

Universidad de **Cádiz**

Proyectos de fin de carrera de **Ingeniería Técnica Naval**

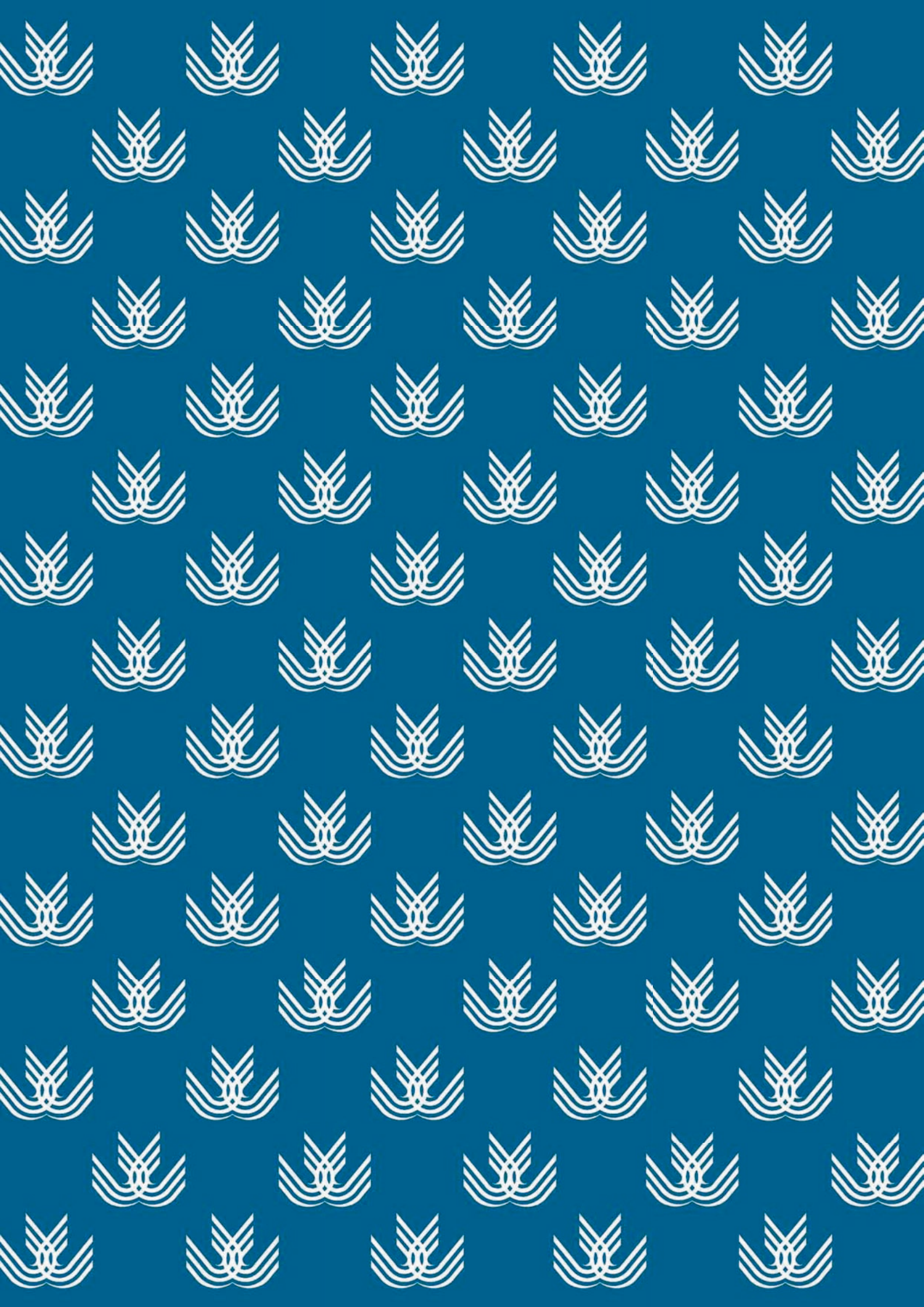
**Rediseño de la estructura básica de un Shuttle  
Tanker de 145.000 m<sup>3</sup> en acero normal**

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# **MEMORIA**



## 1.- RESUMEN EJECUTIVO

El proyecto consiste en el rediseño de la estructura básica de un SHUTTLE TANKER de 145.000 M<sup>3</sup>, usando solamente acero dulce: el diseño de partida (con el que se construyeron dos buques en la Factoría de Puerto Real, de Astilleros Españoles S.A. en el año 1998. Actualmente Navantia) incluía parte de acero de alto límite elástico en la estructura longitudinal.

El interés de este trabajo se centra en la tendencia de los requerimientos de algunos armadores en relación con la vida a fatiga de la estructura del buque: el acero dulce es más resistente frente a sollicitaciones variables en el tiempo que el acero de alto límite elástico.

Como datos de entrada se han manejado los siguientes del diseño de partida: Disposición General del buque, planos de la Cuaderna Maestra y del Mamparo Transversal principal y Peso Total de Acero desglosado por bloques.

En el estudio se han mantenido las siguientes características o aspectos del buque original:

- Dimensiones y formas del buque.
- Calado de escantillonado
- Distribución de espacios "disposición general"
- Sociedad de Clasificación y notaciones excepto a lo referente al uso de HTS.

A lo largo del texto denominaremos "**BUQUE BASE**" al proyecto original (C/83-85 de Puerto Real, actualmente Navantia) y "**BUQUE PROYECTO**" al que resultará tras aplicar las modificaciones que son objeto de este trabajo.

Inicialmente, como referencia, realizamos los cálculos de escantillonado correspondiente al BUQUE BASE, mediante el programa "Nauticus Hull" usando la siguiente información contenida en los planos de la cuaderna maestra:

- Momentos flectores de diseño: "Arrufo y Quebranto"
- Características principales
- Tipos de acero empleados: acero de alto límite elástico (HTS) y acero normal (MTS)

Después se "rediseña" la estructura sustituyendo los elementos de acero de alto límite elástico por otros de acero normal, con los escantillones correspondientes, es decir mayores. Como consecuencia de ello aumenta el Peso de Acero de la estructura y por tanto el del Buque en Rosca. (Hay que tener en cuenta que se mantienen los momentos flectores del "**BUQUE BASE**" y sus "Características Principales").

Uno de los datos de salida del programa usado (Nauticus) es el área de las secciones de los elementos longitudinales de la cuaderna maestra. A partir de la diferencia de área entre ambos diseños ( "**BUQUE BASE**" y "**BUQUE PROYECTO**" ) se calcula el incremento de peso de acero, así como el peso total de los elementos longitudinales.

Sumando al peso en rosca del "**BUQUE BASE**" el incremento de peso anteriormente calculado obtenemos el peso en rosca del "**BUQUE PROYECTO**". (Haciendo la hipótesis razonable de que los Pesos de la Maquinaria y del Equipo no varían como consecuencia del proceso de rediseño de la estructura.)

Considerando este último Peso en Rosca se realiza el estudio de Resistencia Longitudinal de dos condiciones crítica: la condición de carga que da mayor momento flector en

arrufo y la condición de lastre que de mayor momento flector en quebranto. Comprobamos que no se exceden los valores “de diseño”.

Además de lo anterior se ha analizado la posible influencia del requerimiento de emplear solo Acero Normal en los mamparos transversales.

Finalmente se incluye una estimación del Coste Diferencial correspondiente al criterio especificado (Emplear solo Acero Dulce).

## **2.- BUQUE BASE.**

Se denomina así al proyecto correspondiente a las C/83-85 de Puerto Real (Actualmente Navantia) como se ha indicado anteriormente en el Resumen Ejecutivo.

A continuación se presentan las características del “**BUQUE BASE**” y se hace una revisión de su resistencia estructural frente a las solicitaciones operativas, con el fin de poder comparar después la situación con los resultados para el diseño modificado (**BUQUE PROYECTO**).

### **2.1.- CARACTERÍSTICAS PRINCIPALES:**

(Ver anexo2, punto 1, hoja 1)

ESLORA TOTAL	265.00 M.
ESLORA ENTRE PP AL CALADO DE 15.5	256.50 M.
ESLORA DE ESCANTILLONADO	252.69 M.
MANGA DE TRAZADO	42.50 M.
PUNTAL	22.00 M.
CALADO DE ESCANTILLONADO	15.50 M.
COEFICIENTE DE BLOQUE	0.879
VELOCIDAD MÁXIMA EN SERVICIO	14.50 N.

### **2.2.- MATERIAL EMPLEADO.**

El material empleado en este diseño es de acero dulce (límite elástico de 235 N/mm), excepto donde se indica, que es de acero de alto límite elástico HTS= 355 N/mm (Ver anexo2, punto 1, hojas 3 y 4)

### **2.3.- MOMENTOS FLECTORES:**

En lo referente a los Momentos Flectores (SWBM: Still Water Bending Moments): (Ver anexo 1, punto 1, hoja 17)



	ARRUFO (TXM)	QUEBRANTO (TXM)
<b>MOMENTOS FLECTORES REGLAMENTARIOS ( * )</b>	<b>295.972</b>	<b>315.235</b>
<b>MOMENTOS FLECTORES OPERATIVOS ( ** )</b>	<b>335.946</b>	<b>359.585</b>
<b>MOMENTOS FLECTORES DE DISEÑO</b>	<b>407.000</b>	<b>418.000</b>

( \* ) Momentos flectores que corresponden al “Módulo mínimo Reglamentario”

( \*\* ) Momentos Flectores máximos en condiciones de carga. (Dato obtenido en los Astilleros de Puerto Real, Actualmente Navantia)

En este caso los momentos flectores que se consideran para el chequeo de la estructura son los “de Diseño” los cuales se encuentran por encima de los reglamentarios y de los que figuran en el manual de carga (Condiciones Operativas) del buque. Estos últimos momentos flectores, son datos obtenidos en el Astillero de Puerto Real, (Actualmente Navantia).

Los momentos flectores de Diseño exceden respecto a los máximos operativos (Condiciones de carga) en:

- **Momento flector en Arrufo: Excede en un 18%.**
- **Momento flector en Quebranto: Excede en un 14%.**

#### 2.4.- MÓDULOS RESISTENTES.

Se debe comprobar que los módulos resistentes en cubierta y fondo no son inferiores a los exigidos por las reglas en función de los momentos flectores de Diseño.

**M.R.C: Módulo Resistente en Cubierta.**

**M.R.F: Módulo Resistente en Fondo.**

	EXIGIBLES (M <sup>3</sup> )	ACTUALES (M <sup>3</sup> )	MARGEN
<b>M.R.C</b>	<b>36.614</b>	<b>38.012</b>	<b>+ 3.82 %</b>
<b>M.R.F</b>	<b>36.614</b>	<b>46.604</b>	<b>+ 27.3 %</b>

Como se puede observar en la tabla, los módulos resistentes actuales para el “**BUQUE BASE**” se encuentran por encima de los requeridos. (Ver anexo 1, punto 1, hoja 19)

#### 2.5.- PANDEO.

Se comprueba que tanto las planchas como los refuerzos de los elementos longitudinales no tienen problemas de pandeo. (Ver anexo 1, punto 1, hojas 22 a 33, donde se puede observar el detalle del cálculo y márgenes existentes).

#### 2.6.- ÁREA CUADERNA MAESTRA.

Uno de los resultados de salida del programa “ Nauticus Hull “ para el “**BUQUE BASE**” es el área de la sección de los elementos longitudinales de la cuaderna maestra (simplificadamente: “Área de la Cuaderna Maestra”). Este resultado se empleará

posteriormente para calcular el peso total del acero del “**BUQUE PROYECTO**”. (Ver anexo 1, punto 1, hoja 16)

**Área Cuaderna Maestra B.B. = 61.490 cm<sup>2</sup>.**

**(B.B. .... Buque Base)**

## 2.7.- PESO TOTAL DE ACERO BUQUE BASE.

El peso total de acero del “**BUQUE BASE**” se ha obtenido a partir del peso desglosado en bloques, (Ver anexo 1, punto 2) de manera que el peso total de acero (Peso de Acero Teórico: sin incluir exceso de laminación ni material de aportación de soldadura) es:

**Peso Total de Acero Buque Base = 20.356 Tons.**

## 3.- APROXIMACIONES.

Una vez realizados los cálculos de escantillonado con las hipótesis del diseño original (BUQUE BASE) acometemos el rediseño de la estructura considerando el uso de solo Acero Dulce. Como consecuencia del cambio de acero en Cubierta, Fondo y Doble Fondo, pasando de acero de alto límite elástico **HTS, E = 355 N/mm** a acero normal **MTS, E = 235 N/mm**, los espesores de planchas y módulos de refuerzos requeridos para los elementos longitudinales aumentan. El criterio seguido es comprobar que los módulos resistentes “actuales” (es decir, resultantes del escantillonado) de la cuaderna maestra tanto en cubierta como en fondo satisfacen los valores requeridos. Así mismo habrá que comprobar la resistencia al pandeo.

Se mantienen los Momentos Flectores de Diseño del “**BUQUE BASE**” y las características principales del mismo y se han realizado varios tanteos aumentando algunos escantillones.

### MOMENTOS FLECTORES Y MÓDULOS RESISTENTES:

MOMENTOS FLECTORES		UNIDADES	ARRUFO	QUEBR.
DE DISEÑO		T x M	407.000	418.000
ADMISIBLES 1º APROX.		T x M	295.972	315.235
ADMISIBLES 2º APROX.		T x M	295.972	315.235
MÓDULOS RESISTENTES			REQUER.	ACTUAL
1ª APROX.	en Cta.	CM <sup>3</sup>	50.893	42.585
	en Fondo	CM <sup>3</sup>	50.893	54.596
2ª APROX.	en Cta.	CM <sup>3</sup>	50.893	48.838
	en Fondo	CM <sup>3</sup>	50.893	56.700

Como se puede ver en la tabla anterior, (correspondiente a la primera aproximación del proceso de escantillonado), el módulo resistente actual en el fondo se encuentra por encima del requerido excediendo en un 7.3%. Lo contrario sucede con el módulo resistente en cubierta, el cual se encuentra por debajo del requerido en un 16.3%. Todo esto nos indica que en cubierta se han de aumentar tanto espesores como módulos de planchas y refuerzos



respectivamente. (Ver anexo 1, punto 3.1, hojas 17 y 19), mientras que en el fondo nos vemos forzados a mantener los escantillones existentes por razones de resistencia local. (A pesar de haber tenido en cuenta una reducción de requerimientos de escantillado local al aplicar el correspondiente factor  $F_b$ )

En una segunda aproximación hemos conseguido aumentar los módulos resistentes, pasando en el fondo de un exceso del 7.3% al 11.4%, pero sin llegar a alcanzar en la cubierta el valor requerido: esta aproximación se ha quedado un 4% por debajo del modulo requerido en cubierta. (Ver anexo 1, punto 3.2, hojas 17 y 19)

Es decir, que en ninguna de las dos “aproximaciones” citadas se alcanza una situación satisfactoria en cuanto a los módulos resistentes en cubierta.

Por otro lado hemos detectado que aparecerían problemas de pandeo con las planchas y refuerzos en ambas aproximaciones. (Ver anexo 1, punto 3.1 y 3.2 hojas 22 a 33)

Por todo ello ha sido necesario hacer un ajuste adicional (con el que finaliza el proceso de aproximaciones sucesivas) cuyo resultado es lo que denominaremos “**BUQUE PROYECTO**”.

## **4.- BUQUE PROYECTO.**

### **4.1.- CARACTERÍSTICAS PRINCIPALES:**

(Ver anexo2, punto 3, hoja 1). Se mantienen las mismas características principales del "BUQUE BASE", esto es:

ESLORA TOTAL	265.00 M.
ESLORA ENTRE PP AL CALADO DE 15.5	256.50 M.
ESLORA DE ESCANTILLONADO	252.69 M.
MANGA DE TRAZADO	42.50 M.
PUNTAL	22.00 M.
CALADO DE ESCANTILLONADO	15.50 M.
COEFICIENTE DE BLOQUE	0.879
VELOCIDAD MÁXIMA EN SERVICIO	14.50 N.

### **4.2.- MATERIAL EMPLEADO.**

El "BUQUE PROYECTO" tiene una estructura diseñada totalmente en acero normal MTS, E = 235 N/mm (Ver anexo 2, punto 3, hojas 3 y 4)

### **4.3.- MOMENTOS FLECTORES.**

Para el rediseño del "BUQUE PROYECTO" se consideran los mismos momentos flectores de diseño que los empleados en el "BUQUE BASE", habiéndose comprobado en los resultados de salida del programa " NAUTICUS HULL " que dichos momentos flectores de diseño empleados se encuentran por encima de los que corresponden al "Módulo Mínimo Reglamentario" y de los que cubren los máximos operativos. (Los que recogerá el Manual de Carga del buque)

	ARRUFO (TXM)	QUEBRANTO (TXM)
<b>MOMENTOS FLECTORES REGLAMENTARIOS ( * )</b>	<b>295.972</b>	<b>315.235</b>
<b>MOMENTOS FLECTORES MÁXIMOS OPERATIVOS ( ** )</b>	<b>306.425</b>	<b>379.971</b>
<b>MOMENTOS FLECTORES DE DISEÑO BUQUE PROYECTO</b>	<b>407.000</b>	<b>418.000</b>

( \* ) Correspondientes al módulo mínimo reglamentario.

( \*\* ) Correspondientes a los momentos flectores máximos en condición de carga.

Como se puede observar en la tabla anterior, los momentos flectores de Diseño empleados para el Buque Proyecto, se encuentran por encima de los correspondientes al módulo mínimo reglamentario (Ver anexo 1, punto 4 hoja 17) y a los máximos operativos (es



decir los que requiere la operación del buque). Estos últimos momentos flectores se han obtenido una vez conocido el peso total de acero del buque proyecto y tras realizar un estudio de la Resistencia Longitudinal de las dos condiciones críticas. (Ver anexo 1, punto 5)

	ARRUFO (TXM)	QUEBRANTO (TXM)
<b>MOMENTOS FLECTORES OPERATIVOS B.B</b>	<b>335.946</b>	<b>359.585</b>
<b>MOMENTOS FLECTORES DE DISEÑO PARA B.B</b>	<b>407.000</b>	<b>418.000</b>
<b>MOMENTOS FLECTORES OPERATIVOS B.P</b>	<b>306.425</b>	<b>379.971</b>
<b>MOMENTOS FLECTORES DE DISEÑO PARA B.P</b>	<b>407.000</b>	<b>418.000</b>

**B.B:** Buque Base.

**B.P:** Buque Proyecto.

El sobredimensionamiento o margen de los momentos flectores de diseño respecto a los máximos operativos queda reflejado en la siguiente tabla:

	ARRUFO	QUEBRANTO
<b>BUQUE BASE:</b>	<b>18%</b>	<b>14%</b>
<b>BUQUE PROYECTO:</b>	<b>25%</b>	<b>10%</b>

Con el escantillonado adoptado para el “**BUQUE PROYECTO**” se consigue aumentar el margen operativo en Arrufo (Condición de carga), aunque se reduce ligeramente el margen en Quebranto (Condición de Lastre). No obstante teniendo en cuenta la operación de este buque como SHUTTLE TANKER, entiendo adecuado el resultado obtenido.

#### 4.4.- MÓDULO RESISTENTE.

Se ha comprobado en los resultados de salida del programa “NAUTICUS HULL” que los módulos resistentes tanto en fondo como en cubierta se encuentran por encima de los exigidos, teniendo en cuenta los Momentos Flectores de Diseño antes citados. (Ver anexo 1, punto 4, hoja 19)

	EXIGIBLES (CM <sup>3</sup> )	ACTUALES (CM <sup>3</sup> )
<b>MODULOS RESISTENTES EN CUBIERTA</b>	<b>50.893</b>	<b>51.066</b>
<b>MODULO RESISTENTE EN FONDO</b>	<b>50.893</b>	<b>57.178</b>

#### 4.5.- PANDEO.

Se ha chequeado que tanto las planchas como los refuerzos de los elementos longitudinales no presentan riesgo de pandeo. (Ver anexo 1, punto 4 hojas 22 a 33)

#### 4.6.- AREA CUADERNA MAESTRA.

El conocimiento del área de los elementos longitudinales de la cuaderna maestra del “**BUQUE PROYECTO**” nos permite obtener una diferencia de área respecto al “**BUQUE BASE**” y poder evaluar a partir de la misma el incremento del peso de los elementos longitudinales de la viga buque y (considerando que no se alteran los elementos transversales) en consecuencia el Peso Total de Acero del Buque Proyecto. (Ver anexo 1, punto 4, hoja 16)

$$\text{Área Cuaderna Maestra B.P.} = 73.196 \text{ cm}^2.$$

(B.P. .... Buque Proyecto.)

#### 4.7.- PESO TOTAL DE ACERO BUQUE PROYECTO.

Una vez que se conoce el área de los elementos longitudinales tanto del “**BUQUE BASE**” como del “**BUQUE PROYECTO**”, se calcula la diferencia de área, con la cual obtendremos un incremento del peso por metro de los elementos longitudinales y finalmente el peso de acero del “**BUQUE PROYECTO**”.

$\Delta A$ : Incremento de área.  
 $AB.B$ : Área “**BUQUE BASE**”.  
 $AB.P$ : Área “**BUQUE PROYECTO**”.

$$\Delta A = AB.P - AB.B$$

$$\Delta A = 73.196 - 61.490$$

$$\Delta A = 11.706 \text{ cm}^2.$$

$\Delta P$ : Incremento de peso de acero por metro.  
 $\Delta A$ : Incremento de área.  
 $\gamma_{ACERO}$ : Peso específico del acero.

$$\Delta P = \Delta A \times \gamma_{ACERO}$$

$$\Delta P = 1,1706 \times 7,85$$

$$\Delta P = 9.2 \text{ T/M}$$

Una vez obtenido el incremento de peso por metro, la diferencia de peso total de acero del “**BUQUE PROYECTO**” con el del “**BUQUE BASE**” será de:

$\Delta P_T$ : Incremento de peso total.  
 $\Delta P$ : Incremento de peso por metro.  
 $C_b$ : Coeficiente de bloque.  
 $L_{pp}$ : Eslora entre perpendiculares

$$\Delta P_T = (0.725 + 0.25 \times C_b) \times \Delta P \times L_{pp}$$

$$\Delta P_T = (0.725 + 0.25 \times 0.879) \times 9.2 \times 256.5$$

$$\Delta P_T = 2.229,5 \text{ Tons.}$$

Ya obtenido el incremento total debido al cambio del mismo, podemos ya obtener el Peso de Acero del “**BUQUE PROYECTO**”:

$P_{TBP}$ : Peso de Acero del “BUQUE PROYECTO”.  
 $P_{TBB}$ : Peso de Acero del “BUQUE BASE”.  
 $\Delta P_T$ : Incremento del peso total.

$$P_{TBP} = P_{TBB} + \Delta P_T$$

$$P_{TBP} = 20.356 + 2.229,5$$

$$P_{TBP} = 22.585,5 \text{ Tons.}$$

#### 4.8.- ESTUDIO DE RESISTENCIA LONGITUDINAL.

Teniendo en cuenta este último Peso de Acero del “BUQUE PROYECTO” se ha realizado el estudio de Resistencia Longitudinal considerando dos condiciones críticas: la condición de Carga que da mayor momento flector en Arrufo y la condición de Lastre que da mayor momento flector en Quebranto:

Momentos flectores (SWBM), en T x m		
	Condición crítica	Valores de Diseño
Arrufo	306.425	407.000
Quebranto	379.971	418.000

Como se puede observar, los Momentos Flectores obtenidos como consecuencia del estudio de Resistencia Longitudinal son algo menores que los de Diseño, por lo que no será necesario reconsiderar el trabajo de rediseño de la estructura. (Ver anexo 1, punto 5, hojas 7 y 14)

### 5.- INFLUENCIA DEL CAMBIO DE TIPO DE ACERO EN LOS MAMPAROS TRANSVERSALES.

El material considerado en el diseño original es acero dulce, MTS  $E=235$  N/mm excepto unas consolas que son de acero de alto límite elástico HTS = 355 N/mm. Como conclusión se puede decir que la influencia de peso en los mamparos transversales es despreciable. (Ver anexo 2, punto 4)

### 6.- ESTIMACIÓN DEL COSTE DIFERENCIAL.

La estimación del Coste Diferencial debido al rediseño se ha realizado calculando el coste de construcción de la estructura del “BUQUE BASE” y el del “BUQUE PROYECTO” y obteniendo la diferencia entre ambos. Para ello se han considerado, entre otros, los siguientes parámetros:

- Peso total de acero del “BUQUE BASE”.
- Peso total de acero del “BUQUE PROYECTO”.
- Precios del kilo de acero (de cada tipo).
- Cantidad y coste del material de aportación (soldadura)
- Horas por tonelada de Acero Neto (horas /TAN)
- Precio Hora (Precio de la mano de obra).

En primer lugar se ha de tener en cuenta el porcentaje de acero normal y de alto límite elástico existente en el “BUQUE BASE”; en este caso se han obtenido los datos necesarios, a partir de información proporcionada por técnicos del Astillero de Puerto Real:

% EN CHAPA = 76 %.  
% EN PERFILES = 24 %.

Dentro de lo que es el acero en forma de chapa resultaron los siguientes porcentajes y costes por kilo:

- Calidad (A): 70% 0.41 €/kilo.
- Calidad (AH): 27% 0.46 €/Kilo.
- Otras Calidades: 3% 0.47 €/Kilo.

Por lo que respecta a perfiles resultó:

- Calidad (A): 64% 0.55 €/kilo.
- Calidad (AH): 35% 0.59 €/Kilo.
- Otras Calidades: 1%<sup>o</sup> 0.76 €/Kilo.

El coste del material de acero debe hacerse a partir del Peso de Acero Bruto, teniendo en cuenta el exceso de laminación (del orden de 1,2 % del acero teórico) y el porcentaje de chatarra. Si consideramos que el porcentaje de chatarra es de un 16% (lo que es optimista) el Peso de Acero Bruto (PAB) a partir del Peso de Acero Teórico (PAT) se calcula como sigue:

$$PAB = PAT \times 1,012 \times (100/84) = PAT \times 1,2048$$

Considerando los porcentajes antes citados (tipo de acero; planchas, perfiles) y los precios correspondientes se calcula el coste de adquisición de dicho material. A ello se le añade el coste del material de aportación (soldadura), que se ha calculado teniendo en cuenta un precio de 9,01 €/kilo.

Realizando las operaciones oportunas se obtiene un coste total del materiales de **14,043** millones de €.

A este coste habrá que añadir:

- a) el debido a la fabricación del casco del buque, multiplicando el valor unitario (25 horas / TAN) por el peso en Toneladas de Acero Neto (TAN); en este caso resulta **20,119** millones de euros.
- b) los correspondientes Gastos Generales, que ciframos en un 2,5% de la suma del coste de materiales y de mano de obra.

Con todo ello resulta un Coste Total del Casco del “BUQUE BASE” de **35,016** millones de euros.

(Los cálculos se han realizado mediante una Hoja de Cálculo Excel y se presentan resumidos en forma de Tabla. Ver hoja 12)



Una vez calculado el coste del casco del **“BUQUE BASE”**, se ha obtenido el del **“BUQUE PROYECTO”** aplicando un algoritmo similar y resumiendo los resultados en la mencionada Tabla Excel. Resulta un coste del casco de este último de **38,472** millones de euros.

Una vez calculados ambos costes: el del **“BUQUE BASE”** y el del **“BUQUE PROYECTO”** podemos ya obtener el **coste diferencial** debido al rediseño realizado.

$$C_D = 38,472 - 35,016 = \mathbf{3,456} \text{ millones de Euros}$$

## Cálculo del Coste Diferencial

	Buque Base				Buque Proyecto			
Peso de Acero Teórico (t)			20.356				22.586	
% de exceso de laminación			1,2%				1,2%	
Peso de Acero Neto (t)			20.600				22.857	
% material aportación soldadura			1,5%				1,5%	
% de chatarra supuesto			16,0%				16,0%	
Peso de Acero Bruto (t)			24.524				27.211	
% de chapa			76,0%				76,0%	
% de perfiles			24,0%				24,0%	
<b>A) MATERIALES</b>								
<b>Ítem</b>	<b>€/Kg.</b>	<b>%</b>	<b>Peso (t)</b>	<b>miles de €</b>	<b>%</b>	<b>Peso (t)</b>	<b>miles de €</b>	
Chapa "A"	0,41	70,0%	13.047	5.349	97,0%	20.060	8.225	
Chapa "AH"	0,46	27,0%	5.032	2.315	0,0%	0	0	
Chapa, otras calidades	0,47	3,0%	559	263	3,0%	620	292	
Peso Bruto de Chapa (t) ...			18.638			20.680		
Perfiles "A"	0,55	64,0%	3.767	2.072	99,0%	6.465	3.556	
Perfiles "AH"	0,59	35,0%	2.060	1.215	0,0%	0	0	
Perfiles, otras calidades	0,76	1,0%	59	45	1,0%	65	50	
Peso Bruto de Perfiles (t) ...			5.886			6.531		
Planchas y perfiles ...				11.259			12.122	
Material aportación	9,01		309,0	2.784		342,9	3.089	
<u>Coste de los materiales ...</u>				<b>14.043</b>			<b>15.211</b>	
<b>B) TRANSFORMACIONES</b>								
Horas/tonelada de Acero Neto			25			25		
Horas construcción del casco			515.007			571.426		
Coste hora (€)			39,0658			39,0658		
<u>Coste de la mano de obra ...</u>				<b>20.119</b>			<b>22.323</b>	
<b>C) GASTOS GENERALES ...</b>		2,5%		<b>854</b>			<b>938</b>	
<b><u>COSTE total del casco: ...</u></b>				<b>35.016</b>			<b>38.472</b>	
			miles de €	5.826,2			6.401,3	
			(Millones de Pts.)					
			<b><u>COSTE DIFERENCIAL:</u></b>	<b>3,456</b>		millones de €		
				575,1		(Millones de Pts.)		

## **7.- CONCLUSIÓN**

El trabajo de rediseño del casco del petrolero (Shuttle Tanker) objeto de este proyecto sugiere apuntar lo siguiente:

1. Hablando en términos generales se puede decir que el uso de HTS en una estructura naval permite reducir algunos escantillones y en consecuencia su peso total de acero y su coste. Sin embargo en ciertos buques en los que se había usado extensivamente este tipo de acero han aparecido grietas en zonas concretas: en elementos sometidos principalmente a fatiga, el uso de HTS no parece apropiado, salvo que se reduzcan los esfuerzos de diseño al mismo nivel de los admisibles que cuando se considera Acero Dulce (MS). (Pero entonces no se obtendría un ahorro neto de peso en estos elementos).
2. Aunque no tenemos noticia de la aparición de este tipo de problemas de fatiga en el buque base, se han estudiado las implicaciones que traería consigo el cambio de criterio de diseño, acercándonos a una posición de Armadores “conservadores”, poco amantes del HTS.
3. Este acercamiento a posiciones más conservadoras, aunque reduce el riesgo potencial que acabamos de mencionar, implica un incremento de coste de construcción del buque y una pérdida de oportunidad de rentabilidad que se desprende de lo siguiente:
  - a) El Peso de Acero se incrementa en unas **1.930 t**.
  - b) El Peso en Rosca aumenta y el Peso Muerto máximo se reduce en esta misma cantidad (Hemos supuesto que no modificamos las formas del buque ni el calado de diseño, o sea que mantenemos el Desplazamiento)
  - c) El Coste de Construcción aumenta en casi **3,5 millones de euros**

Estamos pues frente a un dilema clásico: una posición más conservadora nos deja más “tranquilos” pero se reducen nuestras expectativas de rentabilidad.

# **ANEXOS**

## **ANEXO I: CÁLCULOS**

## **ANEXO II: PLANOS**



# **Anexo I**

# **“Cálculos”**

- 1.- DATOS DE SALIDA DEL PROGRAMA “NAUTICUS HULL”  
PARA EL BUQUE BASE.**
- 2.- CÁLCULO DEL PESO DE ACERO PARA EL BUQUE BASE.**
- 3.- RESULTADOS DE SALIDA DEL PROGRAMA “NAUTICUS  
HULL” PARA APROXIMACIONES:**
  - 3.1.- PRIMERA**
  - 3.2.- SEGUNDA**
- 4.- RESULTADOS DE SALIDA DEL PROGRAMA “NAUTICUS  
HULL” PARA EL “BUQUE PROYECTO”. (Ajuste final)**
- 5.- ESTUDIO DE LA RESISTENCIA LONGITUDINAL DEL “BUQUE  
PROYECTO”.**

**1.-** A continuación se muestran los siguientes datos (input) y resultados (output) del programa “NAUTICUS HULL” para el **“BUQUE BASE”**:

- Distribución, tipo, dimensiones y acero empleado para refuerzos longitudinales. Ver hojas 3 a 5.
- Referencias a la reglamentación. Ver hoja 6
- Datos de entrada necesarios para el programa. Ver hoja 7.
- Espaciado entre cuadernas. Ver hoja 8.
- Geometría de planchas. Ver hoja 9.
- Cálculo del área de la cuaderna maestra. Ver hojas 11 a 16.
- Momentos flectores. Ver hoja 17.
- Módulo resistente. Ver hojas 18 y 19.
- Resistencia local y pandeo para planchas y refuerzos. Ver hojas 22 a 33.



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## SECTION SCANTLINGS

### Hull Section Scantlings according to DNV Rules

Rule edition ..... : Jan 1998  
 Program version ..... : 3.3-372-980619

#### Ship Identification SHUTTEL TANKER 145000 M3

ID No ..... : BASE  
 Date/Sign .....

#### Cross Section Identification CUADERNA MAESTRA

Midship section? ..... : Yes  
 Distance from AP ..... (m) : 128.250  
 Date/Sign .....

Database: C:\NautHull\SHIPS\Base1\SectSca\base .pw

#### Main Dimensions

Length betw. perpendiculars, Lbp .....	(m) :	256.500
Rule length, L .....	(m) :	252.690
Breadth moulded, B .....	(m) :	42.500
Depth moulded, D .....	(m) :	22.000
Draught moulded, T .....	(m) :	15.500
Block coefficient, Cb .....	:	0.879
Min. design draught at AP .....	(m) :	0.000
Min. design draught at FP .....	(m) :	0.000



Section Scantlings - v.3.3-372-980619  
SHUTTLE TANKER 145000 M3  
CUADERNA MAESTRA

Ship Id No : BASE

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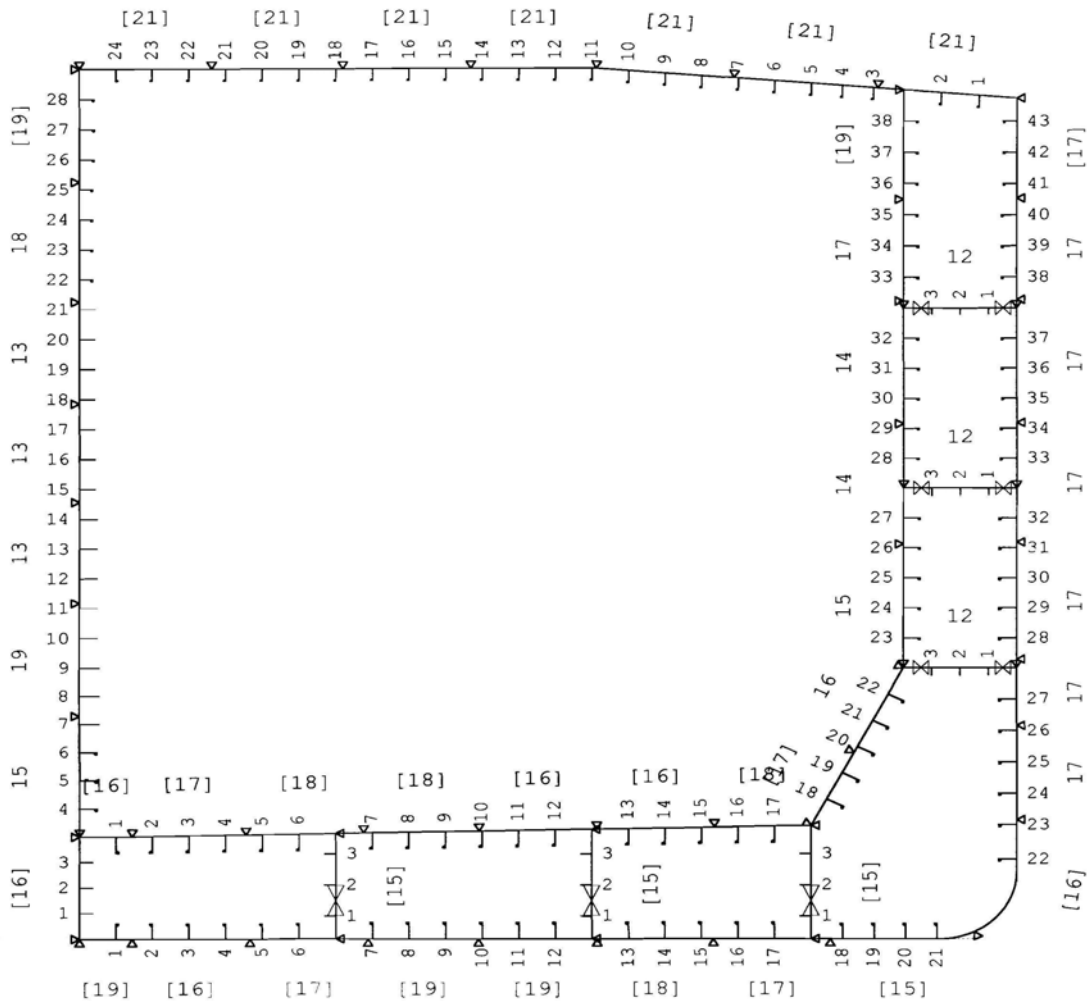
- 1 Rule Reference
- 2 Input Data
- 3 Panel Geometry
- 4 Node Co-ordinates
- 5 Layout of Plates and Profiles
- 6 Cross-Sectional Area
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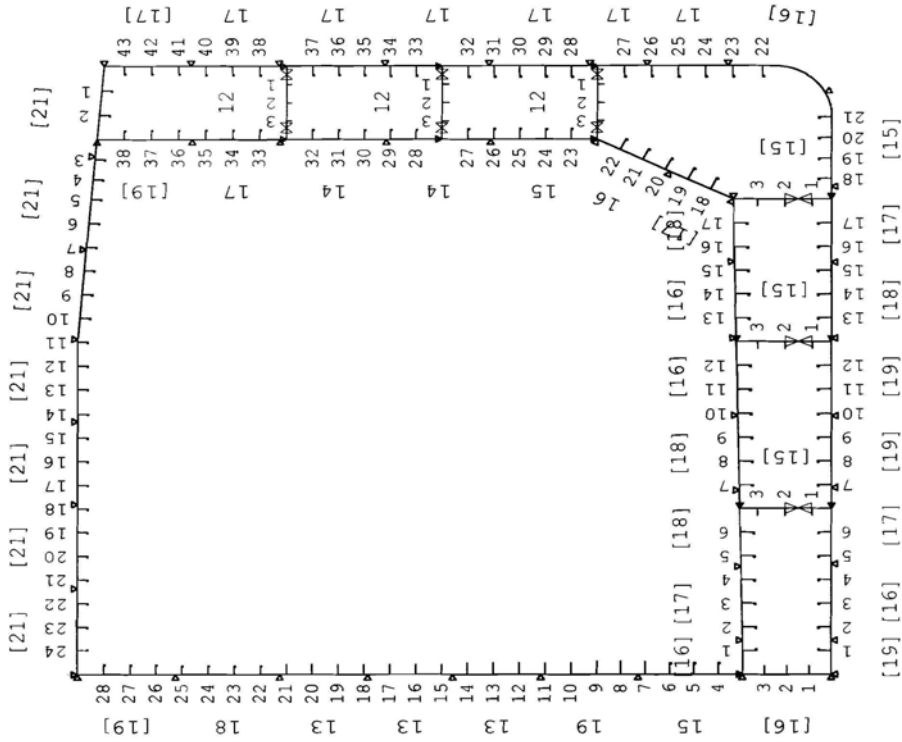
Section Scantlings - v.3.3-372-980619  
 SHUTTEL TANKER 145000 M3  
 CUADERNA MAESTRA

Ship Id No

:

BASE





Scale:  
 1:200

SHUTTLE TANKER 145000 M3  
 Date/Sign : 00-02-14  
 Main dim. : Lpp=256.5 B=42.5 D=22 T=15.5 CB=0.879

Nauticus Hull  
 Section Scantlings

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 SHUTTLE TANKER 145000 M3  
 CUADERNA MAESTRA

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### Profiles

Nos	Type	Dimensions	Steel
<b>Outer Shell</b>			
1 - 6	HPbulb	400 x 16	NV-36
7 - 17	HPbulb	430 x 15	NV-36
18 - 21	HPbulb	400 x 14	NV-36
22 - 23	HPbulb	400 x 16	NV-36
24 - 30	HPbulb	400 x 16	
31 - 32	HPbulb	400 x 14	
33 - 34	HPbulb	370 x 13	
35 - 40	HPbulb	340 x 14	
41 - 43	HPbulb	300 x 12	NV-36
1 - 24	HPbulb	320 x 12	NV-36
<b>CL Bulkhead</b>			
1 - 3	Fbar	300 x 20	NV-36
4 - 6	HPbulb	400 x 16	NV-36
7 - 9	Fbar	450 x 25	
10 - 14	Fbar	400 x 25	
15 - 21	Fbar	350 x 25	
22 - 25	HPbulb	300 x 12	NV-36
26 - 28	HPbulb	340 x 12	NV-36
<b>Inner Bottom &amp; Inner Side</b>			
1 - 17	HPbulb	430 x 15	NV-36
18 - 20	HPbulb	430 x 15	
21 - 22	HPbulb	400 x 14	
23 - 27	HPbulb	370 x 13	
28 - 34	HPbulb	340 x 14	
35 - 38	HPbulb	320 x 12	NV-36
<b>Bottom girder 5810</b>			
1 - 3	Fbar	250 x 15	NV-36
<b>Bottom girder 11620</b>			
1 - 3	Fbar	250 x 15	NV-36
<b>Bottom girder 16600</b>			
1 - 3	Fbar	250 x 15	NV-36
<b>Stringer 7092</b>			
1 - 3	Fbar	200 x 15	
<b>Stringer 11796</b>			
1 - 3	Fbar	200 x 15	
<b>Stringer 16500</b>			
1 - 3	Fbar	150 x 15	



Section Scantlings - v.3.3-372-980619  
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CUADERNA MAESTRA

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## 1 Rule Reference

DET NORSKE VERITAS' Rules for Classification of Ships, January 1998.  
Ships with length 100 metres and above.

STRENGTH ITEM	REFERENCE TO DNV RULES
<b>HULL GIRDER STRENGTH</b>	
- Design bending moments	Jan 1998 Pt.3 Ch.1 Sec.5 B 102-202
- Bending strength	Jan 1998 Pt.3 Ch.1 Sec.5 C
<b>PLATES</b>	
- Bottom and inner bottom	Jan 1998 Pt.3 Ch.1 Sec.6 C 100-503
- Side	Jan 1998 Pt.3 Ch.1 Sec.7 C 100-104
- Deck	Jan 1998 Pt.3 Ch.1 Sec.8 C 100-202
- Bulkheads	Jan 1998 Pt.3 Ch.1 Sec.9 C 100-105
- Wheel loaded decks	Jan 1998 Pt.5 Ch.2 Sec.4 C 200-302
- Bulk cargo (HC-Class)	Jan 1998 Pt.5 Ch.2 Sec.5 B, C300-304,D200-202
- Container carriers	Jan 1998 Pt.5 Ch.2 Sec.6 B & C
- IB(+) Notation	Jan 1998 Pt.3 Ch.1 Sec.6 H 302
- Buckling strength	Jan 1998 Pt.3 Ch.1 Sec.14 B 100, 201, 205, 206
<b>STIFFENERS</b>	
- Bottom and inner bottom	Jan 1998 Pt.3 Ch.1 Sec.6 C 700-901
- Side	Jan 1998 Pt.3 Ch.1 Sec.7 C 300-304, E 501
- Main frames in general	Jan 1998 Pt.3 Ch.1 Sec.7 C 400-404
- For bulkcarriers, L>150 m	Jan 1998 Pt.5 Ch.2 Sec.10 B (IACS UR S12)
- Deck	Jan 1998 Pt.3 Ch.1 Sec.8 C 300-303
- Bulkheads	Jan 1998 Pt.3 Ch.1 Sec.9 C 200-204
- Wheel loaded decks	Jan 1998 Pt.5 Ch.2 Sec.4 C 200-202, 401
- Bulk cargo (HC-Class)	Jan 1998 Pt.5 Ch.2 Sec.5 B, C300-302, 305-306
- Container carriers	Jan 1998 Pt.5 Ch.2 Sec.6 B & C
- Buckling strength	Jan 1998 Pt.3 Ch.1 Sec.14 C 100-202, 300-402
- Connection area at supp.	Jan 1998 Pt.3 Ch.1 Sec.12 C 402 (C=1.25)

Current Rule booklets:  
Pt.3 Ch.1: January 1998  
Pt.3 Ch.2: January 1998  
Pt.5 Ch.2: January 1998

The January 1998 Rules come into force on July 1, 1998.

NOTE: THE FOLLOWING REQUIREMENTS ARE NOT INCLUDED:

- Floors and brackets
- Ice strengthening of hull
- Slamming and bow impact
- Tugs, Supply vessels and other offshore/harbour vessels
- Class notation ICM (Increased corrosion margins)

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## 2 Input Data

### Main Dimensions

Length betw. perpendiculars, Lbp .....	(m) :	256.500
Rule length, L .....	(m) :	252.690
Breadth moulded, B .....	(m) :	42.500
Depth moulded, D .....	(m) :	22.000
Draught moulded, T .....	(m) :	15.500
Block coefficient, Cb .....	:	0.879
Min. design draught at AP .....	(m) :	0.000
Min. design draught at FP .....	(m) :	0.000

### General Ship Data

Maximum service speed, V .....	(knots) :	14.500
Bilge keel? .....	:	Yes
Active roll damping facility? .....	:	No
Period of roll, Tr .....	(s) :	0.000
Metacentric height, GM .....	(m) :	0.000
Homogeneous stowage rate, roDC .....	(t/m3) :	0.000
No of decks above 0.7D from baseline .....	:	1
Height from base to top of ship side .....	(mm) :	22000

#### Areas forward of 0.2L from FP:

- Projected area of the upper deck .....	(m2) :	0.000
- Area of the waterplane .....	(m2) :	0.000
Height from base to deck line at FP .....	(mm) :	0
Speed/flare factor, Caf .....	:	0.000

### Continuous Strength Members above Strength Deck

None

### Class notations

Tanker for Oil

### Hull Section Material (Strength group & yield point (N/mm2))

Location	Amidships		Current cross-sect.	
	Group	Yield	Group	Yield
- Bottom .....	NV-36	355	NV-36	355
- Deck .....	NV-36	355	NV-36	355
- Between bottom and deck .....	NV-NS	235	NV-NS	235

#### Height of HS-steel zone

- Bottom .....	(mm) :	3114
- Deck .....	(mm) :	2658

#### Longitudinal extension of HS-steel

Entire ship length.

### Transverse Bulkhead Positions (Frame No)

Aft peak bulkhead .....	:Not given.
Engine room bulkhead .....	:Not given.
Fore peak bulkhead .....	:Not given.

### Specified Bending Moments

(Based on actual cargo/ballast conditions)

Considered cross-section: 128.250 m from AP.

Utilization factor for the Rule still water bending moments:

- Sagging: 1.00
- Hogging: 1.00

Specified bending moments:

	Amidships	Current cross-sect.
- Still water, sagging .....	(kNm) : 3992670	0
- Still water, hogging .....	(kNm) : 4100580	0
- Wave, sagging .....	(kNm) : 0	0
- Wave, hogging .....	(kNm) : 0	0
- Wave, horizontal .....	(kNm) : 0	0

**Spacing between Transverse Frames**

(Where the frame spacing changes along the ship)

Position of frame 0: 0 mm forward of A.P.

Frame Nos where the spacing changes:

Frame No	Spacing forward (mm)
Stern	700
14	960
39	3200
43	3200
44	4000
94	700

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CUADERNA MAESTRA

Ship Id No : BASE

### 3 Panel Geometry

Node No	y (mm)	z (mm)	Radius (mm)	Position
---------	--------	--------	-------------	----------

#### Outer Shell

0	0	0		
5810	0	0		Bottom
11620	0	0		Bottom
16600	0	0		Bottom
19500	0	0		Bottom
21250	1750	1750	1750	Bilge
21250	7092	7092		Side
21250	11796	11796		Side
21250	16500	16500		Side
21250	22000	22000		Side
18690	22214	22214		Strength deck
11700	22800	22800		Strength deck
0	22800	22800		Strength deck

#### CL Bulkhead

0	0	0		
0	2680	2680		Longitudinal bulkhead - Long. girder
0	22800	22800		Longitudinal bulkhead

#### Inner Bottom & Inner Side

0	2680	2680		Inner bottom
1200	2680	2680		Inner bottom
5810	2767	2767		Inner bottom
11620	2876	2876		Inner bottom
16600	2970	2970		Inner bottom
18690	7092	7092		Hopper tank top
18690	11796	11796		Inner side
18690	16500	16500		Inner side
18690	22214	22214		Inner side

#### Bottom girder 5810

5810	0	0		
5810	2767	2767		Bottom - Long. girder

#### Bottom girder 11620

11620	0	0		
11620	2876	2876		Bottom - Long. girder

#### Bottom girder 16600

16600	0	0		
16600	2970	2970		Bottom - Long. girder

#### Stringer 7092

21250	7092	7092		
18690	7092	7092		Side - Stringer

#### Stringer 11796

21250	11796	11796		
18690	11796	11796		Side - Stringer

#### Stringer 16500

21250	16500	16500		
18690	16500	16500		Side - Stringer

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#### 4 Node Co-ordinates

Node No	y (mm)	z (mm)
---------	--------	--------

18690	16500
21250	16500
18690	11796
21250	11796
21250	7092
16600	0
11620	2876
11620	0
5810	2767
5810	0
1200	2680
18690	22214
18690	7092
16600	2970
0	2680
21250	22000
11700	22800
0	22800
21250	1750
19500	0
0	0

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CUADERNA MAESTRA

Ship Id No : BASE

## 5 Layout of Plates and Profiles

Plate		Y <sub>1</sub> (mm)	Z <sub>1</sub> (mm)	Y <sub>2</sub> (mm)	Z <sub>2</sub> (mm)	—	B (mm)	BCUT (mm)	T (mm)	Steel	Area cm <sup>2</sup>
Stiff	No	Y	Z	Y <sub>CG</sub>	Z <sub>CG</sub>	Typ	H	BF	T	TF (mm)	Area

### Outer Shell (Bending efficiency: 100%)

PL	1	0	0	1200	0		1200	0	19.0	std	228.00
PL	2	1200	0	3870	0		2670	0	16.0	std	427.20
PL	3	3870	0	6540	0		2670	0	17.0	std	453.90
PL	4	6540	0	9045	0		2505	0	19.0	std	475.95
PL	5	9045	0	11735	0		2690	0	19.0	std	511.10
PL	6	11735	0	14385	0		2650	0	18.0	std	477.00
PL	7	14385	0	17035	0		2650	0	17.0	std	450.50
PL	8	17035	0	20299	193		3295	0	15.0	std	494.25
PL	9	20299	193	21250	3126		3295	0	16.0	std	527.20
PL	10	21250	3126	21250	5586		2460	0	17.0	std	418.20
PL	11	21250	5586	21250	7317		1731	0	17.0	std	294.27
PL	12	21250	7317	21250	10378		3061	0	17.0	std	520.37
PL	13	21250	10378	21250	13514		3136	0	17.0	std	533.12
PL	14	21250	13514	21250	16725		3211	0	17.0	std	545.87
PL	15	21250	16725	21250	19391		2666	0	17.0	std	453.22
PL	16	21250	19391	21250	21999		2608	0	17.0	std	443.51
PL	17	21250	21999	18100	22263		3161	0	21.0	std	663.81
PL	18	18100	22263	14841	22536		3270	0	21.0	std	686.70
PL	19	14841	22536	11707	22799		3145	0	21.0	std	660.45
PL	20	11707	22799	8867	22800		2840	0	21.0	std	596.40
PL	21	8867	22800	5967	22800		2900	0	21.0	std	609.00
PL	22	5967	22800	3007	22800		2960	0	21.0	std	621.60
PL	23	3007	22800	0	22800		3007	0	21.0	std	631.56
ST	1	830	0	839	250	20	400	0	16.0	0.0	89.48
ST	2	1660	0	1651	250	20	400	0	16.0	0.0	89.48
ST	3	2490	0	2481	250	20	400	0	16.0	0.0	89.48
ST	4	3320	0	3311	250	20	400	0	16.0	0.0	89.48
ST	5	4150	0	4141	250	20	400	0	16.0	0.0	89.48
ST	6	4980	0	4971	250	20	400	0	16.0	0.0	89.48
ST	7	6640	0	6630	274	20	430	0	15.0	0.0	94.18
ST	8	7470	0	7460	274	20	430	0	15.0	0.0	94.18
ST	9	8300	0	8290	274	20	430	0	15.0	0.0	94.18
ST	10	9130	0	9120	274	20	430	0	15.0	0.0	94.18
ST	11	9960	0	9950	274	20	430	0	15.0	0.0	94.18
ST	12	10790	0	10780	274	20	430	0	15.0	0.0	94.18
ST	13	12450	0	12440	274	20	430	0	15.0	0.0	94.18
ST	14	13280	0	13270	274	20	430	0	15.0	0.0	94.18
ST	15	14110	0	14100	274	20	430	0	15.0	0.0	94.18
ST	16	14940	0	14930	274	20	430	0	15.0	0.0	94.18
ST	17	15770	0	15760	274	20	430	0	15.0	0.0	94.18
ST	18	17313	0	17304	254	20	400	0	14.0	0.0	81.48
ST	19	18026	0	18017	254	20	400	0	14.0	0.0	81.48
ST	20	18739	0	18730	254	20	400	0	14.0	0.0	81.48
ST	21	19452	0	19443	254	20	400	0	14.0	0.0	81.48
ST	22	21250	2094	21000	2085	20	400	0	16.0	0.0	89.48
ST	23	21250	2994	21000	2985	20	400	0	16.0	0.0	89.48
ST	24	21250	3814	21000	3805	20	400	0	16.0	0.0	89.48
ST	25	21250	4634	21000	4625	20	400	0	16.0	0.0	89.48
ST	26	21250	5454	21000	5445	20	400	0	16.0	0.0	89.48
ST	27	21250	6274	21000	6265	20	400	0	16.0	0.0	89.48
ST	28	21250	7876	21000	7867	20	400	0	16.0	0.0	89.48
ST	29	21250	8660	21000	8651	20	400	0	16.0	0.0	89.48
ST	30	21250	9444	21000	9435	20	400	0	16.0	0.0	89.48
ST	31	21250	10228	20996	10219	20	400	0	14.0	0.0	81.48
ST	32	21250	11012	20996	11003	20	400	0	14.0	0.0	81.48
ST	33	21250	12580	21015	12572	20	370	0	13.0	0.0	69.70
ST	34	21250	13364	21015	13356	20	370	0	13.0	0.0	69.70
ST	35	21250	14148	21039	14141	20	340	0	14.0	0.0	65.64
ST	36	21250	14932	21039	14925	20	340	0	14.0	0.0	65.64
ST	37	21250	15716	21039	15709	20	340	0	14.0	0.0	65.64
ST	38	21250	17316	21039	17309	20	340	0	14.0	0.0	65.64
ST	39	21250	18132	21039	18125	20	340	0	14.0	0.0	65.64
ST	40	21250	18948	21039	18941	20	340	0	14.0	0.0	65.64
ST	41	21250	19764	21064	19758	20	300	0	12.0	0.0	49.79
ST	42	21250	20580	21064	20574	20	300	0	12.0	0.0	49.79
ST	43	21250	21396	21064	21390	20	300	0	12.0	0.0	49.79
ST	1	20395	22071	20388	21870	20	320	0	12.0	0.0	54.25
ST	2	19540	22143	19533	21942	20	320	0	12.0	0.0	54.25
ST	3	18000	22272	17993	22071	20	320	0	12.0	0.0	54.25
ST	4	17300	22330	17293	22129	20	320	0	12.0	0.0	54.25
ST	5	16600	22389	16593	22188	20	320	0	12.0	0.0	54.25
ST	6	15770	22459	15763	22258	20	320	0	12.0	0.0	54.25
ST	7	14940	22528	14933	22327	20	320	0	12.0	0.0	54.25



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**Layout of Plates and Profiles (cont.)**

Plate	No	Y <sub>1</sub> (mm)	Z <sub>1</sub> (mm)	Y <sub>2</sub> (mm)	Z <sub>2</sub> (mm)	—	B (mm)	BCUT (mm)	T (mm)	Steel	Area cm <sup>2</sup>
Stiff		Y	Z	Y <sub>CG</sub>	Z <sub>CG</sub>	Typ	H	BF	T	TF (mm)	Area
ST	8	14110	22598	14103	22397	20	320	0	12.0	0.0	54.25
ST	9	13280	22667	13273	22466	20	320	0	12.0	0.0	54.25
ST	10	12450	22737	12443	22536	20	320	0	12.0	0.0	54.25
ST	11	11620	22800	11613	22599	20	320	0	12.0	0.0	54.25
ST	12	10790	22800	10783	22599	20	320	0	12.0	0.0	54.25
ST	13	9960	22800	9953	22599	20	320	0	12.0	0.0	54.25
ST	14	9130	22800	9123	22599	20	320	0	12.0	0.0	54.25
ST	15	8300	22800	8293	22599	20	320	0	12.0	0.0	54.25
ST	16	7470	22800	7463	22599	20	320	0	12.0	0.0	54.25
ST	17	6640	22800	6633	22599	20	320	0	12.0	0.0	54.25
ST	18	5810	22800	5803	22599	20	320	0	12.0	0.0	54.25
ST	19	4980	22800	4973	22599	20	320	0	12.0	0.0	54.25
ST	20	4150	22800	4143	22599	20	320	0	12.0	0.0	54.25
ST	21	3320	22800	3313	22599	20	320	0	12.0	0.0	54.25
ST	22	2490	22800	2483	22599	20	320	0	12.0	0.0	54.25
ST	23	1660	22800	1653	22599	20	320	0	12.0	0.0	54.25
ST	24	830	22800	837	22599	20	320	0	12.0	0.0	54.25

**CL Bulkhead (Bending efficiency: 100%)**

PL	1	0	0	0	2680		2680	0	16.0	std	428.80
PL	2	0	2680	0	5837		3157	0	15.0	std	473.55
PL	3	0	5837	0	8797		2960	0	19.0	std	562.40
PL	4	0	8797	0	11457		2660	0	13.0	std	345.80
PL	5	0	11457	0	14035		2578	0	13.0	std	335.14
PL	6	0	14035	0	16695		2660	0	13.0	std	345.80
PL	7	0	16695	0	19840		3145	0	18.0	std	566.10
PL	8	0	19840	0	22800		2960	0	19.0	std	562.40
ST	1	0	670	150	670	10	300	0	20.0	0.0	60.00
ST	2	0	1340	150	1340	10	300	0	20.0	0.0	60.00
ST	3	0	2010	150	2010	10	300	0	20.0	0.0	60.00
ST	4	0	3417	250	3408	20	400	0	16.0	0.0	89.48
ST	5	0	4152	250	4143	20	400	0	16.0	0.0	89.48
ST	6	0	4887	250	4878	20	400	0	16.0	0.0	89.48
ST	7	0	5622	225	5622	10	450	0	25.0	0.0	112.50
ST	8	0	6357	225	6357	10	450	0	25.0	0.0	112.50
ST	9	0	7092	225	7092	10	450	0	25.0	0.0	112.50
ST	10	0	7876	200	7876	10	400	0	25.0	0.0	100.00
ST	11	0	8660	200	8660	10	400	0	25.0	0.0	100.00
ST	12	0	9444	200	9444	10	400	0	25.0	0.0	100.00
ST	13	0	10228	200	10228	10	400	0	25.0	0.0	100.00
ST	14	0	11012	200	11012	10	400	0	25.0	0.0	100.00
ST	15	0	11796	175	11796	10	350	0	25.0	0.0	87.50
ST	16	0	12580	175	12580	10	350	0	25.0	0.0	87.50
ST	17	0	13364	175	13364	10	350	0	25.0	0.0	87.50
ST	18	0	14148	175	14148	10	350	0	25.0	0.0	87.50
ST	19	0	14932	175	14932	10	350	0	25.0	0.0	87.50
ST	20	0	15716	175	15716	10	350	0	25.0	0.0	87.50
ST	21	0	16500	175	16500	10	350	0	25.0	0.0	87.50
ST	22	0	17284	186	17278	20	300	0	12.0	0.0	49.79
ST	23	0	18070	186	18064	20	300	0	12.0	0.0	49.79
ST	24	0	18856	186	18850	20	300	0	12.0	0.0	49.79
ST	25	0	19642	186	19636	20	300	0	12.0	0.0	49.79
ST	26	0	20428	215	20420	20	340	0	12.0	0.0	58.84
ST	27	0	21214	215	21206	20	340	0	12.0	0.0	58.84
ST	28	0	22007	215	21999	20	340	0	12.0	0.0	58.84

**Inner Bottom & Inner Side (Bending efficiency: 100%)**

PL	1	0	2680	1200	2680		1200	0	16.0	std	192.00
PL	2	1200	2680	3777	2728		2578	0	17.0	std	438.26
PL	3	3777	2728	6447	2778		2670	0	18.0	std	480.60
PL	4	6447	2778	9066	2828		2620	0	18.0	std	471.60
PL	5	9066	2828	11736	2878		2670	0	16.0	std	427.20
PL	6	11736	2878	14405	2928		2670	0	16.0	std	427.20
PL	7	14405	2928	16600	2970		2195	0	18.0	std	395.10
PL	8	16600	2970	17565	4874		2135	0	17.0	std	362.95
PL	9	17565	4874	18683	7079		2472	0	16.0	std	395.52
PL	10	18683	7079	18690	10322		3245	0	15.0	std	486.75
PL	11	18690	10322	18690	13486		3164	0	14.0	std	442.96
PL	12	18690	13486	18690	16689		3202	0	14.0	std	448.42
PL	13	18690	16689	18690	19349		2659	0	17.0	std	452.20

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**Layout of Plates and Profiles (cont.)**

Plate		Y <sub>1</sub> (mm)	Z <sub>1</sub> (mm)	Y <sub>2</sub> (mm)	Z <sub>2</sub> (mm)	—	B (mm)	BCUT (mm)	T (mm)	Steel	Area cm <sup>2</sup>
Stiff	No	Y	Z	Y <sub>CG</sub>	Z <sub>CG</sub>	Typ	H	BF	T	TF (mm)	Area
PL	14	18690	19349	18690	22214		2864	0	19.0	std	544.30
ST	1	830	2680	840	2406	20	430	0	15.0	0.0	94.18
ST	2	1659	2688	1649	2414	20	430	0	15.0	0.0	94.18
ST	3	2489	2704	2479	2430	20	430	0	15.0	0.0	94.18
ST	4	3319	2719	3309	2445	20	430	0	15.0	0.0	94.18
ST	5	4149	2735	4139	2461	20	430	0	15.0	0.0	94.18
ST	6	4979	2751	4969	2477	20	430	0	15.0	0.0	94.18
ST	7	6639	2782	6629	2508	20	430	0	15.0	0.0	94.18
ST	8	7469	2798	7459	2524	20	430	0	15.0	0.0	94.18
ST	9	8299	2813	8289	2539	20	430	0	15.0	0.0	94.18
ST	10	9129	2829	9119	2555	20	430	0	15.0	0.0	94.18
ST	11	9959	2844	9949	2570	20	430	0	15.0	0.0	94.18
ST	12	10789	2860	10779	2586	20	430	0	15.0	0.0	94.18
ST	13	12449	2891	12439	2617	20	430	0	15.0	0.0	94.18
ST	14	13279	2907	13269	2633	20	430	0	15.0	0.0	94.18
ST	15	14109	2923	14099	2649	20	430	0	15.0	0.0	94.18
ST	16	14939	2938	14929	2664	20	430	0	15.0	0.0	94.18
ST	17	15769	2954	15759	2680	20	430	0	15.0	0.0	94.18
ST	18	16947	3654	17186	3521	20	430	0	15.0	0.0	94.18
ST	19	17294	4339	17533	4206	20	430	0	15.0	0.0	94.18
ST	20	17641	5024	17880	4891	20	430	0	15.0	0.0	94.18
ST	21	17989	5709	18211	5585	20	400	0	14.0	0.0	81.48
ST	22	18336	6394	18558	6270	20	400	0	14.0	0.0	81.48
ST	23	18690	7875	18925	7867	20	370	0	13.0	0.0	69.70
ST	24	18690	8659	18925	8651	20	370	0	13.0	0.0	69.70
ST	25	18690	9443	18925	9435	20	370	0	13.0	0.0	69.70
ST	26	18690	10227	18925	10219	20	370	0	13.0	0.0	69.70
ST	27	18690	11011	18925	11003	20	370	0	13.0	0.0	69.70
ST	28	18690	12579	18901	12572	20	340	0	14.0	0.0	65.64
ST	29	18690	13363	18901	13356	20	340	0	14.0	0.0	65.64
ST	30	18690	14148	18901	14141	20	340	0	14.0	0.0	65.64
ST	31	18690	14932	18901	14925	20	340	0	14.0	0.0	65.64
ST	32	18690	15716	18901	15709	20	340	0	14.0	0.0	65.64
ST	33	18690	17316	18901	17309	20	340	0	14.0	0.0	65.64
ST	34	18690	18132	18901	18125	20	340	0	14.0	0.0	65.64
ST	35	18690	18947	18891	18940	20	320	0	12.0	0.0	54.25
ST	36	18690	19763	18891	19756	20	320	0	12.0	0.0	54.25
ST	37	18690	20579	18891	20572	20	320	0	12.0	0.0	54.25
ST	38	18690	21395	18891	21388	20	320	0	12.0	0.0	54.25

**Bottom girder 5810 (Bending efficiency: 100%)**

PL	1	5810	0	5810	2766		2766	800	15.0	std	295.02
ST	1	5810	590	5685	590	10	250	0	15.0	0.0	37.50
ST	2	5810	1410	5685	1410	10	250	0	15.0	0.0	37.50
ST	3	5810	2230	5685	2230	10	250	0	15.0	0.0	37.50

**Bottom girder 11620 (Bending efficiency: 100%)**

PL	1	11620	0	11620	2876		2876	800	15.0	std	311.43
ST	1	11620	590	11495	590	10	250	0	15.0	0.0	37.50
ST	2	11620	1410	11495	1410	10	250	0	15.0	0.0	37.50
ST	3	11620	2230	11495	2230	10	250	0	15.0	0.0	37.50

**Bottom girder 16600 (Bending efficiency: 100%)**

PL	1	16600	0	16600	2970		2970	800	15.0	std	325.50
ST	1	16600	590	16475	590	10	250	0	15.0	0.0	37.50
ST	2	16600	1410	16475	1410	10	250	0	15.0	0.0	37.50
ST	3	16600	2230	16475	2230	10	250	0	15.0	0.0	37.50

**Stringer 7092 (Bending efficiency: 100%)**

PL	1	21250	7092	18690	7092		2560	700	12.0	std	223.20
ST	1	20610	7092	20610	6992	10	200	0	15.0	0.0	30.00

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**Layout of Plates and Profiles (cont.)**

Plate	No	Y <sub>1</sub> (mm)	Z <sub>1</sub> (mm)	Y <sub>2</sub> (mm)	Z <sub>2</sub> (mm)	—	B (mm)	BCUT (mm)	T (mm)	Steel	Area cm <sup>2</sup>
Stiff		Y	Z	Y <sub>CG</sub>	Z <sub>CG</sub>	Typ	H	BF	T	TF (mm)	Area
ST	2	19970	7092	19970	6992	10	200	0	15.0	0.0	30.00
ST	3	19330	7092	19330	6992	10	200	0	15.0	0.0	30.00
<b>Stringer 11796 (Bending efficiency: 100%)</b>											
PL	1	21250	11796	18690	11796		2560	700	12.0	std	223.20
ST	1	20610	11796	20610	11696	10	200	0	15.0	0.0	30.00
ST	2	19970	11796	19970	11696	10	200	0	15.0	0.0	30.00
ST	3	19330	11796	19330	11696	10	200	0	15.0	0.0	30.00
<b>Stringer 16500 (Bending efficiency: 100%)</b>											
PL	1	21250	16500	18690	16500		2560	700	12.0	std	223.20
ST	1	20610	16500	20610	16425	10	150	0	15.0	0.0	22.50
ST	2	19970	16500	19970	16425	10	150	0	15.0	0.0	22.50
ST	3	19330	16500	19330	16425	10	150	0	15.0	0.0	22.50

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## 6 Cross-Sectional Area

### Plates

Panels:	NS-Steel		HS-Steel		Total	
	Effective cm <sup>2</sup>	Gross cm <sup>2</sup>	Effective cm <sup>2</sup>	Gross cm <sup>2</sup>	Effective cm <sup>2</sup>	Gross cm <sup>2</sup>
Outer Shell	5530.1	5530.1	17916.3	17916.3	23446.4	23446.4
CL Bulkhead	2628.8	2628.8	991.2	991.2	3620.0	3620.0
Inner Bottom & Inner Side	4451.7	4451.7	7478.4	7478.4	11930.1	11930.1
Bottom girder 5810	0.0	0.0	590.0	830.0	590.0	830.0
Bottom girder 11620	0.0	0.0	622.9	862.9	622.9	862.9
Bottom girder 16600	0.0	0.0	651.0	891.0	651.0	891.0
Stringer 7092	446.4	614.4	0.0	0.0	446.4	614.4
Stringer 11796	446.4	614.4	0.0	0.0	446.4	614.4
Stringer 16500	446.4	614.4	0.0	0.0	446.4	614.4
<b>TOTAL AREA</b>	<b>13949.8</b>	<b>14453.8</b>	<b>28249.8</b>	<b>28969.8</b>	<b>42199.6</b>	<b>43423.6</b>

### Profiles

Panels:	NS-Steel		HS-Steel		Total	
	Effective cm <sup>2</sup>	Gross cm <sup>2</sup>	Effective cm <sup>2</sup>	Gross cm <sup>2</sup>	Effective cm <sup>2</sup>	Gross cm <sup>2</sup>
Outer Shell	2645.2	2645.2	7058.2	7058.2	9703.4	9703.4
CL Bulkhead	1450.0	1450.0	824.1	824.1	2274.1	2274.1
Inner Bottom & Inner Side	2507.0	2507.0	3636.2	3636.2	6143.3	6143.3
Bottom girder 5810	0.0	0.0	225.0	225.0	225.0	225.0
Bottom girder 11620	0.0	0.0	225.0	225.0	225.0	225.0
Bottom girder 16600	0.0	0.0	225.0	225.0	225.0	225.0
Stringer 7092	180.0	180.0	0.0	0.0	180.0	180.0
Stringer 11796	180.0	180.0	0.0	0.0	180.0	180.0
Stringer 16500	135.0	135.0	0.0	0.0	135.0	135.0
<b>TOTAL AREA</b>	<b>7097.3</b>	<b>7097.3</b>	<b>12193.6</b>	<b>12193.6</b>	<b>19290.8</b>	<b>19290.8</b>

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## 7 Cross-Sectional Data

		EFFECTIVE Cut-outs subtracted	GROSS Cut-outs disreg.
<b>Cross sectional area of the longitudinal elements</b> .....	(cm <sup>2</sup> ) :	<b>61490.4</b>	62714.4
Position of the centroid: Ycg .....	(mm) :	7	7
Position of the centroid: Zcg .....	(mm) :	9883	9796
Moment of inertia about the horz. neutral axis, I <sub>h</sub> .....	(m <sup>4</sup> ) :	460.592	467.158
Moment of inertia about the vert. neutral axis, I <sub>v</sub> .....	(m <sup>4</sup> ) :	1303.772	1334.708
Product of inertia about the neutral axes, I <sub>hv</sub> .....	(m <sup>4</sup> ) :	0.109	0.113
<hr/>			
SECTION MODULUS, BOTTOM (z = 0 mm) .....	(m <sup>3</sup> ) :	46.604	47.687
SECTION MODULUS, DECK LINE (z = 22000 mm) .....	(m <sup>3</sup> ) :	38.012	38.280
SECTION MODULUS, AT SIDE (y = 21250 mm) .....	(m <sup>3</sup> ) :	61.375	62.831
<hr/>			
First moment of the area above the neutral axis, S .....	(cm <sup>3</sup> ) :	24193914.9	24576888.5
I/S .....	(cm) :	1903	1900

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## 8 Design Bending Moments

AT ACTUAL POSITION (128.2 m from AP)

Still water bending moments:

- Standard values according to Rules, Ms ..... :  
 - Given as input (actual cargo/ballast conditions) ..... :

Design still water bending moments:

SAGGING (kNm)                      HOGGING (kNm)

2903485	3092458
3992670	4100580
3992670	4100580

Design wave bending moments, Mw ..... :

4913590 (Rules)                      4724616 (Rules)

Design wave bending moments, Mw for buckling check ..... :

4913590 (Rules)                      4724616 (Rules)

Horizontal wave bending moment acc. to Rules, Mwh ..... :

2779966



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## 9 Hull Girder Strength Requirements

	BOTTOM	DECK	SIDE
Material strength group .....	NV-36	NV-36	NV-NS
Yield point of material ..... (N/mm <sup>2</sup> ) :	355	355	235
Material factor, f1 .....	1.390	1.390	1.000
Stress factor, f2 .....	1.000	1.336	
Minimum vertical extent of HS-steel ..... (mm) :		3044	
Speed factor, Cav .....	0.182		
Speed/flare factor, Caf .....	0.182		
Wave coefficient, Cw .....	10.425		
Wave coefficient, Cwo .....	10.425		
Wave coefficient, Cwu .....	10.425		

AT ACTUAL POSITION ( 128.2 m from AP ) (Midship section)

	BOTTOM	DECK
Minimum section modulus, Zo ..... (m <sup>3</sup> ) :	32.13597	32.13597
Section modulus requirement based on design bending moments:		
- Sagging (3992670 kNm) ..... (m <sup>3</sup> ) :	36.61361	36.61361
- Hogging (4100580 kNm) ..... (m <sup>3</sup> ) :	36.28035	36.28035
<b>Rule section modulus</b> ..... (m <sup>3</sup> ):	<b>36.61361</b>	<b>36.61361</b>
Combined stresses at bilge and deck corners ..... (N/mm <sup>2</sup> ) :	200.4	242.0
Minimum moment of inertia ..... (m <sup>4</sup> ) :	338.62226	
Minimum section modulus at side ..... (m <sup>3</sup> ) :	31.60825	

### GUIDANCE:

The required section modulus along the hull girder will normally be satisfied when calculated for the midship section only, provided the following rules for tapering are complied with:

- Scantlings at bottom and deck are kept unaltered within 0.4L amidships.
- Scantlings outside 0.4L amidships are gradually reduced to the local requirements at the ends, and the same material strength group is applied over the full length of the ship.

