200	0,420	90,909	86,957	84,348	36,305	-16,790	22,280	36,826
	4,000	0,620	86,580	82,816	80,332	36,305	-16,790	22,180	36,826
	3,800	0,820	82,251	78,676	76,315	36,305	-16,790	22,080	36,826
	3,600	1,020	77,922	74,535	72,299	36,305	-16,790	21,980	36,826
	3,400	1,220	73,593	70,394	68,282	36,305	-16,790	21,880	36,826
	3,200	1,420	69,264	66,253	64,265	36,305	-16,790	21,780	36,826
	3,000	1,620	64,935	62,112	60,249	36,305	-16,790	21,680	36,826
	2,800	1,820	60,606	57,971	56,232	36,305	-16,790	21,580	36,826
	2,600	2,020	56,277	53,831	52,216	36,305	-16,790	21,480	36,826
	2,400	2,220	51,948	49,690	48,199	36,305	-16,790	21,380	36,826
	2,200	2,420	47,619	45,549	44,183	36,305	-16,790	21,280	36,826
	2,000	2,620	43,290	41,408	40,166	36,305	-16,790	21,180	36,826
	1,800	2,820	38,961	37,267	36,149	36,305	-16,790	21,080	36,826
	1,600	3,020	34,632	33,127	32,133	36,305	-16,790	20,980	36,826
	1,400	3,220	30,303	28,986	28,116	36,305	-16,790	20,880	36,826
	1,200	3,420	25,974	24,845	24,100	36,305	-16,790	20,780	36,826
	1,000	3,620	21,645	20,704	20,083	36,305	-16,790	20,680	36,826
	0,800	3,820	17,316	16,563	16,066	36,305	-16,790	20,580	36,826
	0,600	4,020	12,987	12,422	12,050	36,305	-16,790	20,480	36,826
	0,400	4,220	8,658	8,282	8,033	36,305	-16,790	20,380	36,826
	0,200	4,420	4,329	4,141	4,017	36,305	-16,790	20,280	36,826
	0,046	4,574	1,000	0,957	0,928	36,305	-16,790	20,203	36,826
	0,000	4,620	0,000	0,000	0,000	36,305	-16,790	20,180	0,000

Tank Calibrations - FO UD ER

Fluid Type = Specific gravity = 0,97
 Permeability = 97 %
 Trim = 0 m (+ve by stern); Heel = 0 deg to starboard

Tank Name	Sounding m	Ullage m	% Full	Capacity m ³	Capacity tonne	LCG m	TCG m	VCG m	FSM tonne.m
FO UD ER	4,620	0,000	100,000	95,653	92,783	36,305	16,790	22,490	0,000
	4,600	0,020	99,567	95,239	92,382	36,305	16,790	22,480	36,826
	4,528	0,092	98,000	93,740	90,928	36,305	16,790	22,444	36,826
	4,523	0,097	97,900	93,644	90,835	36,305	16,790	22,441	36,826
	4,400	0,220	95,238	91,098	88,365	36,305	16,790	22,380	36,826
	4,200	0,420	90,909	86,957	84,348	36,305	16,790	22,280	36,826
	4,000	0,620	86,580	82,816	80,332	36,305	16,790	22,180	36,826
	3,800	0,820	82,251	78,676	76,315	36,305	16,790	22,080	36,826
	3,600	1,020	77,922	74,535	72,299	36,305	16,790	21,980	36,826
	3,400	1,220	73,593	70,394	68,282	36,305	16,790	21,880	36,826
	3,200	1,420	69,264	66,253	64,265	36,305	16,790	21,780	36,826
	3,000	1,620	64,935	62,112	60,249	36,305	16,790	21,680	36,826
	2,800	1,820	60,606	57,971	56,232	36,305	16,790	21,580	36,826
	2,600	2,020	56,277	53,831	52,216	36,305	16,790	21,480	36,826
	2,400	2,220	51,948	49,690	48,199	36,305	16,790	21,380	36,826
	2,200	2,420	47,619	45,549	44,183	36,305	16,790	21,280	36,826
	2,000	2,620	43,290	41,408	40,166	36,305	16,790	21,180	36,826
	1,800	2,820	38,961	37,267	36,149	36,305	16,790	21,080	36,826
	1,600	3,020	34,632	33,127	32,133	36,305	16,790	20,980	36,826
	1,400	3,220	30,303	28,986	28,116	36,305	16,790	20,880	36,826
	1,200	3,420	25,974	24,845	24,100	36,305	16,790	20,780	36,826
	1,000	3,620	21,645	20,704	20,083	36,305	16,790	20,680	36,826
	0,800	3,820	17,316	16,563	16,066	36,305	16,790	20,580	36,826
	0,600	4,020	12,987	12,422	12,050	36,305	16,790	20,480	36,826
	0,400	4,220	8,658	8,282	8,033	36,305	16,790	20,380	36,826
	0,200	4,420	4,329	4,141	4,017	36,305	16,790	20,280	36,826
	0,046	4,574	1,000	0,957	0,928	36,305	16,790	20,203	36,826
	0,000	4,620	0,000	0,000	0,000	36,305	16,790	20,180	0,000

Tank Calibrations - FO Sed. BR

Fluid Type = Specific gravity = 0,97
 Permeability = 97 %
 Trim = 0 m (+ve by stern); Heel = 0 deg to starboard

Tank Name	Sounding m	Ullage m	% Full	Capacity m ³	Capacity tonne	LCG m	TCG m	VCG m	FSM tonne.m
FO Sed. BR	5,320	0,000	100,000	143,855	139,540	41,235	-16,440	22,140	0,000
	5,250	0,070	98,684	141,963	137,704	41,235	-16,440	22,105	63,776
	5,214	0,106	98,000	140,978	136,749	41,235	-16,440	22,087	63,776
	5,208	0,112	97,900	140,834	136,609	41,235	-16,440	22,084	63,776
	5,000	0,320	93,985	135,202	131,146	41,235	-16,440	21,980	63,776
	4,750	0,570	89,286	128,442	124,589	41,235	-16,440	21,855	63,776
	4,500	0,820	84,586	121,682	118,032	41,235	-16,440	21,730	63,776
	4,250	1,070	79,887	114,922	111,474	41,235	-16,440	21,605	63,776
	4,000	1,320	75,188	108,162	104,917	41,235	-16,440	21,480	63,776
	3,750	1,570	70,489	101,402	98,360	41,235	-16,440	21,355	63,776
	3,500	1,820	65,789	94,642	91,802	41,235	-16,440	21,230	63,776
	3,250	2,070	61,090	87,882	85,245	41,235	-16,440	21,105	63,776
	3,000	2,320	56,391	81,121	78,688	41,235	-16,440	20,980	63,776
	2,750	2,570	51,692	74,361	72,131	41,235	-16,440	20,855	63,776
	2,500	2,820	46,992	67,601	65,573	41,235	-16,440	20,730	63,776
	2,250	3,070	42,293	60,841	59,016	41,235	-16,440	20,605	63,776
	2,000	3,320	37,594	54,081	52,459	41,235	-16,440	20,480	63,776
	1,750	3,570	32,895	47,321	45,901	41,235	-16,440	20,355	63,776
	1,500	3,820	28,195	40,561	39,344	41,235	-16,440	20,230	63,776
	1,250	4,070	23,496	33,801	32,787	41,235	-16,440	20,105	63,776
	1,000	4,320	18,797	27,040	26,229	41,235	-16,440	19,980	63,776
	0,750	4,570	14,098	20,280	19,672	41,235	-16,440	19,855	63,776
	0,500	4,820	9,398	13,520	13,115	41,235	-16,440	19,730	63,776
	0,250	5,070	4,699	6,760	6,557	41,235	-16,440	19,605	63,776
	0,053	5,267	1,000	1,439	1,395	41,235	-16,440	19,507	63,776
	0,000	5,320	0,000	0,000	0,000	41,235	-16,440	19,480	0,000

Tank Calibrations - FO Sed. ER

Fluid Type = Specific gravity = 0,97
 Permeability = 97 %
 Trim = 0 m (+ve by stern); Heel = 0 deg to starboard

Tank Name	Sounding m	Ullage m	% Full	Capacity m ³	Capacity tonne	LCG m	TCG m	VCG m	FSM tonne.m
FO Sed. ER	5,320	0,000	100,000	143,855	139,540	41,235	16,440	22,140	0,000
	5,250	0,070	98,684	141,963	137,704	41,235	16,440	22,105	63,776
	5,214	0,106	98,000	140,978	136,749	41,235	16,440	22,087	63,776
	5,208	0,112	97,900	140,834	136,609	41,235	16,440	22,084	63,776
	5,000	0,320	93,985	135,202	131,146	41,235	16,440	21,980	63,776
	4,750	0,570	89,286	128,442	124,589	41,235	16,440	21,855	63,776
	4,500	0,820	84,586	121,682	118,032	41,235	16,440	21,730	63,776
	4,250	1,070	79,887	114,922	111,474	41,235	16,440	21,605	63,776
	4,000	1,320	75,188	108,162	104,917	41,235	16,440	21,480	63,776
	3,750	1,570	70,489	101,402	98,360	41,235	16,440	21,355	63,776
	3,500	1,820	65,789	94,642	91,802	41,235	16,440	21,230	63,776
	3,250	2,070	61,090	87,882	85,245	41,235	16,440	21,105	63,776
	3,000	2,320	56,391	81,121	78,688	41,235	16,440	20,980	63,776
	2,750	2,570	51,692	74,361	72,131	41,235	16,440	20,855	63,776
	2,500	2,820	46,992	67,601	65,573	41,235	16,440	20,730	63,776
	2,250	3,070	42,293	60,841	59,016	41,235	16,440	20,605	63,776
	2,000	3,320	37,594	54,081	52,459	41,235	16,440	20,480	63,776
	1,750	3,570	32,895	47,321	45,901	41,235	16,440	20,355	63,776
	1,500	3,820	28,195	40,561	39,344	41,235	16,440	20,230	63,776
	1,250	4,070	23,496	33,801	32,787	41,235	16,440	20,105	63,776
	1,000	4,320	18,797	27,040	26,229	41,235	16,440	19,980	63,776
	0,750	4,570	14,098	20,280	19,672	41,235	16,440	19,855	63,776
	0,500	4,820	9,398	13,520	13,115	41,235	16,440	19,730	63,776
	0,250	5,070	4,699	6,760	6,557	41,235	16,440	19,605	63,776
	0,053	5,267	1,000	1,439	1,395	41,235	16,440	19,507	63,776
	0,000	5,320	0,000	0,000	0,000	41,235	16,440	19,480	0,000

Tank Calibrations - Diesel BR

Fluid Type = Specific gravity = 0,9
 Permeability = 97 %
 Trim = 0 m (+ve by stern); Heel = 0 deg to starboard

Tank Name	Sounding m	Ullage m	% Full	Capacity m ³	Capacity tonne	LCG m	TCG m	VCG m	FSM tonne.m
Diesel BR	7,510	0,000	100,000	425,414	382,873	47,627	-15,230	21,045	0,000
	7,500	0,010	99,867	424,848	382,363	47,627	-15,230	21,040	262,388
	7,360	0,150	98,000	416,906	375,215	47,627	-15,230	20,970	262,388
	7,352	0,158	97,900	416,480	374,832	47,627	-15,230	20,966	262,388
	7,000	0,510	93,209	396,525	356,872	47,627	-15,230	20,790	262,388
	6,500	1,010	86,551	368,201	331,381	47,627	-15,230	20,540	262,388
	6,000	1,510	79,893	339,878	305,890	47,627	-15,230	20,290	262,388
	5,500	2,010	73,236	311,555	280,400	47,627	-15,230	20,040	262,388
	5,000	2,510	66,578	283,232	254,909	47,627	-15,230	19,790	262,388
	4,500	3,010	59,920	254,909	229,418	47,627	-15,230	19,540	262,388
	4,000	3,510	53,262	226,585	203,927	47,627	-15,230	19,290	262,388
	3,500	4,010	46,605	198,262	178,436	47,627	-15,230	19,040	262,388
	3,000	4,510	39,947	169,939	152,945	47,627	-15,230	18,790	262,388
	2,500	5,010	33,289	141,616	127,454	47,627	-15,230	18,540	262,388
	2,000	5,510	26,631	113,293	101,963	47,627	-15,230	18,290	262,388
	1,500	6,010	19,973	84,970	76,473	47,627	-15,230	18,040	262,388
	1,000	6,510	13,316	56,646	50,982	47,627	-15,230	17,790	262,388
	0,500	7,010	6,658	28,323	25,491	47,627	-15,230	17,540	262,388
	0,075	7,435	1,000	4,254	3,829	47,627	-15,230	17,328	262,388
	0,000	7,510	0,000	0,000	0,000	47,627	-15,230	17,290	0,000

Tank Calibrations - Diesel ER

Fluid Type = Specific gravity = 0,9
 Permeability = 97 %
 Trim = 0 m (+ve by stern); Heel = 0 deg to starboard

Tank Name	Sounding m	Ullage m	% Full	Capacity m ³	Capacity tonne	LCG m	TCG m	VCG m	FSM tonne.m
Diesel ER	7,510	0,000	100,000	425,414	382,873	47,627	15,230	21,045	0,000
	7,500	0,010	99,867	424,848	382,363	47,627	15,230	21,040	262,388
	7,360	0,150	98,000	416,906	375,215	47,627	15,230	20,970	262,388
	7,352	0,158	97,900	416,480	374,832	47,627	15,230	20,966	262,388
	7,000	0,510	93,209	396,525	356,872	47,627	15,230	20,790	262,388
	6,500	1,010	86,551	368,201	331,381	47,627	15,230	20,540	262,388
	6,000	1,510	79,893	339,878	305,890	47,627	15,230	20,290	262,388
	5,500	2,010	73,236	311,555	280,400	47,627	15,230	20,040	262,388
	5,000	2,510	66,578	283,232	254,909	47,627	15,230	19,790	262,388
	4,500	3,010	59,920	254,909	229,418	47,627	15,230	19,540	262,388
	4,000	3,510	53,262	226,585	203,927	47,627	15,230	19,290	262,388
	3,500	4,010	46,605	198,262	178,436	47,627	15,230	19,040	262,388
	3,000	4,510	39,947	169,939	152,945	47,627	15,230	18,790	262,388
	2,500	5,010	33,289	141,616	127,454	47,627	15,230	18,540	262,388
	2,000	5,510	26,631	113,293	101,963	47,627	15,230	18,290	262,388
	1,500	6,010	19,973	84,970	76,473	47,627	15,230	18,040	262,388
	1,000	6,510	13,316	56,646	50,982	47,627	15,230	17,790	262,388
	0,500	7,010	6,658	28,323	25,491	47,627	15,230	17,540	262,388
	0,075	7,435	1,000	4,254	3,829	47,627	15,230	17,328	262,388
	0,000	7,510	0,000	0,000	0,000	47,627	15,230	17,290	0,000

Tank Calibrations - Aguas grises

Fluid Type = Specific gravity = 1,5

Permeability = 97 %

Trim = 0 m (+ve by stern); Heel = 0 deg to starboard

Tank Name	Sounding m	Ullage m	% Full	Capacity m ³	Capacity tonne	LCG m	TCG m	VCG m	FSM tonne.m
Aguas grises	2,500	0,000	100,000	158,979	238,468	47,383	0,000	1,318	0,000
	2,453	0,047	98,000	155,799	233,699	47,384	0,000	1,294	642,417
	2,450	0,050	97,900	155,640	233,460	47,384	0,000	1,293	642,417
	2,400	0,100	95,760	152,238	228,358	47,384	0,000	1,268	642,417
	2,300	0,200	91,520	145,498	218,247	47,385	0,000	1,218	642,417
	2,200	0,300	87,281	138,758	208,137	47,387	0,000	1,167	642,417
	2,100	0,400	83,041	132,017	198,026	47,388	0,000	1,117	642,417
	2,000	0,500	78,801	125,277	187,916	47,389	0,000	1,067	642,417
	1,900	0,600	74,561	118,537	177,805	47,391	0,000	1,017	642,417
	1,800	0,700	70,322	111,796	167,695	47,393	0,000	0,967	642,417
	1,700	0,800	66,082	105,056	157,584	47,395	0,000	0,916	642,417
	1,600	0,900	61,842	98,316	147,474	47,397	0,000	0,866	642,417
	1,500	1,000	57,602	91,575	137,363	47,400	0,000	0,816	642,417
	1,400	1,100	53,362	84,835	127,253	47,403	0,000	0,765	642,417
	1,300	1,200	49,123	78,095	117,142	47,407	0,000	0,715	642,417
	1,200	1,300	44,883	71,354	107,032	47,412	0,000	0,664	642,417
	1,100	1,400	40,643	64,614	96,921	47,417	0,000	0,614	642,417
	1,000	1,500	36,403	57,874	86,811	47,424	0,000	0,563	642,417
	0,900	1,600	32,164	51,133	76,700	47,432	0,000	0,512	642,417
	0,800	1,700	27,924	44,393	66,590	47,443	0,000	0,460	642,417
	0,700	1,800	23,684	37,653	56,479	47,458	0,000	0,408	642,417
	0,600	1,900	19,444	30,912	46,369	47,479	0,000	0,356	642,417
	0,500	2,000	15,207	24,176	36,263	47,512	0,000	0,302	636,613
	0,400	2,100	11,034	17,542	26,313	47,551	0,000	0,246	581,895
	0,300	2,200	7,087	11,267	16,900	47,575	0,000	0,187	456,587
	0,200	2,300	3,671	5,836	8,754	47,572	0,000	0,127	235,730
	0,100	2,400	1,118	1,777	2,666	47,601	0,000	0,066	79,131
	0,094	2,406	1,000	1,590	2,385	47,610	0,000	0,063	72,399
	0,000	2,500	0,000	0,000	0,000	47,624	0,000	0,000	0,000

Tank Calibrations - Lodos

Fluid Type = Specific gravity = 1,5
 Permeability = 97 %
 Trim = 0 m (+ve by stern); Heel = 0 deg to starboard

Tank Name	Sounding m	Ullage m	% Full	Capacity m ³	Capacity tonne	LCG m	TCG m	VCG m	FSM tonne.m
Lodos	2,500	0,000	100,000	75,439	113,158	40,477	0,000	1,302	0,000
	2,452	0,048	98,000	73,930	110,895	40,477	0,000	1,278	131,950
	2,450	0,050	97,900	73,855	110,782	40,477	0,000	1,277	131,950
	2,400	0,100	95,822	72,287	108,431	40,477	0,000	1,252	131,950
	2,300	0,200	91,645	69,136	103,704	40,477	0,000	1,202	131,950
	2,200	0,300	87,467	65,984	98,976	40,478	0,000	1,152	131,950
	2,100	0,400	83,290	62,833	94,249	40,478	0,000	1,102	131,950
	2,000	0,500	79,112	59,681	89,522	40,479	0,000	1,051	131,950
	1,900	0,600	74,934	56,530	84,794	40,479	0,000	1,001	131,950
	1,800	0,700	70,757	53,378	80,067	40,480	0,000	0,951	131,950
	1,700	0,800	66,579	50,227	75,340	40,480	0,000	0,901	131,950
	1,600	0,900	62,402	47,075	70,613	40,481	0,000	0,851	131,950
	1,500	1,000	58,224	43,923	65,885	40,482	0,000	0,801	131,950
	1,400	1,100	54,046	40,772	61,158	40,483	0,000	0,751	131,950
	1,300	1,200	49,869	37,620	56,431	40,484	0,000	0,700	131,950
	1,200	1,300	45,691	34,469	51,703	40,485	0,000	0,650	131,950
	1,100	1,400	41,514	31,317	46,976	40,486	0,000	0,600	131,950
	1,000	1,500	37,336	28,166	42,249	40,488	0,000	0,550	131,950
	0,900	1,600	33,158	25,014	37,521	40,491	0,000	0,499	131,950
	0,800	1,700	28,981	21,863	32,794	40,494	0,000	0,448	131,950
	0,700	1,800	24,803	18,711	28,067	40,498	0,000	0,398	131,950
	0,600	1,900	20,626	15,560	23,340	40,503	0,000	0,347	131,950
	0,500	2,000	16,448	12,408	18,612	40,512	0,000	0,295	131,950
	0,400	2,100	12,270	9,257	13,885	40,526	0,000	0,242	131,950
	0,300	2,200	8,099	6,110	9,165	40,553	0,000	0,187	127,345
	0,200	2,300	4,248	3,204	4,806	40,561	0,000	0,128	75,886
	0,100	2,400	1,224	0,923	1,385	40,586	0,000	0,067	26,944
	0,090	2,410	1,000	0,754	1,132	40,586	0,000	0,060	19,901
	0,000	2,500	0,000	0,000	0,000	40,586	0,000	0,000	0,000

Tank Calibrations - FO Almacén

Fluid Type = Specific gravity = 0,97
 Permeability = 97 %
 Trim = 0 m (+ve by stern); Heel = 0 deg to starboard

Tank Name	Sounding m	Ullage m	% Full	Capacity m ³	Capacity tonne	LCG m	TCG m	VCG m	FSM tonne.m
FO Almacén	22,000	0,000	100,000	2394,493	2322,658	251,161	-4,284	15,197	0,000
	21,728	0,272	98,000	2346,603	2276,205	251,154	-4,243	15,010	2397,042
	21,714	0,286	97,900	2344,208	2273,882	251,153	-4,241	15,001	2392,601
	21,000	1,000	92,794	2221,948	2155,290	251,136	-4,138	14,513	2170,307
	20,000	2,000	85,948	2058,008	1996,268	251,113	-4,000	13,837	1897,269
	19,000	3,000	79,444	1902,289	1845,220	251,091	-3,869	13,168	1657,687
	18,000	4,000	73,275	1754,556	1701,920	251,072	-3,746	12,509	1442,852
	17,000	5,000	67,432	1614,652	1566,212	251,055	-3,631	11,859	1249,699
	16,000	6,000	61,908	1482,385	1437,913	251,041	-3,525	11,221	1078,446
	15,000	7,000	56,692	1357,476	1316,751	251,030	-3,429	10,597	929,482
	14,000	8,000	51,767	1239,553	1202,366	251,023	-3,343	9,988	802,378
	13,000	9,000	47,115	1128,160	1094,315	251,020	-3,266	9,394	695,999
	12,000	10,000	42,712	1022,741	992,059	251,023	-3,198	8,815	608,792
	11,000	11,000	38,532	922,641	894,962	251,032	-3,138	8,252	538,190
	10,000	12,000	34,543	827,130	802,316	251,048	-3,085	7,704	480,887
	9,000	13,000	30,713	735,429	713,366	251,070	-3,038	7,168	434,084
	8,000	14,000	27,009	646,718	627,316	251,098	-2,994	6,642	395,763
	7,000	15,000	23,394	560,172	543,367	251,129	-2,954	6,122	364,403
	6,000	16,000	19,841	475,080	460,828	251,159	-2,913	5,607	338,543
	5,000	17,000	16,328	390,973	379,244	251,185	-2,869	5,092	316,310
	4,000	18,000	12,851	307,708	298,477	251,204	-2,817	4,575	295,215
	3,000	19,000	9,420	225,553	218,787	251,209	-2,751	4,056	272,213
	2,000	20,000	6,072	145,382	141,021	251,195	-2,660	3,534	242,963
	1,000	21,000	2,883	69,034	66,963	251,159	-2,530	3,012	200,580
	0,364	21,636	1,000	23,945	23,227	251,128	-2,418	2,684	162,470
	0,000	22,000	0,000	0,000	0,000	251,111	-2,340	2,500	0,000

Tank Calibrations - FO Almacén

Fluid Type = Specific gravity = 0,97
 Permeability = 97 %
 Trim = 0 m (+ve by stern); Heel = 0 deg to starboard

Tank Name	Sounding m	Ullage m	% Full	Capacity m ³	Capacity tonne	LCG m	TCG m	VCG m	FSM tonne.m
FO Almacén	22,000	0,000	100,000	2394,493	2322,658	251,161	4,284	15,197	0,000
	21,728	0,272	98,000	2346,603	2276,205	251,154	4,243	15,010	2397,042
	21,714	0,286	97,900	2344,208	2273,882	251,153	4,241	15,001	2392,601
	21,000	1,000	92,794	2221,948	2155,290	251,136	4,138	14,513	2170,307
	20,000	2,000	85,948	2058,008	1996,268	251,113	4,000	13,837	1897,269
	19,000	3,000	79,444	1902,289	1845,220	251,091	3,869	13,168	1657,687
	18,000	4,000	73,275	1754,556	1701,920	251,072	3,746	12,509	1442,852
	17,000	5,000	67,432	1614,652	1566,212	251,055	3,631	11,859	1249,699
	16,000	6,000	61,908	1482,385	1437,913	251,041	3,525	11,221	1078,446
	15,000	7,000	56,692	1357,476	1316,751	251,030	3,429	10,597	929,482
	14,000	8,000	51,767	1239,553	1202,366	251,023	3,343	9,988	802,378
	13,000	9,000	47,115	1128,160	1094,315	251,020	3,266	9,394	695,999
	12,000	10,000	42,712	1022,741	992,059	251,023	3,198	8,815	608,792
	11,000	11,000	38,532	922,641	894,962	251,032	3,138	8,252	538,190
	10,000	12,000	34,543	827,130	802,316	251,048	3,085	7,704	480,887
	9,000	13,000	30,713	735,429	713,366	251,070	3,038	7,168	434,084
	8,000	14,000	27,009	646,718	627,316	251,098	2,994	6,642	395,763
	7,000	15,000	23,394	560,172	543,367	251,129	2,954	6,122	364,403
	6,000	16,000	19,841	475,080	460,828	251,159	2,913	5,607	338,543
	5,000	17,000	16,328	390,973	379,244	251,185	2,869	5,092	316,310
	4,000	18,000	12,851	307,708	298,477	251,204	2,817	4,575	295,215
	3,000	19,000	9,420	225,553	218,787	251,209	2,751	4,056	272,213
	2,000	20,000	6,072	145,382	141,021	251,195	2,660	3,534	242,963
	1,000	21,000	2,883	69,034	66,963	251,159	2,530	3,012	200,580
	0,364	21,636	1,000	23,945	23,227	251,128	2,418	2,684	162,470
	0,000	22,000	0,000	0,000	0,000	251,111	2,340	2,500	0,000

Tank Calibrations - Tanque 4

Fluid Type = Specific gravity = 0,43
 Permeability = 97 %
 Trim = 0 m (+ve by stern); Heel = 0 deg to starboard

Tank Name	Sounding m	Ullage m	% Full	Capacity m ³	Capacity tonne	LCG m	TCG m	VCG m	FSM tonne.m
Tanque 4	26,000	0,000	100,000	40427,198	17383,695	78,000	0,000	15,992	0,000
	25,294	0,706	98,000	39618,656	17036,022	78,015	0,000	15,744	32334,779
	25,260	0,740	97,900	39578,225	17018,637	78,015	0,000	15,731	32814,379
	25,000	1,000	97,103	39256,148	16880,144	78,022	0,000	15,634	36717,889
	24,000	2,000	93,766	37907,164	16300,081	78,049	0,000	15,230	54573,336
	23,000	3,000	89,990	36380,247	15643,506	78,082	0,000	14,778	77442,473
	22,000	4,000	85,817	34693,412	14918,167	78,122	0,000	14,281	92382,356
	21,000	5,000	81,578	32979,664	14181,256	78,167	0,000	13,776	92382,356
	20,000	6,000	77,339	31265,917	13444,345	78,216	0,000	13,271	92382,356
	19,000	7,000	73,100	29552,170	12707,433	78,272	0,000	12,764	92382,356
	18,000	8,000	68,861	27838,422	11970,522	78,334	0,000	12,257	92382,356
	17,000	9,000	64,622	26124,675	11233,610	78,405	0,000	11,749	92382,356
	16,000	10,000	60,382	24410,927	10496,699	78,485	0,000	11,240	92382,356
	15,000	11,000	56,143	22697,180	9759,787	78,577	0,000	10,730	92382,356
	14,000	12,000	51,904	20983,432	9022,876	78,685	0,000	10,218	92382,356
	13,000	13,000	47,665	19269,685	8285,965	78,812	0,000	9,704	92382,356
	12,000	14,000	43,426	17555,937	7549,053	78,963	0,000	9,187	92382,356
	11,000	15,000	39,187	15842,190	6812,142	79,147	0,000	8,666	92382,356
	10,000	16,000	34,948	14128,443	6075,230	79,376	0,000	8,140	92382,356
	9,000	17,000	30,709	12414,702	5338,322	79,669	0,000	7,608	92351,048
	8,000	18,000	26,481	10705,457	4603,346	80,045	0,000	7,066	90635,396
	7,000	19,000	22,298	9014,383	3876,185	80,523	0,000	6,515	87184,606
	6,000	20,000	18,174	7347,405	3159,384	81,158	0,000	5,951	83531,655
	5,000	21,000	14,129	5712,158	2456,228	82,066	0,000	5,364	77838,620
	4,000	22,000	10,239	4139,241	1779,874	83,573	0,000	4,741	67425,742
	3,000	23,000	6,891	2785,954	1197,960	85,167	0,000	4,118	50421,617
	2,000	24,000	4,266	1724,652	741,601	85,897	0,000	3,565	39089,169
	1,000	25,000	1,895	766,258	329,491	87,269	0,000	3,005	28130,618
	0,535	25,465	1,000	404,274	173,838	87,269	0,000	2,769	26046,387
	0,000	26,000	0,000	0,000	0,000	87,269	0,000	2,500	0,000

Tank Calibrations - Tanque 3

Fluid Type = Specific gravity = 0,43
 Permeability = 97 %
 Trim = 0 m (+ve by stern); Heel = 0 deg to starboard

Tank Name	Sounding m	Ullage m	% Full	Capacity m ³	Capacity tonne	LCG m	TCG m	VCG m	FSM tonne.m
Tanque 3	26,000	0,000	100,000	42409,786	18236,208	126,285	0,000	15,460	0,000
	25,261	0,739	98,000	41561,589	17871,484	126,285	0,000	15,202	32805,164
	25,226	0,774	97,900	41519,180	17853,247	126,285	0,000	15,189	33310,713
	25,000	1,000	97,239	41238,736	17732,657	126,285	0,000	15,105	36717,898
	24,000	2,000	94,058	39889,752	17152,594	126,285	0,000	14,703	54573,349
	23,000	3,000	90,458	38362,834	16496,019	126,285	0,000	14,253	77442,493
	22,000	4,000	86,480	36675,999	15770,680	126,285	0,000	13,759	92382,379
	21,000	5,000	82,439	34962,251	15033,768	126,285	0,000	13,257	92382,379
	20,000	6,000	78,398	33248,503	14296,857	126,285	0,000	12,755	92382,379
	19,000	7,000	74,357	31534,755	13559,945	126,285	0,000	12,253	92382,379
	18,000	8,000	70,316	29821,007	12823,033	126,285	0,000	11,750	92382,379
	17,000	9,000	66,275	28107,259	12086,122	126,285	0,000	11,247	92382,379
	16,000	10,000	62,234	26393,512	11349,210	126,285	0,000	10,744	92382,379
	15,000	11,000	58,194	24679,764	10612,299	126,285	0,000	10,240	92382,379
	14,000	12,000	54,153	22966,016	9875,387	126,285	0,000	9,735	92382,379
	13,000	13,000	50,112	21252,268	9138,475	126,285	0,000	9,230	92382,379
	12,000	14,000	46,071	19538,520	8401,564	126,285	0,000	8,724	92382,379
	11,000	15,000	42,030	17824,772	7664,652	126,285	0,000	8,217	92382,379
	10,000	16,000	37,989	16111,024	6927,741	126,285	0,000	7,708	92382,379
	9,000	17,000	33,948	14397,276	6190,829	126,285	0,000	7,197	92382,379
	8,000	18,000	29,907	12683,529	5453,917	126,285	0,000	6,683	92382,379
	7,000	19,000	25,866	10969,781	4717,006	126,285	0,000	6,165	92382,379
	6,000	20,000	21,825	9256,033	3980,094	126,285	0,000	5,640	92382,379
	5,000	21,000	17,788	7543,803	3243,836	126,285	0,000	5,105	89948,474
	4,000	22,000	13,872	5883,200	2529,776	126,285	0,000	4,569	78418,193
	3,000	23,000	10,136	4298,519	1848,363	126,285	0,000	4,040	67917,955
	2,000	24,000	6,578	2789,758	1199,596	126,285	0,000	3,518	58399,523
	1,000	25,000	3,200	1356,918	583,475	126,285	0,000	3,005	49814,742
	0,319	25,681	1,000	424,096	182,361	126,285	0,000	2,660	44475,360
	0,000	26,000	0,000	0,000	0,000	126,285	0,000	2,500	0,000

Tank Calibrations - Tanque 2

Fluid Type = Specific gravity = 0,43
 Permeability = 97 %
 Trim = 0 m (+ve by stern); Heel = 0 deg to starboard

Tank Name	Sounding m	Ullage m	% Full	Capacity m ³	Capacity tonne	LCG m	TCG m	VCG m	FSM tonne.m
Tanque 2	26,000	0,000	100,000	42363,021	18216,099	175,287	0,000	15,463	0,000
	25,261	0,739	98,000	41515,762	17851,778	175,287	0,000	15,205	32721,810
	25,226	0,774	97,900	41473,401	17833,563	175,287	0,000	15,192	33225,866
	25,000	1,000	97,238	41192,930	17712,960	175,287	0,000	15,107	36627,237
	24,000	2,000	94,056	39845,079	17133,384	175,287	0,000	14,705	54435,527
	23,000	3,000	90,455	38319,470	16477,372	175,286	0,000	14,256	77243,512
	22,000	4,000	86,477	36634,101	15752,664	175,286	0,000	13,762	92143,138
	21,000	5,000	82,435	34921,846	15016,394	175,286	0,000	13,260	92143,138
	20,000	6,000	78,393	33209,591	14280,124	175,285	0,000	12,758	92143,138
	19,000	7,000	74,351	31497,336	13543,855	175,285	0,000	12,255	92143,138
	18,000	8,000	70,309	29785,081	12807,585	175,285	0,000	11,753	92143,138
	17,000	9,000	66,267	28072,826	12071,315	175,284	0,000	11,250	92143,138
	16,000	10,000	62,225	26360,571	11335,046	175,284	0,000	10,746	92143,138
	15,000	11,000	58,184	24648,316	10598,776	175,283	0,000	10,242	92143,138
	14,000	12,000	54,142	22936,061	9862,506	175,283	0,000	9,738	92143,138
	13,000	13,000	50,100	21223,806	9126,237	175,282	0,000	9,233	92143,138
	12,000	14,000	46,058	19511,551	8389,967	175,281	0,000	8,726	92143,138
	11,000	15,000	42,016	17799,296	7653,697	175,280	0,000	8,219	92143,138
	10,000	16,000	37,974	16087,041	6917,428	175,279	0,000	7,710	92143,138
	9,000	17,000	33,932	14374,786	6181,158	175,277	0,000	7,199	92143,138
	8,000	18,000	29,891	12662,531	5444,888	175,275	0,000	6,685	92143,138
	7,000	19,000	25,849	10950,276	4708,619	175,273	0,000	6,167	92143,138
	6,000	20,000	21,807	9238,021	3972,349	175,269	0,000	5,642	92143,138
	5,000	21,000	17,769	7527,298	3236,738	175,264	0,000	5,106	89692,592
	4,000	22,000	13,853	5868,656	2523,522	175,258	0,000	4,570	78090,077
	3,000	23,000	10,119	4286,606	1843,241	175,252	0,000	4,040	67534,864
	2,000	24,000	6,565	2781,146	1195,893	175,245	0,000	3,518	57977,327
	1,000	25,000	3,192	1352,278	581,479	175,238	0,000	3,005	49367,912
	0,319	25,681	1,000	423,633	182,162	175,233	0,000	2,660	44025,461
	0,000	26,000	0,000	0,000	0,000	175,231	0,000	2,500	0,000

Tank Calibrations - Tanque 1

Fluid Type = Specific gravity = 0,43
 Permeability = 97 %
 Trim = 0 m (+ve by stern); Heel = 0 deg to starboard

Tank Name	Sounding m	Ullage m	% Full	Capacity m ³	Capacity tonne	LCG m	TCG m	VCG m	FSM tonne.m
Tanque 1	26,000	0,000	100,000	23672,952	10179,370	218,207	0,000	16,095	0,000
	25,357	0,643	98,000	23199,492	9975,782	218,199	0,000	15,849	12539,554
	25,326	0,674	97,900	23175,821	9965,603	218,199	0,000	15,836	12661,794
	25,000	1,000	96,828	22921,933	9856,431	218,194	0,000	15,705	13998,034
	24,000	2,000	93,306	22088,384	9498,005	218,176	0,000	15,280	18694,153
	23,000	3,000	89,437	21172,306	9104,092	218,151	0,000	14,816	24363,285
	22,000	4,000	85,254	20182,121	8678,312	218,120	0,000	14,317	27914,428
	21,000	5,000	81,021	19180,001	8247,400	218,084	0,000	13,811	27880,037
	20,000	6,000	76,790	18178,527	7816,767	218,045	0,000	13,304	27845,735
	19,000	7,000	72,563	17177,699	7386,411	218,002	0,000	12,798	27811,519
	18,000	8,000	68,338	16177,517	6956,332	217,955	0,000	12,291	27777,390
	17,000	9,000	64,115	15177,981	6526,532	217,901	0,000	11,783	27743,350
	16,000	10,000	59,896	14179,091	6097,009	217,841	0,000	11,274	27709,396
	15,000	11,000	55,679	13180,846	5667,764	217,771	0,000	10,765	27675,528
	14,000	12,000	51,465	12183,248	5238,797	217,691	0,000	10,255	27641,748
	13,000	13,000	47,253	11186,296	4810,107	217,598	0,000	9,743	27608,054
	12,000	14,000	43,045	10189,989	4381,695	217,487	0,000	9,228	27574,447
	11,000	15,000	38,839	9194,329	3953,561	217,353	0,000	8,712	27540,925
	10,000	16,000	34,636	8199,314	3525,705	217,187	0,000	8,191	27507,491
	9,000	17,000	30,435	7204,946	3098,127	216,976	0,000	7,666	27474,142
	8,000	18,000	26,240	6211,847	2671,094	216,701	0,000	7,133	27394,389
	7,000	19,000	22,066	5223,651	2246,170	216,341	0,000	6,590	27144,517
	6,000	20,000	17,939	4246,695	1826,079	215,859	0,000	6,035	26445,487
	5,000	21,000	13,901	3290,825	1415,055	215,171	0,000	5,464	24660,605
	4,000	22,000	10,032	2374,892	1021,204	214,016	0,000	4,870	21161,901
	3,000	23,000	6,501	1538,953	661,750	212,218	0,000	4,249	17437,061
	2,000	24,000	3,600	852,250	366,467	210,215	0,000	3,629	14053,659
	1,000	25,000	1,454	344,168	147,992	208,418	0,000	3,040	9556,936
	0,742	25,258	1,000	236,730	101,794	207,855	0,000	2,890	9102,831
	0,000	26,000	0,000	0,000	0,000	207,390	0,000	2,500	0,000

Tank Calibrations - Cofferdam 5

Fluid Type = Water Ballast Specific gravity = 1,025
 Permeability = 97 %
 Trim = 0 m (+ve by stern); Heel = 0 deg to starboard

