UNIVERSIDADE DA CORUÑA

Escola Politécnica Superior

**TRABAJO FIN DE GRADO**

**CURSO 2017/2018**

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# *PETROLERO SUEZMAX 148.000 TPM*

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**Grado en Ingeniería Naval y Oceánica**

**Cuaderno 6**

# PREDICCIÓN DE POTENCIA Y DISEÑO DEL PROPULSOR Y TIMÓN

ESCOLA POLITÉCNICA SUPERIOR

UNIVERSIDADE DA CORUÑA

**GRADO EN INGENIERÍA NAVAL Y OCEÁNICA**

**TRABAJO FIN DE GRADO**

*CURSO 2.016-2017*

**PROYECTO NÚMERO 17-12**

**TIPO DE BUQUE:** Petrolero Suezmax 148000 TPM

**CLASIFICACIÓN, COTA Y REGLAMENTOS DE APLICACIÓN:** DNV, MARPOL, SOLAS, CONVENIO DE LINEAS DE CARGA TIER 3

**CARACTERÍSTICAS DE LA CARGA:** 148000 TPM. Transporte de petróleo CRUDOS Y DERIVADOS.

**VELOCIDAD Y AUTONOMÍA:** 15,8 nudos con 85%MCR+ 15% margen de mar

**SISTEMAS Y EQUIPOS DE CARGA / DESCARGA:** Bombas de carga y descarga en los tanques de carga. Calefacción en tanques de carga.

**PROPULSIÓN:** Motor diésel directamente acoplado.

**TRIPULACIÓN Y PASAJE:** 30 personas

**OTROS EQUIPOS E INSTALACIONES:** Los habituales en este tipo de buques.

Ferrol, 10 Setiembre 2016

ALUMNO/A: **Dª PABLO MARTÍNEZ MARTÍNEZ**

**Fernando Junco Ocampo**

# Contenido

# 1 INTRODUCCIÓN.

El cálculo de predicción de potencia consiste en realizar una estimación de la potencia que va a necesitar el propulsor para empujar el buque.

La planta propulsora de este buque es un motor diésel lento directamente acoplado, tal y como se especifica en la RPA, el cual tiene que desarrollar una potencia para que le buque alcance la velocidad de 15,8 nudos, a plena carga y con el motor al 85% de la potencia máxima continua con un 15% de margen de mar.

Previamente a los cálculos, se presentan los datos de las hidrostáticas del buque al calado de diseño:

| | |
|---|---|
| Displacement t | 195606 |
| Heel deg | 0 |
| Draft at FP m | 17,7 |
| Draft at AP m | 17,7 |
| Draft at LCF m | 17,7 |
| Trim (+ve by stern) m | 0 |
| WL Length m | 277,195 |
| Beam max extents on WL m | 45,3 |
| Wetted Area m^2 | 19697,852 |
| Waterpl. Area m^2 | 11598,96 |
| Prismatic coeff. (Cp) | 0,865 |
| Block coeff. (Cb) | 0,859 |
| Max Sect. area coeff. (Cm) | 0,993 |
| Waterpl. area coeff. (Cwp) | 0,924 |
| LCB from zero pt. (+ve fwd) m | 141,489 |
| LCF from zero pt. (+ve fwd) m | 134,691 |
| KB m | 9,133 |
| KG m | 17,7 |
| BMt m | 9,683 |
| BML m | 338,277 |
| GMt m | 1,116 |
| GML m | 329,71 |
| KMt m | 18,816 |
| KML m | 347,41 |
| Immersion (TPc) tonne/cm | 118,889 |
| MTc tonne.m | 2358,069 |
| RM at 1deg = GMt.Disp.sin(1) tonne.m | 3810,61 |
| Max deck inclination deg | 0 |
| Trim angle (+ve by stern) deg | 0 |

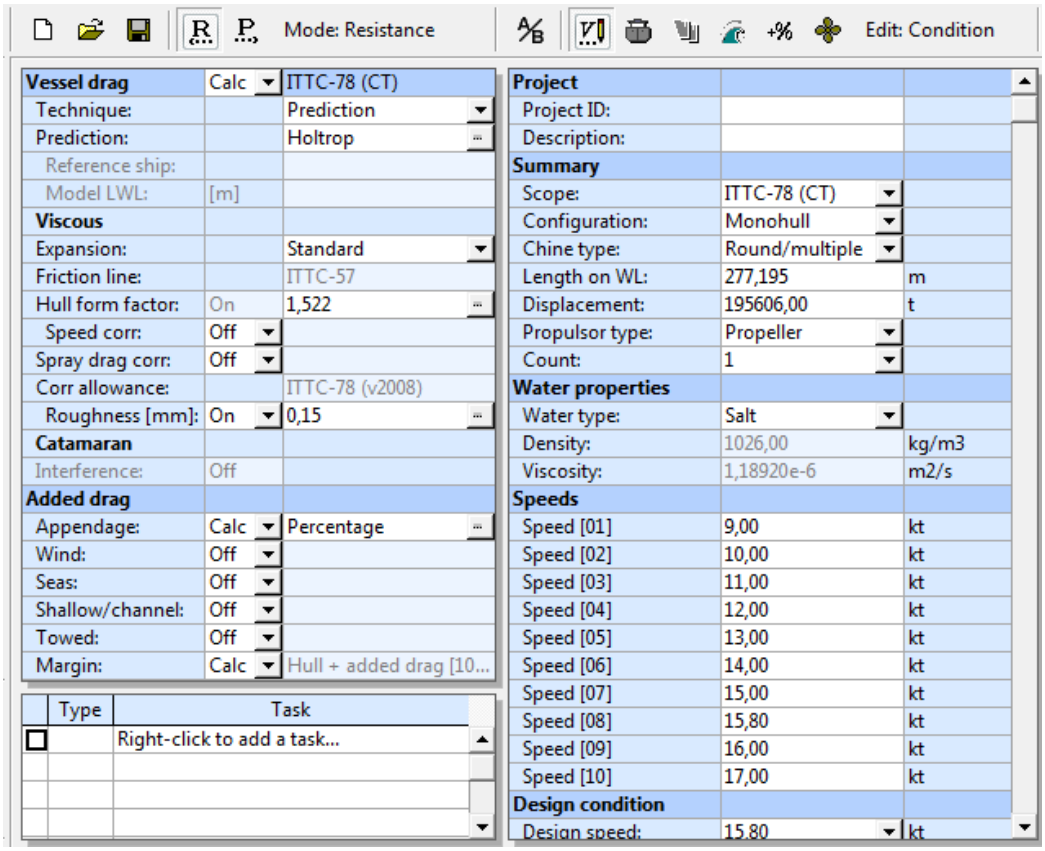
# 2 PREDICCIÓN DE POTENCIA.

Partiendo de los datos dados anteriormente, se realizará la predicción de potencia mediante el programa NavCAD.

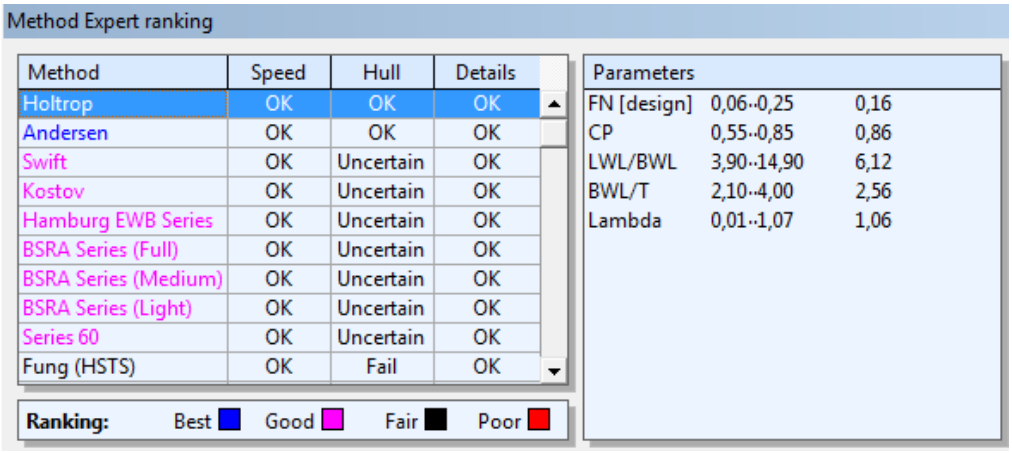
Todos los reports obtenidos mediante el cálculo con NavCAD se muestran al final del documento en el ANEXO III con el nombre “Reports”.

## 2.1 Método de Cálculo.

En el software NavCAD introduzco las caracterícticas principales:



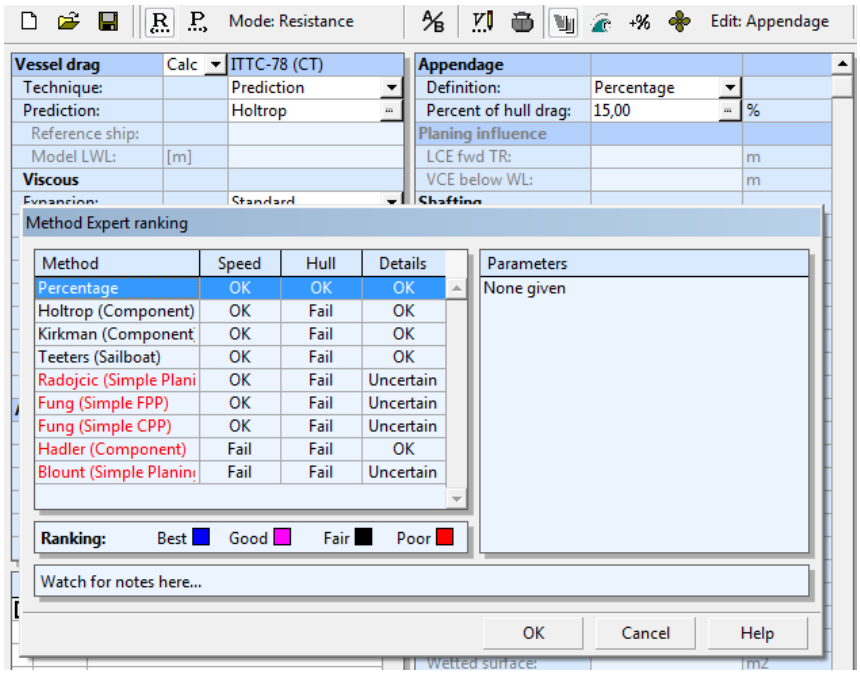
Los métodos de cálculo posibles son los siguientes:




El método elegido es Holtrop, ya que es el método más utilizado para este tipo de buque.

Para el factor de forma del casco, también se emplea el método de Holtrop.

En cuanto al cálculo de los apéndices, se selecciona el siguiente método:

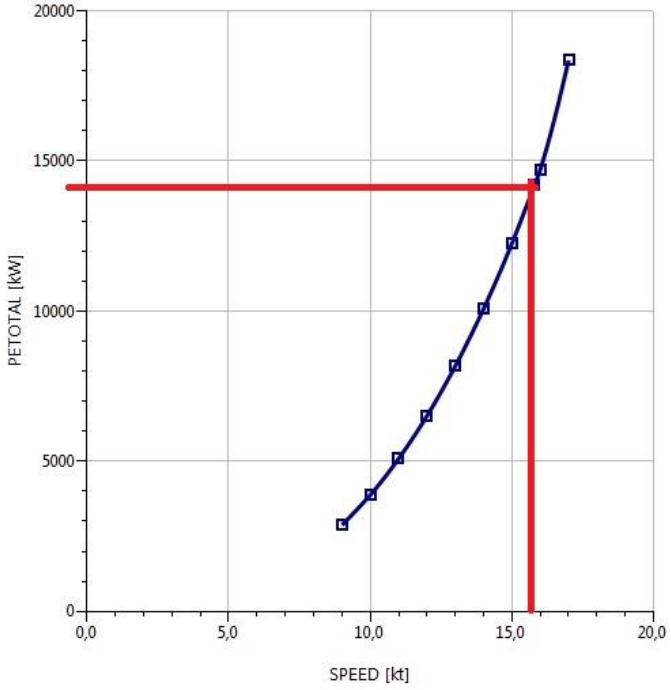


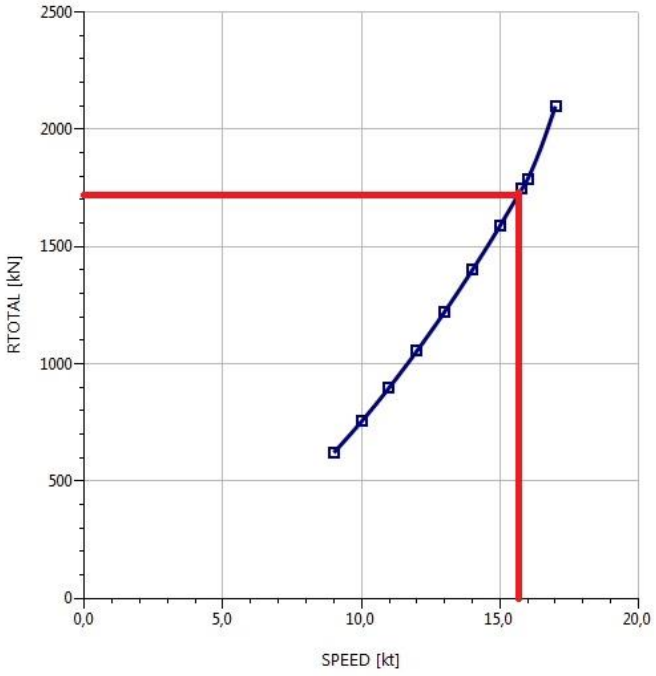
El método “Percentage” lo que hace es estimar los valores de los apéndices, como el timón, con un porcentaje de fricción del casco del 5%.