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## 10 Hull Girder Strength Summary

	ACTUAL	RULE	STATUS (%) (100=Rule)
Cross-sectional area ..... (cm <sup>2</sup> ) :	61490		
Height to the neutral axis ..... (mm) :	9883		
Moment of inertia ..... (m <sup>4</sup> ) :	460.592	338.622	136.0
Section modulus. bottom ..... (m <sup>3</sup> ) :	46.604	36.614	127.3
Section modulus. deck line ..... (m <sup>3</sup> ) :	38.012	36.614	103.8
(at z = 22000 mm)			
Material factor. f1. bottom ..... :	1.390		
Material factor. f1. deck ..... :	1.390		
Stress factor. f2. bottom ..... (Input) :	1.000		
Stress factor. f2. deck ..... (Rules) :	1.336		

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## 11 Compartments and Loads

### 11.1 Compartment Data I

Ref.	Comp. group (Comp. type)	Comp. No	Frame No aft	Frame No fwd	Restr. filling (*)	Coated (*)	Contents WB / Oil / Liq / Hliq / Bulk
1	2	2					WB
2	1	1					Oil

### 11.2 Compartment Data II

Ref.	Comp. group (Comp type)	Comp. No	Length (mm)	Sloshing length (mm)	Sloshing breadth (mm)	Top of air pipe (mm)	WL in dam'gd cond (mm)	Over-pressure po (kN/m2)	Top of hatch (mm)	Volume (m3)
1	2	2	32000	4000	5810	22760	22000	25.00	0	0
2	1	1	32000	32000	18690	22760	22000	25.00	0	0

### 11.3 Bulk Cargo and Liquid Loads

Ref.	Comp. group (Comp type)	Comp. No	Load No	Load type	Density t/m3	Filling height mm	Mass t	Angle of repose degrees	Permeability
1	2	2	1	WB	1.025	22215			
2	1	1	1	Oil	1.025	22800			

### 11.4 Double Bottom Stresses and Hull Girder Bending Moments

Ref.	Comp. group (Comp. type)	Comp. No	Load No	Load type	Dbl. bottom stresses		Still water bending moments - = sagging, + = hogging kNm
					Bottom N/mm <sup>2</sup>	Inner bot. N/mm <sup>2</sup>	
1	2	2	1	WB	0	0	0.00
2	1	1	1	Oil	0	0	0.00

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## 12 Summary of Data Involved in the Local Rule Requirements

Distance from AP to considered section .....	(m) :	128.250	
Section modulus at bottom .....	(m <sup>3</sup> ) :	46.604	
Section modulus at deck line .....	(m <sup>3</sup> ) :	38.012	
Height from base line to the neutral axis .....	(mm) :	9883	
STRESS FACTOR, f2:			
f2B (f2 at bottom) .....	:	1.000	(Input)
f2D (f2 at deck) .....	:	1.336	(Rules)
DESIGN MOMENTS:			
Design still water bending moment, sagging .....	(kNm) :	3992670	(Input)
Design still water bending moment, hogging .....	(kNm) :	4100580	(Input)
Design wave bending moment, sagging .....	(kNm) :	4913590	(Rules)
Design wave bending moment, hogging .....	(kNm) :	4724616	(Rules)
MOTION PARAMETERS:			
Acceleration parameter, a0 .....	:	0.306	(Rules)
Period of roll, Tr.....	(s) :	14.679	(Rules)
Pitch angle, theta.....	(rad/deg) :	0.087 / 5	(Rules)
Roll angle, Fi.....	(rad/deg) :	0.376 / 22	(Rules)
Vertical acceleration, av .....	(m/s <sup>2</sup> ) :	2.392	(Rules)
Ballast draught, Tb .....	(m) :	7.054	(Rules)

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### 13 Local Rule Requirements - Plates

Plate No	ACT	t_act (mm)	Steel	tk (mm)	tk_b (mm)			Eff. (%)	Span (mm)	Spac (mm)	Sigf N/mm <sup>2</sup> f <sub>1</sub>	
LOC		t_loc (mm)	Pos		Load Ref.		Loc. ref.	y <sub>1</sub> (mm)	z <sub>1</sub> (mm)	Comp ref.	Sigma N/mm <sup>2</sup>	p kN/m <sup>2</sup>
BUC		t_buc (mm)	Eta	psi	k	c	Buc. ref.	y <sub>b</sub> (mm)	z <sub>b</sub> (mm)	SigL N/mm <sup>2</sup>	Sig_c N/mm <sup>2</sup>	Sig_cr N/mm <sup>2</sup>

#### Outer Shell

##### Bottom

1	ACT LOC BUC	19.0	std 18.72 15.23	1.0 Bottom 0.9	1.0		WB acc 1 4.00	100 Min	4000 415 0	830 0 0		355.0 166.8 264.7	1.39 180.1 210.4
2	ACT LOC BUC	16.0	std 14.63 15.23	1.0 Bottom 0.9	1.0		WB acc 1 4.00	100 Lat	4000 1245 1200	830 0 0		355.0 166.8 224.9	1.39 180.1 210.4
3	ACT LOC BUC	17.0	std 14.63 15.23	1.0 Bottom 0.9	1.0		WB acc 1 4.00	100 Lat	4000 3870 3870	830 0 0		355.0 166.8 240.7	1.39 180.1 210.4
4	ACT LOC BUC	19.0	std 14.63 15.23	1.0 Bottom 0.9	1.0		WB acc 1 4.00	100 Lat	4000 7055 6640	830 0 0		355.0 166.8 264.7	1.39 180.1 210.4
5	ACT LOC BUC	19.0	std 14.63 15.23	1.0 Bottom 0.9	1.0		WB acc 1 4.00	100 Lat	4000 9545 9130	830 0 0		355.0 166.8 264.7	1.39 180.1 210.4
6	ACT LOC BUC	18.0	std 14.63 15.23	1.0 Bottom 0.9	1.0		Sea 4.00	100 Lat	4000 14385 11735	830 0 0		355.0 166.8 253.7	1.39 180.3 210.4
7	ACT LOC BUC	17.0	std 14.71 15.23	1.0 Bottom 0.9	1.0		Sea 4.00	100 Lat	4000 16185 14385	830 0 0		355.0 166.8 240.7	1.39 182.3 210.4
8	ACT LOC BUC	15.0	std 14.57 12.42	1.0 Bottom 1.0	1.0		Sea 4.00	100 Min	4000 17035 17035	713 0 0		355.0 166.8 244.8	1.39 185.7 189.4

##### Bilge

9	ACT LOC BUC	16.0	std 15.37 13.41	1.0 Side 1.0	1.0		WB tst 5 4.23	100 Lat	4000 21250 21250	900 2544 2094		355.0 174.0 210.5	1.39 177.7 149.2
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##### Side

10	ACT LOC BUC	17.0	std 16.33 11.62	1.0 Side 1.0	1.0		WB tst 5 4.20	100 Lat	4000 21250 21250	820 3404 3126		235.0 126.9 188.5	1.00 177.6 129.5
11	ACT LOC BUC	17.0	std 16.48 9.30	1.0 Side 1.0	1.0		WB tst 5 4.33	100 quay	4000 21250 21250	784 7317 5586		235.0 134.8 189.8	1.00 174.8 82.3
12	ACT LOC BUC	17.0	std 16.48 7.04	1.0 Side 1.0	1.0		WB tst 5 4.46	100 quay	4000 21250 21250	784 7484 7317		235.0 135.1 194.9	1.00 173.1 49.2
13	ACT LOC BUC	17.0	std 16.48 8.06	1.0 Side 1.0	1.0		WB tst 5 4.48	100 quay	4000 21250 21250	784 10620 13363		235.0 138.8 195.1	1.00 141.6 67.3
14	ACT LOC BUC	17.0	std 17.11 11.90	1.0 Side 1.0	1.0		WB tst 5 4.06	100 quay	4000 21250 21250	816 16725 16725		235.0 128.7 187.3	1.00 80.2 132.3
15	ACT LOC BUC	17.0	std 17.11 16.39	1.0 Side 1.0	1.0		WB tst 5 4.09	100 quay	4000 21250 21250	816 16907 19391		235.0 128.4 187.7	1.00 78.4 183.9

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**Local Rule Requirements - Plates (cont)**

Plate No	ACT	t_act (mm)	Steel	tk (mm)	tk_b (mm)		Eff. (%)	Span (mm)	Spac (mm)		Sigf N/mm <sup>2</sup>	f <sub>1</sub>
	LOC	t_loc (mm)	Pos			Load Ref.	Loc. ref.	y <sub>1</sub> (mm)	z <sub>1</sub> (mm)	Comp ref.	Sigma N/mm <sup>2</sup>	p kN/m <sup>2</sup>
	BUC	t_buc (mm)	Eta	psi	k	c	Buc. ref.	y <sub>b</sub> (mm)	z <sub>b</sub> (mm)	SigL N/mm <sup>2</sup>	Sig_c N/mm <sup>2</sup>	Sig_cr N/mm <sup>2</sup>
16	ACT	17.0	std	1.0	2.0		100	4000	816		355.0	1.39
	LOC		14.57	Side			Min	21250	19391	1	172.8	53.4
	BUC		16.37	1.0	0.93	WB tst 5 4.14		21250	21395	222.6	233.5	222.6
<b>Strength deck</b>												
17	ACT	21.0	std	2.0	2.0		100	4000	857		355.0	1.39
	LOC		11.79	Strdk		Oil slo e	Min	20822	22035	2	166.8	89.8
	BUC		18.26	1.0	0.99	4.01		18690	22214	238.4	269.6	238.4
18	ACT	21.0	std	1.0	1.0		100	4000	702		355.0	1.39
	LOC		10.79	Strdk		Oil slo e	Min	17649	22301	2	166.8	89.8
	BUC		17.31	1.0	0.99	4.01		14939	22528	244.5	281.5	244.5
19	ACT	21.0	std	1.0	1.0		100	4000	832		355.0	1.39
	LOC		10.79	Strdk		Oil slo e	Min	14525	22563	2	166.8	89.8
	BUC		17.71	1.0	1.00	4.01		11707	22799	249.8	281.5	249.8
20	ACT	21.0	std	1.0	1.0		100	4000	830		355.0	1.39
	LOC		10.79	Strdk		Oil slo e	Min	11205	22800	2	166.8	89.8
	BUC		17.68	1.0	1.00	4.00		11620	22800	249.8	281.8	249.8
21	ACT	21.0	std	1.0	1.0		100	4000	830		355.0	1.39
	LOC		10.79	Strdk		Oil slo e	Min	8715	22800	2	166.8	89.8
	BUC		17.68	1.0	1.00	4.00		8867	22800	249.8	281.8	249.8
22	ACT	21.0	std	1.0	1.0		100	4000	830		355.0	1.39
	LOC		10.79	Strdk		Oil slo e	Min	5395	22800	2	166.8	89.8
	BUC		17.68	1.0	1.00	4.00		5810	22800	249.8	281.8	249.8
23	ACT	21.0	std	1.0	1.0		100	4000	830		355.0	1.39
	LOC		10.79	Strdk		Oil slo e	Min	2905	22800	2	166.8	89.8
	BUC		17.68	1.0	1.00	4.00		3007	22800	249.8	281.8	249.8
<b>CL Bulkhead</b>												
1	ACT	16.0	std	1.5	1.5		100	2000	670		355.0	1.39
	LOC		14.31	Lgird		WB acc 1	Lat	0	335	1	168.7	246.8
	BUC		12.06	1.0	0.93	4.13		0	0	189.4	267.2	189.4
2	ACT	15.0	std	0.0	0.0		100	4000	737		235.0	1.00
	LOC		15.14	Lbhd		Oil tst 5	Lat	0	3048	2	132.3	223.6
	BUC		10.19	1.0	0.90	4.20	s/t	0	2680	138.0	192.2	142.4
3	ACT	19.0	std	0.0	0.0		100	4000	784		235.0	1.00
	LOC		13.52	Lbhd		Oil tst 5	Lat	0	7484	2	150.3	179.0
	BUC		10.84	1.0	0.72	4.62	s/t	0	7092	53.5	207.5	150.7
4	ACT	13.0	std	0.0	0.0		100	4000	784		235.0	1.00
	LOC		12.65	Lbhd		Oil tst 5	Lat	0	9052	2	156.6	163.2
	BUC		10.84	1.0	0.40	5.58	s/t	0	8797	20.8	186.5	165.3
5	ACT	13.0	std	0.0	0.0		100	4000	784		235.0	1.00
	LOC		12.58	Lbhd		Oil tst 5	Min	0	11457	2	154.8	139.1
	BUC		10.84	1.0	0.82	4.37	s/t	0	11796	37.0	173.0	145.9
6	ACT	13.0	std	0.0	0.0		100	4000	784		235.0	1.00
	LOC		12.58	Lbhd		Oil tst 5	Min	0	14540	2	144.6	108.1
	BUC		10.84	1.0	0.84	4.32	s/t	0	14932	97.6	172.3	144.9
7	ACT	18.0	std	0.0	0.0		100	4000	784		235.0	1.00
	LOC		12.58	Lbhd		Oil slo e	Min	0	16892	2	136.9	89.8
	BUC		16.38	1.0	0.98	4.04		0	19840	192.5	199.8	192.5
8	ACT	19.0	std	2.0	2.0		100	4000	793		355.0	1.39
	LOC		13.43	Lbhd		Oil slo e	Min	0	21610	2	168.6	89.8
	BUC		17.70	1.0	0.94	4.12		0	22800	249.8	265.3	249.8



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**Local Rule Requirements - Plates (cont)**

Plate No	ACT	t_act (mm)	Steel	tk (mm)	tk_b (mm)		Eff. (%)	Span (mm)	Spac (mm)		Sigf N/mm <sup>2</sup>	f <sub>1</sub>
	LOC	t_loc (mm)	Pos			Load Ref.	Loc. ref.	y <sub>1</sub> (mm)	z <sub>1</sub> (mm)	Comp ref.	Sigma N/mm <sup>2</sup>	p kN/m <sup>2</sup>
	BUC	t_buc (mm)	Eta	psi	k	c	Buc. ref.	y <sub>b</sub> (mm)	z <sub>b</sub> (mm)	SigL N/mm <sup>2</sup>	Sig_c N/mm <sup>2</sup>	Sig_cr N/mm <sup>2</sup>

**Inner Bottom & Inner Side**

1	ACT LOC BUC	16.0	std 15.67 13.44	1.5 Inbot 0.9	1.5 1.00	Oil tst 5 4.00	100 Lat	4000 415 0	830 2680 2680	2 138.0	355.0 194.6 215.8	1.39 227.3 153.3
2	ACT LOC BUC	17.0	std 15.67 13.43	1.5 Inbot 0.9	1.5 1.00	Oil tst 5 4.00	100 Lat	4000 1244 1200	830 2680 2680	2 138.0	355.0 194.6 233.2	1.39 227.3 153.3
3	ACT LOC BUC	18.0	std 15.66 13.39	1.5 Inbot 0.9	1.5 1.00	Oil tst 5 4.00	100 Lat	4000 5394 3777	830 2758 2728	2 137.1	355.0 194.6 247.5	1.39 226.5 152.3
4	ACT LOC BUC	18.0	std 15.64 13.34	1.5 Inbot 0.9	1.5 1.00	Oil tst 5 4.00	100 Lat	4000 7054 6639	830 2790 2782	2 136.1	355.0 194.6 247.6	1.39 226.2 151.2
5	ACT LOC BUC	16.0	std 15.63 13.30	1.5 Inbot 0.9	1.5 1.00	Oil tst 5 4.00	100 Lat	4000 11204 9129	831 2868 2829	2 135.2	355.0 194.6 215.9	1.39 225.4 150.2
6	ACT LOC BUC	16.0	std 15.61 13.26	1.5 Inbot 0.9	1.5 1.00	Oil tst 5 4.00	100 Lat	4000 12034 11736	829 2884 2878	2 134.2	355.0 194.6 215.9	1.39 225.3 149.1
7	ACT LOC BUC	18.0	std 15.60 13.22	1.5 Inbot 0.9	1.5 1.00	Oil tst 5 4.00	100 Lat	4000 16184 14405	830 2962 2928	2 133.2	355.0 194.6 247.6	1.39 224.5 148.1
8	ACT LOC BUC	17.0	std 14.25 11.62	1.0 Hoptk 1.0	1.0 0.89	Oil tst 5 4.22	100 Lat s/t	4000 16773 16947	767 3312 3654	2 119.3	355.0 185.4 262.2	1.39 221.0 149.7
9	ACT LOC BUC	16.0	std 15.43 11.81	1.0 Hoptk 1.0	1.0 0.80	Oil tst 5 4.41	100 Lat s/t	4000 17815 18336	768 5367 6394	2 66.8	235.0 141.7 189.2	1.00 200.3 146.7
10	ACT LOC BUC	15.0	std 14.52 11.84	1.0 Insid 1.0	1.0 0.78	Oil tst 5 4.47	100 Lat s/t	4000 18690 18690	783 7483 7875	2 38.5	235.0 150.3 182.7	1.00 179.0 147.8
11	ACT LOC BUC	14.0	std 12.98 11.84	1.0 Insid 1.0	1.0 0.81	Oil tst 5 4.40	100 Lat s/t	4000 18690 18690	784 10619 11795	2 37.0	235.0 157.6 173.4	1.00 147.5 146.4
12	ACT LOC BUC	14.0	std 11.99 11.84	1.0 Insid 1.0	1.0 0.84	Oil tst 5 4.32	100 Lat s/t	4000 18690 18690	784 13755 14148	2 82.5	235.0 147.2 172.3	1.00 115.9 144.8
13	ACT LOC BUC	17.0	std 11.76 15.29	1.0 Insid 1.0	1.0 0.96	Oil slo e 4.08	100 Lat	4000 18690 18690	816 19349 19349	2 183.1	235.0 128.7 187.6	1.00 89.8 183.1
14	ACT LOC BUC	19.0	std 11.96 17.88	2.5 Insid 1.0	2.5 0.93	Oil slo e 4.13	100 Lat	4000 18690 18690	818 21805 22214	2 238.4	355.0 167.7 253.8	1.39 89.8 238.4

**Bottom girder 5810**

1	ACT LOC BUC	15.0	std 11.79 13.94	1.5 DBGird 1.0	1.5 0.91	WB slo m 4.18	100 Min	4000 5810 5810	590 295 590	1 178.1	355.0 180.7 204.8	1.39 20.0 178.1
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**Bottom girder 11620**

1	ACT LOC BUC	15.0	std 11.79 13.94	1.5 DBGird 1.0	1.5 0.91	WB slo m 4.18	100 Min	4000 11620 11620	590 295 590	1 178.1	355.0 180.7 204.8	1.39 20.0 178.1
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### Local Rule Requirements - Plates (cont)

Plate No	ACT	t_act (mm)	Steel	tk (mm)	tk_b (mm)		Eff. (%)	Span (mm)	Spac (mm)		Sigf N/mm <sup>2</sup>	f <sub>1</sub>
LOC		t_loc (mm)	Pos		Load Ref.		Loc. ref.	y <sub>1</sub> (mm)	z <sub>1</sub> (mm)	Comp ref.	Sigma N/mm <sup>2</sup>	p kN/m <sup>2</sup>
BUC		t_buc (mm)	Eta	psi	k	c	Buc. ref.	y <sub>b</sub> (mm)	z <sub>b</sub> (mm)	SigL N/mm <sup>2</sup>	Sig_c N/mm <sup>2</sup>	Sig_cr N/mm <sup>2</sup>

#### Bottom girder 16600

1	ACT	15.0	std	1.5	1.5		100	4000	590		355.0	1.39
	LOC		11.79	DBgird		WB slo m	Min	16600	295	1	180.7	20.0
	BUC		13.94	1.0	0.91	4.18		16600	590	178.1	204.8	178.1

#### Stringer 7092

1	ACT	12.0	std	1.5	1.5		100	4000	640		235.0	1.00
	LOC		11.55	Strng		WB slo m	Min	20930	7092	1	148.7	20.0
	BUC		6.93	1.0	1.00	4.00		21250	7092	53.5	165.8	53.5

#### Stringer 11796

1	ACT	12.0	std	1.5	1.5		100	4000	640		235.0	1.00
	LOC		11.55	Strng		WB slo m	Min	20930	11796	1	153.7	20.0
	BUC		6.02	1.0	1.00	4.00		21250	11796	37.0	165.8	37.0

#### Stringer 16500

1	ACT	12.0	std	1.5	1.5		100	4000	640		235.0	1.00
	LOC		11.55	Strng		WB slo m	Min	20930	16500	1	138.2	20.0
	BUC		9.94	1.0	1.00	4.00		21250	16500	127.9	165.8	127.9

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### 14 Local Rule Requirements - Stiffeners

Stiff. No	ACT ACT	POS Za cm³	K c	Type Type	h t (mm)	bf tf (mm)	y z (mm)	SigF f <sub>t</sub> N/mm²	m wk	tkw tkf (mm)	tpl (mm)	span spac (mm)
LOC			Zr cm³	Exc. %	tmin (mm)	Load Ref.		Sigma N/mm²	Sigdb N/mm²	p kN/m²	Comp ref.	a_conn cm²
FAT/BUC			Zrf cm³	Exc. %	pd kN/m²	Sigd N/mm²		SigL N/mm²	Lat N/mm²	Torsion N/mm²	Web N/mm²	bf/tf

#### Outer Shell

##### Bottom

1	ACT ACT LOC FAT/BUC	Bottom 1670	0.00 0.0 1437 0	20 HPbulb 16	400 16.0 10.7 0.0	0 0.0 WB acc 1 0.0	830 0	355.0 1.39 150.4 189.4	12.0 1.09 46.1 344.5	1.5 1.5 180.1 315.8	19.0 1 330.5	4000 830 83.7 0.0
2	ACT ACT LOC FAT/BUC	Bottom 1638	0.00 0.0 1437 0	20 HPbulb 13	400 16.0 10.7 0.0	0 0.0 WB acc 1 0.0	1660 0	355.0 1.39 150.4 189.4	12.0 1.09 46.1 344.9	1.5 1.5 180.1 297.3	16.0 1 330.5	4000 830 83.7 0.0
Similar for No(s): 3 4 5 6												
7	ACT ACT LOC FAT/BUC	Bottom 1945	0.00 0.0 1437 0	20 HPbulb 35	430 15.0 10.7 0.0	0 0.0 WB acc 1 0.0	6640 0	355.0 1.39 150.4 189.4	12.0 1.09 46.1 346.3	1.5 1.5 180.1 308.5	19.0 1 322.4	4000 830 83.7 0.0
Similar for No(s): 8 9 10 11 12 13 14 15												
16	ACT ACT LOC FAT/BUC	Bottom 1921	0.00 0.0 1444 0	20 HPbulb 33	430 15.0 10.7 0.0	0 0.0 Sea 0.0	14940 0	355.0 1.39 150.4 189.4	12.0 1.09 46.1 346.5	1.5 1.5 180.9 299.7	17.0 1 322.4	4000 830 83.7 0.0
Similar for No(s): 17												
18	ACT ACT LOC FAT/BUC	Bottom 1523	0.00 0.0 1037 0	20 HPbulb 46	400 14.0 10.7 0.0	0 0.0 Sea 0.0	17313 0	355.0 1.39 182.8 189.4	12.0 1.09 0.0 345.4	1.5 1.5 183.6 300.5	15.0 1 322.1	4000 713 73.1 0.0
Similar for No(s): 19 20												
21	ACT ACT LOC FAT/BUC	Bottom 1523	0.00 0.0 1050 0	20 HPbulb 44	400 14.0 10.7 0.0	0 0.0 Sea 0.0	19452 0	355.0 1.39 182.8 189.4	12.0 1.09 0.0 345.4	1.5 1.5 186.1 300.5	15.0 1 322.1	4000 713 73.1 0.0

##### Side

22	ACT ACT LOC FAT/BUC	Side 1649	2.50 1.1 1281 1480	20 HPbulb 28 11	400 16.0 10.7 55.0	0 0.0 WB tst 5 48.4	21250 2094	355.0 1.39 180.7 149.2	12.0 1.09 0.0 344.7	1.5 1.5 177.7 299.6	16.0 1 330.5	4000 900 88.7 0.0
23	ACT ACT LOC FAT/BUC	Side 1643	2.50 1.1 1223 1434	20 HPbulb 34 14	400 16.0 10.7 55.8	0 0.0 WB tst 5 48.4	21250 2994	355.0 1.39 180.7 132.0	12.0 1.09 0.0 344.8	1.5 1.5 177.7 306.4	16.0 1 330.5	4000 860 85.2 0.0
24	ACT ACT LOC FAT/BUC	Side 1647	2.50 1.1 1621 1384	20 HPbulb 1 18	400 16.0 11.5 56.5	0 0.0 WB tst 5 48.4	21250 3814	235.0 1.00 130.0 116.3	12.0 1.09 0.0 230.5	1.5 1.5 177.6 217.1	17.0 1 224.3	4000 820 81.7 0.0
25	ACT ACT LOC FAT/BUC	Side 1647	2.50 1.1 1621 1402	20 HPbulb 1 17	400 16.0 11.5 57.2	0 0.0 WB tst 5 48.4	21250 4634	235.0 1.00 130.0 100.6	12.0 1.09 0.0 230.5	1.5 1.5 177.6 217.4	17.0 1 224.3	4000 820 81.7 0.0
26	ACT ACT LOC FAT/BUC	Side 1647	2.50 1.1 1620 1419	20 HPbulb 1 16	400 16.0 11.5 57.9	0 0.0 WB tst 5 48.4	21250 5454	235.0 1.00 130.0 84.9	12.0 1.09 0.0 230.5	1.5 1.5 177.5 217.6	17.0 1 224.3	4000 820 81.7 0.0
27	ACT ACT LOC FAT/BUC	Side 1647	2.50 1.1 1618 1434	20 HPbulb 1 14	400 16.0 11.5 58.6	0 0.0 WB tst 5 48.4	21250 6274	235.0 1.00 130.0 69.2	12.0 1.09 0.0 230.5	1.5 1.5 177.5 217.8	17.0 1 224.3	4000 819 81.6 0.0

Section Scantlings - v.3.3-372-980619  
 SHUTTEL TANKER 145000 M3  
 CUADERNA MAESTRA

Ship Id No : BASE

**Local Rule Requirements - Stiffeners (cont.)**

Stiff. No	ACT ACT	POS Za cm <sup>2</sup>	K c	Type Type	h t (mm)	bf tf (mm)	y z (mm)	SigF f <sub>1</sub> N/mm <sup>2</sup>	m wk	tkw tkf (mm)	tpl (mm)	span spac (mm)
LOC			Zr cm <sup>2</sup>	Exc. %	tmin (mm)	Load Ref.		Sigma N/mm <sup>2</sup>	Sigdb N/mm <sup>2</sup>	p kN/m <sup>2</sup>	Comp ref.	a_conn cm <sup>2</sup>
FAT/BUC			Zrf cm <sup>2</sup>	Exc. %	pd kN/m <sup>2</sup>	Sigd N/mm <sup>2</sup>		SigL N/mm <sup>2</sup>	Lat N/mm <sup>2</sup>	Torsion N/mm <sup>2</sup>	Web N/mm <sup>2</sup>	bf/tf
28	ACT	Side	2.50	20	400	0	21250	235.0	12.0	1.5	17.0	4000
	ACT	1641	1.1	HPbulb	16.0	0.0	7876	1.00	1.09	1.5		784
	LOC		1476	11	11.5	WB tst 5		130.0	0.0	169.2	1	74.8
	FAT/BUC		1405	16	60.0	48.4		38.5	230.6	217.9	224.3	0.0
29	ACT	Side	2.50	20	400	0	21250	235.0	12.0	1.5	17.0	4000
	ACT	1641	1.1	HPbulb	16.0	0.0	8660	1.00	1.09	1.5		784
	LOC		1408	16	11.5	WB tst 5		130.0	0.0	161.3	1	71.3
	FAT/BUC		1421	15	60.6	48.4		30.0	230.6	217.9	224.3	0.0
30	ACT	Side	2.50	20	400	0	21250	235.0	12.0	1.5	17.0	4000
	ACT	1641	1.1	HPbulb	16.0	0.0	9444	1.00	1.09	1.5		784
	LOC		1339	22	11.5	WB tst 5		130.0	0.0	153.4	1	67.8
	FAT/BUC		1428	14	60.9	48.4		30.0	230.6	217.9	224.3	0.0
31	ACT	Side	2.50	20	400	0	21250	235.0	12.0	1.5	17.0	4000
	ACT	1556	1.1	HPbulb	14.0	0.0	10228	1.00	1.09	1.5		784
	LOC		1270	22	11.5	WB tst 5		130.0	0.0	145.5	1	64.3
	FAT/BUC		1344	15	57.3	48.4		30.0	230.6	216.5	220.6	0.0
32	ACT	Side	2.50	20	400	0	21250	235.0	12.0	1.5	17.0	4000
	ACT	1556	1.1	HPbulb	14.0	0.0	11012	1.00	1.09	1.5		784
	LOC		1201	29	11.5	WB tst 5		130.0	0.0	137.6	1	60.8
	FAT/BUC		1260	23	53.8	48.4		30.0	230.6	216.5	220.6	0.0
33	ACT	Side	2.50	20	370	0	21250	235.0	12.0	1.5	17.0	4000
	ACT	1245	1.1	HPbulb	13.0	0.0	12580	1.00	1.09	1.5		783
	LOC		1063	17	11.5	WB tst 5		130.0	0.0	121.9	1	53.9
	FAT/BUC		1092	14	46.6	48.4		52.1	229.6	215.9	220.4	0.0
34	ACT	Side	2.50	20	370	0	21250	235.0	12.0	1.5	17.0	4000
	ACT	1245	1.1	HPbulb	13.0	0.0	13364	1.00	1.09	1.5		784
	LOC		995	25	11.5	WB tst 5		130.0	0.0	114.0	1	50.4
	FAT/BUC		1008	23	43.0	48.4		67.3	229.6	215.9	220.4	0.0
35	ACT	Side	2.50	20	340	0	21250	235.0	12.0	1.5	17.0	4000
	ACT	1042	1.1	HPbulb	14.0	0.0	14148	1.00	1.09	1.5		784
	LOC		926	12	11.5	WB tst 5		130.0	0.0	106.1	1	46.9
	FAT/BUC		924	12	39.4	48.4		82.5	228.3	216.5	224.5	0.0
36	ACT	Side	2.50	20	340	0	21250	235.0	12.0	1.5	17.0	4000
	ACT	1042	1.1	HPbulb	14.0	0.0	14932	1.00	1.09	1.5		784
	LOC		857	21	11.5	WB tst 5		130.0	0.0	98.2	1	43.4
	FAT/BUC		840	24	35.8	48.4		97.6	228.3	216.4	224.5	0.0
37	ACT	Side	2.50	20	340	0	21250	235.0	12.0	1.5	17.0	4000
	ACT	1042	1.1	HPbulb	14.0	0.0	15716	1.00	1.09	1.5		784
	LOC		788	32	11.5	WB tst 5		130.0	0.0	90.3	1	39.9
	FAT/BUC		754	38	32.2	48.4		112.8	228.3	216.3	224.5	0.0
38	ACT	Side	2.50	20	340	0	21250	235.0	12.0	1.5	17.0	4000
	ACT	1045	1.1	HPbulb	14.0	0.0	17316	1.00	1.09	1.5		816
	LOC		740	41	11.5	WB tst 5		118.5	0.0	74.3	1	34.0
	FAT/BUC		589	77	24.2	48.4		143.7	228.2	215.8	224.5	0.0
39	ACT	Side	2.50	20	340	0	21250	235.0	12.0	1.5	17.0	4000
	ACT	1045	1.1	HPbulb	14.0	0.0	18132	1.00	1.09	1.5		816
	LOC		730	43	11.5	WB tst 5		106.8	0.0	66.1	1	30.2
	FAT/BUC		490	113	20.1	48.4		159.5	228.2	215.6	224.5	0.0
40	ACT	Side	2.50	20	340	0	21250	235.0	12.0	1.5	17.0	4000
	ACT	1045	1.1	HPbulb	14.0	0.0	18948	1.00	1.09	1.5		816
	LOC		718	45	11.5	WB tst 5		95.1	0.0	57.8	1	26.5
	FAT/BUC		390	167	16.0	48.4		175.3	228.2	215.3	224.5	0.0
41	ACT	Side	2.50	20	300	0	21250	355.0	12.0	1.5	17.0	4000
	ACT	717	1.1	HPbulb	12.0	0.0	19764	1.39	1.09	1.5		816
	LOC		342	109	10.7	WB tst 5		171.2	0.0	49.6	1	22.7
	FAT/BUC		290	146	11.9	48.4		191.1	332.9	307.7	328.5	0.0



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 SHUTTEL TANKER 145000 M3  
 CUADERNA MAESTRA

Ship Id No : BASE

**Local Rule Requirements - Stiffeners (cont.)**

Stiff. No	ACT ACT	POS Za cm <sup>3</sup>	K c	Type Type	h t (mm)	bf tf (mm)	y z (mm)	SigF <sub>f1</sub> N/mm <sup>2</sup>	m wk	tkw tkf (mm)	tpl (mm)	span spac (mm)
LOC			Zr cm <sup>3</sup>	Exc. %	tmin (mm)	Load Ref.		Sigma N/mm <sup>2</sup>	Sigdb N/mm <sup>2</sup>	p kN/m <sup>2</sup>	Comp ref.	a_conn cm <sup>2</sup>
FAT/BUC			Zrf cm <sup>3</sup>	Exc. %	pd kN/m <sup>2</sup>	Sigd N/mm <sup>2</sup>		SigL N/mm <sup>2</sup>	Lat N/mm <sup>2</sup>	Torsion N/mm <sup>2</sup>	Web N/mm <sup>2</sup>	bf/tf
42	ACT	Side	2.50	20	300	0	21250	355.0	12.0	3.0	17.0	4000
	ACT	717	1.1	HPbulb	12.0	0.0	20580	1.39	1.18	3.0		816
	LOC		332	116	12.2	WB tst 5		159.5	0.0	41.4	1	19.0
	FAT/BUC		207	246	7.8	48.4		206.8	333.2	298.9	318.5	0.0
43	ACT	Side	2.50	20	300	0	21250	355.0	12.0	3.0	17.0	4000
	ACT	711	1.1	HPbulb	12.0	0.0	21396	1.39	1.18	3.0		710
	LOC		250	184	12.2	WB tst 5		147.8	0.0	33.2	1	13.4
	FAT/BUC		86	723	3.8	48.4		222.6	334.5	303.8	318.5	0.0
<b>Strength deck</b>												
1	ACT	Strdk	0.00	20	320	0	20395	355.0	12.0	3.0	21.0	4000
	ACT	856	0.0	HPbulb	12.0	0.0	22071	1.39	1.18	3.0		857
	LOC		255	235	12.2	WB tst 5		139.1	0.0	26.4	1	12.7
	FAT/BUC		0		0.0	0.0		235.7	334.3	305.9	313.6	0.0
2	ACT	Strdk	0.00	20	320	0	19540	355.0	12.0	3.0	21.0	4000
	ACT	855	0.0	HPbulb	12.0	0.0	22143	1.39	1.18	3.0		855
	LOC		247	245	12.2	WB tst 5		139.1	0.0	25.7	1	12.3
	FAT/BUC		0		0.0	0.0		237.1	334.4	305.9	313.6	0.0
3	ACT	Strdk	0.00	20	320	0	18000	355.0	12.0	2.0	21.0	4000
	ACT	846	0.0	HPbulb	12.0	0.0	22272	1.39	1.12	2.0		697
	LOC		669	26	11.2	Oil slo e		139.1	0.0	89.8	2	35.7
	FAT/BUC		0		0.0	0.0		239.6	336.3	311.5	321.7	0.0
Similar for No(s): 4												
5	ACT	Strdk	0.00	20	320	0	16600	355.0	12.0	2.0	21.0	4000
	ACT	851	0.0	HPbulb	12.0	0.0	22389	1.39	1.12	2.0		767
	LOC		736	15	11.2	Oil slo e		139.1	0.0	89.8	2	38.9
	FAT/BUC		0		0.0	0.0		241.8	335.4	310.8	321.7	0.0
6	ACT	Strdk	0.00	20	320	0	15770	355.0	12.0	2.0	21.0	4000
	ACT	854	0.0	HPbulb	12.0	0.0	22459	1.39	1.12	2.0		832
	LOC		799	6	11.2	Oil slo e		139.1	0.0	89.8	2	41.9
	FAT/BUC		0		0.0	0.0		243.2	334.6	310.0	321.7	0.0
Similar for No(s): 7 8 9 10 11												
12	ACT	Strdk	0.00	20	320	0	10790	355.0	12.0	2.0	21.0	4000
	ACT	860	0.0	HPbulb	12.0	0.0	22800	1.39	1.12	2.0		830
	LOC		796	8	11.2	Oil slo e		139.1	0.0	89.8	2	41.7
	FAT/BUC		0		0.0	0.0		249.8	334.6	310.0	321.7	0.0
Similar for No(s): 13 14 15 16 17 18 19 20 21 22 23 24												
<b>CL Bulkhead</b>												
1	ACT	Lgird	0.00	10	300	0	0	355.0	12.0	1.5	16.0	2000
	ACT	562	0.0	Fbar	20.0	0.0	670	1.39	1.08	1.5		670
	LOC		303	85	16.5	WB acc 1		191.6	0.0	243.0	1	42.4
	FAT/BUC		0		0.0	0.0		176.5	348.3	283.6	0.0	0.0
2	ACT	Lgird	0.00	10	300	0	0	355.0	12.0	1.5	16.0	2000
	ACT	562	0.0	Fbar	20.0	0.0	1340	1.39	1.08	1.5		670
	LOC		281	100	16.5	WB acc 1		200.4	0.0	235.5	1	41.0
	FAT/BUC		0		0.0	0.0		163.7	348.3	284.5	0.0	0.0
3	ACT	Lgird	0.00	10	300	0	0	355.0	12.0	1.5	16.0	2000
	ACT	562	0.0	Fbar	20.0	0.0	2010	1.39	1.08	1.5		670
	LOC		260	115	16.5	WB tst 5		209.2	0.0	228.2	1	39.8
	FAT/BUC		0		0.0	0.0		150.9	348.3	285.3	0.0	0.0
4	ACT	Lbhd	0.00	20	400	0	0	355.0	12.0	1.0	15.0	4000
	ACT	1608	0.0	HPbulb	16.0	0.0	3417	1.39	1.06	0.0		736
	LOC		1024	57	10.2	Oil tst 5		222.4	0.0	219.9	2	91.8
	FAT/BUC		0		0.0	0.0		123.9	345.1	314.0	332.3	0.0

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Ship Id No : BASE

**Local Rule Requirements - Stiffeners (cont.)**

Stiff. No	ACT ACT	POS Za cm <sup>3</sup>	K c	Type Type	h t (mm)	bf tf (mm)	y z (mm)	SigF f <sub>1</sub> N/mm <sup>2</sup>	m wk	tkw tkf (mm)	tpl (mm)	span spac (mm)
LOC			Zr cm <sup>3</sup>	Exc. %	tmin (mm)	Load Ref.		Sigma N/mm <sup>2</sup>	Sigdb N/mm <sup>2</sup>	p kN/m <sup>2</sup>	Comp ref.	a_conn cm <sup>2</sup>
FAT/BUC			Zrf cm <sup>3</sup>	Exc. %	pd kN/m <sup>2</sup>	Sigd N/mm <sup>2</sup>		SigL N/mm <sup>2</sup>	Lat N/mm <sup>2</sup>	Torsion N/mm <sup>2</sup>	Web N/mm <sup>2</sup>	bf/ft
5	ACT	Lbhd	0.00	20	400	0	0	355.0	12.0	1.0	15.0	4000
	ACT	1608	0.0	HPbulb	16.0	0.0	4152	1.39	1.06	0.0		735
	LOC		988	62	10.2	Oil tst 5		222.4	0.0	212.5	2	88.7
	FAT/BUC		0		0.0	0.0		109.8	345.1	314.6	332.3	0.0
6	ACT	Lbhd	0.00	20	400	0	0	355.0	12.0	1.0	15.0	4000
	ACT	1608	0.0	HPbulb	16.0	0.0	4887	1.39	1.06	0.0		735
	LOC		954	68	10.2	Oil tst 5		222.4	0.0	205.1	2	85.6
	FAT/BUC		0		0.0	0.0		95.7	345.1	315.1	332.3	0.0
7	ACT	Lbhd	0.00	10	450	0	0	235.0	12.0	1.0	15.0	4000
	ACT	1443	0.0	Fbar	25.0	0.0	5622	1.00	1.04	0.0		735
	LOC		1254	15	23.5	Oil tst 5		160.0	0.0	197.7	2	82.5
	FAT/BUC		0		0.0	0.0		81.6	230.3	193.2	0.0	0.0
8	ACT	Lbhd	0.00	10	450	0	0	235.0	12.0	1.0	19.0	4000
	ACT	1501	0.0	Fbar	25.0	0.0	6357	1.00	1.04	0.0		735
	LOC		1207	24	23.5	Oil tst 5		160.0	0.0	190.3	2	79.4
	FAT/BUC		0		0.0	0.0		67.6	230.1	198.7	0.0	0.0
Similar for No(s): 9												
10	ACT	Lbhd	0.00	10	400	0	0	235.0	12.0	1.0	19.0	4000
	ACT	1218	0.0	Fbar	25.0	0.0	7876	1.00	1.04	0.0		784
	LOC		1184	2	21.0	Oil tst 5		160.0	0.0	175.1	2	77.4
	FAT/BUC		0		0.0	0.0		38.5	228.6	205.4	0.0	0.0
11	ACT	Lbhd	0.00	10	400	0	0	235.0	12.0	1.0	19.0	4000
	ACT	1218	0.0	Fbar	25.0	0.0	8660	1.00	1.04	0.0		784
	LOC		1131	7	21.0	Oil tst 5		160.0	0.0	167.2	2	73.9
	FAT/BUC		0		0.0	0.0		23.4	228.6	205.5	0.0	0.0
12	ACT	Lbhd	0.00	10	400	0	0	235.0	12.0	1.0	13.0	4000
	ACT	1146	0.0	Fbar	25.0	0.0	9444	1.00	1.04	0.0		784
	LOC		1078	6	21.0	Oil tst 5		160.0	0.0	159.3	2	70.4
	FAT/BUC		0		0.0	0.0		8.4	229.0	200.4	0.0	0.0
13	ACT	Lbhd	0.00	10	400	0	0	235.0	12.0	1.0	13.0	4000
	ACT	1146	0.0	Fbar	25.0	0.0	10228	1.00	1.04	0.0		784
	LOC		1024	11	21.0	Oil tst 5		160.0	0.0	151.4	2	66.9
	FAT/BUC		0		0.0	0.0		6.7	229.0	200.5	0.0	0.0
14	ACT	Lbhd	0.00	10	400	0	0	235.0	12.0	1.0	13.0	4000
	ACT	1146	0.0	Fbar	25.0	0.0	11012	1.00	1.04	0.0		784
	LOC		971	18	21.0	Oil tst 5		160.0	0.0	143.5	2	63.4
	FAT/BUC		0		0.0	0.0		21.8	229.0	200.1	0.0	0.0
15	ACT	Lbhd	0.00	10	350	0	0	235.0	12.0	1.0	13.0	4000
	ACT	896	0.0	Fbar	25.0	0.0	11796	1.00	1.04	0.0		784
	LOC		917	-2	18.5	Oil tst 5		160.0	0.0	135.6	2	60.0
	FAT/BUC		0		0.0	0.0		37.0	227.0	207.6	0.0	0.0
16	ACT	Lbhd	0.00	10	350	0	0	235.0	12.0	1.0	13.0	4000
	ACT	896	0.0	Fbar	25.0	0.0	12580	1.00	1.04	0.0		784
	LOC		864	3	18.5	Oil tst 5		160.0	0.0	127.8	2	56.5
	FAT/BUC		0		0.0	0.0		52.1	227.0	207.3	0.0	0.0
17	ACT	Lbhd	0.00	10	350	0	0	235.0	12.0	1.0	13.0	4000
	ACT	896	0.0	Fbar	25.0	0.0	13364	1.00	1.04	0.0		784
	LOC		811	10	18.5	Oil tst 5		160.0	0.0	119.9	2	53.0
	FAT/BUC		0		0.0	0.0		67.3	227.0	206.9	0.0	0.0
18	ACT	Lbhd	0.00	10	350	0	0	235.0	12.0	1.0	13.0	4000
	ACT	896	0.0	Fbar	25.0	0.0	14148	1.00	1.04	0.0		784
	LOC		757	18	18.5	Oil tst 5		160.0	0.0	112.0	2	49.5
	FAT/BUC		0		0.0	0.0		82.5	227.0	206.5	0.0	0.0



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 SHUTTEL TANKER 145000 M3  
 CUADERNA MAESTRA

Ship Id No : BASE

**Local Rule Requirements - Stiffeners (cont.)**

Stiff. No	ACT ACT	POS Za cm <sup>3</sup>	K c	Type Type	h t (mm)	bf tf (mm)	y z (mm)	SigF f <sub>1</sub> N/mm <sup>2</sup>	m wk	tkw tkf (mm)	tpl (mm)	span spac (mm)
LOC			Zr cm <sup>3</sup>	Exc. %	tmin (mm)	Load Ref.		Sigma N/mm <sup>2</sup>	Sigdb N/mm <sup>2</sup>	p kN/m <sup>2</sup>	Comp ref.	a_conn cm <sup>2</sup>
FAT/BUC			Zrf cm <sup>3</sup>	Exc. %	pd kN/m <sup>2</sup>	Sigd N/mm <sup>2</sup>		SigL N/mm <sup>2</sup>	Lat N/mm <sup>2</sup>	Torsion N/mm <sup>2</sup>	Web N/mm <sup>2</sup>	bf/tf
19	ACT	Lbhd	0.00	10	350	0	0	235.0	12.0	1.0	13.0	4000
	ACT	896	0.0	Fbar	25.0	0.0	14932	1.00	1.04	0.0		784
	LOC		738	21	18.5	Oil tst 5		152.7	0.0	104.1	2	46.0
	FAT/BUC		0		0.0	0.0		97.6	227.0	206.1	0.0	0.0
	Similar for No(s): 20											
21	ACT	Lbhd	0.00	10	350	0	0	235.0	12.0	1.0	13.0	4000
	ACT	896	0.0	Fbar	25.0	0.0	16500	1.00	1.04	0.0		784
	LOC		746	20	18.5	Oil slo e		130.2	0.0	89.8	2	39.7
	FAT/BUC		0		0.0	0.0		127.9	227.0	205.3	0.0	0.0
22	ACT	Lbhd	0.00	20	300	0	0	355.0	12.0	1.0	18.0	4000
	ACT	720	0.0	HPbulb	12.0	0.0	17284	1.39	1.06	0.0		785
	LOC		479	50	10.2	Oil slo e		206.7	0.0	89.8	2	39.7
	FAT/BUC		0		0.0	0.0		143.1	332.6	315.6	331.1	0.0
23	ACT	Lbhd	0.00	20	300	0	0	355.0	12.0	1.0	18.0	4000
	ACT	720	0.0	HPbulb	12.0	0.0	18070	1.39	1.06	0.0		786
	LOC		508	41	10.2	Oil slo e		195.4	0.0	89.8	2	39.8
	FAT/BUC		0		0.0	0.0		158.3	332.6	315.4	331.1	0.0
24	ACT	Lbhd	0.00	20	300	0	0	355.0	12.0	1.0	18.0	4000
	ACT	720	0.0	HPbulb	12.0	0.0	18856	1.39	1.06	0.0		786
	LOC		539	33	10.2	Oil slo e		184.2	0.0	89.8	2	39.8
	FAT/BUC		0		0.0	0.0		173.5	332.6	315.1	331.1	0.0
25	ACT	Lbhd	0.00	20	300	0	0	355.0	12.0	1.0	18.0	4000
	ACT	720	0.0	HPbulb	12.0	0.0	19642	1.39	1.06	0.0		786
	LOC		574	25	10.2	Oil slo e		172.9	0.0	89.8	2	39.8
	FAT/BUC		0		0.0	0.0		188.7	332.6	314.8	331.1	0.0
26	ACT	Lbhd	0.00	20	340	0	0	355.0	12.0	1.0	19.0	4000
	ACT	987	0.0	HPbulb	12.0	0.0	20428	1.39	1.06	0.0		786
	LOC		614	60	10.2	Oil slo e		161.7	0.0	89.8	2	39.8
	FAT/BUC		0		0.0	0.0		203.9	338.8	312.1	324.4	0.0
27	ACT	Lbhd	0.00	20	340	0	0	355.0	12.0	1.0	19.0	4000
	ACT	988	0.0	HPbulb	12.0	0.0	21214	1.39	1.06	0.0		789
	LOC		663	48	10.2	Oil slo e		150.4	0.0	89.8	2	39.9
	FAT/BUC		0		0.0	0.0		219.1	338.8	311.9	324.4	0.0
28	ACT	Lbhd	0.00	20	340	0	0	355.0	12.0	2.0	19.0	4000
	ACT	988	0.0	HPbulb	12.0	0.0	22007	1.39	1.12	2.0		793
	LOC		760	29	11.2	Oil slo e		139.1	0.0	89.8	2	40.1
	FAT/BUC		0		0.0	0.0		234.4	338.9	306.6	317.5	0.0
<b>Inner Bottom &amp; Inner Side</b>												
1	ACT	Inbot	0.00	20	430	0	830	355.0	12.0	1.5	16.0	4000
	ACT	1908	0.0	HPbulb	15.0	0.0	2680	1.39	1.09	1.5		830
	LOC		1513	26	10.7	Oil tst 5		180.4	46.1	227.3	2	102.9
	FAT/BUC		0		0.0	0.0		138.0	346.6	297.9	322.4	0.0
	Similar for No(s): 2 3 4											
5	ACT	Inbot	0.00	20	430	0	4149	355.0	12.0	1.5	18.0	4000
	ACT	1928	0.0	HPbulb	15.0	0.0	2735	1.39	1.09	1.5		829
	LOC		1509	27	10.7	Oil tst 5		180.4	46.1	226.8	2	102.7
	FAT/BUC		0		0.0	0.0		137.0	346.3	306.6	322.4	0.0
	Similar for No(s): 6 7 8 9											
10	ACT	Inbot	0.00	20	430	0	9129	355.0	12.0	1.5	16.0	4000
	ACT	1903	0.0	HPbulb	15.0	0.0	2829	1.39	1.09	1.5		830
	LOC		1503	26	10.7	Oil tst 5		180.4	46.1	225.8	2	102.2
	FAT/BUC		0		0.0	0.0		135.2	346.5	298.2	322.4	0.0
	Similar for No(s): 11 12 13 14 15											

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 CUADERNA MAESTRA

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**Local Rule Requirements - Stiffeners (cont.)**

Stiff. No.	ACT ACT	POS Za cm <sup>3</sup>	K c	Type Type	h t (mm)	bf tf (mm)	y z (mm)	SigF f <sub>1</sub> N/mm <sup>2</sup>	m wk	tkw tkf (mm)	tpl (mm)	span spac (mm)
LOC			Zr cm <sup>3</sup>	Exc. %	tmin (mm)	Load Ref.		Sigma N/mm <sup>2</sup>	Sigdb N/mm <sup>2</sup>	p kN/m <sup>2</sup>	Comp ref.	a_conn cm <sup>2</sup>
FAT/BUC			Zrf cm <sup>3</sup>	Exc. %	pd kN/m <sup>2</sup>	Sigd N/mm <sup>2</sup>		SigL N/mm <sup>2</sup>	Lat N/mm <sup>2</sup>	Torsion N/mm <sup>2</sup>	Web N/mm <sup>2</sup>	bf/ft
16	ACT ACT LOC FAT/BUC	Inbot 1928	0.00 0.0	20 HPbulb	430 15.0	0 0.0	14939 2938	355.0 1.39	12.0 1.09	1.5 1.5	18.0	4000 830
			1496	28	10.7	Oil tst 5		180.4	46.1	224.7	2	101.7
			0		0.0	0.0		133.1	346.3	306.7	322.4	0.0
			Similar for No(s): 17									
18	ACT ACT LOC FAT/BUC	Hoptk 1909	0.00 0.0	20 HPbulb	430 15.0	0 0.0	16947 3654	235.0 1.00	12.0 1.09	1.5 1.5	17.0	4000 768
			1690	12	11.5	Oil tst 5		143.1	0.0	217.5	2	91.8
			0		0.0	0.0		119.3	231.3	214.2	220.7	0.0
19	ACT ACT LOC FAT/BUC	Hoptk 1909	0.00 0.0	20 HPbulb	430 15.0	0 0.0	17294 4339	235.0 1.00	12.0 1.09	1.5 1.5	17.0	4000 768
			1539	24	11.5	Oil tst 5		152.1	0.0	210.6	2	88.8
			0		0.0	0.0		106.2	231.3	214.4	220.7	0.0
20	ACT ACT LOC FAT/BUC	Hoptk 1895	0.00 0.0	20 HPbulb	430 15.0	0 0.0	17641 5024	235.0 1.00	12.0 1.09	1.5 1.5	16.0	4000 768
			1415	33	11.5	Oil tst 5		160.0	0.0	203.7	2	85.8
			0		0.0	0.0		93.1	231.4	213.3	220.7	0.0
21	ACT ACT LOC FAT/BUC	Hoptk 1544	0.00 0.0	20 HPbulb	400 14.0	0 0.0	17989 5709	235.0 1.00	12.0 1.09	1.5 1.5	16.0	4000 767
			1367	12	11.5	Oil tst 5		160.0	0.0	196.8	2	82.9
			0		0.0	0.0		80.0	230.7	215.2	220.6	0.0
22	ACT ACT LOC FAT/BUC	Hoptk 1545	0.00 0.0	20 HPbulb	400 14.0	0 0.0	18336 6394	235.0 1.00	12.0 1.09	1.5 1.5	16.0	4000 774
			1331	16	11.5	Oil tst 5		160.0	0.0	190.0	2	80.5
			0		0.0	0.0		66.8	230.7	215.3	220.6	0.0
23	ACT ACT LOC FAT/BUC	Insid 1229	0.00 0.0	20 HPbulb	370 13.0	0 0.0	18690 7875	235.0 1.00	12.0 1.09	1.5 1.5	15.0	4000 783
			1241	0	11.5	Oil tst 5		160.0	0.0	175.1	2	74.8
			0		0.0	0.0		38.5	229.8	215.3	220.4	0.0
24	ACT ACT LOC FAT/BUC	Insid 1229	0.00 0.0	20 HPbulb	370 13.0	0 0.0	18690 8659	235.0 1.00	12.0 1.09	1.5 1.5	15.0	4000 784
			1185	3	11.5	Oil tst 5		160.0	0.0	167.2	2	71.3
			0		0.0	0.0		30.0	229.8	215.3	220.4	0.0
25	ACT ACT LOC FAT/BUC	Insid 1229	0.00 0.0	20 HPbulb	370 13.0	0 0.0	18690 9443	235.0 1.00	12.0 1.09	1.5 1.5	15.0	4000 784
			1129	8	11.5	Oil tst 5		160.0	0.0	159.3	2	67.8
			0		0.0	0.0		30.0	229.8	215.3	220.4	0.0
26	ACT ACT LOC FAT/BUC	Insid 1229	0.00 0.0	20 HPbulb	370 13.0	0 0.0	18690 10227	235.0 1.00	12.0 1.09	1.5 1.5	15.0	4000 784
			1073	14	11.5	Oil tst 5		160.0	0.0	151.4	2	64.3
			0		0.0	0.0		30.0	229.8	215.3	220.4	0.0
27	ACT ACT LOC FAT/BUC	Insid 1220	0.00 0.0	20 HPbulb	370 13.0	0 0.0	18690 11011	235.0 1.00	12.0 1.09	1.5 1.5	14.0	4000 784
			1018	19	11.5	Oil tst 5		160.0	0.0	143.5	2	60.8
			0		0.0	0.0		30.0	229.9	215.0	220.4	0.0
28	ACT ACT LOC FAT/BUC	Insid 1021	0.00 0.0	20 HPbulb	340 14.0	0 0.0	18690 12579	235.0 1.00	12.0 1.09	1.5 1.5	14.0	4000 783
			906	12	11.5	Oil tst 5		160.0	0.0	127.8	2	53.9
			0		0.0	0.0		52.1	228.7	214.8	224.5	0.0
29	ACT ACT LOC FAT/BUC	Insid 1021	0.00 0.0	20 HPbulb	340 14.0	0 0.0	18690 13363	235.0 1.00	12.0 1.09	1.5 1.5	14.0	4000 784
			850	20	11.5	Oil tst 5		160.0	0.0	119.9	2	50.4
			0		0.0	0.0		67.3	228.7	214.7	224.5	0.0
30	ACT ACT LOC FAT/BUC	Insid 1021	0.00 0.0	20 HPbulb	340 14.0	0 0.0	18690 14148	235.0 1.00	12.0 1.09	1.5 1.5	14.0	4000 784
			794	28	11.5	Oil tst 5		160.0	0.0	112.0	2	46.9
			0		0.0	0.0		82.5	228.7	214.5	224.5	0.0

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**Local Rule Requirements - Stiffeners (cont.)**

Stiff. No	ACT ACT	POS Za cm³	K c	Type Type	h t (mm)	bf tf (mm)	y z (mm)	SigF f <sub>1</sub> N/mm²	m wk	tkw tkf (mm)	tpl (mm)	span spac (mm)
LOC			Zr cm³	Exc. %	tmin (mm)	Load Ref.		Sigma N/mm²	Sigdb N/mm²	p kN/m²	Comp ref.	a_conn cm²
FAT/BUC			Zrf cm³	Exc. %	pd kN/m²	Sigd N/mm²		SigL N/mm²	Lat N/mm²	Torsion N/mm²	Web N/mm²	bf/tf
31	ACT	Insid	0.00	20	340	0	18690	235.0	12.0	1.5	14.0	4000
	ACT	1021	0.0	HPbulb	14.0	0.0	14932	1.00	1.09	1.5		784
	LOC		773	31	11.5	Oil slo e		152.7	0.0	104.1	2	43.4
	FAT/BUC		0		0.0	0.0		97.6	228.7	214.3	224.5	0.0
Similar for No(s): 32												
33	ACT	Insid	0.00	20	340	0	18690	235.0	12.0	1.5	17.0	4000
	ACT	1045	0.0	HPbulb	14.0	0.0	17316	1.00	1.09	1.5		816
	LOC		894	16	11.5	Oil slo e		118.5	0.0	89.8	2	34.0
	FAT/BUC		0		0.0	0.0		143.7	228.2	215.8	224.5	0.0
34	ACT	Insid	0.00	20	340	0	18690	235.0	12.0	1.5	17.0	4000
	ACT	1045	0.0	HPbulb	14.0	0.0	18132	1.00	1.09	1.5		815
	LOC		992	5	11.5	Oil slo e		106.8	0.0	89.8	2	32.9
	FAT/BUC		0		0.0	0.0		159.5	228.2	215.6	224.5	0.0
35	ACT	Insid	0.00	20	320	0	18690	355.0	12.0	1.5	17.0	4000
	ACT	842	0.0	HPbulb	12.0	0.0	18947	1.39	1.09	1.5		815
	LOC		579	45	10.7	Oil slo e		182.9	0.0	89.8	2	32.9
	FAT/BUC		0		0.0	0.0		175.3	336.5	307.3	324.9	0.0
36	ACT	Insid	0.00	20	320	0	18690	355.0	12.0	1.5	19.0	4000
	ACT	851	0.0	HPbulb	12.0	0.0	19763	1.39	1.09	1.5		816
	LOC		619	37	10.7	Oil slo e		171.2	0.0	89.8	2	32.9
	FAT/BUC		0		0.0	0.0		191.1	335.6	310.2	324.9	0.0
37	ACT	Insid	0.00	20	320	0	18690	355.0	12.0	1.5	19.0	4000
	ACT	851	0.0	HPbulb	12.0	0.0	20579	1.39	1.09	1.5		816
	LOC		664	28	10.7	Oil slo e		159.5	0.0	89.8	2	32.9
	FAT/BUC		0		0.0	0.0		206.8	335.6	309.9	324.9	0.0
38	ACT	Insid	0.00	20	320	0	18690	355.0	12.0	3.0	19.0	4000
	ACT	851	0.0	HPbulb	12.0	0.0	21395	1.39	1.18	3.0		817
	LOC		777	9	12.2	Oil slo e		147.8	0.0	89.8	2	32.9
	FAT/BUC		0		0.0	0.0		222.6	335.9	303.2	313.6	0.0
<b>Bottom girder 5810</b>												
1	ACT	DBGird	0.00	10	250	0	5810	355.0	10.0	1.5	15.0	4000
	ACT	306	0.0	Fbar	15.0	0.0	590	1.39	1.10	1.5		705
	LOC		85	258	14.0	WB slo s		222.4	0.0	15.3	1	6.2
	FAT/BUC		0		0.0	0.0		178.1	308.9	268.6	0.0	0.0
2	ACT	DBGird	0.00	10	250	0	5810	355.0	10.0	1.5	15.0	4000
	ACT	309	0.0	Fbar	15.0	0.0	1410	1.39	1.10	1.5		820
	LOC		99	211	14.0	WB slo s		222.4	0.0	15.3	1	7.1
	FAT/BUC		0		0.0	0.0		162.3	305.2	255.0	0.0	0.0
3	ACT	DBGird	0.00	10	250	0	5810	355.0	10.0	1.5	15.0	4000
	ACT	305	0.0	Fbar	15.0	0.0	2230	1.39	1.10	1.5		678
	LOC		82	271	14.0	WB slo s		222.4	0.0	15.3	1	6.0
	FAT/BUC		0		0.0	0.0		146.6	309.7	277.5	0.0	0.0
<b>Bottom girder 11620</b>												
1	ACT	DBGird	0.00	10	250	0	11620	355.0	10.0	1.5	15.0	4000
	ACT	306	0.0	Fbar	15.0	0.0	590	1.39	1.10	1.5		705
	LOC		85	258	14.0	WB slo s		222.4	0.0	15.3	1	6.2
	FAT/BUC		0		0.0	0.0		178.1	308.9	268.6	0.0	0.0
2	ACT	DBGird	0.00	10	250	0	11620	355.0	10.0	1.5	15.0	4000
	ACT	309	0.0	Fbar	15.0	0.0	1410	1.39	1.10	1.5		820
	LOC		99	211	14.0	WB slo s		222.4	0.0	15.3	1	7.1
	FAT/BUC		0		0.0	0.0		162.3	305.2	255.0	0.0	0.0
3	ACT	DBGird	0.00	10	250	0	11620	355.0	10.0	1.5	15.0	4000
	ACT	307	0.0	Fbar	15.0	0.0	2230	1.39	1.10	1.5		733
	LOC		88	245	14.0	WB slo s		222.4	0.0	15.3	1	6.4
	FAT/BUC		0		0.0	0.0		146.6	308.0	271.8	0.0	0.0

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### Local Rule Requirements - Stiffeners (cont.)

Stiff. No	ACT ACT	POS Za cm <sup>3</sup>	K c	Type Type	h t (mm)	bf tf (mm)	y z (mm)	SigF f <sub>1</sub> N/mm <sup>2</sup>	m wk	tkw tkf (mm)	tpl (mm)	span spac (mm)
	LOC		Zr cm <sup>3</sup>	Exc. %	tmin (mm)	Load Ref.		Sigma N/mm <sup>2</sup>	Sigdb N/mm <sup>2</sup>	p kN/m <sup>2</sup>	Comp ref.	a_conn cm <sup>2</sup>
	FAT/BUC		Zrf cm <sup>3</sup>	Exc. %	pd kN/m <sup>2</sup>	Sigd N/mm <sup>2</sup>		SigL N/mm <sup>2</sup>	Lat N/mm <sup>2</sup>	Torsion N/mm <sup>2</sup>	Web N/mm <sup>2</sup>	bf/tf

#### Bottom girder 16600

1	ACT	DBgird	0.00	10	250	0	16600	355.0	10.0	1.5	15.0	4000
	ACT	306	0.0	Fbar	15.0	0.0	590	1.39	1.10	1.5		705
	LOC		85	258	14.0	WB slo s		222.4	0.0	15.3	1	6.2
	FAT/BUC		0		0.0	0.0		178.1	308.9	268.6	0.0	0.0
2	ACT	DBgird	0.00	10	250	0	16600	355.0	10.0	1.5	15.0	4000
	ACT	309	0.0	Fbar	15.0	0.0	1410	1.39	1.10	1.5		820
	LOC		99	211	14.0	WB slo s		222.4	0.0	15.3	1	7.1
	FAT/BUC		0		0.0	0.0		162.3	305.2	255.0	0.0	0.0
3	ACT	DBgird	0.00	10	250	0	16600	355.0	10.0	1.5	15.0	4000
	ACT	308	0.0	Fbar	15.0	0.0	2230	1.39	1.10	1.5		780
	LOC		94	226	14.0	WB slo s		222.4	0.0	15.3	1	6.7
	FAT/BUC		0		0.0	0.0		146.6	306.5	266.2	0.0	0.0

#### Stringer 7092

1	ACT	Strng	0.00	10	200	0	20610	235.0	12.0	1.5	12.0	4000
	ACT	194	0.0	Fbar	15.0	0.0	7092	1.00	1.10	1.5		640
	LOC		89	117	11.5	WB slo s		160.0	0.0	15.3	1	5.6
	FAT/BUC		0		0.0	0.0		53.5	205.1	212.6	0.0	0.0

Similar for No(s): 2 3

#### Stringer 11796

1	ACT	Strng	0.00	10	200	0	20610	235.0	12.0	1.5	12.0	4000
	ACT	194	0.0	Fbar	15.0	0.0	11796	1.00	1.10	1.5		640
	LOC		89	117	11.5	WB slo s		160.0	0.0	15.3	1	5.6
	FAT/BUC		0		0.0	0.0		37.0	205.1	213.4	0.0	0.0

Similar for No(s): 2 3

#### Stringer 16500

1	ACT	Strng	0.00	10	150	0	20610	235.0	12.0	1.5	12.0	4000
	ACT	114	0.0	Fbar	15.0	0.0	16500	1.00	1.10	1.5		640
	LOC		89	27	9.0	WB slo s		160.0	0.0	15.3	1	5.6
	FAT/BUC		0		0.0	0.0		127.9	175.4	220.6	0.0	0.0

Similar for No(s): 2 3

## 2.- PESO DE ACERO DEL “BUQUE BASE”

Para el cálculo del peso de acero del “BUQUE BASE“, se ha obtenido toda la información necesaria del constructor del mismo (Astillero de Puerto Real). Este peso está desglosado en bloques y se detalla a continuación:

### CÁLCULO DEL PESO DE ACERO C / 83-85

#### \* PIQUE DE POPA \*

	BLOQUE	PESOS (KGRS)
PIQUE DE POPA	417	192442
PIQUE DE POPA	419	330144
PIQUE DE POPA	421	281130
	TIMON	39500

**\*\* PESO TOTAL PIQUE DE POPA \*\***

**843216**

NOTA: El TIMÓN se computa aparte porque en este caso es de tipo Becket

#### \* CÁMARA DE MÁQUINAS \*

	BLOQUES	PESOS (KGRS)
CÁMARA DE MÁQUINAS	401	176171
CÁMARA DE MÁQUINAS	402	176171
CÁMARA DE MÁQUINAS	403	112028
CÁMARA DE MÁQUINAS	404	112028
CÁMARA DE MÁQUINAS	405	107578
CÁMARA DE MÁQUINAS	406	107578
CÁMARA DE MÁQUINAS	407	96897
CÁMARA DE MÁQUINAS	409	138847
CÁMARA DE MÁQUINAS	411	84368
CÁMARA DE MÁQUINAS	412	84368
CÁMARA DE MÁQUINAS	413	70359
CÁMARA DE MÁQUINAS	414	68050
CÁMARA DE MÁQUINAS	415	55609
CÁMARA DE MÁQUINAS	423	27697
CÁMARA DE MÁQUINAS	425	108477
CÁMARA DE MÁQUINAS	427	96252
CÁMARA DE MÁQUINAS	428	98962
CÁMARA DE MÁQUINAS	431	88065
CÁMARA DE MÁQUINAS	433	92864



**\*\* PESO TOTAL CÁMARA MÁQUINAS \*\***
**1902369**
**\* CÁMARA DE BOMBAS \***

	BLOQUES	PESOS (KGRS)
CÁMARA BOMBAS	101	260033
CÁMARA BOMBAS	121	183793
CÁMARA BOMBAS	122	183793
CÁMARA BOMBAS	145	118394
CASETA CÁMARA BOMBAS	913	11384

**\*\* PESO TOTAL CÁMARA BOMBAS \*\***
**757397**
**\* FONDO CENTRAL \***

	BLOQUE	PESOS (KGRS)
FONDO CENTRAL	103	122130
FONDO CENTRAL	104	153818
FONDO CENTRAL	105	128870
FONDO CENTRAL	106	165006
FONDO CENTRAL	107	132366
FONDO CENTRAL	108	161647
FONDO CENTRAL	109	125254
FONDO CENTRAL	110	160007
FONDO CENTRAL	111	127956
FONDO CENTRAL	112	160046
FONDO CENTRAL	113	124236
FONDO CENTRAL	114	157805
FONDO CENTRAL	115	126264
FONDO CENTRAL	116	162114
FONDO CENTRAL	117	132625
FONDO CENTRAL	118	166620
FONDO CENTRAL	119	117173
FONDO CENTRAL	120	148173

**\*\* PESO TOTAL FONDO CENTRAL \*\***
**2572110**
**\* FONDO LATERAL \***

	BLOQUES	PESOS (KGRS)
FONDO LATERAL	123	153061
FONDO LATERAL	124	153061
FONDO LATERAL	125	146413



FONDO LATERAL	126	146413
FONDO LATERAL	127	163319
FONDO LATERAL	128	163319
FONDO LATERAL	129	159076
FONDO LATERAL	130	159076
FONDO LATERAL	131	162574
FONDO LATERAL	132	162574
FONDO LATERAL	133	158574
FONDO LATERAL	134	158574
FONDO LATERAL	135	167271
FONDO LATERAL	136	167271
FONDO LATERAL	137	153721
FONDO LATERAL	138	153721
FONDO LATERAL	139	136412
FONDO LATERAL	140	136412

**\*\* PESO TOTAL FONDO LATERAL \*\***
**2800842**
**\* TANQUES LATERALES DE ZONA CENTRAL \***

	BLOQUE	PESOS (KGRS)
TANQUES LATERALES	601	104905
TANQUES LATERALES	602	104905
TANQUES LATERALES	603	101206
TANQUES LATERALES	604	101206
TANQUES LATERALES	605	101894
TANQUES LATERALES	606	101894
TANQUES LATERALES	607	101744
TANQUES LATERALES	608	101744
TANQUES LATERALES	609	100941
TANQUES LATERALES	610	100941
TANQUES LATERALES	611	101506
TANQUES LATERALES	612	101506
TANQUES LATERALES	613	100512
TANQUES LATERALES	614	100512
TANQUES LATERALES	615	107872
TANQUES LATERALES	616	107872
TANQUES LATERALES	617	104143
TANQUES LATERALES	618	104143
TANQUES LATERALES	619	105162
TANQUES LATERALES	620	105162

**\*\* PESO TOTAL TANQUES LATERALES \*\***
**2059770**

**\* MAMPARO TRANSVERSAL \***

	<b>BLOQUES</b>	<b>PESOS (KGRS)</b>
MAMPARO TRANSVERSAL	201	48349
MAMPARO TRANSVERSAL	202	48349
MAMPARO TRANSVERSAL	203	58456
MAMPARO TRANSVERSAL	205	120728
MAMPARO TRANSVERSAL	207	129614
MAMPARO TRANSVERSAL	209	125485
MAMPARO TRANSVERSAL	211	126974
MAMPARO TRANSVERSAL	213	129173
MAMPARO TRANSVERSAL	215	122004
MAMPARO TRANSVERSAL	217	126230
MAMPARO TRANSVERSAL	219	129637
MAMPARO TRANSVERSAL	221	48983
MAMPARO TRANSVERSAL	223	115980
MAMPARO TRANSVERSAL	225	66574
MAMPARO TRANSVERSAL	226	80484
MAMPARO TRANSVERSAL	227	83927
MAMPARO TRANSVERSAL	228	97835
MAMPARO TRANSVERSAL	229	83927
MAMPARO TRANSVERSAL	230	99877
MAMPARO TRANSVERSAL	231	83927
MAMPARO TRANSVERSAL	232	97835
MAMPARO TRANSVERSAL	233	83927
MAMPARO TRANSVERSAL	234	97835
MAMPARO TRANSVERSAL	235	83927
MAMPARO TRANSVERSAL	236	97835

**\*\* PESO TOTAL MPR. TRANSVERSAL \*\***

**2387872**

**\* CUBIERTA CENTRAL \***

	<b>BLOQUES</b>	<b>PESOS (KGRS)</b>
CUBIERTA CENTRAL	701	89706
CUBIERTA CENTRAL	702	63217
CUBIERTA CENTRAL	703	73809
CUBIERTA CENTRAL	704	73809
CUBIERTA CENTRAL	705	101436
CUBIERTA CENTRAL	706	87722
CUBIERTA CENTRAL	707	91613
CUBIERTA CENTRAL	708	74174
CUBIERTA CENTRAL	709	110008
CUBIERTA CENTRAL	710	90237
CUBIERTA CENTRAL	711	112347
CUBIERTA CENTRAL	712	98887

CUBIERTA CENTRAL	713	112849
CUBIERTA CENTRAL	714	93044
CUBIERTA CENTRAL	715	101585
CUBIERTA CENTRAL	716	84326
CUBIERTA CENTRAL	717	124491
CUBIERTA CENTRAL	718	107393
CUBIERTA CENTRAL	719	101761
CUBIERTA CENTRAL	720	84618
CUBIERTA CENTRAL	721	112878
CUBIERTA CENTRAL	722	93850
CUBIERTA CENTRAL	723	101771
CUBIERTA CENTRAL	724	84420
CUBIERTA CENTRAL	725	122561
CUBIERTA CENTRAL	726	105265
CUBIERTA CENTRAL	727	100905
CUBIERTA CENTRAL	728	84312
CUBIERTA CENTRAL	729	113208
CUBIERTA CENTRAL	730	93088
CUBIERTA CENTRAL	731	114717
CUBIERTA CENTRAL	732	101146
CUBIERTA CENTRAL	733	107634
CUBIE RTA CENTRAL	734	89767
CUBIERTA CENTRAL	735	94077
CUBIERTA CENTRAL	736	77723
CUBIERTA CENTRAL	737	114618
CUBIERTA CENTRAL	738	100107
CUBIERTA CENTRAL	739	87223
CUBIERTA CENTRAL	740	70702
CUBIERTA CENTRAL	741	76251
CUBIERTA CENTRAL	742	64266

**\*\* PESO TOTAL CUBIERTA CENTRAL \*\***

**3987521**

**\* PIQUE DE PROA \***

	BLOQUE	PESOS (KGRS)
PIQUE DE PROA	501	267170
PIQUE DE PROA	502	56199
PIQUE DE PROA	503	91234
PIQUE DE PROA	504	91234
PIQUE DE PROA	505	214710
PIQUE DE PROA	507	68609
PIQUE DE PROA	508	68609
PIQUE DE PROA	509	76756
PIQUE DE PROA	510	76756
PIQUE DE PROA	511	83035
PIQUE DE PROA	512	83035

PIQUE DE PROA	513	101532
PIQUE DE PROA	515	157852
PIQUE DE PROA	517	47990
PIQUE DE PROA	518	47990
PIQUE DE PROA	519	113596
PIQUE DE PROA	521	104543
PIQUE DE PROA	523	69789
PIQUE DE PROA	524	69789
PIQUE DE PROA	525	74997
PIQUE DE PROA	526	72614
PIQUE DE PROA	527	97354
PIQUE DE PROA	531	127938
PIQUE DE PROA	533	69830

**\*\* PESO TOTAL PIQUE DE PROA \*\***

**2333161**

**\* SUPERESTRUCTURA \***

	BLOQUE	PESOS (KGRS)
CBT. " A "	910	66538
CBT. BOTES " BR "	911	16238
CBT. BOTES " ER "	912	21731
CBT. " B "	920	60283
CBT. " C "	930	57959
CBT. " D "	940	54229
CBT. PTE. NAVEG.	950	65784
CBT. TECHO. PTE. NAVEG.	960	52134
ALERÓN	961	22835
ALERÓN	962	22835
CASETA S/TECHO PUENTE	970	14164
TRONCO DE CABLES	980	14874
CHIMENEA " ER "	498	39542
CHIMENEA " BR "	499	39542
GUARDACALOR	799	146173
CASETA HELIPUERTO	749	8376
VARIOS	747	4120
VARIOS	748	4120

**\*\* PESO TOTAL SUPERESTRUCTURA \*\***

**711477**

**\*\*\* PESO TOTAL DE ACERO \*\*\***

**20355735**

**3.-** A continuación se muestran los siguientes datos (input) y resultados (output) del programa “NAUTICUS HULL” para las dos aproximaciones realizadas del proceso de escantillonado atendiendo a los criterios de rediseño expuestos en la Memoria:

- Distribución, tipo, dimensiones y acero empleado para refuerzos longitudinales. Ver hojas 3 a 5.
- Referencias a la reglamentación. Ver hoja 6
- Datos de entrada necesarios para el programa. Ver hoja 7.
- Espaciado entre cuadernas. Ver hoja 8.
- Geometría de planchas. Ver hoja 9.
- Cálculo del área de la cuaderna maestra. Ver hojas 11 a 16.
- Momentos flectores. Ver hoja 17.
- Módulo resistente. Ver hojas 18 y 19.
- Resistencia local y pandeo para planchas y refuerzos. Ver hojas 22 a 33.

# **1º APROXIMACION**



**3.1.-** A continuación se muestran los siguientes datos (input) y resultados (output) del programa “NAUTICUS HULL” para una primera aproximación.

- Distribución, tipo, dimensiones y acero empleado para refuerzos longitudinales. Ver hojas 3 a 5.
- Referencias a la reglamentación. Ver hoja 6
- Datos de entrada necesarios para el programa. Ver hoja 7.
- Espaciado entre cuadernas. Ver hoja 8.
- Geometría de planchas. Ver hoja 9.
- Cálculo del área de la cuaderna maestra. Ver hojas 11 a 16.
- Momentos flectores. Ver hoja 17.
- Módulo resistente. Ver hojas 18 y 19.
- Resistencia local y pandeo para planchas y refuerzos. Ver hojas 22 a 33.



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## SECTION SCANTLINGS

### Hull Section Scantlings according to DNV Rules

Rule edition ..... : Jan 1998  
 Program version ..... : 3.3-372-980619

#### Ship Identification SHUTTLE TANKER 145000 M3

ID No ..... : Aprox. 1  
 Date/Sign ..... :  
 CUADERNA MAESTRA REDISEÑADA CON ACERO DULCE

#### Cross Section Identification CUADERNA MAESTRA

Midship section ..... : Yes  
 Distance from AP ..... (m) : 128.250  
 Date/Sign ..... :  
 CUADERNA MAESTRA REALIZADA CON ACERO DULCE

Database: C:\NautHull\SHIPS\Proyec1\SectSca\proyec1.pw

#### Main Dimensions

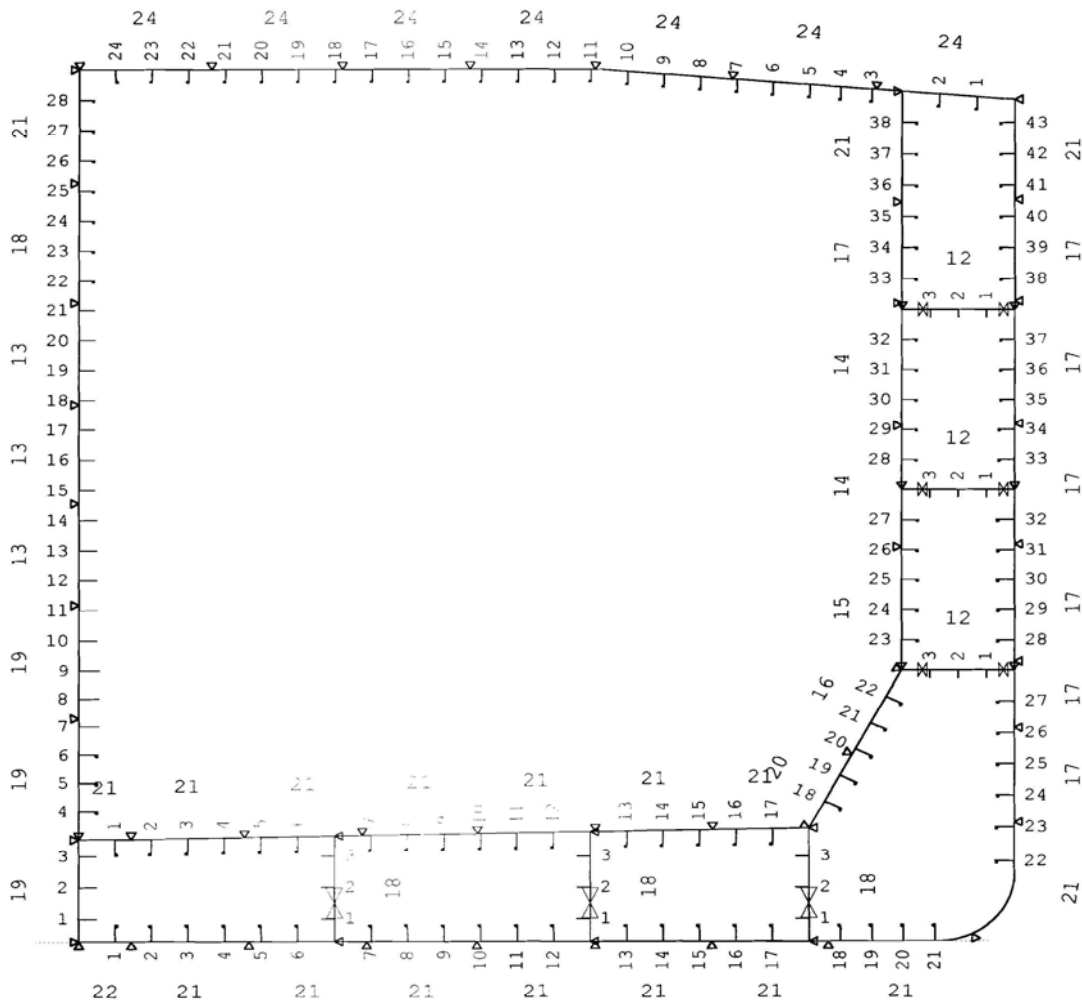
Length betw. perpendiculars, Lbp .....	(m) :	256.500
Rule length, L .....	(m) :	252.690
Breadth moulded, B .....	(m) :	42.500
Depth moulded, D .....	(m) :	22.000
Draught moulded, T .....	(m) :	15.500
Block coefficient, C <sub>b</sub> .....	:	0.879
Min. design draught at AP .....	(m) :	0.000
Min. design draught at FP .....	(m) :	0.000

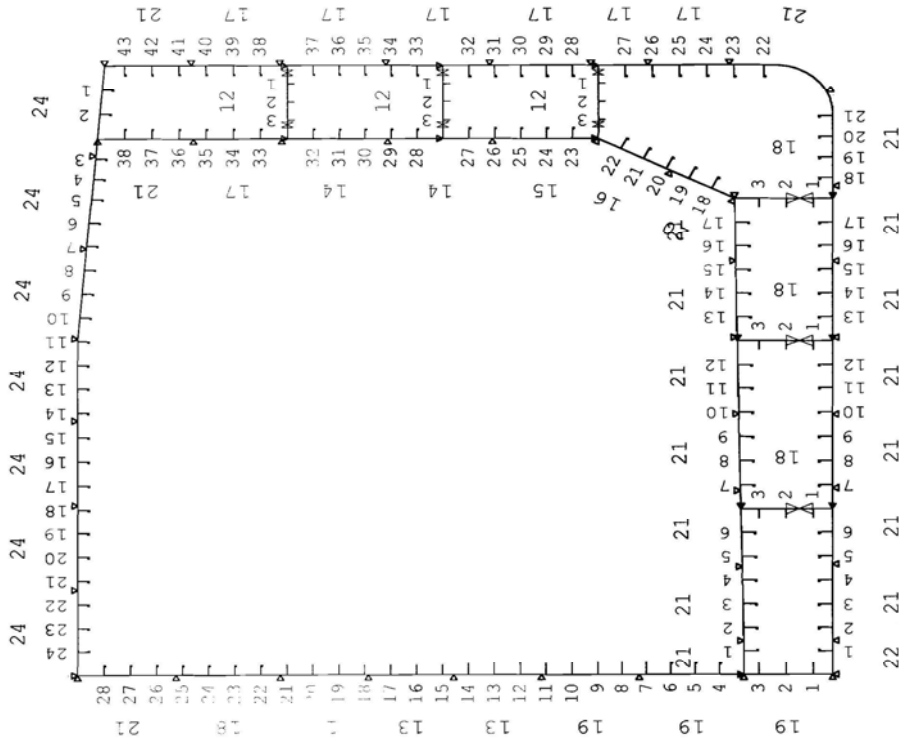
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Section Scantlings - v.3.3-372-980619  
 SHUTTLE TANKER 145000 M3  
 CUADERNA MAESTRA

Ship Id No : Aprox. 1





Scale:  
 1:200

SHUTTLE TANKER 145000 M3  
 Date/Sign : 00-02-16  
 Main dim. : Lpp=256.5 B=42.5 T=15.5 D=22 CB=0.879

Nauticus Hull  
 Section Scantlings

Section Scantlings - v.3.3-372-980619  
SHUTTLE TANKER 145000 M3  
CUADERNA MAESTRA

Ship Id No : Aprox. 1

### Profiles

Nos	Type	Dimensions	Steel
<b>Outer Shell</b>			
1 - 17	HPbulb	430 x 17	
18 - 23	HPbulb	430 x 15	
24 - 30	HPbulb	400 x 16	
31 - 32	HPbulb	400 x 14	
33 - 34	HPbulb	370 x 13	
35 - 40	HPbulb	340 x 14	
41 - 24	HPbulb	340 x 12	
<b>Inner Bottom &amp; Inner Side</b>			
1 - 20	HPbulb	430 x 15	
21 - 22	HPbulb	400 x 14	
23 - 27	HPbulb	370 x 13	
28 - 38	HPbulb	340 x 12	
<b>CL Bulkhead</b>			
1 - 3	Fbar	400 x 25	
4 - 6	HPbulb	430 x 15	
7 - 9	Fbar	450 x 25	
10 - 14	Fbar	400 x 25	
15 - 21	Fbar	350 x 25	
22 - 28	HPbulb	340 x 12	
<b>Stringer 7092</b>			
1 - 3	Fbar	200 x 15	
<b>Stringer 11796</b>			
1 - 3	Fbar	200 x 15	
<b>Stringer 16500</b>			
1 - 3	Fbar	200 x 15	
<b>Bottom girder 5810</b>			
1 - 3	Fbar	300 x 20	
<b>Bottom girder 11620</b>			
1 - 3	Fbar	300 x 20	
<b>Bottom girder 16600</b>			
1 - 3	Fbar	300 x 20	



Section Scantlings - v.3.3-372-980619  
 SHUTTLE TANKER 145000 M3  
 CUADERNA MAESTRA

Ship Id No : Aprox. 1

## 1 Rule Reference

DET NORSE VERITAS' Rules for Classification of Ships, January 1998.  
 Ships with length 100 metres and above.

STRENGTH ITEM	REFERENCE TO DNV RULES
<b>HULL GIRDER STRENGTH</b>	
- Design bending moments	Jan 1998 Pt.3 Ch.1 Sec.5 B 102-202
- Bending strength	Jan 1998 Pt.3 Ch.1 Sec.5 C
<b>PLATES</b>	
- Bottom and inner bottom	Jan 1998 Pt.3 Ch.1 Sec.6 C 100-503
- Side	Jan 1998 Pt.3 Ch.1 Sec.7 C 100-104
- Deck	Jan 1998 Pt.3 Ch.1 Sec.8 C 100-202
- Bulkheads	Jan 1998 Pt.3 Ch.1 Sec.9 C 100-105
- Wheel loaded decks	Jan 1998 Pt.5 Ch.2 Sec.4 C 200-302
- Bulk cargo (HC-Class)	Jan 1998 Pt.5 Ch.2 Sec.5 B, C300-304,D200-202
- Container carriers	Jan 1998 Pt.5 Ch.2 Sec.6 B & C
- IB(+) Notation	Jan 1998 Pt.3 Ch.1 Sec.6 H 302
- Buckling strength	Jan 1998 Pt.3 Ch.1 Sec.14 B 100, 201, 205, 206
<b>STIFFENERS</b>	
- Bottom and inner bottom	Jan 1998 Pt.3 Ch.1 Sec.6 C 700-901
- Side	Jan 1998 Pt.3 Ch.1 Sec.7 C 300-304, E 501
- Main frames in general	Jan 1998 Pt.3 Ch.1 Sec.7 C 400-404
For bulkcarriers, L>150 m	Jan 1998 Pt.5 Ch.2 Sec.10 B (IACS UR S12)
- Deck	Jan 1998 Pt.3 Ch.1 Sec.8 C 300-303
- Bulkheads	Jan 1998 Pt.3 Ch.1 Sec.9 C 200-204
- Wheel loaded decks	Jan 1998 Pt.5 Ch.2 Sec.4 C 200-202, 401
- Bulk cargo (HC-Class)	Jan 1998 Pt.5 Ch.2 Sec.5 B, C300-302, 305-306
- Container carriers	Jan 1998 Pt.5 Ch.2 Sec.6 B & C
- Buckling strength	Jan 1998 Pt.3 Ch.1 Sec.14 C 100-202, 300-402
- Connection area at supp.	Jan 1998 Pt.3 Ch.1 Sec.12 C 402 (C=1.25)

Current Rule booklets:  
 Pt.3 Ch.1: January 1998  
 Pt.3 Ch.2: January 1998  
 Pt.5 Ch.2: January 1998

The January 1998 Rules come into force on July 1, 1998.

**NOTE: THE FOLLOWING REQUIREMENTS ARE NOT INCLUDED:**

- Floors and brackets
- Ice strengthening of hull
- Slamming and bow impact
- Tugs, Supply vessels and other offshore/harbour vessels
- Class notation ICM (Increased corrosion margins)

Section Scantlings - v.3.3-372-980619  
 SHUTTLE TANKER 145000 M3  
 CUADERNA MAESTRA

Ship Id No : Aprox. 1

## 2 Input Data

### Main Dimensions

Length betw. perpendiculars, Lbp .....	(m) :	256.500
Rule length, L .....	(m) :	252.690
Breadth moulded, B .....	(m) :	42.500
Depth moulded, D .....	(m) :	22.000
Draught moulded, T .....	(m) :	15.500
Block coefficient, Cb .....	:	0.879
Min. design draught at AP .....	(m) :	0.000
Min. design draught at FP .....	(m) :	0.000

### General Ship Data

Maximum service speed, V .....	(knots) :	14.500
Bilge keel? .....	:	Yes
Active roll damping facility? .....	:	No
Period of roll, Tr .....	(s) :	0.000
Metacentric height, GM .....	(m) :	0.000
Homogeneous stowage rate, roDC .....	(t/m3) :	0.000
No of decks above 0.7D from baseline .....	:	1
Height from base to top of ship side .....	(mm) :	22000
Areas forward of 0.2L from FP:		
- Projected area of the upper deck .....	(m2) :	0.000
- Area of the waterplane .....	(m2) :	0.000
Height from base to deck line at FP .....	(mm) :	0
Speed/flare factor, Caf .....	:	0.000

### Continuous Strength Members above Strength Deck

None

### Class notations

Tanker for Oil

### Hull Section Material (Strength group & yield point (N/mm2))

Location	Amidships		Current cross-sect.	
	Group	Yield	Group	Yield
- Bottom .....	NV-NS	235	NV-NS	235
- Deck .....	NV-NS	235	NV-NS	235
- Between bottom and deck .....	NV-NS	235	NV-NS	235

### Transverse Bulkhead Positions (Frame No)

Aft peak bulkhead .....	:Not given.
Engine room bulkhead .....	:Not given.
Fore peak bulkhead .....	:Not given.

### Specified Bending Moments

(Based on actual cargo/ballast conditions)  
 Considered cross-section: 128.250 m from AP.  
 Utilization factor for the Rule still water bending moments:

	Amidships		Current cross-sect.	
	(kNm)			
- Sagging: 1.00				
- Hogging: 1.00				
Specified bending moments:				
- Still water, sagging .....	(kNm) :	3992670		0
- Still water, hogging .....	(kNm) :	4100580		0
- Wave, sagging .....	(kNm) :	0		0
- Wave, hogging .....	(kNm) :	0		0
- Wave, horizontal .....	(kNm) :	2775289		0

**Spacing between Transverse Frames**

(Where the frame spacing changes along the ship)

Position of frame 0: 0 mm forward of A.P.