Tank Name	Sounding m	Ullage m	% Full	Capacity m ³	Capacity tonne	LCG m	TCG m	VCG m	FSM tonne.m
Cofferdam 5	22,077	0,000	100,000	2098,253	2150,709	52,770	0,000	17,477	0,000
	22,000	0,077	99,762	2093,263	2145,595	52,770	0,000	17,451	3404,477
	21,454	0,624	98,000	2056,288	2107,695	52,770	0,000	17,259	4393,410
	21,424	0,654	97,900	2054,189	2105,544	52,770	0,000	17,248	4452,014
	21,000	1,077	96,424	2023,210	2073,791	52,770	0,000	17,089	5346,630
	20,000	2,077	92,584	1942,637	1991,203	52,771	0,000	16,681	7914,738
	19,000	3,077	88,242	1851,544	1897,833	52,771	0,000	16,227	11196,231
	18,000	4,077	83,469	1751,394	1795,179	52,771	0,000	15,730	13019,995
	17,000	5,077	78,640	1650,070	1691,322	52,771	0,000	15,227	13019,995
	16,000	6,077	73,811	1548,746	1587,465	52,771	0,000	14,724	13019,995
	15,000	7,077	68,982	1447,422	1483,607	52,771	0,000	14,220	13019,995
	14,000	8,077	64,153	1346,098	1379,750	52,772	0,000	13,715	13019,995
	13,000	9,077	59,324	1244,773	1275,893	52,772	0,000	13,210	13019,995
	12,000	10,077	54,495	1143,449	1172,035	52,772	0,000	12,704	13019,995
	11,000	11,077	49,666	1042,125	1068,178	52,773	0,000	12,196	13019,995
	10,000	12,077	44,837	940,801	964,321	52,773	0,000	11,687	13019,995
	9,000	13,077	40,008	839,477	860,463	52,774	0,000	11,176	13019,995
	8,000	14,077	35,179	738,152	756,606	52,775	0,000	10,662	13019,995
	7,000	15,077	30,350	636,828	652,749	52,776	0,000	10,143	13019,995
	6,000	16,077	25,521	535,504	548,891	52,778	0,000	9,617	13019,995
	5,000	17,077	20,703	434,411	445,271	52,780	0,000	9,081	12485,870
	4,000	18,077	16,049	336,738	345,157	52,783	0,000	8,545	10876,570
	3,000	19,077	11,608	243,558	249,647	52,788	0,000	8,017	9411,858
	2,000	20,077	7,381	154,869	158,741	52,797	0,000	7,496	8084,925
	1,000	21,077	3,368	70,672	72,439	52,829	0,000	6,982	6888,969
	0,383	21,694	1,000	20,983	21,507	52,968	0,000	6,664	6213,700
	0,000	22,077	0,000	0,000	0,000	54,119	0,000	6,423	0,000

Tank Calibrations - Cofferdam 4

Fluid Type = Water Ballast Specific gravity = 1,025
 Permeability = 97 %
 Trim = 0 m (+ve by stern); Heel = 0 deg to starboard

Tank Name	Sounding m	Ullage m	% Full	Capacity m ³	Capacity tonne	LCG m	TCG m	VCG m	FSM tonne.m
Cofferdam 4	26,000	0,000	100,000	2544,588	2608,203	101,772	0,000	15,460	0,000
	25,261	0,739	98,000	2493,696	2556,039	101,772	0,000	15,202	4691,903
	25,226	0,774	97,900	2491,152	2553,431	101,772	0,000	15,189	4764,208
	25,000	1,000	97,239	2474,325	2536,183	101,772	0,000	15,105	5251,515
	24,000	2,000	94,058	2393,386	2453,221	101,772	0,000	14,703	7805,261
	23,000	3,000	90,458	2301,771	2359,315	101,772	0,000	14,253	11076,082
	22,000	4,000	86,480	2200,561	2255,575	101,772	0,000	13,759	13212,833
	21,000	5,000	82,439	2097,736	2150,179	101,772	0,000	13,257	13212,833
	20,000	6,000	78,398	1994,911	2044,784	101,772	0,000	12,755	13212,833
	19,000	7,000	74,357	1892,086	1939,388	101,772	0,000	12,253	13212,833
	18,000	8,000	70,316	1789,261	1833,993	101,772	0,000	11,750	13212,833
	17,000	9,000	66,275	1686,436	1728,597	101,772	0,000	11,247	13212,833
	16,000	10,000	62,234	1583,611	1623,202	101,772	0,000	10,744	13212,833
	15,000	11,000	58,194	1480,786	1517,806	101,772	0,000	10,240	13212,833
	14,000	12,000	54,153	1377,961	1412,411	101,772	0,000	9,735	13212,833
	13,000	13,000	50,112	1275,137	1307,015	101,772	0,000	9,230	13212,833
	12,000	14,000	46,071	1172,312	1201,619	101,772	0,000	8,724	13212,833
	11,000	15,000	42,030	1069,487	1096,224	101,772	0,000	8,217	13212,833
	10,000	16,000	37,989	966,662	990,828	101,772	0,000	7,708	13212,833
	9,000	17,000	33,948	863,837	885,433	101,772	0,000	7,197	13212,833
	8,000	18,000	29,907	761,012	780,037	101,772	0,000	6,683	13212,833
	7,000	19,000	25,866	658,187	674,642	101,772	0,000	6,165	13212,833
	6,000	20,000	21,825	555,362	569,246	101,772	0,000	5,640	13212,833
	5,000	21,000	17,788	452,628	463,944	101,772	0,000	5,105	12864,728
	4,000	22,000	13,872	352,992	361,817	101,772	0,000	4,569	11215,629
	3,000	23,000	10,136	257,911	264,359	101,772	0,000	4,040	9713,851
	2,000	24,000	6,578	167,386	171,570	101,772	0,000	3,518	8352,493
	1,000	25,000	3,200	81,415	83,451	101,772	0,000	3,005	7124,669
	0,319	25,681	1,000	25,446	26,082	101,772	0,000	2,660	6361,013
	0,000	26,000	0,000	0,000	0,000	101,772	0,000	2,500	0,000

Tank Calibrations - Cofferdam 3

Fluid Type = Water Ballast Specific gravity = 1,025
 Permeability = 97 %
 Trim = 0 m (+ve by stern); Heel = 0 deg to starboard

Tank Name	Sounding m	Ullage m	% Full	Capacity m ³	Capacity tonne	LCG m	TCG m	VCG m	FSM tonne.m
Cofferdam 3	26,000	0,000	100,000	2544,581	2608,196	150,798	0,000	15,460	0,000
	25,261	0,739	98,000	2493,689	2556,032	150,798	0,000	15,202	4691,890
	25,226	0,774	97,900	2491,145	2553,424	150,798	0,000	15,189	4764,195
	25,000	1,000	97,239	2474,318	2536,176	150,798	0,000	15,105	5251,501
	24,000	2,000	94,058	2393,379	2453,214	150,798	0,000	14,703	7805,240
	23,000	3,000	90,458	2301,765	2359,309	150,798	0,000	14,253	11076,051
	22,000	4,000	86,480	2200,555	2255,569	150,798	0,000	13,759	13212,797
	21,000	5,000	82,439	2097,730	2150,173	150,798	0,000	13,257	13212,797
	20,000	6,000	78,398	1994,905	2044,778	150,798	0,000	12,755	13212,797
	19,000	7,000	74,357	1892,081	1939,383	150,798	0,000	12,253	13212,797
	18,000	8,000	70,316	1789,256	1833,988	150,798	0,000	11,750	13212,797
	17,000	9,000	66,275	1686,432	1728,592	150,798	0,000	11,247	13212,797
	16,000	10,000	62,234	1583,607	1623,197	150,798	0,000	10,744	13212,797
	15,000	11,000	58,194	1480,782	1517,802	150,798	0,000	10,240	13212,797
	14,000	12,000	54,153	1377,958	1412,407	150,798	0,000	9,735	13212,797
	13,000	13,000	50,112	1275,133	1307,011	150,798	0,000	9,230	13212,797
	12,000	14,000	46,071	1172,308	1201,616	150,798	0,000	8,724	13212,797
	11,000	15,000	42,030	1069,484	1096,221	150,798	0,000	8,217	13212,797
	10,000	16,000	37,989	966,659	990,826	150,798	0,000	7,708	13212,797
	9,000	17,000	33,948	863,835	885,430	150,798	0,000	7,197	13212,797
	8,000	18,000	29,907	761,010	780,035	150,798	0,000	6,683	13212,797
	7,000	19,000	25,866	658,185	674,640	150,798	0,000	6,165	13212,797
	6,000	20,000	21,825	555,361	569,245	150,798	0,000	5,640	13212,797
	5,000	21,000	17,788	452,627	463,943	150,798	0,000	5,105	12864,693
	4,000	22,000	13,872	352,991	361,816	150,798	0,000	4,569	11215,599
	3,000	23,000	10,136	257,911	264,358	150,798	0,000	4,040	9713,824
	2,000	24,000	6,578	167,385	171,570	150,798	0,000	3,518	8352,470
	1,000	25,000	3,200	81,415	83,450	150,798	0,000	3,005	7124,650
	0,319	25,681	1,000	25,446	26,082	150,798	0,000	2,660	6360,996
	0,000	26,000	0,000	0,000	0,000	150,798	0,000	2,500	0,000

Tank Calibrations - Cofferdam 2

Fluid Type = Water Ballast Specific gravity = 1,025
 Permeability = 97 %
 Trim = 0 m (+ve by stern); Heel = 0 deg to starboard

Tank Name	Sounding m	Ullage m	% Full	Capacity m ³	Capacity tonne	LCG m	TCG m	VCG m	FSM tonne.m
Cofferdam 2	26,000	0,000	100,000	2451,407	2512,692	199,813	0,000	15,509	0,000
	25,274	0,726	98,000	2402,379	2462,438	199,812	0,000	15,251	4381,542
	25,240	0,760	97,900	2399,927	2459,925	199,812	0,000	15,238	4445,091
	25,000	1,000	97,189	2382,486	2442,048	199,812	0,000	15,148	4905,895
	24,000	2,000	93,971	2303,604	2361,194	199,812	0,000	14,742	7170,193
	23,000	3,000	90,346	2214,760	2270,129	199,812	0,000	14,291	10042,339
	22,000	4,000	86,357	2116,964	2169,888	199,812	0,000	13,796	11907,314
	21,000	5,000	82,306	2017,661	2068,102	199,812	0,000	13,294	11907,314
	20,000	6,000	78,255	1918,358	1966,317	199,812	0,000	12,792	11907,314
	19,000	7,000	74,205	1819,055	1864,531	199,812	0,000	12,289	11907,314
	18,000	8,000	70,154	1719,752	1762,746	199,812	0,000	11,786	11907,314
	17,000	9,000	66,103	1620,449	1660,960	199,812	0,000	11,283	11907,314
	16,000	10,000	62,052	1521,146	1559,174	199,812	0,000	10,779	11907,314
	15,000	11,000	58,001	1421,843	1457,389	199,812	0,000	10,275	11907,314
	14,000	12,000	53,950	1322,540	1355,603	199,812	0,000	9,770	11907,314
	13,000	13,000	49,899	1223,237	1253,818	199,812	0,000	9,264	11907,314
	12,000	14,000	45,849	1123,934	1152,032	199,812	0,000	8,757	11907,314
	11,000	15,000	41,798	1024,631	1050,247	199,812	0,000	8,249	11907,314
	10,000	16,000	37,747	925,328	948,461	199,812	0,000	7,739	11907,314
	9,000	17,000	33,696	826,025	846,676	199,812	0,000	7,227	11907,314
	8,000	18,000	29,645	726,722	744,890	199,812	0,000	6,711	11907,314
	7,000	19,000	25,594	627,419	643,105	199,812	0,000	6,191	11907,314
	6,000	20,000	21,543	528,116	541,319	199,812	0,000	5,662	11907,314
	5,000	21,000	17,497	428,913	439,636	199,812	0,000	5,122	11550,651
	4,000	22,000	13,589	333,116	341,444	199,812	0,000	4,580	9873,786
	3,000	23,000	9,885	242,325	248,384	199,812	0,000	4,046	8367,614
	2,000	24,000	6,386	156,543	160,456	199,812	0,000	3,521	7022,973
	1,000	25,000	3,091	75,768	77,662	199,813	0,000	3,006	5830,700
	0,331	25,669	1,000	24,514	25,127	199,813	0,000	2,666	5113,435
	0,000	26,000	0,000	0,000	0,000	199,813	0,000	2,500	0,000

Tank Calibrations - Cofferdam 1

Fluid Type = Water Ballast Specific gravity = 1,025
 Permeability = 97 %
 Trim = 0 m (+ve by stern); Heel = 0 deg to starboard

Tank Name	Sounding m	Ullage m	% Full	Capacity m ³	Capacity tonne	LCG m	TCG m	VCG m	FSM tonne.m
Cofferdam 1	22,171	0,000	100,000	699,857	717,353	243,256	0,000	17,484	0,000
	22,000	0,171	99,450	696,005	713,405	243,256	0,000	17,423	146,121
	21,569	0,602	98,000	685,859	703,006	243,256	0,000	17,265	174,290
	21,540	0,630	97,900	685,160	702,289	243,256	0,000	17,254	176,294
	21,000	1,171	95,955	671,548	688,337	243,256	0,000	17,045	216,740
	20,000	2,171	92,002	643,881	659,978	243,256	0,000	16,625	307,083
	19,000	3,171	87,590	613,005	628,330	243,256	0,000	16,161	419,577
	18,000	4,171	82,808	579,540	594,028	243,255	0,000	15,661	468,199
	17,000	5,171	77,995	545,856	559,502	243,255	0,000	15,157	467,614
	16,000	6,171	73,184	512,185	524,990	243,255	0,000	14,653	467,030
	15,000	7,171	68,375	478,528	490,491	243,255	0,000	14,148	466,447
	14,000	8,171	63,568	444,884	456,006	243,254	0,000	13,642	465,864
	13,000	9,171	58,763	411,254	421,535	243,254	0,000	13,137	465,282
	12,000	10,171	53,959	377,636	387,077	243,253	0,000	12,630	464,700
	11,000	11,171	49,158	344,033	352,633	243,253	0,000	12,122	464,119
	10,000	12,171	44,358	310,442	318,203	243,252	0,000	11,612	463,539
	9,000	13,171	39,560	276,865	283,787	243,251	0,000	11,101	462,959
	8,000	14,171	34,764	243,301	249,384	243,249	0,000	10,587	462,380
	7,000	15,171	29,971	209,751	214,995	243,248	0,000	10,068	461,801
	6,000	16,171	25,179	176,214	180,619	243,245	0,000	9,542	461,223
	5,000	17,171	20,401	142,778	146,348	243,242	0,000	9,007	442,097
	4,000	18,171	15,784	110,462	113,223	243,237	0,000	8,472	386,282
	3,000	19,171	11,374	79,601	81,591	243,230	0,000	7,945	335,374
	2,000	20,171	7,172	50,195	51,450	243,215	0,000	7,424	289,148
	1,000	21,171	3,178	22,245	22,801	243,163	0,000	6,909	247,379
	0,431	21,739	1,000	6,999	7,174	242,964	0,000	6,609	225,526
	0,000	22,171	0,000	0,000	0,000	241,926	0,000	6,329	0,000

Tank Calibrations - Pique PR BR

Fluid Type = Water Ballast Specific gravity = 1,025

Permeability = 97 %

Trim = 0 m (+ve by stern); Heel = 0 deg to starboard

Tank Name	Sounding m	Ullage m	% Full	Capacity m ³	Capacity tonne	LCG m	TCG m	VCG m	FSM tonne.m
Pique PR BR	23,800	0,000	100,000	401,555	411,594	268,098	-1,679	15,907	0,000
	23,613	0,187	98,000	393,524	403,362	268,087	-1,657	15,697	163,800
	23,603	0,197	97,900	393,123	402,951	268,087	-1,656	15,686	163,342
	23,000	0,800	91,782	368,557	377,771	268,056	-1,588	15,012	136,777
	22,000	1,800	82,654	331,900	340,198	268,018	-1,487	13,907	101,138
	21,000	2,800	74,692	299,931	307,429	267,996	-1,400	12,830	74,868
	20,000	3,800	67,831	272,377	279,187	267,993	-1,326	11,800	52,727
	19,000	4,800	62,015	249,025	255,250	268,009	-1,269	10,843	36,390
	18,000	5,800	57,122	229,376	235,110	268,038	-1,230	9,971	23,751
	17,000	6,800	53,151	213,430	218,766	268,080	-1,208	9,220	13,914
	16,000	7,800	50,053	200,989	206,014	268,134	-1,200	8,614	7,330
	15,000	8,800	47,643	191,315	196,098	268,188	-1,204	8,138	3,784
	14,000	9,800	45,789	183,870	188,466	268,236	-1,217	7,778	1,829
	13,000	10,800	44,423	178,384	182,844	268,278	-1,233	7,525	0,829
	12,000	11,800	43,469	174,552	178,916	268,314	-1,248	7,360	0,356
	11,000	12,800	42,778	171,777	176,072	268,345	-1,261	7,252	0,294
	10,000	13,800	42,045	168,832	173,053	268,380	-1,273	7,153	0,605
	9,000	14,800	40,622	163,118	167,196	268,432	-1,290	6,985	2,704
	8,000	15,800	37,862	152,037	155,838	268,494	-1,307	6,695	10,027
	7,000	16,800	33,683	135,257	138,638	268,543	-1,311	6,288	19,255
	6,000	17,800	28,597	114,832	117,703	268,583	-1,290	5,808	25,099
	5,000	18,800	23,054	92,573	94,887	268,611	-1,241	5,282	25,838
	4,000	19,800	17,444	70,049	71,801	268,626	-1,168	4,729	22,722
	3,000	20,800	12,081	48,511	49,723	268,628	-1,074	4,162	17,428
	2,000	21,800	7,225	29,011	29,736	268,611	-0,959	3,591	11,525
	1,000	22,800	3,121	12,534	12,847	268,581	-0,826	3,029	6,095
	0,361	23,439	1,000	4,016	4,116	268,560	-0,732	2,685	3,338
	0,000	23,800	0,000	0,000	0,000	268,543	-0,677	2,500	0,000

Tank Calibrations - Pique PR ER

Fluid Type = Water Ballast Specific gravity = 1,025
 Permeability = 97 %
 Trim = 0 m (+ve by stern); Heel = 0 deg to starboard

Tank Name	Sounding m	Ullage m	% Full	Capacity m ³	Capacity tonne	LCG m	TCG m	VCG m	FSM tonne.m
Pique PR ER	23,800	0,000	100,000	401,555	411,594	268,098	1,679	15,907	0,000
	23,613	0,187	98,000	393,524	403,362	268,087	1,657	15,697	163,800
	23,603	0,197	97,900	393,123	402,951	268,087	1,656	15,686	163,342
	23,000	0,800	91,782	368,557	377,771	268,056	1,588	15,012	136,777
	22,000	1,800	82,654	331,900	340,198	268,018	1,487	13,907	101,138
	21,000	2,800	74,692	299,931	307,429	267,996	1,400	12,830	74,868
	20,000	3,800	67,831	272,377	279,187	267,993	1,326	11,800	52,727
	19,000	4,800	62,015	249,025	255,250	268,009	1,269	10,843	36,390
	18,000	5,800	57,122	229,376	235,110	268,038	1,230	9,971	23,751
	17,000	6,800	53,151	213,430	218,766	268,080	1,208	9,220	13,914
	16,000	7,800	50,053	200,989	206,014	268,134	1,200	8,614	7,330
	15,000	8,800	47,643	191,315	196,098	268,188	1,204	8,138	3,784
	14,000	9,800	45,789	183,870	188,466	268,236	1,217	7,778	1,829
	13,000	10,800	44,423	178,384	182,844	268,278	1,233	7,525	0,829
	12,000	11,800	43,469	174,552	178,916	268,314	1,248	7,360	0,356
	11,000	12,800	42,778	171,777	176,072	268,345	1,261	7,252	0,294
	10,000	13,800	42,045	168,832	173,053	268,380	1,273	7,153	0,605
	9,000	14,800	40,622	163,118	167,196	268,432	1,290	6,985	2,704
	8,000	15,800	37,862	152,037	155,838	268,494	1,307	6,695	10,027
	7,000	16,800	33,683	135,257	138,638	268,543	1,311	6,288	19,255
	6,000	17,800	28,597	114,832	117,703	268,583	1,290	5,808	25,099
	5,000	18,800	23,054	92,573	94,887	268,611	1,241	5,282	25,838
	4,000	19,800	17,444	70,049	71,801	268,626	1,168	4,729	22,722
	3,000	20,800	12,081	48,511	49,723	268,628	1,074	4,162	17,428
	2,000	21,800	7,225	29,011	29,736	268,611	0,959	3,591	11,525
	1,000	22,800	3,121	12,534	12,847	268,581	0,826	3,029	6,095
	0,361	23,439	1,000	4,016	4,116	268,560	0,732	2,685	3,338
	0,000	23,800	0,000	0,000	0,000	268,543	0,677	2,500	0,000

Tank Calibrations - Lastre 4 BR

Fluid Type = Water Ballast Specific gravity = 1,025
 Permeability = 97 %
 Trim = 0 m (+ve by stern); Heel = 0 deg to starboard

Tank Name	Sounding m	Ullage m	% Full	Capacity m ³	Capacity tonne	LCG m	TCG m	VCG m	FSM tonne.m
Lastre 4 BR	26,300	0,000	100,000	4399,155	4509,134	77,576	-15,302	9,501	0,000
	26,000	0,300	99,190	4363,519	4472,606	77,589	-15,261	9,365	65,377
	25,559	0,741	98,000	4311,172	4418,951	77,610	-15,199	9,166	65,377
	25,522	0,778	97,900	4306,773	4414,442	77,612	-15,194	9,149	65,377
	24,000	2,300	93,789	4125,941	4229,090	77,687	-14,968	8,465	65,377
	22,000	4,300	88,389	3888,364	3985,573	77,797	-14,639	7,577	65,377
	20,000	6,300	82,988	3650,787	3742,056	77,921	-14,267	6,703	65,377
	18,000	8,300	77,588	3413,210	3498,540	78,062	-13,844	5,847	65,377
	16,000	10,300	72,187	3175,633	3255,024	78,224	-13,357	5,013	65,375
	14,000	12,300	66,788	2938,091	3011,543	78,413	-12,792	4,205	65,264
	12,000	14,300	61,402	2701,184	2768,714	78,635	-12,129	3,434	63,992
	10,000	16,300	56,106	2468,169	2529,873	78,891	-11,355	2,719	58,307
	8,000	18,300	51,100	2247,951	2304,150	79,149	-10,483	2,102	45,348
	6,000	20,300	46,811	2059,285	2110,767	79,291	-9,600	1,650	27,716
	4,000	22,300	43,911	1931,703	1979,995	79,092	-8,917	1,423	12,507
	2,000	24,300	32,737	1440,137	1476,140	79,218	-8,375	1,098	27121,926
	0,142	26,158	1,000	43,992	45,092	83,378	-5,152	0,090	10215,647
	0,000	26,300	0,000	0,000	0,000	83,509	-0,005	0,000	0,000

Tank Calibrations - Lastre 4 ER

Fluid Type = Water Ballast Specific gravity = 1,025

Permeability = 97 %

Trim = 0 m (+ve by stern); Heel = 0 deg to starboard

Tank Name	Sounding m	Ullage m	% Full	Capacity m ³	Capacity tonne	LCG m	TCG m	VCG m	FSM tonne.m
Lastre 4 ER	26,300	0,000	100,000	4399,155	4509,134	77,576	15,302	9,501	0,000
	26,000	0,300	99,190	4363,519	4472,606	77,589	15,261	9,365	65,377
	25,559	0,741	98,000	4311,172	4418,951	77,610	15,199	9,166	65,377
	25,522	0,778	97,900	4306,773	4414,442	77,612	15,194	9,149	65,377
	24,000	2,300	93,789	4125,941	4229,090	77,687	14,968	8,465	65,377
	22,000	4,300	88,389	3888,364	3985,573	77,797	14,639	7,577	65,377
	20,000	6,300	82,988	3650,787	3742,056	77,921	14,267	6,703	65,377
	18,000	8,300	77,588	3413,210	3498,540	78,062	13,844	5,847	65,377
	16,000	10,300	72,187	3175,633	3255,024	78,224	13,357	5,013	65,375
	14,000	12,300	66,788	2938,091	3011,543	78,413	12,792	4,205	65,264
	12,000	14,300	61,402	2701,184	2768,714	78,635	12,129	3,434	63,992
	10,000	16,300	56,106	2468,169	2529,873	78,891	11,355	2,719	58,307
	8,000	18,300	51,100	2247,951	2304,150	79,149	10,483	2,102	45,348
	6,000	20,300	46,811	2059,285	2110,767	79,291	9,600	1,650	27,716
	4,000	22,300	43,911	1931,703	1979,995	79,092	8,917	1,423	12,507
	2,000	24,300	32,737	1440,137	1476,140	79,218	8,375	1,098	27121,926
	0,142	26,158	1,000	43,992	45,092	83,378	5,152	0,090	10215,647
	0,000	26,300	0,000	0,000	0,000	83,509	0,005	0,000	0,000

Tank Calibrations - Lastre 3 BR

Fluid Type = Water Ballast Specific gravity = 1,025
 Permeability = 97 %
 Trim = 0 m (+ve by stern); Heel = 0 deg to starboard

Tank Name	Sounding m	Ullage m	% Full	Capacity m ³	Capacity tonne	LCG m	TCG m	VCG m	FSM tonne.m
Lastre 3 BR	26,300	0,000	100,000	5237,740	5368,684	124,977	-15,690	8,340	0,000
	26,000	0,300	99,319	5202,074	5332,126	124,977	-15,658	8,218	65,431
	25,419	0,881	98,000	5132,986	5261,310	124,978	-15,595	7,983	65,431
	25,375	0,925	97,900	5127,748	5255,941	124,978	-15,590	7,965	65,431
	24,000	2,300	94,779	4964,303	5088,411	124,981	-15,433	7,414	65,431
	22,000	4,300	90,240	4726,532	4844,695	124,985	-15,186	6,630	65,431
	20,000	6,300	85,700	4488,761	4600,980	124,990	-14,912	5,869	65,431
	18,000	8,300	81,161	4250,989	4357,264	124,995	-14,608	5,135	65,431
	16,000	10,300	76,621	4013,220	4113,550	125,001	-14,268	4,432	65,426
	14,000	12,300	72,083	3775,494	3869,882	125,007	-13,885	3,766	65,338
	12,000	14,300	67,549	3538,032	3626,482	125,014	-13,451	3,147	64,953
	10,000	16,300	63,030	3301,341	3383,874	125,020	-12,957	2,583	64,024
	8,000	18,300	58,542	3066,260	3142,916	125,021	-12,391	2,091	62,373
	6,000	20,300	54,111	2834,190	2905,045	125,013	-11,742	1,689	59,249
	4,000	22,300	49,799	2608,352	2673,561	124,992	-11,002	1,402	52,998
	2,000	24,300	37,081	1942,207	1990,762	124,972	-10,336	1,027	39887,799
	0,090	26,210	1,000	52,377	53,687	125,865	-7,721	0,058	28596,690
	0,000	26,300	0,000	0,000	0,000	126,364	-0,010	0,000	0,000

Tank Calibrations - Lastre 3 ER

Fluid Type = Water Ballast Specific gravity = 1,025
 Permeability = 97 %
 Trim = 0 m (+ve by stern); Heel = 0 deg to starboard

Tank Name	Sounding m	Ullage m	% Full	Capacity m ³	Capacity tonne	LCG m	TCG m	VCG m	FSM tonne.m
Lastre 3 ER	26,300	0,000	100,000	5237,740	5368,684	124,977	15,690	8,340	0,000
	26,000	0,300	99,319	5202,074	5332,126	124,977	15,658	8,218	65,431
	25,419	0,881	98,000	5132,986	5261,310	124,978	15,595	7,983	65,431
	25,375	0,925	97,900	5127,748	5255,941	124,978	15,590	7,965	65,431
	24,000	2,300	94,779	4964,303	5088,411	124,981	15,433	7,414	65,431
	22,000	4,300	90,240	4726,532	4844,695	124,985	15,186	6,630	65,431
	20,000	6,300	85,700	4488,761	4600,980	124,990	14,912	5,869	65,431
	18,000	8,300	81,161	4250,989	4357,264	124,995	14,608	5,135	65,431
	16,000	10,300	76,621	4013,220	4113,550	125,001	14,268	4,432	65,426
	14,000	12,300	72,083	3775,494	3869,882	125,007	13,885	3,766	65,338
	12,000	14,300	67,549	3538,032	3626,482	125,014	13,451	3,147	64,953
	10,000	16,300	63,030	3301,341	3383,874	125,020	12,957	2,583	64,024
	8,000	18,300	58,542	3066,260	3142,916	125,021	12,391	2,091	62,373
	6,000	20,300	54,111	2834,190	2905,045	125,013	11,742	1,689	59,249
	4,000	22,300	49,799	2608,352	2673,561	124,992	11,002	1,402	52,998
	2,000	24,300	37,081	1942,207	1990,762	124,972	10,336	1,027	39887,799
	0,090	26,210	1,000	52,377	53,687	125,865	7,721	0,058	28596,690
	0,000	26,300	0,000	0,000	0,000	126,364	0,010	0,000	0,000

Tank Calibrations - Lastre 2 BR

Fluid Type = Water Ballast Specific gravity = 1,025
 Permeability = 97 %
 Trim = 0 m (+ve by stern); Heel = 0 deg to starboard

Tank Name	Sounding m	Ullage m	% Full	Capacity m ³	Capacity tonne	LCG m	TCG m	VCG m	FSM tonne.m
Lastre 2 BR	26,300	0,000	100,000	4649,212	4765,443	172,522	-15,153	8,809	0,000
	26,000	0,300	99,248	4614,247	4729,603	172,514	-15,114	8,677	62,014
	25,502	0,798	98,000	4556,228	4670,134	172,501	-15,048	8,460	61,883
	25,462	0,838	97,900	4551,579	4665,368	172,500	-15,042	8,443	61,873
	24,000	2,300	94,244	4381,623	4491,164	172,461	-14,837	7,811	61,518
	22,000	4,300	89,258	4149,779	4253,524	172,406	-14,531	6,962	61,086
	20,000	6,300	84,287	3918,672	4016,639	172,348	-14,190	6,134	60,686
	18,000	8,300	79,332	3688,301	3780,508	172,287	-13,807	5,331	60,294
	16,000	10,300	74,394	3458,747	3545,216	172,222	-13,375	4,556	59,788
	14,000	12,300	69,488	3230,651	3311,418	172,156	-12,886	3,818	58,537
	12,000	14,300	64,655	3005,969	3081,118	172,096	-12,333	3,132	55,734
	10,000	16,300	59,974	2788,323	2858,031	172,056	-11,714	2,517	50,827
	8,000	18,300	55,560	2583,112	2647,690	172,063	-11,040	2,001	43,807
	6,000	20,300	51,582	2398,140	2458,094	172,160	-10,338	1,614	34,821
	4,000	22,300	48,320	2246,502	2302,665	172,411	-9,684	1,382	22,613
	2,000	24,300	36,489	1696,441	1738,852	172,578	-9,135	1,050	31766,736
	0,090	26,210	1,000	46,492	47,655	171,848	-6,483	0,055	15433,542
	0,000	26,300	0,000	0,000	0,000	173,923	-0,012	0,000	0,000

Tank Calibrations - Lastre 2 ER

Fluid Type = Water Ballast Specific gravity = 1,025

Permeability = 97 %

Trim = 0 m (+ve by stern); Heel = 0 deg to starboard

Tank Name	Sounding m	Ullage m	% Full	Capacity m ³	Capacity tonne	LCG m	TCG m	VCG m	FSM tonne.m
Lastre 2 ER	26,300	0,000	100,000	4649,212	4765,443	172,522	15,153	8,809	0,000
	26,000	0,300	99,248	4614,247	4729,603	172,514	15,114	8,677	62,014
	25,502	0,798	98,000	4556,228	4670,134	172,501	15,048	8,460	61,883
	25,462	0,838	97,900	4551,579	4665,368	172,500	15,042	8,443	61,873
	24,000	2,300	94,244	4381,623	4491,164	172,461	14,837	7,811	61,518
	22,000	4,300	89,258	4149,779	4253,524	172,406	14,531	6,962	61,086
	20,000	6,300	84,287	3918,672	4016,639	172,348	14,190	6,134	60,686
	18,000	8,300	79,332	3688,301	3780,508	172,287	13,807	5,331	60,294
	16,000	10,300	74,394	3458,747	3545,216	172,222	13,375	4,556	59,788
	14,000	12,300	69,488	3230,651	3311,418	172,156	12,886	3,818	58,537
	12,000	14,300	64,655	3005,969	3081,118	172,096	12,333	3,132	55,734
	10,000	16,300	59,974	2788,323	2858,031	172,056	11,714	2,517	50,827
	8,000	18,300	55,560	2583,112	2647,690	172,063	11,040	2,001	43,807
	6,000	20,300	51,582	2398,140	2458,094	172,160	10,338	1,614	34,821
	4,000	22,300	48,320	2246,502	2302,665	172,411	9,684	1,382	22,613
	2,000	24,300	36,489	1696,441	1738,852	172,578	9,135	1,050	31766,736
	0,090	26,210	1,000	46,492	47,655	171,848	6,483	0,055	15433,542
	0,000	26,300	0,000	0,000	0,000	173,923	0,012	0,000	0,000

Tank Calibrations - Lastre 1 BR

Fluid Type = Water Ballast Specific gravity = 1,025
 Permeability = 97 %
 Trim = 0 m (+ve by stern); Heel = 0 deg to starboard

Tank Name	Sounding m	Ullage m	% Full	Capacity m ³	Capacity tonne	LCG m	TCG m	VCG m	FSM tonne.m
Lastre 1 BR	26,300	0,000	100,000	4463,562	4575,151	222,028	-13,012	14,284	0,000
	26,000	0,300	98,217	4383,973	4493,572	221,963	-12,962	14,069	2405,240
	25,963	0,337	98,000	4374,291	4483,648	221,955	-12,955	14,043	2401,748
	25,946	0,354	97,900	4369,827	4479,073	221,952	-12,953	14,030	2400,140
	24,000	2,300	86,843	3876,308	3973,216	221,516	-12,603	12,636	2235,009
	22,000	4,300	76,296	3405,531	3490,669	221,038	-12,198	11,201	2095,402
	20,000	6,300	66,536	2969,876	3044,123	220,523	-11,729	9,762	1967,554
	18,000	8,300	57,583	2570,236	2634,492	219,981	-11,175	8,323	1835,911
	16,000	10,300	49,477	2208,420	2263,631	219,428	-10,513	6,899	1685,821
	14,000	12,300	42,256	1886,107	1933,260	218,880	-9,720	5,511	1503,898
	12,000	14,300	35,963	1605,245	1645,376	218,352	-8,780	4,196	1283,275
	10,000	16,300	30,680	1369,434	1403,670	217,862	-7,705	3,018	1017,467
	8,000	18,300	26,573	1186,119	1215,772	217,467	-6,588	2,086	690,878
	6,000	20,300	23,951	1069,057	1095,783	217,283	-5,678	1,536	269,513
	4,000	22,300	23,192	1035,167	1061,046	217,319	-5,365	1,409	0,000
	2,000	24,300	17,431	778,034	797,485	217,158	-5,090	1,130	8133,987
	0,235	26,065	1,000	44,635	45,751	214,701	-3,023	0,140	1851,675
	0,000	26,300	0,000	0,000	0,000	212,133	-0,005	0,000	0,000

Tank Calibrations - Lastre 1 ER

Fluid Type = Water Ballast Specific gravity = 1,025
 Permeability = 97 %
 Trim = 0 m (+ve by stern); Heel = 0 deg to starboard

Tank Name	Sounding m	Ullage m	% Full	Capacity m ³	Capacity tonne	LCG m	TCG m	VCG m	FSM tonne.m
Lastre 1 ER	26,300	0,000	100,000	4463,562	4575,151	222,028	13,012	14,284	0,000
	26,000	0,300	98,217	4383,973	4493,572	221,963	12,962	14,069	2405,240
	25,963	0,337	98,000	4374,291	4483,648	221,955	12,955	14,043	2401,748
	25,946	0,354	97,900	4369,827	4479,073	221,952	12,953	14,030	2400,140
	24,000	2,300	86,843	3876,308	3973,216	221,516	12,603	12,636	2235,009
	22,000	4,300	76,296	3405,531	3490,669	221,038	12,198	11,201	2095,402
	20,000	6,300	66,536	2969,876	3044,123	220,523	11,729	9,762	1967,554
	18,000	8,300	57,583	2570,236	2634,492	219,981	11,175	8,323	1835,911
	16,000	10,300	49,477	2208,420	2263,631	219,428	10,513	6,899	1685,821
	14,000	12,300	42,256	1886,107	1933,260	218,880	9,720	5,511	1503,898
	12,000	14,300	35,963	1605,245	1645,376	218,352	8,780	4,196	1283,275
	10,000	16,300	30,680	1369,434	1403,670	217,862	7,705	3,018	1017,467
	8,000	18,300	26,573	1186,119	1215,772	217,467	6,588	2,086	690,878
	6,000	20,300	23,951	1069,057	1095,783	217,283	5,678	1,536	269,513
	4,000	22,300	23,192	1035,167	1061,046	217,319	5,365	1,409	0,000
	2,000	24,300	17,431	778,034	797,485	217,158	5,090	1,130	8133,987
	0,235	26,065	1,000	44,635	45,751	214,701	3,023	0,140	1851,675
	0,000	26,300	0,000	0,000	0,000	212,133	0,005	0,000	0,000

ANEXO IV

Tablas de KN

KN Calculation - PROYECTO

Stability 20.00.04.9, build: 9

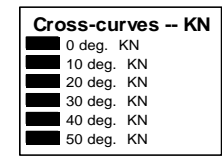
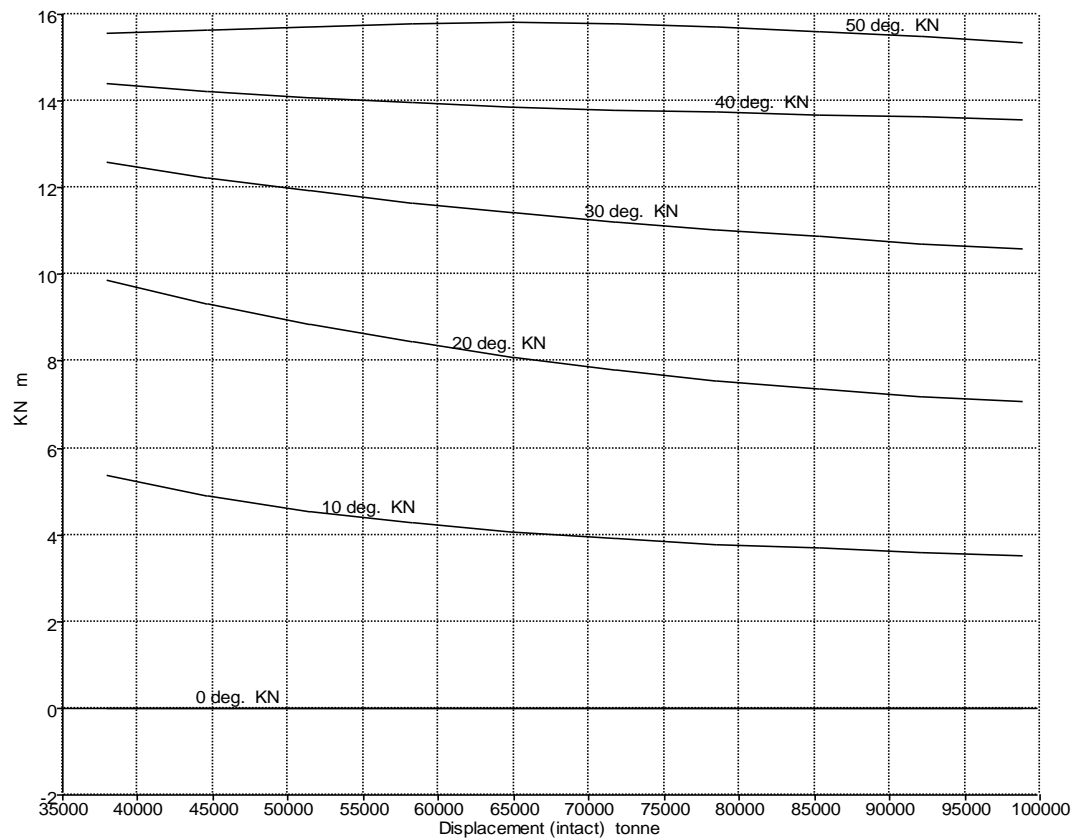
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Damage Case - Intact