## 2.2 Resistencia Total (Rt) y Potencia Efectiva (EHP).

Con los datos anteriores, en modo “Resistencia” calculo la resistencia total al avance y la potencia efectiva. (Todos los reports de este cálculo están en el Anexo III Reports).

A continuación se muestra la gráfica de Rt-Velocidad y la Potencia efectiva frente a velocidad.





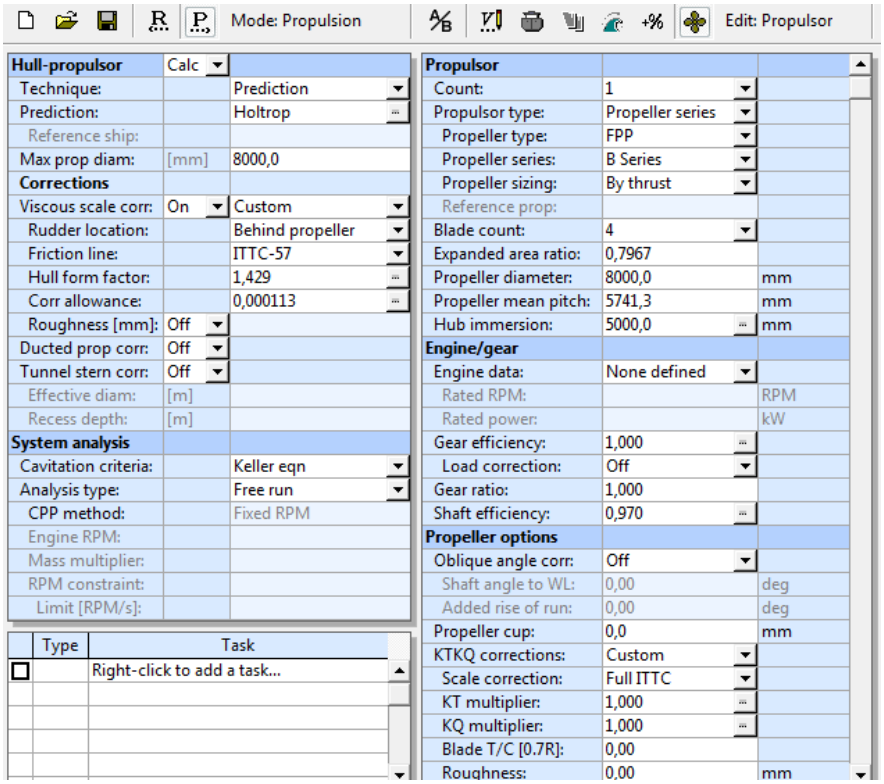

Para una velocidad de 15,8 nudos se obtiene una Potencia Efectiva EHP de 14203 kW, para vencer una resistencia total al avance de 1747 kN.

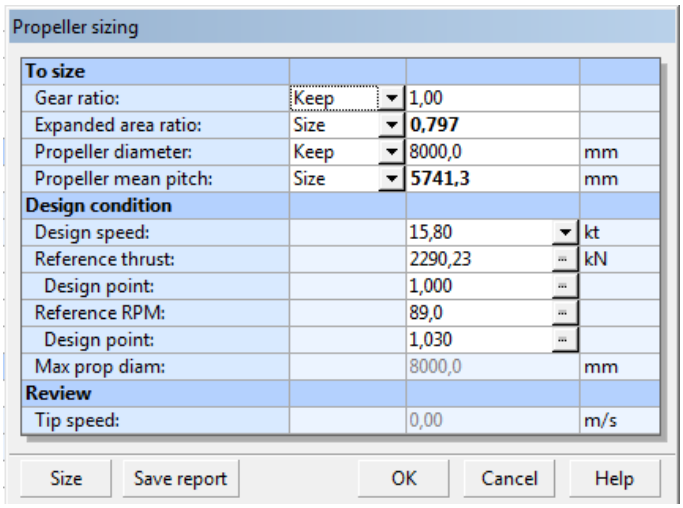
# 3 ELECCIÓN DEL MOTOR.

Para elegir el motor adecuado para este buque, necesito conocer previamente la potencia de freno BHP que la calculo a continuación.

## 3.1 Potencia de Freno (BHP).

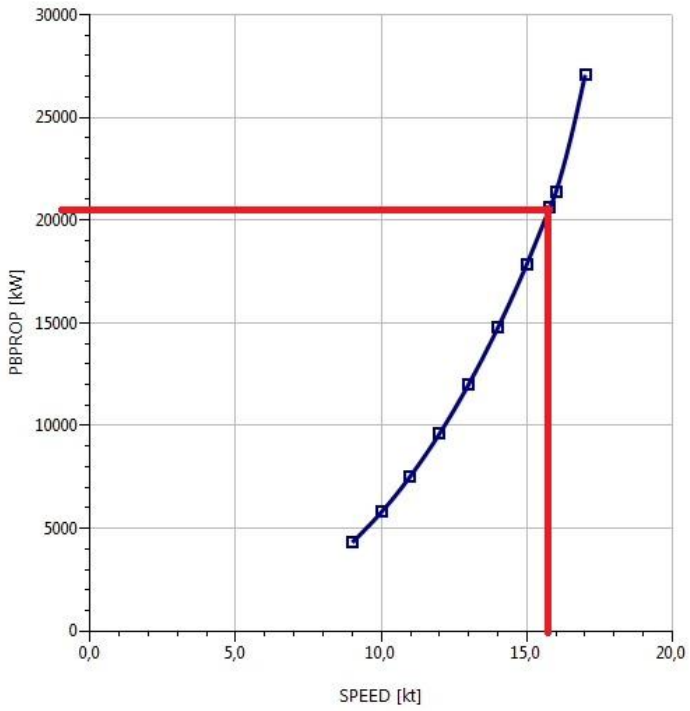
Con los datos antes obtenidos de Resistencia, con el programa NavCAD en modo propulsión, con la opción “by thrust” y siguiendo el buque base (Eagle San Antonio) estimo para 4 palas, así como la altura desde la línea de base hasta el eje de la hélice.






Calculo la potencia de freno, tomando unas RPM al 100%, metiendo 89 RPM como estimación.

A continuación se muestra la gráfica que representa los BHP frente a la velocidad en nudos:




Se obtienen los siguientes resultados:

| Velocidad (kn) | Rt (Kn) | EHP (kW) | BHP (kW) |
|---|---|---|---|
| 15,8 | 1747 | 14203 | 20646 |

En los BHP que proporciona el programa no se incluye el régimen de servicio al 85%, y puesto que no se lleva alternador de cola la potencia del motor se calcula de la siguiente forma:

$$Potencia\ Motor = \frac{BHP}{\eta_{servicio}} = \frac{20646}{0{,}85} = \mathbf{24289\ kW}$$

Los reports de estos cálculos se encuentran en el ANEXO III del documento.

## 3.2 Motor.

Teniendo en cuenta la anterior potencia calculada, se busca un motor superior a esta potencia.

El motor elegido es un motor “WARTSILA WINGD X-72B”, que es un motor diésel de baja velocidad óptimo para buques petroleros Suezmax según el fabricante:

## WinGD X72-B

IMO Tier II/Tier III (SCR)

| | |
|---|---|
| Cylinder bore | 720 mm |
| Piston stroke | 3086 mm |
| Speed | 66–89 rpm |
| Mean effective pressure at R1 | 21.0 bar |
| Stroke / bore | 4.29 |

### Rated power, principal dimensions and weights

| Cyl. | Output in kW at 89 rpm R1 | Output in kW at 89 rpm R2 | Output in kW at 66 rpm R3 | Output in kW at 66 rpm R4 | Length A mm | Weight tonnes |
|---|---|---|---|---|---|---|
| 5 | 19 600 | 14 300 | 14 550 | 10 600 | 8 085 | 481 |
| 6 | 23 520 | 17 160 | 17 460 | 12 720 | 9 375 | 561 |
| 7 | 27 440 | 20 020 | 20 370 | 14 840 | 10 665 | 642 |
| 8 | 31 360 | 22 880 | 23 280 | 16 960 | 11 960 | 716 |

| Dimensions (mm) | B | C | D | E |
|---|---|---|---|---|
| | 4 780 | 1 575 | 10 790 | 4 710 |
| | F1 | F2 | F3 | G |
| | 13 655 | 13 655 | 12 730 | 2 455 |

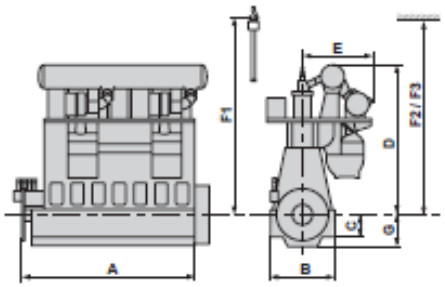
### Brake specific fuel consumption (BSFC) in g/kWh

**Full load**

| Rating point | | R1 | R2 | R3 | R4 |
|---|---|---|---|---|---|
| BMEP, bar | | 21.0 | 15.4 | 21.0 | 15.4 |
| BSFC | Standard Tuning | 166.8 | 159.3 | 166.8 | 159.3 |

| **Part load**, % of R1 | 85 | 70 | 85 | 70 | 65 |
|---|---|---|---|---|---|
| Tuning variant | Standard | Standard | Delta | Delta | Low-Load |
| BSFC | 163.2 | 162.8 | 162.5 | 161.3 | 157.3 |

*For definitions see page 36.*

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# 4 DISEÑO DE LA HÉLICE.

## 4.1 Introducción.

Motor y hélice giran a las mismas revoluciones por ser una hélice de paso fijo directamente acoplada al motor principal.

El objetivo de este apartado es la obtención de un propulsor óptimo que necesite la menor potencia posibke para dotar al buque de la velocidad de servicio, la cual es 15,8 knots como se ha impuesto en la especificación de este proyecto.

Para la definición del propulsor se han de tener en cuenta los siguientes factores:

- Conseguir el rendimiento más óptimo con objeto de rebajar los costes de construcción y explotación del buque.
- No se deben presentar fenómenos de cavitación en los regímenes de velocidad en los que vaya a operar el propulsor.
- El número de palas es un factor importante que repercute directamente en los fenómenos de cavitación, vibraciones en el eje y en el motor propulsor.
- La resistencia estructural tanto de hélice, eje y demás elementos del sistema propulsivo, debe ser la suficiente para evitar el riesgo de fracturas o deformaciones ante los esfuerzos a los que se vean sometidas las palas del propulsor.
- El diámetro de la hélice de ser el máximo posible puesto que se da la relación de que a mayor diámetro mayor rendimiento del propulsor.
- Se deberán cumplir ciertas disposiciones de la Sociedad de clasificación (DNV) referentes a los huelgos de la hélice, casco, timón y línea de base.

La gran mayoría de los petroleros de este tamaño llevan una hélice de 4 o 5 palas, ya que las de 3 palas dan lugar a cavitación. Es por esto que los cálculos que se realizan a continuación se realizan para 4, 5 y 6 palas.

Para realizar este cálculo, se introduce en el software NavCAD los datos del motor elegido, y puesto que no lleva reductora se elige la opción de dimensionar a diámetro óptimo.

Los datos y resultados obtenidos para cada caso se muestran a continuación:

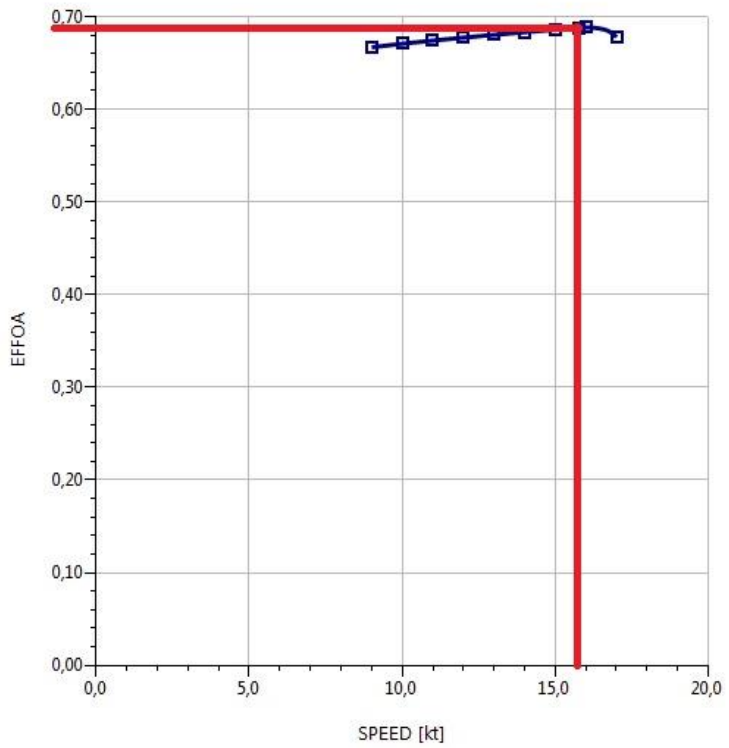
## 4.2 Propulsor con 4 palas.

