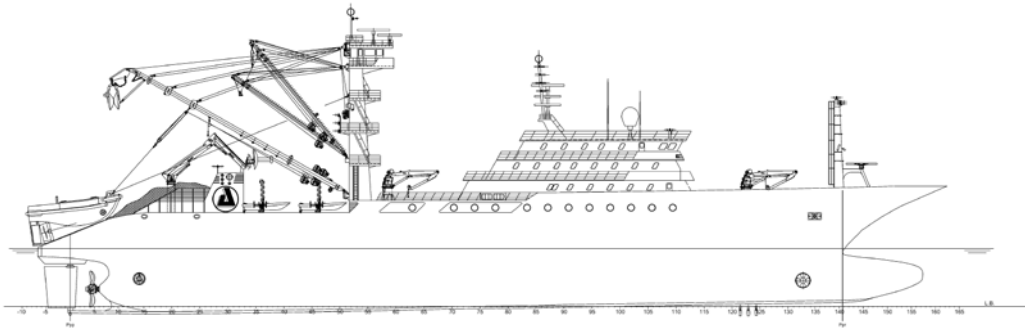


PROYECTO FIN DE CARRERA

CURSO 2.015-2016

PROYECTO NÚMERO 16-15



Atunero 3300m³

Cuaderno 4

Cálculos de arquitectura naval

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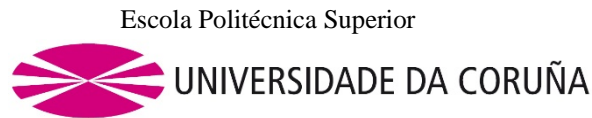
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DEPARTAMENTO DE INGENIERÍA NAVAL Y OCEÁNICA

TRABAJO FIN DE GRADO

CURSO 2.015-2016

PROYECTO NÚMERO 16-15

TIPO DE BUQUE : Atunero de 3300 M3

**CLASIFICACIÓN , COTA Y REGLAMENTOS DE APLICACIÓN : DNV.
TORREMOLINOS MARPOL COLREG ILO 2006**

CARACTERÍSTICAS DE LA CARGA: Atún congelado a -55°C

VELOCIDAD Y AUTONOMÍA : 16,5 nudos en condiciones de servicio al 85% MCR y 15% de MM. 6000 millas de autonomía en estas condiciones

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

PROPULSIÓN : Diesel eléctrica

TRIPULACIÓN Y PASAJE : 30 personas en camarotes individuales y dobles

OTROS EQUIPOS E INSTALACIONES : Hélice transversal en proa y popa. Los habituales en este tipo de buque

Ferrol, Junio 2.016



1-INTRODUCCIÓN

En este cuaderno se va a realizar el compartimentado de las formas obtenidas en el Cuaderno 3 de este proyecto, por lo tanto los temas a tratar serán los siguientes:

- Zona estanca y puntos de inundación progresiva
- Plano de compartimentos y tanques.
- Tabla de capacidades y centro de gravedad de compartimentos y tanques.
- Tablas de características hidrostáticas
- Tablas de valores KN

Las curvas y tablas de KN para distintos desplazamientos y ángulos de escora, permiten determinar la estabilidad transversal del buque intacto.

Las curvas hidrostáticas determinan las características básicas de la carena del buque, para una serie de flotaciones, con ellas se obtienen los parámetros de las formas para los distintos valores de calado durante la operación del buque.

Para la realización del compartimentado estanco se ha utilizado el programa Maxsurf Stability, que permite conocer las capacidades de los tanques. Posteriormente se comprobará si dichas capacidades cumplen las requeridas en el RPA.

Las características del buque proyecto obtenidas en el Cuaderno 3 son:

DIMENSIONES

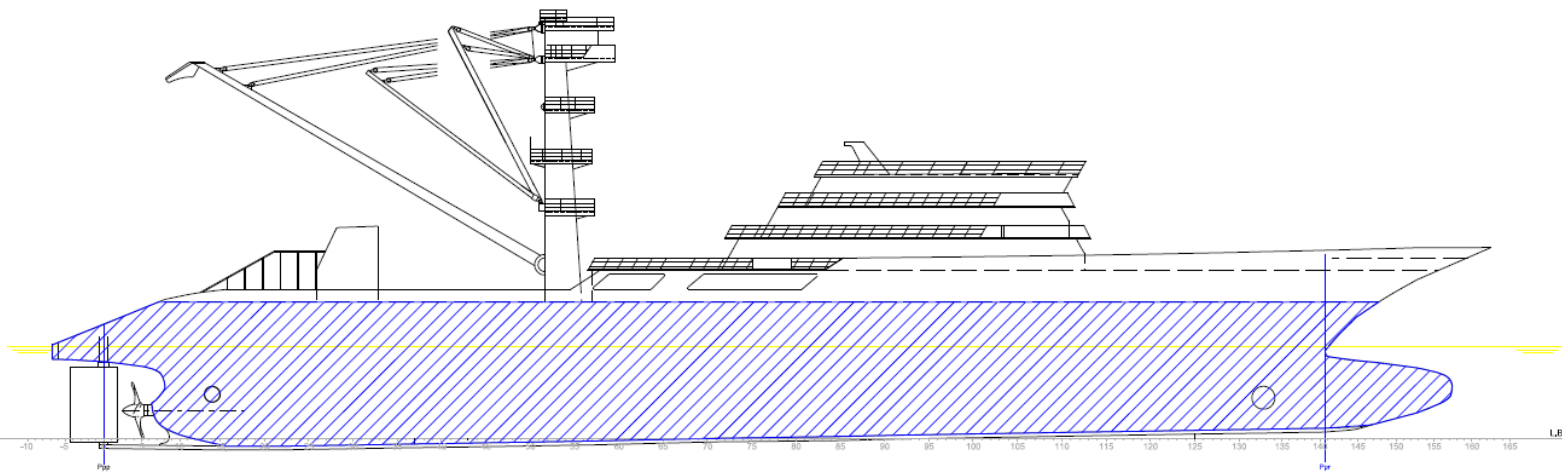
Lt(m)	113,60
Lpp(m)	96,50
B(m)	16,70
Dcp(m)	8,00
Dsup(m)	10,70
Tm(m)	7,20
Fn	0,276
Cb	0,570
Cp	0,588
Cm	0,969
Cf	0,753
Δ (Tn)	6781
Pot (kW)*	6743



*En el cuaderno 6 se ha establecido una potencia de 6000 kW para el buque proyecto.

2-ZONA ESTANCA Y PIP

La zona estanca es la zona del casco sin aperturas al exterior, y en caso de tenerlas cuentan con cierres estancos. El buque proyecto es estanco hasta la cubierta superior, ya que las aperturas practicadas en ella, los dos túneles de descarga y el túnel de entrada de los atunes a las bodegas cumplen los requerimientos de estanqueidad. A continuación se muestra la zona estanca sombreada sobre el perfil del buque:



Por ello, los puntos de inundación progresiva o PIP, que son los puntos por donde puede entrar agua al no poseer cierres estancos, se sitúan por encima de la cubierta superior. En el buque proyecto tenemos:

Zona	X (m)	Y (m)	Z (m)	Ángulo (°)
Salida del guardacalor	20,00	7,75	16,7	51

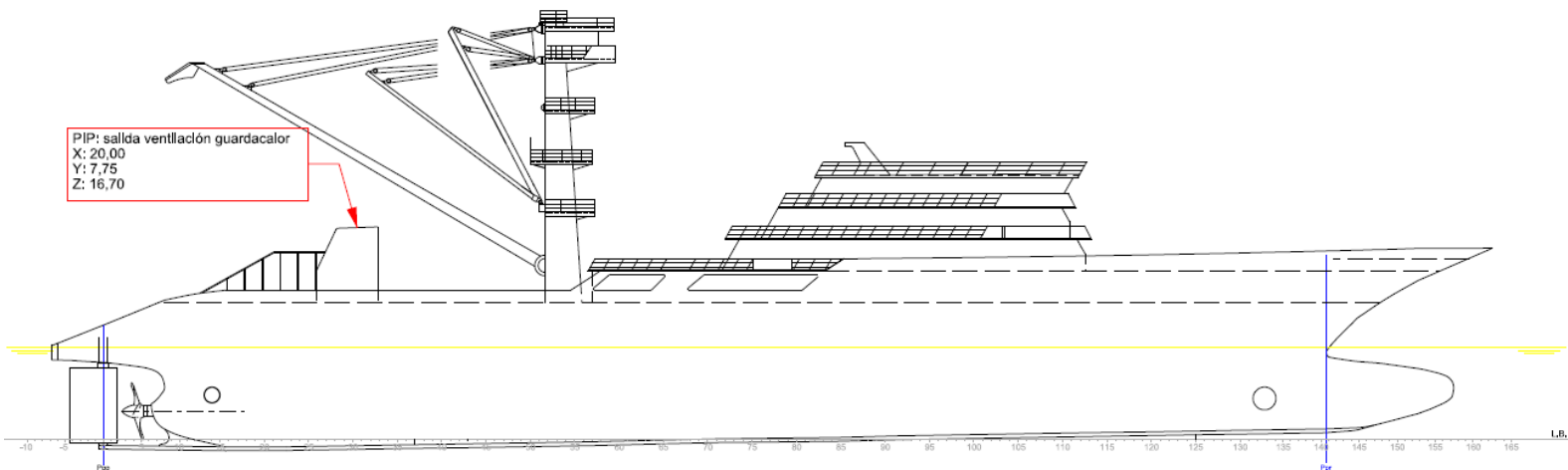
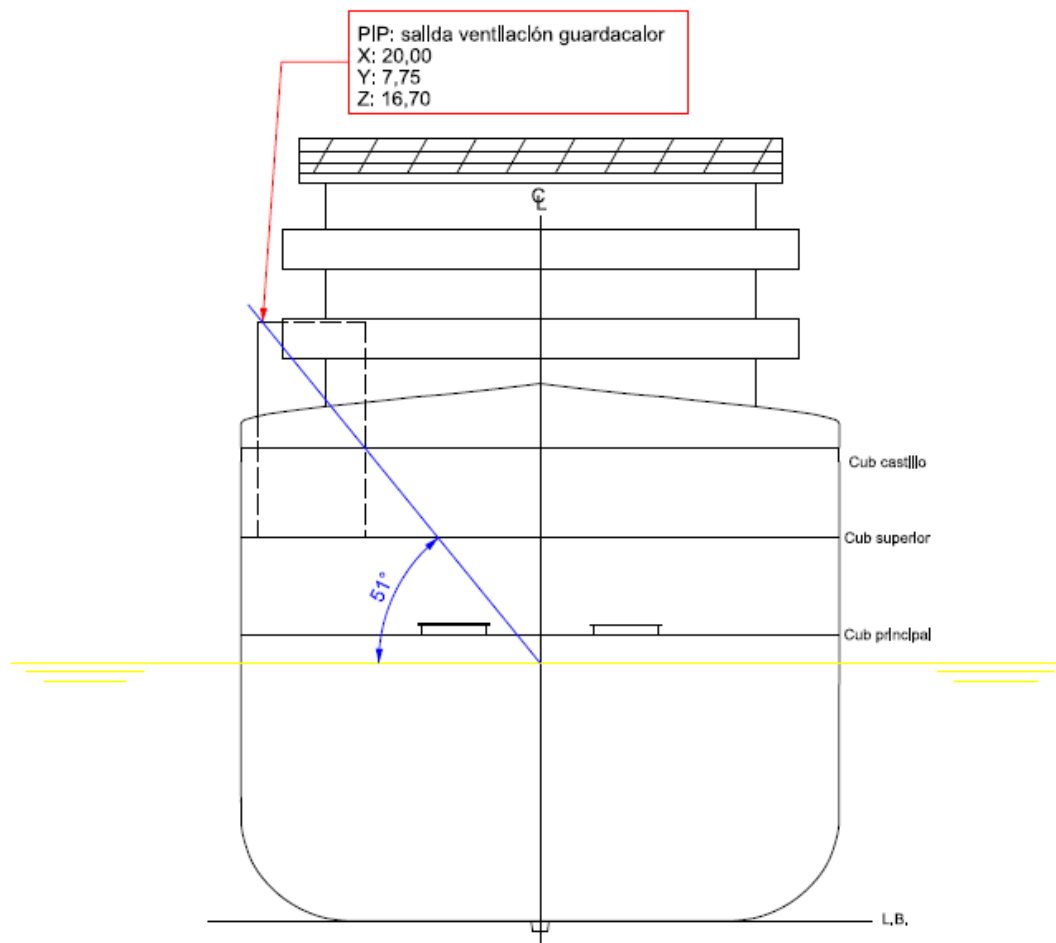
Como el ángulo es mayor de 40° los criterios de estabilidad dinámica no han de restringirse para valores menores a 40°.

A continuación se muestra un croquis con la ubicación del punto de inundación progresiva del buque proyecto:

Cuaderno 4: Cálculos de arquitectura naval

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3-ESPACIADO DE CUADERNAS

El espaciado de las cuadernas será la unidad de división longitudinal básica de nuestro buque proyecto, y en base a ella situaremos los mamparos transversales y se ha basado en la disposición del buque base, siendo:



- Separación de 600 mm en los piques de proa y popa.
- Separación de 700 mm entre los mamparos de colisión y prensaestopas.

4-SUBDIVISIÓN DEL BUQUE

-Mamparos

Los mamparos mínimos que, según la reglamentación, se deben definir son:

- Mamparo de colisión
- Mamparo prensaestopas
- Mamparos de los extremos de Pr y Pp de la cámara de máquinas
- 1 mamparo estanco como mínimo adicional

-Mamparo de Colisión

Para la determinación de este mamparo se ha seguido el Convenio Torremolinos y el Reglamento DNV.

- **Convenio Torremolinos:**

El Torremolinos indica que la posición del mamparo del pique de proa ha de situarse entre el 5% y el 8% de L. Siendo L igual al 96% de la eslora total de flotación situada a una igual al 85% del puntal mínimo de trazado medido desde el canto alto de la quilla; o la distancia entre la cara de proa de la roda y el eje de la mecha del timón en esta flotación si esta última es mayor. En los buques proyectados para navegar con asiento de quilla, la flotación en la que ha de medir la eslora debe ser paralela a la flotación de proyecto:

$$L1 = 0.96 Lf (85\% Dcp) = 0.96 \times 100,563 = 96,54 \text{ m}$$

$$L2 = 96,517 \text{ m}$$

La eslora utilizada será por tanto:

$$L = L1 = 96,54 \text{ m}$$

Como el buque proyecto consta de bulbo, la posición del mamparo de colisión medida desde la Perpendicular de proa debe ser la menor de las siguientes distancias:

- El punto medio de la prolongación del bulbo que sobresalga de la perpendicular de proa



- El punto situado a proa de la perpendicular de proa que diste de ésta 1,5% de la L.

El punto medio del bulbo se sitúa a 5,02 m de la perpendicular de proa y el 1,5% de la L a 1,45 m, por lo que será esta la distancia a la que se sitúa el mamparo de colisión, medida desde la perpendicular de proa.

El mamparo del pique de proa se sitúa en la cuaderna 134, a 4,00 m a popa de la perpendicular de proa, por lo que la eslora del pique de proa será:

$$d = 1,45 + 4,00 = 5,45 \text{ m}$$

El Torremolinos especifica que esta distancia debe estar comprendida entre el 5% y el 8% de la L:

$$\%5L = 0,05 \times 96,54 = 4,827 \text{ m}$$

$$\%8L = 0,08 \times 96,54 = 7,723 \text{ m}$$

Como el mamparo de colisión se sitúa a 5,45 m del punto definido a 1,5% de la L a proa de la perpendicular de proa y se encuentra dentro del intervalo calculado, esta distancia cumple con lo exigido en el Convenio.

- Reglamento DNV

Según el DNV el X_c desde la perpendicular de proa al mamparo de colisión debe situarse entre:

$$X_c \text{ min} = 0,05 L_f - X_r$$

$$X_c \text{ max} = 0,08 L_f - X_r$$

Para buques con bulbo X_r es el menor entre:

$$X_r = 0,5 X_B$$

$$X_r = 0,015 L_f$$

Siendo X_B la distancia desde la perpendicular de proa hasta el extremo más a proa del bulbo de proa. Por lo que:

$$0,5 X_B = 0,5 \times 10,05 = 5,025 \text{ m}$$

$$0,015 L_f = 0,015 \times 96,54 = 1,45 \text{ m}$$

El menor de los valores es $0,015 L_f$, por lo que $X_r = 1,45 \text{ m}$

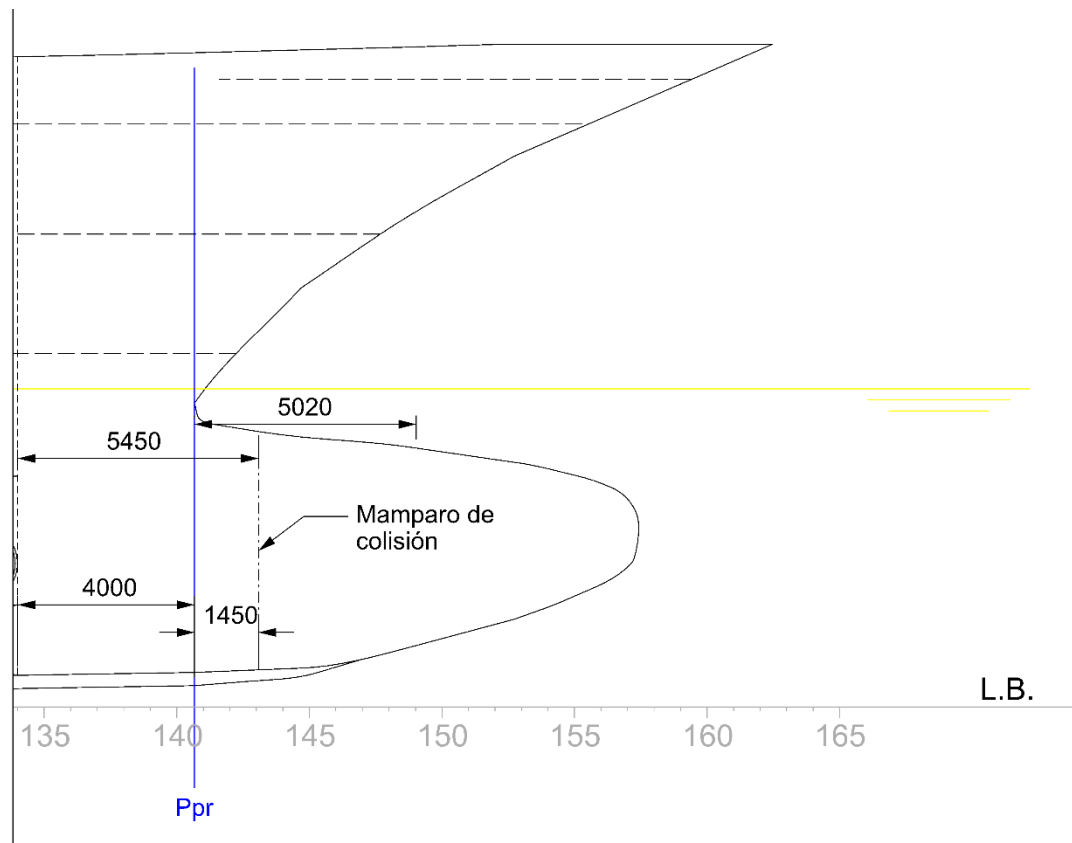
Entonces:



$$X_c \text{ min} = 0,05 L_f - X_r = 3,38 \text{ m}$$

$$X_c \text{ max} = 0,08 L_f - X_r = 6,27 \text{ m}$$

Como el mamparo está situado a 4,00 m a popa de la perpendicular de proa se cumple también lo establecido en el DNV.



-Mamparo del pique de popa

Este mamparo se ha situado, según las necesidades de espacio de la cámara de máquinas y de los tanques dispuestos en ese espacio, en la cuaderna 13.

-Mamparo de la cámara de máquinas

La longitud de la cámara de máquinas se ha fijado a partir de las dimensiones de los diésel generadores y del motor eléctrico. En el ANEXO 2 se disponen las características de los motores.

El mamparo de la cámara de máquinas se ha situado en la cuaderna 37 con lo que tenemos una eslora de cámara de máquinas de 16,80 m para poder albergar toda la maquinaria.



-Mamparos transversales adicionales

A lo largo de la eslora, se dispondrán mamparos para dividir los tanques del doble fondo y las cubas (cuadernas 37, 55, 73, 91 y 109) y los tanques de agua dulce de proa (cuadernas 115 y 120), y mamparos parciales para las cubas que van desde el piso del doble fondo hasta la cubierta principal (cuadernas 43, 49, 61, 67, 79, 85, 97 y 103).

-Cubiertas

-Principal, superior y castillo

El buque dispone de dos cubiertas corridas, la principal a 8,00 m de la línea de base y la superior, a 10,70 m. Las dos cubiertas se han dispuesto sin brusca y arrufo para facilitar el compartimentado.

La cubierta principal es la de francobordo, por lo que debe cumplir la reglamentación correspondiente.

A 13,2 m se sitúa la cubierta castillo, que se extiende desde la medianía del buque hasta proa.

-Doble fondo

El doble fondo se sitúa desde la cuaderna 37 a la 134 con una altura de 1,2 m.

En la cámara de máquinas la altura será de 3,5 metros desde la cuaderna 20 a la 37.

Según DNV la altura del doble fondo en la maestra debe tener como mínimo una altura de 650 mm, y no debe ser inferior a:

$$H_{df} = 250 + 20B + 50T \text{ (mm)} = 944 \text{ mm}$$

Donde B es la manga de trazado y T el calado de verano.

Por tanto la altura de 1,6 m del doble fondo cumple con lo requerido por las sociedades de clasificación, además de dejar espacio suficiente para llevar el combustible necesario y facilitar los trabajos de soldadura, construcción etc.



-Cofferdams

Se situarán cofferdams para separar los tanques de combustible, aceite hidráulico, aceite lubricante y similares de los tanques de agua dulce.

5- COMPARTIMENTADO

-Capacidades necesarias

-Tanques de combustible

Según el RPA la autonomía del buque es de 6000 millas a 16,5 kn, lo que hace una autonomía de $6000 / 16,5 = 363,6$ horas.

Para comprobar la capacidad necesaria de los tanques de combustible se ha de tener en cuenta los consumos de los motores diésel generadores.

-Motores diésel generadores

Después del análisis de la potencia necesaria de nuestro buque en el cuaderno 6, se ha establecido que los diésel generadores son unos wartsila 6L34 con una demanda de potencia del 85% de 3000 kW cada uno y un consumo de 186 gr/kWh con una carga del 85. En el ANEXO 2 podemos ver las características del motor. La capacidad de diesel necesaria para estos motores, más un margen del 10% y una autonomía de 363,36 horas, será:

$$\text{Consumo Mp} = 1.1 \times 186 \times 363,63 \times 6000 \times 0,85 \times 10^{-6} = 379,43 \text{ Tn}$$

Los tanques de uso diario deben tener una capacidad necesaria para una autonomía de 14 horas, por lo que deberán tener 14,61 Tn como mínimo.

El sedimentador tiene que contener los requerimientos de combustible para un día, por lo que deberá tener una capacidad de 25,04 Tn.

Más adelante comprobaremos si los tanques de combustible cumplen esta demanda.

-Tanques aceite

El motor tiene un consumo de aceite de 0,4 gr/kW h, por lo que tenemos una



capacidad necesaria de:

$$\text{Consumo aceite} = 363,63 \times 1,1 \times 6000 \times 0,4 \times 10^{-6} = 0,96 \text{ Tn}$$

Más adelante comprobaremos si los tanques de aceite cumplen esta demanda.

-Tanques de agua

Según la norma UNE-EN ISO 15748-2 (suministro de agua potable en buques y estructuras marinas) se establece un consumo de 150 litros por persona/cama y día. El consumo de agua con una tripulación de 30 personas y una autonomía de 363,63 horas, sin embargo, se calculará la capacidad necesaria para una marea de 30 días, ya que estos buques pesqueros no están navegando todo el tiempo sino que pasan mucha parte de su navegación en el caladero:

$$\text{Consumo agua} = 0,15 \times 30 \times 30 = 135 \text{ Tn}$$

Más adelante comprobaremos si los tanques de agua cumplen esta demanda.

-Tanques de aguas negras y grises

Según la norma UNE-EN ISO 15748-2 (suministro de agua potable en buques y estructuras marinas) se establece un consumo de 25 litros por persona/cama y día. La capacidad para de aguas negras y grises con una tripulación de 30 personas para una marea de 30 días es:

$$\text{Capacidad Aguas sucias} = 0,025 \times 30 \times 30 = 22,5 \text{ m}^3$$

Para evitar tener que disponer de un tanque colector de tales dimensiones para 30 días, se instala una planta de tratamiento de aguas negras que permitirá reducir el tamaño necesario, al ser tratadas estas aguas, total o parcialmente, cuando se llena dicho tanque.

Las aguas sucias, según MARPOL, para poder ser descargadas del tanque, sin haber sido previamente desmenuzadas ni desinfectadas, deberá realizarse a una distancia mayor de 12 millas marinas de la costa. Éstas no se descargarán instantáneamente, sino a un régimen moderado, hallándose el buque en ruta, navegando a una velocidad no menor de 4 nudos.

En el caso de no usarse la planta de tratamiento, la capacidad del buque para estas aguas es de 12,60 m³, capacidad de almacenamiento suficiente para 17 días.



-Tanques de fangos:

Según MARPOL los buques de más de 400 GT, como es nuestro caso, deber llevar un tanque de fangos resultantes de los combustibles, aceites y fugas de hidrocarburos procedentes de la maquinaria. La dimensión de este tanque se calcula:

$$V = K \times Cd \times D$$

$$K = 0,005$$

$$Cd = \text{Consumo diario de combustible} = 19,6 \text{ Tn}$$

$$D = \text{días de autonomía} = 363,63/24 = 15,15 \text{ días}$$

$$V = 1,5 \text{ m}^3$$

Más adelante comprobaremos si los tanques de fangos cumplen esta demanda.

-Cubas

Según el RPA el volumen de cubas requerido es de 3300 m³ de carga útil de atún.

-DEFINICIÓN DE TANQUES

-Tanques de combustible

El buque dispone de 10 tanques de combustible en el doble fondo desde la cuaderna 37 a la 120, simétricos dos a dos con respecto a crujía y se extienden de costado a costado.

-Tanques de Uso diario

Los tanques de uso diario se disponen bajo la cubierta superior. Disponemos de dos simétricos con respecto a crujía y a una altura de 5,00 m sobre la cubierta de la cámara de máquinas.

-Tanques de decantación

Los tanques de decantación se disponen a ambos lados de los de uso diario, y se extienden hasta el costado del buque.

-Tanques aceite

El tanque de aceite del motor principal y el de aceite hidráulico se disponen en el



doble fondo de la cámara de máquinas a babor.

También disponemos un tanque para el aceite sucio bajo el motor principal.

-Tanques de agua

Disponemos de 4 tanques de agua dulce en el buque, dos situados en el doble fondo de la cámara de máquinas a babor y dos bajo la cubierta principal a continuación de las cubas, simétricos con respecto a crujía y extendidos hasta el costado.

Tanques de aguas negras y grises

El tanque de aguas sucias se dispone a popa de la cámara de máquinas, bajo la parte más baja de su doble fondo.

-Tanques de fangos:

El tanque de fangos se dispone en el doble fondo de la cámara de máquinas, a babor.

-Tanques de reboses

El buque cuenta con un tanque de reboses dispuesto en el doble fondo de la cámara de máquinas, bajo el motor principal, entre el tanque de aceite sucio y los tanques de estribor del doble fondo de la cámara de máquinas.

-Cubas

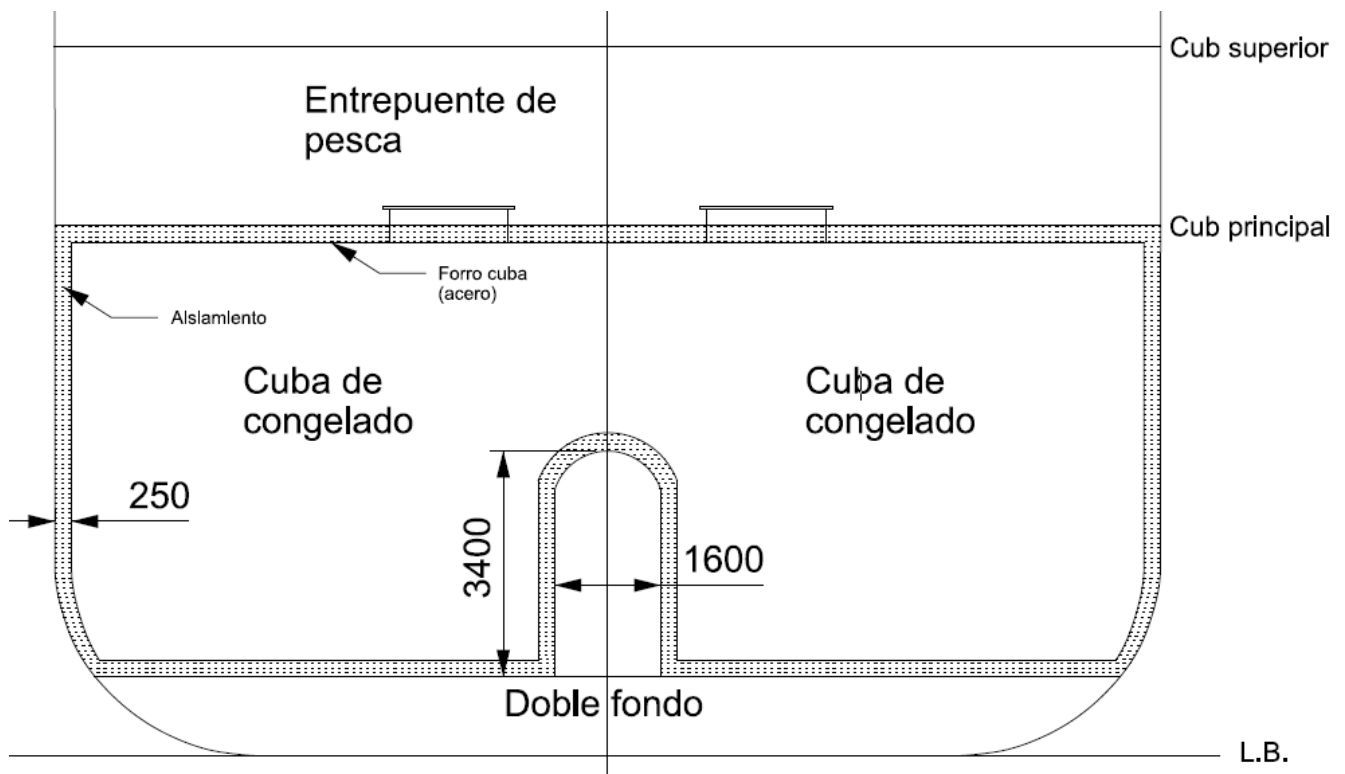
En la zona de las cubas, los mamparos se han situado ocupando la zona desde la cuaderna 37 a la 115 cada seis claras de cuadernas, lo que hace una eslora de 4,2 m para cada cuba, y disponen de un túnel central para las tuberías de 1,6 m de ancho y 3,4 m de altura.

En el cuaderno 1 se determinó que el buque tiene que tener 28 cubas, sin embargo se comprobó que con 26 cubas el buque alcanzaba el volumen requerido en el RPA, por esto y por similitud con el buque base se decidió cambiar la configuración a 26 cubas.

Para minimizar el gasto energético durante el proceso de congelación y posterior conservación del atún, los tanques se revisten interiormente con una chapa de acero que se unirá a la estructura mediante aisladores térmicos. En la cámara comprendida entre los tanques congeladores y la estructura del buque, se inyecta una capa aislante de poliuretano expandido de 250 mm de espesor.



A continuación se muestra un croquis de la disposición de las cubas:



-Tanques estabilizadores:

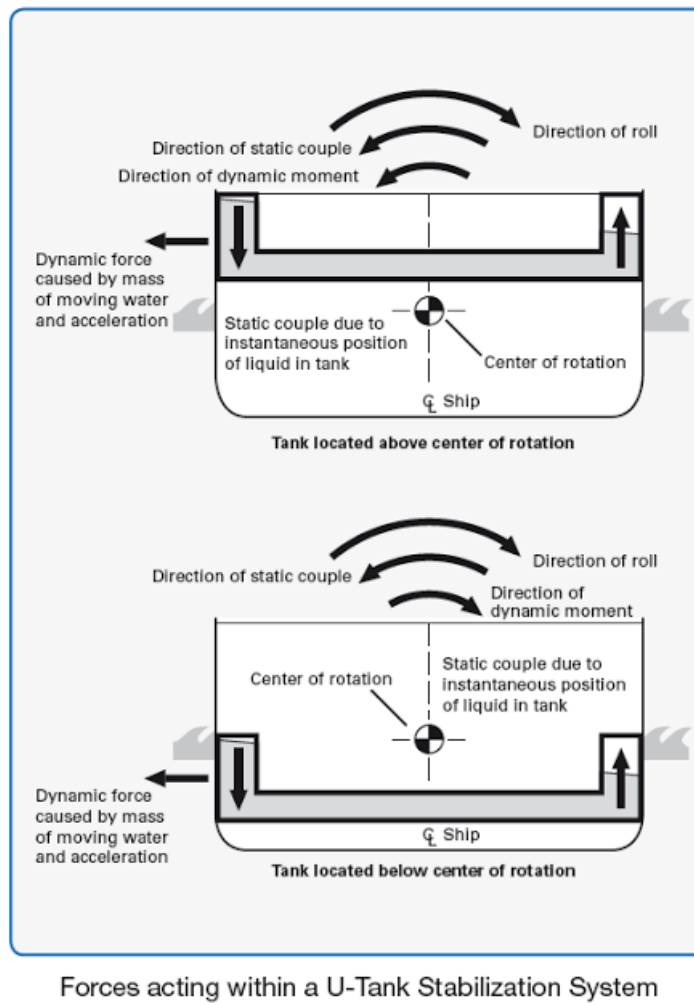
El buque cuenta con un tanque estabilizador sobre la cubierta principal en la zona de popa. Los sistemas de estabilización por tanques pasivos son frecuentes en diversos tipos de buques debido a su simplicidad y bajo coste. Éste está formado por dos tanques altos, unidos formando un solo tanque a través de su base y de un costado a otro, a ras de cubierta.

Los tanques pasivos estabilizadores están basados en el principio de que un fluido en un tanque parcialmente lleno, dentro del buque, se moverá de un lado a otro a través del tanque cuando el buque se mueva en sentido del balance. La diferencia de peso entre producido por el desplazamiento del fluido generará un momento de balance en el buque, el cual puede ser ajustado en contraposición con el balance natural del buque en el mar, sirviendo para amortiguar y disminuir la amplitud en el movimiento de balance del buque.

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-Tanques de lastre

Disponemos de tres tanques de lastre, uno situado en el pique de proa y los dos restantes bajo la rampa de popa, simétricos con respecto a crujía.

A continuación se muestra una tabla con las coordenadas de cada tanque, sus permeabilidades y pesos específicos:

Nombre	Tipo	Permeab(%)	peso específico (Tn/m ³)	Carga	Aft (m)	Fore (m)	Fport (m)	Fstbd(m)	Ftop (m)	Fbott (m)	Aport (m)	Astbd (m)	Atop (m)	Abott (m)
T1_Cuba13_B	Tank	86	0,65	Atun	24,85	28,8	28,8	-8,525	3	1,052	DITTO	DITTO	DITTO	0,991
	Linked Tank	86	0,65	Atun	24,85	28,8	28,8	-8,525	7,85	3	DITTO	DITTO	DITTO	DITTO
T2_Cuba13_E	Tank	86	0,65	Atun	24,85	28,8	28,8	1,25	3	1,052	DITTO	DITTO	DITTO	0,991
	Linked Tank	86	0,65	Atun	24,85	28,8	28,8	0	7,85	3	DITTO	DITTO	DITTO	DITTO

Cuaderno 4: Cálculos de arquitectura naval

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T3_Cuba12_B	Tank	86	0,65	Atun	29,05	33	33	-8,525	3	1,124	DITTO	DITTO	DITTO	1,056
	Linked Tank	86	0,65	Atun	29,05	33	33	-8,525	7,85	3	DITTO	DITTO	DITTO	DITTO
T4_Cuba12_E	Tank	86	0,65	Atun	29,05	33	33	1,05	3	1,124	DITTO	DITTO	DITTO	1,056
	Linked Tank	86	0,65	Atun	29,05	33	33	0	7,85	3	DITTO	DITTO	DITTO	DITTO
T5_Cuba11_B	Tank	86	0,65	Atun	33,25	37,2	37,2	-8,525	3	1,19	DITTO	DITTO	DITTO	1,128
	Linked Tank	86	0,65	Atun	33,25	37,2	37,2	-8,525	7,85	3	DITTO	DITTO	DITTO	DITTO
T6_Cuba11_E	Tank	86	0,65	Atun	33,25	37,2	37,2	1,05	3	1,19	DITTO	DITTO	DITTO	1,128
	Linked Tank	86	0,65	Atun	33,25	37,2	37,2	0	7,85	3	DITTO	DITTO	DITTO	DITTO
T7_Cuba10_B	Tank	86	0,65	Atun	37,45	41,4	41,4	-8,525	3	1,281	DITTO	DITTO	DITTO	1,194
	Linked Tank	86	0,65	Atun	37,45	41,4	41,4	-8,525	7,85	3	DITTO	DITTO	DITTO	DITTO
T8_Cuba10_E	Tank	86	0,65	Atun	37,45	41,4	41,4	1,05	3	1,281	DITTO	DITTO	DITTO	1,194
	Linked Tank	86	0,65	Atun	37,45	41,4	41,4	0	7,85	3	DITTO	DITTO	DITTO	DITTO
T9_Cuba9_B	Tank	86	0,65	Atun	41,65	45,6	45,6	-8,525	3	1,385	DITTO	DITTO	DITTO	1,287
	Linked Tank	86	0,65	Atun	41,65	45,6	45,6	-8,525	7,85	3	DITTO	DITTO	DITTO	DITTO
T10_Cuba9_E	Tank	86	0,65	Atun	41,65	45,6	45,6	1,05	3	1,385	DITTO	DITTO	DITTO	1,287
	Linked Tank	86	0,65	Atun	41,65	45,6	45,6	0	7,85	3	DITTO	DITTO	DITTO	DITTO
T11_Cuba8_B	Tank	86	0,65	Atun	45,85	49,8	49,8	-8,525	3	1,467	DITTO	DITTO	DITTO	1,391
	Linked Tank	86	0,65	Atun	45,85	49,8	49,8	-8,525	7,85	3	DITTO	DITTO	DITTO	DITTO
T12_Cuba8_E	Tank	86	0,65	Atun	45,85	49,8	49,8	1,05	3	1,467	DITTO	DITTO	DITTO	1,391
	Linked Tank	86	0,65	Atun	45,85	49,8	49,8	0	7,85	3	DITTO	DITTO	DITTO	DITTO
T13_Cuba7_B	Tank	86	0,65	Atun	50,05	54	54	-8,525	3	1,512	DITTO	DITTO	DITTO	1,469
	Linked Tank	86	0,65	Atun	50,05	54	54	-8,525	7,85	3	DITTO	DITTO	DITTO	DITTO
T14_Cuba7_E	Tank	86	0,65	Atun	50,05	54	54	1,05	3	1,512	DITTO	DITTO	DITTO	1,469
	Linked Tank	86	0,65	Atun	50,05	54	54	0	7,85	3	DITTO	DITTO	DITTO	DITTO
T15_Cuba6_B	Tank	86	0,65	Atun	54,25	58,2	58,2	-8,525	3	1,562	DITTO	DITTO	DITTO	1,514
	Linked Tank	86	0,65	Atun	54,25	58,2	58,2	-8,525	7,85	3	DITTO	DITTO	DITTO	DITTO
T15_Cuba6_E	Tank	86	0,65	Atun	54,25	58,2	58,2	1,05	3	1,562	DITTO	DITTO	DITTO	1,514
	Linked Tank	86	0,65	Atun	54,25	58,2	58,2	0	7,85	3	DITTO	DITTO	DITTO	DITTO
T16_Cuba5_B	Tank	86	0,65	Atun	58,45	62,4	62,4	-8,525	3	1,674	DITTO	DITTO	DITTO	1,568
	Linked Tank	86	0,65	Atun	58,45	62,4	62,4	-8,525	7,85	3	DITTO	DITTO	DITTO	DITTO
T17_Cuba5_E	Tank	86	0,65	Atun	58,45	62,4	62,4	1,05	3	1,674	DITTO	DITTO	DITTO	1,568
	Linked Tank	86	0,65	Atun	58,45	62,4	62,4	0	7,85	3	DITTO	DITTO	DITTO	DITTO
T18_Cuba4_B	Tank	86	0,65	Atun	62,65	66,6	66,6	-8,525	3	1,746	DITTO	DITTO	DITTO	1,608
	Linked Tank	86	0,65	Atun	62,65	66,6	66,6	-8,525	7,85	3	DITTO	DITTO	DITTO	DITTO
T19_Cuba4_E	Tank	86	0,65	Atun	62,65	66,6	66,6	1,05	3	1,746	DITTO	DITTO	DITTO	1,608
	Linked Tank	86	0,65	Atun	62,65	66,6	66,6	0	7,85	3	DITTO	DITTO	DITTO	DITTO
T20_Cuba3_B	Tank	86	0,65	Atun	66,85	70,8	70,8	-8,367	3	1,812	-8,525	DITTO	DITTO	1,75
	Linked Tank	86	0,65	Atun	66,85	70,8	70,8	-8,525	7,85	3	DITTO	DITTO	DITTO	DITTO
T21_Cuba3_E	Tank	86	0,65	Atun	66,85	70,8	70,8	1,05	3	1,812	DITTO	8,525	DITTO	1,75
	Linked Tank	86	0,65	Atun	66,85	70,8	70,8	0	7,85	3	DITTO	DITTO	DITTO	DITTO
T22_Cuba2_B	Tank	86	0,65	Atun	71,05	75	75	-7,341	3	1,881	-8,306	DITTO	DITTO	1,816
	Linked Tank	86	0,65	Atun	71,05	75	75	-8,525	7,85	3	DITTO	DITTO	DITTO	DITTO

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T23_Cuba2_E	Tank	86	0,65	Atun	71,05	75	75	1,05	3	1,881	DITTO	8,306	DITTO	1,816	
	Linked Tank	86	0,65	Atun	71,05	75	75	0	7,85	3	DITTO	DITTO	DITTO	DITTO	
T24_Cuba1_B	Tank	86	0,65	Atun	75,25	79,2	79,2	-5,774	3	1,97	-	7,162	DITTO	DITTO	1,885
	Linked Tank	86	0,65	Atun	75,25	79,2	79,2	-8,525	7,85	3	DITTO	DITTO	DITTO	DITTO	
T25_Cuba1_E	Tank	86	0,65	Atun	75,25	79,2	79,2	1,05	3	1,97	DITTO	7,162	DITTO	1,885	
	Linked Tank	86	0,65	Atun	75,25	79,2	79,2	0	7,85	3	DITTO	DITTO	DITTO	DITTO	
T26_DF_A.Sucias	Tank	98	0,96	Lodos	7,8	12,7	-0,8	0,8	1	-1	DITTO	DITTO	DITTO	-0,5	
T27_DF_GO5_E	Tank	98	0,84	Diesel	24,6	37,2	0	7	1,34	-0,6	DITTO	3,8	1,14	DITTO	
T28_DF_GO5_B	Tank	98	0,84	Diesel	24,6	37,2	-7	0	1,34	-0,6	-3,8	DITTO	1,14	DITTO	
T29_DF_G4_E	Tank	98	0,84	Diesel	37,2	49,8	0	8,5	1,671	-0,4	DITTO	7	1,34	-0,6	
T30_DF_GO4_B	Tank	98	0,84	Diesel	37,2	49,8	-8,5	0	1,671	-0,4	-7	DITTO	1,34	-0,6	
T31_DF_GO3_E	Tank	98	0,84	Diesel	49,8	62,4	0	6,6	1,824	0,1	DITTO	8,5	1,671	-0,4	
T32_DF_GO3_B	Tank	98	0,84	Diesel	49,8	62,4	-6,6	0	1,824	0,1	-8,5	DITTO	1,671	-0,4	
T33_DF_GO2_E	Tank	98	1	Fresh Water	63	75	0	3,65	2,03	0,431	DITTO	6,4	1,824	0,224	
T34_DF_GO2_B	Tank	98	1	Fresh Water	63	75	-3,65	0	2,03	0,431	-6,4	DITTO	1,824	0,224	
T35_DF_GO1_E	Tank	98	1	Fresh Water	75	82,7	0	2,2	2,178	0,431	DITTO	3,65	2,155	DITTO	
T36_DF_GO1_B	Tank	98	1	Fresh Water	75	82,7	-2,2	0	2,178	0,431	-3,65	DITTO	2,155	DITTO	
T37_DF_Lastre_E	Tank	98	1,025	Water Ballast	86,2	92,5	0	1,2	2,315	0,7	DITTO	2,2	2,178	0,567	
T38_DF_Lastre_B	Tank	98	1,025	Water Ballast	86,2	92,5	-1,2	0	2,315	0,7	-2,2	DITTO	2,178	0,567	
T39_ADulce_E	Tank	98	1	Fresh Water	79,2	82,7	0,5	5,5	8	1,9	DITTO	DITTO	DITTO	DITTO	
T40_ADulce_B	Tank	98	1	Fresh Water	79,2	82,7	-5,5	-0,5	8	1,9	DITTO	DITTO	DITTO	DITTO	
T41_Usodiario_E	Tank	98	0,84	Diesel	3,6	7,8	0	2	8	5	DITTO	DITTO	DITTO	DITTO	
T42_Usodiario_B	Tank	98	0,84	Diesel	3,6	7,8	-2	0	8	5	DITTO	DITTO	DITTO	DITTO	
T43_Sediment_E	Tank	98	0,84	Diesel	3,6	7,8	2	7,2	8	5	DITTO	DITTO	DITTO	DITTO	
T44_Sediment_B	Tank	98	0,84	Diesel	3,6	7,8	-7,2	-2	8	5	DITTO	DITTO	DITTO	DITTO	
T45_Estabilizador	Tank	98	1,025	Lastre	3,6	7,8	2	7,8	10,7	8	DITTO	DITTO	DITTO	DITTO	
	Linked Tank	98	1,025	Lastre	3,6	7,8	-7,8	-2	10,7	8	DITTO	DITTO	DITTO	DITTO	
	Linked Tank	98	1,025	Lastre	3,6	7,8	-2	2	8,5	8	DITTO	DITTO	DITTO	DITTO	
T46_Lastre_Proa_E	Tank	98	1,025	Lastre	82,7	86,2	0,45	5	8	0,3	DITTO	DITTO	DITTO	DITTO	
T47_Lastre_Proa_B	Tank	98	1,025	Lastre	82,7	86,2	-5	-0,45	8	0,3	DITTO	DITTO	DITTO	DITTO	
T48_DFCM_Lodos	Tank	98	0,96	Lodos	19	20,4	-1,7	-0,5	2	-0,7	DITTO	2	DITTO	DITTO	
T49_DFCM_AcHidráulico	Tank	98	0,925	Aceite	16,2	18,3	1,7	4,2	3,5	-0,7	DITTO	3,5	DITTO	DITTO	
T50_DFCM_AcLubricante	Tank	98	0,925	Aceite	18,3	24,6	1,7	5,4	3,5	-0,7	DITTO	4,2	DITTO	DITTO	
T51_DFCM_Reboses	Tank	98	0,84	Diesel	12,7	19	-1,7	-0,5	2	-0,7	DITTO	DITTO	DITTO	DITTO	
T52_DFCM_Acsucio	Tank	98	0,925	Lube Oil	12,7	19	-0,5	0,5	2	-0,7	DITTO	DITTO	DITTO	DITTO	
T53_DFCM_ADulce_E	Tank	98	1	Agua dulce	12,7	19,7	-4,6	-1,7	3,5	-0,7	DITTO	DITTO	DITTO	DITTO	
T54_DFCM_ADulce_B	Tank	98	1	Agua dulce	19,7	23,9	-5,3	-1,7	3,5	-0,7	-4,6	DITTO	DITTO	DITTO	
T55_Lastre_Proa1	Tank	98	1,025	Water Ballast	92,5	97,45	-2	2	8	0,7	-2,7	2,7	DITTO	DITTO	
T56_Lastre_Proa2	Tank	98	1,025	Water Ballast	97,4	106,5	-0,5	0,5	8	0,7	-2,7	2,7	DITTO	DITTO	

Algunas medidas como las mangas de los tanques no coinciden con las reales, ya que han

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tenido que prolongarse para que el tanque interseque con el casco.

En el ANEXO 1 podemos ver los planos de los tanques dispuestos en esta tabla.

-COMPROBACIÓN DE LAS CAPACIDADES:

-Tanques de combustible

TANQUES DE COMBUSTIBLE

Nombre	Fluido	Peso Esp(Tn/m3)	Peso(Tn)	Vol (m3)	XG (m)	YG (m)	ZG (m)
T28_DF_GO5_E	Diesel	0,84	45,767	54,485	31,73	2,02	0,324
T27_DF_GO5_B	Diesel	0,84	45,767	54,485	31,73	-2,02	0,324
T30_DF_GO4_E	Diesel	0,84	81,05	96,488	43,822	3,245	0,536
T29_DF_G4_B	Diesel	0,84	81,05	96,488	43,822	-3,245	0,536
T32_DF_GO3_E	Diesel	0,84	82,303	97,980	55,713	3,239	0,752
T31_DF_GO3_B	Diesel	0,84	82,303	97,980	55,713	-3,239	0,752
T34_DF_GO2_E	Diesel	0,84	43,624	51,933	67,957	1,924	0,991
T33_DF_GO2_B	Diesel	0,84	43,624	51,933	67,957	-1,924	0,991
T36_DF_GO1_E	Diesel	0,84	13,418	15,974	78,485	0,998	1,204
T35_DF_GO1_B	Diesel	0,84	13,418	15,974	78,485	-0,998	1,204
TOTAL			532,324	633,719			

La capacidad de combustible que tiene nuestro buque es de 633,719 m³ lo que hace un total de 532,32 Tn que sobrepasan sobradamente las 379,73 Tn requeridas para la autonomía especificada en el RPA. Con esta capacidad nuestro buque tiene una autonomía de:

$$\text{Horas autonomía} = \frac{532,324}{1.1 \times 186 \times 6000 \times 0.85 \times 10^{-6}} = 510 \text{ horas}$$

510 horas, que hacen un total de 21 días de autonomía.

-Tanques de Uso diario

TANQUES DE USO DIARIO

Nombre	Fluido	Peso Esp(Tn/m3)	Peso(Tn)	Vol (m3)	XG (m)	YG (m)	ZG (m)
T42_UsoDiario_E	Diesel	0,84	16,066	19,126	5,802	0,98	6,827
T41_UsoDiario_B	Diesel	0,84	16,066	19,126	5,802	-0,98	6,827
TOTAL			32,132	38,252			

La capacidad de los tanques de uso diario es de 32,13 Tn, por lo que se cumple el mínimo establecido para 14 horas de 14,60 Tn.

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-Tanques de decantación

TANQUES DE DECANTACIÓN

Nombre	Fluido	Peso Esp(Tn/m3)	Peso(Tn)	Vol (m3)	XG (m)	YG (m)	ZG (m)
T44_Sediment_E	Diesel	0,84	26,011	30,965	5,795	3,971	7,136
T43_Sediment_B	Diesel	0,84	26,011	30,965	5,795	-3,971	7,136
TOTAL			52,022	61,931			

La capacidad de los tanques de uso diario es de 52,02 Tn, por lo que se cumple el mínimo establecido para 24 horas de 25,04 Tn.

-Tanques aceite

TANQUES DE ACEITE

Nombre	Fluido	Peso Esp(Tn/m3)	Peso(Tn)	Vol (m3)	XG (m)	YG (m)	ZG (m)
T49_DFCM_AcHidráulico	Lube Oil	0,925	3,353	3,625	17,276	2,022	2,412
T50_DFCM_AcLubricante	Lube Oil	0,925	32,196	34,806	22,037	2,716	2,171
TOTAL			35,549	38,431			

La capacidad necesaria de aceite es de 0,96 Tn, sin embargo para el buque proyecto se decidió poner una capacidad de dichos tanques mayor, acorde con las capacidades del buque base, para hacerlos más similares.

-Tanques de agua dulce

TANQUES DE AGUA DULCE

Nombre	Fluido	Peso Esp(Tn/m3)	Peso(Tn)	Vol (m3)	XG (m)	YG (m)	ZG (m)
T39_ADulce_E	Fresh Water	1	68,723	68,723	80,879	1,683	5,194
T40_ADulce_B	Fresh Water	1	68,723	68,723	80,879	-1,683	5,194
T54_DFCM_ADulce2	Fresh Water	1	24,614	24,614	22,049	-2,719	2,169
T53_DFCM_ADulce1	Fresh Water	1	8,049	8,049	18,241	-2,162	2,325
TOTAL			170,109	170,109			

Vemos que se cumple el mínimo establecido de 135 Tn.