Initial Trim = 0 m (+ve by stern)

Specific gravity = 1,025; (Density = 1,025 tonne/m³)

VCG = -11,5 m; TCG = 0 m



Displacement (intact tonne)	Draft Amidships m	Trim (+ve by stern) m	LCG m	TCG m	Assumed VCG m	KN 10,0 deg. Starb.	KN 20,0 deg. Starb.	KN 30,0 deg. Starb.	KN 40,0 deg. Starb.	KN 50,0 deg. Starb.
37944	5,058	0,000	138,346	0,000	-11,500	5,373	9,860	12,589	14,392	15,572
44721	5,833	0,000	138,120	0,000	-11,500	4,897	9,325	12,227	14,227	15,652
51498	6,591	0,000	137,850	0,000	-11,500	4,547	8,861	11,919	14,086	15,728
58275	7,334	0,000	137,529	0,000	-11,500	4,281	8,453	11,654	13,969	15,784
65052	8,064	0,000	137,160	0,000	-11,500	4,076	8,098	11,423	13,873	15,801
71829	8,781	0,000	136,749	0,000	-11,500	3,915	7,798	11,218	13,796	15,769
78606	9,486	0,000	136,301	0,000	-11,500	3,788	7,553	11,034	13,737	15,699
85383	10,181	0,000	135,829	0,000	-11,500	3,684	7,353	10,868	13,692	15,600
92160	10,867	0,000	135,341	0,000	-11,500	3,600	7,190	10,718	13,642	15,480
98937	11,546	0,000	134,846	0,000	-11,500	3,530	7,058	10,583	13,573	15,345

KN Calculation - PROYECTO

Stability 20.00.04.9, build: 9

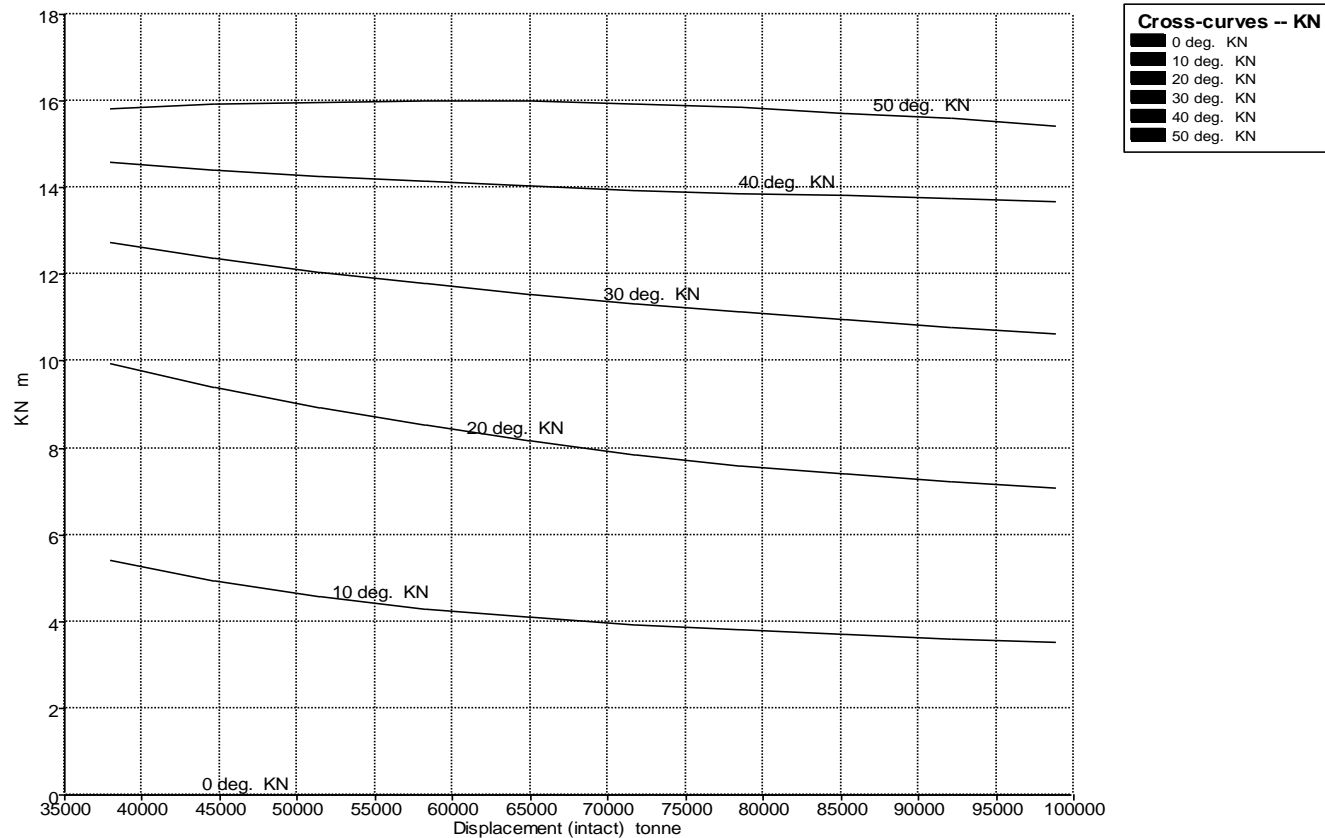
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Damage Case - Intact

Fixed Trim = 0,5 m (+ve by stern)

Specific gravity = 1,025; (Density = 1,025 tonne/m³)

VCG = -11,5 m; TCG = 0 m



Displacement (intact tonne)	Draft Amidships m	Trim (+ve by stern) m	LCG m	TCG m	Assumed VCG m	KN 10,0 deg. Starb.	KN 20,0 deg. Starb.	KN 30,0 deg. Starb.	KN 40,0 deg. Starb.	KN 50,0 deg. Starb.
37944	5,062	0,500 (fixed)	136,766	0,000	-11,500	5,395	9,934	12,725	14,605	15,838
44721	5,835	0,500 (fixed)	136,714	0,000	-11,500	4,919	9,396	12,362	14,423	15,917
51498	6,592	0,500 (fixed)	136,569	0,000	-11,500	4,567	8,928	12,049	14,266	15,976
58275	7,333	0,500 (fixed)	136,343	0,000	-11,500	4,300	8,516	11,778	14,137	16,019
65052	8,061	0,500 (fixed)	136,050	0,000	-11,500	4,093	8,154	11,536	14,031	16,005
71829	8,775	0,500 (fixed)	135,700	0,000	-11,500	3,931	7,849	11,321	13,946	15,943
78606	9,478	0,500 (fixed)	135,304	0,000	-11,500	3,802	7,597	11,127	13,876	15,848
85383	10,171	0,500 (fixed)	134,880	0,000	-11,500	3,696	7,391	10,951	13,819	15,728
92160	10,855	0,500 (fixed)	134,435	0,000	-11,500	3,610	7,223	10,791	13,754	15,589
98937	11,532	0,500 (fixed)	133,979	0,000	-11,500	3,538	7,086	10,645	13,663	15,437

KN Calculation - PROYECTO

Stability 20.00.04.9, build: 9

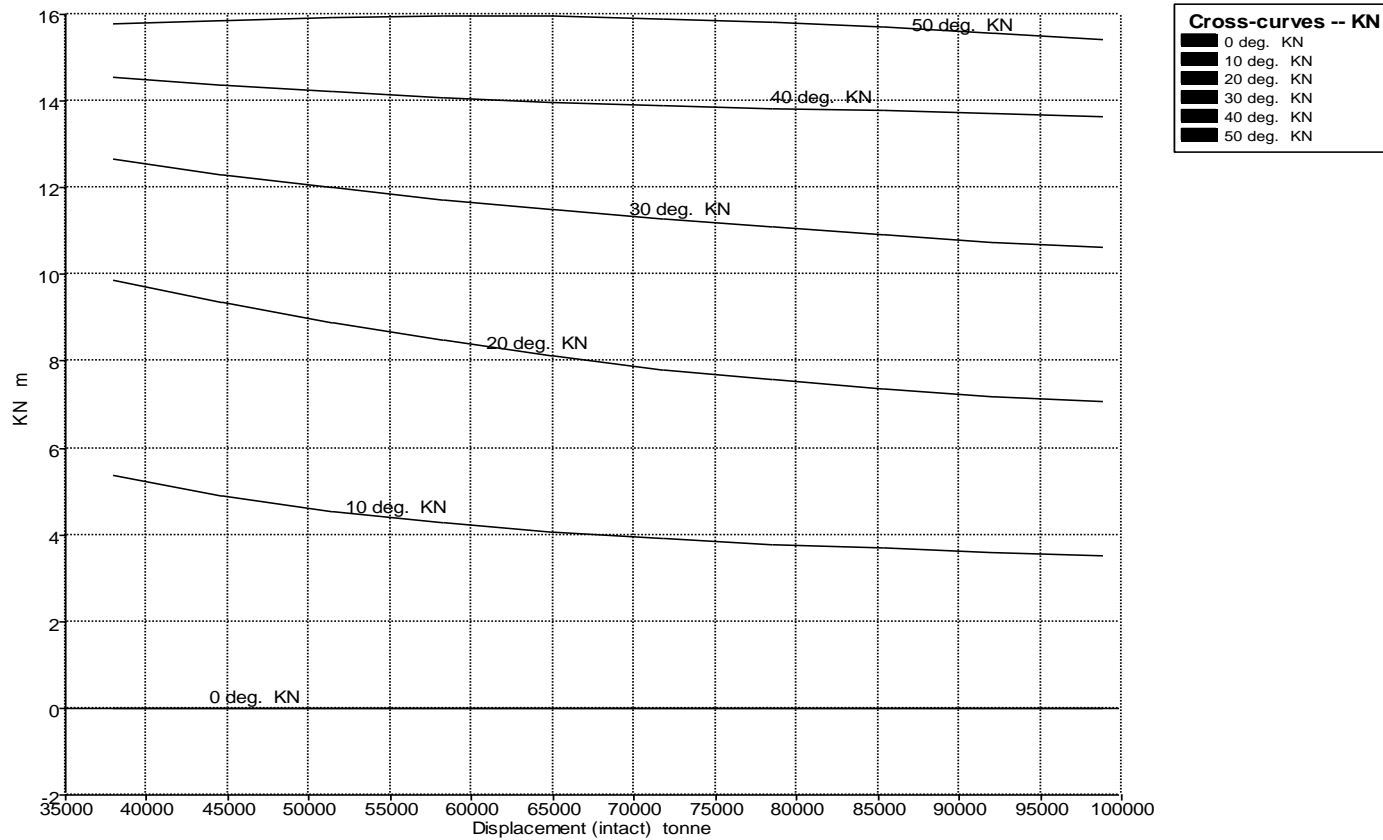
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Damage Case - Intact

Fixed Trim = -0,5 m (+ve by stern)

Specific gravity = 1,025; (Density = 1,025 tonne/m³)

VCG = -11,5 m; TCG = 0 m



Displacement (intact tonne)	Draft Amidships m	Trim (+ve by stern) m	LCG m	TCG m	Assumed VCG m	KN 10,0 deg. Starb.	KN 20,0 deg. Starb.	KN 30,0 deg. Starb.	KN 40,0 deg. Starb.	KN 50,0 deg. Starb.
37944	5,053	-0,500 (fixed)	139,919	0,000	-11,500	5,365	9,881	12,668	14,550	15,785
44721	5,829	-0,500 (fixed)	139,514	0,000	-11,500	4,890	9,346	12,305	14,367	15,865
51498	6,589	-0,500 (fixed)	139,122	0,000	-11,500	4,541	8,880	11,994	14,213	15,926
58275	7,334	-0,500 (fixed)	138,705	0,000	-11,500	4,275	8,471	11,724	14,085	15,970
65052	8,066	-0,500 (fixed)	138,261	0,000	-11,500	4,070	8,114	11,487	13,980	15,963
71829	8,785	-0,500 (fixed)	137,787	0,000	-11,500	3,910	7,811	11,274	13,896	15,907
78606	9,493	-0,500 (fixed)	137,288	0,000	-11,500	3,783	7,564	11,083	13,828	15,815
85383	10,190	-0,500 (fixed)	136,769	0,000	-11,500	3,680	7,361	10,910	13,774	15,698
92160	10,878	-0,500 (fixed)	136,239	0,000	-11,500	3,595	7,195	10,754	13,716	15,563
98937	11,559	-0,500 (fixed)	135,707	0,000	-11,500	3,526	7,061	10,611	13,632	15,414

KN Calculation - PROYECTO

Stability 20.00.04.9, build: 9

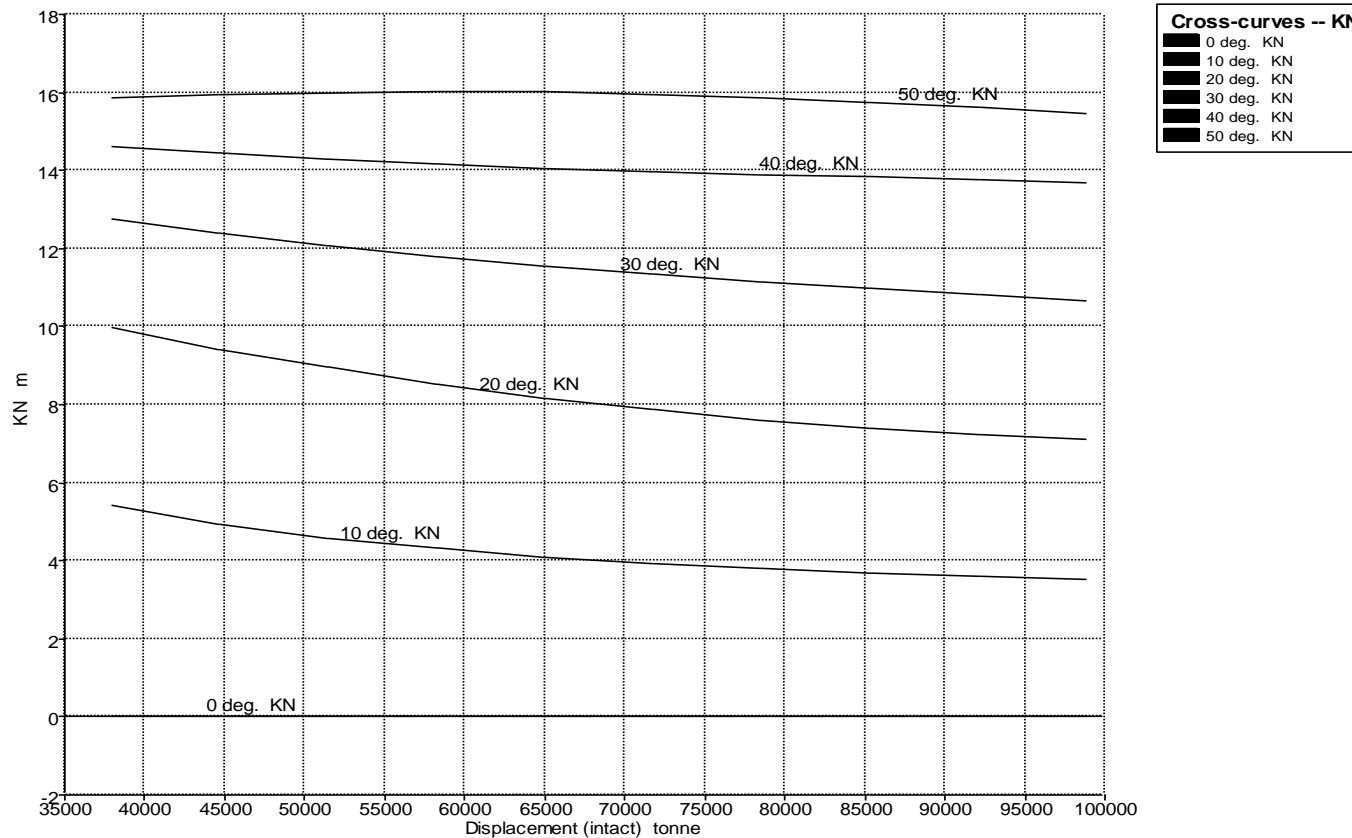
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Damage Case - Intact

Fixed Trim = 1 m (+ve by stern)

Specific gravity = 1,025; (Density = 1,025 tonne/m³)

VCG = -11,5 m; TCG = 0 m



Displacement (intact tonne)	Draft Amidships m	Trim (+ve by stern) m	LCG m	TCG m	Assumed VCG m	KN 10,0 deg. Starb.	KN 20,0 deg. Starb.	KN 30,0 deg. Starb.	KN 40,0 deg. Starb.	KN 50,0 deg. Starb.
37944	5,065	1,000 (fixed)	135,180	0,000	-11,500	5,411	9,961	12,754	14,630	15,864
44721	5,837	1,000 (fixed)	135,301	0,000	-11,500	4,933	9,422	12,390	14,449	15,941
51498	6,592	1,000 (fixed)	135,279	0,000	-11,500	4,580	8,952	12,077	14,293	16,000
58275	7,331	1,000 (fixed)	135,148	0,000	-11,500	4,312	8,538	11,804	14,163	16,041
65052	8,057	1,000 (fixed)	134,929	0,000	-11,500	4,106	8,174	11,561	14,058	16,025
71829	8,769	1,000 (fixed)	134,640	0,000	-11,500	3,943	7,868	11,345	13,972	15,960
78606	9,470	1,000 (fixed)	134,299	0,000	-11,500	3,812	7,614	11,150	13,901	15,863
85383	10,161	1,000 (fixed)	133,922	0,000	-11,500	3,705	7,407	10,973	13,842	15,741
92160	10,843	1,000 (fixed)	133,520	0,000	-11,500	3,617	7,237	10,811	13,773	15,602
98937	11,517	1,000 (fixed)	133,104	0,000	-11,500	3,544	7,100	10,662	13,678	15,449

KN Calculation - PROYECTO

Stability 20.00.04.9, build: 9

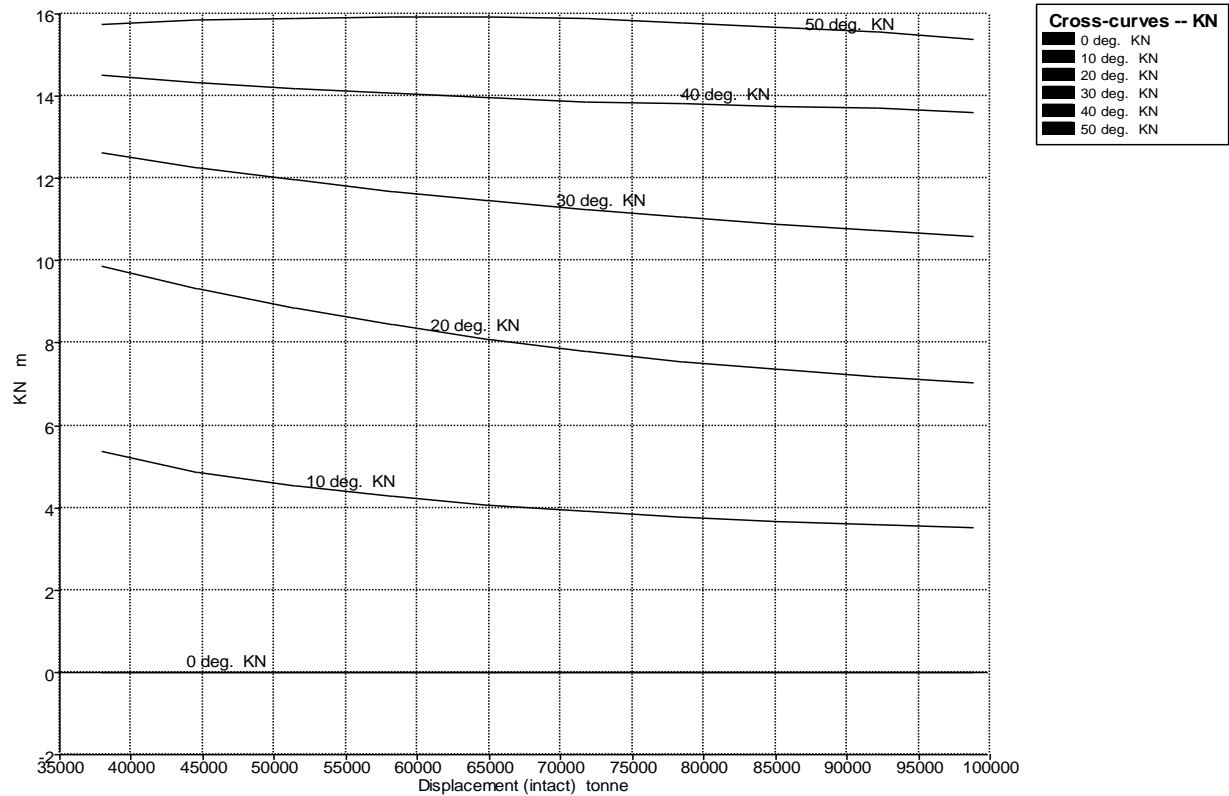
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Damage Case - Intact

Fixed Trim = -1 m (+ve by stern)

Specific gravity = 1,025; (Density = 1,025 tonne/m³)

VCG = -11,5 m; TCG = 0 m



Displacement (intact tonne)	Draft Amidships m	Trim (+ve by stern) m	LCG m	TCG m	Assumed VCG m	KN 10,0 deg. Starb.	KN 20,0 deg. Starb.	KN 30,0 deg. Starb.	KN 40,0 deg. Starb.	KN 50,0 deg. Starb.
37944	5,048	-1,000 (fixed)	141,487	0,000	-11,500	5,350	9,854	12,638	14,520	15,758
44721	5,825	-1,000 (fixed)	140,911	0,000	-11,500	4,876	9,320	12,275	14,338	15,838
51498	6,587	-1,000 (fixed)	140,386	0,000	-11,500	4,528	8,856	11,967	14,186	15,899
58275	7,334	-1,000 (fixed)	139,872	0,000	-11,500	4,264	8,449	11,698	14,060	15,944
65052	8,068	-1,000 (fixed)	139,351	0,000	-11,500	4,059	8,094	11,463	13,956	15,940
71829	8,789	-1,000 (fixed)	138,816	0,000	-11,500	3,900	7,794	11,252	13,872	15,887
78606	9,499	-1,000 (fixed)	138,265	0,000	-11,500	3,773	7,548	11,062	13,805	15,798
85383	10,198	-1,000 (fixed)	137,699	0,000	-11,500	3,671	7,347	10,890	13,752	15,683
92160	10,889	-1,000 (fixed)	137,129	0,000	-11,500	3,588	7,183	10,735	13,697	15,549
98937	11,571	-1,000 (fixed)	136,561	0,000	-11,500	3,520	7,049	10,595	13,615	15,401

KN Calculation - PROYECTO

Stability 20.00.04.9, build: 9

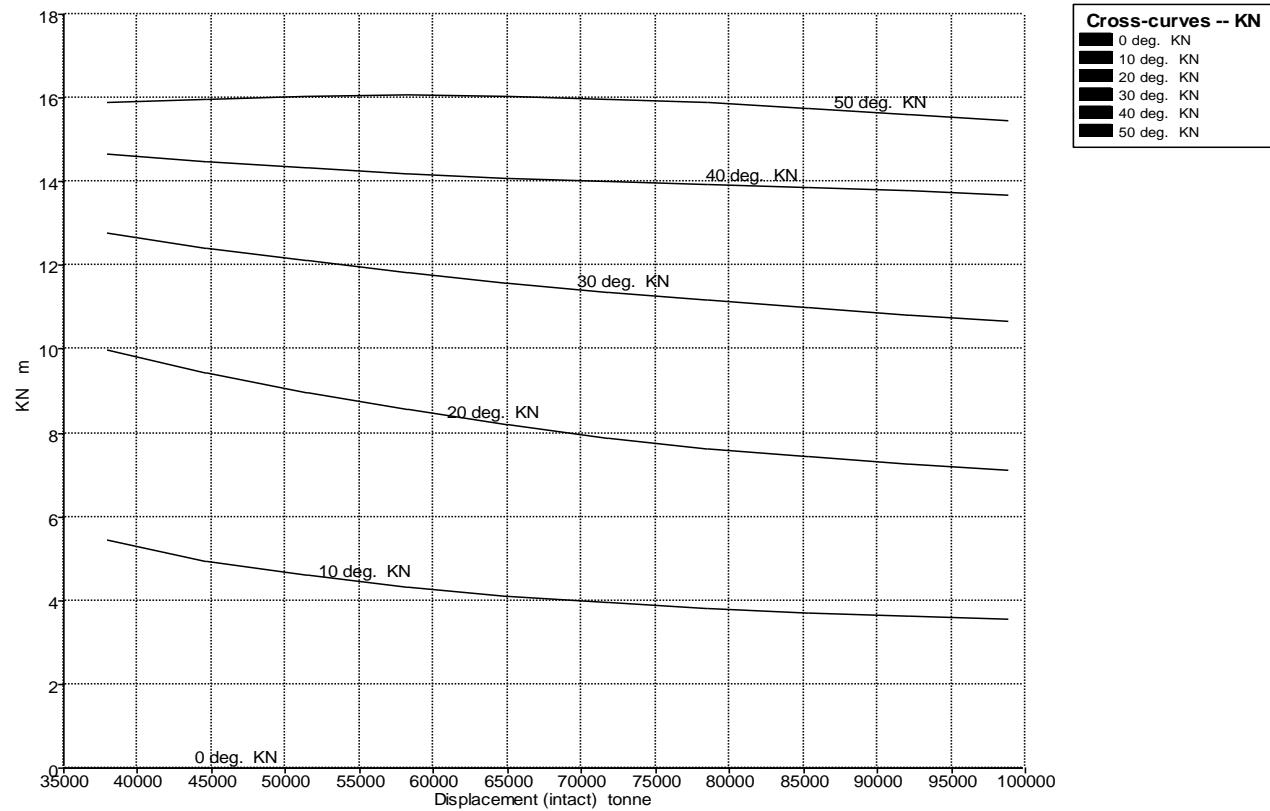
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Damage Case - Intact

Fixed Trim = 1,5 m (+ve by stern)

Specific gravity = 1,025; (Density = 1,025 tonne/m³)

VCG = -11,5 m; TCG = 0 m



Displacement (intact tonne)	Draft Amidships m	Trim (+ve by stern) m	LCG m	TCG m	Assumed VCG m	KN 10,0 deg. Starb.	KN 20,0 deg. Starb.	KN 30,0 deg. Starb.	KN 40,0 deg. Starb.	KN 50,0 deg. Starb.
37944	5,067	1,500 (fixed)	133,589	0,000	-11,500	5,426	9,986	12,781	14,654	15,890
44721	5,838	1,500 (fixed)	133,881	0,000	-11,500	4,948	9,447	12,417	14,475	15,965
51498	6,591	1,500 (fixed)	133,981	0,000	-11,500	4,594	8,976	12,104	14,319	16,023
58275	7,329	1,500 (fixed)	133,944	0,000	-11,500	4,326	8,561	11,831	14,189	16,061
65052	8,052	1,500 (fixed)	133,799	0,000	-11,500	4,118	8,194	11,587	14,084	16,043
71829	8,762	1,500 (fixed)	133,571	0,000	-11,500	3,954	7,887	11,369	13,998	15,977
78606	9,461	1,500 (fixed)	133,285	0,000	-11,500	3,822	7,632	11,173	13,926	15,878
85383	10,149	1,500 (fixed)	132,955	0,000	-11,500	3,714	7,423	10,994	13,864	15,754
92160	10,830	1,500 (fixed)	132,598	0,000	-11,500	3,624	7,252	10,830	13,791	15,613
98937	11,503	1,500 (fixed)	132,221	0,000	-11,500	3,550	7,113	10,680	13,693	15,459

KN Calculation - PROYECTO

Stability 20.00.04.9, build: 9

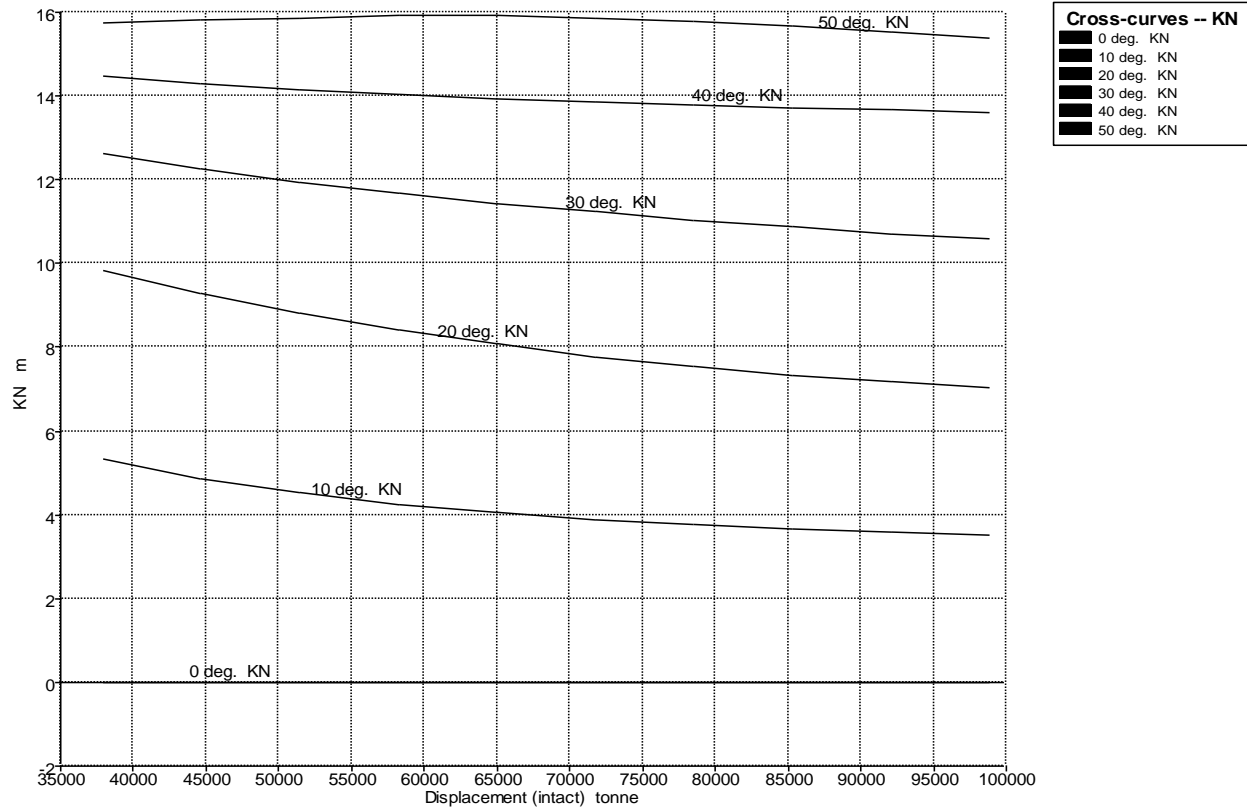
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Damage Case - Intact

Fixed Trim = -1,5 m (+ve by stern)

Specific gravity = 1,025; (Density = 1,025 tonne/m³)

VCG = -11,5 m; TCG = 0 m



Displacement (intact tonne)	Draft Amidships m	Trim (+ve by stern) m	LCG m	TCG m	Assumed VCG m	KN 10,0 deg. Starb.	KN 20,0 deg. Starb.	KN 30,0 deg. Starb.	KN 40,0 deg. Starb.	KN 50,0 deg. Starb.
37944	5,041	-1,500 (fixed)	143,046	0,000	-11,500	5,336	9,827	12,608	14,488	15,730
44721	5,820	-1,500 (fixed)	142,300	0,000	-11,500	4,863	9,295	12,246	14,309	15,810
51498	6,583	-1,500 (fixed)	141,643	0,000	-11,500	4,515	8,832	11,939	14,159	15,871
58275	7,332	-1,500 (fixed)	141,030	0,000	-11,500	4,252	8,428	11,672	14,035	15,917
65052	8,068	-1,500 (fixed)	140,432	0,000	-11,500	4,049	8,075	11,439	13,932	15,916
71829	8,792	-1,500 (fixed)	139,835	0,000	-11,500	3,890	7,777	11,230	13,849	15,866
78606	9,504	-1,500 (fixed)	139,232	0,000	-11,500	3,764	7,532	11,042	13,783	15,780
85383	10,206	-1,500 (fixed)	138,621	0,000	-11,500	3,663	7,333	10,871	13,731	15,667
92160	10,899	-1,500 (fixed)	138,011	0,000	-11,500	3,581	7,170	10,718	13,677	15,535
98937	11,583	-1,500 (fixed)	137,408	0,000	-11,500	3,514	7,038	10,579	13,598	15,388

KN Calculation - PROYECTO

Stability 20.00.04.9, build: 9

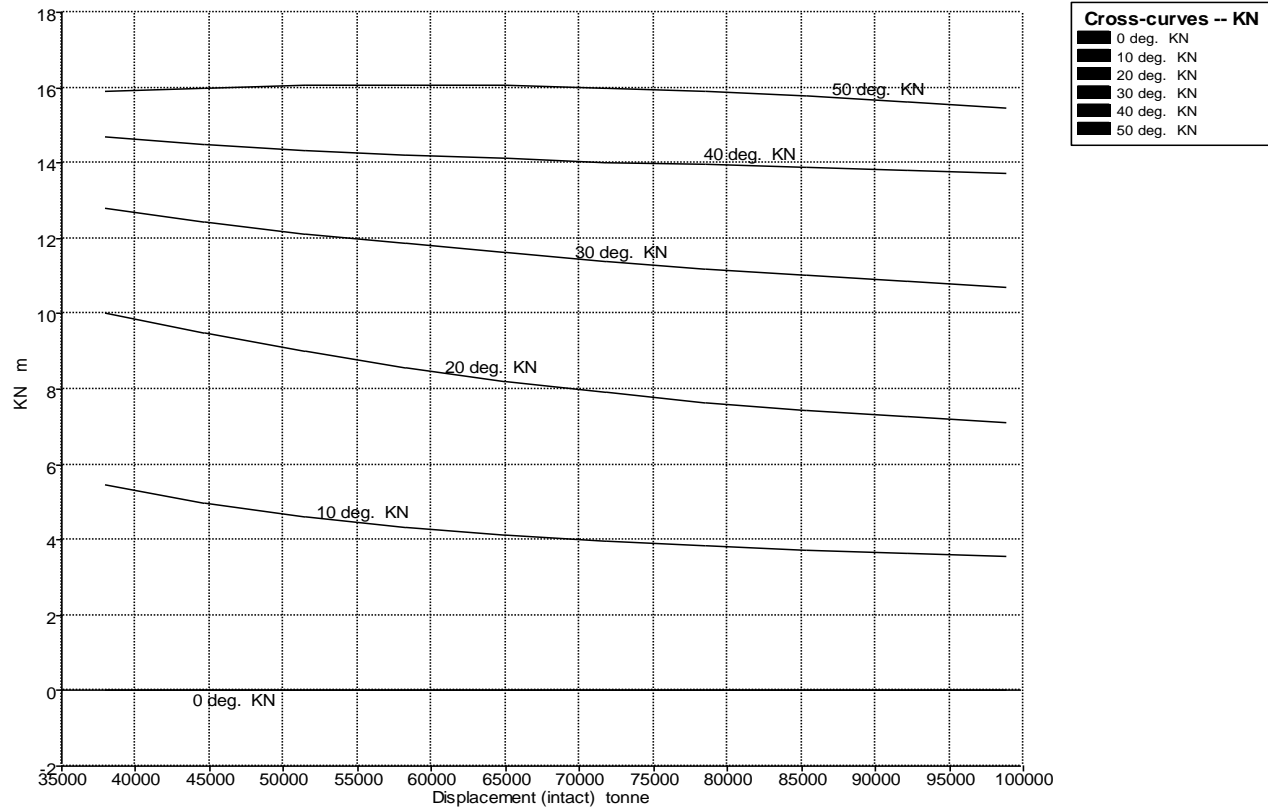
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Damage Case - Intact

Fixed Trim = 2 m (+ve by stern)

Specific gravity = 1,025; (Density = 1,025 tonne/m³)

VCG = -11,5 m; TCG = 0 m



Displacement (intact tonne)	Draft Amidships m	Trim (+ve by stern) m	LCG m	TCG m	Assumed VCG m	KN 10,0 deg. Starb.	KN 20,0 deg. Starb.	KN 30,0 deg. Starb.	KN 40,0 deg. Starb.	KN 50,0 deg. Starb.
37944	5,069	2,000 (fixed)	132,009	0,000	-11,500	5,442	10,011	12,807	14,676	15,915
44721	5,838	2,000 (fixed)	132,454	0,000	-11,500	4,963	9,473	12,444	14,499	15,988
51498	6,590	2,000 (fixed)	132,674	0,000	-11,500	4,608	9,001	12,132	14,345	16,045
58275	7,325	2,000 (fixed)	132,729	0,000	-11,500	4,339	8,583	11,857	14,216	16,079
65052	8,046	2,000 (fixed)	132,658	0,000	-11,500	4,131	8,216	11,612	14,111	16,060
71829	8,754	2,000 (fixed)	132,492	0,000	-11,500	3,966	7,906	11,393	14,024	15,992
78606	9,451	2,000 (fixed)	132,261	0,000	-11,500	3,832	7,650	11,196	13,952	15,891
85383	10,138	2,000 (fixed)	131,980	0,000	-11,500	3,722	7,439	11,016	13,886	15,766
92160	10,816	2,000 (fixed)	131,667	0,000	-11,500	3,632	7,268	10,850	13,808	15,625
98937	11,487	2,000 (fixed)	131,332	0,000	-11,500	3,557	7,127	10,698	13,707	15,469