Propeller sizing

| | | | |
|---|---|---|---|
| **To size** | | | |
| Gear ratio: | Keep | 1,00 | |
| Expanded area ratio: | Size | **0,797** | |
| Propeller diameter: | Keep | 8000,0 | mm |
| Propeller mean pitch: | Size | **5741,3** | mm |
| **Design condition** | | | |
| Design speed: | | 15,80 | kt |
| Reference power: | | 27440,0 | kW |
| Design point: | | 1,000 | |
| Reference RPM: | | 89,0 | |
| Design point: | | 1,030 | |
| Max prop diam: | | 8000,0 | mm |
| **Review** | | | |
| Tip speed: | | 0,00 | m/s |

Size | Save report | OK | Cancel | Help

Con estos datos se obtiene un rendimiento de:



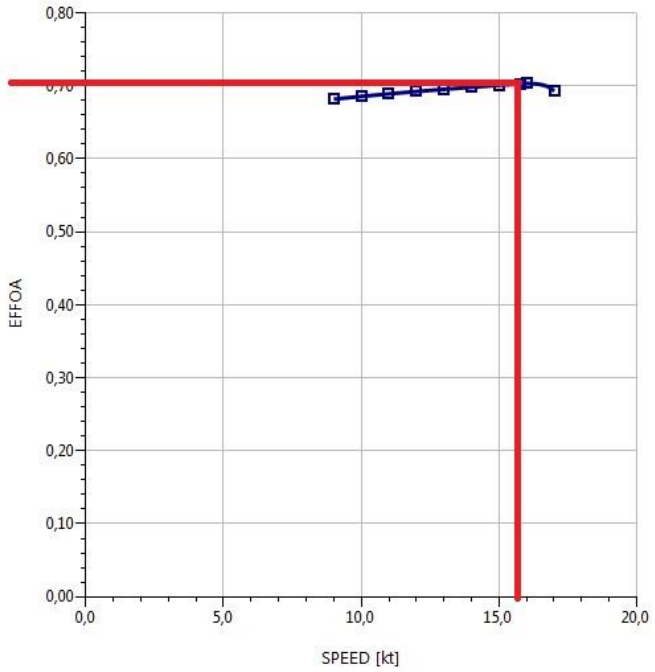
## 4.3 Propulsor con 5 palas.

Propeller sizing

| | | | |
|---|---|---|---|
| **To size** | | | |
| Gear ratio: | Keep | 1,00 | |
| Expanded area ratio: | Size | **0,797** | |
| Propeller diameter: | Keep | 8000,0 | mm |
| Propeller mean pitch: | Size | **5741,3** | mm |
| **Design condition** | | | |
| Design speed: | | 15,80 | kt |
| Reference power: | | 27440,0 | kW |
| Design point: | | 1,000 | |
| Reference RPM: | | 89,0 | |
| Design point: | | 1,030 | |
| Max prop diam: | | 8000,0 | mm |
| **Review** | | | |
| Tip speed: | | 0,00 | m/s |

Size | Save report | OK | Cancel | Help

Para este caso el rendimiento de la hélice es:



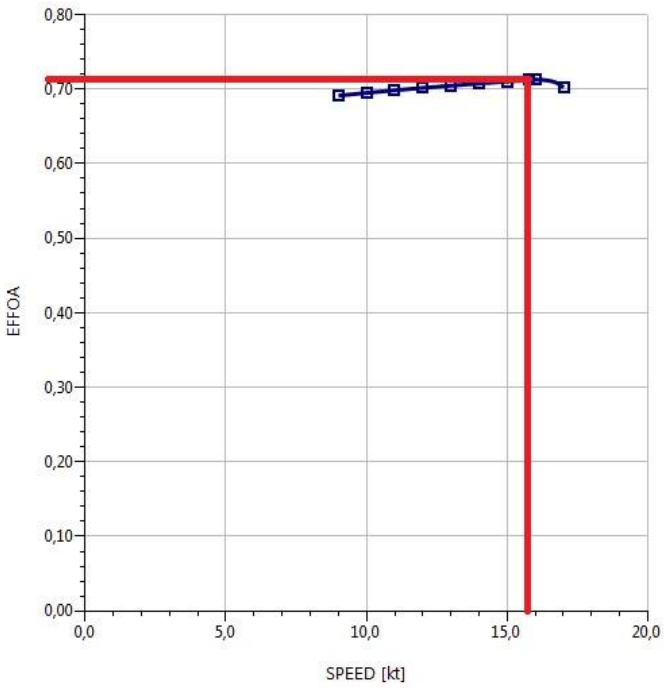

### 1.1. Propulsor con 6 palas.

Propeller sizing

| | | | |
|---|---|---|---|
| **To size** | | | |
| Gear ratio: | Keep | 1,00 | |
| Expanded area ratio: | Size | **0,797** | |
| Propeller diameter: | Keep | 8000,0 | mm |
| Propeller mean pitch: | Size | **5741,3** | mm |
| **Design condition** | | | |
| Design speed: | | 15,80 | kt |
| Reference power: | | 27440,0 | kW |
| Design point: | | 1,000 | |
| Reference RPM: | | 89,0 | |
| Design point: | | 1,030 | |
| Max prop diam: | | 8000,0 | mm |
| **Review** | | | |
| Tip speed: | | 0,00 | m/s |

Size | Save report | OK | Cancel | Help

Para esta condición el rendimiento queda:




Todos los reports de estos cáculos están en el ANEXO III del documento.

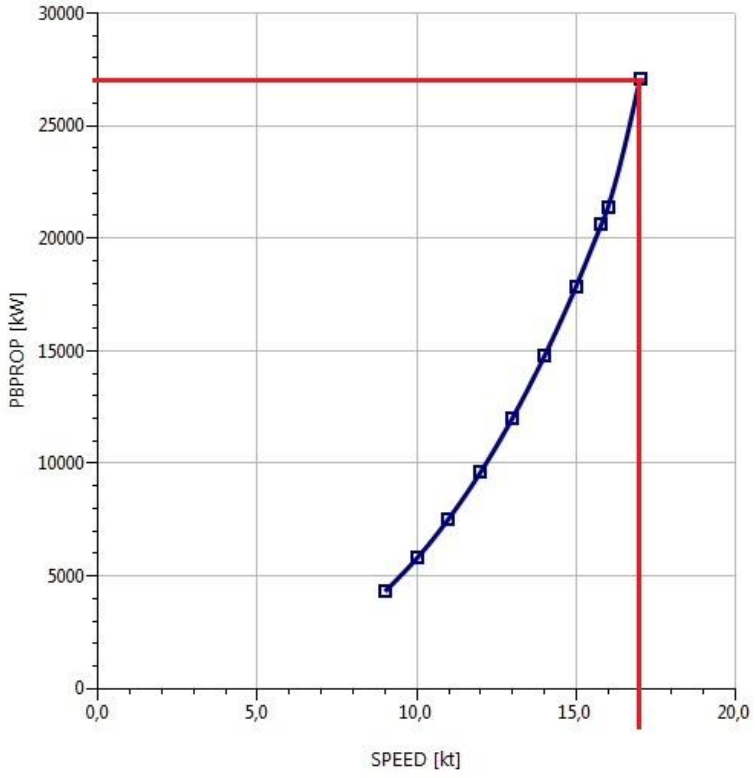
## 4.4 Propulsor obtenido.

Haciendo el cálculo por el método de diámetro óptimo los resultados obtenidos son los siguientes:

| Nº PALAS | DIÁMETRO (m) | VELOCIDAD (kn) | RENDIMIENTO |
|---|---|---|---|
| 4 | 8 | 15,8 | 0,6879 |
| 5 | 8 | 15,8 | 0,7029 |
| 6 | 8 | 15,8 | 0,7122 |

La hélice elegida tendrá 5 palas con un rendimiento de 0,69. La de mayor rendimiento es la de 6 palas pero es un rendimiento ligeramente superior a la de 5 palas, y se descarta con el objetivo de no incrementar los costes de construcción.

En cuanto a la velocidad máxima que alcanza el buque con la potencia establecida (27440 kW) es la siguiente:




La velocidad máxima del motor será entonces de 17 nudos.

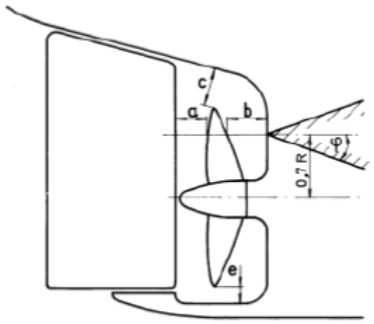
# 5 CLARAS DEL CODASTE.

El perfil de popa debe cumplir con las claras de codaste mínimas exigidas por la sociedad de clasificación DNV en Pt 3 Ch 3 Sec2. Las claras del codaste a cumplir son:

| Table C1 Minimum clearances | |
|---|---|
| *For single screw ships:* | *For twin screw ships:* |
| a ≥ 0.2 R (m) | |
| b ≥ (0.7 – 0.04 $Z_p$) R (m) | |
| c ≥ (0.48 – 0.02 $Z_p$) R (m) | c ≥ (0.6 – 0.02 $Z_p$) R (m) |
| e ≥ 0.07 R (m) | |

R = propeller radius in m
$Z_p$ = number of propeller blades.

---e-n-d---of---G-u-i-d-a-n-c-e---n-o-t-e---




Estos valores se calculan de la siguiente forma:

- $a \geq 0{,}2R$
- $b \geq (0{,}7 - 0{,}04 \cdot Z_p)R$
- $c \geq (0{,}48 - 0{,}02 \cdot Z_p)R$
- $e \geq 0{,}07R$

Donde R es el radio del propulsor que son 4 metros (Diámetro 8 metros) y $Z_p$ es el número de palas que en este caso son 5.

- $a \geq 0{,}2 \cdot 4 = 0{,}8\ m$
- $b \geq (0{,}7 - 0{,}04 \cdot 5) \cdot 4 = 2\ m$
- $c \geq (0{,}48 - 0{,}02 \cdot 5) \cdot 4 = 1{,}52\ m$

- $e \geq 0{,}07 \cdot 4 = 0{,}28\, m$

Al final del documento se adjunta el plano con estas medidas en “Anexo I Planos”.

# 6 CÁLCULO DEL TIMÓN.

## 6.1 Área mínima.

Para hacer el cálculo del timón habrá que basarse en el área de deriva de nuestro buque como parámetro básico para deducir los valores del timón a proyectar.

El codaste en este caso será de tipo abierto y el timón semicompensado para evitar vibraciones.

En una primera aproximación se establece que el área del timón debe de estar dentro del rango 1,5% a 2,5% del área de deriva deducido del libro “El Proyecto Básico del Buque Mercante”.

$$L_{pp} \cdot T = 273{,}5 \cdot 17{,}7 = 4841\ m^2$$

Por tanto, el valor del área del timón estará comprendido entre los siguientes valores:

$$1{,}5\% \rightarrow 4841 \cdot \frac{1{,}5}{100} = 72{,}61\ m^2$$

$$2{,}5\% \rightarrow 4841 \cdot \frac{2{,}5}{100} = 121\ m^2$$

La sociedad de clasificación DNV en Pt3 Ch3 Sec2 indica que para timones que trabajen directamente detrás de una hélice deberán de tener un área no inferior a:

$$A = \frac{L_{pp} \cdot T}{100} \cdot \left(1 + 50 \cdot C_b^2 \cdot \left(\frac{B}{L_{pp}}\right)^2\right)$$

Aplicando esta expresión a mi buque obtengo el área mínima de pala:

$$A = \frac{273{,}5 \cdot 17{,}7}{100} \cdot \left(1 + 50 \cdot 0{,}859^2 \cdot \left(\frac{45{,}3}{273{,}5}\right)^2\right)$$

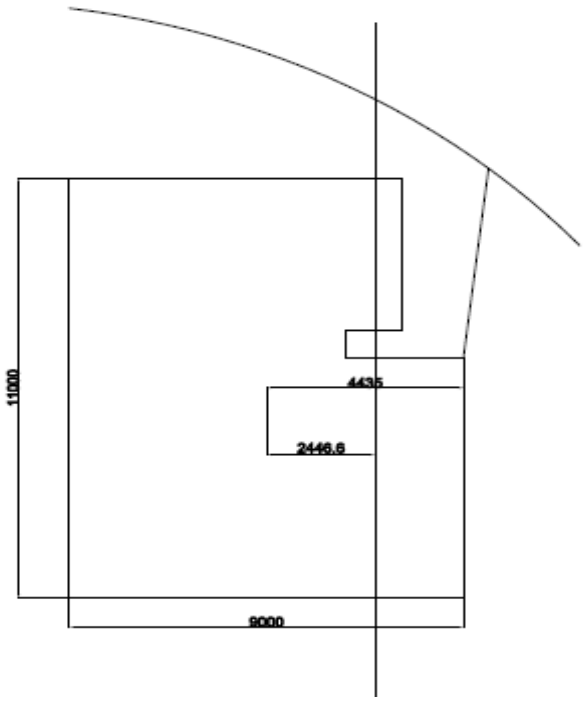
$$A = 97{,}41\ m^2$$

## 6.2 Área real del timón.

Se realiza el diseño del timón teniendo en cuenta los huelgos mínimos exigidos por la Sociedad de Clasificación que se han expuesto anteriormente, y se obtienen los siguientes resultados:

- Cuerda del timón (C) = 9000 mm.
- Altura del timón (H) = 11000 mm.
- Posición del centro de presiones = 4435 mm.
- Distancia del centro de presiones a la mecha del timón = 2446,6 mm.
- Área del timón = 99 $m^2$.

Al final del documento se representa un plano más detallado del timón en el “ANEXO I Planos”.



### *6.2.1 Fuerza sobre el timón.*

Para calcular la fuerza en las condiciones de avante y ciando ultilizo la siguiente fórmula:

$$F = 0{,}044 \cdot k_1 \cdot k_2 \cdot k_3 \cdot A \cdot V^2$$

Siendo:

- $k_1$ es un coeficiente que toma valor de 1,1 para perfiles tipo NACA.
- $k_2$ toma valor 1 como norma general.
- $k_3 = \frac{H^2}{A_t} + 2$ ; el valor de $k_3$ no debe ser mayor que 4.

  H es la altura del timón (11 m).