-Tanques de aguas negras y grises

TANQUES DE AGUAS NEGRAS

Nombre	Fluido	Peso Esp(Tn/m3)	Peso(Tn)	Vol (m3)	XG (m)	YG (m)	ZG (m)
T26_DF_A.Sucias	Lodos	0,96	12,103	12,607	10,37	0	0,368
TOTAL			12,103	12,607			

Vemos que no se cumple el mínimo, pero como se explicó anteriormente, disponemos de una planta de tratamiento para no disponer de un tanque de tales

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dimensiones.

-Tanques de fangos:

TANQUES DE FANGOS

Nombre	Fluido	Peso Esp(Tn/m3)	Peso(Tn)	Vol (m3)	XG (m)	YG (m)	ZG (m)
T48_DFCM_Lodos	Lodos	0,96	3,851	4,011	19,701	1,084	0,803
TOTAL			3,851	4,011			

El volumen mínimo necesario es de 1,5 m³, y la capacidad del tanque es de 4,01 m³ por lo que se cumple el mínimo requerido.

-Cubas:

CUBAS

Nombre	Fluido	Peso Esp(Tn/m3)	Peso(Tn)	Vol (m3)	XG (m)	YG (m)	ZG (m)
T1_Cuba13_B	Atun	0,65	93,646	144,071	26,859	-3,556	4,94
T2_Cuba13_E	Atun	0,65	93,646	144,071	26,859	3,556	4,94
T3_Cuba12_B	Atun	0,65	103,735	159,592	31,05	-3,807	4,792
T4_Cuba12_E	Atun	0,65	103,735	159,592	31,05	3,807	4,792
T5_Cuba11_B	Atun	0,65	110,562	170,095	35,239	-4,037	4,724
T6_Cuba11_E	Atun	0,65	110,562	170,095	35,239	4,037	4,724
T7_Cuba10_B	Atun	0,65	114,197	175,688	39,431	-4,184	4,695
T8_Cuba10_E	Atun	0,65	114,197	175,688	39,431	4,184	4,695
T9_Cuba9_B	Atun	0,65	115,258	177,32	43,625	-4,264	4,703
T10_Cuba9_E	Atun	0,65	115,258	177,32	43,625	4,264	4,703
T11_Cuba8_B	Atun	0,65	114,275	175,808	47,821	-4,275	4,731
T12_Cuba8_E	Atun	0,65	114,275	175,808	47,821	4,275	4,731
T13_Cuba7_B	Atun	0,65	112,698	173,382	52,019	-4,25	4,762
T14_Cuba7_E	Atun	0,65	112,698	173,382	52,019	4,25	4,762
T15_Cuba6_B	Atun	0,65	109,356	168,239	56,212	-4,156	4,799
T15_Cuba6_E	Atun	0,65	109,356	168,239	56,212	4,156	4,799
T16_Cuba5_B	Atun	0,65	102,226	157,271	60,396	-3,943	4,875
T17_Cuba5_E	Atun	0,65	102,226	157,271	60,396	3,943	4,875
T18_Cuba4_B	Atun	0,65	91,925	141,423	64,582	-3,603	4,961
T19_Cuba4_E	Atun	0,65	91,925	141,423	64,582	3,603	4,961
T20_Cuba3_B	Atun	0,65	78,57	120,878	68,772	-3,16	5,065
T21_Cuba3_E	Atun	0,65	78,57	120,878	68,772	3,16	5,065
T22_Cuba2_B	Atun	0,65	65,058	100,09	72,961	-2,676	5,138
T23_Cuba2_E	Atun	0,65	65,058	100,09	72,961	2,676	5,138
T24_Cuba1_B	Atun	0,65	51,82	79,724	77,145	-2,19	5,213
T25_Cuba1_E	Atun	0,65	51,82	79,724	77,145	2,19	5,213
TOTAL			2526,652	3887,162			

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El volumen de cubas especificado en el RPA es de 3300 m³ y con esta disposición de cubas, el buque proyecto alcanza un total de 3887,16 m³ de volumen de cubas, por lo que se cumple sobradamente el volumen requerido.

-Resumen:

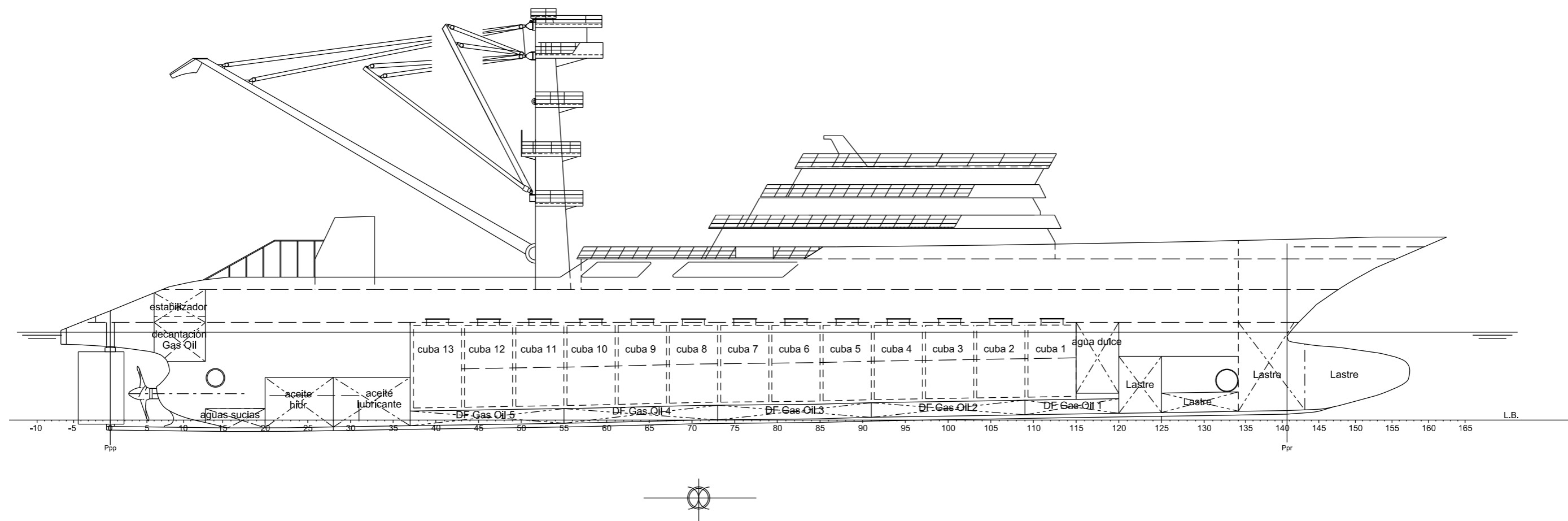
A continuación se muestra una tabla resumen de las capacidades de los distintos tanques y las requeridas.

Tanques	Fluido	Capacidad disponible (Tn)	Capacidad mínima necesaria (Tn)	Cumplimiento
Combustible	Diesel	532,32	379,43	SI
Uso diario	Diesel	32,13	14,61	SI
Decantación	Diesel	52,02	25,04	SI
Aceite	Lube Oil	35,55	0,96	SI
Agua dulce	Fresh water	170,11	135,00	SI
Aguas negras	Lodos	12,10	22,05	NO*
Fangos	Lodos	3,85	1,44	SI
Cubas	Atun	2526,65	2145	SI

*Se dispone de una planta de tratamiento para este tipo de residuos.

ANEXO I

PLANO DE TANQUES

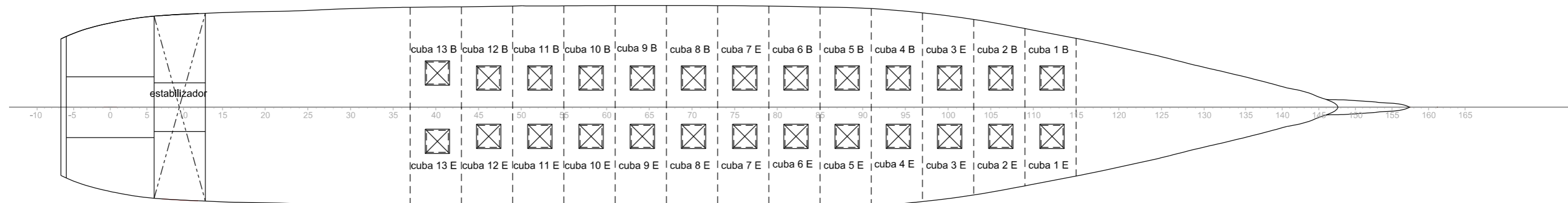


CARACTERÍSTICAS

ESLORA TOTAL113,0 m
 ESLORA ENTRE PERPENDICULARES 96,5 m
 MANGA DE TRAZADO16,7 m
 PUNTA A LA CTA SUPERIOR10,7 m
 PUNTA A LA CTA PRINCIPAL8,0 m
 CALADO MEDIO DE TRAZADO7,2 m



Nº PROYECTO: 16-15	AUTOR: FERNANDO GARCÍA-GANGES ICAZA
FECHA: 2016	NOMBRE DEL PROYECTO: ATUNERO CONGELADOR DE 3300 m3
ESCALA: 1:350 A3	NOMBRE DEL PLANO: DISPOSICIÓN DE TANQUES (PERFIL)
HOJA 1 DE 4	

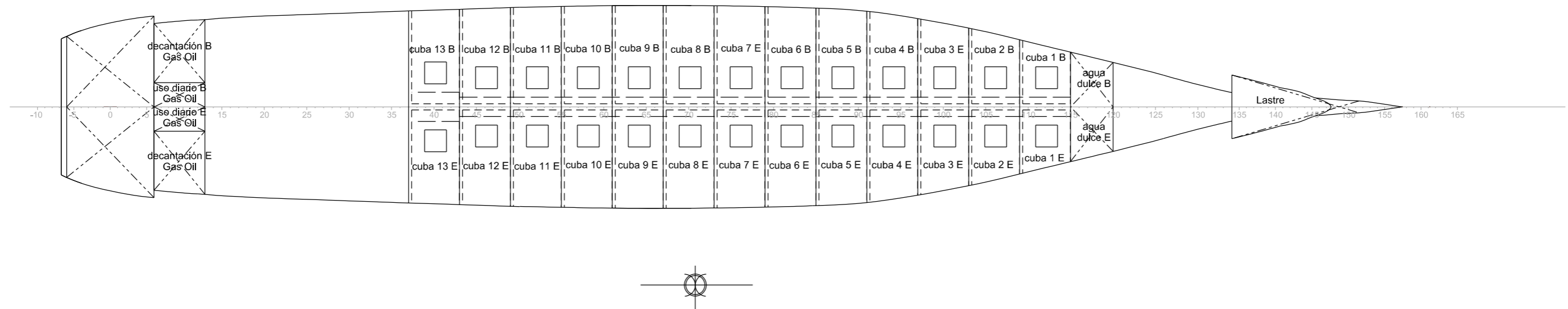


CARACTERÍSTICAS

ESLORA TOTAL113,0 m
 ESLORA ENTRE PERPENDICULARES 96,5 m
 MANGA DE TRAZADO16,7 m
 PUNTA A LA CTA SUPERIOR10,7 m
 PUNTA A LA CTA PRINCIPAL8,0 m
 CALADO MEDIO DE TRAZADO7,2 m



Nº PROYECTO: 16-15	AUTOR: FERNANDO GARCÍA-GANGES ICAZA
FECHA: 2016	NOMBRE DEL PROYECTO: ATUNERO CONGELADOR DE 3300 m3
ESCALA: 1:350 A3	NOMBRE DEL PLANO: DISPOSICIÓN DE TANQUES (CUB. SUPERIOR)
HOJA 2 DE 4	

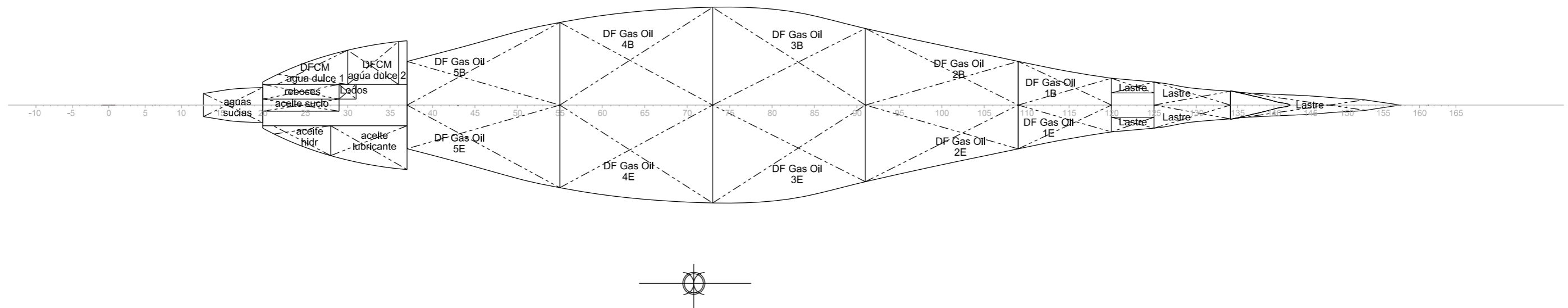


CARACTERÍSTICAS

ESLORA TOTAL113,0 m
 ESLORA ENTRE PERPENDICULARES 96,5 m
 MANGA DE TRAZADO16,7 m
 PUNTAL A LA CTA SUPERIOR10,7 m
 PUNTAL A LA CTA PRINCIPAL8,0 m
 CALADO MEDIO DE TRAZADO7,2 m



Nº PROYECTO: 16-15	AUTOR: FERNANDO GARCÍA-GANGES ICAZA
FECHA: 2016	NOMBRE DEL PROYECTO: ATUNERO CONGELADOR DE 3300 m3
ESCALA: 1:350 A3	NOMBRE DEL PLANO: DISPOSICIÓN DE TANQUES (CUB. PRINCIPAL)
HOJA 3 DE 4	



CARACTERÍSTICAS

ESLORA TOTAL113,0 m
 ESLORA ENTRE PERPENDICULARES 96,5 m
 MANGA DE TRAZADO16,7 m
 PUNTA A LA CTA SUPERIOR10,7 m
 PUNTA A LA CTA PRINCIPAL8,0 m
 CALADO MEDIO DE TRAZADO7,2 m

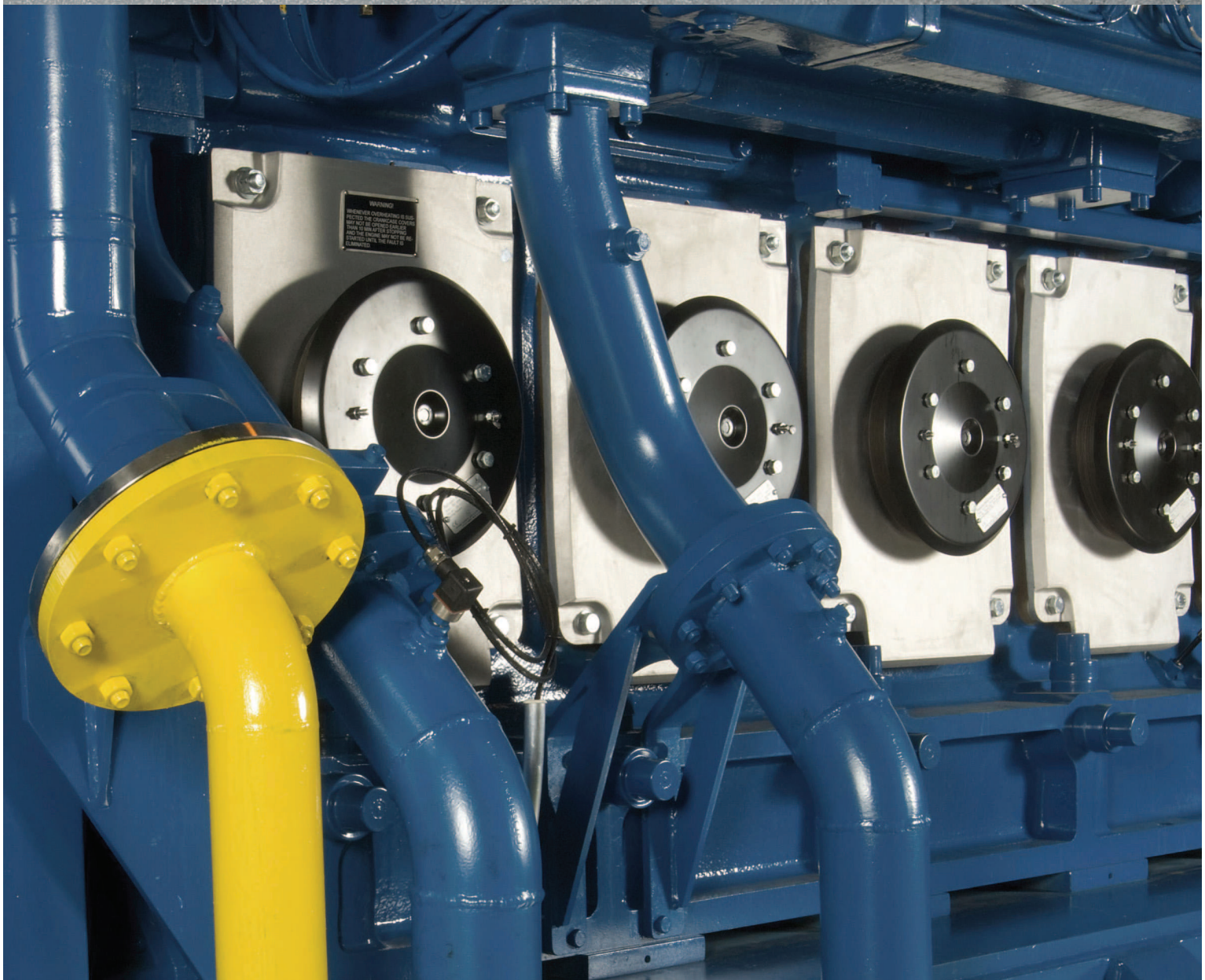


Nº PROYECTO: 16-15	AUTOR: FERNANDO GARCÍA-GANGES ICAZA
FECHA: 2016	NOMBRE DEL PROYECTO: ATUNERO CONGELADOR DE 3300 m3
ESCALA: 1:350 A3	NOMBRE DEL PLANO: DISPOSICIÓN DE TANQUES (DOBLE FONDO)
HOJA 4 DE 4	

ANEXO II

DATOS DE LOS MOTORES

DIÉSEL GENERADORES



3.2 Wärtsilä 6L34DF with 480/500 kW / cylinder

Wärtsilä 6L34DF		AUX		AUX		DE		DE		ME		ME	
		Gas mode	Diesel mode	Gas mode	Diesel mode	Gas mode	Diesel mode	Gas mode	Diesel mode	Gas mode	Diesel mode	Gas mode	Diesel mode
Cylinder output	kW	480		500		480		500		500		500	
Engine speed	rpm	720		750		720		750		750		750	
Engine output	kW	2880		3000		2880		3000		3000		3000	
Mean effective pressure	MPa	2.2		2.2		2.2		2.2		2.2		2.2	
Speed mode		Constant		Constant		Constant		Constant		Constant		Variable	
IMO compliance		Tier 3	Tier 2	Tier 3	Tier 2	Tier 3	Tier 2	Tier 3	Tier 2	Tier 3	Tier 2	Tier 3	Tier 2
Combustion air system (Note 1)													
Flow at 100% load	kg/s	4.2	5.4	4.5	5.4	4.2	5.4	4.5	5.4	4.5	5.4	4.5	5.5
Temperature at turbocharger intake, max.	°C	45		45		45		45		45		45	
Temperature after air cooler (TE 601), load > 70%	°C	45	-	45	-	45	-	45	-	45	-	45	-
Temperature after air cooler (TE 601), load 30...70%	°C	55	-	55	-	55	-	55	-	55	-	55	-
Temperature after air cooler (TE 601)	°C	-	50	-	50	-	50	-	50	-	50	-	50
Exhaust gas system (Note 2)													
Flow at 100% load	kg/s	4.3	5.5	4.6	5.5	4.3	5.5	4.6	5.5	4.6	5.5	4.6	5.7
Flow at 75% load	kg/s	3.6	4.4	3.8	4.4	3.6	4.4	3.8	4.4	3.8	4.4	3.7	4.3
Flow at 50% load	kg/s	2.9	3.1	3.1	3.1	2.9	3.1	3.1	3.1	3.1	3.1	3.0	3.1
Temperature after turbocharger at 100% load (TE 517)	°C	381	355	381	381	381	346	381	370	381	370	381	361
Temperature after turbocharger at 75% load (TE 517)	°C	402	327	401	349	402	318	401	340	401	340	386	348
Temperature after turbocharger at 50% load (TE 517)	°C	406	350	402	371	406	346	402	366	402	366	340	333
Backpressure, max.	kPa	4		4		4		4		4		4	
Calculated exhaust diameter for 35 m/s	mm	537	595	555	608	537	591	555	603	555	603	554	606
Heat balance at 100% load (Note 3)													
Jacket water, HT-circuit	kW	357	410	372	430	357	406	372	425	372	425	372	443
Charge air, HT-circuit	kW	705	933	601	933	705	933	601	933	601	933	601	966
Charge air, LT-circuit	kW	161	179	171	179	161	179	171	179	171	179	171	184
Lubricating oil, LT-circuit	kW	250	252	260	264	250	250	260	261	260	261	260	281
Radiation	kW	115	117	120	123	115	116	120	121	120	121	120	123
Fuel consumption (Note 4)													
Total energy consumption at 100% load	kJ/kWh	7400	-	7400	-	7400	-	7400	-	7400	-	7400	-
Total energy consumption at 75% load	kJ/kWh	7790	-	7790	-	7790	-	7790	-	7790	-	7520	-
Total energy consumption at 50% load	kJ/kWh	8510	-	8510	-	8510	-	8510	-	8510	-	7700	-
Fuel gas consumption at 100% load	kJ/kWh	7323	-	7323	-	7323	-	7323	-	7323	-	7323	-
Fuel gas consumption at 75% load	kJ/kWh	7671	-	7671	-	7671	-	7671	-	7671	-	7413	-

Wärtsilä 6L34DF		AUX		AUX		DE		DE		ME		ME	
		Gas mode	Diesel mode	Gas mode	Diesel mode	Gas mode	Diesel mode	Gas mode	Diesel mode	Gas mode	Diesel mode	Gas mode	Diesel mode
Cylinder output	kW	480		500		480		500		500		500	
Fuel gas consumption at 50% load	kJ/kWh	8350	-	8350	-	8350	-	8350	-	8350	-	7554	-
Fuel oil consumption at 100% load	g/kWh	1.9	188	1.9	189	1.9	186	1.9	187	1.9	187	1.9	189
Fuel oil consumption at 75% load	g/kWh	2.6	186	2.6	187	2.6	184	2.6	185	2.6	185	2.4	182
Fuel oil consumption 50% load	g/kWh	3.8	193	3.8	194	3.8	192	3.8	193	3.8	193	3.5	181
Fuel gas system (Note 5)													
Gas pressure at engine inlet, min (PT901)	kPa (a)	535	-	535	-	535	-	535	-	535	-	535	-
Gas pressure to Gas Valve Unit, min	kPa (a)	655	-	655	-	655	-	655	-	655	-	655	-
Gas temperature before Gas Valve Unit	°C	0...60	-	0...60	-	0...60	-	0...60	-	0...60	-	0...60	-
Fuel oil system													
Pressure before injection pumps (PT 101)	kPa	700±50		700±50		700±50		700±50		700±50		700±50	
Fuel oil flow to engine, approx	m ³ /h	3.1		3.2		3.0		3.2		3.2		3.2	
HFO viscosity before the engine	cSt	-	16...24	-	16...24	-	16...24	-	16...24	-	16...24	-	16...24
Max. HFO temperature before engine (TE 101)	°C	-	140	-	140	-	140	-	140	-	140	-	140
MDF viscosity, min.	cSt	2.0		2.0		2.0		2.0		2.0		2.0	
Max. MDF temperature before engine (TE 101)	°C	45		45		45		45		45		45	
Leak fuel quantity (MDF), clean fuel at 100% load	kg/h	5.6	11.1	5.8	11.6	5.6	11.1	5.8	11.6	5.8	11.6	5.9	11.8
Pilot fuel (MDF) viscosity before the engine	cSt	2...11		2...11		2...11		2...11		2...11		2...11	
Pilot fuel pressure at engine inlet (PT 112)	kPa (a)	550...750		550...750		550...750		550...750		550...750		550...750	
Pilot fuel pressure drop after engine, max	kPa	150		150		150		150		150		150	
Pilot fuel return flow at 100% load	kg/h	590		590		590		590		590		590	
Lubricating oil system													
Pressure before bearings, nom. (PT 201)	kPa	500		500		500		500		500		500	
Suction ability, including pipe loss, max.	kPa	30		30		30		30		30		30	
Priming pressure, nom. (PT 201)	kPa	50		50		50		50		50		50	
Suction ability priming pump, including pipe loss, max.	kPa	30		30		30		30		30		30	
Temperature before bearings, nom. (TE 201)	°C	63		63		63		63		63		63	
Temperature after engine, approx.	°C	78		78		78		78		78		78	
Pump capacity (main), engine driven	m ³ /h	78		81		78		81		81		81	
Pump capacity (main), electrically driven	m ³ /h	67		70		67		70		70		70	
Priming pump capacity (50/60Hz)	m ³ /h	15.0 / 18.0		15.0 / 18.0		15.0 / 18.0		15.0 / 18.0		15.0 / 18.0		15.0 / 18.0	
Oil volume, wet sump, nom.	m ³	1.6		1.6		1.6		1.6		1.6		1.6	
Oil volume in separate system oil tank	m ³	3		3		3		3		3		3	

Wärtsilä 6L34DF		AUX		AUX		DE		DE		ME		ME	
		Gas mode	Diesel mode	Gas mode	Diesel mode	Gas mode	Diesel mode	Gas mode	Diesel mode	Gas mode	Diesel mode	Gas mode	Diesel mode
Cylinder output	kW	480		500		480		500		500		500	
Oil consumption at 100% load, approx.	g/kWh	0.4		0.4		0.4		0.4		0.4		0.4	
Crankcase ventilation flow rate at full load	l/min	840		840		840		840		840		840	
Crankcase ventilation backpressure, max.	kPa	0.3		0.3		0.3		0.3		0.3		0.3	
Oil volume in turning device	l	
Oil volume in speed governor	l	1.4...2.2		1.4...2.2		1.4...2.2		1.4...2.2		1.4...2.2		1.4...2.2	
HT cooling water system													
Pressure at engine, after pump, nom. (PT 401)	kPa	250 + static		250 + static		250 + static		250 + static		250 + static		250 + static	
Pressure at engine, after pump, max. (PT 401)	kPa	530		530		530		530		530		530	
Temperature before cylinders, approx. (TE 401)	°C	85		85		85		85		85		85	
Temperature after engine, nom.	°C	96		96		96		96		96		96	
Capacity of engine driven pump, nom.	m ³ /h	60		60		60		60		60		60	
Pressure drop over engine, total	kPa	100		100		100		100		100		100	
Pressure drop in external system, max.	kPa	100		100		100		100		100		100	
Pressure from expansion tank	kPa	70...150		70...150		70...150		70...150		70...150		70...150	
Water volume in engine	m ³	0.41		0.41		0.41		0.41		0.41		0.41	
Delivery head of stand-by pump	kPa	250		250		250		250		250		250	
LT cooling water system													
Pressure at engine, after pump, nom. (PT 471)	kPa	250+ static		250+ static		250+ static		250+ static		250+ static		250+ static	
Pressure at engine, after pump, max. (PT 471)	kPa	530		530		530		530		530		530	
Temperature before engine, max. (TE 471)	°C	38		38		38		38		38		38	
Temperature before engine, min. (TE 471)	°C	25		25		25		25		25		25	
Capacity of engine driven pump, nom.	m ³ /h	60		60		60		60		60		60	
Pressure drop over charge air cooler	kPa	35		35		35		35		35		35	
Pressure drop in external system, max.	kPa	100		100		100		100		100		100	
Pressure from expansion tank	kPa	70...150		70...150		70...150		70...150		70...150		70...150	
Delivery head of stand-by pump	kPa	250		250		250		250		250		250	
Starting air system													
Pressure, nom.	kPa	3000		3000		3000		3000		3000		3000	
Pressure, max.	kPa	3000		3000		3000		3000		3000		3000	
Pressure at engine during start, min. (alarm) (20°C)	kPa	1500		1500		1500		1500		1500		1500	
Low pressure limit in starting air receiver	kPa	1600		1600		1600		1600		1600		1600	
Starting air consumption, start (successful)	Nm ³	4.7		4.7		4.7		4.7		4.7		4.7	

Wärtsilä 6L34DF		AUX		AUX		DE		DE		ME		ME	
		Gas mode	Diesel mode	Gas mode	Diesel mode	Gas mode	Diesel mode	Gas mode	Diesel mode	Gas mode	Diesel mode	Gas mode	Diesel mode
Cylinder output	kW	480		500		480		500		500		500	
Consumption per start (with slowturn)	Nm ³	6.1		6.1		6.1		6.1		6.1		6.1	

Notes:

- Note 1 At ISO 15550 conditions (ambient air temperature 25°C, LT-water 25°C) and 100% load. Tolerance 5%.
- Note 2 At ISO 15550 conditions (ambient air temperature 25°C, LT-water 25°C) and 100% load. Flow tolerance 5% and temperature tolerance 10°C in gas mode operation. Flow tolerance 8% and temperature tolerance 15°C in diesel mode operation.
- Note 3 At 100% output and nominal speed. The figures are valid for ambient conditions according to ISO 15550 except for LT-water temperature, which is corresponding to charge air receiver temperature 45°C in gas operation. With engine driven water and lubricating oil pumps. Tolerance for cooling water heat 10%, tolerance for radiation heat 30%. Fouling factors and a margin to be taken into account when dimensioning heat exchangers.
- Note 4 At ambient conditions according to ISO 15550 and receiver temperature 45 °C. Lower calorific value 42 700 kJ/kg for pilot fuel and 49 620 kJ/kg for gas fuel. With engine driven pumps (two cooling water pumps, one lubricating oil pump and pilot fuel pump). Tolerance 5%.
- Note 5 Fuel gas pressure given at LHV ≥ 36 MJ/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.

ME = Engine driving propeller, variable speed

AE = Auxiliary engine driving generator

DE = Diesel-Electric engine driving generator

Subject to revision without notice.

MOTOR ELÉCTRICO

Engineered motors

Squirrel cage three phase high voltage motors, Up to 8000 kW



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- >> High voltage induction motors
- >>> Rib cooled motors NXR
- >>> Rib cooled motors HXR
- >>> Process performance rib cooled motors
- >>> Modular induction motors



HV Modular induction motors

Technical data for totally enclosed squirrel cage three phase motors

3000 V - 50 Hz

IP55 - IC 611 - Insulation class F, temperature rise class B

Output kW	Motor type	Product ID	Speed r/min	Efficiency		Power factor		Current			Torque			Rotor inertia kgm ²	Motor weight kg	Sound pressure level L _p dB(A)
				Full load 100 %	3/4 load 75 %	Full load 100 %	3/4 load 75 %	I _N A	$\frac{I_s}{I_N}$	I ₀ A	T _N Nm	$\frac{T_s}{T_N}$	$\frac{T_{max}}{T_N}$			
1500 r/min = 4 poles				3000 V 50 Hz												
630	AMI 400L4A	10024	1482	94.6	94.8	0.87	0.86	146	4.3	38	4058	0.5	1.8	14.6	2930	79
710	AMI 400L4A	10025	1484	95.0	95.2	0.87	0.86	165	4.8	46	4569	0.6	2.0	15.6	3030	79
800	AMI 400L4A	10026	1486	95.2	95.3	0.86	0.83	188	5.4	62	5142	0.7	2.2	16.6	3110	79
900	AMI 400L4A	10027	1486	95.4	95.5	0.86	0.84	210	5.4	66	5785	0.7	2.2	17.6	3210	79
1000	AMI 400L4A	10028	1486	95.6	95.7	0.86	0.83	234	5.5	76	6426	0.7	2.2	18.6	3320	79
1120	AMI 400L4A	10029	1486	95.8	96.0	0.88	0.86	256	5.5	73	7198	0.8	2.2	20.6	3520	79
1250	AMI 450L4A	10030	1486	95.6	95.7	0.88	0.87	286	5.3	77	8033	0.7	2.1	30.9	4190	81
1400	AMI 450L4A	10031	1487	95.8	95.9	0.87	0.85	323	5.7	97	8992	0.7	2.3	32.6	4310	81
1600	AMI 450L4A	10032	1487	96.0	96.1	0.87	0.85	367	5.9	108	10274	0.8	2.4	36.1	4540	81
1750	AMI 450L4A	10033	1489	96.2	96.2	0.87	0.85	403	5.8	124	11224	0.7	2.4	38.3	4680	81
1800	AMI 500L4A	10034	1489	95.8	95.9	0.88	0.87	411	4.8	102	11545	0.5	1.9	50.0	5220	82
2000	AMI 500L4A	10035	1490	96.1	96.2	0.89	0.87	452	5.4	116	12817	0.6	2.1	56.1	5540	82
2240	AMI 500L4A	10036	1490	96.3	96.4	0.88	0.87	507	5.5	131	14354	0.7	2.1	59.1	5710	82
2500	AMI 500L4A	10037	1490	96.4	96.5	0.90	0.89	558	5.5	131	16020	0.7	2.1	65.1	6020	82
2750	AMI 500L4A	10038	1491	96.6	96.7	0.90	0.89	609	5.8	141	17618	0.7	2.2	71.1	6360	82
3250	AMI 560L4A B	10039	1490	96.3	96.4	0.87	0.87	742	4.8	163	20833	0.5	2.1	104.3	8090	86
3750	AMI 560L4A B	10040	1490	96.5	96.7	0.89	0.90	836	4.9	154	24037	0.5	2.1	118.4	8660	86
4250	AMI 560L4A B	10041	1491	96.7	96.9	0.89	0.88	954	5.5	207	27222	0.6	2.4	127.8	9070	86
4750	AMI 560L4A B	10042	1491	96.9	97.0	0.88	0.86	1077	5.8	263	30422	0.7	2.6	140.2	9670	86
5000	AMI 630L4A B	10043	1489	96.7	96.8	0.89	0.89	1121	4.8	216	32055	0.5	2.1	183.2	11360	87
5600	AMI 630L4A B	10044	1491	97.0	97.1	0.89	0.89	1244	5.4	259	35855	0.6	2.4	206.7	12180	87
6100	AMI 630L4A B	10045	1491	97.0	97.2	0.90	0.90	1348	4.9	222	39067	0.5	2.1	222.6	12660	87
7100	AMI 630L4A B	10046	1492	97.2	97.3	0.88	0.87	1591	5.6	363	45428	0.6	2.5	243.8	13390	87

Data presented in rating lists are typical values. Guaranteed values on request.

All engineered motors are optimized for the specified application.

Accurate motor data will be given on request at quotation phase.

Legally binding performance and specification data is given to the end user once each order is confirmed.

ANEXO III

CALIBRACIÓN DE TANQUES

Cuaderno 4: Cálculos de arquitectura naval

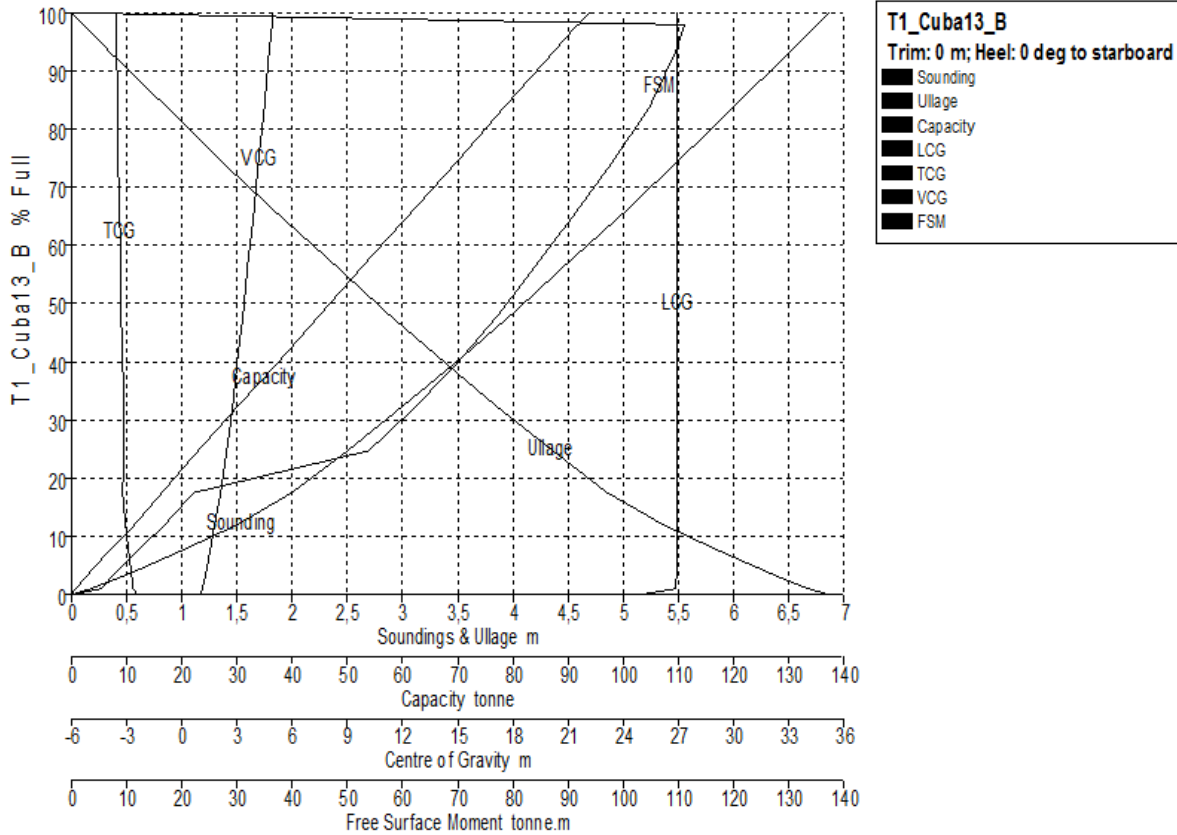
Proyecto nº 16-15.
Fernando García-Ganges Icaza



Tank Calibrations

Tank Calibrations - T1_Cuba13_B

Fluid Type = Atun Specific gravity = 0,65
Permeability = 86 %
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
T1_Cuba13_B	6,859	0,000	100,000	144,110	93,672	26,859	-3,557	4,940	0,000
	6,754	0,105	98,000	141,228	91,798	26,859	-3,547	4,881	111,118
	6,748	0,111	97,900	141,084	91,704	26,860	-3,547	4,878	111,086
	6,500	0,359	93,208	134,322	87,309	26,861	-3,524	4,741	109,397
	6,000	0,859	83,848	120,834	78,542	26,865	-3,474	4,461	104,633
	5,500	1,359	74,655	107,586	69,931	26,868	-3,421	4,181	98,283
	5,000	1,859	65,673	94,641	61,517	26,872	-3,368	3,899	91,310
	4,500	2,359	56,919	82,026	53,317	26,877	-3,314	3,615	84,383
	4,000	2,859	48,402	69,752	45,339	26,882	-3,261	3,329	77,576
	3,500	3,359	40,141	57,847	37,601	26,887	-3,211	3,038	70,293
	3,000	3,859	32,180	46,375	30,144	26,894	-3,169	2,740	62,298
	2,500	4,359	24,573	35,412	23,018	26,902	-3,149	2,429	53,773
	2,000	4,859	17,401	25,077	16,300	26,912	-3,181	2,093	22,272

Cuaderno 4: Cálculos de arquitectura naval

Proyecto nº 16-15.

Fernando García-Ganges Icaza



	1,500	5,359	12,142	17,498	11,374	26,916	-3,046	1,811	16,917
	1,000	5,859	7,413	10,683	6,944	26,917	-2,903	1,533	11,975
	0,500	6,359	3,280	4,727	3,072	26,900	-2,752	1,264	7,679
	0,184	6,675	1,000	1,441	0,937	26,811	-2,648	1,099	5,448
	0,000	6,859	0,000	0,000	0,000	24,872	-2,374	0,991	0,000

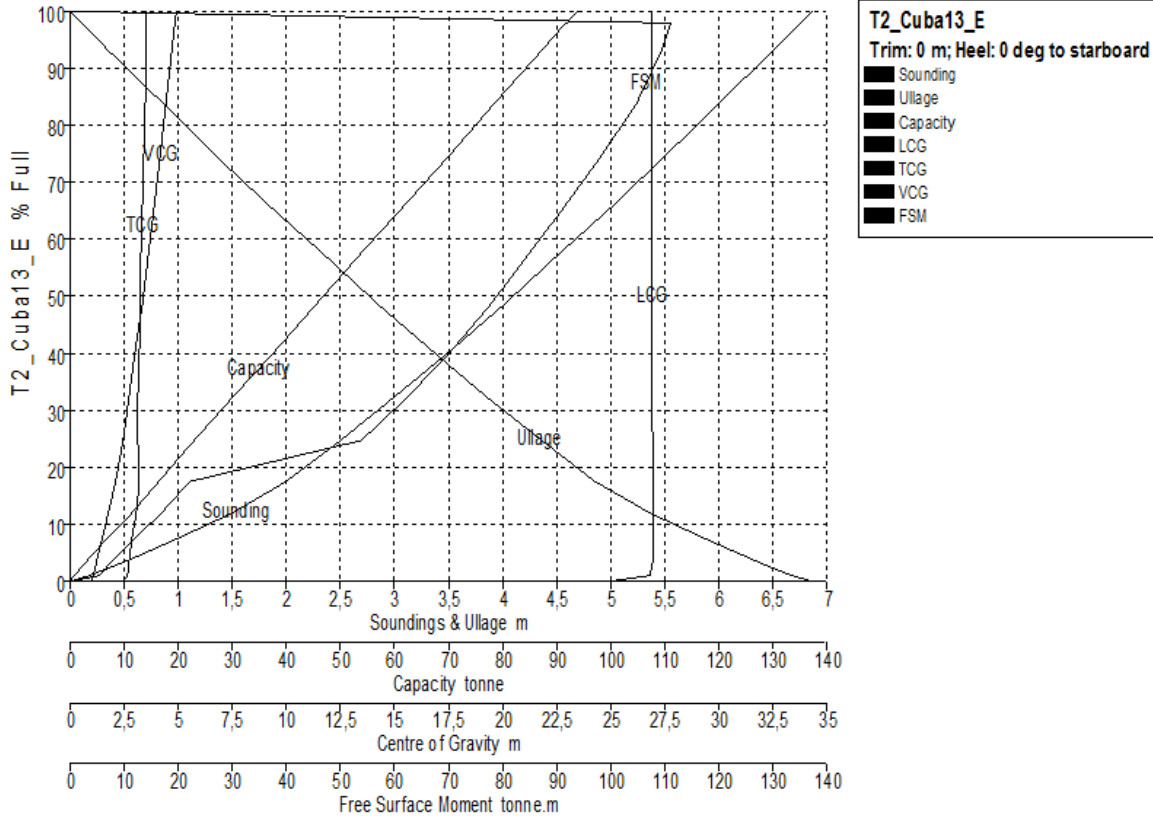
Tank Calibrations - T2_Cuba13_E

Fluid Type = Atun

Specific gravity = 0,65

Permeability = 86 %

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
T2_Cuba13_E	6,859	0,000	100,000	144,110	93,672	26,859	3,557	4,940	0,000
	6,754	0,105	98,000	141,228	91,798	26,859	3,547	4,881	111,118
	6,748	0,111	97,900	141,084	91,704	26,860	3,547	4,878	111,086
	6,500	0,359	93,208	134,322	87,309	26,861	3,524	4,741	109,397
	6,000	0,859	83,848	120,834	78,542	26,865	3,474	4,461	104,633
	5,500	1,359	74,655	107,586	69,931	26,868	3,421	4,181	98,283
	5,000	1,859	65,673	94,641	61,517	26,872	3,368	3,899	91,310
	4,500	2,359	56,919	82,026	53,317	26,877	3,314	3,615	84,383
	4,000	2,859	48,402	69,752	45,339	26,882	3,261	3,329	77,576
	3,500	3,359	40,141	57,847	37,601	26,887	3,211	3,038	70,293
	3,000	3,859	32,180	46,375	30,144	26,894	3,169	2,740	62,298
	2,500	4,359	24,573	35,412	23,018	26,902	3,149	2,429	53,773
	2,000	4,859	17,401	25,077	16,300	26,912	3,181	2,093	22,272
	1,500	5,359	12,142	17,498	11,374	26,916	3,046	1,811	16,917

Cuaderno 4: Cálculos de arquitectura naval

Proyecto nº 16-15.

Fernando García-Ganges Icaza



	1,000	5,859	7,413	10,683	6,944	26,917	2,903	1,533	11,975
	0,500	6,359	3,280	4,727	3,072	26,900	2,752	1,264	7,679
	0,184	6,675	1,000	1,441	0,937	26,811	2,648	1,099	5,448
	0,000	6,859	0,000	0,000	0,000	24,872	2,374	0,991	0,000

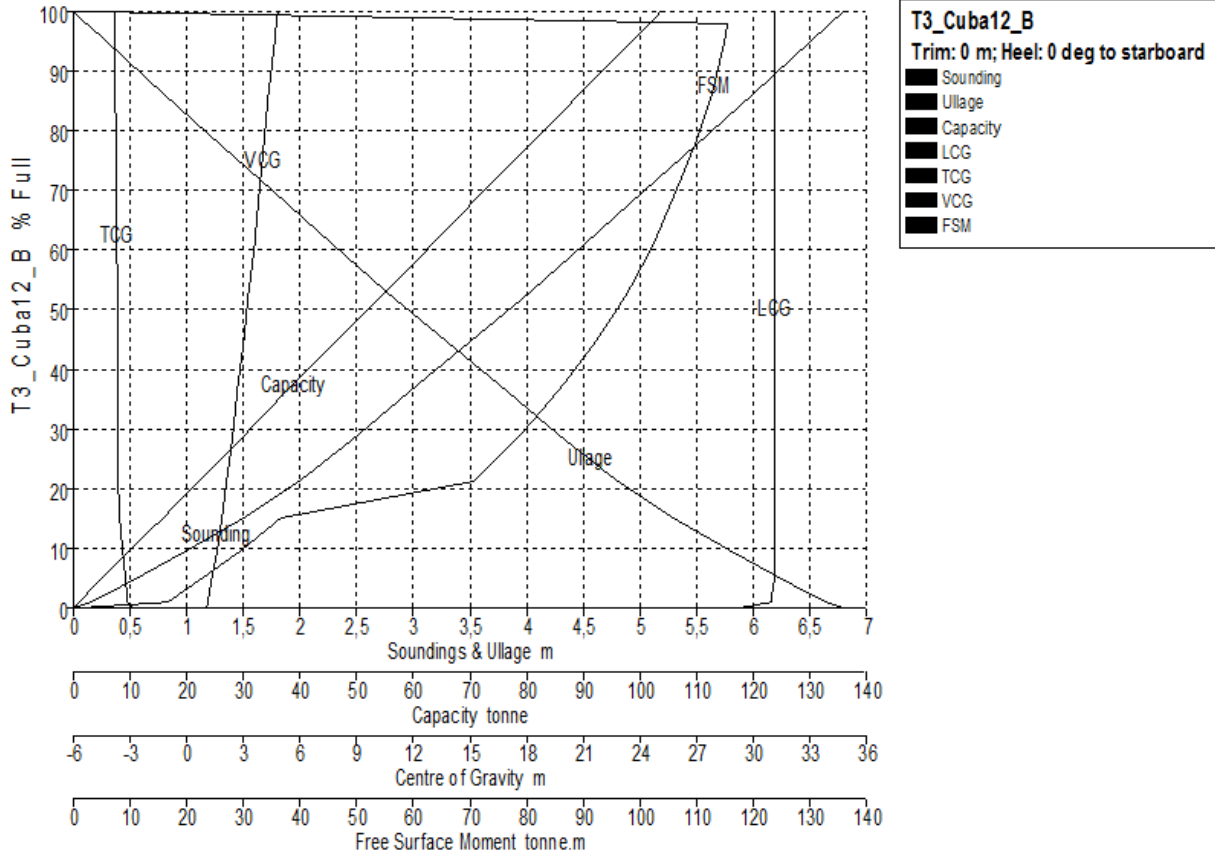
Tank Calibrations - T3_Cuba12_B

Fluid Type = Atun

Specific gravity = 0,65

Permeability = 86 %

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
T3_Cuba12_B	6,794	0,000	100,000	159,641	103,767	31,050	-3,808	4,792	0,000
	6,679	0,115	98,000	156,448	101,691	31,050	-3,802	4,731	115,503
	6,673	0,121	97,900	156,289	101,588	31,050	-3,802	4,728	115,485
	6,500	0,294	94,908	151,512	98,483	31,051	-3,793	4,636	114,872
	6,000	0,794	86,288	137,752	89,539	31,053	-3,768	4,369	112,605
	5,500	1,294	77,736	124,099	80,664	31,055	-3,740	4,101	109,584
	5,000	1,794	69,271	110,585	71,880	31,057	-3,711	3,831	106,042
	4,500	2,294	60,904	97,228	63,198	31,059	-3,680	3,560	102,208
	4,000	2,794	52,653	84,056	54,636	31,062	-3,649	3,286	97,595
	3,500	3,294	44,544	71,110	46,222	31,064	-3,620	3,009	92,121
	3,000	3,794	36,609	58,443	37,988	31,068	-3,596	2,728	85,813
	2,500	4,294	28,879	46,103	29,967	31,071	-3,585	2,439	78,819
	2,000	4,794	21,395	34,155	22,201	31,076	-3,608	2,135	70,770

Cuaderno 4: Cálculos de arquitectura naval

Proyecto nº 16-15.

Fernando García-Ganges Icaza



	1,500	5,294	15,208	24,279	15,781	31,078	-3,515	1,860	36,672
	1,000	5,794	9,525	15,206	9,884	31,075	-3,387	1,592	29,488
	0,500	6,294	4,316	6,890	4,478	31,057	-3,240	1,328	21,871
	0,149	6,645	1,000	1,596	1,038	30,913	-3,110	1,147	16,593
	0,000	6,794	0,000	0,000	0,000	29,072	-2,806	1,056	0,000

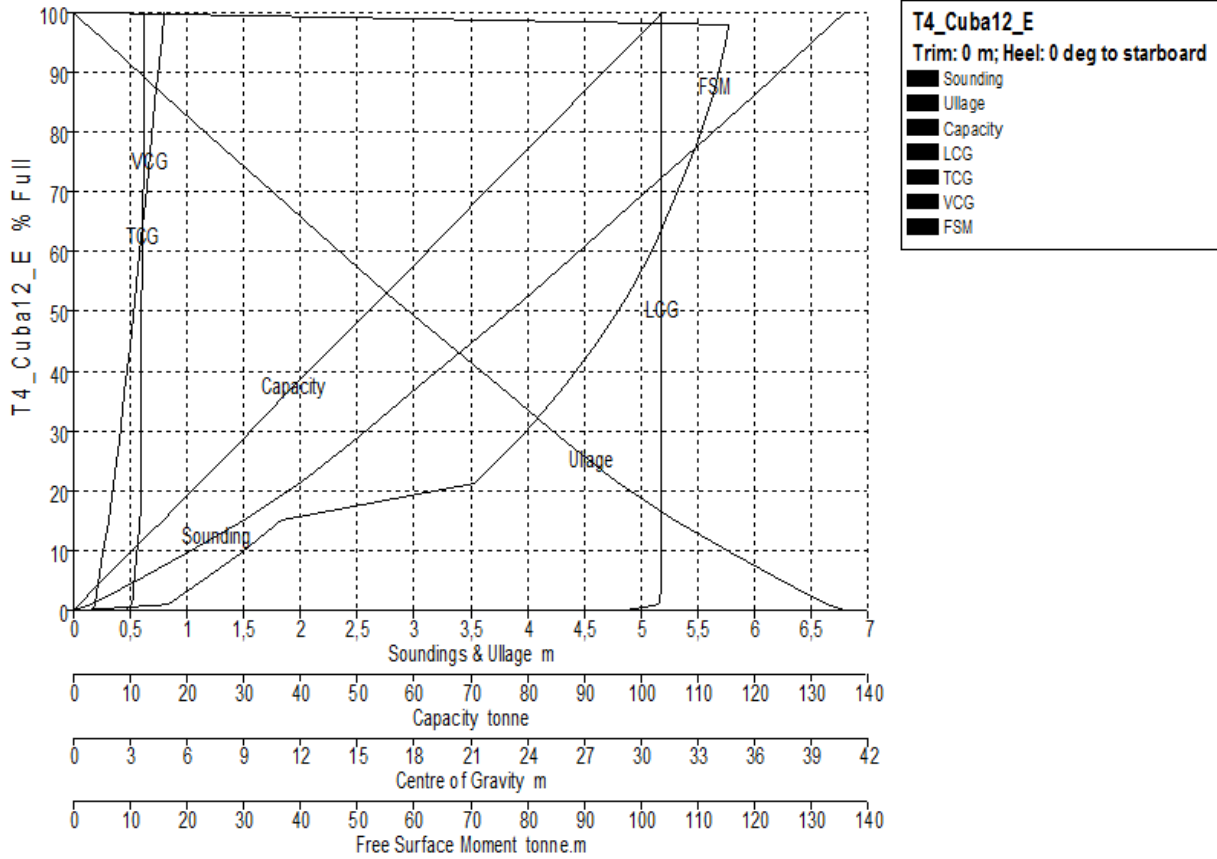
Tank Calibrations - T4_Cuba12_E

Fluid Type = Atun

Specific gravity = 0,65

Permeability = 86 %

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
T4_Cuba12_E	6,794	0,000	100,000	159,641	103,767	31,050	3,808	4,792	0,000
	6,679	0,115	98,000	156,448	101,691	31,050	3,802	4,731	115,503
	6,673	0,121	97,900	156,289	101,588	31,050	3,802	4,728	115,485
	6,500	0,294	94,908	151,512	98,483	31,051	3,793	4,636	114,872
	6,000	0,794	86,288	137,752	89,539	31,053	3,768	4,369	112,605
	5,500	1,294	77,736	124,099	80,664	31,055	3,740	4,101	109,584
	5,000	1,794	69,271	110,585	71,880	31,057	3,711	3,831	106,042
	4,500	2,294	60,904	97,228	63,198	31,059	3,680	3,560	102,208
	4,000	2,794	52,653	84,056	54,636	31,062	3,649	3,286	97,595
	3,500	3,294	44,544	71,110	46,222	31,064	3,620	3,009	92,121
	3,000	3,794	36,609	58,443	37,988	31,068	3,596	2,728	85,813
	2,500	4,294	28,879	46,103	29,967	31,071	3,585	2,439	78,819

Cuaderno 4: Cálculos de arquitectura naval

Proyecto nº 16-15.