Frame Nos where the spacing changes:

Frame No	Spacing forward (mm)
Stern	700
14	960
39	3200
43	3200
44	4000
94	700

Section Scantlings - v.3.3-372-980619  
SHUTTLE TANKER 145000 M3  
CUADERNA MAESTRA

Ship Id No

Aprox. 1

### 3 Panel Geometry

Node No	y (mm)	z (mm)	Radius (mm)	Position
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#### Outer Shell

0	0	0		
5810	0	0		Bottom
11620	0	0		Bottom
16600	0	0		Bottom
19500	0	0		Bottom
21250	1750	1750	1750	Bilge
21250	7092	7092		Side
21250	11796	11796		Side
21250	16500	16500		Side
21250	22000	22000		Side
18690	22214	22214		Strength deck
11700	22800	22800		Strength deck
0	22800	22800		Strength deck

#### Inner Bottom & Inner Side

0	2680	2680		
1200	2680	2680		Inner bottom
5810	2767	2767		Inner bottom
11620	2876	2876		Inner bottom
16600	2970	2970		Inner bottom
18690	7092	7092		Hopper tank top
18690	11796	11796		Inner side
18690	16500	16500		Inner side
18690	22214	22214		Inner side

#### CL Bulkhead

0	0	0		
0	2680	2680		Longitudinal bulkhead
0	22800	22800		Longitudinal bulkhead

#### Stringer 7092

21250	7092	7092		
18690	7092	7092		Side - Stringer

#### Stringer 11796

21250	11796	11796		
18690	11796	11796		Side - Stringer

#### Stringer 16500

21250	16500	16500		
18690	16500	16500		Side - Stringer

#### Bottom girder 5810

5810	0	0		
5810	2767	2767		Bottom - Long. girder

#### Bottom girder 11620

11620	0	0		
11620	2876	2876		Bottom - Long. girder

#### Bottom girder 16600

16600	0	0		
16600	2970	2970		Bottom - Long. girder

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#### 4 Node Co-ordinates

Node No	y (mm)	z (mm)
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16600	0
11620	2876
11620	0
5810	2767
5810	0
18690	16500
21250	16500
18690	11796
21250	11796
21250	7092
1200	2680
18690	22214
18690	7092
16600	2970
0	2680
21250	22000
11700	22800
0	22800
21250	1750
19500	0
0	0

## 5 Layout of Plates and Profiles

Plate		Y <sub>1</sub> (mm)	Z <sub>1</sub> (mm)	Y <sub>2</sub> (mm)	Z <sub>2</sub> (mm)		B (mm)	BCUT (mm)	T (mm)	Steel	Area cm <sup>2</sup>
Stiff	No	Y	Z	Y <sub>CG</sub>	Z <sub>CG</sub>	Typ	H	BF	T	TF (mm)	Area
<b>Outer Shell (Bending efficiency: 100%)</b>											
PL	1	0	0	1200	0		1200	0	22.0	std	264.00
PL	2	1200	0	3870	0		2670	0	21.0	std	560.70
PL	3	3870	0	6540	0		2670	0	21.0	std	560.70
PL	4	6540	0	9045	0		2505	0	21.0	std	526.05
PL	5	9045	0	11735	0		2690	0	21.0	std	564.90
PL	6	11735	0	14385	0		2650	0	21.0	std	556.50
PL	7	14385	0	17035	0		2650	0	21.0	std	556.50
PL	8	17035	0	20299	193		3295	0	21.0	std	691.95
PL	9	20299	193	21250	3126		3295	0	21.0	std	691.95
PL	10	21250	3126	21250	5586		2460	0	17.0	std	418.20
PL	11	21250	5586	21250	7317		1731	0	17.0	std	294.27
PL	12	21250	7317	21250	10378		3061	0	17.0	std	520.37
PL	13	21250	10378	21250	13514		3136	0	17.0	std	533.12
PL	14	21250	13514	21250	16725		3211	0	17.0	std	545.87
PL	15	21250	16725	21250	19391		2666	0	17.0	std	453.22
PL	16	21250	19391	21250	21999		2608	0	21.0	std	547.87
PL	17	21250	21999	18100	22263		3161	0	24.0	std	758.64
PL	18	18100	22263	14841	22536		3270	0	24.0	std	784.80
PL	19	14841	22536	11707	22799		3145	0	24.0	std	754.80
PL	20	11707	22799	8867	22800		2840	0	24.0	std	681.60
PL	21	8867	22800	5967	22800		2900	0	24.0	std	696.00
PL	22	5967	22800	3007	22800		2960	0	24.0	std	710.40
PL	23	3007	22800	0	22800		3007	0	24.0	std	721.79
ST	1	830	0	840	269	20	430	0	17.0	0.0	102.78
ST	2	1660	0	1650	269	20	430	0	17.0	0.0	102.78
ST	3	2490	0	2480	269	20	430	0	17.0	0.0	102.78
ST	4	3320	0	3310	269	20	430	0	17.0	0.0	102.78
ST	5	4150	0	4140	269	20	430	0	17.0	0.0	102.78
ST	6	4980	0	4970	269	20	430	0	17.0	0.0	102.78
ST	7	6640	0	6630	269	20	430	0	17.0	0.0	102.78
ST	8	7470	0	7460	269	20	430	0	17.0	0.0	102.78
ST	9	8300	0	8290	269	20	430	0	17.0	0.0	102.78
ST	10	9130	0	9120	269	20	430	0	17.0	0.0	102.78
ST	11	9960	0	9950	269	20	430	0	17.0	0.0	102.78
ST	12	10790	0	10780	269	20	430	0	17.0	0.0	102.78
ST	13	12450	0	12440	269	20	430	0	17.0	0.0	102.78
ST	14	13280	0	13270	269	20	430	0	17.0	0.0	102.78
ST	15	14110	0	14100	269	20	430	0	17.0	0.0	102.78
ST	16	14940	0	14930	269	20	430	0	17.0	0.0	102.78
ST	17	15770	0	15760	269	20	430	0	17.0	0.0	102.78
ST	18	17313	0	17303	274	20	430	0	15.0	0.0	94.18
ST	19	18026	0	18016	274	20	430	0	15.0	0.0	94.18
ST	20	18739	0	18729	274	20	430	0	15.0	0.0	94.18
ST	21	19452	0	19442	274	20	430	0	15.0	0.0	94.18
ST	22	21250	2094	20976	2084	20	430	0	15.0	0.0	94.18
ST	23	21250	2994	20976	2984	20	430	0	15.0	0.0	94.18
ST	24	21250	3814	21000	3805	20	400	0	16.0	0.0	89.48
ST	25	21250	4634	21000	4625	20	400	0	16.0	0.0	89.48
ST	26	21250	5454	21000	5445	20	400	0	16.0	0.0	89.48
ST	27	21250	6274	21000	6265	20	400	0	16.0	0.0	89.48
ST	28	21250	7876	21000	7867	20	400	0	16.0	0.0	89.48
ST	29	21250	8660	21000	8651	20	400	0	16.0	0.0	89.48
ST	30	21250	9444	21000	9435	20	400	0	16.0	0.0	89.48
ST	31	21250	10228	20996	10219	20	400	0	14.0	0.0	81.48
ST	32	21250	11012	20996	11003	20	400	0	14.0	0.0	81.48
ST	33	21250	12580	21015	12572	20	370	0	13.0	0.0	69.70
ST	34	21250	13364	21015	13356	20	370	0	13.0	0.0	69.70
ST	35	21250	14148	21039	14141	20	340	0	14.0	0.0	65.64
ST	36	21250	14932	21039	14925	20	340	0	14.0	0.0	65.64
ST	37	21250	15716	21039	15709	20	340	0	14.0	0.0	65.64
ST	38	21250	17316	21039	17309	20	340	0	14.0	0.0	65.64
ST	39	21250	18132	21039	18125	20	340	0	14.0	0.0	65.64
ST	40	21250	18948	21039	18941	20	340	0	14.0	0.0	65.64
ST	41	21250	19764	21035	19756	20	340	0	12.0	0.0	58.84
ST	42	21250	20580	21035	20572	20	340	0	12.0	0.0	58.84
ST	43	21250	21396	21035	21388	20	340	0	12.0	0.0	58.84
ST	1	20395	22071	20387	21856	20	340	0	12.0	0.0	58.84
ST	2	19540	22143	19532	21928	20	340	0	12.0	0.0	58.84
ST	3	18000	22272	17992	22057	20	340	0	12.0	0.0	58.84
ST	4	17300	22330	17292	22115	20	340	0	12.0	0.0	58.84
ST	5	16600	22389	16592	22174	20	340	0	12.0	0.0	58.84
ST	6	15770	22459	15762	22244	20	340	0	12.0	0.0	58.84
ST	7	14940	22528	14932	22313	20	340	0	12.0	0.0	58.84



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**Layout of Plates and Profiles (cont.)**

Plate	No	Y <sub>1</sub> (mm) Y	Z <sub>1</sub> (mm) Z	Y <sub>2</sub> (mm) Y <sub>CG</sub>	Z <sub>2</sub> (mm) Z <sub>CG</sub>	— Typ	B (mm) H	BCUT (mm) BF	T (mm) T	Steel TF (mm)	Area cm <sup>2</sup> Area
ST	8	14110	22598	14102	22383	20	340	0	12.0	0.0	58.84
ST	9	13280	22667	13272	22452	20	340	0	12.0	0.0	58.84
ST	10	12450	22737	12442	22522	20	340	0	12.0	0.0	58.84
ST	11	11620	22800	11612	22585	20	340	0	12.0	0.0	58.84
ST	12	10790	22800	10782	22585	20	340	0	12.0	0.0	58.84
ST	13	9960	22800	9952	22585	20	340	0	12.0	0.0	58.84
ST	14	9130	22800	9122	22585	20	340	0	12.0	0.0	58.84
ST	15	8300	22800	8292	22585	20	340	0	12.0	0.0	58.84
ST	16	7470	22800	7462	22585	20	340	0	12.0	0.0	58.84
ST	17	6640	22800	6632	22585	20	340	0	12.0	0.0	58.84
ST	18	5810	22800	5802	22585	20	340	0	12.0	0.0	58.84
ST	19	4980	22800	4972	22585	20	340	0	12.0	0.0	58.84
ST	20	4150	22800	4142	22585	20	340	0	12.0	0.0	58.84
ST	21	3320	22800	3312	22585	20	340	0	12.0	0.0	58.84
ST	22	2490	22800	2482	22585	20	340	0	12.0	0.0	58.84
ST	23	1660	22800	1652	22585	20	340	0	12.0	0.0	58.84
ST	24	830	22800	838	22585	20	340	0	12.0	0.0	58.84

**Inner Bottom & Inner Side (Bending efficiency: 100%)**

PL	1	0	2680	1200	2680		1200	0	21.0	std	252.00
PL	2	1200	2680	3777	2728		2578	0	21.0	std	541.38
PL	3	3777	2728	6447	2778		2670	0	21.0	std	560.70
PL	4	6447	2778	9066	2828		2620	0	21.0	std	550.20
PL	5	9066	2828	11736	2878		2670	0	21.0	std	560.70
PL	6	11736	2878	14405	2928		2670	0	21.0	std	560.70
PL	7	14405	2928	16600	2970		2195	0	21.0	std	460.95
PL	8	16600	2970	17565	4874		2135	0	20.0	std	427.00
PL	9	17565	4874	18683	7079		2472	0	16.0	std	395.52
PL	10	18683	7079	18690	10301		3223	0	15.0	std	483.60
PL	11	18690	10301	18690	13465		3163	0	14.0	std	442.96
PL	12	18690	13465	18690	16668		3202	0	14.0	std	448.42
PL	13	18690	16668	18690	19328		2659	0	17.0	std	452.20
PL	14	18690	19328	18690	22214		2885	0	21.0	std	606.01
ST	1	830	2680	840	2406	20	430	0	15.0	0.0	94.18
ST	2	1659	2688	1649	2414	20	430	0	15.0	0.0	94.18
ST	3	2489	2704	2479	2430	20	430	0	15.0	0.0	94.18
ST	4	3319	2719	3309	2445	20	430	0	15.0	0.0	94.18
ST	5	4149	2735	4139	2461	20	430	0	15.0	0.0	94.18
ST	6	4979	2751	4969	2477	20	430	0	15.0	0.0	94.18
ST	7	6639	2782	6629	2508	20	430	0	15.0	0.0	94.18
ST	8	7469	2798	7459	2524	20	430	0	15.0	0.0	94.18
ST	9	8299	2813	8289	2539	20	430	0	15.0	0.0	94.18
ST	10	9129	2829	9119	2555	20	430	0	15.0	0.0	94.18
ST	11	9959	2844	9949	2570	20	430	0	15.0	0.0	94.18
ST	12	10789	2860	10779	2586	20	430	0	15.0	0.0	94.18
ST	13	12449	2891	12439	2617	20	430	0	15.0	0.0	94.18
ST	14	13279	2907	13269	2633	20	430	0	15.0	0.0	94.18
ST	15	14109	2923	14099	2649	20	430	0	15.0	0.0	94.18
ST	16	14939	2938	14929	2664	20	430	0	15.0	0.0	94.18
ST	17	15769	2954	15759	2680	20	430	0	15.0	0.0	94.18
ST	18	16947	3654	17186	3521	20	430	0	15.0	0.0	94.18
ST	19	17294	4339	17533	4206	20	430	0	15.0	0.0	94.18
ST	20	17641	5024	17880	4891	20	430	0	15.0	0.0	94.18
ST	21	17989	5709	18211	5585	20	400	0	14.0	0.0	81.48
ST	22	18336	6394	18558	6270	20	400	0	14.0	0.0	81.48
ST	23	18690	7875	18925	7867	20	370	0	13.0	0.0	69.70
ST	24	18690	8659	18925	8651	20	370	0	13.0	0.0	69.70
ST	25	18690	9443	18925	9435	20	370	0	13.0	0.0	69.70
ST	26	18690	10227	18925	10219	20	370	0	13.0	0.0	69.70
ST	27	18690	11011	18925	11003	20	370	0	13.0	0.0	69.70
ST	28	18690	12579	18905	12571	20	340	0	12.0	0.0	58.84
ST	29	18690	13363	18905	13355	20	340	0	12.0	0.0	58.84
ST	30	18690	14148	18905	14140	20	340	0	12.0	0.0	58.84
ST	31	18690	14932	18905	14924	20	340	0	12.0	0.0	58.84
ST	32	18690	15716	18905	15708	20	340	0	12.0	0.0	58.84
ST	33	18690	17316	18905	17308	20	340	0	12.0	0.0	58.84
ST	34	18690	18132	18905	18124	20	340	0	12.0	0.0	58.84
ST	35	18690	18947	18905	18939	20	340	0	12.0	0.0	58.84
ST	36	18690	19763	18905	19755	20	340	0	12.0	0.0	58.84
ST	37	18690	20579	18905	20571	20	340	0	12.0	0.0	58.84
ST	38	18690	21395	18905	21387	20	340	0	12.0	0.0	58.84

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**Layout of Plates and Profiles (cont.)**

Plate		Y <sub>1</sub> (mm)	Z <sub>1</sub> (mm)	Y <sub>2</sub> (mm)	Z <sub>2</sub> (mm)	—	B (mm)	BCUT (mm)	T (mm)	Steel	Area cm <sup>2</sup>
Stiff	No	Y	Z	Y <sub>CG</sub>	Z <sub>CG</sub>	Typ	H	BF	T	TF (mm)	Area

**CL Bulkhead (Bending efficiency: 100%)**

PL	1	0	0	0	2680		2680	0	19.0	std	509.20
PL	2	0	2680	0	5837		3157	0	19.0	std	599.83
PL	3	0	5837	0	8797		2960	0	19.0	std	562.40
PL	4	0	8797	0	11457		2660	0	13.0	std	345.80
PL	5	0	11457	0	14035		2578	0	13.0	std	335.14
PL	6	0	14035	0	16695		2660	0	13.0	std	345.80
PL	7	0	16695	0	19840		3145	0	18.0	std	566.10
PL	8	0	19840	0	22800		2960	0	21.0	std	621.60
ST	1	0	590	200	590	10	400	0	25.0	0.0	100.00
ST	2	0	1410	200	1410	10	400	0	25.0	0.0	100.00
ST	3	0	2230	200	2230	10	400	0	25.0	0.0	100.00
ST	4	0	3417	274	3407	20	430	0	15.0	0.0	94.18
ST	5	0	4152	274	4142	20	430	0	15.0	0.0	94.18
ST	6	0	4887	274	4877	20	430	0	15.0	0.0	94.18
ST	7	0	5622	225	5622	10	450	0	25.0	0.0	112.50
ST	8	0	6357	225	6357	10	450	0	25.0	0.0	112.50
ST	9	0	7092	225	7092	10	450	0	25.0	0.0	112.50
ST	10	0	7876	200	7876	10	400	0	25.0	0.0	100.00
ST	11	0	8660	200	8660	10	400	0	25.0	0.0	100.00
ST	12	0	9444	200	9444	10	400	0	25.0	0.0	100.00
ST	13	0	10228	200	10228	10	400	0	25.0	0.0	100.00
ST	14	0	11012	200	11012	10	400	0	25.0	0.0	100.00
ST	15	0	11796	175	11796	10	350	0	25.0	0.0	87.50
ST	16	0	12580	175	12580	10	350	0	25.0	0.0	87.50
ST	17	0	13364	175	13364	10	350	0	25.0	0.0	87.50
ST	18	0	14148	175	14148	10	350	0	25.0	0.0	87.50
ST	19	0	14932	175	14932	10	350	0	25.0	0.0	87.50
ST	20	0	15716	175	15716	10	350	0	25.0	0.0	87.50
ST	21	0	16500	175	16500	10	350	0	25.0	0.0	87.50
ST	22	0	17284	215	17276	20	340	0	12.0	0.0	58.84
ST	23	0	18070	215	18062	20	340	0	12.0	0.0	58.84
ST	24	0	18856	215	18848	20	340	0	12.0	0.0	58.84
ST	25	0	19642	215	19634	20	340	0	12.0	0.0	58.84
ST	26	0	20428	215	20420	20	340	0	12.0	0.0	58.84
ST	27	0	21214	215	21206	20	340	0	12.0	0.0	58.84
ST	28	0	22007	215	21999	20	340	0	12.0	0.0	58.84

**Stringer 7092 (Bending efficiency: 100%)**

PL	1	21250	7092	18690	7092		2560	400	12.0	std	259.20
ST	1	20610	7092	20610	6992	10	200	0	15.0	0.0	30.00
ST	2	19970	7092	19970	6992	10	200	0	15.0	0.0	30.00
ST	3	19330	7092	19330	6992	10	200	0	15.0	0.0	30.00

**Stringer 11796 (Bending efficiency: 100%)**

PL	1	21250	11796	18690	11796		2560	400	12.0	std	259.20
ST	1	20610	11796	20610	11696	10	200	0	15.0	0.0	30.00
ST	2	19970	11796	19970	11696	10	200	0	15.0	0.0	30.00
ST	3	19330	11796	19330	11696	10	200	0	15.0	0.0	30.00

**Stringer 16500 (Bending efficiency: 100%)**

PL	1	21250	16500	18690	16500		2560	400	12.0	std	259.20
ST	1	20610	16500	20610	16400	10	200	0	15.0	0.0	30.00
ST	2	19970	16500	19970	16400	10	200	0	15.0	0.0	30.00
ST	3	19330	16500	19330	16400	10	200	0	15.0	0.0	30.00

**Bottom girder 5810 (Bending efficiency: 100%)**

PL	1	5810	0	5810	2766		2766	800	18.0	std	354.03
ST	1	5810	590	5660	590	10	300	0	20.0	0.0	60.00
ST	2	5810	1410	5660	1410	10	300	0	20.0	0.0	60.00

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**Layout of Plates and Profiles (cont.)**

Plate Stiff	No	Y <sub>1</sub> (mm) Y	Z <sub>1</sub> (mm) Z	Y <sub>2</sub> (mm) Y <sub>CG</sub>	Z <sub>2</sub> (mm) Z <sub>CG</sub>	— Typ	B (mm) H	BCUT (mm) BF	T (mm) T	Steel TF (mm)	Area cm <sup>2</sup> Area
ST	3	5810	2230	5660	2230	10	300	0	20.0	0.0	60.00
<b>Bottom girder 11620 (Bending efficiency: 100%)</b>											
PL	1	11620	0	11620	2876		2876	800	18.0	std	373.72
ST	1	11620	590	11470	590	10	300	0	20.0	0.0	60.00
ST	2	11620	1410	11470	1410	10	300	0	20.0	0.0	60.00
ST	3	11620	2230	11470	2230	10	300	0	20.0	0.0	60.00
<b>Bottom girder 16600 (Bending efficiency: 100%)</b>											
PL	1	16600	0	16600	2970		2970	800	18.0	std	390.60
ST	1	16600	590	16450	590	10	300	0	20.0	0.0	60.00
ST	2	16600	1410	16450	1410	10	300	0	20.0	0.0	60.00
ST	3	16600	2230	16450	2230	10	300	0	20.0	0.0	60.00

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## 6 Cross-Sectional Area

### Plates

Panels:	NS-Steel		HS-Steel		Total	
	Effective cm <sup>2</sup>	Gross cm <sup>2</sup>	Effective cm <sup>2</sup>	Gross cm <sup>2</sup>	Effective cm <sup>2</sup>	Gross cm <sup>2</sup>
Outer Shell	26788.4	26788.4	0.0	0.0	26788.4	26788.4
Inner Bottom & Inner Side	13484.7	13484.7	0.0	0.0	13484.7	13484.7
CL Bulkhead	3885.9	3885.9	0.0	0.0	3885.9	3885.9
Stringer 7092	518.4	614.4	0.0	0.0	518.4	614.4
Stringer 11796	518.4	614.4	0.0	0.0	518.4	614.4
Stringer 16500	518.4	614.4	0.0	0.0	518.4	614.4
Bottom girder 5810	708.1	996.1	0.0	0.0	708.1	996.1
Bottom girder 11620	747.4	1035.4	0.0	0.0	747.4	1035.4
Bottom girder 16600	781.2	1069.2	0.0	0.0	781.2	1069.2
<b>TOTAL AREA</b>	<b>47950.8</b>	<b>49102.8</b>	<b>0.0</b>	<b>0.0</b>	<b>47950.8</b>	<b>49102.8</b>

### Profiles

Panels:	NS-Steel		HS-Steel		Total	
	Effective cm <sup>2</sup>	Gross cm <sup>2</sup>	Effective cm <sup>2</sup>	Gross cm <sup>2</sup>	Effective cm <sup>2</sup>	Gross cm <sup>2</sup>
Outer Shell	10447.5	10447.5	0.0	0.0	10447.5	10447.5
Inner Bottom & Inner Side	6084.8	6084.8	0.0	0.0	6084.8	6084.8
CL Bulkhead	2444.4	2444.4	0.0	0.0	2444.4	2444.4
Stringer 7092	180.0	180.0	0.0	0.0	180.0	180.0
Stringer 11796	180.0	180.0	0.0	0.0	180.0	180.0
Stringer 16500	180.0	180.0	0.0	0.0	180.0	180.0
Bottom girder 5810	360.0	360.0	0.0	0.0	360.0	360.0
Bottom girder 11620	360.0	360.0	0.0	0.0	360.0	360.0
Bottom girder 16600	360.0	360.0	0.0	0.0	360.0	360.0
<b>TOTAL AREA</b>	<b>20596.8</b>	<b>20596.8</b>	<b>0.0</b>	<b>0.0</b>	<b>20596.8</b>	<b>20596.8</b>

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## 7 Cross-Sectional Data

	EFFECTIVE Cut-outs subtracted	GROSS Cut-outs disreg.
Cross sectional area of the longitudinal elements ..... (cm2) :	68547.7	69699.7
Position of the centroid: Ycg ..... (mm) :	7	7
Position of the centroid: Zcg ..... (mm) :	9640	9542
Moment of inertia about the horz. neutral axis, I <sub>h</sub> ..... (m4) :	526.330	533.276
Moment of inertia about the vert. neutral axis, I <sub>v</sub> ..... (m4) :	1422.381	1446.904
Product of inertia about the neutral axes, I <sub>hv</sub> ..... (m4) :	0.082	0.102
<hr/>		
SECTION MODULUS, BOTTOM (z = 0 mm) ..... (m3) :	54.596	55.886
SECTION MODULUS, DECK LINE (z = 22000 mm) ..... (m3) :	42.585	42.807
SECTION MODULUS, AT SIDE (y = 21250 mm) ..... (m3) :	66.959	68.113
<hr/>		
First moment of the area above the neutral axis, S ..... (cm3) :	27396463.7	27775878.3
I/S ..... (cm) :	1921	1919

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## 8 Design Bending Moments

AT ACTUAL POSITION (128.2 m from AP)

Still water bending moments:

- Standard values according to Rules, Ms ..... :  
 - Given as input (actual cargo/ballast conditions) ..... :

Design still water bending moments:

SAGGING (kNm)                      HOGGING (kNm)

2903485	3092458
3992670	4100580
3992670	4100580

Design wave bending moments, Mw ..... :

4913590                      4724616  
 (Rules)                      (Rules)

Design wave bending moments, Mw for buckling check ..... :

4913590                      4724616  
 (Rules)                      (Rules)

Horizontal wave bending moment acc. to Rules, Mwh ..... :

2779966



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## 9 Hull Girder Strength Requirements

	BOTTOM	DECK	SIDE
Material strength group .....	NV-NS	NV-NS	NV-NS
Yield point of material ..... (N/mm <sup>2</sup> ) :	235	235	235
Material factor, f1 .....	1.000	1.000	1.000
Stress factor, f2 (midship values from input)..... :	1.000	1.000	
Speed factor, Cav .....	0.182		
Speed/flare factor, Caf .....	0.182		
Wave coefficient, Cw .....	10.425		
Wave coefficient, Cwo .....	10.425		
Wave coefficient, Cwu .....	10.425		

AT ACTUAL POSITION ( 128.2 m from AP) (Midship section)

	BOTTOM	DECK
Minimum section modulus, Zo ..... (m <sup>3</sup> ) :	44.66900	44.66900
Section modulus requirement based on design bending moments:		
- Sagging (3992670 kNm) ..... (m <sup>3</sup> ) :	50.89291	50.89291
- Hogging (4100580 kNm) ..... (m <sup>3</sup> ) :	50.42969	50.42969
<b>Rule section modulus</b> ..... (m <sup>3</sup> ):	<b>50.89291</b>	<b>50.89291</b>
Combined stresses at bilge and deck corners ..... (N/mm <sup>2</sup> ) :	172.2	216.4
Minimum moment of inertia ..... (m <sup>4</sup> ) :	338.62226	
Minimum section modulus at side ..... (m <sup>3</sup> ) :	31.60825	

### GUIDANCE:

The required section modulus along the hull girder will normally be satisfied when calculated for the midship section only, provided the following rules for tapering are complied with:

- Scantlings at bottom and deck are kept unaltered within 0.4L amidships.
- Scantlings outside 0.4L amidships are gradually reduced to the local requirements at the ends, and the same material strength group is applied over the full length of the ship.



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## 10 Hull Girder Strength Summary

	ACTUAL	RULE	STATUS (%) (100=Rule)
Cross-sectional area ..... (cm <sup>2</sup> ) :	68548		
Height to the neutral axis ..... (mm) :	9640		
Moment of inertia ..... (m <sup>4</sup> ) :	526.330	338.622	155.4
Section modulus, bottom ..... (m <sup>3</sup> ) :	54.596	50.893	107.3
Section modulus, deck line ..... (m <sup>3</sup> ) :	42.585	50.893	83.7 *
<b>(at z = 22000 mm)</b>			
Material factor, f1, bottom ..... :	1.000		
Material factor, f1, deck ..... :	1.000		
Stress factor, f2, bottom ..... (Input) :	1.000		
Stress factor, f2, deck ..... (Input) :	1.000		

NOTE: \* indicates a requirement that is not fulfilled.

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## 11 Compartments and Loads

### 11.1 Compartment Data I

Ref.	Comp. group (Comp. type)	Comp. No	Frame No aft	Frame No fwd	Restr. filling (*)	Coated (*)	Contents WB / Oil / Liq / Hliq / Bulk
1	2	2				*	WB
2	1	1				*	Oil

### 11.2 Compartment Data II

Ref.	Comp. group (Comp type)	Comp. No	Length (mm)	Sloshing length (mm)	Sloshing breadth (mm)	Top of air pipe (mm)	WL in dam'gd cond (mm)	Over-pressure po (kN/m2)	Top of hatch (mm)	Volume (m3)
1	2	2	32000	4000	5810	22760	22000	25.00	0	0
2	1	1	32000	32000	18690	22760	22000	25.00	0	0

### 11.3 Bulk Cargo and Liquid Loads

Ref.	Comp. group (Comp type)	Comp. No	Load No	Load type	Density t/m3	Filling height mm	Mass t	Angle of repose degrees	Permeability
1	2	2	1	WB	1.025	22215			
2	1	1	1	Oil	1.025	22800			

### 11.4 Double Bottom Stresses and Hull Girder Bending Moments

Ref.	Comp. group (Comp. type)	Comp. No	Load No	Load type	Dbl. bottom stresses		Still water bending moments - = sagging, + = hogging kNm
					Bottom N/mm <sup>2</sup>	Inner bot. N/mm <sup>2</sup>	
1	2	2	1	WB	0	0	0.00
2	1	1	1	Oil	0	0	0.00

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## 12 Summary of Data Involved in the Local Rule Requirements

Distance from AP to considered section .....	(m) :	128.250	
Section modulus at bottom .....	(m <sup>3</sup> ) :	54.596	
Section modulus at deck line .....	(m <sup>3</sup> ) :	42.585	
Height from base line to the neutral axis .....	(mm) :	9640	
<b>STRESS FACTOR, f2:</b>			
f2B (f2 at bottom) .....	:	1.000	(Input)
f2D (f2 at deck) .....	:	1.000	(Input)
<b>DESIGN MOMENTS:</b>			
Design still water bending moment, sagging .....	(kNm) :	3992670	(Input)
Design still water bending moment, hogging .....	(kNm) :	4100580	(Input)
Design wave bending moment, sagging .....	(kNm) :	4913590	(Rules)
Design wave bending moment, hogging .....	(kNm) :	4724616	(Rules)
<b>MOTION PARAMETERS:</b>			
Acceleration parameter, a0 .....	:	0.306	(Rules)
Period of roll, Tr .....	(s) :	14.679	(Rules)
Pitch angle, theta .....	(rad/deg) :	0.087 / 5	(Rules)
Roll angle, Fi .....	(rad/deg) :	0.376 / 22	(Rules)
Vertical acceleration, av .....	(m/s <sup>2</sup> ) :	2.392	(Rules)
Ballast draught, Tb .....	(m) :	7.054	(Rules)

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### 13 Local Rule Requirements - Plates

Plate No	ACT	t_act (mm)	Steel	tk (mm)	tk_b (mm)		Eff. (%)	Span (mm)	Spac (mm)		Sigf N/mm <sup>2</sup>	f <sub>1</sub>	
	LOC		t_loc (mm)	Pos		Load Ref.	Loc. ref.	y <sub>1</sub> (mm)	z <sub>1</sub> (mm)	Comp ref.	Sigma N/mm <sup>2</sup>	p kN/m <sup>2</sup>	
	BUC		t_buc (mm)	Eta	psi	k	c	Buc. ref.	y <sub>b</sub> (mm)	z <sub>b</sub> (mm)	SigL N/mm <sup>2</sup>	Sig_c N/mm <sup>2</sup>	Sig_cr N/mm <sup>2</sup>

#### Outer Shell

##### Bottom

1	ACT LOC BUC	22.0	std 20.63 16.22	1.0 Bottom 0.9	1.0	WB acc 1 4.00	100 Min	4000 415 0	830 0 0	1	235.0 120.0 205.9	1.00 180.1 179.6
2	ACT LOC BUC	21.0	std 17.06 16.22	1.0 Bottom 0.9	1.0	WB acc 1 4.00	100 Lat	4000 1245 1200	830 0 0	1	235.0 120.0 202.9	1.00 180.1 179.6
3	ACT LOC BUC	21.0	std 17.06 16.22	1.0 Bottom 0.9	1.0	WB acc 1 4.00	100 Lat	4000 3870 3870	830 0 0	1	235.0 120.0 202.9	1.00 180.1 179.6
4	ACT LOC BUC	21.0	std 17.06 16.22	1.0 Bottom 0.9	1.0	WB acc 1 4.00	100 Lat	4000 7055 6640	830 0 0	1	235.0 120.0 202.9	1.00 180.1 179.6
5	ACT LOC BUC	21.0	std 17.06 16.22	1.0 Bottom 0.9	1.0	WB acc 1 4.00	100 Lat	4000 9545 9130	830 0 0	1	235.0 120.0 202.9	1.00 180.1 179.6
6	ACT LOC BUC	21.0	std 17.07 16.22	1.0 Bottom 0.9	1.0	Sea 4.00	100 Lat	4000 14385 11735	830 0 0	1	235.0 120.0 202.9	1.00 180.3 179.6
7	ACT LOC BUC	21.0	std 17.17 16.22	1.0 Bottom 0.9	1.0	Sea 4.00	100 Lat	4000 16185 14385	830 0 0	1	235.0 120.0 202.9	1.00 182.3 179.6
8	ACT LOC BUC	21.0	std 16.11 12.36	1.0 Bottom 1.0	1.0	Sea 4.00	100 Min	4000 17035 17035	713 0 0	1	235.0 120.0 211.3	1.00 185.7 161.6

##### Bilge

9	ACT LOC BUC	21.0	std 17.94 12.45	1.0 Side 1.0	1.0	WB tst 5 4.24	100 Lat	4000 21250 21250	900 2544 2094	1	235.0 125.3 199.4	1.00 177.7 126.5
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##### Side

10	ACT LOC BUC	17.0	std 16.32 10.70	1.0 Side 1.0	1.0	WB tst 5 4.21	100 Lat	4000 21250 21250	820 3404 3126	1	235.0 127.1 188.6	1.00 177.6 109.2
11	ACT LOC BUC	17.0	std 16.48 8.53	1.0 Side 1.0	1.0	WB tst 5 4.35	100 quay	4000 21250 21250	784 7317 5586	1	235.0 135.2 190.1	1.00 174.8 68.0
12	ACT LOC BUC	17.0	std 16.48 6.36	1.0 Side 1.0	1.0	WB tst 5 4.49	100 quay	4000 21250 21250	784 7484 7317	1	235.0 135.5 195.2	1.00 173.1 39.0
13	ACT LOC BUC	17.0	std 16.48 7.85	1.0 Side 1.0	1.0	WB tst 5 4.45	100 quay	4000 21250 21250	784 10620 13363	1	235.0 138.4 194.8	1.00 141.6 63.0
14	ACT LOC BUC	17.0	std 17.11 11.30	1.0 Side 1.0	1.0	WB tst 5 4.06	100 quay	4000 21250 21250	816 16725 16725	1	235.0 128.5 187.3	1.00 80.2 119.9
15	ACT LOC BUC	17.0	std 17.11 14.16	1.0 Side 1.0	1.0	WB tst 5 4.09	100 quay	4000 21250 21250	816 16907 19391	1	235.0 128.2 187.6	1.00 78.4 165.0

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**Local Rule Requirements - Plates (cont)**

Plate No	ACT	t_act (mm)	Steel	tk (mm)	tk_b (mm)		Eff. (%)	Span (mm)	Spac (mm)		Sigf N/mm <sup>2</sup>	f <sub>1</sub>
	LOC	t_loc (mm)		Pos		Load Ref.	Loc. ref.	y <sub>1</sub> (mm)	z <sub>1</sub> (mm)	Comp ref.	Sigma N/mm <sup>2</sup>	p kN/m <sup>2</sup>
	BUC	t_buc (mm)		Eta	psi	k c	Buc. ref.	y <sub>b</sub> (mm)	z <sub>b</sub> (mm)	SigL N/mm <sup>2</sup>	Sig_c N/mm <sup>2</sup>	Sig_cr N/mm <sup>2</sup>
16	ACT	21.0	std	1.0	2.0		100	4000	816		235.0	1.00
	LOC		16.11	Side			Min	21250	19391	1	124.2	53.4
	BUC		20.23	1.0	0.93	WB tst 5 4.14		21250	21395	198.9	201.8	198.9
<b>Strength deck</b>												
17	ACT	24.0	std	2.0	2.0		100	4000	857		235.0	1.00
	LOC		12.55	Strdk		Oil slo e	Min	20822	22035	2	120.0	89.8
	BUC	*	26.65	1.0	0.99	4.01		18690	22214	212.8	207.1	212.8
18	ACT	24.0	std	1.0	1.0		100	4000	832		235.0	1.00
	LOC		12.38	Strdk		Oil slo e	Lat	15355	22493	2	120.0	89.8
	BUC	*	28.60	1.0	0.99	4.01		14939	22528	218.1	210.6	218.1
19	ACT	24.0	std	1.0	1.0		100	4000	832		235.0	1.00
	LOC		12.38	Strdk		Oil slo e	Lat	12865	22702	2	120.0	89.8
	BUC	*	33.31	1.0	1.00	4.01		11707	22799	222.7	210.7	222.7
20	ACT	24.0	std	1.0	1.0		100	4000	830		235.0	1.00
	LOC		12.34	Strdk		Oil slo e	Lat	11205	22800	2	120.0	89.8
	BUC	*	33.26	1.0	1.00	4.00		11620	22800	222.7	210.8	222.7
21	ACT	24.0	std	1.0	1.0		100	4000	830		235.0	1.00
	LOC		12.34	Strdk		Oil slo e	Lat	8715	22800	2	120.0	89.8
	BUC	*	33.26	1.0	1.00	4.00		8867	22800	222.7	210.8	222.7
22	ACT	24.0	std	1.0	1.0		100	4000	830		235.0	1.00
	LOC		12.34	Strdk		Oil slo e	Lat	5395	22800	2	120.0	89.8
	BUC	*	33.26	1.0	1.00	4.00		5810	22800	222.7	210.8	222.7
23	ACT	24.0	std	1.0	1.0		100	4000	830		235.0	1.00
	LOC		12.34	Strdk		Oil slo e	Lat	2905	22800	2	120.0	89.8
	BUC	*	33.26	1.0	1.00	4.00		3007	22800	222.7	210.8	222.7
<b>Inner Bottom &amp; Inner Side</b>												
1	ACT	21.0	std	1.5	1.5		100	4000	830		235.0	1.00
	LOC		18.21	Inbot		Oil tst 5	Lat	415	2680	2	140.0	227.3
	BUC		12.53	0.9	1.00	4.00		0	2680	116.7	201.3	129.7
2	ACT	21.0	std	1.5	1.5		100	4000	830		235.0	1.00
	LOC		18.21	Inbot		Oil tst 5	Lat	1244	2680	2	140.0	227.3
	BUC		12.53	0.9	1.00	4.00		1200	2680	116.7	201.3	129.7
3	ACT	21.0	std	1.5	1.5		100	4000	830		235.0	1.00
	LOC		18.20	Inbot		Oil tst 5	Lat	5394	2758	2	140.0	226.5
	BUC		12.49	0.9	1.00	4.00		3777	2728	115.9	201.3	128.8
4	ACT	21.0	std	1.5	1.5		100	4000	830		235.0	1.00
	LOC		18.17	Inbot		Oil tst 5	Lat	7054	2790	2	140.0	226.2
	BUC		12.43	0.9	1.00	4.00		6639	2782	115.0	201.3	127.8
5	ACT	21.0	std	1.5	1.5		100	4000	831		235.0	1.00
	LOC		18.16	Inbot		Oil tst 5	Lat	11204	2868	2	140.0	225.4
	BUC		12.39	0.9	1.00	4.00		9129	2829	114.2	201.3	126.9
6	ACT	21.0	std	1.5	1.5		100	4000	829		235.0	1.00
	LOC		18.13	Inbot		Oil tst 5	Lat	12034	2884	2	140.0	225.3
	BUC		12.34	0.9	1.00	4.00		11736	2878	113.4	201.3	126.0
7	ACT	21.0	std	1.5	1.5		100	4000	830		235.0	1.00
	LOC		18.12	Inbot		Oil tst 5	Lat	16184	2962	2	140.0	224.5
	BUC		12.30	0.9	1.00	4.00		14405	2928	112.5	201.3	125.0
8	ACT	20.0	std	1.0	1.0		100	4000	767		235.0	1.00
	LOC		16.60	Hoptk		Oil tst 5	Lat	16773	3312	2	133.7	221.0
	BUC		11.62	1.0	0.89	4.23	s/t	16947	3654	100.4	206.2	143.0

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**Local Rule Requirements - Plates (cont)**

Plate No	ACT	t_act (mm)	Steel	tk (mm)	tk_b (mm)		Eff. (%)	Span (mm)	Spac (mm)		Sigf N/mm <sup>2</sup>	f <sub>1</sub>
	LOC	t_loc (mm)	Pos			Load Ref.	Loc. ref.	y <sub>1</sub> (mm)	z <sub>1</sub> (mm)	Comp ref.	Sigma N/mm <sup>2</sup>	p kN/m <sup>2</sup>
	BUC	t_buc (mm)	Eta	psi	k	c	Buc. ref.	y <sub>b</sub> (mm)	z <sub>b</sub> (mm)	SigL N/mm <sup>2</sup>	Sig_c N/mm <sup>2</sup>	Sig_cr N/mm <sup>2</sup>
9	ACT LOC BUC	16.0 15.40 11.81	std Hoptk	1.0 1.0	1.0 0.79		100 Lat s/t	4000 17815 18336	768 5367 6394		235.0 142.3 189.5	1.00 200.3 147.4
10	ACT LOC BUC	15.0 14.48 11.84	std Insid	1.0 1.0	1.0 1.00	Oil tst 5 4.00	100 Lat s/t	4000 18690 18690	783 7483 7875	2 30.0	235.0 151.1 176.6	1.00 179.0 137.7
11	ACT LOC BUC	14.0 13.01 11.84	std Insid	1.0 1.0	1.0 0.82	Oil tst 5 4.37	100 Lat s/t	4000 18690 18690	784 10619 11795	2 36.5	235.0 156.8 173.0	1.00 147.5 145.9
12	ACT LOC BUC	14.0 12.01 11.84	std Insid	1.0 1.0	1.0 0.85	Oil tst 5 4.31	100 Lat s/t	4000 18690 18690	784 13755 14148	2 76.3	235.0 146.7 172.2	1.00 115.9 144.7
13	ACT LOC BUC	17.0 11.77 14.08	std Insid	1.0 1.0	1.0 0.96	Oil slo e 4.08	100 Lat	4000 18690 18690	816 19328 19328	2 163.9	235.0 128.6 187.5	1.00 89.8 163.9
14	ACT LOC BUC	21.0 13.65 25.82	std Insid	2.5 1.0	2.5 0.93	Oil slo e 4.13	100 Lat	4000 18690 18690	818 21805 22214	2 212.8	235.0 120.6 199.7	1.00 89.8 212.8
<b>CL Bulkhead</b>												
1	ACT LOC BUC	19.0 19.40 13.50	std Lbhd	1.5 1.0	1.5 0.91	WB acc 1 4.18	100 Lat	2000 0 0	820 1000 590	1 151.8	235.0 124.1 195.9	1.00 239.3 151.8
2	ACT LOC BUC	19.0 15.12 10.19	std Lbhd	0.0 1.0	0.0 0.89	Oil tst 5 4.21	100 Lat s/t	4000 0 0	737 3048 2680	2 116.7	235.0 132.6 208.4	1.00 223.6 142.6
3	ACT LOC BUC	19.0 13.48 10.84	std Lbhd	0.0 1.0	0.0 0.69	Oil tst 5 4.69	100 Lat s/t	4000 0 0	784 7484 7092	2 42.7	235.0 151.1 207.9	1.00 179.0 151.9
4	ACT LOC BUC	13.0 12.61 10.84	std Lbhd	0.0 1.0	0.0 0.23	Oil tst 5 6.30	100 Lat s/t	4000 0 0	784 9052 8797	2 14.1	235.0 157.6 192.0	1.00 163.2 173.2
5	ACT LOC BUC	13.0 12.58 10.84	std Lbhd	0.0 1.0	0.0 0.84	Oil tst 5 4.32	100 Min s/t	4000 0 0	784 11457 11796	2 36.5	235.0 154.1 172.4	1.00 139.1 144.9
6	ACT LOC BUC	13.0 12.58 10.84	std Lbhd	0.0 1.0	0.0 0.85	Oil tst 5 4.30	100 Min s/t	4000 0 0	784 14540 14932	2 89.5	235.0 144.1 172.1	1.00 108.1 144.5
7	ACT LOC BUC	18.0 12.58 13.51	std Lbhd	0.0 1.0	0.0 0.98	Oil slo e 4.04	100 Min	4000 0 0	784 16892 19840	2 172.6	235.0 136.5 199.8	1.00 89.8 172.6
8	ACT LOC BUC	21.0 14.58 32.38	std Lbhd	2.0 1.0	2.0 0.94	Oil slo e 4.12	100 Min	4000 0 0	793 21610 22800	2 222.7	235.0 121.3 203.5	1.00 89.8 222.7
<b>Stringer 7092</b>												
1	ACT LOC BUC	12.0 11.55 6.36	std Strng	1.5 1.0	1.5 1.00	WB slo m 4.00	100 Min	4000 20930 21250	640 7092 7092	1 42.7	235.0 149.4 165.8	1.00 20.0 42.7
<b>Stringer 11796</b>												
1	ACT LOC BUC	12.0 11.55 5.99	std Strng	1.5 1.0	1.5 1.00	WB slo m 4.00	100 Min	4000 20930 21250	640 11796 11796	1 36.5	235.0 153.0 165.8	1.00 20.0 36.5



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### Local Rule Requirements - Plates (cont)

Plate No	ACT	t_act (mm)	Steel	tk (mm)	tk_b (mm)		Eff. (%)	Span (mm)	Spac (mm)		Sigf N/mm <sup>2</sup>	f <sub>1</sub>
LOC		t_loc (mm)	Pos			Load Ref.	Loc. ref.	y <sub>1</sub> (mm)	z <sub>1</sub> (mm)	Comp ref.	Sigma N/mm <sup>2</sup>	p kN/m <sup>2</sup>
BUC		t_buc (mm)	Eta	psi	k	c	Buc. ref.	y <sub>b</sub> (mm)	z <sub>b</sub> (mm)	SigL N/mm <sup>2</sup>	Sig_c N/mm <sup>2</sup>	Sig_cr N/mm <sup>2</sup>

#### Stringer 16500

1	ACT	12.0	std	1.5	1.5		100	4000	640		235.0	1.00
	LOC		11.55	Strng		WB slo m	Min	20930	16500	1	137.8	20.0
	BUC		9.51	1.0	1.00	4.00		21250	16500	116.1	165.8	116.1

#### Bottom girder 5810

1	ACT	18.0	std	1.5	1.5		100	4000	590		235.0	1.00
	LOC		12.55	DBgird		WB slo m	Min	5810	295	1	130.0	20.0
	BUC		13.50	1.0	0.91	4.18		5810	590	151.8	191.0	151.8

#### Bottom girder 11620

1	ACT	18.0	std	1.5	1.5		100	4000	590		235.0	1.00
	LOC		12.55	DBgird		WB slo m	Min	11620	295	1	130.0	20.0
	BUC		13.50	1.0	0.91	4.18		11620	590	151.8	191.0	151.8

#### Bottom girder 16600

1	ACT	18.0	std	1.5	1.5		100	4000	590		235.0	1.00
	LOC		12.55	DBgird		WB slo m	Min	16600	295	1	130.0	20.0
	BUC		13.50	1.0	0.91	4.18		16600	590	151.8	191.0	151.8



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### 14 Local Rule Requirements - Stiffeners

Stiff. No	ACT ACT	POS Za cm³	K c	Type Type	h t (mm)	bf tf (mm)	y z (mm)	SigF f <sub>1</sub> N/mm²	m wk	tkw tkf (mm)	tpl (mm)	span spac (mm)
	LOC		Zr cm³	Exc. %	tmin (mm)	Load Ref.		Sigma N/mm²	Sigdb N/mm²	p kN/m²	Comp ref.	a_conn cm²
	FAT/BUC		Zrf cm³	Exc. %	pd kN/m²	Sigd N/mm²		SigL N/mm²	Lat N/mm²	Torsion N/mm²	Web N/mm²	bf/tf

#### Outer Shell

##### Bottom

1	ACT ACT LOC FAT/BUC	Bottom 2078 *	0.00 0.0 3014 0	20 HPbulb -31	430 17.0 11.5 0.0	0 0.0 WB acc 1 0.0	830 0	235.0 1.00 71.8 161.6	12.0 1.09 33.2 231.0	1.5 1.5 180.1 219.6	22.0 1	4000 830 83.7 0.0
Similar for No(s): 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17												
18	ACT ACT LOC FAT/BUC	Bottom 1943 *	0.00 0.0 1995 0	20 HPbulb -2	430 15.0 11.5 0.0	0 0.0 Sea 0.0	17313 0	235.0 1.00 95.0 161.6	12.0 1.09 0.0 231.2	1.5 1.5 183.6 217.7	21.0	4000 713 73.1 0.0
Similar for No(s): 19 20												
21	ACT ACT LOC FAT/BUC	Bottom 1943 *	0.00 0.0 2021 0	20 HPbulb -3	430 15.0 11.5 0.0	0 0.0 Sea 0.0	19452 0	235.0 1.00 95.0 161.6	12.0 1.09 0.0 231.2	1.5 1.5 186.1 217.7	21.0	4000 713 73.1 0.0

##### Side

22	ACT ACT LOC FAT/BUC	Side 1977	2.50 1.1 1878 1480	20 HPbulb 5 33	430 15.0 11.5 55.0	0 0.0 WB tst 5 48.4	21250 2094	235.0 1.00 123.2 126.5	12.0 1.09 0.0 231.0	1.5 1.5 177.7 216.7	21.0 1	4000 900 88.7 0.0
23	ACT ACT LOC FAT/BUC	Side 1970	2.50 1.1 1701 1434	20 HPbulb 15 37	430 15.0 11.5 55.8	0 0.0 WB tst 5 48.4	21250 2994	235.0 1.00 130.0 111.4	12.0 1.09 0.0 231.0	1.5 1.5 177.7 217.0	21.0 1	4000 860 85.2 0.0
24	ACT ACT LOC FAT/BUC	Side 1647	2.50 1.1 1621 1384	20 HPbulb 1 18	400 16.0 11.5 56.5	0 0.0 WB tst 5 48.4	21250 3814	235.0 1.00 130.0 97.7	12.0 1.09 0.0 230.5	1.5 1.5 177.6 217.4	17.0 1	4000 820 81.7 0.0
25	ACT ACT LOC FAT/BUC	Side 1647	2.50 1.1 1621 1402	20 HPbulb 1 17	400 16.0 11.5 57.2	0 0.0 WB tst 5 48.4	21250 4634	235.0 1.00 130.0 83.9	12.0 1.09 0.0 230.5	1.5 1.5 177.6 217.6	17.0 1	4000 820 81.7 0.0
26	ACT ACT LOC FAT/BUC	Side 1647	2.50 1.1 1620 1419	20 HPbulb 1 16	400 16.0 11.5 57.9	0 0.0 WB tst 5 48.4	21250 5454	235.0 1.00 130.0 70.2	12.0 1.09 0.0 230.5	1.5 1.5 177.5 217.7	17.0 1	4000 820 81.7 0.0
27	ACT ACT LOC FAT/BUC	Side 1647	2.50 1.1 1618 1434	20 HPbulb 1 14	400 16.0 11.5 58.6	0 0.0 WB tst 5 48.4	21250 6274	235.0 1.00 130.0 56.4	12.0 1.09 0.0 230.5	1.5 1.5 177.5 217.8	17.0 1	4000 819 81.6 0.0
28	ACT ACT LOC FAT/BUC	Side 1641	2.50 1.1 1476 1405	20 HPbulb 11 16	400 16.0 11.5 60.0	0 0.0 WB tst 5 48.4	21250 7876	235.0 1.00 130.0 30.0	12.0 1.09 0.0 230.6	1.5 1.5 169.2 217.9	17.0 1	4000 784 74.8 0.0
29	ACT ACT LOC FAT/BUC	Side 1641	2.50 1.1 1408 1421	20 HPbulb 16 15	400 16.0 11.5 60.6	0 0.0 WB tst 5 48.4	21250 8660	235.0 1.00 130.0 30.0	12.0 1.09 0.0 230.6	1.5 1.5 161.3 217.9	17.0 1	4000 784 71.3 0.0
30	ACT ACT LOC FAT/BUC	Side 1641	2.50 1.1 1339 1428	20 HPbulb 22 14	400 16.0 11.5 60.9	0 0.0 WB tst 5 48.4	21250 9444	235.0 1.00 130.0 30.0	12.0 1.09 0.0 230.6	1.5 1.5 153.4 217.9	17.0 1	4000 784 67.8 0.0

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**Local Rule Requirements - Stiffeners (cont.)**

Stiff. No	ACT ACT	POS Za cm³	K c	Type Type	h t (mm)	bf tf (mm)	y z (mm)	SigF f <sub>1</sub> N/mm²	m wk	tkw tkf (mm)	tpl (mm)	span spac (mm)
LOC			Zr cm³	Exc. %	tmin (mm)	Load Ref.		Sigma N/mm²	Sigdb N/mm²	p kN/m²	Comp ref.	a_conn cm²
FAT/BUC			Zrf cm³	Exc. %	pd kN/m²	Sigd N/mm²		SigL N/mm²	Lat N/mm²	Torsion N/mm²	Web N/mm²	bf/tf
31	ACT	Side 1556	2.50	20	400	0	21250	235.0	12.0	1.5	17.0	4000
	ACT		1.1	HPbulb	14.0	0.0	10228	1.00	1.09	1.5		784
	LOC		1270	22	11.5	WB tst 5		130.0	0.0	145.5	1	64.3
	FAT/BUC		1344	15	57.3	48.4		30.0	230.6	216.5	220.6	0.0
32	ACT	Side 1556	2.50	20	400	0	21250	235.0	12.0	1.5	17.0	4000
	ACT		1.1	HPbulb	14.0	0.0	11012	1.00	1.09	1.5		784
	LOC		1201	29	11.5	WB tst 5		130.0	0.0	137.6	1	60.8
	FAT/BUC		1260	23	53.8	48.4		30.0	230.6	216.5	220.6	0.0
33	ACT	Side 1245	2.50	20	370	0	21250	235.0	12.0	1.5	17.0	4000
	ACT		1.1	HPbulb	13.0	0.0	12580	1.00	1.09	1.5		783
	LOC		1063	17	11.5	WB tst 5		130.0	0.0	121.9	1	53.9
	FAT/BUC		1092	14	46.6	48.4		49.7	229.6	215.9	220.4	0.0
34	ACT	Side 1245	2.50	20	370	0	21250	235.0	12.0	1.5	17.0	4000
	ACT		1.1	HPbulb	13.0	0.0	13364	1.00	1.09	1.5		784
	LOC		995	25	11.5	WB tst 5		130.0	0.0	114.0	1	50.4
	FAT/BUC		1008	23	43.0	48.4		63.0	229.6	215.9	220.4	0.0
35	ACT	Side 1042	2.50	20	340	0	21250	235.0	12.0	1.5	17.0	4000
	ACT		1.1	HPbulb	14.0	0.0	14148	1.00	1.09	1.5		784
	LOC		926	12	11.5	WB tst 5		130.0	0.0	106.1	1	46.9
	FAT/BUC		924	12	39.4	48.4		76.3	228.3	216.5	224.5	0.0
36	ACT	Side 1042	2.50	20	340	0	21250	235.0	12.0	1.5	17.0	4000
	ACT		1.1	HPbulb	14.0	0.0	14932	1.00	1.09	1.5		784
	LOC		857	21	11.5	WB tst 5		130.0	0.0	98.2	1	43.4
	FAT/BUC		840	24	35.8	48.4		89.5	228.3	216.5	224.5	0.0
37	ACT	Side 1042	2.50	20	340	0	21250	235.0	12.0	1.5	17.0	4000
	ACT		1.1	HPbulb	14.0	0.0	15716	1.00	1.09	1.5		784
	LOC		788	32	11.5	WB tst 5		130.0	0.0	90.3	1	39.9
	FAT/BUC		754	38	32.2	48.4		102.8	228.3	216.4	224.5	0.0
38	ACT	Side 1045	2.50	20	340	0	21250	235.0	12.0	1.5	17.0	4000
	ACT		1.1	HPbulb	14.0	0.0	17316	1.00	1.09	1.5		816
	LOC		674	54	11.5	WB tst 5		130.0	0.0	74.3	1	34.0
	FAT/BUC		589	77	24.2	48.4		129.9	228.2	216.0	224.5	0.0
39	ACT	Side 1045	2.50	20	340	0	21250	235.0	12.0	1.5	17.0	4000
	ACT		1.1	HPbulb	14.0	0.0	18132	1.00	1.09	1.5		816
	LOC		600	74	11.5	WB tst 5		130.0	0.0	66.1	1	30.2
	FAT/BUC		490	113	20.1	48.4		143.7	228.2	215.8	224.5	0.0
40	ACT	Side 1045	2.50	20	340	0	21250	235.0	12.0	1.5	17.0	4000
	ACT		1.1	HPbulb	14.0	0.0	18948	1.00	1.09	1.5		816
	LOC		537	94	11.5	WB tst 5		127.1	0.0	57.8	1	26.5
	FAT/BUC		390	167	16.0	48.4		157.5	228.2	215.6	224.5	0.0
41	ACT	Side 999	2.50	20	340	0	21250	235.0	12.0	1.5	21.0	4000
	ACT		1.1	HPbulb	12.0	0.0	19764	1.00	1.09	1.5		816
	LOC		494	102	11.5	WB tst 5		118.5	0.0	49.6	1	22.7
	FAT/BUC		290	243	11.9	48.4		171.3	227.5	215.8	220.1	0.0
42	ACT	Side 999	2.50	20	340	0	21250	235.0	12.0	3.0	21.0	4000
	ACT		1.1	HPbulb	12.0	0.0	20580	1.00	1.18	3.0		816
	LOC		481	107	13.0	WB tst 5		109.9	0.0	41.4	1	19.0
	FAT/BUC		207	382	7.8	48.4		185.1	227.6	213.9	214.6	0.0
43	ACT	Side 992	2.50	20	340	0	21250	235.0	12.0	3.0	21.0	4000
	ACT		1.1	HPbulb	12.0	0.0	21396	1.00	1.18	3.0		710
	LOC		364	172	13.0	WB tst 5		101.4	0.0	33.2	1	13.4
	FAT/BUC		86	*	3.8	48.4		198.9	228.1	214.1	214.6	0.0

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### Local Rule Requirements - Stiffeners (cont.)

Stiff. No	ACT ACT	POS Za cm³	K c	Type Type	h t (mm)	bf tf (mm)	y z (mm)	SigF f <sub>1</sub> N/mm²	m wk	tkw tkf (mm)	tpl (mm)	span spac (mm)
LOC			Zr cm³	Exc. %	tmin (mm)	Load Ref.		Sigma N/mm²	Sigdb N/mm²	p kN/m²	Comp ref.	a_conn cm²
FAT/BUC			Zrf cm³	Exc. %	pd kN/m²	Sigd N/mm²		SigL N/mm²	Lat N/mm²	Torsion N/mm²	Web N/mm²	bf/tf

#### Strength deck

1	ACT	Strdk	0.00	20	340	0	20395	235.0	12.0	3.0	24.0	4000
	ACT	1009	0.0	HPbulb	12.0	0.0	22071	1.00	1.18	3.0		857
	LOC		374	169	*	13.0	WB tst 5	95.0	0.0	26.4	1	12.7
	FAT/BUC		0		0.0	0.0		210.4	226.9	214.3	214.6	0.0
2	ACT	Strdk	0.00	20	340	0	19540	235.0	12.0	3.0	24.0	4000
	ACT	1009	0.0	HPbulb	12.0	0.0	22143	1.00	1.18	3.0		855
	LOC		362	178	*	13.0	WB tst 5	95.0	0.0	25.7	1	12.3
	FAT/BUC		0		0.0	0.0		211.6	226.9	214.3	214.6	0.0
3	ACT	Strdk	0.00	20	340	0	18000	235.0	12.0	2.0	24.0	4000
	ACT	998	0.0	HPbulb	12.0	0.0	22272	1.00	1.12	2.0		697
	LOC		980	1		12.0	Oil slo e	95.0	0.0	89.8	2	35.7
	FAT/BUC		0		0.0	0.0		213.7	227.7	215.9	218.6	0.0
Similar for No(s): 4												
5	ACT	Strdk	0.00	20	340	0	16600	235.0	12.0	2.0	24.0	4000
	ACT	1003	0.0	HPbulb	12.0	0.0	22389	1.00	1.12	2.0		767
	LOC		1078	-6		12.0	Oil slo e	95.0	0.0	89.8	2	38.9
	FAT/BUC		0		0.0	0.0		215.7	227.3	215.8	218.6	0.0
6	ACT	Strdk	0.00	20	340	0	15770	235.0	12.0	2.0	24.0	4000
	ACT	1007	0.0	HPbulb	12.0	0.0	22459	1.00	1.12	2.0		832
	LOC		1170	-13		12.0	Oil slo e	95.0	0.0	89.8	2	41.9
	FAT/BUC		0		0.0	0.0		216.9	227.0	215.7	218.6	0.0
Similar for No(s): 7 8 9 10 11												
12	ACT	Strdk	0.00	20	340	0	10790	235.0	12.0	2.0	24.0	4000
	ACT	1014	0.0	HPbulb	12.0	0.0	22800	1.00	1.12	2.0		830
	LOC		1166	-13		12.0	Oil slo e	95.0	0.0	89.8	2	41.7
	FAT/BUC		0		0.0	0.0		222.7	227.0	215.7	218.6	0.0
Similar for No(s): 13 14 15 16 17 18 19 20 21 22 23 24												

#### Inner Bottom & Inner Side

1	ACT	Inbot	0.00	20	430	0	830	235.0	12.0	1.5	21.0	4000
	ACT	1966	0.0	HPbulb	15.0	0.0	2680	1.00	1.09	1.5		830
	LOC		2683	-26		11.5	Oil tst 5	101.8	33.2	227.3	2	102.9
	FAT/BUC		0		0.0	0.0		116.7	231.1	216.9	220.7	0.0
Similar for No(s): 2 3 4 5 6 7 8 9 10 11 12 13												
14	ACT	Inbot	0.00	20	430	0	13279	235.0	12.0	1.5	21.0	4000
	ACT	1961	0.0	HPbulb	15.0	0.0	2907	1.00	1.09	1.5		829
	LOC		2656	-26		11.5	Oil tst 5	101.8	33.2	225.0	2	101.9
	FAT/BUC		0		0.0	0.0		112.9	231.1	216.9	220.7	0.0
Similar for No(s): 15 16 17												
18	ACT	Hoptk	0.00	20	430	0	16947	235.0	12.0	1.5	20.0	4000
	ACT	1944	0.0	HPbulb	15.0	0.0	3654	1.00	1.09	1.5		768
	LOC		1675	16		11.5	Oil tst 5	144.3	0.0	217.5	2	91.8
	FAT/BUC		0		0.0	0.0		100.4	231.2	217.0	220.7	0.0
19	ACT	Hoptk	0.00	20	430	0	17294	235.0	12.0	1.5	20.0	4000
	ACT	1944	0.0	HPbulb	15.0	0.0	4339	1.00	1.09	1.5		768
	LOC		1525	27		11.5	Oil tst 5	153.5	0.0	210.6	2	88.8
	FAT/BUC		0		0.0	0.0		88.9	231.2	217.1	220.7	0.0
20	ACT	Hoptk	0.00	20	430	0	17641	235.0	12.0	1.5	16.0	4000
	ACT	1895	0.0	HPbulb	15.0	0.0	5024	1.00	1.09	1.5		768
	LOC		1415	33		11.5	Oil tst 5	160.0	0.0	203.7	2	85.8
	FAT/BUC		0		0.0	0.0		77.4	231.4	213.5	220.7	0.0

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**Local Rule Requirements - Stiffeners (cont.)**

Stiff. No	ACT ACT	POS Za cm³	K c	Type Type	h t (mm)	bf tf (mm)	y z (mm)	SigF f <sub>1</sub> N/mm²	m wk	tkw tkf (mm)	tpl (mm)	span spac (mm)
LOC			Zr cm³	Exc. %	tmin (mm)	Load Ref.		Sigma N/mm²	Sigdb N/mm²	p kN/m²	Comp ref.	a_conn cm²
FAT/BUC			Zrf cm³	Exc. %	pd kN/m²	Sigd N/mm²		SigL N/mm²	Lat N/mm²	Torsion N/mm²	Web N/mm²	bf/tf
21	ACT	Hoptk	0.00	20	400	0	17989	235.0	12.0	1.5	16.0	4000
	ACT	1544	0.0	HPbulb	14.0	0.0	5709	1.00	1.09	1.5		767
	LOC		1367	12	11.5	Oil tst 5		160.0	0.0	196.8	2	82.9
	FAT/BUC		0		0.0	0.0		65.9	230.7	215.4	220.6	0.0
22	ACT	Hoptk	0.00	20	400	0	18336	235.0	12.0	1.5	16.0	4000
	ACT	1545	0.0	HPbulb	14.0	0.0	6394	1.00	1.09	1.5		774
	LOC		1331	16	11.5	Oil tst 5		160.0	0.0	190.0	2	80.5
	FAT/BUC		0		0.0	0.0		54.4	230.7	215.4	220.6	0.0
23	ACT	Insid	0.00	20	370	0	18690	235.0	12.0	1.5	15.0	4000
	ACT	1229	0.0	HPbulb	13.0	0.0	7875	1.00	1.09	1.5		783
	LOC		1241	0	11.5	Oil tst 5		160.0	0.0	175.1	2	74.8
	FAT/BUC		0		0.0	0.0		30.0	229.8	215.3	220.4	0.0
24	ACT	Insid	0.00	20	370	0	18690	235.0	12.0	1.5	15.0	4000
	ACT	1229	0.0	HPbulb	13.0	0.0	8659	1.00	1.09	1.5		784
	LOC		1185	3	11.5	Oil tst 5		160.0	0.0	167.2	2	71.3
	FAT/BUC		0		0.0	0.0		30.0	229.8	215.3	220.4	0.0
25	ACT	Insid	0.00	20	370	0	18690	235.0	12.0	1.5	15.0	4000
	ACT	1229	0.0	HPbulb	13.0	0.0	9443	1.00	1.09	1.5		784
	LOC		1129	8	11.5	Oil tst 5		160.0	0.0	159.3	2	67.8
	FAT/BUC		0		0.0	0.0		30.0	229.8	215.3	220.4	0.0
26	ACT	Insid	0.00	20	370	0	18690	235.0	12.0	1.5	15.0	4000
	ACT	1229	0.0	HPbulb	13.0	0.0	10227	1.00	1.09	1.5		784
	LOC		1073	14	11.5	Oil tst 5		160.0	0.0	151.4	2	64.3
	FAT/BUC		0		0.0	0.0		30.0	229.8	215.3	220.4	0.0
27	ACT	Insid	0.00	20	370	0	18690	235.0	12.0	1.5	14.0	4000
	ACT	1220	0.0	HPbulb	13.0	0.0	11011	1.00	1.09	1.5		784
	LOC		1018	19	11.5	Oil tst 5		160.0	0.0	143.5	2	60.8
	FAT/BUC		0		0.0	0.0		30.0	229.9	215.0	220.4	0.0
28	ACT	Insid	0.00	20	340	0	18690	235.0	12.0	1.5	14.0	4000
	ACT	958	0.0	HPbulb	12.0	0.0	12579	1.00	1.09	1.5		783
	LOC		906	5	11.5	Oil tst 5		160.0	0.0	127.8	2	53.9
	FAT/BUC		0		0.0	0.0		49.7	228.7	213.7	220.1	0.0
29	ACT	Insid	0.00	20	340	0	18690	235.0	12.0	1.5	14.0	4000
	ACT	958	0.0	HPbulb	12.0	0.0	13363	1.00	1.09	1.5		784
	LOC		850	12	11.5	Oil tst 5		160.0	0.0	119.9	2	50.4
	FAT/BUC		0		0.0	0.0		63.0	228.7	213.6	220.1	0.0
30	ACT	Insid	0.00	20	340	0	18690	235.0	12.0	1.5	14.0	4000
	ACT	958	0.0	HPbulb	12.0	0.0	14148	1.00	1.09	1.5		784
	LOC		794	20	11.5	Oil tst 5		160.0	0.0	112.0	2	46.9
	FAT/BUC		0		0.0	0.0		76.3	228.7	213.5	220.1	0.0
31	ACT	Insid	0.00	20	340	0	18690	235.0	12.0	1.5	14.0	4000
	ACT	958	0.0	HPbulb	12.0	0.0	14932	1.00	1.09	1.5		784
	LOC		738	29	11.5	Oil tst 5		160.0	0.0	104.1	2	43.4
	FAT/BUC		0		0.0	0.0		89.5	228.7	213.4	220.1	0.0
32	ACT	Insid	0.00	20	340	0	18690	235.0	12.0	1.5	14.0	4000
	ACT	958	0.0	HPbulb	12.0	0.0	15716	1.00	1.09	1.5		784
	LOC		682	40	11.5	Oil tst 5		160.0	0.0	96.2	2	39.9
	FAT/BUC		0		0.0	0.0		102.8	228.7	213.2	220.1	0.0
33	ACT	Insid	0.00	20	340	0	18690	235.0	12.0	1.5	17.0	4000
	ACT	979	0.0	HPbulb	12.0	0.0	17316	1.00	1.09	1.5		816
	LOC		734	33	11.5	Oil slo e		144.3	0.0	89.8	2	34.0
	FAT/BUC		0		0.0	0.0		129.9	228.1	214.5	220.1	0.0
34	ACT	Insid	0.00	20	340	0	18690	235.0	12.0	1.5	17.0	4000
	ACT	979	0.0	HPbulb	12.0	0.0	18132	1.00	1.09	1.5		815
	LOC		781	25	11.5	Oil slo e		135.7	0.0	89.8	2	32.9
	FAT/BUC		0		0.0	0.0		143.7	228.1	214.4	220.1	0.0



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**Local Rule Requirements - Stiffeners (cont.)**

Stiff. No	ACT ACT	POS Za cm³	K c	Type Type	h t (mm)	bf tf (mm)	y z (mm)	SigF f <sub>1</sub> N/mm²	m wk	tkw tkf (mm)	tpl (mm)	span spac (mm)
LOC			Zr cm³	Exc. %	tmin (mm)	Load Ref.		Sigma N/mm²	Sigdb N/mm²	p kN/m²	Comp ref.	a_conn cm²
FAT/BUC			Zrf cm³	Exc. %	pd kN/m²	Sigd N/mm²		SigL N/mm²	Lat N/mm²	Torsion N/mm²	Web N/mm²	bf/tf
35	ACT	Insid 979	0.00	20	340	0	18690	235.0	12.0	1.5	17.0	4000
	ACT		0.0	HPbulb	12.0	0.0	18947	1.00	1.09	1.5		815
	LOC		834	17	11.5	Oil slo e		127.1	0.0	89.8	2	32.9
	FAT/BUC		0		0.0	0.0		157.5	228.1	214.3	220.1	0.0
36	ACT	Insid 999	0.00	20	340	0	18690	235.0	12.0	1.5	21.0	4000
	ACT		0.0	HPbulb	12.0	0.0	19763	1.00	1.09	1.5		816
	LOC		894	11	11.5	Oil slo e		118.5	0.0	89.8	2	32.9
	FAT/BUC		0		0.0	0.0		171.3	227.5	215.8	220.1	0.0
37	ACT	Insid 999	0.00	20	340	0	18690	235.0	12.0	1.5	21.0	4000
	ACT		0.0	HPbulb	12.0	0.0	20579	1.00	1.09	1.5		816
	LOC		964	3	11.5	Oil slo e		109.9	0.0	89.8	2	32.9
	FAT/BUC		0		0.0	0.0		185.1	227.5	215.7	220.1	0.0
38	ACT	Insid 999	0.00	20	340	0	18690	235.0	12.0	3.0	21.0	4000
	ACT		0.0	HPbulb	12.0	0.0	21395	1.00	1.18	3.0		817
	LOC		1134	-11	13.0	Oil slo e		101.4	0.0	89.8	2	32.9
	FAT/BUC		0		0.0	0.0		198.9	227.6	213.8	214.6	0.0
<b>CL Bulkhead</b>												
1	ACT	Lbhd 1203	0.00	10	400	0	0	235.0	12.0	1.5	19.0	2000
	ACT		0.0	Fbar	25.0	0.0	590	1.00	1.06	1.5		705
	LOC		587	104	21.5	WB acc 1		103.0	0.0	244.0	1	44.3
	FAT/BUC		0		0.0	0.0		151.8	233.5	202.6	0.0	0.0
2	ACT	Lbhd 1224	0.00	10	400	0	0	235.0	12.0	1.5	19.0	2000
	ACT		0.0	Fbar	25.0	0.0	1410	1.00	1.06	1.5		820
	LOC		594	106	21.5	WB acc 1		114.0	0.0	234.7	1	47.8
	FAT/BUC		0		0.0	0.0		138.0	233.4	201.6	0.0	0.0
3	ACT	Lbhd 1187	0.00	10	400	0	0	235.0	12.0	1.5	19.0	2000
	ACT		0.0	Fbar	25.0	0.0	2230	1.00	1.06	1.5		635
	LOC		403	194	21.5	WB tst 5		125.1	0.0	225.9	1	37.7
	FAT/BUC		0		0.0	0.0		124.3	233.5	203.6	0.0	0.0
4	ACT	Lbhd 1926	0.00	20	430	0	0	235.0	12.0	1.0	19.0	4000
	ACT		0.0	HPbulb	15.0	0.0	3417	1.00	1.06	0.0		736
	LOC		1614	19	11.0	Oil tst 5		141.1	0.0	219.9	2	91.8
	FAT/BUC		0		0.0	0.0		104.4	231.3	217.9	221.8	0.0
5	ACT	Lbhd 1926	0.00	20	430	0	0	235.0	12.0	1.0	19.0	4000
	ACT		0.0	HPbulb	15.0	0.0	4152	1.00	1.06	0.0		735
	LOC		1456	32	11.0	Oil tst 5		151.0	0.0	212.5	2	88.7
	FAT/BUC		0		0.0	0.0		92.0	231.3	218.0	221.8	0.0
6	ACT	Lbhd 1926	0.00	20	430	0	0	235.0	12.0	1.0	19.0	4000
	ACT		0.0	HPbulb	15.0	0.0	4887	1.00	1.06	0.0		735
	LOC		1326	45	11.0	Oil tst 5		160.0	0.0	205.1	2	85.6
	FAT/BUC		0		0.0	0.0		79.7	231.3	218.0	221.8	0.0
7	ACT	Lbhd 1501	0.00	10	450	0	0	235.0	12.0	1.0	19.0	4000
	ACT		0.0	Fbar	25.0	0.0	5622	1.00	1.04	0.0		735
	LOC		1254	19	23.5	Oil tst 5		160.0	0.0	197.7	2	82.5
	FAT/BUC		0		0.0	0.0		67.4	230.1	198.7	0.0	0.0
8	ACT	Lbhd 1501	0.00	10	450	0	0	235.0	12.0	1.0	19.0	4000
	ACT		0.0	Fbar	25.0	0.0	6357	1.00	1.04	0.0		735
	LOC		1207	24	23.5	Oil tst 5		160.0	0.0	190.3	2	79.4
	FAT/BUC		0		0.0	0.0		55.1	230.1	198.8	0.0	0.0
Similar for No(s): 9												
10	ACT	Lbhd 1218	0.00	10	400	0	0	235.0	12.0	1.0	19.0	4000
	ACT		0.0	Fbar	25.0	0.0	7876	1.00	1.04	0.0		784
	LOC		1184	2	21.0	Oil tst 5		160.0	0.0	175.1	2	77.4
	FAT/BUC		0		0.0	0.0		29.6	228.6	205.5	0.0	0.0

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**Local Rule Requirements - Stiffeners (cont.)**

Stiff. No	ACT ACT	POS Za cm³	K c	Type Type	h t (mm)	bf tf (mm)	y z (mm)	SigF f <sub>1</sub> N/mm²	m wk	tkw tkf (mm)	tpl (mm)	span spac (mm)
LOC			Zr cm³	Exc. %	tmin (mm)	Load Ref.		Sigma N/mm²	Sigdb N/mm²	p kN/m²	Comp ref.	a_conn cm²
FAT/BUC			Zrf cm³	Exc. %	pd kN/m²	Sigd N/mm²		SigL N/mm²	Lat N/mm²	Torsion N/mm²	Web N/mm²	bf/tf
11	ACT	Lbhd	0.00	10	400	0	0	235.0	12.0	1.0	19.0	4000
	ACT	1218	0.0	Fbar	25.0	0.0	8660	1.00	1.04	0.0		784
	LOC		1131	7	21.0	Oil tst 5		160.0	0.0	167.2	2	73.9
	FAT/BUC		0		0.0	0.0		16.4	228.6	205.6	0.0	0.0
12	ACT	Lbhd	0.00	10	400	0	0	235.0	12.0	1.0	13.0	4000
	ACT	1146	0.0	Fbar	25.0	0.0	9444	1.00	1.04	0.0		784
	LOC		1078	6	21.0	Oil tst 5		160.0	0.0	159.3	2	70.4
	FAT/BUC		0		0.0	0.0		3.3	229.0	200.5	0.0	0.0
13	ACT	Lbhd	0.00	10	400	0	0	235.0	12.0	1.0	13.0	4000
	ACT	1146	0.0	Fbar	25.0	0.0	10228	1.00	1.04	0.0		784
	LOC		1024	11	21.0	Oil tst 5		160.0	0.0	151.4	2	66.9
	FAT/BUC		0		0.0	0.0		9.9	229.0	200.4	0.0	0.0
14	ACT	Lbhd	0.00	10	400	0	0	235.0	12.0	1.0	13.0	4000
	ACT	1146	0.0	Fbar	25.0	0.0	11012	1.00	1.04	0.0		784
	LOC		971	18	21.0	Oil tst 5		160.0	0.0	143.5	2	63.4
	FAT/BUC		0		0.0	0.0		23.2	229.0	200.1	0.0	0.0
15	ACT	Lbhd	0.00	10	350	0	0	235.0	12.0	1.0	13.0	4000
	ACT	896	0.0	Fbar	25.0	0.0	11796	1.00	1.04	0.0		784
	LOC		917	-2	18.5	Oil tst 5		160.0	0.0	135.6	2	60.0
	FAT/BUC		0		0.0	0.0		36.5	227.0	207.7	0.0	0.0
16	ACT	Lbhd	0.00	10	350	0	0	235.0	12.0	1.0	13.0	4000
	ACT	896	0.0	Fbar	25.0	0.0	12580	1.00	1.04	0.0		784
	LOC		864	3	18.5	Oil tst 5		160.0	0.0	127.8	2	56.5
	FAT/BUC		0		0.0	0.0		49.7	227.0	207.3	0.0	0.0
17	ACT	Lbhd	0.00	10	350	0	0	235.0	12.0	1.0	13.0	4000
	ACT	896	0.0	Fbar	25.0	0.0	13364	1.00	1.04	0.0		784
	LOC		811	10	18.5	Oil tst 5		160.0	0.0	119.9	2	53.0
	FAT/BUC		0		0.0	0.0		63.0	227.0	207.0	0.0	0.0
18	ACT	Lbhd	0.00	10	350	0	0	235.0	12.0	1.0	13.0	4000
	ACT	896	0.0	Fbar	25.0	0.0	14148	1.00	1.04	0.0		784
	LOC		757	18	18.5	Oil tst 5		160.0	0.0	112.0	2	49.5
	FAT/BUC		0		0.0	0.0		76.3	227.0	206.7	0.0	0.0
19	ACT	Lbhd	0.00	10	350	0	0	235.0	12.0	1.0	13.0	4000
	ACT	896	0.0	Fbar	25.0	0.0	14932	1.00	1.04	0.0		784
	LOC		704	27	18.5	Oil tst 5		160.0	0.0	104.1	2	46.0
	FAT/BUC		0		0.0	0.0		89.5	227.0	206.3	0.0	0.0
20	ACT	Lbhd	0.00	10	350	0	0	235.0	12.0	1.0	13.0	4000
	ACT	896	0.0	Fbar	25.0	0.0	15716	1.00	1.04	0.0		784
	LOC		651	37	18.5	Oil tst 5		160.0	0.0	96.2	2	42.5
	FAT/BUC		0		0.0	0.0		102.8	227.0	206.0	0.0	0.0
21	ACT	Lbhd	0.00	10	350	0	0	235.0	12.0	1.0	13.0	4000
	ACT	896	0.0	Fbar	25.0	0.0	16500	1.00	1.04	0.0		784
	LOC		635	41	18.5	Oil slo e		152.9	0.0	89.8	2	39.7
	FAT/BUC		0		0.0	0.0		116.1	227.0	205.6	0.0	0.0
22	ACT	Lbhd	0.00	20	340	0	0	235.0	12.0	1.0	18.0	4000
	ACT	982	0.0	HPbulb	12.0	0.0	17284	1.00	1.06	0.0		785
	LOC		685	43	11.0	Oil slo e		144.6	0.0	89.8	2	39.7
	FAT/BUC		0		0.0	0.0		129.3	228.1	216.2	221.6	0.0
23	ACT	Lbhd	0.00	20	340	0	0	235.0	12.0	1.0	18.0	4000
	ACT	982	0.0	HPbulb	12.0	0.0	18070	1.00	1.06	0.0		786
	LOC		728	34	11.0	Oil slo e		136.3	0.0	89.8	2	39.8
	FAT/BUC		0		0.0	0.0		142.6	228.1	216.1	221.6	0.0
24	ACT	Lbhd	0.00	20	340	0	0	235.0	12.0	1.0	18.0	4000
	ACT	982	0.0	HPbulb	12.0	0.0	18856	1.00	1.06	0.0		786
	LOC		775	26	11.0	Oil slo e		128.1	0.0	89.8	2	39.8
	FAT/BUC		0		0.0	0.0		155.9	228.1	216.0	221.6	0.0

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**Local Rule Requirements - Stiffeners (cont.)**

Stiff. No	ACT ACT	POS Za cm <sup>3</sup>	K c	Type Type	h t (mm)	bf tf (mm)	y z (mm)	SigF f <sub>1</sub> N/mm <sup>2</sup>	m wk	tkw tkf (mm)	tpl (mm)	span spac (mm)
LOC			Zr cm <sup>3</sup>	Exc. %	tmin (mm)	Load Ref.		Sigma N/mm <sup>2</sup>	Sigdb N/mm <sup>2</sup>	p kN/m <sup>2</sup>	Comp ref.	a_conn cm <sup>2</sup>
FAT/BUC			Zrf cm <sup>3</sup>	Exc. %	pd kN/m <sup>2</sup>	Sigd N/mm <sup>2</sup>		SigL N/mm <sup>2</sup>	Lat N/mm <sup>2</sup>	Torsion N/mm <sup>2</sup>	Web N/mm <sup>2</sup>	bf/tf
25	ACT ACT LOC FAT/BUC	Lbhd 982	0.00 0.0 828 0	20 HPbulb 18	340 12.0 11.0 0.0	0 0.0 Oil slo e 0.0	0 19642	235.0 1.00 119.8 169.2	12.0 1.06 0.0 228.1	1.0 0.0 89.8 216.0	18.0 2 221.6	4000 786 39.8 0.0
26	ACT ACT LOC FAT/BUC	Lbhd 997	0.00 0.0 890 0	20 HPbulb 12	340 12.0 11.0 0.0	0 0.0 Oil slo e 0.0	0 20428	235.0 1.00 111.5 182.5	12.0 1.06 0.0 227.6	1.0 0.0 89.8 216.8	21.0 2 221.6	4000 786 39.8 0.0
27	ACT ACT LOC FAT/BUC	Lbhd 998	0.00 0.0 965 0	20 HPbulb 3	340 12.0 11.0 0.0	0 0.0 Oil slo e 0.0	0 21214	235.0 1.00 103.3 195.8	12.0 1.06 0.0 227.6	1.0 0.0 89.8 216.8	21.0 2 221.6	4000 789 39.9 0.0
28	ACT ACT LOC FAT/BUC	Lbhd 998	0.00 0.0 1114 0	20 HPbulb -10	340 12.0 12.0 0.0	0 0.0 Oil slo e 0.0	0 22007	235.0 1.00 95.0 209.3	12.0 1.12 0.0 227.6	2.0 2.0 89.8 214.9	21.0 2 218.6	4000 793 40.1 0.0
<b>Stringer 7092</b>												
1	ACT ACT LOC FAT/BUC	Strng 194	0.00 0.0 89 0	10 Fbar 117	200 15.0 11.5 0.0	0 0.0 WB slo s 0.0	20610 7092	235.0 1.00 160.0 42.7	12.0 1.10 0.0 205.1	1.5 1.5 15.3 213.1	12.0 1 0.0	4000 640 5.6 0.0
Similar for No(s): 2 3												
<b>Stringer 11796</b>												
1	ACT ACT LOC FAT/BUC	Strng 194	0.00 0.0 89 0	10 Fbar 117	200 15.0 11.5 0.0	0 0.0 WB slo s 0.0	20610 11796	235.0 1.00 160.0 36.5	12.0 1.10 0.0 205.1	1.5 1.5 15.3 213.4	12.0 1 0.0	4000 640 5.6 0.0
Similar for No(s): 2 3												
<b>Stringer 16500</b>												
1	ACT ACT LOC FAT/BUC	Strng 194	0.00 0.0 89 0	10 Fbar 117	200 15.0 11.5 0.0	0 0.0 WB slo s 0.0	20610 16500	235.0 1.00 160.0 116.1	12.0 1.10 0.0 205.1	1.5 1.5 15.3 208.8	12.0 1 0.0	4000 640 5.6 0.0
Similar for No(s): 2 3												
<b>Bottom girder 5810</b>												
1	ACT ACT LOC FAT/BUC	DBgird 575	0.00 0.0 118 0	10 Fbar 386	300 20.0 16.5 0.0	0 0.0 WB slo e 0.0	5810 590	235.0 1.00 115.0 151.8	10.0 1.08 0.0 222.6	1.5 1.5 11.2 207.0	18.0 1 0.0	4000 705 4.5 0.0
2	ACT ACT LOC FAT/BUC	DBgird 582	0.00 0.0 137 0	10 Fbar 323	300 20.0 16.5 0.0	0 0.0 WB slo e 0.0	5810 1410	235.0 1.00 115.0 138.0	10.0 1.08 0.0 221.9	1.5 1.5 11.2 205.2	18.0 1 0.0	4000 820 5.2 0.0
3	ACT ACT LOC FAT/BUC	DBgird 573	0.00 0.0 113 0	10 Fbar 403	300 20.0 16.5 0.0	0 0.0 WB slo e 0.0	5810 2230	235.0 1.00 115.0 124.3	10.0 1.08 0.0 222.8	1.5 1.5 11.2 208.0	18.0 1 0.0	4000 678 4.4 0.0
<b>Bottom girder 11620</b>												
1	ACT ACT LOC FAT/BUC	DBgird 575	0.00 0.0 118 0	10 Fbar 386	300 20.0 16.5 0.0	0 0.0 WB slo e 0.0	11620 590	235.0 1.00 115.0 151.8	10.0 1.08 0.0 222.6	1.5 1.5 11.2 207.0	18.0 1 0.0	4000 705 4.5 0.0



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 SHUTTLE TANKER 145000 M3  
 CUADERNA MAESTRA

Ship Id No : Aprox. 1

**Local Rule Requirements - Stiffeners (cont.)**

Stiff. No	ACT ACT	POS Za cm³	K c	Type Type	h t (mm)	bf tf (mm)	y z (mm)	SigF f <sub>1</sub> N/mm²	m wk	tkw tkf (mm)	tpl (mm)	span spac (mm)
	LOC		Zr cm³	Exc. %	tmin (mm)	Load Ref.		Sigma N/mm²	Sigdb N/mm²	p kN/m²	Comp ref.	a_conn cm²
	FAT/BUC		Zrf cm³	Exc. %	pd kN/m²	Sigd N/mm²		SigL N/mm²	Lat N/mm²	Torsion N/mm²	Web N/mm²	bf/tf
2	ACT	DBgird	0.00	10	300	0	11620	235.0	10.0	1.5	18.0	4000
	ACT	582	0.0	Fbar	20.0	0.0	1410	1.00	1.08	1.5		820
	LOC		137	323	16.5	WB slo e		115.0	0.0	11.2	1	5.2
	FAT/BUC		0		0.0	0.0		138.0	221.9	205.2	0.0	0.0
3	ACT	DBgird	0.00	10	300	0	11620	235.0	10.0	1.5	18.0	4000
	ACT	577	0.0	Fbar	20.0	0.0	2230	1.00	1.08	1.5		733
	LOC		123	369	16.5	WB slo e		115.0	0.0	11.2	1	4.7
	FAT/BUC		0		0.0	0.0		124.3	222.5	207.2	0.0	0.0
<b>Bottom girder 16600</b>												
1	ACT	DBgird	0.00	10	300	0	16600	235.0	10.0	1.5	18.0	4000
	ACT	575	0.0	Fbar	20.0	0.0	590	1.00	1.08	1.5		705
	LOC		118	386	16.5	WB slo e		115.0	0.0	11.2	1	4.5
	FAT/BUC		0		0.0	0.0		151.8	222.6	207.0	0.0	0.0
2	ACT	DBgird	0.00	10	300	0	16600	235.0	10.0	1.5	18.0	4000
	ACT	582	0.0	Fbar	20.0	0.0	1410	1.00	1.08	1.5		820
	LOC		137	323	16.5	WB slo e		115.0	0.0	11.2	1	5.2
	FAT/BUC		0		0.0	0.0		138.0	221.9	205.2	0.0	0.0
3	ACT	DBgird	0.00	10	300	0	16600	235.0	10.0	1.5	18.0	4000
	ACT	580	0.0	Fbar	20.0	0.0	2230	1.00	1.08	1.5		780
	LOC		130	343	16.5	WB slo e		115.0	0.0	11.2	1	4.9
	FAT/BUC		0		0.0	0.0		124.3	222.1	206.4	0.0	0.0

# **2º APROXIMACION**

**3.2.-** A continuación se muestran los siguientes datos (input) y resultados (output) del programa “NAUTICUS HULL” para una segunda aproximación.

- Distribución, tipo, dimensiones y acero empleado para refuerzos longitudinales. Ver hojas 3 a 5.
- Referencias a la reglamentación. Ver hoja 6
- Datos de entrada necesarios para el programa. Ver hoja 7.
- Espaciado entre cuadernas. Ver hoja 8.
- Geometría de planchas. Ver hoja 9.
- Cálculo del área de la cuaderna maestra. Ver hojas 11 a 16.
- Momentos flectores. Ver hoja 17.
- Módulo resistente. Ver hojas 18 y 19.
- Resistencia local y pandeo para planchas y refuerzos. Ver hojas 22 a 33.