KN Calculation - PROYECTO

Stability 20.00.04.9, build: 9

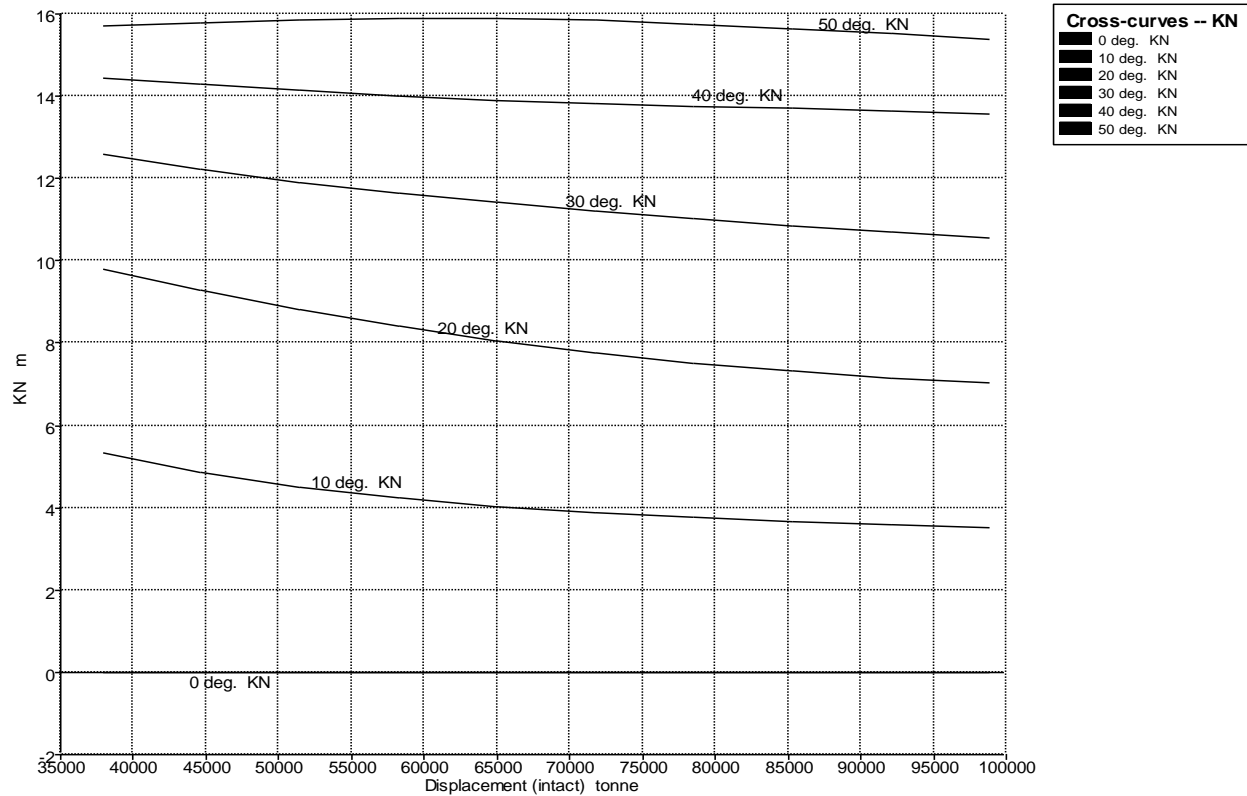
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Damage Case - Intact

Fixed Trim = -2 m (+ve by stern)

Specific gravity = 1,025; (Density = 1,025 tonne/m³)

VCG = -11,5 m; TCG = 0 m



Displacement (intact tonne)	Draft Amidships m	Trim (+ve by stern) m	LCG m	TCG m	Assumed VCG m	KN 10,0 deg. Starb.	KN 20,0 deg. Starb.	KN 30,0 deg. Starb.	KN 40,0 deg. Starb.	KN 50,0 deg. Starb.
37944	5,034	-2,000 (fixed)	144,598	0,000	-11,500	5,321	9,799	12,576	14,455	15,702
44721	5,815	-2,000 (fixed)	143,682	0,000	-11,500	4,850	9,269	12,217	14,280	15,780
51498	6,579	-2,000 (fixed)	142,886	0,000	-11,500	4,503	8,809	11,912	14,132	15,842
58275	7,330	-2,000 (fixed)	142,179	0,000	-11,500	4,241	8,407	11,647	14,009	15,889
65052	8,068	-2,000 (fixed)	141,503	0,000	-11,500	4,039	8,055	11,415	13,908	15,891
71829	8,794	-2,000 (fixed)	140,843	0,000	-11,500	3,880	7,760	11,208	13,826	15,845
78606	9,509	-2,000 (fixed)	140,188	0,000	-11,500	3,755	7,516	11,022	13,762	15,761
85383	10,213	-2,000 (fixed)	139,533	0,000	-11,500	3,655	7,319	10,853	13,711	15,650
92160	10,908	-2,000 (fixed)	138,884	0,000	-11,500	3,575	7,158	10,701	13,657	15,520
98937	11,594	-2,000 (fixed)	138,249	0,000	-11,500	3,509	7,028	10,564	13,581	15,374

KN Calculation - PROYECTO

Stability 20.00.04.9, build: 9

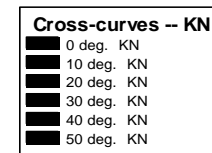
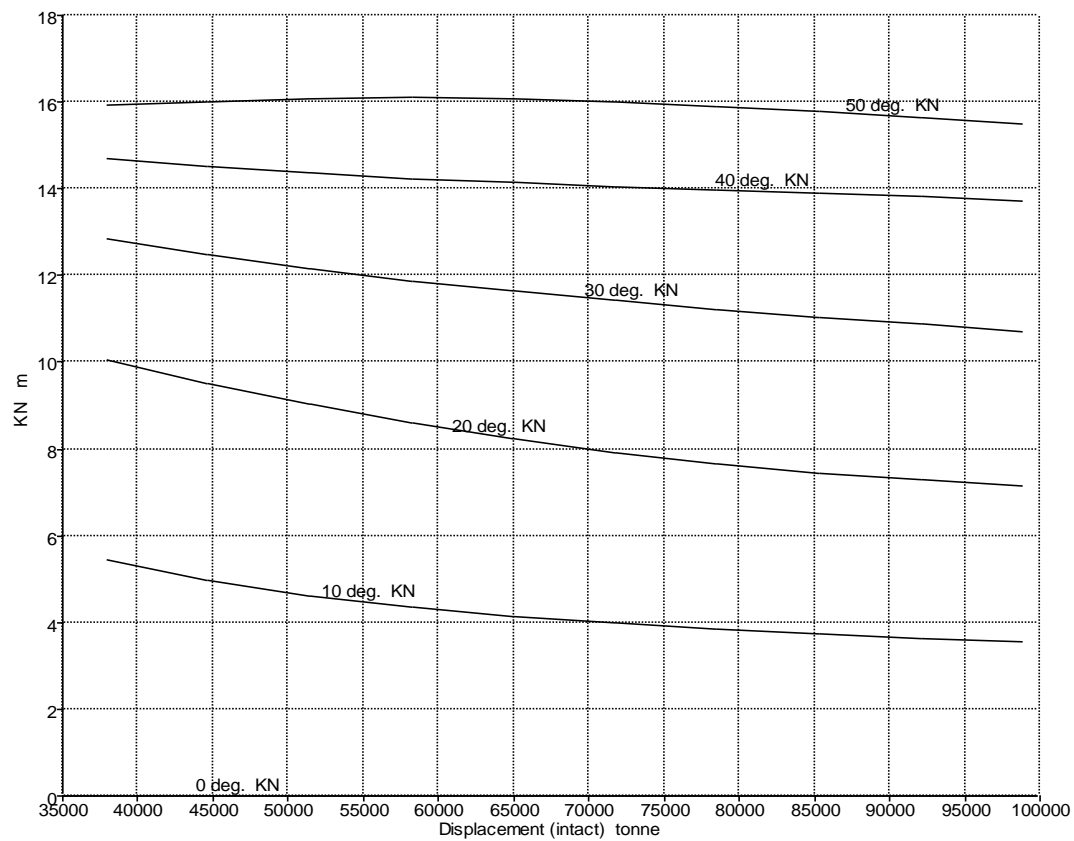
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Damage Case - Intact

Fixed Trim = 2,5 m (+ve by stern)

Specific gravity = 1,025; (Density = 1,025 tonne/m³)

VCG = -11,5 m; TCG = 0 m



Displacement (intact) tonne	Draft Amidships m	Trim (+ve by stern) m	LCG m	TCG m	Assumed VCG m	KN 10,0 deg. Starb.	KN 20,0 deg. Starb.	KN 30,0 deg. Starb.	KN 40,0 deg. Starb.	KN 50,0 deg. Starb.
37944	5,069	2,500 (fixed)	130,415	0,000	-11,500	5,458	10,035	12,832	14,696	15,939
44721	5,837	2,500 (fixed)	131,019	0,000	-11,500	4,978	9,497	12,470	14,522	16,011
51498	6,587	2,500 (fixed)	131,359	0,000	-11,500	4,623	9,025	12,159	14,370	16,067
58275	7,321	2,500 (fixed)	131,505	0,000	-11,500	4,353	8,605	11,883	14,243	16,096
65052	8,040	2,500 (fixed)	131,507	0,000	-11,500	4,144	8,237	11,638	14,138	16,075
71829	8,745	2,500 (fixed)	131,405	0,000	-11,500	3,978	7,925	11,419	14,051	16,007
78606	9,440	2,500 (fixed)	131,227	0,000	-11,500	3,842	7,668	11,220	13,978	15,904
85383	10,125	2,500 (fixed)	130,996	0,000	-11,500	3,731	7,456	11,038	13,908	15,778
92160	10,802	2,500 (fixed)	130,729	0,000	-11,500	3,639	7,284	10,871	13,825	15,635
98937	11,471	2,500 (fixed)	130,434	0,000	-11,500	3,563	7,142	10,717	13,721	15,478

KN Calculation - PROYECTO

Stability 20.00.04.9, build: 9

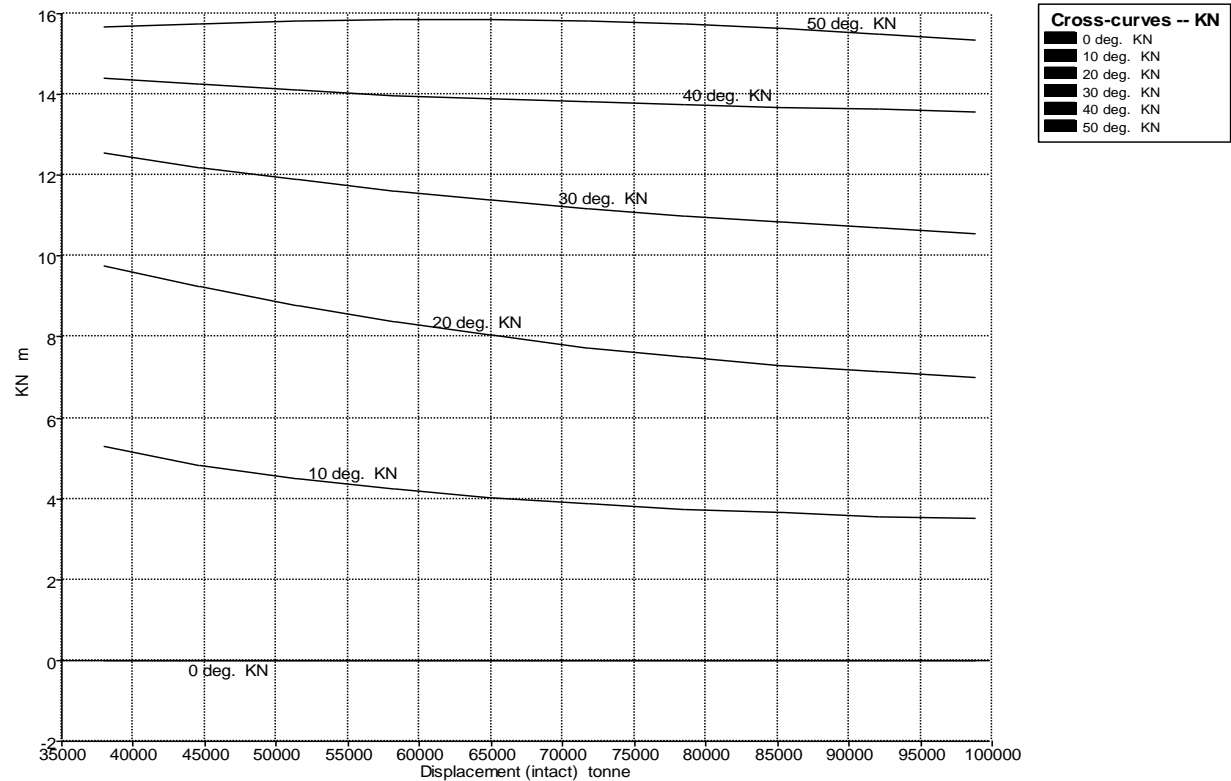
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Damage Case - Intact

Fixed Trim = -2,5 m (+ve by stern)

Specific gravity = 1,025; (Density = 1,025 tonne/m³)

VCG = -11,5 m; TCG = 0 m



Displacement (intact tonne)	Draft Amidships m	Trim (+ve by stern) m	LCG m	TCG m	Assumed VCG m	KN 10,0 deg. Starb.	KN 20,0 deg. Starb.	KN 30,0 deg. Starb.	KN 40,0 deg. Starb.	KN 50,0 deg. Starb.
37944	5,026	-2,500 (fixed)	146,143	0,000	-11,500	5,307	9,770	12,544	14,420	15,673
44721	5,808	-2,500 (fixed)	145,056	0,000	-11,500	4,837	9,243	12,188	14,249	15,750
51498	6,574	-2,500 (fixed)	144,131	0,000	-11,500	4,491	8,787	11,884	14,105	15,812
58275	7,327	-2,500 (fixed)	143,320	0,000	-11,500	4,231	8,386	11,622	13,985	15,860
65052	8,067	-2,500 (fixed)	142,565	0,000	-11,500	4,029	8,037	11,391	13,885	15,866
71829	8,796	-2,500 (fixed)	141,842	0,000	-11,500	3,871	7,743	11,187	13,805	15,823
78606	9,513	-2,500 (fixed)	141,134	0,000	-11,500	3,747	7,502	11,002	13,741	15,741
85383	10,220	-2,500 (fixed)	140,436	0,000	-11,500	3,648	7,306	10,835	13,691	15,633
92160	10,917	-2,500 (fixed)	139,749	0,000	-11,500	3,568	7,146	10,684	13,636	15,504
98937	11,605	-2,500 (fixed)	139,083	0,000	-11,500	3,503	7,017	10,549	13,563	15,361

KN Calculation - PROYECTO

Stability 20.00.04.9, build: 9

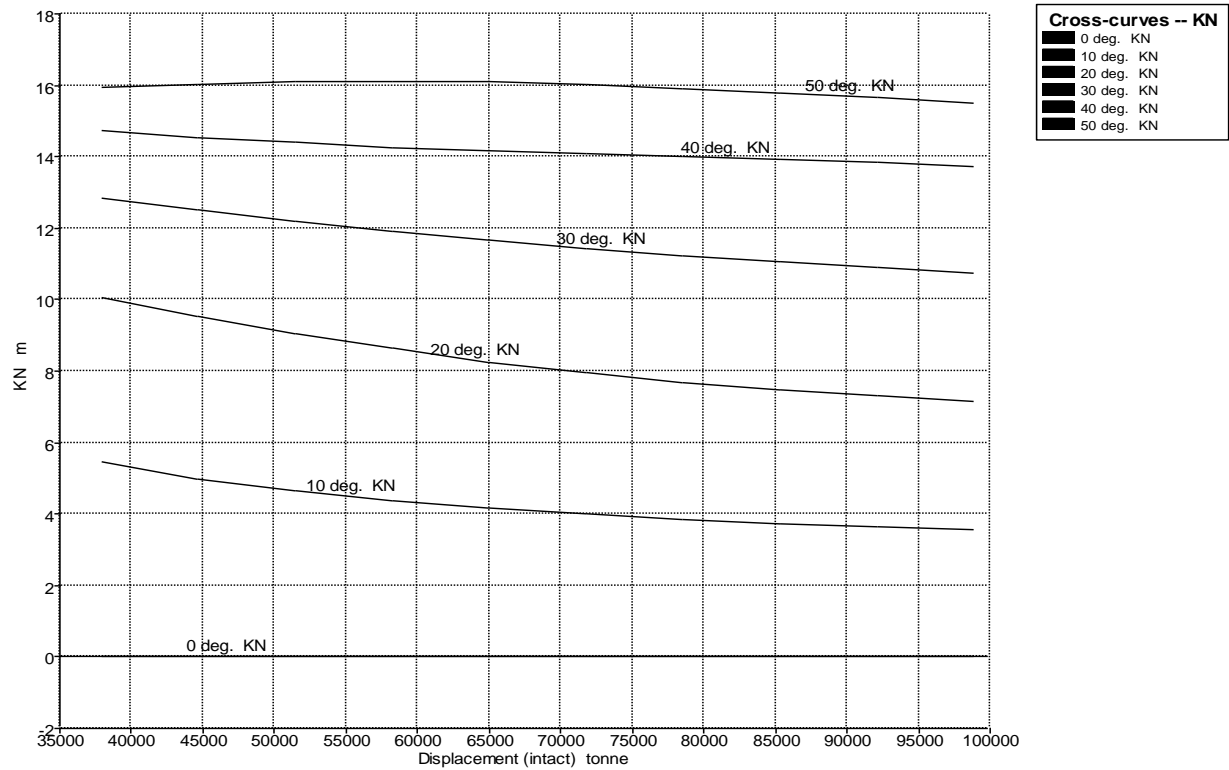
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Damage Case - Intact

Fixed Trim = 3 m (+ve by stern)

Specific gravity = 1,025; (Density = 1,025 tonne/m³)

VCG = -11,5 m; TCG = 0 m



Displacement (intact tonne)	Draft Amidships m	Trim (+ve by stern) m	LCG m	TCG m	Assumed VCG m	KN 10,0 deg. Starb.	KN 20,0 deg. Starb.	KN 30,0 deg. Starb.	KN 40,0 deg. Starb.	KN 50,0 deg. Starb.
37944	5,068	3,000 (fixed)	128,816	0,000	-11,500	5,474	10,060	12,856	14,715	15,963
44721	5,835	3,000 (fixed)	129,578	0,000	-11,500	4,993	9,521	12,496	14,544	16,032
51498	6,584	3,000 (fixed)	130,034	0,000	-11,500	4,638	9,049	12,185	14,396	16,087
58275	7,315	3,000 (fixed)	130,271	0,000	-11,500	4,368	8,627	11,910	14,270	16,112
65052	8,032	3,000 (fixed)	130,347	0,000	-11,500	4,157	8,258	11,664	14,166	16,089
71829	8,736	3,000 (fixed)	130,308	0,000	-11,500	3,989	7,945	11,444	14,078	16,020
78606	9,429	3,000 (fixed)	130,186	0,000	-11,500	3,853	7,686	11,244	14,004	15,916
85383	10,112	3,000 (fixed)	130,005	0,000	-11,500	3,740	7,474	11,060	13,930	15,790
92160	10,787	3,000 (fixed)	129,783	0,000	-11,500	3,647	7,300	10,891	13,842	15,645
98937	11,454	3,000 (fixed)	129,528	0,000	-11,500	3,570	7,156	10,736	13,734	15,487

KN Calculation - PROYECTO

Stability 20.00.04.9, build: 9

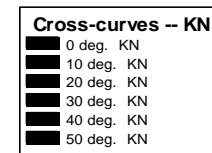
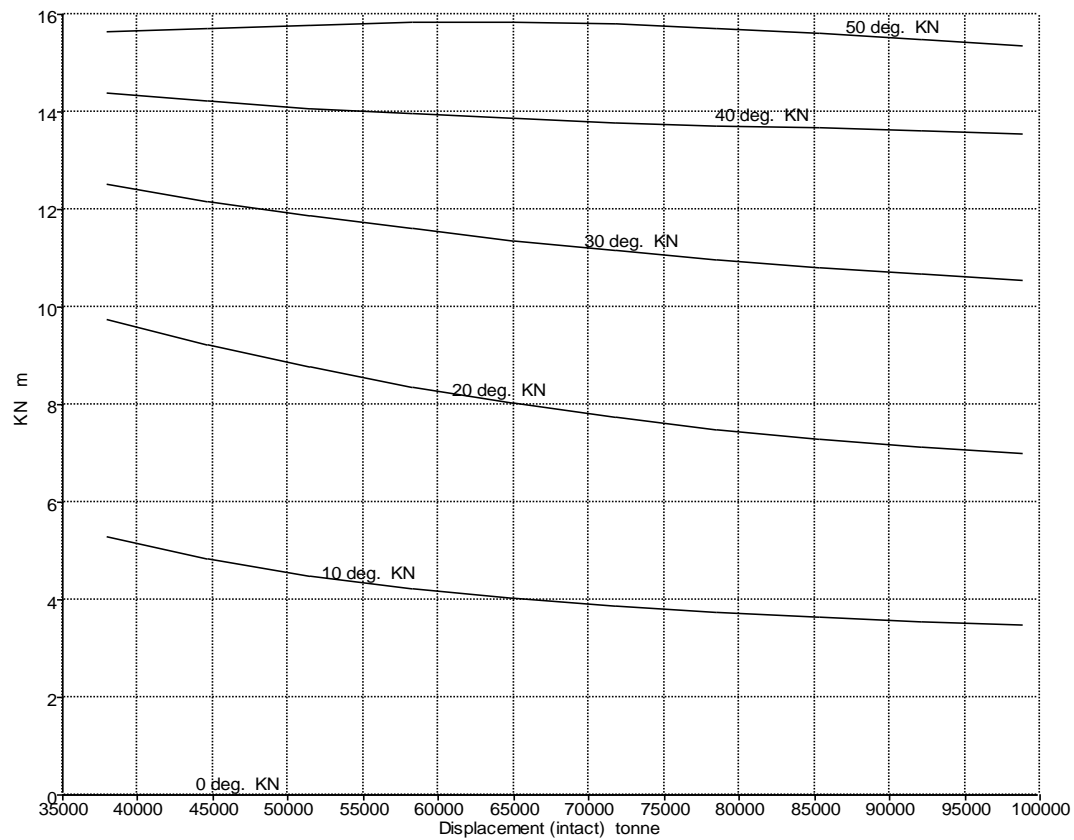
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Damage Case - Intact

Fixed Trim = -3 m (+ve by stern)

Specific gravity = 1,025; (Density = 1,025 tonne/m³)

VCG = -11,5 m; TCG = 0 m



Displacement (intact tonne)	Draft Amidships m	Trim (+ve by stern) m	LCG m	TCG m	Assumed VCG m	KN 10,0 deg. Starb.	KN 20,0 deg. Starb.	KN 30,0 deg. Starb.	KN 40,0 deg. Starb.	KN 50,0 deg. Starb.
37944	5,017	-3,000 (fixed)	147,680	0,000	-11,500	5,292	9,740	12,512	14,383	15,643
44721	5,801	-3,000 (fixed)	146,422	0,000	-11,500	4,824	9,219	12,158	14,219	15,719
51498	6,569	-3,000 (fixed)	145,368	0,000	-11,500	4,480	8,764	11,857	14,078	15,783
58275	7,324	-3,000 (fixed)	144,452	0,000	-11,500	4,220	8,366	11,597	13,960	15,831
65052	8,066	-3,000 (fixed)	143,618	0,000	-11,500	4,019	8,019	11,368	13,863	15,840
71829	8,797	-3,000 (fixed)	142,831	0,000	-11,500	3,862	7,727	11,166	13,784	15,800
78606	9,516	-3,000 (fixed)	142,071	0,000	-11,500	3,738	7,487	10,983	13,721	15,721
85383	10,225	-3,000 (fixed)	141,330	0,000	-11,500	3,640	7,292	10,818	13,672	15,615
92160	10,925	-3,000 (fixed)	140,608	0,000	-11,500	3,562	7,135	10,669	13,617	15,488
98937	11,614	-3,000 (fixed)	139,911	0,000	-11,500	3,498	7,007	10,535	13,544	15,347

KN Calculation - PROYECTO

Stability 20.00.04.9, build: 9

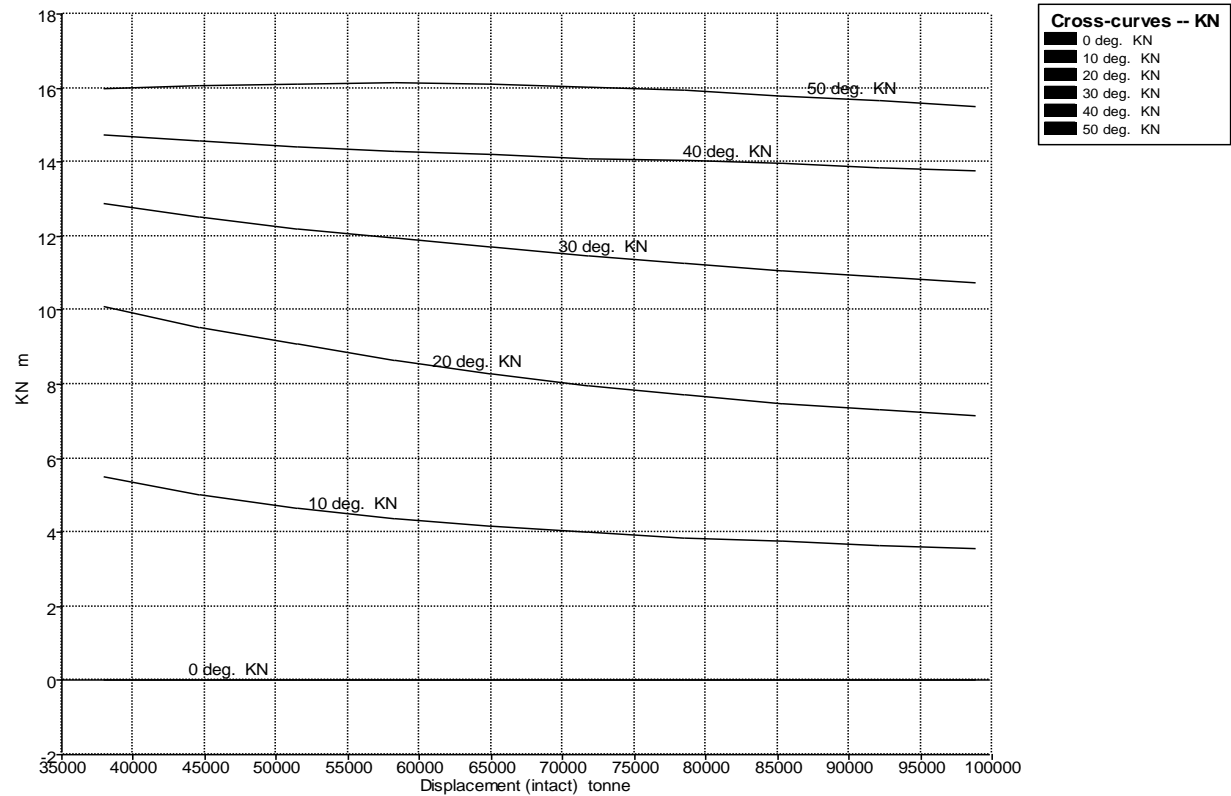
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Damage Case - Intact

Fixed Trim = 3,5 m (+ve by stern)

Specific gravity = 1,025; (Density = 1,025 tonne/m³)

VCG = -11,5 m; TCG = 0 m



Displacement (intact tonne)	Draft Amidships m	Trim (+ve by stern) m	LCG m	TCG m	Assumed VCG m	KN 10,0 deg. Starb.	KN 20,0 deg. Starb.	KN 30,0 deg. Starb.	KN 40,0 deg. Starb.	KN 50,0 deg. Starb.
37944	5,067	3,500 (fixed)	127,212	0,000	-11,500	5,489	10,083	12,879	14,733	15,986
44721	5,832	3,500 (fixed)	128,129	0,000	-11,500	5,009	9,546	12,522	14,565	16,053
51498	6,579	3,500 (fixed)	128,701	0,000	-11,500	4,653	9,072	12,212	14,420	16,106
58275	7,309	3,500 (fixed)	129,028	0,000	-11,500	4,382	8,650	11,936	14,297	16,126
65052	8,024	3,500 (fixed)	129,177	0,000	-11,500	4,171	8,279	11,690	14,193	16,101
71829	8,726	3,500 (fixed)	129,202	0,000	-11,500	4,001	7,965	11,470	14,106	16,032
78606	9,417	3,500 (fixed)	129,136	0,000	-11,500	3,863	7,705	11,268	14,030	15,928
85383	10,098	3,500 (fixed)	129,006	0,000	-11,500	3,749	7,492	11,083	13,951	15,800
92160	10,771	3,500 (fixed)	128,830	0,000	-11,500	3,655	7,317	10,912	13,858	15,655
98937	11,437	3,500 (fixed)	128,611	0,000	-11,500	3,578	7,171	10,755	13,746	15,495

KN Calculation - PROYECTO

Stability 20.00.04.9, build: 9

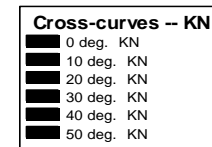
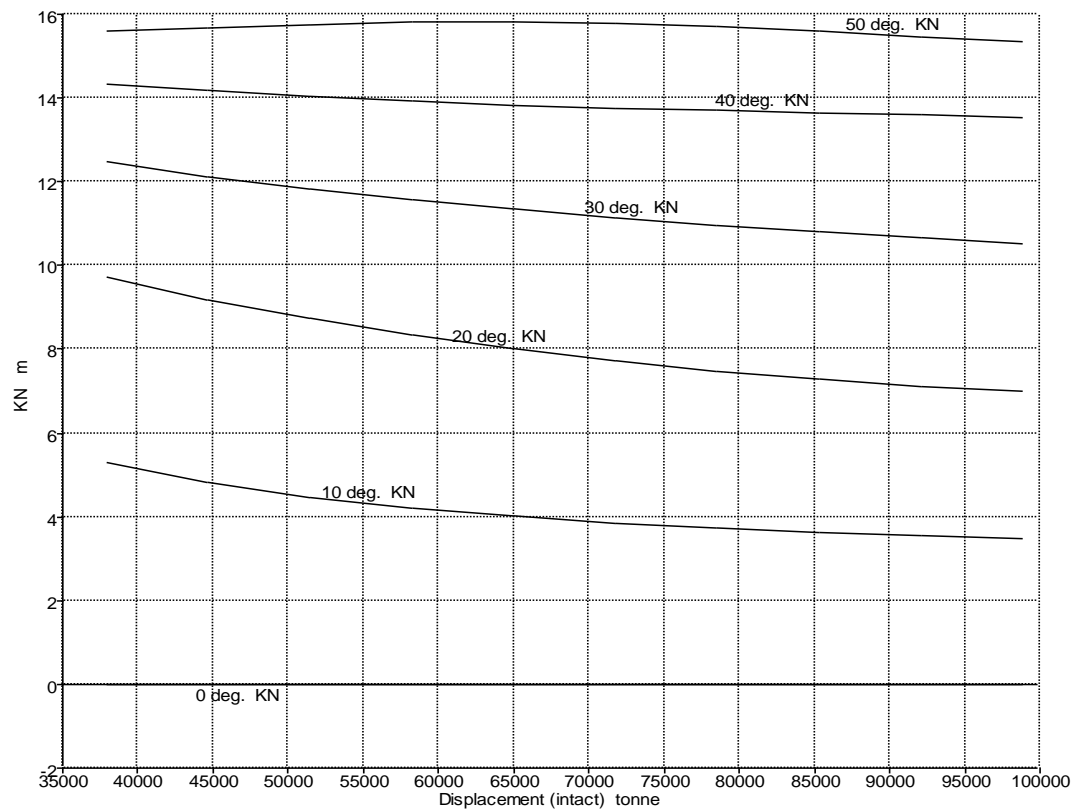
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Damage Case - Intact

Fixed Trim = -3,5 m (+ve by stern)

Specific gravity = 1,025; (Density = 1,025 tonne/m³)

VCG = -11,5 m; TCG = 0 m



Displacement (intact tonne)	Draft Amidships m	Trim (+ve by stern) m	LCG m	TCG m	Assumed VCG m	KN 10,0 deg. Starb.	KN 20,0 deg. Starb.	KN 30,0 deg. Starb.	KN 40,0 deg. Starb.	KN 50,0 deg. Starb.
37944	5,008	-3,500 (fixed)	149,208	0,000	-11,500	5,278	9,709	12,480	14,346	15,613
44721	5,793	-3,500 (fixed)	147,780	0,000	-11,500	4,812	9,194	12,128	14,187	15,687
51498	6,563	-3,500 (fixed)	146,597	0,000	-11,500	4,469	8,741	11,829	14,051	15,753
58275	7,320	-3,500 (fixed)	145,571	0,000	-11,500	4,210	8,346	11,572	13,935	15,802
65052	8,064	-3,500 (fixed)	144,661	0,000	-11,500	4,010	8,002	11,346	13,840	15,812
71829	8,797	-3,500 (fixed)	143,810	0,000	-11,500	3,854	7,711	11,145	13,763	15,776
78606	9,519	-3,500 (fixed)	142,998	0,000	-11,500	3,730	7,473	10,965	13,703	15,701
85383	10,230	-3,500 (fixed)	142,215	0,000	-11,500	3,633	7,280	10,801	13,653	15,596
92160	10,932	-3,500 (fixed)	141,459	0,000	-11,500	3,555	7,124	10,654	13,597	15,472
98937	11,623	-3,500 (fixed)	140,733	0,000	-11,500	3,493	6,998	10,521	13,525	15,332

KN Calculation - PROYECTO

Stability 20.00.04.9, build: 9

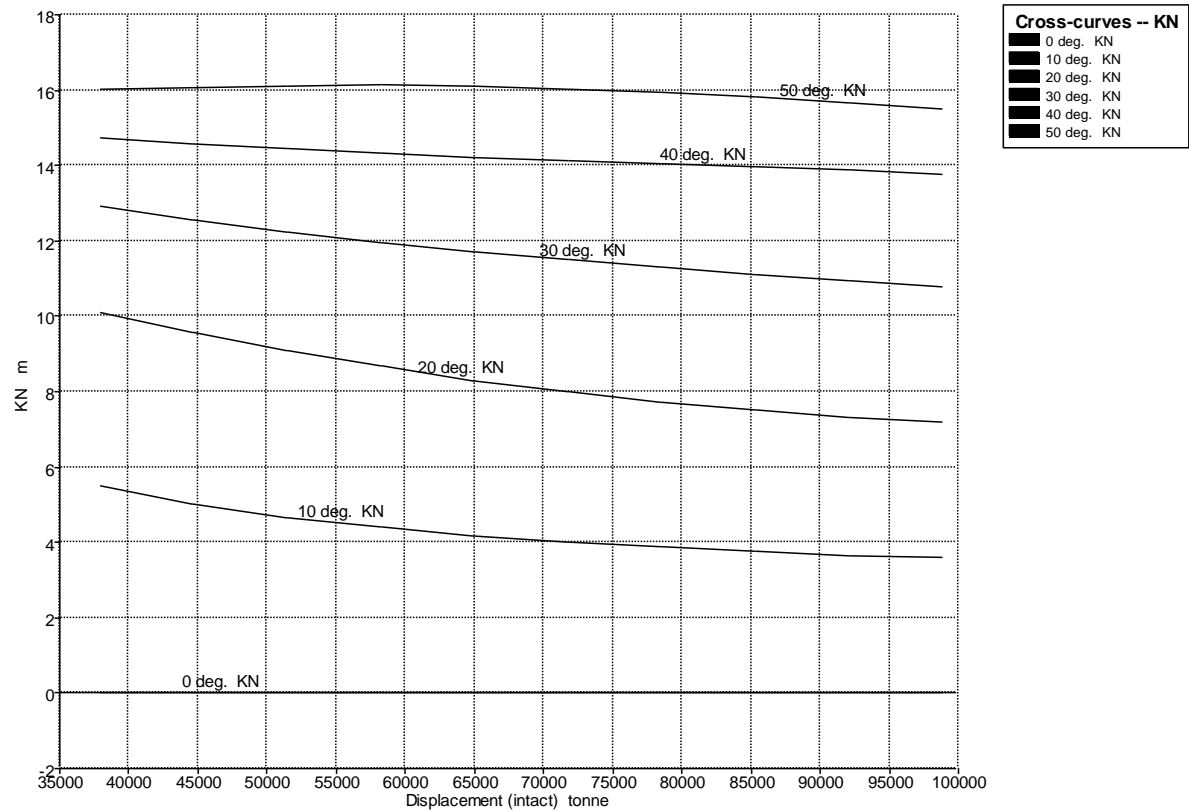
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Damage Case - Intact

Fixed Trim = 4 m (+ve by stern)

Specific gravity = 1,025; (Density = 1,025 tonne/m³)

VCG = -11,5 m; TCG = 0 m



Displacement (intact tonne)	Draft Amidships m	Trim (+ve by stern) m	LCG m	TCG m	Assumed VCG m	KN 10,0 deg. Starb.	KN 20,0 deg. Starb.	KN 30,0 deg. Starb.	KN 40,0 deg. Starb.	KN 50,0 deg. Starb.
37944	5,064	4,000 (fixed)	125,605	0,000	-11,500	5,505	10,106	12,900	14,749	16,009
44721	5,828	4,000 (fixed)	126,673	0,000	-11,500	5,025	9,570	12,547	14,586	16,073
51498	6,573	4,000 (fixed)	127,359	0,000	-11,500	4,669	9,095	12,237	14,445	16,123
58275	7,301	4,000 (fixed)	127,774	0,000	-11,500	4,397	8,673	11,962	14,324	16,139
65052	8,014	4,000 (fixed)	127,999	0,000	-11,500	4,184	8,301	11,717	14,221	16,113
71829	8,714	4,000 (fixed)	128,087	0,000	-11,500	4,013	7,985	11,495	14,134	16,043
78606	9,404	4,000 (fixed)	128,078	0,000	-11,500	3,873	7,725	11,292	14,055	15,938
85383	10,083	4,000 (fixed)	128,000	0,000	-11,500	3,758	7,511	11,105	13,971	15,810
92160	10,755	4,000 (fixed)	127,868	0,000	-11,500	3,663	7,333	10,933	13,874	15,663
98937	11,419	4,000 (fixed)	127,684	0,000	-11,500	3,585	7,185	10,774	13,758	15,502