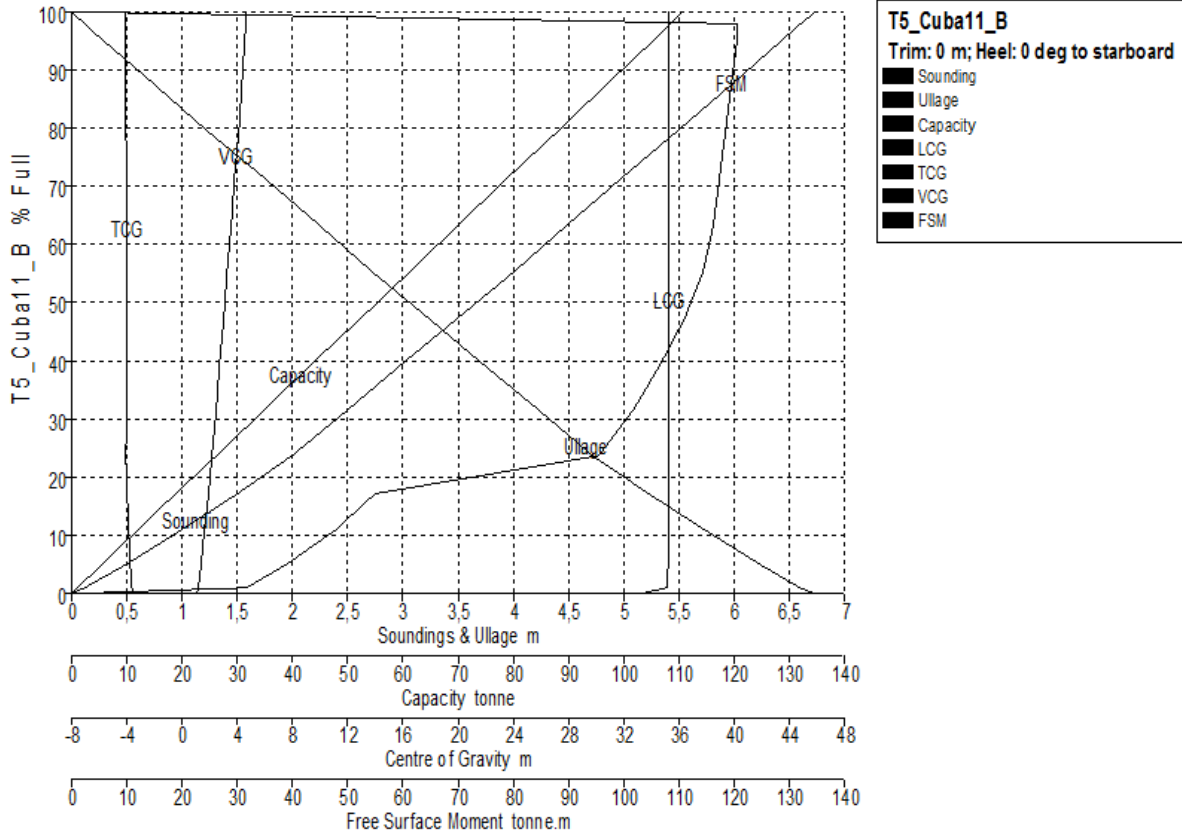
Fernando García-Ganges Icaza



	2,000	4,794	21,395	34,155	22,201	31,076	3,608	2,135	70,770
	1,500	5,294	15,208	24,279	15,781	31,078	3,515	1,860	36,672
	1,000	5,794	9,525	15,206	9,884	31,075	3,387	1,592	29,488
	0,500	6,294	4,316	6,890	4,478	31,057	3,240	1,328	21,871
	0,149	6,645	1,000	1,596	1,038	30,913	3,110	1,147	16,593
	0,000	6,794	0,000	0,000	0,000	29,072	2,806	1,056	0,000

Tank Calibrations - T5_Cuba11_B

Fluid Type = Atun Specific gravity = 0,65
 Permeability = 86 %
 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
T5_Cuba11_B	6,722	0,000	100,000	170,152	110,599	35,239	-4,038	4,723	0,000
	6,601	0,121	98,000	166,749	108,387	35,240	-4,036	4,661	120,695
	6,595	0,127	97,900	166,579	108,276	35,240	-4,036	4,657	120,684
	6,500	0,222	96,338	163,921	106,548	35,240	-4,034	4,609	120,516
	6,000	0,722	88,105	149,912	97,443	35,241	-4,026	4,350	119,532
	5,500	1,222	79,896	135,945	88,365	35,242	-4,017	4,090	118,417
	5,000	1,722	71,714	122,023	79,315	35,243	-4,008	3,829	117,296
	4,500	2,222	63,559	108,146	70,295	35,245	-3,998	3,566	116,100
	4,000	2,722	55,437	94,327	61,313	35,246	-3,987	3,300	114,233
	3,500	3,222	47,376	80,611	52,397	35,248	-3,979	3,032	111,073
	3,000	3,722	39,408	67,053	43,584	35,249	-3,976	2,760	106,645
	2,500	4,222	31,559	53,699	34,904	35,251	-3,987	2,481	101,599

Cuaderno 4: Cálculos de arquitectura naval

Proyecto nº 16-15.

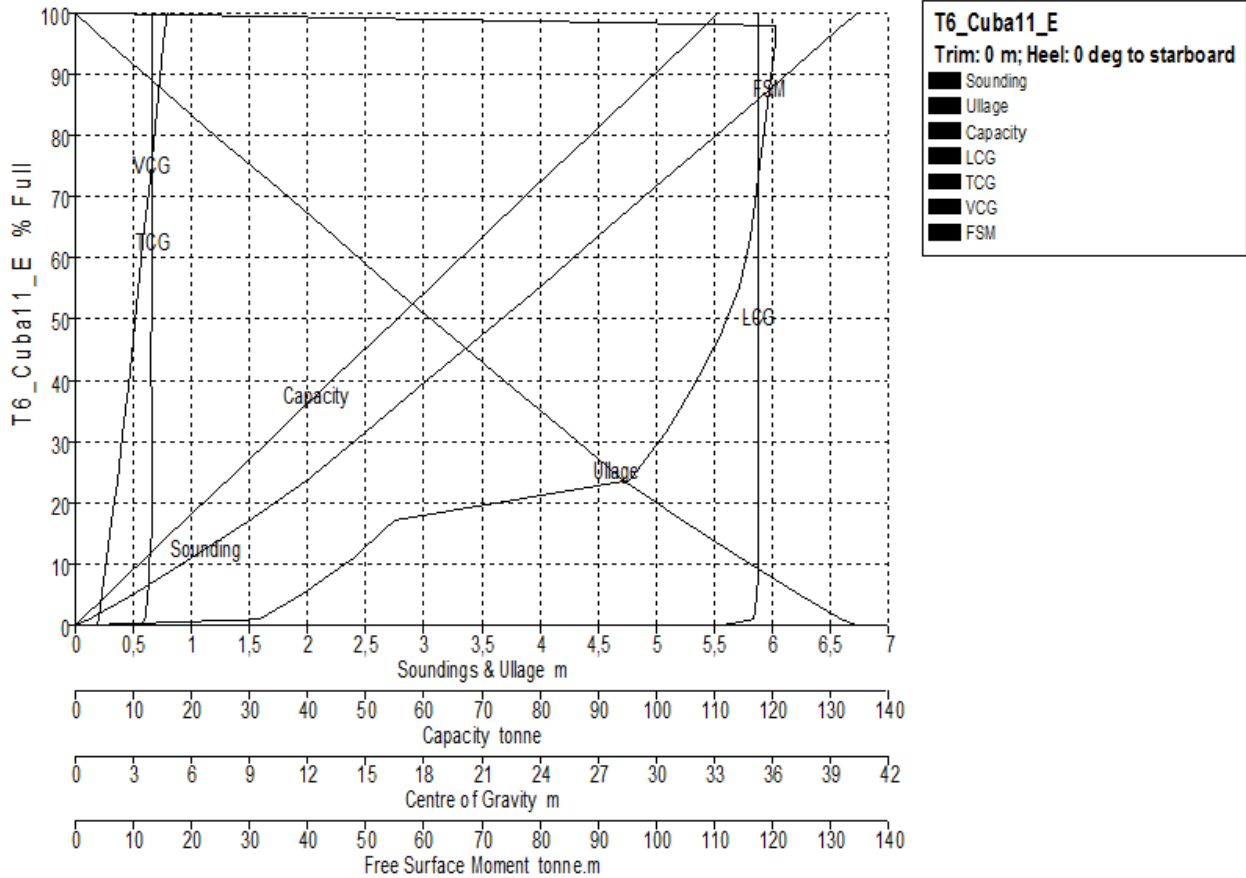
Fernando García-Ganges Icaza



	2,000	4,722	23,854	40,589	26,383	35,252	-4,027	2,192	95,304
	1,500	5,222	17,127	29,141	18,942	35,252	-3,984	1,918	55,066
	1,000	5,722	10,928	18,594	12,086	35,249	-3,885	1,656	47,804
	0,500	6,222	5,069	8,624	5,606	35,232	-3,764	1,397	39,184
	0,128	6,594	1,000	1,702	1,106	35,068	-3,641	1,206	31,798
	0,000	6,722	0,000	0,000	0,000	33,272	-3,391	1,128	0,000

Tank Calibrations - T6_Cuba11_E

Fluid Type = Atun Specific gravity = 0,65
 Permeability = 86 %
 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
T6_Cuba11_E	6,722	0,000	100,000	170,152	110,599	35,239	4,038	4,723	0,000
	6,601	0,121	98,000	166,749	108,387	35,240	4,036	4,661	120,695
	6,595	0,127	97,900	166,579	108,276	35,240	4,036	4,657	120,684
	6,500	0,222	96,338	163,921	106,548	35,240	4,034	4,609	120,516
	6,000	0,722	88,105	149,912	97,443	35,241	4,026	4,350	119,532
	5,500	1,222	79,896	135,945	88,365	35,242	4,017	4,090	118,417
	5,000	1,722	71,714	122,023	79,315	35,243	4,008	3,829	117,296
	4,500	2,222	63,559	108,146	70,295	35,245	3,998	3,566	116,100
	4,000	2,722	55,437	94,327	61,313	35,246	3,987	3,300	114,233
	3,500	3,222	47,376	80,611	52,397	35,248	3,979	3,032	111,073

Cuaderno 4: Cálculos de arquitectura naval

Proyecto nº 16-15.

Fernando García-Ganges Icaza



	3,000	3,722	39,408	67,053	43,584	35,249	3,976	2,760	106,645
	2,500	4,222	31,559	53,699	34,904	35,251	3,987	2,481	101,599
	2,000	4,722	23,854	40,589	26,383	35,252	4,027	2,192	95,304
	1,500	5,222	17,127	29,141	18,942	35,252	3,984	1,918	55,066
	1,000	5,722	10,928	18,594	12,086	35,249	3,885	1,656	47,804
	0,500	6,222	5,069	8,624	5,606	35,232	3,764	1,397	39,184
	0,128	6,594	1,000	1,702	1,106	35,068	3,641	1,206	31,798
	0,000	6,722	0,000	0,000	0,000	33,272	3,391	1,128	0,000

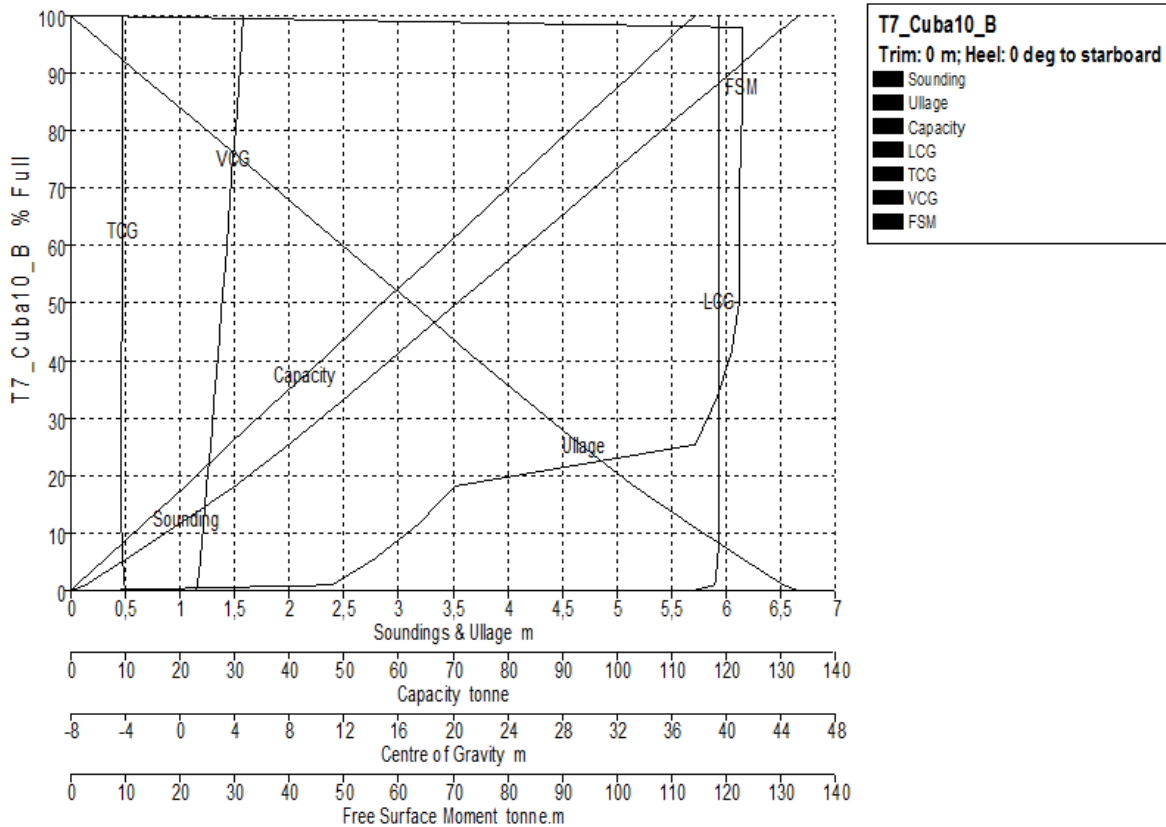
Tank Calibrations - T7_Cuba10_B

Fluid Type = Atun

Specific gravity = 0,65

Permeability = 86 %

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
T7_Cuba10_B	6,656	0,000	100,000	175,739	114,230	39,431	-4,185	4,694	0,000
	6,532	0,124	98,000	172,224	111,946	39,431	-4,186	4,631	122,893
	6,525	0,131	97,900	172,048	111,831	39,431	-4,186	4,628	122,891
	6,500	0,156	97,493	171,334	111,367	39,431	-4,186	4,615	122,886
	6,000	0,656	89,461	157,217	102,191	39,432	-4,189	4,361	122,787
	5,500	1,156	81,430	143,104	93,018	39,432	-4,192	4,107	122,703
	5,000	1,656	73,401	128,994	83,846	39,433	-4,196	3,851	122,621
	4,500	2,156	65,374	114,888	74,677	39,433	-4,201	3,594	122,534
	4,000	2,656	57,349	100,785	65,510	39,434	-4,208	3,335	122,481
	3,500	3,156	49,325	86,683	56,344	39,434	-4,218	3,073	122,358

Cuaderno 4: Cálculos de arquitectura naval

Proyecto nº 16-15.

Fernando García-Ganges Icaza



	3,000	3,656	41,316	72,609	47,196	39,434	-4,232	2,808	120,881
	2,500	4,156	33,357	58,621	38,103	39,434	-4,259	2,536	118,150
	2,000	4,656	25,468	44,756	29,092	39,434	-4,314	2,255	114,425
	1,500	5,156	18,320	32,195	20,927	39,431	-4,310	1,983	70,358
	1,000	5,656	11,758	20,663	13,431	39,422	-4,235	1,724	63,646
	0,500	6,156	5,450	9,578	6,226	39,392	-4,141	1,468	55,395
	0,130	6,526	1,000	1,757	1,142	39,125	-4,040	1,278	47,983
	0,000	6,656	0,000	0,000	0,000	37,472	-3,869	1,194	0,000

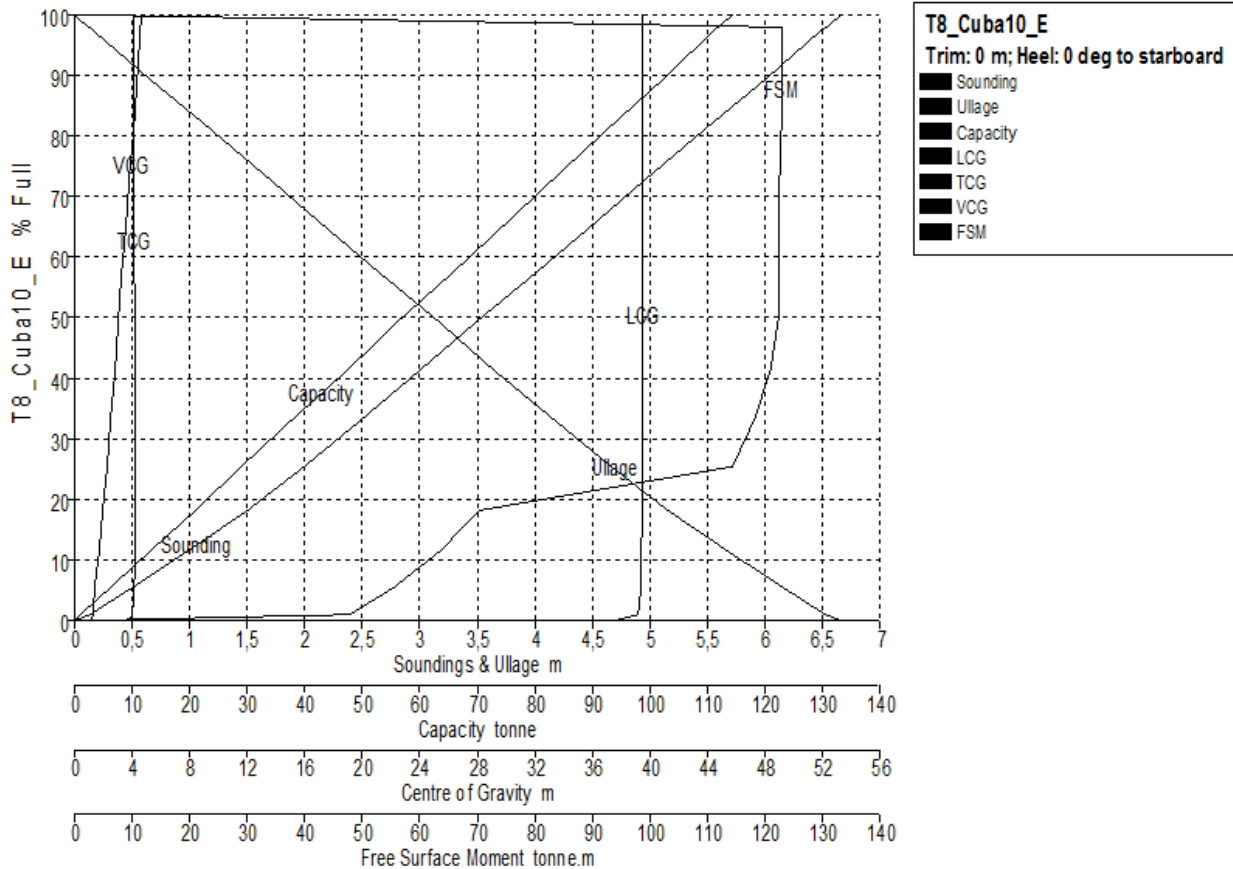
Tank Calibrations - T8_Cuba10_E

Fluid Type = Atun

Specific gravity = 0,65

Permeability = 86 %

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
T8_Cuba10_E	6,656	0,000	100,000	175,739	114,230	39,431	4,185	4,694	0,000
	6,532	0,124	98,000	172,224	111,946	39,431	4,186	4,631	122,893
	6,525	0,131	97,900	172,048	111,831	39,431	4,186	4,628	122,891
	6,500	0,156	97,493	171,334	111,367	39,431	4,186	4,615	122,886
	6,000	0,656	89,461	157,217	102,191	39,432	4,189	4,361	122,787
	5,500	1,156	81,430	143,104	93,018	39,432	4,192	4,107	122,703
	5,000	1,656	73,401	128,994	83,846	39,433	4,196	3,851	122,621
	4,500	2,156	65,374	114,888	74,677	39,433	4,201	3,594	122,534
	4,000	2,656	57,349	100,785	65,510	39,434	4,208	3,335	122,481

Cuaderno 4: Cálculos de arquitectura naval

Proyecto nº 16-15.

Fernando García-Ganges Icaza



	3,500	3,156	49,325	86,683	56,344	39,434	4,218	3,073	122,358
	3,000	3,656	41,316	72,609	47,196	39,434	4,232	2,808	120,881
	2,500	4,156	33,357	58,621	38,103	39,434	4,259	2,536	118,150
	2,000	4,656	25,468	44,756	29,092	39,434	4,314	2,255	114,425
	1,500	5,156	18,320	32,195	20,927	39,431	4,310	1,983	70,358
	1,000	5,656	11,758	20,663	13,431	39,422	4,235	1,724	63,646
	0,500	6,156	5,450	9,578	6,226	39,392	4,141	1,468	55,395
	0,130	6,526	1,000	1,757	1,142	39,125	4,040	1,278	47,983
	0,000	6,656	0,000	0,000	0,000	37,472	3,869	1,194	0,000

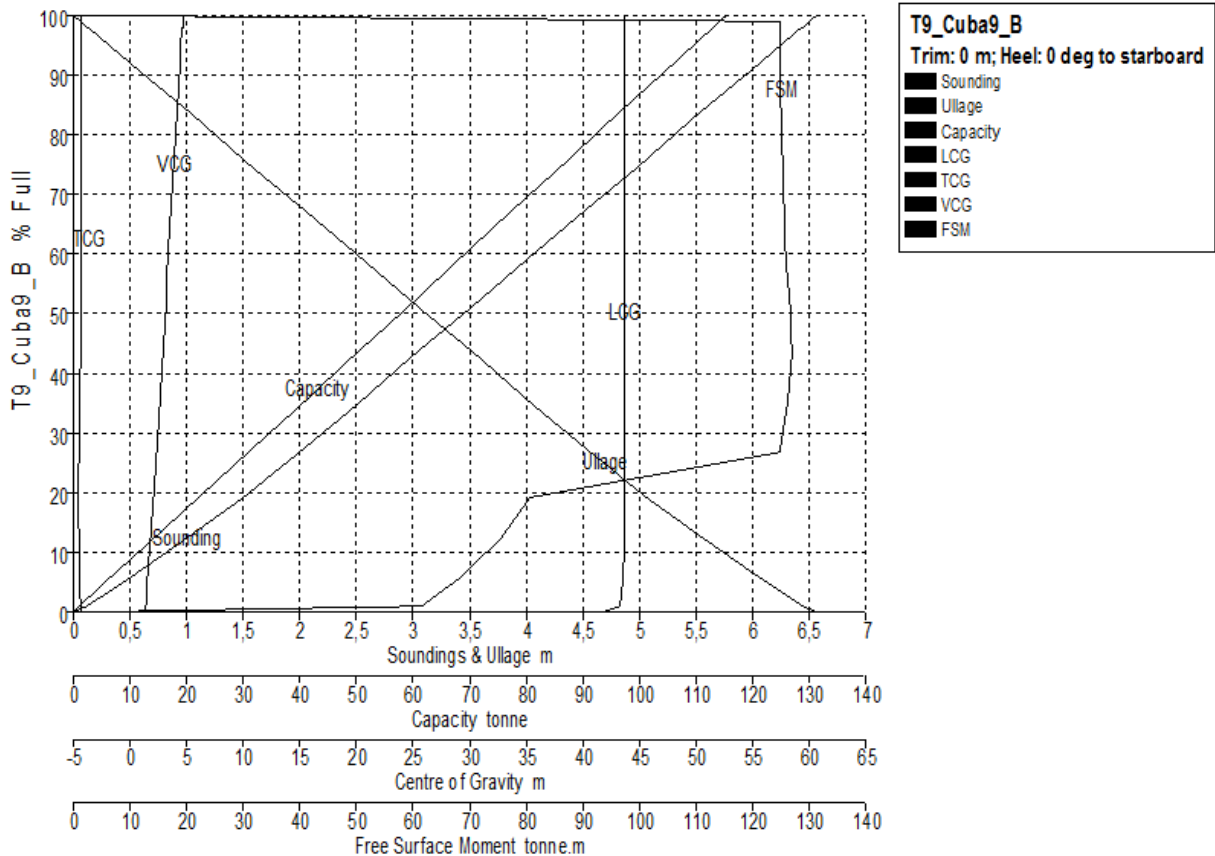
Tank Calibrations - T9_Cuba9_B

Fluid Type = Atun

Specific gravity = 0,65

Permeability = 86 %

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
T9_Cuba9_B	6,563	0,000	100,000	177,369	115,290	43,625	-4,265	4,703	0,000
	6,500	0,063	98,992	175,582	114,128	43,625	-4,266	4,671	124,599
	6,438	0,125	98,000	173,822	112,984	43,625	-4,267	4,640	124,613
	6,432	0,131	97,900	173,644	112,869	43,625	-4,267	4,637	124,614
	6,000	0,563	90,994	161,395	104,907	43,624	-4,274	4,419	124,768
	5,500	1,063	82,991	147,201	95,680	43,624	-4,283	4,167	125,002
	5,000	1,563	74,983	132,996	86,448	43,624	-4,294	3,914	125,281
	4,500	2,063	66,969	118,782	77,208	43,624	-4,307	3,660	125,547

Cuaderno 4: Cálculos de arquitectura naval

Proyecto nº 16-15.

Fernando García-Ganges Icaza



	4,000	2,563	58,948	104,556	67,961	43,624	-4,323	3,404	125,870
	3,500	3,063	50,918	90,313	58,703	43,623	-4,344	3,147	126,563
	3,000	3,563	42,874	76,045	49,429	43,623	-4,371	2,886	126,864
	2,500	4,063	34,836	61,789	40,163	43,622	-4,411	2,620	126,020
	2,000	4,563	26,823	47,576	30,925	43,620	-4,479	2,346	124,604
	1,500	5,063	19,285	34,206	22,234	43,616	-4,523	2,073	80,737
	1,000	5,563	12,438	22,061	14,340	43,606	-4,467	1,817	75,455
	0,500	6,063	5,776	10,246	6,660	43,570	-4,395	1,563	68,396
	0,129	6,434	1,000	1,774	1,153	43,238	-4,315	1,371	61,455
	0,000	6,563	0,000	0,000	0,000	41,672	-4,208	1,287	0,000

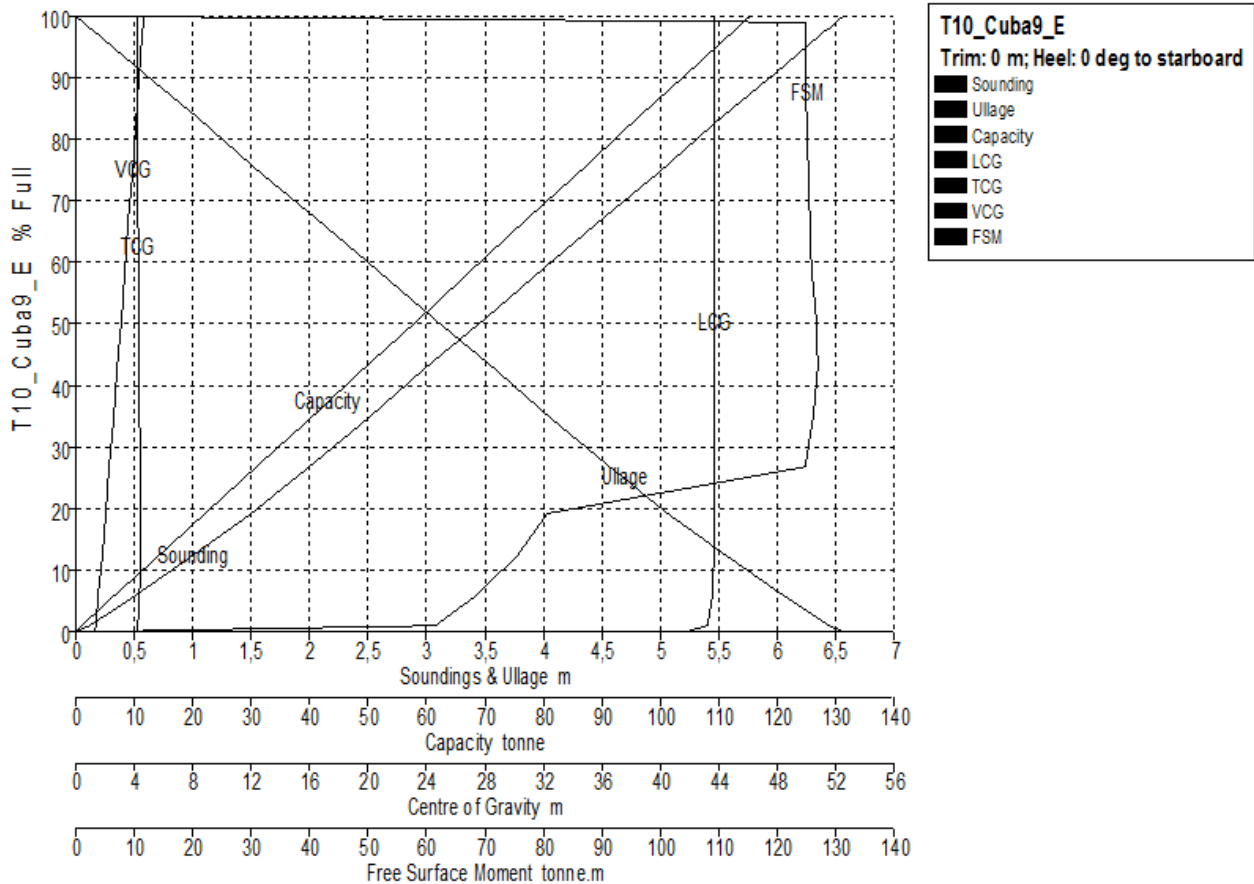
Tank Calibrations - T10_Cuba9_E

Fluid Type = Atun

Specific gravity = 0,65

Permeability = 86 %

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
T10_Cuba9_E	6,563	0,000	100,000	177,369	115,290	43,625	4,265	4,703	0,000
	6,500	0,063	98,992	175,582	114,128	43,625	4,266	4,671	124,599
	6,438	0,125	98,000	173,822	112,984	43,625	4,267	4,640	124,613
	6,432	0,131	97,900	173,644	112,869	43,625	4,267	4,637	124,614
	6,000	0,563	90,994	161,395	104,907	43,624	4,274	4,419	124,768
	5,500	1,063	82,991	147,201	95,680	43,624	4,283	4,167	125,002

Cuaderno 4: Cálculos de arquitectura naval

Proyecto nº 16-15.

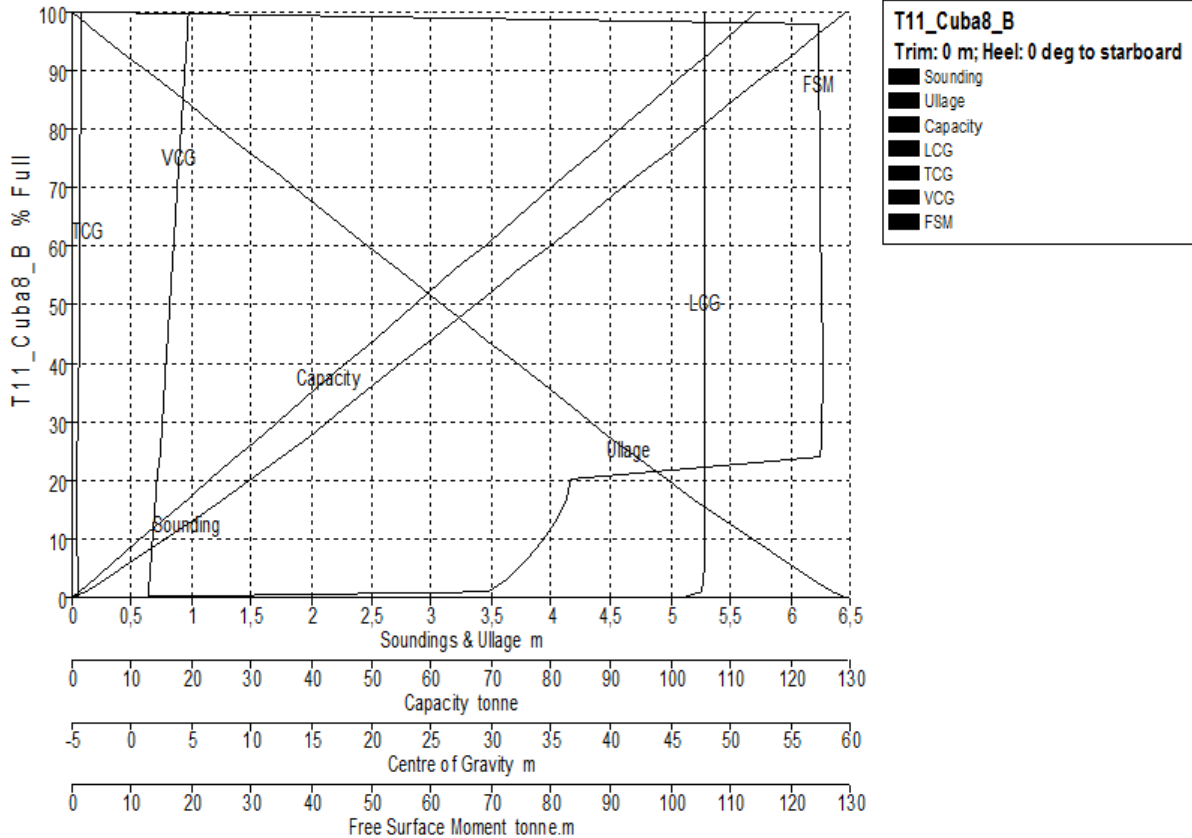
Fernando García-Ganges Icaza



	5,000	1,563	74,983	132,996	86,448	43,624	4,294	3,914	125,281
	4,500	2,063	66,969	118,782	77,208	43,624	4,307	3,660	125,547
	4,000	2,563	58,948	104,556	67,961	43,624	4,323	3,404	125,870
	3,500	3,063	50,918	90,313	58,703	43,623	4,344	3,147	126,563
	3,000	3,563	42,874	76,045	49,429	43,623	4,371	2,886	126,864
	2,500	4,063	34,836	61,789	40,163	43,622	4,411	2,620	126,020
	2,000	4,563	26,823	47,576	30,925	43,620	4,479	2,346	124,604
	1,500	5,063	19,285	34,206	22,234	43,616	4,523	2,073	80,737
	1,000	5,563	12,438	22,061	14,340	43,606	4,467	1,817	75,455
	0,500	6,063	5,776	10,246	6,660	43,570	4,395	1,563	68,396
	0,129	6,434	1,000	1,774	1,153	43,238	4,315	1,371	61,455
	0,000	6,563	0,000	0,000	0,000	41,672	4,208	1,287	0,000

Tank Calibrations - T11_Cuba8_B

Fluid Type = Atun Specific gravity = 0,65
 Permeability = 86 %
 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
T11_Cuba8_B	6,459	0,000	100,000	175,856	114,307	47,821	-4,276	4,730	0,000
	6,335	0,124	98,000	172,339	112,020	47,821	-4,278	4,668	124,681
	6,329	0,130	97,900	172,163	111,906	47,821	-4,278	4,665	124,682
	6,250	0,209	96,628	169,926	110,452	47,821	-4,280	4,625	124,689
	6,000	0,459	92,594	162,832	105,841	47,821	-4,284	4,499	124,715
	5,750	0,709	88,560	155,738	101,230	47,820	-4,289	4,373	124,746

Cuaderno 4: Cálculos de arquitectura naval

Proyecto nº 16-15.

Fernando García-Ganges Icaza



	5,500	0,959	84,525	148,643	96,618	47,820	-4,294	4,247	124,780
	5,250	1,209	80,490	141,547	92,006	47,820	-4,300	4,121	124,819
	5,000	1,459	76,455	134,451	87,393	47,820	-4,307	3,994	124,859
	4,750	1,709	72,419	127,353	82,780	47,820	-4,314	3,868	124,900
	4,500	1,959	68,383	120,255	78,166	47,819	-4,322	3,741	124,942
	4,250	2,209	64,346	113,157	73,552	47,819	-4,331	3,614	124,985
	4,000	2,459	60,309	106,057	68,937	47,819	-4,341	3,487	125,034
	3,750	2,709	56,271	98,956	64,322	47,818	-4,352	3,359	125,092
	3,500	2,959	52,233	91,854	59,705	47,818	-4,365	3,231	125,178
	3,250	3,209	48,193	84,750	55,088	47,818	-4,381	3,102	125,292
	3,000	3,459	44,152	77,645	50,469	47,817	-4,399	2,973	125,356
	2,750	3,709	40,111	70,538	45,850	47,817	-4,420	2,842	125,361
	2,500	3,959	36,071	63,432	41,231	47,816	-4,447	2,711	125,309
	2,250	4,209	32,031	56,328	36,613	47,815	-4,480	2,578	125,229
	2,000	4,459	27,992	49,225	31,996	47,814	-4,523	2,442	125,119
	1,750	4,709	23,954	42,125	27,381	47,812	-4,581	2,304	124,936
	1,500	4,959	20,140	35,418	23,022	47,810	-4,617	2,168	83,217
	1,250	5,209	16,620	29,227	18,997	47,807	-4,601	2,041	82,462
	1,000	5,459	13,117	23,066	14,993	47,802	-4,580	1,914	80,796
	0,750	5,709	9,643	16,958	11,023	47,794	-4,556	1,787	78,435
	0,500	5,959	6,208	10,917	7,096	47,775	-4,528	1,661	75,599
	0,250	6,209	2,821	4,961	3,225	47,712	-4,495	1,534	71,989
	0,114	6,345	1,000	1,759	1,143	47,499	-4,471	1,464	69,495
	0,000	6,459	0,000	0,000	0,000	45,872	-4,417	1,391	0,000

Tank Calibrations - T12_Cuba8_E

Fluid Type = Atun

Specific gravity = 0,65

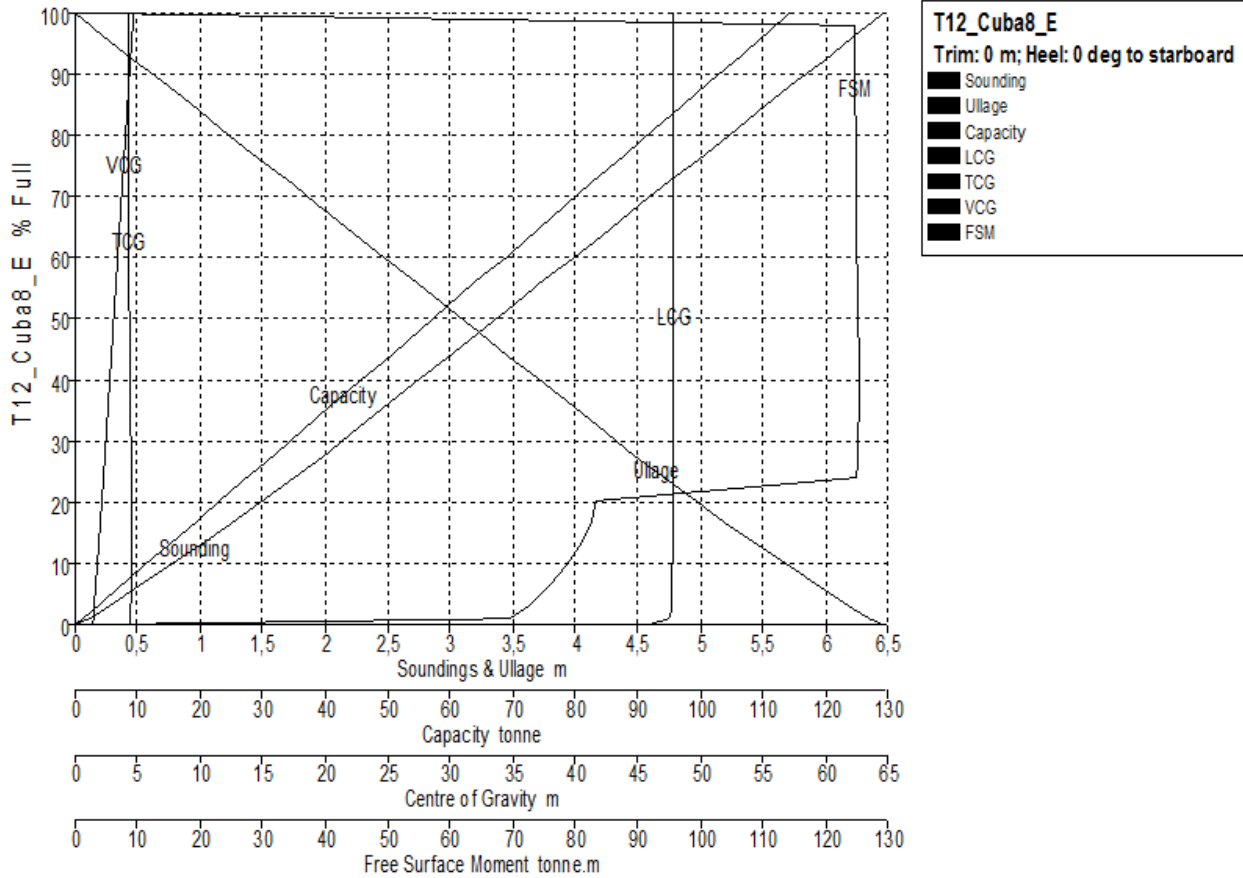
Permeability = 86 %

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

Cuaderno 4: Cálculos de arquitectura naval

Proyecto nº 16-15.

Fernando García-Ganges Icaza



Tank Name	Sounding m	Ullage m	% Full	Capacity m ³	Capacity tonne	LCG m	TCG m	VCG m	FSM tonne.m
T12_Cuba8_E	6,459	0,000	100,000	175,856	114,307	47,821	4,276	4,730	0,000
	6,335	0,124	98,000	172,339	112,020	47,821	4,278	4,668	124,681
	6,329	0,130	97,900	172,163	111,906	47,821	4,278	4,665	124,682
	6,250	0,209	96,628	169,926	110,452	47,821	4,280	4,625	124,689
	6,000	0,459	92,594	162,832	105,841	47,821	4,284	4,499	124,715
	5,750	0,709	88,560	155,738	101,230	47,820	4,289	4,373	124,746
	5,500	0,959	84,525	148,643	96,618	47,820	4,294	4,247	124,780
	5,250	1,209	80,490	141,547	92,006	47,820	4,300	4,121	124,819
	5,000	1,459	76,455	134,451	87,393	47,820	4,307	3,994	124,859
	4,750	1,709	72,419	127,353	82,780	47,820	4,314	3,868	124,900
	4,500	1,959	68,383	120,255	78,166	47,819	4,322	3,741	124,942
	4,250	2,209	64,346	113,157	73,552	47,819	4,331	3,614	124,985
	4,000	2,459	60,309	106,057	68,937	47,819	4,341	3,487	125,034
	3,750	2,709	56,271	98,956	64,322	47,818	4,352	3,359	125,092
	3,500	2,959	52,233	91,854	59,705	47,818	4,365	3,231	125,178
	3,250	3,209	48,193	84,750	55,088	47,818	4,381	3,102	125,292
	3,000	3,459	44,152	77,645	50,469	47,817	4,399	2,973	125,356
	2,750	3,709	40,111	70,538	45,850	47,817	4,420	2,842	125,361
	2,500	3,959	36,071	63,432	41,231	47,816	4,447	2,711	125,309
	2,250	4,209	32,031	56,328	36,613	47,815	4,480	2,578	125,229
	2,000	4,459	27,992	49,225	31,996	47,814	4,523	2,442	125,119
	1,750	4,709	23,954	42,125	27,381	47,812	4,581	2,304	124,936
	1,500	4,959	20,140	35,418	23,022	47,810	4,617	2,168	83,217
	1,250	5,209	16,620	29,227	18,997	47,807	4,601	2,041	82,462

Cuaderno 4: Cálculos de arquitectura naval

Proyecto nº 16-15.

Fernando García-Ganges Icaza



	1,000	5,459	13,117	23,066	14,993	47,802	4,580	1,914	80,796
	0,750	5,709	9,643	16,958	11,023	47,794	4,556	1,787	78,435
	0,500	5,959	6,208	10,917	7,096	47,775	4,528	1,661	75,599
	0,250	6,209	2,821	4,961	3,225	47,712	4,495	1,534	71,989
	0,114	6,345	1,000	1,759	1,143	47,499	4,471	1,464	69,495
	0,000	6,459	0,000	0,000	0,000	45,872	4,417	1,391	0,000

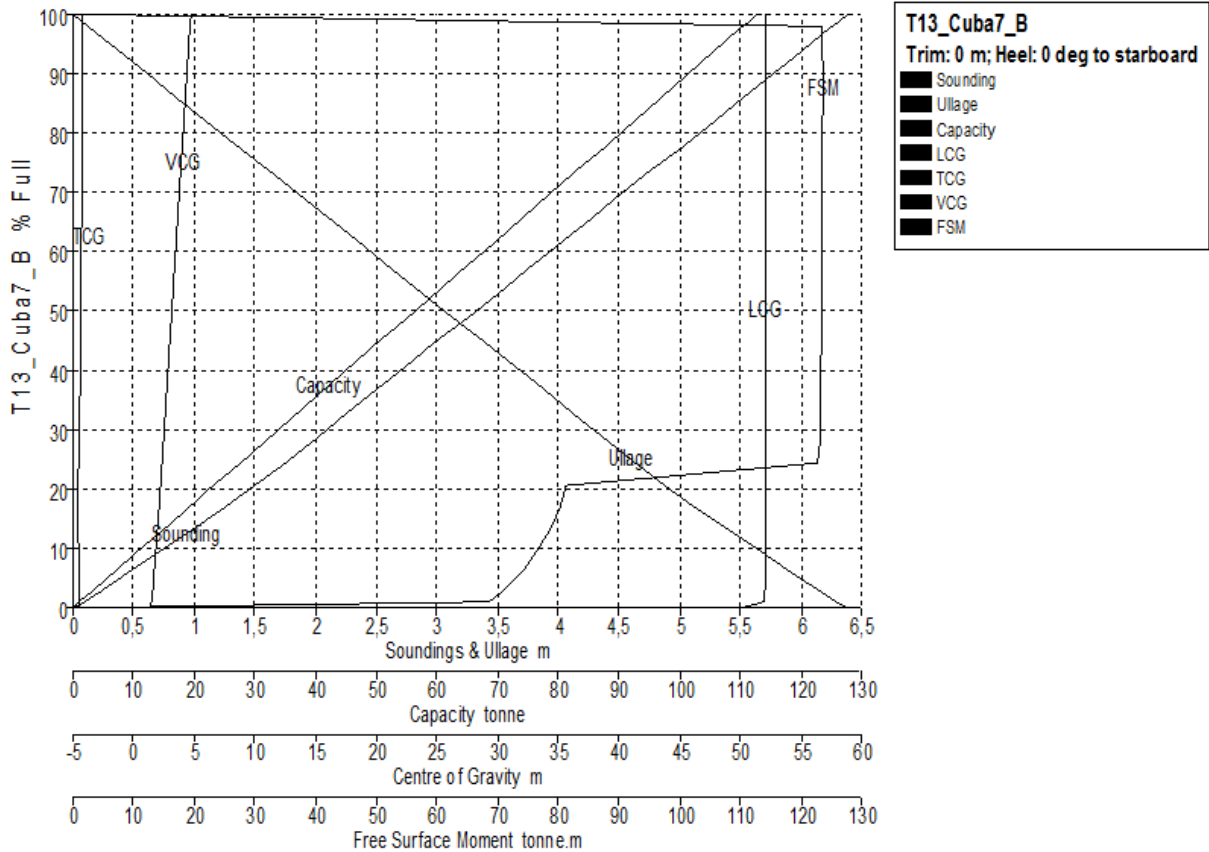
Tank Calibrations - T13_Cuba7_B

Fluid Type = Atun

Specific gravity = 0,65

Permeability = 86 %

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
T13_Cuba7_B	6,381	0,000	100,000	173,431	112,730	52,019	-4,252	4,761	0,000
	6,258	0,123	98,000	169,963	110,476	52,019	-4,253	4,699	123,490
	6,252	0,129	97,900	169,789	110,363	52,019	-4,253	4,696	123,491
	6,250	0,131	97,864	169,726	110,322	52,019	-4,253	4,695	123,491
	6,000	0,381	93,787	162,655	105,726	52,019	-4,257	4,569	123,513
	5,750	0,631	89,709	155,584	101,130	52,019	-4,262	4,443	123,526
	5,500	0,881	85,632	148,512	96,533	52,019	-4,266	4,317	123,529
	5,250	1,131	81,554	141,441	91,937	52,018	-4,271	4,191	123,525
	5,000	1,381	77,477	134,370	87,340	52,018	-4,277	4,064	123,509
	4,750	1,631	73,400	127,299	82,744	52,018	-4,283	3,937	123,485
	4,500	1,881	69,323	120,228	78,148	52,018	-4,291	3,811	123,461

Cuaderno 4: Cálculos de arquitectura naval

Proyecto nº 16-15.