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## SECTION SCANTLINGS

### Hull Section Scantlings according to DNV Rules

Rule edition ..... : Jan 1998  
Program version ..... : 3.3-372-980619

#### Ship Identification SHUTTLE TANKER 145000 M3

ID No ..... : Aprox. 2  
Date/Sign ..... :  
CUADERNA MAESTRA REDISEÑADA CON ACERO DULCE

#### Cross Section Identification CUADERNA MAESTRA

Midship section? ..... : Yes  
Distance from AP ..... (m) : 128.250  
Date/Sign ..... :  
CUADERNA MAESTRA REALIZADA CON ACERO DULCE

Database: C:\NautHull\SHIPS\Proyec1\SectSca\proyec1.pw

#### Main Dimensions

Length betw. perpendiculars, Lbp .....	(m) :	256.500
Rule length, L .....	(m) :	252.690
Breadth moulded, B .....	(m) :	42.500
Depth moulded, D .....	(m) :	22.000
Draught moulded, T .....	(m) :	15.500
Block coefficient, Cb .....	:	0.879
Min. design draught at AP .....	(m) :	0.000
Min. design draught at FP .....	(m) :	0.000

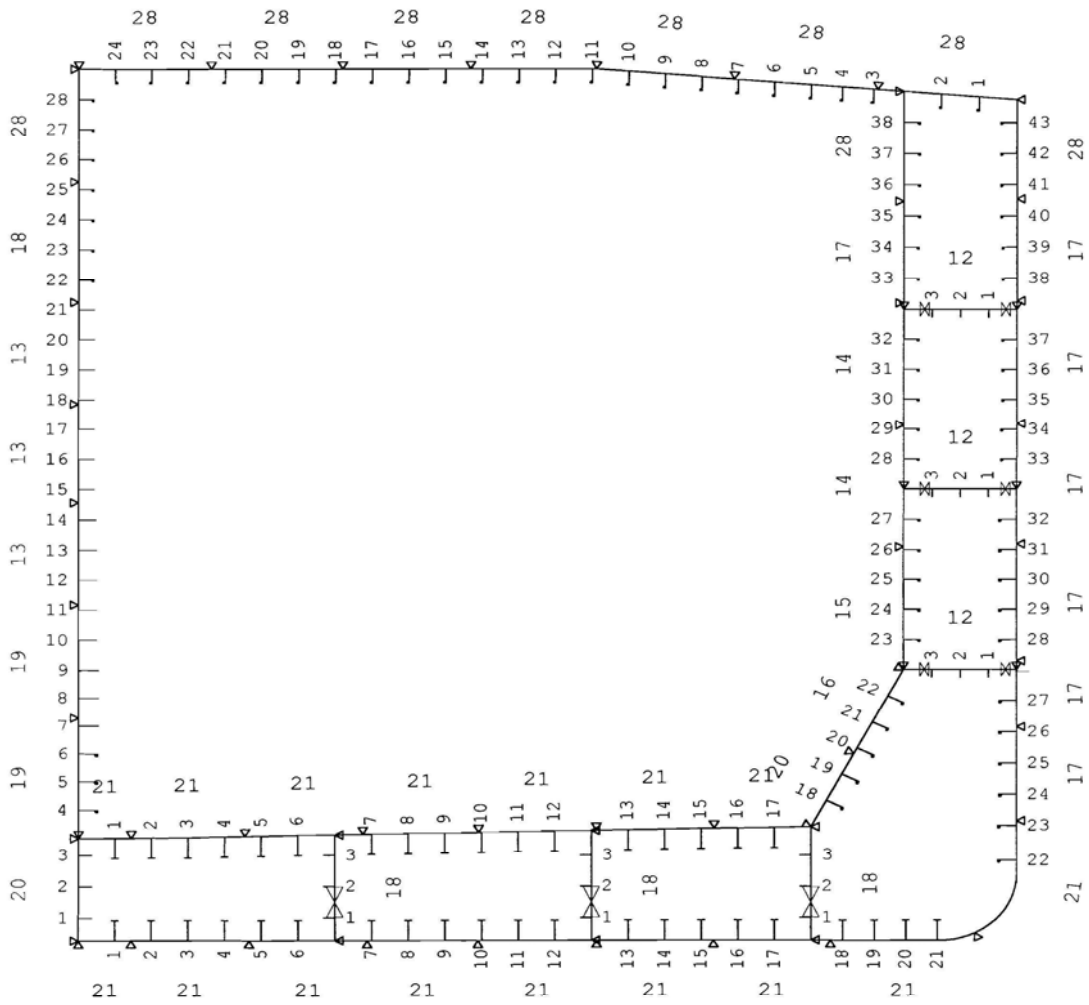
**Table of Contents**

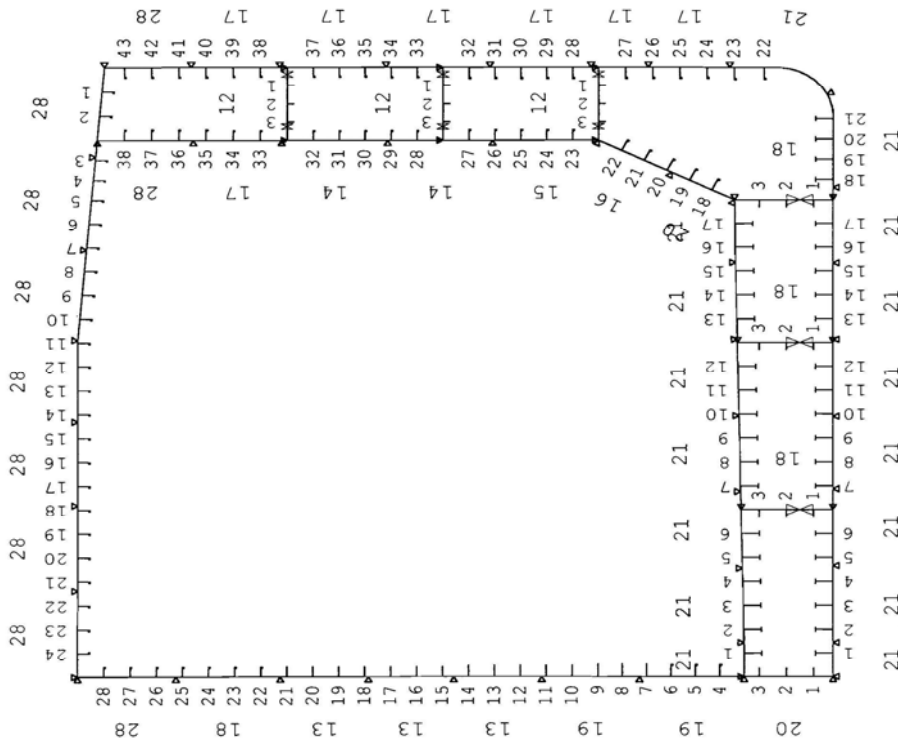
1	Rule Reference
2	Input Data
3	Panel Geometry
4	Node Co-ordinates
5	Layout of Plates and Profiles
6	Cross-Sectional Area
7	Cross-Sectional Data
8	Design Bending Moments
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Section Scantlings - v.3.3-372-980619  
 SHUTTLE TANKER 145000 M3  
 CUADERNA MAESTRA

Ship Id No

Aprox. 2





Scale:  
 1:200

SHUTTLE TANKER 145000 M3  
 Date/Sign : 00-02-16  
 Main dim. : Lpp=256.5 B=42.5 D=22 T=15.5 (m) CB=0.879

Nauticus Hull  
 Section Scantlings



Section Scantlings - v.3.3-372-980619  
 SHUTTLE TANKER 145000 M3  
 CUADERNA MAESTRA

Ship Id No : Aprox. 2

### Profiles

Nos	Type	Dimensions	Steel
<b>Outer Shell</b>			
1 - 21	Tbar	530 x 150 x 12 x 35	
22 - 23	HPbulb	430 x 15	
24 - 30	HPbulb	400 x 16	
31 - 32	HPbulb	400 x 14	
33 - 34	HPbulb	370 x 13	
35 - 39	HPbulb	340 x 14	
40 - 24	HPbulb	370 x 13	
<b>Inner Bottom &amp; Inner Side</b>			
1 - 17	Tbar	530 x 150 x 12 x 30	
18 - 20	HPbulb	430 x 15	
21 - 22	HPbulb	400 x 14	
23 - 27	HPbulb	370 x 13	
28 - 34	HPbulb	340 x 12	
35 - 38	HPbulb	370 x 13	
<b>CL Bulkhead</b>			
1 - 3	Fbar	300 x 20	
4 - 6	HPbulb	430 x 15	
7 - 9	Fbar	450 x 25	
10 - 14	Fbar	400 x 25	
15 - 21	Fbar	350 x 25	
22 - 28	HPbulb	340 x 12	
<b>Stringer 7092</b>			
1 - 3	Fbar	200 x 15	
<b>Stringer 11796</b>			
1 - 3	Fbar	200 x 15	
<b>Stringer 16500</b>			
1 - 3	Fbar	200 x 15	
<b>Bottom girder 5810</b>			
1 - 3	Fbar	250 x 15	
<b>Bottom girder 11620</b>			
1 - 3	Fbar	250 x 15	
<b>Bottom girder 16600</b>			
1 - 3	Fbar	250 x 15	

Section Scantlings - v.3.3-372-980619  
 SHUTTLE TANKER 145000 M3  
 CUADERNA MAESTRA

Ship Id No : Aprox. 2

## 1 Rule Reference

 DET NORSE VERITAS' Rules for Classification of Ships, January 1998.  
 Ships with length 100 metres and above.

STRENGTH ITEM	REFERENCE TO DNV RULES
<b>HULL GIRDER STRENGTH</b>	
- Design bending moments	Jan 1998 Pt.3 Ch.1 Sec.5 B 102-202
- Bending strength	Jan 1998 Pt.3 Ch.1 Sec.5 C
<b>PLATES</b>	
- Bottom and inner bottom	Jan 1998 Pt.3 Ch.1 Sec.6 C 100-503
- Side	Jan 1998 Pt.3 Ch.1 Sec.7 C 100-104
- Deck	Jan 1998 Pt.3 Ch.1 Sec.8 C 100-202
- Bulkheads	Jan 1998 Pt.3 Ch.1 Sec.9 C 100-105
- Wheel loaded decks	Jan 1998 Pt.5 Ch.2 Sec.4 C 200-302
- Bulk cargo (HC-Class)	Jan 1998 Pt.5 Ch.2 Sec.5 B, C300-304, D200-202
- Container carriers	Jan 1998 Pt.5 Ch.2 Sec.6 B & C
- IB(+) Notation	Jan 1998 Pt.3 Ch.1 Sec.6 H 302
- Buckling strength	Jan 1998 Pt.3 Ch.1 Sec.14 B 100, 201, 205, 206
<b>STIFFENERS</b>	
- Bottom and inner bottom	Jan 1998 Pt.3 Ch.1 Sec.6 C 700-901
- Side	Jan 1998 Pt.3 Ch.1 Sec.7 C 300-304, E 501
- Main frames in general	Jan 1998 Pt.3 Ch.1 Sec.7 C 400-404
- For bulkcarriers, L>150 m	Jan 1998 Pt.5 Ch.2 Sec.10 B (IACS UR S12)
- Deck	Jan 1998 Pt.3 Ch.1 Sec.8 C 300-303
- Bulkheads	Jan 1998 Pt.3 Ch.1 Sec.9 C 200-204
- Wheel loaded decks	Jan 1998 Pt.5 Ch.2 Sec.4 C 200-202, 401
- Bulk cargo (HC-Class)	Jan 1998 Pt.5 Ch.2 Sec.5 B, C300-302, 305-306
- Container carriers	Jan 1998 Pt.5 Ch.2 Sec.6 B & C
- Buckling strength	Jan 1998 Pt.3 Ch.1 Sec.14 C 100-202, 300-402
- Connection area at supp.	Jan 1998 Pt.3 Ch.1 Sec.12 C 402 (C=1.25)

 Current Rule booklets:  
 Pt.3 Ch.1: January 1998  
 Pt.3 Ch.2: January 1998  
 Pt.5 Ch.2: January 1998

The January 1998 Rules come into force on July 1, 1998.

NOTE: THE FOLLOWING REQUIREMENTS ARE NOT INCLUDED:

- Floors and brackets
- Ice strengthening of hull
- Slamming and bow impact
- Tugs, Supply vessels and other offshore/harbour vessels
- Class notation ICM (Increased corrosion margins)

## 2 Input Data

### Main Dimensions

Length betw. perpendiculars, Lbp .....	(m) :	256.500
Rule length, L .....	(m) :	252.690
Breadth moulded, B .....	(m) :	42.500
Depth moulded, D .....	(m) :	22.000
Draught moulded, T .....	(m) :	15.500
Block coefficient, Cb .....	:	0.879
Min. design draught at AP .....	(m) :	0.000
Min. design draught at FP .....	(m) :	0.000

### General Ship Data

Maximum service speed, V .....	(knots) :	14.500
Bilge keel? .....	:	Yes
Active roll damping facility? .....	:	No
Period of roll, Tr .....	(s) :	0.000
Metacentric height, GM .....	(m) :	0.000
Homogeneous stowage rate, roDC .....	(t/m3) :	0.000
No of decks above 0.7D from baseline .....	:	1
Height from base to top of ship side .....	(mm) :	22000
Areas forward of 0.2L from FP:		
- Projected area of the upper deck .....	(m2) :	0.000
- Area of the waterplane .....	(m2) :	0.000
Height from base to deck line at FP .....	(mm) :	0
Speed/flare factor, Caf .....	:	0.000

### Continuous Strength Members above Strength Deck

None

### Class notations

Tanker for Oil

### Hull Section Material (Strength group & yield point (N/mm2))

Location	Amidships		Current cross-sect.	
	Group	Yield	Group	Yield
- Bottom .....	NV-NS	235	NV-NS	235
- Deck .....	NV-NS	235	NV-NS	235
- Between bottom and deck .....	NV-NS	235	NV-NS	235

### Transverse Bulkhead Positions (Frame No)

Aft peak bulkhead .....	:Not given.
Engine room bulkhead .....	:Not given.
Fore peak bulkhead .....	:Not given.

### Specified Bending Moments

(Based on actual cargo/ballast conditions)  
 Considered cross-section: 128.250 m from AP.  
 Utilization factor for the Rule still water bending moments:

- Sagging: 1.00
- Hogging: 1.00

Specified bending moments:	Amidships		Current cross-sect.	
	(kNm) :			
- Still water, sagging .....	(kNm) :	3992670		0
- Still water, hogging .....	(kNm) :	4100580		0
- Wave, sagging .....	(kNm) :	0		0
- Wave, hogging .....	(kNm) :	0		0
- Wave, horizontal .....	(kNm) :	0		0

**Spacing between Transverse Frames**

(Where the frame spacing changes along the ship)

Position of frame 0: 0 mm forward of A.P.

Frame Nos where the spacing changes:

Frame No	Spacing forward (mm)
Stern	700
14	960
39	3200
43	3200
44	4000
94	700

Section Scantlings - v.3.3-372-980619  
 SHUTTLE TANKER 145000 M3  
 CUADERNA MAESTRA

Ship Id No

Aprox. 2

### 3 Panel Geometry

Node No	y (mm)	z (mm)	Radius (mm)	Position
---------	--------	--------	-------------	----------

**Outer Shell**

0	0			
5810	0			Bottom
11620	0			Bottom
16600	0			Bottom
19500	0			Bottom
21250	1750		1750	Bilge
21250	7092			Side
21250	11796			Side
21250	16500			Side
21250	22000			Side
18690	22214			Strength deck
11700	22800			Strength deck
0	22800			Strength deck

**Inner Bottom & Inner Side**

0	2680			
1200	2680			Inner bottom
5810	2767			Inner bottom
11620	2876			Inner bottom
16600	2970			Inner bottom
18690	7092			Hopper tank top
18690	11796			Inner side
18690	16500			Inner side
18690	22214			Inner side

**CL Bulkhead**

0	0			
0	2680			Longitudinal bulkhead
0	22800			Longitudinal bulkhead

**Stringer 7092**

21250	7092			
18690	7092			Side - Stringer

**Stringer 11796**

21250	11796			
18690	11796			Side - Stringer

**Stringer 16500**

21250	16500			
18690	16500			Side - Stringer

**Bottom girder 5810**

5810	0			
5810	2767			Bottom - Long. girder

**Bottom girder 11620**

11620	0			
11620	2876			Bottom - Long. girder

**Bottom girder 16600**

16600	0			
16600	2970			Bottom - Long. girder

Section Scantlings - v.3.3-372-980619  
 SHUTTLE TANKER 145000 M3  
 CUADERNA MAESTRA

Ship Id No : Aprox. 2

#### 4 Node Co-ordinates

Node No	y (mm)	z (mm)
	16600	0
	11620	2876
	11620	0
	5810	2767
	5810	0
	18690	16500
	21250	16500
	18690	11796
	21250	11796
	21250	7092
	1200	2680
	18690	22214
	18690	7092
	16600	2970
	0	2680
	21250	22000
	11700	22800
	0	22800
	21250	1750
	19500	0
	0	0



Section Scantlings - v.3.3-372-980619  
 SHUTTLE TANKER 145000 M3  
 CUADERNA MAESTRA

Ship Id No

Aprox. 2

## 5 Layout of Plates and Profiles

Plate		Y <sub>1</sub> (mm)	Z <sub>1</sub> (mm)	Y <sub>2</sub> (mm)	Z <sub>2</sub> (mm)	—	B (mm)	BCUT (mm)	T (mm)	Steel	Area cm <sup>2</sup>
Stiff	No	Y	Z	Y <sub>CG</sub>	Z <sub>CG</sub>	Typ	H	BF	T	TF (mm)	Area
<b>Outer Shell (Bending efficiency: 100%)</b>											
PL	1	0	0	1200	0		1200	0	21.0	std	252.00
PL	2	1200	0	3870	0		2670	0	21.0	std	560.70
PL	3	3870	0	6540	0		2670	0	21.0	std	560.70
PL	4	6540	0	9045	0		2505	0	21.0	std	526.05
PL	5	9045	0	11735	0		2690	0	21.0	std	564.90
PL	6	11735	0	14385	0		2650	0	21.0	std	556.50
PL	7	14385	0	17035	0		2650	0	21.0	std	556.50
PL	8	17035	0	20299	193		3295	0	21.0	std	691.95
PL	9	20299	193	21250	3126		3295	0	21.0	std	691.95
PL	10	21250	3126	21250	5586		2460	0	17.0	std	418.20
PL	11	21250	5586	21250	7317		1731	0	17.0	std	294.27
PL	12	21250	7317	21250	10378		3061	0	17.0	std	520.37
PL	13	21250	10378	21250	13514		3136	0	17.0	std	533.12
PL	14	21250	13514	21250	16725		3211	0	17.0	std	545.87
PL	15	21250	16725	21250	19391		2666	0	17.0	std	453.22
PL	16	21250	19391	21250	21999		2608	0	28.0	std	730.49
PL	17	21250	21999	18100	22263		3161	0	28.0	std	885.08
PL	18	18100	22263	14841	22536		3270	0	28.0	std	915.60
PL	19	14841	22536	11707	22799		3145	0	28.0	std	880.60
PL	20	11707	22799	8867	22800		2840	0	28.0	std	795.20
PL	21	8867	22800	5967	22800		2900	0	28.0	std	812.00
PL	22	5967	22800	3007	22800		2960	0	28.0	std	828.80
PL	23	3007	22800	0	22800		3007	0	28.0	std	842.09
ST	1	830	0	830	371	43	530	150	12.0	35.0	111.90
ST	2	1660	0	1660	371	43	530	150	12.0	35.0	111.90
ST	3	2490	0	2490	371	43	530	150	12.0	35.0	111.90
ST	4	3320	0	3320	371	43	530	150	12.0	35.0	111.90
ST	5	4150	0	4150	371	43	530	150	12.0	35.0	111.90
ST	6	4980	0	4980	371	43	530	150	12.0	35.0	111.90
ST	7	6640	0	6640	371	43	530	150	12.0	35.0	111.90
ST	8	7470	0	7470	371	43	530	150	12.0	35.0	111.90
ST	9	8300	0	8300	371	43	530	150	12.0	35.0	111.90
ST	10	9130	0	9130	371	43	530	150	12.0	35.0	111.90
ST	11	9960	0	9960	371	43	530	150	12.0	35.0	111.90
ST	12	10790	0	10790	371	43	530	150	12.0	35.0	111.90
ST	13	12450	0	12450	371	43	530	150	12.0	35.0	111.90
ST	14	13280	0	13280	371	43	530	150	12.0	35.0	111.90
ST	15	14110	0	14110	371	43	530	150	12.0	35.0	111.90
ST	16	14940	0	14940	371	43	530	150	12.0	35.0	111.90
ST	17	15770	0	15770	371	43	530	150	12.0	35.0	111.90
ST	18	17313	0	17313	371	43	530	150	12.0	35.0	111.90
ST	19	18026	0	18026	371	43	530	150	12.0	35.0	111.90
ST	20	18739	0	18739	371	43	530	150	12.0	35.0	111.90
ST	21	19452	0	19452	371	43	530	150	12.0	35.0	111.90
ST	22	21250	2094	20976	2084	20	430	0	15.0	0.0	94.18
ST	23	21250	2994	20976	2984	20	430	0	15.0	0.0	94.18
ST	24	21250	3814	21000	3805	20	400	0	16.0	0.0	89.48
ST	25	21250	4634	21000	4625	20	400	0	16.0	0.0	89.48
ST	26	21250	5454	21000	5445	20	400	0	16.0	0.0	89.48
ST	27	21250	6274	21000	6265	20	400	0	16.0	0.0	89.48
ST	28	21250	7876	21000	7867	20	400	0	16.0	0.0	89.48
ST	29	21250	8660	21000	8651	20	400	0	16.0	0.0	89.48
ST	30	21250	9444	21000	9435	20	400	0	16.0	0.0	89.48
ST	31	21250	10228	20996	10219	20	400	0	14.0	0.0	81.48
ST	32	21250	11012	20996	11003	20	400	0	14.0	0.0	81.48
ST	33	21250	12580	21015	12572	20	370	0	13.0	0.0	69.70
ST	34	21250	13364	21015	13356	20	370	0	13.0	0.0	69.70
ST	35	21250	14148	21039	14141	20	340	0	14.0	0.0	65.64
ST	36	21250	14932	21039	14925	20	340	0	14.0	0.0	65.64
ST	37	21250	15716	21039	15709	20	340	0	14.0	0.0	65.64
ST	38	21250	17316	21039	17309	20	340	0	14.0	0.0	65.64
ST	39	21250	18132	21039	18125	20	340	0	14.0	0.0	65.64
ST	40	21250	18948	21015	18940	20	370	0	13.0	0.0	69.70
ST	41	21250	19764	21015	19756	20	370	0	13.0	0.0	69.70
ST	42	21250	20580	21015	20572	20	370	0	13.0	0.0	69.70
ST	43	21250	21396	21015	21388	20	370	0	13.0	0.0	69.70
ST	1	20395	22071	20387	21836	20	370	0	13.0	0.0	69.70
ST	2	19540	22143	19532	21908	20	370	0	13.0	0.0	69.70
ST	3	18000	22272	17992	22037	20	370	0	13.0	0.0	69.70
ST	4	17300	22330	17292	22095	20	370	0	13.0	0.0	69.70
ST	5	16600	22389	16592	22154	20	370	0	13.0	0.0	69.70
ST	6	15770	22459	15762	22224	20	370	0	13.0	0.0	69.70
ST	7	14940	22528	14932	22293	20	370	0	13.0	0.0	69.70

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**Layout of Plates and Profiles (cont.)**

Plate		Y <sub>1</sub> (mm)	Z <sub>1</sub> (mm)	Y <sub>2</sub> (mm)	Z <sub>2</sub> (mm)	—	B (mm)	BCUT (mm)	T (mm)	Steel	Area cm <sup>2</sup>
Stiff	No	Y	Z	Y <sub>CG</sub>	Z <sub>CG</sub>	Typ	H	BF	T	TF (mm)	Area
ST	8	14110	22598	14102	22363	20	370	0	13.0	0.0	69.70
ST	9	13280	22667	13272	22432	20	370	0	13.0	0.0	69.70
ST	10	12450	22737	12442	22502	20	370	0	13.0	0.0	69.70
ST	11	11620	22800	11612	22565	20	370	0	13.0	0.0	69.70
ST	12	10790	22800	10782	22565	20	370	0	13.0	0.0	69.70
ST	13	9960	22800	9952	22565	20	370	0	13.0	0.0	69.70
ST	14	9130	22800	9122	22565	20	370	0	13.0	0.0	69.70
ST	15	8300	22800	8292	22565	20	370	0	13.0	0.0	69.70
ST	16	7470	22800	7462	22565	20	370	0	13.0	0.0	69.70
ST	17	6640	22800	6632	22565	20	370	0	13.0	0.0	69.70
ST	18	5810	22800	5802	22565	20	370	0	13.0	0.0	69.70
ST	19	4980	22800	4972	22565	20	370	0	13.0	0.0	69.70
ST	20	4150	22800	4142	22565	20	370	0	13.0	0.0	69.70
ST	21	3320	22800	3312	22565	20	370	0	13.0	0.0	69.70
ST	22	2490	22800	2482	22565	20	370	0	13.0	0.0	69.70
ST	23	1660	22800	1652	22565	20	370	0	13.0	0.0	69.70
ST	24	830	22800	838	22565	20	370	0	13.0	0.0	69.70

**Inner Bottom & Inner Side (Bending efficiency: 100%)**

PL	1	0	2680	1200	2680		1200	0	21.0	std	252.00
PL	2	1200	2680	3777	2728		2578	0	21.0	std	541.38
PL	3	3777	2728	6447	2778		2670	0	21.0	std	560.70
PL	4	6447	2778	9066	2828		2620	0	21.0	std	550.20
PL	5	9066	2828	11736	2878		2670	0	21.0	std	560.70
PL	6	11736	2878	14405	2928		2670	0	21.0	std	560.70
PL	7	14405	2928	16600	2970		2195	0	21.0	std	460.95
PL	8	16600	2970	17565	4874		2135	0	20.0	std	427.00
PL	9	17565	4874	18683	7079		2472	0	16.0	std	395.52
PL	10	18683	7079	18690	10301		3223	0	15.0	std	483.60
PL	11	18690	10301	18690	13465		3163	0	14.0	std	442.96
PL	12	18690	13465	18690	16668		3202	0	14.0	std	448.42
PL	13	18690	16668	18690	19328		2659	0	17.0	std	452.20
PL	14	18690	19328	18690	22214		2885	0	28.0	std	808.01
ST	1	830	2680	830	2317	43	530	150	12.0	30.0	105.00
ST	2	1659	2688	1659	2325	43	530	150	12.0	30.0	105.00
ST	3	2489	2704	2489	2341	43	530	150	12.0	30.0	105.00
ST	4	3319	2719	3319	2356	43	530	150	12.0	30.0	105.00
ST	5	4149	2735	4149	2372	43	530	150	12.0	30.0	105.00
ST	6	4979	2751	4979	2388	43	530	150	12.0	30.0	105.00
ST	7	6639	2782	6639	2419	43	530	150	12.0	30.0	105.00
ST	8	7469	2798	7469	2435	43	530	150	12.0	30.0	105.00
ST	9	8299	2813	8299	2450	43	530	150	12.0	30.0	105.00
ST	10	9129	2829	9129	2466	43	530	150	12.0	30.0	105.00
ST	11	9959	2844	9959	2481	43	530	150	12.0	30.0	105.00
ST	12	10789	2860	10789	2497	43	530	150	12.0	30.0	105.00
ST	13	12449	2891	12449	2528	43	530	150	12.0	30.0	105.00
ST	14	13279	2907	13279	2544	43	530	150	12.0	30.0	105.00
ST	15	14109	2923	14109	2560	43	530	150	12.0	30.0	105.00
ST	16	14939	2938	14939	2575	43	530	150	12.0	30.0	105.00
ST	17	15769	2954	15769	2591	43	530	150	12.0	30.0	105.00
ST	18	16947	3654	17186	3521	20	430	0	15.0	0.0	94.18
ST	19	17294	4339	17533	4206	20	430	0	15.0	0.0	94.18
ST	20	17641	5024	17880	4891	20	430	0	15.0	0.0	94.18
ST	21	17989	5709	18211	5585	20	400	0	14.0	0.0	81.48
ST	22	18336	6394	18558	6270	20	400	0	14.0	0.0	81.48
ST	23	18690	7875	18925	7867	20	370	0	13.0	0.0	69.70
ST	24	18690	8659	18925	8651	20	370	0	13.0	0.0	69.70
ST	25	18690	9443	18925	9435	20	370	0	13.0	0.0	69.70
ST	26	18690	10227	18925	10219	20	370	0	13.0	0.0	69.70
ST	27	18690	11011	18925	11003	20	370	0	13.0	0.0	69.70
ST	28	18690	12579	18905	12571	20	340	0	12.0	0.0	58.84
ST	29	18690	13363	18905	13355	20	340	0	12.0	0.0	58.84
ST	30	18690	14148	18905	14140	20	340	0	12.0	0.0	58.84
ST	31	18690	14932	18905	14924	20	340	0	12.0	0.0	58.84
ST	32	18690	15716	18905	15708	20	340	0	12.0	0.0	58.84
ST	33	18690	17316	18905	17308	20	340	0	12.0	0.0	58.84
ST	34	18690	18132	18905	18124	20	340	0	12.0	0.0	58.84
ST	35	18690	18947	18925	18939	20	370	0	13.0	0.0	69.70
ST	36	18690	19763	18925	19755	20	370	0	13.0	0.0	69.70
ST	37	18690	20579	18925	20571	20	370	0	13.0	0.0	69.70
ST	38	18690	21395	18925	21387	20	370	0	13.0	0.0	69.70

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**Layout of Plates and Profiles (cont.)**

Plate	No	Y <sub>1</sub> (mm) Y	Z <sub>1</sub> (mm) Z	Y <sub>2</sub> (mm) Y <sub>CG</sub>	Z <sub>2</sub> (mm) Z <sub>CG</sub>	— Typ	B (mm) H	BCUT (mm) BF	T (mm) T	Steel TF (mm)	Area cm <sup>2</sup> Area
<b>CL Bulkhead (Bending efficiency: 100%)</b>											
PL	1	0	0	0	2680		2680	0	20.0	std	536.00
PL	2	0	2680	0	5837		3157	0	19.0	std	599.83
PL	3	0	5837	0	8797		2960	0	19.0	std	562.40
PL	4	0	8797	0	11457		2660	0	13.0	std	345.80
PL	5	0	11457	0	14035		2578	0	13.0	std	335.14
PL	6	0	14035	0	16695		2660	0	13.0	std	345.80
PL	7	0	16695	0	19840		3145	0	18.0	std	566.10
PL	8	0	19840	0	22800		2960	0	28.0	std	828.80
ST	1	0	590	150	590	10	300	0	20.0	0.0	60.00
ST	2	0	1410	150	1410	10	300	0	20.0	0.0	60.00
ST	3	0	2230	150	2230	10	300	0	20.0	0.0	60.00
ST	4	0	3417	274	3407	20	430	0	15.0	0.0	94.18
ST	5	0	4152	274	4142	20	430	0	15.0	0.0	94.18
ST	6	0	4887	274	4877	20	430	0	15.0	0.0	94.18
ST	7	0	5622	225	5622	10	450	0	25.0	0.0	112.50
ST	8	0	6357	225	6357	10	450	0	25.0	0.0	112.50
ST	9	0	7092	225	7092	10	450	0	25.0	0.0	112.50
ST	10	0	7876	200	7876	10	400	0	25.0	0.0	100.00
ST	11	0	8660	200	8660	10	400	0	25.0	0.0	100.00
ST	12	0	9444	200	9444	10	400	0	25.0	0.0	100.00
ST	13	0	10228	200	10228	10	400	0	25.0	0.0	100.00
ST	14	0	11012	200	11012	10	400	0	25.0	0.0	100.00
ST	15	0	11796	175	11796	10	350	0	25.0	0.0	87.50
ST	16	0	12580	175	12580	10	350	0	25.0	0.0	87.50
ST	17	0	13364	175	13364	10	350	0	25.0	0.0	87.50
ST	18	0	14148	175	14148	10	350	0	25.0	0.0	87.50
ST	19	0	14932	175	14932	10	350	0	25.0	0.0	87.50
ST	20	0	15716	175	15716	10	350	0	25.0	0.0	87.50
ST	21	0	16500	175	16500	10	350	0	25.0	0.0	87.50
ST	22	0	17284	215	17276	20	340	0	12.0	0.0	58.84
ST	23	0	18070	215	18062	20	340	0	12.0	0.0	58.84
ST	24	0	18856	215	18848	20	340	0	12.0	0.0	58.84
ST	25	0	19642	215	19634	20	340	0	12.0	0.0	58.84
ST	26	0	20428	215	20420	20	340	0	12.0	0.0	58.84
ST	27	0	21214	215	21206	20	340	0	12.0	0.0	58.84
ST	28	0	22007	215	21999	20	340	0	12.0	0.0	58.84
<b>Stringer 7092 (Bending efficiency: 100%)</b>											
PL	1	21250	7092	18690	7092		2560	400	12.0	std	259.20
ST	1	20610	7092	20610	6992	10	200	0	15.0	0.0	30.00
ST	2	19970	7092	19970	6992	10	200	0	15.0	0.0	30.00
ST	3	19330	7092	19330	6992	10	200	0	15.0	0.0	30.00
<b>Stringer 11796 (Bending efficiency: 100%)</b>											
PL	1	21250	11796	18690	11796		2560	400	12.0	std	259.20
ST	1	20610	11796	20610	11696	10	200	0	15.0	0.0	30.00
ST	2	19970	11796	19970	11696	10	200	0	15.0	0.0	30.00
ST	3	19330	11796	19330	11696	10	200	0	15.0	0.0	30.00
<b>Stringer 16500 (Bending efficiency: 100%)</b>											
PL	1	21250	16500	18690	16500		2560	400	12.0	std	259.20
ST	1	20610	16500	20610	16400	10	200	0	15.0	0.0	30.00
ST	2	19970	16500	19970	16400	10	200	0	15.0	0.0	30.00
ST	3	19330	16500	19330	16400	10	200	0	15.0	0.0	30.00
<b>Bottom girder 5810 (Bending efficiency: 100%)</b>											
PL	1	5810	0	5810	2766		2766	800	18.0	std	354.03
ST	1	5810	590	5685	590	10	250	0	15.0	0.0	37.50
ST	2	5810	1410	5685	1410	10	250	0	15.0	0.0	37.50

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**Layout of Plates and Profiles (cont.)**

Plate		Y <sub>1</sub> (mm)	Z <sub>1</sub> (mm)	Y <sub>2</sub> (mm)	Z <sub>2</sub> (mm)	—	B (mm)	BCUT (mm)	T (mm)	Steel	Area cm <sup>2</sup>
Stiff	No	Y	Z	Y <sub>CG</sub>	Z <sub>CG</sub>	Typ	H	BF	T	TF (mm)	Area
ST	3	5810	2230	5685	2230	10	250	0	15.0	0.0	37.50
<b>Bottom girder 11620 (Bending efficiency: 100%)</b>											
PL	1	11620	0	11620	2876		2876	800	18.0	std	373.72
ST	1	11620	590	11495	590	10	250	0	15.0	0.0	37.50
ST	2	11620	1410	11495	1410	10	250	0	15.0	0.0	37.50
ST	3	11620	2230	11495	2230	10	250	0	15.0	0.0	37.50
<b>Bottom girder 16600 (Bending efficiency: 100%)</b>											
PL	1	16600	0	16600	2970		2970	800	18.0	std	390.60
ST	1	16600	590	16475	590	10	250	0	15.0	0.0	37.50
ST	2	16600	1410	16475	1410	10	250	0	15.0	0.0	37.50
ST	3	16600	2230	16475	2230	10	250	0	15.0	0.0	37.50



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## 6 Cross-Sectional Area

### Plates

Panels:	NS-Steel		HS-Steel		Total	
	Effective cm <sup>2</sup>	Gross cm <sup>2</sup>	Effective cm <sup>2</sup>	Gross cm <sup>2</sup>	Effective cm <sup>2</sup>	Gross cm <sup>2</sup>
Outer Shell	28832.3	28832.3	0.0	0.0	28832.3	28832.3
Inner Bottom & Inner Side	13888.7	13888.7	0.0	0.0	13888.7	13888.7
CL Bulkhead	4119.9	4119.9	0.0	0.0	4119.9	4119.9
Stringer 7092	518.4	614.4	0.0	0.0	518.4	614.4
Stringer 11796	518.4	614.4	0.0	0.0	518.4	614.4
Stringer 16500	518.4	614.4	0.0	0.0	518.4	614.4
Bottom girder 5810	708.1	996.1	0.0	0.0	708.1	996.1
Bottom girder 11620	747.4	1035.4	0.0	0.0	747.4	1035.4
Bottom girder 16600	781.2	1069.2	0.0	0.0	781.2	1069.2
<b>TOTAL AREA</b>	<b>50632.8</b>	<b>51784.8</b>	<b>0.0</b>	<b>0.0</b>	<b>50632.8</b>	<b>51784.8</b>

### Profiles

Panels:	NS-Steel		HS-Steel		Total	
	Effective cm <sup>2</sup>	Gross cm <sup>2</sup>	Effective cm <sup>2</sup>	Gross cm <sup>2</sup>	Effective cm <sup>2</sup>	Gross cm <sup>2</sup>
Outer Shell	11493.8	11493.8	0.0	0.0	11493.8	11493.8
Inner Bottom & Inner Side	6539.5	6539.5	0.0	0.0	6539.5	6539.5
CL Bulkhead	2324.4	2324.4	0.0	0.0	2324.4	2324.4
Stringer 7092	180.0	180.0	0.0	0.0	180.0	180.0
Stringer 11796	180.0	180.0	0.0	0.0	180.0	180.0
Stringer 16500	180.0	180.0	0.0	0.0	180.0	180.0
Bottom girder 5810	225.0	225.0	0.0	0.0	225.0	225.0
Bottom girder 11620	225.0	225.0	0.0	0.0	225.0	225.0
Bottom girder 16600	225.0	225.0	0.0	0.0	225.0	225.0
<b>TOTAL AREA</b>	<b>21572.7</b>	<b>21572.7</b>	<b>0.0</b>	<b>0.0</b>	<b>21572.7</b>	<b>21572.7</b>

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## 7 Cross-Sectional Data

	EFFECTIVE Cut-outs subtracted	GROSS Cut-outs disreg.
Cross sectional area of the longitudinal elements ..... (cm2) :	72205.5	73357.5
Position of the centroid: Ycg ..... (mm) :	6	6
Position of the centroid: Zcg ..... (mm) :	10180	10078
Moment of inertia about the horz. neutral axis, I <sub>h</sub> ..... (m4) :	577.235	584.946
Moment of inertia about the vert. neutral axis, I <sub>v</sub> ..... (m4) :	1497.635	1522.156
Product of inertia about the neutral axes, I <sub>hv</sub> ..... (m4) :	0.078	0.100
<hr/>		
SECTION MODULUS, BOTTOM (z = 0 mm) ..... (m3) :	56.700	58.037
SECTION MODULUS, DECK LINE (z = 22000 mm) ..... (m3) :	48.838	49.068
SECTION MODULUS, AT SIDE (y = 21250 mm) ..... (m3) :	70.499	71.653
<hr/>		
First moment of the area above the neutral axis, S ..... (cm3) :	29763276.8	30173001.8
I/S ..... (cm) :	1939	1938

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## 8 Design Bending Moments

AT ACTUAL POSITION (128.2 m from AP)

Still water bending moments:

- Standard values according to Rules, Ms ..... : 2903485

- Given as input (actual cargo/ballast conditions) ..... : 3992670

**Design still water bending moments:**

SAGGING (kNm)

HOGGING (kNm)

2903485

3092458

3992670

4100580

Design wave bending moments, Mw ..... : 4913590

(Rules)

4724616

(Rules)

Design wave bending moments, Mw for buckling check ..... : 4913590

(Rules)

4724616

(Rules)

Horizontal wave bending moment acc. to Rules, Mwh ..... :

2779966



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## 9 Hull Girder Strength Requirements

	BOTTOM	DECK	SIDE
Material strength group .....	NV-NS	NV-NS	NV-NS
Yield point of material ..... (N/mm <sup>2</sup> ) :	235	235	235
Material factor, f1 .....	1.000	1.000	1.000
Stress factor, f2 (midship values from input).....	1.000	1.000	
Speed factor, Cav .....	0.182		
Speed/flare factor, Caf .....	0.182		
Wave coefficient, Cw .....	10.425		
Wave coefficient, Cwo .....	10.425		
Wave coefficient, Cwu .....	10.425		

AT ACTUAL POSITION ( 128.2 m from AP) (Midship section)

	BOTTOM	DECK
Minimum section modulus, Zo ..... (m <sup>3</sup> ) :	44.66900	44.66900
Section modulus requirement based on design bending moments:		
- Sagging (3992670 kNm) ..... (m <sup>3</sup> ) :	50.89291	50.89291
- Hogging (4100580 kNm) ..... (m <sup>3</sup> ) :	50.42969	50.42969
<b>Rule section modulus</b> ..... (m <sup>3</sup> ) :	<b>50.89291</b>	<b>50.89291</b>

Combined stresses at bilge and deck corners ..... (N/mm<sup>2</sup>) : 165.6 189.8

Minimum moment of inertia ..... (m<sup>4</sup>) : 338.62226  
 Minimum section modulus at side ..... (m<sup>3</sup>) : 31.60825

**GUIDANCE:**

The required section modulus along the hull girder will normally be satisfied when calculated for the midship section only, provided the following rules for tapering are complied with:

- Scantlings at bottom and deck are kept unaltered within 0.4L amidships.
- Scantlings outside 0.4L amidships are gradually reduced to the local requirements at the ends, and the same material strength group is applied over the full length of the ship.

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## 10 Hull Girder Strength Summary

	ACTUAL	RULE	STATUS (%) (100=Rule)
Cross-sectional area ..... (cm2) :	72205		
Height to the neutral axis ..... (mm) :	10180		
Moment of inertia ..... (m4) :	577.235	338.622	170.5
Section modulus, bottom ..... (m3) :	56.700	50.893	111.4
Section modulus, deck line ..... (m3) :	48.838	50.893	96.0 *
<b>(at z = 22000 mm)</b>			
Material factor, f1, bottom ..... :	1.000		
Material factor, f1, deck ..... :	1.000		
Stress factor, f2, bottom ..... (Input) :	1.000		
Stress factor, f2, deck ..... (Input) :	1.000		

NOTE: \* indicates a requirement that is not fulfilled.

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## 11 Compartments and Loads

### 11.1 Compartment Data I

Ref.	Comp. group (Comp. type)	Comp. No	Frame No aft	Frame No fwd	Restr. filling (*)	Ccated (*)	Contents WB / Oil / Liq / Hliq / Bulk
1	2	2				*	WB
2	1	1				*	Oil

### 11.2 Compartment Data II

Ref.	Comp. group (Comp type)	Comp. No	Length (mm)	Sloshing length (mm)	Sloshing breadth (mm)	Top of air pipe (mm)	WL in dam'gd cond (mm)	Over-pressure po (kN/m2)	Top of hatch (mm)	Volume (m3)
1	2	2	32000	4000	5810	22760	22000	25.00	0	0
2	1	1	32000	32000	18690	22760	22000	25.00	0	0

### 11.3 Bulk Cargo and Liquid Loads

Ref.	Comp. group (Comp type)	Comp. No	Load No	Load type	Density t/m3	Filling height mm	Mass t	Angle of repose degrees	Permeability
1	2	2	1	WB	1.025	22215			
2	1	1	1	Oil	1.025	22800			

### 11.4 Double Bottom Stresses and Hull Girder Bending Moments

Ref.	Comp. group (Comp. type)	Comp. No	Load No	Load type	Dbl. bottom stresses		Still water bending moments - = sagging, + = hogging kNm
					Bottom N/mm <sup>2</sup>	Inner bot. N/mm <sup>2</sup>	
1	2	2	1	WB	0	0	0.00
2	1	1	1	Oil	0	0	0.00

## 12 Summary of Data Involved in the Local Rule Requirements

Distance from AP to considered section .....	(m) :	128.250	
Section modulus at bottom .....	(m <sup>3</sup> ) :	56.700	
Section modulus at deck line .....	(m <sup>3</sup> ) :	48.838	
Height from base line to the neutral axis .....	(mm) :	10181	
STRESS FACTOR, f2:			
f2B (f2 at bottom) .....	:	1.000	(Input)
f2D (f2 at deck) .....	:	1.000	(Input)
DESIGN MOMENTS:			
Design still water bending moment, sagging .....	(kNm) :	3992670	(Input)
Design still water bending moment, hogging .....	(kNm) :	4100580	(Input)
Design wave bending moment, sagging .....	(kNm) :	4913590	(Rules)
Design wave bending moment, hogging .....	(kNm) :	4724616	(Rules)
MOTION PARAMETERS:			
Acceleration parameter, ao .....	:	0.306	(Rules)
Period of roll, Tr .....	(s) :	14.679	(Rules)
Pitch angle, theta .....	(rad/deg) :	0.087 / 5	(Rules)
Roll angle, Fi .....	(rad/deg) :	0.376 / 22	(Rules)
Vertical acceleration, av .....	(m/s <sup>2</sup> ) :	2.392	(Rules)
Ballast draught, Tb .....	(m) :	7.054	(Rules)

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### 13 Local Rule Requirements - Plates

Plate No	ACT	t_act (mm)	Steel	tk (mm)	tk_b (mm)		Eff. (%)	Span (mm)	Spac (mm)		Sigf N/mm <sup>2</sup>	f <sub>i</sub>
LOC		t_loc (mm)	Pos			Load Ref.	Loc. ref.	y <sub>l</sub> (mm)	z <sub>l</sub> (mm)	Comp ref.	Sigma N/mm <sup>2</sup>	p kN/m <sup>2</sup>
BUC		t_buc (mm)	Eta	psi	k	c	Buc. ref.	y <sub>b</sub> (mm)	z <sub>b</sub> (mm)	SigL N/mm <sup>2</sup>	Sig_c N/mm <sup>2</sup>	Sig_cr N/mm <sup>2</sup>

#### Outer Shell

##### Bottom

1	ACT	21.0	std	1.0	1.0		100	4000	830		235.0	1.00
	LOC		20.63	Bottom		WB acc 1	Min	415	0	1	120.0	180.1
	BUC		15.38	0.9	1.00	4.00		0	0	155.6	202.9	172.9
2	ACT	21.0	std	1.0	1.0		100	4000	830		235.0	1.00
	LOC		17.06	Bottom		WB acc 1	Lat	1245	0	1	120.0	180.1
	BUC		15.38	0.9	1.00	4.00		1200	0	155.6	202.9	172.9
3	ACT	21.0	std	1.0	1.0		100	4000	830		235.0	1.00
	LOC		17.06	Bottom		WB acc 1	Lat	3870	0	1	120.0	180.1
	BUC		15.38	0.9	1.00	4.00		3870	0	155.6	202.9	172.9
4	ACT	21.0	std	1.0	1.0		100	4000	830		235.0	1.00
	LOC		17.06	Bottom		WB acc 1	Lat	7055	0	1	120.0	180.1
	BUC		15.38	0.9	1.00	4.00		6640	0	155.6	202.9	172.9
5	ACT	21.0	std	1.0	1.0		100	4000	830		235.0	1.00
	LOC		17.06	Bottom		WB acc 1	Lat	9545	0	1	120.0	180.1
	BUC		15.38	0.9	1.00	4.00		9130	0	155.6	202.9	172.9
6	ACT	21.0	std	1.0	1.0		100	4000	830		235.0	1.00
	LOC		17.07	Bottom		Sea	Lat	14385	0		120.0	180.3
	BUC		15.38	0.9	1.00	4.00		11735	0	155.6	202.9	172.9
7	ACT	21.0	std	1.0	1.0		100	4000	830		235.0	1.00
	LOC		17.17	Bottom		Sea	Lat	16185	0		120.0	182.3
	BUC		15.38	0.9	1.00	4.00		14385	0	155.6	202.9	172.9
8	ACT	21.0	std	1.0	1.0		100	4000	713		235.0	1.00
	LOC		16.11	Bottom		Sea	Min	17035	0		120.0	185.7
	BUC		11.92	1.0	1.00	4.00		17035	0	155.6	211.3	155.6

##### Bilge

9	ACT	21.0	std	1.0	1.0		100	4000	900		235.0	1.00
	LOC		17.95	Side		WB tst 5	Lat	21250	2544	1	125.0	177.7
	BUC		12.32	1.0	0.89	4.22		21250	2094	123.6	199.3	123.6

##### Side

10	ACT	17.0	std	1.0	1.0		100	4000	820		235.0	1.00
	LOC		16.34	Side		WB tst 5	Lat	21250	3404	1	126.7	177.6
	BUC		10.66	1.0	0.90	4.19		21250	3126	107.9	188.4	107.9
11	ACT	17.0	std	1.0	1.0		100	4000	784		235.0	1.00
	LOC		16.48	Side		WB tst 5	quay	21250	7317	1	134.4	174.8
	BUC		8.69	1.0	0.85	4.31		21250	5586	70.2	189.6	70.2
12	ACT	17.0	std	1.0	1.0		100	4000	784		235.0	1.00
	LOC		16.48	Side		WB tst 5	quay	21250	7484	1	134.7	173.1
	BUC		6.74	1.0	0.80	4.41		21250	7317	43.8	194.5	43.8
13	ACT	17.0	std	1.0	1.0		100	4000	784		235.0	1.00
	LOC		16.48	Side		WB tst 5	quay	21250	10620	1	139.3	141.6
	BUC		6.99	1.0	0.75	4.53		21250	13363	49.1	195.5	49.1
14	ACT	17.0	std	1.0	1.0		100	4000	816		235.0	1.00
	LOC		17.11	Side		WB tst 5	quay	21250	16725	1	128.9	80.2
	BUC		10.44	1.0	0.97	4.07		21250	16725	101.0	187.4	101.0
15	ACT	17.0	std	1.0	1.0		100	4000	816		235.0	1.00
	LOC		17.11	Side		WB tst 5	quay	21250	16907	1	128.6	78.4
	BUC		12.42	1.0	0.95	4.09		21250	19391	142.1	187.7	142.1

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**Local Rule Requirements - Plates (cont)**

Plate No	ACT	t_act (mm)	Steel	tk (mm)	tk_b (mm)		Eff. (%)	Span (mm)	Spac (mm)		Sigf N/mm <sup>2</sup>	f <sub>1</sub>
LOC		t_loc (mm)	Pos		Load Ref.		Loc. ref.	y <sub>1</sub> (mm)	z <sub>1</sub> (mm)	Comp ref.	Sigma N/mm <sup>2</sup>	p kN/m <sup>2</sup>
BUC		t_buc (mm)	Eta	psi	k	c	Buc. ref.	y <sub>b</sub> (mm)	z <sub>b</sub> (mm)	SigL N/mm <sup>2</sup>	Sig_c N/mm <sup>2</sup>	Sig_cr N/mm <sup>2</sup>
16	ACT	28.0	std	1.0	2.0		100	4000	816		235.0	1.00
	LOC		16.11	Side			Min	21250	19391	1	124.4	53.4
	BUC		15.90	1.0	0.93	WB tst 5		21250	21395	173.0	217.3	173.0
						4.14						
<b>Strength deck</b>												
17	ACT	28.0	std	2.0	2.0		100	4000	857		235.0	1.00
	LOC		12.55	Strdk		Oil slo e	Min	20822	22035	2	120.0	89.8
	BUC		18.55	1.0	0.99	4.01		18690	22214	185.7	215.0	185.7
18	ACT	28.0	std	1.0	1.0		100	4000	832		235.0	1.00
	LOC		12.38	Strdk		Oil slo e	Lat	15355	22493	2	120.0	89.8
	BUC		18.02	1.0	0.99	4.01		14939	22528	190.5	217.3	190.5
19	ACT	28.0	std	1.0	1.0		100	4000	832		235.0	1.00
	LOC		12.38	Strdk		Oil slo e	Lat	12865	22702	2	120.0	89.8
	BUC		18.87	1.0	1.00	4.01		11707	22799	194.7	217.3	194.7
20	ACT	28.0	std	1.0	1.0		100	4000	830		235.0	1.00
	LOC		12.34	Strdk		Oil slo e	Lat	11205	22800	2	120.0	89.8
	BUC		18.84	1.0	1.00	4.00		11620	22800	194.7	217.4	194.7
21	ACT	28.0	std	1.0	1.0		100	4000	830		235.0	1.00
	LOC		12.34	Strdk		Oil slo e	Lat	8715	22800	2	120.0	89.8
	BUC		18.84	1.0	1.00	4.00		8867	22800	194.7	217.4	194.7
22	ACT	28.0	std	1.0	1.0		100	4000	830		235.0	1.00
	LOC		12.34	Strdk		Oil slo e	Lat	5395	22800	2	120.0	89.8
	BUC		18.84	1.0	1.00	4.00		5810	22800	194.7	217.4	194.7
23	ACT	28.0	std	1.0	1.0		100	4000	830		235.0	1.00
	LOC		12.34	Strdk		Oil slo e	Lat	2905	22800	2	120.0	89.8
	BUC		18.84	1.0	1.00	4.00		3007	22800	194.7	217.4	194.7
<b>Inner Bottom &amp; Inner Side</b>												
1	ACT	21.0	std	1.5	1.5		100	4000	830		235.0	1.00
	LOC		18.21	Inbot		Oil tst 5	Lat	415	2680	2	140.0	227.3
	BUC		12.42	0.9	1.00	4.00		0	2680	114.7	201.3	127.4
2	ACT	21.0	std	1.5	1.5		100	4000	830		235.0	1.00
	LOC		18.21	Inbot		Oil tst 5	Lat	1244	2680	2	140.0	227.3
	BUC		12.42	0.9	1.00	4.00		1200	2680	114.7	201.3	127.4
3	ACT	21.0	std	1.5	1.5		100	4000	830		235.0	1.00
	LOC		18.20	Inbot		Oil tst 5	Lat	5394	2758	2	140.0	226.5
	BUC		12.37	0.9	1.00	4.00		3777	2728	113.9	201.3	126.6
4	ACT	21.0	std	1.5	1.5		100	4000	830		235.0	1.00
	LOC		18.17	inbot		Oil tst 5	Lat	7054	2790	2	140.0	226.2
	BUC		12.33	0.9	1.00	4.00		6639	2782	113.1	201.3	125.7
5	ACT	21.0	std	1.5	1.5		100	4000	831		235.0	1.00
	LOC		18.16	Inbot		Oil tst 5	Lat	11204	2868	2	140.0	225.4
	BUC		12.29	0.9	1.00	4.00		9129	2829	112.4	201.3	124.9
6	ACT	21.0	std	1.5	1.5		100	4000	829		235.0	1.00
	LOC		18.13	Inbot		Oil tst 5	Lat	12034	2884	2	140.0	225.3
	BUC		12.25	0.9	1.00	4.00		11736	2878	111.6	201.3	124.0
7	ACT	21.0	std	1.5	1.5		100	4000	830		235.0	1.00
	LOC		18.12	Inbot		Oil tst 5	Lat	16184	2962	2	140.0	224.5
	BUC		12.21	0.9	1.00	4.00		14405	2928	110.9	201.3	123.2
8	ACT	20.0	std	1.0	1.0		100	4000	767		235.0	1.00
	LOC		16.64	Hoptk		Oil tst 5	Lat	16773	3312	2	133.0	221.0
	BUC		11.62	1.0	0.90	4.21	s/t	16947	3654	99.8	206.1	142.5



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**Local Rule Requirements - Plates (cont)**

Plate No	ACT	t_act (mm)	Steel	tk (mm)	tk_b (mm)		Eff. (%)	Span (mm)	Spac (mm)		Sigf N/mm <sup>2</sup>	f <sub>1</sub>
	LOC	t_loc (mm)	Pos			Load Ref.	Loc. ref.	y <sub>1</sub> (mm)	z <sub>1</sub> (mm)	Comp ref.	Sigma N/mm <sup>2</sup>	p kN/m <sup>2</sup>
	BUC	t_buc (mm)	Eta	psi	k	c	Buc. ref.	y <sub>b</sub> (mm)	z <sub>b</sub> (mm)	SigL N/mm <sup>2</sup>	Sig_c N/mm <sup>2</sup>	Sig_cr N/mm <sup>2</sup>
9	ACT	16.0	std	1.0	1.0		100	4000	768		235.0	1.00
	LOC	15.46	Hoptk	1.0		Oil tst 5	Lat	17815	5367	2	141.1	200.3
	BUC	11.81		0.82		4.38	s/t	18336	6394	57.9	188.8	146.0
10	ACT	15.0	std	1.0	1.0		100	4000	783		235.0	1.00
	LOC	14.56	Insid	1.0		Oil tst 5	Lat	18690	7483	2	149.4	179.0
	BUC	11.84		0.85		4.30	s/t	18690	7875	35.2	180.7	144.5
11	ACT	14.0	std	1.0	1.0		100	4000	784		235.0	1.00
	LOC	12.95	Insid	1.0		Oil tst 5	Lat	18690	10619	2	158.5	147.5
	BUC	11.84		1.00		4.00	s/t	18690	11011	30.0	167.3	137.7
12	ACT	14.0	std	1.0	1.0		100	4000	784		235.0	1.00
	LOC	11.97	Insid	1.0		Oil tst 5	Lat	18690	13755	2	147.9	115.9
	BUC	11.84		0.83		4.36	s/t	18690	14148	61.2	172.8	145.6
13	ACT	17.0	std	1.0	1.0		100	4000	816		235.0	1.00
	LOC	11.75	Insid	1.0		Oil slo e	Lat	18690	19328	2	129.0	89.8
	BUC	12.38		0.96		4.08		18690	19328	141.1	187.5	141.1
14	ACT	28.0	std	2.5	2.5		100	4000	818		235.0	1.00
	LOC	13.65	Insid	1.0		Oil slo e	Lat	18690	21805	2	120.7	89.8
	BUC	18.14		0.93		4.13		18690	22214	185.7	216.4	185.7
<b>CL Bulkhead</b>												
1	ACT	20.0	std	1.5	1.5		100	2000	820		235.0	1.00
	LOC	19.41	Lbhd	1.0		WB acc 1	Lat	0	1000	1	123.9	239.3
	BUC	13.16		0.91		4.17		0	590	146.6	199.9	146.6
2	ACT	19.0	std	0.0	0.0		100	4000	737		235.0	1.00
	LOC	15.16	Lbhd	1.0		Oil tst 5	Lat	0	3048	2	132.0	223.6
	BUC	10.19		0.90		4.20	s/t	0	2680	114.7	208.3	142.2
3	ACT	19.0	std	0.0	0.0		100	4000	784		235.0	1.00
	LOC	13.56	Lbhd	1.0		Oil tst 5	Lat	0	7484	2	149.4	179.0
	BUC	10.84		0.75		4.55	s/t	0	7092	47.2	207.1	149.4
4	ACT	13.0	std	0.0	0.0		100	4000	784		235.0	1.00
	LOC	12.69	Lbhd	1.0		Oil tst 5	Lat	0	9052	2	155.6	163.2
	BUC	10.84		0.53		5.15	s/t	0	8797	21.2	182.4	159.3
5	ACT	13.0	std	0.0	0.0		100	4000	784		235.0	1.00
	LOC	12.58	Lbhd	1.0		Oil tst 5	Min	0	11457	2	155.7	139.1
	BUC	10.84		0.79		4.44	s/t	0	11796	24.9	174.1	147.4
6	ACT	13.0	std	0.0	0.0		100	4000	784		235.0	1.00
	LOC	12.58	Lbhd	1.0		Oil tst 5	Min	0	14540	2	145.2	108.1
	BUC	10.84		0.83		4.34	s/t	0	14932	73.3	172.6	145.3
7	ACT	18.0	std	0.0	0.0		100	4000	784		235.0	1.00
	LOC	12.58	Lbhd	1.0		Oil slo e	Min	0	16892	2	137.3	89.8
	BUC	11.51		0.98		4.04		0	19840	149.0	199.8	149.0
8	ACT	28.0	std	2.0	2.0		100	4000	793		235.0	1.00
	LOC	14.58	Lbhd	1.0		Oil slo e	Min	0	21610	2	121.3	89.8
	BUC	18.79		0.94		4.12		0	22800	194.7	218.2	194.7
<b>Stringer 7092</b>												
1	ACT	12.0	std	1.5	1.5		100	4000	640		235.0	1.00
	LOC	11.55	Strng	1.0		WB slo m	Min	20930	7092	1	147.9	20.0
	BUC	6.61		1.00		4.00		21250	7092	47.2	165.8	47.2
<b>Stringer 11796</b>												
1	ACT	12.0	std	1.5	1.5		100	4000	640		235.0	1.00
	LOC	11.55	Strng	1.0		WB slo m	Min	20930	11796	1	154.5	20.0
	BUC	5.57		1.00		4.00		21250	11796	30.0	165.8	30.0

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**Local Rule Requirements - Plates (cont)**

Plate No	ACT	t_act (mm)	Steel	tk (mm)	tk_b (mm)		Eff. (%)	Span (mm)	Spac (mm)		Sigf N/mm <sup>2</sup>	f <sub>1</sub>
LOC		t_loc (mm)	Pos			Load Ref.	Loc. ref.	y <sub>1</sub> (mm)	z <sub>1</sub> (mm)	Comp ref.	Sigma N/mm <sup>2</sup>	p kN/m <sup>2</sup>
BUC		t_buc (mm)	Eta	psi	k	c	Buc. ref.	y <sub>b</sub> (mm)	z <sub>b</sub> (mm)	SigL N/mm <sup>2</sup>	Sig_c N/mm <sup>2</sup>	Sig_cr N/mm <sup>2</sup>

**Stringer 16500**

1	ACT	12.0	std	1.5	1.5		100	4000	640		235.0	1.00
	LOC		11.55	Strng		WB slo m	Min	20930	16500	1	138.6	20.0
	BUC		8.84	1.0	1.00	4.00		21250	16500	97.5	165.8	97.5

**Bottom girder 5810**

1	ACT	18.0	std	1.5	1.5		100	4000	590		235.0	1.00
	LOC		12.55	DBGird		WB slo m	Min	5810	295	1	130.0	20.0
	BUC		13.16	1.0	0.91	4.17		5810	590	146.6	190.9	146.6

**Bottom girder 11620**

1	ACT	18.0	std	1.5	1.5		100	4000	590		235.0	1.00
	LOC		12.55	DBGird		WB slo m	Min	11620	295	1	130.0	20.0
	BUC		13.16	1.0	0.91	4.17		11620	590	146.6	190.9	146.6

**Bottom girder 16600**

1	ACT	18.0	std	1.5	1.5		100	4000	590		235.0	1.00
	LOC		12.55	DBGird		WB slo m	Min	16600	295	1	130.0	20.0
	BUC		13.16	1.0	0.91	4.17		16600	590	146.6	190.9	146.6

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## 14 Local Rule Requirements - Stiffeners

Stiff. No.	ACT ACT	POS Za cm³	K c	Type Type	h t (mm)	bf tf (mm)	y z (mm)	SigF f <sub>1</sub> N/mm <sup>2</sup>	m wk	tkw tkf (mm)	tpl (mm)	span spac (mm)
LOC			Zr cm³	Exc. %	tmin (mm)	Load Ref.		Sigma N/mm <sup>2</sup>	Sigdb N/mm <sup>2</sup>	p kN/m <sup>2</sup>	Comp ref.	a_conn cm <sup>2</sup>
FAT/BUC			Zrf cm³	Exc. %	pd kN/m <sup>2</sup>	Sigd N/mm <sup>2</sup>		SigL N/mm <sup>2</sup>	Lat N/mm <sup>2</sup>	Torsion N/mm <sup>2</sup>	Web N/mm <sup>2</sup>	bf/tf

### Outer Shell

#### Bottom

1	ACT ACT LOC FAT/BUC	Bottom 3361	0.00 0.0 3180 0	43 Tbar 5	530 12.0 11.5 0.0	150 35.0 WB acc 1 0.0	830 0	235.0 1.00 71.8 155.6	12.0 1.15 33.2 232.8	1.5 1.5 180.1 196.6	21.0 1	4000 830 83.7 2.2
Similar for No(s): 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17												
18	ACT ACT LOC FAT/BUC	Bottom 3326	0.00 0.0 2104 0	43 Tbar 58	530 12.0 11.5 0.0	150 35.0 Sea 0.0	17313 0	235.0 1.00 95.0 155.6	12.0 1.15 0.0 232.9	1.5 1.5 183.6 197.0	21.0 195.6	4000 713 73.1 2.2
Similar for No(s): 19 20												
21	ACT ACT LOC FAT/BUC	Bottom 3326	0.00 0.0 2133 0	43 Tbar 55	530 12.0 11.5 0.0	150 35.0 Sea 0.0	19452 0	235.0 1.00 95.0 155.6	12.0 1.15 0.0 232.9	1.5 1.5 186.1 197.0	21.0 195.6	4000 713 73.1 2.2

#### Side

22	ACT ACT LOC FAT/BUC	Side 1977	2.50 1.1 1901 1480	20 HPbulb 3	430 15.0 11.5 55.0	0 0.0 WB tst 5 48.4	21250 2094	235.0 1.00 121.7 123.6	12.0 1.09 0.0 231.0	1.5 1.5 177.7 216.7	21.0 1 220.7	4000 900 88.7 0.0
23	ACT ACT LOC FAT/BUC	Side 1970	2.50 1.1 1701 1434	20 HPbulb 15	430 15.0 11.5 55.8	0 0.0 WB tst 5 48.4	21250 2994	235.0 1.00 130.0 109.9	12.0 1.09 0.0 231.0	1.5 1.5 177.7 217.1	21.0 1 220.7	4000 860 85.2 0.0
24	ACT ACT LOC FAT/BUC	Side 1647	2.50 1.1 1621 1384	20 HPbulb 1	400 16.0 11.5 56.5	0 0.0 WB tst 5 48.4	21250 3814	235.0 1.00 130.0 97.3	12.0 1.09 0.0 230.5	1.5 1.5 177.6 217.4	17.0 1 224.3	4000 820 81.7 0.0
25	ACT ACT LOC FAT/BUC	Side 1647	2.50 1.1 1621 1402	20 HPbulb 1	400 16.0 11.5 57.2	0 0.0 WB tst 5 48.4	21250 4634	235.0 1.00 130.0 84.8	12.0 1.09 0.0 230.5	1.5 1.5 177.6 217.6	17.0 1 224.3	4000 820 81.7 0.0
26	ACT ACT LOC FAT/BUC	Side 1647	2.50 1.1 1620 1419	20 HPbulb 1	400 16.0 11.5 57.9	0 0.0 WB tst 5 48.4	21250 5454	235.0 1.00 130.0 72.3	12.0 1.09 0.0 230.5	1.5 1.5 177.5 217.7	17.0 1 224.3	4000 820 81.7 0.0
27	ACT ACT LOC FAT/BUC	Side 1647	2.50 1.1 1618 1434	20 HPbulb 1	400 16.0 11.5 58.6	0 0.0 WB tst 5 48.4	21250 6274	235.0 1.00 130.0 59.7	12.0 1.09 0.0 230.5	1.5 1.5 177.5 217.8	17.0 1 224.3	4000 819 81.6 0.0
28	ACT ACT LOC FAT/BUC	Side 1641	2.50 1.1 1476 1405	20 HPbulb 11	400 16.0 11.5 60.0	0 0.0 WB tst 5 48.4	21250 7876	235.0 1.00 130.0 35.2	12.0 1.09 0.0 230.6	1.5 1.5 169.2 217.9	17.0 1 224.3	4000 784 74.8 0.0
29	ACT ACT LOC FAT/BUC	Side 1641	2.50 1.1 1408 1421	20 HPbulb 16	400 16.0 11.5 60.6	0 0.0 WB tst 5 48.4	21250 8660	235.0 1.00 130.0 30.0	12.0 1.09 0.0 230.6	1.5 1.5 161.3 217.9	17.0 1 224.3	4000 784 71.3 0.0
30	ACT ACT LOC FAT/BUC	Side 1641	2.50 1.1 1339 1428	20 HPbulb 22	400 16.0 11.5 60.9	0 0.0 WB tst 5 48.4	21250 9444	235.0 1.00 130.0 30.0	12.0 1.09 0.0 230.6	1.5 1.5 153.4 217.9	17.0 1 224.3	4000 784 67.8 0.0

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**Local Rule Requirements - Stiffeners (cont.)**

Stiff. No	ACT ACT	POS Za cm³	K c	Type Type	h t (mm)	bf tf (mm)	y z (mm)	SigF f <sub>1</sub> N/mm²	m wk	tkw tkf (mm)	tpl (mm)	span spac (mm)
LOC			Zr cm³	Exc. %	tmin (mm)	Load Ref.		Sigma N/mm²	Sigdb N/mm²	p kN/m²	Comp ref.	a_conn cm²
FAT/BUC			Zrf cm³	Exc. %	pd kN/m²	Sigd N/mm²		Sigl N/mm²	Lat N/mm²	Torsion N/mm²	Web N/mm²	bf/tf
31	ACT	Side	2.50	20	400	0	21250	235.0	12.0	1.5	17.0	4000
	ACT	1556	1.1	HPbulb	14.0	0.0	10228	1.00	1.09	1.5		784
	LOC		1270	22	11.5	WB tst 5		130.0	0.0	145.5	1	64.3
	FAT/BUC		1344	15	57.3	48.4		30.0	230.6	216.5	220.6	0.0
32	ACT	Side	2.50	20	400	0	21250	235.0	12.0	1.5	17.0	4000
	ACT	1556	1.1	HPbulb	14.0	0.0	11012	1.00	1.09	1.5		784
	LOC		1201	29	11.5	WB tst 5		130.0	0.0	137.6	1	60.8
	FAT/BUC		1260	23	53.8	48.4		30.0	230.6	216.5	220.6	0.0
33	ACT	Side	2.50	20	370	0	21250	235.0	12.0	1.5	17.0	4000
	ACT	1245	1.1	HPbulb	13.0	0.0	12580	1.00	1.09	1.5		783
	LOC		1063	17	11.5	WB tst 5		130.0	0.0	121.9	1	53.9
	FAT/BUC		1092	14	46.6	48.4		37.0	229.6	215.9	220.4	0.0
34	ACT	Side	2.50	20	370	0	21250	235.0	12.0	1.5	17.0	4000
	ACT	1245	1.1	HPbulb	13.0	0.0	13364	1.00	1.09	1.5		784
	LOC		995	25	11.5	WB tst 5		130.0	0.0	114.0	1	50.4
	FAT/BUC		1008	23	43.0	48.4		49.1	229.6	215.9	220.4	0.0
35	ACT	Side	2.50	20	340	0	21250	235.0	12.0	1.5	17.0	4000
	ACT	1042	1.1	HPbulb	14.0	0.0	14148	1.00	1.09	1.5		784
	LOC		926	12	11.5	WB tst 5		130.0	0.0	106.1	1	46.9
	FAT/BUC		924	12	39.4	48.4		61.2	228.3	216.6	224.5	0.0
36	ACT	Side	2.50	20	340	0	21250	235.0	12.0	1.5	17.0	4000
	ACT	1042	1.1	HPbulb	14.0	0.0	14932	1.00	1.09	1.5		784
	LOC		857	21	11.5	WB tst 5		130.0	0.0	98.2	1	43.4
	FAT/BUC		840	24	35.8	48.4		73.3	228.3	216.5	224.5	0.0
37	ACT	Side	2.50	20	340	0	21250	235.0	12.0	1.5	17.0	4000
	ACT	1042	1.1	HPbulb	14.0	0.0	15716	1.00	1.09	1.5		784
	LOC		788	32	11.5	WB tst 5		130.0	0.0	90.3	1	39.9
	FAT/BUC		754	38	32.2	48.4		85.4	228.3	216.5	224.5	0.0
38	ACT	Side	2.50	20	340	0	21250	235.0	12.0	1.5	17.0	4000
	ACT	1045	1.1	HPbulb	14.0	0.0	17316	1.00	1.09	1.5		816
	LOC		674	54	11.5	WB tst 5		130.0	0.0	74.3	1	34.0
	FAT/BUC		589	77	24.2	48.4		110.1	228.2	216.2	224.5	0.0
39	ACT	Side	2.50	20	340	0	21250	235.0	12.0	1.5	17.0	4000
	ACT	1045	1.1	HPbulb	14.0	0.0	18132	1.00	1.09	1.5		816
	LOC		600	74	11.5	WB tst 5		130.0	0.0	66.1	1	30.2
	FAT/BUC		490	113	20.1	48.4		122.7	228.2	216.0	224.5	0.0
40	ACT	Side	2.50	20	370	0	21250	235.0	12.0	1.5	17.0	4000
	ACT	1249	1.1	HPbulb	13.0	0.0	18948	1.00	1.09	1.5		816
	LOC		531	135	11.5	WB tst 5		128.6	0.0	57.8	1	26.5
	FAT/BUC		390	219	16.0	48.4		135.3	229.6	215.5	220.4	0.0
41	ACT	Side	2.50	20	370	0	21250	235.0	12.0	1.5	28.0	4000
	ACT	1315	1.1	HPbulb	13.0	0.0	19764	1.00	1.09	1.5		816
	LOC		490	168	11.5	WB tst 5		119.6	0.0	49.6	1	22.7
	FAT/BUC		290	351	11.9	48.4		147.9	228.4	217.4	220.4	0.0
42	ACT	Side	2.50	20	370	0	21250	235.0	12.0	3.0	28.0	4000
	ACT	1315	1.1	HPbulb	13.0	0.0	20580	1.00	1.18	3.0		816
	LOC		478	174	13.0	WB tst 5		110.6	0.0	41.4	1	19.0
	FAT/BUC		207	534	7.8	48.4		160.5	228.4	216.0	215.5	0.0
43	ACT	Side	2.50	20	370	0	21250	235.0	12.0	3.0	28.0	4000
	ACT	1305	1.1	HPbulb	13.0	0.0	21396	1.00	1.18	3.0		710
	LOC		363	259	13.0	WB tst 5		101.6	0.0	33.2	1	13.4
	FAT/BUC		86	*	3.8	48.4		173.0	228.8	216.1	215.5	0.0



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**Local Rule Requirements - Stiffeners (cont.)**

Stiff. No	ACT ACT	POS Za cm <sup>3</sup>	K c	Type Type	h t (mm)	bf tf (mm)	y z (mm)	SigF f <sub>1</sub> N/mm <sup>2</sup>	m wk	tkw tkf (mm)	tpl (mm)	span spac (mm)
	LOC		Zr cm <sup>3</sup>	Exc. %	tmin (mm)	Load Ref.		Sigma N/mm <sup>2</sup>	Sigdb N/mm <sup>2</sup>	p kN/m <sup>2</sup>	Comp ref.	a_conn cm <sup>2</sup>
	FAT/BUC		Zrf cm <sup>3</sup>	Exc. %	pd kN/m <sup>2</sup>	Sigd N/mm <sup>2</sup>		SigL N/mm <sup>2</sup>	Lat N/mm <sup>2</sup>	Torsion N/mm <sup>2</sup>	Web N/mm <sup>2</sup>	bf/tf

**Strength deck**

1	ACT	Strdk	0.00	20	370	0	20395	235.0	12.0	3.0	28.0	4000
	ACT	1309	0.0	HPbulb	13.0	0.0	22071	1.00	1.18	3.0		857
	LOC		374	250	13.0	WB tst 5		95.0	0.0	26.4	1	12.7
	FAT/BUC		0		0.0	0.0		183.5	228.2	216.0	215.5	0.0
2	ACT	Strdk	0.00	20	370	0	19540	235.0	12.0	3.0	28.0	4000
	ACT	1309	0.0	HPbulb	13.0	0.0	22143	1.00	1.18	3.0		855
	LOC		362	260	13.0	WB tst 5		95.0	0.0	25.7	1	12.3
	FAT/BUC		0		0.0	0.0		184.6	228.2	216.0	215.5	0.0
3	ACT	Strdk	0.00	20	370	0	18000	235.0	12.0	2.0	28.0	4000
	ACT	1295	0.0	HPbulb	13.0	0.0	22272	1.00	1.12	2.0		697
	LOC		980	32	12.0	Oil slo e		95.0	0.0	89.8	2	35.7
	FAT/BUC		0		0.0	0.0		186.6	228.9	217.1	219.0	0.0
Similar for No(s): 4												
5	ACT	Strdk	0.00	20	370	0	16600	235.0	12.0	2.0	28.0	4000
	ACT	1302	0.0	HPbulb	13.0	0.0	22389	1.00	1.12	2.0		767
	LOC		1078	20	12.0	Oil slo e		95.0	0.0	89.8	2	38.9
	FAT/BUC		0		0.0	0.0		188.4	228.6	217.0	219.0	0.0
6	ACT	Strdk	0.00	20	370	0	15770	235.0	12.0	2.0	28.0	4000
	ACT	1307	0.0	HPbulb	13.0	0.0	22459	1.00	1.12	2.0		832
	LOC		1170	11	12.0	Oil slo e		95.0	0.0	89.8	2	41.9
	FAT/BUC		0		0.0	0.0		189.4	228.3	217.0	219.0	0.0
Similar for No(s): 7 8 9 10 11												
12	ACT	Strdk	0.00	20	370	0	10790	235.0	12.0	2.0	28.0	4000
	ACT	1316	0.0	HPbulb	13.0	0.0	22800	1.00	1.12	2.0		830
	LOC		1166	12	12.0	Oil slo e		95.0	0.0	89.8	2	41.7
	FAT/BUC		0		0.0	0.0		194.7	228.3	217.0	219.0	0.0
Similar for No(s): 13 14 15 16 17 18 19 20 21 22 23 24												

**Inner Bottom & Inner Side**

1	ACT	Inbot	0.00	43	530	150	830	235.0	12.0	1.5	21.0	4000
	ACT	3059	0.0	Tbar	12.0	30.0	2680	1.00	1.15	1.5		830
	LOC		2831	8	11.5	Oil tst 5		101.8	33.2	227.3	2	102.9
	FAT/BUC		0		0.0	0.0		114.7	232.7	194.1	194.8	2.6
Similar for No(s): 2 3 4 5 6 7 8 9 10 11 12 13												
14	ACT	Inbot	0.00	43	530	150	13279	235.0	12.0	1.5	21.0	4000
	ACT	3048	0.0	Tbar	12.0	30.0	2907	1.00	1.15	1.5		829
	LOC		2803	8	11.5	Oil tst 5		101.8	33.2	225.0	2	101.9
	FAT/BUC		0		0.0	0.0		111.2	232.7	194.1	194.8	2.6
Similar for No(s): 15 16 17												
18	ACT	Hoptk	0.00	20	430	0	16947	235.0	12.0	1.5	20.0	4000
	ACT	1944	0.0	HPbulb	15.0	0.0	3654	1.00	1.09	1.5		768
	LOC		1706	13	11.5	Oil tst 5		141.7	0.0	217.5	2	91.8
	FAT/BUC		0		0.0	0.0		99.8	231.2	217.0	220.7	0.0
19	ACT	Hoptk	0.00	20	430	0	17294	235.0	12.0	1.5	20.0	4000
	ACT	1944	0.0	HPbulb	15.0	0.0	4339	1.00	1.09	1.5		768
	LOC		1556	24	11.5	Oil tst 5		150.4	0.0	210.6	2	88.8
	FAT/BUC		0		0.0	0.0		89.3	231.2	217.1	220.7	0.0
20	ACT	Hoptk	0.00	20	430	0	17641	235.0	12.0	1.5	16.0	4000
	ACT	1895	0.0	HPbulb	15.0	0.0	5024	1.00	1.09	1.5		768
	LOC		1422	33	11.5	Oil tst 5		159.2	0.0	203.7	2	85.8
	FAT/BUC		0		0.0	0.0		78.8	231.4	213.5	220.7	0.0
21	ACT	Hoptk	0.00	20	400	0	17989	235.0	12.0	1.5	16.0	4000
	ACT	1544	0.0	HPbulb	14.0	0.0	5709	1.00	1.09	1.5		767
	LOC		1367	12	11.5	Oil tst 5		160.0	0.0	196.8	2	82.9
	FAT/BUC		0		0.0	0.0		68.4	230.7	215.3	220.6	0.0

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**Local Rule Requirements - Stiffeners (cont.)**

Stiff. No	ACT ACT	POS Za cm³	K c	Type Type	h t (mm)	bf tf (mm)	y z (mm)	SigF f <sub>1</sub> N/mm²	m wk	tkw tkf (mm)	tpl (mm)	span spac (mm)
LOC			Zr cm³	Exc. %	tmin (mm)	Load Ref.		Sigma N/mm²	Sigdb N/mm²	p kN/m²	Comp ref.	a_conn cm²
FAT/BUC			Zrf cm³	Exc. %	pd kN/m²	Sigd N/mm²		SigL N/mm²	Lat N/mm²	Torsion N/mm²	Web N/mm²	bf/tf
22	ACT	Hoptk	0.00	20	400	0	18336	235.0	12.0	1.5	16.0	4000
	ACT	1545	0.0	HPbulb	14.0	0.0	6394	1.00	1.09	1.5		774
	LOC		1331	16	11.5	Oil tst 5		160.0	0.0	190.0	2	80.5
	FAT/BUC		0		0.0	0.0		57.9	230.7	215.4	220.6	0.0
23	ACT	Insid	0.00	20	370	0	18690	235.0	12.0	1.5	15.0	4000
	ACT	1229	0.0	HPbulb	13.0	0.0	7875	1.00	1.09	1.5		783
	LOC		1241	0	11.5	Oil tst 5		160.0	0.0	175.1	2	74.8
	FAT/BUC		0		0.0	0.0		35.2	229.8	215.3	220.4	0.0
24	ACT	Insid	0.00	20	370	0	18690	235.0	12.0	1.5	15.0	4000
	ACT	1229	0.0	HPbulb	13.0	0.0	8659	1.00	1.09	1.5		784
	LOC		1185	3	11.5	Oil tst 5		160.0	0.0	167.2	2	71.3
	FAT/BUC		0		0.0	0.0		30.0	229.8	215.3	220.4	0.0
25	ACT	Insid	0.00	20	370	0	18690	235.0	12.0	1.5	15.0	4000
	ACT	1229	0.0	HPbulb	13.0	0.0	9443	1.00	1.09	1.5		784
	LOC		1129	8	11.5	Oil tst 5		160.0	0.0	159.3	2	67.8
	FAT/BUC		0		0.0	0.0		30.0	229.8	215.3	220.4	0.0
26	ACT	Insid	0.00	20	370	0	18690	235.0	12.0	1.5	15.0	4000
	ACT	1229	0.0	HPbulb	13.0	0.0	10227	1.00	1.09	1.5		784
	LOC		1073	14	11.5	Oil tst 5		160.0	0.0	151.4	2	64.3
	FAT/BUC		0		0.0	0.0		30.0	229.8	215.3	220.4	0.0
27	ACT	Insid	0.00	20	370	0	18690	235.0	12.0	1.5	14.0	4000
	ACT	1220	0.0	HPbulb	13.0	0.0	11011	1.00	1.09	1.5		784
	LOC		1018	19	11.5	Oil tst 5		160.0	0.0	143.5	2	60.8
	FAT/BUC		0		0.0	0.0		30.0	229.9	215.0	220.4	0.0
28	ACT	Insid	0.00	20	340	0	18690	235.0	12.0	1.5	14.0	4000
	ACT	958	0.0	HPbulb	12.0	0.0	12579	1.00	1.09	1.5		783
	LOC		906	5	11.5	Oil tst 5		160.0	0.0	127.8	2	53.9
	FAT/BUC		0		0.0	0.0		37.0	228.7	213.7	220.1	0.0
29	ACT	Insid	0.00	20	340	0	18690	235.0	12.0	1.5	14.0	4000
	ACT	958	0.0	HPbulb	12.0	0.0	13363	1.00	1.09	1.5		784
	LOC		850	12	11.5	Oil tst 5		160.0	0.0	119.9	2	50.4
	FAT/BUC		0		0.0	0.0		49.1	228.7	213.7	220.1	0.0
30	ACT	Insid	0.00	20	340	0	18690	235.0	12.0	1.5	14.0	4000
	ACT	958	0.0	HPbulb	12.0	0.0	14148	1.00	1.09	1.5		784
	LOC		794	20	11.5	Oil tst 5		160.0	0.0	112.0	2	46.9
	FAT/BUC		0		0.0	0.0		61.2	228.7	213.6	220.1	0.0
31	ACT	Insid	0.00	20	340	0	18690	235.0	12.0	1.5	14.0	4000
	ACT	958	0.0	HPbulb	12.0	0.0	14932	1.00	1.09	1.5		784
	LOC		738	29	11.5	Oil tst 5		160.0	0.0	104.1	2	43.4
	FAT/BUC		0		0.0	0.0		73.3	228.7	213.5	220.1	0.0
32	ACT	Insid	0.00	20	340	0	18690	235.0	12.0	1.5	14.0	4000
	ACT	958	0.0	HPbulb	12.0	0.0	15716	1.00	1.09	1.5		784
	LOC		682	40	11.5	Oil tst 5		160.0	0.0	96.2	2	39.9
	FAT/BUC		0		0.0	0.0		85.4	228.7	213.4	220.1	0.0
33	ACT	Insid	0.00	20	340	0	18690	235.0	12.0	1.5	17.0	4000
	ACT	979	0.0	HPbulb	12.0	0.0	17316	1.00	1.09	1.5		816
	LOC		723	35	11.5	Oil slo e		146.5	0.0	89.8	2	34.0
	FAT/BUC		0		0.0	0.0		110.1	228.1	214.7	220.1	0.0
34	ACT	Insid	0.00	20	340	0	18690	235.0	12.0	1.5	17.0	4000
	ACT	979	0.0	HPbulb	12.0	0.0	18132	1.00	1.09	1.5		815
	LOC		770	27	11.5	Oil slo e		137.5	0.0	89.8	2	32.9
	FAT/BUC		0		0.0	0.0		122.7	228.1	214.6	220.1	0.0
35	ACT	Insid	0.00	20	370	0	18690	235.0	12.0	1.5	17.0	4000
	ACT	1249	0.0	HPbulb	13.0	0.0	18947	1.00	1.09	1.5		815
	LOC		824	51	11.5	Oil slo e		128.6	0.0	89.8	2	32.9
	FAT/BUC		0		0.0	0.0		135.3	229.6	215.5	220.4	0.0



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**Local Rule Requirements - Stiffeners (cont.)**

Stiff. No	ACT ACT	POS Za cm³	K c	Type Type	h t (mm)	bf tf (mm)	y z (mm)	SigF f <sub>t</sub> N/mm²	m wk	tkw tkf (mm)	tpl (mm)	span spac (mm)
LOC			Zr cm³	Exc. %	tmin (mm)	Load Ref.		Sigma N/mm²	Sigdb N/mm²	p kN/m²	Comp ref.	a_conn cm²
FAT/BUC			Zrf cm³	Exc. %	pd kN/m²	Sigd N/mm²		Sigl N/mm²	Lat N/mm²	Torsion N/mm²	Web N/mm²	bf/tf
36	ACT	Insid	0.00	20	370	0	18690	235.0	12.0	1.5	28.0	4000
	ACT	1315	0.0	HPbulb	13.0	0.0	19763	1.00	1.09	1.5		816
	LOC		886	48	11.5	Oil slo e		119.6	0.0	89.8	2	32.9
	FAT/BUC		0		0.0	0.0		147.9	228.4	217.4	220.4	0.0
37	ACT	Insid	0.00	20	370	0	18690	235.0	12.0	1.5	28.0	4000
	ACT	1315	0.0	HPbulb	13.0	0.0	20579	1.00	1.09	1.5		816
	LOC		958	37	11.5	Oil slo e		110.6	0.0	89.8	2	32.9
	FAT/BUC		0		0.0	0.0		160.5	228.4	217.4	220.4	0.0
38	ACT	Insid	0.00	20	370	0	18690	235.0	12.0	3.0	28.0	4000
	ACT	1315	0.0	HPbulb	13.0	0.0	21395	1.00	1.18	3.0		817
	LOC		1130	16	13.0	Oil slo e		101.6	0.0	89.8	2	32.9
	FAT/BUC		0		0.0	0.0		173.0	228.4	216.0	215.5	0.0
<b>CL Bulkhead</b>												
1	ACT	Lbhd	0.00	10	300	0	0	235.0	12.0	1.5	20.0	2000
	ACT	584	0.0	Fbar	20.0	0.0	590	1.00	1.08	1.5		705
	LOC		598	-2	16.5	WB acc 1		102.5	0.0	244.0	1	44.3
	FAT/BUC		0		0.0	0.0		146.6	231.8	208.3	0.0	0.0
2	ACT	Lbhd	0.00	10	300	0	0	235.0	12.0	1.5	20.0	2000
	ACT	591	0.0	Fbar	20.0	0.0	1410	1.00	1.08	1.5		820
	LOC		607	-2	16.5	WB acc 1		113.0	0.0	234.7	1	47.8
	FAT/BUC		0		0.0	0.0		134.1	231.6	207.5	0.0	0.0
3	ACT	Lbhd	0.00	10	300	0	0	235.0	12.0	1.5	20.0	2000
	ACT	578	0.0	Fbar	20.0	0.0	2230	1.00	1.08	1.5		635
	LOC		414	39	16.5	WB tst 5		123.5	0.0	225.9	1	37.7
	FAT/BUC		0		0.0	0.0		121.6	231.9	209.0	0.0	0.0
4	ACT	Lbhd	0.00	20	430	0	0	235.0	12.0	1.0	19.0	4000
	ACT	1926	0.0	HPbulb	15.0	0.0	3417	1.00	1.06	0.0		736
	LOC		1643	17	11.0	Oil tst 5		138.6	0.0	219.9	2	91.8
	FAT/BUC		0		0.0	0.0		103.4	231.3	217.9	221.8	0.0
5	ACT	Lbhd	0.00	20	430	0	0	235.0	12.0	1.0	19.0	4000
	ACT	1926	0.0	HPbulb	15.0	0.0	4152	1.00	1.06	0.0		735
	LOC		1485	29	11.0	Oil tst 5		148.0	0.0	212.5	2	88.7
	FAT/BUC		0		0.0	0.0		92.2	231.3	218.0	221.8	0.0
6	ACT	Lbhd	0.00	20	430	0	0	235.0	12.0	1.0	19.0	4000
	ACT	1926	0.0	HPbulb	15.0	0.0	4887	1.00	1.06	0.0		735
	LOC		1348	42	11.0	Oil tst 5		157.4	0.0	205.1	2	85.6
	FAT/BUC		0		0.0	0.0		80.9	231.3	218.0	221.8	0.0
7	ACT	Lbhd	0.00	10	450	0	0	235.0	12.0	1.0	19.0	4000
	ACT	1501	0.0	Fbar	25.0	0.0	5622	1.00	1.04	0.0		735
	LOC		1254	19	23.5	Oil tst 5		160.0	0.0	197.7	2	82.5
	FAT/BUC		0		0.0	0.0		69.7	230.1	198.7	0.0	0.0
8	ACT	Lbhd	0.00	10	450	0	0	235.0	12.0	1.0	19.0	4000
	ACT	1501	0.0	Fbar	25.0	0.0	6357	1.00	1.04	0.0		735
	LOC		1207	24	23.5	Oil tst 5		160.0	0.0	190.3	2	79.4
	FAT/BUC		0		0.0	0.0		58.5	230.1	198.8	0.0	0.0
Similar for No(s): 9												
10	ACT	Lbhd	0.00	10	400	0	0	235.0	12.0	1.0	19.0	4000
	ACT	1218	0.0	Fbar	25.0	0.0	7876	1.00	1.04	0.0		784
	LOC		1184	2	21.0	Oil tst 5		160.0	0.0	175.1	2	77.4
	FAT/BUC		0		0.0	0.0		35.2	228.6	205.4	0.0	0.0
11	ACT	Lbhd	0.00	10	400	0	0	235.0	12.0	1.0	19.0	4000
	ACT	1218	0.0	Fbar	25.0	0.0	8660	1.00	1.04	0.0		784
	LOC		1131	7	21.0	Oil tst 5		160.0	0.0	167.2	2	73.9
	FAT/BUC		0		0.0	0.0		23.2	228.6	205.5	0.0	0.0