KN Calculation - PROYECTO

Stability 20.00.04.9, build: 9

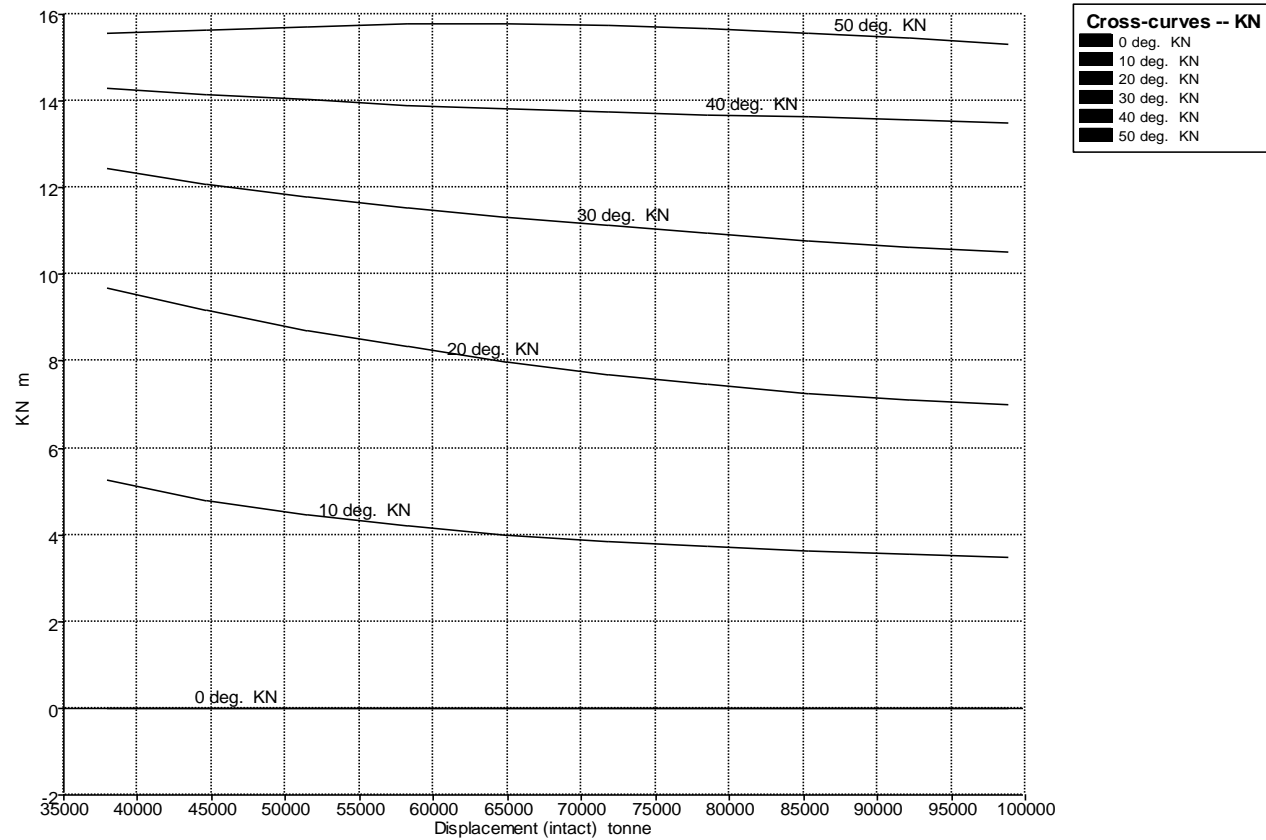
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Damage Case - Intact

Fixed Trim = -4 m (+ve by stern)

Specific gravity = 1,025; (Density = 1,025 tonne/m³)

VCG = -11,5 m; TCG = 0 m



Displacement (intact tonne)	Draft Amidships m	Trim (+ve by stern) m	LCG m	TCG m	Assumed VCG m	KN 10,0 deg. Starb.	KN 20,0 deg. Starb.	KN 30,0 deg. Starb.	KN 40,0 deg. Starb.	KN 50,0 deg. Starb.
37944	4,997	-4,000 (fixed)	150,727	0,000	-11,500	5,265	9,679	12,446	14,309	15,582
44721	5,785	-4,000 (fixed)	149,129	0,000	-11,500	4,800	9,168	12,098	14,156	15,655
51498	6,557	-4,000 (fixed)	147,818	0,000	-11,500	4,458	8,719	11,803	14,023	15,722
58275	7,315	-4,000 (fixed)	146,689	0,000	-11,500	4,200	8,327	11,548	13,911	15,772
65052	8,061	-4,000 (fixed)	145,696	0,000	-11,500	4,001	7,984	11,324	13,819	15,784
71829	8,796	-4,000 (fixed)	144,779	0,000	-11,500	3,846	7,695	11,125	13,744	15,751
78606	9,521	-4,000 (fixed)	143,915	0,000	-11,500	3,723	7,460	10,947	13,685	15,679
85383	10,235	-4,000 (fixed)	143,091	0,000	-11,500	3,626	7,268	10,785	13,635	15,577
92160	10,938	-4,000 (fixed)	142,303	0,000	-11,500	3,549	7,114	10,639	13,578	15,455
98937	11,631	-4,000 (fixed)	141,550	0,000	-11,500	3,487	6,989	10,508	13,506	15,317

KN Calculation - PROYECTO

Stability 20.00.04.9, build: 9

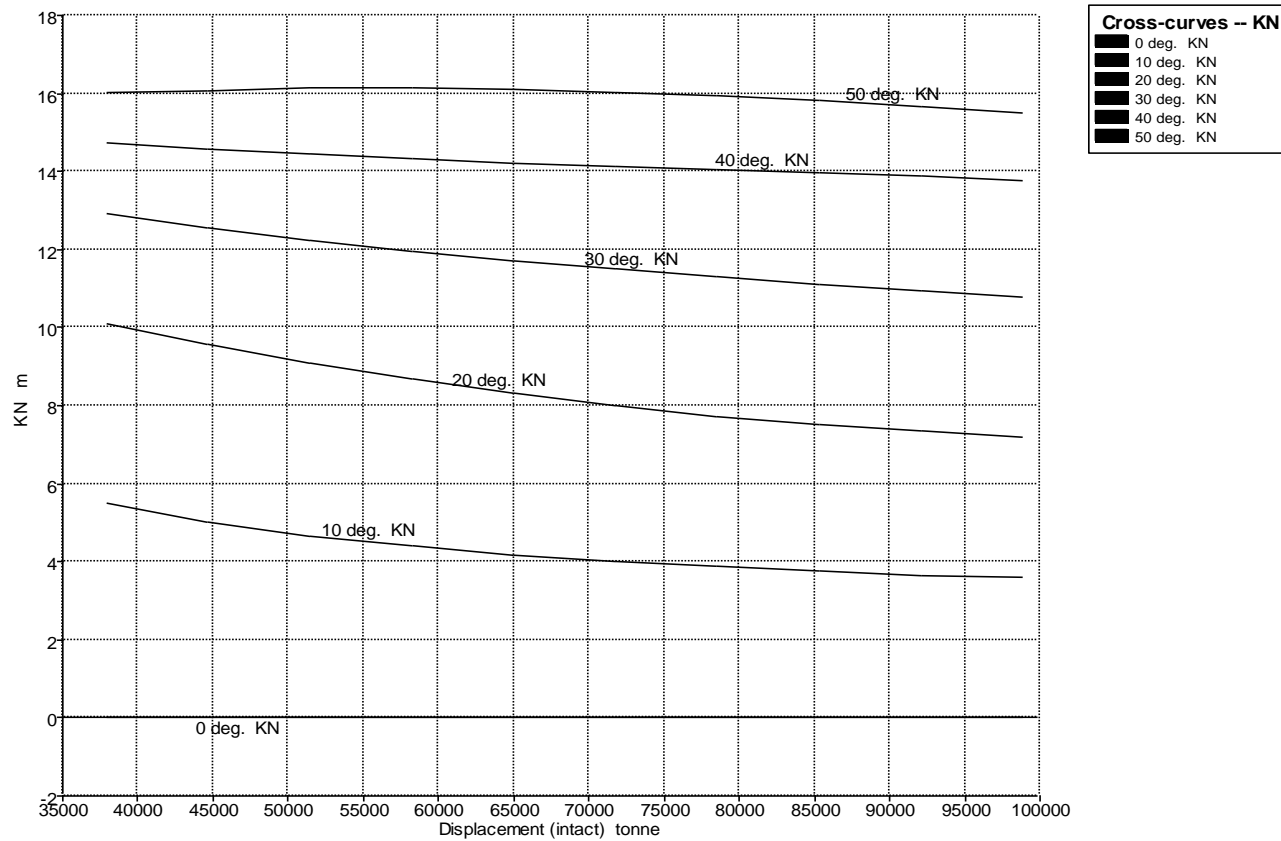
Model file: C:\Users\Usuario\Desktop\TFG\CUADERNO 3\MAXSURF\PROYECTO (Medium precision, 65 sections, Trimming off, Skin thickness not applied). Long datum: AP; Vert. datum: DWL. Analysis tolerance - ideal(worst case): Disp. %: 0,01000(0,100); Trim%(LCG-TCG): 0,01000(0,100); Heel%(LCG-TCG): 0,01000(0,100)

Damage Case - Intact

Fixed Trim = 4,05 m (+ve by stern)

Specific gravity = 1,025; (Density = 1,025 tonne/m³)

VCG = -11,5 m; TCG = 0 m



Displacement (intact tonne)	Draft Amidships m	Trim (+ve by stern) m	LCG m	TCG m	Assumed VCG m	KN 10,0 deg. Starb.	KN 20,0 deg. Starb.	KN 30,0 deg. Starb.	KN 40,0 deg. Starb.	KN 50,0 deg. Starb.
37944	5,063	4,050 (fixed)	125,444	0,000	-11,500	5,506	10,108	12,902	14,750	16,011
44721	5,828	4,050 (fixed)	126,527	0,000	-11,500	5,026	9,572	12,550	14,588	16,075
51498	6,573	4,050 (fixed)	127,224	0,000	-11,500	4,670	9,097	12,240	14,447	16,125
58275	7,300	4,050 (fixed)	127,649	0,000	-11,500	4,399	8,675	11,965	14,327	16,141
65052	8,013	4,050 (fixed)	127,881	0,000	-11,500	4,186	8,303	11,720	14,224	16,114
71829	8,713	4,050 (fixed)	127,975	0,000	-11,500	4,014	7,988	11,498	14,136	16,044
78606	9,402	4,050 (fixed)	127,972	0,000	-11,500	3,874	7,727	11,295	14,057	15,939
85383	10,082	4,050 (fixed)	127,899	0,000	-11,500	3,759	7,513	11,108	13,973	15,811
92160	10,753	4,050 (fixed)	127,772	0,000	-11,500	3,664	7,335	10,935	13,875	15,664
98937	11,417	4,050 (fixed)	127,591	0,000	-11,500	3,586	7,187	10,776	13,759	15,503

KN Calculation - PROYECTO

Stability 20.00.04.9, build: 9

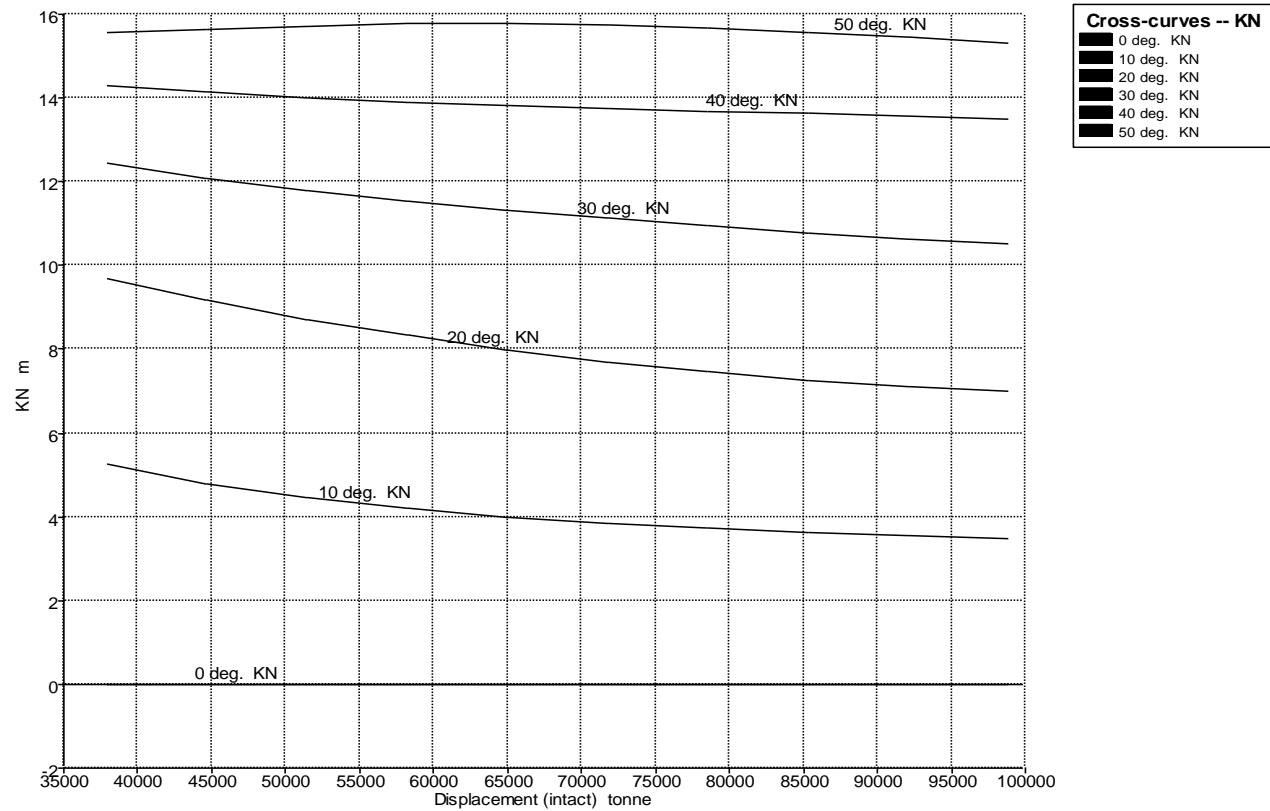
Model file: C:\Users\Usuario\Desktop\TFG\CUADERNO 3\MAXSURF\PROYECTO (Medium precision, 65 sections, Trimming off, Skin thickness not applied). Long. datum: AP; Vert. datum: DWL. Analysis tolerance - ideal(worst case): Disp.%, 0,01000(0,100); Trim%(LCG-TCG): 0,01000(0,100); Heel%(LCG-TCG): 0,01000(0,100)

Damage Case - Intact

Fixed Trim = -4,05 m (+ve by stern)

Specific gravity = 1,025; (Density = 1,025 tonne/m³)

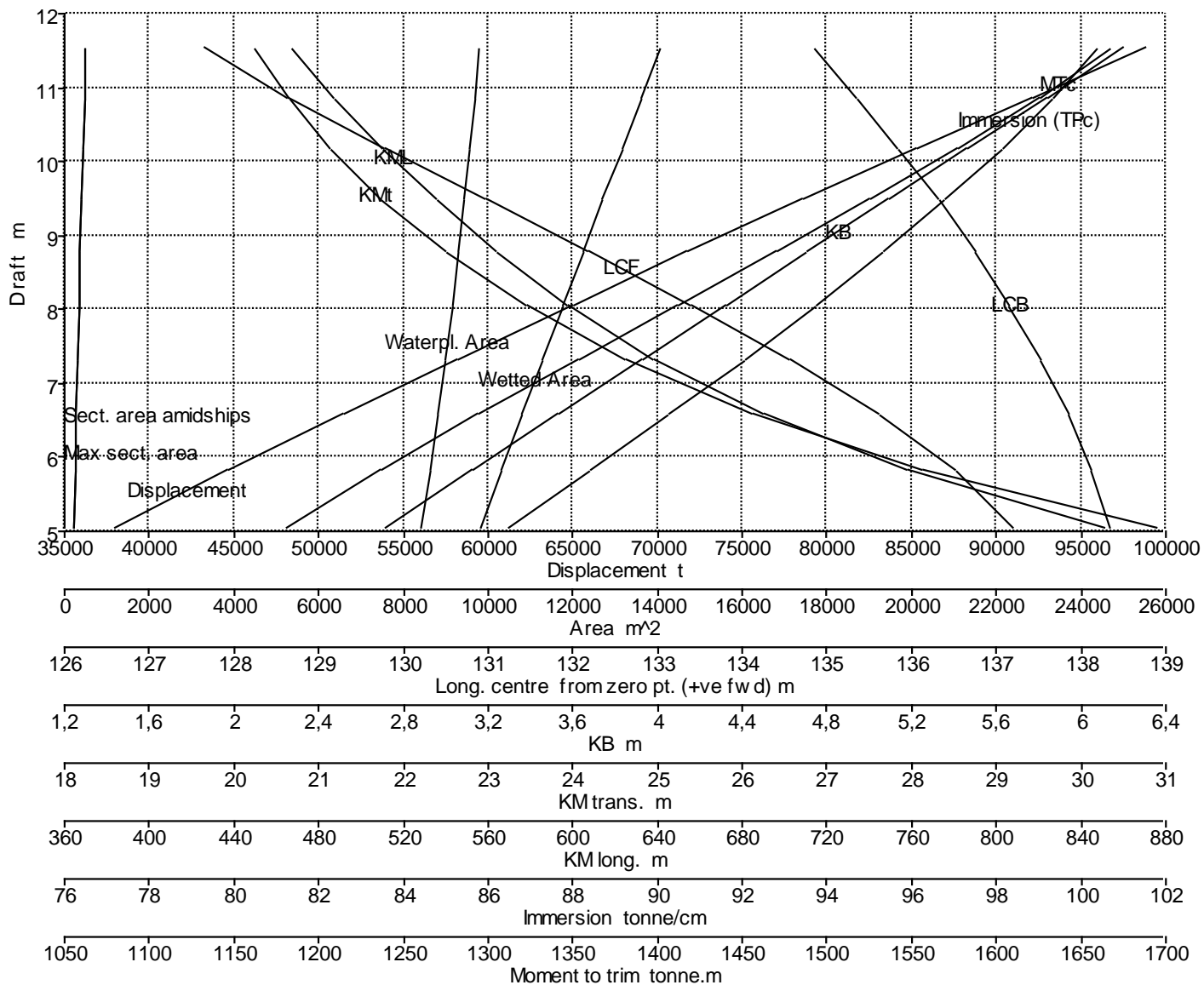
VCG = -11,5 m; TCG = 0 m



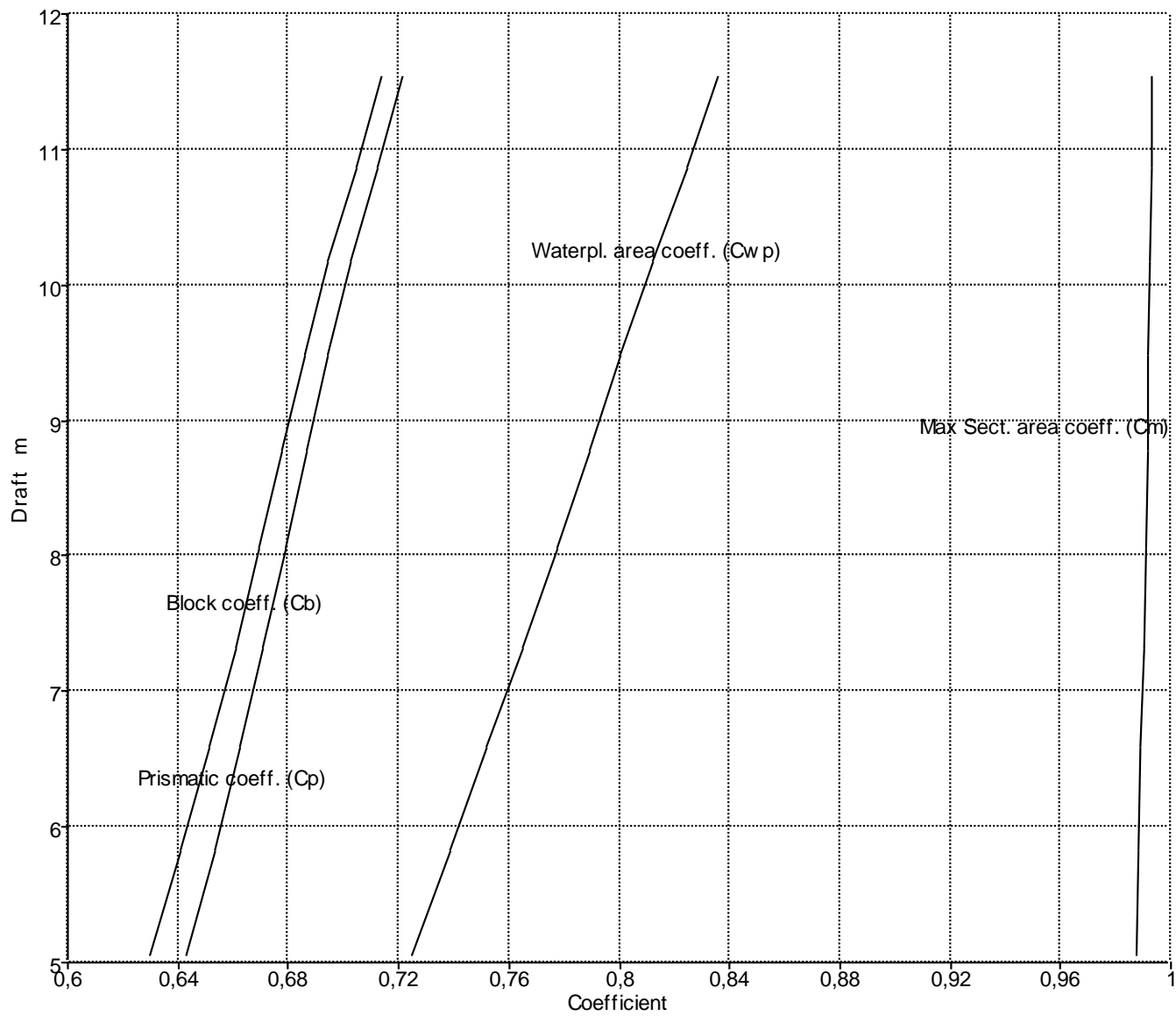
Displacement (intact) tonne	Draft Amidships m	Trim (+ve by stern) m	LCG m	TCG m	Assumed VCG m	KN 10,0 deg. Starb.	KN 20,0 deg. Starb.	KN 30,0 deg. Starb.	KN 40,0 deg. Starb.	KN 50,0 deg. Starb.
37944	4,996	-4,050 (fixed)	150,879	0,000	-11,500	5,264	9,676	12,443	14,305	15,578
44721	5,784	-4,050 (fixed)	149,264	0,000	-11,500	4,798	9,166	12,095	14,152	15,652
51498	6,556	-4,050 (fixed)	147,940	0,000	-11,500	4,457	8,717	11,800	14,020	15,719
58275	7,314	-4,050 (fixed)	146,801	0,000	-11,500	4,199	8,325	11,545	13,909	15,769
65052	8,061	-4,050 (fixed)	145,799	0,000	-11,500	4,000	7,983	11,322	13,816	15,781
71829	8,796	-4,050 (fixed)	144,875	0,000	-11,500	3,845	7,694	11,123	13,742	15,749
78606	9,521	-4,050 (fixed)	144,006	0,000	-11,500	3,722	7,458	10,945	13,683	15,677
85383	10,235	-4,050 (fixed)	143,178	0,000	-11,500	3,625	7,267	10,784	13,633	15,576
92160	10,939	-4,050 (fixed)	142,387	0,000	-11,500	3,548	7,113	10,638	13,576	15,453
98937	11,632	-4,050 (fixed)	141,631	0,000	-11,500	3,487	6,988	10,507	13,505	15,316

ANEXO V

Tablas de hidrostáticas

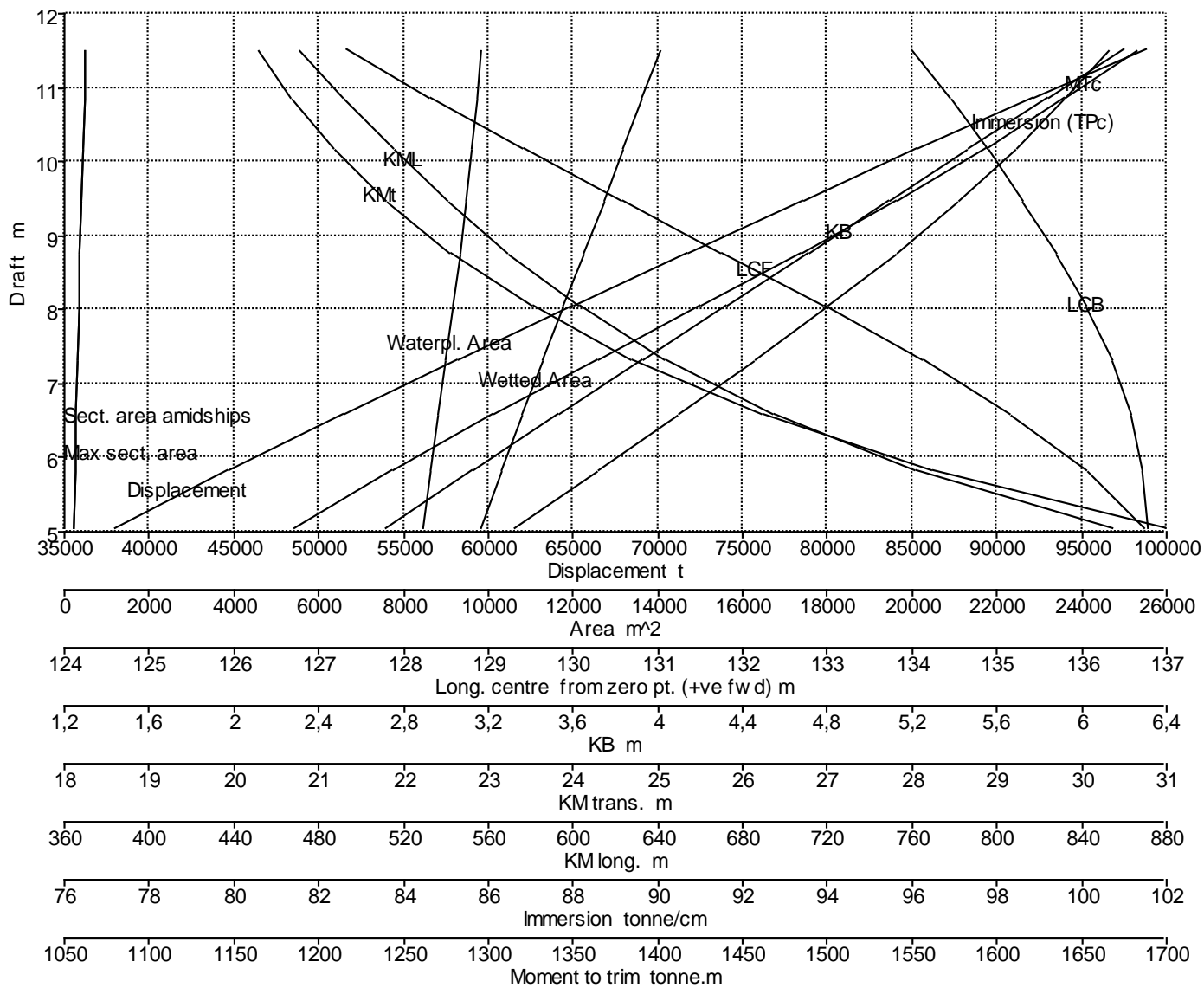


- Hydrostatics**
- Displacement
 - Max sect. area
 - Sect. area amidships
 - Wetted Area
 - Waterpl. Area
 - LCB
 - LCF
 - KB
 - KMt
 - KML
 - Immersion (TPc)
 - MTc



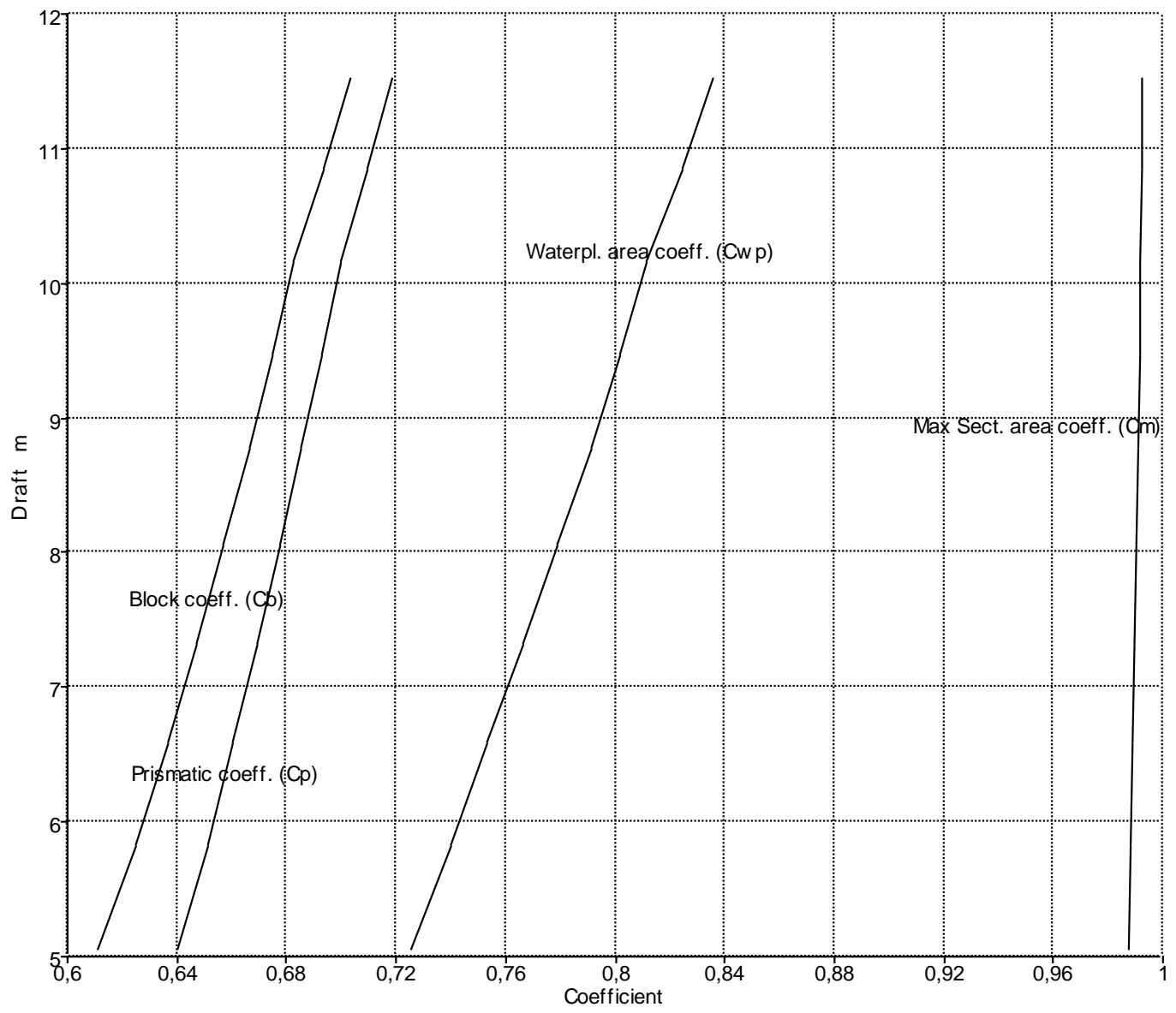
Curves of Form

- Prismatic coeff. (C_p)
- Block coeff. (C_b)
- Max Sect. area coeff. (C_m)
- Waterpl. area coeff. (C_{wp})



Hydrostatics

- Displacement
- Max sect. area
- Sect. area amidships
- Wetted Area
- Waterpl. Area
- LCB
- LCF
- KB
- KML
- Immersion (TPc)
- MTc



Curves of Form

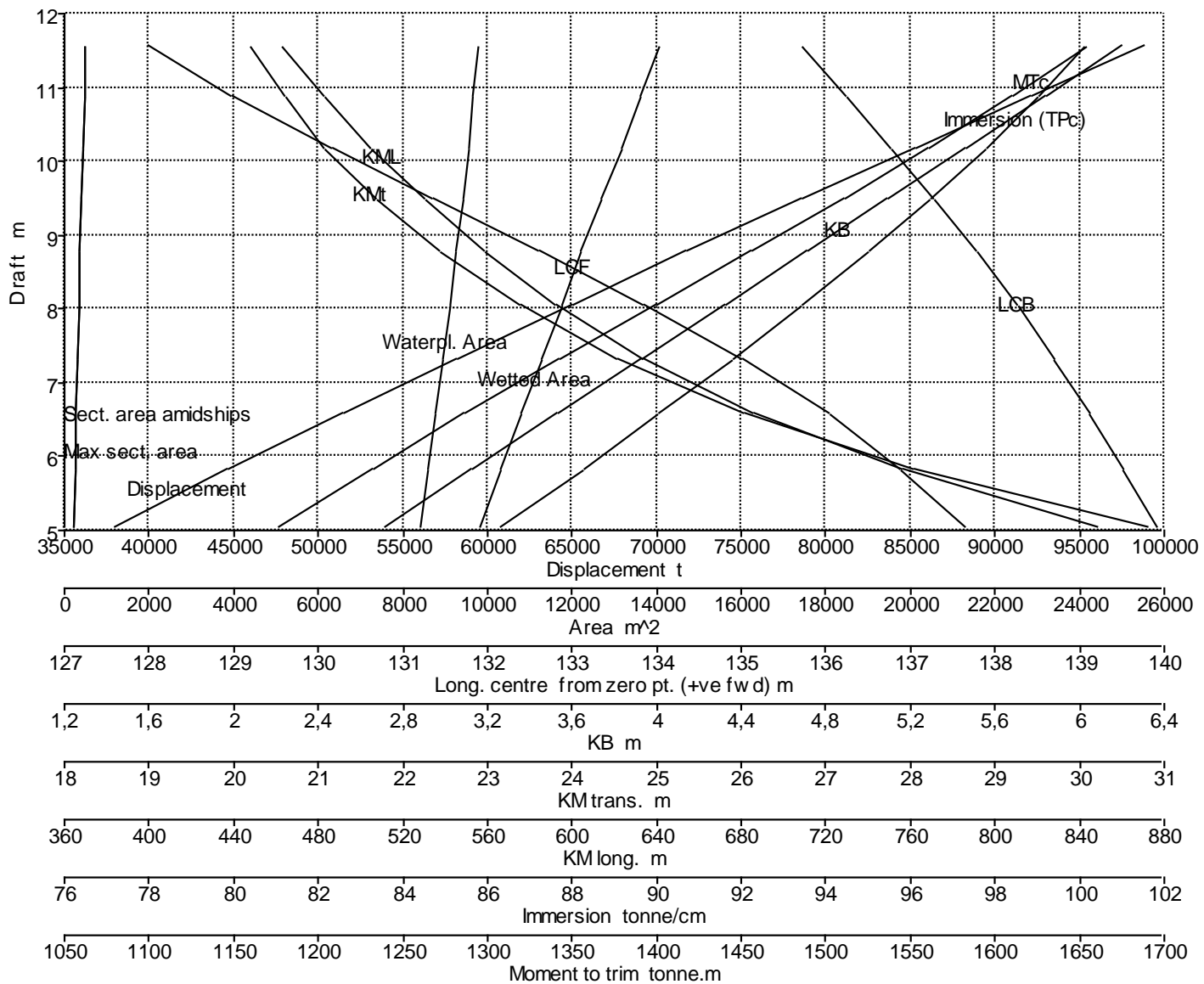
- Prismatic coeff. (Cp)
- Block coeff. (Cb)
- Max Sect. area coeff. (Cm)
- Waterpl. area coeff. (Cwp)

Block coeff. (Cb)

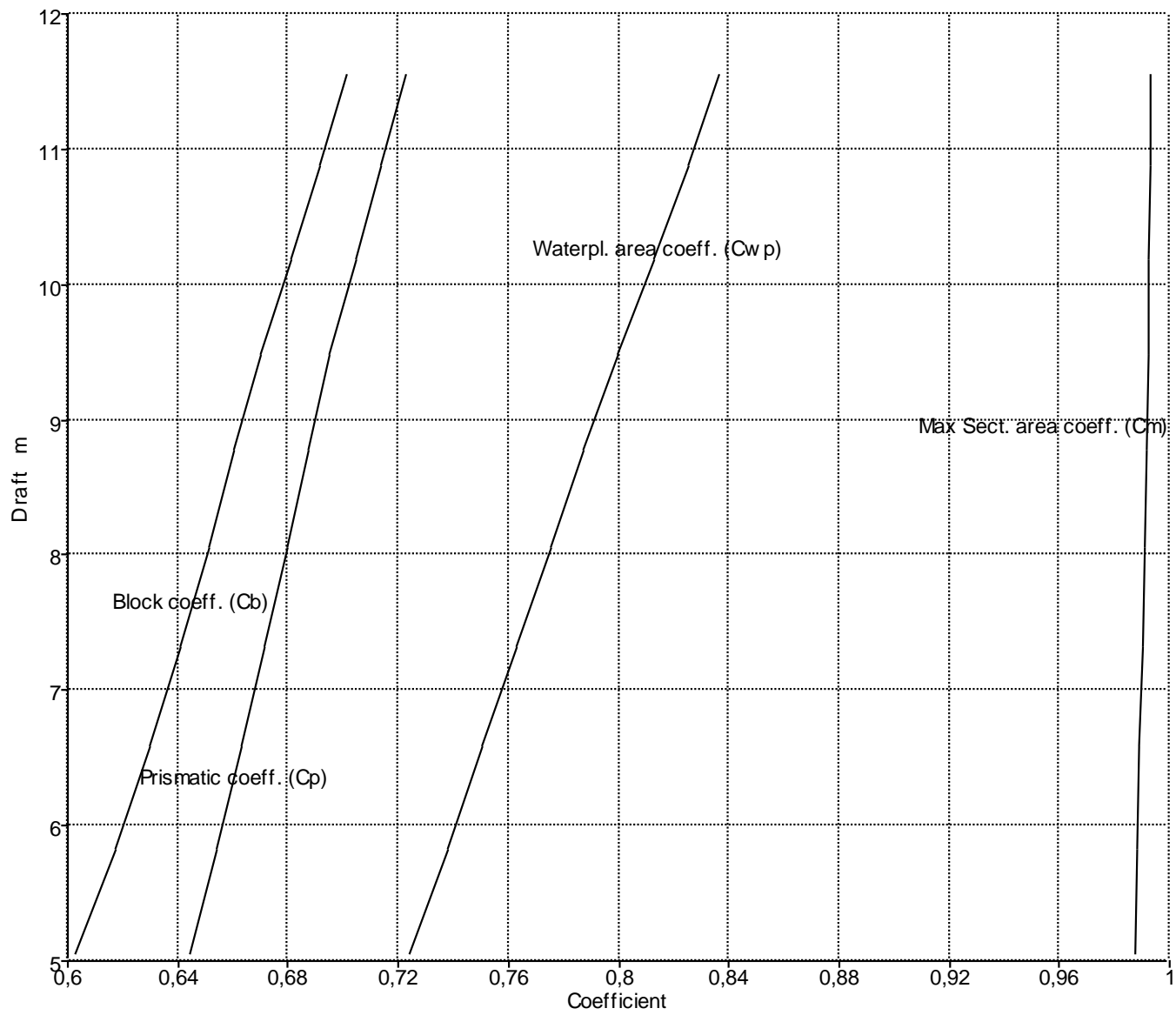
Prismatic coeff. (Cp)

Waterpl. area coeff. (Cwp)

Max Sect. area coeff. (Cm)