Fernando García-Ganges Icaza



	4,250	2,131	65,247	113,158	73,553	52,018	-4,299	3,684	123,435
	4,000	2,381	61,171	106,089	68,958	52,017	-4,308	3,556	123,413
	3,750	2,631	57,095	99,020	64,363	52,017	-4,318	3,429	123,393
	3,500	2,881	53,019	91,951	59,768	52,016	-4,330	3,301	123,356
	3,250	3,131	48,944	84,884	55,174	52,016	-4,344	3,172	123,312
	3,000	3,381	44,869	77,817	50,581	52,015	-4,361	3,043	123,274
	2,750	3,631	40,795	70,750	45,988	52,015	-4,381	2,913	123,240
	2,500	3,881	36,720	63,685	41,395	52,014	-4,405	2,782	123,214
	2,250	4,131	32,647	56,620	36,803	52,013	-4,436	2,650	123,197
	2,000	4,381	28,573	49,555	32,211	52,012	-4,475	2,515	123,081
	1,750	4,631	24,503	42,495	27,622	52,010	-4,528	2,377	122,680
	1,500	4,881	20,502	35,558	23,112	52,008	-4,591	2,237	81,198
	1,250	5,131	16,964	29,421	19,124	52,006	-4,576	2,110	80,229
	1,000	5,381	13,444	23,317	15,156	52,003	-4,558	1,984	78,693
	0,750	5,631	9,951	17,257	11,217	51,998	-4,537	1,857	76,731
	0,500	5,881	6,490	11,256	7,316	51,988	-4,513	1,731	74,294
	0,250	6,131	3,073	5,330	3,464	51,955	-4,483	1,605	71,064
	0,096	6,285	1,000	1,734	1,127	51,828	-4,464	1,527	68,544
	0,000	6,381	0,000	0,000	0,000	50,072	-4,479	1,469	0,000

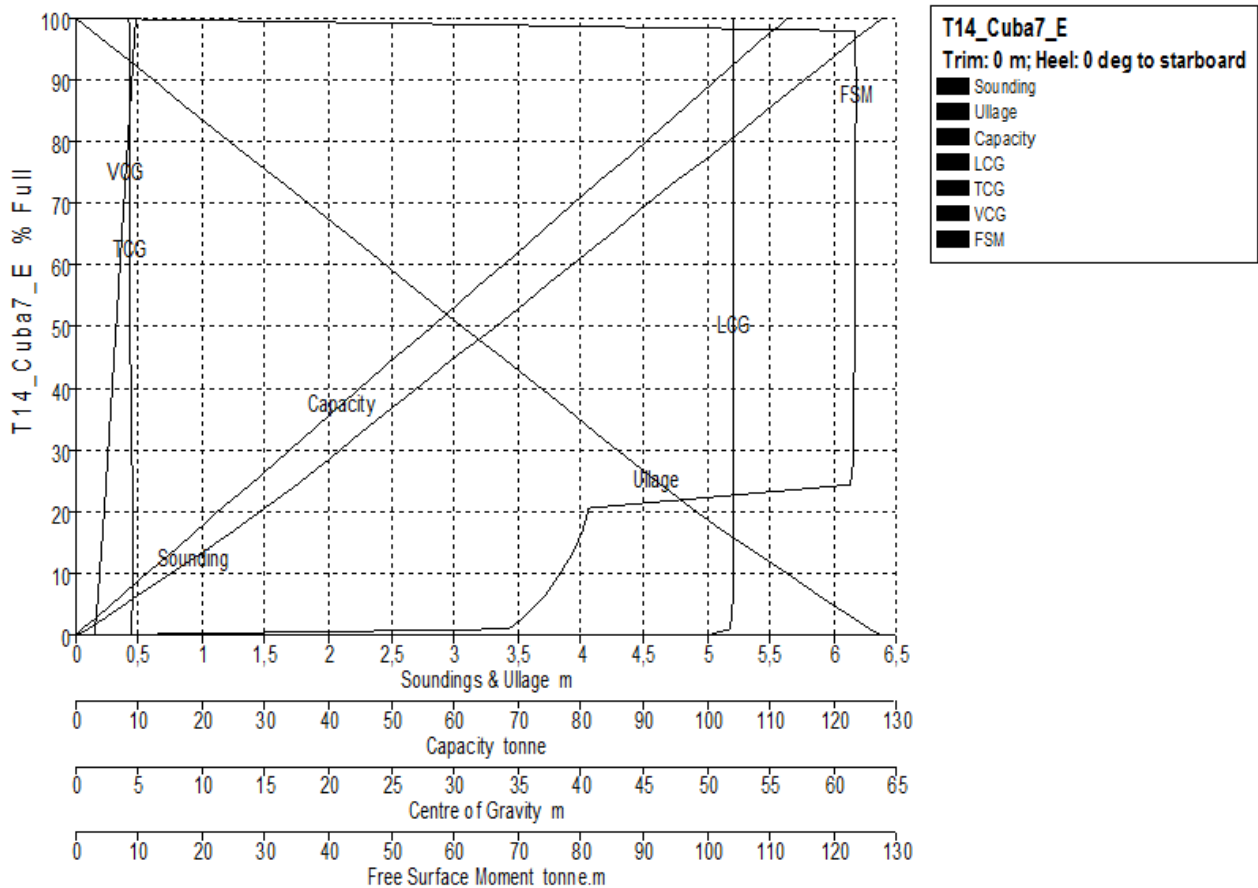
Tank Calibrations - T14_Cuba7_E

Fluid Type = Atun

Specific gravity = 0,65

Permeability = 86 %

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



Cuaderno 4: Cálculos de arquitectura naval

Proyecto nº 16-15.

Fernando García-Ganges Icaza



Tank Name	Sounding m	Ullage m	% Full	Capacity m ³	Capacity tonne	LCG m	TCG m	VCG m	FSM tonne.m
T14_Cuba7_E	6,381	0,000	100,000	173,431	112,730	52,019	4,252	4,761	0,000
	6,258	0,123	98,000	169,963	110,476	52,019	4,253	4,699	123,490
	6,252	0,129	97,900	169,789	110,363	52,019	4,253	4,696	123,491
	6,250	0,131	97,864	169,726	110,322	52,019	4,253	4,695	123,491
	6,000	0,381	93,787	162,655	105,726	52,019	4,257	4,569	123,513
	5,750	0,631	89,709	155,584	101,130	52,019	4,262	4,443	123,526
	5,500	0,881	85,632	148,512	96,533	52,019	4,266	4,317	123,529
	5,250	1,131	81,554	141,441	91,937	52,018	4,271	4,191	123,525
	5,000	1,381	77,477	134,370	87,340	52,018	4,277	4,064	123,509
	4,750	1,631	73,400	127,299	82,744	52,018	4,283	3,937	123,485
	4,500	1,881	69,323	120,228	78,148	52,018	4,291	3,811	123,461
	4,250	2,131	65,247	113,158	73,553	52,018	4,299	3,684	123,435
	4,000	2,381	61,171	106,089	68,958	52,017	4,308	3,556	123,413
	3,750	2,631	57,095	99,020	64,363	52,017	4,318	3,429	123,393
	3,500	2,881	53,019	91,951	59,768	52,016	4,330	3,301	123,356
	3,250	3,131	48,944	84,884	55,174	52,016	4,344	3,172	123,312
	3,000	3,381	44,869	77,817	50,581	52,015	4,361	3,043	123,274
	2,750	3,631	40,795	70,750	45,988	52,015	4,381	2,913	123,240
	2,500	3,881	36,720	63,685	41,395	52,014	4,405	2,782	123,214
	2,250	4,131	32,647	56,620	36,803	52,013	4,436	2,650	123,197
	2,000	4,381	28,573	49,555	32,211	52,012	4,475	2,515	123,081
	1,750	4,631	24,503	42,495	27,622	52,010	4,528	2,377	122,680
	1,500	4,881	20,502	35,558	23,112	52,008	4,591	2,237	81,198
	1,250	5,131	16,964	29,421	19,124	52,006	4,576	2,110	80,229
	1,000	5,381	13,444	23,317	15,156	52,003	4,558	1,984	78,693
	0,750	5,631	9,951	17,257	11,217	51,998	4,537	1,857	76,731
	0,500	5,881	6,490	11,256	7,316	51,988	4,513	1,731	74,294
	0,250	6,131	3,073	5,330	3,464	51,955	4,483	1,605	71,064
	0,096	6,285	1,000	1,734	1,127	51,828	4,464	1,527	68,544
	0,000	6,381	0,000	0,000	0,000	50,072	4,479	1,469	0,000

Tank Calibrations - T15_Cuba6_B

Fluid Type = Atun

Specific gravity = 0,65

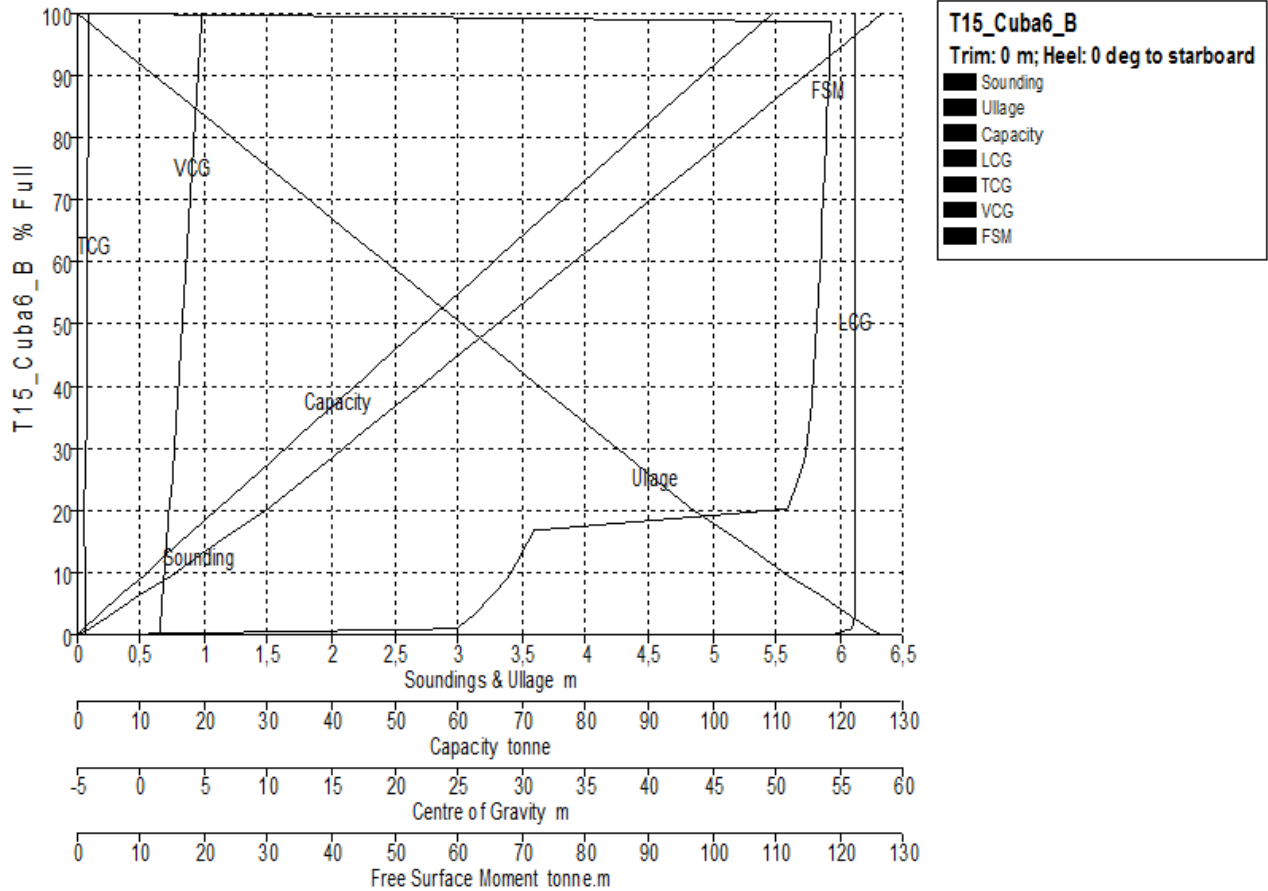
Permeability = 86 %

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

Cuaderno 4: Cálculos de arquitectura naval

Proyecto nº 16-15.

Fernando García-Ganges Icaza



Tank Name	Sounding m	Ullage m	% Full	Capacity m ³	Capacity tonne	LCG m	TCG m	VCG m	FSM tonne.m
T15_Cuba6_B	6,336	0,000	100,000	168,293	109,391	56,212	-4,157	4,799	0,000
	6,250	0,086	98,574	165,894	107,831	56,212	-4,158	4,755	118,575
	6,215	0,121	98,000	164,927	107,203	56,211	-4,158	4,737	118,555
	6,209	0,127	97,900	164,759	107,093	56,211	-4,158	4,734	118,552
	6,000	0,336	94,430	158,920	103,298	56,211	-4,160	4,628	118,431
	5,750	0,586	90,288	151,949	98,767	56,211	-4,163	4,502	118,277
	5,500	0,836	86,148	144,981	94,238	56,211	-4,166	4,375	118,111
	5,250	1,086	82,010	138,017	89,711	56,210	-4,169	4,248	117,932
	5,000	1,336	77,874	131,056	85,186	56,210	-4,173	4,121	117,739
	4,750	1,586	73,740	124,099	80,665	56,209	-4,177	3,994	117,539
	4,500	1,836	69,609	117,147	76,145	56,209	-4,182	3,867	117,335
	4,250	2,086	65,480	110,198	71,629	56,208	-4,187	3,739	117,130
	4,000	2,336	61,353	103,254	67,115	56,208	-4,194	3,612	116,928
	3,750	2,586	57,229	96,313	62,604	56,207	-4,202	3,483	116,716
	3,500	2,836	53,108	89,377	58,095	56,207	-4,211	3,355	116,477
	3,250	3,086	48,990	82,447	53,590	56,206	-4,222	3,226	116,218
	3,000	3,336	44,875	75,521	49,089	56,205	-4,235	3,096	115,952
	2,750	3,586	40,763	68,601	44,591	56,204	-4,251	2,966	115,678
	2,500	3,836	36,654	61,687	40,096	56,203	-4,272	2,835	115,401
	2,250	4,086	32,549	54,778	35,606	56,201	-4,297	2,702	115,099
	2,000	4,336	28,449	47,878	31,121	56,200	-4,331	2,566	114,471
	1,750	4,586	24,360	40,996	26,648	56,197	-4,378	2,428	113,298
	1,500	4,836	20,288	34,144	22,194	56,195	-4,447	2,286	111,618
	1,250	5,086	16,740	28,172	18,312	56,192	-4,435	2,158	71,887

Cuaderno 4: Cálculos de arquitectura naval

Proyecto nº 16-15.

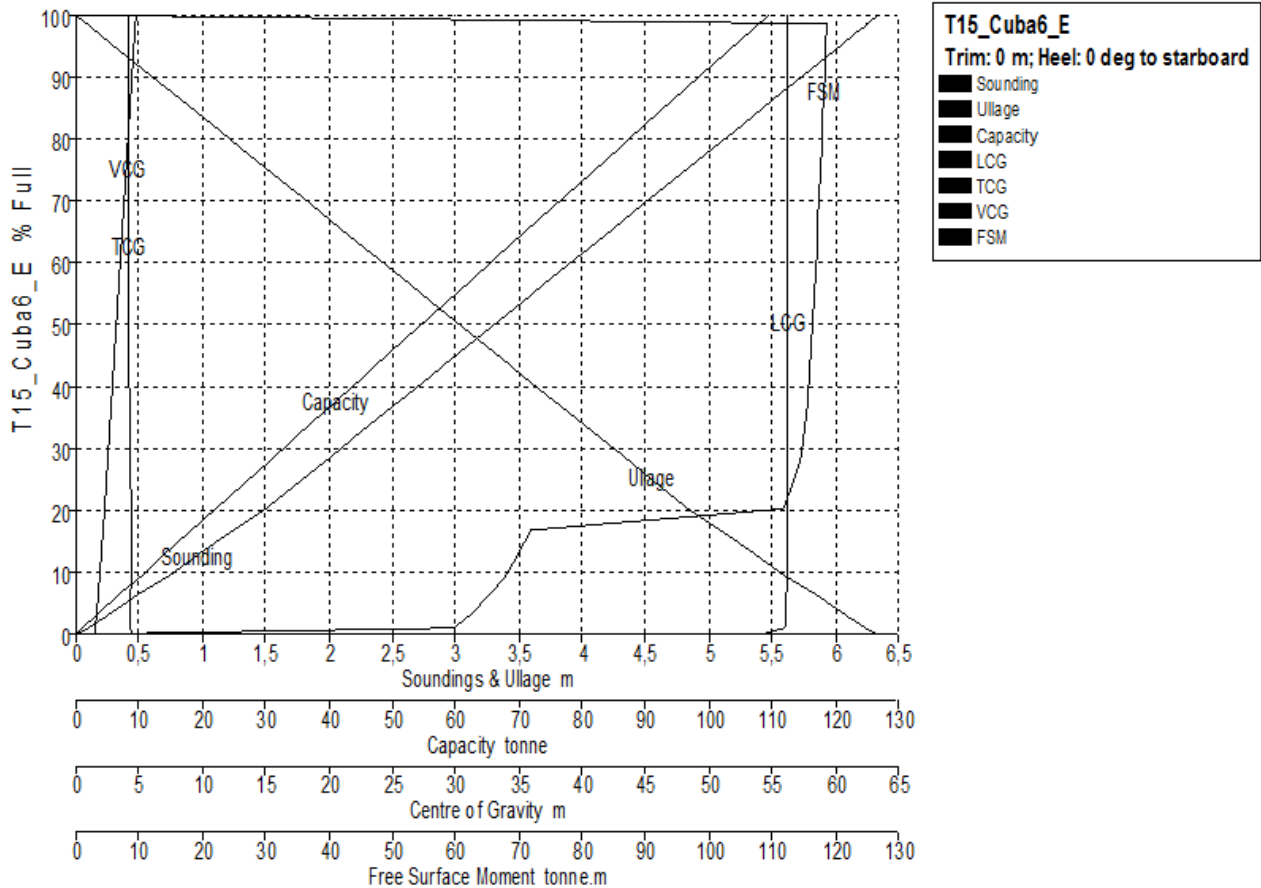
Fernando García-Ganges Icaza



	1,000	5,336	13,247	22,294	14,491	56,188	-4,414	2,031	70,186
	0,750	5,586	9,785	16,467	10,704	56,182	-4,391	1,904	68,163
	0,500	5,836	6,362	10,706	6,959	56,169	-4,362	1,777	65,541
	0,250	6,086	2,991	5,034	3,272	56,132	-4,330	1,651	62,121
	0,100	6,236	1,000	1,683	1,094	55,994	-4,315	1,575	59,656
	0,000	6,336	0,000	0,000	0,000	54,272	-4,391	1,514	0,000

Tank Calibrations - T15_Cuba6_E

Fluid Type = Atun Specific gravity = 0,65
 Permeability = 86 %
 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
T15_Cuba6_E	6,336	0,000	100,000	168,293	109,391	56,212	4,157	4,799	0,000
	6,250	0,086	98,574	165,894	107,831	56,212	4,158	4,755	118,575
	6,215	0,121	98,000	164,927	107,203	56,211	4,158	4,737	118,555
	6,209	0,127	97,900	164,759	107,093	56,211	4,158	4,734	118,552
	6,000	0,336	94,430	158,920	103,298	56,211	4,160	4,628	118,431
	5,750	0,586	90,288	151,949	98,767	56,211	4,163	4,502	118,277
	5,500	0,836	86,148	144,981	94,238	56,211	4,166	4,375	118,111
	5,250	1,086	82,010	138,017	89,711	56,210	4,169	4,248	117,932
	5,000	1,336	77,874	131,056	85,186	56,210	4,173	4,121	117,739
	4,750	1,586	73,740	124,099	80,665	56,209	4,177	3,994	117,539

Cuaderno 4: Cálculos de arquitectura naval

Proyecto nº 16-15.

Fernando García-Ganges Icaza



	4,500	1,836	69,609	117,147	76,145	56,209	4,182	3,867	117,335
	4,250	2,086	65,480	110,198	71,629	56,208	4,187	3,739	117,130
	4,000	2,336	61,353	103,254	67,115	56,208	4,194	3,612	116,928
	3,750	2,586	57,229	96,313	62,604	56,207	4,202	3,483	116,716
	3,500	2,836	53,108	89,377	58,095	56,207	4,211	3,355	116,477
	3,250	3,086	48,990	82,447	53,590	56,206	4,222	3,226	116,218
	3,000	3,336	44,875	75,521	49,089	56,205	4,235	3,096	115,952
	2,750	3,586	40,763	68,601	44,591	56,204	4,251	2,966	115,678
	2,500	3,836	36,654	61,687	40,096	56,203	4,272	2,835	115,401
	2,250	4,086	32,549	54,778	35,606	56,201	4,297	2,702	115,099
	2,000	4,336	28,449	47,878	31,121	56,200	4,331	2,566	114,471
	1,750	4,586	24,360	40,996	26,648	56,197	4,378	2,428	113,298
	1,500	4,836	20,288	34,144	22,194	56,195	4,447	2,286	111,618
	1,250	5,086	16,740	28,172	18,312	56,192	4,435	2,158	71,887
	1,000	5,336	13,247	22,294	14,491	56,188	4,414	2,031	70,186
	0,750	5,586	9,785	16,467	10,704	56,182	4,391	1,904	68,163
	0,500	5,836	6,362	10,706	6,959	56,169	4,362	1,777	65,541
	0,250	6,086	2,991	5,034	3,272	56,132	4,330	1,651	62,121
	0,100	6,236	1,000	1,683	1,094	55,994	4,315	1,575	59,656
	0,000	6,336	0,000	0,000	0,000	54,272	4,391	1,514	0,000

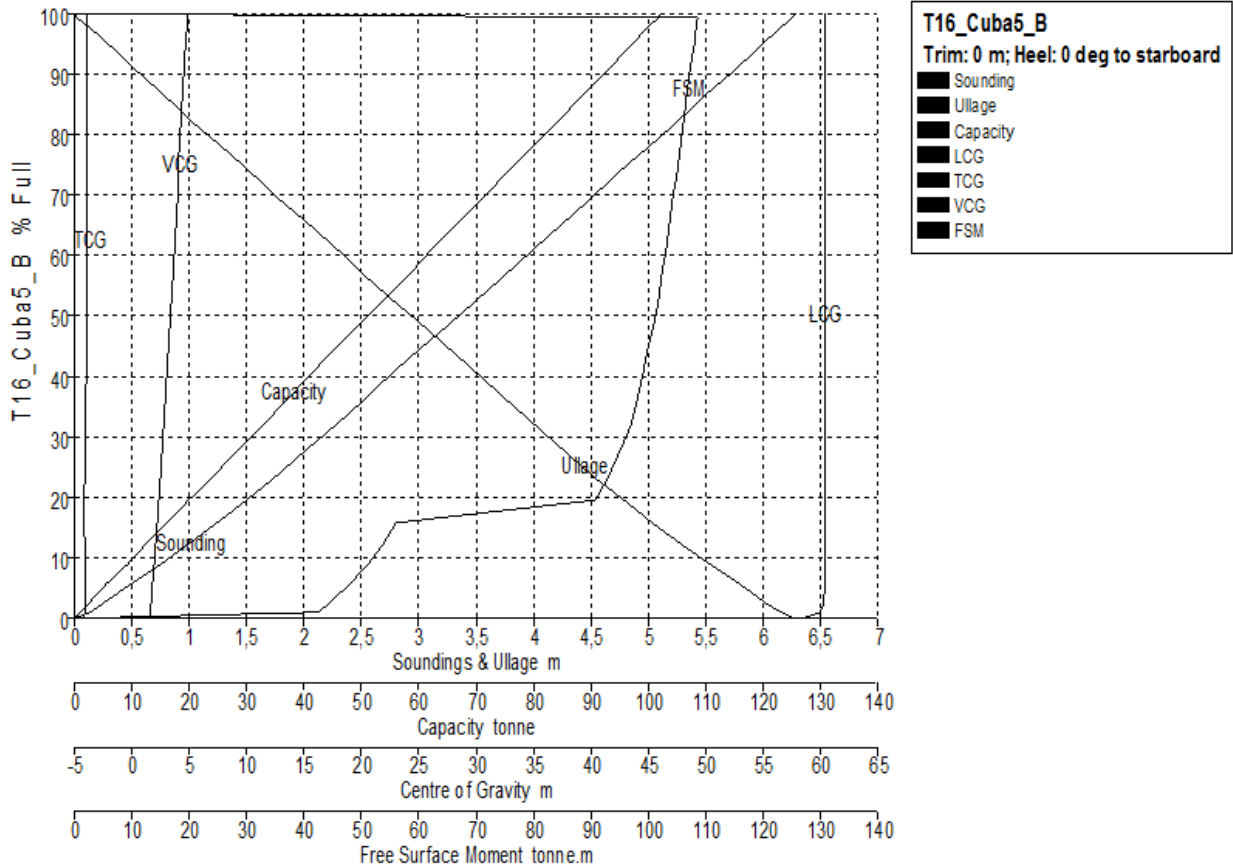
Tank Calibrations - T16_Cuba5_B

Fluid Type = Atun

Specific gravity = 0,65

Permeability = 86 %

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



Cuaderno 4: Cálculos de arquitectura naval

Proyecto nº 16-15.

Fernando García-Ganges Icaza



Tank Name	Sounding m	Ullage m	% Full	Capacity m ³	Capacity tonne	LCG m	TCG m	VCG m	FSM tonne.m
T16_Cuba5_B	6,282	0,000	100,000	157,323	102,260	60,396	-3,945	4,874	0,000
	6,250	0,032	99,449	156,456	101,696	60,396	-3,944	4,858	108,540
	6,166	0,116	98,000	154,176	100,215	60,396	-3,944	4,814	108,330
	6,160	0,122	97,900	154,019	100,112	60,396	-3,944	4,811	108,316
	6,000	0,282	95,149	149,691	97,299	60,395	-3,942	4,729	107,922
	5,750	0,532	90,857	142,939	92,911	60,394	-3,941	4,601	107,311
	5,500	0,782	86,574	136,201	88,530	60,394	-3,940	4,473	106,699
	5,250	1,032	82,299	129,475	84,159	60,393	-3,938	4,345	106,086
	5,000	1,282	78,032	122,762	79,795	60,392	-3,938	4,216	105,478
	4,750	1,532	73,774	116,063	75,441	60,391	-3,937	4,088	104,865
	4,500	1,782	69,524	109,377	71,095	60,390	-3,937	3,959	104,250
	4,250	2,032	65,282	102,704	66,757	60,389	-3,938	3,830	103,629
	4,000	2,282	61,049	96,045	62,429	60,388	-3,939	3,701	102,996
	3,750	2,532	56,826	89,400	58,110	60,386	-3,941	3,572	102,327
	3,500	2,782	52,612	82,770	53,801	60,385	-3,944	3,442	101,593
	3,250	3,032	48,409	76,158	49,503	60,383	-3,948	3,311	100,786
	3,000	3,282	44,218	69,564	45,217	60,381	-3,954	3,180	99,917
	2,750	3,532	40,039	62,991	40,944	60,379	-3,963	3,049	98,990
	2,500	3,782	35,875	56,439	36,686	60,376	-3,975	2,916	97,978
	2,250	4,032	31,727	49,914	32,444	60,373	-3,992	2,782	96,693
	2,000	4,282	27,601	43,423	28,225	60,370	-4,017	2,645	94,981
	1,750	4,532	23,503	36,976	24,034	60,365	-4,055	2,506	92,904
	1,500	4,782	19,438	30,580	19,877	60,359	-4,115	2,363	90,651
	1,250	5,032	15,820	24,889	16,178	60,351	-4,118	2,229	55,946
	1,000	5,282	12,398	19,504	12,678	60,342	-4,089	2,101	53,843
	0,750	5,532	9,026	14,199	9,230	60,327	-4,055	1,973	51,252
	0,500	5,782	5,718	8,996	5,847	60,297	-4,019	1,845	48,090
	0,250	6,032	2,491	3,920	2,548	60,197	-3,985	1,717	44,323
	0,132	6,150	1,000	1,573	1,023	59,938	-3,993	1,654	42,323
	0,000	6,282	0,000	0,000	0,000	58,472	-4,130	1,568	0,000

Tank Calibrations - T17_Cuba5_E

Fluid Type = Atun

Specific gravity = 0,65

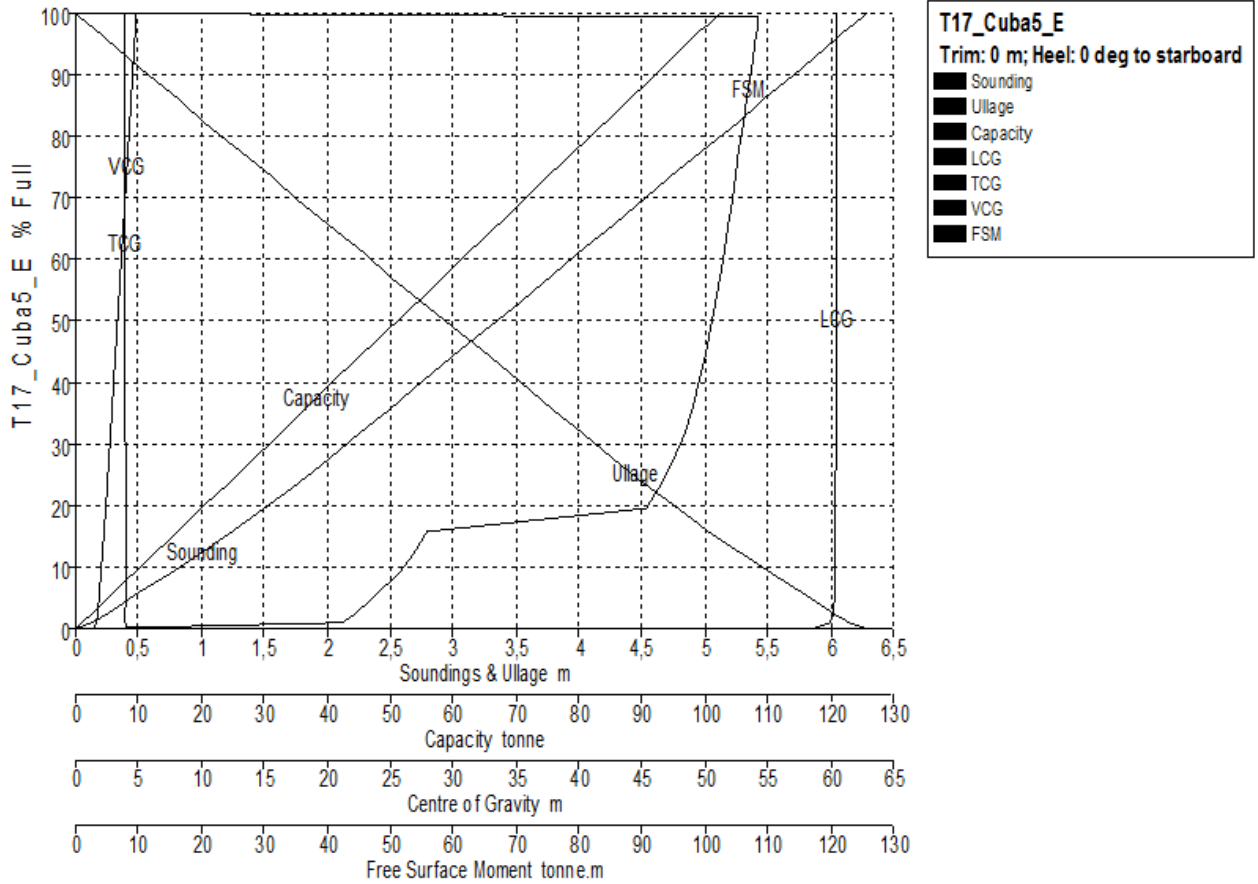
Permeability = 86 %

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

Cuaderno 4: Cálculos de arquitectura naval

Proyecto nº 16-15.

Fernando García-Ganges Icaza



Tank Name	Sounding m	Ullage m	% Full	Capacity m ³	Capacity tonne	LCG m	TCG m	VCG m	FSM tonne.m
T17_Cuba5_E	6,282	0,000	100,000	157,323	102,260	60,396	3,945	4,874	0,000
	6,250	0,032	99,449	156,456	101,696	60,396	3,944	4,858	108,540
	6,166	0,116	98,000	154,176	100,215	60,396	3,944	4,814	108,330
	6,160	0,122	97,900	154,019	100,112	60,396	3,944	4,811	108,316
	6,000	0,282	95,149	149,691	97,299	60,395	3,942	4,729	107,922
	5,750	0,532	90,857	142,939	92,911	60,394	3,941	4,601	107,311
	5,500	0,782	86,574	136,201	88,530	60,394	3,940	4,473	106,699
	5,250	1,032	82,299	129,475	84,159	60,393	3,938	4,345	106,086
	5,000	1,282	78,032	122,762	79,795	60,392	3,938	4,216	105,478
	4,750	1,532	73,774	116,063	75,441	60,391	3,937	4,088	104,865
	4,500	1,782	69,524	109,377	71,095	60,390	3,937	3,959	104,250
	4,250	2,032	65,282	102,704	66,757	60,389	3,938	3,830	103,629
	4,000	2,282	61,049	96,045	62,429	60,388	3,939	3,701	102,996
	3,750	2,532	56,826	89,400	58,110	60,386	3,941	3,572	102,327
	3,500	2,782	52,612	82,770	53,801	60,385	3,944	3,442	101,593
	3,250	3,032	48,409	76,158	49,503	60,383	3,948	3,311	100,786
	3,000	3,282	44,218	69,564	45,217	60,381	3,954	3,180	99,917
	2,750	3,532	40,039	62,991	40,944	60,379	3,963	3,049	98,990
	2,500	3,782	35,875	56,439	36,686	60,376	3,975	2,916	97,978
	2,250	4,032	31,727	49,914	32,444	60,373	3,992	2,782	96,693
	2,000	4,282	27,601	43,423	28,225	60,370	4,017	2,645	94,981
	1,750	4,532	23,503	36,976	24,034	60,365	4,055	2,506	92,904
	1,500	4,782	19,438	30,580	19,877	60,359	4,115	2,363	90,651
	1,250	5,032	15,820	24,889	16,178	60,351	4,118	2,229	55,946

Cuaderno 4: Cálculos de arquitectura naval

Proyecto nº 16-15.

Fernando García-Ganges Icaza



	1,000	5,282	12,398	19,504	12,678	60,342	4,089	2,101	53,843
	0,750	5,532	9,026	14,199	9,230	60,327	4,055	1,973	51,252
	0,500	5,782	5,718	8,996	5,847	60,297	4,019	1,845	48,090
	0,250	6,032	2,491	3,920	2,548	60,197	3,985	1,717	44,323
	0,132	6,150	1,000	1,573	1,023	59,938	3,993	1,654	42,323
	0,000	6,282	0,000	0,000	0,000	58,472	4,130	1,568	0,000

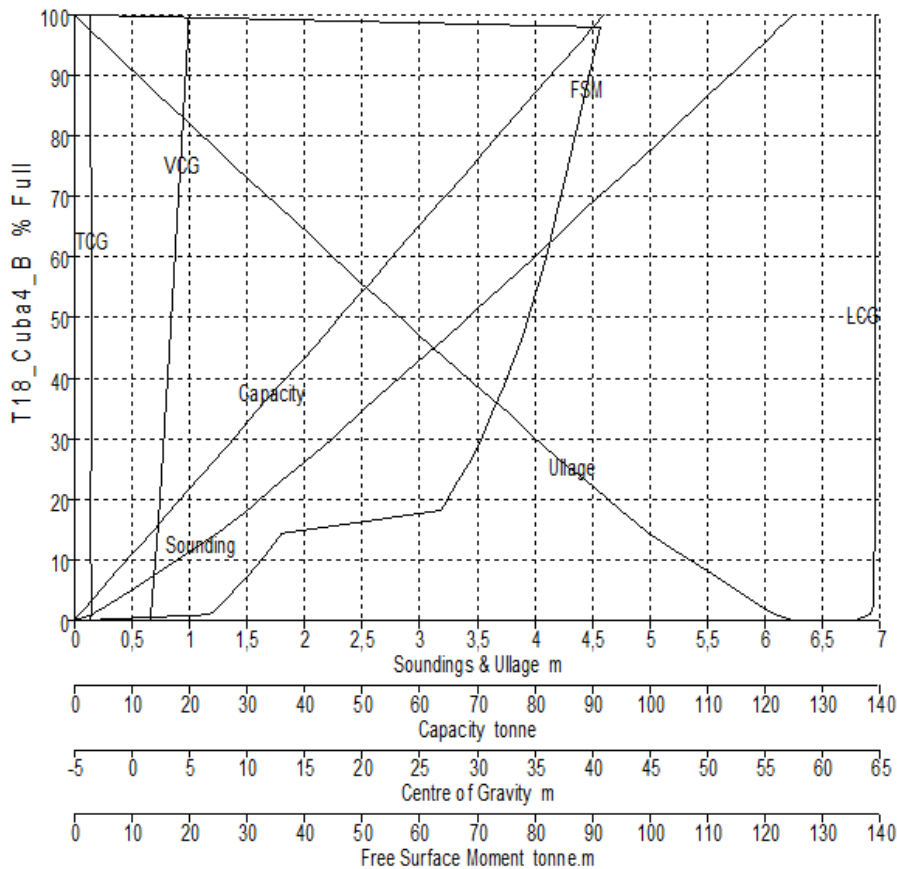
Tank Calibrations - T18_Cuba4_B

Fluid Type = Atun

Specific gravity = 0,65

Permeability = 86 %

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
T18_Cuba4_B	6,242	0,000	100,000	141,472	91,957	64,582	-3,604	4,960	0,000
	6,131	0,111	98,000	138,642	90,117	64,581	-3,601	4,903	91,392
	6,126	0,116	97,900	138,501	90,026	64,581	-3,601	4,900	91,367
	6,000	0,242	95,629	135,287	87,937	64,581	-3,597	4,834	90,787
	5,750	0,492	91,131	128,925	83,801	64,580	-3,590	4,703	89,655
	5,500	0,742	86,653	122,590	79,683	64,579	-3,582	4,572	88,541
	5,250	0,992	82,194	116,281	75,583	64,578	-3,575	4,442	87,453
	5,000	1,242	77,753	109,999	71,499	64,576	-3,568	4,311	86,373
	4,750	1,492	73,332	103,743	67,433	64,575	-3,561	4,180	85,293
	4,500	1,742	68,929	97,515	63,384	64,574	-3,554	4,049	84,202
	4,250	1,992	64,545	91,313	59,354	64,572	-3,547	3,917	83,096

Cuaderno 4: Cálculos de arquitectura naval

Proyecto nº 16-15.

Fernando García-Ganges Icaza



	4,000	2,242	60,182	85,141	55,341	64,571	-3,541	3,786	81,949
	3,750	2,492	55,840	78,998	51,349	64,569	-3,534	3,654	80,694
	3,500	2,742	51,523	72,891	47,379	64,567	-3,529	3,521	79,313
	3,250	2,992	47,232	66,820	43,433	64,565	-3,525	3,388	77,825
	3,000	3,242	42,970	60,791	39,514	64,563	-3,522	3,255	76,233
	2,750	3,492	38,740	54,805	35,624	64,560	-3,521	3,121	74,540
	2,500	3,742	34,543	48,868	31,764	64,557	-3,524	2,986	72,703
	2,250	3,992	30,384	42,984	27,940	64,553	-3,531	2,849	70,689
	2,000	4,242	26,266	37,159	24,153	64,548	-3,546	2,711	68,532
	1,750	4,492	22,193	31,397	20,408	64,542	-3,574	2,569	66,205
	1,500	4,742	18,172	25,709	16,711	64,533	-3,622	2,422	63,587
	1,250	4,992	14,570	20,612	13,398	64,524	-3,632	2,281	60,006
	1,000	5,242	11,310	16,001	10,401	64,512	-3,592	2,151	55,596
	0,750	5,492	8,135	11,509	7,481	64,493	-3,548	2,021	50,911
	0,500	5,742	5,057	7,154	4,650	64,453	-3,503	1,892	45,956
	0,250	5,992	2,093	2,961	1,925	64,309	-3,467	1,762	40,756
	0,155	6,087	1,000	1,415	0,920	64,044	-3,479	1,710	34,486
	0,000	6,242	0,000	0,000	0,000	62,672	-3,616	1,608	27,000

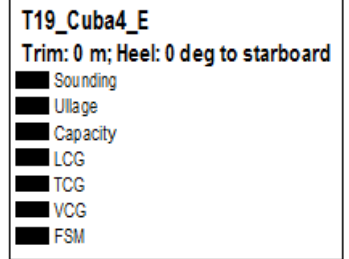
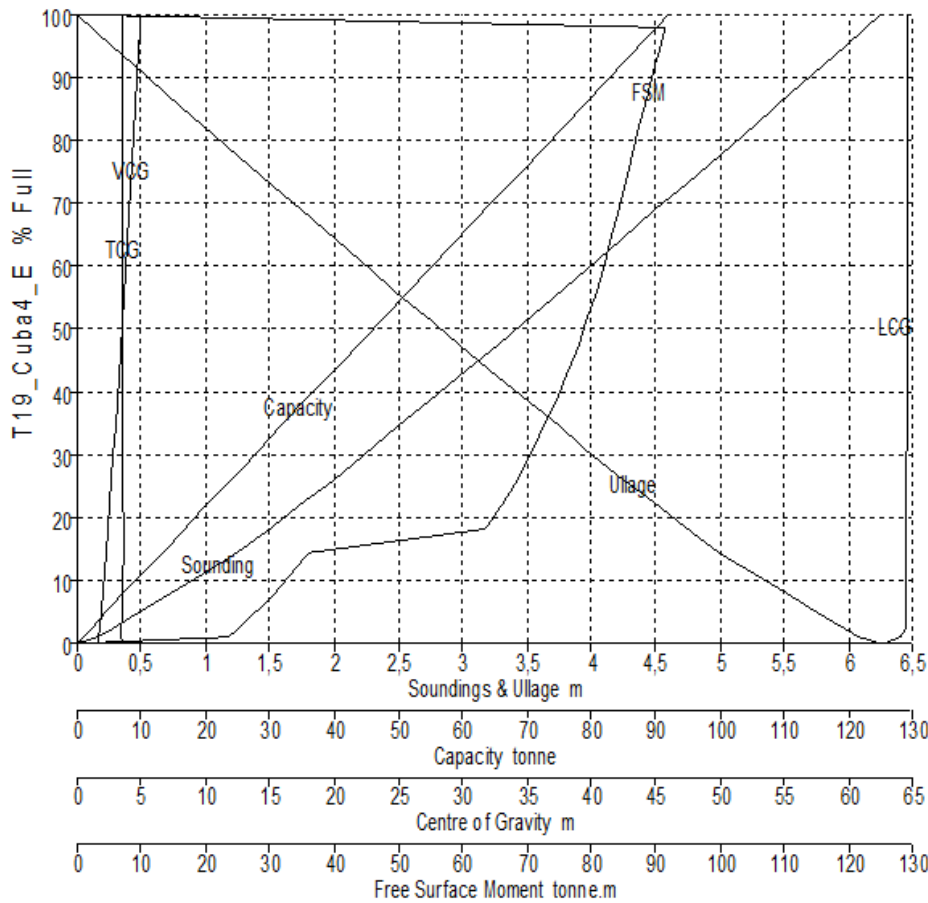
Tank Calibrations - T19_Cuba4_E

Fluid Type = Atun

Specific gravity = 0,65

Permeability = 86 %

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



Cuaderno 4: Cálculos de arquitectura naval

Proyecto nº 16-15.

Fernando García-Ganges Icaza



Tank Name	Sounding m	Ullage m	% Full	Capacity m ³	Capacity tonne	LCG m	TCG m	VCG m	FSM tonne.m
T19_Cuba4_E	6,242	0,000	100,000	141,472	91,957	64,582	3,604	4,960	0,000
	6,131	0,111	98,000	138,642	90,117	64,581	3,601	4,903	91,392
	6,126	0,116	97,900	138,501	90,026	64,581	3,601	4,900	91,367
	6,000	0,242	95,629	135,287	87,937	64,581	3,597	4,834	90,787
	5,750	0,492	91,131	128,925	83,801	64,580	3,590	4,703	89,655
	5,500	0,742	86,653	122,590	79,683	64,579	3,582	4,572	88,541
	5,250	0,992	82,194	116,281	75,583	64,578	3,575	4,442	87,453
	5,000	1,242	77,753	109,999	71,499	64,576	3,568	4,311	86,373
	4,750	1,492	73,332	103,743	67,433	64,575	3,561	4,180	85,293
	4,500	1,742	68,929	97,515	63,384	64,574	3,554	4,049	84,202
	4,250	1,992	64,545	91,313	59,354	64,572	3,547	3,917	83,096
	4,000	2,242	60,182	85,141	55,341	64,571	3,541	3,786	81,949
	3,750	2,492	55,840	78,998	51,349	64,569	3,534	3,654	80,694
	3,500	2,742	51,523	72,891	47,379	64,567	3,529	3,521	79,313
	3,250	2,992	47,232	66,820	43,433	64,565	3,525	3,388	77,825
	3,000	3,242	42,970	60,791	39,514	64,563	3,522	3,255	76,233
	2,750	3,492	38,740	54,805	35,624	64,560	3,521	3,121	74,540
	2,500	3,742	34,543	48,868	31,764	64,557	3,524	2,986	72,703
	2,250	3,992	30,384	42,984	27,940	64,553	3,531	2,849	70,689
	2,000	4,242	26,266	37,159	24,153	64,548	3,546	2,711	68,532
	1,750	4,492	22,193	31,397	20,408	64,542	3,574	2,569	66,205
	1,500	4,742	18,172	25,709	16,711	64,533	3,622	2,422	63,587
	1,250	4,992	14,570	20,612	13,398	64,524	3,632	2,281	36,006
	1,000	5,242	11,310	16,001	10,401	64,512	3,592	2,151	33,596
	0,750	5,492	8,135	11,509	7,481	64,493	3,548	2,021	30,911
	0,500	5,742	5,057	7,154	4,650	64,453	3,503	1,892	27,956
	0,250	5,992	2,093	2,961	1,925	64,309	3,467	1,762	24,756
	0,155	6,087	1,000	1,415	0,920	64,044	3,479	1,710	23,486
	0,000	6,242	0,000	0,000	0,000	62,672	3,616	1,608	0,000

Tank Calibrations - T20_Cuba3_B

Fluid Type = Atun

Specific gravity = 0,65

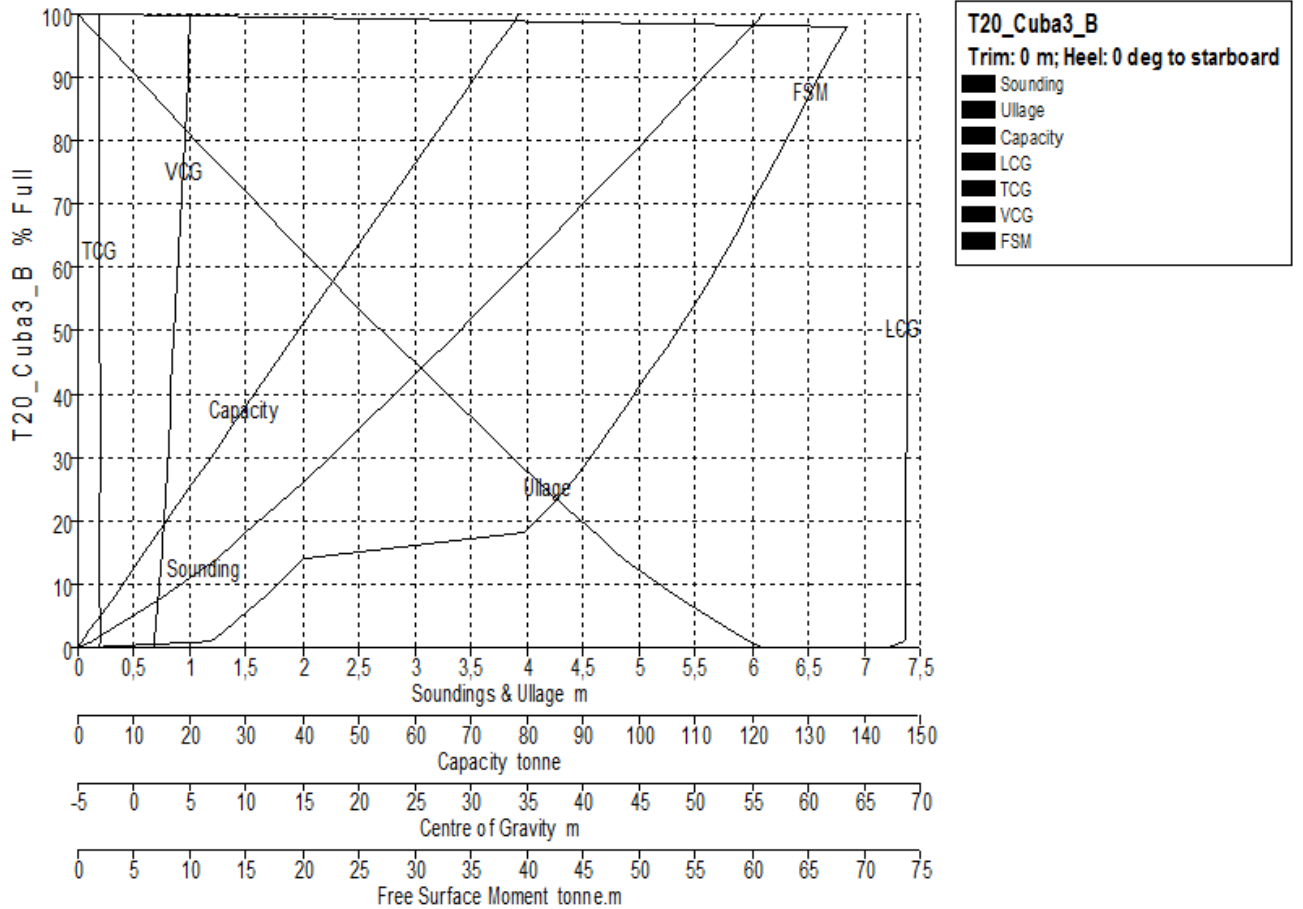
Permeability = 86 %

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

Cuaderno 4: Cálculos de arquitectura naval

Proyecto nº 16-15.

Fernando García-Ganges Icaza



Tank Name	Sounding m	Ullage m	% Full	Capacity m ³	Capacity tonne	LCG m	TCG m	VCG m	FSM tonne.m
T20_Cuba3_B	6,100	0,000	100,000	120,905	78,588	68,772	-3,160	5,065	0,000
	6,000	0,100	98,080	118,583	77,079	68,772	-3,155	5,011	68,435
	5,996	0,104	98,000	118,487	77,016	68,772	-3,155	5,009	68,410
	5,991	0,109	97,900	118,366	76,938	68,772	-3,155	5,006	68,379
	5,750	0,350	93,303	112,808	73,325	68,771	-3,142	4,877	66,973
	5,500	0,600	88,562	107,075	69,599	68,770	-3,130	4,744	65,537
	5,250	0,850	83,855	101,385	65,900	68,769	-3,117	4,610	64,126
	5,000	1,100	79,183	95,736	62,229	68,768	-3,105	4,476	62,729
	4,750	1,350	74,547	90,131	58,585	68,767	-3,092	4,343	61,335
	4,500	1,600	69,946	84,568	54,969	68,766	-3,080	4,209	59,943
	4,250	1,850	65,382	79,050	51,382	68,765	-3,068	4,075	58,547
	4,000	2,100	60,855	73,577	47,825	68,764	-3,056	3,941	57,105
	3,750	2,350	56,368	68,151	44,298	68,763	-3,044	3,807	55,593
	3,500	2,600	51,923	62,777	40,805	68,762	-3,034	3,673	54,023
	3,250	2,850	47,522	57,457	37,347	68,761	-3,024	3,538	52,400
	3,000	3,100	43,168	52,192	33,925	68,759	-3,016	3,404	50,751
	2,750	3,350	38,861	46,985	30,540	68,758	-3,009	3,268	49,109
	2,500	3,600	34,602	41,836	27,193	68,756	-3,006	3,132	47,461
	2,250	3,850	30,393	36,747	23,886	68,753	-3,006	2,994	45,771
	2,000	4,100	26,239	31,724	20,621	68,750	-3,013	2,855	43,937
	1,750	4,350	22,146	26,775	17,404	68,747	-3,030	2,713	41,901
	1,500	4,600	18,122	21,911	14,242	68,742	-3,066	2,565	39,667
	1,250	4,850	14,178	17,142	11,142	68,734	-3,135	2,410	20,022

Cuaderno 4: Cálculos de arquitectura naval

Proyecto nº 16-15.