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**Local Rule Requirements - Stiffeners (cont.)**

Stiff. No	ACT ACT	POS Za cm³	K c	Type Type	h t (mm)	bf tf (mm)	y z (mm)	SigF f <sub>1</sub> N/mm²	m wk	tkw tkf (mm)	tpl (mm)	span spac (mm)
LOC			Zr cm³	Exc. %	tmin (mm)	Load Ref.		Sigma N/mm²	Sigdb N/mm²	p kN/m²	Comp ref.	a_conn cm²
FAT/BUC			Zrf cm³	Exc. %	pd kN/m²	Sigd N/mm²		SigL N/mm²	Lat N/mm²	Torsion N/mm²	Web N/mm²	bf/tf
12	ACT ACT LOC FAT/BUC	Lbhd 1146	0.00 0.0 1078 0	10 Fbar 6	400 25.0 21.0 0.0	0 0.0 Oil tst 5 0.0	0 9444	235.0 1.00 160.0 11.3	12.0 1.04 0.0 229.0	1.0 0.0 159.3 200.4	13.0 2 0.0	4000 784 70.4 0.0
13	ACT ACT LOC FAT/BUC	Lbhd 1146	0.00 0.0 1024 0	10 Fbar 11	400 25.0 21.0 0.0	0 0.0 Oil tst 5 0.0	0 10228	235.0 1.00 160.0 0.7	12.0 1.04 0.0 229.0	1.0 0.0 151.4 200.6	13.0 2 0.0	4000 784 66.9 0.0
14	ACT ACT LOC FAT/BUC	Lbhd 1146	0.00 0.0 971 0	10 Fbar 18	400 25.0 21.0 0.0	0 0.0 Oil tst 5 0.0	0 11012	235.0 1.00 160.0 12.8	12.0 1.04 0.0 229.0	1.0 0.0 143.5 200.3	13.0 2 0.0	4000 784 63.4 0.0
15	ACT ACT LOC FAT/BUC	Lbhd 896	0.00 0.0 917 0	10 Fbar -2	350 25.0 18.5 0.0	0 0.0 Oil tst 5 0.0	0 11796	235.0 1.00 160.0 24.9	12.0 1.04 0.0 227.0	1.0 0.0 135.6 207.9	13.0 2 0.0	4000 784 60.0 0.0
16	ACT ACT LOC FAT/BUC	Lbhd 896	0.00 0.0 864 0	10 Fbar 3	350 25.0 18.5 0.0	0 0.0 Oil tst 5 0.0	0 12580	235.0 1.00 160.0 37.0	12.0 1.04 0.0 227.0	1.0 0.0 127.8 207.6	13.0 2 0.0	4000 784 56.5 0.0
17	ACT ACT LOC FAT/BUC	Lbhd 896	0.00 0.0 811 0	10 Fbar 10	350 25.0 18.5 0.0	0 0.0 Oil tst 5 0.0	0 13364	235.0 1.00 160.0 49.1	12.0 1.04 0.0 227.0	1.0 0.0 119.9 207.4	13.0 2 0.0	4000 784 53.0 0.0
18	ACT ACT LOC FAT/BUC	Lbhd 896	0.00 0.0 757 0	10 Fbar 18	350 25.0 18.5 0.0	0 0.0 Oil tst 5 0.0	0 14148	235.0 1.00 160.0 61.2	12.0 1.04 0.0 227.0	1.0 0.0 112.0 207.1	13.0 2 0.0	4000 784 49.5 0.0
19	ACT ACT LOC FAT/BUC	Lbhd 896	0.00 0.0 704 0	10 Fbar 27	350 25.0 18.5 0.0	0 0.0 Oil tst 5 0.0	0 14932	235.0 1.00 160.0 73.3	12.0 1.04 0.0 227.0	1.0 0.0 104.1 206.8	13.0 2 0.0	4000 784 46.0 0.0
20	ACT ACT LOC FAT/BUC	Lbhd 896	0.00 0.0 651 0	10 Fbar 37	350 25.0 18.5 0.0	0 0.0 Oil tst 5 0.0	0 15716	235.0 1.00 160.0 85.4	12.0 1.04 0.0 227.0	1.0 0.0 96.2 206.4	13.0 2 0.0	4000 784 42.5 0.0
21	ACT ACT LOC FAT/BUC	Lbhd 896	0.00 0.0 625 0	10 Fbar 43	350 25.0 18.5 0.0	0 0.0 Oil slo e 0.0	0 16500	235.0 1.00 155.5 97.5	12.0 1.04 0.0 227.0	1.0 0.0 89.8 206.1	13.0 2 0.0	4000 784 39.7 0.0
22	ACT ACT LOC FAT/BUC	Lbhd 982	0.00 0.0 675 0	20 HPbulb 45	340 12.0 11.0 0.0	0 0.0 Oil slo e 0.0	0 17284	235.0 1.00 146.9 109.6	12.0 1.06 0.0 228.1	1.0 0.0 89.8 216.2	18.0 2 221.6	4000 785 39.7 0.0
23	ACT ACT LOC FAT/BUC	Lbhd 982	0.00 0.0 718 0	20 HPbulb 36	340 12.0 11.0 0.0	0 0.0 Oil slo e 0.0	0 18070	235.0 1.00 138.2 121.7	12.0 1.06 0.0 228.1	1.0 0.0 89.8 216.2	18.0 2 221.6	4000 786 39.8 0.0
24	ACT ACT LOC FAT/BUC	Lbhd 982	0.00 0.0 766 0	20 HPbulb 28	340 12.0 11.0 0.0	0 0.0 Oil slo e 0.0	0 18856	235.0 1.00 129.6 133.9	12.0 1.06 0.0 228.1	1.0 0.0 89.8 216.1	18.0 2 221.6	4000 786 39.8 0.0
25	ACT ACT LOC FAT/BUC	Lbhd 982	0.00 0.0 821 0	20 HPbulb 19	340 12.0 11.0 0.0	0 0.0 Oil slo e 0.0	0 19642	235.0 1.00 120.9 146.0	12.0 1.06 0.0 228.1	1.0 0.0 89.8 216.1	18.0 2 221.6	4000 786 39.8 0.0

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**Local Rule Requirements - Stiffeners (cont.)**

Stiff. No	ACT ACT	POS Za cm³	K c	Type Type	h t (mm)	bf tf (mm)	y z (mm)	SigF f <sub>1</sub> N/mm²	m wk	tkw tkf (mm)	tpl (mm)	span spac (mm)
LOC			Zr cm³	Exc. %	tmin (mm)	Load Ref.		Sigma N/mm²	Sigdb N/mm²	p kN/m²	Comp ref.	a_conn cm²
FAT/BUC			Zrf cm³	Exc. %	pd kN/m²	Sigd N/mm²		SigL N/mm²	Lat N/mm²	Torsion N/mm²	Web N/mm²	bf/ft
26	ACT	Lbhd	0.00	20	340	0	0	235.0	12.0	1.0	28.0	4000
	ACT	1028	0.0	HPbulb	12.0	0.0	20428	1.00	1.06	0.0		786
	LOC		884	16	11.0	Oil slo e		112.3	0.0	89.8	2	39.8
	FAT/BUC		0		0.0	0.0		158.1	226.6	217.7	221.6	0.0
27	ACT	Lbhd	0.00	20	340	0	0	235.0	12.0	1.0	28.0	4000
	ACT	1028	0.0	HPbulb	12.0	0.0	21214	1.00	1.06	0.0		789
	LOC		962	6	11.0	Oil slo e		103.6	0.0	89.8	2	39.9
	FAT/BUC		0		0.0	0.0		170.2	226.6	217.7	221.6	0.0
28	ACT	Lbhd	0.00	20	340	0	0	235.0	12.0	2.0	28.0	4000
	ACT	1029 *	0.0	HPbulb	12.0	0.0	22007	1.00	1.12	2.0		793
	LOC		1114	-7	12.0	Oil slo e		95.0	0.0	89.8	2	40.1
	FAT/BUC		0		0.0	0.0		182.5	226.5	216.0	218.6	0.0
<b>Stringer 7092</b>												
1	ACT	Strng	0.00	10	200	0	20610	235.0	12.0	1.5	12.0	4000
	ACT	194	0.0	Fbar	15.0	0.0	7092	1.00	1.10	1.5		640
	LOC		89	117	11.5	WB slo s		160.0	0.0	15.3	1	5.6
	FAT/BUC		0		0.0	0.0		47.2	205.1	212.9	0.0	0.0
Similar for No(s): 2 3												
<b>Stringer 11796</b>												
1	ACT	Strng	0.00	10	200	0	20610	235.0	12.0	1.5	12.0	4000
	ACT	194	0.0	Fbar	15.0	0.0	11796	1.00	1.10	1.5		640
	LOC		89	117	11.5	WB slo s		160.0	0.0	15.3	1	5.6
	FAT/BUC		0		0.0	0.0		30.0	205.1	213.7	0.0	0.0
Similar for No(s): 2 3												
<b>Stringer 16500</b>												
1	ACT	Strng	0.00	10	200	0	20610	235.0	12.0	1.5	12.0	4000
	ACT	194	0.0	Fbar	15.0	0.0	16500	1.00	1.10	1.5		640
	LOC		89	117	11.5	WB slo s		160.0	0.0	15.3	1	5.6
	FAT/BUC		0		0.0	0.0		97.5	205.1	210.1	0.0	0.0
Similar for No(s): 2 3												
<b>Bottom girder 5810</b>												
1	ACT	DBgird	0.00	10	250	0	5810	235.0	10.0	1.5	18.0	4000
	ACT	314	0.0	Fbar	15.0	0.0	590	1.00	1.10	1.5		705
	LOC		121	159	14.0	WB slo e		115.0	0.0	11.2	1	4.5
	FAT/BUC		0		0.0	0.0		146.6	213.0	208.6	0.0	0.0
2	ACT	DBgird	0.00	10	250	0	5810	235.0	10.0	1.5	18.0	4000
	ACT	317	0.0	Fbar	15.0	0.0	1410	1.00	1.10	1.5		820
	LOC		140	125	14.0	WB slo e		115.0	0.0	11.2	1	5.2
	FAT/BUC		0		0.0	0.0		134.1	211.0	205.9	0.0	0.0
3	ACT	DBgird	0.00	10	250	0	5810	235.0	10.0	1.5	18.0	4000
	ACT	313	0.0	Fbar	15.0	0.0	2230	1.00	1.10	1.5		678
	LOC		116	169	14.0	WB slo e		115.0	0.0	11.2	1	4.4
	FAT/BUC		0		0.0	0.0		121.6	213.4	209.9	0.0	0.0
<b>Bottom girder 11620</b>												
1	ACT	DBgird	0.00	10	250	0	11620	235.0	10.0	1.5	18.0	4000
	ACT	314	0.0	Fbar	15.0	0.0	590	1.00	1.10	1.5		705
	LOC		121	159	14.0	WB slo e		115.0	0.0	11.2	1	4.5
	FAT/BUC		0		0.0	0.0		146.6	213.0	208.6	0.0	0.0
2	ACT	DBgird	0.00	10	250	0	11620	235.0	10.0	1.5	18.0	4000
	ACT	317	0.0	Fbar	15.0	0.0	1410	1.00	1.10	1.5		820
	LOC		140	125	14.0	WB slo e		115.0	0.0	11.2	1	5.2
	FAT/BUC		0		0.0	0.0		134.1	211.0	205.9	0.0	0.0

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**Local Rule Requirements - Stiffeners (cont.)**

Stiff. No	ACT ACT	POS Za cm³	K c	Type Type	h t (mm)	bf tf (mm)	y z (mm)	SigF f <sub>1</sub> N/mm²	m wk	tkw tkf (mm)	tpl (mm)	span spac (mm)
LOC			Zr cm³	Exc. %	tmin (mm)	Load Ref.		Sigma N/mm²	Sigdb N/mm²	p kN/m²	Comp ref.	a_conn cm²
FAT/BUC			Zrf cm³	Exc. %	pd kN/m²	Sigd N/mm²		SigL N/mm²	Lat N/mm²	Torsion N/mm²	Web N/mm²	bf/tf
3	ACT	DBgird	0.00	10	250	0	11620	235.0	10.0	1.5	18.0	4000
	ACT	315	0.0	Fbar	15.0	0.0	2230	1.00	1.10	1.5		733
	LOC		125	150	14.0	WB slo e		115.0	0.0	11.2	1	4.7
	FAT/BUC		0		0.0	0.0		121.6	212.5	208.7	0.0	0.0
<b>Bottom girder 16600</b>												
1	ACT	DBgird	0.00	10	250	0	16600	235.0	10.0	1.5	18.0	4000
	ACT	314	0.0	Fbar	15.0	0.0	590	1.00	1.10	1.5		705
	LOC		121	159	14.0	WB slo e		115.0	0.0	11.2	1	4.5
	FAT/BUC		0		0.0	0.0		146.6	213.0	208.6	0.0	0.0
2	ACT	DBgird	0.00	10	250	0	16600	235.0	10.0	1.5	18.0	4000
	ACT	317	0.0	Fbar	15.0	0.0	1410	1.00	1.10	1.5		820
	LOC		140	125	14.0	WB slo e		115.0	0.0	11.2	1	5.2
	FAT/BUC		0		0.0	0.0		134.1	211.0	205.9	0.0	0.0
3	ACT	DBgird	0.00	10	250	0	16600	235.0	10.0	1.5	18.0	4000
	ACT	316	0.0	Fbar	15.0	0.0	2230	1.00	1.10	1.5		780
	LOC		133	136	14.0	WB slo e		115.0	0.0	11.2	1	4.9
	FAT/BUC		0		0.0	0.0		121.6	211.7	207.6	0.0	0.0

**4.-** Seguidamente se muestran los siguientes datos (input) y resultados (output) del programa “NAUTICUS HULL” correspondientes al paso final de rediseño, lo que hemos denominado “BUQUE PROYECTO”.

- Distribución, tipo, dimensiones y acero empleado para refuerzos longitudinales. Ver hojas 3 a 5.
- Referencias a la reglamentación. Ver hoja 6
- Datos de entrada necesarios para el programa. Ver hoja 7.
- Espaciado entre cuadernas. Ver hoja 8.
- Geometría de planchas. Ver hoja 9.
- Cálculo del área de la cuaderna maestra. Ver hojas 11 a 16.
- Momentos flectores. Ver hoja 17.
- Módulo resistente. Ver hojas 18 y 19.
- Resistencia local y pandeo para planchas y refuerzos. Ver hojas 22 a 33.



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## SECTION SCANTLINGS

### Hull Section Scantlings according to DNV Rules

Rule edition ..... : Jan 1998  
Program version ..... : 3.3-372-980619

#### Ship Identification SHUTTLE TANKER 145000 M3

ID No ..... : proyec  
Date/Sign ..... :  
CUADERNA MAESTRA CON ACERO DULCE

#### Cross Section Identification CUADERNA MAESTRA

Midship section? ..... : Yes  
Distance from AP ..... (m) : 128.250  
Date/Sign ..... :  
CUADERNA MAESTRA REALIZADA CON ACERO DULCE

Database: C:\NautHull\SHIPS\Proyec1\SectSca\proyec .pw

#### Main Dimensions

Length betw. perpendiculars, Lbp .....	(m) :	256.500
Rule length, L .....	(m) :	252.690
Breadth moulded, B .....	(m) :	42.500
Depth moulded, D .....	(m) :	22.000
Draught moulded, T .....	(m) :	15.500
Block coefficient, Cb .....		0.879
Min. design draught at AP .....	(m) :	0.000
Min. design draught at FP .....	(m) :	0.000

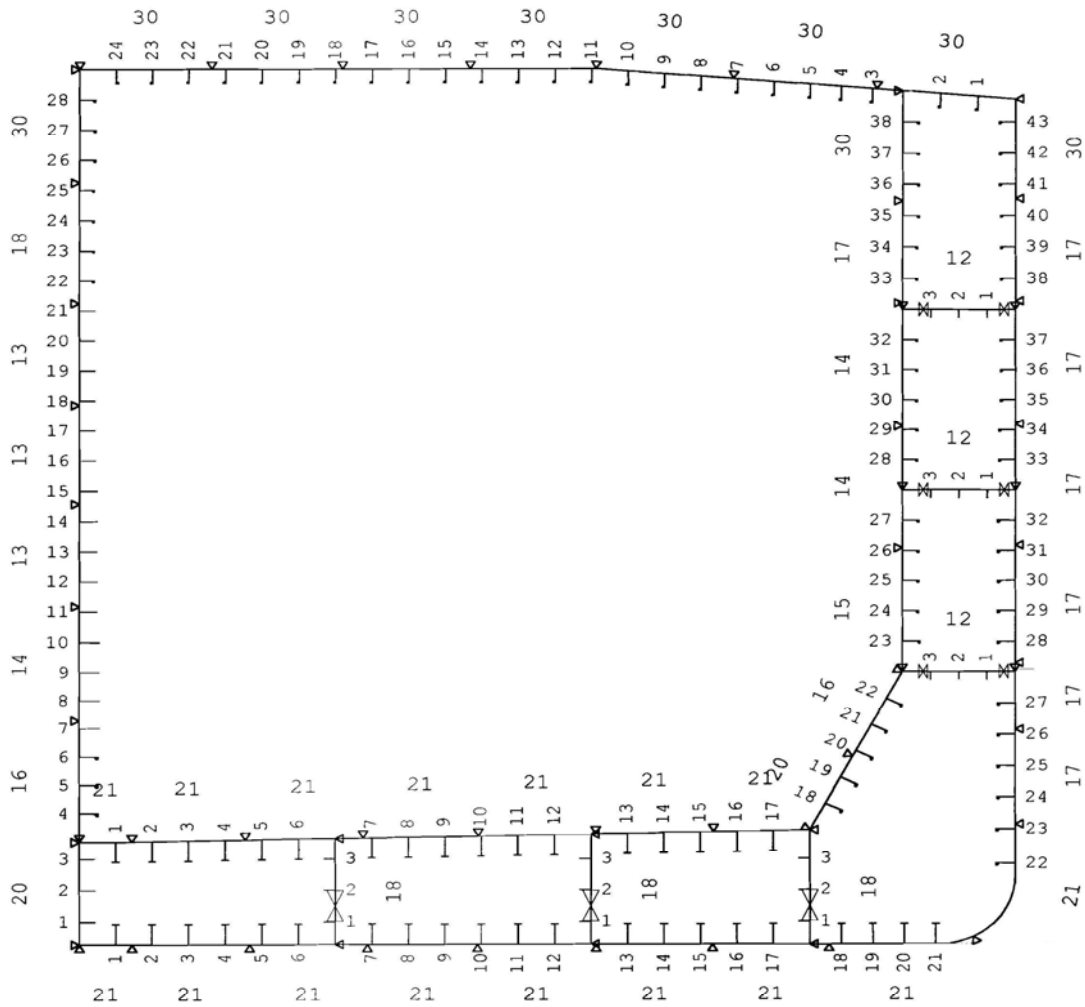


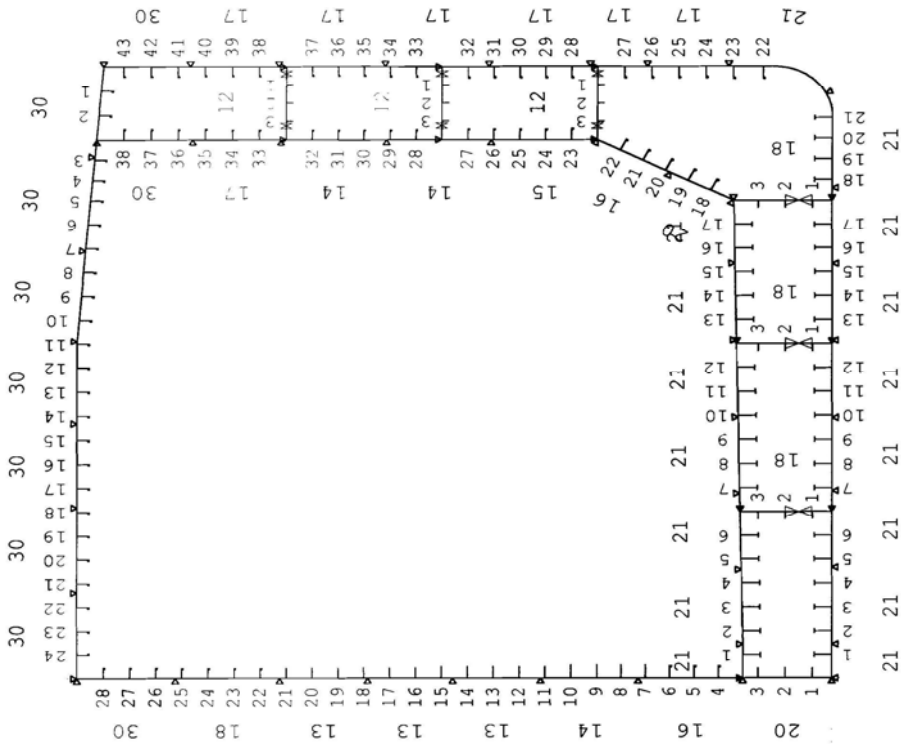
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Section Scantlings - v.3.3-372-980619  
 SHUTTLE TANKER 145000 M3  
 CUADERNA MAESTRA

Ship Id No : proyec





Scale:  
 1:200

SHUTTLE TANKER 145000 M3  
 Date/Sign : 00-02-16  
 Main dim. : Lpp=256.5 B=42.5 D=22 T=15.5 CB=0.879

Nauticus Hull  
 Section Scantlings

Section Scantlings - v.3.3-372-980619  
 SHUTTLE TANKER 145000 M3  
 CUADERNA MAESTRA

Ship Id No : proyec

### Profiles

Nos	Type	Dimensions	Steel
<b>Outer Shell</b>			
1 - 21	Tbar	530 x 150 x 12 x 35	
22 - 23	HPbulb	430 x 15	
24 - 30	HPbulb	400 x 16	
31 - 32	HPbulb	400 x 14	
33 - 34	HPbulb	370 x 13	
35 - 40	HPbulb	340 x 14	
41 - 24	HPbulb	370 x 13	
<b>Inner Bottom &amp; Inner Side</b>			
1 - 17	Tbar	530 x 150 x 12 x 30	
18 - 20	HPbulb	430 x 15	
21 - 23	HPbulb	400 x 14	
24 - 27	HPbulb	370 x 13	
28 - 34	HPbulb	340 x 12	
35 - 38	HPbulb	370 x 13	
<b>CL Bulkhead</b>			
1 - 3	Fbar	350 x 20	
4 - 6	HPbulb	430 x 15	
7 - 10	Fbar	450 x 25	
11 - 15	Fbar	400 x 25	
16 - 21	Fbar	350 x 25	
22 - 25	HPbulb	340 x 12	
26 - 28	HPbulb	370 x 13	
<b>Stringer 7092</b>			
1 - 3	Fbar	200 x 15	
<b>Stringer 11796</b>			
1 - 3	Fbar	200 x 15	
<b>Stringer 16500</b>			
1 - 3	Fbar	200 x 15	
<b>Bottom girder 5810</b>			
1 - 3	Fbar	250 x 15	
<b>Bottom girder 11620</b>			
1 - 3	Fbar	250 x 15	
<b>Bottom girder 16600</b>			
1 - 3	Fbar	250 x 15	

Section Scantlings - v.3.3-372-980619  
 SHUTTLE TANKER 145000 M3  
 CUADERNA MAESTRA

Ship Id No : proyec

## 1 Rule Reference

DET NORSKE VERITAS' Rules for Classification of Ships, January 1998.  
 Ships with length 100 metres and above.

STRENGTH ITEM	REFERENCE TO DNV RULES
<b>HULL GIRDER STRENGTH</b>	
- Design bending moments	Jan 1998 Pt.3 Ch.1 Sec.5 B 102-202
- Bending strength	Jan 1998 Pt.3 Ch.1 Sec.5 C
<b>PLATES</b>	
- Bottom and inner bottom	Jan 1998 Pt.3 Ch.1 Sec.6 C 100-503
- Side	Jan 1998 Pt.3 Ch.1 Sec.7 C 100-104
- Deck	Jan 1998 Pt.3 Ch.1 Sec.8 C 100-202
- Bulkheads	Jan 1998 Pt.3 Ch.1 Sec.9 C 100-105
- Wheel loaded decks	Jan 1998 Pt.5 Ch.2 Sec.4 C 200-302
- Bulk cargo (HC-Class)	Jan 1998 Pt.5 Ch.2 Sec.5 B, C300-304,D200-202
- Container carriers	Jan 1998 Pt.5 Ch.2 Sec.6 B & C
- IB(+) Notation	Jan 1998 Pt.3 Ch.1 Sec.6 H 302
- Buckling strength	Jan 1998 Pt.3 Ch.1 Sec.14 B 100, 201, 205, 206
<b>STIFFENERS</b>	
- Bottom and inner bottom	Jan 1998 Pt.3 Ch.1 Sec.6 C 700-901
- Side	Jan 1998 Pt.3 Ch.1 Sec.7 C 300-304, E 501
- Main frames in general	Jan 1998 Pt.3 Ch.1 Sec.7 C 400-404
For bulkcarriers. L>150 m	Jan 1998 Pt.5 Ch.2 Sec.10 B (IACS UR S12)
- Deck	Jan 1998 Pt.3 Ch.1 Sec.8 C 300-303
- Bulkheads	Jan 1998 Pt.3 Ch.1 Sec.9 C 200-204
- Wheel loaded decks	Jan 1998 Pt.5 Ch.2 Sec.4 C 200-202, 401
- Bulk cargo (HC-Class)	Jan 1998 Pt.5 Ch.2 Sec.5 B, C300-302, 305-306
- Container carriers	Jan 1998 Pt.5 Ch.2 Sec.6 B & C
- Buckling strength	Jan 1998 Pt.3 Ch.1 Sec.14 C 100-202, 300-402
- Connection area at supp.	Jan 1998 Pt.3 Ch.1 Sec.12 C 402 (C=1.25)

Current Rule booklets:  
 Pt.3 Ch.1: January 1998  
 Pt.3 Ch.2: January 1998  
 Pt.5 Ch.2: January 1998

The January 1998 Rules come into force on July 1, 1998.

NOTE: THE FOLLOWING REQUIREMENTS ARE NOT INCLUDED:

- Floors and brackets
- Ice strengthening of hull
- Slamming and bow impact
- Tugs, Supply vessels and other offshore/harbour vessels
- Class notation ICM (Increased corrosion margins)

Section Scantlings - v.3.3-372-980619  
 SHUTTLE TANKER 145000 M3  
 CUADERNA MAESTRA

Ship Id No : proyec

## 2 Input Data

### Main Dimensions

Length betw. perpendiculars, Lbp .....	(m) :	256.500
Rule length, L .....	(m) :	252.690
Breadth moulded, B .....	(m) :	42.500
Depth moulded, D .....	(m) :	22.000
Draught moulded, T .....	(m) :	15.500
Block coefficient, Cb .....	:	0.879
Min. design draught at AP .....	(m) :	0.000
Min. design draught at FP .....	(m) :	0.000

### General Ship Data

Maximum service speed, V .....	(knots) :	14.500
Bilge keel? .....	:	Yes
Active roll damping facility? .....	:	No
Period of roll, Tr .....	(s) :	0.000
Metacentric height, GM .....	(m) :	0.000
Homogeneous stowage rate, roDC .....	(t/m3) :	0.000
No of decks above 0.7D from baseline .....	:	1
Height from base to top of ship side .....	(mm) :	22000
Areas forward of 0.2L from FP:		
- Projected area of the upper deck .....	(m2) :	0.000
- Area of the waterplane .....	(m2) :	0.000
Height from base to deck line at FP .....	(mm) :	0
Speed/flare factor, Caf .....	:	0.000

### Continuous Strength Members above Strength Deck

None

### Class notations

Tanker for Oil

### Hull Section Material (Strength group & yield point (N/mm2))

Location	Amidships		Current cross-sect.	
	Group	Yield	Group	Yield
- Bottom .....	NV-NS	235	NV-NS	235
- Deck .....	NV-NS	235	NV-NS	235
- Between bottom and deck .....	NV-NS	235	NV-NS	235

### Transverse Bulkhead Positions (Frame No)

Aft peak bulkhead .....:Not given.  
 Engine room bulkhead .....:Not given.  
 Fore peak bulkhead .....:Not given.

### Specified Bending Moments

(Based on actual cargo/ballast conditions)  
 Considered cross-section: 128.250 m from AP.  
 Utilization factor for the Rule still water bending moments:

- Sagging: 1.00  
 - Hogging: 1.00

Specified bending moments:

	Amidships	Current cross-sect.
- Still water, sagging .....	(kNm) : 3992670	0
- Still water, hogging .....	(kNm) : 4100580	0
- Wave, sagging .....	(kNm) : 0	0
- Wave, hogging .....	(kNm) : 0	0
- Wave, horizontal .....	(kNm) : 0	0



**Spacing between Transverse Frames**

(Where the frame spacing changes along the ship)

Position of frame 0: 0 mm forward of A.P.

Frame Nos where the spacing changes:

Frame No	Spacing forward (mm)
Stern	700
14	960
39	3200
43	3200
44	4000
94	700

Section Scantlings - v.3.3-372-980619  
 SHUTTLE TANKER 145000 M3  
 CUADERNA MAESTRA

Ship Id No : proyec

### 3 Panel Geometry

Node No	y (mm)	z (mm)	Radius (mm)	Position
---------	--------	--------	-------------	----------

#### Outer Shell

0	0	0		
5810	0	0		Bottom
11620	0	0		Bottom
16600	0	0		Bottom
19500	0	0		Bottom
21250	1750	1750	1750	Bilge
21250	7092	7092		Side
21250	11796	11796		Side
21250	16500	16500		Side
21250	22000	22000		Side
18690	22214	22214		Strength deck
11700	22800	22800		Strength deck
0	22800	22800		Strength deck

#### Inner Bottom & Inner Side

0	2680	2680		
1200	2680	2680		Inner bottom
5810	2767	2767		Inner bottom
11620	2876	2876		Inner bottom
16600	2970	2970		Inner bottom
18690	7092	7092		Hopper tank top
18690	11796	11796		Inner side
18690	16500	16500		Inner side
18690	22214	22214		Inner side

#### CL Bulkhead

0	0	0		
0	2680	2680		Longitudinal bulkhead
0	22800	22800		Longitudinal bulkhead

#### Stringer 7092

21250	7092	7092		
18690	7092	7092		Side - Stringer

#### Stringer 11796

21250	11796	11796		
18690	11796	11796		Side - Stringer

#### Stringer 16500

21250	16500	16500		
18690	16500	16500		Side - Stringer

#### Bottom girder 5810

5810	0	0		
5810	2767	2767		Bottom - Long. girder

#### Bottom girder 11620

11620	0	0		
11620	2876	2876		Bottom - Long. girder

#### Bottom girder 16600

16600	0	0		
16600	2970	2970		Bottom - Long. girder

Section Scantlings - v.3.3-372-980619  
 SHUTTLE TANKER 145000 M3  
 CUADERNA MAESTRA

Ship Id No : proyec

#### 4 Node Co-ordinates

Node No	y (mm)	z (mm)
16600		0
11620		2876
11620		0
5810		2767
5810		0
18690		16500
21250		16500
18690		11796
21250		11796
21250		7092
1200		2680
18690		22214
18690		7092
16600		2970
0		2680
21250		22000
11700		22800
0		22800
21250		1750
19500		0
0		0

Section Scantlings - v.3.3-372-980619  
 SHUTTLE TANKER 145000 M3  
 CUADERNA MAESTRA

Ship Id No : proyec

## 5 Layout of Plates and Profiles

Plate	No	Y <sub>1</sub> (mm) Y	Z <sub>1</sub> (mm) Z	Y <sub>2</sub> (mm) Y <sub>CG</sub>	Z <sub>2</sub> (mm) Z <sub>CG</sub>	— Typ	B (mm) H	BCUT (mm) BF	T (mm) T	Steel TF (mm)	Area cm <sup>2</sup> Area
<b>Outer Shell (Bending efficiency: 100%)</b>											
PL	1	0	0	1200	0		1200	0	21.0	std	252.00
PL	2	1200	0	3870	0		2670	0	21.0	std	560.70
PL	3	3870	0	6540	0		2670	0	21.0	std	560.70
PL	4	6540	0	9045	0		2505	0	21.0	std	526.05
PL	5	9045	0	11735	0		2690	0	21.0	std	564.90
PL	6	11735	0	14385	0		2650	0	21.0	std	556.50
PL	7	14385	0	17035	0		2650	0	21.0	std	556.50
PL	8	17035	0	20299	193		3295	0	21.0	std	691.95
PL	9	20299	193	21250	3126		3295	0	21.0	std	691.95
PL	10	21250	3126	21250	5586		2460	0	17.0	std	418.20
PL	11	21250	5586	21250	7317		1731	0	17.0	std	294.27
PL	12	21250	7317	21250	10378		3061	0	17.0	std	520.37
PL	13	21250	10378	21250	13514		3136	0	17.0	std	533.12
PL	14	21250	13514	21250	16725		3211	0	17.0	std	545.87
PL	15	21250	16725	21250	19391		2666	0	17.0	std	453.22
PL	16	21250	19391	21250	21999		2608	0	17.0	std	782.67
PL	17	21250	21999	18100	22263		3161	0	30.0	std	948.30
PL	18	18100	22263	14841	22536		3270	0	30.0	std	981.00
PL	19	14841	22536	11707	22799		3145	0	30.0	std	943.50
PL	20	11707	22799	8867	22800		2840	0	30.0	std	852.00
PL	21	8867	22800	5967	22800		2900	0	30.0	std	870.00
PL	22	5967	22800	3007	22800		2960	0	30.0	std	888.00
PL	23	3007	22800	0	22800		3007	0	30.0	std	902.23
ST	1	830	0	830	371	43	530	150	12.0	35.0	111.90
ST	2	1660	0	1660	371	43	530	150	12.0	35.0	111.90
ST	3	2490	0	2490	371	43	530	150	12.0	35.0	111.90
ST	4	3320	0	3320	371	43	530	150	12.0	35.0	111.90
ST	5	4150	0	4150	371	43	530	150	12.0	35.0	111.90
ST	6	4980	0	4980	371	43	530	150	12.0	35.0	111.90
ST	7	6640	0	6640	371	43	530	150	12.0	35.0	111.90
ST	8	7470	0	7470	371	43	530	150	12.0	35.0	111.90
ST	9	8300	0	8300	371	43	530	150	12.0	35.0	111.90
ST	10	9130	0	9130	371	43	530	150	12.0	35.0	111.90
ST	11	9960	0	9960	371	43	530	150	12.0	35.0	111.90
ST	12	10790	0	10790	371	43	530	150	12.0	35.0	111.90
ST	13	12450	0	12450	371	43	530	150	12.0	35.0	111.90
ST	14	13280	0	13280	371	43	530	150	12.0	35.0	111.90
ST	15	14110	0	14110	371	43	530	150	12.0	35.0	111.90
ST	16	14940	0	14940	371	43	530	150	12.0	35.0	111.90
ST	17	15770	0	15770	371	43	530	150	12.0	35.0	111.90
ST	18	17313	0	17313	371	43	530	150	12.0	35.0	111.90
ST	19	18026	0	18026	371	43	530	150	12.0	35.0	111.90
ST	20	18739	0	18739	371	43	530	150	12.0	35.0	111.90
ST	21	19452	0	19452	371	43	530	150	12.0	35.0	111.90
ST	22	21250	2094	20976	2084	20	430	0	15.0	0.0	94.18
ST	23	21250	2994	20976	2984	20	430	0	15.0	0.0	94.18
ST	24	21250	3814	21000	3805	20	400	0	16.0	0.0	89.48
ST	25	21250	4634	21000	4625	20	400	0	16.0	0.0	89.48
ST	26	21250	5454	21000	5445	20	400	0	16.0	0.0	89.48
ST	27	21250	6274	21000	6265	20	400	0	16.0	0.0	89.48
ST	28	21250	7876	21000	7867	20	400	0	16.0	0.0	89.48
ST	29	21250	8660	21000	8651	20	400	0	16.0	0.0	89.48
ST	30	21250	9444	21000	9435	20	400	0	16.0	0.0	89.48
ST	31	21250	10228	20996	10219	20	400	0	14.0	0.0	81.48
ST	32	21250	11012	20996	11003	20	400	0	14.0	0.0	81.48
ST	33	21250	12580	21015	12572	20	370	0	13.0	0.0	69.70
ST	34	21250	13364	21015	13356	20	370	0	13.0	0.0	69.70
ST	35	21250	14148	21039	14141	20	340	0	14.0	0.0	65.64
ST	36	21250	14932	21039	14925	20	340	0	14.0	0.0	65.64
ST	37	21250	15716	21039	15709	20	340	0	14.0	0.0	65.64
ST	38	21250	17316	21039	17309	20	340	0	14.0	0.0	65.64
ST	39	21250	18132	21039	18125	20	340	0	14.0	0.0	65.64
ST	40	21250	18948	21039	18941	20	340	0	14.0	0.0	65.64
ST	41	21250	19764	21015	19756	20	370	0	13.0	0.0	69.70
ST	42	21250	20580	21015	20572	20	370	0	13.0	0.0	69.70
ST	43	21250	21396	21015	21388	20	370	0	13.0	0.0	69.70
ST	1	20395	22071	20387	21836	20	370	0	13.0	0.0	69.70
ST	2	19540	22143	19532	21908	20	370	0	13.0	0.0	69.70
ST	3	18000	22272	17992	22037	20	370	0	13.0	0.0	69.70
ST	4	17300	22330	17292	22095	20	370	0	13.0	0.0	69.70
ST	5	16600	22389	16592	22154	20	370	0	13.0	0.0	69.70
ST	6	15770	22459	15762	22224	20	370	0	13.0	0.0	69.70
ST	7	14940	22528	14932	22293	20	370	0	13.0	0.0	69.70

Section Scantlings - v.3.3-372-980619  
 SHUTTLE TANKER 145000 M3  
 CUADERNA MAESTRA

Ship Id No : proyec

**Layout of Plates and Profiles (cont.)**

Plate		Y <sub>1</sub> (mm)	Z <sub>1</sub> (mm)	Y <sub>2</sub> (mm)	Z <sub>2</sub> (mm)	—	B (mm)	BCUT (mm)	T (mm)	Steel	Area cm <sup>2</sup>
Stiff	No	Y	Z	Y <sub>CG</sub>	Z <sub>CG</sub>	Typ	H	BF	T	TF (mm)	Area
ST	8	14110	22598	14102	22363	20	370	0	13.0	0.0	69.70
ST	9	13280	22667	13272	22432	20	370	0	13.0	0.0	69.70
ST	10	12450	22737	12442	22502	20	370	0	13.0	0.0	69.70
ST	11	11620	22800	11612	22565	20	370	0	13.0	0.0	69.70
ST	12	10790	22800	10782	22565	20	370	0	13.0	0.0	69.70
ST	13	9960	22800	9952	22565	20	370	0	13.0	0.0	69.70
ST	14	9130	22800	9122	22565	20	370	0	13.0	0.0	69.70
ST	15	8300	22800	8292	22565	20	370	0	13.0	0.0	69.70
ST	16	7470	22800	7462	22565	20	370	0	13.0	0.0	69.70
ST	17	6640	22800	6632	22565	20	370	0	13.0	0.0	69.70
ST	18	5810	22800	5802	22565	20	370	0	13.0	0.0	69.70
ST	19	4980	22800	4972	22565	20	370	0	13.0	0.0	69.70
ST	20	4150	22800	4142	22565	20	370	0	13.0	0.0	69.70
ST	21	3320	22800	3312	22565	20	370	0	13.0	0.0	69.70
ST	22	2490	22800	2482	22565	20	370	0	13.0	0.0	69.70
ST	23	1660	22800	1652	22565	20	370	0	13.0	0.0	69.70
ST	24	830	22800	838	22565	20	370	0	13.0	0.0	69.70

**Inner Bottom & Inner Side (Bending efficiency: 100%)**

PL	1	0	2680	1200	2680		1200	0	21.0	std	252.00
PL	2	1200	2680	3777	2728		2578	0	21.0	std	541.38
PL	3	3777	2728	6447	2778		2670	0	21.0	std	560.70
PL	4	6447	2778	9066	2828		2620	0	21.0	std	550.20
PL	5	9066	2828	11736	2878		2670	0	21.0	std	560.70
PL	6	11736	2878	14405	2928		2670	0	21.0	std	560.70
PL	7	14405	2928	16600	2970		2195	0	21.0	std	460.95
PL	8	16600	2970	17565	4874		2135	0	20.0	std	427.00
PL	9	17565	4874	18683	7079		2472	0	16.0	std	395.52
PL	10	18683	7079	18690	10301		3223	0	15.0	std	483.60
PL	11	18690	10301	18690	13465		3163	0	14.0	std	442.96
PL	12	18690	13465	18690	16668		3202	0	14.0	std	448.42
PL	13	18690	16668	18690	19328		2659	0	17.0	std	452.20
PL	14	18690	19328	18690	22214		2885	0	30.0	std	865.73
ST	1	830	2680	830	2317	43	530	150	12.0	30.0	105.00
ST	2	1659	2688	1659	2325	43	530	150	12.0	30.0	105.00
ST	3	2489	2704	2489	2341	43	530	150	12.0	30.0	105.00
ST	4	3319	2719	3319	2356	43	530	150	12.0	30.0	105.00
ST	5	4149	2735	4149	2372	43	530	150	12.0	30.0	105.00
ST	6	4979	2751	4979	2388	43	530	150	12.0	30.0	105.00
ST	7	6639	2782	6639	2419	43	530	150	12.0	30.0	105.00
ST	8	7469	2798	7469	2435	43	530	150	12.0	30.0	105.00
ST	9	8299	2813	8299	2450	43	530	150	12.0	30.0	105.00
ST	10	9129	2829	9129	2466	43	530	150	12.0	30.0	105.00
ST	11	9959	2844	9959	2481	43	530	150	12.0	30.0	105.00
ST	12	10789	2860	10789	2497	43	530	150	12.0	30.0	105.00
ST	13	12449	2891	12449	2528	43	530	150	12.0	30.0	105.00
ST	14	13279	2907	13279	2544	43	530	150	12.0	30.0	105.00
ST	15	14109	2923	14109	2560	43	530	150	12.0	30.0	105.00
ST	16	14939	2938	14939	2575	43	530	150	12.0	30.0	105.00
ST	17	15769	2954	15769	2591	43	530	150	12.0	30.0	105.00
ST	18	16947	3654	17186	3521	20	430	0	15.0	0.0	94.18
ST	19	17294	4339	17533	4206	20	430	0	15.0	0.0	94.18
ST	20	17641	5024	17880	4891	20	430	0	15.0	0.0	94.18
ST	21	17989	5709	18211	5585	20	400	0	14.0	0.0	81.48
ST	22	18336	6394	18558	6270	20	400	0	14.0	0.0	81.48
ST	23	18690	7875	18944	7866	20	400	0	14.0	0.0	81.48
ST	24	18690	8659	18925	8651	20	370	0	13.0	0.0	69.70
ST	25	18690	9443	18925	9435	20	370	0	13.0	0.0	69.70
ST	26	18690	10227	18925	10219	20	370	0	13.0	0.0	69.70
ST	27	18690	11011	18925	11003	20	370	0	13.0	0.0	69.70
ST	28	18690	12579	18905	12571	20	340	0	12.0	0.0	58.84
ST	29	18690	13363	18905	13355	20	340	0	12.0	0.0	58.84
ST	30	18690	14148	18905	14140	20	340	0	12.0	0.0	58.84
ST	31	18690	14932	18905	14924	20	340	0	12.0	0.0	58.84
ST	32	18690	15716	18905	15708	20	340	0	12.0	0.0	58.84
ST	33	18690	17316	18905	17308	20	340	0	12.0	0.0	58.84
ST	34	18690	18132	18905	18124	20	340	0	12.0	0.0	58.84
ST	35	18690	18947	18925	18939	20	370	0	13.0	0.0	69.70
ST	36	18690	19763	18925	19755	20	370	0	13.0	0.0	69.70
ST	37	18690	20579	18925	20571	20	370	0	13.0	0.0	69.70
ST	38	18690	21395	18925	21387	20	370	0	13.0	0.0	69.70

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### Layout of Plates and Profiles (cont.)

Plate	No	Y <sub>1</sub> (mm)	Z <sub>1</sub> (mm)	Y <sub>2</sub> (mm)	Z <sub>2</sub> (mm)	—	B (mm)	BCUT (mm)	T (mm)	Steel	Area cm <sup>2</sup>
Stiff		Y	Z	Y <sub>CG</sub>	Z <sub>CG</sub>	Typ	H	BF	T	TF (mm)	Area

#### CL Bulkhead (Bending efficiency: 100%)

PL	1	0	0	0	2680		2680	0	20.0	std	536.00
PL	2	0	2680	0	5837		3157	0	16.0	std	505.12
PL	3	0	5837	0	8797		2960	0	14.0	std	414.40
PL	4	0	8797	0	11457		2660	0	13.0	std	345.80
PL	5	0	11457	0	14035		2578	0	13.0	std	335.14
PL	6	0	14035	0	16695		2660	0	13.0	std	345.80
PL	7	0	16695	0	19840		3145	0	18.0	std	566.10
PL	8	0	19840	0	22800		2960	0	30.0	std	888.00

ST	1	0	590	175	590	10	350	0	20.0	0.0	70.00
ST	2	0	1410	175	1410	10	350	0	20.0	0.0	70.00
ST	3	0	2230	175	2230	10	350	0	20.0	0.0	70.00
ST	4	0	3417	274	3407	20	430	0	15.0	0.0	94.18
ST	5	0	4152	274	4142	20	430	0	15.0	0.0	94.18
ST	6	0	4887	274	4877	20	430	0	15.0	0.0	94.18
ST	7	0	5622	225	5622	10	450	0	25.0	0.0	112.50
ST	8	0	6357	225	6357	10	450	0	25.0	0.0	112.50
ST	9	0	7092	225	7092	10	450	0	25.0	0.0	112.50
ST	10	0	7876	225	7876	10	450	0	25.0	0.0	112.50
ST	11	0	8660	200	8660	10	400	0	25.0	0.0	100.00
ST	12	0	9444	200	9444	10	400	0	25.0	0.0	100.00
ST	13	0	10228	200	10228	10	400	0	25.0	0.0	100.00
ST	14	0	11012	200	11012	10	400	0	25.0	0.0	100.00
ST	15	0	11796	200	11796	10	400	0	25.0	0.0	100.00
ST	16	0	12580	175	12580	10	350	0	25.0	0.0	87.50
ST	17	0	13364	175	13364	10	350	0	25.0	0.0	87.50
ST	18	0	14148	175	14148	10	350	0	25.0	0.0	87.50
ST	19	0	14932	175	14932	10	350	0	25.0	0.0	87.50
ST	20	0	15716	175	15716	10	350	0	25.0	0.0	87.50
ST	21	0	16500	175	16500	10	350	0	25.0	0.0	87.50
ST	22	0	17284	215	17276	20	340	0	12.0	0.0	58.84
ST	23	0	18070	215	18062	20	340	0	12.0	0.0	58.84
ST	24	0	18856	215	18848	20	340	0	12.0	0.0	58.84
ST	25	0	19642	215	19634	20	340	0	12.0	0.0	58.84
ST	26	0	20428	235	20420	20	370	0	13.0	0.0	69.70
ST	27	0	21214	235	21206	20	370	0	13.0	0.0	69.70
ST	28	0	22007	235	21999	20	370	0	13.0	0.0	69.70

#### Stringer 7092 (Bending efficiency: 100%)

PL	1	21250	7092	18690	7092		2560	400	12.0	std	259.20
ST	1	20610	7092	20610	6992	10	200	0	15.0	0.0	30.00
ST	2	19970	7092	19970	6992	10	200	0	15.0	0.0	30.00
ST	3	19330	7092	19330	6992	10	200	0	15.0	0.0	30.00

#### Stringer 11796 (Bending efficiency: 100%)

PL	1	21250	11796	18690	11796		2560	400	12.0	std	259.20
ST	1	20610	11796	20610	11696	10	200	0	15.0	0.0	30.00
ST	2	19970	11796	19970	11696	10	200	0	15.0	0.0	30.00
ST	3	19330	11796	19330	11696	10	200	0	15.0	0.0	30.00

#### Stringer 16500 (Bending efficiency: 100%)

PL	1	21250	16500	18690	16500		2560	400	12.0	std	259.20
ST	1	20610	16500	20610	16400	10	200	0	15.0	0.0	30.00
ST	2	19970	16500	19970	16400	10	200	0	15.0	0.0	30.00
ST	3	19330	16500	19330	16400	10	200	0	15.0	0.0	30.00

#### Bottom girder 5810 (Bending efficiency: 100%)

PL	1	5810	0	5810	2766		2766	800	18.0	std	354.03
ST	1	5810	590	5685	590	10	250	0	15.0	0.0	37.50
ST	2	5810	1410	5685	1410	10	250	0	15.0	0.0	37.50



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**Layout of Plates and Profiles (cont.)**

Plate Stiff	No	Y <sub>1</sub> (mm) Y	Z <sub>1</sub> (mm) Z	Y <sub>2</sub> (mm) Y <sub>CG</sub>	Z <sub>2</sub> (mm) Z <sub>CG</sub>	— Typ	B (mm) H	BCUT (mm) BF	T (mm) T	Steel TF (mm)	Area cm <sup>2</sup> Area
ST	3	5810	2230	5685	2230	10	250	0	15.0	0.0	37.50
<b>Bottom girder 11620 (Bending efficiency: 100%)</b>											
PL	1	11620	0	11620	2876		2876	800	18.0	std	373.72
ST	1	11620	590	11495	590	10	250	0	15.0	0.0	37.50
ST	2	11620	1410	11495	1410	10	250	0	15.0	0.0	37.50
ST	3	11620	2230	11495	2230	10	250	0	15.0	0.0	37.50
<b>Bottom girder 16600 (Bending efficiency: 100%)</b>											
PL	1	16600	0	16600	2970		2970	800	18.0	std	390.60
ST	1	16600	590	16475	590	10	250	0	15.0	0.0	37.50
ST	2	16600	1410	16475	1410	10	250	0	15.0	0.0	37.50
ST	3	16600	2230	16475	2230	10	250	0	15.0	0.0	37.50

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## 6 Cross-Sectional Area

### Plates

Panels:	NS-Steel		HS-Steel		Total	
	Effective cm <sup>2</sup>	Gross cm <sup>2</sup>	Effective cm <sup>2</sup>	Gross cm <sup>2</sup>	Effective cm <sup>2</sup>	Gross cm <sup>2</sup>
Outer Shell	29788.0	29788.0	0.0	0.0	29788.0	29788.0
Inner Bottom & Inner Side	14004.1	14004.1	0.0	0.0	14004.1	14004.1
CL Bulkhead	3936.4	3936.4	0.0	0.0	3936.4	3936.4
Stringer 7092	518.4	614.4	0.0	0.0	518.4	614.4
Stringer 11796	518.4	614.4	0.0	0.0	518.4	614.4
Stringer 16500	518.4	614.4	0.0	0.0	518.4	614.4
Bottom girder 5810	708.1	996.1	0.0	0.0	708.1	996.1
Bottom girder 11620	747.4	1035.4	0.0	0.0	747.4	1035.4
Bottom girder 16600	781.2	1069.2	0.0	0.0	781.2	1069.2
<b>TOTAL AREA</b>	51520.4	52672.4	0.0	0.0	51520.4	52672.4

### Profiles

Panels:	NS-Steel		HS-Steel		Total	
	Effective cm <sup>2</sup>	Gross cm <sup>2</sup>	Effective cm <sup>2</sup>	Gross cm <sup>2</sup>	Effective cm <sup>2</sup>	Gross cm <sup>2</sup>
Outer Shell	11485.7	11485.7	0.0	0.0	11485.7	11485.7
Inner Bottom & Inner Side	6563.0	6563.0	0.0	0.0	6563.0	6563.0
CL Bulkhead	2412.0	2412.0	0.0	0.0	2412.0	2412.0
Stringer 7092	180.0	180.0	0.0	0.0	180.0	180.0
Stringer 11796	180.0	180.0	0.0	0.0	180.0	180.0
Stringer 16500	180.0	180.0	0.0	0.0	180.0	180.0
Bottom girder 5810	225.0	225.0	0.0	0.0	225.0	225.0
Bottom girder 11620	225.0	225.0	0.0	0.0	225.0	225.0
Bottom girder 16600	225.0	225.0	0.0	0.0	225.0	225.0
<b>TOTAL AREA</b>	21675.7	21675.7	0.0	0.0	21675.7	21675.7

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## 7 Cross-Sectional Data

	EFFECTIVE Cut-outs subtracted	GROSS Cut-outs disreg.
Cross sectional area of the longitudinal elements ..... (cm2) :	73196.1	74348.1
Position of the centroid: Ycg ..... (mm) :	6	6
Position of the centroid: Zcg ..... (mm) :	10378	10275
Moment of inertia about the horz. neutral axis, I <sub>h</sub> ..... (m4) :	593.446	601.453
Moment of inertia about the vert. neutral axis, I <sub>v</sub> ..... (m4) :	1519.552	1544.079
Product of inertia about the neutral axes, I <sub>hv</sub> ..... (m4) :	0.077	0.101
<hr/>		
SECTION MODULUS, BOTTOM (z = 0 mm) ..... (m3) :	57.178	58.533
SECTION MODULUS, DECK LINE (z = 22000 mm) ..... (m3) :	51.066	51.298
SECTION MODULUS, AT SIDE (y = 21250 mm) ..... (m3) :	71.532	72.686
<hr/>		
First moment of the area above the neutral axis, S ..... (cm3) :	30490477.8	30908369.6
I/S ..... (cm) :	1946	1945

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## 8 Design Bending Moments

AT ACTUAL POSITION (128.2 m from AP)

Still water bending moments:

- Standard values according to Rules, Ms ..... :  
 - Given as input (actual cargo/ballast conditions) ..... :

Design still water bending moments

SAGGING (kNm)	HOGGING (kNm)
2903485	3092458
3992670	4100580
3992670	4100580

Design wave bending moments, Mw ..... :

4913590 (Rules)      4724616 (Rules)

Design wave bending moments, Mw for buckling check ..... :

4913590 (Rules)      4724616 (Rules)

Horizontal wave bending moment acc. to Rules, Mwh ..... :

2779966

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## 9 Hull Girder Strength Requirements

	BOTTOM	DECK	SIDE
Material strength group .....	NV-NS	NV-NS	NV-NS
Yield point of material .....	235	235	235
Material factor, f1 .....	1.000	1.000	1.000
Stress factor, f2 (midship values from input).....	1.000	1.000	
Speed factor, Cav .....	0.182		
Speed/flare factor, Caf .....	0.182		
Wave coefficient, Cw .....	10.425		
Wave coefficient, Cwo .....	10.425		
Wave coefficient, Cwu .....	10.425		

AT ACTUAL POSITION ( 128.2 m from AP) (Midship section)

	BOTTOM	DECK
Minimum section modulus, Zo .....	44.66900	44.66900
Section modulus requirement based on design bending moments:		
- Sagging (3992670 kNm) .....	50.89291	50.89291
- Hogging (4100580 kNm) .....	50.42969	50.42969
<b>Rule section modulus</b> .....	<b>50.89291</b>	<b>50.89291</b>
Combined stresses at bilge and deck corners .....	164.1	182.0
Minimum moment of inertia .....	(m4) : 338.62226	
Minimum section modulus at side .....	(m3) : 31.60825	

### GUIDANCE:

The required section modulus along the hull girder will normally be satisfied when calculated for the midship section only, provided the following rules for tapering are complied with:

- Scantlings at bottom and deck are kept unaltered within 0.4L amidships.
- Scantlings outside 0.4L amidships are gradually reduced to the local requirements at the ends, and the same material strength group is applied over the full length of the ship.

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## 10 Hull Girder Strength Summary

	ACTUAL	RULE	STATUS (%) (100=Rule)
Cross-sectional area ..... (cm <sup>2</sup> ) :	73196		
Height to the neutral axis ..... (mm) :	10378		
Moment of inertia ..... (m <sup>4</sup> ) :	593.446	338.622	175.3
Section modulus, bottom ..... (m <sup>3</sup> ) :	57.178	50.893	112.3
Section modulus, deck line ..... (m <sup>3</sup> ) :	51.066	50.893	100.3
(at z = 22000 mm)			
Material factor, f1, bottom ..... :	1.000		
Material factor, f1, deck ..... :	1.000		
Stress factor, f2, bottom ..... (Input) :	1.000		
Stress factor, f2, deck ..... (Input) :	1.000		



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 Signature: \_\_\_\_\_  
 Ship Id No : \_\_\_\_\_ **proyec**

## 11 Compartments and Loads

### 11.1 Compartment Data I

Ref.	Comp. group (Comp. type)	Comp. No	Frame No aft	Frame No fwd	Restr. filling (*)	Coated (*)	Contents WB / Oil / Liq / Hliq / Bulk
1	2	2				*	WB
2	1	1				*	Oil

### 11.2 Compartment Data II

Ref.	Comp. group (Comp type)	Comp. No	Length (mm)	Sloshing length (mm)	Sloshing breadth (mm)	Top of air pipe (mm)	WL in dam'gd cond (mm)	Over-pressure po (kN/m2)	Top of hatch (mm)	Volume (m3)
1	2	2	32000	4000	5810	22760	22000	25.00	0	0
2	1	1	32000	32000	18690	22760	22000	25.00	0	0

### 11.3 Bulk Cargo and Liquid Loads

Ref.	Comp. group (Comp type)	Comp. No	Load No	Load type	Density t/m3	Filling height mm	Mass t	Angle of repose degrees	Permeability
1	2	2	1	WB	1.025	22215			
2	1	1	1	Oil	1.025	22800			

### 11.4 Double Bottom Stresses and Hull Girder Bending Moments

Ref.	Comp. group (Comp. type)	Comp. No	Load No	Load type	Dbl. bottom stresses		Still water bending moments - = sagging, + = hogging kNm
					Bottom N/mm <sup>2</sup>	Inner bot. N/mm <sup>2</sup>	
1	2	2	1	WB	0	0	0.00
2	1	1	1	Oil	0	0	0.00

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## 12 Summary of Data Involved in the Local Rule Requirements

Distance from AP to considered section .....	(m) :	128.250	
Section modulus at bottom .....	(m <sup>3</sup> ) :	57.178	
Section modulus at deck line .....	(m <sup>3</sup> ) :	51.066	
Height from base line to the neutral axis .....	(mm) :	10379	
STRESS FACTOR, f2:			
f2B (f2 at bottom) .....	:	1.000	(Input)
f2D (f2 at deck) .....	:	1.000	(Input)
DESIGN MOMENTS:			
Design still water bending moment, sagging .....	(kNm) :	3992670	(Input)
Design still water bending moment, hogging .....	(kNm) :	4100580	(Input)
Design wave bending moment, sagging .....	(kNm) :	4913590	(Rules)
Design wave bending moment, hogging .....	(kNm) :	4724616	(Rules)
MOTION PARAMETERS:			
Acceleration parameter, a0 .....	:	0.306	(Rules)
Period of roll, Tr .....	(s) :	14.679	(Rules)
Pitch angle, theta .....	(rad/deg) :	0.087	/ 5 (Rules)
Roll angle, Fi .....	(rad/deg) :	0.376	/ 22 (Rules)
Vertical acceleration, av .....	(m/s <sup>2</sup> ) :	2.392	(Rules)
Ballast draught, Tb .....	(m) :	7.054	(Rules)

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SHUTTLE TANKER 145000 M3  
CUADERNA MAESTRA

Ship Id No : proyec

### 13 Local Rule Requirements - Plates

Plate No	ACT	t_act (mm)	Steel	tk (mm)	tk_b (mm)		Eff. (%)	Span (mm)	Spac (mm)		Sigf N/mm <sup>2</sup>	f <sub>1</sub>
LOC		t_loc (mm)	Pos			Load Ref.	Loc. ref.	y <sub>l</sub> (mm)	z <sub>l</sub> (mm)	Comp ref.	Sigma N/mm <sup>2</sup>	p kN/m <sup>2</sup>
BUC		t_buc (mm)	Eta	psi	k	c	Buc. ref.	y <sub>b</sub> (mm)	z <sub>b</sub> (mm)	SigL N/mm <sup>2</sup>	Sig_c N/mm <sup>2</sup>	Sig_cr N/mm <sup>2</sup>

#### Outer Shell

##### Bottom

1	ACT LOC BUC	21.0	std 20.63 15.21	1.0 Bottom 0.9	1.0		WB acc 1 4.00	100 Min	4000 415 0	830 0 0	1 154.3	235.0 120.0 202.9	1.00 180.1 171.5
2	ACT LOC BUC	21.0	std 17.06 15.21	1.0 Bottom 0.9	1.0		WB acc 1 4.00	100 Lat	4000 1245 1200	830 0 0	1 154.3	235.0 120.0 202.9	1.00 180.1 171.5
3	ACT LOC BUC	21.0	std 17.06 15.21	1.0 Bottom 0.9	1.0		WB acc 1 4.00	100 Lat	4000 3870 3870	830 0 0	1 154.3	235.0 120.0 202.9	1.00 180.1 171.5
4	ACT LOC BUC	21.0	std 17.06 15.21	1.0 Bottom 0.9	1.0		WB acc 1 4.00	100 Lat	4000 7055 6640	830 0 0	1 154.3	235.0 120.0 202.9	1.00 180.1 171.5
5	ACT LOC BUC	21.0	std 17.06 15.21	1.0 Bottom 0.9	1.0		WB acc 1 4.00	100 Lat	4000 9545 9130	830 0 0	1 154.3	235.0 120.0 202.9	1.00 180.1 171.5
6	ACT LOC BUC	21.0	std 17.07 15.21	1.0 Bottom 0.9	1.0	Sea	4.00	100 Lat	4000 14385 11735	830 0 0	154.3	235.0 120.0 202.9	1.00 180.3 171.5
7	ACT LOC BUC	21.0	std 17.17 15.21	1.0 Bottom 0.9	1.0	Sea	4.00	100 Lat	4000 16185 14385	830 0 0	154.3	235.0 120.0 202.9	1.00 182.3 171.5
8	ACT LOC BUC	21.0	std 16.11 11.83	1.0 Bottom 1.0	1.0	Sea	4.00	100 Min	4000 17035 17035	713 0 0	154.3	235.0 120.0 211.3	1.00 185.7 154.3

##### Bilge

9	ACT LOC BUC	21.0	std 17.96 12.31	1.0 Side 1.0	1.0		WB tst 5 4.22	100 Lat	4000 21250 21250	900 2544 2094	1 123.2	235.0 124.9 199.3	1.00 177.7 123.2
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##### Side

10	ACT LOC BUC	17.0	std 16.35 10.66	1.0 Side 1.0	1.0		WB tst 5 4.19	100 Lat	4000 21250 21250	820 3404 3126	1 107.9	235.0 126.6 188.3	1.00 177.6 107.9
11	ACT LOC BUC	17.0	std 16.48 8.76	1.0 Side 1.0	1.0		WB tst 5 4.29	100 quay	4000 21250 21250	784 7317 5586	1 71.3	235.0 134.1 189.4	1.00 174.8 71.3
12	ACT LOC BUC	17.0	std 16.48 6.87	1.0 Side 1.0	1.0		WB tst 5 4.38	100 quay	4000 21250 21250	784 7484 7317	1 45.5	235.0 134.4 194.2	1.00 173.1 45.5
13	ACT LOC BUC	17.0	std 16.48 6.70	1.0 Side 1.0	1.0		WB tst 5 4.57	100 quay	4000 21250 21250	784 10620 13363	1 44.8	235.0 139.6 195.9	1.00 141.6 44.8
14	ACT LOC BUC	17.0	std 17.11 10.17	1.0 Side 1.0	1.0		WB tst 5 4.07	100 quay	4000 21250 21250	816 16725 16725	1 95.2	235.0 129.1 187.4	1.00 80.2 95.2
15	ACT LOC BUC	17.0	std 17.11 12.02	1.0 Side 1.0	1.0		WB tst 5 4.10	100 quay	4000 21250 21250	816 16907 19391	1 135.3	235.0 128.8 187.7	1.00 78.4 135.3

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Ship Id No

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**Local Rule Requirements - Plates (cont)**

Plate No	ACT	t_act (mm)	Steel	tk (mm)	tk_b (mm)		Eff. (%)	Span (mm)	Spac (mm)		Sigf N/mm <sup>2</sup>	f <sub>1</sub>	
	LOC		t_loc (mm)	Pos		Load Ref.	Loc. ref.	y <sub>l</sub> (mm)	z <sub>l</sub> (mm)	Comp ref.	Sigma N/mm <sup>2</sup>	p kN/m <sup>2</sup>	
	BUC		t_buc (mm)	Eta	psi	k	c	Buc. ref.	y <sub>b</sub> (mm)	z <sub>b</sub> (mm)	SigL N/mm <sup>2</sup>	Sig_c N/mm <sup>2</sup>	Sig_cr N/mm <sup>2</sup>
16	ACT	30.0	std	1.0	2.0		100	4000	816		235.0	1.00	
	LOC		16.11	Side		WB tst 5	Min	21250	19391	1	124.5	53.4	
	BUC		15.10	1.0	0.93	4.15		21250	21395	165.3	219.7	165.3	
<b>Strength deck</b>													
17	ACT	30.0	std	2.0	2.0		100	4000	857		235.0	1.00	
	LOC		12.55	Strdk		Oil slo e	Min	20822	22035	2	120.0	89.8	
	BUC		17.34	1.0	0.99	4.01		18690	22214	177.6	217.8	177.6	
18	ACT	30.0	std	1.0	1.0		100	4000	832		235.0	1.00	
	LOC		12.38	Strdk		Oil slo e	Lat	15355	22493	2	120.0	89.8	
	BUC		16.64	1.0	0.99	4.01		14939	22528	182.3	219.7	182.3	
19	ACT	30.0	std	1.0	1.0		100	4000	832		235.0	1.00	
	LOC		12.38	Strdk		Oil slo e	Lat	12865	22702	2	120.0	89.8	
	BUC		17.28	1.0	0.99	4.01		11707	22799	186.4	219.7	186.4	
20	ACT	30.0	std	1.0	1.0		100	4000	830		235.0	1.00	
	LOC		12.34	Strdk		Oil slo e	Lat	11205	22800	2	120.0	89.8	
	BUC		17.25	1.0	1.00	4.00		11620	22800	186.4	219.8	186.4	
21	ACT	30.0	std	1.0	1.0		100	4000	830		235.0	1.00	
	LOC		12.34	Strdk		Oil slo e	Lat	8715	22800	2	120.0	89.8	
	BUC		17.25	1.0	1.00	4.00		8867	22800	186.4	219.8	186.4	
22	ACT	30.0	std	1.0	1.0		100	4000	830		235.0	1.00	
	LOC		12.34	Strdk		Oil slo e	Lat	5395	22800	2	120.0	89.8	
	BUC		17.25	1.0	1.00	4.00		5810	22800	186.4	219.8	186.4	
23	ACT	30.0	std	1.0	1.0		100	4000	830		235.0	1.00	
	LOC		12.34	Strdk		Oil slo e	Lat	2905	22800	2	120.0	89.8	
	BUC		17.25	1.0	1.00	4.00		3007	22800	186.4	219.8	186.4	
<b>Inner Bottom &amp; Inner Side</b>													
1	ACT	21.0	std	1.5	1.5		100	4000	830		235.0	1.00	
	LOC		18.21	Inbot		Oil tst 5	Lat	415	2680	2	140.0	227.3	
	BUC		12.41	0.9	1.00	4.00		0	2680	114.5	201.3	127.2	
2	ACT	21.0	std	1.5	1.5		100	4000	830		235.0	1.00	
	LOC		18.21	Inbot		Oil tst 5	Lat	1244	2680	2	140.0	227.3	
	BUC		12.41	0.9	1.00	4.00		1200	2680	114.5	201.3	127.2	
3	ACT	21.0	std	1.5	1.5		100	4000	830		235.0	1.00	
	LOC		18.20	Inbot		Oil tst 5	Lat	5394	2758	2	140.0	226.5	
	BUC		12.37	0.9	1.00	4.00		3777	2728	113.8	201.3	126.4	
4	ACT	21.0	std	1.5	1.5		100	4000	830		235.0	1.00	
	LOC		18.17	Inbot		Oil tst 5	Lat	7054	2790	2	140.0	226.2	
	BUC		12.32	0.9	1.00	4.00		6639	2782	113.0	201.3	125.5	
5	ACT	21.0	std	1.5	1.5		100	4000	831		235.0	1.00	
	LOC		18.16	Inbot		Oil tst 5	Lat	11204	2868	2	140.0	225.4	
	BUC		12.28	0.9	1.00	4.00		9129	2829	112.3	201.3	124.7	
6	ACT	21.0	std	1.5	1.5		100	4000	829		235.0	1.00	
	LOC		18.13	Inbot		Oil tst 5	Lat	12034	2884	2	140.0	225.3	
	BUC		12.24	0.9	1.00	4.00		11736	2878	111.5	201.3	123.9	
7	ACT	21.0	std	1.5	1.5		100	4000	830		235.0	1.00	
	LOC		18.12	Inbot		Oil tst 5	Lat	16184	2962	2	140.0	224.5	
	BUC		12.20	0.9	1.00	4.00		14405	2928	110.8	201.3	123.1	
8	ACT	20.0	std	1.0	1.0		100	4000	767		235.0	1.00	
	LOC		16.65	Hoptk		Oil tst 5	Lat	16773	3312	2	132.8	221.0	
	BUC		11.62	1.0	0.90	4.20	s/t	16947	3654	100.0	206.1	142.4	

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**Local Rule Requirements - Plates (cont)**

Plate No	ACT	t_act (mm)	Steel	tk (mm)	tk_b (mm)		Eff. (%)	Span (mm)	Spac (mm)		Sigf N/mm <sup>2</sup>	f <sub>1</sub>
	LOC	t_loc (mm)	Pos			Load Ref.	Loc. ref.	y <sub>l</sub> (mm)	z <sub>l</sub> (mm)	Comp ref.	Sigma N/mm <sup>2</sup>	p kN/m <sup>2</sup>
	BUC	t_buc (mm)	Eta	psi	k	c	Buc. ref.	y <sub>b</sub> (mm)	z <sub>b</sub> (mm)	SigL N/mm <sup>2</sup>	Sig_c N/mm <sup>2</sup>	Sig_cr N/mm <sup>2</sup>
9	ACT	16.0	std	1.0	1.0		100	4000	768		235.0	1.00
	LOC	15.48	Hoptk				Lat	17815	5367	2	140.7	200.3
	BUC	11.81	1.0	0.83		Oil tst 5	s/t	18336	6394	59.2	188.6	145.6
10	ACT	15.0	std	1.0	1.0		100	4000	783		235.0	1.00
	LOC	14.58	Insid				Lat	18690	7483	2	148.8	179.0
	BUC	11.84	1.0	0.81	4.41	Oil tst 5	s/t	18690	7875	37.2	182.0	146.6
11	ACT	14.0	std	1.0	1.0		100	4000	784		235.0	1.00
	LOC	12.92	Insid				Lat	18690	10619	2	159.2	147.5
	BUC	11.84	1.0	1.00	4.00	Oil tst 5	s/t	18690	11011	30.0	167.3	137.7
12	ACT	14.0	std	1.0	1.0		100	4000	784		235.0	1.00
	LOC	11.95	Insid				Lat	18690	13755	2	148.4	115.9
	BUC	11.84	1.0	0.82	4.38	Oil tst 5	s/t	18690	14148	56.6	173.1	146.0
13	ACT	17.0	std	1.0	1.0		100	4000	816		235.0	1.00
	LOC	11.75	Insid				Lat	18690	19328	2	129.2	89.8
	BUC	12.28	1.0	0.91	4.19	Oil slo e	s/t	18690	17316	104.1	188.7	142.0
14	ACT	30.0	std	2.5	2.5		100	4000	818		235.0	1.00
	LOC	13.65	Insid				Lat	18690	21805	2	120.7	89.8
	BUC	17.00	1.0	0.93	4.14	Oil slo e		18690	22214	177.6	219.1	177.6
<b>CL Bulkhead</b>												
1	ACT	20.0	std	1.5	1.5		100	2000	820		235.0	1.00
	LOC	19.42	Lbhd			WB acc 1	Lat	0	1000	1	123.9	239.3
	BUC	13.09	1.0	0.92	4.17			0	590	145.6	199.9	145.6
2	ACT	16.0	std	0.0	0.0		100	4000	737		235.0	1.00
	LOC	15.17	Lbhd				Lat	0	3048	2	131.7	223.6
	BUC	10.19	1.0	0.90	4.19	Oil tst 5	s/t	0	2680	114.5	197.3	142.1
3	ACT	14.0	std	0.0	0.0		100	4000	784		235.0	1.00
	LOC	13.58	Lbhd				Lat	0	7484	2	148.8	179.0
	BUC	10.84	1.0	0.76	4.51	Oil tst 5	s/t	0	7092	48.9	183.2	148.7
4	ACT	13.0	std	0.0	0.0		100	4000	784		235.0	1.00
	LOC	12.72	Lbhd				Lat	0	9052	2	154.9	163.2
	BUC	10.84	1.0	0.59	4.97	Oil tst 5	s/t	0	8797	23.5	180.5	156.6
5	ACT	13.0	std	0.0	0.0		100	4000	784		235.0	1.00
	LOC	12.58	Lbhd				Min	0	11457	2	156.3	139.1
	BUC	10.84	1.0	0.76	4.51	Oil tst 5	s/t	0	11796	21.3	175.0	148.7
6	ACT	13.0	std	0.0	0.0		100	4000	784		235.0	1.00
	LOC	12.58	Lbhd				Min	0	14540	2	145.7	108.1
	BUC	10.84	1.0	0.83	4.36	Oil tst 5	s/t	0	14932	68.3	172.8	145.6
7	ACT	18.0	std	0.0	0.0		100	4000	784		235.0	1.00
	LOC	12.58	Lbhd				Min	0	16892	2	137.6	89.8
	BUC	11.06	1.0	0.98	4.04	Oil slo e		0	19840	142.0	199.9	142.0
8	ACT	30.0	std	2.0	2.0		100	4000	793		235.0	1.00
	LOC	14.58	Lbhd				Min	0	21610	2	121.3	89.8
	BUC	17.28	1.0	0.94	4.13	Oil slo e		0	22800	186.4	220.5	186.4
<b>Stringer 7092</b>												
1	ACT	12.0	std	1.5	1.5		100	4000	640		235.0	1.00
	LOC	11.55	Strng			WB slo m	Min	20930	7092	1	147.3	20.0
	BUC	6.70	1.0	1.00	4.00			21250	7092	48.9	165.8	48.9
<b>Stringer 11796</b>												
1	ACT	12.0	std	1.5	1.5		100	4000	640		235.0	1.00
	LOC	11.55	Strng			WB slo m	Min	20930	11796	1	155.1	20.0
	BUC	5.57	1.0	1.00	4.00			21250	11796	30.0	165.8	30.0

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**Local Rule Requirements - Plates (cont)**

Plate No	ACT	t_act (mm)	Steel	tk (mm)	tk_b (mm)		Eff. (%)	Span (mm)	Spac (mm)		Sigf N/mm <sup>2</sup>	f <sub>1</sub>
	LOC	t_loc (mm)	Pos			Load Ref.	Loc. ref.	y <sub>l</sub> (mm)	z <sub>l</sub> (mm)	Comp ref.	Sigma N/mm <sup>2</sup>	p kN/m <sup>2</sup>
	BUC	t_buc (mm)	Eta	psi	k	c	Buc. ref.	y <sub>b</sub> (mm)	z <sub>b</sub> (mm)	SigL N/mm <sup>2</sup>	Sig_c N/mm <sup>2</sup>	Sig_cr N/mm <sup>2</sup>

**Stringer 16500**

1	ACT	12.0	std	1.5	1.5		100	4000	640		235.0	1.00
	LOC		11.55	String		WB slo m	Min	20930	16500	1	138.9	20.0
	BUC		8.62	1.0	1.00	4.00		21250	16500	91.9	165.8	91.9

**Bottom girder 5810**

1	ACT	18.0	std	1.5	1.5		100	4000	590		235.0	1.00
	LOC		12.55	DBgird		WB slo m	Min	5810	295	1	130.0	20.0
	BUC		13.09	1.0	0.92	4.17		5810	590	145.6	190.9	145.6

**Bottom girder 11620**

1	ACT	18.0	std	1.5	1.5		100	4000	590		235.0	1.00
	LOC		12.55	DBgird		WB slo m	Min	11620	295	1	130.0	20.0
	BUC		13.09	1.0	0.92	4.17		11620	590	145.6	190.9	145.6

**Bottom girder 16600**

1	ACT	18.0	std	1.5	1.5		100	4000	590		235.0	1.00
	LOC		12.55	DBgird		WB slo m	Min	16600	295	1	130.0	20.0
	BUC		13.09	1.0	0.92	4.17		16600	590	145.6	190.9	145.6



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### 14 Local Rule Requirements - Stiffeners

Stiff. No	ACT ACT	POS Za cm³	K c	Type Type	h t (mm)	bf tf (mm)	y z (mm)	SigF f <sub>1</sub> N/mm²	m wk	tkw tkf (mm)	tpl (mm)	span spac (mm)
	LOC		Zr cm³	Exc. %	tmin (mm)	Load Ref.		Sigma N/mm²	Sigdb N/mm²	p kN/m²	Comp ref.	a_conn cm²
	FAT/BUC		Zrf cm³	Exc. %	pd kN/m²	Sigd N/mm²		SigL N/mm²	Lat N/mm²	Torsion N/mm²	Web N/mm²	bf/tf

#### Outer Shell

##### Bottom

1	ACT ACT LOC FAT/BUC	Bottom 3361	0.00 0.0 3180 0	43 Tbar 5	530 12.0 11.5 0.0	150 35.0 WB acc 1 0.0	830 0	235.0 1.00 71.8 154.3	12.0 1.15 33.2 232.8	1.5 1.5 180.1 196.6	21.0 1	4000 830 83.7 2.2
Similar for No(s): 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17												
18	ACT ACT LOC FAT/BUC	Bottom 3326	0.00 0.0 2104 0	43 Tbar 58	530 12.0 11.5 0.0	150 35.0 Sea 0.0	17313 0	235.0 1.00 95.0 154.3	12.0 1.15 0.0 232.9	1.5 1.5 183.6 197.0	21.0	4000 713 73.1 2.2
Similar for No(s): 19 20												
21	ACT ACT LOC FAT/BUC	Bottom 3326	0.00 0.0 2133 0	43 Tbar 55	530 12.0 11.5 0.0	150 35.0 Sea 0.0	19452 0	235.0 1.00 95.0 154.3	12.0 1.15 0.0 232.9	1.5 1.5 186.1 197.0	21.0	4000 713 73.1 2.2

##### Side

22	ACT ACT LOC FAT/BUC	Side 1977	2.50 1.1 1909 1480	20 HPbulb 3 33	430 15.0 11.5 55.0	0 0.0 WB tst 5 48.4	21250 2094	235.0 1.00 121.2 123.2	12.0 1.09 0.0 231.0	1.5 1.5 177.7 216.7	21.0 1	4000 900 88.7 0.0
23	ACT ACT LOC FAT/BUC	Side 1970	2.50 1.1 1701 1434	20 HPbulb 15 37	430 15.0 11.5 55.8	0 0.0 WB tst 5 48.4	21250 2994	235.0 1.00 130.0 109.8	12.0 1.09 0.0 231.0	1.5 1.5 177.7 217.1	21.0 1	4000 860 85.2 0.0
24	ACT ACT LOC FAT/BUC	Side 1647	2.50 1.1 1621 1384	20 HPbulb 1 18	400 16.0 11.5 56.5	0 0.0 WB tst 5 48.4	21250 3814	235.0 1.00 130.0 97.6	12.0 1.09 0.0 230.5	1.5 1.5 177.6 217.4	17.0 1	4000 820 81.7 0.0
25	ACT ACT LOC FAT/BUC	Side 1647	2.50 1.1 1621 1402	20 HPbulb 1 17	400 16.0 11.5 57.2	0 0.0 WB tst 5 48.4	21250 4634	235.0 1.00 130.0 85.4	12.0 1.09 0.0 230.5	1.5 1.5 177.6 217.6	17.0 1	4000 820 81.7 0.0
26	ACT ACT LOC FAT/BUC	Side 1647	2.50 1.1 1620 1419	20 HPbulb 1 16	400 16.0 11.5 57.9	0 0.0 WB tst 5 48.4	21250 5454	235.0 1.00 130.0 73.2	12.0 1.09 0.0 230.5	1.5 1.5 177.5 217.7	17.0 1	4000 820 81.7 0.0
27	ACT ACT LOC FAT/BUC	Side 1647	2.50 1.1 1618 1434	20 HPbulb 1 14	400 16.0 11.5 58.6	0 0.0 WB tst 5 48.4	21250 6274	235.0 1.00 130.0 61.0	12.0 1.09 0.0 230.5	1.5 1.5 177.5 217.8	17.0 1	4000 819 81.6 0.0
28	ACT ACT LOC FAT/BUC	Side 1641	2.50 1.1 1476 1405	20 HPbulb 11 16	400 16.0 11.5 60.0	0 0.0 WB tst 5 48.4	21250 7876	235.0 1.00 130.0 37.2	12.0 1.09 0.0 230.6	1.5 1.5 169.2 217.9	17.0 1	4000 784 74.8 0.0
29	ACT ACT LOC FAT/BUC	Side 1641	2.50 1.1 1408 1421	20 HPbulb 16 15	400 16.0 11.5 60.6	0 0.0 WB tst 5 48.4	21250 8660	235.0 1.00 130.0 30.0	12.0 1.09 0.0 230.6	1.5 1.5 161.3 217.9	17.0 1	4000 784 71.3 0.0
30	ACT ACT LOC FAT/BUC	Side 1641	2.50 1.1 1339 1428	20 HPbulb 22 14	400 16.0 11.5 60.9	0 0.0 WB tst 5 48.4	21250 9444	235.0 1.00 130.0 30.0	12.0 1.09 0.0 230.6	1.5 1.5 153.4 217.9	17.0 1	4000 784 67.8 0.0

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**Local Rule Requirements - Stiffeners (cont.)**

Stiff. No	ACT ACT	POS Za cm³	K c	Type Type	h t (mm)	bf tf (mm)	y z (mm)	SigF f <sub>t</sub> N/mm²	m wk	tkw tkf (mm)	tpl (mm)	span spac (mm)
LOC			Zr cm³	Exc. %	tmin (mm)	Load Ref.		Sigma N/mm²	Sigdb N/mm²	p kN/m²	Comp ref.	a_conn cm²
FAT/BUC			Zrf cm³	Exc. %	pd kN/m²	Sigd N/mm²		SigL N/mm²	Lat N/mm²	Torsion N/mm²	Web N/mm²	bf/tf
31	ACT	Side	2.50	20	400	0	21250	235.0	12.0	1.5	17.0	4000
	ACT	1556	1.1	HPbulb	14.0	0.0	10228	1.00	1.09	1.5		784
	LOC		1270	22	11.5	WB tst 5		130.0	0.0	145.5	1	64.3
	FAT/BUC		1344	15	57.3	48.4		30.0	230.6	216.5	220.6	0.0
32	ACT	Side	2.50	20	400	0	21250	235.0	12.0	1.5	17.0	4000
	ACT	1556	1.1	HPbulb	14.0	0.0	11012	1.00	1.09	1.5		784
	LOC		1201	29	11.5	WB tst 5		130.0	0.0	137.6	1	60.8
	FAT/BUC		1260	23	53.8	48.4		30.0	230.6	216.5	220.6	0.0
33	ACT	Side	2.50	20	370	0	21250	235.0	12.0	1.5	17.0	4000
	ACT	1245	1.1	HPbulb	13.0	0.0	12580	1.00	1.09	1.5		783
	LOC		1063	17	11.5	WB tst 5		130.0	0.0	121.9	1	53.9
	FAT/BUC		1092	14	46.6	48.4		33.0	229.6	215.9	220.4	0.0
34	ACT	Side	2.50	20	370	0	21250	235.0	12.0	1.5	17.0	4000
	ACT	1245	1.1	HPbulb	13.0	0.0	13364	1.00	1.09	1.5		784
	LOC		995	25	11.5	WB tst 5		130.0	0.0	114.0	1	50.4
	FAT/BUC		1008	23	43.0	48.4		44.8	229.6	215.9	220.4	0.0
35	ACT	Side	2.50	20	340	0	21250	235.0	12.0	1.5	17.0	4000
	ACT	1042	1.1	HPbulb	14.0	0.0	14148	1.00	1.09	1.5		784
	LOC		926	12	11.5	WB tst 5		130.0	0.0	106.1	1	46.9
	FAT/BUC		924	12	39.4	48.4		56.6	228.3	216.6	224.5	0.0
36	ACT	Side	2.50	20	340	0	21250	235.0	12.0	1.5	17.0	4000
	ACT	1042	1.1	HPbulb	14.0	0.0	14932	1.00	1.09	1.5		784
	LOC		857	21	11.5	WB tst 5		130.0	0.0	98.2	1	43.4
	FAT/BUC		840	24	35.8	48.4		68.3	228.3	216.6	224.5	0.0
37	ACT	Side	2.50	20	340	0	21250	235.0	12.0	1.5	17.0	4000
	ACT	1042	1.1	HPbulb	14.0	0.0	15716	1.00	1.09	1.5		784
	LOC		788	32	11.5	WB tst 5		130.0	0.0	90.3	1	39.9
	FAT/BUC		754	38	32.2	48.4		80.1	228.3	216.5	224.5	0.0
38	ACT	Side	2.50	20	340	0	21250	235.0	12.0	1.5	17.0	4000
	ACT	1045	1.1	HPbulb	14.0	0.0	17316	1.00	1.09	1.5		816
	LOC		674	54	11.5	WB tst 5		130.0	0.0	74.3	1	34.0
	FAT/BUC		589	77	24.2	48.4		104.1	228.2	216.2	224.5	0.0
39	ACT	Side	2.50	20	340	0	21250	235.0	12.0	1.5	17.0	4000
	ACT	1045	1.1	HPbulb	14.0	0.0	18132	1.00	1.09	1.5		816
	LOC		600	74	11.5	WB tst 5		130.0	0.0	66.1	1	30.2
	FAT/BUC		490	113	20.1	48.4		116.4	228.2	216.1	224.5	0.0
40	ACT	Side	2.50	20	340	0	21250	235.0	12.0	1.5	17.0	4000
	ACT	1045	1.1	HPbulb	14.0	0.0	18948	1.00	1.09	1.5		816
	LOC		529	97	11.5	WB tst 5		129.1	0.0	57.8	1	26.5
	FAT/BUC		390	167	16.0	48.4		128.6	228.2	216.0	224.5	0.0
41	ACT	Side	2.50	20	370	0	21250	235.0	12.0	1.5	30.0	4000
	ACT	1325	1.1	HPbulb	13.0	0.0	19764	1.00	1.09	1.5		816
	LOC		486	171	11.5	WB tst 5		120.0	0.0	49.6	1	22.7
	FAT/BUC		290	355	11.9	48.4		140.8	228.2	217.6	220.4	0.0
42	ACT	Side	2.50	20	370	0	21250	235.0	12.0	3.0	30.0	4000
	ACT	1325	1.1	HPbulb	13.0	0.0	20580	1.00	1.18	3.0		816
	LOC		477	177	13.0	WB tst 5		110.9	0.0	41.4	1	19.0
	FAT/BUC		207	539	7.8	48.4		153.1	228.1	216.1	215.5	0.0
43	ACT	Side	2.50	20	370	0	21250	235.0	12.0	3.0	30.0	4000
	ACT	1316	1.1	HPbulb	13.0	0.0	21396	1.00	1.18	3.0		710
	LOC		363	262	13.0	WB tst 5		101.8	0.0	33.2	1	13.4
	FAT/BUC		86	*	3.8	48.4		165.3	228.6	216.1	215.5	0.0