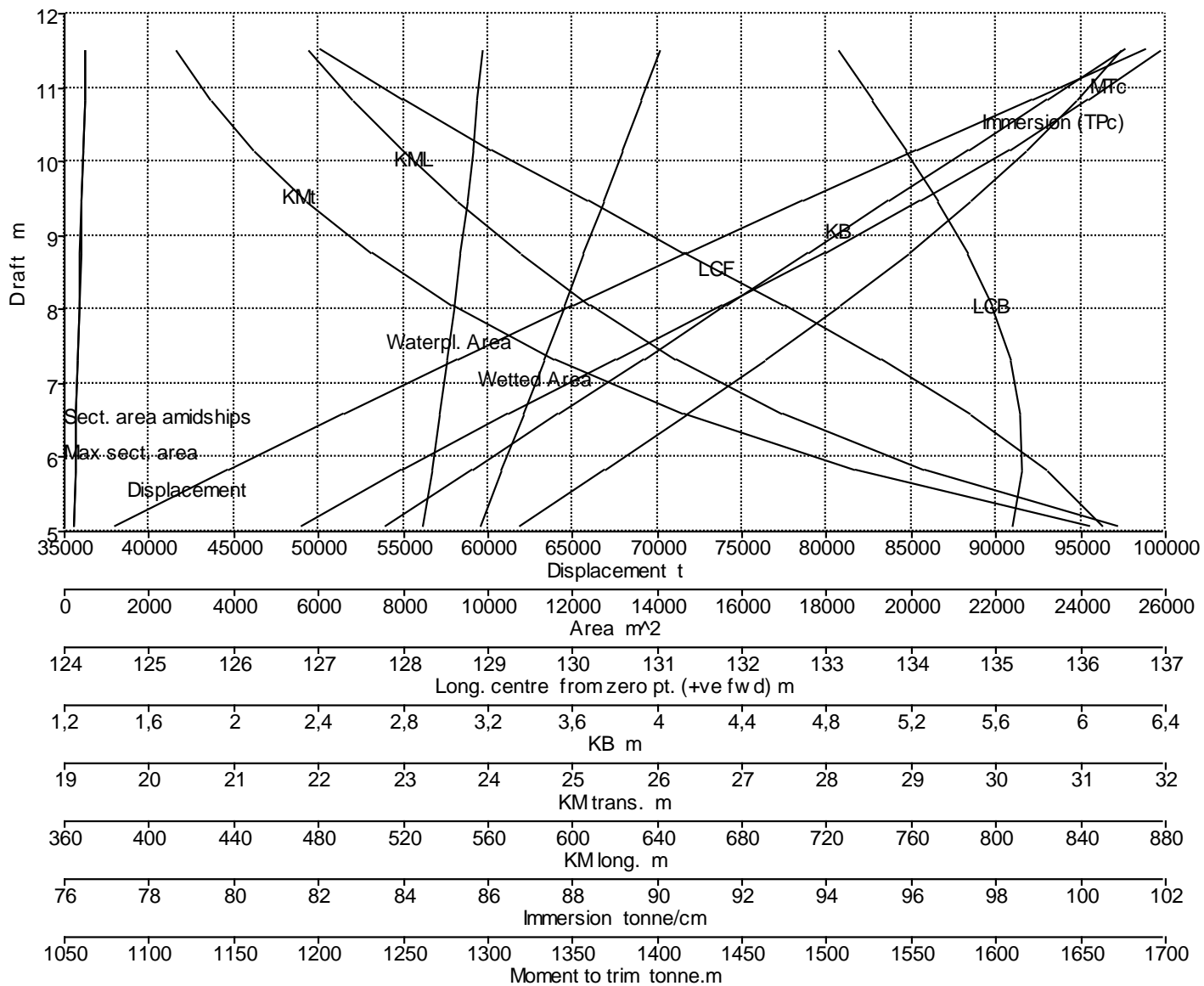


- Hydrostatics**
- Displacement
 - Max sect. area
 - Sect. area amidships
 - Wetted Area
 - Waterpl. Area
 - LCB
 - LCF
 - KB
 - KMT
 - KML
 - Immersion (TPc)
 - MTC

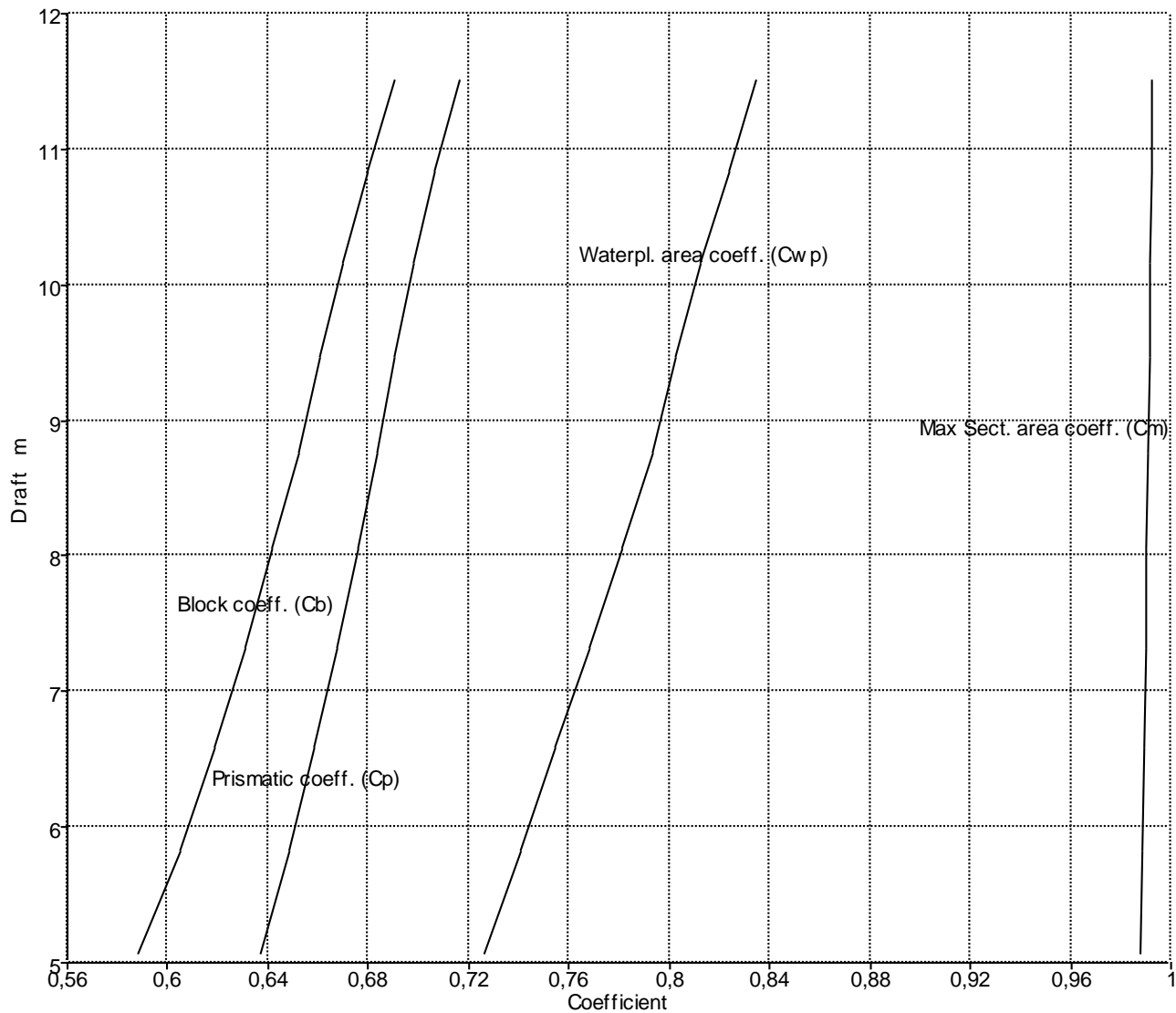


Curves of Form

- Prismatic coeff. (Cp)
- Block coeff. (Cb)
- Max Sect. area coeff. (Cm)
- Waterpl. area coeff. (Cwp)

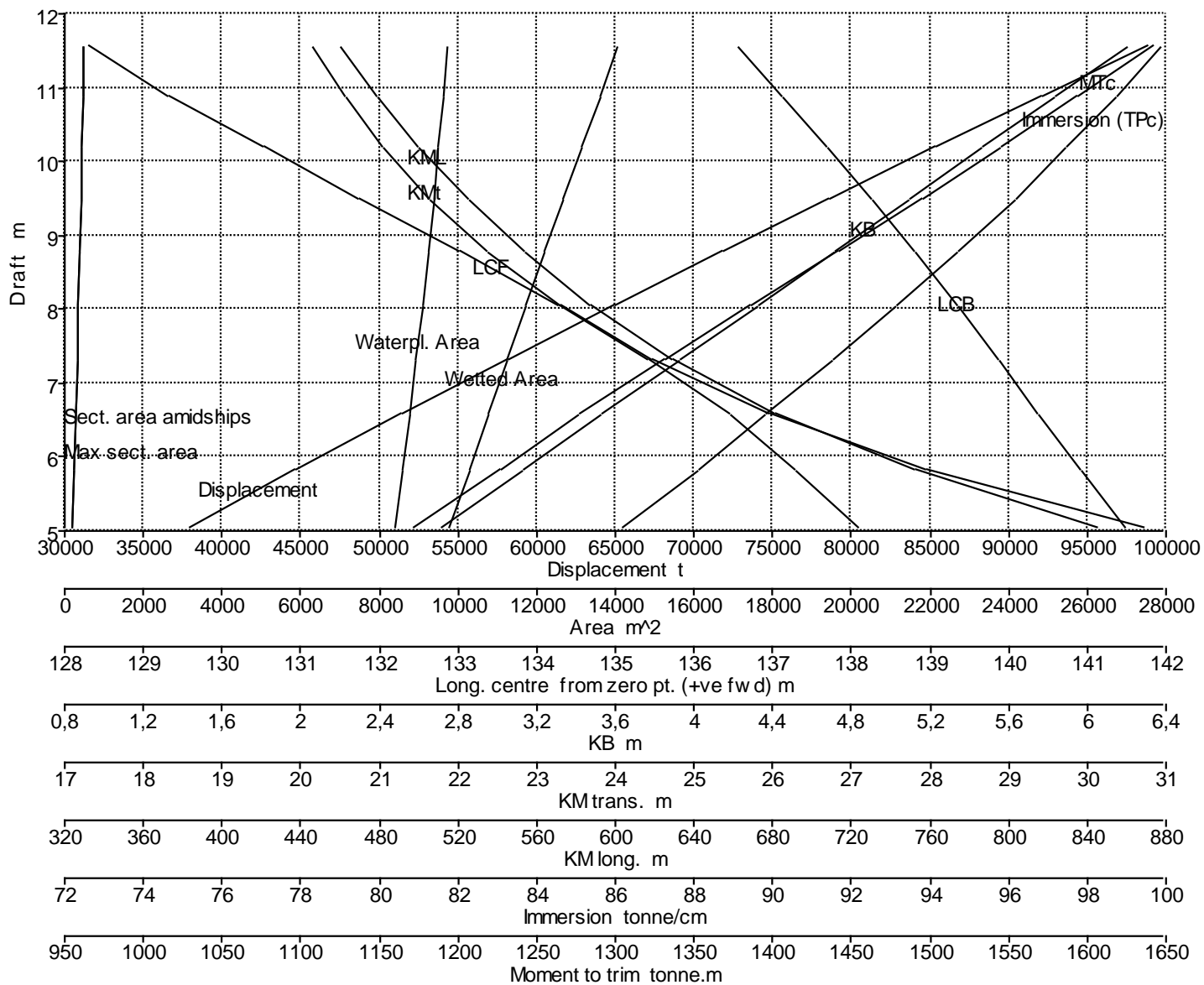


- Hydrostatics**
- Displacement
 - Max sect. area
 - Sect. area amidships
 - Wetted Area
 - Waterpl. Area
 - LCB
 - LCF
 - KB
 - KMt
 - KML
 - Immersion (TPc)
 - MTC

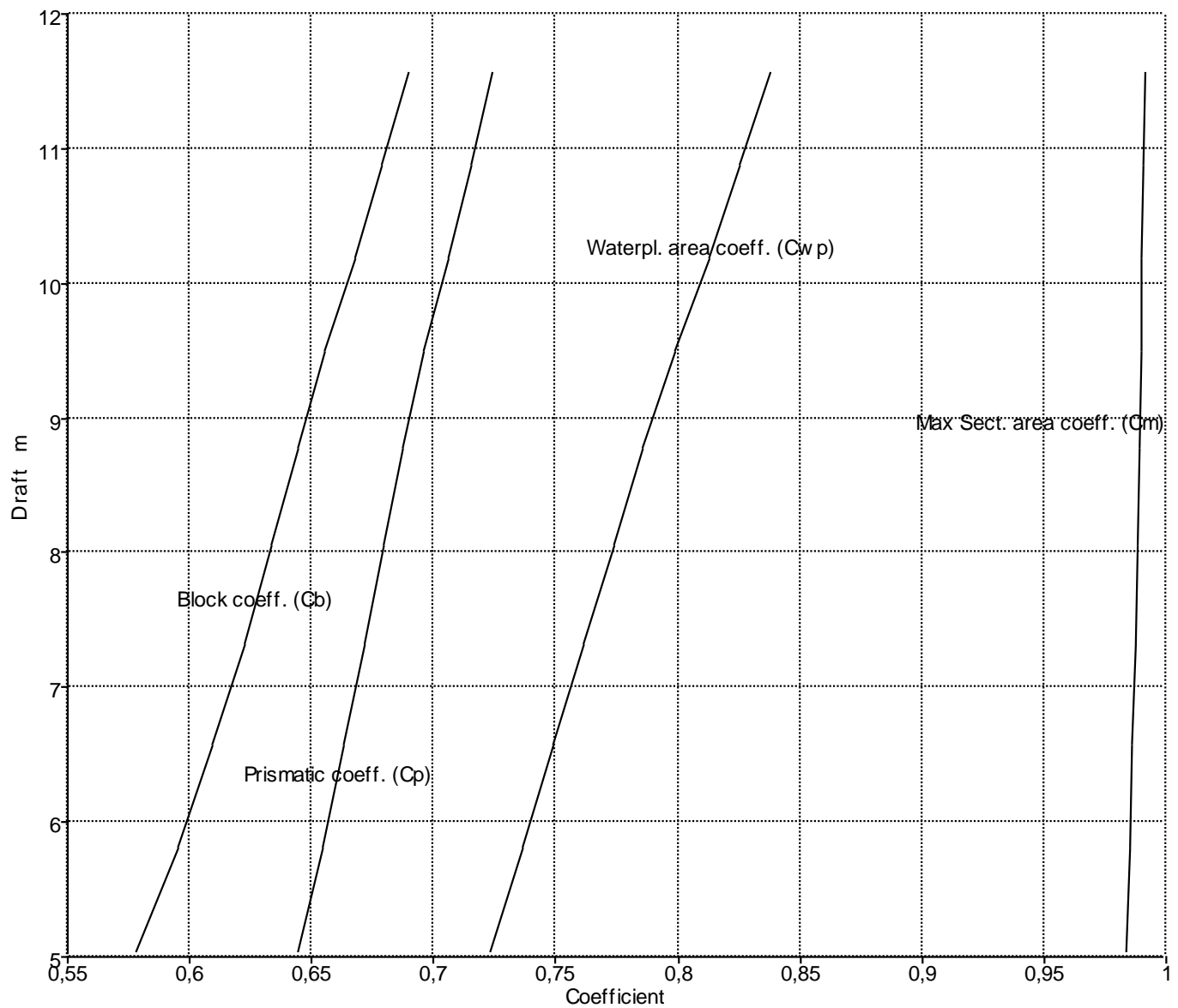


Curves of Form

- Prismatic coeff. (Cp)
- Block coeff. (Cb)
- Max Sect. area coeff. (Cm)
- Waterpl. area coeff. (Cwp)

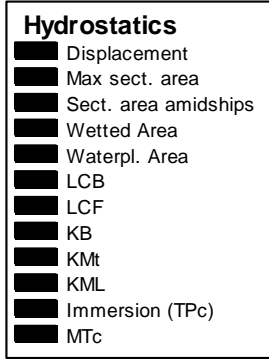
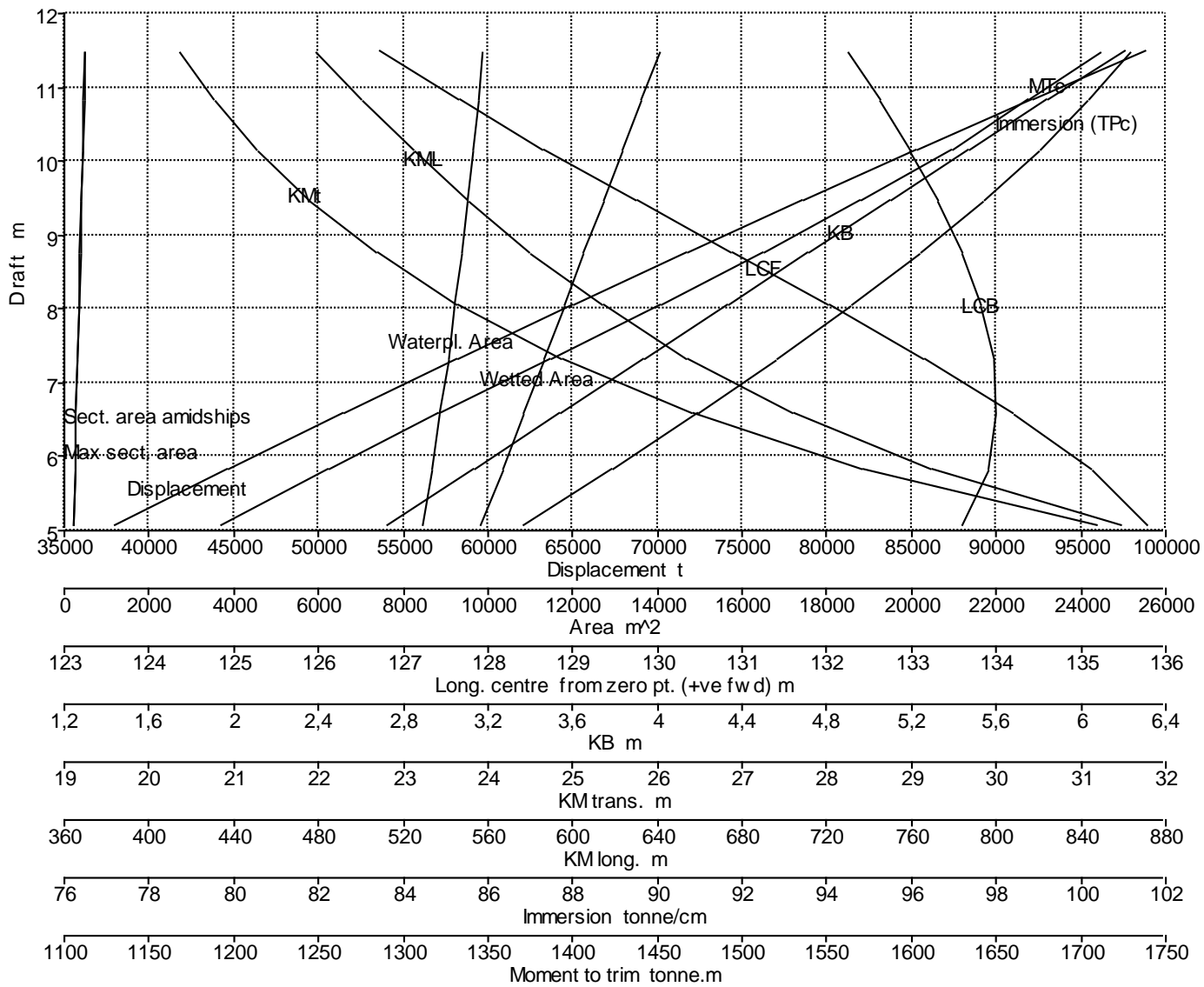


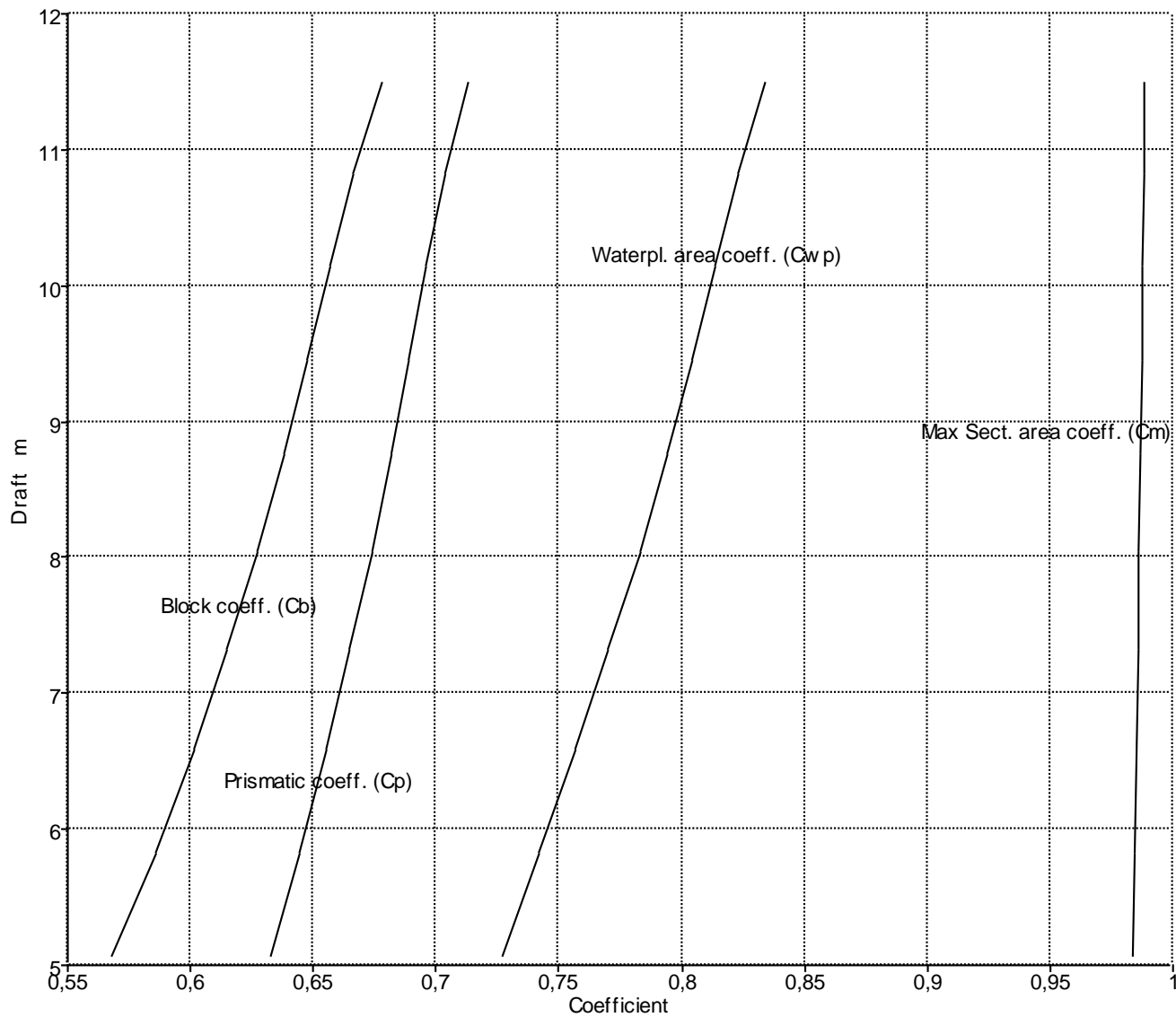
- Hydrostatics**
- Displacement
 - Max sect. area
 - Sect. area amidships
 - Wetted Area
 - Waterpl. Area
 - LCB
 - LCF
 - KB
 - KMt
 - KML
 - Immersion (TPc)
 - MTC



Curves of Form

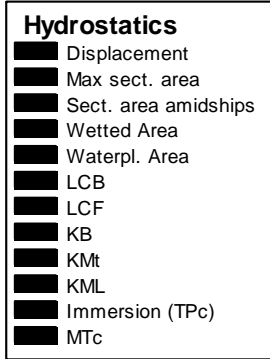
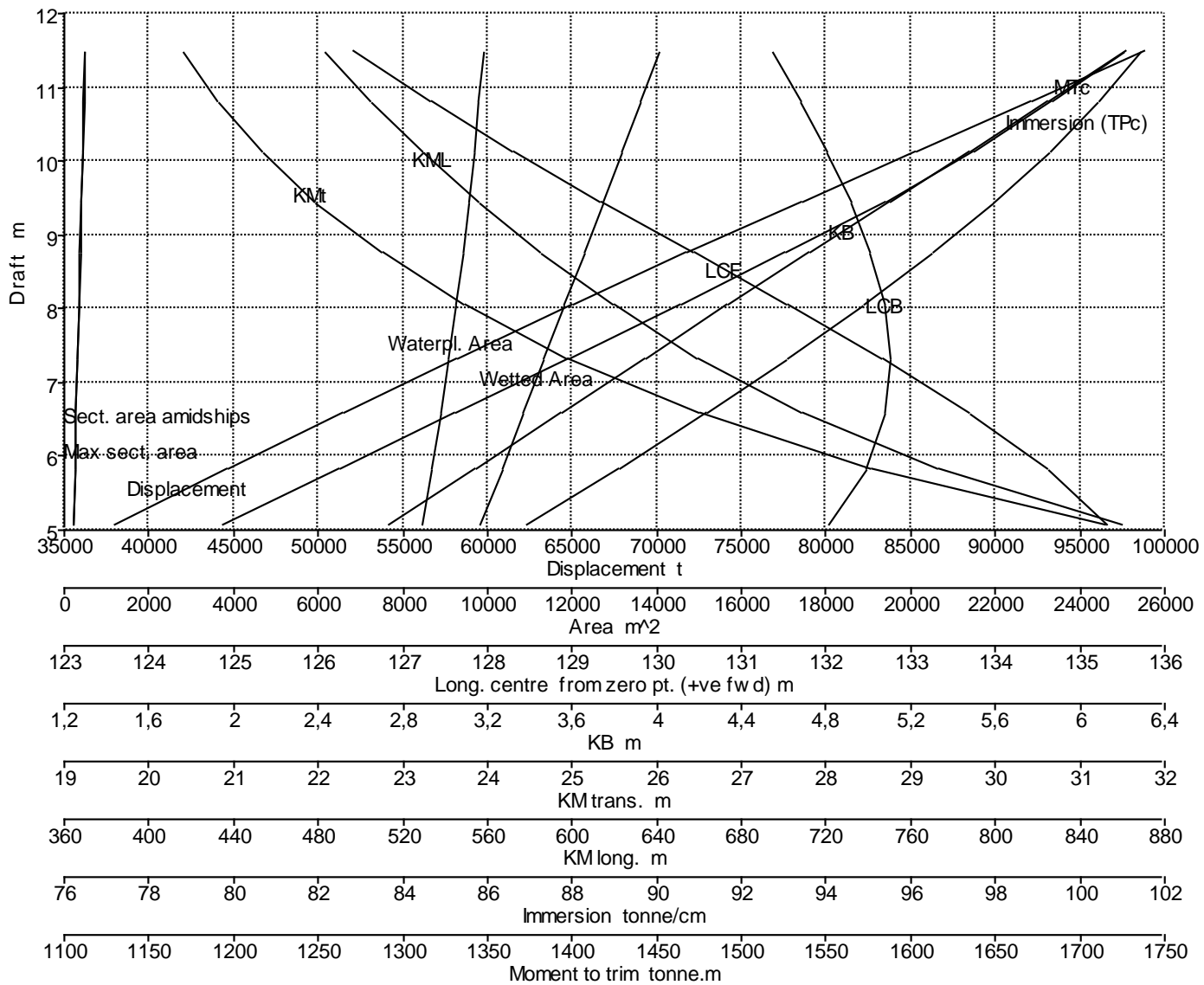
- Prismatic coeff. (Cp)
- Block coeff. (Cb)
- Max Sect. area coeff. (Cm)
- Waterpl. area coeff. (Cwp)

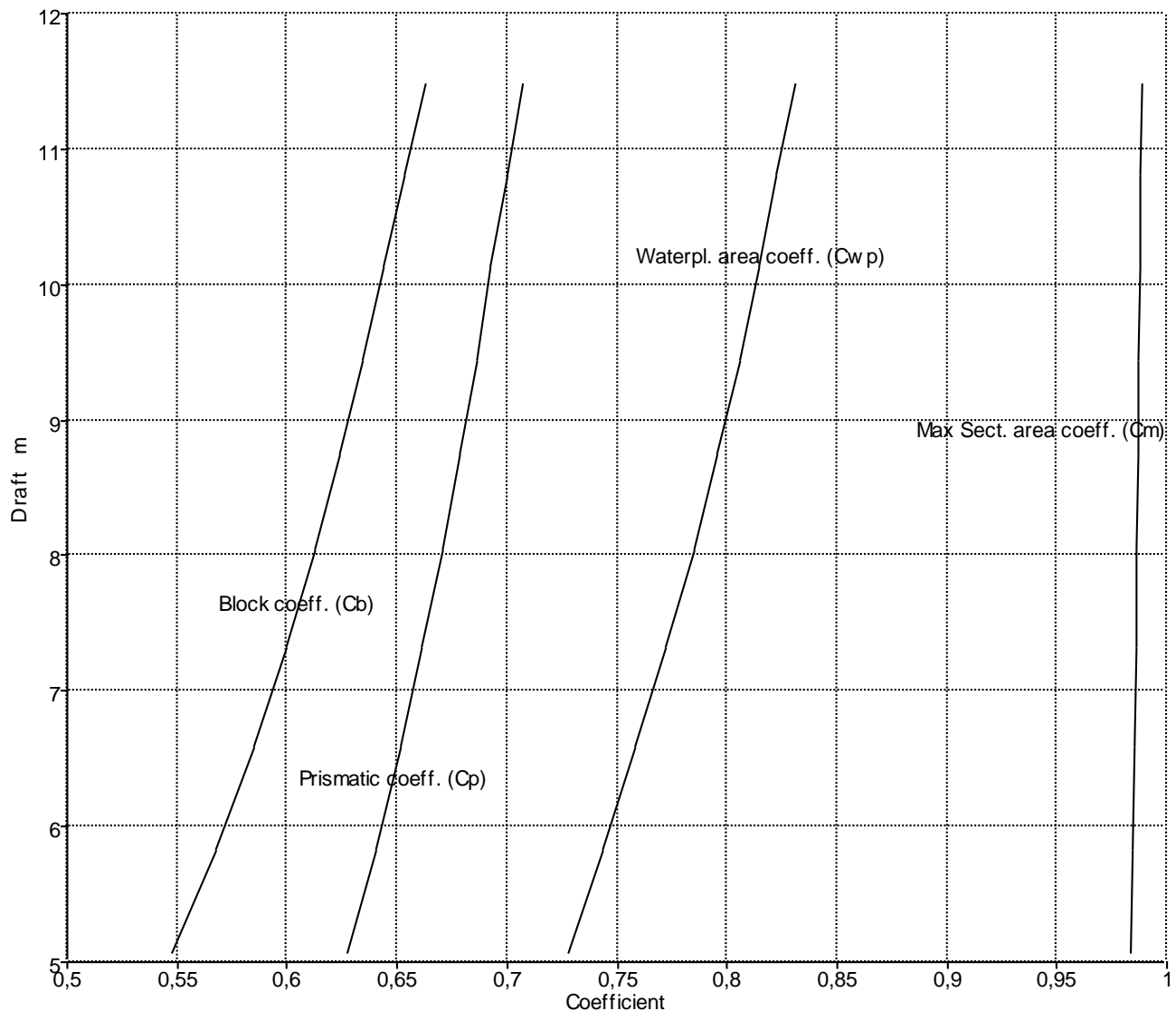




Curves of Form

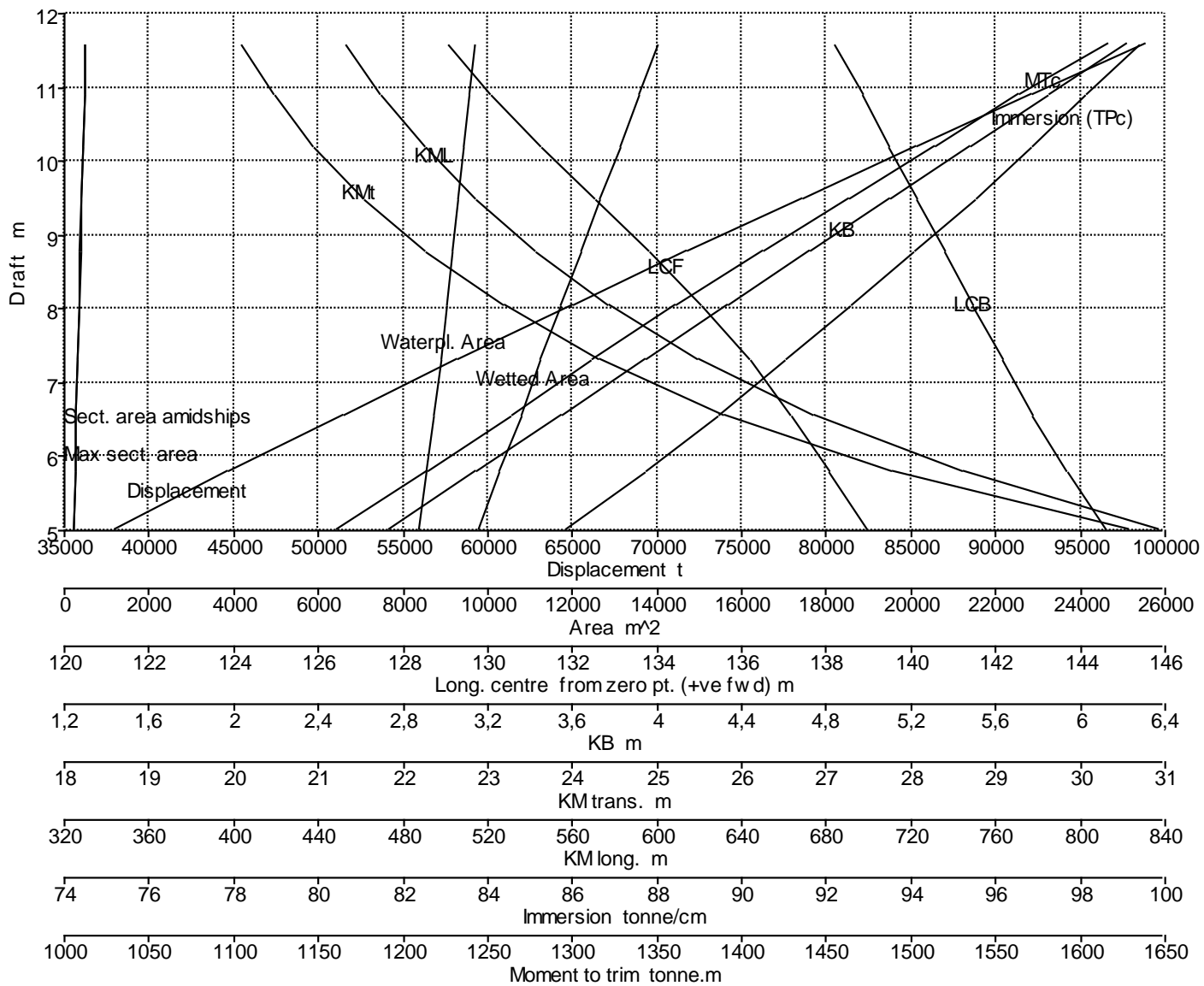
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- Block coeff. (Cb)
- Max Sect. area coeff. (Cm)
- Waterpl. area coeff. (Cwp)





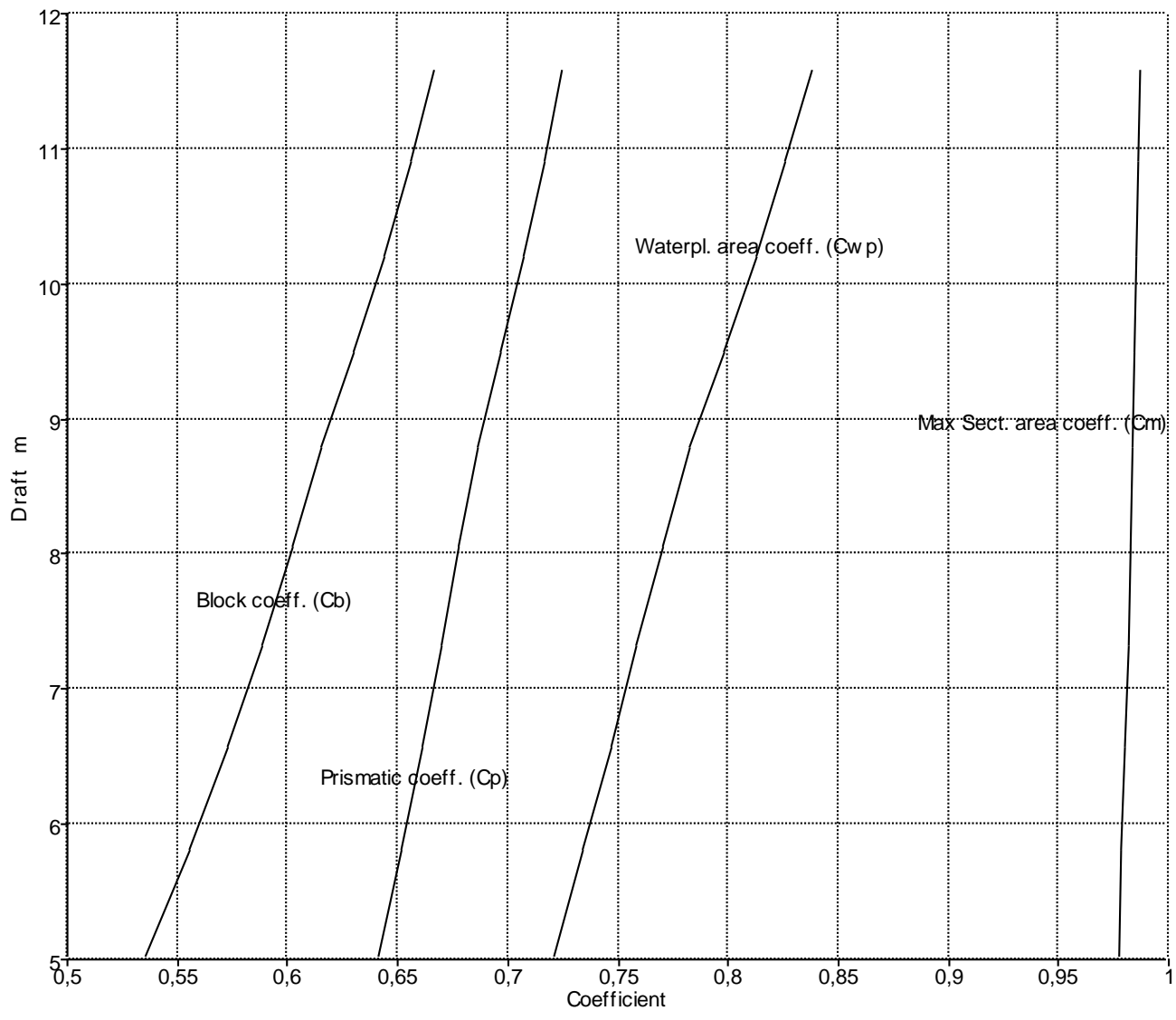
Curves of Form

- Prismatic coeff. (Cp)
- Block coeff. (Cb)
- Max Sect. area coeff. (Cm)
- Waterpl. area coeff. (Cwp)