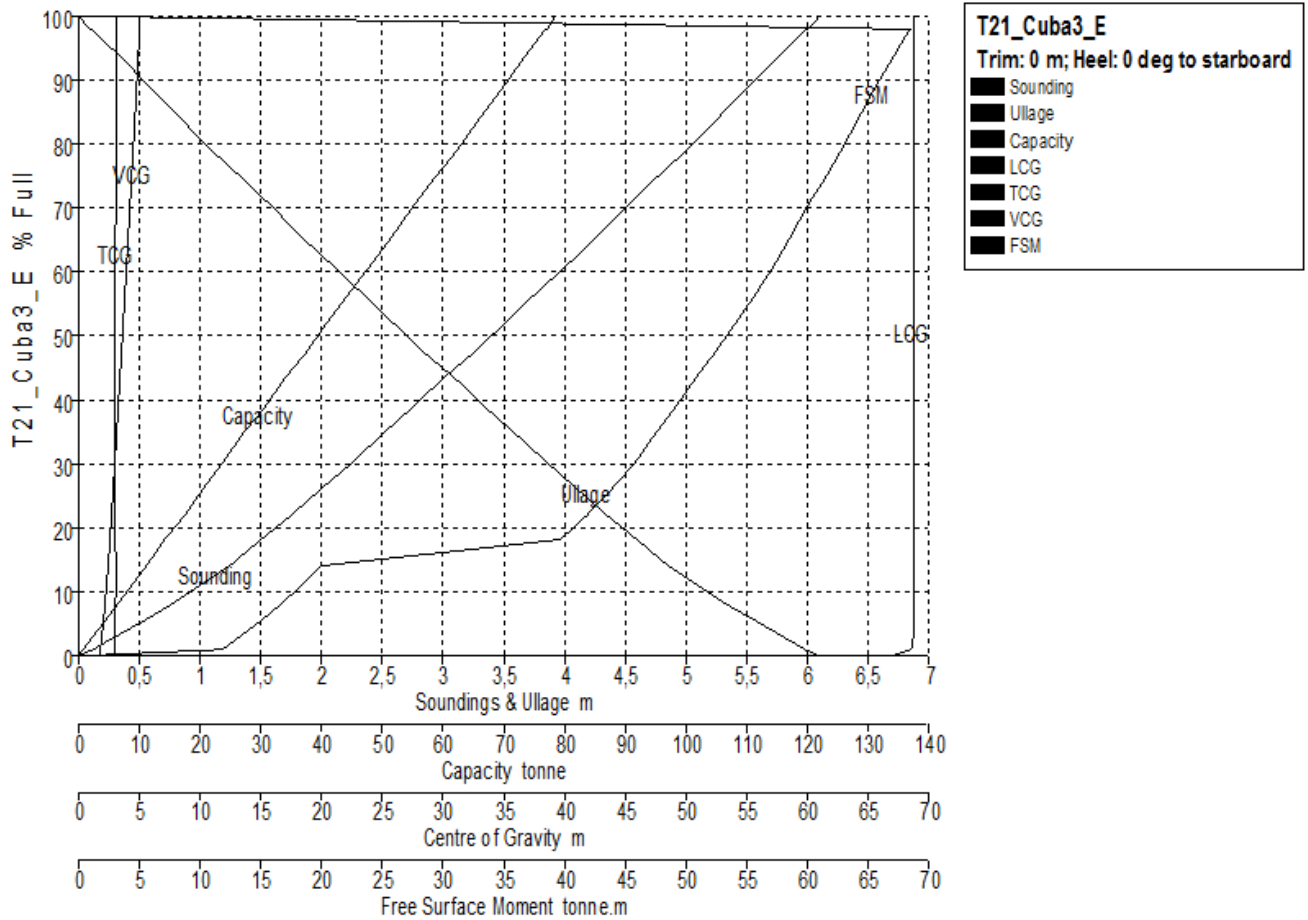
Fernando García-Ganges Icaza



	1,000	5,100	11,060	13,372	8,692	68,729	-3,095	2,278	18,317
	0,750	5,350	8,041	9,722	6,319	68,721	-3,052	2,148	16,534
	0,500	5,600	5,132	6,205	4,033	68,705	-3,008	2,018	14,708
	0,250	5,850	2,343	2,833	1,841	68,655	-2,963	1,890	12,835
	0,125	5,975	1,000	1,209	0,786	68,533	-2,951	1,826	11,862
	0,000	6,100	0,000	0,000	0,000	66,872	-3,120	1,750	0,000

Tank Calibrations - T21_Cuba3_E

Fluid Type = Atun Specific gravity = 0,65
 Permeability = 86 %
 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
T21_Cuba3_E	6,100	0,000	100,000	120,905	78,588	68,772	3,160	5,065	0,000
	6,000	0,100	98,080	118,583	77,079	68,772	3,155	5,011	68,435
	5,996	0,104	98,000	118,487	77,016	68,772	3,155	5,009	68,410
	5,991	0,109	97,900	118,366	76,938	68,772	3,155	5,006	68,379
	5,750	0,350	93,303	112,808	73,325	68,771	3,142	4,877	66,973
	5,500	0,600	88,562	107,075	69,599	68,770	3,130	4,744	65,537
	5,250	0,850	83,855	101,385	65,900	68,769	3,117	4,610	64,126
	5,000	1,100	79,183	95,736	62,229	68,768	3,105	4,476	62,729
	4,750	1,350	74,547	90,131	58,585	68,767	3,092	4,343	61,335

Cuaderno 4: Cálculos de arquitectura naval

Proyecto nº 16-15.

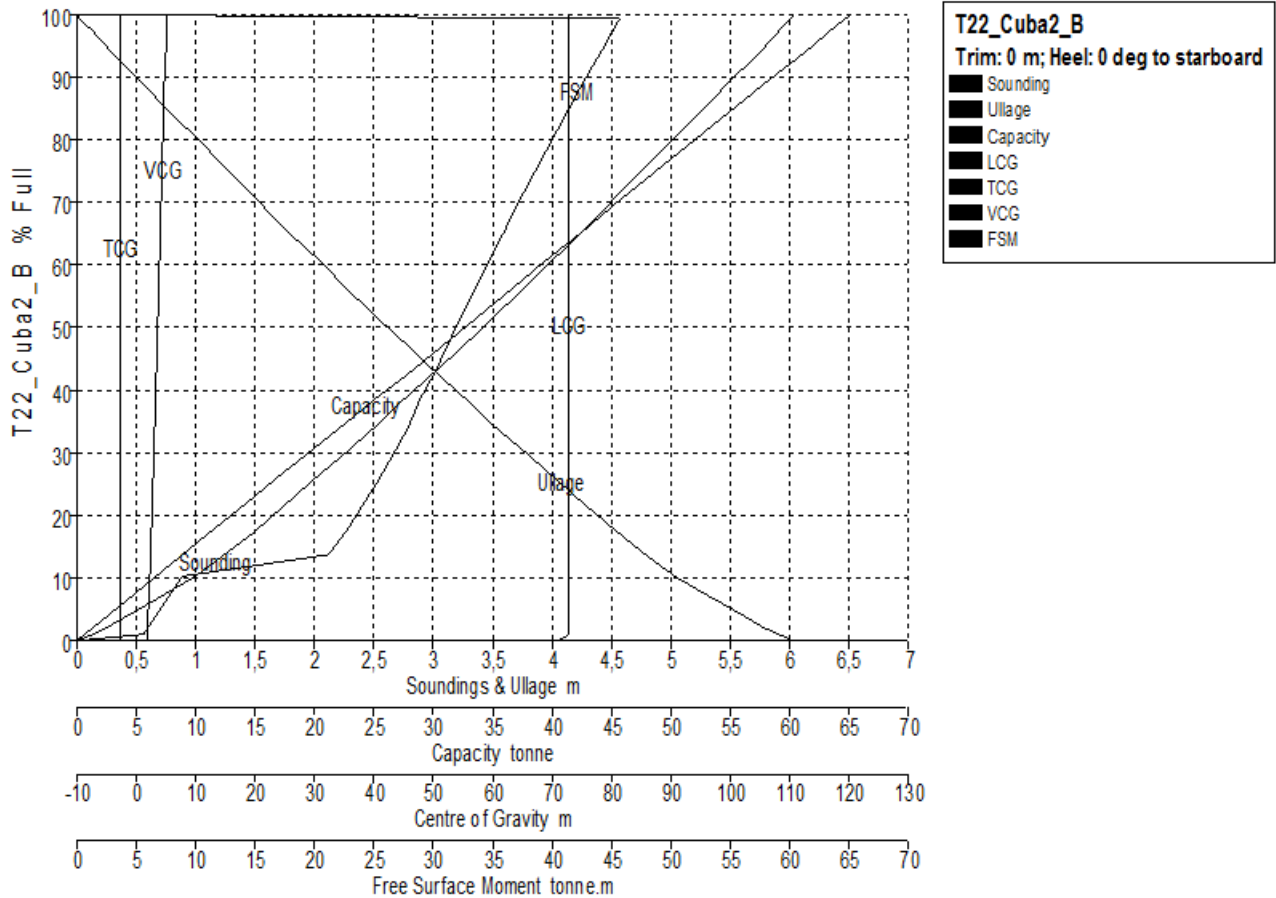
Fernando García-Ganges Icaza



	4,500	1,600	69,946	84,568	54,969	68,766	3,080	4,209	59,943
	4,250	1,850	65,382	79,050	51,382	68,765	3,068	4,075	58,547
	4,000	2,100	60,855	73,577	47,825	68,764	3,056	3,941	57,105
	3,750	2,350	56,368	68,151	44,298	68,763	3,044	3,807	55,593
	3,500	2,600	51,923	62,777	40,805	68,762	3,034	3,673	54,023
	3,250	2,850	47,522	57,457	37,347	68,761	3,024	3,538	52,400
	3,000	3,100	43,168	52,192	33,925	68,759	3,016	3,404	50,751
	2,750	3,350	38,861	46,985	30,540	68,758	3,009	3,268	49,109
	2,500	3,600	34,602	41,836	27,193	68,756	3,006	3,132	47,461
	2,250	3,850	30,393	36,747	23,886	68,753	3,006	2,994	45,771
	2,000	4,100	26,239	31,724	20,621	68,750	3,013	2,855	43,937
	1,750	4,350	22,146	26,775	17,404	68,747	3,030	2,713	41,901
	1,500	4,600	18,122	21,911	14,242	68,742	3,066	2,565	39,667
	1,250	4,850	14,178	17,142	11,142	68,734	3,135	2,410	37,022
	1,000	5,100	11,060	13,372	8,692	68,729	3,095	2,278	34,317
	0,750	5,350	8,041	9,722	6,319	68,721	3,052	2,148	31,534
	0,500	5,600	5,132	6,205	4,033	68,705	3,008	2,018	28,708
	0,250	5,850	2,343	2,833	1,841	68,655	2,963	1,890	25,835
	0,125	5,975	1,000	1,209	0,786	68,533	2,951	1,826	23,862
	0,000	6,100	0,000	0,000	0,000	66,872	3,120	1,750	21,900

Tank Calibrations - T22_Cuba2_B

Fluid Type = Atun Specific gravity = 0,65
 Permeability = 86 %
 Trim = 0 m (+ve by stern); Heel = 0 deg to starboard



Cuaderno 4: Cálculos de arquitectura naval

Proyecto nº 16-15.

Fernando García-Ganges Icaza



Tank Name	Sounding m	Ullage m	% Full	Capacity m ³	Capacity tonne	LCG m	TCG m	VCG m	FSM tonne.m
T22_Cuba2_B	6,034	0,000	100,000	100,108	65,070	72,961	-2,677	5,138	0,000
	6,000	0,034	99,313	99,420	64,623	72,961	-2,675	5,119	45,642
	5,935	0,099	98,000	98,106	63,769	72,960	-2,670	5,084	45,246
	5,930	0,104	97,900	98,006	63,704	72,960	-2,670	5,081	45,216
	5,750	0,284	94,293	94,395	61,357	72,960	-2,659	4,982	44,138
	5,500	0,534	89,331	89,427	58,128	72,959	-2,644	4,846	42,675
	5,250	0,784	84,425	84,516	54,935	72,959	-2,629	4,710	41,253
	5,000	1,034	79,575	79,661	51,780	72,958	-2,615	4,574	39,871
	4,750	1,284	74,781	74,862	48,660	72,957	-2,601	4,438	38,526
	4,500	1,534	70,043	70,118	45,577	72,956	-2,587	4,302	37,216
	4,250	1,784	65,359	65,430	42,529	72,956	-2,574	4,167	35,942
	4,000	2,034	60,731	60,796	39,518	72,955	-2,562	4,032	34,699
	3,750	2,284	56,157	56,218	36,541	72,954	-2,551	3,896	33,486
	3,500	2,534	51,638	51,694	33,601	72,953	-2,540	3,761	32,302
	3,250	2,784	47,173	47,224	30,696	72,952	-2,531	3,626	31,143
	3,000	3,034	42,763	42,809	27,826	72,951	-2,523	3,490	30,014
	2,750	3,284	38,408	38,449	24,992	72,949	-2,517	3,354	28,914
	2,500	3,534	34,107	34,144	22,193	72,947	-2,514	3,217	27,828
	2,250	3,784	29,863	29,896	19,432	72,945	-2,515	3,079	26,684
	2,000	4,034	25,683	25,711	16,712	72,942	-2,522	2,938	25,451
	1,750	4,284	21,572	21,596	14,037	72,938	-2,539	2,795	24,121
	1,500	4,534	17,540	17,559	11,414	72,933	-2,575	2,646	22,688
	1,250	4,784	13,595	13,609	8,846	72,925	-2,645	2,488	21,180
	1,000	5,034	10,399	10,411	6,767	72,918	-2,647	2,346	8,916
	0,750	5,284	7,543	7,551	4,908	72,909	-2,611	2,215	7,970
	0,500	5,534	4,798	4,803	3,122	72,891	-2,573	2,085	7,026
	0,250	5,784	2,178	2,180	1,417	72,837	-2,535	1,957	6,054
	0,133	5,901	1,000	1,001	0,651	72,724	-2,525	1,896	5,576
	0,000	6,034	0,000	0,000	0,000	71,072	-2,666	1,816	0,000

Tank Calibrations - T23_Cuba2_E

Fluid Type = Atun

Specific gravity = 0,65

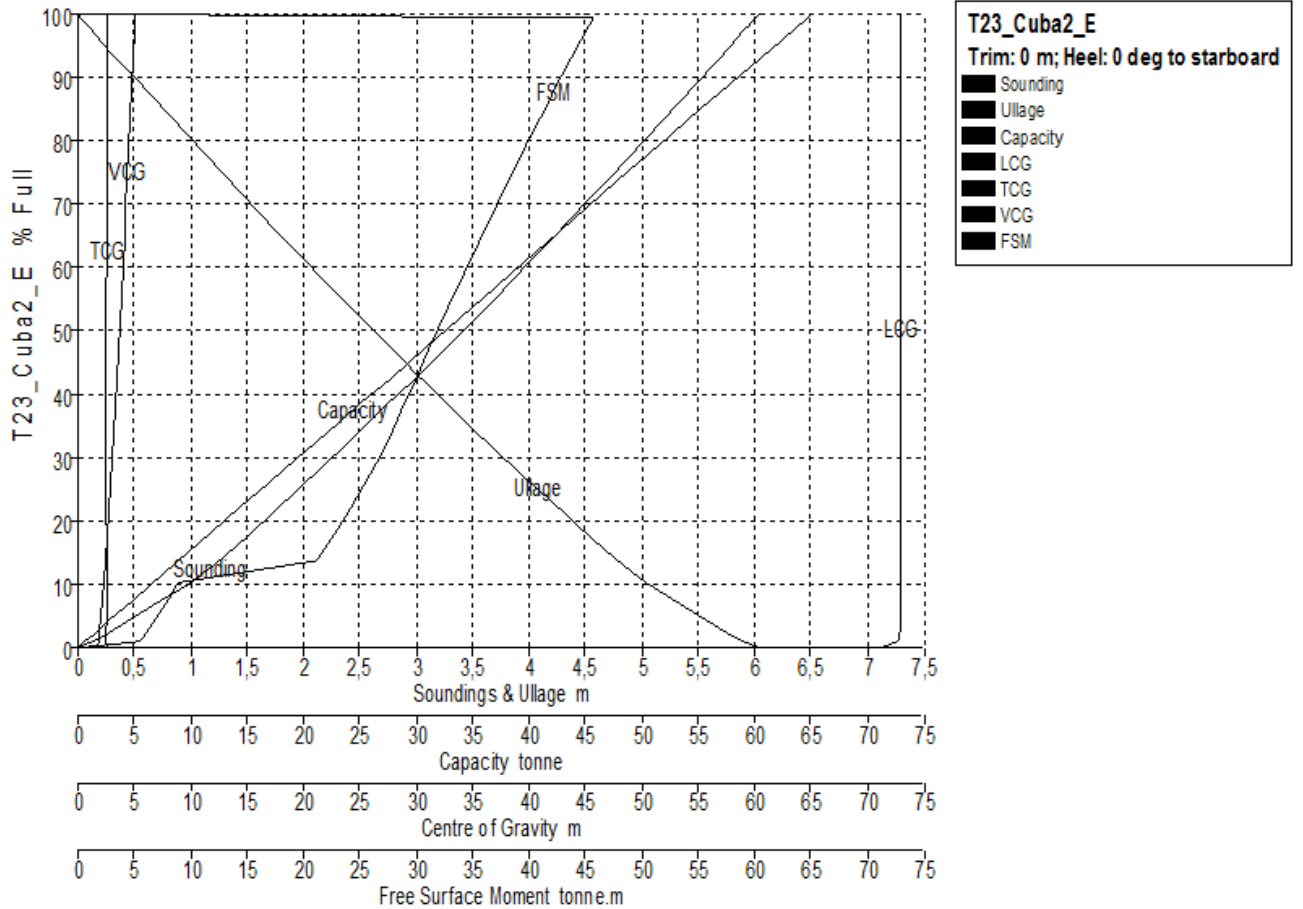
Permeability = 86 %

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

Cuaderno 4: Cálculos de arquitectura naval

Proyecto nº 16-15.

Fernando García-Ganges Icaza



Tank Name	Sounding m	Ullage m	% Full	Capacity m ³	Capacity tonne	LCG m	TCG m	VCG m	FSM tonne.m
T23_Cuba2_E	6,034	0,000	100,000	100,108	65,070	72,961	2,677	5,138	0,000
	6,000	0,034	99,313	99,420	64,623	72,961	2,675	5,119	45,642
	5,935	0,099	98,000	98,106	63,769	72,960	2,670	5,084	45,246
	5,930	0,104	97,900	98,006	63,704	72,960	2,670	5,081	45,216
	5,750	0,284	94,293	94,395	61,357	72,960	2,659	4,982	44,138
	5,500	0,534	89,331	89,427	58,128	72,959	2,644	4,846	42,675
	5,250	0,784	84,425	84,516	54,935	72,959	2,629	4,710	41,253
	5,000	1,034	79,575	79,661	51,780	72,958	2,615	4,574	39,871
	4,750	1,284	74,781	74,862	48,660	72,957	2,601	4,438	38,526
	4,500	1,534	70,043	70,118	45,577	72,956	2,587	4,302	37,216
	4,250	1,784	65,359	65,430	42,529	72,956	2,574	4,167	35,942
	4,000	2,034	60,731	60,796	39,518	72,955	2,562	4,032	34,699
	3,750	2,284	56,157	56,218	36,541	72,954	2,551	3,896	33,486
	3,500	2,534	51,638	51,694	33,601	72,953	2,540	3,761	32,302
	3,250	2,784	47,173	47,224	30,696	72,952	2,531	3,626	31,143
	3,000	3,034	42,763	42,809	27,826	72,951	2,523	3,490	30,014
	2,750	3,284	38,408	38,449	24,992	72,949	2,517	3,354	28,914
	2,500	3,534	34,107	34,144	22,193	72,947	2,514	3,217	27,828
	2,250	3,784	29,863	29,896	19,432	72,945	2,515	3,079	26,684
	2,000	4,034	25,683	25,711	16,712	72,942	2,522	2,938	25,451
	1,750	4,284	21,572	21,596	14,037	72,938	2,539	2,795	24,121
	1,500	4,534	17,540	17,559	11,414	72,933	2,575	2,646	22,688
	1,250	4,784	13,595	13,609	8,846	72,925	2,645	2,488	21,180

Cuaderno 4: Cálculos de arquitectura naval

Proyecto nº 16-15.

Fernando García-Ganges Icaza



	1,000	5,034	10,399	10,411	6,767	72,918	2,647	2,346	8,916
	0,750	5,284	7,543	7,551	4,908	72,909	2,611	2,215	7,970
	0,500	5,534	4,798	4,803	3,122	72,891	2,573	2,085	7,026
	0,250	5,784	2,178	2,180	1,417	72,837	2,535	1,957	6,054
	0,133	5,901	1,000	1,001	0,651	72,724	2,525	1,896	5,576
	0,000	6,034	0,000	0,000	0,000	71,072	2,666	1,816	0,000

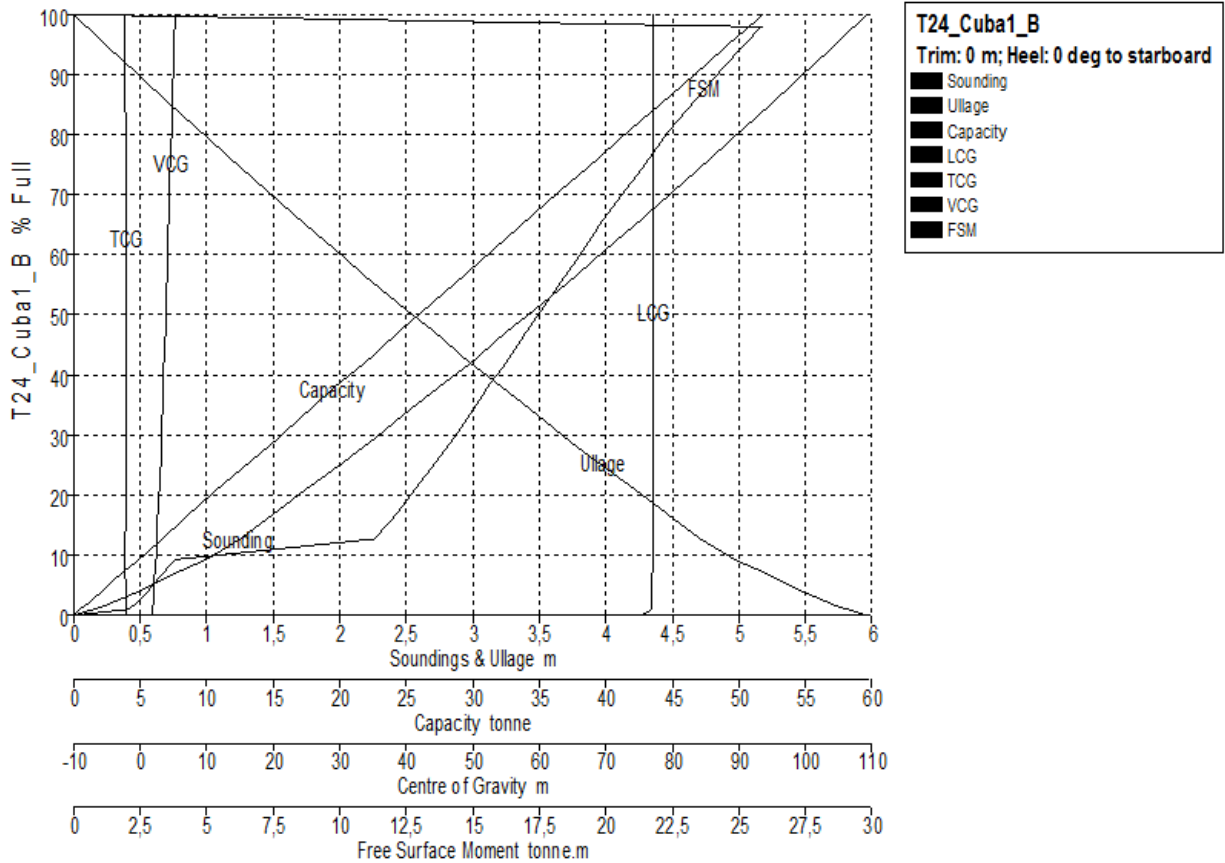
Tank Calibrations - T24_Cuba1_B

Fluid Type = Atun

Specific gravity = 0,65

Permeability = 86 %

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
T24_Cuba1_B	5,965	0,000	100,000	79,735	51,828	77,145	-2,190	5,213	0,000
	5,870	0,095	98,000	78,140	50,791	77,145	-2,185	5,160	25,878
	5,865	0,100	97,900	78,060	50,739	77,145	-2,184	5,157	25,856
	5,750	0,215	95,503	76,149	49,497	77,144	-2,177	5,094	25,330
	5,500	0,465	90,346	72,037	46,824	77,144	-2,163	4,956	24,253
	5,250	0,715	85,262	67,983	44,189	77,143	-2,149	4,818	23,263
	5,000	0,965	80,248	63,985	41,590	77,142	-2,136	4,681	22,351
	4,750	1,215	75,300	60,040	39,026	77,141	-2,123	4,545	21,489
	4,500	1,465	70,416	56,146	36,495	77,140	-2,111	4,408	20,669
	4,250	1,715	65,596	52,302	33,997	77,138	-2,099	4,272	19,888
	4,000	1,965	60,837	48,508	31,530	77,137	-2,088	4,136	19,135

Cuaderno 4: Cálculos de arquitectura naval

Proyecto nº 16-15.

Fernando García-Ganges Icaza



	3,750	2,215	56,140	44,763	29,096	77,135	-2,077	4,000	18,403
	3,500	2,465	51,505	41,068	26,694	77,134	-2,068	3,864	17,686
	3,250	2,715	46,933	37,422	24,324	77,132	-2,059	3,728	16,980
	3,000	2,965	42,425	33,827	21,988	77,129	-2,052	3,592	16,286
	2,750	3,215	37,980	30,283	19,684	77,127	-2,047	3,455	15,605
	2,500	3,465	33,601	26,792	17,415	77,124	-2,045	3,318	14,924
	2,250	3,715	29,290	23,354	15,180	77,120	-2,046	3,179	14,239
	2,000	3,965	25,048	19,972	12,982	77,116	-2,054	3,039	13,550
	1,750	4,215	20,878	16,647	10,821	77,109	-2,072	2,894	12,854
	1,500	4,465	16,785	13,384	8,699	77,100	-2,106	2,744	12,124
	1,250	4,715	12,780	10,190	6,624	77,087	-2,174	2,582	11,300
	1,000	4,965	9,394	7,491	4,869	77,071	-2,222	2,424	3,812
	0,750	5,215	6,734	5,369	3,490	77,058	-2,185	2,291	3,312
	0,500	5,465	4,212	3,358	2,183	77,033	-2,147	2,160	2,796
	0,250	5,715	1,849	1,474	0,958	76,958	-2,111	2,030	2,271
	0,155	5,810	1,000	0,797	0,518	76,849	-2,105	1,980	2,071
	0,000	5,965	0,000	0,000	0,000	75,272	-2,245	1,885	0,000

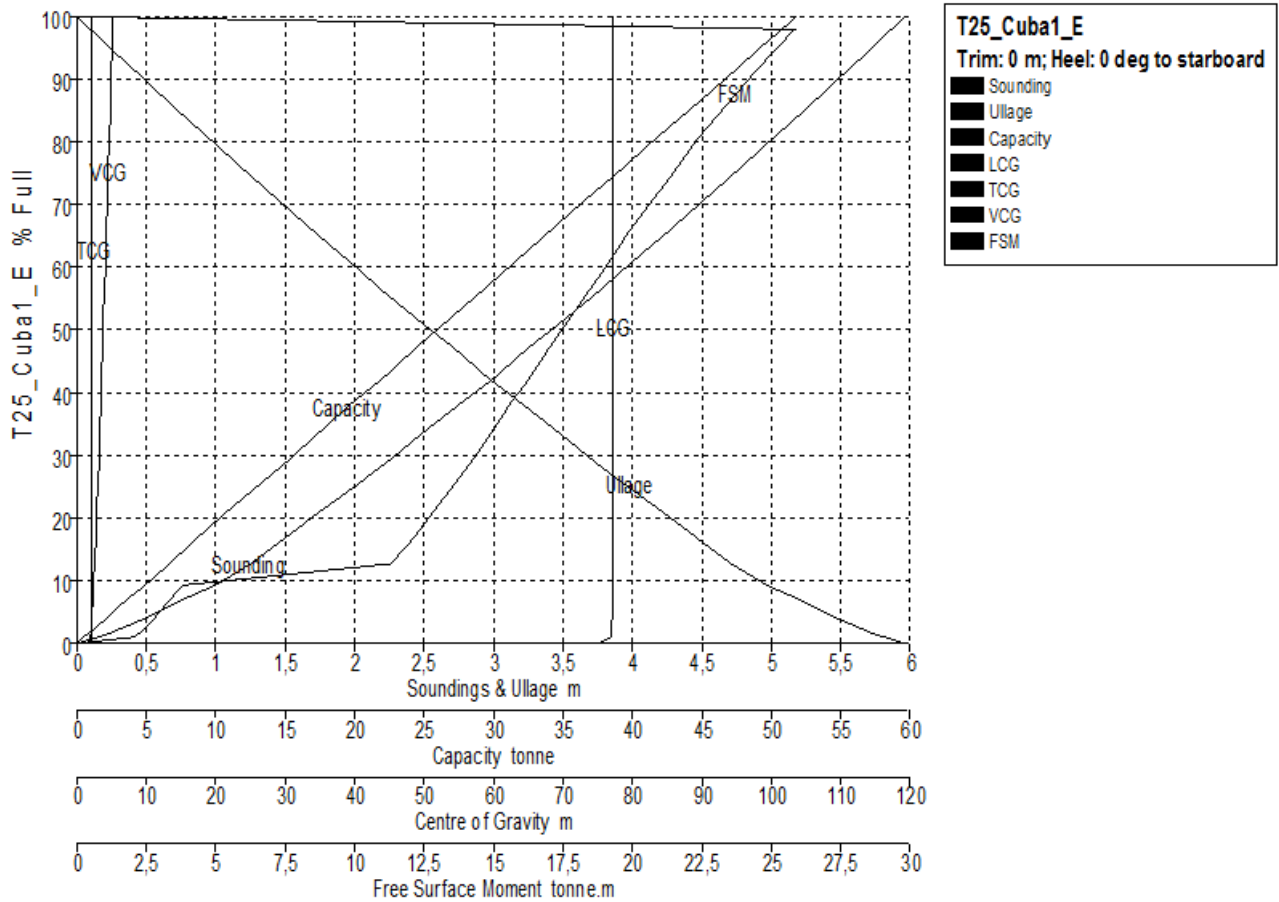
Tank Calibrations - T25_Cuba1_E

Fluid Type = Atun

Specific gravity = 0,65

Permeability = 86 %

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



Cuaderno 4: Cálculos de arquitectura naval

Proyecto nº 16-15.

Fernando García-Ganges Icaza



Tank Name	Sounding m	Ullage m	% Full	Capacity m ³	Capacity tonne	LCG m	TCG m	VCG m	FSM tonne.m
T25_Cuba1_E	5,965	0,000	100,000	79,735	51,828	77,145	2,190	5,213	0,000
	5,870	0,095	98,000	78,140	50,791	77,145	2,185	5,160	25,878
	5,865	0,100	97,900	78,060	50,739	77,145	2,184	5,157	25,856
	5,750	0,215	95,503	76,149	49,497	77,144	2,177	5,094	25,330
	5,500	0,465	90,346	72,037	46,824	77,144	2,163	4,956	24,253
	5,250	0,715	85,262	67,983	44,189	77,143	2,149	4,818	23,263
	5,000	0,965	80,248	63,985	41,590	77,142	2,136	4,681	22,351
	4,750	1,215	75,300	60,040	39,026	77,141	2,123	4,545	21,489
	4,500	1,465	70,416	56,146	36,495	77,140	2,111	4,408	20,669
	4,250	1,715	65,596	52,302	33,997	77,138	2,099	4,272	19,888
	4,000	1,965	60,837	48,508	31,530	77,137	2,088	4,136	19,135
	3,750	2,215	56,140	44,763	29,096	77,135	2,077	4,000	18,403
	3,500	2,465	51,505	41,068	26,694	77,134	2,068	3,864	17,686
	3,250	2,715	46,933	37,422	24,324	77,132	2,059	3,728	16,980
	3,000	2,965	42,425	33,827	21,988	77,129	2,052	3,592	16,286
	2,750	3,215	37,980	30,283	19,684	77,127	2,047	3,455	15,605
	2,500	3,465	33,601	26,792	17,415	77,124	2,045	3,318	14,924
	2,250	3,715	29,290	23,354	15,180	77,120	2,046	3,179	14,239
	2,000	3,965	25,048	19,972	12,982	77,116	2,054	3,039	13,550
	1,750	4,215	20,878	16,647	10,821	77,109	2,072	2,894	12,854
	1,500	4,465	16,785	13,384	8,699	77,100	2,106	2,744	12,124
	1,250	4,715	12,780	10,190	6,624	77,087	2,174	2,582	11,300
	1,000	4,965	9,394	7,491	4,869	77,071	2,222	2,424	3,812
	0,750	5,215	6,734	5,369	3,490	77,058	2,185	2,291	3,312
	0,500	5,465	4,212	3,358	2,183	77,033	2,147	2,160	2,796
	0,250	5,715	1,849	1,474	0,958	76,958	2,111	2,030	2,271
	0,155	5,810	1,000	0,797	0,518	76,849	2,105	1,980	2,071
	0,000	5,965	0,000	0,000	0,000	75,272	2,245	1,885	0,000

Tank Calibrations - T26_DF_A.Sucias

Fluid Type = Lodos

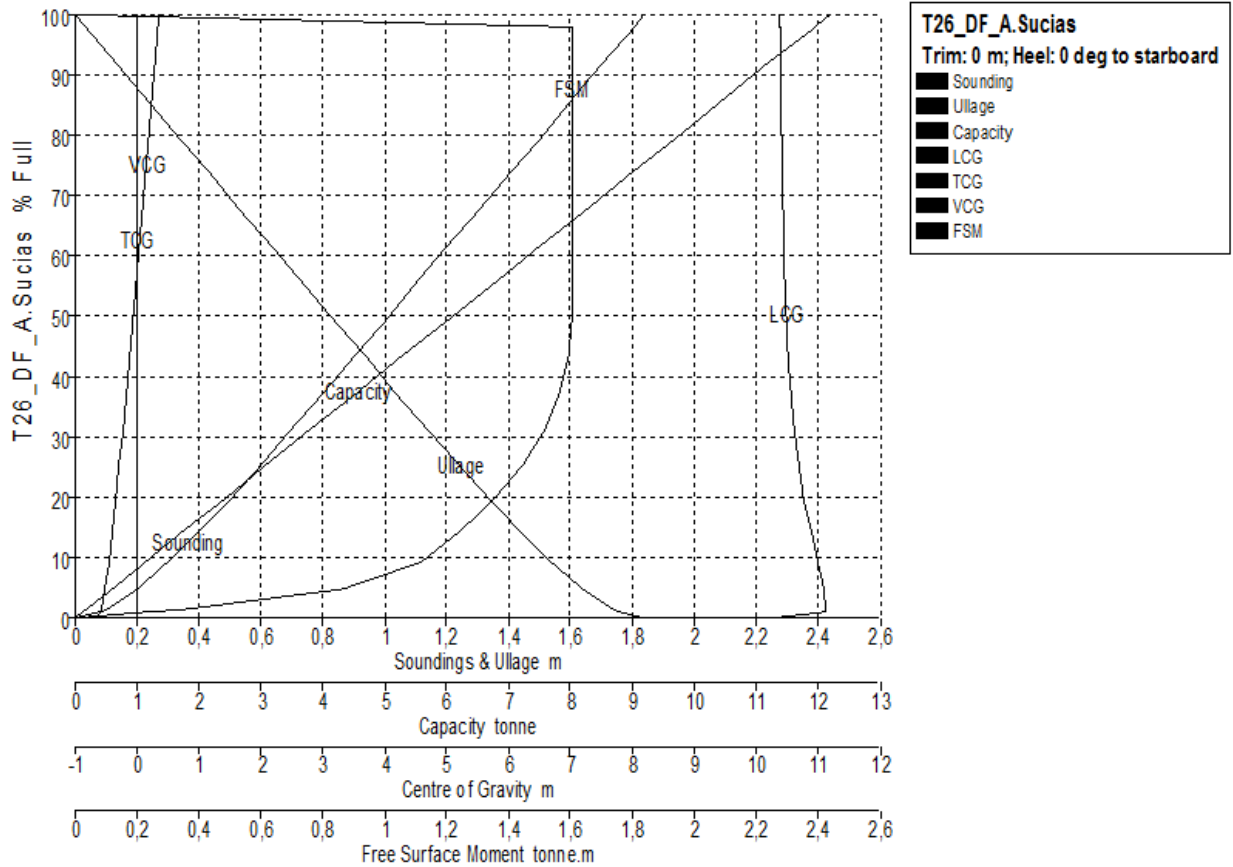
Specific gravity = 0,96

Permeability = 98 %

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

Cuaderno 4: Cálculos de arquitectura naval

Proyecto nº 16-15.
Fernando García-Ganges Icaza



Tank Name	Sounding m	Ullage m	% Full	Capacity m ³	Capacity tonne	LCG m	TCG m	VCG m	FSM tonne.m
T26_DF_A.Sucias	1,839	0,000	100,000	12,696	12,188	10,366	0,000	0,363	0,000
	1,806	0,033	98,000	12,442	11,944	10,369	0,000	0,347	1,606
	1,804	0,035	97,900	12,429	11,932	10,369	0,000	0,346	1,606
	1,800	0,039	97,666	12,400	11,904	10,369	0,000	0,344	1,606
	1,700	0,139	91,614	11,631	11,166	10,377	0,000	0,293	1,606
	1,600	0,239	85,563	10,863	10,429	10,386	0,000	0,242	1,606
	1,500	0,339	79,511	10,095	9,691	10,396	0,000	0,191	1,606
	1,400	0,439	73,459	9,326	8,953	10,408	0,000	0,140	1,606
	1,300	0,539	67,408	8,558	8,216	10,422	0,000	0,089	1,606
	1,200	0,639	61,356	7,790	7,478	10,439	0,000	0,038	1,606
	1,100	0,739	55,305	7,021	6,741	10,460	0,000	-0,014	1,606
	1,000	0,839	49,253	6,253	6,003	10,486	0,000	-0,067	1,605
	0,900	0,939	43,207	5,486	5,266	10,519	0,000	-0,120	1,595
	0,800	1,039	37,189	4,722	4,533	10,560	0,000	-0,173	1,565
	0,700	1,139	31,224	3,964	3,806	10,613	0,000	-0,227	1,518
	0,600	1,239	25,363	3,220	3,091	10,682	0,000	-0,283	1,449
	0,500	1,339	19,664	2,497	2,397	10,770	0,000	-0,339	1,348
	0,400	1,439	14,274	1,812	1,740	10,876	0,000	-0,396	1,246
	0,300	1,539	9,338	1,186	1,138	10,984	0,000	-0,453	1,118
	0,200	1,639	4,958	0,629	0,604	11,082	0,000	-0,512	0,864
	0,100	1,739	1,509	0,192	0,184	11,117	0,000	-0,572	0,343
	0,081	1,758	1,000	0,127	0,122	11,116	0,000	-0,584	0,233
	0,000	1,839	0,000	0,000	0,000	10,250	0,000	-0,639	0,000

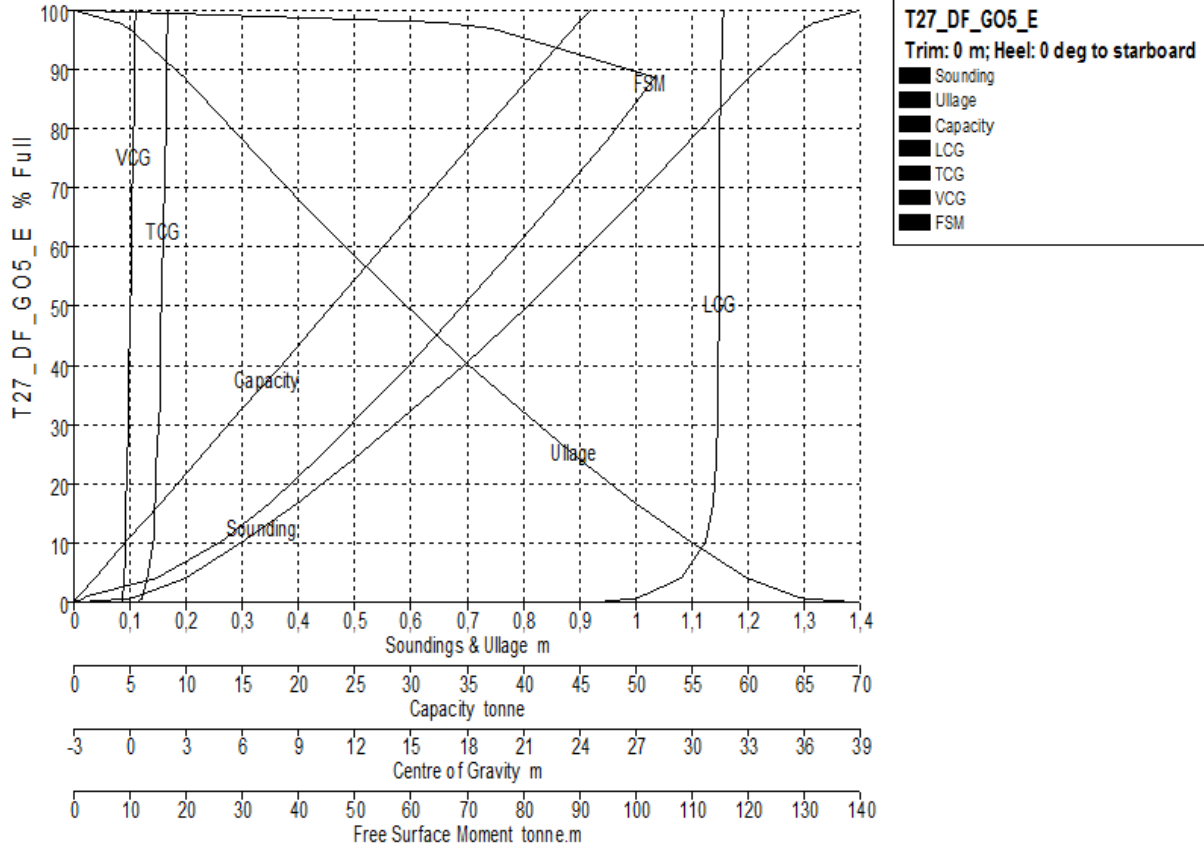
Cuaderno 4: Cálculos de arquitectura naval

Proyecto nº 16-15.
Fernando García-Ganges Icaza



Tank Calibrations - T27_DF_GO5_E

Fluid Type = Diesel Specific gravity = 0,84
Permeability = 98 %
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
T27_DF_GO5_E	1,398	0,000	100,000	54,610	45,872	31,728	2,021	0,323	0,000
	1,321	0,077	98,000	53,518	44,955	31,649	2,002	0,311	65,475
	1,319	0,079	97,900	53,463	44,909	31,646	2,001	0,311	65,378
	1,300	0,098	96,848	52,889	44,427	31,615	1,992	0,305	74,500
	1,200	0,198	88,490	48,324	40,593	31,503	1,938	0,259	103,281
	1,100	0,298	78,235	42,724	35,888	31,493	1,884	0,203	95,035
	1,000	0,398	68,309	37,303	31,335	31,481	1,828	0,146	86,116
	0,900	0,498	58,731	32,073	26,941	31,463	1,768	0,089	77,343
	0,800	0,598	49,521	27,043	22,716	31,439	1,704	0,033	68,714
	0,700	0,698	40,703	22,228	18,671	31,403	1,634	-0,024	60,181
	0,600	0,798	32,308	17,643	14,820	31,350	1,558	-0,080	51,740
	0,500	0,898	24,376	13,312	11,182	31,262	1,471	-0,136	43,349
	0,400	0,998	16,960	9,262	7,780	31,098	1,366	-0,192	34,992
	0,300	1,098	10,143	5,539	4,653	30,726	1,226	-0,250	26,374
	0,200	1,198	4,111	2,245	1,886	29,392	0,977	-0,315	14,776
	0,113	1,284	1,000	0,546	0,459	27,238	0,701	-0,378	2,290
	0,100	1,298	0,745	0,407	0,342	26,957	0,661	-0,387	1,797
	0,000	1,398	0,000	0,000	0,000	24,733	0,401	-0,458	0,000

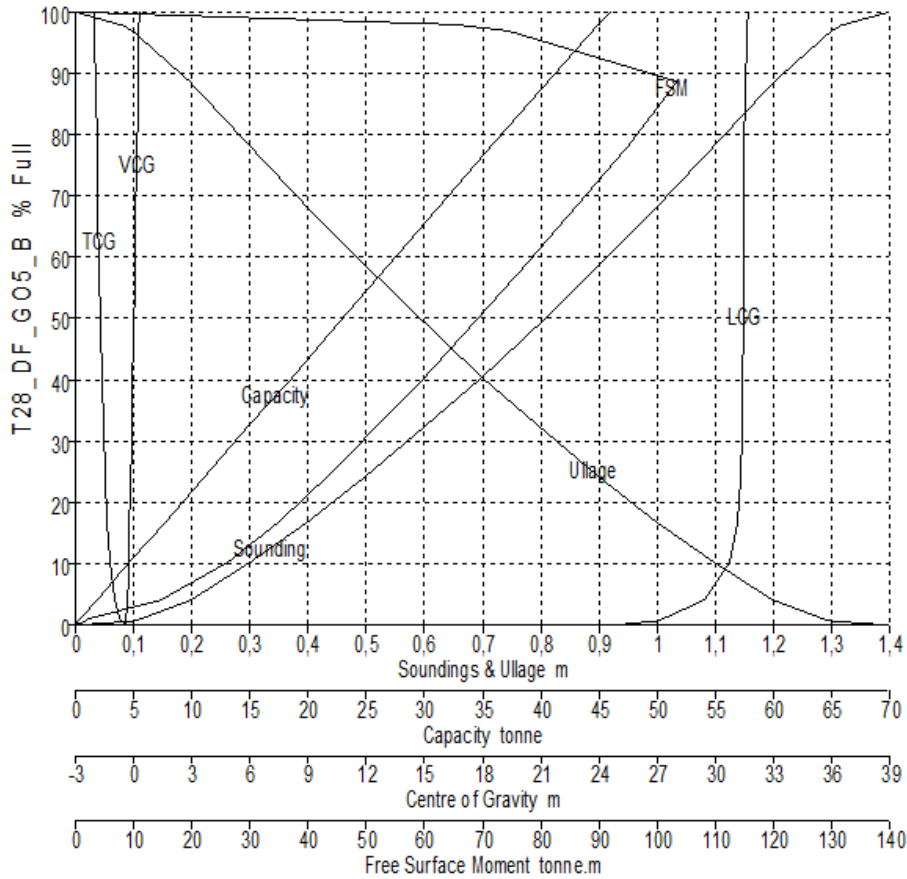
Cuaderno 4: Cálculos de arquitectura naval

Proyecto nº 16-15.
Fernando García-Ganges Icaza



Tank Calibrations - T28_DF_GO5_B

Fluid Type = Diesel Specific gravity = 0,84
Permeability = 98 %
Trim = 0 m (+ve by stern); Heel = 0 deg to starboard



T28_DF_GO5_B
Trim: 0 m; Heel: 0 deg to starboard

- Sounding
- Ullage
- Capacity
- LCG
- TCG
- VCG
- FSM

Tank Name	Sounding m	Ullage m	% Full	Capacity m ³	Capacity tonne	LCG m	TCG m	VCG m	FSM tonne.m
T28_DF_GO5_B	1,398	0,000	100,000	54,610	45,872	31,728	-2,021	0,323	0,000
	1,321	0,077	98,000	53,518	44,955	31,649	-2,002	0,311	65,475
	1,319	0,079	97,900	53,463	44,909	31,646	-2,001	0,311	65,378
	1,300	0,098	96,848	52,889	44,427	31,615	-1,992	0,305	74,500
	1,200	0,198	88,490	48,324	40,593	31,503	-1,938	0,259	103,281
	1,100	0,298	78,235	42,724	35,888	31,493	-1,884	0,203	95,035
	1,000	0,398	68,309	37,303	31,335	31,481	-1,828	0,146	86,116
	0,900	0,498	58,731	32,073	26,941	31,463	-1,768	0,089	77,343
	0,800	0,598	49,521	27,043	22,716	31,439	-1,704	0,033	68,714
	0,700	0,698	40,703	22,228	18,671	31,403	-1,634	-0,024	60,181
	0,600	0,798	32,308	17,643	14,820	31,350	-1,558	-0,080	51,740
	0,500	0,898	24,376	13,312	11,182	31,262	-1,471	-0,136	43,349
	0,400	0,998	16,960	9,262	7,780	31,098	-1,366	-0,192	34,992
	0,300	1,098	10,143	5,539	4,653	30,726	-1,226	-0,250	26,374
	0,200	1,198	4,111	2,245	1,886	29,392	-0,977	-0,315	14,776
	0,113	1,284	1,000	0,546	0,459	27,238	-0,701	-0,378	2,290

Cuaderno 4: Cálculos de arquitectura naval

Proyecto nº 16-15.

Fernando García-Ganges Icaza



	0,100	1,298	0,745	0,407	0,342	26,957	-0,661	-0,387	1,797
	0,000	1,398	0,000	0,000	0,000	24,733	-0,401	-0,458	0,000

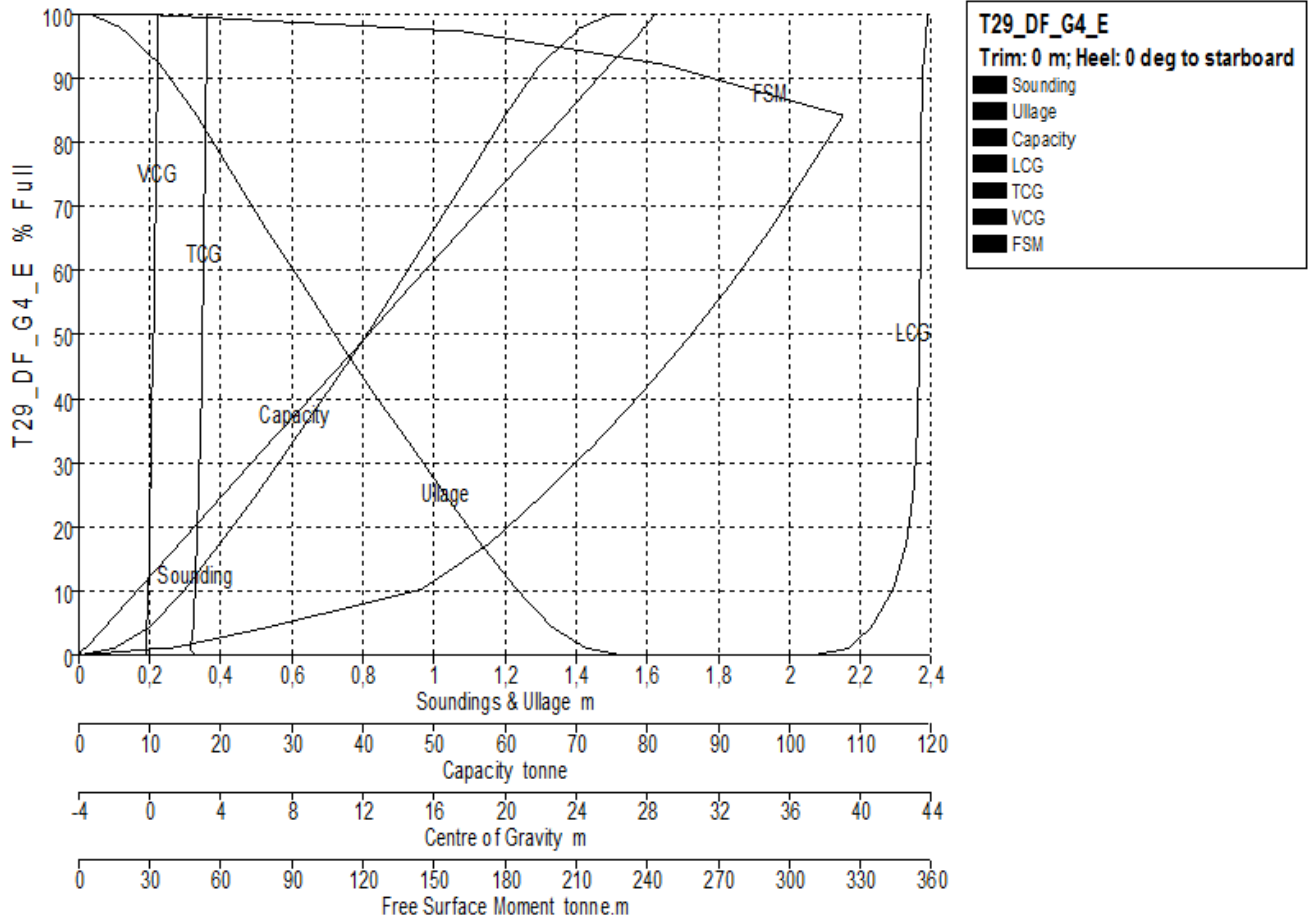
Tank Calibrations - T29_DF_G4_E

Fluid Type = Diesel

Specific gravity = 0,84

Permeability = 98 %

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
T29_DF_G4_E	1,531	0,000	100,000	96,709	81,235	43,822	3,251	0,535	0,000
	1,500	0,031	99,839	96,553	81,105	43,813	3,250	0,534	25,491
	1,416	0,115	98,000	94,774	79,611	43,730	3,239	0,522	130,458
	1,413	0,118	97,900	94,678	79,529	43,726	3,238	0,521	130,313
	1,400	0,131	97,419	94,212	79,138	43,708	3,236	0,518	163,197
	1,300	0,231	92,158	89,125	74,865	43,562	3,205	0,485	247,394
	1,200	0,331	84,297	81,523	68,479	43,473	3,165	0,439	322,663
	1,100	0,431	75,282	72,804	61,155	43,449	3,120	0,385	307,554
	1,000	0,531	66,420	64,234	53,957	43,417	3,072	0,331	291,629
	0,900	0,631	57,728	55,828	46,895	43,376	3,020	0,276	274,885
	0,800	0,731	49,222	47,601	39,985	43,319	2,965	0,222	256,883
	0,700	0,831	40,922	39,575	33,243	43,240	2,904	0,168	237,974
	0,600	0,931	32,851	31,770	26,687	43,122	2,838	0,113	217,827

Cuaderno 4: Cálculos de arquitectura naval

Proyecto nº 16-15.