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**Local Rule Requirements - Stiffeners (cont.)**

Stiff. No	ACT ACT	POS Za cm <sup>3</sup>	K c	Type Type	h t (mm)	bf tf (mm)	y z (mm)	SigF f <sub>1</sub> N/mm <sup>2</sup>	m wk	tkw tkf (mm)	tpl (mm)	span spac (mm)
	LOC		Zr cm <sup>3</sup>	Exc. %	tmin (mm)	Load Ref.		Sigma N/mm <sup>2</sup>	Sigdb N/mm <sup>2</sup>	p kN/m <sup>2</sup>	Comp ref.	a_conn cm <sup>2</sup>
	FAT/BUC		Zrf cm <sup>3</sup>	Exc. %	pd kN/m <sup>2</sup>	Sigd N/mm <sup>2</sup>		SigL N/mm <sup>2</sup>	Lat N/mm <sup>2</sup>	Torsion N/mm <sup>2</sup>	Web N/mm <sup>2</sup>	bf/tf

**Strength deck**

1	ACT	Strdk	0.00	20	370	0	20395	235.0	12.0	3.0	30.0	4000
	ACT	1319	0.0	HPbulb	13.0	0.0	22071	1.00	1.18	3.0		857
	LOC		374	252	13.0	WB tst 5		95.0	0.0	26.4	1	12.7
	FAT/BUC		0		0.0	0.0		175.5	228.0	216.1	215.5	0.0
2	ACT	Strdk	0.00	20	370	0	19540	235.0	12.0	3.0	30.0	4000
	ACT	1319	0.0	HPbulb	13.0	0.0	22143	1.00	1.18	3.0		855
	LOC		362	263	13.0	WB tst 5		95.0	0.0	25.7	1	12.3
	FAT/BUC		0		0.0	0.0		176.6	228.0	216.1	215.5	0.0
3	ACT	Strdk	0.00	20	370	0	18000	235.0	12.0	2.0	30.0	4000
	ACT	1306	0.0	HPbulb	13.0	0.0	22272	1.00	1.12	2.0		697
	LOC		980	33	12.0	Oil slo e		95.0	0.0	89.8	2	35.7
	FAT/BUC		0		0.0	0.0		178.5	228.7	217.1	219.0	0.0
Similar for No(s): 4												
5	ACT	Strdk	0.00	20	370	0	16600	235.0	12.0	2.0	30.0	4000
	ACT	1312	0.0	HPbulb	13.0	0.0	22389	1.00	1.12	2.0		767
	LOC		1078	21	12.0	Oil slo e		95.0	0.0	89.8	2	38.9
	FAT/BUC		0		0.0	0.0		180.3	228.4	217.1	219.0	0.0
6	ACT	Strdk	0.00	20	370	0	15770	235.0	12.0	2.0	30.0	4000
	ACT	1317	0.0	HPbulb	13.0	0.0	22459	1.00	1.12	2.0		832
	LOC		1170	12	12.0	Oil slo e		95.0	0.0	89.8	2	41.9
	FAT/BUC		0		0.0	0.0		181.3	228.1	217.1	219.0	0.0
Similar for No(s): 7 8 9 10 11												
12	ACT	Strdk	0.00	20	370	0	10790	235.0	12.0	2.0	30.0	4000
	ACT	1326	0.0	HPbulb	13.0	0.0	22800	1.00	1.12	2.0		830
	LOC		1166	13	12.0	Oil slo e		95.0	0.0	89.8	2	41.7
	FAT/BUC		0		0.0	0.0		186.4	228.1	217.1	219.0	0.0
Similar for No(s): 13 14 15 16 17 18 19 20 21 22 23 24												

**Inner Bottom & Inner Side**

1	ACT	Inbot	0.00	43	530	150	830	235.0	12.0	1.5	21.0	4000
	ACT	3059	0.0	Tbar	12.0	30.0	2680	1.00	1.15	1.5		830
	LOC		2831	8	11.5	Oil tst 5		101.8	33.2	227.3	2	102.9
	FAT/BUC		0		0.0	0.0		114.5	232.7	194.1	194.8	2.6
Similar for No(s): 2 3 4 5 6 7 8 9 10 11 12 13												
14	ACT	Inbot	0.00	43	530	150	13279	235.0	12.0	1.5	21.0	4000
	ACT	3048	0.0	Tbar	12.0	30.0	2907	1.00	1.15	1.5		829
	LOC		2803	8	11.5	Oil tst 5		101.8	33.2	225.0	2	101.9
	FAT/BUC		0		0.0	0.0		111.1	232.7	194.1	194.8	2.6
Similar for No(s): 15 16 17												
18	ACT	Hoptk	0.00	20	430	0	16947	235.0	12.0	1.5	20.0	4000
	ACT	1944	0.0	HPbulb	15.0	0.0	3654	1.00	1.09	1.5		768
	LOC		1717	13	11.5	Oil tst 5		140.8	0.0	217.5	2	91.8
	FAT/BUC		0		0.0	0.0		100.0	231.2	217.0	220.7	0.0
19	ACT	Hoptk	0.00	20	430	0	17294	235.0	12.0	1.5	20.0	4000
	ACT	1944	0.0	HPbulb	15.0	0.0	4339	1.00	1.09	1.5		768
	LOC		1567	24	11.5	Oil tst 5		149.4	0.0	210.6	2	88.8
	FAT/BUC		0		0.0	0.0		89.8	231.2	217.0	220.7	0.0
20	ACT	Hoptk	0.00	20	430	0	17641	235.0	12.0	1.5	16.0	4000
	ACT	1895	0.0	HPbulb	15.0	0.0	5024	1.00	1.09	1.5		768
	LOC		1434	32	11.5	Oil tst 5		157.9	0.0	203.7	2	85.8
	FAT/BUC		0		0.0	0.0		79.6	231.4	213.5	220.7	0.0
21	ACT	Hoptk	0.00	20	400	0	17989	235.0	12.0	1.5	16.0	4000
	ACT	1544	0.0	HPbulb	14.0	0.0	5709	1.00	1.09	1.5		767
	LOC		1367	12	11.5	Oil tst 5		160.0	0.0	196.8	2	82.9
	FAT/BUC		0		0.0	0.0		69.4	230.7	215.3	220.6	0.0

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**Local Rule Requirements - Stiffeners (cont.)**

Stiff. No	ACT ACT	POS Za cm³	K c	Type Type	h t (mm)	bf tf (mm)	y z (mm)	SigF f <sub>1</sub> N/mm²	m wk	tkw tkf (mm)	tpl (mm)	span spac (mm)
LOC			Zr cm³	Exc. %	tmin (mm)	Load Ref.		Sigma N/mm²	Sigdb N/mm²	p kN/m²	Comp ref.	a_conn cm²
FAT/BUC			Zrf cm³	Exc. %	pd kN/m²	Sigd N/mm²		SigL N/mm²	Lat N/mm²	Torsion N/mm²	Web N/mm²	bf/tf
22	ACT	Hoptk	0.00	20	400	0	18336	235.0	12.0	1.5	16.0	4000
	ACT	1545	0.0	HPbulb	14.0	0.0	6394	1.00	1.09	1.5		774
	LOC		1331	16	11.5	Oil tst 5		160.0	0.0	190.0	2	80.5
	FAT/BUC		0		0.0	0.0		59.2	230.7	215.4	220.6	0.0
23	ACT	Insid	0.00	20	400	0	18690	235.0	12.0	1.5	15.0	4000
	ACT	1535	0.0	HPbulb	14.0	0.0	7875	1.00	1.09	1.5		783
	LOC		1241	23	11.5	Oil tst 5		160.0	0.0	175.1	2	74.8
	FAT/BUC		0		0.0	0.0		37.2	230.7	214.2	220.6	0.0
24	ACT	Insid	0.00	20	370	0	18690	235.0	12.0	1.5	15.0	4000
	ACT	1229	0.0	HPbulb	13.0	0.0	8659	1.00	1.09	1.5		784
	LOC		1185	3	11.5	Oil tst 5		160.0	0.0	167.2	2	71.3
	FAT/BUC		0		0.0	0.0		30.0	229.8	215.3	220.4	0.0
25	ACT	Insid	0.00	20	370	0	18690	235.0	12.0	1.5	15.0	4000
	ACT	1229	0.0	HPbulb	13.0	0.0	9443	1.00	1.09	1.5		784
	LOC		1129	8	11.5	Oil tst 5		160.0	0.0	159.3	2	67.8
	FAT/BUC		0		0.0	0.0		30.0	229.8	215.3	220.4	0.0
26	ACT	Insid	0.00	20	370	0	18690	235.0	12.0	1.5	15.0	4000
	ACT	1229	0.0	HPbulb	13.0	0.0	10227	1.00	1.09	1.5		784
	LOC		1073	14	11.5	Oil tst 5		160.0	0.0	151.4	2	64.3
	FAT/BUC		0		0.0	0.0		30.0	229.8	215.3	220.4	0.0
27	ACT	Insid	0.00	20	370	0	18690	235.0	12.0	1.5	14.0	4000
	ACT	1220	0.0	HPbulb	13.0	0.0	11011	1.00	1.09	1.5		784
	LOC		1018	19	11.5	Oil tst 5		160.0	0.0	143.5	2	60.8
	FAT/BUC		0		0.0	0.0		30.0	229.9	215.0	220.4	0.0
28	ACT	Insid	0.00	20	340	0	18690	235.0	12.0	1.5	14.0	4000
	ACT	958	0.0	HPbulb	12.0	0.0	12579	1.00	1.09	1.5		783
	LOC		906	5	11.5	Oil tst 5		160.0	0.0	127.8	2	53.9
	FAT/BUC		0		0.0	0.0		33.0	228.7	213.8	220.1	0.0
29	ACT	Insid	0.00	20	340	0	18690	235.0	12.0	1.5	14.0	4000
	ACT	958	0.0	HPbulb	12.0	0.0	13363	1.00	1.09	1.5		784
	LOC		850	12	11.5	Oil tst 5		160.0	0.0	119.9	2	50.4
	FAT/BUC		0		0.0	0.0		44.8	228.7	213.7	220.1	0.0
30	ACT	Insid	0.00	20	340	0	18690	235.0	12.0	1.5	14.0	4000
	ACT	958	0.0	HPbulb	12.0	0.0	14148	1.00	1.09	1.5		784
	LOC		794	20	11.5	Oil tst 5		160.0	0.0	112.0	2	46.9
	FAT/BUC		0		0.0	0.0		56.6	228.7	213.6	220.1	0.0
31	ACT	Insid	0.00	20	340	0	18690	235.0	12.0	1.5	14.0	4000
	ACT	958	0.0	HPbulb	12.0	0.0	14932	1.00	1.09	1.5		784
	LOC		738	29	11.5	Oil tst 5		160.0	0.0	104.1	2	43.4
	FAT/BUC		0		0.0	0.0		68.3	228.7	213.6	220.1	0.0
32	ACT	Insid	0.00	20	340	0	18690	235.0	12.0	1.5	14.0	4000
	ACT	958	0.0	HPbulb	12.0	0.0	15716	1.00	1.09	1.5		784
	LOC		682	40	11.5	Oil tst 5		160.0	0.0	96.2	2	39.9
	FAT/BUC		0		0.0	0.0		80.1	228.7	213.5	220.1	0.0
33	ACT	Insid	0.00	20	340	0	18690	235.0	12.0	1.5	17.0	4000
	ACT	979	0.0	HPbulb	12.0	0.0	17316	1.00	1.09	1.5		816
	LOC		719	36	11.5	Oil slo e		147.4	0.0	89.8	2	34.0
	FAT/BUC		0		0.0	0.0		104.1	228.1	214.7	220.1	0.0
34	ACT	Insid	0.00	20	340	0	18690	235.0	12.0	1.5	17.0	4000
	ACT	979	0.0	HPbulb	12.0	0.0	18132	1.00	1.09	1.5		815
	LOC		766	27	11.5	Oil slo e		138.3	0.0	89.8	2	32.9
	FAT/BUC		0		0.0	0.0		116.4	228.1	214.6	220.1	0.0
35	ACT	Insid	0.00	20	370	0	18690	235.0	12.0	1.5	17.0	4000
	ACT	1249	0.0	HPbulb	13.0	0.0	18947	1.00	1.09	1.5		815
	LOC		820	52	11.5	Oil slo e		129.1	0.0	89.8	2	32.9
	FAT/BUC		0		0.0	0.0		128.6	229.6	215.6	220.4	0.0



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**Local Rule Requirements - Stiffeners (cont.)**

Stiff. No	ACT ACT	POS Za cm <sup>3</sup>	K c	Type Type	h t (mm)	bf tf (mm)	y z (mm)	SigF <sub>f1</sub> N/mm <sup>2</sup>	m wk	tkw tkf (mm)	tpl (mm)	span spac (mm)
LOC			Zr cm <sup>3</sup>	Exc. %	tmin (mm)	Load Ref.		Sigma N/mm <sup>2</sup>	Sigdb N/mm <sup>2</sup>	p kN/m <sup>2</sup>	Comp ref.	a_conn cm <sup>2</sup>
FAT/BUC			Zrf cm <sup>3</sup>	Exc. %	pd kN/m <sup>2</sup>	Sigd N/mm <sup>2</sup>		SigL N/mm <sup>2</sup>	Lat N/mm <sup>2</sup>	Torsion N/mm <sup>2</sup>	Web N/mm <sup>2</sup>	bf/tf
36	ACT	Insid	0.00	20	370	0	18690	235.0	12.0	1.5	30.0	4000
	ACT	1325	0.0	HPbulb	13.0	0.0	19763	1.00	1.09	1.5		816
	LOC		883	50	11.5	Oil slo e		120.0	0.0	89.8	2	32.9
	FAT/BUC		0		0.0	0.0		140.8	228.2	217.6	220.4	0.0
37	ACT	Insid	0.00	20	370	0	18690	235.0	12.0	1.5	30.0	4000
	ACT	1325	0.0	HPbulb	13.0	0.0	20579	1.00	1.09	1.5		816
	LOC		956	38	11.5	Oil slo e		110.9	0.0	89.8	2	32.9
	FAT/BUC		0		0.0	0.0		153.1	228.2	217.6	220.4	0.0
38	ACT	Insid	0.00	20	370	0	18690	235.0	12.0	3.0	30.0	4000
	ACT	1325	0.0	HPbulb	13.0	0.0	21395	1.00	1.18	3.0		817
	LOC		1129	17	13.0	Oil slo e		101.8	0.0	89.8	2	32.9
	FAT/BUC		0		0.0	0.0		165.3	228.1	216.1	215.5	0.0
<b>CL Bulkhead</b>												
1	ACT	Lbhd	0.00	10	350	0	0	235.0	12.0	1.5	20.0	2000
	ACT	776	0.0	Fbar	20.0	0.0	590	1.00	1.08	1.5		705
	LOC		599	29	19.0	WB acc 1		102.4	0.0	244.0	1	44.3
	FAT/BUC		0		0.0	0.0		145.6	232.8	200.0	0.0	0.0
2	ACT	Lbhd	0.00	10	350	0	0	235.0	12.0	1.5	20.0	2000
	ACT	787	0.0	Fbar	20.0	0.0	1410	1.00	1.08	1.5		820
	LOC		609	29	19.0	WB acc 1		112.7	0.0	234.7	1	47.8
	FAT/BUC		0		0.0	0.0		133.4	232.6	198.2	0.0	0.0
3	ACT	Lbhd	0.00	10	350	0	0	235.0	12.0	1.5	20.0	2000
	ACT	769	0.0	Fbar	20.0	0.0	2230	1.00	1.08	1.5		635
	LOC		416	84	19.0	WB tst 5		122.9	0.0	225.9	1	37.7
	FAT/BUC		0		0.0	0.0		121.2	232.8	201.4	0.0	0.0
4	ACT	Lbhd	0.00	20	430	0	0	235.0	12.0	1.0	16.0	4000
	ACT	1888	0.0	HPbulb	15.0	0.0	3417	1.00	1.06	0.0		736
	LOC		1653	14	11.0	Oil tst 5		137.8	0.0	219.9	2	91.8
	FAT/BUC		0		0.0	0.0		103.5	231.4	215.4	221.8	0.0
5	ACT	Lbhd	0.00	20	430	0	0	235.0	12.0	1.0	16.0	4000
	ACT	1888	0.0	HPbulb	15.0	0.0	4152	1.00	1.06	0.0		735
	LOC		1495	26	11.0	Oil tst 5		147.0	0.0	212.5	2	88.7
	FAT/BUC		0		0.0	0.0		92.6	231.4	215.5	221.8	0.0
6	ACT	Lbhd	0.00	20	430	0	0	235.0	12.0	1.0	16.0	4000
	ACT	1888	0.0	HPbulb	15.0	0.0	4887	1.00	1.06	0.0		735
	LOC		1358	38	11.0	Oil tst 5		156.2	0.0	205.1	2	85.6
	FAT/BUC		0		0.0	0.0		81.7	231.4	215.6	221.8	0.0
7	ACT	Lbhd	0.00	10	450	0	0	235.0	12.0	1.0	16.0	4000
	ACT	1459	0.0	Fbar	25.0	0.0	5622	1.00	1.04	0.0		735
	LOC		1254	16	23.5	Oil tst 5		160.0	0.0	197.7	2	82.5
	FAT/BUC		0		0.0	0.0		70.7	230.2	194.8	0.0	0.0
8	ACT	Lbhd	0.00	10	450	0	0	235.0	12.0	1.0	14.0	4000
	ACT	1427	0.0	Fbar	25.0	0.0	6357	1.00	1.04	0.0		735
	LOC		1207	18	23.5	Oil tst 5		160.0	0.0	190.3	2	79.4
	FAT/BUC		0		0.0	0.0		59.8	230.3	192.4	0.0	0.0
Similar for No(s): 9												
10	ACT	Lbhd	0.00	10	450	0	0	235.0	12.0	1.0	14.0	4000
	ACT	1440	0.0	Fbar	25.0	0.0	7876	1.00	1.04	0.0		784
	LOC		1184	21	23.5	Oil tst 5		160.0	0.0	175.1	2	77.4
	FAT/BUC		0		0.0	0.0		37.2	230.3	192.5	0.0	0.0
11	ACT	Lbhd	0.00	10	400	0	0	235.0	12.0	1.0	14.0	4000
	ACT	1160	0.0	Fbar	25.0	0.0	8660	1.00	1.04	0.0		784
	LOC		1131	2	21.0	Oil tst 5		160.0	0.0	167.2	2	73.9
	FAT/BUC		0		0.0	0.0		25.6	228.9	201.1	0.0	0.0

Section Scantlings - v.3.3-372-980619  
 SHUTTLE TANKER 145000 M3  
 CUADERNA MAESTRA

Ship Id No : proyec

**Local Rule Requirements - Stiffeners (cont.)**

Stiff. No	ACT ACT	POS Za cm³	K c	Type Type	h t (mm)	bf tf (mm)	y z (mm)	SigF f <sub>t</sub> N/mm²	m wk	tkw tkf (mm)	tpl (mm)	span spac (mm)
LOC			Zr cm³	Exc. %	tmin (mm)	Load Ref.		Sigma N/mm²	Sigdb N/mm²	p kN/m²	Comp ref.	a_conn cm²
FAT/BUC			Zrf cm³	Exc. %	pd kN/m²	Sigd N/mm²		SigL N/mm²	Lat N/mm²	Torsion N/mm²	Web N/mm²	bf/tf
12	ACT	Lbhd	0.00	10	400	0	0	235.0	12.0	1.0	13.0	4000
	ACT	1146	0.0	Fbar	25.0	0.0	9444	1.00	1.04	0.0		784
	LOC		1078	6	21.0	Oil tst 5		160.0	0.0	159.3	2	70.4
	FAT/BUC		0		0.0	0.0		13.9	229.0	200.3	0.0	0.0
13	ACT	Lbhd	0.00	10	400	0	0	235.0	12.0	1.0	13.0	4000
	ACT	1146	0.0	Fbar	25.0	0.0	10228	1.00	1.04	0.0		784
	LOC		1024	11	21.0	Oil tst 5		160.0	0.0	151.4	2	66.9
	FAT/BUC		0		0.0	0.0		2.2	229.0	200.6	0.0	0.0
14	ACT	Lbhd	0.00	10	400	0	0	235.0	12.0	1.0	13.0	4000
	ACT	1146	0.0	Fbar	25.0	0.0	11012	1.00	1.04	0.0		784
	LOC		971	18	21.0	Oil tst 5		160.0	0.0	143.5	2	63.4
	FAT/BUC		0		0.0	0.0		9.5	229.0	200.4	0.0	0.0
15	ACT	Lbhd	0.00	10	400	0	0	235.0	12.0	1.0	13.0	4000
	ACT	1146	0.0	Fbar	25.0	0.0	11796	1.00	1.04	0.0		784
	LOC		917	24	21.0	Oil tst 5		160.0	0.0	135.6	2	60.0
	FAT/BUC		0		0.0	0.0		21.3	229.0	200.1	0.0	0.0
16	ACT	Lbhd	0.00	10	350	0	0	235.0	12.0	1.0	13.0	4000
	ACT	896	0.0	Fbar	25.0	0.0	12580	1.00	1.04	0.0		784
	LOC		864	3	18.5	Oil tst 5		160.0	0.0	127.8	2	56.5
	FAT/BUC		0		0.0	0.0		33.0	227.0	207.7	0.0	0.0
17	ACT	Lbhd	0.00	10	350	0	0	235.0	12.0	1.0	13.0	4000
	ACT	896	0.0	Fbar	25.0	0.0	13364	1.00	1.04	0.0		784
	LOC		811	10	18.5	Oil tst 5		160.0	0.0	119.9	2	53.0
	FAT/BUC		0		0.0	0.0		44.8	227.0	207.5	0.0	0.0
18	ACT	Lbhd	0.00	10	350	0	0	235.0	12.0	1.0	13.0	4000
	ACT	896	0.0	Fbar	25.0	0.0	14148	1.00	1.04	0.0		784
	LOC		757	18	18.5	Oil tst 5		160.0	0.0	112.0	2	49.5
	FAT/BUC		0		0.0	0.0		56.6	227.0	207.2	0.0	0.0
19	ACT	Lbhd	0.00	10	350	0	0	235.0	12.0	1.0	13.0	4000
	ACT	896	0.0	Fbar	25.0	0.0	14932	1.00	1.04	0.0		784
	LOC		704	27	18.5	Oil tst 5		160.0	0.0	104.1	2	46.0
	FAT/BUC		0		0.0	0.0		68.3	227.0	206.9	0.0	0.0
20	ACT	Lbhd	0.00	10	350	0	0	235.0	12.0	1.0	13.0	4000
	ACT	896	0.0	Fbar	25.0	0.0	15716	1.00	1.04	0.0		784
	LOC		651	37	18.5	Oil tst 5		160.0	0.0	96.2	2	42.5
	FAT/BUC		0		0.0	0.0		80.1	227.0	206.6	0.0	0.0
21	ACT	Lbhd	0.00	10	350	0	0	235.0	12.0	1.0	13.0	4000
	ACT	896	0.0	Fbar	25.0	0.0	16500	1.00	1.04	0.0		784
	LOC		620	44	18.5	Oil slo e		156.5	0.0	89.8	2	39.7
	FAT/BUC		0		0.0	0.0		91.9	227.0	206.3	0.0	0.0
22	ACT	Lbhd	0.00	20	340	0	0	235.0	12.0	1.0	18.0	4000
	ACT	982	0.0	HPbulb	12.0	0.0	17284	1.00	1.06	0.0		785
	LOC		671	46	11.0	Oil slo e		147.8	0.0	89.8	2	39.7
	FAT/BUC		0		0.0	0.0		103.6	228.1	216.2	221.6	0.0
23	ACT	Lbhd	0.00	20	340	0	0	235.0	12.0	1.0	18.0	4000
	ACT	982	0.0	HPbulb	12.0	0.0	18070	1.00	1.06	0.0		786
	LOC		714	37	11.0	Oil slo e		139.0	0.0	89.8	2	39.8
	FAT/BUC		0		0.0	0.0		115.4	228.1	216.2	221.6	0.0
24	ACT	Lbhd	0.00	20	340	0	0	235.0	12.0	1.0	18.0	4000
	ACT	982	0.0	HPbulb	12.0	0.0	18856	1.00	1.06	0.0		786
	LOC		762	28	11.0	Oil slo e		130.2	0.0	89.8	2	39.8
	FAT/BUC		0		0.0	0.0		127.2	228.1	216.2	221.6	0.0
25	ACT	Lbhd	0.00	20	340	0	0	235.0	12.0	1.0	18.0	4000
	ACT	982	0.0	HPbulb	12.0	0.0	19642	1.00	1.06	0.0		786
	LOC		818	20	11.0	Oil slo e		121.4	0.0	89.8	2	39.8
	FAT/BUC		0		0.0	0.0		139.0	228.1	216.1	221.6	0.0



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 CUADERNA MAESTRA

Ship Id No : proyec

**Local Rule Requirements - Stiffeners (cont.)**

Stiff. No	ACT ACT	POS Za cm³	K c	Type Type	h t (mm)	bf tf (mm)	y z (mm)	SigF f <sub>1</sub> N/mm²	m wk	tkw tkf (mm)	tpl (mm)	span spac (mm)
LOC			Zr cm³	Exc. %	tmin (mm)	Load Ref.		Sigma N/mm²	Sigdb N/mm²	p kN/m²	Comp ref.	a_conn cm²
FAT/BUC			Zrf cm³	Exc. %	pd kN/m²	Sigd N/mm²		SigL N/mm²	Lat N/mm²	Torsion N/mm²	Web N/mm²	bf/ff
26	ACT	Lbhd	0.00	20	370	0	0	235.0	12.0	1.0	30.0	4000
	ACT	1322	0.0	HPbulb	13.0	0.0	20428	1.00	1.06	0.0		786
	LOC		882	49	11.0	Oil slo e		112.6	0.0	89.8	2	39.8
	FAT/BUC		0		0.0	0.0		150.8	228.3	218.3	221.7	0.0
27	ACT	Lbhd	0.00	20	370	0	0	235.0	12.0	1.0	30.0	4000
	ACT	1323	0.0	HPbulb	13.0	0.0	21214	1.00	1.06	0.0		789
	LOC		961	37	11.0	Oil slo e		103.8	0.0	89.8	2	39.9
	FAT/BUC		0		0.0	0.0		162.6	228.3	218.3	221.7	0.0
28	ACT	Lbhd	0.00	20	370	0	0	235.0	12.0	2.0	30.0	4000
	ACT	1323	0.0	HPbulb	13.0	0.0	22007	1.00	1.12	2.0		793
	LOC		1114	18	12.0	Oil slo e		95.0	0.0	89.8	2	40.1
	FAT/BUC		0		0.0	0.0		174.5	228.3	217.0	219.0	0.0
<b>Stringer 7092</b>												
1	ACT	Strng	0.00	10	200	0	20610	235.0	12.0	1.5	12.0	4000
	ACT	194	0.0	Fbar	15.0	0.0	7092	1.00	1.10	1.5		640
	LOC		89	117	11.5	WB slo s		160.0	0.0	15.3	1	5.6
	FAT/BUC		0		0.0	0.0		48.9	205.1	212.8	0.0	0.0
Similar for No(s): 2 3												
<b>Stringer 11796</b>												
1	ACT	Strng	0.00	10	200	0	20610	235.0	12.0	1.5	12.0	4000
	ACT	194	0.0	Fbar	15.0	0.0	11796	1.00	1.10	1.5		640
	LOC		89	117	11.5	WB slo s		160.0	0.0	15.3	1	5.6
	FAT/BUC		0		0.0	0.0		30.0	205.1	213.7	0.0	0.0
Similar for No(s): 2 3												
<b>Stringer 16500</b>												
1	ACT	Strng	0.00	10	200	0	20610	235.0	12.0	1.5	12.0	4000
	ACT	194	0.0	Fbar	15.0	0.0	16500	1.00	1.10	1.5		640
	LOC		89	117	11.5	WB slo s		160.0	0.0	15.3	1	5.6
	FAT/BUC		0		0.0	0.0		91.9	205.1	210.5	0.0	0.0
Similar for No(s): 2 3												
<b>Bottom girder 5810</b>												
1	ACT	DBgird	0.00	10	250	0	5810	235.0	10.0	1.5	18.0	4000
	ACT	314	0.0	Fbar	15.0	0.0	590	1.00	1.10	1.5		705
	LOC		121	159	14.0	WB slo e		115.0	0.0	11.2	1	4.5
	FAT/BUC		0		0.0	0.0		145.6	213.0	208.6	0.0	0.0
2	ACT	DBgird	0.00	10	250	0	5810	235.0	10.0	1.5	18.0	4000
	ACT	317	0.0	Fbar	15.0	0.0	1410	1.00	1.10	1.5		820
	LOC		140	125	14.0	WB slo e		115.0	0.0	11.2	1	5.2
	FAT/BUC		0		0.0	0.0		133.4	211.0	206.0	0.0	0.0
3	ACT	DBgird	0.00	10	250	0	5810	235.0	10.0	1.5	18.0	4000
	ACT	313	0.0	Fbar	15.0	0.0	2230	1.00	1.10	1.5		678
	LOC		116	169	14.0	WB slo e		115.0	0.0	11.2	1	4.4
	FAT/BUC		0		0.0	0.0		121.2	213.4	209.9	0.0	0.0
<b>Bottom girder 11620</b>												
1	ACT	DBgird	0.00	10	250	0	11620	235.0	10.0	1.5	18.0	4000
	ACT	314	0.0	Fbar	15.0	0.0	590	1.00	1.10	1.5		705
	LOC		121	159	14.0	WB slo e		115.0	0.0	11.2	1	4.5
	FAT/BUC		0		0.0	0.0		145.6	213.0	208.6	0.0	0.0
2	ACT	DBgird	0.00	10	250	0	11620	235.0	10.0	1.5	18.0	4000
	ACT	317	0.0	Fbar	15.0	0.0	1410	1.00	1.10	1.5		820
	LOC		140	125	14.0	WB slo e		115.0	0.0	11.2	1	5.2
	FAT/BUC		0		0.0	0.0		133.4	211.0	206.0	0.0	0.0

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Ship Id No : proyec

### Local Rule Requirements - Stiffeners (cont.)

Stiff. No	ACT ACT	POS Za cm <sup>3</sup>	K c	Type Type	h t (mm)	bf tf (mm)	y z (mm)	SigF <sub>f<sub>1</sub></sub> N/mm <sup>2</sup>	m wk	tkw tkf (mm)	tpl (mm)	span spac (mm)
	LOC		Zr cm <sup>3</sup>	Exc. %	tmin (mm)	Load Ref.		Sigma N/mm <sup>2</sup>	Sigdb N/mm <sup>2</sup>	p kN/m <sup>2</sup>	Comp ref.	a_conn cm <sup>2</sup>
	FAT/BUC		Zrf cm <sup>3</sup>	Exc. %	pd kN/m <sup>2</sup>	Sigd N/mm <sup>2</sup>		SigL N/mm <sup>2</sup>	Lat N/mm <sup>2</sup>	Torsion N/mm <sup>2</sup>	Web N/mm <sup>2</sup>	bf/tf
3	ACT	DBgird	0.00	10	250	0	11620	235.0	10.0	1.5	18.0	4000
	ACT	315	0.0	Fbar	15.0	0.0	2230	1.00	1.10	1.5		733
	LOC		125	150	14.0	WB slo e		115.0	0.0	11.2	1	4.7
	FAT/BUC		0		0.0	0.0		121.2	212.5	208.7	0.0	0.0
<b>Bottom girder 16600</b>												
1	ACT	DBgird	0.00	10	250	0	16600	235.0	10.0	1.5	18.0	4000
	ACT	314	0.0	Fbar	15.0	0.0	590	1.00	1.10	1.5		705
	LOC		121	159	14.0	WB slo e		115.0	0.0	11.2	1	4.5
	FAT/BUC		0		0.0	0.0		145.6	213.0	208.6	0.0	0.0
2	ACT	DBgird	0.00	10	250	0	16600	235.0	10.0	1.5	18.0	4000
	ACT	317	0.0	Fbar	15.0	0.0	1410	1.00	1.10	1.5		820
	LOC		140	125	14.0	WB slo e		115.0	0.0	11.2	1	5.2
	FAT/BUC		0		0.0	0.0		133.4	211.0	206.0	0.0	0.0
3	ACT	DBgird	0.00	10	250	0	16600	235.0	10.0	1.5	18.0	4000
	ACT	316	0.0	Fbar	15.0	0.0	2230	1.00	1.10	1.5		780
	LOC		133	136	14.0	WB slo e		115.0	0.0	11.2	1	4.9
	FAT/BUC		0		0.0	0.0		121.2	211.7	207.6	0.0	0.0

## 5.- Estudio de Resistencia Longitudinal.-

Partiendo del peso total de acero calculado para el “**BUQUE PROYECTO**” y considerando que no se modifican las formas de la carena y que el Peso del Armamento se mantiene sensiblemente igual, se ha llevado a cabo un estudio de resistencia longitudinal en dos condiciones críticas como son: la condición de carga que da mayor momento flector en arrufo y la condición de lastre que de mayor momento flector en quebranto. De esta manera comprobamos que los momentos flectores operativos no excederán los valores de diseño.

SISTEMA FORAN MODULO LOAD VERSION 40 DATOS

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CLIENTE - statoil FNAM  
DESCRIPCION DEL BUQUE - c.314-315 y c/083 P.REAL c083

Situacion de carga LIGHT BALLAST

OPCIONES SELECCIONADAS

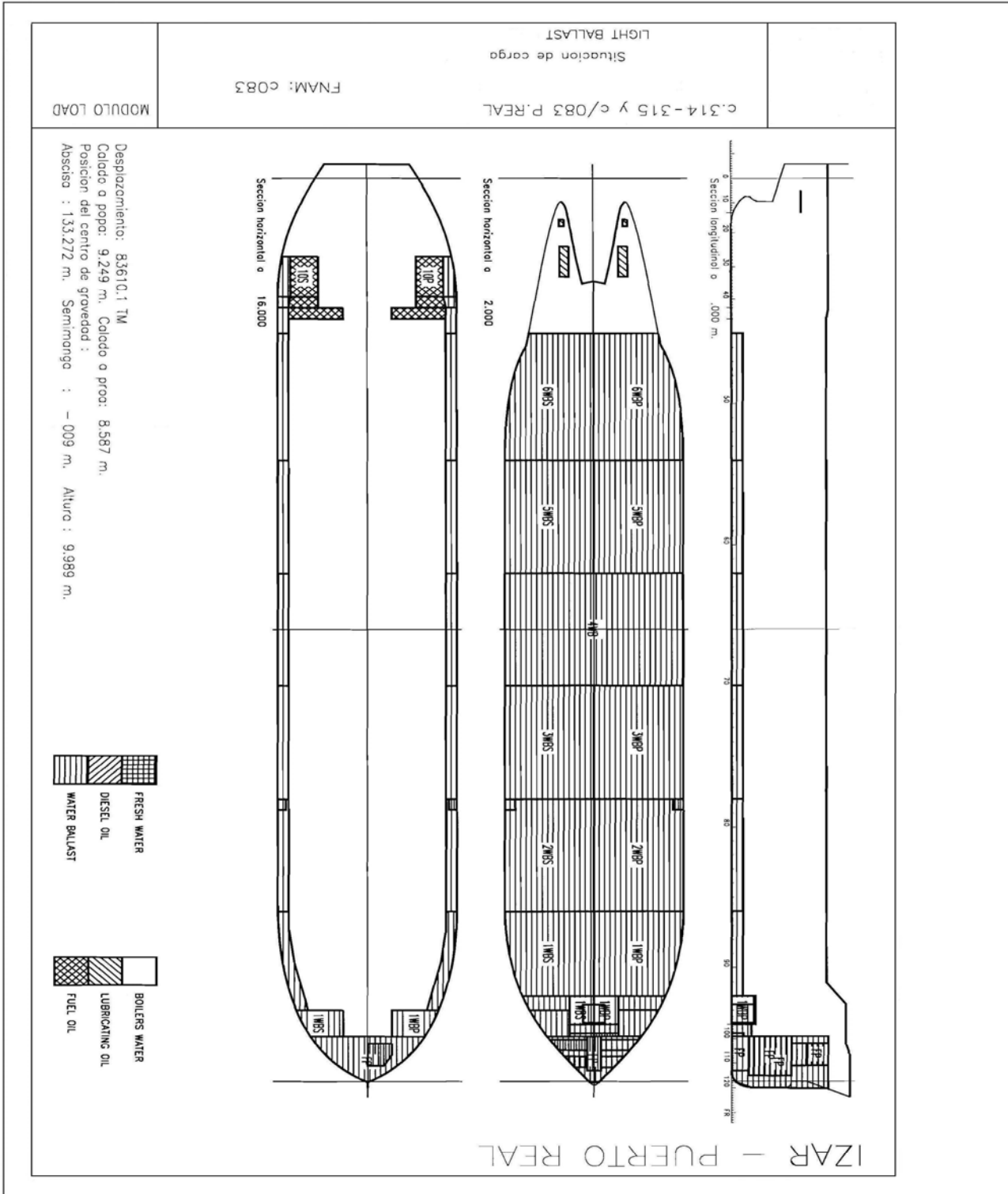
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Flotacion de equilibrio con asiento y escora  
Buque en aguas tranquilas  
Peso especifico del agua de mar : 1.025 T/M3.  
Descuento por gases : 2.0 %  
Espesor de la plancha de quilla : 19 MM  
Altura metacentrica calculada para la flotacion de equilibrio  
Abcisas referidas a la perpendicular de popa  
Abscisa marca calado(Ppp): 0.00 M. Abscisa marca calado(Ppr): 254.90 M.  
No se utilizan las caract. de las secciones del buque (calculo directo)

OPCIONES DE ESTABILIDAD

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Angulos escora: -.00 10.00 15.00 20.00 30.00 40.00 50.00 60.00  
80.00

Criterio de estabilidad IMO seleccionado  
Criterio de IMO de viento Area quilla de balance = 50.00 M2  
Valores KN calculados con trimado libre  
Correccion por superficies libres por momentos escorantes segun IMO  
Correccion por superficies libres considerando escora y trimado  
OPCIONES DE RESISTENCIA LONGITUDINAL

-----  
Se dibuja resistencia longitudinal



SISTEMA FORAN MODULO LOAD VERSION 40 RESULTADOS

-----  
 CLIENTE - statoil  
 DESCRIPCION DEL BUQUE - c.314-315 y c/083 P.REAL

FNAM  
 c083

Situacion de carga

**LIGHT BALLAST**

IDSP	DESCRIP.	WT TONS.	Z.C.G. M	X.C.G. M	INER. M4
	PESO EN ROSCA	28287.0	13.558	114.460	
9P	F-O STORAGE T.PT. (43-44)	529.3	15.510	38.606	356.5
9S	F-O STORAGE T.ST. (43-44)	529.3	15.510	38.606	356.5
10P	F-O STORAGE T.PT. (27-43)	690.5	16.678	28.075	226.2
10S	F-O STORAGE T.ST. (27-43)	679.3	16.585	28.124	139.6
11P	F-O SERVICE T.PT. (39-43)	112.8	19.097	35.401	94.2
11S	F-O SERVICE T.ER. (39-43)	112.8	19.097	35.401	94.2
12P	F-O SETTL.T.PT. (35-39)	135.1	19.102	31.880	113.1
12S	F-O SETTL.T.PT. (35-39)	135.1	19.102	31.880	113.1
13P	D-O SERVICE T.PT. (15-21)	31.0	14.011	13.640	2.6
13S	D-O SERVICE T.ST. (15-21)	31.0	14.011	13.640	2.6
14P	D-O STORAGE T.PT. (15-21)	40.8	14.011	13.640	6.0
14S	D-O STORAGE T ST. (15-21)	40.8	14.011	13.640	6.0
15P	L-O STOR.ME.PT. (15-21)	17.6	14.011	13.640	.5
15S	L-O STOR.ME.ST. (15-21)	17.6	14.011	13.640	.5
16P	L-O CYLIN.TK.PT. (15-21)	39.6	14.011	13.640	5.5
16S	L-O CYLIN.TK.ST. (15-21)	39.6	14.011	13.640	5.5
17P	L-O AA.EE.TK.PT. (15-21)	17.6	14.011	13.640	.5
17S	L-O AA.EE.TK.ST. (15-21)	17.6	14.011	13.640	.5
18P	SUMP OIL TK. PT. (24-33)	17.2	1.669	23.720	7.6
18S	SUMP OIL TK. ST. (24-33)	17.2	1.669	23.720	7.6
24P	DRINKING WATER PT. (5-14)	129.1	19.650	6.650	19.2
24S	DRINKING WATER ST. (5-14)	129.1	19.650	6.650	19.2
25P	BOILLER WATER PT. (5-14)	64.6	19.650	6.650	2.4
25S	BOILLER WATER ST. (5-14)	129.1	19.650	6.650	19.2
28P	OIL TANK C.P.P. PT.	2.0	2.203	12.680	.2
28S	OIL TANK C.P.P. ST.	2.0	2.203	12.680	.2
4WB	N.4 W.BALLAST T(62-70)	7277.1	6.345	128.200	
1WBP	N.1 W.BALLAST T.P(86-99)	4894.8	8.424	228.324	
1WBS	N.1 W.BALLAST T.S(86-99)	4894.8	8.424	228.324	
2WBP	N.2 W.BALLAST T.P(78-86)	3504.2	6.180	192.752	
2WBS	N.2 W.BALLAST T.S(78-86)	3504.2	6.180	192.752	
3WBP	N.3 W.BALLAST T.P(70-78)	3638.6	6.345	160.200	
3WBS	N.3 W.BALLAST T.S(70-78)	3638.6	6.345	160.200	
5WBP	N.5 W.BALLAST T.P(54-62)	3637.6	6.346	96.204	
5WBS	N.5 W.BALLAST T.S(54-62)	3637.6	6.346	96.204	
6WBP	N.6 W.BALLAST T.P(43-54)	4299.1	7.263	60.676	
6WBS	N.6 W.BALLAST T.S(43-54)	4299.1	7.263	60.676	
7WBP	N.7 W.BALLAST T.P(27-43)	440.5	16.807	30.136	
7WBS	N.7 W.BALLAST T.S(27-43)	440.5	16.807	30.136	
FP	FORE PEAK (98-FWD)	3473.5	13.685	248.998	
	CREW & EFFECTS	5.0	30.000	29.640	
	PROVISIONS	5.0	24.250	26.600	
	STORES	25.0	23.500	128.150	
	DESPLAZAMIENTO	83610.1	9.989	133.272	
	C.G. S/BASE (CORREGIDO SUP. LIBRE)		10.008		

Abscisas referidas a la perpendicular de popa



SISTEMA FORAN MODULO LOAD VERSION 40 RESULTADOS

-----  
 CLIENTE - statoil FNAM  
 DESCRIPCION DEL BUQUE - c.314-315 y c/083 P.REAL c083

Situacion de carga	LIGHT BALLAST		
	PESO	CENTRO DE	GRAVEDAD
CONTENIDO	TM.	S/BASE M.	A PPP M.
-----	-----	-----	-----
WATER BALLAST	51580.2	7.543	151.179
FUEL OIL	2924.2	16.644	32.816
DIESEL OIL	143.6	14.011	13.640
LUBRICATING OIL	188.1	11.500	15.461
FRESH WATER	258.3	19.650	6.650
BOILERS WATER	193.7	19.650	6.650
CREW & EFECTS	35.0	24.536	99.570
-----	-----	-----	-----
PESO MUERTO	55323.1	8.164	142.891
PESO EN ROSCA	28287.0	13.558	114.460
-----	-----	-----	-----
DESPLAZAMIENTO	83610.1	9.989	133.272
-----	-----	-----	-----

SISTEMA FORAN MODULO LOAD VERSION 40

RESULTADOS

-----  
CLIENTE - statoil  
DESCRIPCION DEL BUQUE - c.314-315 y c/083 P.REAL

FNAM  
c083

Situacion de carga LIGHT BALLAST

FLOTACION DE EQUILIBRIO

```

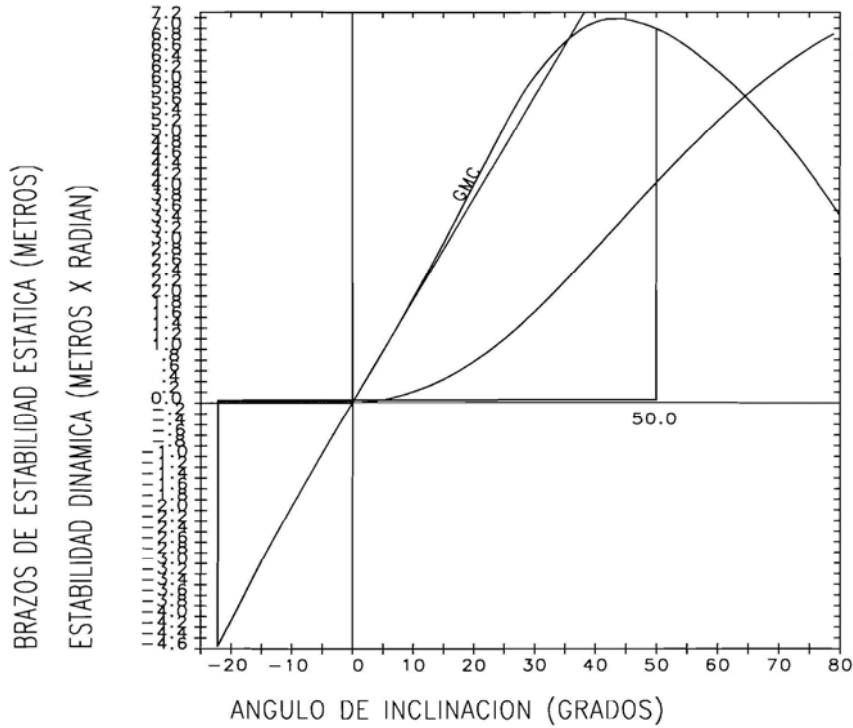
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CALADOS (TRAZADO)                PERPENDICULAR DE POPA = 9.249 M
                                   PERPENDICULAR DE PROA = 8.587 M
                                   MEDIO = 8.918 M
CALADOS (CANTO BAJO DE LA QUILLA) PERPENDICULAR DE POPA = 9.268 M
                                   PERPENDICULAR DE PROA = 8.606 M
                                   MEDIO = 8.937 M
                                   ASIENTO (POPA) = .661 M
CALADOS (EN LAS MARCAS)          PERPENDICULAR DE POPA = 9.268 M
                                   PERPENDICULAR DE PROA = 8.610 M
CALADOS (EN LAS MARCAS)          PERPENDICULAR DE POPA = 9.268 M
  (REFERIDOS A LA LINEA BASE)    PERPENDICULAR DE PROA = 8.610 M
                                   MOMENTO PARA CAMBIAR EL TRIMADO 1 CM MCT = 1712.5 T
                                   ANGULO DE ESCORA = -.000 G
CENTRO DE GRAVEDAD (P.P.) LCG = 133.272 M KG = 9.989 M
                                   TG = -.009 M
CENTRO DE CARENA (P.P.) LCB = 133.257 M KB = 4.564 M
CENTRO DE FLOTACION (P.P.) LCF = 131.436 M
                                   ALTURA METACENTRICA GM = 10.955 M
                                   ALTURA METACENTRICA CORREGIDA GMC = 10.936 M
                                   METACENTRO TRANSVERSAL KM = 20.944 M
  
```

CURVAS DE ESTABILIDAD

```

=====
ANG      KN      GZ      DN
(DEG)   (M)      (M)      MM*RADIAN
=====
-.00    .000    .000    .00
10.00   3.668   1.943   167.12
15.00   5.554   2.977   381.40
20.00   7.486   4.078   689.23
30.00  11.079   6.093  1585.85
40.00  13.528   7.114  2753.83
50.00  14.640   6.994  3998.08
60.00  14.858   6.210  5157.93
80.00  13.368   3.512  6898.71
  
```

IZAR – PUERTO REAL



CRITERIO DE VIENTO DE IMO

Situacion de carga	<b>LIGHT BALLAST</b>
DESPLAZAMIENTO	= 83610.1 TONELADAS
ANGULO DE GZ MAXIMO	= 43.3 GRADOS
GZ MAXIMO	= 7.183 METROS
ALTURA METACENTRICA CORREGIDA	= 10.936 METROS
AREA A= 50.283 GR*M	AREA B= 226.391 GR*M
ANGULO DE ESCORA	= .191 GRADOS
ANGULO DE BALANCE	= 22.409 GRADOS
ANGULO LIMITE	= 50.000 GRADOS

c.314–315 y c/083 P.REAL

FNAM: c083

MODULO LOAD

CURVAS DE ESTABILIDAD

1 CM= 1.0 M

SISTEMA FORAN MODULO LOAD VERSION 40 RESULTADOS

-----  
 CLIENTE - statoil FNAM  
 DESCRIPCION DEL BUQUE - c.314-315 y c/083 P.REAL c083

\*\*\*\*\* CRITERIO DE IMO \*\*\*\*\*

SE CUMPLE EL CRITERIO DE IMO

Item	Valor Real	Valor Limite	
MAXIMO BRAZO ADRIZANTE = 7.183 M. A =	43.3 GR.	25.0 GR.	OK
MAXIMO GZ ENTRE 30.0 GR. - 80.0 GR. =	7.183 M.	.200 M.	OK
ESTAB. DINAMICA ENTRE .0 GR. - 30.0 GR. =	1585.8 MM*RAD	55.0 MM*RAD	OK
ESTAB. DINAMICA ENTRE .0 GR. - 40.0 GR. =	2753.8 MM*RAD	90.0 MM*RAD	OK
ESTAB. DINAMICA ENTRE 30.0 GR. - 40.0 GR. =	1168.0 MM*RAD	30.0 MM*RAD	OK
GM - ALTURA METACENTRICA CORREGIDA =	10.9 M.	.150 M.	OK

SE CUMPLE EL CRITERIO DE VIENTO DE IMO

AREA B = 226.391 GR\*M MAYOR QUE AREA A = 50.283 GR\*M  
 ANGULO DE ESCORA = .19 GR ANGULO DE BALANCE = 22.41 GR  
 ANGULO LIMITE = 50.00 GR BRAZO VIENTO CONSTANTE = .036 M  
 AREA EXPUESTA AL VIENTO = 4269.49 M2 ALTURA C. DE GRAVEDAD 18.208 M

RESISTENCIA LONGITUDINAL

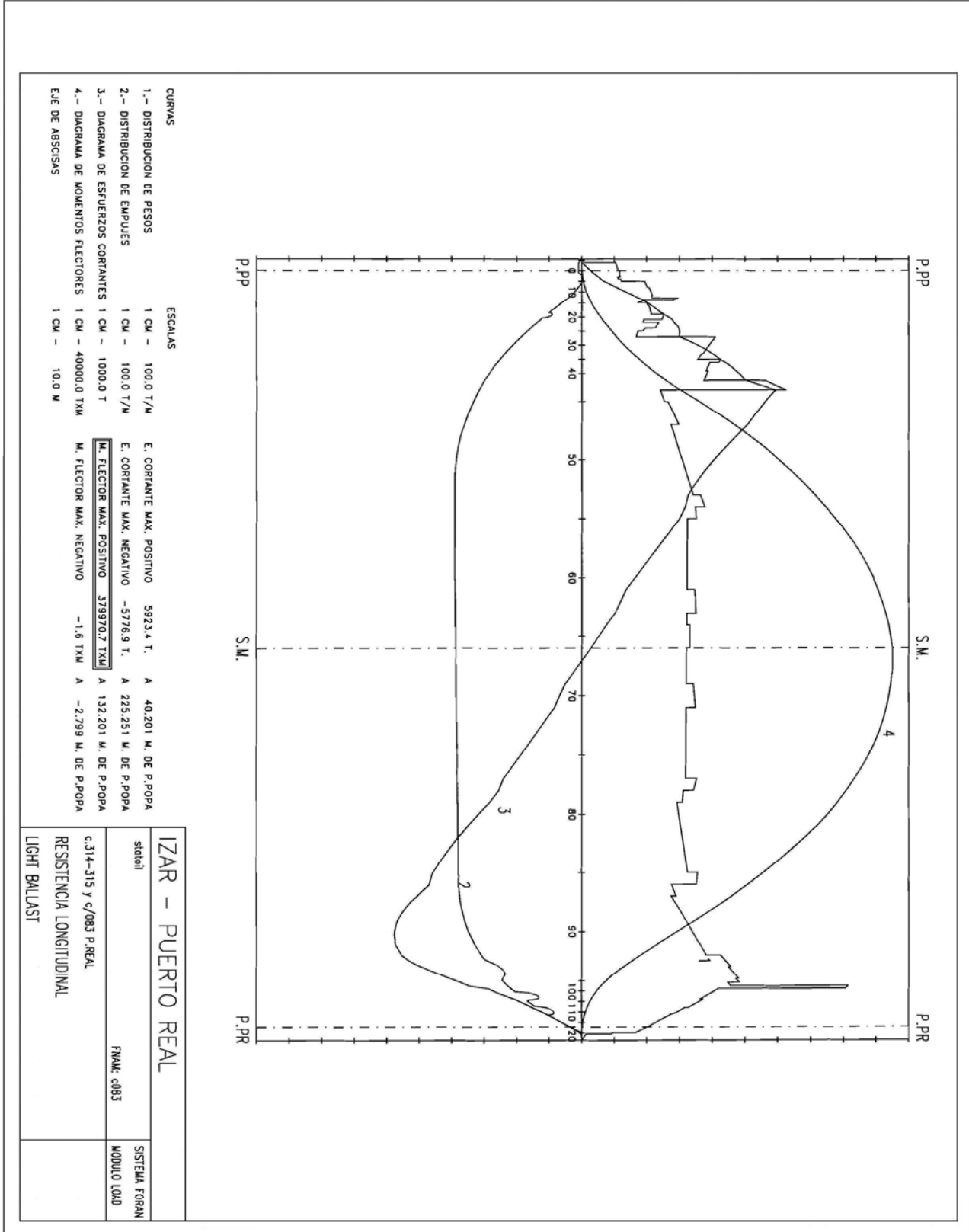
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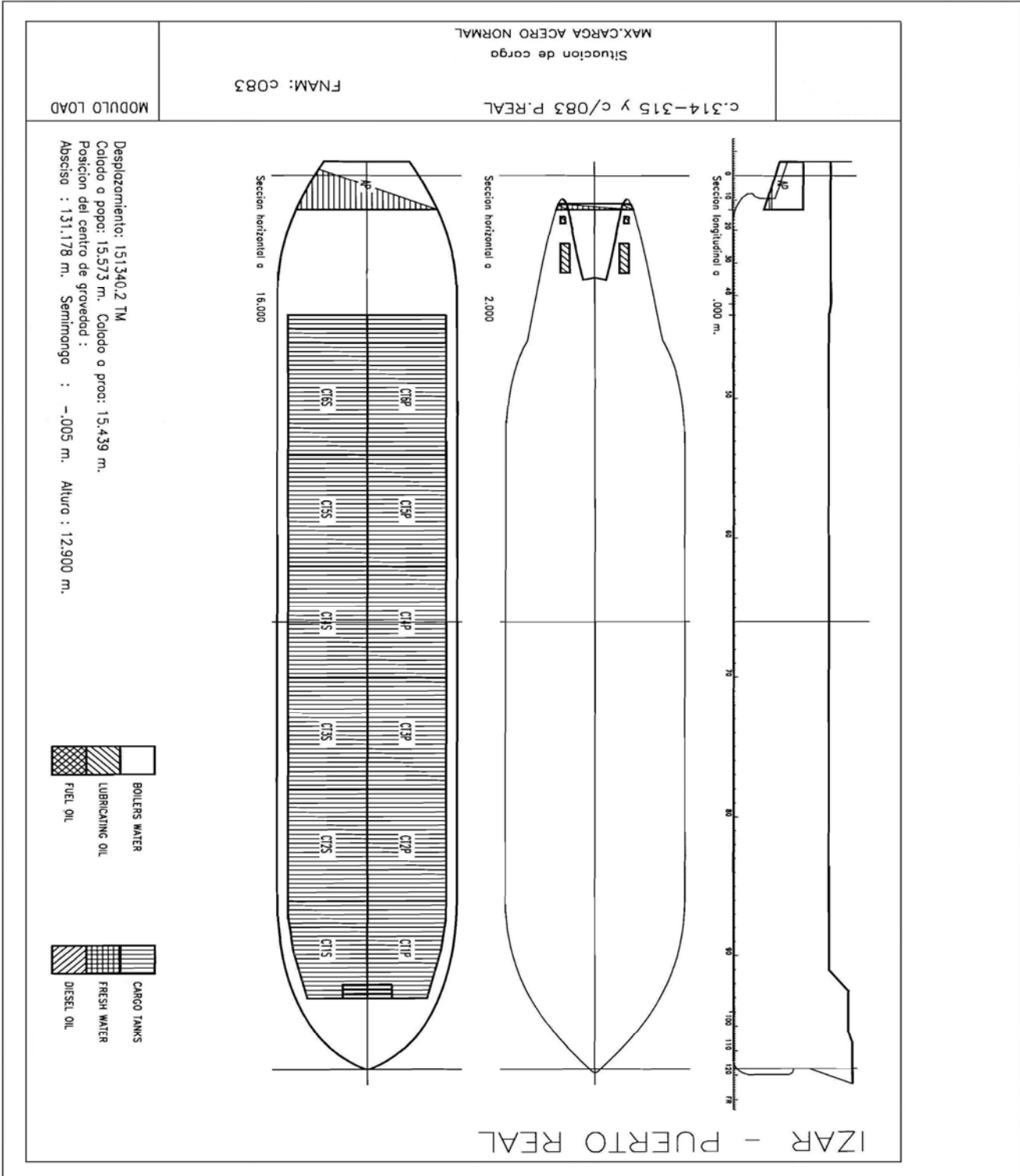
Situacion de carga

**LIGHT BALLAST**

	VALOR (-ARRUFO/+QUEBRANTO)	CNA. NUMERO	ABSCISA A PERP. POPA
ESFUERZO CORTANTE MAXIMO POSITIVO	5923.39 T.	44.000	40.200 M.
ESFUERZO CORTANTE MAXIMO NEGATIVO	-5776.94 T.	90.263	225.250 M.
<b>MOMENTO FLECTOR MAXIMO POSITIVO</b>	<b>379970.74 TxM</b>	67.000	132.200 M.
MOMENTO FLECTOR MAXIMO NEGATIVO	-1.63 TxM	-4.000	-2.800 M.

CUADERNA	DISTANCIA	ESFUERZO CORTANTE (T)	MOMENTO FLECTOR (TxM)
46	.000	5336.15	166201.12
54	.000	3166.50	297907.74
62	.000	1180.47	367331.71
70	.000	-684.70	375579.70
78	.000	-2556.81	323457.31
86	.000	-4702.22	203081.10
92	.000	-5538.59	71681.76







SISTEMA FORAN MODULO LOAD VERSION 40

RESULTADOS

-----  
CLIENTE - statoil  
DESCRIPCION DEL BUQUE - c.314-315 y c/083 P.REAL

FNAM  
c083

Situacion de carga

MAX.CARGA ACERO NORMAL

IDSP	DESCRIP.	WT TONS.	Z.C.G. M	X.C.G. M	INER. M4
	PESO EN ROSCA	28287.0	13.558	114.460	
11P	F-O SERVICE T.PT. (39-43)	112.8	19.097	35.401	94.2
11S	F-O SERVICE T.ER. (39-43)	112.8	19.097	35.401	94.2
12P	F-O SETTL.T.PT. (35-39)	33.7	17.157	31.880	113.1
12S	F-O SETTL.T.PT. (35-39)	33.7	17.157	31.880	113.1
13P	D-O SERVICE T.PT. (15-21)	7.2	12.694	13.640	2.6
13S	D-O SERVICE T.ST. (15-21)	7.2	12.694	13.640	2.6
15P	L-O STOR.ME.PT. (15-21)	17.6	14.011	13.640	.5
15S	L-O STOR.ME.ST. (15-21)	17.6	14.011	13.640	.5
16P	L-O CYLIN.TK.PT. (15-21)	39.6	14.011	13.640	5.5
16S	L-O CYLIN.TK.ST. (15-21)	39.6	14.011	13.640	5.5
17P	L-O AA.EE.TK.PT. (15-21)	17.6	14.011	13.640	.5
17S	L-O AA.EE.TK.ST. (15-21)	17.6	14.011	13.640	.5
18P	SUMP OIL TK. PT. (24-33)	17.2	1.669	23.720	7.6
18S	SUMP OIL TK. ST. (24-33)	17.2	1.669	23.720	7.6
24P	DRINKING WATER PT. (5-14)	12.9	16.815	6.650	19.2
24S	DRINKING WATER ST. (5-14)	12.9	16.815	6.650	19.2
25P	BOILLER WATER PT. (5-14)	6.5	16.815	6.650	2.4
25S	BOILLER WATER ST. (5-14)	12.9	16.815	6.650	19.2
28P	OIL TANK C.P.P. PT.	2.0	2.203	12.680	.2
28S	OIL TANK C.P.P. ST.	2.0	2.203	12.680	.2
AP	AFTER PEAK W.B. (PP-14)	1549.5	13.295	4.187	24150.2
CT1P	N.1 CARGO TANK PT. (86-93)	7705.0	12.688	220.874	10236.2
CT1S	N.1 CARGO TANK ST. (86-93)	7714.2	12.693	220.874	10088.0
CT2P	N.2 CARGO TANK PT. (78-86)	10139.5	12.661	192.203	15181.7
CT2S	N.2 CARGO TANK ST. (78-86)	10151.7	12.667	192.203	14839.7
CT3P	N.3 CARGO TANK PT. (70-78)	10139.5	12.661	160.203	15181.7
CT3S	N.3 CARGO TANK ST. (70-78)	10151.7	12.667	160.203	14839.7
CT4P	N.4 CARGO TANK PT. (62-70)	10139.5	12.661	128.203	15181.8
CT4S	N.4 CARGO TANK ST. (62-70)	10151.7	12.667	128.203	14839.7
CT5P	N.5 CARGO TANK PT. (54-62)	10139.5	12.661	96.203	15181.6
CT5S	N.5 CARGO TANK ST. (54-62)	10151.7	12.667	96.203	14839.6
CT6P	N.6 CARGO TANK PT. (46-54)	10038.3	12.731	64.319	15059.3
CT6S	N.6 CARGO TANK ST. (46-54)	10050.3	12.737	64.319	14721.5
STP	SLOP CARGO TANK P (44-46)	2127.8	13.966	44.461	3188.7
STS	SLOP CARGO TANK S (44-46)	2132.0	13.963	44.461	3225.9
	CREW & EFFECTS	5.0	30.000	29.640	
	PROVISIONS	.5	24.250	26.600	
	STORES	25.0	23.500	128.150	
	DESPLAZAMIENTO	151340.2	12.900	131.178	
	C.G. S/BASE (CORREGIDO SUP. LIBRE)		14.099		

Abscisas referidas a la perpendicular de popa

SISTEMA FORAN MODULO LOAD VERSION 40

RESULTADOS

-----  
 CLIENTE - statoil  
 DESCRIPCION DEL BUQUE - c.314-315 y c/083 P.REAL

FNAM  
 c083

Situacion de carga

MAX.CARGA ACERO NORMAL

CONTENIDO	PESO CENTRO DE GRAVEDAD		
	TM.	S/BASE M.	A PPP M.
-----	-----	-----	-----
WATER BALLAST	1549.5	13.295	4.187
FUEL OIL	293.0	18.651	34.591
DIESEL OIL	14.4	12.694	13.640
LUBRICATING OIL	188.1	11.500	15.461
FRESH WATER	25.8	16.815	6.650
BOILERS WATER	19.4	16.815	6.650
CARGO TANKS	120932.5	12.725	137.196
CREW & EFFECTS	30.5	24.578	110.336
-----	-----	-----	-----
PESO MUERTO	123053.2	12.749	135.021
PESO EN ROSCA	28287.0	13.558	114.460
-----	-----	-----	-----
DESPLAZAMIENTO	151340.2	12.900	131.178
-----	-----	-----	-----

SISTEMA FORAN MODULO LOAD VERSION 40 RESULTADOS

-----  
 CLIENTE - statoil FNAM  
 DESCRIPCION DEL BUQUE - c.314-315 y c/083 P.REAL c083

Situacion de carga MAX.CARGA ACERO NORMAL

FLOTACION DE EQUILIBRIO

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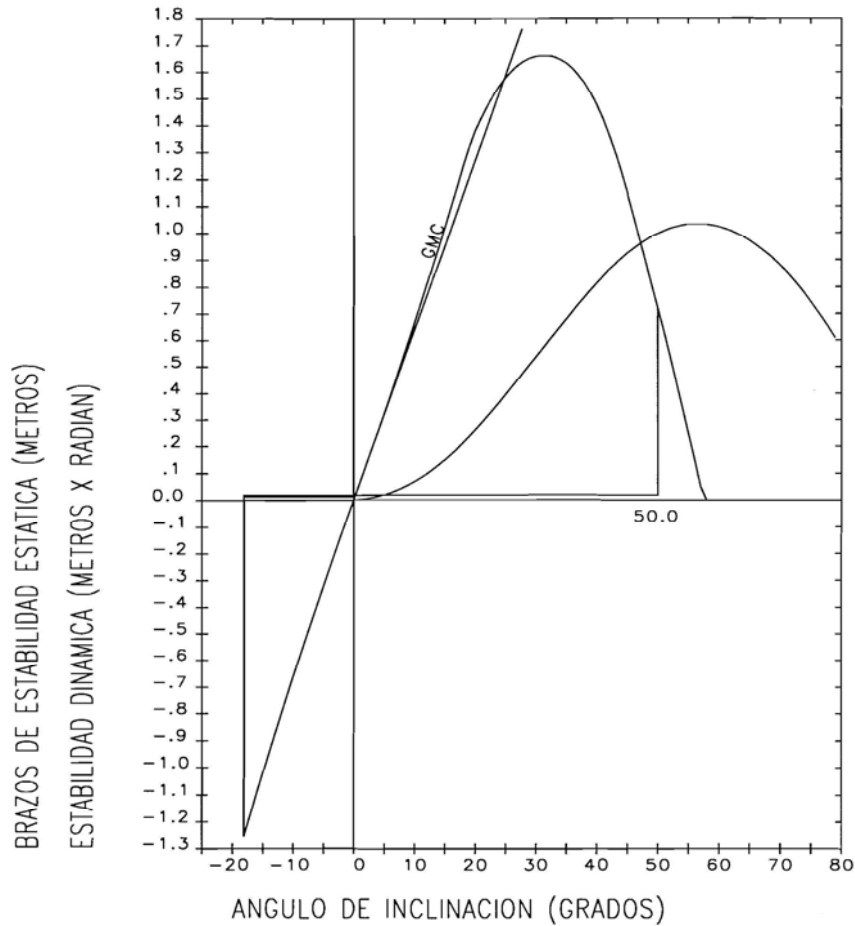
=====
CALADOS (TRAZADO)                PERPENDICULAR DE POPA = 15.573 M
                                   PERPENDICULAR DE PROA = 15.439 M
                                   MEDIO = 15.506 M
CALADOS (CANTO BAJO DE LA QUILLA) PERPENDICULAR DE POPA = 15.592 M
                                   PERPENDICULAR DE PROA = 15.458 M
                                   MEDIO = 15.525 M
                                   ASIENTO (POPA) = .134 M
CALADOS (EN LAS MARCAS)          PERPENDICULAR DE POPA = 15.592 M
                                   PERPENDICULAR DE PROA = 15.459 M
CALADOS (EN LAS MARCAS)          PERPENDICULAR DE POPA = 15.592 M
  (REFERIDOS A LA LINEA BASE)    PERPENDICULAR DE PROA = 15.459 M
                                   MOMENTO PARA CAMBIAR EL TRIMADO 1 CM MCT = 2037.4 T
                                   ANGULO DE ESCORA = -.000 G
CENTRO DE GRAVEDAD (P.P.) LCG = 131.178 M KG = 12.900 M
                                   TG = -.005 M
CENTRO DE CARENA (P.P.) LCB = 131.175 M KB = 8.004 M
CENTRO DE FLOTACION (P.P.) LCF = 124.034 M
                                   ALTURA METACENTRICA GM = 4.832 M
                                   ALTURA METACENTRICA CORREGIDA GMC = 3.633 M
                                   METACENTRO TRANSVERSAL KM = 17.732 M
  
```

CURVAS DE ESTABILIDAD