  $k_3$ = 3,22 m.
- A es el área del timón = 99 $m^2$.
- V es la velocidad máxima de servicio del buque = 15,8 knots.

  $$V_{avante} = 15{,}8\ kn$$

  $$V_{ciando} = 0{,}5 \cdot V = 7{,}9\ kn$$

  Cuando la velocidad sea menor de 10 nudos, se sustituye en la siguiente expresión:

  $$V_{mín} = \frac{V + 20}{3}$$

Con estos datos la fuerza sobre el timón queda:

$$\boldsymbol{F_{avante} = 0{,}044 \cdot 1{,}1 \cdot 1 \cdot 3{,}22 \cdot 99 \cdot 15{,}8^2 = 3851{,}68\ kN}$$

$$\boldsymbol{F_{ciando} = 0{,}044 \cdot 1{,}1 \cdot 1 \cdot 3{,}22 \cdot 99 \cdot 7{,}9^2 = 962{,}92\ kN}$$

### *6.2.2 Par torsor.*

El par se define como:

$$M_{TR} = F_R \cdot x_e$$

Siendo:

- $F_R$ es el valor de la fuerza calculado antes para avante y ciando.
- $x_e = B \cdot (\alpha - k)$

  B es la longitud media del área del timón = 9 m.

  α según el reglamento toma valores de 0,33 para la condición de avanate y 0,66 si está ciando.

  $k = \frac{A_F}{A}$ donde $A_F$ es el área a proa de la mecha del timón (21,88 $m^2$) y A es el área total:

$$K = 0{,}221$$

Con estos datos el par es el siguiente:

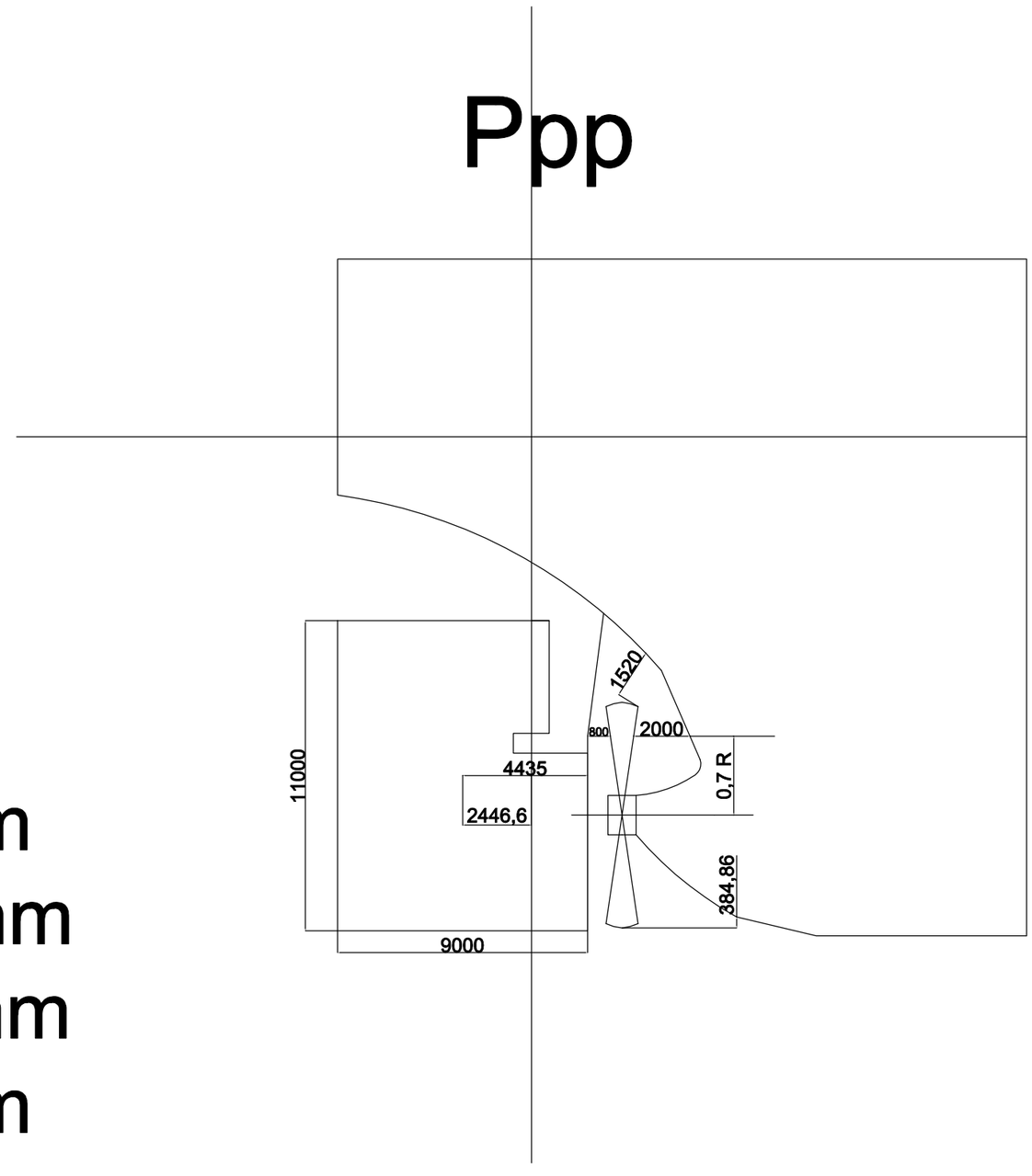
$$\boldsymbol{M_{TR\ Avance} = 3851{,}68 \cdot 9 \cdot (0{,}33 - 0{,}221) = 3778{,}49 \ \ kN \cdot m}$$

$$\boldsymbol{M_{TR\ Ciando} = 962{,}92 \cdot 9 \cdot (0{,}66 - 0{,}221) = 3804{,}49 \ \ kN \cdot m}$$

# 7 ANEXO I “PLANOS”

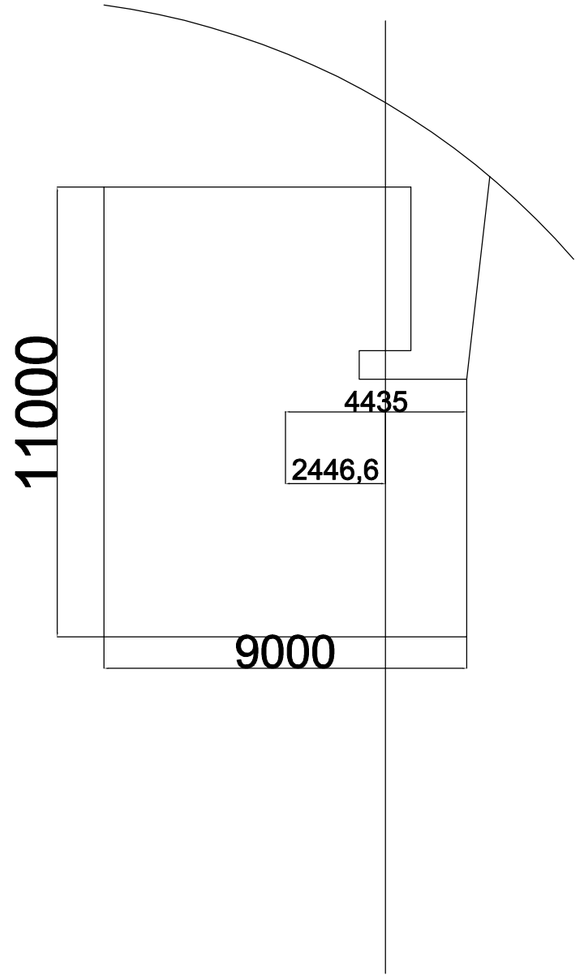
”

Ppp




a = 800 mm
b = 2000 mm
c = 1520 mm
e = 280 mm

| ESCOLA POLITECNICA SUPERIOR DE FERROL | | | |
|---|---|---|---|
| ALUMNO | PABLO MARTÍNEZ MARTÍNEZ | | |
| TRABAJO | PERFIL ZONA ESTANCA | NUMERO | ESCALA |
| | | 1/1 | 1/200 |
| | | | FECHA |
| | | | 02/04/2018 |




Cuerda = 9000 mm

Altura = 2000 mm

Centro de presiones = 1520 mm

Distancia centro pr. a mecha = 280 mm

| ESCOLA POLITECNICA SUPERIOR DE FERROL | | | |
|---|---|---|---|
| ALUMNO | PABLO MARTÍNEZ MARTÍNEZ | | |
| TRABAJO | TIMÓN | NUMERO | ESCALA |
| | | 1/1 | 1/150 |
| | | | FECHA |
| | | | 02/04/2018 |

# 8 ANEXO II“REPORTS NAVCAD”

# Resistance

**23 mar 2018 11:33**
**HydroComp NavCad 2014**

Project ID
Description
File name **nav.hcnc**

## Analysis parameters

| **Vessel drag** | | **ITTC-78 (CT)** |
|---|---|---|
| Technique: | **[Calc]** | **Prediction** |
| Prediction: | | **Andersen** |
| Reference ship: | | |
| Model LWL: | | |
| Expansion: | | **Standard** |
| Friction line: | | **ITTC-57** |
| Hull form factor: | **[On]** | **1,429** |
| Speed corr: | **[Off]** | |
| Spray drag corr: | **[Off]** | |
| Corr allowance: | | **ITTC-78 (v2008)** |
| Roughness [mm]: | **[On]** | **0,00** |

| **Added drag** | | |
|---|---|---|
| Appendage: | **[Calc]** | **Percentage** |
| Wind: | **[Off]** | |
| Seas: | **[Off]** | |
| Shallow/channel: | **[Off]** | |
| Towed: | **[Off]** | |
| Margin: | **[Calc]** | **Hull + added drag [10%]** |
| **Water properties** | | |
| Water type: | | **Salt** |
| Density: | | **1026,00 kg/m3** |
| Viscosity: | | **1,18920e-6 m2/s** |

## Prediction method check [Andersen]

| Parameters | FN [design] | CVOL | CB | LWL/BWL |
|---|---|---|---|---|
| Value | **0,16** | **4,82** | **0,86** | **6,12** |
| Range | **0,05··0,33** | **4,00··6,00** | **0,55··0,85** | **5,00··8,00** |

## Prediction results

| | SPEED COEFS | | ITTC-78 COEFS | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| SPEED [kt] | FN | FV | RN | CF | [CTLT/CF] | CR | dCF | CA | CT |
| **9,00** | **0,089** | **0,195** | **1,08e9** | **0,001516** | **1,429** | **0,000001** | **0,000000** | **0,000315** | **0,002482** |
| **10,00** | **0,099** | **0,217** | **1,20e9** | **0,001497** | **1,429** | **0,000001** | **0,000000** | **0,000302** | **0,002442** |
| **11,00** | **0,109** | **0,238** | **1,32e9** | **0,001479** | **1,429** | **0,000001** | **0,000000** | **0,000290** | **0,002405** |
| **12,00** | **0,118** | **0,260** | **1,44e9** | **0,001464** | **1,429** | **0,000001** | **0,000000** | **0,000279** | **0,002372** |
| **13,00** | **0,128** | **0,282** | **1,56e9** | **0,001450** | **1,429** | **0,000001** | **0,000000** | **0,000268** | **0,002341** |
| **14,00** | **0,138** | **0,303** | **1,68e9** | **0,001437** | **1,429** | **0,000001** | **0,000000** | **0,000258** | **0,002312** |
| **15,00** | **0,148** | **0,325** | **1,80e9** | **0,001425** | **1,429** | **0,000001** | **0,000000** | **0,000249** | **0,002286** |
| **+ 15,80 +** | **0,156** | **0,342** | **1,89e9** | **0,001416** | **1,429** | **0,000001** | **0,000000** | **0,000241** | **0,002266** |
| **16,00** | **0,158** | **0,346** | **1,92e9** | **0,001414** | **1,429** | **0,000001** | **0,000000** | **0,000240** | **0,002261** |
| **17,00** | **0,168** | **0,368** | **2,04e9** | **0,001404** | **1,429** | **0,000114** | **0,000000** | **0,000231** | **0,002351** |

| | RESISTANCE | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| SPEED [kt] | RBARE [kN] | RAPP [kN] | RWIND [kN] | RSEAS [kN] | RCHAN [kN] | RTOWED [kN] | RMARGIN [kN] | RTOTAL [kN] | |
| **9,00** | **537,74** | **26,89** | **0,00** | **0,00** | **0,00** | **56,46** | **56,46** | **621,09** | |
| **10,00** | **653,03** | **32,65** | **0,00** | **0,00** | **0,00** | **68,57** | **68,57** | **754,25** | |
| **11,00** | **778,30** | **38,91** | **0,00** | **0,00** | **0,00** | **81,72** | **81,72** | **898,93** | |
| **12,00** | **913,35** | **45,67** | **0,00** | **0,00** | **0,00** | **95,90** | **95,90** | **1054,92** | |
| **13,00** | **1058,01** | **52,90** | **0,00** | **0,00** | **0,00** | **111,09** | **111,09** | **1222,01** | |
| **14,00** | **1212,12** | **60,61** | **0,00** | **0,00** | **0,00** | **127,27** | **127,27** | **1400,00** | |
| **15,00** | **1375,53** | **68,78** | **0,00** | **0,00** | **0,00** | **144,43** | **144,43** | **1588,74** | |
| **+ 15,80 +** | **1512,86** | **75,64** | **0,00** | **0,00** | **0,00** | **158,85** | **158,85** | **1747,35** | |
| **16,00** | **1548,10** | **77,40** | **0,00** | **0,00** | **0,00** | **162,55** | **162,55** | **1788,05** | |
| **17,00** | **1816,93** | **90,85** | **0,00** | **0,00** | **0,00** | **190,78** | **190,78** | **2098,55** | |

| | EFFECTIVE POWER | | OTHER | | | |
|---|---|---|---|---|---|---|
| SPEED [kt] | PEBARE [kW] | PETOTAL [kW] | CTLR | CTLT | RBARE/W | |
| **9,00** | **2489,7** | **2875,7** | **0,00001** | **0,03555** | **0,00028** | |
| **10,00** | **3359,5** | **3880,2** | **0,00001** | **0,03497** | **0,00034** | |
| **11,00** | **4404,3** | **5087,0** | **0,00001** | **0,03444** | **0,00041** | |
| **12,00** | **5638,4** | **6512,4** | **0,00001** | **0,03396** | **0,00048** | |
| **13,00** | **7075,8** | **8172,5** | **0,00001** | **0,03352** | **0,00055** | |
| **14,00** | **8730,0** | **10083,1** | **0,00001** | **0,03311** | **0,00063** | |
| **15,00** | **10614,5** | **12259,8** | **0,00001** | **0,03274** | **0,00072** | |
| **+ 15,80 +** | **12296,9** | **14202,9** | **0,00001** | **0,03245** | **0,00079** | |
| **16,00** | **12742,6** | **14717,7** | **0,00001** | **0,03238** | **0,00081** | |
| **17,00** | **15890,0** | **18353,0** | **0,00163** | **0,03366** | **0,00095** | |