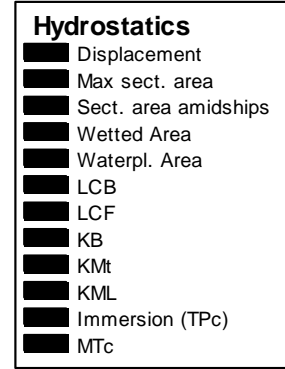
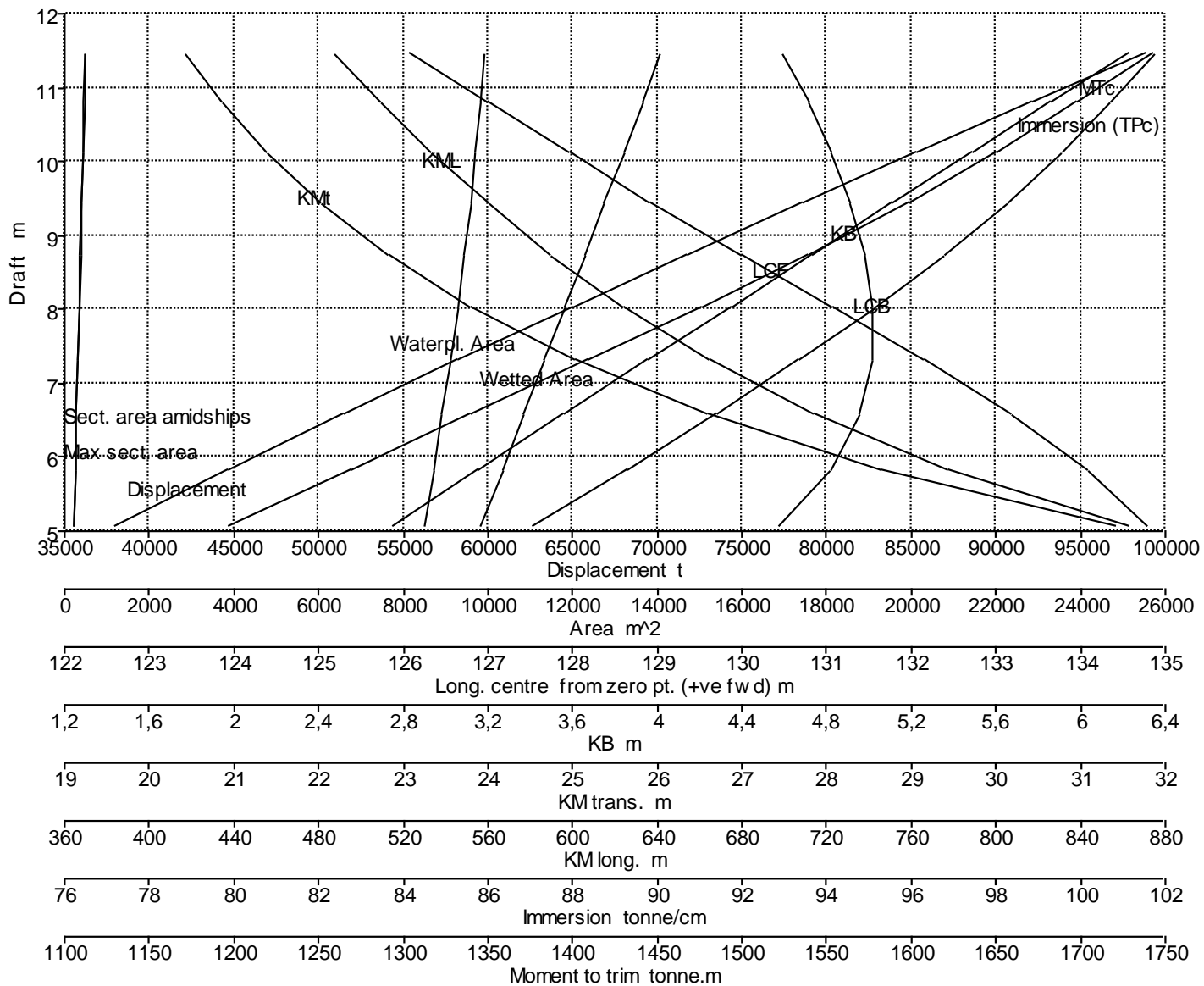
Hydrostatics

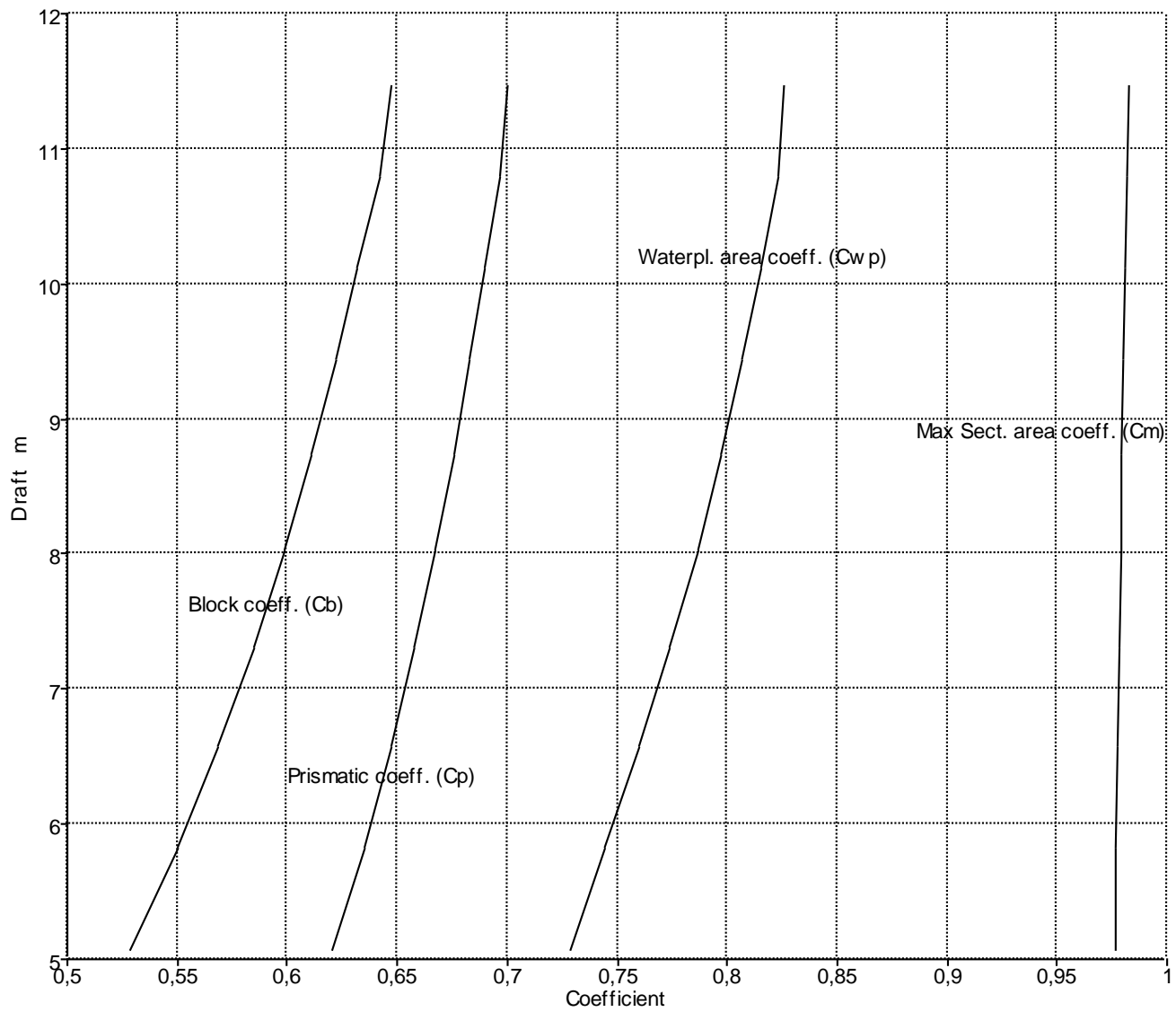
- Displacement
- Max sect. area
- Sect. area amidships
- Wetted Area
- Waterpl. Area
- LCB
- LCF
- KB
- KMt
- KML
- Immersion (TPc)
- MTc



Curves of Form

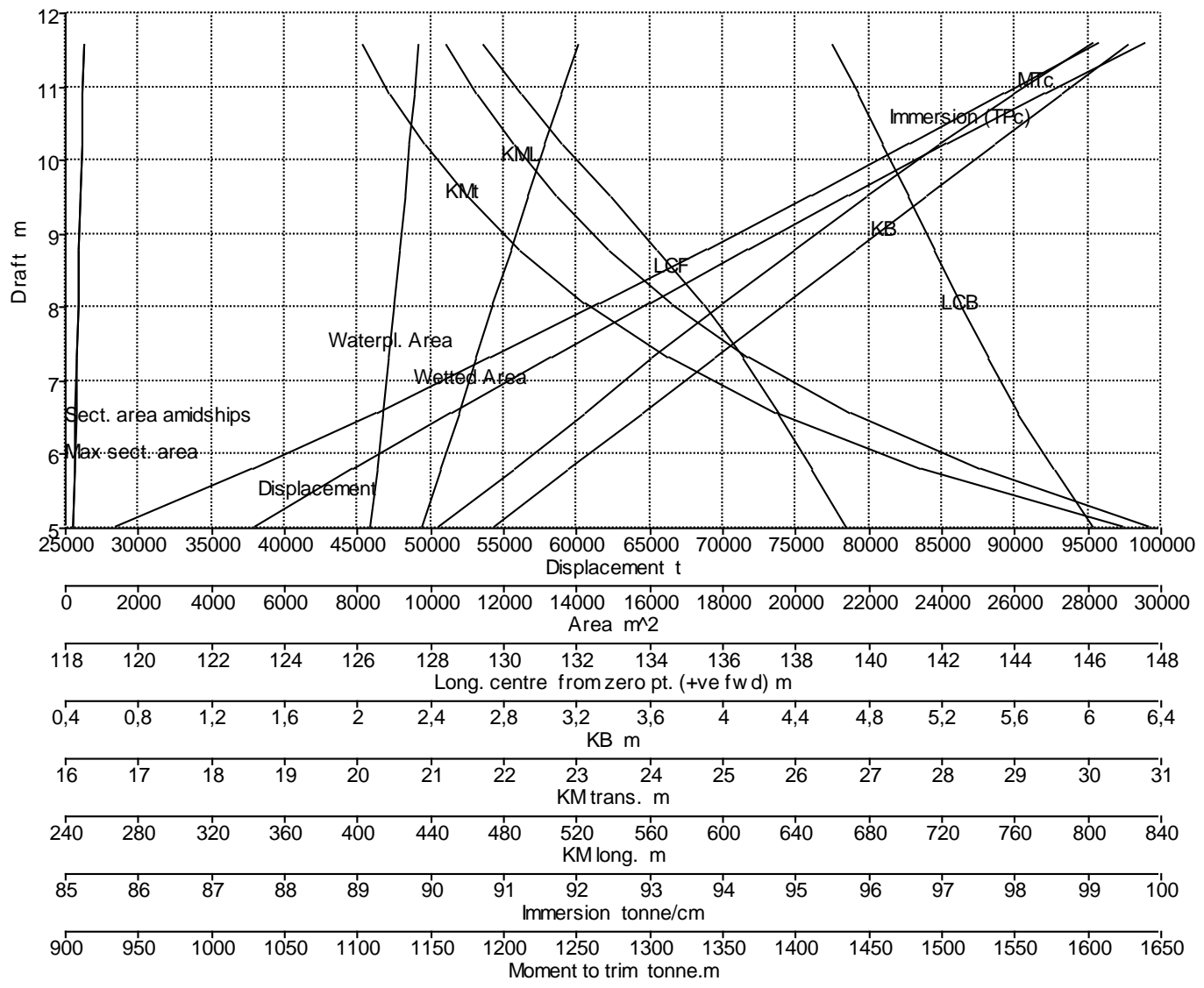
- Prismatic coeff. (Cp)
- Block coeff. (Cb)
- Max Sect. area coeff. (Cm)
- Waterpl. area coeff. (Cwp)





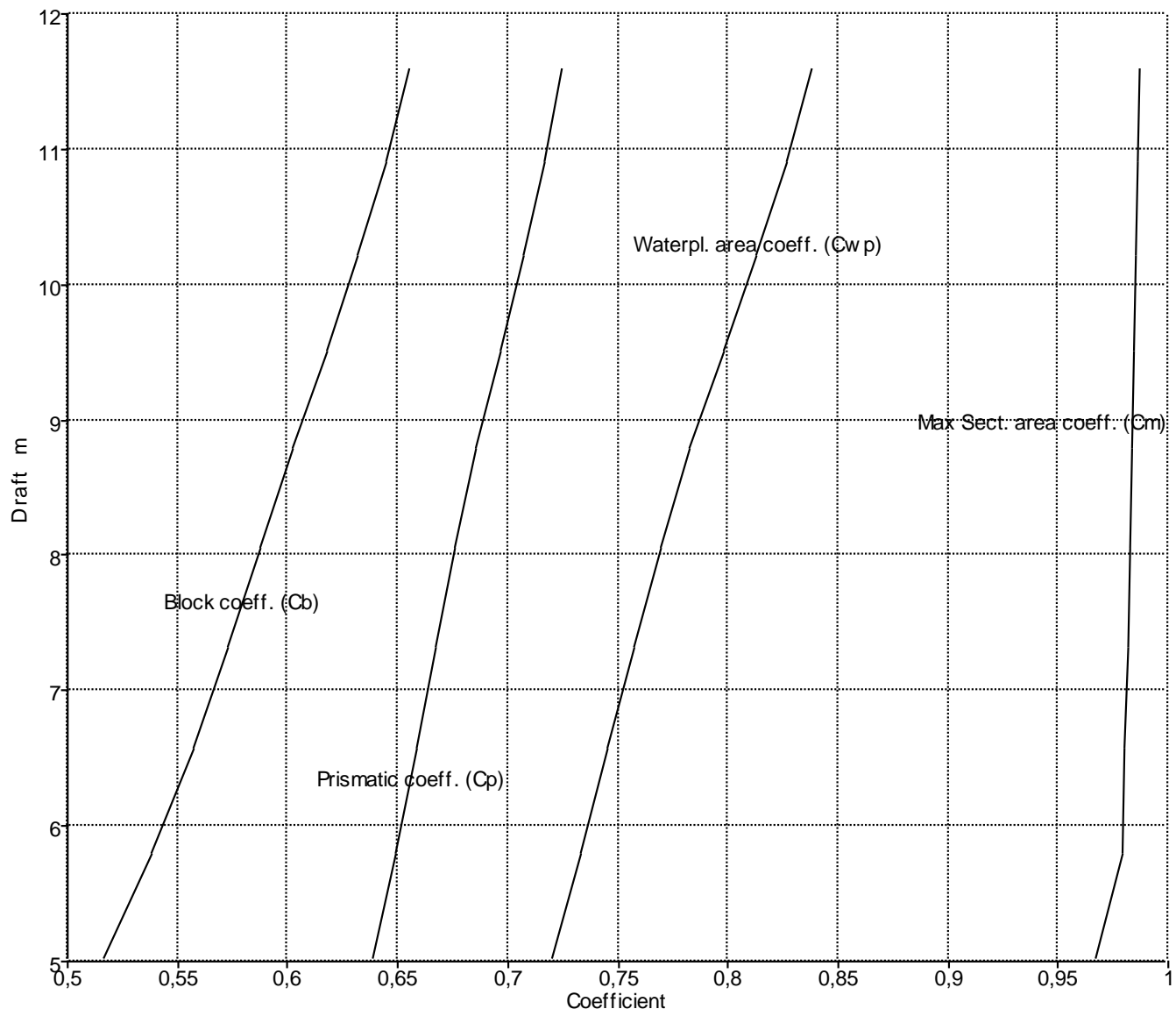
Curves of Form

- Prismatic coeff. (Cp)
- Block coeff. (Cb)
- Max Sect. area coeff. (Cm)
- Waterpl. area coeff. (Cwp)



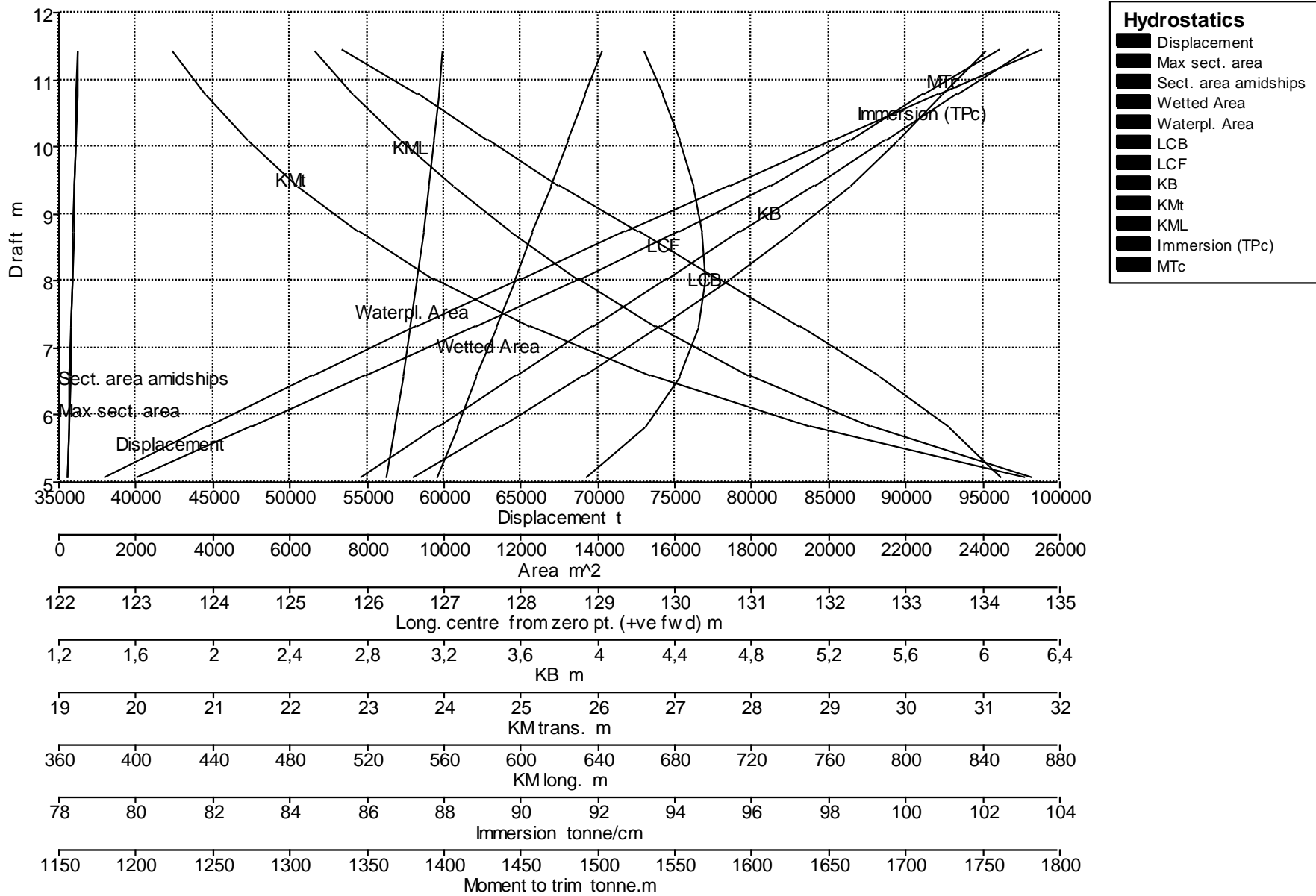
Hydrostatics

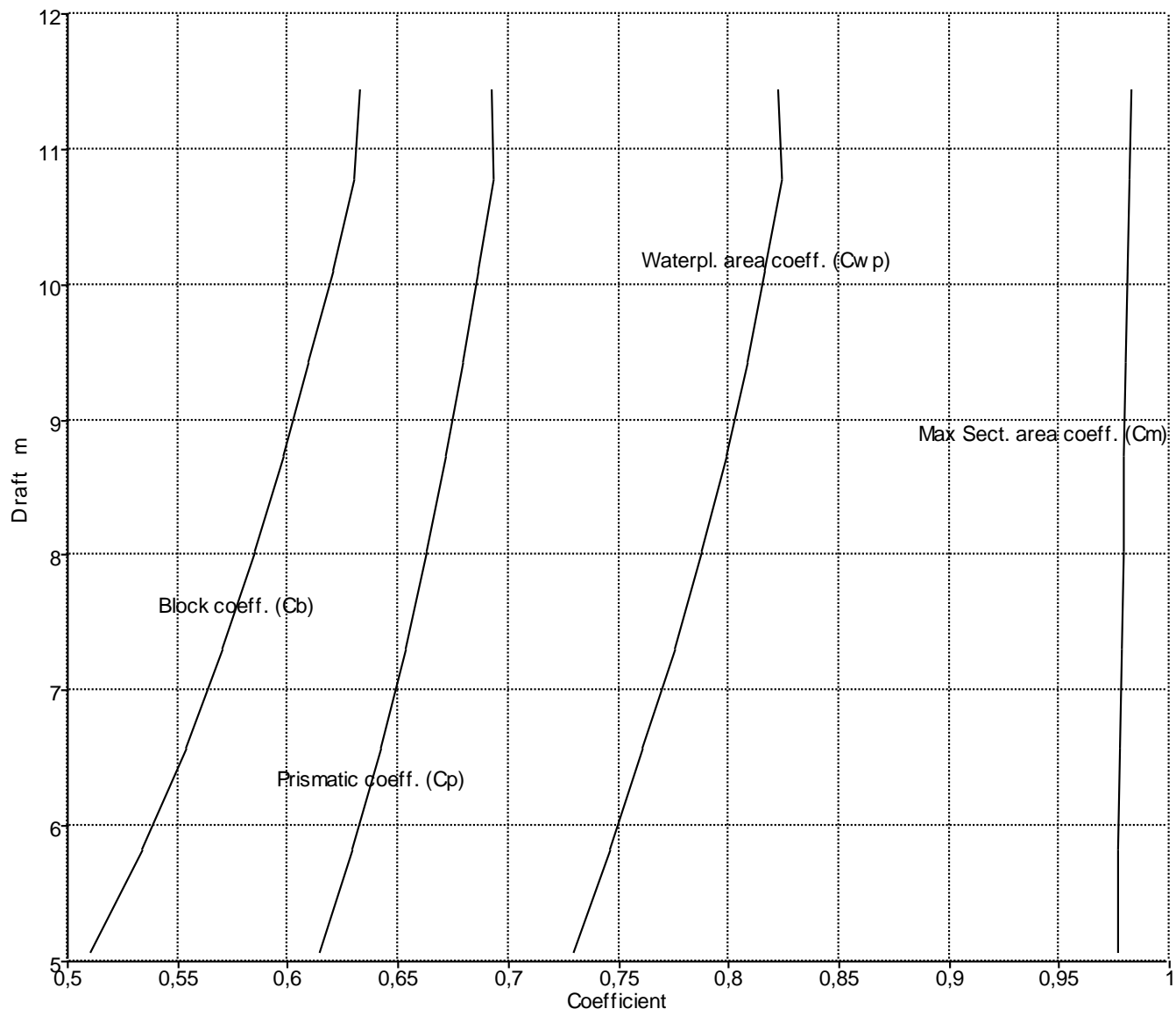
- Displacement
- Max sect. area
- Sect. area amidships
- Wetted Area
- Waterpl. Area
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- KB
- KML
- Immersion (TPc)
- MTC



Curves of Form

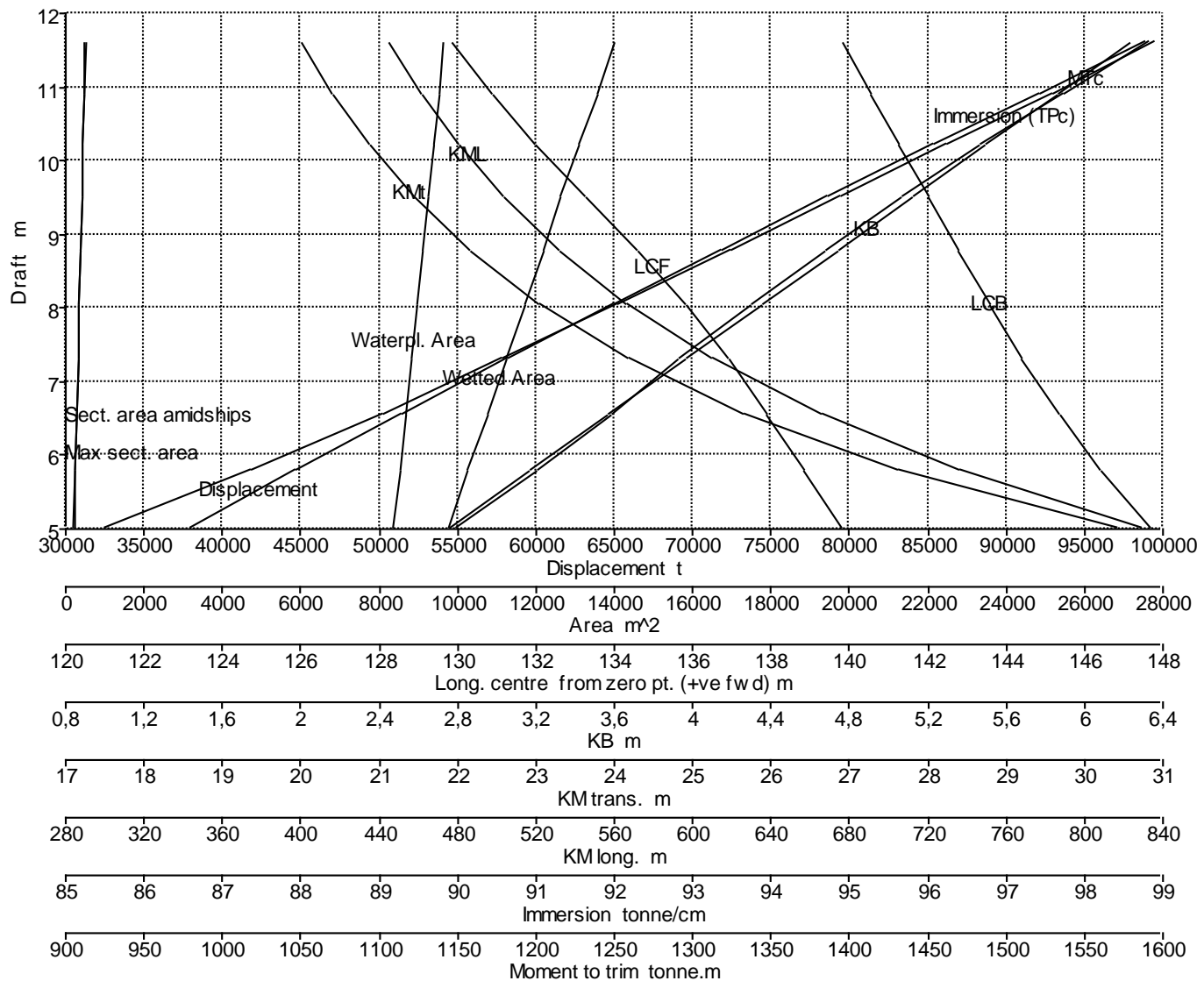
- Prismatic coeff. (Cp)
- Block coeff. (Cb)
- Max Sect. area coeff. (Cm)
- Waterpl. area coeff. (Cwp)





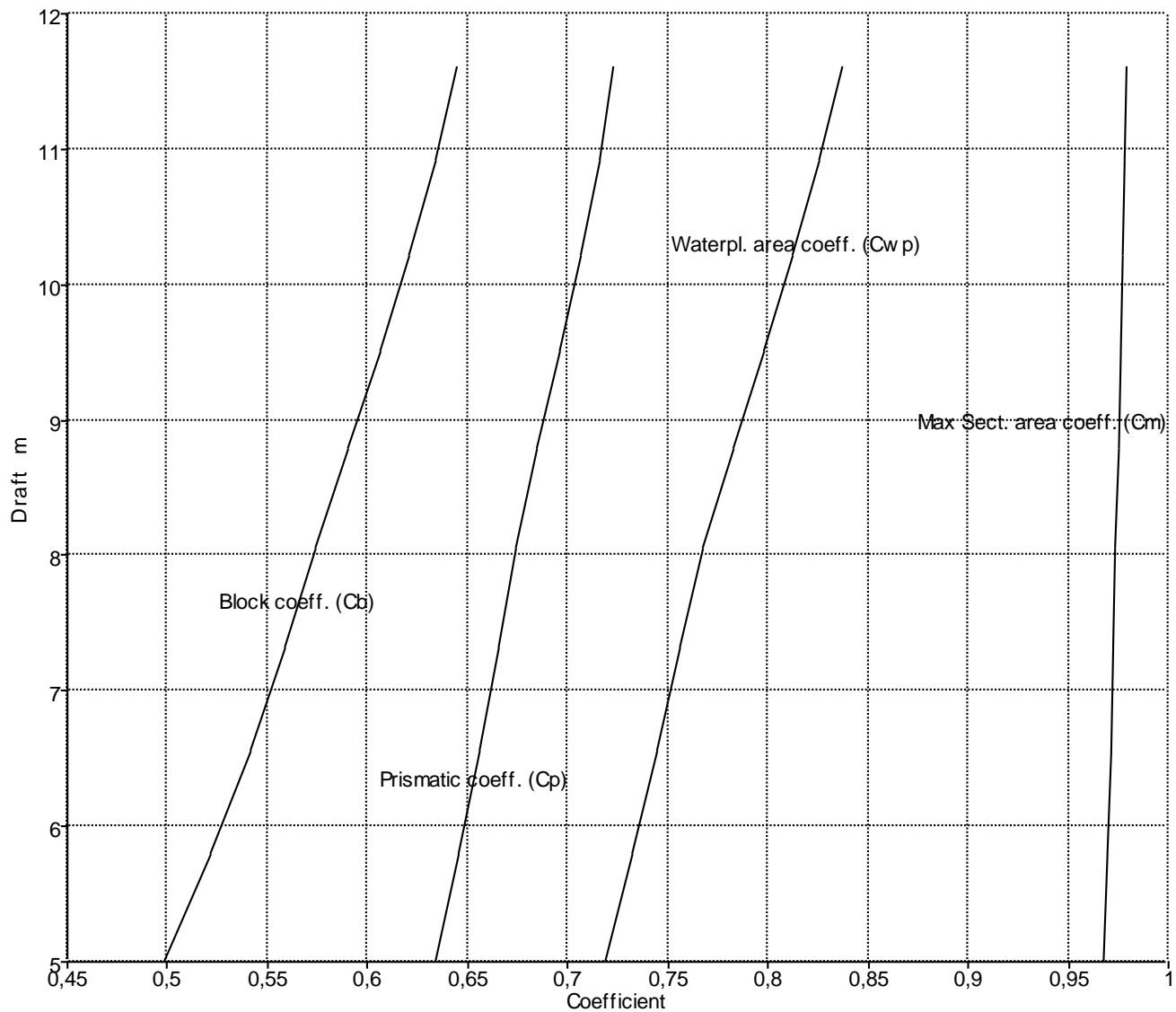
Curves of Form

- Prismatic coeff. (Cp)
- Block coeff. (Cb)
- Max Sect. area coeff. (Cm)
- Waterpl. area coeff. (Cwp)



Hydrostatics

- Displacement
- Max sect. area
- Sect. area amidships
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- MTc



Curves of Form

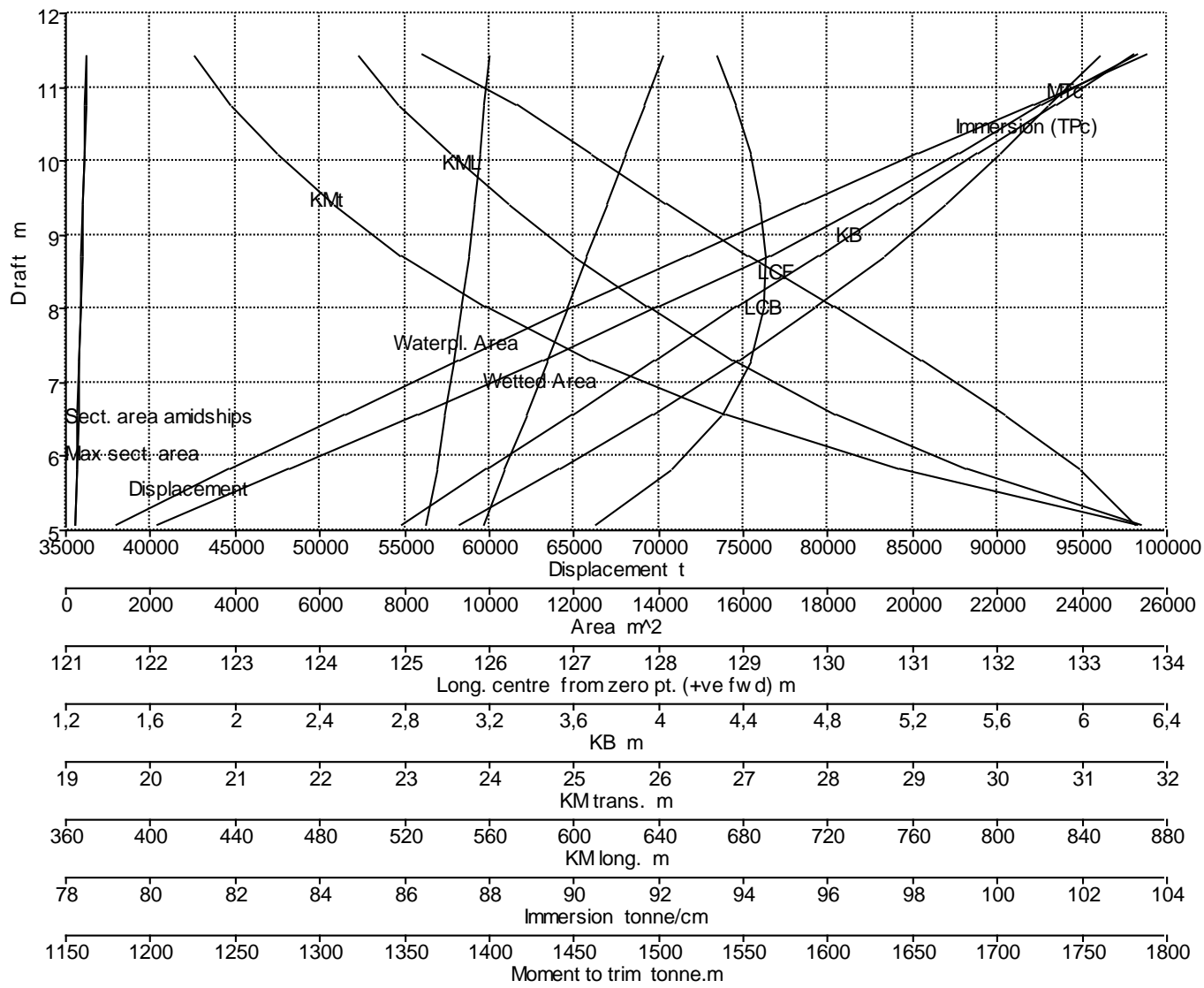
- Prismatic coeff. (Cp)
- Block coeff. (Cb)
- Max Sect. area coeff. (Cm)
- Waterpl. area coeff. (Cwp)

Block coeff. (Cb)

Prismatic coeff. (Cp)

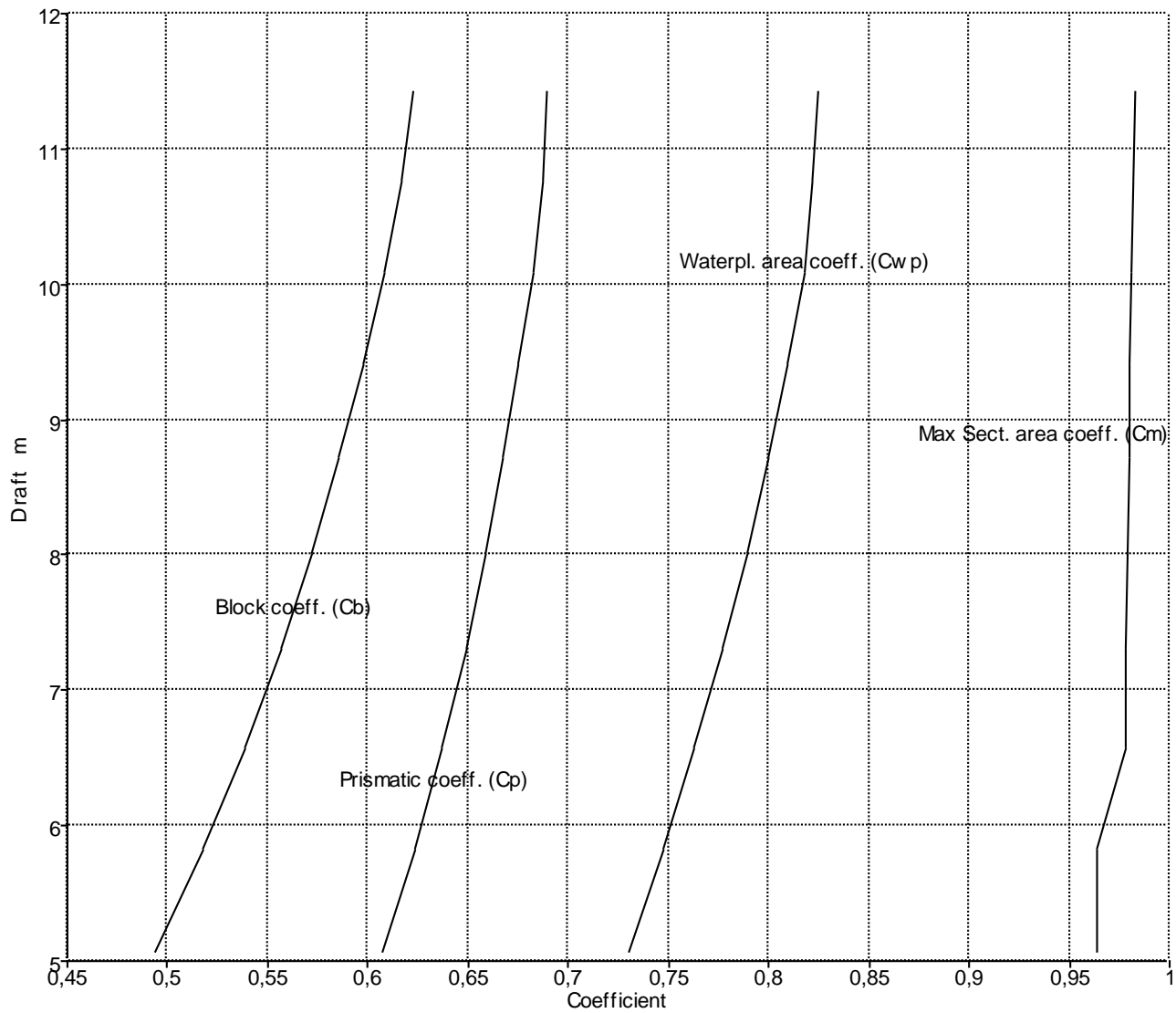
Waterpl. area coeff. (Cwp)

Max Sect. area coeff. (Cm)