```

=====
      ANG      KN      GZ      DN
      (DEG)    (M)      (M)      MM*RADIAN
      =====
      -.00      .000      .000      .00
      10.00     3.099      .661      56.55
      15.00     4.663      1.021     129.88
      20.00     6.207      1.380     235.20
      30.00     8.772      1.658     507.02
      40.00    10.755      1.478     788.19
      50.00    12.064      .723     986.01
      60.00    12.747     -.246    1029.13
      80.00    12.616     -2.149     609.77
  
```

IZAR – PUERTO REAL



CRITERIO DE VIENTO DE IMO

Situacion de carga "CES3" MAX.CARGA ACERO NORMAL  
 DESPLAZAMIENTO = 151340.2 TONELADAS  
 ANGULO DE GZ MAXIMO = 31.3 GRADOS  
 GZ MAXIMO = 1.661 METROS  
 ALTURA METACENTRICA CORREGIDA = 3.633 METROS  
 AREA A= 11.313 GR\*M AREA B= 55.558 GR\*M  
 ANGULO DE ESCORA = .198 GRADOS  
 ANGULO DE BALANCE = 18.298 GRADOS  
 ANGULO LIMITE = 50.000 GRADOS

FECHA 05.04.01	c.314 -315 y c/083 P.REAL	FNAM: c083	MODULO LOAD
HORA 09:37:03	CURVAS DE ESTABILIDAD		1 CM= .200 M

SISTEMA FORAN MODULO LOAD VERSION 40 RESULTADOS

-----  
 CLIENTE - statoil FNAME  
 DESCRIPCION DEL BUQUE - c.314-315 y c/083 P.REAL c083

\*\*\*\*\* CRITERIO DE IMO \*\*\*\*\*

SE CUMPLE EL CRITERIO DE IMO

Item	Valor Real	Valor Limite	
MAXIMO BRAZO ADRIZANTE = 1.661 M. A =	31.3 GR.	25.0 GR.	OK
MAXIMO GZ ENTRE 30.0 GR. - 80.0 GR. =	1.661 M.	.200 M.	OK
ESTAB. DINAMICA ENTRE .0 GR. - 30.0 GR. =	507.0 MM*RAD	55.0 MM*RAD	OK
ESTAB. DINAMICA ENTRE .0 GR. - 40.0 GR. =	788.2 MM*RAD	90.0 MM*RAD	OK
ESTAB. DINAMICA ENTRE 30.0 GR. - 40.0 GR. =	281.2 MM*RAD	30.0 MM*RAD	OK
GM - ALTURA METACENTRICA CORREGIDA =	3.6 M.	.150 M.	OK

SE CUMPLE EL CRITERIO DE VIENTO DE IMO

AREA B = 55.558 GR\*M MAYOR QUE AREA A = 11.313 GR\*M  
 ANGULO DE ESCORA = .20 GR ANGULO DE BALANCE = 18.30 GR  
 ANGULO LIMITE = 50.00 GR BRAZO VIENTO CONSTANTE = .013 M  
 AREA EXPUESTA AL VIENTO = 2553.60 M2 ALTURA C. DE GRAVEDAD 22.234 M

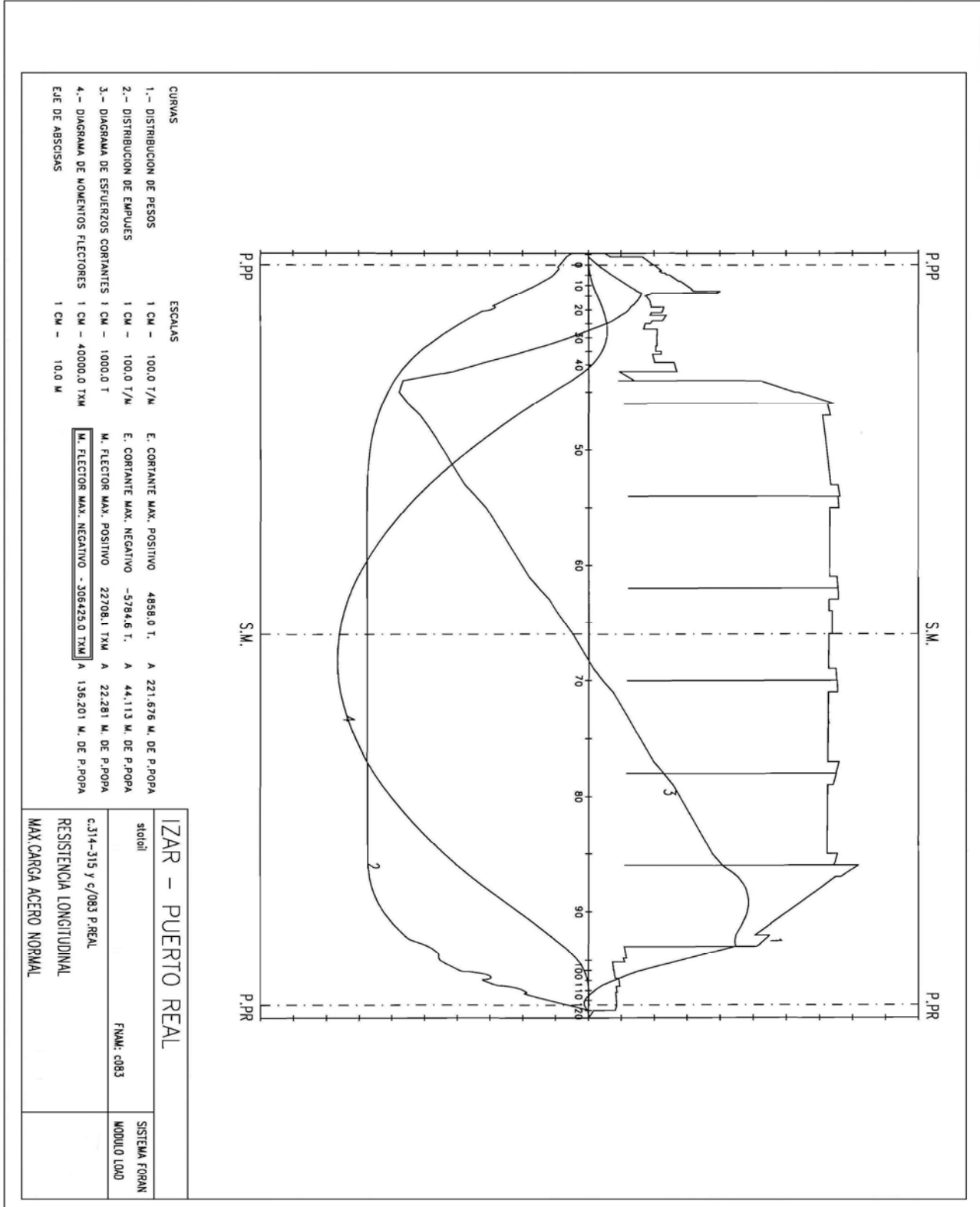
RESISTENCIA LONGITUDINAL

=====  
 Situacion de carga

**MAX.CARGA ACERO NORMAL**

	VALOR (-ARRUFO/+QUEBRANTO)	CNA. NUMERO	ABSCISA A PERP. POPA
ESFUERZO CORTANTE MAXIMO POSITIVO	4858.00 T.	89.369	221.675 M.
ESFUERZO CORTANTE MAXIMO NEGATIVO	-5784.59 T.	44.978	44.113 M.
MOMENTO FLECTOR MAXIMO POSITIVO	22708.08 T×M	27.000	22.280 M.
<b>MOMENTO FLECTOR MAXIMO NEGATIVO</b>	<b>-306425.00 T×M</b>	68.000	136.200 M.

CUADERNA	DISTANCIA	ESFUERZO CORTANTE (T)	MOMENTO FLECTOR (T×M)
46	.000	-5505.08	-66817.46
54	.000	-3442.30	-209245.90
62	.000	-1513.86	-288462.12
70	.000	441.77	-305120.30
78	.000	2298.98	-261344.60
86	.000	4060.17	-159835.10
92	.000	4474.61	-47985.20





### **Peso de Acero del Buque Base**

	kg
Pique de Popa y timón	843.216
Cámara de Máquinas	1.902.369
Cámara de Bombas	757.397
Fondos Centrales	2.572.110
Fondos Laterales	2.800.842
Tanques Laterales	2.059.770
Mamparos Transversales	2.387.872
Cubiertas Centrales	3.987.521
Pique de Proa	2.333.161
Superestructura	711.477
Peso Acero Teórico	20.355.735

## Rediseño de la Estructura de un Shuttle Tanker

### Cálculo del Coste Diferencial

		Buque Base		Buque Proyecto			
Peso de Acero Teórico (t)		20.356		22.586			
% de exceso de laminación		1,2%		1,2%			
Peso de Acero Neto (t)		20.600		22.857			
% material aportación soldadura		1,5%		1,5%			
% de chatarra supuesto		16,0%		16,0%			
Peso de Acero Bruto (t)		24.524		27.211			
% de chapa		76,0%		76,0%			
% de perfiles		24,0%		24,0%			
		miles de €		miles de €			
<b>A) MATERIALES</b>							
<b>Item</b>	<b>€/kg</b>	<b>%</b>	<b>Peso (t)</b>		<b>%</b>	<b>Peso (t)</b>	
Chapa "A"	0,41	70,0%	13.047	5.349	97,0%	20.060	8.225
Chapa "AH"	0,46	27,0%	5.032	2.315	0,0%	0	0
Chapa, otras calidades	0,47	3,0%	559	263	3,0%	620	292
Peso Bruto de Chapa (t) ...			18.638			20.680	
Perfiles "A"	0,55	64,0%	3.767	2.072	99,0%	6.465	3.556
Perfiles "AH"	0,59	35,0%	2.060	1.215	0,0%	0	0
Perfiles, otras calidades	0,76	1,0%	59	45	1,0%	65	50
Peso Bruto de Perfiles (t) ...			5.886			6.531	
Planchas y perfiles ...				11.259			12.122
Material aportación	9,01		309,0	2.784		342,9	3.089
<u>Coste de los materiales ...</u>				<b>14.043</b>			<b>15.211</b>
<b>B) TRANSFORMACIONES</b>							
Horas/tonelada de Acero Neto			25			25	
Horas construcción del casco			515.007			571.426	
Coste hora (€)			39,0658			39,0658	
<u>Coste de la mano de obra ...</u>				<b>20.119</b>			<b>22.323</b>
<b>C) GASTOS GENERALES ...</b>		2,5%		<b>854</b>			<b>938</b>
<b><u>COSTE total del casco: ...</u></b>				<b>35.016</b>			<b>38.472</b>
		miles de €		5.826,2			6.401,3
		(millones de pts.)					
				<b>3,456</b>		millones de €	
				575,1		(millones de pts.)	

## Cálculo del Coste Diferencial

	Buque Base				Buque Proyecto			
Peso de Acero Teórico (t)			20.356				22.586	
% de exceso de laminación			1,2%				1,2%	
Peso de Acero Neto (t)			20.600				22.857	
% material aportación soldadura			1,5%				1,5%	
% de chatarra supuesto			16,0%				16,0%	
Peso de Acero Bruto (t)			24.524				27.211	
% de chapa			76,0%				76,0%	
% de perfiles			24,0%				24,0%	
<b>A) MATERIALES</b>				miles de €			miles de €	
<b>Item</b>	€/kg	%	Peso (t)		%	Peso (t)		
Chapa "A"	0,41	70,0%	13.047	5.349	97,0%	20.060	8.225	
Chapa "AH"	0,46	27,0%	5.032	2.315	0,0%	0	0	
Chapa, otras calidades	0,47	3,0%	559	263	3,0%	620	292	
Peso Bruto de Chapa (t) ...			18.638			20.680		
Perfiles "A"	0,55	64,0%	3.767	2.072	99,0%	6.465	3.556	
Perfiles "AH"	0,59	35,0%	2.060	1.215	0,0%	0	0	
Perfiles, otras calidades	0,76	1,0%	59	45	1,0%	65	50	
Peso Bruto de Perfiles (t) ...			5.886			6.531		
Planchas y perfiles ...				11.259			12.122	
Material aportación	9,01		309,0	2.784		342,9	3.089	
<u>Coste de los materiales ...</u>				<b>14.043</b>			<b>15.211</b>	
<b>B) TRANSFORMACIONES</b>								
Horas/tonelada de Acero Neto			25			25		
Horas construcción del casco			515.007			571.426		
Coste hora (€)			39,0658			39,0658		
<u>Coste de la mano de obra ...</u>				<b>20.119</b>			<b>22.323</b>	
<b>C) GASTOS GENERALES ...</b>		2,5%		<b>854</b>			<b>938</b>	
<b><u>COSTE total del casco: ...</u></b>				<b>35.016</b>			<b>38.472</b>	
			miles de €	5.826,2			6.401,3	
			(millones de pts.)					
			<b><u>COSTE DIFERENCIAL:</u></b>	<b>3,456</b>		millones de €		
				575,1		(millones de pts.)		

# **Anexo II**

# **“Dibujos”**

## 1.- BUQUE BASE:

A continuación se muestran los planos del “**BUQUE BASE**”:

- **Hoja 1 : Características principales.**
- **Hoja 2: Geometría y espaciado de refuerzos longitudinales.**
- **Hoja 3: Escantillonado y calidad de planchas.**
- **Hoja 4: Escantillonado y calidad de refuerzos.**

### **Nota.-**

Los planos que se incorporan en este documento están fuera de escala,  
Estos mismos planos se incluyen a su escala en formatos A3 después de este documento.

NOTAS

TODO EL MATERIAL SERA DE LIMITE ELASTICO DE 235 N/mm<sup>2</sup> (EXCEPTO DONDE SE INDICA)

MAXIMO MOMENTO FLECTOR EN AGUAS TRANQUILAS(CONSIDERADO)

CONDICION EN ARRUFO \_\_\_\_\_ 407000 T\*M  
 CONDICION EN QUEBRANTO \_\_\_\_\_ 418000 T\*M

MOMENTO FLECTOR EN LA OLA: LOS REGLAMENTARIOS.

CARACTERISTICAS

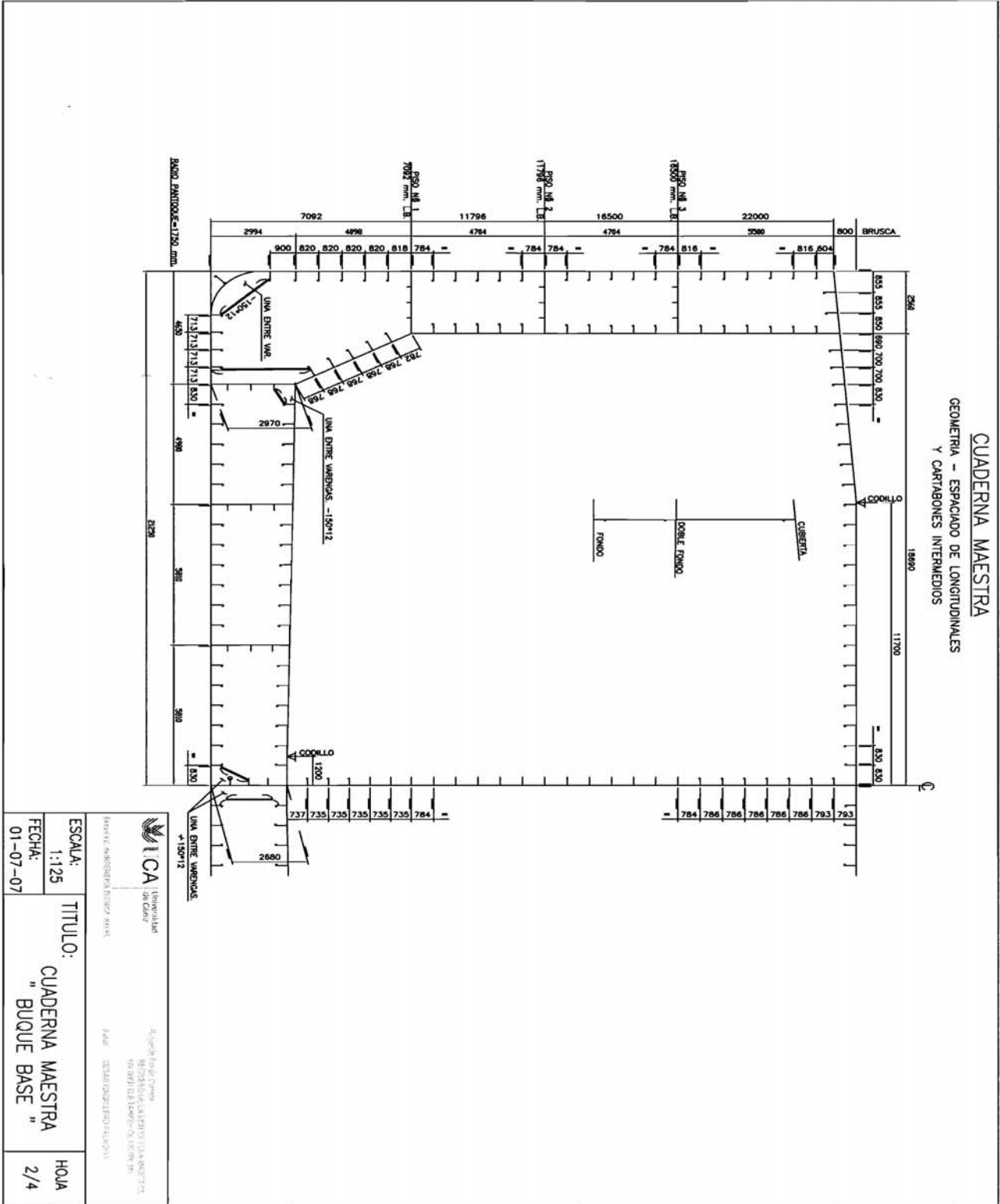
ESLORA TOTAL ----- 265.00 MTS.  
 ESLORA EN LA FLOTACION AL CALADO DE 15.50 ----- 260.50 =  
 ESLORA ENTRE PERPENDICULARES AL CALADO DE 15.50 ----- 256.50 =  
 ESLORA DE ESCANTILLONADO ----- 252.69 =  
 MANGA DE TRAZADO ----- 42.50 =  
 PUNTA (AL COSTADO) ----- 22.00 =  
 CALADO DE DISEÑO ----- 15.00 =  
 CALADO DE ESCANTILLONADO ----- 15.50 MTS.  
 COEFICIENTE DE BLOQUE (PARA ESLORA DE ESCANTILLONES) ----- 0.879  
 ESPACIADO TRANSVERSAL ----- 4.00 MTS  
 VELOCIDAD MAXIMA EN SERVICIO ----- 14.50 N.

CLASIFICACION

DET NORSE VERITAS **+1A1**  
 "TANKER FOR OIL" ESP. EQ. BOW LOADING,  
 OPP-F, ICS, W/F-AMC, DYMPOS AUTR, CSA-1(NORTH ATLANTIC) HEDK SH, SBM  
 ADDITIONALY, THE VESSEL SHALL COMPLY WITH THE REQUIREMENTS FOR THE  
 PREVIOUS D.N.V. "BIS" NOTATION  
 THE FATIGUE LIFE SHALL BE MINIMUM 20 YEARS

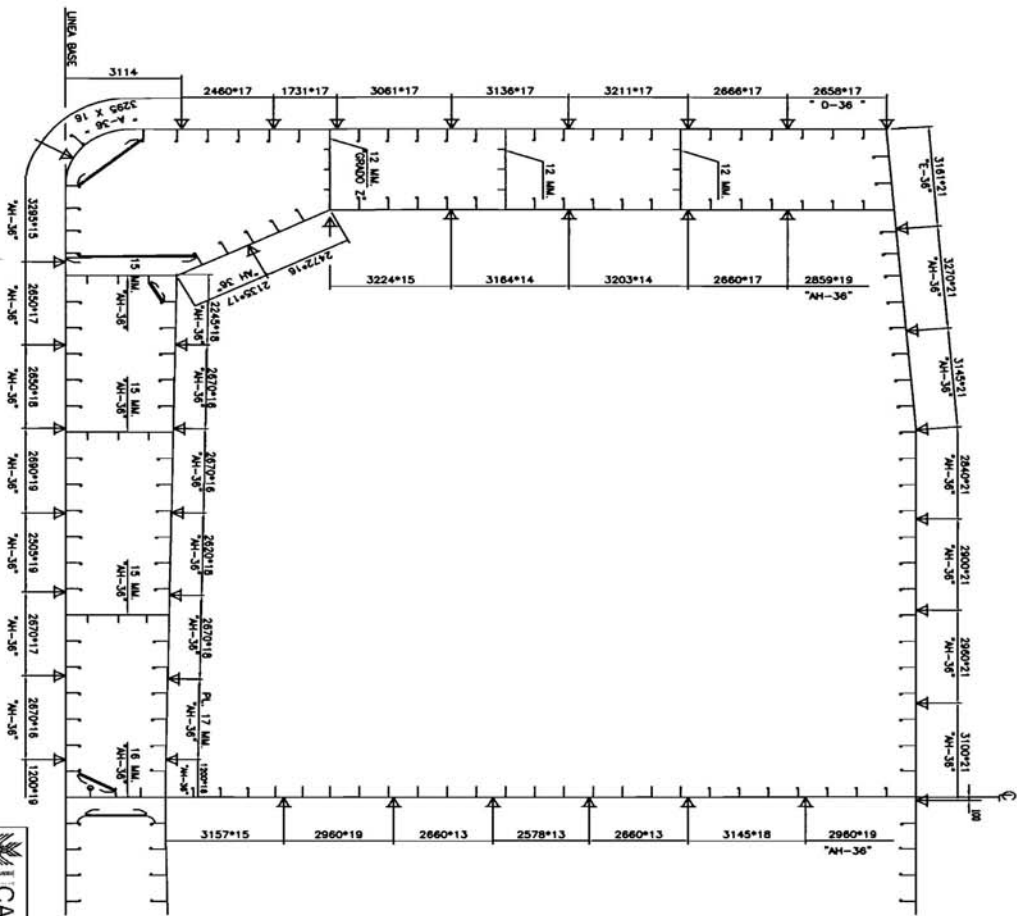
 UCA Universidad de Cádiz		Proyecto Fin de Carrera: REDISEÑO DE LA ESTRUCTURA BÁSICA DE UN SHUTTLE TANKER DE 145.000 M3	
Escuela U. de INGENIERÍA TÉCNICA NAVAL		Autor: <b>CESAR CABALLERO PALACIOS</b>	
ESCALA:	1:125	TITULO:	CUADERNA MAESTRA " BUQUE BASE "
FECHA	01-07-07		HOJA 1/4






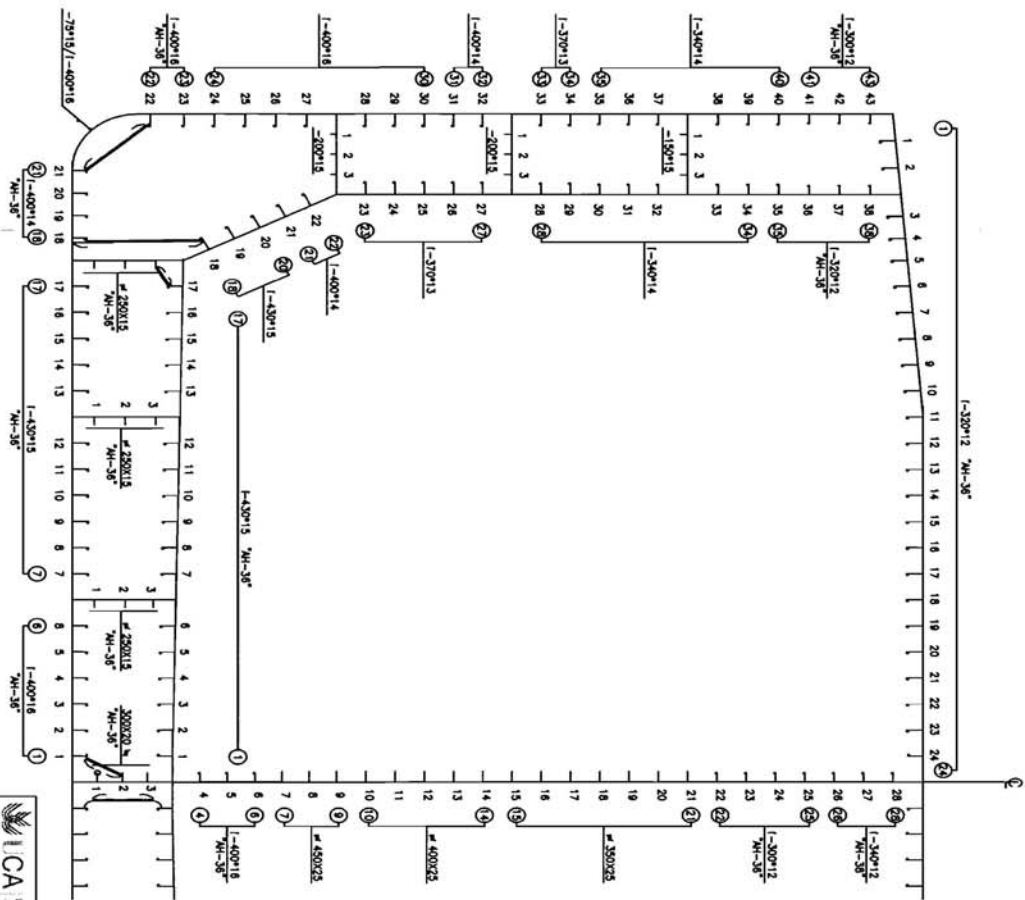
 UCA Universidad de Cádiz Escuela U. de INGENIERÍA TÉCNICA NAVAL		Proyecto Fin de Carrera REDISEÑO DE LA ESTRUCTURA BÁSICA DE UN SHUTTLE TANKER DE 145.000 M3. Autor: CESAR CABALLERO PALACIOS	
ESCALA:	1:125	TÍTULO:	CUADERNA MAESTRA "BUQUE BASE"
FECHA:	01-07-07	HOLA:	2/4

CUADERNA MAESTRA  
 ESCANTILLON DE PLANCHAS



 Universidad de Cádiz ESCUELA DE INGENIERIA TECNICA NAVAL		Ing. de Nav. y Arq. Naval DEPARTAMENTO DE INGENIERIA TECNICA NAVAL C/ MARCA, S/N. 11013 B. CADEZ. (Cádiz)	
ESCALA: 1:125	TITULO: CUADERNA MAESTRA " BUQUE BASE "	Autor: CESAR CABALLERO PALACIOS	
FECHA: 01-07-07	HOLA 3/4		

CUADERNA MAESTRA  
ESCANTILLON DE LONGITUDINALES



		TITULO: <b>CUADERNA MAESTRA                  " BUQUE BASE "</b>		HOLA 4/4	
ESCALA: 1:125		FECHA: 01-07-07		UNIVERSIDAD DE CÁDIZ ESCUELA TÉCNICA NAVAL	

## **2.- APROXIMACIONES.**

A continuación se muestran los planos de las aproximaciones realizadas:

## 2.1.- PRIMERA APROXIMACIÓN.

- **Hoja 1: Características principales.**
- **Hoja 2: Escantillonado y calidad de planchas.**
- **Hoja 3: Escantillonado y calidad de refuerzos.**

### **Nota.-**

Los planos que se incorporan en este documento están fuera de escala,

Estos mismos planos se incluyen a su escala en formatos A3 después de este documento.

NOTAS

TODO EL MATERIAL SERA DE LIMITE ELASTICO DE 235 N/mm<sup>2</sup> (EXCEPTO DONDE SE INDICA)

MAXIMO MOMENTO FLECTOR EN AGUAS TRANQUILAS(CONSIDERADO)

CONDICION EN ARRUFO \_\_\_\_\_ 407000 T\*M  
 CONDICION EN QUEBRANTO \_\_\_\_\_ 418000 T\*M


MOMENTO FLECTOR EN LA OLA: LOS REGLAMENTARIOS.

CARACTERISTICAS

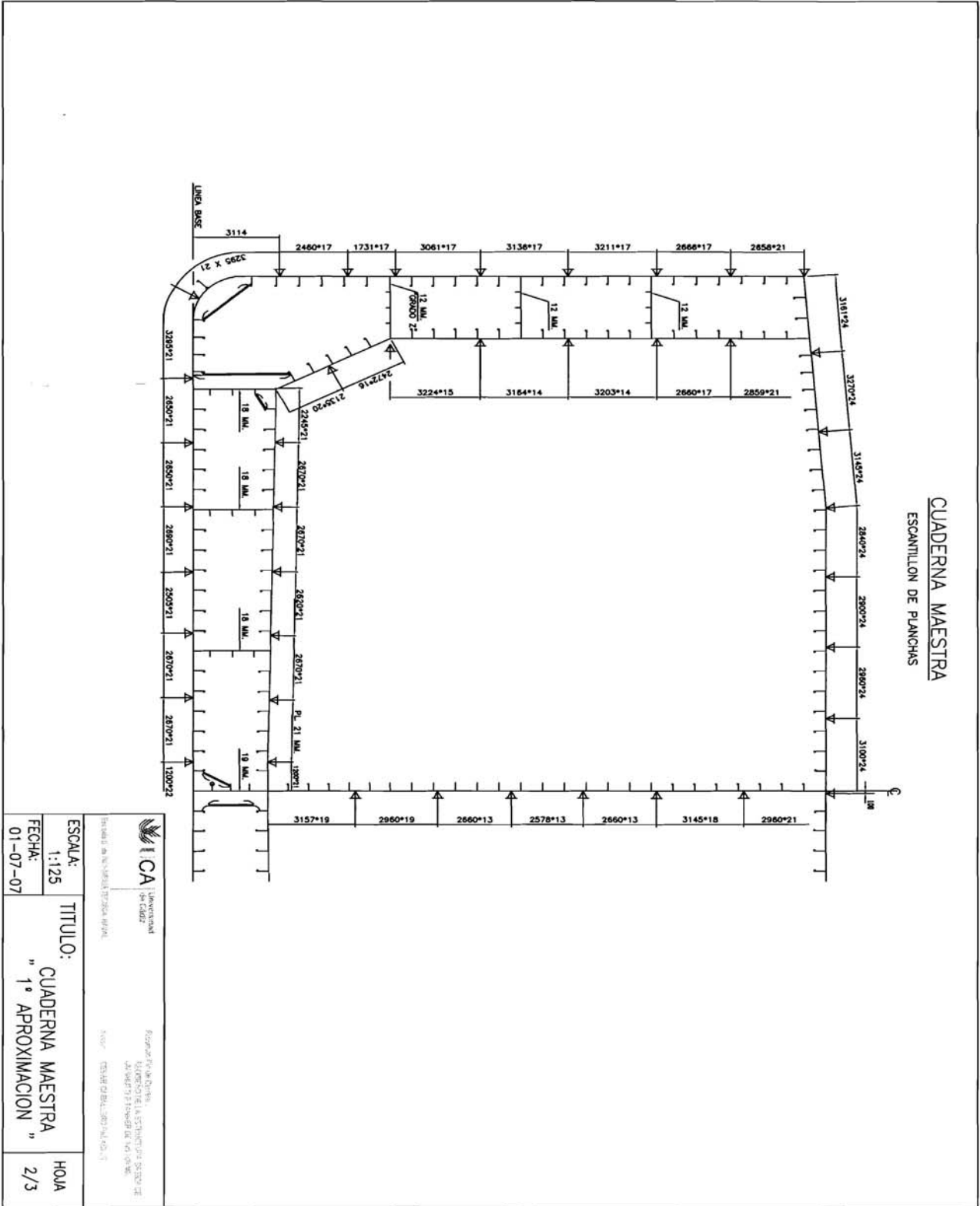
ESLORA TOTAL -----265.00 MTS.  
 ESLORA EN LA FLOTACION AL CALADO DE 15.50 -----260.50 =  
 ESLORA ENTRE PERPENDICULARES AL CALADO DE 15.50 -----256.50 =  
 ESLORA DE ESCANTILLONADO -----252.69 =  
 MANGA DE TRAZADO -----42.50 =  
 PUNTAL (AL COSTADO) -----22.00 =  
 CALADO DE DISEÑO -----15.00 =  
 CALADO DE ESCANTILLONADO -----15.50 MTS.  
 COEFICIENTE DE BLOQUE (PARA ESLORA DE ESCANTILLONES) -----0.879  
 ESPACIADO TRANSVERSAL -----4.00 MTS  
 VELOCIDAD MAXIMA EN SERVICIO -----14.50 N.

CLASIFICACION

DET NORSEK VERITAS **+1A1**  
 "TANKER FOR OIL" ESP. EQ. BOW LOADING.  
 OIP-F, ICS, WIF-AMC, DYMPOS ATR, CSA-1(NORTH ATLANTIC) HELDK SH, SBM  
 ADDITIONALY, THE VESSEL SHALL COMPLY WITH THE REQUIREMENTS FOR THE  
 PREVIOUS D.N.V. "BIS" NOTATION  
 THE FATIGUE LIFE SHALL BE MINIMUM 20 YEARS

 UCA Universidad de Cádiz		Proyecto Fin de Carrera: REDISEÑO DE LA ESTRUCTURA BÁSICA DE UN SHUTTLE TANKER DE 145000 M3	
Escuela U. de INGENIERÍA TÉCNICA NAVAL		Autor: CESAR CABALLERO PALACIOS	
ESCALA:	1:125	TITULO:	CUADERNA MAESTRA "1º APROXIMACION"
FECHA	01-07-07		HOUJA 1/3

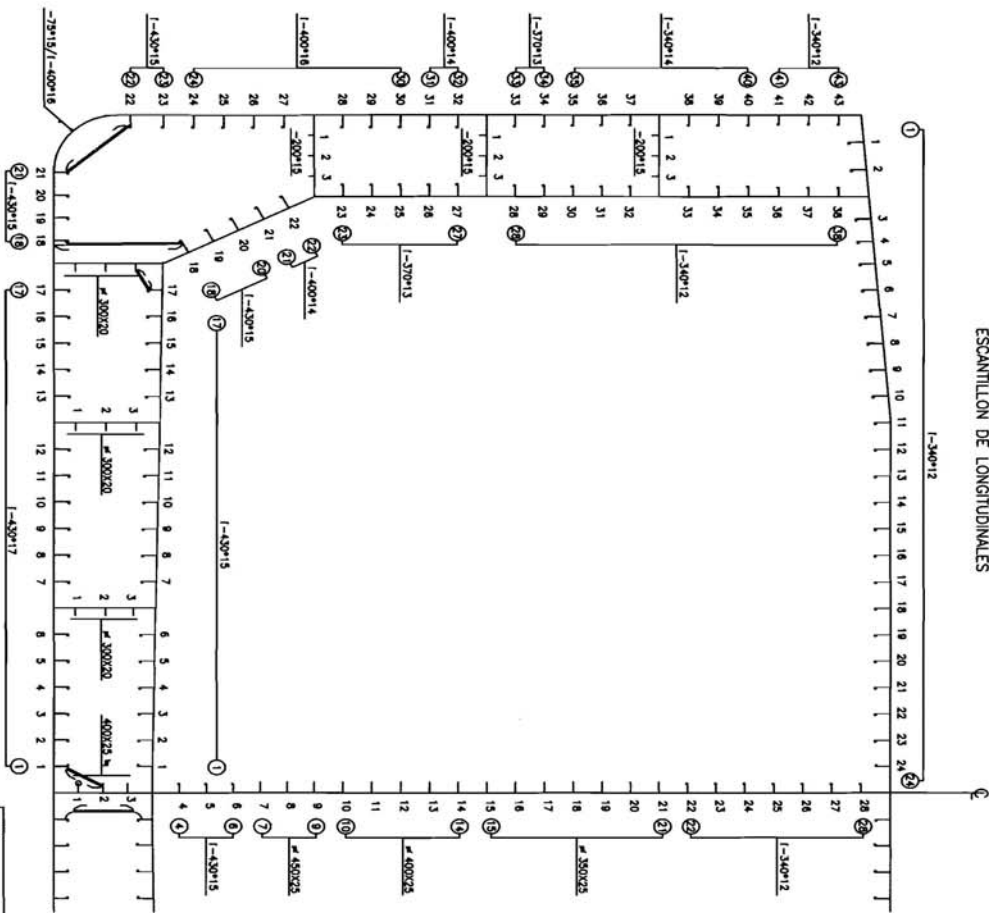





CUADERNA MAESTRA  
 ESCANTILLON DE PLANCHAS

 UCA Universidad de Cádiz Facultad de Ingeniería Naval Escuela U. de Ingeniería Técnica Naval		Proyecto Fin de Carrera: REDISEÑO DE LA ESTRUCTURA BÁSICA DE UN SHUTTLE TANKER DE 145.000 M3. Autor: CESAR CABALLERO PALACIOS	
ESCALA: 1:125	TÍTULO: "CUADERNA MAESTRA" "1ª APROXIMACION"	FECHA: 01-07-07	HOJA 2/3

CUADERNA MAESTRA  
 ESCANTILLON DE LONGITUDINALES



 UCA Universidad de Cádiz Escuela U. de Ingeniería Técnica Naval		Facultad de Ingeniería Naval Área de Estructuras Navales	
ESCALA:	1:125	TÍTULO:	CUADERNA MAESTRA
FECHA:	01-07-07		" 1ª APROXIMACION "
			HOJA 3/3

## 2.2.- SEGUNDA APROXIMACIÓN.

- **Hoja 1: Características principales.**
- **Hoja 2: Escantillonado y calidad de planchas.**
- **Hoja 3: Escantillonado y calidad de refuerzos.**

### **Nota.-**

Los planos que se incorporan en este documento están fuera de escala,

Estos mismos planos se incluyen a su escala en formatos A3 después de este documento.

NOTAS

TODO EL MATERIAL SERA DE LIMITE ELASTICO DE 235 N/mm<sup>2</sup> (EXCEPTO DONDE SE INDICA)

MAXIMO MOMENTO FLECTOR EN AGUAS TRANQUILAS(CONSIDERADO)

CONDICION EN ARRUFO \_\_\_\_\_ 407000 T\*M  
 CONDICION EN QUEBRANTO \_\_\_\_\_ 418000 T\*M

MOMENTO FLECTOR EN LA OLA: LOS REGLAMENTARIOS.

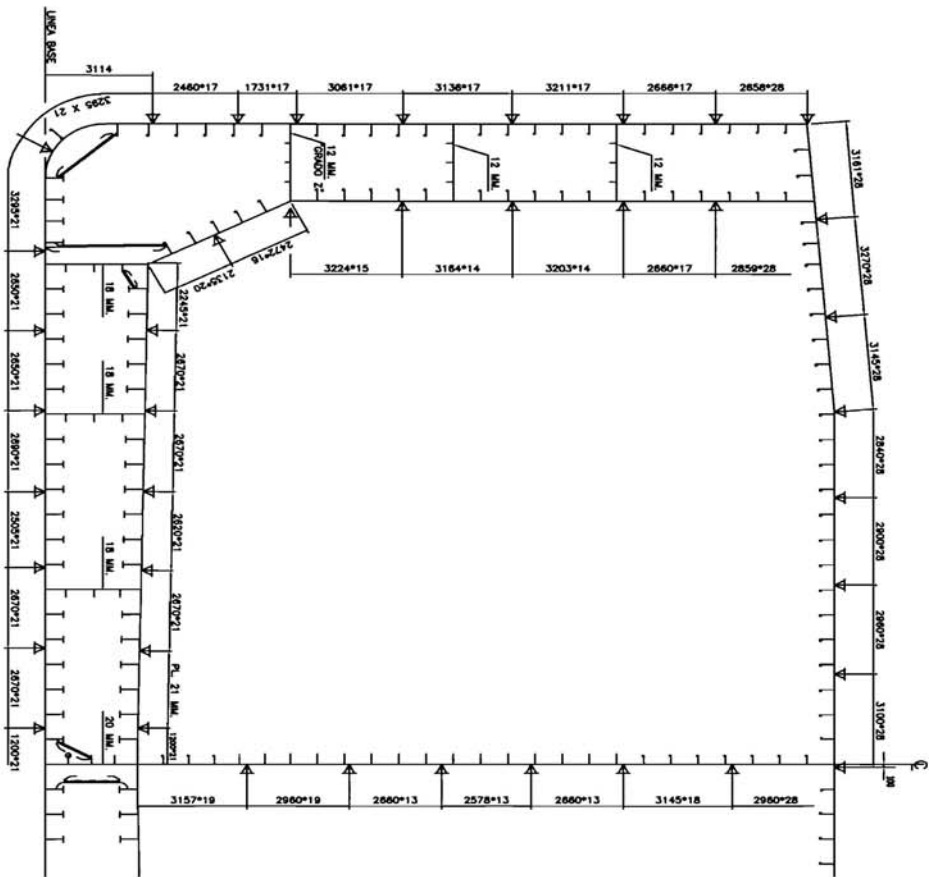
CARACTERISTICAS

ESLORA TOTAL ----- 265,00 MTS.  
 ESLORA EN LA FLOTACION AL CALADO DE 15,50 ----- 260,50 =  
 ESLORA ENTRE PERPENDICULARES AL CALADO DE 15,50 ----- 256,50 =  
 ESLORA DE ESCANTILLONADO ----- 252,69 =  
 MANGA DE TRAZADO ----- 42,50 =  
 PUNTAL (AL COSTADO) ----- 22,00 =  
 CALADO DE DISEÑO ----- 15,00 =  
 CALADO DE ESCANTILLONADO ----- 15,50 MTS.  
 COEFICIENTE DE BLOQUE (PARA ESLORA DE ESCANTILLONES) ----- 0,879  
 ESPACIADO TRANSVERSAL ----- 4,00 MTS  
 VELOCIDAD MAXIMA EN SERVICIO ----- 14,50 N.

CLASIFICACION

DET NORSEK VERITAS +1A1  
 "TANKER FOR OIL" ESP. EQ. BOW LOADING,  
 OPP-F. ICS, W/F-AMC, DYMPOS AUTR. CSA-1(NORTH ATLANTIC) HELDK SH. SBM  
 ADDITIONALY, THE VESSEL SHALL COMPLY WITH THE REQUIREMENTS FOR THE  
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 THE FATIGUE LIFE SHALL BE MINIMUM 20 YEARS

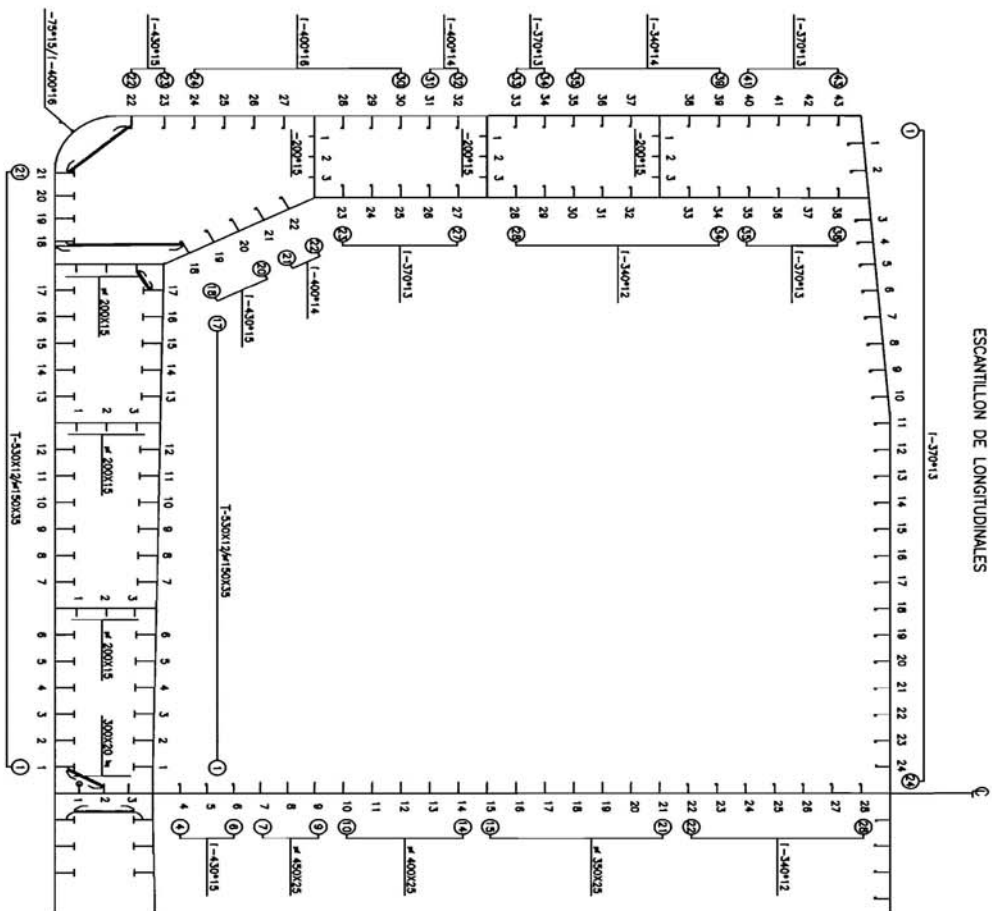
 <p>UCA Universidad de Cádiz</p>		<p>Proyecto Fin de Carrera:          REDISEÑO DE LA ESTRUCTURA BÁSICA DE UN SHUTTLE TANKER DE 145.000 M3</p>	
<p>Escuela U. de INGENIERÍA TÉCNICA NAVAL</p>		<p>Autor: CESAR CABALLERO PALACIOS</p>	
ESCALA:	TITULO:	<p>CUADERNA MAESTRA          " 2º APROXIMACION "</p>	
FECHA			
01-07-07		HOJA	1/3



CUADERNA MAESTRA  
 ESCANTILLON DE PLANCHAS

 Universidad de Cádiz Escuela U. de INGENIERÍA TÉCNICA NAVAL		Proyecto Fin de Carrera: REDISEÑO DE LA ESTRUCTURA BÁSICA DE UN SHUTTLE TANKER DE 145.000 M3 Autor: CESAR CABALLERO PALACIOS	
ESCALA:	1:100	TÍTULO:	CUADERNA MAESTRA " 2ª APROXIMACION "
FECHA:	01-07-07	HOLA:	2/3

CUADERNA MAESTRA  
 ESCANTILLÓN DE LONGITUDINALES



 Universidad de Cádiz Facultad de Ingeniería Naval		Proyecto Fin de Carrera Rediseño de la Estructura Básica de un Shuttle Tanker de 145.000 M <sup>3</sup> Autor: CESAR CABALLERO PALACIOS	
ESCALA:	1:125	TÍTULO:	CUADERNA MAESTRA
FECHA:	01-07-07		" 2ª APROXIMACION "
			HOLA 3/3



### 3.- BUQUE PROYECTO:

A continuación se muestran los planos que consideramos definitivos tras los ajustes pertinentes para satisfacer los requisitos estructurales, es decir los que se han considerado para el “**BUQUE PROYECTO**”:

- **Hoja 1 : Características principales.**
- **Hoja 2: Geometría y espaciado de refuerzos longitudinales.**
- **Hoja 3: Escantillonado y calidad de planchas.**
- **Hoja 4: Escantillonado y calidad de refuerzos.**

**Nota.-**

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Estos mismos planos se incluyen a su escala en formatos A3 después de este documento.

NOTAS

TODO EL MATERIAL SERA DE LIMITE ELASTICO DE 235 N/mm<sup>2</sup>

MAXIMO MOMENTO FLECTOR EN AGUAS TRANQUILAS(CONSIDERADO)

CONDICION EN ARRUFO \_\_\_\_\_ 407000 T\*M

CONDICION EN QUEBRANTO \_\_\_\_\_ 418000 T\*M

MOMENTO FLECTOR EN LA OLA: LOS REGLAMENTARIOS.

CARACTERISTICAS

ESLORA TOTAL ----- 265.00 MTS.  
 ESLORA EN LA FLOTACION AL CALADO DE 15.50 ----- 260.50 =  
 ESLORA ENTRE PERPENDICULARES AL CALADO DE 15.50 ----- 256.50 =  
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 PUNTAL (AL COSTADO) ----- 22.00 =  
 CALADO DE DISEÑO ----- 15.00 =  
 CALADO DE ESCANTILLONADO ----- 15.50 MTS.  
 COEFICIENTE DE BLOQUE (PARA ESLORA DE ESCANTILLONES) ----- 0.879  
 ESPACIADO TRANSVERSAL ----- 4.00 MTS  
 VELOCIDAD MAXIMA EN SERVICIO ----- 14.50 N.

CLASIFICACION

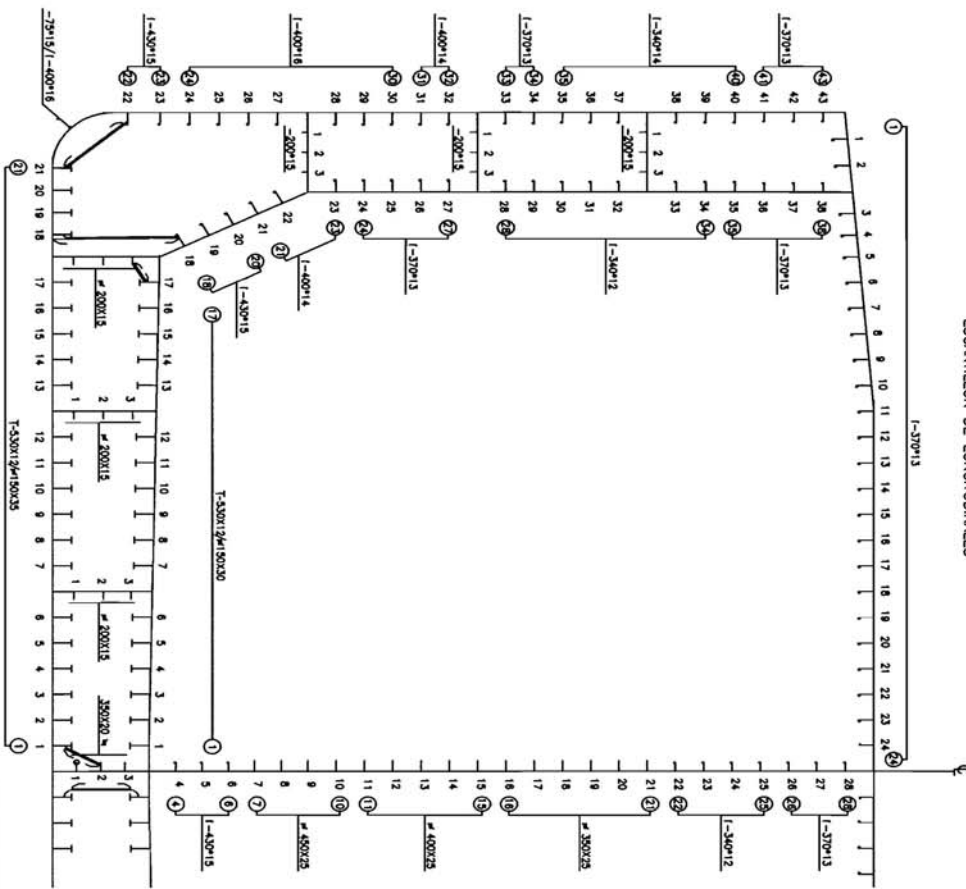
DET NORSEK VERITAS + IAI  
 "TANKER FOR OIL" ESP. EQ. BOW LOADING.  
 O.P.-F. ICS. W/F-AMC. DYMPOS AUTR. CSA-(NORTH ATLANTIC) HELDK SH. SBM  
 ADDITIONALLY, THE VESSEL SHALL COMPLY WITH THE REQUIREMENTS FOR THE  
 PREVIOUS D.N.V. "BIS" NOTATION  
 THE FATIGUE LIFE SHALL BE MINIMUM 20 YEARS


 <p>UCA Universidad de Cádiz</p>		<p>Proyecto Fin de Carrera:          REDISEÑO DE LA ESTRUCTURA BÁSICA DE UN SHUTTLE TANKER DE 145.000 M3.</p>	
<p>Escuela U. de INGENIERÍA TÉCNICA NAVAL</p>		<p>Autor: CESAR CABALLERO PALACIOS</p>	
ESCALA:	TITULO:	HOJA	
1:125	" CUADERNA MAESTRA "	1/4	
FECHA			
01-07-07	" BUQUE PROYECTO "		





CUADERNA MAESTRA  
ESCANTILLON DE LONGITUDINALES



 Universidad de Cádiz Escuela U. de INGENIERÍA TÉCNICA NAVAL		Proyecto Fin de Carrera REDISEÑO DE LA ESTRUCTURA BÁSICA DE UN SHUTTLE TANKER DE 145.000 M3	
ESCALA:	1:125	TÍTULO:	CUADERNA MAESTRA "BUQUE PROYECTO"
FECHA:	01-07-07	HOLA:	4/4

#### **4.- MAMPARO TRANSVERSAL.**

A continuación se muestran los planos del mamparo transversal:

#### **4.1.- MAMPARO TRANSVERSAL DEL “ BUQUE BASE “.**

- **Hoja 1: Características Principales.**
- **Hoja 2: Mamparo Transversal**
- **Hoja 3: Palmejar a 7092 mm de L.B.**
- **Hoja 4: Palmejar a 11796 mm de L.B.**
- **Hoja 5: Palmejar a 16500 mm de L.B.**
- **Hoja 6: Secciones y Detalles.**

**Nota.-**

Los planos que se incorporan en este documento están fuera de escala,  
Estos mismos planos se incluyen a su escala en formatos A3 después de este documento.



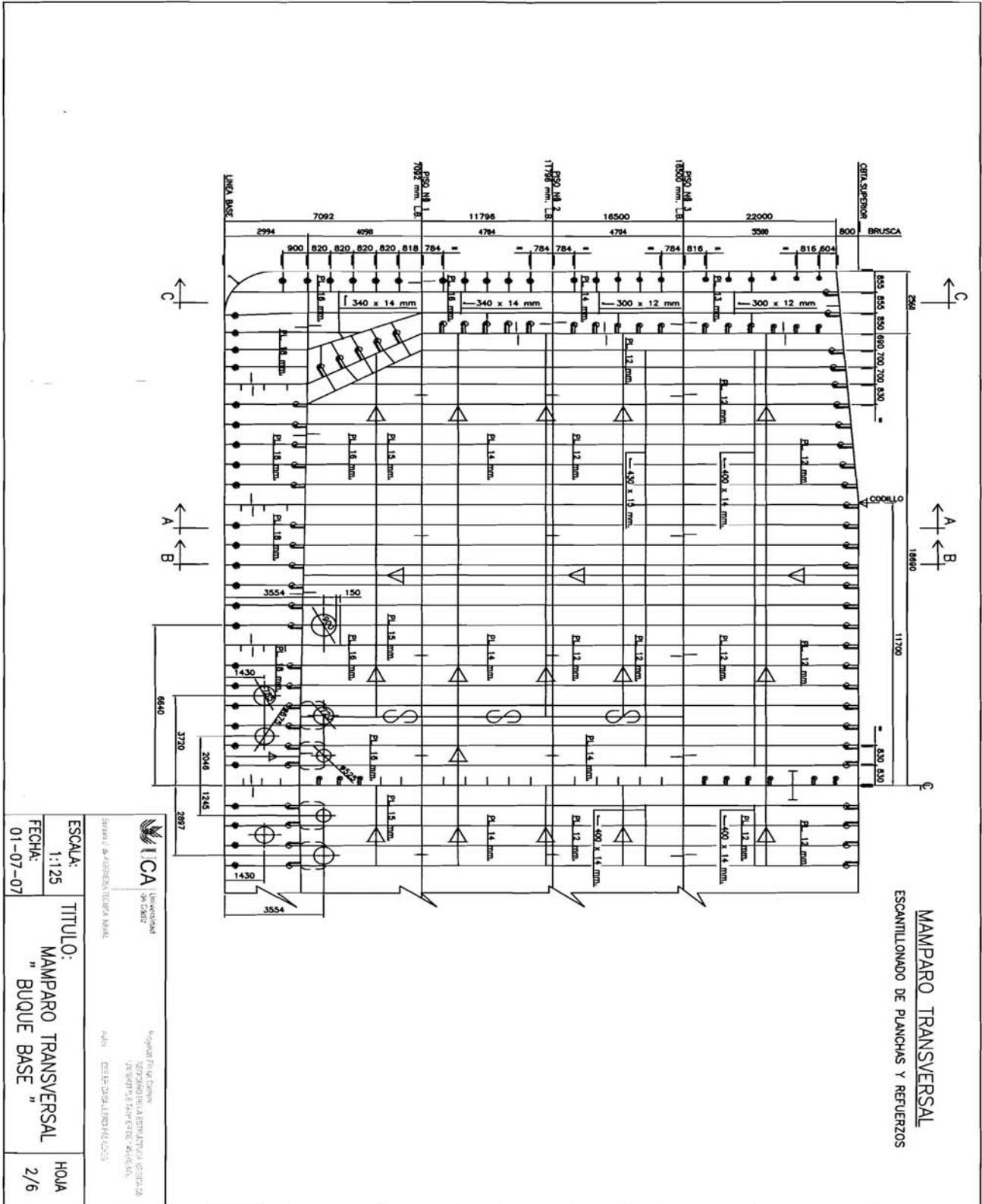
CARACTERÍSTICAS

ESLORA TOTAL	-----	265,00 MTS.
ESLORA EN LA FLOTACION AL CALADO DE 15,50	-----	260,50 =
ESLORA ENTRE PERPENDICULARES AL CALADO DE 15,50	-----	256,50 =
ESLORA DE ESCANTILLONADO	-----	252,69 =
MANGA DE TRAZADO	-----	42,50 =
PUNTA (AL COSTADO)	-----	22,00 =
CALADO DE DISEÑO	-----	15,00 =