# Resistance

**23 mar 2018 11:33**
**HydroComp NavCad 2014**

Project ID
Description
File name **nav.hcnc**

## Hull data

| General | | |
|---|---|---|
| Configuration: | | **Monohull** |
| Chine type: | | **Round/multiple** |
| Length on WL: | | **277,195 m** |
| Max beam on WL: | [LWL/BWL 6,119] | **45,300 m** |
| Max molded draft: | [BWL/T 2,559] | **17,700 m** |
| Displacement: | [CB 0,858] | **195606,00 t** |
| Wetted surface: | [CS 2,710] | **19697,9 m2** |

| ITTC-78 (CT) | | |
|---|---|---|
| LCB fwd TR: | [XCB/LWL 0,510] | **141,489 m** |
| LCF fwd TR: | [XCF/LWL 0,490] | **135,706 m** |
| Max section area: | [CX 0,999] | **801,0 m2** |
| Waterplane area: | [CWP 0,924] | **11599,0 m2** |
| Bulb section area: | | **91,0 m2** |
| Bulb ctr below WL: | | **10,300 m** |
| Bulb nose fwd TR: | | **280,600 m** |
| Imm transom area: | [ATR/AX 0,000] | **0,0 m2** |
| Transom beam WL: | [BTR/BWL 0,000] | **0,000 m** |
| Transom immersion: | [TTR/T 0,000] | **0,000 m** |
| Half entrance angle: | | **60,00 deg** |
| Bow shape factor: | [WL flow] | **1,0** |
| Stern shape factor: | [WL flow] | **1,0** |

| Planing | | |
|---|---|---|
| *Proj chine length:* | | ***0,000 m*** |
| *Proj bottom area:* | | ***0,0 m2*** |
| *LCG fwd TR:* | *[XCG/LP 0,000]* | ***0,000 m*** |
| *VCG below WL:* | | ***0,000 m*** |
| *Aft station (fwd TR):* | | ***0,000 m*** |
| *Deadrise:* | | ***0,00 deg*** |
| *Chine beam:* | | ***0,000 m*** |
| *Chine ht below WL:* | | ***0,000 m*** |
| *Fwd station (fwd TR):* | | ***0,000 m*** |
| *Deadrise:* | | ***0,00 deg*** |
| *Chine beam:* | | ***0,000 m*** |
| *Chine ht below WL:* | | ***0,000 m*** |
| *Propulsor type:* | | ***Propeller*** |
| *Max prop diameter:* | | ***8000,0 mm*** |
| *Shaft angle to WL:* | | ***0,00 deg*** |
| *Position fwd TR:* | | ***0,000 m*** |
| *Position below WL:* | | ***0,000 m*** |
| *Transom lift device:* | | ***Flap*** |
| *Device count:* | | ***0*** |
| *Span:* | | ***0,000 m*** |
| *Chord length:* | | ***0,000 m*** |
| *Deflection angle:* | | ***0,00 deg*** |
| *Tow point fwd TR:* | | ***0,000 m*** |
| *Tow point below WL:* | | ***0,000 m*** |

# Resistance

**23 mar 2018 11:33**
**HydroComp NavCad 2014**

Project ID
Description
File name **nav.hcnc**

## Appendage data

| General | |
|---|---|
| Definition: | **Percentage** |
| Percent of hull drag: | **5,00 %** |
| **Planing influence** | |
| LCE fwd TR: | **0,000 m** |
| VCE below WL: | **0,000 m** |
| **Shafting** | |
| Count: | **1** |
| Max prop diameter: | **8000,0 mm** |
| Shaft angle to WL: | **0,00 deg** |
| Exposed shaft length: | **0,000 m** |
| Shaft diameter: | **0,000 m** |
| Wetted surface: | **0,0 m2** |
| Strut bossing length: | **0,000 m** |
| Bossing diameter: | **0,000 m** |
| Wetted surface: | **0,0 m2** |
| Hull bossing length: | **0,000 m** |
| Bossing diameter: | **0,000 m** |
| Wetted surface: | **0,0 m2** |
| **Strut (per shaft line)** | |
| Count: | **0** |
| Root chord: | **0,000 m** |
| Tip chord: | **0,000 mm** |
| Span: | **0,000 m** |
| T/C ratio: | **0,000** |
| Projected area: | **0,0 m2** |
| Wetted surface: | **0,0 m2** |
| Exposed palm depth: | **0,000 m** |
| Exposed palm width: | **0,000 m** |
| **Rudder** | |
| Count: | **0** |
| Rudder location: | **Behind propeller** |
| Type: | **Balanced foil** |
| Root chord: | **0,000 m** |
| Tip chord: | **0,000 m** |
| Span: | **0,000 m** |
| T/C ratio: | **0,000** |
| LE sweep: | **0,00 deg** |
| Projected area: | **0,0 m2** |
| Wetted surface: | **0,0 m2** |

| Skeg/Keel | |
|---|---|
| Count: | **0** |
| Type: | **Skeg** |
| Mean length: | **0,000 m** |
| Mean width: | **0,000 m** |
| Height aft: | **0,000 m** |
| Height mid: | **0,000 m** |
| Height fwd: | **0,000 m** |
| Projected area: | **0,0 m2** |
| Wetted surface: | **0,0 m2** |
| **Stabilizer** | |
| Count: | **0** |
| Root chord: | **0,000 m** |
| Tip chord: | **0,000 m** |
| Span: | **0,000 m** |
| T/C ratio: | **0,000** |
| LE sweep: | **0,00 deg** |
| Wetted surface: | **0,0 m2** |
| Projected area: | **0,0 m2** |
| Dynamic multiplier: | **1,00** |
| **Bilge keel** | |
| Count: | **0** |
| Mean length: | **0,000 m** |
| Mean base width: | **0,000 m** |
| Mean projection: | **0,000 m** |
| Wetted surface: | **0,0 m2** |
| **Tunnel thruster** | |
| Count: | **0** |
| Diameter: | **0,000 m** |
| **Sonar dome** | |
| Count: | **0** |
| Wetted surface: | **0,0 m2** |
| **Miscellaneous** | |
| Count: | **0** |
| Drag area: | **0,0 m2** |
| Drag coef: | **0,00** |

## Environment data

| Wind | |
|---|---|
| Wind speed: | **0,00 kt** |
| Angle off bow: | **0,00 deg** |
| Gradient correction: | **Off** |
| **Exposed hull** | |
| Transverse area: | **0,0 m2** |
| VCE above WL: | **0,000 m** |
| Profile area: | **0,0 m2** |
| **Superstructure** | |
| Superstructure shape: | **Cargo ship** |
| Transverse area: | **0,0 m2** |
| VCE above WL: | **0,000 m** |
| Profile area: | **0,0 m2** |

| Seas | |
|---|---|
| Significant wave ht: | **0,000 m** |
| Modal wave period: | **0,0 sec** |
| **Shallow/channel** | |
| Water depth: | **0,000 m** |
| Type: | **Shallow water** |
| Channel width: | **0,000 m** |
| Channel side slope: | **0,00 deg** |
| Hull girth: | **0,000 m** |

# Resistance

**23 mar 2018 11:33**

**HydroComp NavCad 2014**

Project ID
Description
File name **nav.hcnc**

## Symbols and values

| | |
|---|---|
| SPEED = | Vessel speed |
| FN = | Froude number [LWL] |
| FV = | Froude number [VOL] |
| RN = | Reynolds number [LWL] |
| CF = | Frictional resistance coefficient |
| CV/CF = | Viscous/frictional resistance coefficient ratio [dynamic form factor] |
| CR = | Residuary resistance coefficient |
| dCF = | Added frictional resistance coefficient for roughness |
| CA = | Correlation allowance [dynamic] |
| CT = | Total bare-hull resistance coefficient |
| RBARE = | Bare-hull resistance |
| RAPP = | Additional appendage resistance |
| RWIND = | Additional wind resistance |
| RSEAS = | Additional sea-state resistance |
| RCHAN = | Additional shallow/channel resistance |
| RTOWED = | Additional towed object resistance |
| RMARGIN = | Resistance margin |
| RTOTAL = | Total vessel resistance |
| PEBARE = | Bare-hull effective power |
| PETOTAL = | Total effective power |
| CTLR = | Telfer residuary resistance coefficient |
| CTLT = | Telfer total bare-hull resistance coefficient |
| RBARE/W = | Bare-hull resistance to weight ratio |
| + = | Design speed indicator |
| * = | Exceeds parameter limit |

# Propulsion

**23 mar 2018 12:18**
**HydroComp NavCad 2014**

Project ID
Description
File name **nav.hcnc**

## Analysis parameters

| | | | |
|---|---|---|---|
| **Hull-propulsor interaction** | | **System analysis** | |
| Technique: | **[Calc] Prediction** | Cavitation criteria: | **Keller eqn** |
| Prediction: | **Holtrop** | Analysis type: | **Free run** |
| Reference ship: | | CPP method: | |
| Max prop diam: | **8000,0 mm** | Engine RPM: | |
| **Corrections** | | Mass multiplier: | |
| Viscous scale corr: | **[On] Custom** | RPM constraint: | |
| Rudder location: | **Behind propeller** | Limit [RPM/s]: | |
| Friction line: | **ITTC-57** | **Water properties** | |
| Hull form factor: | **1,429** | Water type: | **Salt** |
| Corr allowance: | **0,000113** | Density: | **1026,00 kg/m3** |
| Roughness [mm]: | **[Off] 0,00** | Viscosity: | **1,18920e-6 m2/s** |
| Ducted prop corr: | **[Off]** | | |
| Tunnel stern corr: | **[Off]** | | |
| Effective diam: | | | |
| Recess depth: | | | |

## Prediction method check [Holtrop]

| Parameters | FN [design] | CP | LWL/BWL | BWL/T |
|---|---|---|---|---|
| Value | **0,16** | **0,86** | **6,12** | **2,56** |
| Range | **0,06··0,80** | **0,55··0,85** | **3,90··14,90** | **2,10··4,00** |

## Prediction results [System]

| | HULL-PROPULSOR | | | | ENGINE | | | |
|---|---|---|---|---|---|---|---|---|
| SPEED [kt] | PETOTAL [kW] | WFT | THD | EFFR | RPMENG [RPM] | PBPROP [kW] | FUEL [L/h] | LOADENG [%] |
| **9,00** | **2875,7** | **0,6419** | **0,2277** | **1,0065** | **54** | **4311,4** | **---** | **0,0** |
| **10,00** | **3880,2** | **0,6403** | **0,2277** | **1,0065** | **59** | **5785,1** | **---** | **0,0** |
| **11,00** | **5087,0** | **0,6389** | **0,2277** | **1,0065** | **65** | **7545,6** | **---** | **0,0** |
| **12,00** | **6512,4** | **0,6377** | **0,2277** | **1,0065** | **70** | **9614,2** | **---** | **0,0** |
| **13,00** | **8172,5** | **0,6365** | **0,2277** | **1,0065** | **76** | **12011,7** | **---** | **0,0** |
| **14,00** | **10083,1** | **0,6355** | **0,2277** | **1,0065** | **81** | **14758,6** | **---** | **0,0** |
| **15,00** | **12259,8** | **0,6346** | **0,2277** | **1,0065** | **87** | **17874,6** | **---** | **0,0** |
| **+ 15,80 +** | **14202,9** | **0,6339** | **0,2277** | **1,0065** | **91** | **20646,2** | **---** | **0,0** |
| **16,00** | **14717,7** | **0,6337** | **0,2277** | **1,0065** | **92** | **21379,1** | **---** | **0,0** |
| **17,00** | **18353,0** | **0,6329** | **0,2277** | **1,0065** | **100** | **27078,3** | **---** | **0,0** |