Fernando García-Ganges Icaza



	0,500	1,031	25,036	24,212	20,338	42,934	2,765	0,058	196,413
	0,400	1,131	17,510	16,933	14,224	42,594	2,681	0,001	173,343
	0,300	1,231	10,335	9,995	8,396	41,824	2,585	-0,060	145,005
	0,200	1,331	4,631	4,479	3,762	40,600	2,478	-0,127	80,661
	0,100	1,431	1,179	1,140	0,958	39,335	2,311	-0,192	37,871
	0,092	1,439	1,000	0,967	0,812	39,215	2,286	-0,197	31,600
	0,000	1,531	0,000	0,000	0,000	37,230	2,532	-0,260	0,000

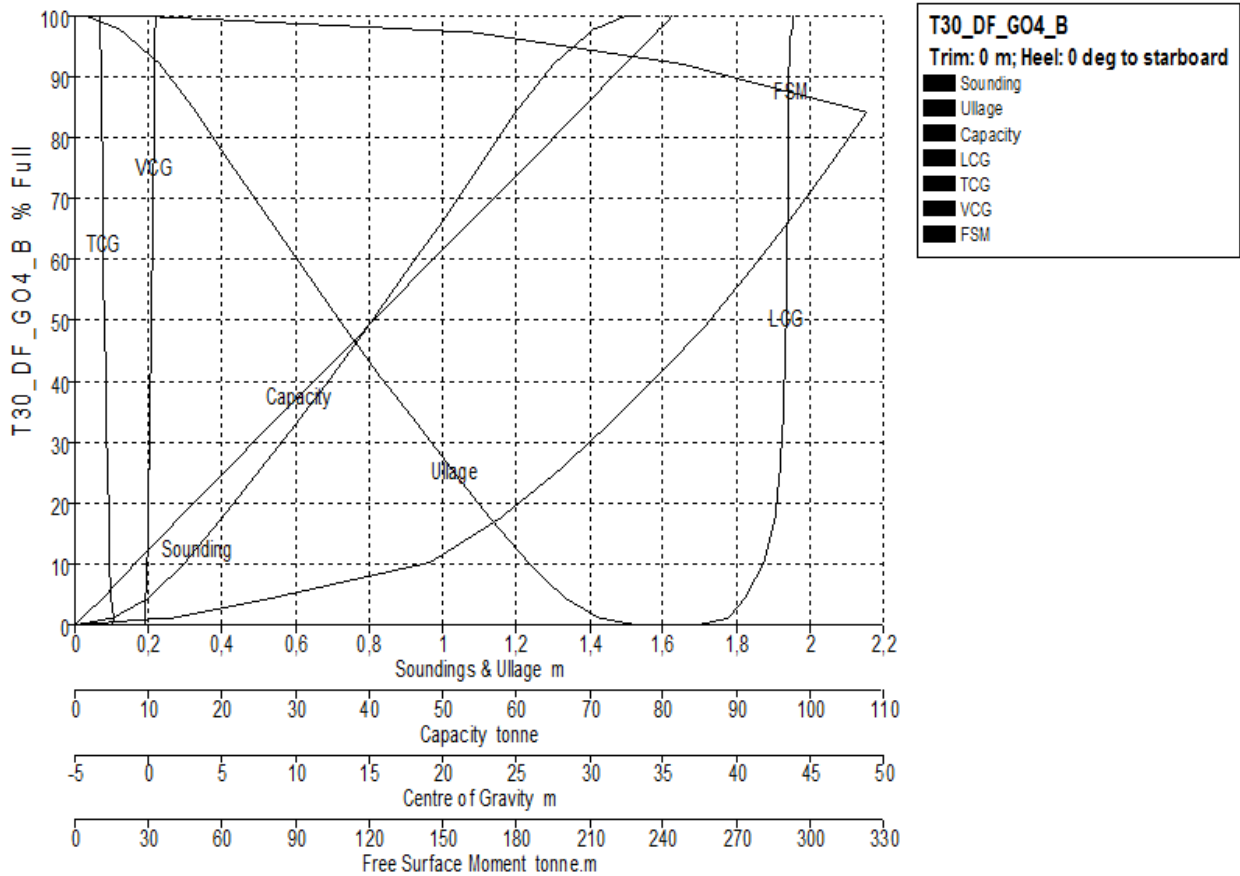
Tank Calibrations - T30_DF_GO4_B

Fluid Type = Diesel

Specific gravity = 0,84

Permeability = 98 %

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
T30_DF_GO4_B	1,531	0,000	100,000	96,709	81,235	43,822	-3,251	0,535	0,000
	1,500	0,031	99,839	96,553	81,105	43,813	-3,250	0,534	25,491
	1,416	0,115	98,000	94,774	79,611	43,730	-3,239	0,522	130,458
	1,413	0,118	97,900	94,678	79,529	43,726	-3,238	0,521	130,313
	1,400	0,131	97,419	94,212	79,138	43,708	-3,236	0,518	163,197
	1,300	0,231	92,158	89,125	74,865	43,562	-3,205	0,485	247,394
	1,200	0,331	84,297	81,523	68,479	43,473	-3,165	0,439	322,663
	1,100	0,431	75,282	72,804	61,155	43,449	-3,120	0,385	307,554
	1,000	0,531	66,420	64,234	53,957	43,417	-3,072	0,331	291,629

Cuaderno 4: Cálculos de arquitectura naval

Proyecto nº 16-15.

Fernando García-Ganges Icaza



	0,900	0,631	57,728	55,828	46,895	43,376	-3,020	0,276	274,885
	0,800	0,731	49,222	47,601	39,985	43,319	-2,965	0,222	256,883
	0,700	0,831	40,922	39,575	33,243	43,240	-2,904	0,168	237,974
	0,600	0,931	32,851	31,770	26,687	43,122	-2,838	0,113	217,827
	0,500	1,031	25,036	24,212	20,338	42,934	-2,765	0,058	196,413
	0,400	1,131	17,510	16,933	14,224	42,594	-2,681	0,001	173,343
	0,300	1,231	10,335	9,995	8,396	41,824	-2,585	-0,060	145,005
	0,200	1,331	4,631	4,479	3,762	40,600	-2,478	-0,127	80,661
	0,100	1,431	1,179	1,140	0,958	39,335	-2,311	-0,192	37,871
	0,092	1,439	1,000	0,967	0,812	39,215	-2,286	-0,197	31,600
	0,000	1,531	0,000	0,000	0,000	37,230	-2,532	-0,260	0,000

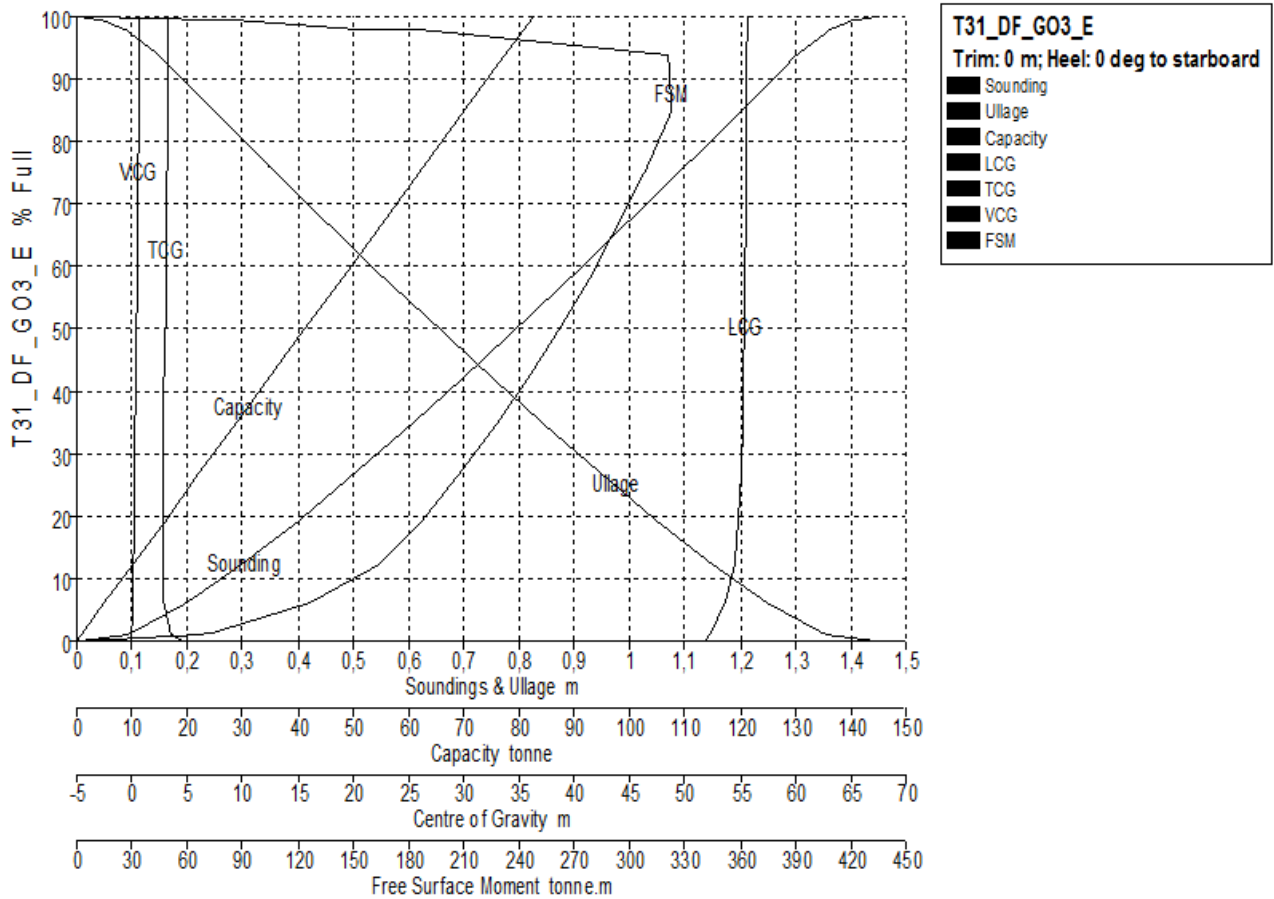
Tank Calibrations - T31_DF_GO3_E

Fluid Type = Diesel

Specific gravity = 0,84

Permeability = 98 %

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
T31_DF_GO3_E	1,449	0,000	100,000	98,251	82,531	55,713	3,246	0,752	0,000
	1,400	0,049	99,365	97,627	82,007	55,679	3,247	0,748	90,588
	1,363	0,086	98,000	96,286	80,880	55,627	3,245	0,739	150,933
	1,361	0,088	97,900	96,188	80,798	55,624	3,245	0,739	184,694
	1,300	0,149	93,713	92,074	77,342	55,554	3,232	0,713	320,624

Cuaderno 4: Cálculos de arquitectura naval

Proyecto nº 16-15.

Fernando García-Ganges Icaza



	1,200	0,249	84,788	83,305	69,976	55,525	3,195	0,660	322,813
	1,100	0,349	75,981	74,652	62,708	55,493	3,156	0,606	309,118
	1,000	0,449	67,318	66,140	55,558	55,454	3,116	0,552	294,580
	0,900	0,549	58,814	57,785	48,540	55,408	3,073	0,498	279,124
	0,800	0,649	50,486	49,603	41,667	55,350	3,028	0,444	262,812
	0,700	0,749	42,354	41,614	34,955	55,277	2,981	0,390	245,549
	0,600	0,849	34,441	33,839	28,425	55,179	2,933	0,335	227,152
	0,500	0,949	26,775	26,307	22,098	55,039	2,885	0,281	207,847
	0,400	1,049	19,395	19,056	16,007	54,817	2,844	0,226	187,131
	0,300	1,149	12,377	12,161	10,215	54,410	2,830	0,170	164,541
	0,200	1,249	6,052	5,946	4,995	53,601	2,915	0,110	126,765
	0,100	1,349	1,352	1,329	1,116	52,304	3,472	0,047	73,596
	0,089	1,360	1,000	0,983	0,825	52,148	3,672	0,039	63,584
	0,000	1,449	0,000	0,000	0,000	51,812	4,731	-0,025	0,000

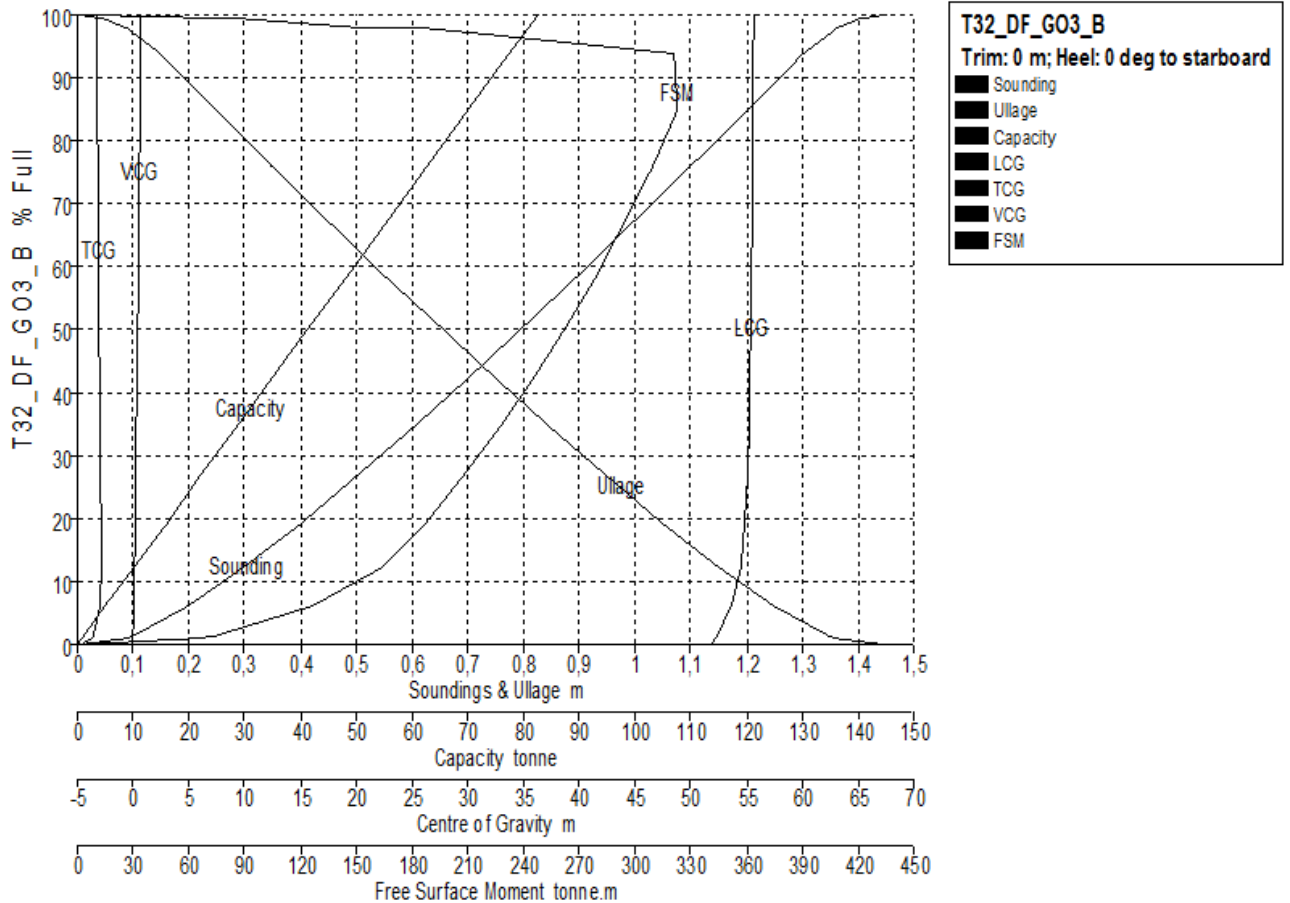
Tank Calibrations - T32_DF_GO3_B

Fluid Type = Diesel

Specific gravity = 0,84

Permeability = 98 %

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
T32_DF_GO3_B	1,449	0,000	100,000	98,251	82,531	55,713	-3,246	0,752	0,000

Cuaderno 4: Cálculos de arquitectura naval

Proyecto nº 16-15.

Fernando García-Ganges Icaza



	1,400	0,049	99,365	97,627	82,007	55,679	-3,247	0,748	90,588
	1,363	0,086	98,000	96,286	80,880	55,627	-3,245	0,739	150,933
	1,361	0,088	97,900	96,188	80,798	55,624	-3,245	0,739	184,694
	1,300	0,149	93,713	92,074	77,342	55,554	-3,232	0,713	320,624
	1,200	0,249	84,788	83,305	69,976	55,525	-3,195	0,660	322,813
	1,100	0,349	75,981	74,652	62,708	55,493	-3,156	0,606	309,118
	1,000	0,449	67,318	66,140	55,558	55,454	-3,116	0,552	294,580
	0,900	0,549	58,814	57,785	48,540	55,408	-3,073	0,498	279,124
	0,800	0,649	50,486	49,603	41,667	55,350	-3,028	0,444	262,812
	0,700	0,749	42,354	41,614	34,955	55,277	-2,981	0,390	245,549
	0,600	0,849	34,441	33,839	28,425	55,179	-2,933	0,335	227,152
	0,500	0,949	26,775	26,307	22,098	55,039	-2,885	0,281	207,847
	0,400	1,049	19,395	19,056	16,007	54,817	-2,844	0,226	187,131
	0,300	1,149	12,377	12,161	10,215	54,410	-2,830	0,170	164,541
	0,200	1,249	6,052	5,946	4,995	53,601	-2,915	0,110	126,765
	0,100	1,349	1,352	1,329	1,116	52,304	-3,472	0,047	73,596
	0,089	1,360	1,000	0,983	0,825	52,148	-3,672	0,039	63,584
	0,000	1,449	0,000	0,000	0,000	51,812	-4,731	-0,025	0,000

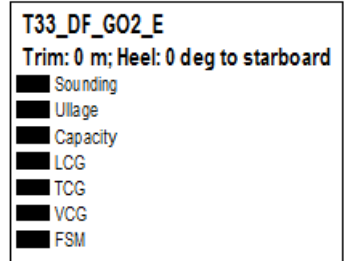
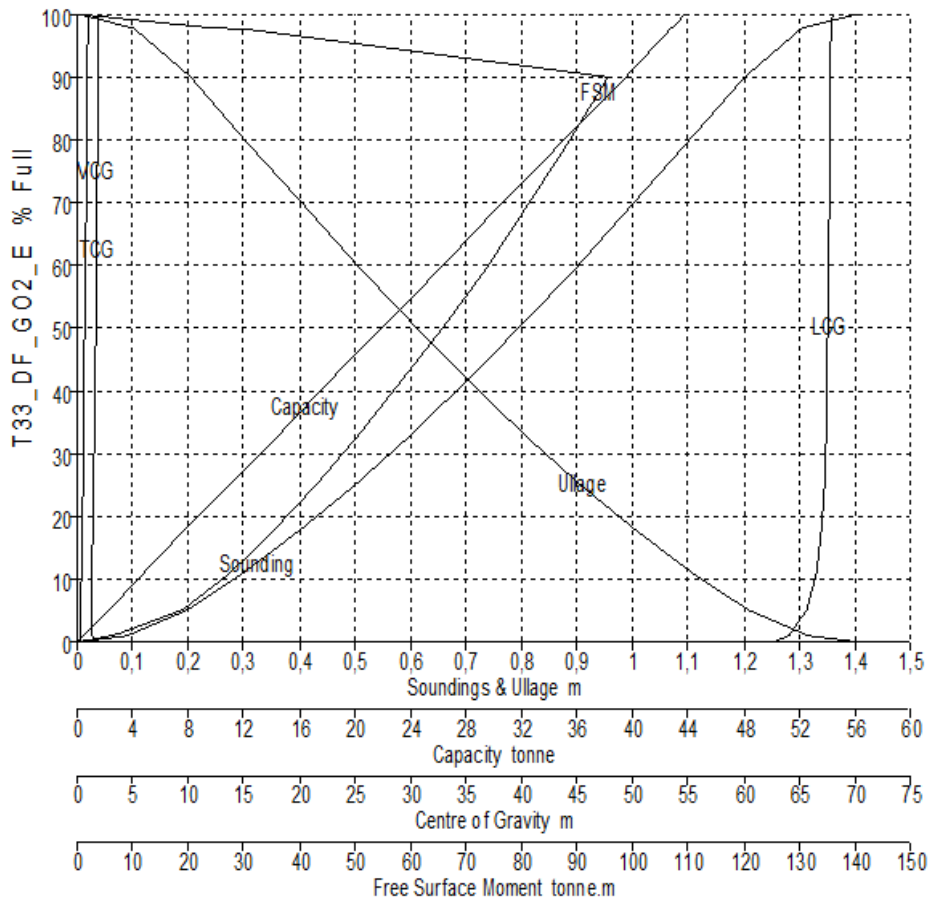
Tank Calibrations - T33_DF_GO2_E

Fluid Type = Diesel

Specific gravity = 0,84

Permeability = 98 %

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



Cuaderno 4: Cálculos de arquitectura naval

Proyecto nº 16-15.

Fernando García-Ganges Icaza



Tank Name	Sounding m	Ullage m	% Full	Capacity m ³	Capacity tonne	LCG m	TCG m	VCG m	FSM tonne.m
T33_DF_GO2_E	1,406	0,000	100,000	52,077	43,744	67,959	1,926	0,991	0,000
	1,400	0,006	99,984	52,069	43,738	67,958	1,926	0,991	1,023
	1,308	0,098	98,000	51,035	42,869	67,859	1,928	0,979	23,564
	1,306	0,100	97,900	50,983	42,826	67,855	1,928	0,979	23,517
	1,300	0,106	97,637	50,846	42,711	67,844	1,928	0,977	31,063
	1,200	0,206	90,158	46,951	39,439	67,700	1,911	0,937	95,627
	1,100	0,306	79,751	41,532	34,887	67,663	1,863	0,879	88,585
	1,000	0,406	69,664	36,279	30,474	67,619	1,811	0,822	81,252
	0,900	0,506	59,927	31,208	26,215	67,566	1,757	0,765	73,764
	0,800	0,606	50,574	26,337	22,123	67,503	1,700	0,708	66,134
	0,700	0,706	41,639	21,684	18,215	67,424	1,639	0,651	58,419
	0,600	0,806	33,161	17,269	14,506	67,320	1,574	0,593	50,717
	0,500	0,906	25,191	13,119	11,020	67,176	1,505	0,536	43,105
	0,400	1,006	17,795	9,267	7,784	66,959	1,431	0,479	35,505
	0,300	1,106	11,072	5,766	4,844	66,574	1,357	0,420	27,662
	0,200	1,206	5,238	2,728	2,291	65,679	1,308	0,358	18,944
	0,100	1,306	1,263	0,658	0,552	64,138	1,301	0,292	7,557
	0,090	1,316	1,000	0,521	0,437	63,946	1,305	0,285	6,257
	0,000	1,406	0,000	0,000	0,000	62,594	1,962	0,224	0,000

Tank Calibrations - T34_DF_GO2_B

Fluid Type = Diesel

Specific gravity = 0,84

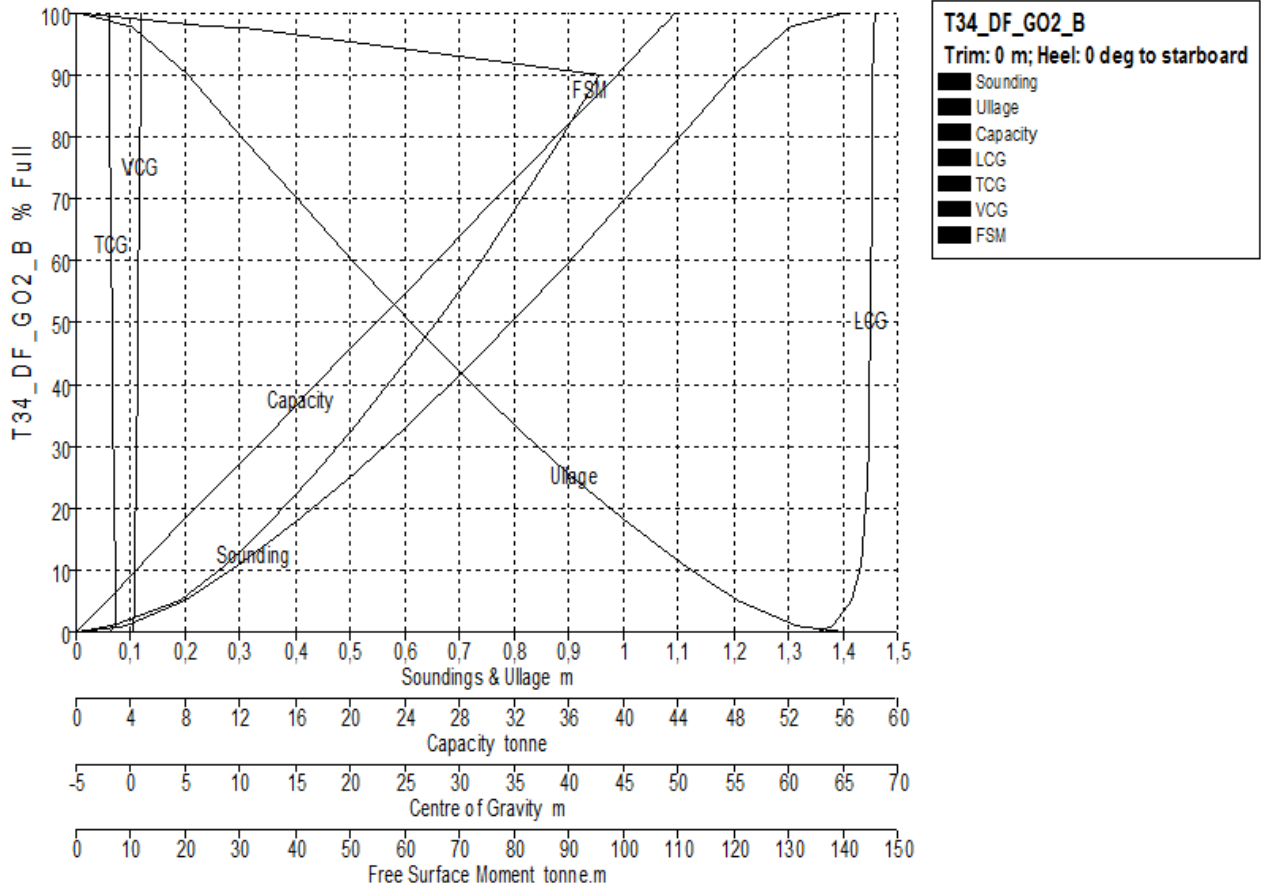
Permeability = 98 %

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

Cuaderno 4: Cálculos de arquitectura naval

Proyecto nº 16-15.

Fernando García-Ganges Icaza



Tank Name	Sounding m	Ullage m	% Full	Capacity m ³	Capacity tonne	LCG m	TCG m	VCG m	FSM tonne.m
T34_DF_G02_B	1,406	0,000	100,000	52,077	43,744	67,959	-1,926	0,991	0,000
	1,400	0,006	99,984	52,069	43,738	67,958	-1,926	0,991	1,023
	1,308	0,098	98,000	51,035	42,869	67,859	-1,928	0,979	23,564
	1,306	0,100	97,900	50,983	42,826	67,855	-1,928	0,979	23,517
	1,300	0,106	97,637	50,846	42,711	67,844	-1,928	0,977	31,063
	1,200	0,206	90,158	46,951	39,439	67,700	-1,911	0,937	95,627
	1,100	0,306	79,751	41,532	34,887	67,663	-1,863	0,879	88,585
	1,000	0,406	69,664	36,279	30,474	67,619	-1,811	0,822	81,252
	0,900	0,506	59,927	31,208	26,215	67,566	-1,757	0,765	73,764
	0,800	0,606	50,574	26,337	22,123	67,503	-1,700	0,708	66,134
	0,700	0,706	41,639	21,684	18,215	67,424	-1,639	0,651	58,419
	0,600	0,806	33,161	17,269	14,506	67,320	-1,574	0,593	50,717
	0,500	0,906	25,191	13,119	11,020	67,176	-1,505	0,536	43,105
	0,400	1,006	17,795	9,267	7,784	66,959	-1,431	0,479	35,505
	0,300	1,106	11,072	5,766	4,844	66,574	-1,357	0,420	27,662
	0,200	1,206	5,238	2,728	2,291	65,679	-1,308	0,358	18,944
	0,100	1,306	1,263	0,658	0,552	64,138	-1,301	0,292	7,557
	0,090	1,316	1,000	0,521	0,437	63,946	-1,305	0,285	6,257
	0,000	1,406	0,000	0,000	0,000	62,594	-1,962	0,224	0,000

Tank Calibrations - T35_DF_G01_E

Cuaderno 4: Cálculos de arquitectura naval

Proyecto nº 16-15.

Fernando García-Ganges Icaza

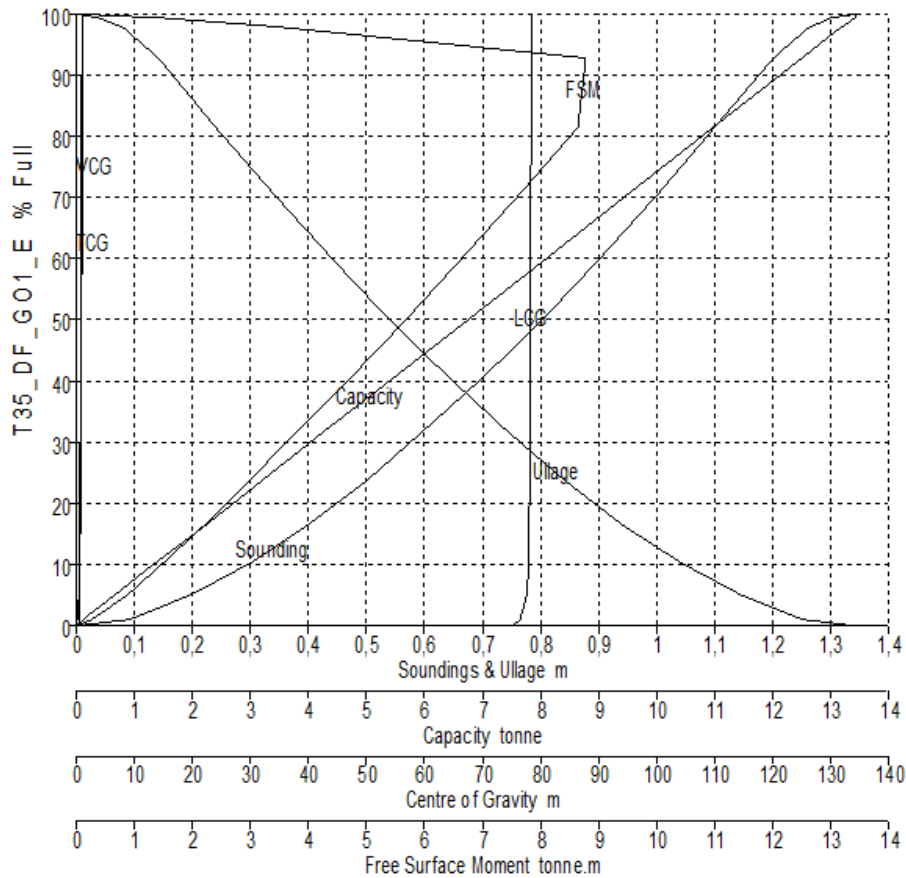


Fluid Type = Diesel

Specific gravity = 0,84

Permeability = 98 %

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



T35_DF_GO1_E
Trim: 0 m; Heel: 0 deg to starboard

- Sounding
- Ullage
- Capacity
- LCG
- TCG
- VCG
- FSM

Tank Name	Sounding m	Ullage m	% Full	Capacity m ³	Capacity tonne	LCG m	TCG m	VCG m	FSM tonne.m
T35_DF_GO1_E	1,342	0,000	100,000	16,029	13,465	78,485	0,999	1,203	0,000
	1,300	0,042	99,413	15,935	13,385	78,465	0,999	1,200	1,532
	1,265	0,077	98,000	15,709	13,195	78,428	0,998	1,193	3,423
	1,263	0,079	97,900	15,693	13,182	78,426	0,998	1,192	3,416
	1,200	0,142	92,786	14,873	12,493	78,365	0,988	1,166	8,774
	1,100	0,242	81,361	13,041	10,955	78,349	0,951	1,107	8,637
	1,000	0,342	70,374	11,280	9,475	78,330	0,911	1,048	7,621
	0,900	0,442	59,884	9,599	8,063	78,307	0,869	0,988	6,626
	0,800	0,542	49,930	8,003	6,723	78,277	0,825	0,929	5,656
	0,700	0,642	40,559	6,501	5,461	78,240	0,777	0,869	4,722
	0,600	0,742	31,825	5,101	4,285	78,191	0,726	0,810	3,832
	0,500	0,842	23,802	3,815	3,205	78,124	0,670	0,750	2,991
	0,400	0,942	16,576	2,657	2,232	78,027	0,610	0,690	2,208
	0,300	1,042	10,256	1,644	1,381	77,866	0,544	0,630	1,502
	0,200	1,142	4,995	0,801	0,673	77,525	0,471	0,569	0,889
	0,100	1,242	1,236	0,198	0,166	76,558	0,401	0,504	0,333
	0,090	1,251	1,000	0,160	0,135	76,432	0,393	0,498	0,284
	0,000	1,342	0,000	0,000	0,000	75,044	0,006	0,436	0,000

Cuaderno 4: Cálculos de arquitectura naval

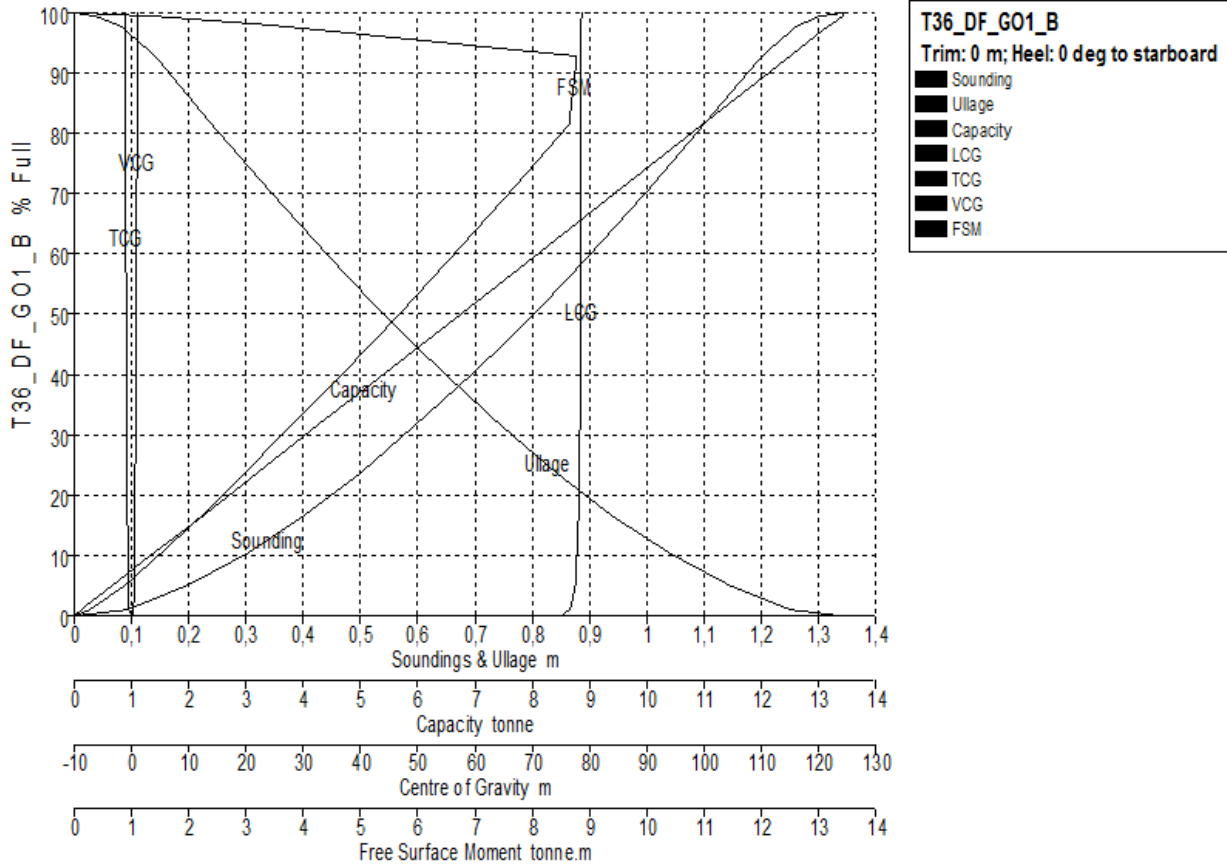
Proyecto nº 16-15.

Fernando García-Ganges Icaza



Tank Calibrations - T36_DF_GO1_B

Fluid Type = Diesel Specific gravity = 0,84
 Permeability = 98 %
 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
T36_DF_GO1_B	1,342	0,000	100,000	16,029	13,465	78,485	-0,999	1,203	0,000
	1,300	0,042	99,413	15,935	13,385	78,465	-0,999	1,200	1,532
	1,265	0,077	98,000	15,709	13,195	78,428	-0,998	1,193	3,423
	1,263	0,079	97,900	15,693	13,182	78,426	-0,998	1,192	3,416
	1,200	0,142	92,786	14,873	12,493	78,365	-0,988	1,166	8,774
	1,100	0,242	81,361	13,041	10,955	78,349	-0,951	1,107	8,637
	1,000	0,342	70,374	11,280	9,475	78,330	-0,911	1,048	7,621
	0,900	0,442	59,884	9,599	8,063	78,307	-0,869	0,988	6,626
	0,800	0,542	49,930	8,003	6,723	78,277	-0,825	0,929	5,656
	0,700	0,642	40,559	6,501	5,461	78,240	-0,777	0,869	4,722
	0,600	0,742	31,825	5,101	4,285	78,191	-0,726	0,810	3,832
	0,500	0,842	23,802	3,815	3,205	78,124	-0,670	0,750	2,991
	0,400	0,942	16,576	2,657	2,232	78,027	-0,610	0,690	2,208
	0,300	1,042	10,256	1,644	1,381	77,866	-0,544	0,630	1,502
	0,200	1,142	4,995	0,801	0,673	77,525	-0,471	0,569	0,889
	0,100	1,242	1,236	0,198	0,166	76,558	-0,401	0,504	0,333
	0,090	1,251	1,000	0,160	0,135	76,432	-0,393	0,498	0,284
	0,000	1,342	0,000	0,000	0,000	75,044	-0,006	0,436	0,000

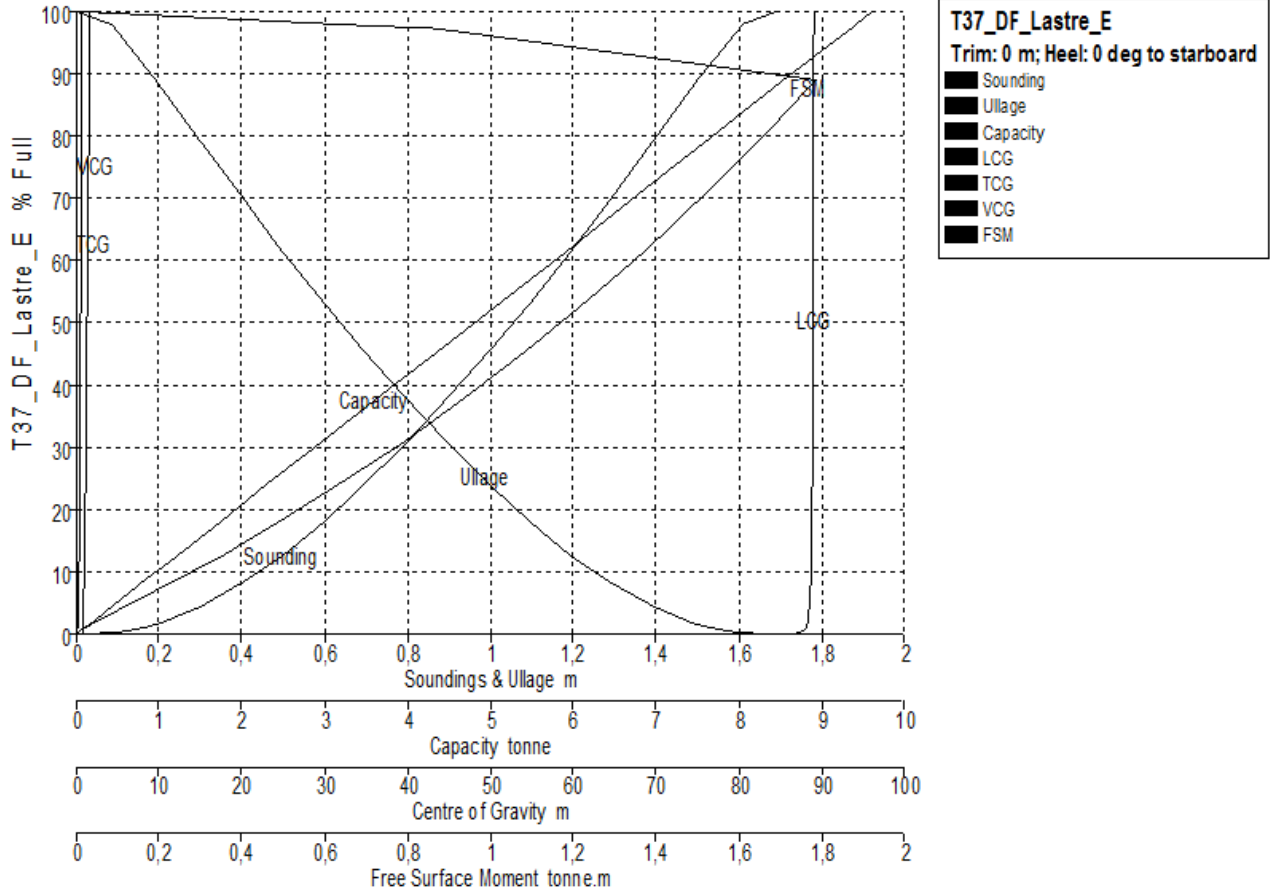
Cuaderno 4: Cálculos de arquitectura naval

Proyecto nº 16-15.
Fernando García-Ganges Icaza



Tank Calibrations - T37_DF_Lastre_E

Fluid Type = Water Ballast Specific gravity = 1,025
Permeability = 98 %
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
T37_DF_Lastre_E	1,693	0,000	100,000	9,373	9,607	89,043	0,582	1,635	0,000
	1,611	0,082	98,000	9,185	9,415	89,000	0,582	1,622	0,624
	1,609	0,084	97,900	9,176	9,405	88,998	0,582	1,622	0,623
	1,600	0,093	97,399	9,129	9,357	88,991	0,581	1,619	0,866
	1,500	0,193	88,839	8,326	8,535	88,964	0,568	1,566	1,786
	1,400	0,293	79,635	7,464	7,650	88,954	0,551	1,507	1,655
	1,300	0,393	70,680	6,625	6,790	88,941	0,532	1,448	1,519
	1,200	0,493	62,008	5,812	5,957	88,925	0,512	1,389	1,379
	1,100	0,593	53,656	5,029	5,155	88,907	0,490	1,329	1,235
	1,000	0,693	45,661	4,280	4,387	88,886	0,466	1,269	1,090
	0,900	0,793	38,067	3,568	3,657	88,861	0,439	1,209	0,943
	0,800	0,893	30,923	2,898	2,971	88,831	0,410	1,148	0,792
	0,700	0,993	24,285	2,276	2,333	88,795	0,378	1,086	0,642
	0,600	1,093	18,216	1,707	1,750	88,749	0,342	1,024	0,494
	0,500	1,193	12,801	1,200	1,230	88,688	0,301	0,961	0,354
	0,400	1,293	8,153	0,764	0,783	88,601	0,254	0,897	0,226
	0,300	1,393	4,410	0,413	0,424	88,470	0,201	0,832	0,118

Cuaderno 4: Cálculos de arquitectura naval

Proyecto nº 16-15.

Fernando García-Ganges Icaza



	0,200	1,493	1,737	0,163	0,167	88,228	0,139	0,765	0,041
	0,160	1,533	1,000	0,094	0,096	88,040	0,114	0,738	0,021
	0,100	1,593	0,290	0,027	0,028	87,522	0,076	0,695	0,005
	0,000	1,693	0,000	0,000	0,000	86,236	0,000	0,622	0,000

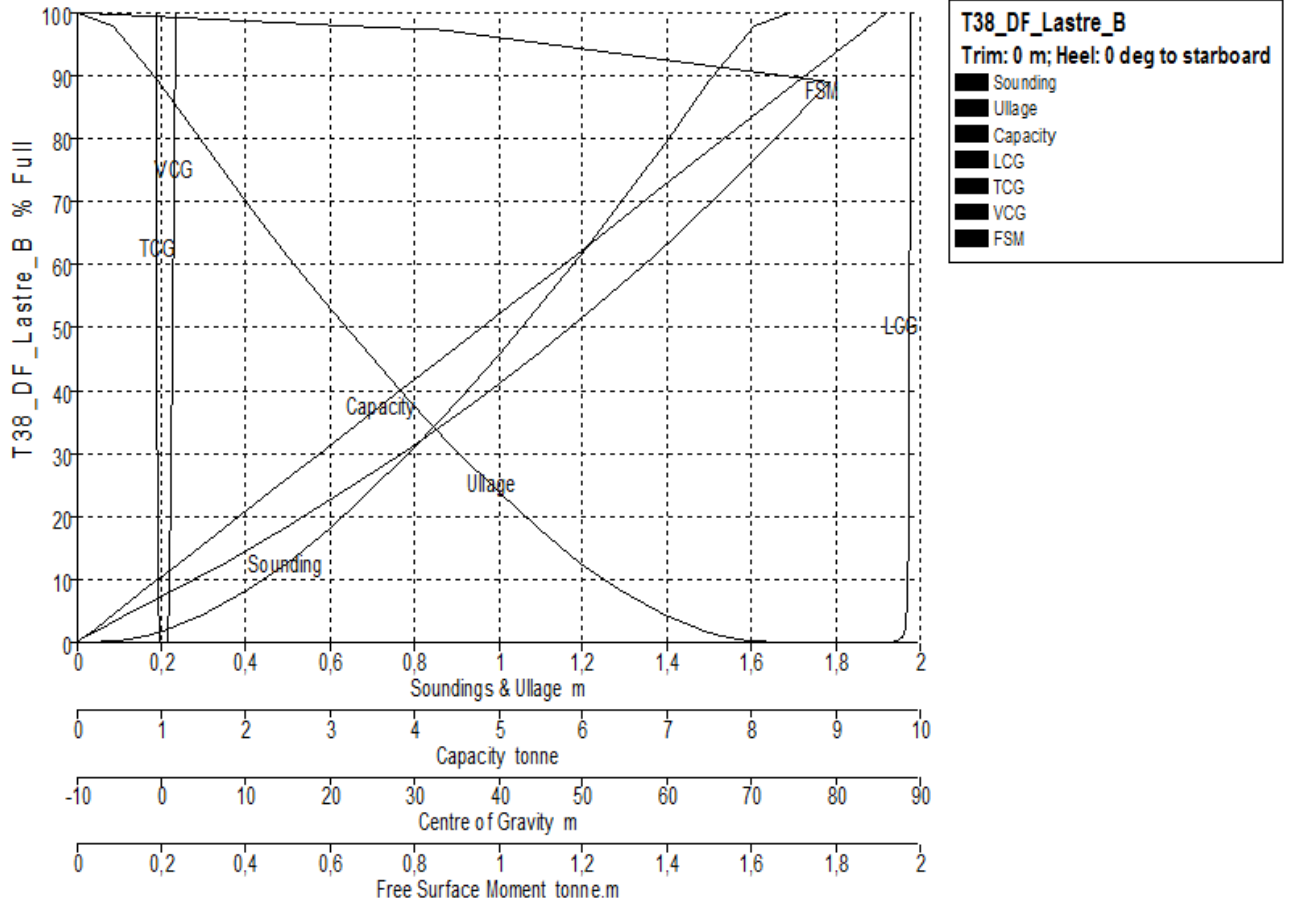
Tank Calibrations - T38_DF_Lastre_B

Fluid Type = Water Ballast

Specific gravity = 1,025

Permeability = 98 %

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
T38_DF_Lastre_B	1,693	0,000	100,000	9,373	9,607	89,043	-0,582	1,635	0,000
	1,611	0,082	98,000	9,185	9,415	89,000	-0,582	1,622	0,624
	1,609	0,084	97,900	9,176	9,405	88,998	-0,582	1,622	0,623
	1,600	0,093	97,399	9,129	9,357	88,991	-0,581	1,619	0,866
	1,500	0,193	88,839	8,326	8,535	88,964	-0,568	1,566	1,786
	1,400	0,293	79,635	7,464	7,650	88,954	-0,551	1,507	1,655
	1,300	0,393	70,680	6,625	6,790	88,941	-0,532	1,448	1,519
	1,200	0,493	62,008	5,812	5,957	88,925	-0,512	1,389	1,379
	1,100	0,593	53,656	5,029	5,155	88,907	-0,490	1,329	1,235
	1,000	0,693	45,661	4,280	4,387	88,886	-0,466	1,269	1,090
	0,900	0,793	38,067	3,568	3,657	88,861	-0,439	1,209	0,943

Cuaderno 4: Cálculos de arquitectura naval

Proyecto nº 16-15.

Fernando García-Ganges Icaza



	0,800	0,893	30,923	2,898	2,971	88,831	-0,410	1,148	0,792
	0,700	0,993	24,285	2,276	2,333	88,795	-0,378	1,086	0,642
	0,600	1,093	18,216	1,707	1,750	88,749	-0,342	1,024	0,494
	0,500	1,193	12,801	1,200	1,230	88,688	-0,301	0,961	0,354
	0,400	1,293	8,153	0,764	0,783	88,601	-0,254	0,897	0,226
	0,300	1,393	4,410	0,413	0,424	88,470	-0,201	0,832	0,118
	0,200	1,493	1,737	0,163	0,167	88,228	-0,139	0,765	0,041
	0,160	1,533	1,000	0,094	0,096	88,040	-0,114	0,738	0,021
	0,100	1,593	0,290	0,027	0,028	87,522	-0,076	0,695	0,005
	0,000	1,693	0,000	0,000	0,000	86,236	0,000	0,622	0,000

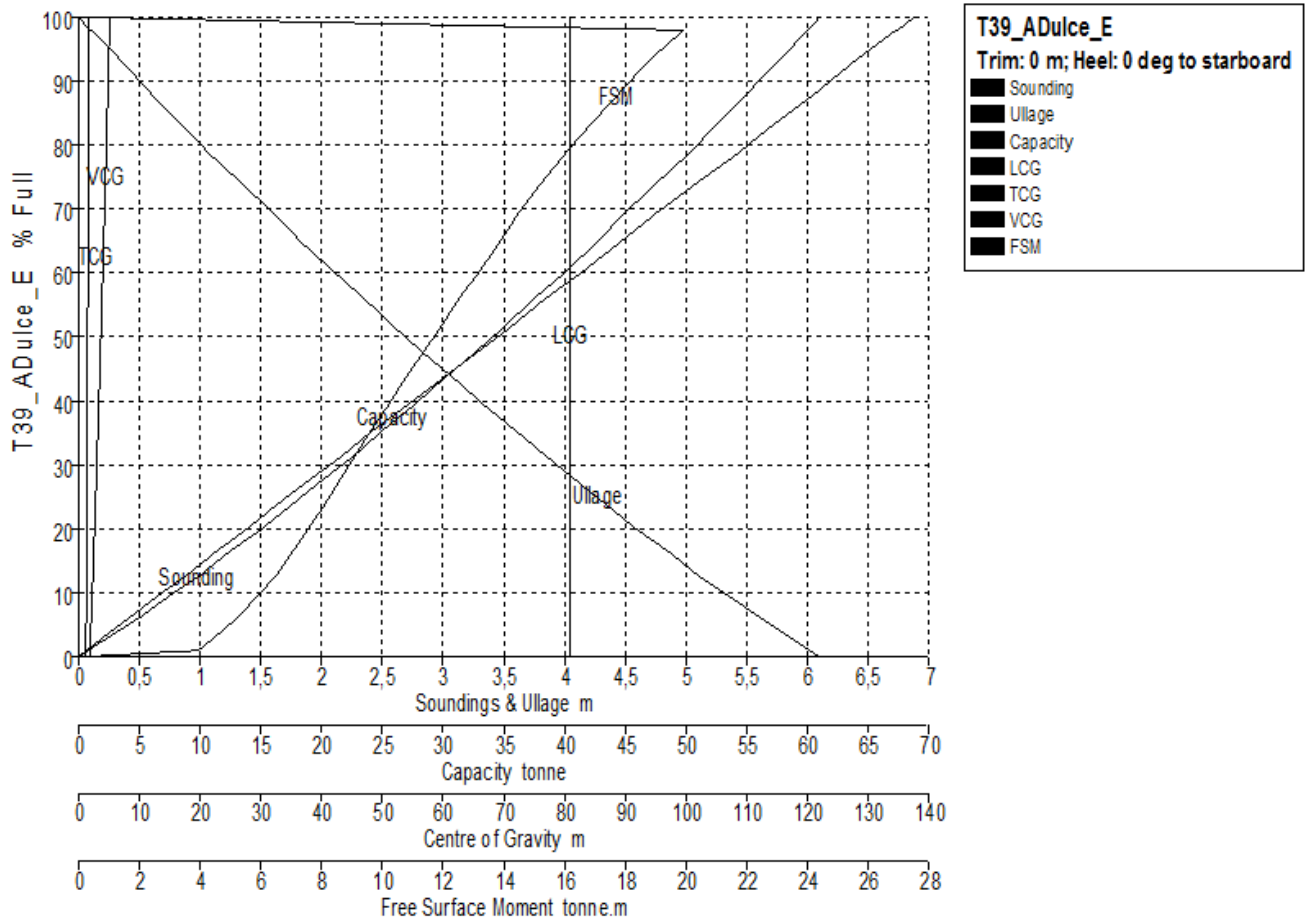
Tank Calibrations - T39_ADulce_E

Fluid Type = Fresh Water

Specific gravity = 1

Permeability = 98 %

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
T39_ADulce_E	6,100	0,000	100,000	68,730	68,730	80,879	1,683	5,194	0,000
	6,002	0,098	98,000	67,355	67,355	80,879	1,675	5,138	19,906
	6,000	0,100	97,967	67,333	67,333	80,879	1,675	5,137	19,898
	5,997	0,103	97,900	67,287	67,287	80,879	1,675	5,135	19,883
	5,750	0,350	92,957	63,889	63,889	80,879	1,657	4,994	18,772

Cuaderno 4: Cálculos de arquitectura naval

Proyecto nº 16-15.