CALADO DE ESCANTILLONADO	-----	15,50 MTS.
COEFICIENTE DE BLOQUE (PARA ESLORA DE ESCANTILLONES)	-----	0,879
ESPACIADO TRANSVERSAL	-----	4,00 MTS
VELOCIDAD MÁXIMA EN SERVICIO	-----	14,50 N.

NOTAS

TODO EL MATERIAL SERA DE LIMITE ELASTICO DE 235 N/mm (EXCEPTO DONDE SE INDIQUE)  
 PARA TODOS LOS DETALLES INDICADOS VER PLANO "DETALLES NORMALIZADOS A USAR EN BUQUE"  
 TODAS LA SECCIONES ESTAN DIBUJADAS MIRANDO A PROA Y BABOR (EXCEPTO DONDE SE INDIQUE)  
 LLENADOS PARCALES EN TANQUES DE CARGA SON PERMITIDOS

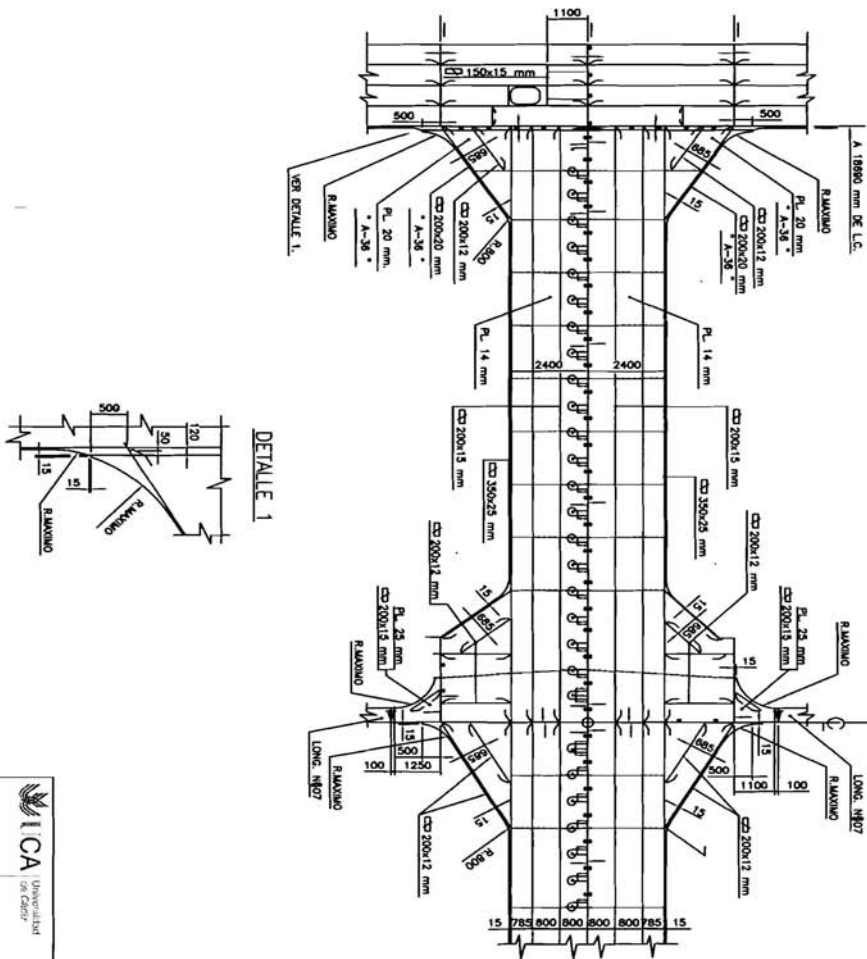
 <p>UCA Universidad de Cádiz</p> <p>Escuela U. de INGENIERÍA TÉCNICA NAVAL</p>		<p>Proyecto Fin de Carrera:</p> <p>REDISEÑO DE LA ESTRUCTURA BÁSICA DE UN SHUTTLE TANKER DE 145.000 M3.</p> <p>Autor: CESAR CABALLERO PALACIOS</p>	
ESCALA:	1:125	TÍTULO:	MAMPARO TRANSVERSAL " BUQUE BASE "
FECHA	01-07-07	HOJA	1/6



ESCALA: 1:125	TITULO: MAMPARO TRANSVERSAL	HOLA 2/6
FECHA: 01-07-07		

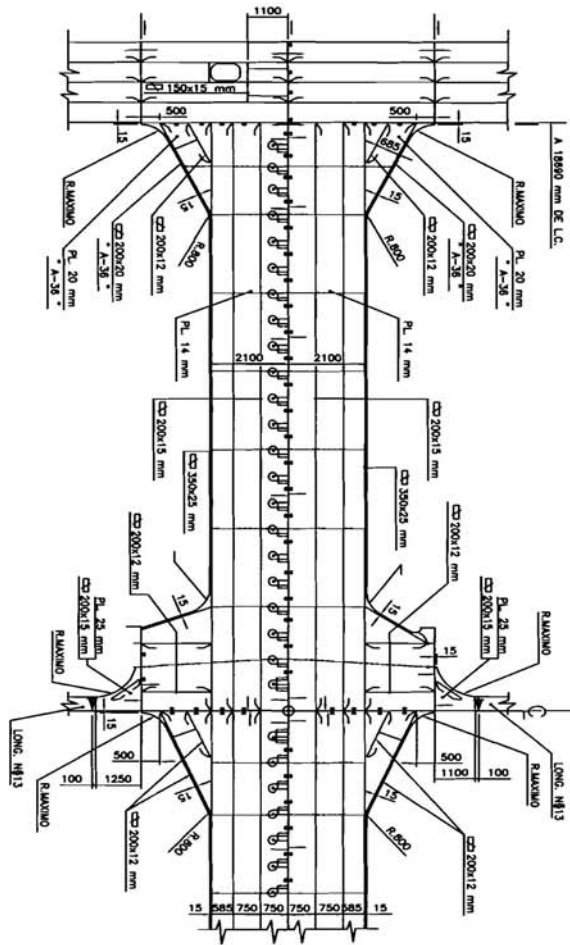
UCA Universidad de Cádiz  
 Ingeniería Técnica Naval  
 Proyecto Fin de Carrera  
 REDISEÑO DE LA ESTRUCTURA BÁSICA DE UN SHUTTLE TANKER DE 145.000 M3.  
 Autor: CESAR CABALLERO PALACIOS

**PALMEJAR A 7092 DE L.B.**  
 ESCANTILLONADO DE PLANCHAS Y REFUERZOS



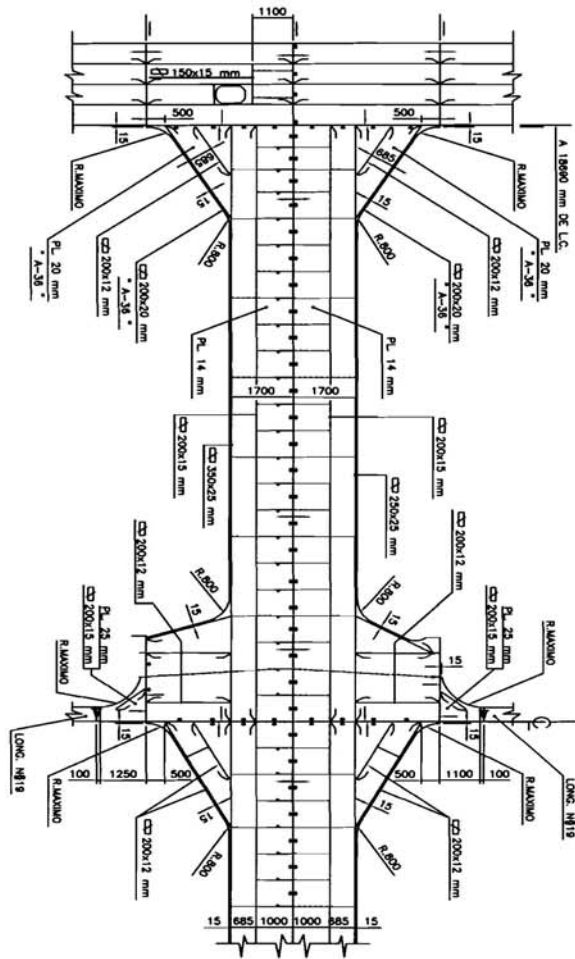
 Universidad de Cádiz Escuela U. de INGENIERÍA TÉCNICA NAVAL		Proyecto Fin de Carrera REDISEÑO DE LA ESTRUCTURA BÁSICA DE UN SHUTTLE TANKER DE 145.000 M3. Autor: CESAR CABALLERO PALACIOS	
ESCALA:	1:125	TÍTULO:	PALMEJAR A 7092 DE L.B.
FECHA:	01-07-07		"BUQUE BASE"
		HOJA	3/6

PALMEJAR A 11796 DE L.B.  
 ESCANTILLONADO DE PLANCHAS Y REFUERZOS



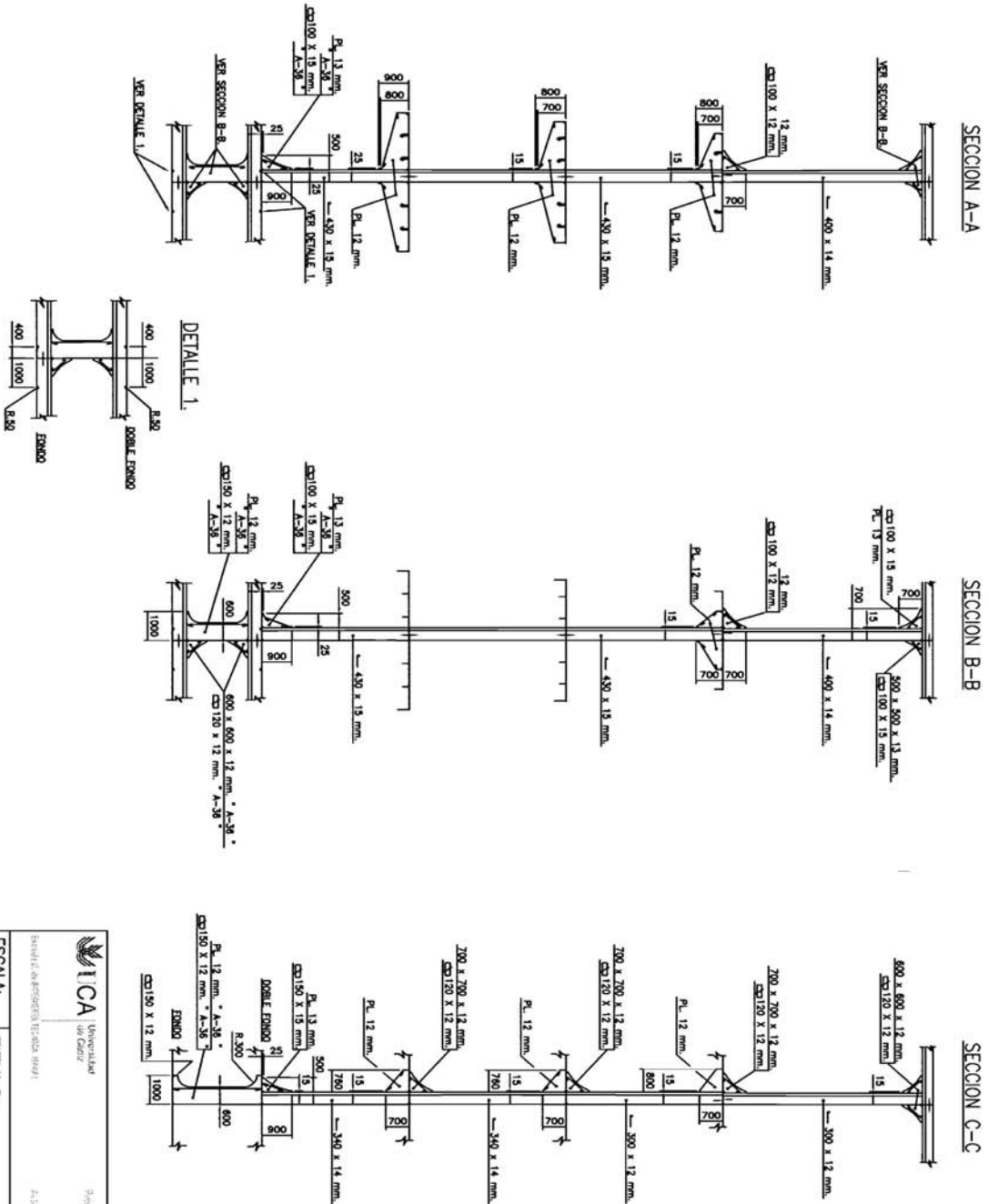
 Universidad de Cádiz Escuela U. de Ingeniería Técnica Naval	TÍTULO: PALMEJAR A 11796 DE L.B. "BUQUE BASE"	HOLA 4/6
	ESCALA: 1:125	FECHA: 01-07-07

**PALMEJAR A 16500 DE L.B.**  
**ESCAANTILLADO DE PLANCHAS Y REFUERZOS**



 Universidad de Cádiz Escuela de Ingeniería Técnica Naval		Proyecto Fin de Carrera REDISEÑO DE LA ESTRUCTURA BÁSICA DE UN SHUTTLE TANKER DE 145.000 M3. Autor: CESAR CABALLERO PALACIOS	
ESCALA:	1:125	TÍTULO:	PALMEJAR A 16500 DE L.B.
FECHA:	01-07-07		"BUQUE BASE"
		HOJA	5/6

SECCION LONGITUDINAL  
ESCANTILLONADO DE CARTABONES Y REFUERZOS



		Proyecto Fin de Carrera REDISEÑO DE LA ESTRUCTURA BÁSICA DE UN SHUTTLE TANKER DE 145.000 M3.	
ESCALA: 1:125	TÍTULO: SECCION LONGITUDINAL "BUQUE BASE"	HOLA 6/6	
FECHA: 01-07-07	ESCUELA U. DE INGENIERÍA TÉCNICA NAVAL		



## **4.2.- MAMPARO TRANSVERSAL DEL “ BUQUE PROYECTO “.**

- **Hoja 1: Características Principales.**
- **Hoja 2: Mamparo Transversal**
- **Hoja 3: Palmejar a 7092 mm de L.B.**
- **Hoja 4: Palmejar a 11796 mm de L.B.**
- **Hoja 5: Palmejar a 16500 mm de L.B.**
- **Hoja 6: Secciones y Detalles.**

### **Nota.-**

Los planos que se incorporan en este documento están fuera de escala,  
Estos mismos planos se incluyen a su escala en formatos A3 después de este documento.



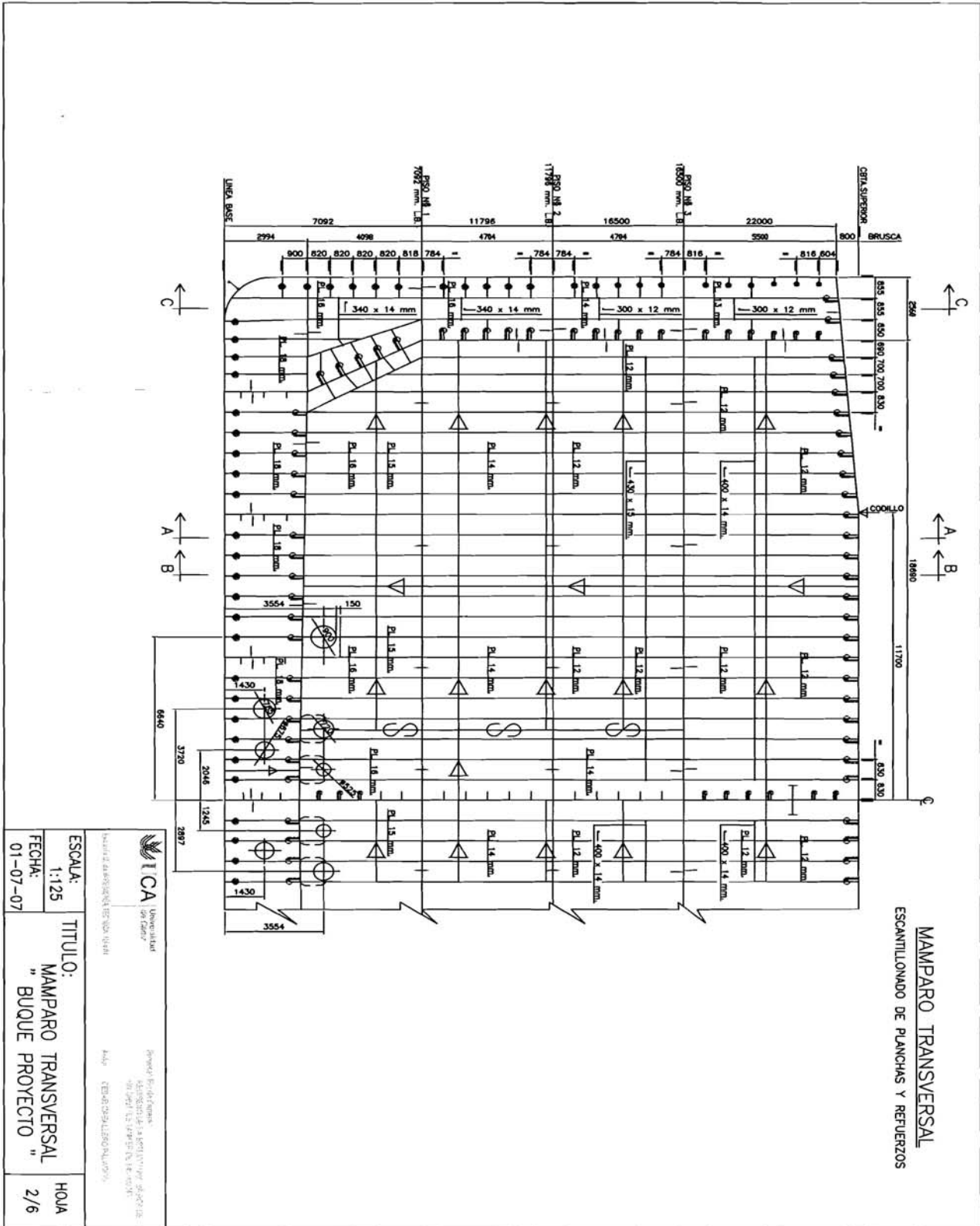
CARACTERÍSTICAS

ESLORA TOTAL ----- 265,00 MTS.  
 ESLORA EN LA FLOTACION AL CALADO DE 15,50 ----- 260,50 =  
 ESLORA ENTRE PERPENDICULARES AL CALADO DE 15,50 ----- 256,50 =  
 ESLORA DE ESCANTILLONADO ----- 252,69 =  
 MANGA DE TRAZADO ----- 42,50 =  
 PUNTA (AL COSTADO) ----- 22,00 =  
 CALADO DE DISEÑO ----- 15,00 =  
 CALADO DE ESCANTILLONADO ----- 15,50 MTS.  
 COEFICIENTE DE BLOQUE (PARA ESLORA DE ESCANTILLONES) ----- 0,879  
 ESPACIADO TRANSVERSAL ----- 4,00 MTS  
 VELOCIDAD MÁXIMA EN SERVICIO ----- 14,50 N.


NOTAS

TODO EL MATERIAL SERA DE LIMITE ELASTICO DE 235 N/mm (EXCEPTO DONDE SE INDIQUE)  
 PARA TODOS LOS DETALLES INDICADOS VER PLANO "DETALLES NORMALIZADOS A USAR EN BUQUE"  
 TODAS LA SECCIONES ESTAN DIBUJADAS MIRANDO A PROA Y BABOR (EXCEPTO DONDE SE INDIQUE)  
 LLENADOS PARCIALES EN TANQUES DE CARGA SON PERMITIDOS

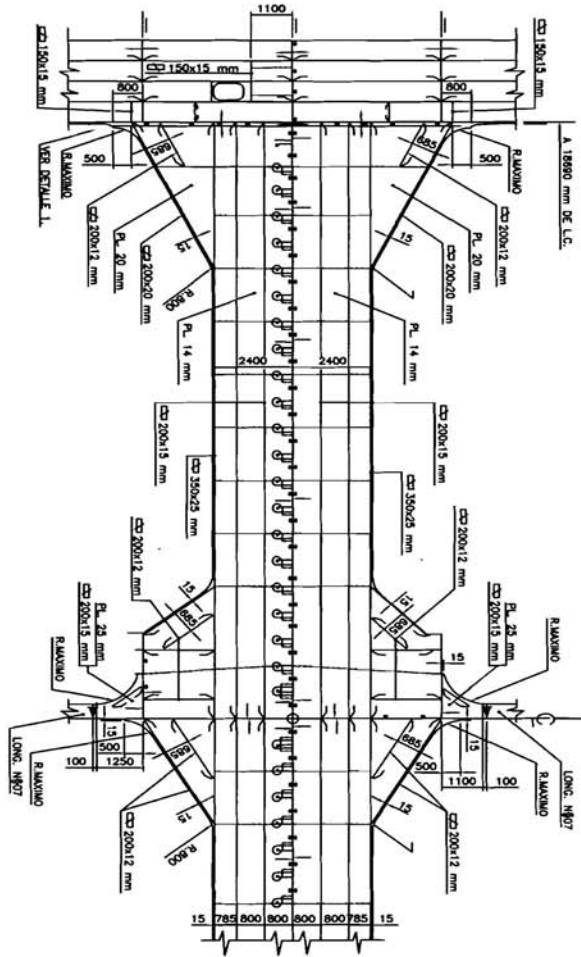
 UCA Universidad de Cádiz Escuela U. de INGENIERÍA TÉCNICA NAVAL		Proyecto Fin de Carrera: REDISEÑO DE LA ESTRUCTURA BÁSICA DE UN SHUTTLE TANKER DE 145.000 M3. Autor: CESAR CABALLERO PALACIOS	
ESCALA:	1:125	TÍTULO:	MAMPARO TRANSVERSAL "BUQUE PROYECTO "
FECHA	01-07-07		HOJA 1/6



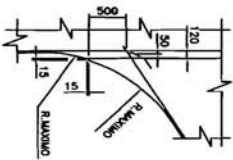
MAMPARO TRANSVERSAL  
 ESCANTILLONADO DE PLANCHAS Y REFUERZOS

 Universidad de Cádiz Facultad de Ingeniería Naval		Proyecto Fin de Carrera Rediseño de la Estructura Básica de un Shuttle Tanker de 145.000 M <sup>3</sup> Autor: CESAR CABALLERO PALACIOS	
ESCALA:	1:125	TÍTULO:	MAMPARO TRANSVERSAL
FECHA:	01-07-07		"BUQUE PROYECTO"
		HOLA	2/6

PALMEJAR A 7092 DE L.B.  
ESCAANTILLONADO DE PLANCHAS Y REFUERZOS

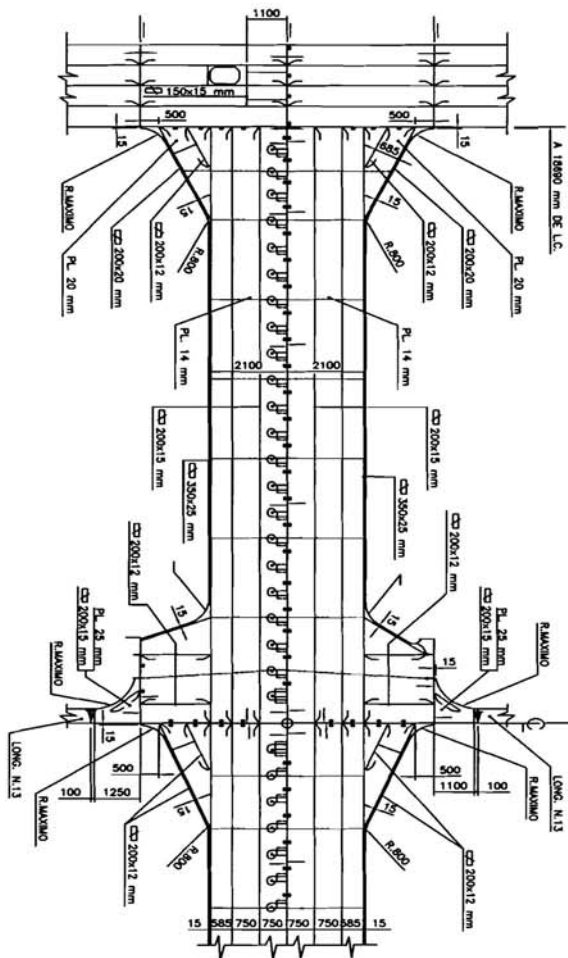



DETALLE 1



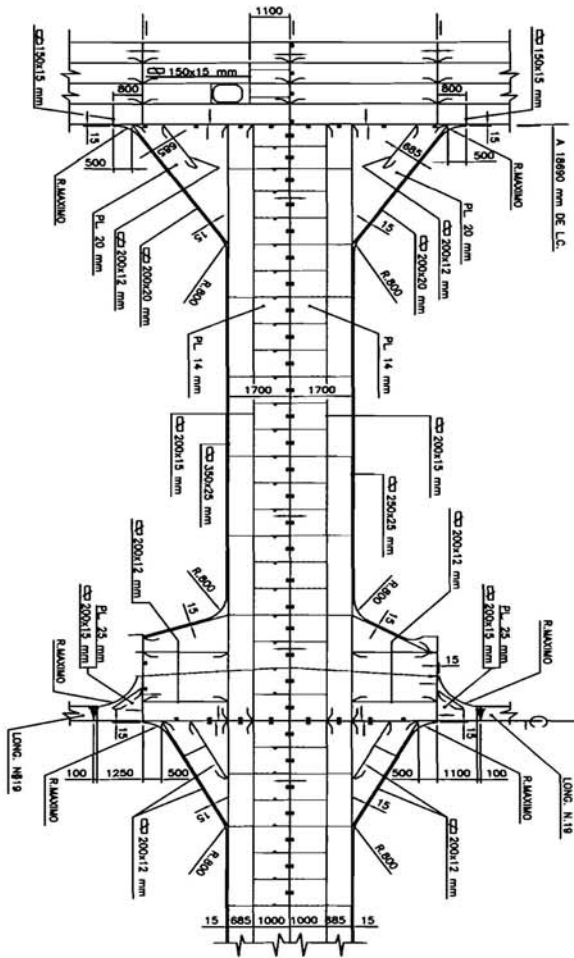
 UNIVERSIDAD DE CÁDIZ ESCUELA U. DE INGENIERÍA TÉCNICA NAVAL		TÍTULO: PALMEJAR A 7092 DE L.B. "BUQUE PROYECTO"		HOLA 3/6	
ESCALA: 1:125					
FECHA: 01-07-07					


**PALMEJAR A 11796 DE L.B.**  
ESCAANTILLONADO DE PLANCHAS Y REFUERZOS



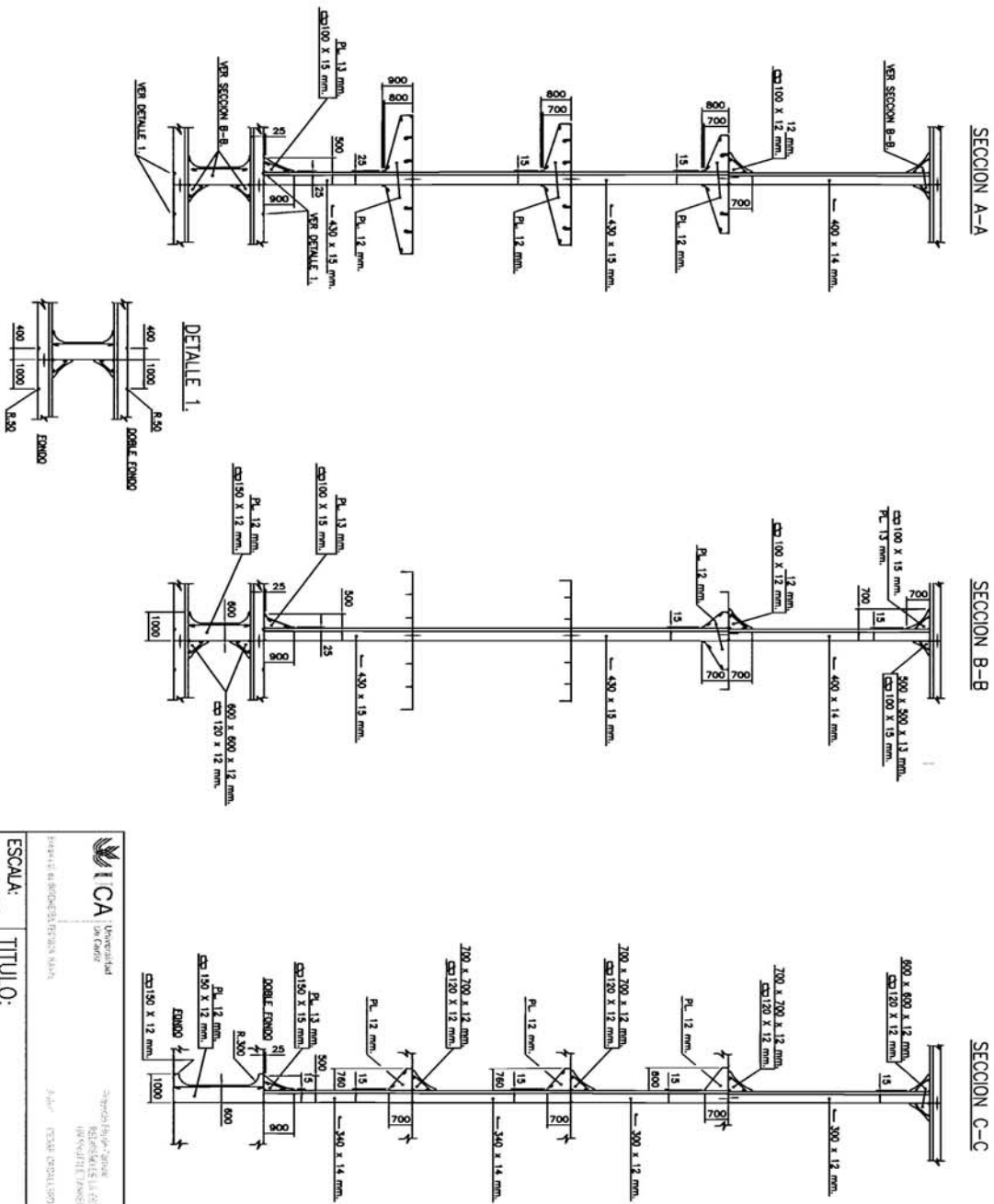
 Universidad de Cádiz		Escuela U. de INGENIERÍA TÉCNICA NAVAL	
Escriba y sellará la presente ficha técnica		Fecha: 01-07-07	
Proyecto Fin de Carrera: REDISEÑO DE LA ESTRUCTURA BÁSICA DE UN SHUTTLE TANKER DE 145.000 M3.		Autor: CESAR CABALLERO PALACIOS	
ESCALA: 1:125	TÍTULO: PALMEJAR A 11796 DE L.B.	HOJA 4/6	
FECHA: 01-07-07	"BUQUE PROYECTO"		

PALMEJAR A 16500 DE L.B.  
 ESCANTILLONADO DE PLANCHAS Y REFUERZOS



 Universidad de Cádiz Escuela U. de INGENIERÍA TÉCNICA NAVAL		Proyecto Fin de Carrera REDISEÑO DE LA ESTRUCTURA BÁSICA DE UN SHUTTLE TANKER DE 145.000 M3. Autor: CESAR CABALLERO PALACIOS	
ESCALA:	1:125	TÍTULO:	PALMEJAR A 16500 DE L.B.
FECHA:	01-07-07		"BUQUE PROYECTO"
		HOJA	5/6

SECCION LONGITUDINAL  
 ESCANTILLONADO DE CARTABONES Y REFUERZOS



 UCA Universidad de Cádiz Calle: ESCUELA DE INGENIERIA TECNICA NAVAL		2º Grado Ingeniería Naval RESERVA DE LA ESTRUCTURA BÁSICA DE UN SHUTTLE TANKER DE 145.000 M3	
ESCALA: 1:125	TITULO: SECCION LONGITUDINAL "BUQUE PROYECTO"	HOJA 6/6	
FECHA: 01-07-07			



## NOTAS

TODO EL MATERIAL SERA DE LIMITE ELASTICO  
DE 235 N/mm<sup>2</sup> (EXCEPTO DONDE SE INDICA)

### MAXIMO MOMENTO FLECTOR EN AGUAS TRANQUILAS(CONSIDERADO)

CONDICION EN ARRUFO \_\_\_\_\_ 407000 T\*M  
CONDICION EN QUEBRANTO \_\_\_\_\_ 418000 T\*M

### MOMENTO FLECTOR EN LA OLA: LOS REGLAMENTARIOS.

## CARACTERISTICAS

ESLORA TOTAL ----- 265.00 MTS.  
ESLORA EN LA FLOTACION AL CALADO DE 15.50 ----- 260.50 =  
ESLORA ENTRE PERPENDICULARES AL CALADO DE 15.50 ---- 256.50 =  
ESLORA DE ESCANTILLONADO ----- 252.69 =  
MANGA DE TRAZADO ----- 42.50 =  
PUNTAL (AL COSTADO) ----- 22.00 =  
CALADO DE DISEÑO ----- 15.00 =  
CALADO DE ESCANTILLONADO ----- 15.50 MTS.  
COEFICIENTE DE BLOQUE (PARA ESLORA DE ESCANTILLONES) \_ 0.879  
ESPACIADO TRANSVERSAL ----- 4.00 MTS  
VELOCIDAD MAXIMA EN SERVICIO ----- 14.50 N.

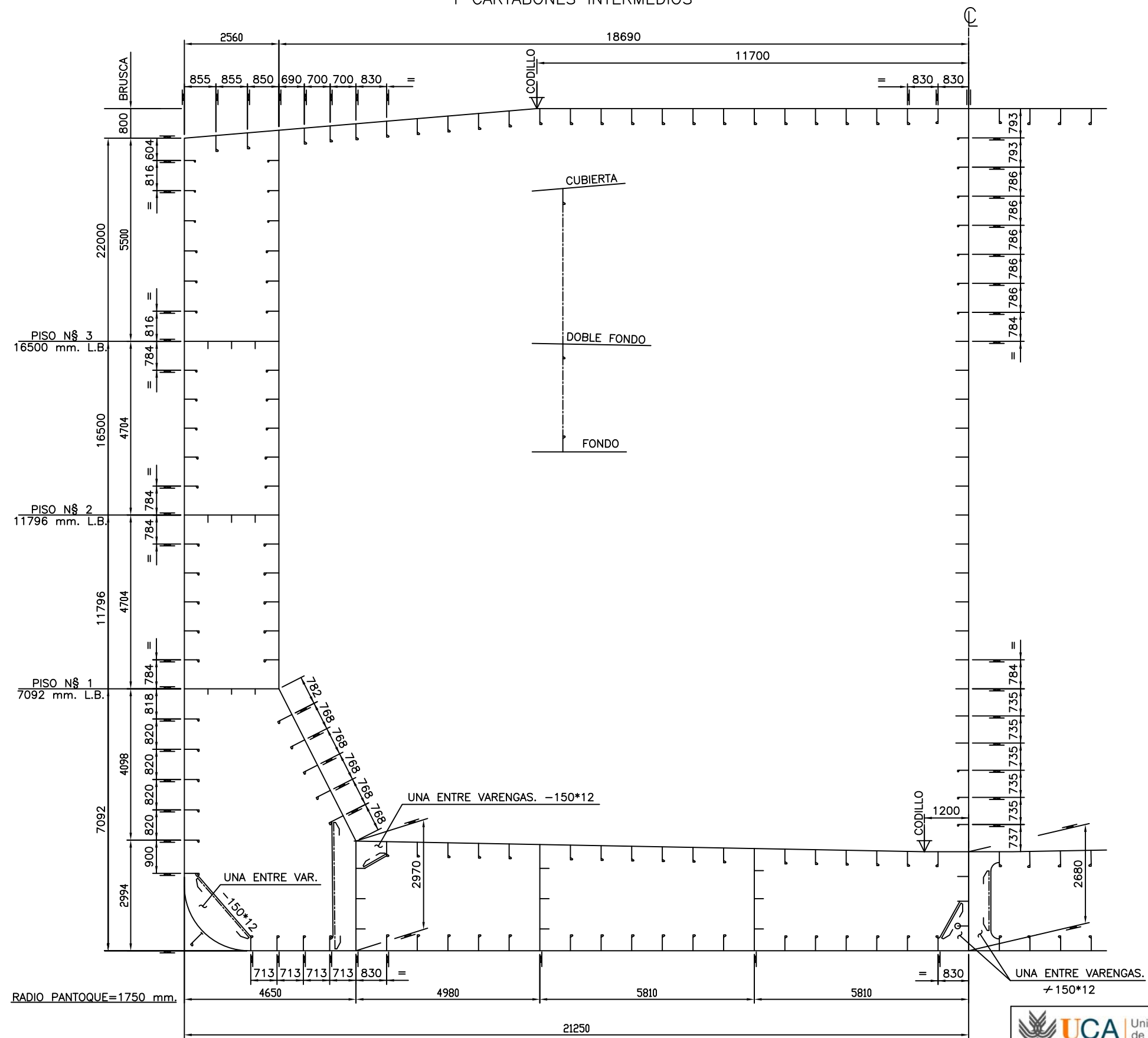
## CLASIFICACION

DET NORSKE VERITAS ✚1A1  
"TANKER FOR OIL" ESP, EO, BOW LOADING,  
OPP-F, ICS, W1F-AMC, DYMPOS ATR, CSA-1(NORTH ATLANTIC) HELDK SH, SBM  
ADDITIONALLY, THE VESSEL SHALL COMPLY WITH THE REQUIREMENTS FOR THE  
PREVIOUS D.N.V. "BIS" NOTATION  
THE FATIGUE LIFE SHALL BE MINIMUM 20 YEARS



# CUADERNA MAESTRA

## GEOMETRIA - ESPACIADO DE LONGITUDINALES Y CARTABONES INTERMEDIOS



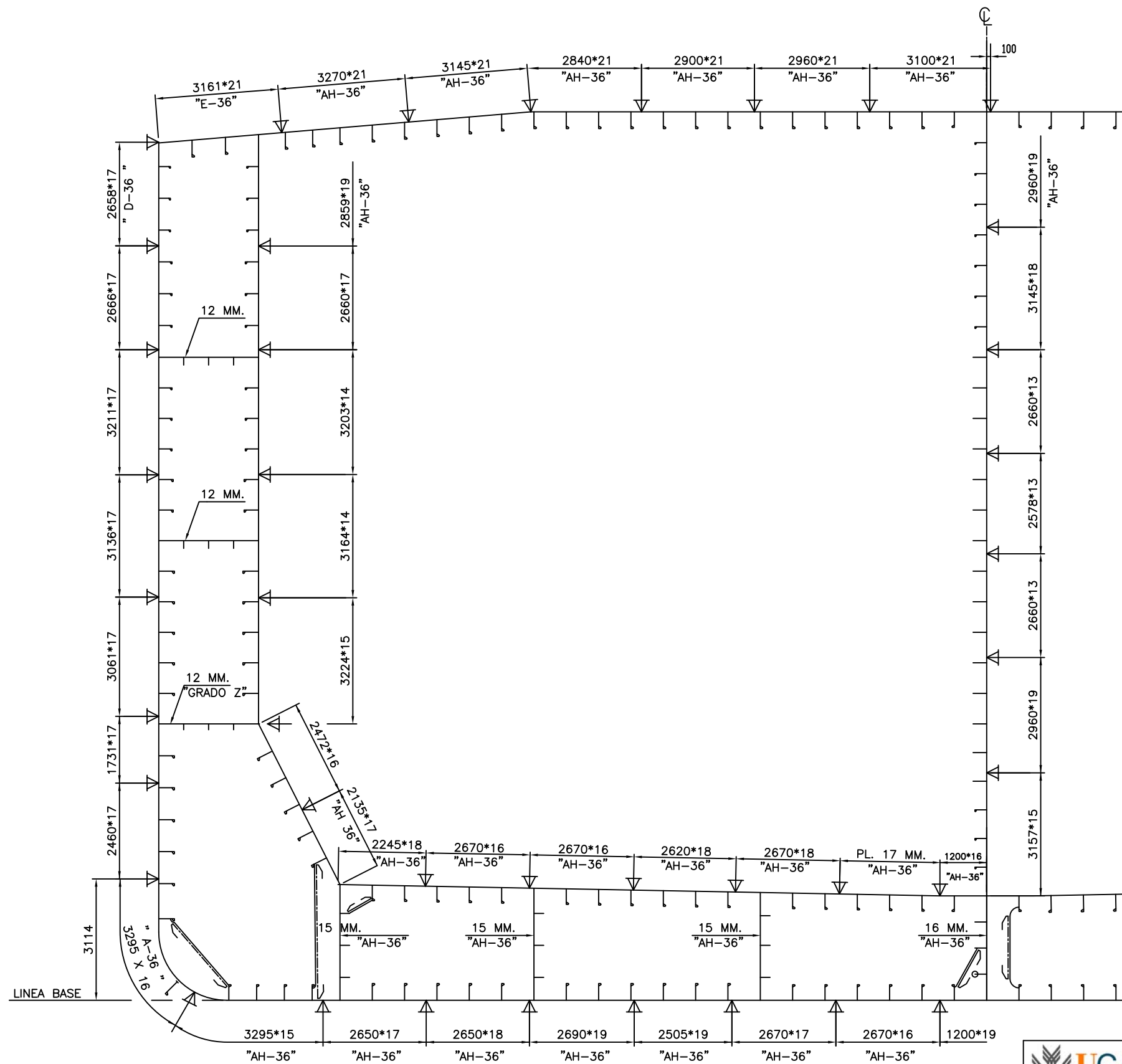
**UCA** Universidad de Cádiz  
 Escuela U. de INGENIERÍA TÉCNICA NAVAL

Proyecto Fin de Carrera:  
 REDISEÑO DE LA ESTRUCTURA BÁSICA DE  
 UN SHUTTLE TANKER DE 145.000 M3.  
 Autor: CESAR CABALLERO PALACIOS

ESCALA: 1:125	TITULO: CUADERNA MAESTRA " BUQUE BASE "	HOJA 2/4
FECHA: 01-07-07		

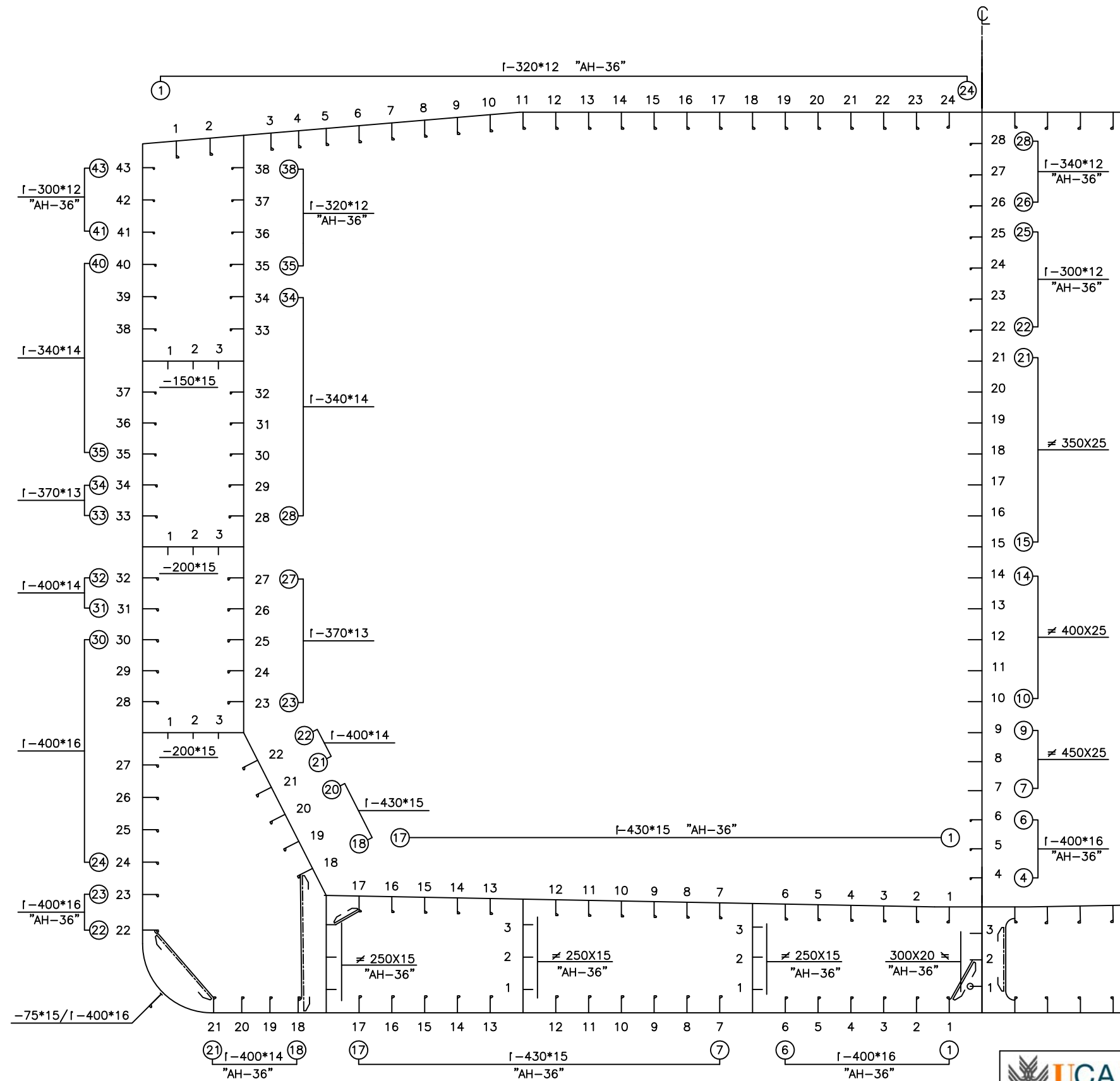
# CUADERNA MAESTRA

## ESCANTILLON DE PLANCHAS



# CUADERNA MAESTRA

## ESCANTILLON DE LONGITUDINALES



## NOTAS

TODO EL MATERIAL SERA DE LIMITE ELASTICO  
DE 235 N/mm<sup>2</sup> (EXCEPTO DONDE SE INDICA)

### MAXIMO MOMENTO FLECTOR EN AGUAS TRANQUILAS(CONSIDERADO)

CONDICION EN ARRUFO \_\_\_\_\_ 407000 T\*M  
CONDICION EN QUEBRANTO \_\_\_\_\_ 418000 T\*M

### MOMENTO FLECTOR EN LA OLA: LOS REGLAMENTARIOS.

## CARACTERISTICAS

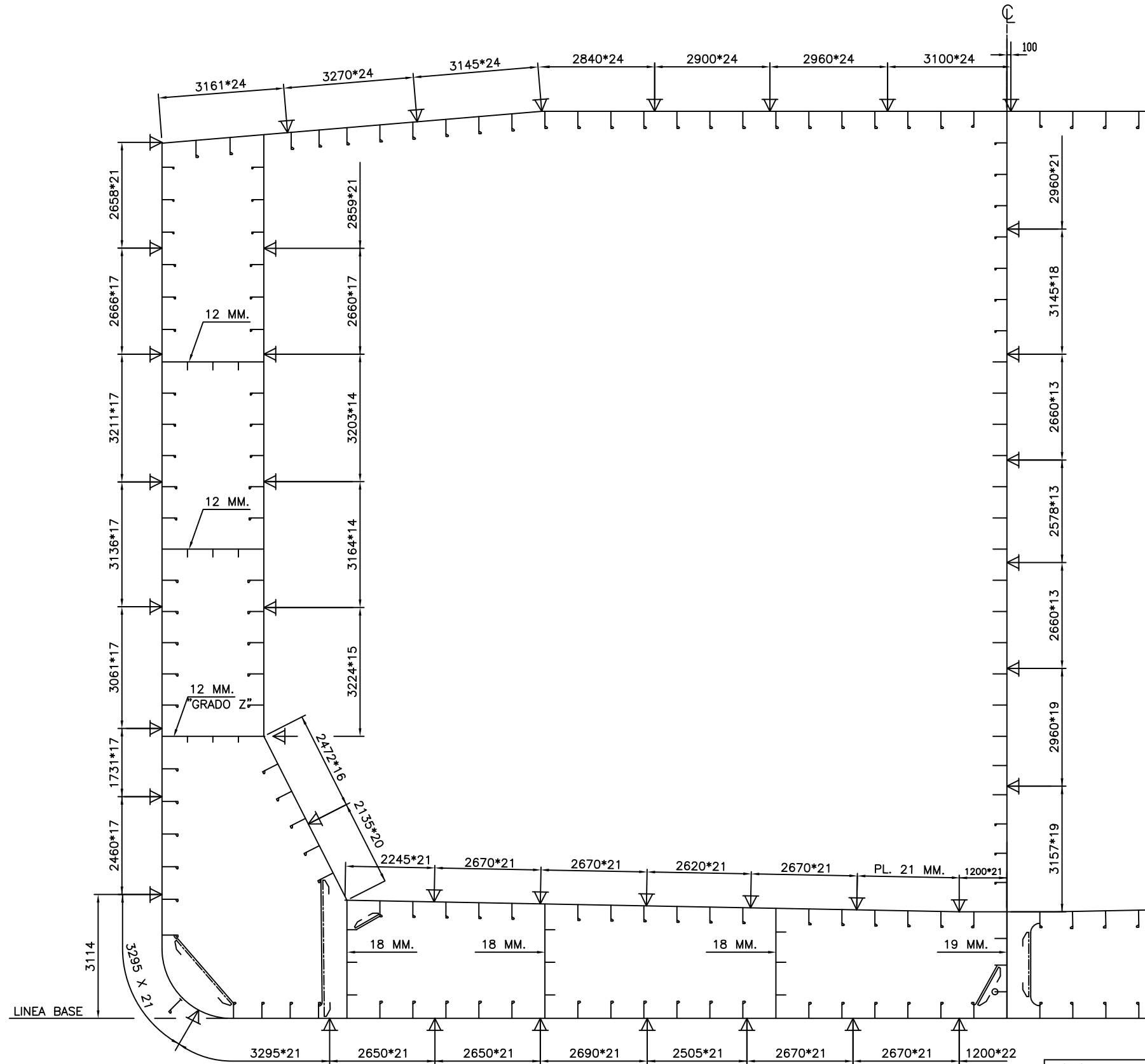
ESLORA TOTAL	-----	265.00	MTS.
ESLORA EN LA FLOTACION AL CALADO DE 15.50	-----	260.50	=
ESLORA ENTRE PERPENDICULARES AL CALADO DE 15.50	-----	256.50	=
ESLORA DE ESCANTILLONADO	-----	252.69	=
MANGA DE TRAZADO	-----	42.50	=
PUNTAL (AL COSTADO)	-----	22.00	=
CALADO DE DISEÑO	-----	15.00	=
CALADO DE ESCANTILLONADO	-----	15.50	MTS.
COEFICIENTE DE BLOQUE (PARA ESLORA DE ESCANTILLONES)	-----	0.879	
ESPACIADO TRANSVERSAL	-----	4.00	MTS
VELOCIDAD MAXIMA EN SERVICIO	-----	14.50	N.

## CLASIFICACION

DET NORSKE VERITAS ✚1A1  
"TANKER FOR OIL" ESP, EO, BOW LOADING,  
OPP-F, ICS, W1F-AMC, DYMPOS ATR, CSA-1(NORTH ATLANTIC) HELDK SH, SBM  
ADDITIONALLY, THE VESSEL SHALL COMPLY WITH THE REQUIREMENTS FOR THE  
PREVIOUS D.N.V. "BIS" NOTATION  
THE FATIGUE LIFE SHALL BE MINIMUM 20 YEARS

# CUADERNA MAESTRA

## ESCANTILLON DE PLANCHAS




**UCA** Universidad de Cádiz  
 Escuela U. de INGENIERÍA TÉCNICA NAVAL

Proyecto Fin de Carrera:  
 REDISEÑO DE LA ESTRUCTURA BÁSICA DE  
 UN SHUTTLE TANKER DE 145.000 M3.

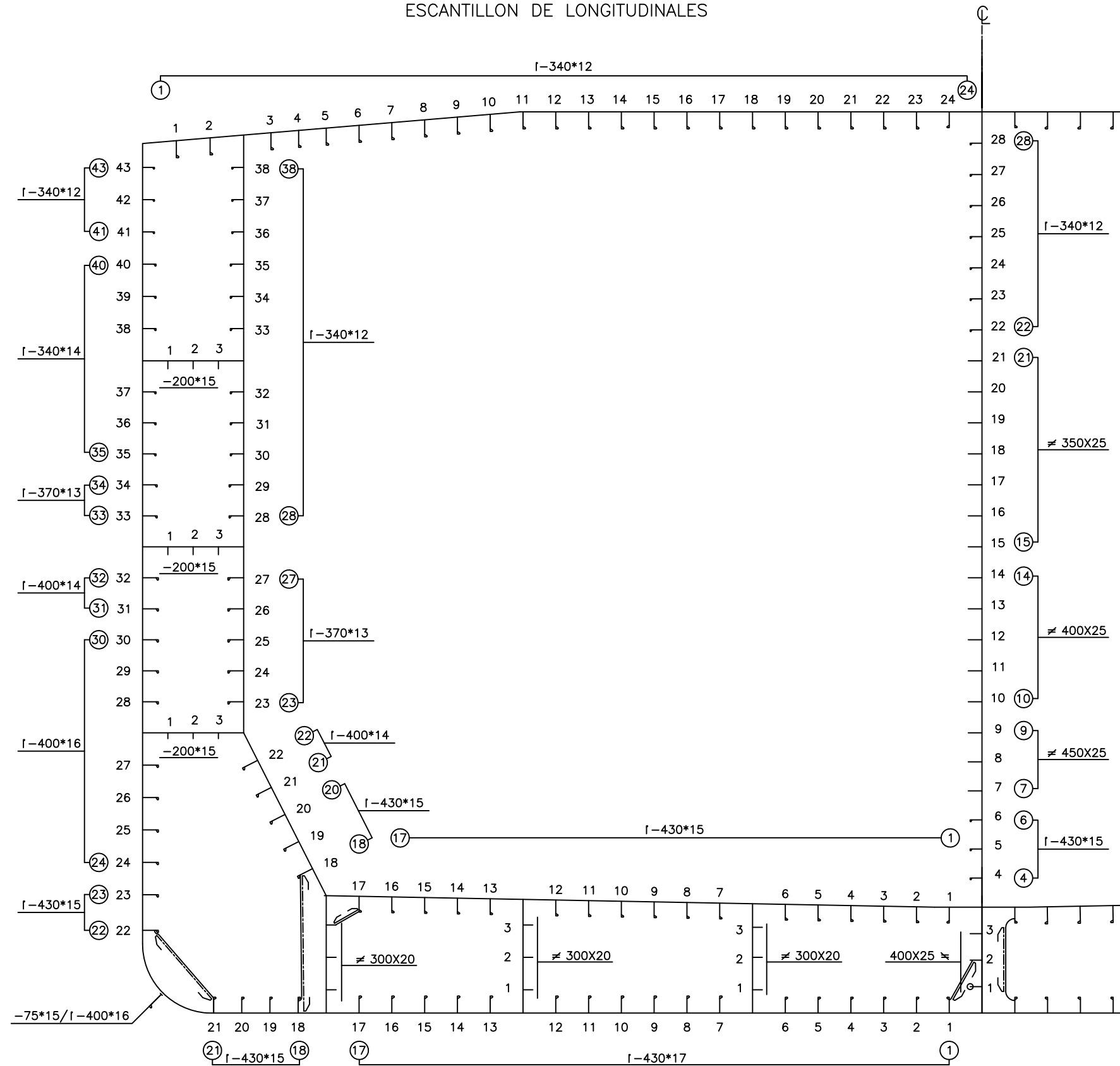
Autor: CESAR CABALLERO PALACIOS

ESCALA:  
 1:125  
 FECHA:  
 01-07-07

TITULO:  
 CUADERNA MAESTRA  
 " 1º APROXIMACION "

HOJA  
 2/3

CUADERNA MAESTRA  
 ESCANTILLON DE LONGITUDINALES



## NOTAS

TODO EL MATERIAL SERA DE LIMITE ELASTICO  
DE 235 N/mm<sup>2</sup> (EXCEPTO DONDE SE INDICA)

### MAXIMO MOMENTO FLECTOR EN AGUAS TRANQUILAS(CONSIDERADO)

CONDICION EN ARRUFO \_\_\_\_\_ 407000 T\*M  
CONDICION EN QUEBRANTO \_\_\_\_\_ 418000 T\*M

### MOMENTO FLECTOR EN LA OLA: LOS REGLAMENTARIOS.

## CARACTERISTICAS

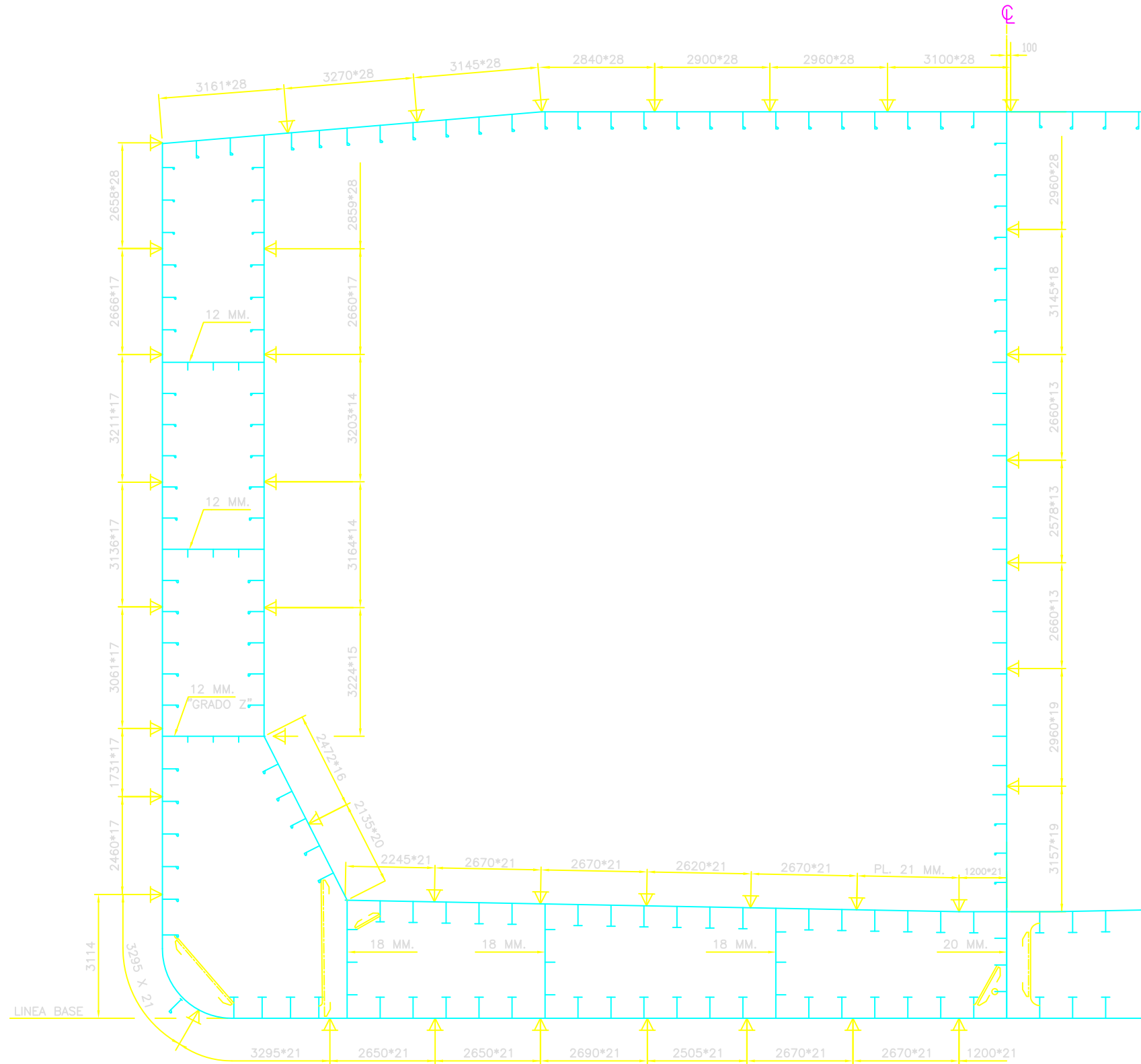
ESLORA TOTAL	-----	265.00	MTS.
ESLORA EN LA FLOTACION AL CALADO DE 15.50	-----	260.50	=
ESLORA ENTRE PERPENDICULARES AL CALADO DE 15.50	-----	256.50	=
ESLORA DE ESCANTILLONADO	-----	252.69	=
MANGA DE TRAZADO	-----	42.50	=
PUNTAL (AL COSTADO)	-----	22.00	=
CALADO DE DISEÑO	-----	15.00	=
CALADO DE ESCANTILLONADO	-----	15.50	MTS.
COEFICIENTE DE BLOQUE (PARA ESLORA DE ESCANTILLONES)	-----	0.879	
ESPACIADO TRANSVERSAL	-----	4.00	MTS
VELOCIDAD MAXIMA EN SERVICIO	-----	14.50	N.

## CLASIFICACION

DET NORSKE VERITAS ✚1A1  
"TANKER FOR OIL" ESP, EO, BOW LOADING,  
OPP-F, ICS, W1F-AMC, DYMPOS ATR, CSA-1(NORTH ATLANTIC) HELDK SH, SBM  
ADDITIONALLY, THE VESSEL SHALL COMPLY WITH THE REQUIREMENTS FOR THE  
PREVIOUS D.N.V. "BIS" NOTATION  
THE FATIGUE LIFE SHALL BE MINIMUM 20 YEARS



CUADERNA MAESTRA  
 ESCANTILLON DE PLANCHAS



 **UCA** Universidad de Cádiz  
 Escuela U. de INGENIERÍA TÉCNICA NAVAL

Proyecto Fin de Carrera:  
 REDISEÑO DE LA ESTRUCTURA BÁSICA DE  
 UN SHUTTLE TANKER DE 145.000 M3.

Autor: CESAR CABALLERO PALACIOS

ESCALA:  
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 FECHA  
 01-07-07

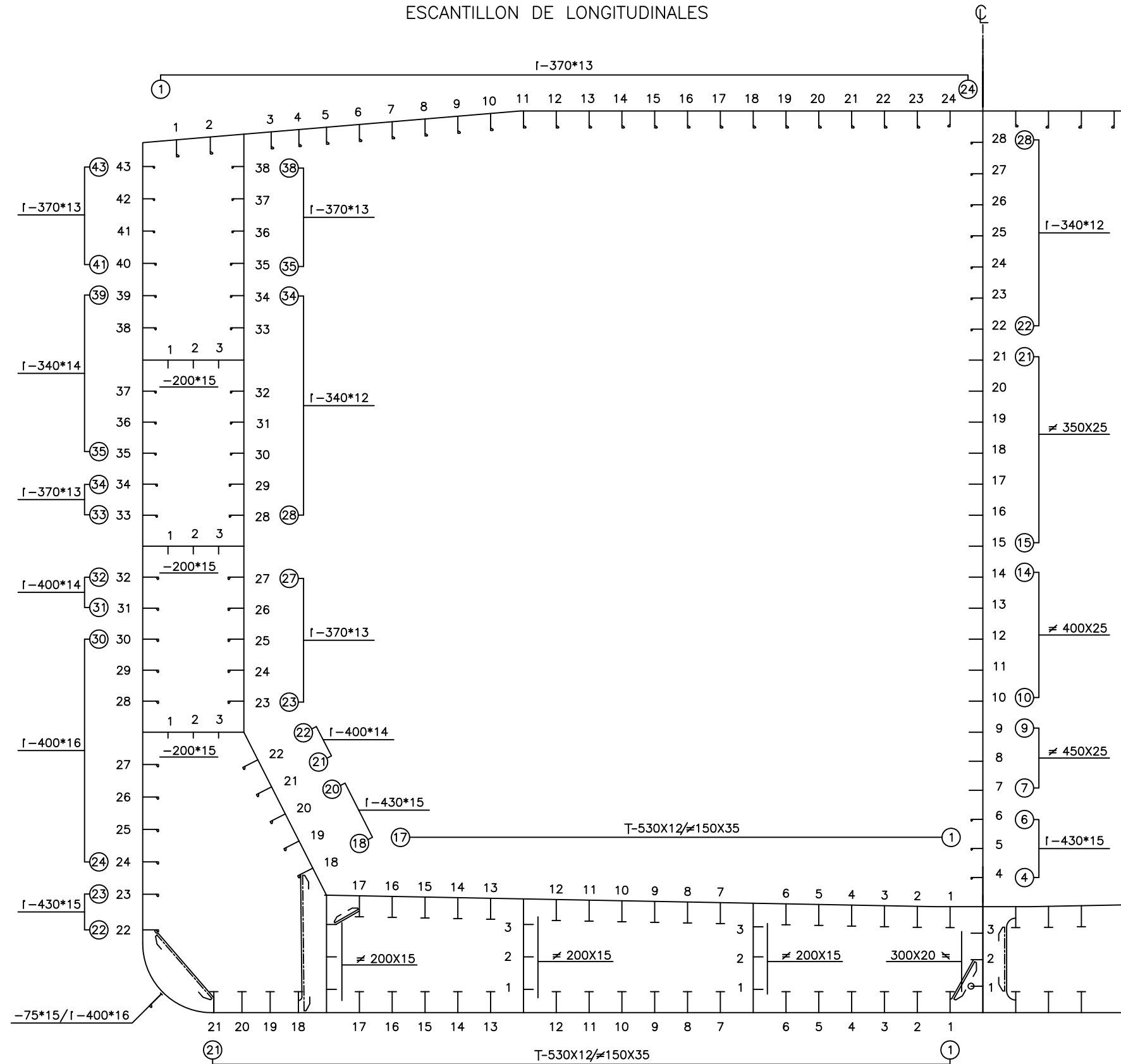
TITULO:

CUADERNA MAESTRA  
 " 2º APROXIMACION "

HOJA  
 2/3

# CUADERNA MAESTRA

## ESCANTILLON DE LONGITUDINALES



## NOTAS

TODO EL MATERIAL SERA DE LIMITE ELASTICO  
DE 235 N/mm<sup>2</sup>

### MAXIMO MOMENTO FLECTOR EN AGUAS TRANQUILAS(CONSIDERADO)

CONDICION EN ARRUFO \_\_\_\_\_ 407000 T\*M  
CONDICION EN QUEBRANTO \_\_\_\_\_ 418000 T\*M

### MOMENTO FLECTOR EN LA OLA: LOS REGLAMENTARIOS.

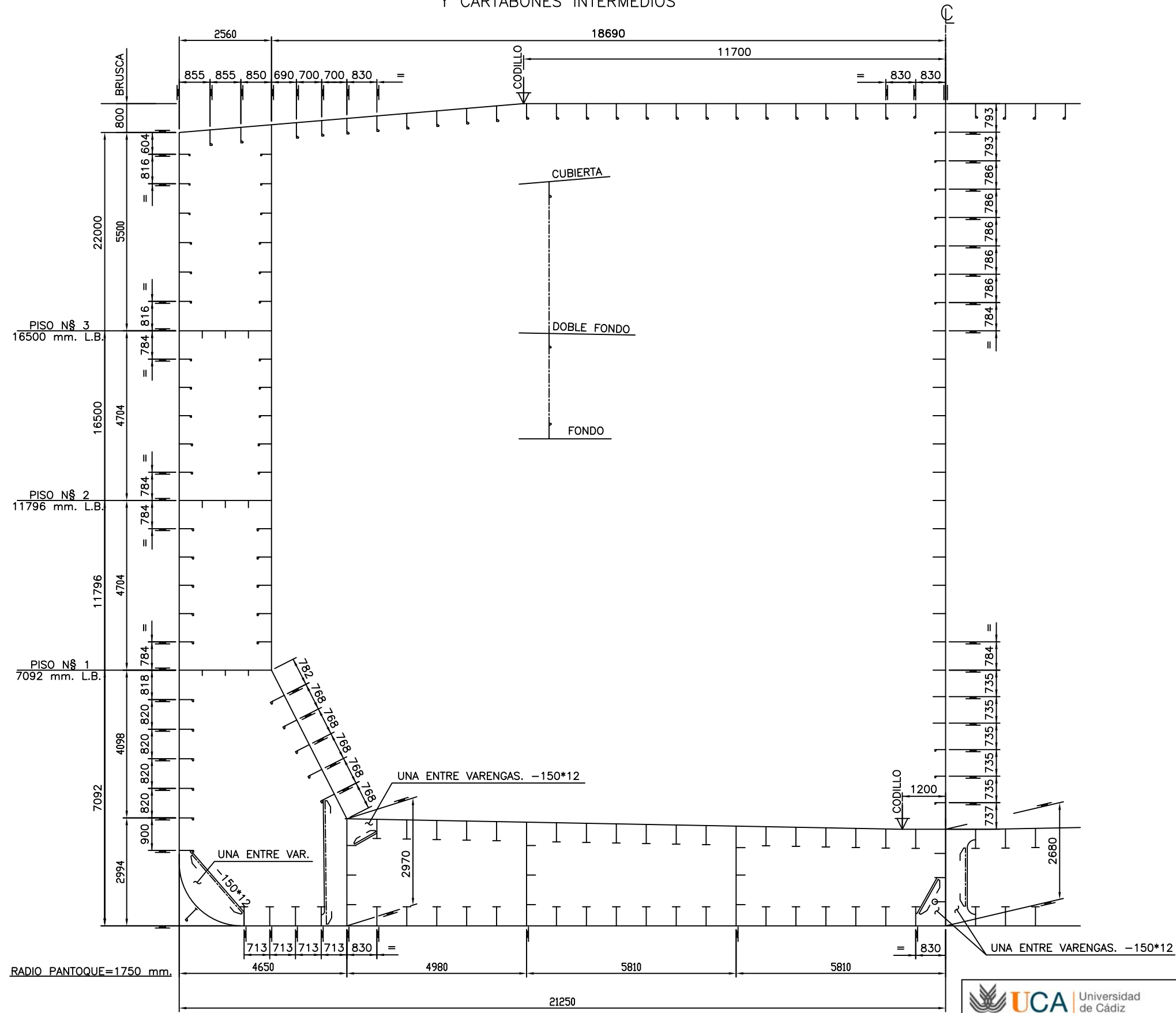
## CARACTERISTICAS

ESLORA TOTAL	-----	265.00	MTS.
ESLORA EN LA FLOTACION AL CALADO DE 15.50	-----	260.50	=
ESLORA ENTRE PERPENDICULARES AL CALADO DE 15.50	-----	256.50	=
ESLORA DE ESCANTILLONADO	-----	252.69	=
MANGA DE TRAZADO	-----	42.50	=
PUNTAL (AL COSTADO)	-----	22.00	=
CALADO DE DISEÑO	-----	15.00	=
CALADO DE ESCANTILLONADO	-----	15.50	MTS.
COEFICIENTE DE BLOQUE (PARA ESLORA DE ESCANTILLONES)	-----	0.879	
ESPACIADO TRANSVERSAL	-----	4.00	MTS
VELOCIDAD MAXIMA EN SERVICIO	-----	14.50	N.

## CLASIFICACION

DET NORSKE VERITAS ✚1A1  
"TANKER FOR OIL" ESP, EO, BOW LOADING,  
OPP-F, ICS, W1F-AMC, DYMPOS ATR, CSA-1(NORTH ATLANTIC) HELDK SH, SBM  
ADDITIONALLY, THE VESSEL SHALL COMPLY WITH THE REQUIREMENTS FOR THE  
PREVIOUS D.N.V. "BIS" NOTATION  
THE FATIGUE LIFE SHALL BE MINIMUM 20 YEARS

**CUADERNA MAESTRA**  
 GEOMETRIA – ESPACIADO DE LONGITUDINALES  
 Y CARTABONES INTERMEDIOS



 **UCA** Universidad de Cádiz  
 Escuela U. de INGENIERÍA TÉCNICA NAVAL

Proyecto Fin de Carrera:  
 REDISEÑO DE LA ESTRUCTURA BÁSICA DE  
 UN SHUTTLE TANKER DE 145.000 M3.

Autor: CESAR CABALLERO PALACIOS

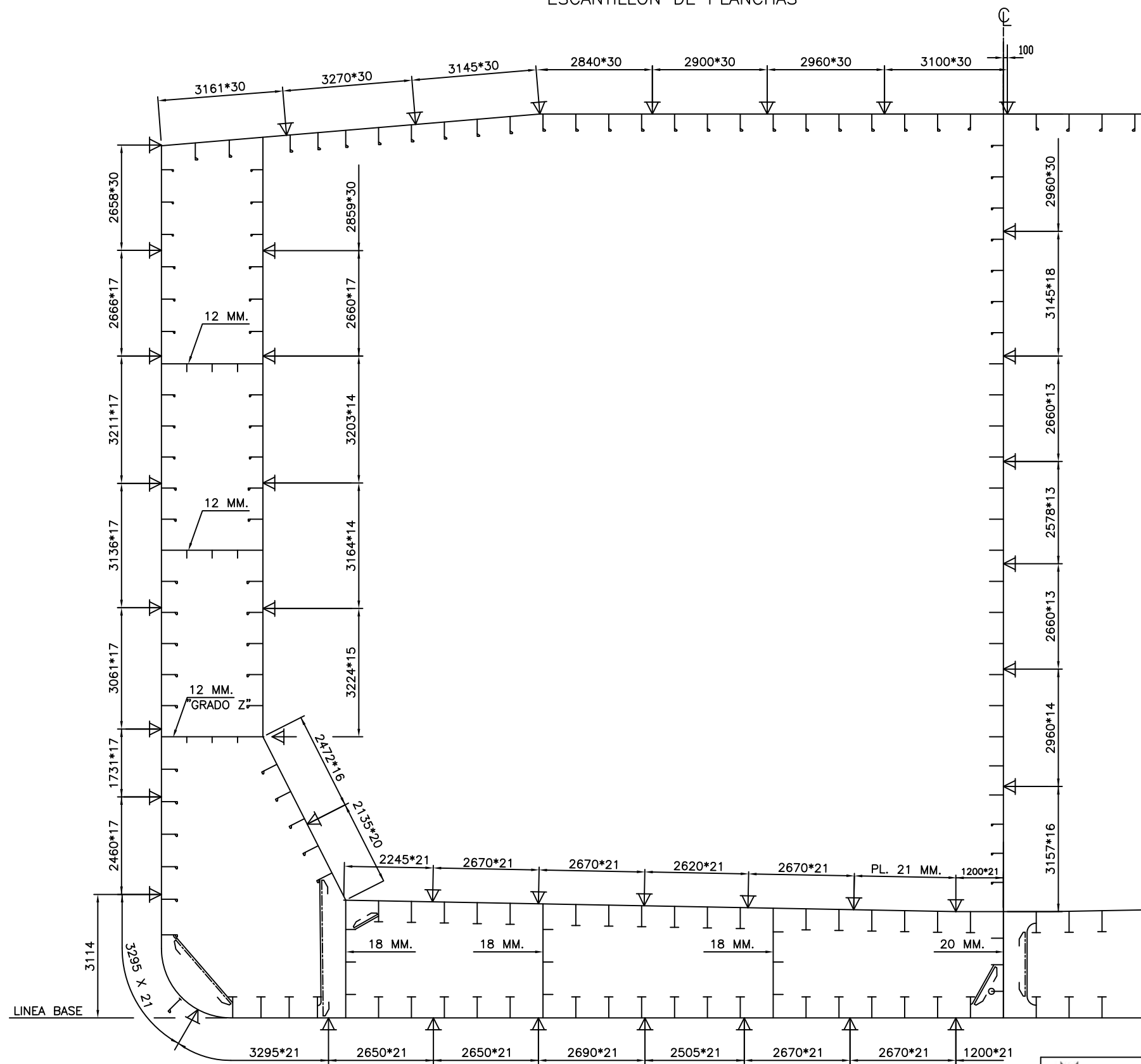
ESCALA:  
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 FECHA:  
 01-07-07

TITULO:  
 CUADERNA MAESTRA  
 " BUQUE PROYECTO "

HOJA  
 2/4

# CUADERNA MAESTRA

## ESCANTILLON DE PLANCHAS




**UCA** Universidad de Cádiz  
 Escuela U. de INGENIERÍA TÉCNICA NAVAL

Proyecto Fin de Carrera:  
**REDISEÑO DE LA ESTRUCTURA BÁSICA DE UN SHUTTLE TANKER DE 145.000 M3.**

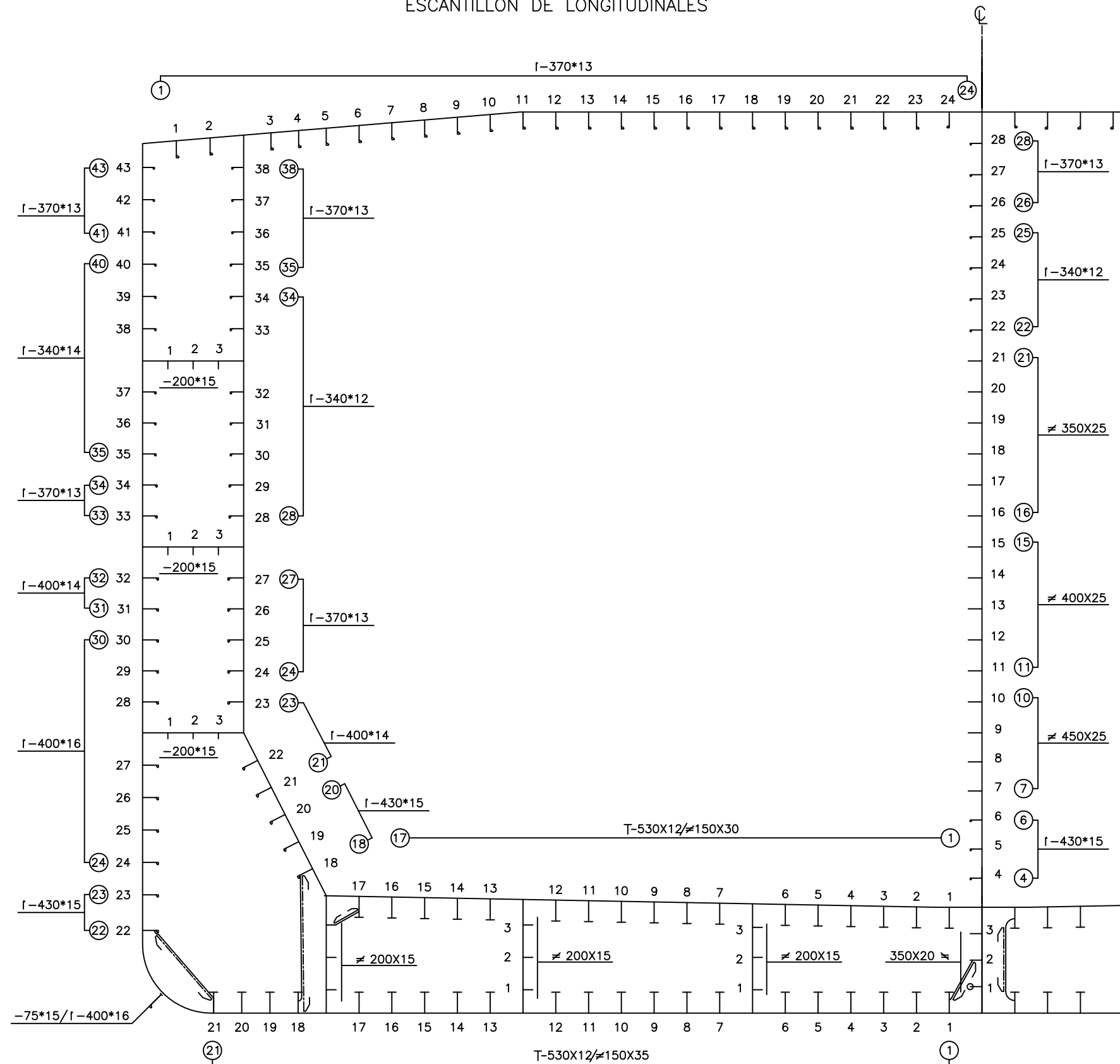
Autor: **CESAR CABALLERO PALACIOS**

ESCALA:  
 1:125  
 FECHA:  
 01-07-07

TITULO:  
**CUADERNA MAESTRA**  
**" BUQUE PROYECTO "**

HOJA  
 3/4

CUADERNA MAESTRA  
 ESCANTILLON DE LONGITUDINALES



## CARACTERISTICAS

ESLORA TOTAL	-----	265.00	MTS.
ESLORA EN LA FLOTACION AL CALADO DE 15.50	-----	260.50	=
ESLORA ENTRE PERPENDICULARES AL CALADO DE 15.50	-----	256.50	=
ESLORA DE ESCANTILLONADO	-----	252.69	=
MANGA DE TRAZADO	-----	42.50	=
PUNTAL (AL COSTADO)	-----	22.00	=
CALADO DE DISEÑO	-----	15.00	=
CALADO DE ESCANTILLONADO	-----	15.50	MTS.
COEFICIENTE DE BLOQUE (PARA ESLORA DE ESCANTILLONES)	-----	0.879	
ESPACIADO TRANSVERSAL	-----	4.00	MTS
VELOCIDAD MAXIMA EN SERVICIO	-----	14.50	N.

## NOTAS

TODO EL MATERIAL SERA DE LIMITE ELASTICO DE 235 N/mm (EXCEPTO DONDE SE INDIQUE)  
PARA TODOS LOS DETALLES INDICADOS VER PLANO "DETALLES NORMALIZADOS A USAR EN BUQUE"  
TODAS LA SECCIONES ESTAN DIBUJADAS MIRANDO A PROA Y BABOR (EXCEPTO DONDE SE INDIQUE)  
LLENADOS PARCIALES EN TANQUES DE CARGA SON PERMITIDOS



Proyecto Fin de Carrera:  
REDISEÑO DE LA ESTRUCTURA BÁSICA DE  
UN SHUTTLE TANKER DE 145.000 M3.

Autor: CESAR CABALLERO PALACIOS

ESCALA:  
1:125  
FECHA  
01-07-07

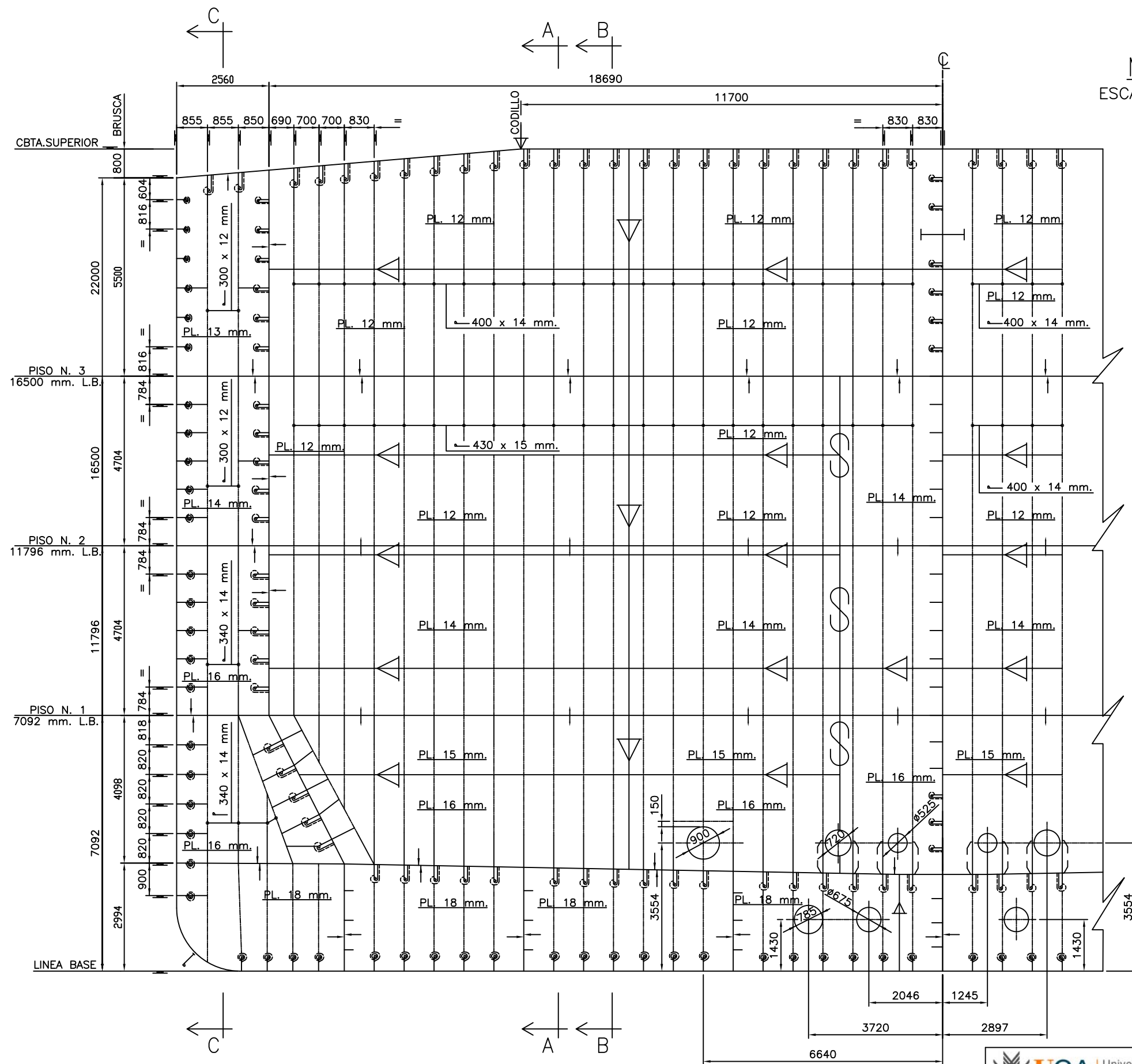
TITULO:  
MAMPARO TRANSVERSAL  
" BUQUE BASE "

HOJA  
1/6

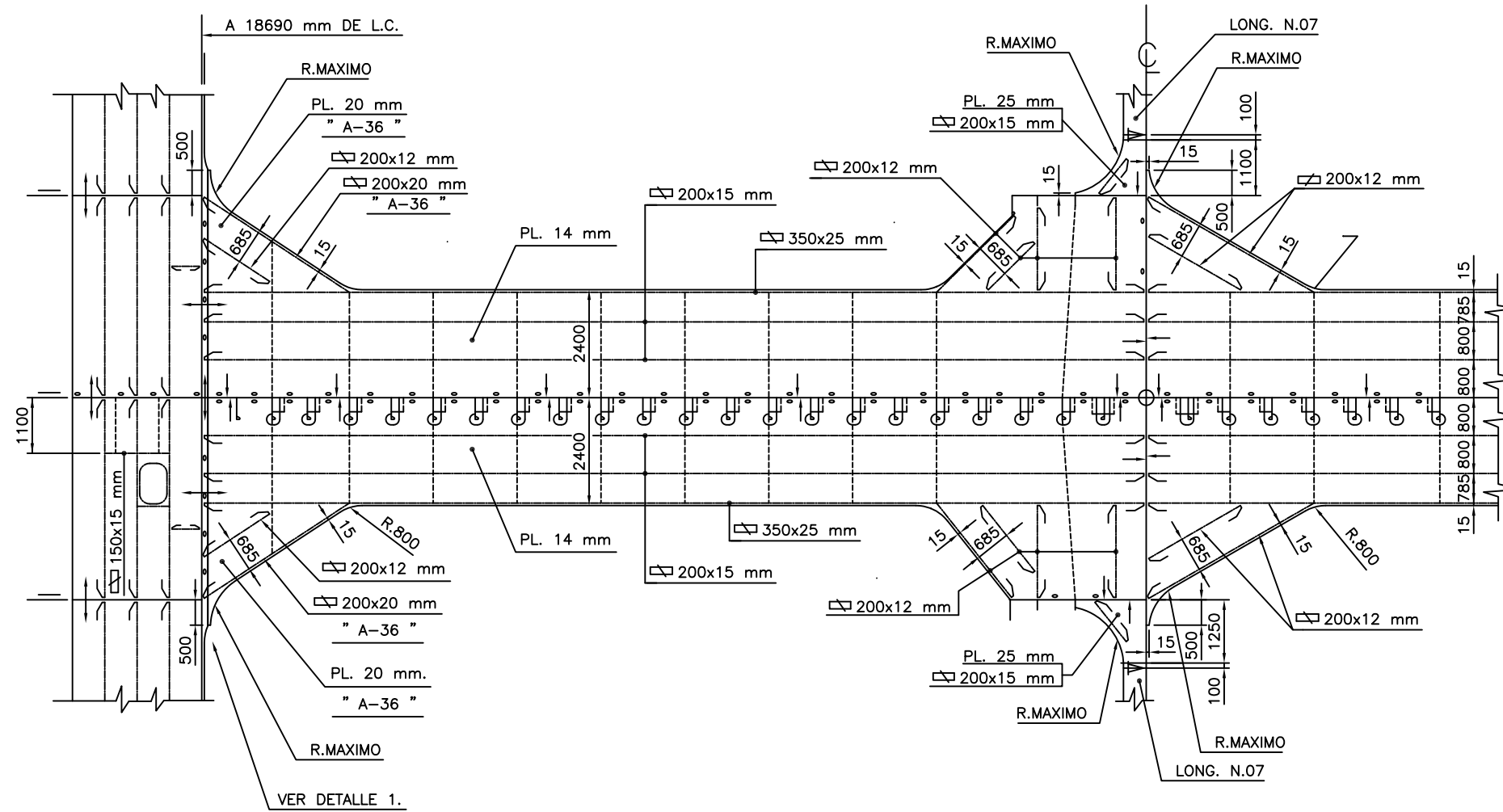


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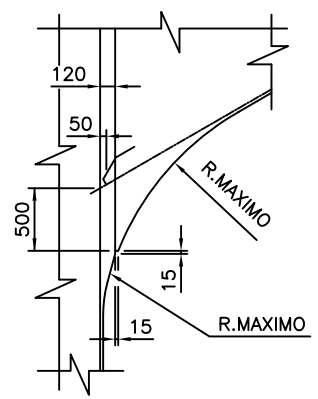
## ESCANTILLONADO DE PLANCHAS Y REFUERZOS




PALMEJAR A 7092 DE L.B.  
 ESCANTILLONADO DE PLANCHAS Y REFUERZOS



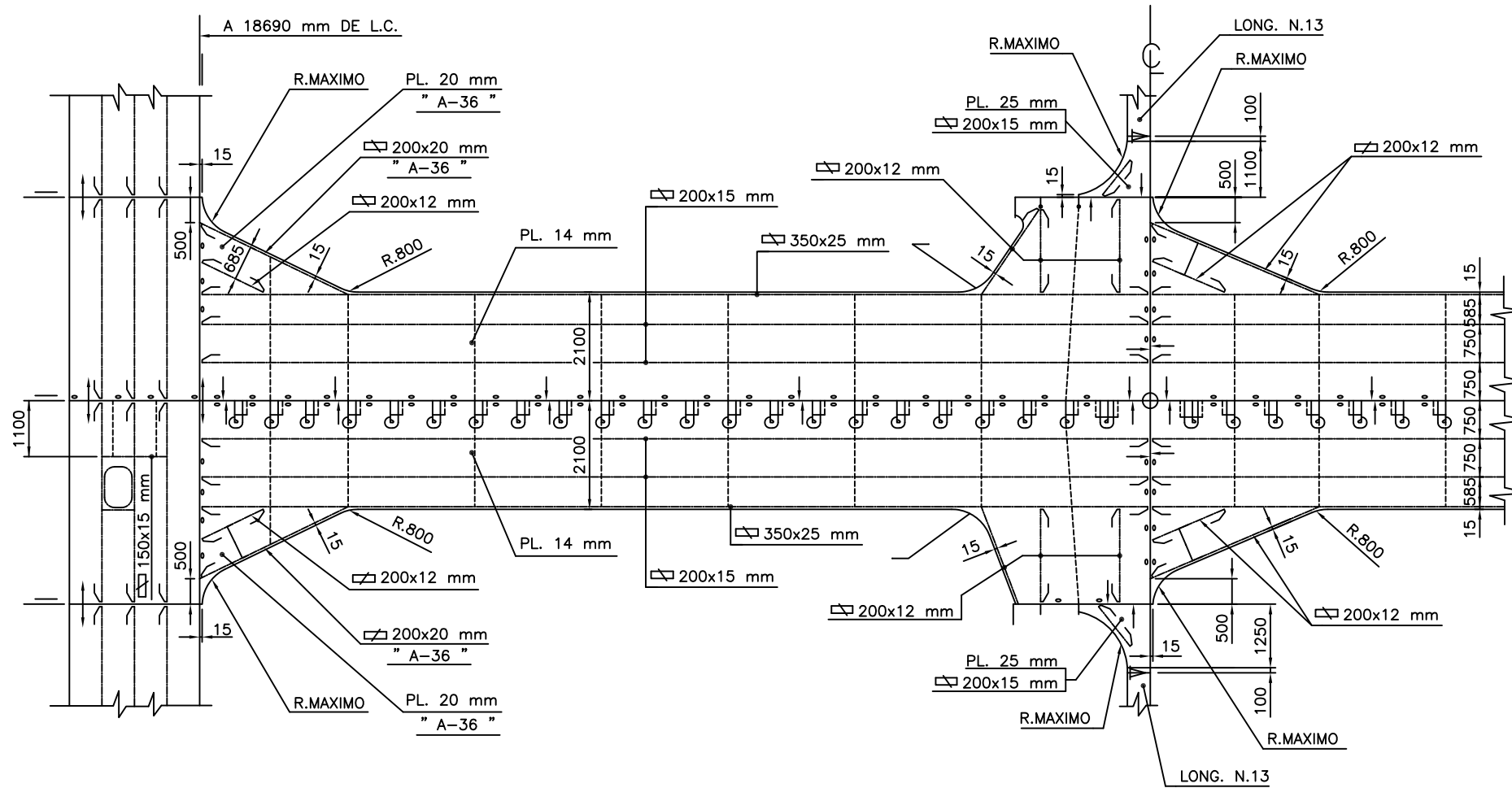
DETALLE 1



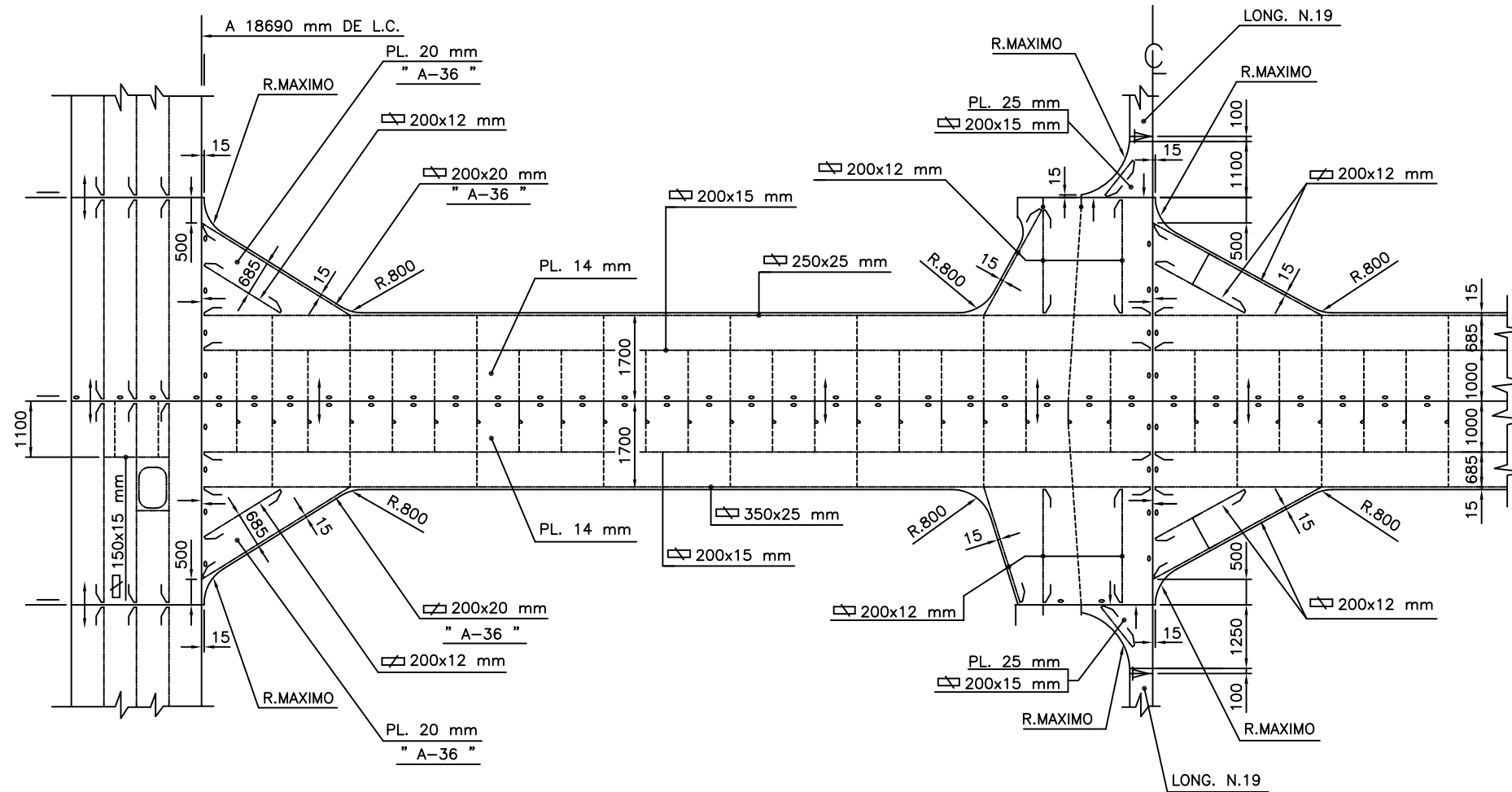

 Universidad de Cádiz  
 Proyecto Fin de Carrera:  
 REDISEÑO DE LA ESTRUCTURA BÁSICA DE UN SHUTTLE TANKER DE 145.000 M3.  
 Escuela U. de INGENIERÍA TÉCNICA NAVAL  
 Autor: CESAR CABALLERO PALACIOS

ESCALA: 1:125	TITULO: PALMEJAR A 7092 DE L.B. "BUQUE BASE"	HOJA 3/6
FECHA: 01-07-07		

PALMEJAR A 11796 DE L.B.  
 ESCANTILLONADO DE PLANCHAS Y REFUERZOS



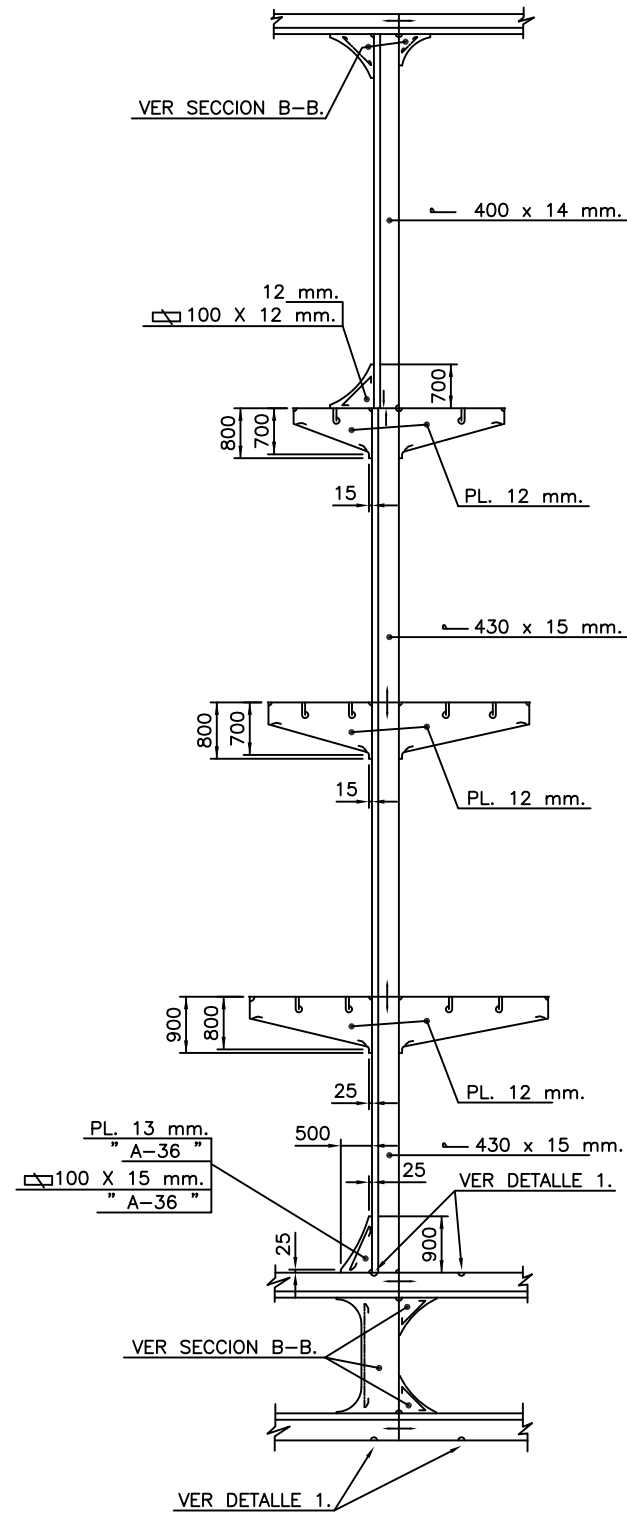
PALMEJAR A 16500 DE L.B.  
 ESCANTILLONADO DE PLANCHAS Y REFUERZOS



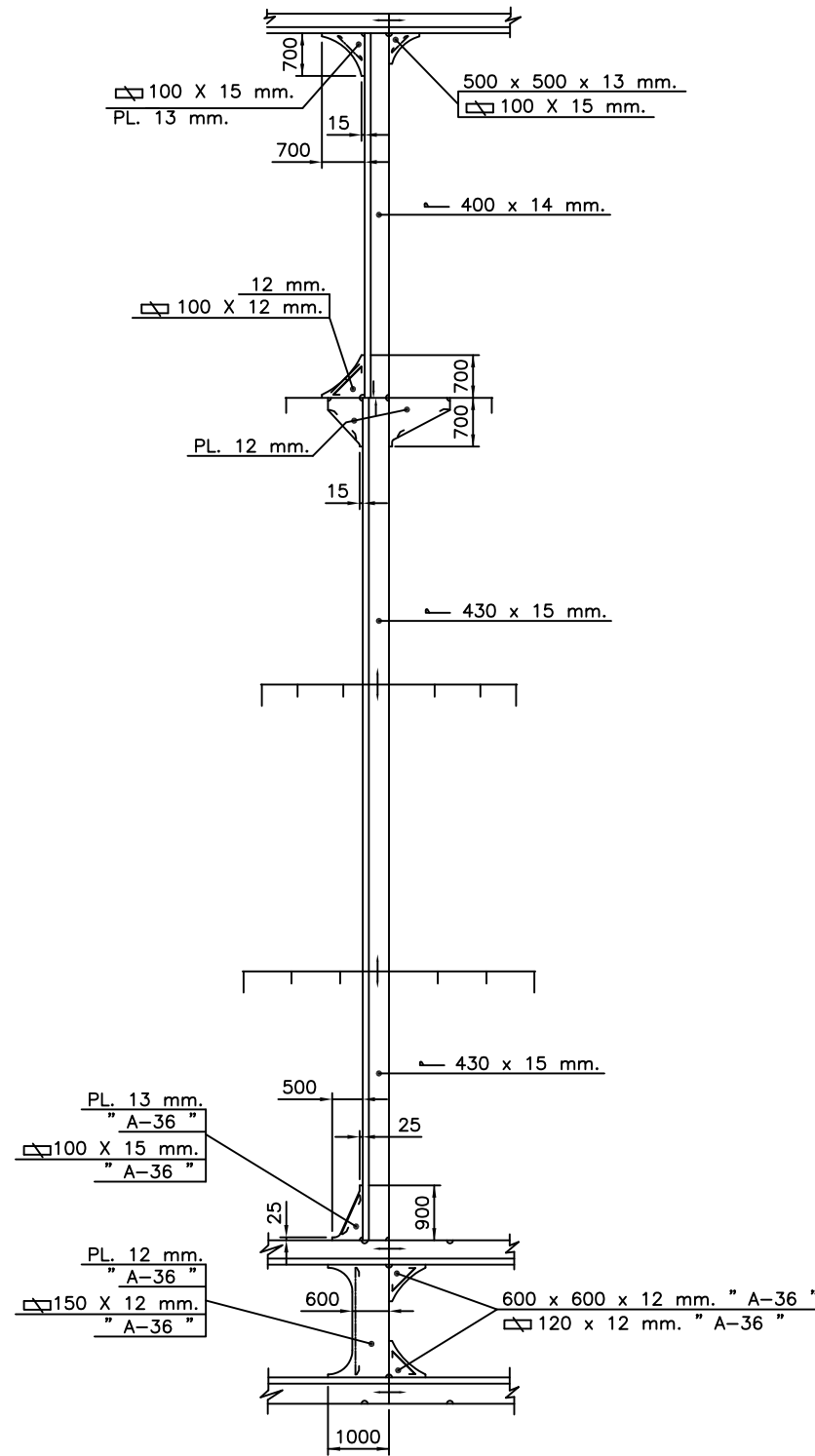
# SECCION LONGITUDINAL

## ESCANTILLONADO DE CARTABONES Y REFUERZOS

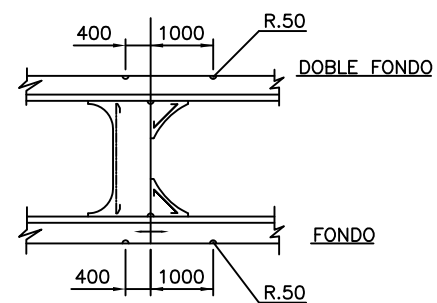
SECCION A-A



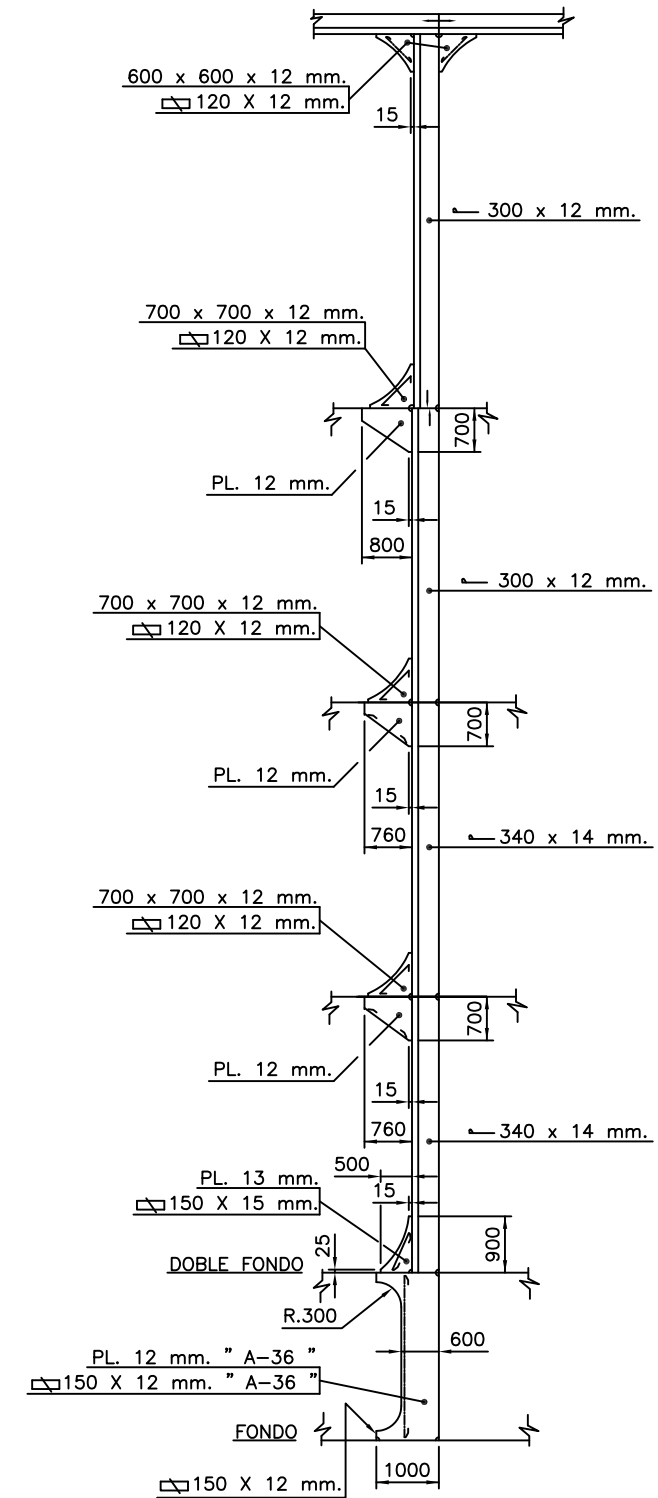
SECCION B-B



DETALLE 1.



SECCION C-C



## CARACTERISTICAS

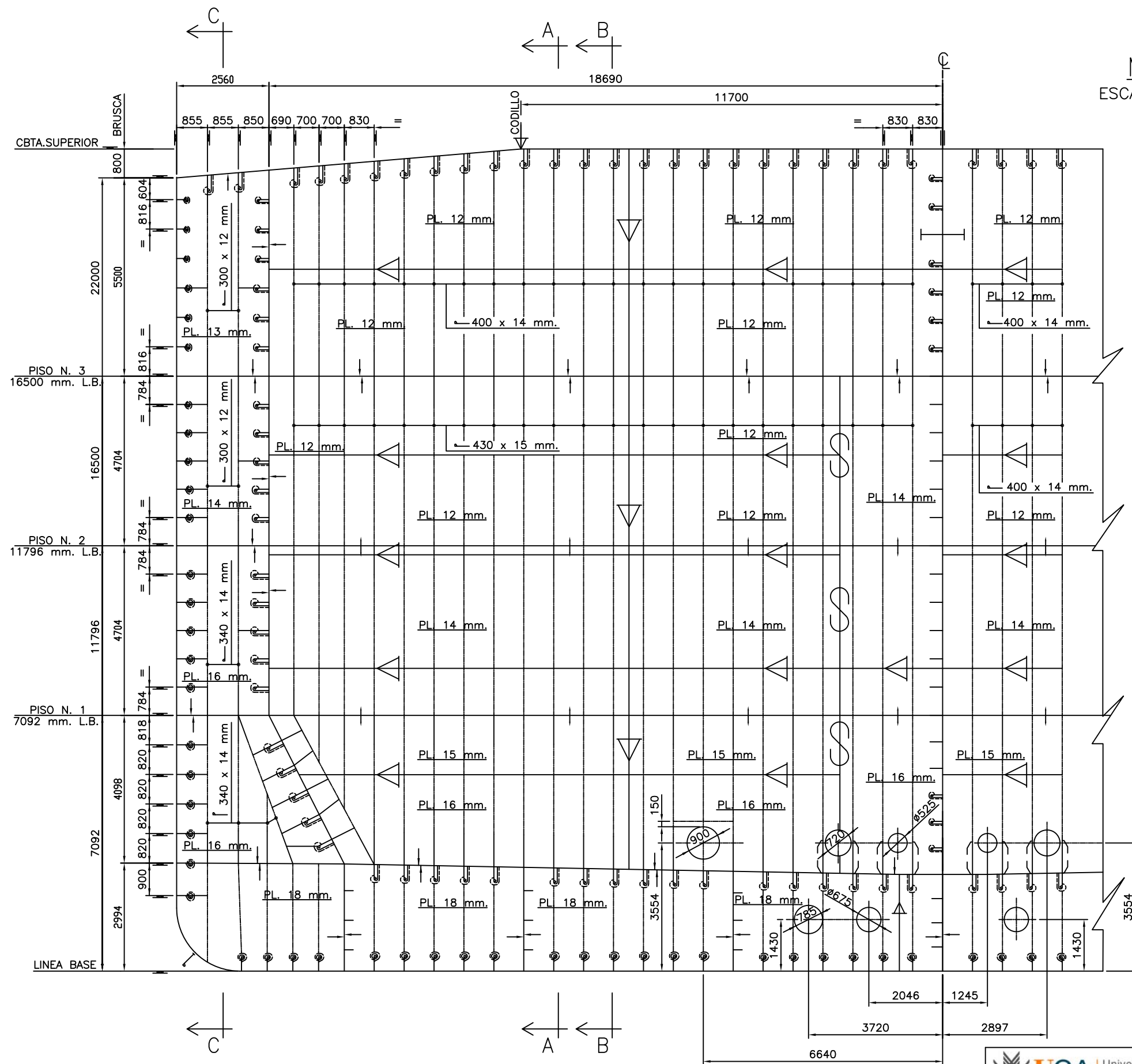
ESLORA TOTAL	-----	265.00	MTS.
ESLORA EN LA FLOTACION AL CALADO DE 15.50	-----	260.50	=
ESLORA ENTRE PERPENDICULARES AL CALADO DE 15.50	-----	256.50	=
ESLORA DE ESCANTILLONADO	-----	252.69	=
MANGA DE TRAZADO	-----	42.50	=
PUNTAL (AL COSTADO)	-----	22.00	=
CALADO DE DISEÑO	-----	15.00	=
CALADO DE ESCANTILLONADO	-----	15.50	MTS.
COEFICIENTE DE BLOQUE (PARA ESLORA DE ESCANTILLONES)	-----	0.879	
ESPACIADO TRANSVERSAL	-----	4.00	MTS
VELOCIDAD MAXIMA EN SERVICIO	-----	14.50	N.

## NOTAS

TODO EL MATERIAL SERA DE LIMITE ELASTICO DE 235 N/mm (EXCEPTO DONDE SE INDIQUE)  
PARA TODOS LOS DETALLES INDICADOS VER PLANO "DETALLES NORMALIZADOS A USAR EN BUQUE"  
TODAS LA SECCIONES ESTAN DIBUJADAS MIRANDO A PROA Y BABOR (EXCEPTO DONDE SE INDIQUE)  
LLENADOS PARCIALES EN TANQUES DE CARGA SON PERMITIDOS

# MAMPARO TRANSVERSAL

## ESCANTILLONADO DE PLANCHAS Y REFUERZOS




**UCA** Universidad de Cádiz  
 Escuela U. de INGENIERÍA TÉCNICA NAVAL

Proyecto Fin de Carrera:  
 REDISEÑO DE LA ESTRUCTURA BÁSICA DE  
 UN SHUTTLE TANKER DE 145.000 M3.

Autor: CESAR CABALLERO PALACIOS

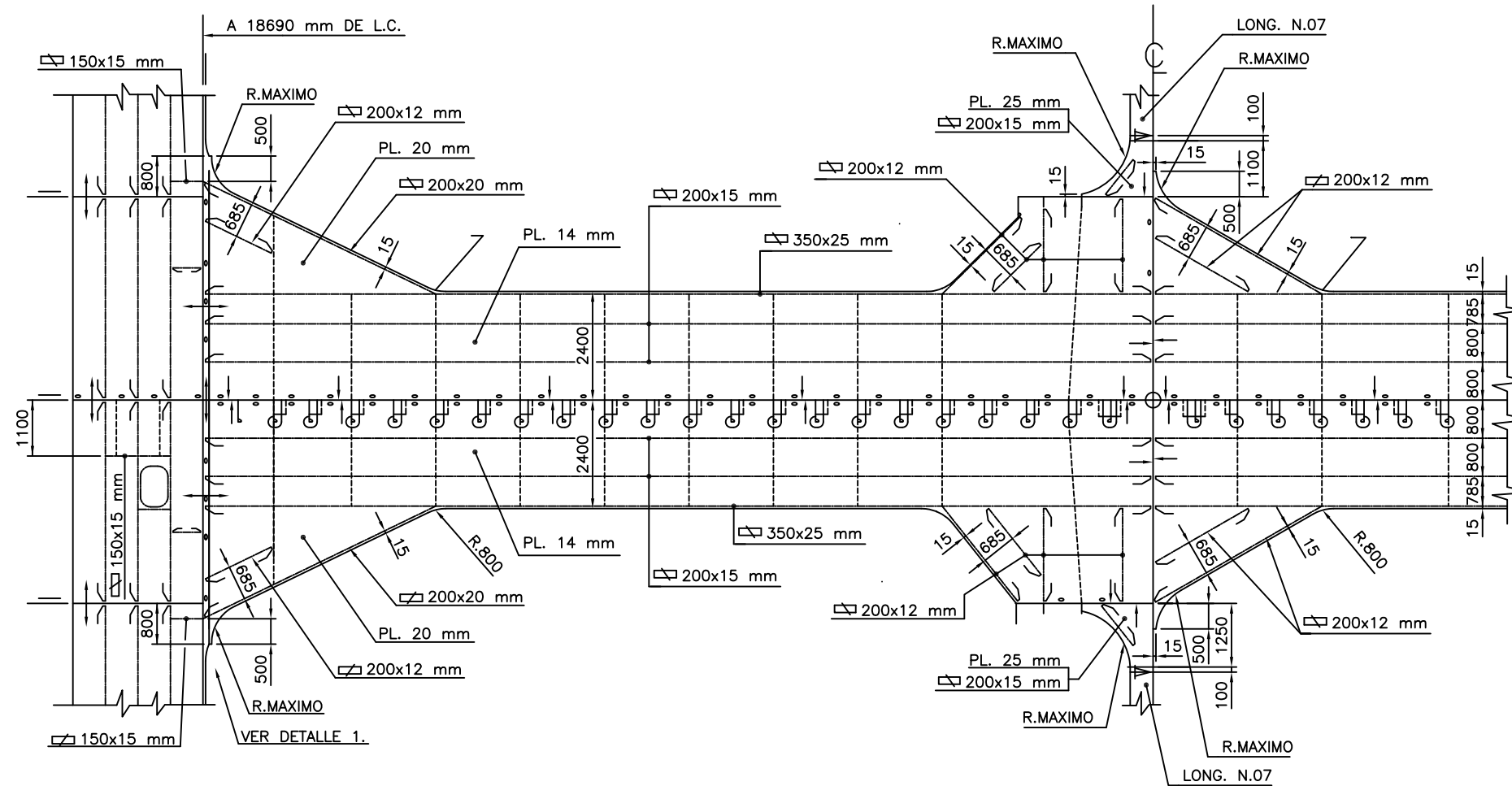
ESCALA:  
 1:125  
 FECHA:  
 01-07-07

TITULO:  
 MAMPARO TRANSVERSAL  
 " BUQUE PROYECTO "

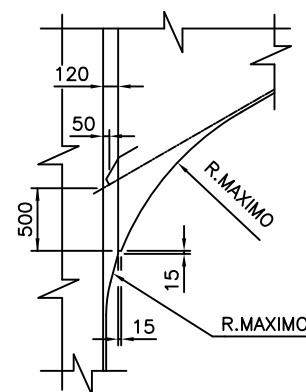
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 2/6



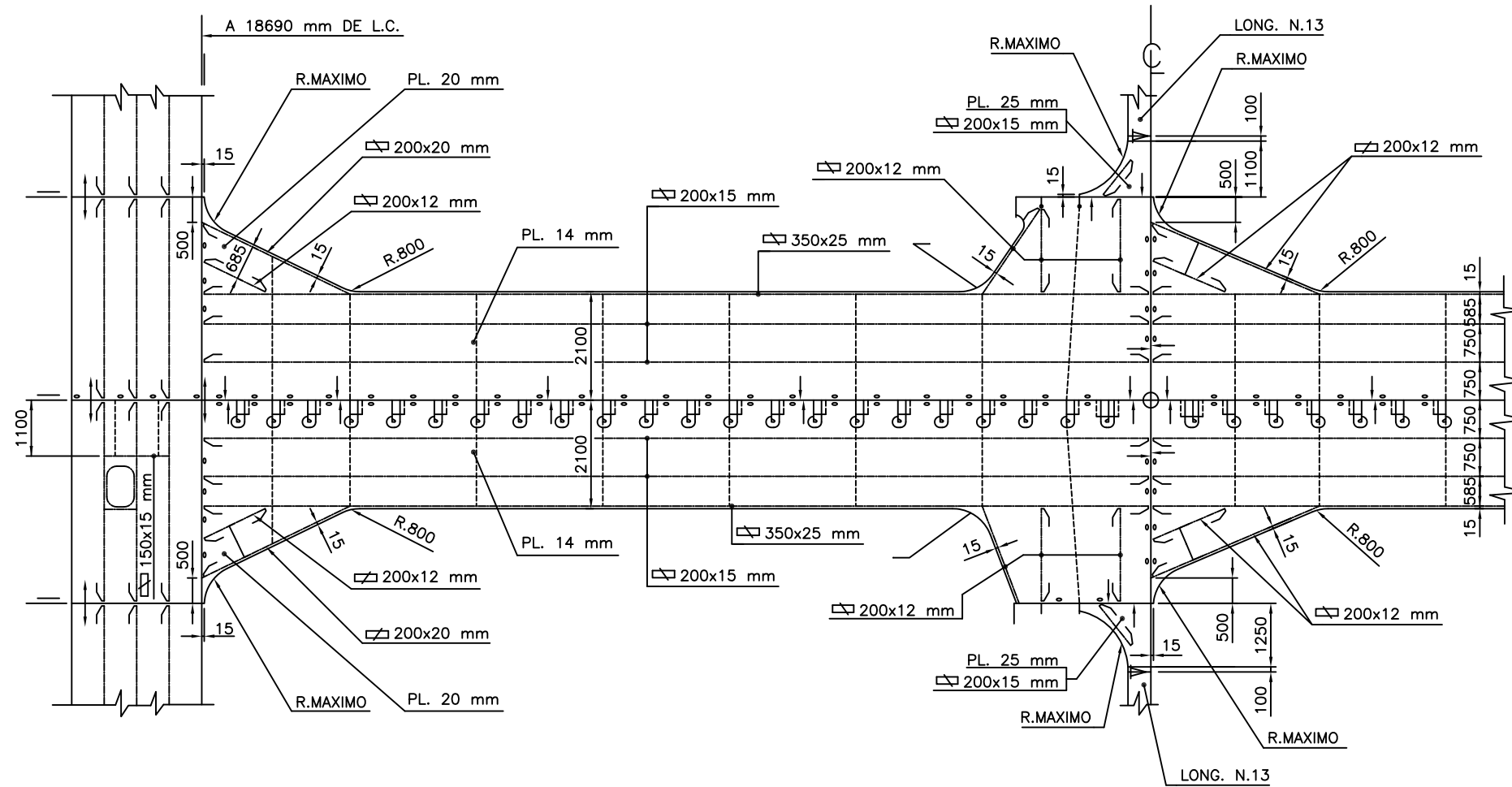
PALMEJAR A 7092 DE L.B.  
 ESCANTILLONADO DE PLANCHAS Y REFUERZOS



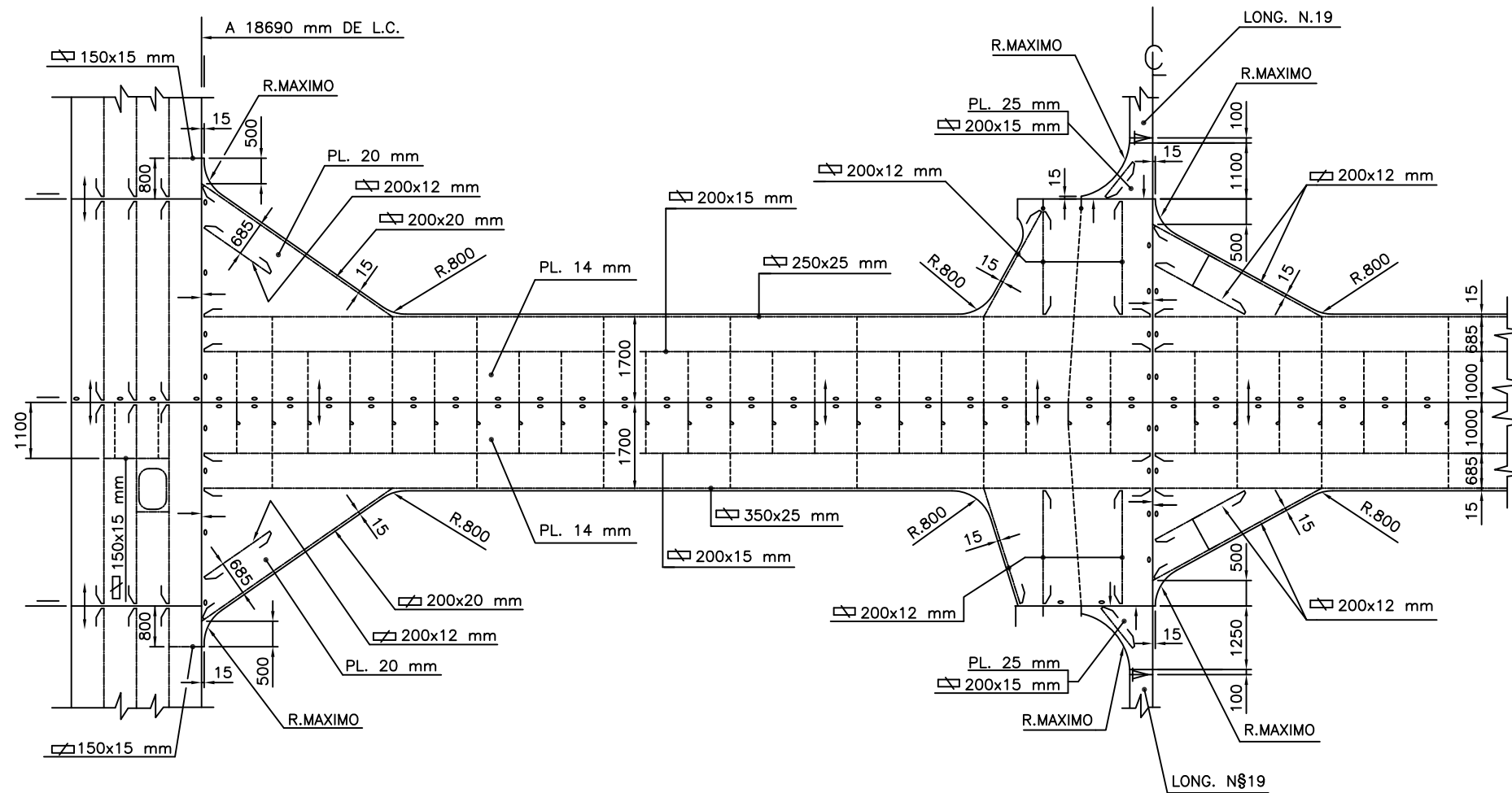
DETALLE 1



PALMEJAR A 11796 DE L.B.  
 ESCANTILLONADO DE PLANCHAS Y REFUERZOS

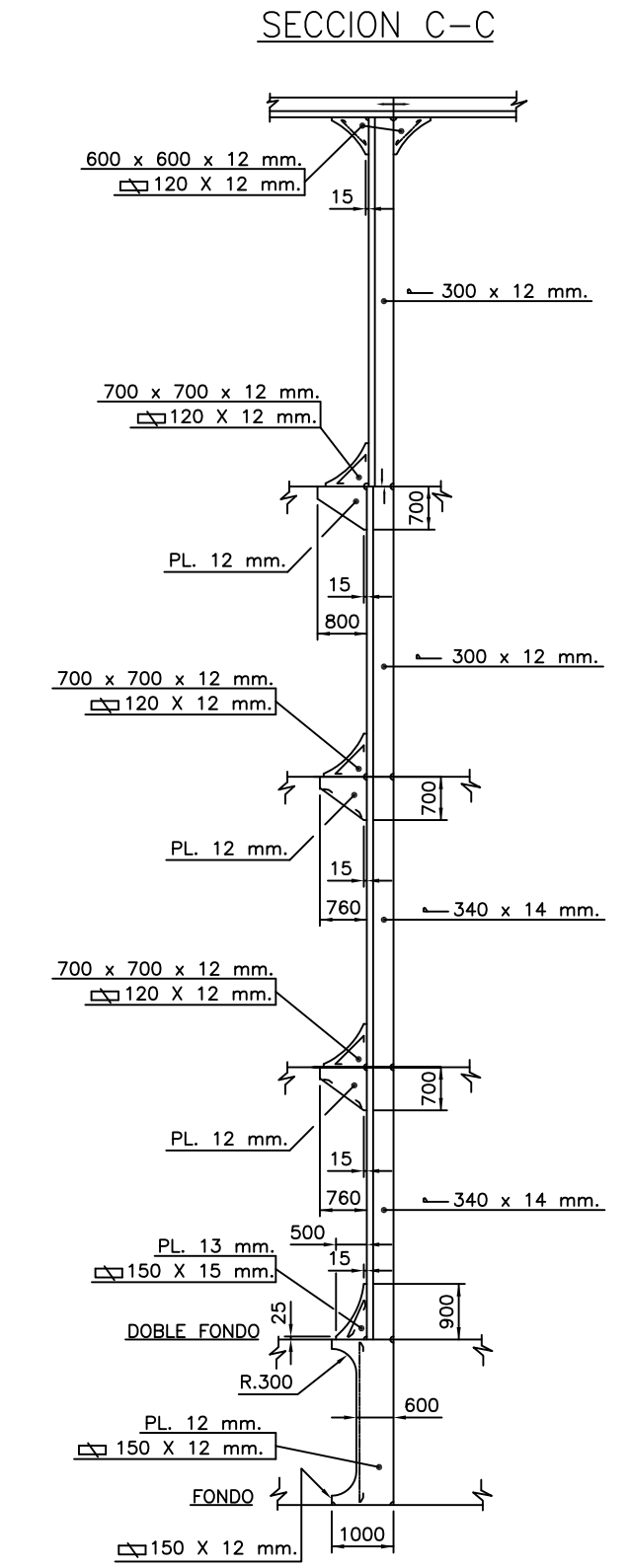
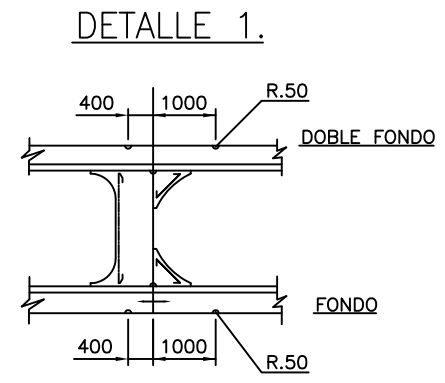
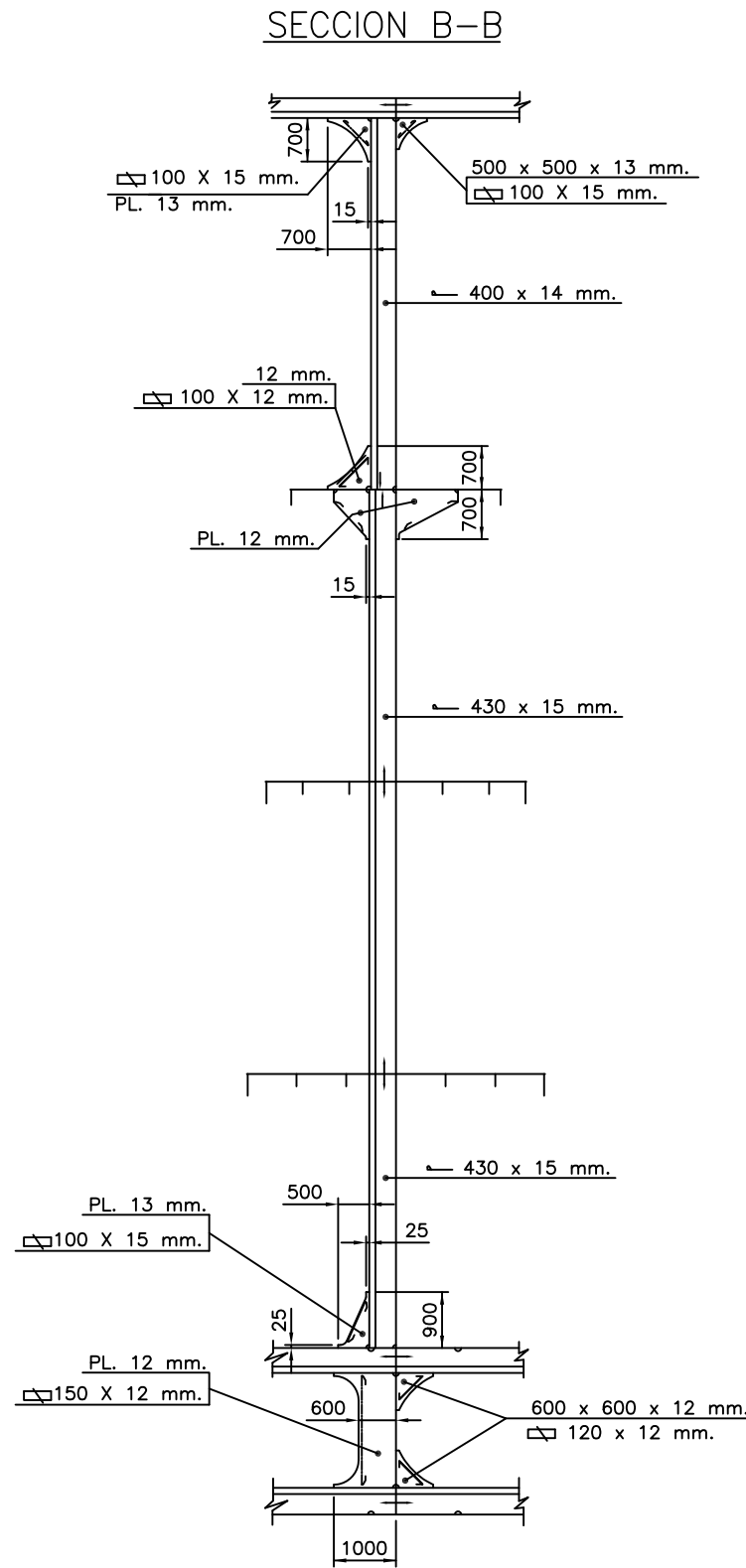
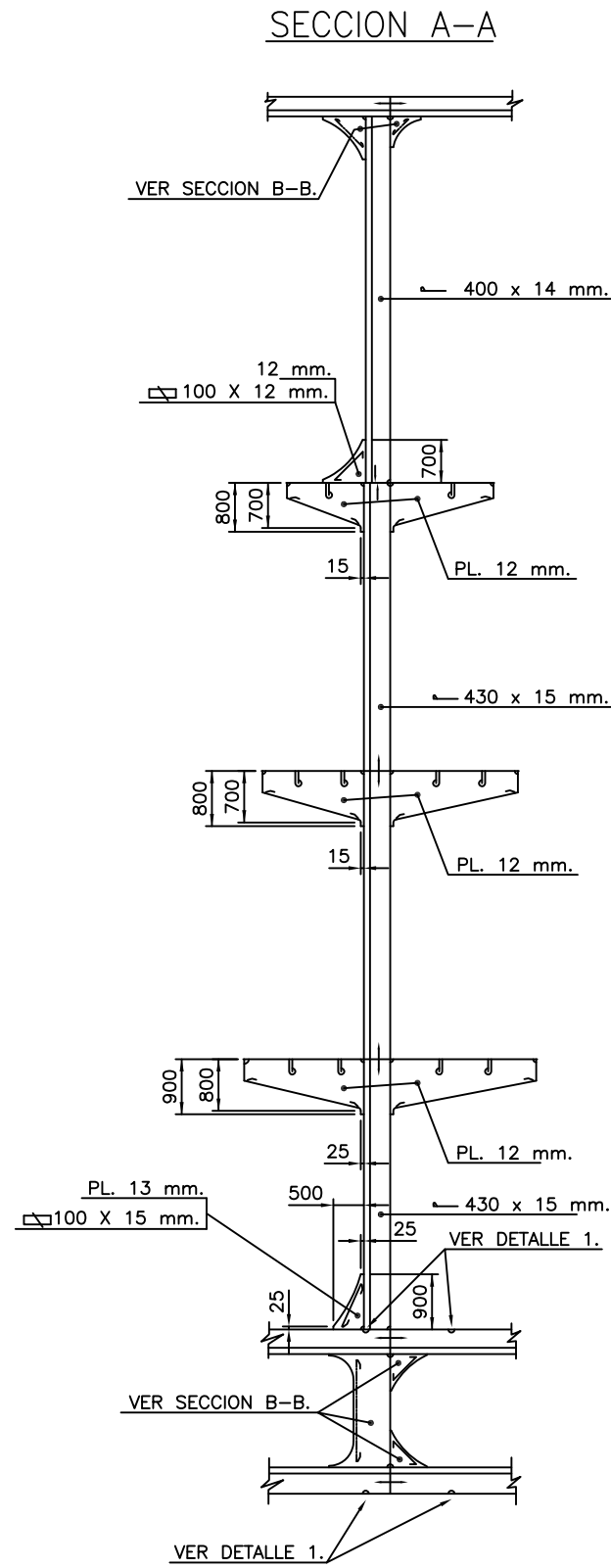


PALMEJAR A 16500 DE L.B.  
 ESCANTILLONADO DE PLANCHAS Y REFUERZOS



# SECCION LONGITUDINAL

## ESCANTILLONADO DE CARTABONES Y REFUERZOS



	Universidad de Cádiz Escuela U. de INGENIERÍA TÉCNICA NAVAL	Proyecto Fin de Carrera: REDISEÑO DE LA ESTRUCTURA BÁSICA DE UN SHUTTLE TANKER DE 145.000 M3. Autor: CESAR CABALLERO PALACIOS
ESCALA: 1:125	TITULO: SECCION LONGITUDINAL " BUQUE PROYECTO "	HOJA 6/6
FECHA: 01-07-07		