| | POWER DELIVERY | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| SPEED [kt] | RPMPROP [RPM] | QPROP [kN·m] | QENG [kN·m] | PDPROP [kW] | PSPROP [kW] | PSTOTAL [kW] | PBTOTAL [kW] | TRANSP |
| **9,00** | **54** | **747,41** | **747,41** | **4182,1** | **4311,4** | **4311,4** | **4311,4** | **---** |
| **10,00** | **59** | **908,24** | **908,24** | **5611,6** | **5785,1** | **5785,1** | **5785,1** | **---** |
| **11,00** | **65** | **1083,11** | **1083,11** | **7319,2** | **7545,6** | **7545,6** | **7545,6** | **---** |
| **12,00** | **70** | **1271,77** | **1271,77** | **9325,7** | **9614,2** | **9614,2** | **9614,2** | **---** |
| **13,00** | **76** | **1473,96** | **1473,96** | **11651,4** | **12011,7** | **12011,7** | **12011,7** | **---** |
| **14,00** | **81** | **1689,48** | **1689,48** | **14315,8** | **14758,6** | **14758,6** | **14758,6** | **936,1** |
| **15,00** | **87** | **1918,12** | **1918,12** | **17338,4** | **17874,6** | **17874,6** | **17874,6** | **828,1** |
| **+ 15,80 +** | **91** | **2110,35** | **2110,35** | **20026,8** | **20646,2** | **20646,2** | **20646,2** | **755,2** |
| **16,00** | **92** | **2159,69** | **2159,69** | **20737,8** | **21379,1** | **21379,1** | **21379,1** | **738,5** |
| **17,00** | **100** | **2532,31** | **2532,31** | **26265,9** | **27078,3** | **27078,3** | **27078,3** | **619,5** |

| | EFFICIENCY | | | | THRUST | |
|---|---|---|---|---|---|---|
| SPEED [kt] | EFFO | EFFG | EFFOA | MERIT | THRPROP [kN] | DELTHR [kN] |
| **9,00** | **0,3168** | **1,0000** | **0,6670** | **0,75453** | **804,25** | **621,09** |
| **10,00** | **0,3200** | **1,0000** | **0,6707** | **0,75252** | **976,67** | **754,25** |
| **11,00** | **0,3229** | **1,0000** | **0,6742** | **0,75068** | **1164,02** | **898,93** |
| **12,00** | **0,3255** | **1,0000** | **0,6774** | **0,74899** | **1366,01** | **1054,92** |
| **13,00** | **0,3280** | **1,0000** | **0,6804** | **0,74742** | **1582,36** | **1222,01** |
| **14,00** | **0,3303** | **1,0000** | **0,6832** | **0,74594** | **1812,85** | **1400,00** |
| **15,00** | **0,3324** | **1,0000** | **0,6859** | **0,74456** | **2057,25** | **1588,74** |
| **+ 15,80 +** | **0,3340** | **1,0000** | **0,6879** | **0,74351** | **2262,63** | **1747,35** |
| **16,00** | **0,3344** | **1,0000** | **0,6884** | **0,74326** | **2315,34** | **1788,05** |
| **17,00** | **0,3300** | **1,0000** | **0,6778** | **0,74613** | **2717,40** | **2098,55** |

# Propulsion

**23 mar 2018 12:18**
**HydroComp NavCad 2014**

Project ID
Description
File name **nav.hcnc**

**Prediction results [Propulsor]**

| | PROPULSOR COEFS | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| SPEED [kt] | J | KT | KQ | KTJ2 | KQJ3 | CTH | CP | RNPROP | |
| **9,00** | **0,2312** | **0,2382** | **0,02767** | **4,4559** | **2,2388** | **11,347** | **35,589** | **4,91e7** | |
| **10,00** | **0,2337** | **0,2373** | **0,02758** | **4,3444** | **2,161** | **11,063** | **34,353** | **5,43e7** | |
| **11,00** | **0,2359** | **0,2364** | **0,02749** | **4,246** | **2,0931** | **10,812** | **33,273** | **5,93e7** | |
| **12,00** | **0,2380** | **0,2356** | **0,02742** | **4,1581** | **2,033** | **10,588** | **32,318** | **6,44e7** | |
| **13,00** | **0,2399** | **0,2348** | **0,02734** | **4,0787** | **1,9792** | **10,386** | **31,464** | **6,94e7** | |
| **14,00** | **0,2417** | **0,2341** | **0,02728** | **4,0065** | **1,9307** | **10,203** | **30,692** | **7,44e7** | |
| **15,00** | **0,2434** | **0,2335** | **0,02721** | **3,9404** | **1,8866** | **10,034** | **29,991** | **7,94e7** | |
| **+ 15,80 +** | **0,2447** | **0,2330** | **0,02716** | **3,8913** | **1,8541** | **9,909** | **29,473** | **8,34e7** | |
| **16,00** | **0,2450** | **0,2329** | **0,02715** | **3,8794** | **1,8462** | **9,8789** | **29,349** | **8,44e7** | |
| **17,00** | **0,2415** | **0,2342** | **0,02728** | **4,0157** | **1,9369** | **10,226** | **30,79** | **9,11e7** | |

| | CAVITATION | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| SPEED [kt] | SIGMAV | SIGMAN | SIGMA07R | TIPSPEED [m/s] | MINBAR | PRESS [kPa] | CAVAVG [%] | CAVMAX [%] | PITCHFC [mm] |
| **9,00** | **106,33** | **5,68** | **1,16** | **22,53** | **0,410** | **20,08** | **2,0** | **2,0** | **4174,6** |
| **10,00** | **85,37** | **4,66** | **0,95** | **24,87** | **0,454** | **24,39** | **2,0** | **2,0** | **4181,3** |
| **11,00** | **70,01** | **3,90** | **0,80** | **27,21** | **0,503** | **29,07** | **2,0** | **2,0** | **4187,5** |
| **12,00** | **58,42** | **3,31** | **0,68** | **29,52** | **0,556** | **34,11** | **2,0** | **2,0** | **4193,2** |
| **13,00** | **49,47** | **2,85** | **0,58** | **31,82** | **0,612** | **39,51** | **2,5** | **2,5** | **4198,5** |
| **14,00** | **42,42** | **2,48** | **0,51** | **34,11** | **0,672** | **45,27** | **3,1** | **3,1** | **4203,4** |
| **15,00** | **36,76** | **2,18** | **0,44** | **36,39** | **0,736** | **51,37** | **3,9** | **3,9** | **4208,0** |
| **+ 15,80 +** | **33,01** | **1,98** | **0,40** | **38,21** | **0,789** | **56,50 !** | **4,8** | **4,8** | **4211,5** |
| **16,00** | **32,16** | **1,93** | **0,39** | **38,66** | **0,803** | **57,82 !** | **5,0** | **5,0** | **4212,4** |
| **17,00** | **28,36** | **1,65** | **0,34** | **41,76** | **0,908** | **67,86 !!** | **7,0** | **7,0** | **4202,8** |

# Propulsion

**23 mar 2018 12:18**
**HydroComp NavCad 2014**

Project ID
Description
File name **nav.hcnc**

## Hull data

| General | | |
|---|---|---|
| Configuration: | | **Monohull** |
| Chine type: | | **Round/multiple** |
| Length on WL: | | **277,195 m** |
| Max beam on WL: | [LWL/BWL 6,119] | **45,300 m** |
| Max molded draft: | [BWL/T 2,559] | **17,700 m** |
| Displacement: | [CB 0,858] | **195606,00 t** |
| Wetted surface: | [CS 2,710] | **19697,9 m2** |

| ITTC-78 (CT) | | |
|---|---|---|
| LCB fwd TR: | [XCB/LWL 0,510] | **141,489 m** |
| LCF fwd TR: | [XCF/LWL 0,490] | **135,706 m** |
| Max section area: | [CX 0,999] | **801,0 m2** |
| Waterplane area: | [CWP 0,924] | **11599,0 m2** |
| Bulb section area: | | **91,0 m2** |
| Bulb ctr below WL: | | **10,300 m** |
| Bulb nose fwd TR: | | **280,600 m** |
| Imm transom area: | [ATR/AX 0,000] | **0,0 m2** |
| Transom beam WL: | [BTR/BWL 0,000] | **0,000 m** |
| Transom immersion: | [TTR/T 0,000] | **0,000 m** |
| Half entrance angle: | | **60,00 deg** |
| Bow shape factor: | [WL flow] | **1,0** |
| Stern shape factor: | [WL flow] | **1,0** |

| Planing | | |
|---|---|---|
| *Proj chine length:* | | ***0,000 m*** |
| *Proj bottom area:* | | ***0,0 m2*** |
| *LCG fwd TR:* | *[XCG/LP 0,000]* | ***0,000 m*** |
| *VCG below WL:* | | ***0,000 m*** |
| *Aft station (fwd TR):* | | ***0,000 m*** |
| *Deadrise:* | | ***0,00 deg*** |
| *Chine beam:* | | ***0,000 m*** |
| *Chine ht below WL:* | | ***0,000 m*** |
| *Fwd station (fwd TR):* | | ***0,000 m*** |
| *Deadrise:* | | ***0,00 deg*** |
| *Chine beam:* | | ***0,000 m*** |
| *Chine ht below WL:* | | ***0,000 m*** |
| *Propulsor type:* | | ***Propeller*** |
| *Max prop diameter:* | | ***8000,0 mm*** |
| *Shaft angle to WL:* | | ***0,00 deg*** |
| *Position fwd TR:* | | ***0,000 m*** |
| *Position below WL:* | | ***0,000 m*** |
| *Transom lift device:* | | ***Flap*** |
| *Device count:* | | ***0*** |
| *Span:* | | ***0,000 m*** |
| *Chord length:* | | ***0,000 m*** |
| *Deflection angle:* | | ***0,00 deg*** |
| *Tow point fwd TR:* | | ***0,000 m*** |
| *Tow point below WL:* | | ***0,000 m*** |

## Propulsor data

| Propulsor | | | |
|---|---|---|---|
| Count: | | **1** | |
| Propulsor type: | | **Propeller series** | |
| Propeller type: | | **FPP** | |
| Propeller series: | | **B Series** | |
| Propeller sizing: | | **By thrust** | |
| Reference prop: | | | |
| Blade count: | | **4** | |
| Expanded area ratio: | | **0,7967** | **[Size]** |
| Propeller diameter: | | **8000,0 mm** | **[Keep]** |
| Propeller mean pitch: | [P/D 0,7177] | **5741,3 mm** | **[Size]** |
| Hub immersion: | | **5000,0 mm** | |

| Engine/gear | | |
|---|---|---|
| Engine data: | | **Generic diesel** |
| Rated RPM: | | **0 RPM** |
| Rated power: | | **0,0 kW** |
| Gear efficiency: | | **1,000** |
| Load correction: | | **Off** |
| Gear ratio: | | **1,000** **[Keep]** |
| Shaft efficiency: | | **0,970** |

| Propeller options | |
|---|---|
| Oblique angle corr: | **Off** |
| Shaft angle to WL: | **0,00 deg** |
| Added rise of run: | **0,00 deg** |
| Propeller cup: | **0,0 mm** |
| KTKQ corrections: | **Custom** |
| Scale correction: | **Full ITTC** |
| KT multiplier: | **1,000** |
| KQ multiplier: | **1,000** |
| Blade T/C [0.7R]: | **0,00** |
| Roughness: | **0,00 mm** |
| Cav breakdown: | **On** |

| Design condition | |
|---|---|
| Max prop diam: | **8000,0 mm** |
| Design speed: | **15,80 kt** |
| Reference power: | **27440,0 kW** |
| Design point: | **1,000** |
| Reference RPM: | **89,0** |
| Design point: | **1,030** |

# Propulsion

**23 mar 2018 12:18**
**HydroComp NavCad 2014**

Project ID
Description
File name **nav.hcnc**

## Symbols and values

| | |
|---|---|
| SPEED = | Vessel speed |
| PETOTAL = | Total vessel effective power |
| WFT = | Taylor wake fraction coefficient |
| THD = | Thrust deduction coefficient |
| EFFR = | Relative-rotative efficiency |
| RPMENG = | Engine RPM |
| PBPROP = | Brake power per propulsor |
| FUEL = | Fuel rate per engine |
| LOADENG = | Percentage of engine max available power at given RPM |
| RPMPROP = | Propulsor RPM |
| QPROP = | Propulsor open water torque |
| QENG = | Engine torque |
| PDPROP = | Delivered power per propulsor |
| PSPROP = | Shaft power per propulsor |
| PSTOTAL = | Total vessel shaft power |
| PBTOTAL = | Total vessel brake power |
| TRANSP = | Transport factor |
| EFFO = | Propulsor open-water efficiency |
| EFFG = | Gear efficiency (load corrected) |
| EFFOA = | Overall propulsion efficiency [=PETOTAL/PSTOTAL] |
| MERIT = | Propulsor merit coefficient |
| THRPROP = | Open-water thrust per propulsor |
| DELTHR = | Total vessel delivered thrust |
| J = | Propulsor advance coefficient |
| KT = | Propulsor thrust coefficient [horizontal, if in oblique flow] |
| KQ = | Propulsor torque coefficient |
| KTJ2 = | Propulsor thrust loading ratio |
| KQJ3 = | Propulsor torque loading ratio |
| CTH = | Horizontal component of bare-hull resistance coefficient |
| CP = | Propulsor thrust loading coefficient |
| RNPROP = | Propeller Reynolds number at 0.7R |
| SIGMAV = | Cavitation number of propeller by vessel speed |
| SIGMAN = | Cavitation number of propeller by RPM |
| SIGMA07R = | Cavitation number of blade section at 0.7R |
| TIPSPEED = | Propeller circumferential tip speed |
| MINBAR = | Minimum expanded blade area ratio recommended by selected cavitation criteria |
| PRESS = | Average propeller loading pressure |
| CAVAVG = | Average predicted back cavitation percentage |
| CAVMAX = | Peak predicted back cavitation percentage [if in oblique flow] |
| PITCHFC = | Minimum recommended pitch to avoid face cavitation |
| + = | Design speed indicator |
| * = | Exceeds recommended parameter limit |
| ! = | Exceeds recommended cavitation criteria [warning] |
| !! = | Substantially exceeds recommended cavitation criteria [critical] |
| !!! = | Thrust breakdown is indicated [severe] |
| --- = | Insignificant or not applicable |