Fernando García-Ganges Icaza



	5,500	0,600	88,043	60,512	60,512	80,878	1,639	4,853	17,754
	5,250	0,850	83,220	57,197	57,197	80,878	1,621	4,713	16,837
	5,000	1,100	78,481	53,940	53,940	80,878	1,604	4,573	15,996
	4,750	1,350	73,825	50,740	50,740	80,877	1,587	4,434	15,216
	4,500	1,600	69,245	47,592	47,592	80,877	1,570	4,296	14,499
	4,250	1,850	64,740	44,495	44,495	80,877	1,553	4,158	13,833
	4,000	2,100	60,306	41,448	41,448	80,877	1,536	4,021	13,183
	3,750	2,350	55,946	38,451	38,451	80,877	1,518	3,884	12,548
	3,500	2,600	51,659	35,505	35,505	80,878	1,501	3,748	11,926
	3,250	2,850	47,446	32,609	32,609	80,878	1,483	3,612	11,322
	3,000	3,100	43,306	29,764	29,764	80,878	1,466	3,477	10,736
	2,750	3,350	39,241	26,970	26,970	80,879	1,448	3,343	10,168
	2,500	3,600	35,250	24,227	24,227	80,880	1,430	3,209	9,618
	2,250	3,850	31,332	21,535	21,535	80,880	1,411	3,075	9,092
	2,000	4,100	27,488	18,892	18,892	80,881	1,391	2,943	8,589
	1,750	4,350	23,717	16,301	16,301	80,883	1,371	2,810	8,085
	1,500	4,600	20,023	13,762	13,762	80,884	1,349	2,678	7,568
	1,250	4,850	16,411	11,279	11,279	80,886	1,326	2,547	7,041
	1,000	5,100	12,887	8,857	8,857	80,887	1,300	2,416	6,492
	0,750	5,350	9,458	6,500	6,500	80,888	1,271	2,285	5,924
	0,500	5,600	6,141	4,221	4,221	80,888	1,237	2,155	5,267
	0,250	5,850	2,975	2,045	2,045	80,887	1,198	2,026	4,480
	0,086	6,014	1,000	0,687	0,687	80,887	1,169	1,943	3,924
	0,000	6,100	0,000	0,000	0,000	80,886	1,154	1,900	0,000

Tank Calibrations - T40_ADulce_B

Fluid Type = Fresh Water Specific gravity = 1

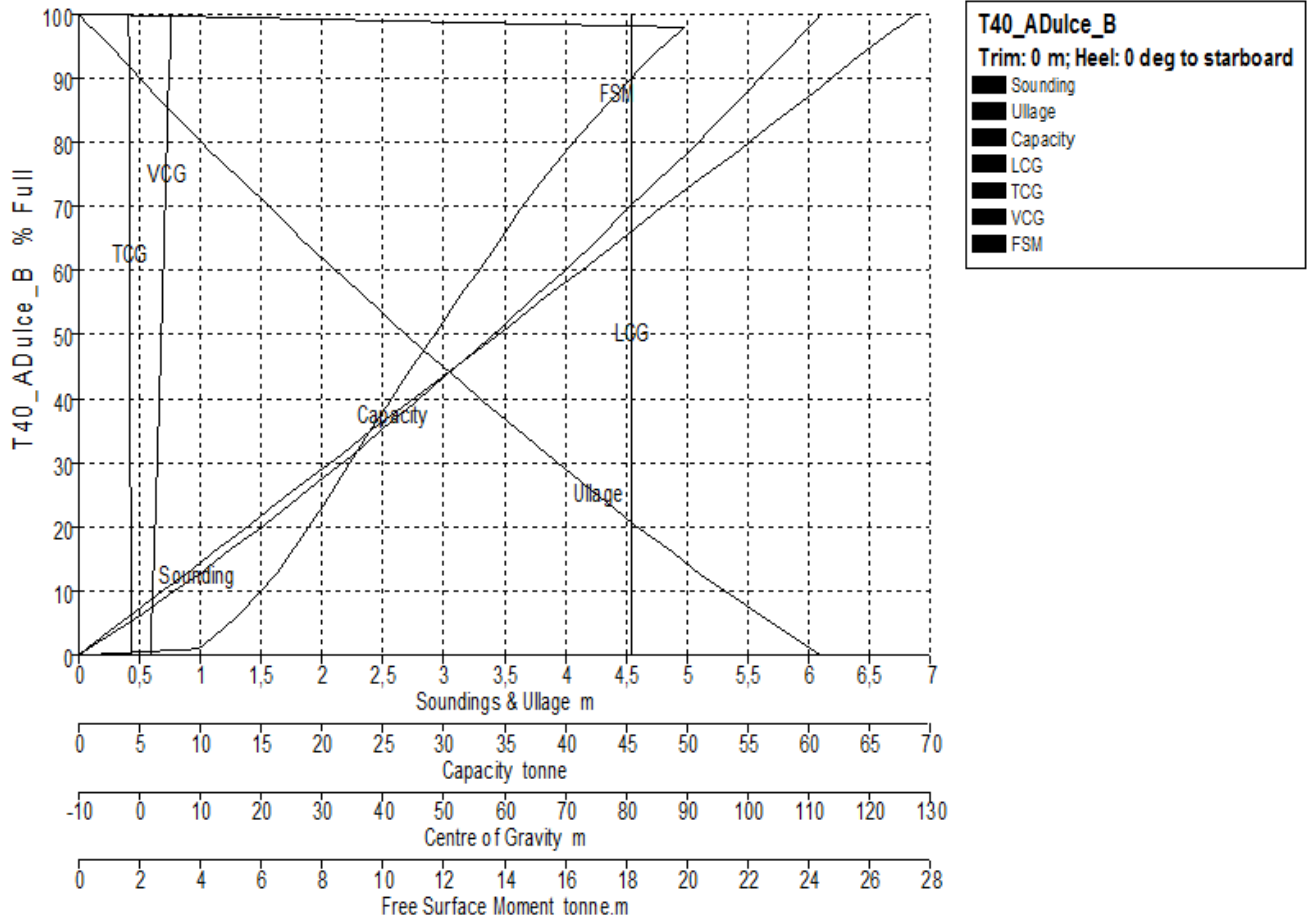
Permeability = 98 %

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

Cuaderno 4: Cálculos de arquitectura naval

Proyecto nº 16-15.

Fernando García-Ganges Icaza



Tank Name	Sounding m	Ullage m	% Full	Capacity m ³	Capacity tonne	LCG m	TCG m	VCG m	FSM tonne.m
T40_ADulce_B	6,100	0,000	100,000	68,730	68,730	80,879	-1,683	5,194	0,000
	6,002	0,098	98,000	67,355	67,355	80,879	-1,675	5,138	19,906
	6,000	0,100	97,967	67,333	67,333	80,879	-1,675	5,137	19,898
	5,997	0,103	97,900	67,287	67,287	80,879	-1,675	5,135	19,883
	5,750	0,350	92,957	63,889	63,889	80,879	-1,657	4,994	18,772
	5,500	0,600	88,043	60,512	60,512	80,878	-1,639	4,853	17,754
	5,250	0,850	83,220	57,197	57,197	80,878	-1,621	4,713	16,837
	5,000	1,100	78,481	53,940	53,940	80,878	-1,604	4,573	15,996
	4,750	1,350	73,825	50,740	50,740	80,877	-1,587	4,434	15,216
	4,500	1,600	69,245	47,592	47,592	80,877	-1,570	4,296	14,499
	4,250	1,850	64,740	44,495	44,495	80,877	-1,553	4,158	13,833
	4,000	2,100	60,306	41,448	41,448	80,877	-1,536	4,021	13,183
	3,750	2,350	55,946	38,451	38,451	80,877	-1,518	3,884	12,548
	3,500	2,600	51,659	35,505	35,505	80,878	-1,501	3,748	11,926
	3,250	2,850	47,446	32,609	32,609	80,878	-1,483	3,612	11,322
	3,000	3,100	43,306	29,764	29,764	80,878	-1,466	3,477	10,736
	2,750	3,350	39,241	26,970	26,970	80,879	-1,448	3,343	10,168
	2,500	3,600	35,250	24,227	24,227	80,880	-1,430	3,209	9,618
	2,250	3,850	31,332	21,535	21,535	80,880	-1,411	3,075	9,092
	2,000	4,100	27,488	18,892	18,892	80,881	-1,391	2,943	8,589
	1,750	4,350	23,717	16,301	16,301	80,883	-1,371	2,810	8,085
	1,500	4,600	20,023	13,762	13,762	80,884	-1,349	2,678	7,568
	1,250	4,850	16,411	11,279	11,279	80,886	-1,326	2,547	7,041

Cuaderno 4: Cálculos de arquitectura naval

Proyecto nº 16-15.

Fernando García-Ganges Icaza



	1,000	5,100	12,887	8,857	8,857	80,887	-1,300	2,416	6,492
	0,750	5,350	9,458	6,500	6,500	80,888	-1,271	2,285	5,924
	0,500	5,600	6,141	4,221	4,221	80,888	-1,237	2,155	5,267
	0,250	5,850	2,975	2,045	2,045	80,887	-1,198	2,026	4,480
	0,086	6,014	1,000	0,687	0,687	80,887	-1,169	1,943	3,924
	0,000	6,100	0,000	0,000	0,000	80,886	-1,154	1,900	0,000

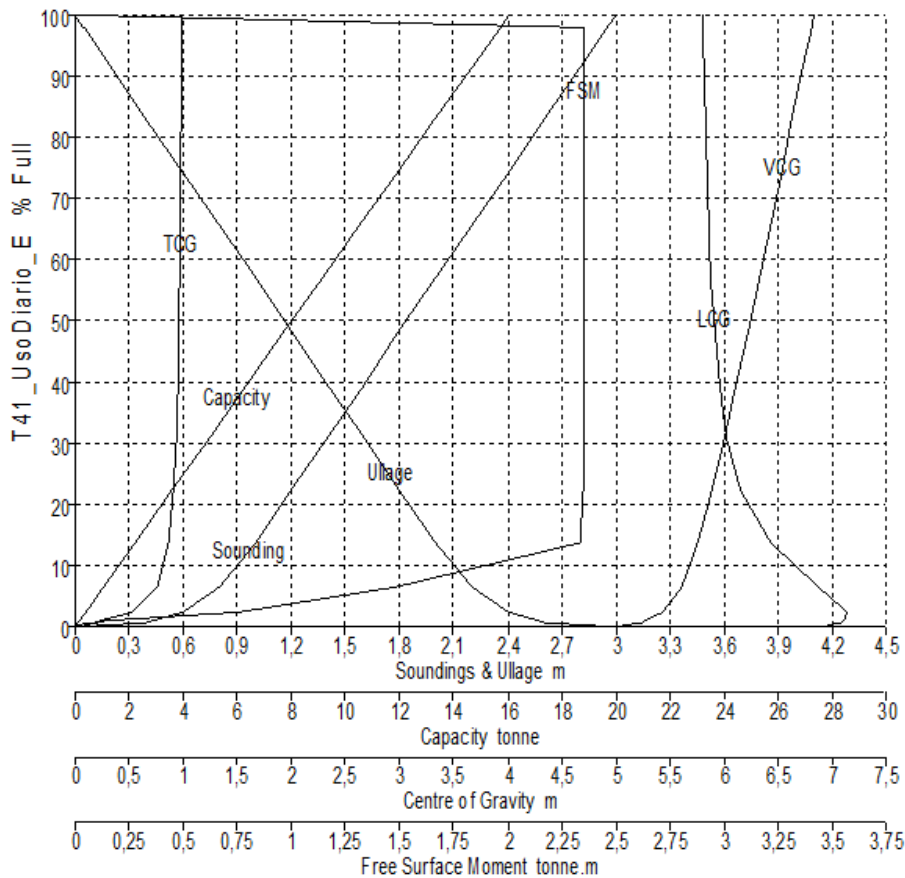
Tank Calibrations - T41_Usodiario_E

Fluid Type = Diesel

Specific gravity = 0,84

Permeability = 98 %

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



T41_Usodiario_E
Trim: 0 m; Heel: 0 deg to starboard

- Sounding
- Ullage
- Capacity
- LCG
- TCG
- VCG
- FSM

Tank Name	Sounding m	Ullage m	% Full	Capacity m ³	Capacity tonne	LCG m	TCG m	VCG m	FSM tonne.m
T41_Usodiario_E	3,000	0,000	100,000	19,103	16,046	5,800	0,981	6,829	0,000
	2,954	0,046	98,000	18,721	15,726	5,802	0,980	6,805	2,352
	2,951	0,049	97,900	18,702	15,709	5,802	0,980	6,804	2,352
	2,800	0,200	91,381	17,457	14,663	5,810	0,979	6,728	2,352
	2,600	0,400	82,763	15,810	13,281	5,821	0,977	6,626	2,352
	2,400	0,600	74,144	14,164	11,898	5,835	0,974	6,525	2,352
	2,200	0,800	65,526	12,517	10,515	5,853	0,970	6,423	2,352
	2,000	1,000	56,907	10,871	9,132	5,876	0,966	6,320	2,352
	1,800	1,200	48,289	9,225	7,749	5,908	0,960	6,217	2,352
	1,600	1,400	39,670	7,578	6,366	5,953	0,951	6,112	2,352

Cuaderno 4: Cálculos de arquitectura naval

Proyecto nº 16-15.

Fernando García-Ganges Icaza



	1,400	1,600	31,051	5,932	4,983	6,023	0,938	6,004	2,352
	1,200	1,800	22,433	4,285	3,600	6,147	0,914	5,891	2,352
	1,000	2,000	13,815	2,639	2,217	6,426	0,860	5,760	2,334
	0,800	2,200	6,683	1,277	1,072	6,869	0,758	5,603	1,480
	0,600	2,400	2,563	0,490	0,411	7,126	0,526	5,429	0,754
	0,432	2,568	1,000	0,191	0,160	7,099	0,240	5,272	0,147
	0,400	2,600	0,842	0,161	0,135	7,080	0,203	5,245	0,089
	0,200	2,800	0,286	0,055	0,046	6,965	0,102	5,108	0,005
	0,000	3,000	0,000	0,000	0,000	6,922	0,078	5,000	0,000

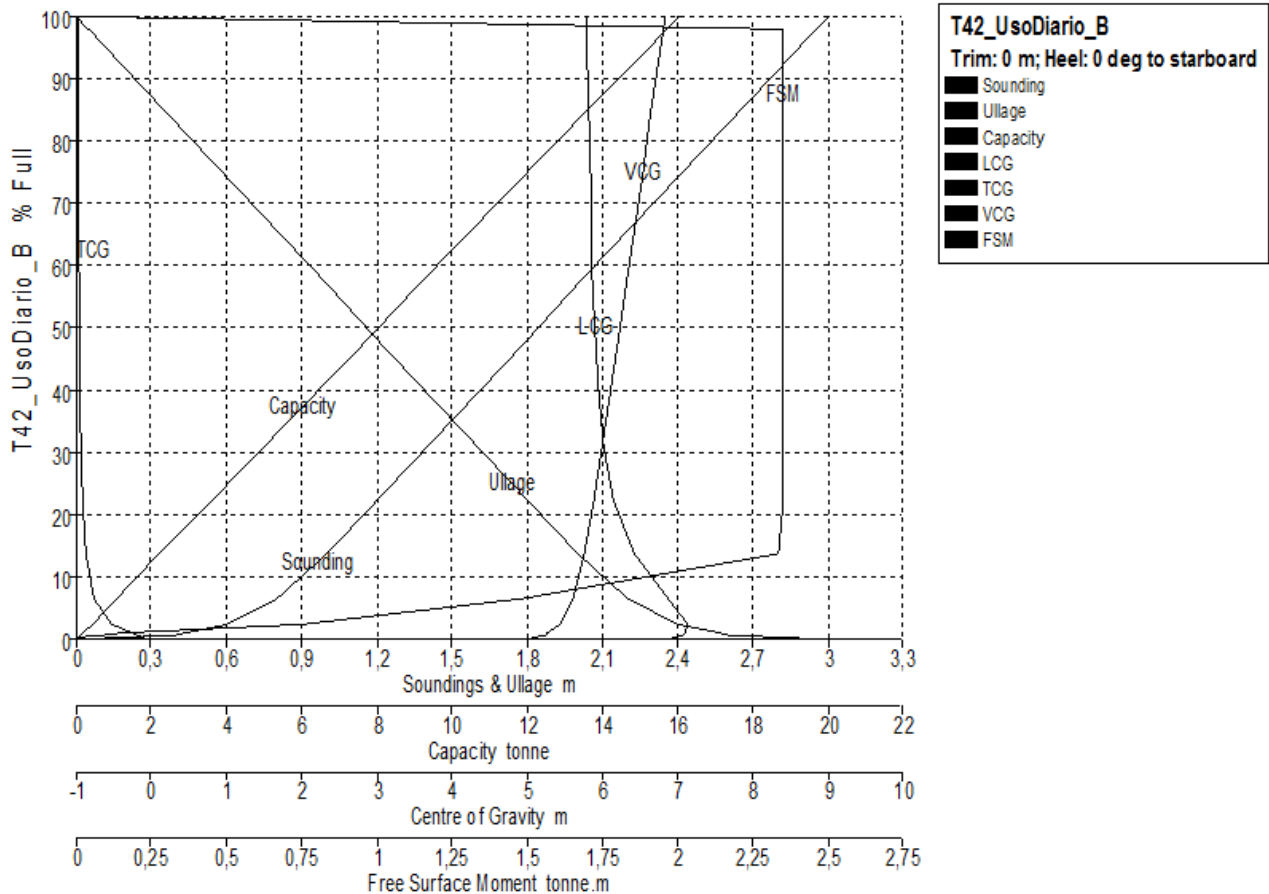
Tank Calibrations - T42_Usodiario_B

Fluid Type = Diesel

Specific gravity = 0,84

Permeability = 98 %

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
T42_Usodiario_B	3,000	0,000	100,000	19,100	16,044	5,800	-0,981	6,829	0,000
	2,954	0,046	98,000	18,718	15,723	5,802	-0,980	6,805	2,352
	2,951	0,049	97,900	18,699	15,707	5,803	-0,980	6,804	2,352
	2,800	0,200	91,380	17,454	14,661	5,810	-0,979	6,728	2,352
	2,600	0,400	82,760	15,807	13,278	5,821	-0,977	6,627	2,352
	2,400	0,600	74,141	14,161	11,895	5,835	-0,974	6,525	2,352
	2,200	0,800	65,521	12,515	10,512	5,853	-0,971	6,423	2,352

Cuaderno 4: Cálculos de arquitectura naval

Proyecto nº 16-15.

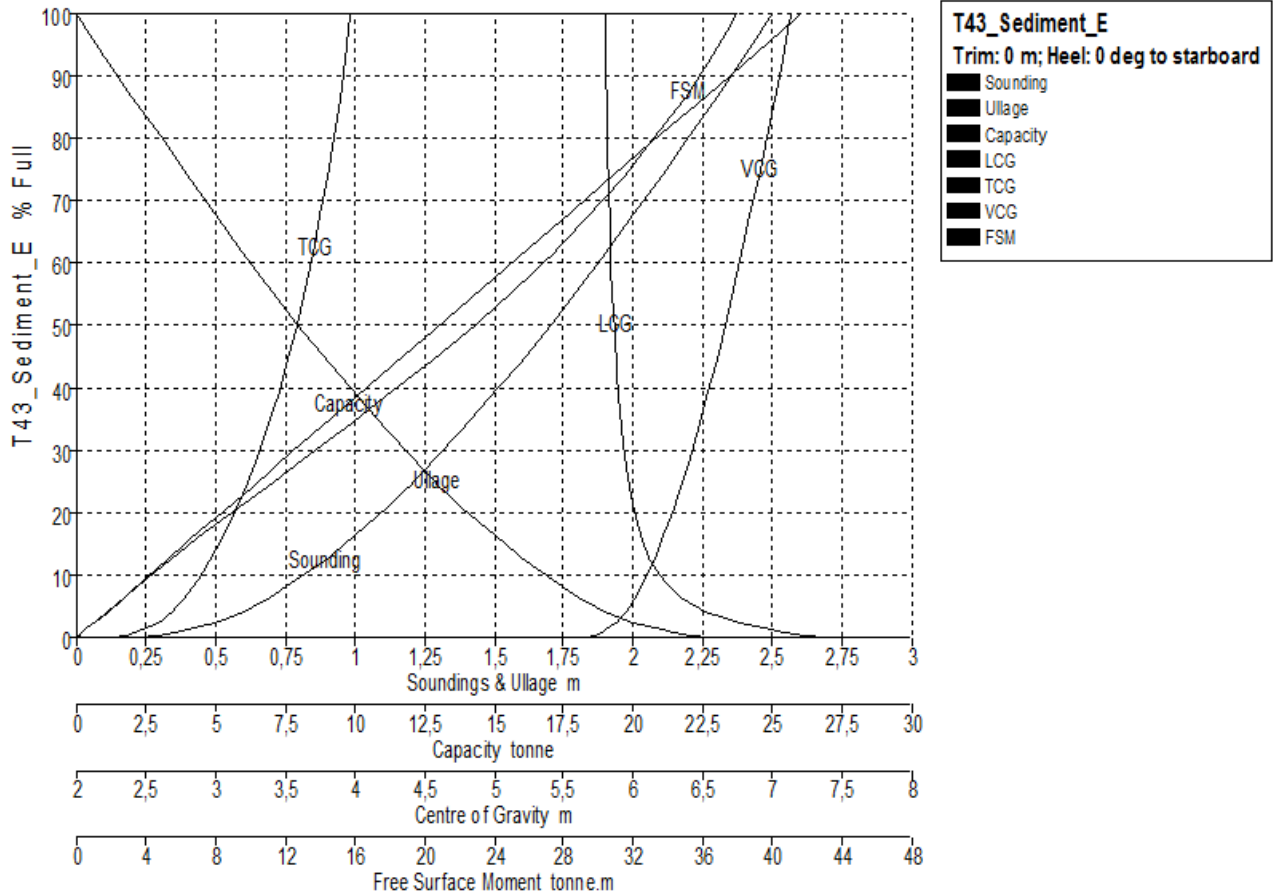
Fernando García-Ganges Icaza



	2,000	1,000	56,901	10,868	9,129	5,876	-0,966	6,321	2,352
	1,800	1,200	48,281	9,222	7,746	5,908	-0,960	6,217	2,352
	1,600	1,400	39,662	7,575	6,363	5,953	-0,952	6,112	2,352
	1,400	1,600	31,042	5,929	4,980	6,024	-0,938	6,005	2,352
	1,200	1,800	22,422	4,283	3,597	6,148	-0,914	5,891	2,352
	1,000	2,000	13,803	2,636	2,215	6,427	-0,861	5,760	2,334
	0,800	2,200	6,670	1,274	1,070	6,873	-0,760	5,602	1,480
	0,600	2,400	2,557	0,488	0,410	7,132	-0,527	5,428	0,746
	0,431	2,569	1,000	0,191	0,160	7,092	-0,239	5,271	0,144
	0,400	2,600	0,845	0,161	0,136	7,070	-0,202	5,244	0,089
	0,200	2,800	0,289	0,055	0,046	6,937	-0,101	5,108	0,005
	0,000	3,000	0,000	0,000	0,000	6,905	-0,078	5,000	0,000

Tank Calibrations - T43_Sediment_E

Fluid Type = Diesel Specific gravity = 0,84
 Permeability = 98 %
 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
T43_Sediment_E	2,501	0,000	100,000	31,013	26,051	5,796	3,973	7,136	0,000
	2,500	0,001	99,948	30,996	26,037	5,796	3,973	7,135	37,941
	2,471	0,030	98,000	30,392	25,530	5,797	3,962	7,118	37,558
	2,469	0,031	97,900	30,361	25,503	5,797	3,961	7,117	37,538

Cuaderno 4: Cálculos de arquitectura naval

Proyecto nº 16-15.

Fernando García-Ganges Icaza



	2,400	0,101	93,287	28,931	24,302	5,801	3,934	7,077	36,513
	2,300	0,201	86,716	26,893	22,590	5,807	3,893	7,019	35,003
	2,200	0,301	80,245	24,886	20,904	5,813	3,849	6,960	33,291
	2,100	0,401	73,889	22,915	19,248	5,821	3,802	6,900	31,474
	2,000	0,501	67,661	20,983	17,626	5,829	3,752	6,840	29,459
	1,900	0,601	61,579	19,097	16,042	5,839	3,699	6,780	27,367
	1,800	0,701	55,657	17,261	14,499	5,850	3,642	6,720	25,123
	1,700	0,801	49,914	15,480	13,003	5,863	3,582	6,659	22,813
	1,600	0,901	44,370	13,760	11,559	5,877	3,518	6,597	20,439
	1,500	1,001	39,042	12,108	10,171	5,895	3,451	6,536	18,032
	1,400	1,101	33,951	10,529	8,844	5,915	3,380	6,474	15,646
	1,300	1,201	29,118	9,030	7,585	5,939	3,305	6,411	13,327
	1,200	1,301	24,563	7,617	6,399	5,969	3,228	6,349	11,108
	1,100	1,401	20,304	6,297	5,289	6,007	3,147	6,285	9,050
	1,000	1,501	16,360	5,074	4,262	6,055	3,062	6,222	7,180
	0,900	1,601	12,753	3,955	3,322	6,118	2,973	6,157	5,508
	0,800	1,701	9,512	2,950	2,478	6,205	2,880	6,091	4,057
	0,700	1,801	6,670	2,069	1,738	6,330	2,783	6,023	2,831
	0,600	1,901	4,284	1,329	1,116	6,515	2,685	5,952	1,840
	0,500	2,001	2,446	0,759	0,637	6,765	2,588	5,878	1,010
	0,400	2,101	1,228	0,381	0,320	6,987	2,477	5,803	0,438
	0,375	2,126	1,000	0,310	0,261	7,044	2,447	5,784	0,334
	0,300	2,201	0,494	0,153	0,129	7,216	2,359	5,727	0,141
	0,200	2,301	0,137	0,043	0,036	7,434	2,240	5,650	0,027
	0,100	2,401	0,016	0,005	0,004	7,627	2,125	5,574	0,002
	0,000	2,501	0,000	0,000	0,000	7,776	2,000	5,499	0,000

Tank Calibrations - T44_Sediment_B

Fluid Type = Diesel

Specific gravity = 0,84

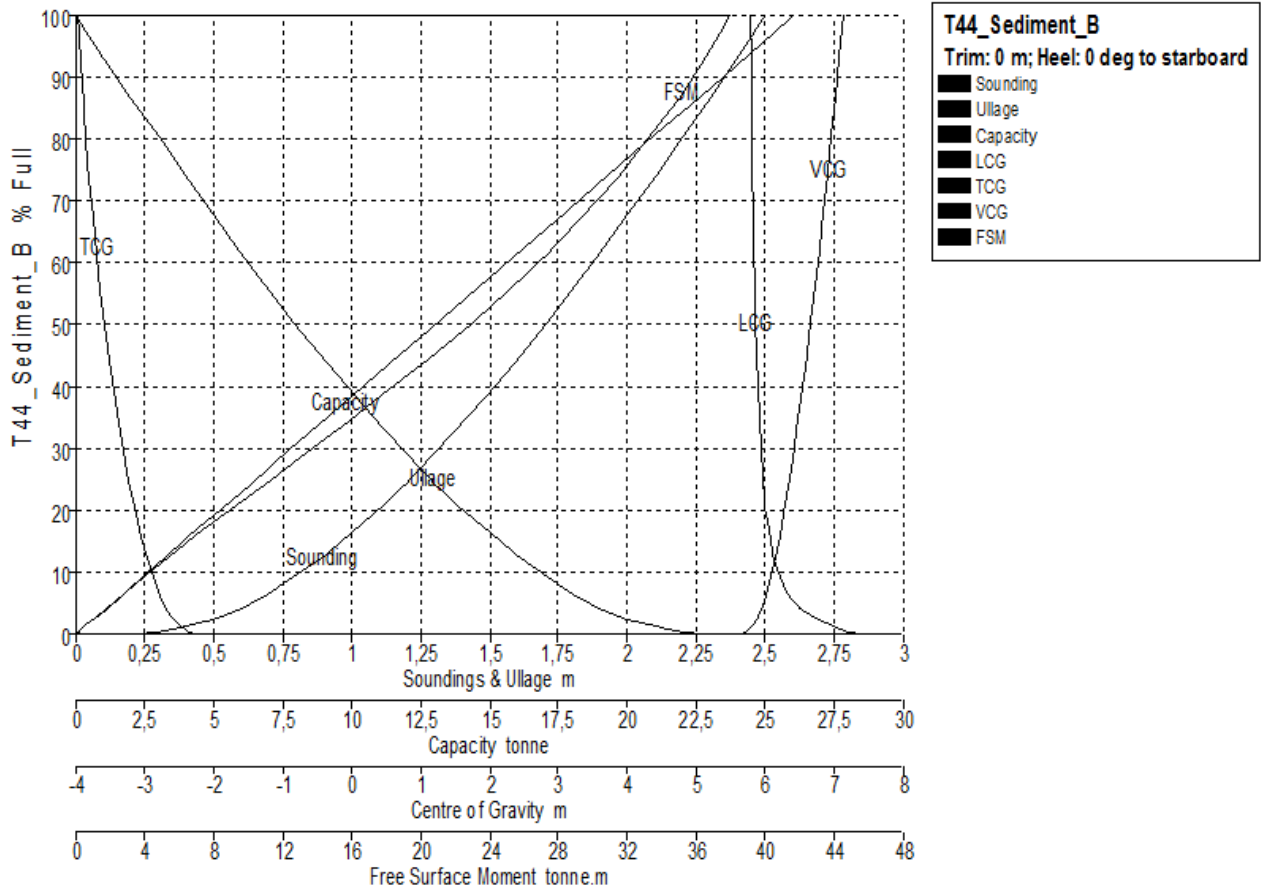
Permeability = 98 %

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

Cuaderno 4: Cálculos de arquitectura naval

Proyecto nº 16-15.

Fernando García-Ganges Icaza



Tank Name	Sounding m	Ullage m	% Full	Capacity m ³	Capacity tonne	LCG m	TCG m	VCG m	FSM tonne.m
T44_Sediment_B	2,501	0,000	100,000	31,013	26,051	5,796	-3,973	7,136	0,000
	2,500	0,001	99,948	30,996	26,037	5,796	-3,973	7,135	37,941
	2,471	0,030	98,000	30,392	25,530	5,797	-3,962	7,118	37,558
	2,469	0,031	97,900	30,361	25,503	5,797	-3,961	7,117	37,538
	2,400	0,101	93,287	28,931	24,302	5,801	-3,934	7,077	36,513
	2,300	0,201	86,716	26,893	22,590	5,807	-3,893	7,019	35,003
	2,200	0,301	80,245	24,886	20,904	5,813	-3,849	6,960	33,291
	2,100	0,401	73,889	22,915	19,248	5,821	-3,802	6,900	31,474
	2,000	0,501	67,661	20,983	17,626	5,829	-3,752	6,840	29,459
	1,900	0,601	61,579	19,097	16,042	5,839	-3,699	6,780	27,367
	1,800	0,701	55,657	17,261	14,499	5,850	-3,642	6,720	25,123
	1,700	0,801	49,914	15,480	13,003	5,863	-3,582	6,659	22,813
	1,600	0,901	44,370	13,760	11,559	5,877	-3,518	6,597	20,439
	1,500	1,001	39,042	12,108	10,171	5,895	-3,451	6,536	18,032
	1,400	1,101	33,951	10,529	8,844	5,915	-3,380	6,474	15,646
	1,300	1,201	29,118	9,030	7,585	5,939	-3,305	6,411	13,327
	1,200	1,301	24,563	7,617	6,399	5,969	-3,228	6,349	11,108
	1,100	1,401	20,304	6,297	5,289	6,007	-3,147	6,285	9,050
	1,000	1,501	16,360	5,074	4,262	6,055	-3,062	6,222	7,180
	0,900	1,601	12,753	3,955	3,322	6,118	-2,973	6,157	5,508
	0,800	1,701	9,512	2,950	2,478	6,205	-2,880	6,091	4,057
	0,700	1,801	6,670	2,069	1,738	6,330	-2,783	6,023	2,831
	0,600	1,901	4,284	1,329	1,116	6,515	-2,685	5,952	1,840
	0,500	2,001	2,446	0,759	0,637	6,765	-2,588	5,878	1,010

Cuaderno 4: Cálculos de arquitectura naval

Proyecto nº 16-15.

Fernando García-Ganges Icaza



	0,400	2,101	1,228	0,381	0,320	6,987	-2,477	5,803	0,438
	0,375	2,126	1,000	0,310	0,261	7,044	-2,447	5,784	0,334
	0,300	2,201	0,494	0,153	0,129	7,216	-2,359	5,727	0,141
	0,200	2,301	0,137	0,043	0,036	7,434	-2,240	5,650	0,027
	0,100	2,401	0,016	0,005	0,004	7,627	-2,125	5,574	0,002
	0,000	2,501	0,000	0,000	0,000	7,776	-2,000	5,499	0,000

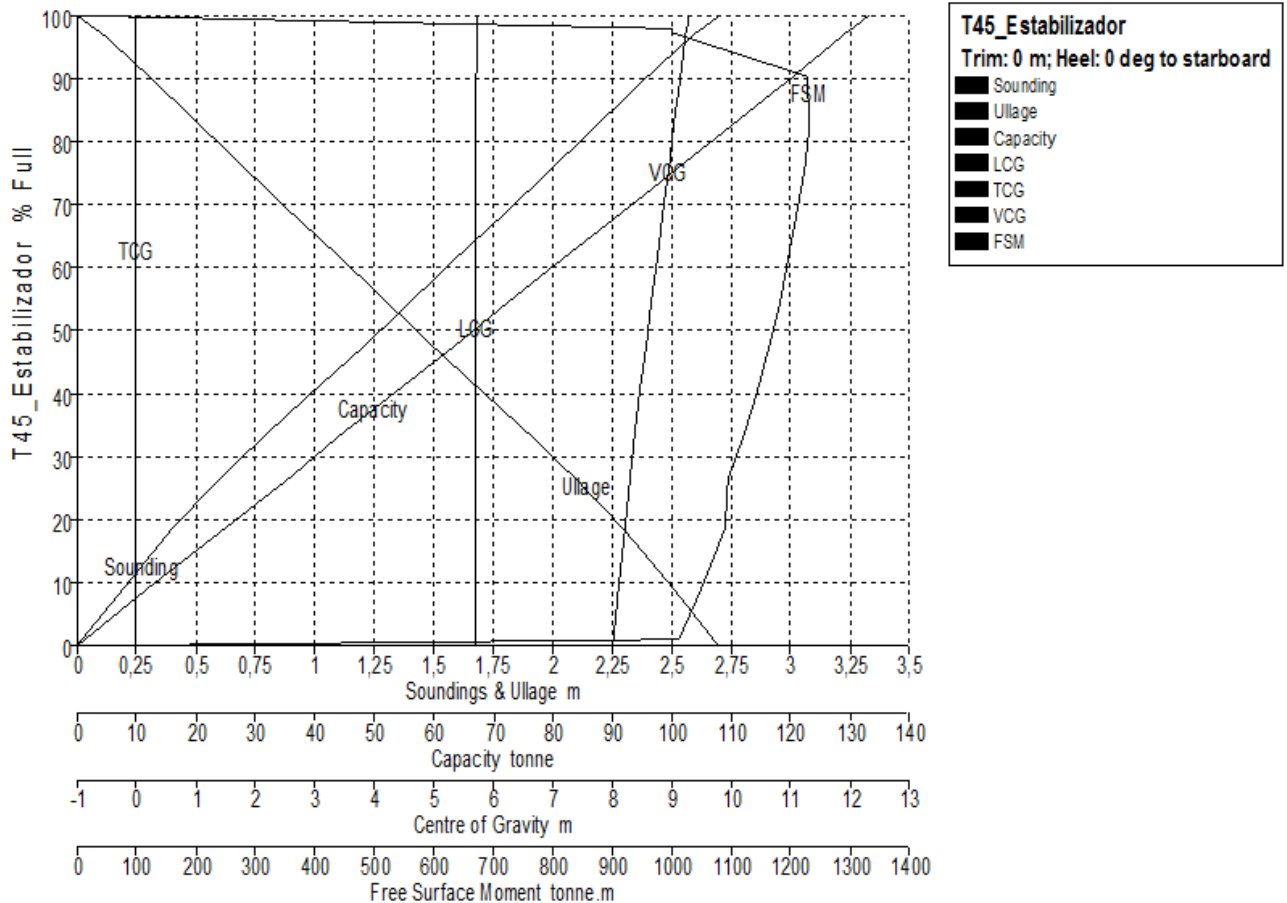
Tank Calibrations - T45_Estabilizador

Fluid Type = Water Ballast

Specific gravity = 1,025

Permeability = 100 %

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
T45_Estabilizador	2,700	0,000	100,000	129,809	133,054	5,740	0,000	9,281	0,000
	2,628	0,072	98,000	127,212	130,393	5,731	0,000	9,253	1002,451
	2,624	0,076	97,900	127,083	130,260	5,731	0,000	9,252	1002,442
	2,600	0,100	97,191	126,162	129,316	5,728	0,000	9,242	1002,379
	2,400	0,300	90,540	117,529	120,467	5,717	0,000	9,150	1226,809
	2,200	0,500	83,301	108,132	110,835	5,717	0,000	9,050	1231,814
	2,000	0,700	76,078	98,756	101,225	5,717	0,000	8,950	1223,127
	1,800	0,900	68,882	89,415	91,650	5,717	0,000	8,851	1211,523
	1,600	1,100	61,720	80,117	82,120	5,717	0,000	8,752	1197,518

Cuaderno 4: Cálculos de arquitectura naval

Proyecto nº 16-15.

Fernando García-Ganges Icaza



	1,400	1,300	54,597	70,872	72,644	5,717	0,000	8,655	1181,655
	1,200	1,500	47,521	61,686	63,228	5,717	0,000	8,559	1163,802
	1,000	1,700	40,495	52,566	53,880	5,717	0,000	8,465	1143,699
	0,800	1,900	33,528	43,522	44,610	5,717	0,000	8,374	1121,231
	0,600	2,100	26,626	34,563	35,427	5,716	0,000	8,290	1095,753
	0,400	2,300	18,509	24,026	24,627	5,716	0,000	8,201	1088,626
	0,200	2,500	9,194	11,934	12,233	5,716	0,000	8,100	1051,897
	0,022	2,678	1,000	1,298	1,331	5,717	0,000	8,011	1011,576
	0,000	2,700	0,000	0,000	0,000	5,717	0,000	8,000	0,000

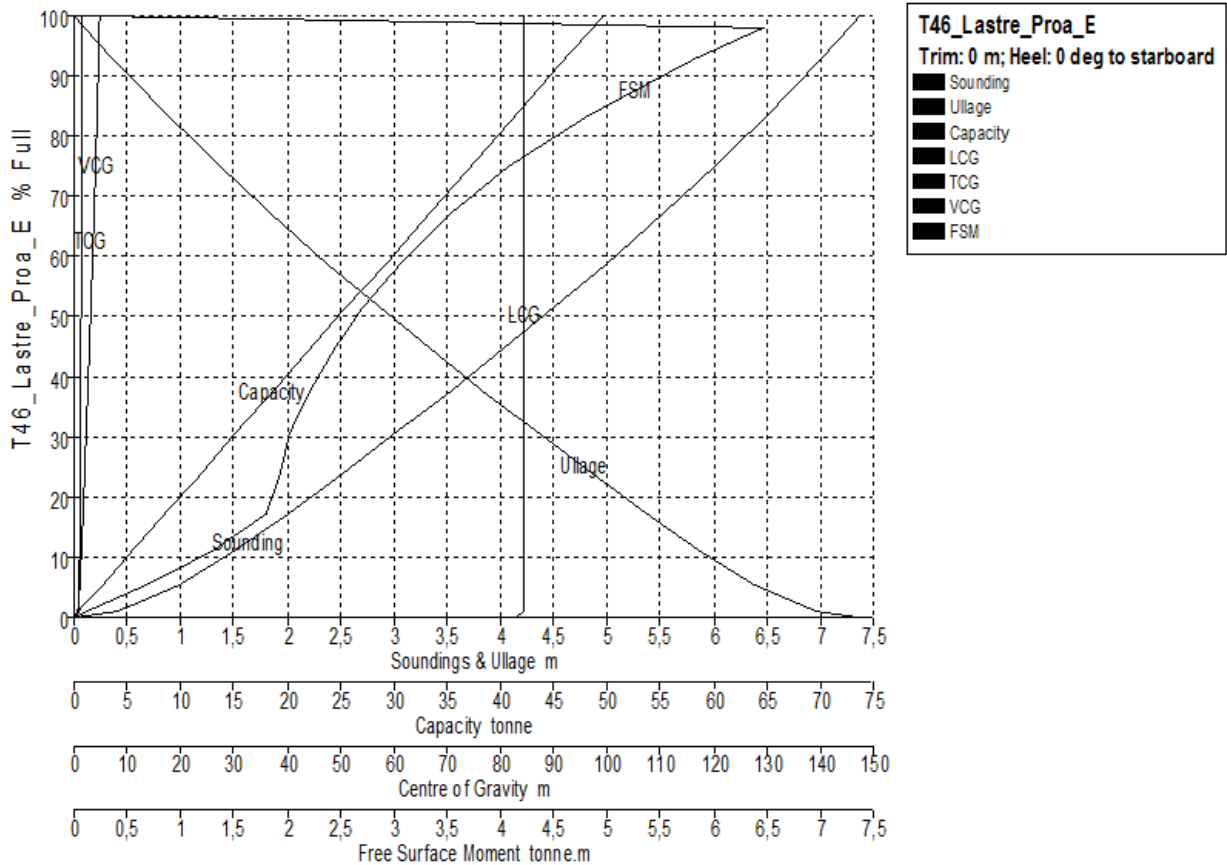
Tank Calibrations - T46_Lastre_Proa_E

Fluid Type = Water Ballast

Specific gravity = 1,025

Permeability = 100 %

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
T46_Lastre_Proa_E	7,372	0,000	100,000	48,422	49,632	84,349	1,480	4,882	0,000
	7,272	0,100	98,000	47,453	48,640	84,349	1,473	4,820	6,476
	7,267	0,105	97,900	47,405	48,590	84,349	1,472	4,817	6,463
	7,000	0,372	92,716	44,895	46,017	84,349	1,454	4,652	5,818
	6,500	0,872	83,496	40,430	41,441	84,349	1,422	4,351	4,827
	6,000	1,372	74,844	36,241	37,147	84,351	1,394	4,058	4,069
	5,500	1,872	66,669	32,282	33,089	84,354	1,369	3,773	3,501
	5,000	2,372	58,881	28,511	29,224	84,357	1,346	3,495	3,062

Cuaderno 4: Cálculos de arquitectura naval

Proyecto nº 16-15.

Fernando García-Ganges Icaza



	4,500	2,872	51,415	24,896	25,518	84,362	1,324	3,221	2,710
	4,000	3,372	44,214	21,409	21,944	84,367	1,302	2,951	2,429
	3,500	3,872	37,237	18,031	18,481	84,372	1,278	2,684	2,201
	3,000	4,372	30,443	14,741	15,109	84,377	1,251	2,417	2,023
	2,500	4,872	23,769	11,509	11,797	84,381	1,214	2,147	1,930
	2,000	5,372	17,157	8,308	8,515	84,381	1,155	1,865	1,795
	1,500	5,872	10,928	5,291	5,424	84,375	1,063	1,571	1,283
	1,000	6,372	5,621	2,722	2,790	84,361	0,944	1,273	0,690
	0,500	6,872	1,596	0,773	0,792	84,287	0,761	0,966	0,199
	0,396	6,976	1,000	0,484	0,496	84,240	0,708	0,900	0,117
	0,000	7,372	0,000	0,000	0,000	82,720	0,450	0,628	0,000

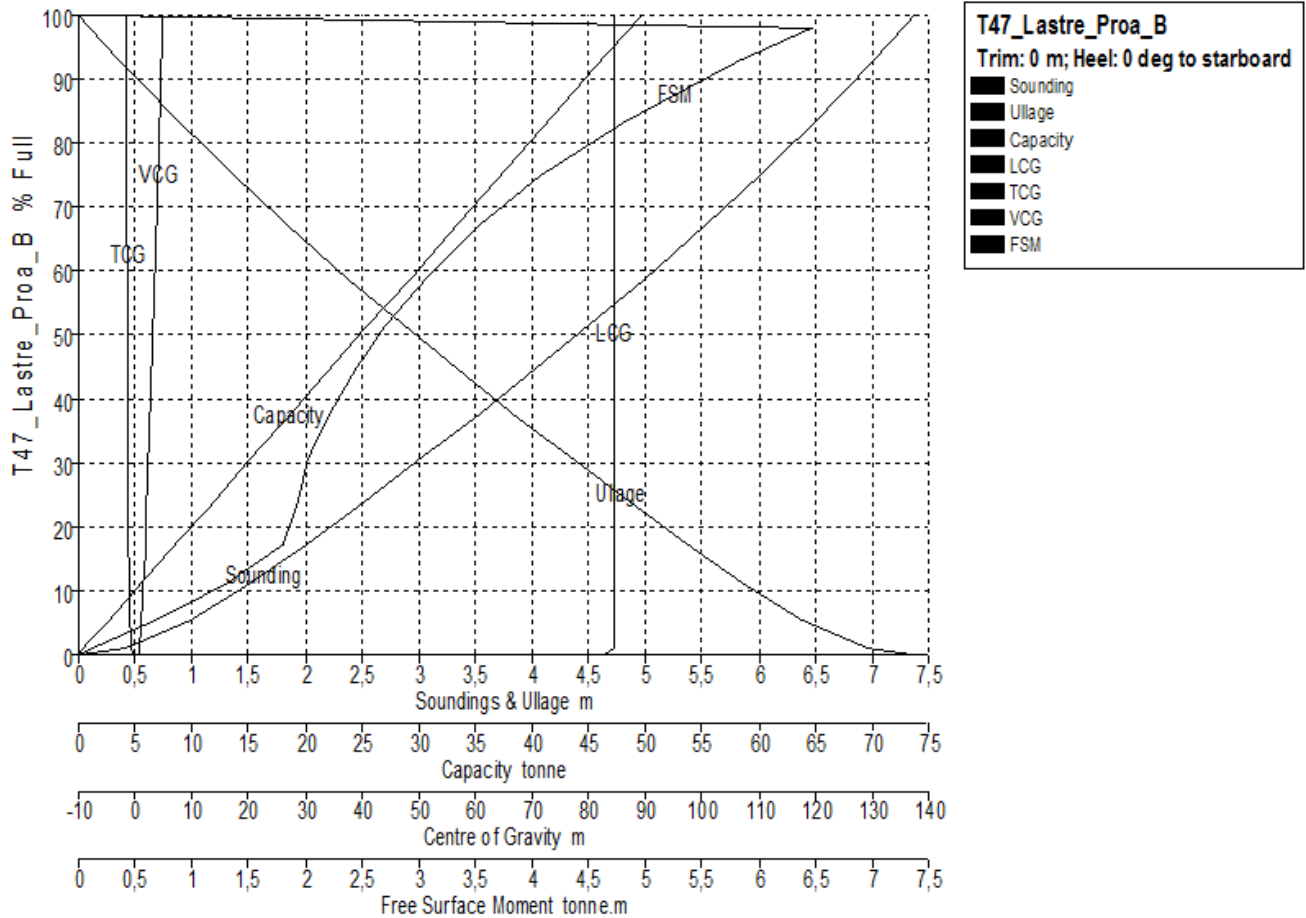
Tank Calibrations - T47_Lastre_Proa_B

Fluid Type = Water Ballast

Specific gravity = 1,025

Permeability = 100 %

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
T47_Lastre_Proa_B	7,372	0,000	100,000	48,422	49,632	84,349	-1,480	4,882	0,000
	7,272	0,100	98,000	47,453	48,640	84,349	-1,473	4,820	6,476
	7,267	0,105	97,900	47,405	48,590	84,349	-1,472	4,817	6,463
	7,000	0,372	92,716	44,895	46,017	84,349	-1,454	4,652	5,818

Cuaderno 4: Cálculos de arquitectura naval

Proyecto nº 16-15.

Fernando García-Ganges Icaza



	6,500	0,872	83,496	40,430	41,441	84,349	-1,422	4,351	4,827
	6,000	1,372	74,844	36,241	37,147	84,351	-1,394	4,058	4,069
	5,500	1,872	66,669	32,282	33,089	84,354	-1,369	3,773	3,501
	5,000	2,372	58,881	28,511	29,224	84,357	-1,346	3,495	3,062
	4,500	2,872	51,415	24,896	25,518	84,362	-1,324	3,221	2,710
	4,000	3,372	44,214	21,409	21,944	84,367	-1,302	2,951	2,429
	3,500	3,872	37,237	18,031	18,481	84,372	-1,278	2,684	2,201
	3,000	4,372	30,443	14,741	15,109	84,377	-1,251	2,417	2,023
	2,500	4,872	23,769	11,509	11,797	84,381	-1,214	2,147	1,930
	2,000	5,372	17,157	8,308	8,515	84,381	-1,155	1,865	1,795
	1,500	5,872	10,928	5,291	5,424	84,375	-1,063	1,571	1,283
	1,000	6,372	5,621	2,722	2,790	84,361	-0,944	1,273	0,690
	0,500	6,872	1,596	0,773	0,792	84,287	-0,761	0,966	0,199
	0,396	6,976	1,000	0,484	0,496	84,240	-0,708	0,900	0,117
	0,000	7,372	0,000	0,000	0,000	82,720	-0,450	0,628	0,000

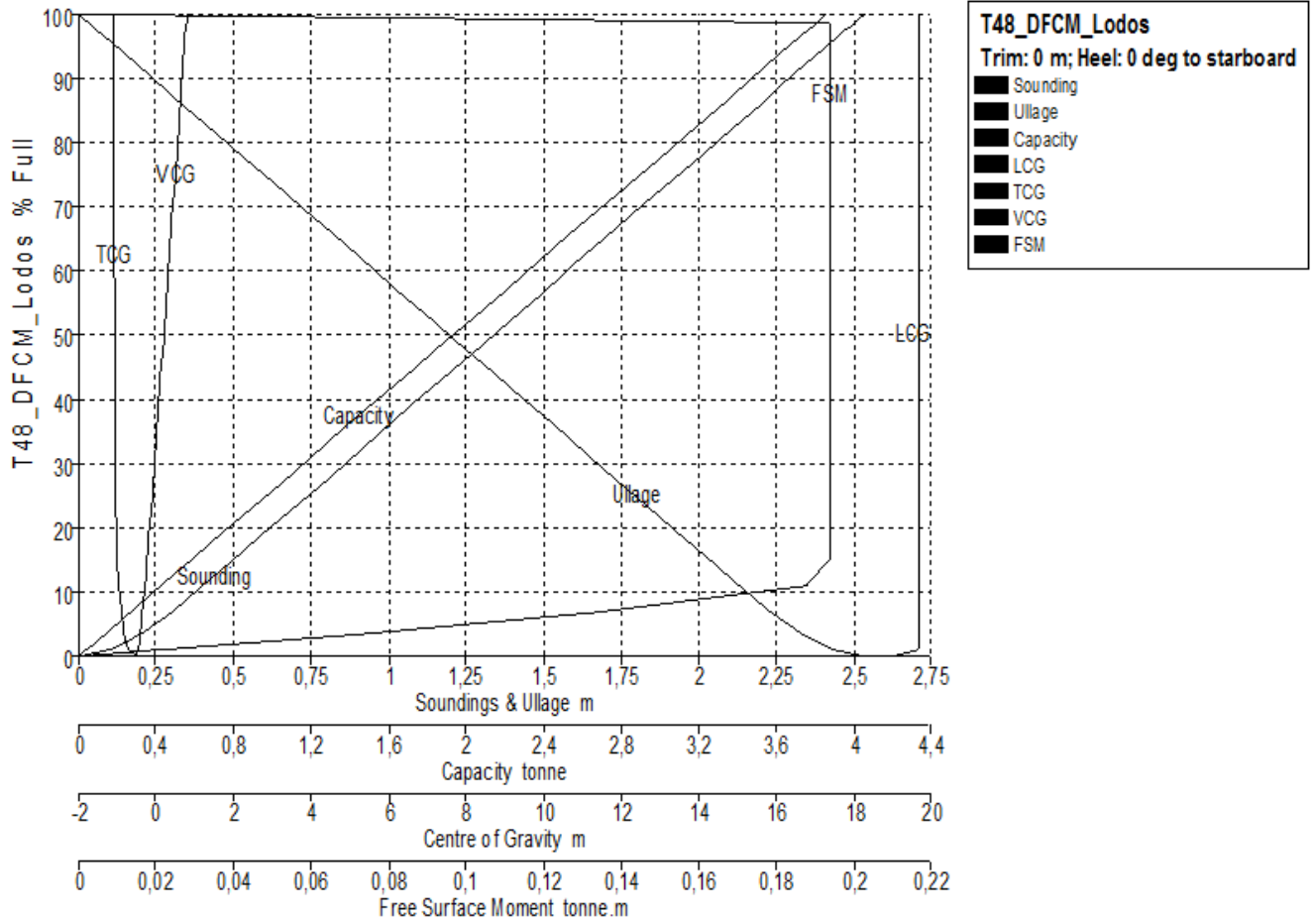
Tank Calibrations - T48_DFCM_Lodos

Fluid Type = Lodos

Specific gravity = 0,96

Permeability = 100 %

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



Tank Name	Sounding	Ullage	% Full	Capacity	Capacity	LCG m	TCG m	VCG m	FSM
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Cuaderno 4: Cálculos de arquitectura naval

Proyecto nº 16-15.