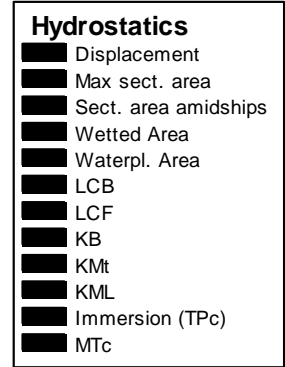
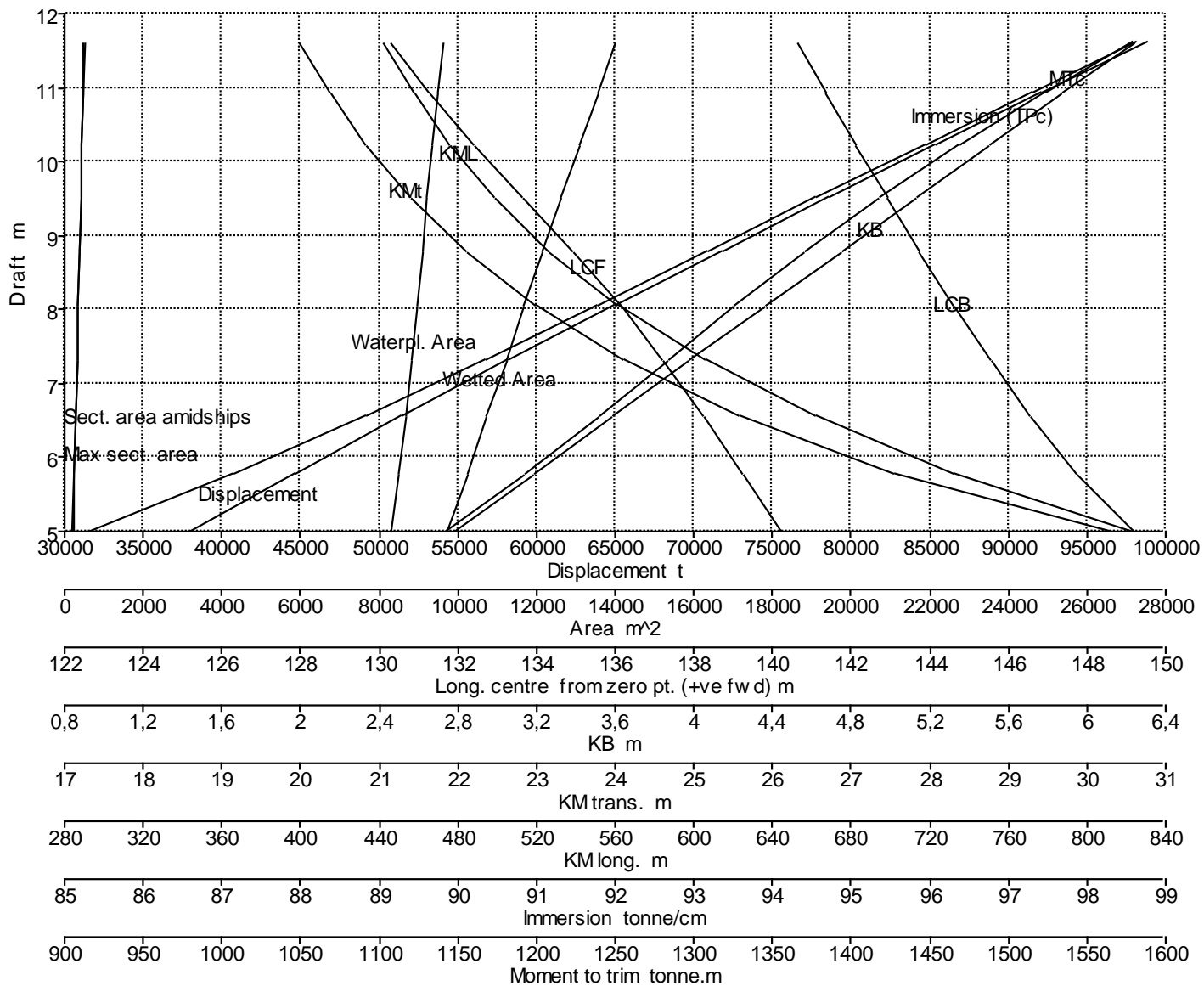
Hydrostatics

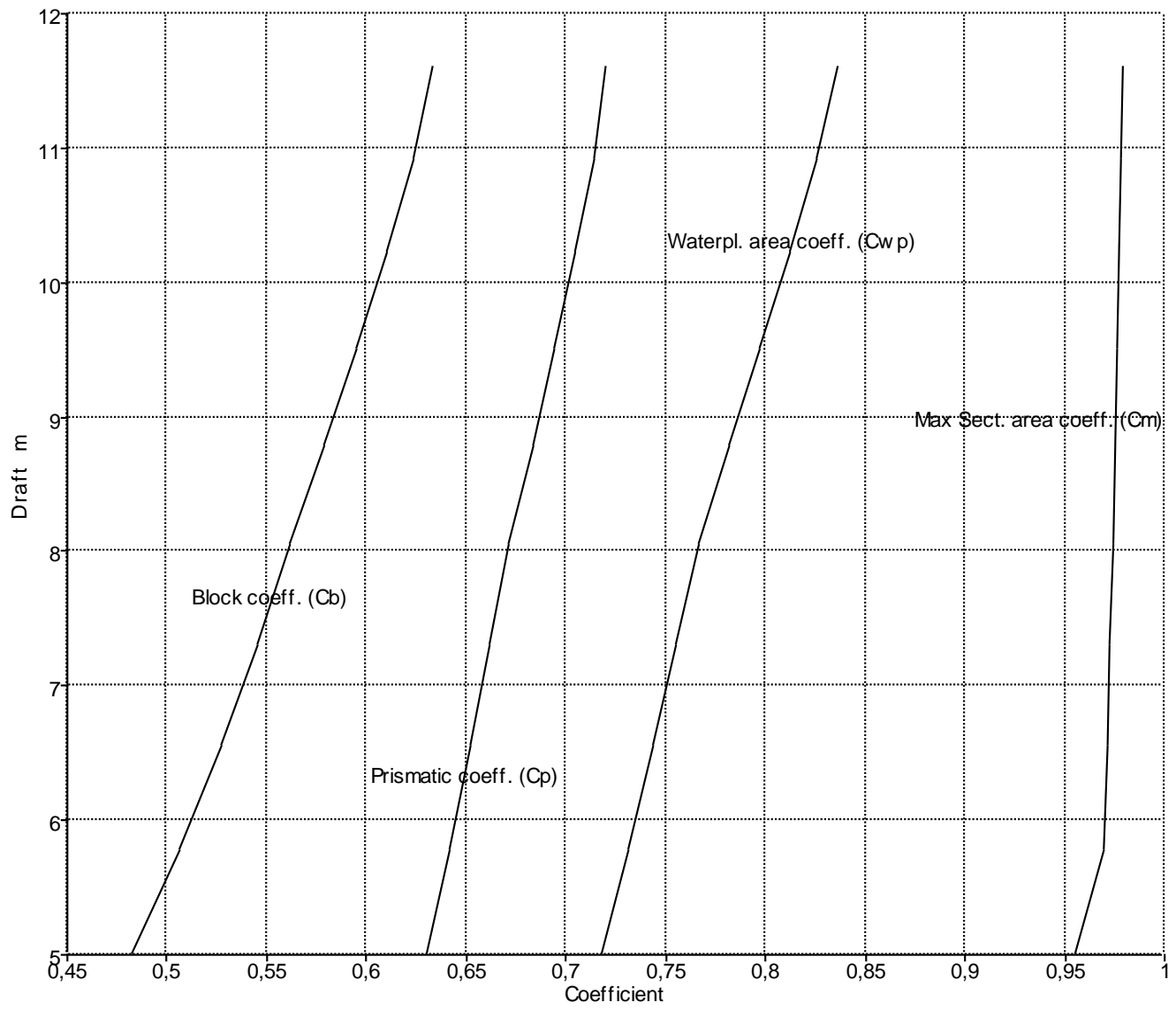
- Displacement
- Max sect. area
- Sect. area amidships
- Wetted Area
- Waterpl. Area
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- KB
- KML
- Immersion (TPc)
- MTc



Curves of Form

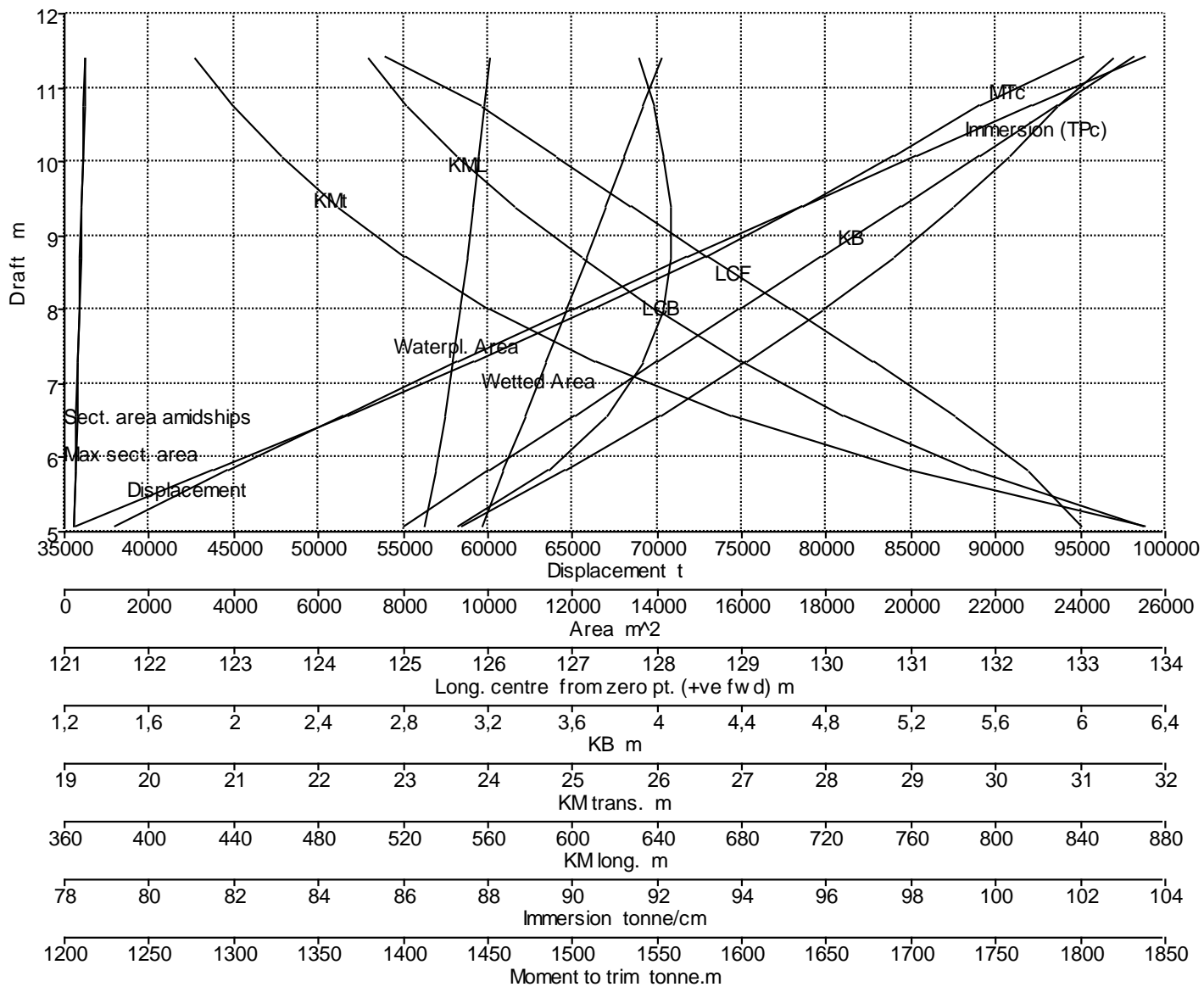
- Prismatic coeff. (Cp)
- Block coeff. (Cb)
- Max Sect. area coeff. (Cm)
- Waterpl. area coeff. (Cwp)



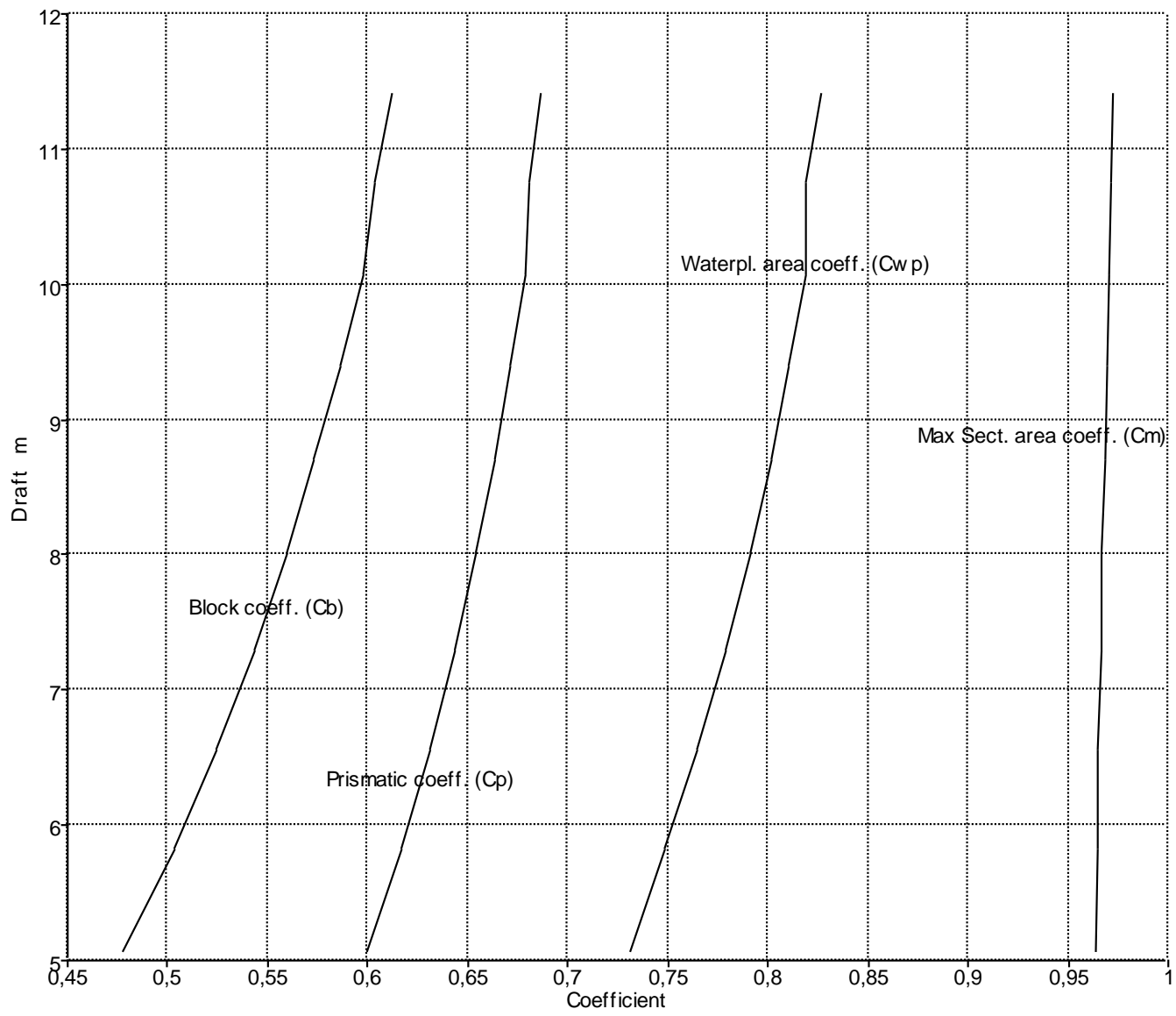


Curves of Form

- Prismatic coeff. (Cp)
- Block coeff. (Cb)
- Max Sect. area coeff. (Cm)
- Waterpl. area coeff. (Cwp)

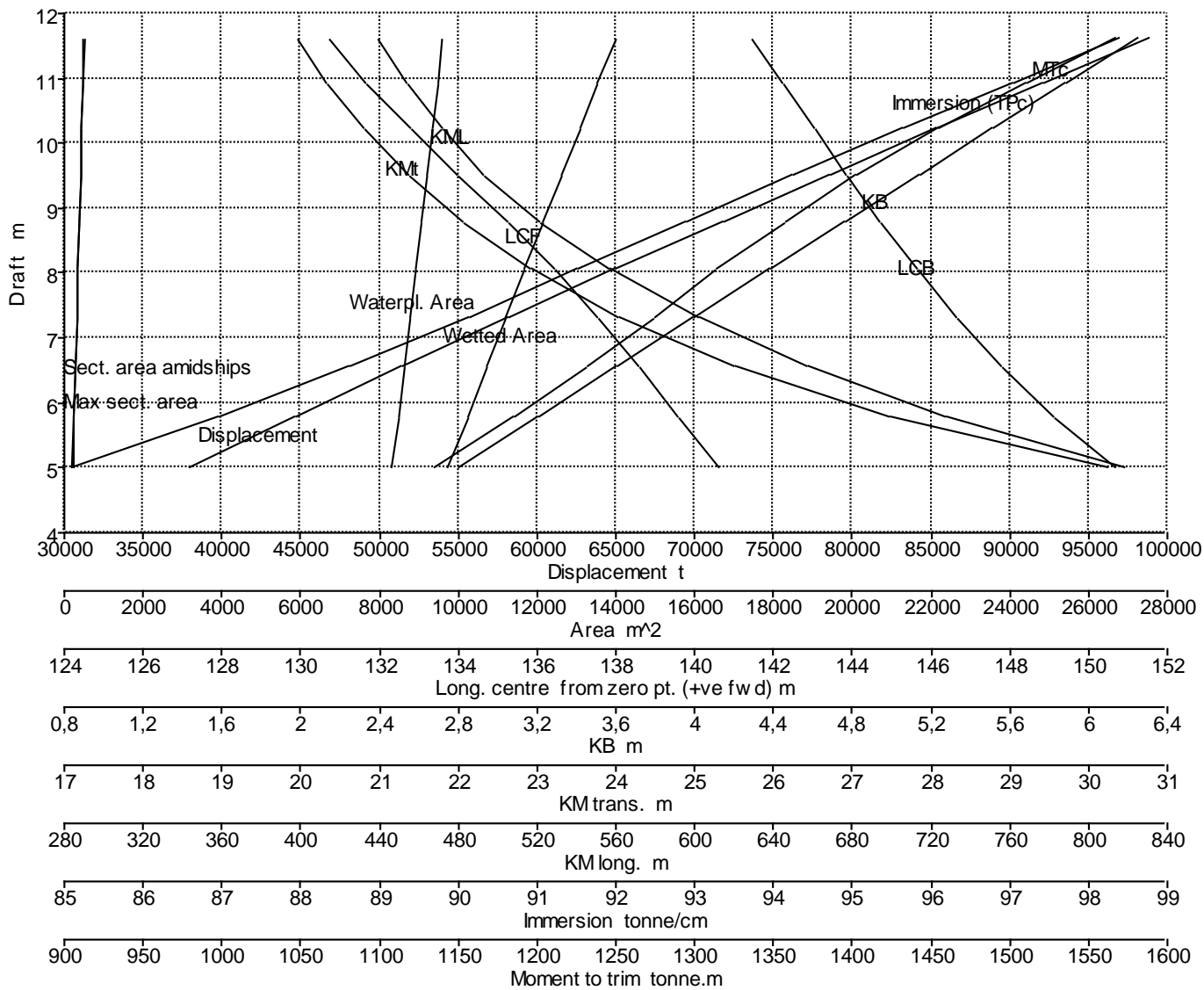


- Hydrostatics**
- Displacement
 - Max sect. area
 - Sect. area amidships
 - Wetted Area
 - Waterpl. Area
 - LCB
 - LCF
 - KB
 - KMt
 - KML
 - Immersion (TPc)
 - MTC



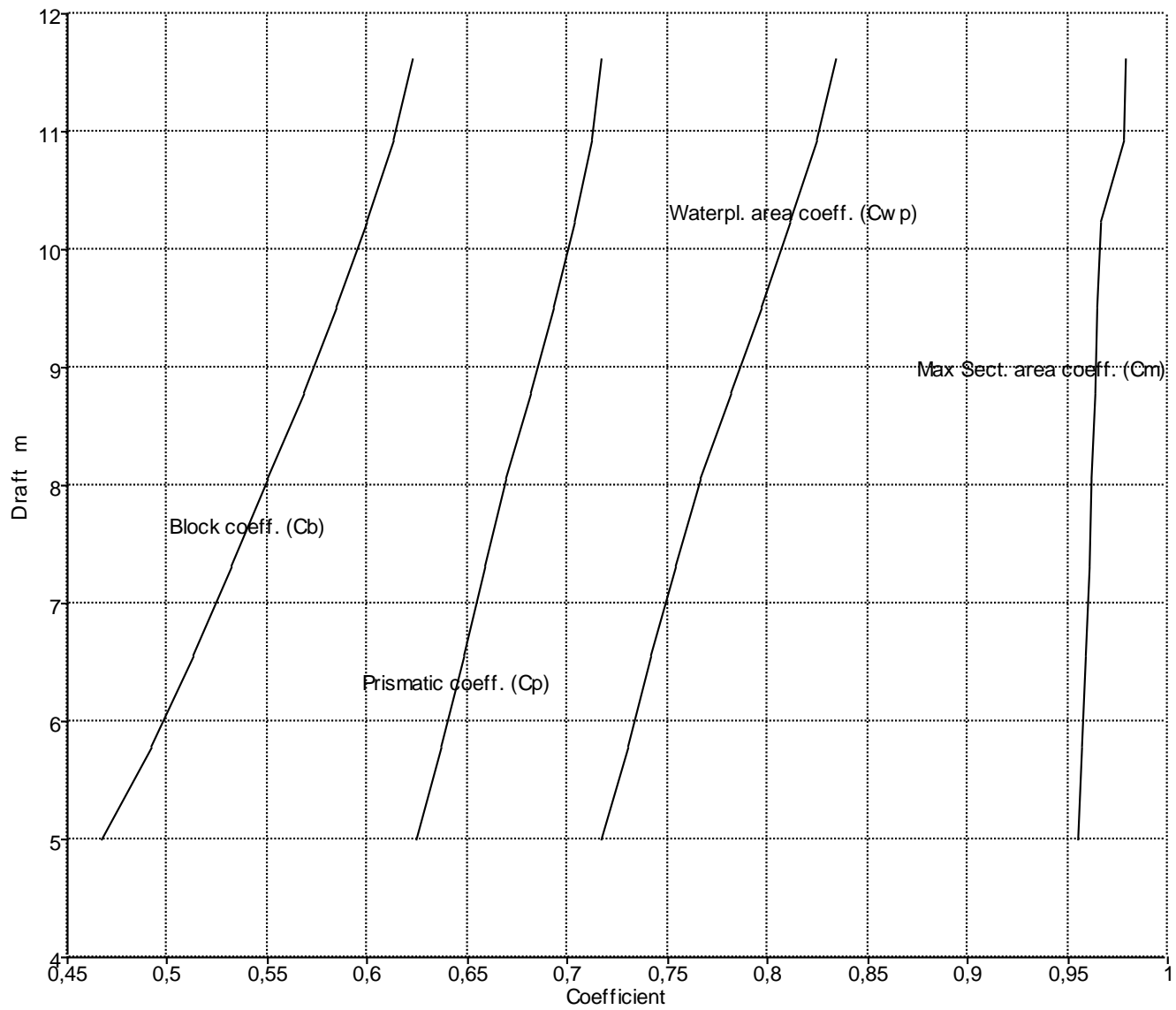
Curves of Form

- Prismatic coeff. (Cp)
- Block coeff. (Cb)
- Max Sect. area coeff. (Cm)
- Waterpl. area coeff. (Cwp)



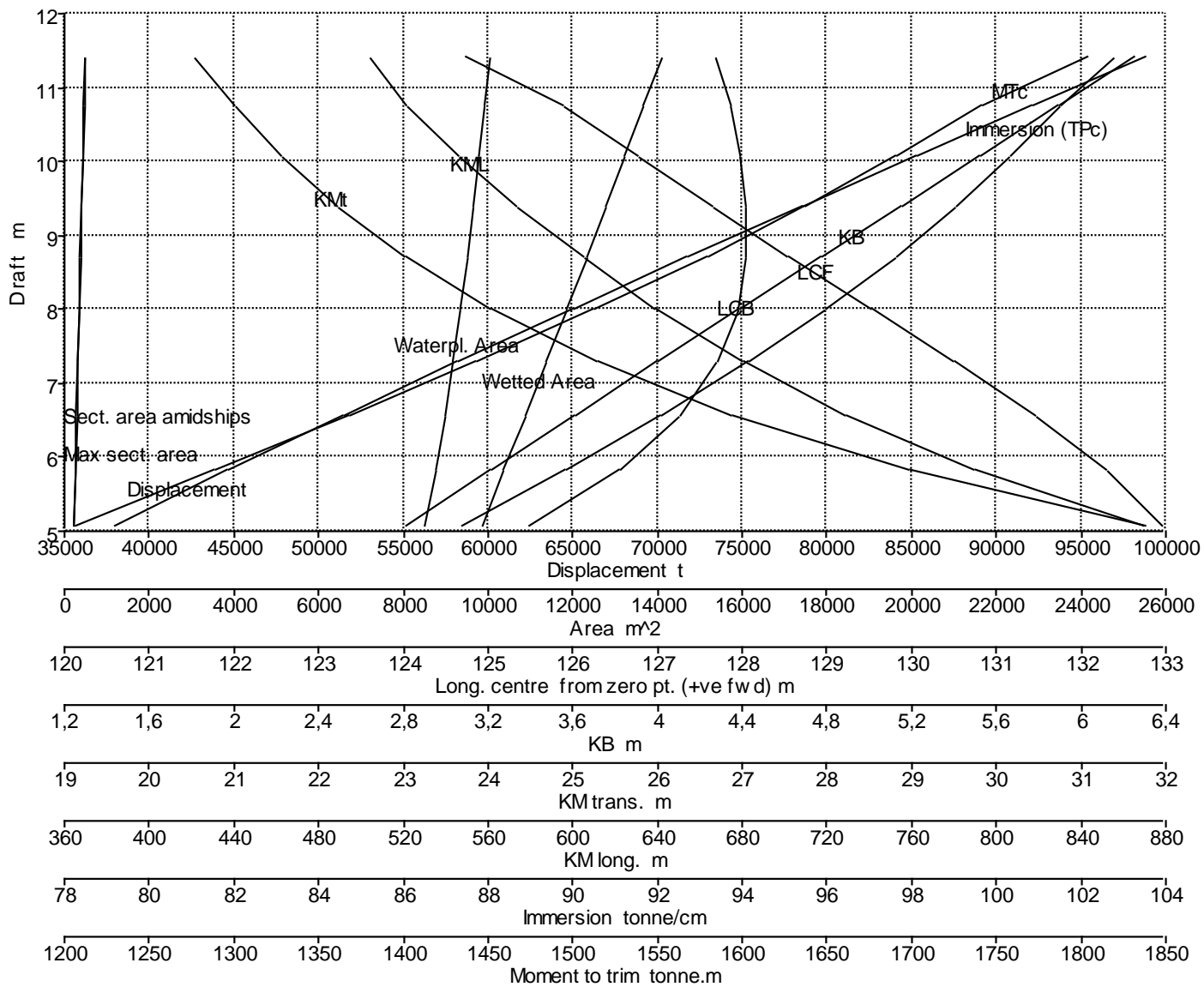
Hydrostatics

- Displacement
- Max sect. area
- Sect. area amidships
- Wetted Area
- Waterpl. Area
- LCB
- LCF
- KB
- KMt
- KML
- Immersion (TPc)
- MTc

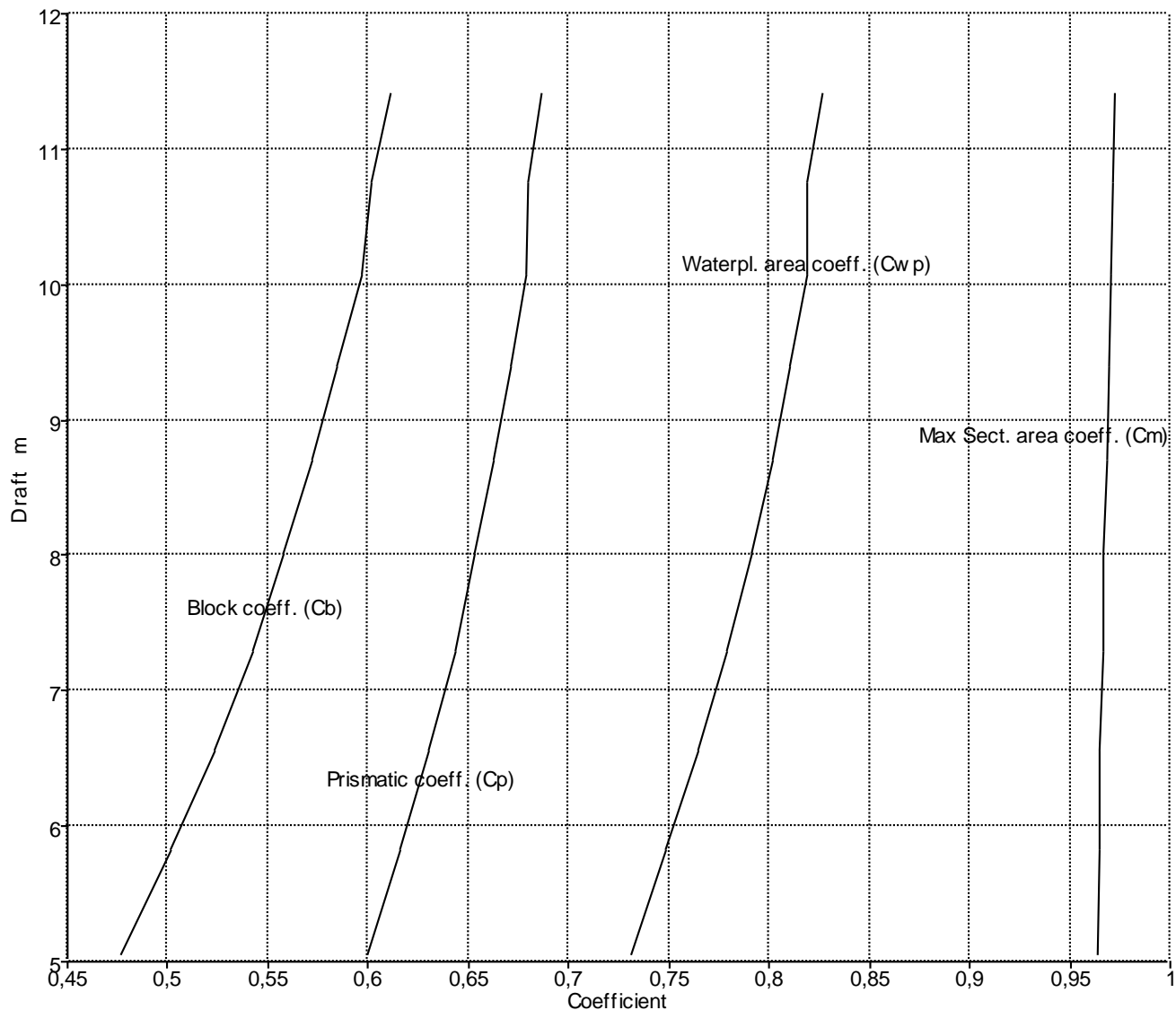


Curves of Form

- Prismatic coeff. (Cp)
- Block coeff. (Cb)
- Max Sect. area coeff. (Cm)
- Waterpl. area coeff. (Cwp)

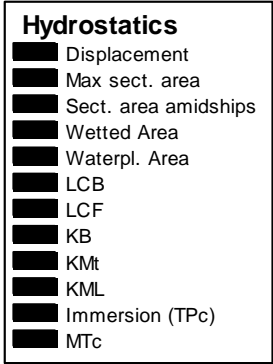
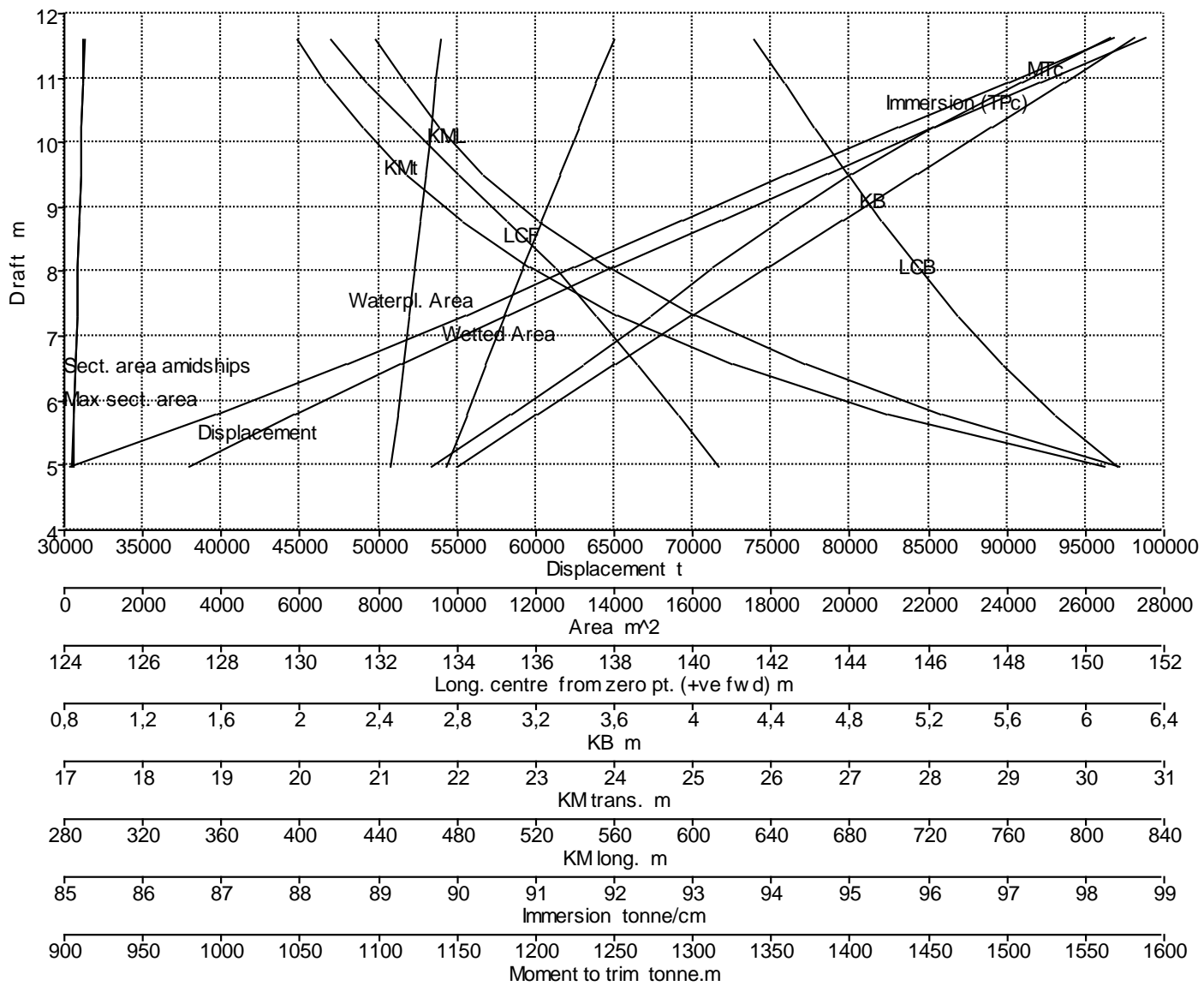


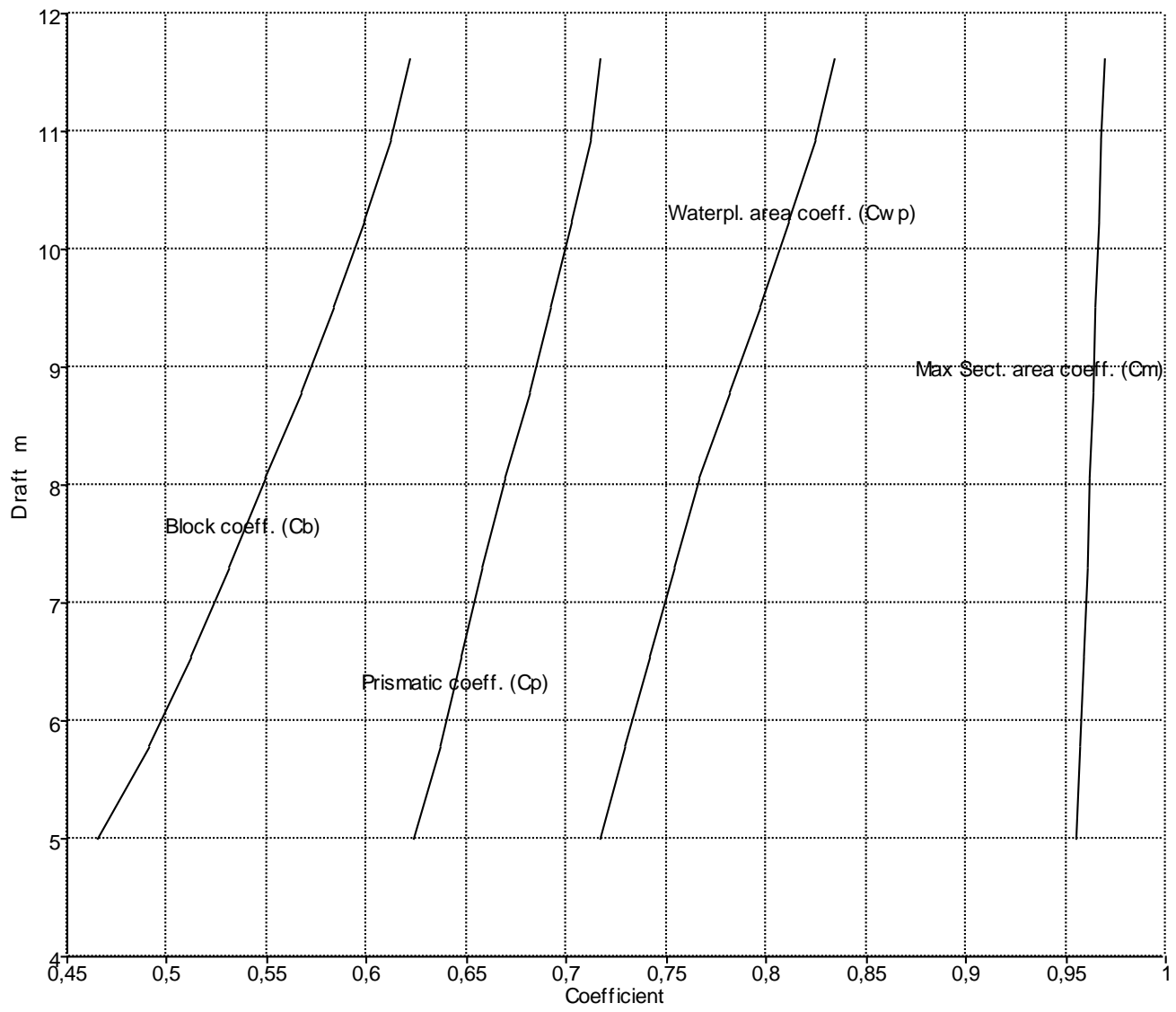
- Hydrostatics**
- Displacement
 - Max sect. area
 - Sect. area amidships
 - Wetted Area
 - Waterpl. Area
 - LCB
 - LCF
 - KB
 - KM
 - KML
 - Immersion (TPc)
 - MTC



Curves of Form

- Prismatic coeff. (Cp)
- Block coeff. (Cb)
- Max Sect. area coeff. (Cm)
- Waterpl. area coeff. (Cwp)





Curves of Form

- Prismatic coeff. (Cp)
- Block coeff. (Cb)
- Max Sect. area coeff. (Cm)
- Waterpl. area coeff. (Cwp)