# Propulsion

**23 mar 2018 12:20**
**HydroComp NavCad 2014**

Project ID
Description
File name **nav.hcnc**

## Analysis parameters

| **Hull-propulsor interaction** | | **System analysis** | |
|---|---|---|---|
| Technique: | **[Calc] Prediction** | Cavitation criteria: | **Keller eqn** |
| Prediction: | **Holtrop** | Analysis type: | **Free run** |
| Reference ship: | | CPP method: | |
| Max prop diam: | **8000,0 mm** | Engine RPM: | |
| **Corrections** | | Mass multiplier: | |
| Viscous scale corr: | **[On] Custom** | RPM constraint: | |
| Rudder location: | **Behind propeller** | Limit [RPM/s]: | |
| Friction line: | **ITTC-57** | **Water properties** | |
| Hull form factor: | **1,429** | Water type: | **Salt** |
| Corr allowance: | **0,000113** | Density: | **1026,00 kg/m3** |
| Roughness [mm]: | **[Off] 0,00** | Viscosity: | **1,18920e-6 m2/s** |
| Ducted prop corr: | **[Off]** | | |
| Tunnel stern corr: | **[Off]** | | |
| Effective diam: | | | |
| Recess depth: | | | |

## Prediction method check [Holtrop]

| Parameters | FN [design] | CP | LWL/BWL | BWL/T |
|---|---|---|---|---|
| Value | **0,16** | **0,86** | **6,12** | **2,56** |
| Range | **0,06··0,80** | **0,55··0,85** | **3,90··14,90** | **2,10··4,00** |

## Prediction results [System]

| | HULL-PROPULSOR | | | | ENGINE | | | |
|---|---|---|---|---|---|---|---|---|
| SPEED [kt] | PETOTAL [kW] | WFT | THD | EFFR | RPMENG [RPM] | PBPROP [kW] | FUEL [L/h] | LOADENG [%] |
| **9,00** | **2875,7** | **0,6419** | **0,2277** | **1,0065** | **54** | **4311,4** | **---** | **0,0** |
| **10,00** | **3880,2** | **0,6403** | **0,2277** | **1,0065** | **59** | **5785,1** | **---** | **0,0** |
| **11,00** | **5087,0** | **0,6389** | **0,2277** | **1,0065** | **65** | **7545,6** | **---** | **0,0** |
| **12,00** | **6512,4** | **0,6377** | **0,2277** | **1,0065** | **70** | **9614,2** | **---** | **0,0** |
| **13,00** | **8172,5** | **0,6365** | **0,2277** | **1,0065** | **76** | **12011,7** | **---** | **0,0** |
| **14,00** | **10083,1** | **0,6355** | **0,2277** | **1,0065** | **81** | **14758,6** | **---** | **0,0** |
| **15,00** | **12259,8** | **0,6346** | **0,2277** | **1,0065** | **87** | **17874,6** | **---** | **0,0** |
| **+ 15,80 +** | **14202,9** | **0,6339** | **0,2277** | **1,0065** | **91** | **20646,2** | **---** | **0,0** |
| **16,00** | **14717,7** | **0,6337** | **0,2277** | **1,0065** | **92** | **21379,1** | **---** | **0,0** |
| **17,00** | **18353,0** | **0,6329** | **0,2277** | **1,0065** | **100** | **27078,3** | **---** | **0,0** |

| | POWER DELIVERY | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| SPEED [kt] | RPMPROP [RPM] | QPROP [kN·m] | QENG [kN·m] | PDPROP [kW] | PSPROP [kW] | PSTOTAL [kW] | PBTOTAL [kW] | TRANSP |
| **9,00** | **54** | **747,41** | **747,41** | **4182,1** | **4311,4** | **4311,4** | **4311,4** | **---** |
| **10,00** | **59** | **908,24** | **908,24** | **5611,6** | **5785,1** | **5785,1** | **5785,1** | **---** |
| **11,00** | **65** | **1083,11** | **1083,11** | **7319,2** | **7545,6** | **7545,6** | **7545,6** | **---** |
| **12,00** | **70** | **1271,77** | **1271,77** | **9325,7** | **9614,2** | **9614,2** | **9614,2** | **---** |
| **13,00** | **76** | **1473,96** | **1473,96** | **11651,4** | **12011,7** | **12011,7** | **12011,7** | **---** |
| **14,00** | **81** | **1689,48** | **1689,48** | **14315,8** | **14758,6** | **14758,6** | **14758,6** | **936,1** |
| **15,00** | **87** | **1918,12** | **1918,12** | **17338,4** | **17874,6** | **17874,6** | **17874,6** | **828,1** |
| **+ 15,80 +** | **91** | **2110,35** | **2110,35** | **20026,8** | **20646,2** | **20646,2** | **20646,2** | **755,2** |
| **16,00** | **92** | **2159,69** | **2159,69** | **20737,8** | **21379,1** | **21379,1** | **21379,1** | **738,5** |
| **17,00** | **100** | **2532,31** | **2532,31** | **26265,9** | **27078,3** | **27078,3** | **27078,3** | **619,5** |

| | EFFICIENCY | | | | THRUST | |
|---|---|---|---|---|---|---|
| SPEED [kt] | EFFO | EFFG | EFFOA | MERIT | THRPROP [kN] | DELTHR [kN] |
| **9,00** | **0,3168** | **1,0000** | **0,6670** | **0,75453** | **804,25** | **621,09** |
| **10,00** | **0,3200** | **1,0000** | **0,6707** | **0,75252** | **976,67** | **754,25** |
| **11,00** | **0,3229** | **1,0000** | **0,6742** | **0,75068** | **1164,02** | **898,93** |
| **12,00** | **0,3255** | **1,0000** | **0,6774** | **0,74899** | **1366,01** | **1054,92** |
| **13,00** | **0,3280** | **1,0000** | **0,6804** | **0,74742** | **1582,36** | **1222,01** |
| **14,00** | **0,3303** | **1,0000** | **0,6832** | **0,74594** | **1812,85** | **1400,00** |
| **15,00** | **0,3324** | **1,0000** | **0,6859** | **0,74456** | **2057,25** | **1588,74** |
| **+ 15,80 +** | **0,3340** | **1,0000** | **0,6879** | **0,74351** | **2262,63** | **1747,35** |
| **16,00** | **0,3344** | **1,0000** | **0,6884** | **0,74326** | **2315,34** | **1788,05** |
| **17,00** | **0,3300** | **1,0000** | **0,6778** | **0,74613** | **2717,40** | **2098,55** |

# Propulsion

**23 mar 2018 12:20**
**HydroComp NavCad 2014**

Project ID
Description
File name **nav.hcnc**

**Prediction results [Propulsor]**

| | PROPULSOR COEFS | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| SPEED [kt] | J | KT | KQ | KTJ2 | KQJ3 | CTH | CP | RNPROP | |
| **9,00** | **0,2312** | **0,2382** | **0,02767** | **4,4559** | **2,2388** | **11,347** | **35,589** | **4,91e7** | |
| **10,00** | **0,2337** | **0,2373** | **0,02758** | **4,3444** | **2,161** | **11,063** | **34,353** | **5,43e7** | |
| **11,00** | **0,2359** | **0,2364** | **0,02749** | **4,246** | **2,0931** | **10,812** | **33,273** | **5,93e7** | |
| **12,00** | **0,2380** | **0,2356** | **0,02742** | **4,1581** | **2,033** | **10,588** | **32,318** | **6,44e7** | |
| **13,00** | **0,2399** | **0,2348** | **0,02734** | **4,0787** | **1,9792** | **10,386** | **31,464** | **6,94e7** | |
| **14,00** | **0,2417** | **0,2341** | **0,02728** | **4,0065** | **1,9307** | **10,203** | **30,692** | **7,44e7** | |
| **15,00** | **0,2434** | **0,2335** | **0,02721** | **3,9404** | **1,8866** | **10,034** | **29,991** | **7,94e7** | |
| **+ 15,80 +** | **0,2447** | **0,2330** | **0,02716** | **3,8913** | **1,8541** | **9,909** | **29,473** | **8,34e7** | |
| **16,00** | **0,2450** | **0,2329** | **0,02715** | **3,8794** | **1,8462** | **9,8789** | **29,349** | **8,44e7** | |
| **17,00** | **0,2415** | **0,2342** | **0,02728** | **4,0157** | **1,9369** | **10,226** | **30,79** | **9,11e7** | |

| | CAVITATION | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| SPEED [kt] | SIGMAV | SIGMAN | SIGMA07R | TIPSPEED [m/s] | MINBAR | PRESS [kPa] | CAVAVG [%] | CAVMAX [%] | PITCHFC [mm] |
| **9,00** | **106,33** | **5,68** | **1,16** | **22,53** | **0,410** | **20,08** | **2,0** | **2,0** | **4174,6** |
| **10,00** | **85,37** | **4,66** | **0,95** | **24,87** | **0,454** | **24,39** | **2,0** | **2,0** | **4181,3** |
| **11,00** | **70,01** | **3,90** | **0,80** | **27,21** | **0,503** | **29,07** | **2,0** | **2,0** | **4187,5** |
| **12,00** | **58,42** | **3,31** | **0,68** | **29,52** | **0,556** | **34,11** | **2,0** | **2,0** | **4193,2** |
| **13,00** | **49,47** | **2,85** | **0,58** | **31,82** | **0,612** | **39,51** | **2,5** | **2,5** | **4198,5** |
| **14,00** | **42,42** | **2,48** | **0,51** | **34,11** | **0,672** | **45,27** | **3,1** | **3,1** | **4203,4** |
| **15,00** | **36,76** | **2,18** | **0,44** | **36,39** | **0,736** | **51,37** | **3,9** | **3,9** | **4208,0** |
| **+ 15,80 +** | **33,01** | **1,98** | **0,40** | **38,21** | **0,789** | **56,50 !** | **4,8** | **4,8** | **4211,5** |
| **16,00** | **32,16** | **1,93** | **0,39** | **38,66** | **0,803** | **57,82 !** | **5,0** | **5,0** | **4212,4** |
| **17,00** | **28,36** | **1,65** | **0,34** | **41,76** | **0,908** | **67,86 !!** | **7,0** | **7,0** | **4202,8** |

# Propulsion

**23 mar 2018 12:20**
**HydroComp NavCad 2014**

Project ID
Description
File name **nav.hcnc**

## Hull data

| General | | |
|---|---|---|
| Configuration: | | **Monohull** |
| Chine type: | | **Round/multiple** |
| Length on WL: | | **277,195 m** |
| Max beam on WL: | [LWL/BWL 6,119] | **45,300 m** |
| Max molded draft: | [BWL/T 2,559] | **17,700 m** |
| Displacement: | [CB 0,858] | **195606,00 t** |
| Wetted surface: | [CS 2,710] | **19697,9 m2** |

| ITTC-78 (CT) | | |
|---|---|---|
| LCB fwd TR: | [XCB/LWL 0,510] | **141,489 m** |
| LCF fwd TR: | [XCF/LWL 0,490] | **135,706 m** |
| Max section area: | [CX 0,999] | **801,0 m2** |
| Waterplane area: | [CWP 0,924] | **11599,0 m2** |
| Bulb section area: | | **91,0 m2** |
| Bulb ctr below WL: | | **10,300 m** |
| Bulb nose fwd TR: | | **280,600 m** |
| Imm transom area: | [ATR/AX 0,000] | **0,0 m2** |
| Transom beam WL: | [BTR/BWL 0,000] | **0,000 m** |
| Transom immersion: | [TTR/T 0,000] | **0,000 m** |
| Half entrance angle: | | **60,00 deg** |
| Bow shape factor: | [WL flow] | **1,0** |
| Stern shape factor: | [WL flow] | **1,0** |

| Planing | | |
|---|---|---|
| *Proj chine length:* | | ***0,000 m*** |
| *Proj bottom area:* | | ***0,0 m2*** |
| *LCG fwd TR:* | *[XCG/LP 0,000]* | ***0,000 m*** |
| *VCG below WL:* | | ***0,000 m*** |
| *Aft station (fwd TR):* | | ***0,000 m*** |
| *Deadrise:* | | ***0,00 deg*** |
| *Chine beam:* | | ***0,000 m*** |
| *Chine ht below WL:* | | ***0,000 m*** |
| *Fwd station (fwd TR):* | | ***0,000 m*** |
| *Deadrise:* | | ***0,00 deg*** |
| *Chine beam:* | | ***0,000 m*** |
| *Chine ht below WL:* | | ***0,000 m*** |
| *Propulsor type:* | | ***Propeller*** |
| *Max prop diameter:* | | ***8000,0 mm*** |
| *Shaft angle to WL:* | | ***0,00 deg*** |
| *Position fwd TR:* | | ***0,000 m*** |
| *Position below WL:* | | ***0,000 m*** |
| *Transom lift device:* | | ***Flap*** |
| *Device count:* | | ***0*** |
| *Span:* | | ***0,000 m*** |
| *Chord length:* | | ***0,000 m*** |
| *Deflection angle:* | | ***0,00 deg*** |
| *Tow point fwd TR:* | | ***0,000 m*** |
| *Tow point below WL:* | | ***0,000 m*** |