Fernando García-Ganges Icaza



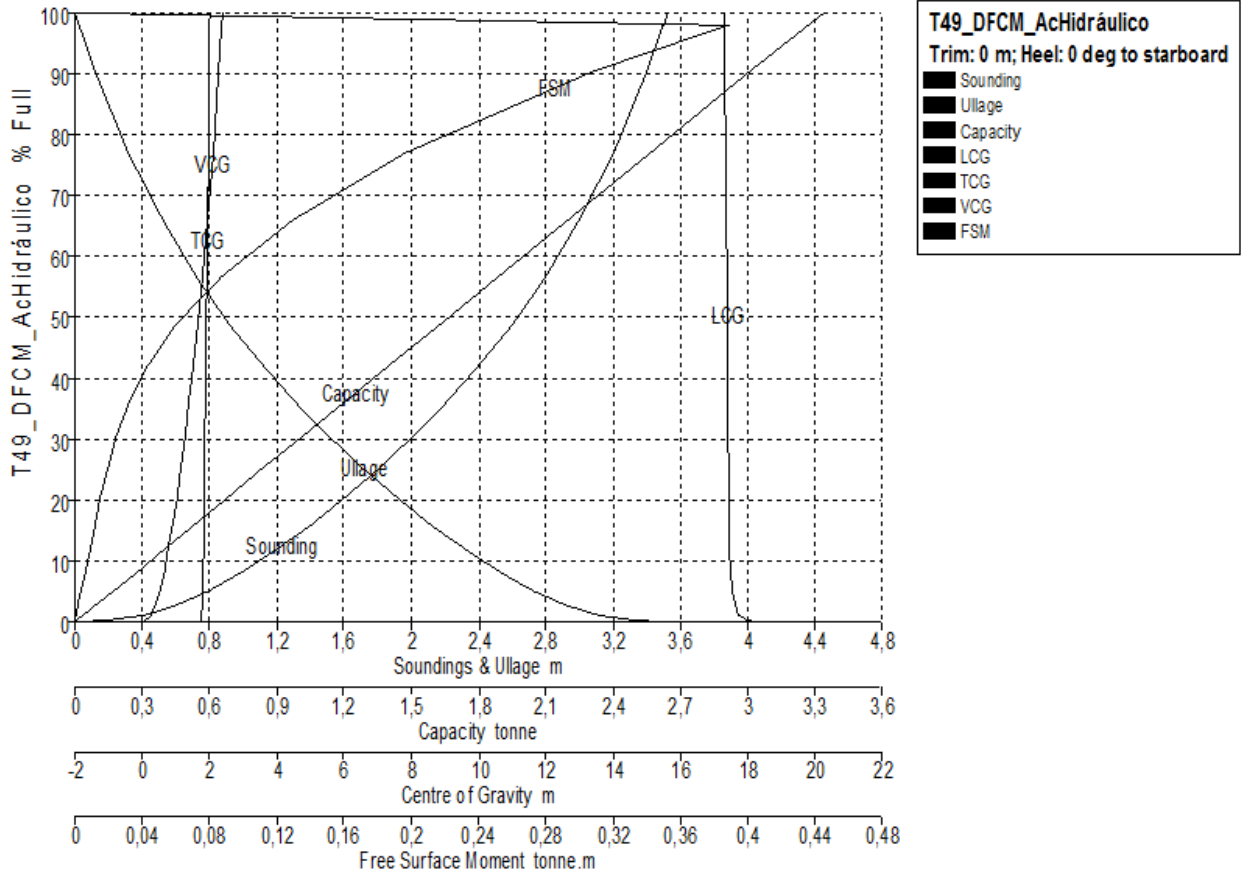
	m	m		m ³	tonne				tonne.m
T48_DFCM_Lodos	2,534	0,000	100,000	4,023	3,862	19,701	-1,085	0,800	0,000
	2,500	0,034	98,594	3,966	3,807	19,701	-1,085	0,783	0,194
	2,486	0,048	98,000	3,942	3,784	19,701	-1,084	0,776	0,194
	2,483	0,050	97,900	3,938	3,781	19,701	-1,084	0,775	0,194
	2,400	0,134	94,418	3,798	3,646	19,701	-1,084	0,733	0,194
	2,300	0,234	90,242	3,630	3,485	19,701	-1,083	0,683	0,194
	2,200	0,334	86,065	3,462	3,324	19,701	-1,082	0,633	0,194
	2,100	0,434	81,889	3,294	3,162	19,701	-1,081	0,583	0,194
	2,000	0,534	77,712	3,126	3,001	19,701	-1,080	0,533	0,194
	1,900	0,634	73,536	2,958	2,840	19,701	-1,079	0,483	0,194
	1,800	0,734	69,360	2,790	2,678	19,701	-1,078	0,432	0,194
	1,700	0,834	65,183	2,622	2,517	19,701	-1,077	0,382	0,194
	1,600	0,934	61,007	2,454	2,356	19,701	-1,075	0,332	0,194
	1,500	1,034	56,830	2,286	2,195	19,701	-1,073	0,282	0,194
	1,400	1,134	52,654	2,118	2,033	19,701	-1,071	0,231	0,194
	1,300	1,234	48,478	1,950	1,872	19,701	-1,069	0,181	0,194
	1,200	1,334	44,301	1,782	1,711	19,701	-1,066	0,130	0,194
	1,100	1,434	40,125	1,614	1,550	19,701	-1,062	0,080	0,194
	1,000	1,534	35,948	1,446	1,388	19,702	-1,058	0,029	0,194
	0,900	1,634	31,772	1,278	1,227	19,702	-1,052	-0,022	0,194
	0,800	1,734	27,596	1,110	1,066	19,702	-1,045	-0,073	0,194
	0,700	1,834	23,419	0,942	0,904	19,703	-1,035	-0,125	0,194
	0,600	1,934	19,243	0,774	0,743	19,703	-1,021	-0,177	0,194
	0,500	2,034	15,066	0,606	0,582	19,704	-0,999	-0,231	0,194
	0,400	2,134	10,897	0,438	0,421	19,705	-0,960	-0,287	0,188
	0,300	2,234	6,956	0,280	0,269	19,702	-0,900	-0,346	0,134
	0,200	2,334	3,605	0,145	0,139	19,695	-0,822	-0,406	0,072
	0,100	2,434	1,060	0,043	0,041	19,671	-0,708	-0,466	0,021
	0,097	2,437	1,000	0,040	0,039	19,669	-0,704	-0,468	0,020
	0,000	2,534	0,000	0,000	0,000	19,008	-0,500	-0,534	0,000

Tank Calibrations - T49_DFCM_AcHidráulico

Fluid Type = Lube Oil Specific gravity = 0,925
 Permeability = 100 %
 Trim = 0 m (+ve by stern); Heel = 0 deg to starboard

Cuaderno 4: Cálculos de arquitectura naval

Proyecto nº 16-15.
Fernando García-Ganges Icaza



Tank Name	Sounding m	Ullage m	% Full	Capacity m ³	Capacity tonne	LCG m	TCG m	VCG m	FSM tonne.m
T49_DFCM_AcHidráulico	3,523	0,000	100,000	3,607	3,337	17,282	2,020	2,401	0,000
	3,499	0,024	98,000	3,535	3,270	17,288	2,016	2,379	0,389
	3,498	0,025	97,900	3,531	3,266	17,288	2,015	2,378	0,388
	3,400	0,123	90,234	3,255	3,011	17,309	1,999	2,289	0,309
	3,200	0,323	76,900	2,774	2,566	17,339	1,970	2,117	0,196
	3,000	0,523	65,902	2,377	2,199	17,361	1,946	1,957	0,130
	2,800	0,723	56,686	2,045	1,891	17,377	1,927	1,807	0,087
	2,600	0,923	48,800	1,760	1,628	17,388	1,911	1,666	0,060
	2,400	1,123	41,873	1,510	1,397	17,398	1,898	1,531	0,044
	2,200	1,323	35,686	1,287	1,191	17,407	1,886	1,401	0,032
	2,000	1,523	30,092	1,085	1,004	17,415	1,875	1,276	0,025
	1,800	1,723	24,979	0,901	0,833	17,423	1,864	1,152	0,019
	1,600	1,923	20,274	0,731	0,676	17,431	1,853	1,030	0,015
	1,400	2,123	15,929	0,575	0,531	17,443	1,842	0,908	0,012
	1,200	2,323	11,930	0,430	0,398	17,463	1,829	0,784	0,009
	1,000	2,523	8,350	0,301	0,279	17,494	1,815	0,658	0,006
	0,800	2,723	5,279	0,190	0,176	17,544	1,800	0,529	0,004
	0,600	2,923	2,823	0,102	0,094	17,627	1,782	0,397	0,002
	0,400	3,123	1,115	0,040	0,037	17,745	1,762	0,262	0,001
	0,382	3,141	1,000	0,036	0,033	17,758	1,760	0,250	0,001
	0,200	3,323	0,194	0,007	0,006	17,942	1,737	0,123	0,000
	0,000	3,523	0,000	0,000	0,000	18,268	1,700	-0,023	0,000

Cuaderno 4: Cálculos de arquitectura naval

Proyecto nº 16-15.

Fernando García-Ganges Icaza



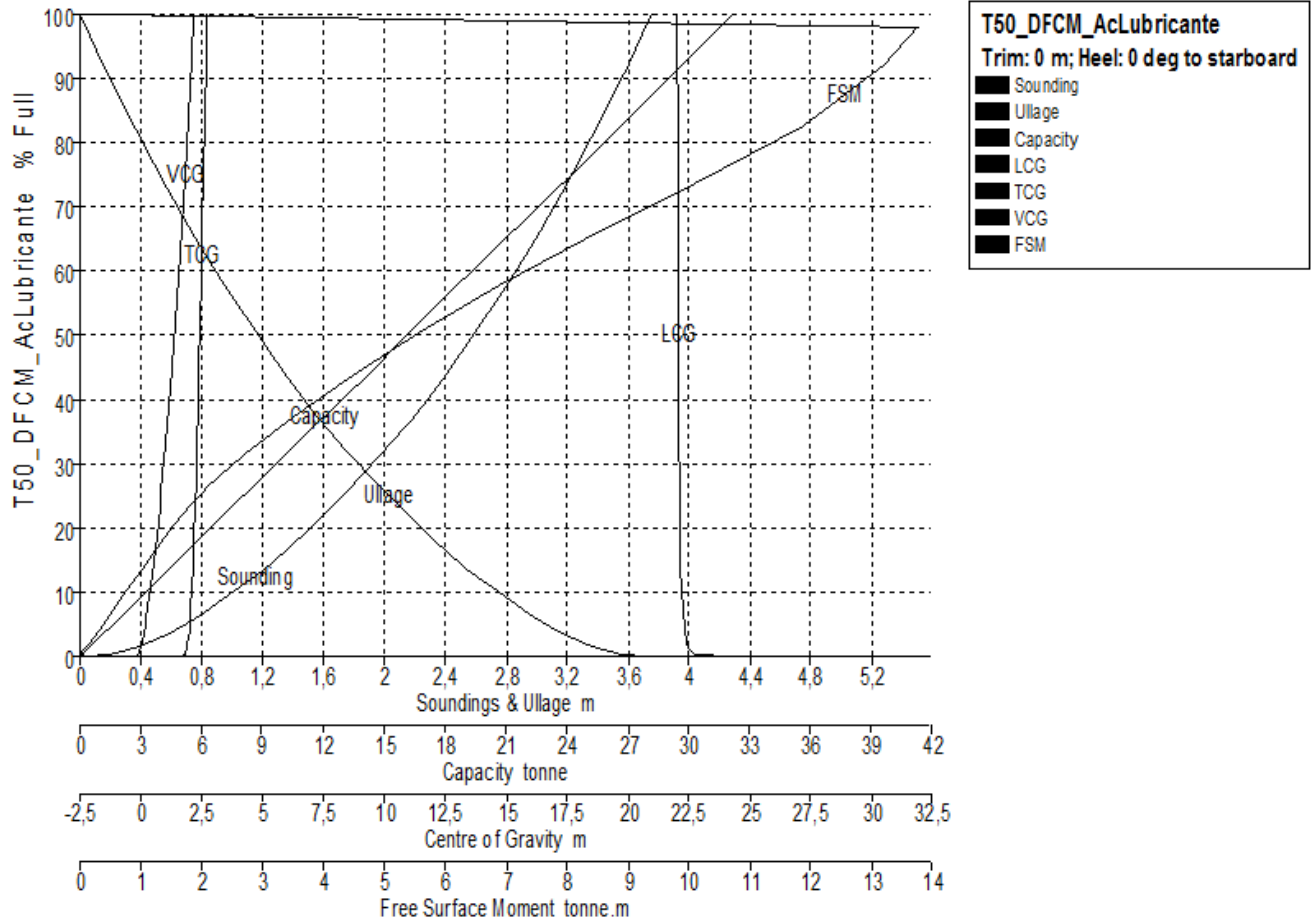
Tank Calibrations - T50_DFCM_AcLubricante

Fluid Type = Lube Oil

Specific gravity = 0,925

Permeability = 100 %

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
T50_DFCM_AcLubricante	3,757	0,000	100,000	34,836	32,223	22,037	2,715	2,168	0,000
	3,718	0,039	98,000	34,139	31,579	22,041	2,706	2,142	13,769
	3,716	0,041	97,900	34,104	31,546	22,041	2,706	2,140	13,760
	3,600	0,157	92,144	32,099	29,692	22,051	2,677	2,061	13,193
	3,400	0,357	82,604	28,776	26,617	22,065	2,627	1,925	11,870
	3,200	0,557	73,652	25,657	23,733	22,075	2,576	1,789	10,070
	3,000	0,757	65,317	22,753	21,047	22,084	2,527	1,654	8,364
	2,800	0,957	57,571	20,055	18,551	22,092	2,479	1,521	6,870
	2,600	1,157	50,390	17,554	16,237	22,098	2,433	1,389	5,579
	2,400	1,357	43,748	15,240	14,097	22,104	2,388	1,260	4,470
	2,200	1,557	37,621	13,105	12,122	22,109	2,346	1,132	3,532
	2,000	1,757	31,979	11,140	10,304	22,115	2,305	1,006	2,760
	1,800	1,957	26,781	9,329	8,630	22,124	2,267	0,882	2,148
	1,600	2,157	21,985	7,658	7,084	22,137	2,229	0,759	1,681
	1,400	2,357	17,559	6,117	5,658	22,155	2,190	0,637	1,313
	1,200	2,557	13,502	4,703	4,351	22,181	2,148	0,515	1,005
	1,000	2,757	9,837	3,427	3,170	22,215	2,103	0,392	0,740

Cuaderno 4: Cálculos de arquitectura naval

Proyecto nº 16-15.

Fernando García-Ganges Icaza



	0,800	2,957	6,609	2,302	2,130	22,263	2,051	0,268	0,504
	0,600	3,157	3,886	1,354	1,252	22,332	1,990	0,143	0,296
	0,400	3,357	1,764	0,614	0,568	22,459	1,917	0,015	0,126
	0,304	3,453	1,000	0,348	0,322	22,575	1,876	-0,047	0,066
	0,200	3,557	0,399	0,139	0,129	22,783	1,825	-0,116	0,021
	0,000	3,757	0,000	0,000	0,000	24,564	1,700	-0,257	0,000

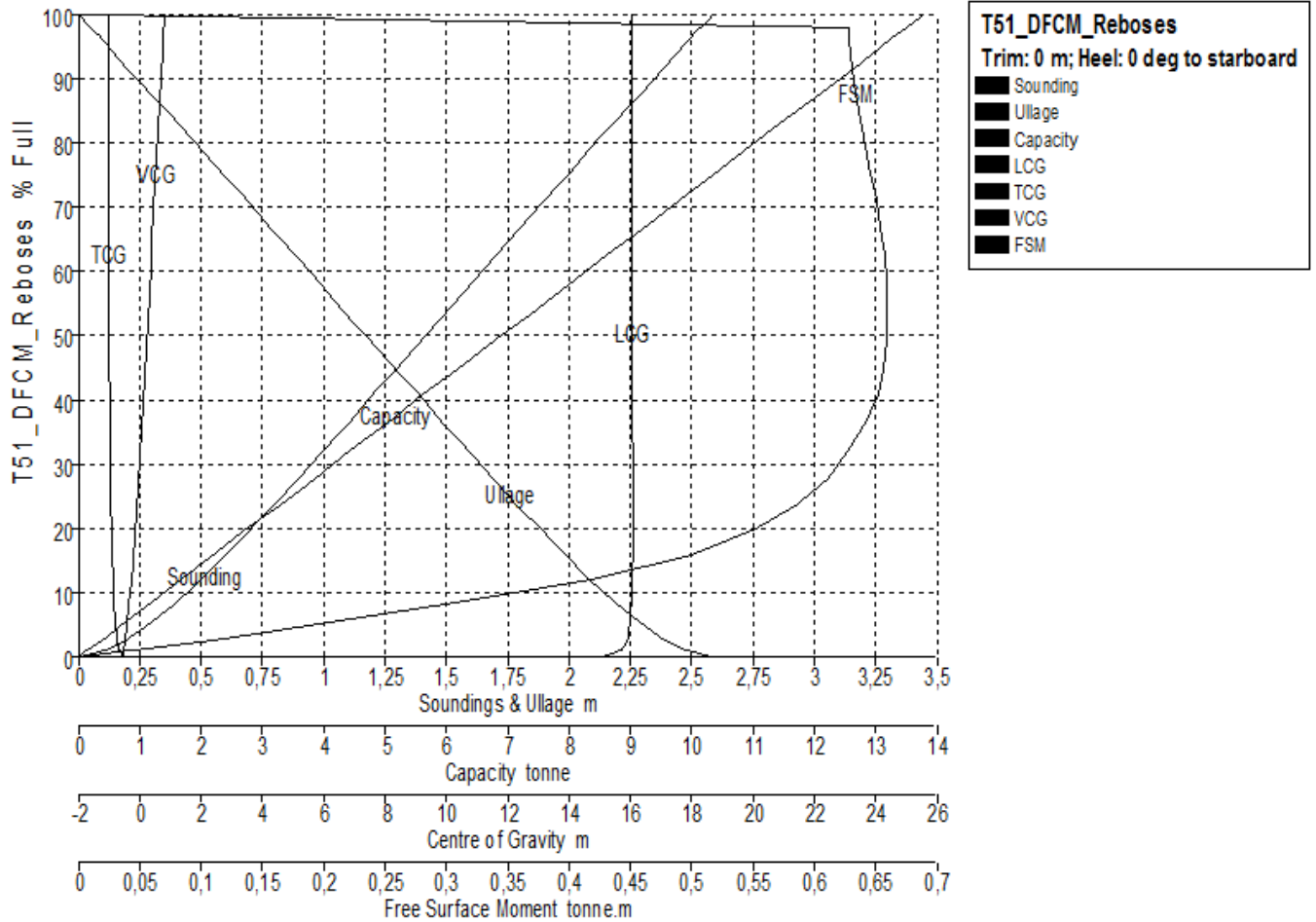
Tank Calibrations - T51_DFCM_Reboses

Fluid Type = Diesel

Specific gravity = 0,84

Permeability = 100 %

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
T51_DFCM_Reboses	2,586	0,000	100,000	16,417	13,791	16,028	-1,034	0,815	0,000
	2,538	0,048	98,000	16,089	13,515	16,027	-1,033	0,792	0,628
	2,536	0,050	97,900	16,073	13,501	16,027	-1,033	0,791	0,628
	2,500	0,086	96,411	15,828	13,296	16,026	-1,033	0,773	0,628
	2,400	0,186	92,226	15,141	12,718	16,024	-1,032	0,723	0,630
	2,300	0,286	88,024	14,451	12,139	16,023	-1,031	0,674	0,633
	2,200	0,386	83,803	13,758	11,557	16,022	-1,029	0,624	0,637

Cuaderno 4: Cálculos de arquitectura naval

Proyecto nº 16-15.

Fernando García-Ganges Icaza



	2,100	0,486	79,560	13,062	10,972	16,021	-1,028	0,574	0,642
	2,000	0,586	75,297	12,362	10,384	16,022	-1,026	0,523	0,646
	1,900	0,686	71,013	11,659	9,793	16,022	-1,023	0,473	0,651
	1,800	0,786	66,713	10,953	9,200	16,024	-1,021	0,422	0,654
	1,700	0,886	62,398	10,244	8,605	16,026	-1,018	0,370	0,657
	1,600	0,986	58,074	9,534	8,009	16,028	-1,014	0,319	0,659
	1,500	1,086	53,743	8,823	7,411	16,032	-1,009	0,267	0,660
	1,400	1,186	49,411	8,112	6,814	16,036	-1,004	0,214	0,659
	1,300	1,286	45,084	7,402	6,217	16,041	-0,998	0,161	0,656
	1,200	1,386	40,765	6,693	5,622	16,047	-0,991	0,108	0,652
	1,100	1,486	36,467	5,987	5,029	16,054	-0,982	0,055	0,641
	1,000	1,586	32,202	5,287	4,441	16,060	-0,972	0,000	0,628
	0,900	1,686	27,981	4,594	3,859	16,066	-0,959	-0,055	0,611
	0,800	1,786	23,824	3,911	3,285	16,071	-0,944	-0,110	0,586
	0,700	1,886	19,761	3,244	2,725	16,073	-0,925	-0,167	0,551
	0,600	1,986	15,832	2,599	2,183	16,067	-0,901	-0,224	0,498
	0,500	2,086	12,100	1,986	1,669	16,051	-0,871	-0,282	0,416
	0,400	2,186	8,651	1,420	1,193	16,025	-0,835	-0,341	0,310
	0,300	2,286	5,559	0,913	0,767	15,985	-0,793	-0,399	0,207
	0,200	2,386	2,909	0,478	0,401	15,908	-0,740	-0,459	0,115
	0,108	2,478	1,000	0,164	0,138	15,706	-0,671	-0,514	0,043
	0,100	2,486	0,863	0,142	0,119	15,666	-0,663	-0,519	0,038
	0,000	2,586	0,000	0,000	0,000	15,053	-0,500	-0,586	0,000

Tank Calibrations - T52_DFCM_Acsucio

Fluid Type = Lube Oil

Specific gravity = 0,925

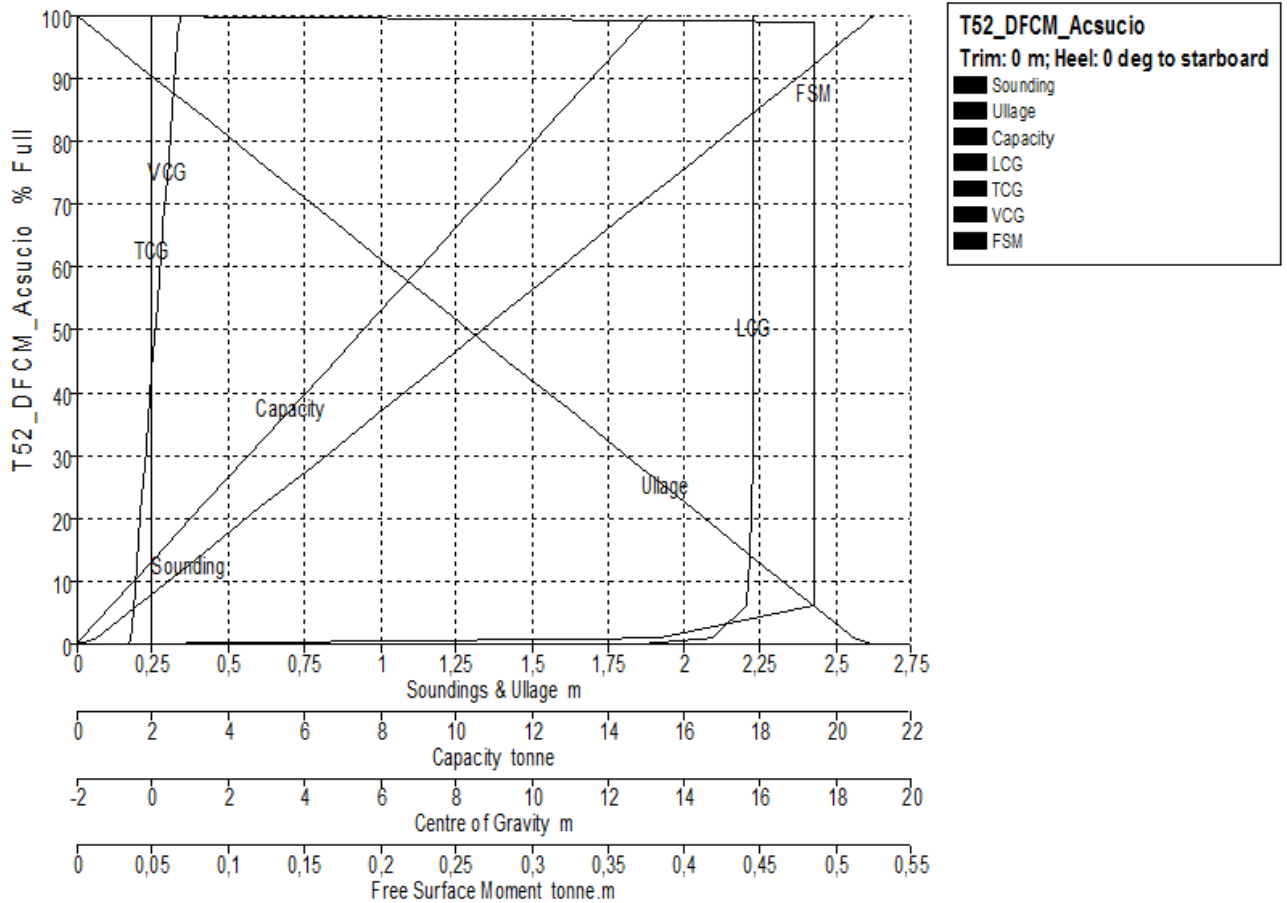
Permeability = 100 %

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

Cuaderno 4: Cálculos de arquitectura naval

Proyecto nº 16-15.

Fernando García-Ganges Icaza



Tank Name	Sounding m	Ullage m	% Full	Capacity m ³	Capacity tonne	LCG m	TCG m	VCG m	FSM tonne.m
T52_DFCM_Acsucio	2,629	0,000	100,000	16,288	15,066	15,837	0,000	0,707	0,000
	2,600	0,029	98,892	16,108	14,900	15,837	0,000	0,693	0,486
	2,577	0,052	98,000	15,962	14,765	15,837	0,000	0,681	0,486
	2,574	0,054	97,900	15,946	14,750	15,837	0,000	0,680	0,486
	2,400	0,229	91,157	14,848	13,734	15,836	0,000	0,593	0,486
	2,200	0,429	83,421	13,588	12,569	15,835	0,000	0,493	0,486
	2,000	0,629	75,685	12,328	11,403	15,833	0,000	0,393	0,486
	1,800	0,829	67,949	11,068	10,238	15,831	0,000	0,293	0,486
	1,600	1,029	60,214	9,808	9,072	15,829	0,000	0,193	0,486
	1,400	1,229	52,478	8,548	7,907	15,826	0,000	0,093	0,486
	1,200	1,429	44,742	7,288	6,741	15,821	0,000	-0,007	0,486
	1,000	1,629	37,006	6,028	5,576	15,815	0,000	-0,107	0,486
	0,800	1,829	29,271	4,768	4,410	15,806	0,000	-0,207	0,486
	0,600	2,029	21,535	3,508	3,245	15,791	0,000	-0,307	0,486
	0,400	2,229	13,799	2,248	2,079	15,757	0,000	-0,408	0,486
	0,200	2,429	6,063	0,988	0,914	15,639	0,000	-0,509	0,486
	0,067	2,561	1,000	0,163	0,151	14,763	0,000	-0,581	0,383
	0,000	2,629	0,000	0,000	0,000	12,736	0,000	-0,629	0,000

Tank Calibrations - T53_DFCM_ADulce1

Cuaderno 4: Cálculos de arquitectura naval

Proyecto nº 16-15.

Fernando García-Ganges Icaza

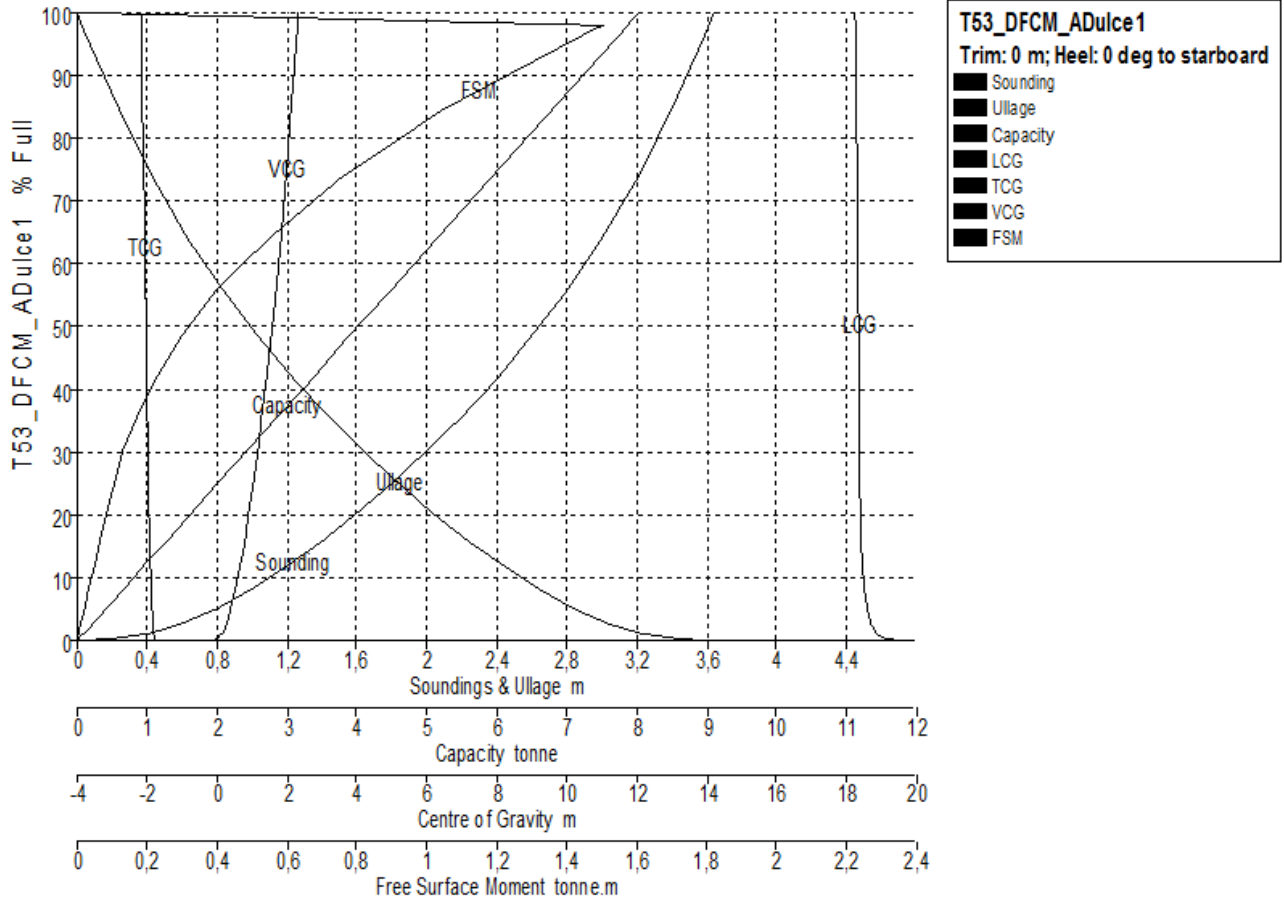


Fluid Type = Fresh Water

Specific gravity = 1

Permeability = 100 %

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
T53_DFCM_ADulce1	3,639	0,000	100,000	8,032	8,032	18,247	-2,161	2,317	0,000
	3,610	0,028	98,000	7,872	7,872	18,252	-2,155	2,293	1,506
	3,609	0,030	97,900	7,863	7,863	18,253	-2,155	2,292	1,502
	3,600	0,039	97,286	7,814	7,814	18,254	-2,153	2,285	1,477
	3,400	0,239	84,538	6,790	6,790	18,288	-2,117	2,122	1,047
	3,200	0,439	73,577	5,910	5,910	18,313	-2,086	1,967	0,753
	3,000	0,639	64,087	5,148	5,148	18,330	-2,058	1,819	0,545
	2,800	0,839	55,785	4,481	4,481	18,341	-2,033	1,679	0,398
	2,600	1,039	48,394	3,887	3,887	18,348	-2,011	1,543	0,297
	2,400	1,239	41,725	3,351	3,351	18,356	-1,992	1,412	0,224
	2,200	1,439	35,665	2,865	2,865	18,364	-1,974	1,285	0,171
	2,000	1,639	30,118	2,419	2,419	18,374	-1,958	1,160	0,132
	1,800	1,839	25,003	2,008	2,008	18,386	-1,942	1,037	0,105
	1,600	2,039	20,265	1,628	1,628	18,402	-1,926	0,914	0,084
	1,400	2,239	15,884	1,276	1,276	18,425	-1,909	0,790	0,066
	1,200	2,439	11,882	0,954	0,954	18,459	-1,890	0,665	0,050
	1,000	2,639	8,326	0,669	0,669	18,509	-1,869	0,537	0,035
	0,800	2,839	5,300	0,426	0,426	18,586	-1,847	0,408	0,021
	0,600	3,039	2,894	0,232	0,232	18,697	-1,822	0,276	0,011
	0,400	3,239	1,183	0,095	0,095	18,859	-1,793	0,143	0,004

Cuaderno 4: Cálculos de arquitectura naval

Proyecto nº 16-15.

Fernando García-Ganges Icaza



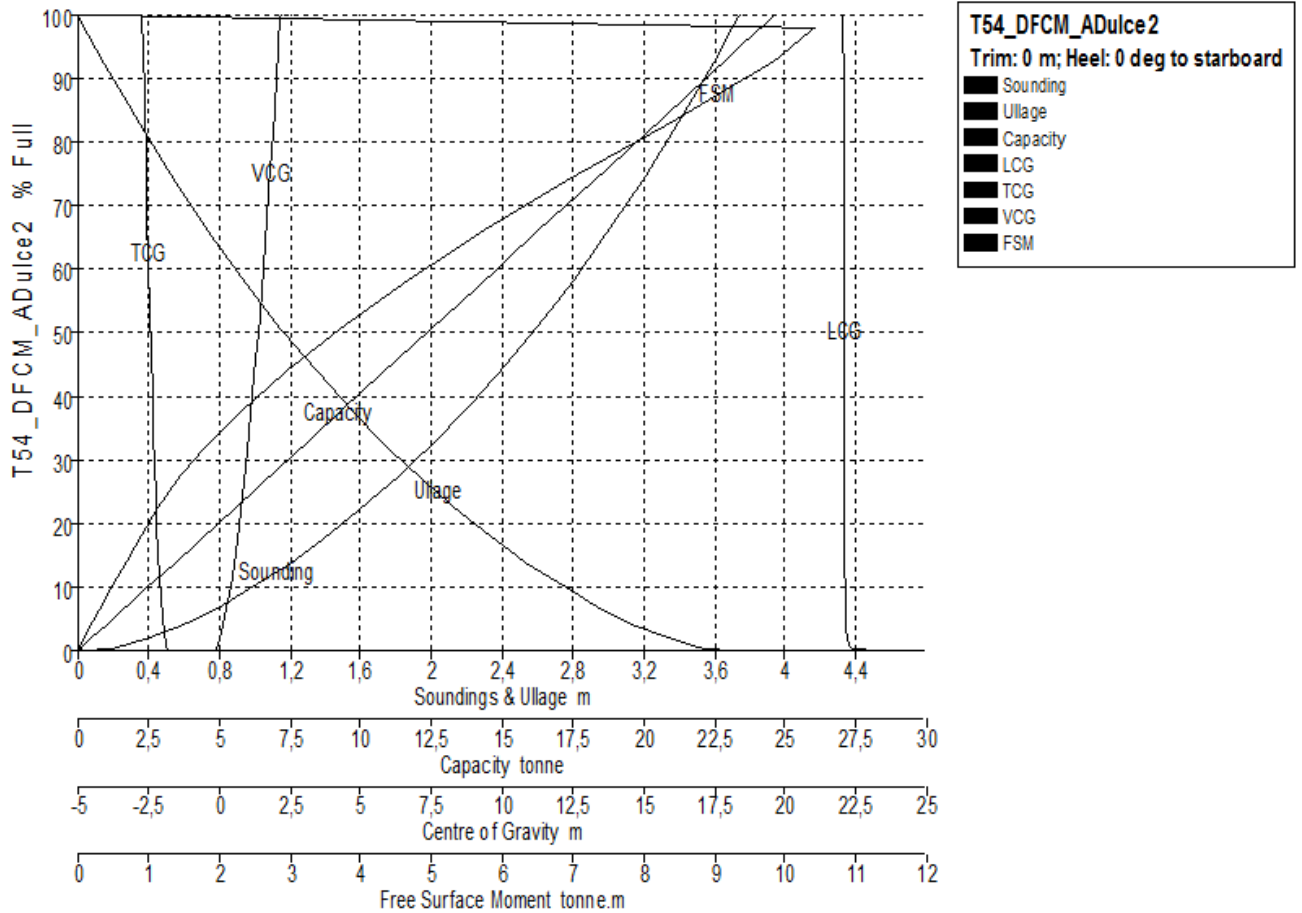
	0,372	3,267	1,000	0,080	0,080	18,893	-1,789	0,124	0,003
	0,200	3,439	0,224	0,018	0,018	19,132	-1,755	0,004	0,001
	0,000	3,639	0,000	0,000	0,000	19,660	-1,700	-0,139	0,000

Tank Calibrations - T54_DFCM_ADulce2

Fluid Type = Fresh Water Specific gravity = 1

Permeability = 100 %

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
T54_DFCM_ADulce2	3,741	0,000	100,000	24,636	24,636	22,049	-2,718	2,167	0,000
	3,702	0,039	98,000	24,143	24,143	22,050	-2,708	2,140	10,427
	3,700	0,041	97,900	24,118	24,118	22,051	-2,707	2,138	10,416
	3,600	0,141	92,905	22,888	22,888	22,054	-2,681	2,070	9,846
	3,400	0,341	83,312	20,525	20,525	22,060	-2,627	1,933	8,406
	3,200	0,541	74,342	18,315	18,315	22,064	-2,574	1,797	6,969
	3,000	0,741	65,980	16,255	16,255	22,068	-2,524	1,662	5,716
	2,800	0,941	58,202	14,339	14,339	22,071	-2,475	1,529	4,648
	2,600	1,141	50,984	12,560	12,560	22,074	-2,428	1,397	3,746
	2,400	1,341	44,304	10,915	10,915	22,077	-2,384	1,267	2,983
	2,200	1,541	38,142	9,397	9,397	22,079	-2,341	1,139	2,347
	2,000	1,741	32,472	8,000	8,000	22,082	-2,301	1,013	1,830

Cuaderno 4: Cálculos de arquitectura naval

Proyecto nº 16-15.

Fernando García-Ganges Icaza



	1,800	1,941	27,255	6,714	6,714	22,085	-2,262	0,889	1,426
	1,600	2,141	22,441	5,528	5,528	22,090	-2,224	0,766	1,119
	1,400	2,341	17,996	4,433	4,433	22,097	-2,185	0,644	0,876
	1,200	2,541	13,912	3,427	3,427	22,108	-2,143	0,522	0,672
	1,000	2,741	10,209	2,515	2,515	22,123	-2,096	0,399	0,495
	0,800	2,941	6,934	1,708	1,708	22,141	-2,043	0,275	0,335
	0,600	3,141	4,156	1,024	1,024	22,166	-1,982	0,150	0,195
	0,400	3,341	1,968	0,485	0,485	22,209	-1,910	0,024	0,083
	0,281	3,460	1,000	0,246	0,246	22,265	-1,860	-0,052	0,037
	0,200	3,541	0,502	0,124	0,124	22,348	-1,821	-0,105	0,016
	0,000	3,741	0,000	0,000	0,000	23,478	-1,700	-0,241	0,000

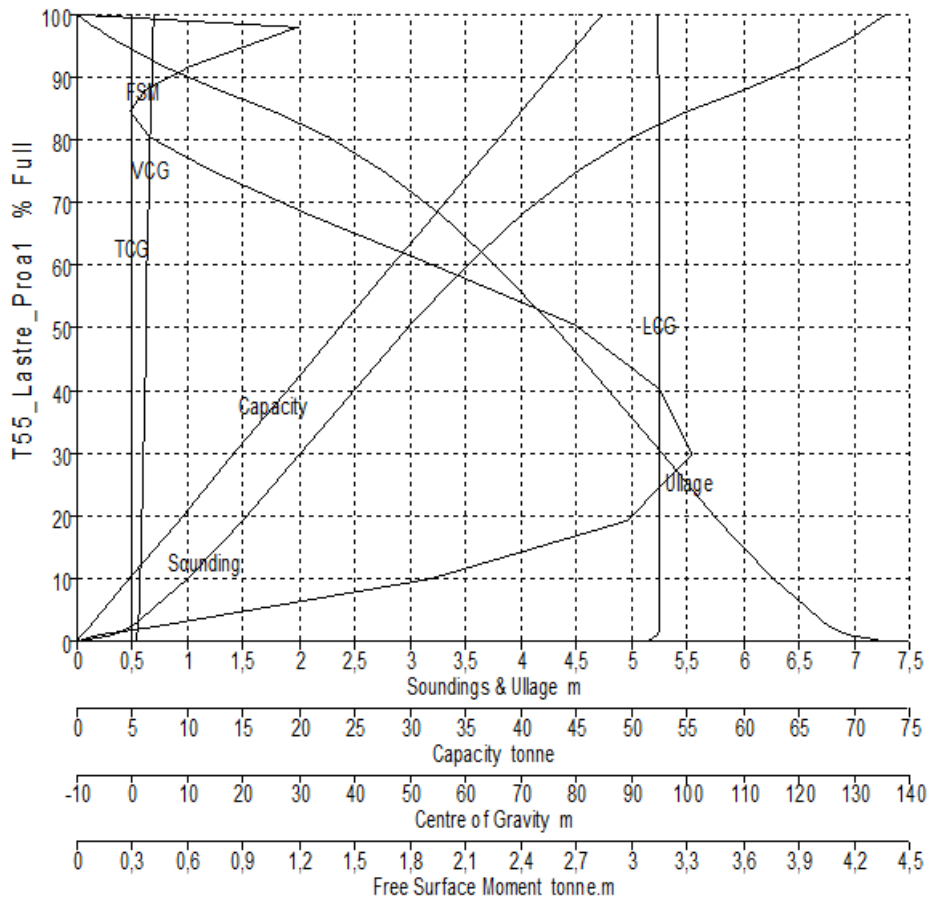
Tank Calibrations - T55_Lastre_Proa1

Fluid Type = Water Ballast

Specific gravity = 1,025

Permeability = 100 %

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



T55_Lastre_Proa1
 Trim: 0 m; Heel: 0 deg to starboard

- Sounding
- Ullage
- Capacity
- LCG
- TCG
- VCG
- FSM

Cuaderno 4: Cálculos de arquitectura naval

Proyecto nº 16-15.

Fernando García-Ganges Icaza



Tank Name	Sounding m	Ullage m	% Full	Capacity m ³	Capacity tonne	LCG m	TCG m	VCG m	FSM tonne.m
T55_Lastre_Proa1	7,274	0,000	100,000	46,148	47,302	94,662	0,000	3,990	0,000
	7,112	0,163	98,000	45,225	46,356	94,672	0,000	3,910	1,198
	7,103	0,171	97,900	45,179	46,309	94,673	0,000	3,906	1,187
	7,000	0,274	96,716	44,633	45,748	94,680	0,000	3,858	1,061
	6,500	0,774	91,776	42,353	43,412	94,716	0,000	3,663	0,612
	6,000	1,274	87,894	40,562	41,576	94,754	0,000	3,516	0,372
	5,500	1,774	84,498	38,994	39,969	94,789	0,000	3,397	0,290
	5,000	2,274	80,516	37,157	38,086	94,817	0,000	3,270	0,400
	4,500	2,774	75,060	34,639	35,505	94,833	0,000	3,111	0,738
	4,000	3,274	68,131	31,441	32,227	94,840	0,000	2,922	1,255
	3,500	3,774	59,890	27,638	28,329	94,840	0,000	2,709	1,942
	3,000	4,274	50,508	23,309	23,892	94,838	0,000	2,475	2,688
	2,500	4,774	40,339	18,616	19,081	94,833	0,000	2,223	3,150
	2,000	5,274	29,832	13,767	14,111	94,828	0,000	1,958	3,322
	1,500	5,774	19,410	8,957	9,181	94,826	0,000	1,680	2,969
	1,000	6,274	9,827	4,535	4,649	94,816	0,000	1,385	1,908
	0,500	6,774	2,536	1,170	1,199	94,753	0,000	1,069	0,426
	0,325	6,949	1,000	0,461	0,473	94,675	0,000	0,954	0,116
	0,000	7,274	0,000	0,000	0,000	92,528	0,000	0,726	0,000

Tank Calibrations - T56_Lastre_Proa2

Fluid Type = Water Ballast

Specific gravity = 1,025

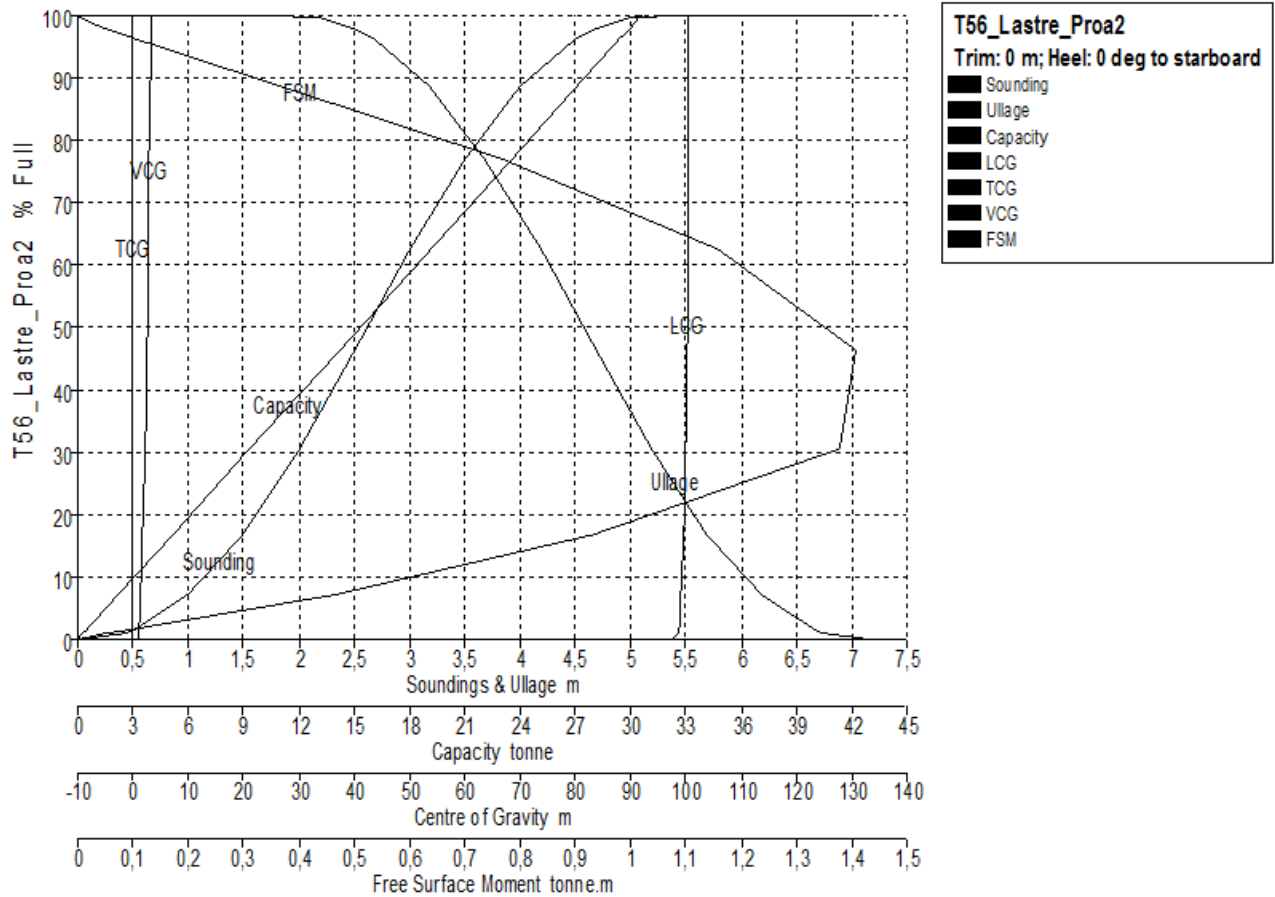
Permeability = 100 %

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

Cuaderno 4: Cálculos de arquitectura naval

Proyecto nº 16-15.

Fernando García-Ganges Icaza



Tank Name	Sounding m	Ullage m	% Full	Capacity m ³	Capacity tonne	LCG m	TCG m	VCG m	FSM tonne.m
T56_Lastre_Proa2	7,183	0,000	100,000	29,835	30,581	100,456	0,000	3,437	0,000
	7,000	0,183	100,000	29,835	30,581	100,456	0,000	3,437	0,000
	6,500	0,683	100,000	29,835	30,581	100,456	0,000	3,437	0,000
	6,000	1,183	100,000	29,835	30,581	100,456	0,000	3,437	0,000
	5,500	1,683	100,000	29,835	30,581	100,456	0,000	3,437	0,000
	5,000	2,183	99,569	29,706	30,449	100,463	0,000	3,426	0,006
	4,704	2,479	98,000	29,238	29,969	100,481	0,000	3,391	0,047
	4,691	2,492	97,900	29,209	29,939	100,482	0,000	3,389	0,050
	4,500	2,683	96,113	28,675	29,392	100,495	0,000	3,351	0,104
	4,000	3,183	88,524	26,411	27,072	100,512	0,000	3,206	0,366
	3,500	3,683	76,984	22,968	23,543	100,477	0,000	3,004	0,768
	3,000	4,183	62,523	18,654	19,120	100,373	0,000	2,759	1,158
	2,500	4,683	46,532	13,883	14,230	100,180	0,000	2,482	1,405
	2,000	5,183	30,513	9,103	9,331	99,864	0,000	2,174	1,378
	1,500	5,683	16,820	5,018	5,144	99,462	0,000	1,845	0,931
	1,000	6,183	7,060	2,106	2,159	99,047	0,000	1,513	0,465
	0,500	6,683	1,422	0,424	0,435	98,607	0,000	1,170	0,080
	0,432	6,751	1,000	0,298	0,306	98,530	0,000	1,122	0,050
	0,000	7,183	0,000	0,000	0,000	97,424	0,000	0,817	0,000