## Propulsor data

| Propulsor | | | |
|---|---|---|---|
| Count: | | **1** | |
| Propulsor type: | | **Propeller series** | |
| Propeller type: | | **FPP** | |
| Propeller series: | | **B Series** | |
| Propeller sizing: | | **By power** | |
| Reference prop: | | | |
| Blade count: | | **4** | |
| Expanded area ratio: | | **0,7967** | **[Size]** |
| Propeller diameter: | | **8000,0 mm** | **[Keep]** |
| Propeller mean pitch: | [P/D 0,7177] | **5741,3 mm** | **[Size]** |
| Hub immersion: | | **5000,0 mm** | |

| Engine/gear | | |
|---|---|---|
| Engine data: | **Generic diesel** | |
| Rated RPM: | **0 RPM** | |
| Rated power: | **0,0 kW** | |
| Gear efficiency: | **1,000** | |
| Load correction: | **Off** | |
| Gear ratio: | **1,000** | **[Keep]** |
| Shaft efficiency: | **0,970** | |

| Propeller options | |
|---|---|
| Oblique angle corr: | **Off** |
| Shaft angle to WL: | **0,00 deg** |
| Added rise of run: | **0,00 deg** |
| Propeller cup: | **0,0 mm** |
| KTKQ corrections: | **Custom** |
| Scale correction: | **Full ITTC** |
| KT multiplier: | **1,000** |
| KQ multiplier: | **1,000** |
| Blade T/C [0.7R]: | **0,00** |
| Roughness: | **0,00 mm** |
| Cav breakdown: | **On** |

| Design condition | |
|---|---|
| Max prop diam: | **8000,0 mm** |
| Design speed: | **15,80 kt** |
| Reference power: | **27440,0 kW** |
| Design point: | **1,000** |
| Reference RPM: | **89,0** |
| Design point: | **1,030** |

# Propulsion

**23 mar 2018 12:20**
**HydroComp NavCad 2014**

Project ID
Description
File name **nav.hcnc**

## Symbols and values

| | |
|---|---|
| SPEED = | Vessel speed |
| PETOTAL = | Total vessel effective power |
| WFT = | Taylor wake fraction coefficient |
| THD = | Thrust deduction coefficient |
| EFFR = | Relative-rotative efficiency |
| RPMENG = | Engine RPM |
| PBPROP = | Brake power per propulsor |
| FUEL = | Fuel rate per engine |
| LOADENG = | Percentage of engine max available power at given RPM |
| RPMPROP = | Propulsor RPM |
| QPROP = | Propulsor open water torque |
| QENG = | Engine torque |
| PDPROP = | Delivered power per propulsor |
| PSPROP = | Shaft power per propulsor |
| PSTOTAL = | Total vessel shaft power |
| PBTOTAL = | Total vessel brake power |
| TRANSP = | Transport factor |
| EFFO = | Propulsor open-water efficiency |
| EFFG = | Gear efficiency (load corrected) |
| EFFOA = | Overall propulsion efficiency [=PETOTAL/PSTOTAL] |
| MERIT = | Propulsor merit coefficient |
| THRPROP = | Open-water thrust per propulsor |
| DELTHR = | Total vessel delivered thrust |
| J = | Propulsor advance coefficient |
| KT = | Propulsor thrust coefficient [horizontal, if in oblique flow] |
| KQ = | Propulsor torque coefficient |
| KTJ2 = | Propulsor thrust loading ratio |
| KQJ3 = | Propulsor torque loading ratio |
| CTH = | Horizontal component of bare-hull resistance coefficient |
| CP = | Propulsor thrust loading coefficient |
| RNPROP = | Propeller Reynolds number at 0.7R |
| SIGMAV = | Cavitation number of propeller by vessel speed |
| SIGMAN = | Cavitation number of propeller by RPM |
| SIGMA07R = | Cavitation number of blade section at 0.7R |
| TIPSPEED = | Propeller circumferential tip speed |
| MINBAR = | Minimum expanded blade area ratio recommended by selected cavitation criteria |
| PRESS = | Average propeller loading pressure |
| CAVAVG = | Average predicted back cavitation percentage |
| CAVMAX = | Peak predicted back cavitation percentage [if in oblique flow] |
| PITCHFC = | Minimum recommended pitch to avoid face cavitation |
| + = | Design speed indicator |
| * = | Exceeds recommended parameter limit |
| ! = | Exceeds recommended cavitation criteria [warning] |
| !! = | Substantially exceeds recommended cavitation criteria [critical] |
| !!! = | Thrust breakdown is indicated [severe] |
| --- = | Insignificant or not applicable |

# Propulsion

**23 mar 2018 12:22**
**HydroComp NavCad 2014**

Project ID
Description
File name **nav.hcnc**

## Analysis parameters

| **Hull-propulsor interaction** | | **System analysis** | |
|---|---|---|---|
| Technique: | **[Calc] Prediction** | Cavitation criteria: | **Keller eqn** |
| Prediction: | **Holtrop** | Analysis type: | **Free run** |
| Reference ship: | | CPP method: | |
| Max prop diam: | **8000,0 mm** | Engine RPM: | |
| **Corrections** | | Mass multiplier: | |
| Viscous scale corr: | **[On] Custom** | RPM constraint: | |
| Rudder location: | **Behind propeller** | Limit [RPM/s]: | |
| Friction line: | **ITTC-57** | **Water properties** | |
| Hull form factor: | **1,429** | Water type: | **Salt** |
| Corr allowance: | **0,000113** | Density: | **1026,00 kg/m3** |
| Roughness [mm]: | **[Off] 0,00** | Viscosity: | **1,18920e-6 m2/s** |
| Ducted prop corr: | **[Off]** | | |
| Tunnel stern corr: | **[Off]** | | |
| Effective diam: | | | |
| Recess depth: | | | |

## Prediction method check [Holtrop]

| Parameters | FN [design] | CP | LWL/BWL | BWL/T |
|---|---|---|---|---|
| Value | **0,16** | **0,86** | **6,12** | **2,56** |
| Range | **0,06··0,80** | **0,55··0,85** | **3,90··14,90** | **2,10··4,00** |

## Prediction results [System]

| | HULL-PROPULSOR | | | | ENGINE | | | |
|---|---|---|---|---|---|---|---|---|
| SPEED [kt] | PETOTAL [kW] | WFT | THD | EFFR | RPMENG [RPM] | PBPROP [kW] | FUEL [L/h] | LOADENG [%] |
| **9,00** | **2875,7** | **0,6419** | **0,2277** | **1,0065** | **53** | **4217,7** | **---** | **0,0** |
| **10,00** | **3880,2** | **0,6403** | **0,2277** | **1,0065** | **58** | **5659,8** | **---** | **0,0** |
| **11,00** | **5087,0** | **0,6389** | **0,2277** | **1,0065** | **64** | **7382,5** | **---** | **0,0** |
| **12,00** | **6512,4** | **0,6377** | **0,2277** | **1,0065** | **69** | **9407,0** | **---** | **0,0** |
| **13,00** | **8172,5** | **0,6365** | **0,2277** | **1,0065** | **75** | **11753,6** | **---** | **0,0** |
| **14,00** | **10083,1** | **0,6355** | **0,2277** | **1,0065** | **80** | **14442,2** | **---** | **0,0** |
| **15,00** | **12259,8** | **0,6346** | **0,2277** | **1,0065** | **85** | **17492,4** | **---** | **0,0** |
| **+ 15,80 +** | **14202,9** | **0,6339** | **0,2277** | **1,0065** | **90** | **20205,6** | **---** | **0,0** |
| **16,00** | **14717,7** | **0,6337** | **0,2277** | **1,0065** | **91** | **20923,1** | **---** | **0,0** |
| **17,00** | **18353,0** | **0,6329** | **0,2277** | **1,0065** | **98** | **26497,7** | **---** | **0,0** |

| | POWER DELIVERY | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| SPEED [kt] | RPMPROP [RPM] | QPROP [kN·m] | QENG [kN·m] | PDPROP [kW] | PSPROP [kW] | PSTOTAL [kW] | PBTOTAL [kW] | TRANSP |
| **9,00** | **53** | **744,96** | **744,96** | **4091,1** | **4217,7** | **4217,7** | **4217,7** | **---** |
| **10,00** | **58** | **905,36** | **905,36** | **5490,0** | **5659,8** | **5659,8** | **5659,8** | **---** |
| **11,00** | **64** | **1079,78** | **1079,78** | **7161,1** | **7382,5** | **7382,5** | **7382,5** | **---** |
| **12,00** | **69** | **1267,97** | **1267,97** | **9124,8** | **9407,0** | **9407,0** | **9407,0** | **---** |
| **13,00** | **75** | **1469,69** | **1469,69** | **11401,0** | **11753,6** | **11753,6** | **11753,6** | **---** |
| **14,00** | **80** | **1684,72** | **1684,72** | **14009,0** | **14442,2** | **14442,2** | **14442,2** | **956,6** |
| **15,00** | **85** | **1912,86** | **1912,86** | **16967,7** | **17492,4** | **17492,4** | **17492,4** | **846,2** |
| **+ 15,80 +** | **90** | **2104,69** | **2104,69** | **19599,5** | **20205,6** | **20205,6** | **20205,6** | **771,7** |
| **16,00** | **91** | **2153,93** | **2153,93** | **20295,4** | **20923,1** | **20923,1** | **20923,1** | **754,6** |
| **17,00** | **98** | **2525,15** | **2525,15** | **25702,8** | **26497,7** | **26497,7** | **26497,7** | **633,1** |

| | EFFICIENCY | | | | THRUST | |
|---|---|---|---|---|---|---|
| SPEED [kt] | EFFO | EFFG | EFFOA | MERIT | THRPROP [kN] | DELTHR [kN] |
| **9,00** | **0,3238** | **1,0000** | **0,6818** | **0,77129** | **804,25** | **621,09** |
| **10,00** | **0,3270** | **1,0000** | **0,6856** | **0,76919** | **976,67** | **754,25** |
| **11,00** | **0,3300** | **1,0000** | **0,6891** | **0,76726** | **1164,02** | **898,93** |
| **12,00** | **0,3327** | **1,0000** | **0,6923** | **0,76548** | **1366,01** | **1054,92** |
| **13,00** | **0,3352** | **1,0000** | **0,6953** | **0,76383** | **1582,36** | **1222,00** |
| **14,00** | **0,3375** | **1,0000** | **0,6982** | **0,76228** | **1812,85** | **1400,00** |
| **15,00** | **0,3397** | **1,0000** | **0,7009** | **0,76083** | **2057,25** | **1588,74** |
| **+ 15,80 +** | **0,3413** | **1,0000** | **0,7029** | **0,75973** | **2262,63** | **1747,35** |
| **16,00** | **0,3417** | **1,0000** | **0,7034** | **0,75946** | **2315,34** | **1788,05** |
| **17,00** | **0,3372** | **1,0000** | **0,6926** | **0,76248** | **2717,40** | **2098,55** |

# Propulsion

**23 mar 2018 12:22**
**HydroComp NavCad 2014**

Project ID
Description
File name **nav.hcnc**

**Prediction results [Propulsor]**

| | PROPULSOR COEFS | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| SPEED [kt] | J | KT | KQ | KTJ2 | KQJ3 | CTH | CP | RNPROP | |
| **9,00** | **0,2356** | **0,2473** | **0,02863** | **4,4559** | **2,1901** | **11,347** | **34,815** | **3,86e7** | |
| **10,00** | **0,2381** | **0,2463** | **0,02854** | **4,3444** | **2,1142** | **11,063** | **33,608** | **4,26e7** | |
| **11,00** | **0,2404** | **0,2454** | **0,02846** | **4,246** | **2,0479** | **10,812** | **32,554** | **4,66e7** | |
| **12,00** | **0,2425** | **0,2446** | **0,02838** | **4,1581** | **1,9892** | **10,588** | **31,622** | **5,06e7** | |
| **13,00** | **0,2445** | **0,2438** | **0,02831** | **4,0787** | **1,9367** | **10,386** | **30,787** | **5,45e7** | |
| **14,00** | **0,2463** | **0,2431** | **0,02824** | **4,0065** | **1,8894** | **10,203** | **30,035** | **5,84e7** | |
| **15,00** | **0,2481** | **0,2425** | **0,02818** | **3,9404** | **1,8463** | **10,034** | **29,35** | **6,24e7** | |
| **+ 15,80 +** | **0,2494** | **0,2420** | **0,02813** | **3,8913** | **1,8145** | **9,909** | **28,844** | **6,55e7** | |
| **16,00** | **0,2497** | **0,2418** | **0,02812** | **3,8794** | **1,8069** | **9,8789** | **28,723** | **6,62e7** | |
| **17,00** | **0,2461** | **0,2432** | **0,02825** | **4,0157** | **1,8954** | **10,226** | **30,13** | **7,15e7** | |

| | CAVITATION | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| SPEED [kt] | SIGMAV | SIGMAN | SIGMA07R | TIPSPEED [m/s] | MINBAR | PRESS [kPa] | CAVAVG [%] | CAVMAX [%] | PITCHFC [mm] |
| **9,00** | **106,33** | **5,90** | **1,21** | **22,11** | **0,435** | **20,08** | **2,0** | **2,0** | **4253,4** |
| **10,00** | **85,37** | **4,84** | **0,99** | **24,41** | **0,485** | **24,39** | **2,0** | **2,0** | **4260,4** |
| **11,00** | **70,01** | **4,05** | **0,83** | **26,70** | **0,540** | **29,07** | **2,0** | **2,0** | **4266,8** |
| **12,00** | **58,42** | **3,44** | **0,70** | **28,97** | **0,599** | **34,11** | **2,0** | **2,0** | **4272,7** |
| **13,00** | **49,47** | **2,96** | **0,60** | **31,23** | **0,662** | **39,51** | **2,5** | **2,5** | **4278,2** |
| **14,00** | **42,42** | **2,57** | **0,53** | **33,48** | **0,729** | **45,27** | **3,1** | **3,1** | **4283,3** |
| **15,00** | **36,76** | **2,26** | **0,46** | **35,71** | **0,800** | **51,37** | **3,9** | **3,9** | **4288,2** |
| **+ 15,80 +** | **33,01** | **2,05** | **0,42** | **37,49** | **0,860** | **56,50 !** | **4,7** | **4,7** | **4291,8** |
| **16,00** | **32,16** | **2,00** | **0,41** | **37,93** | **0,876** | **57,82 !** | **5,0** | **5,0** | **4292,7** |
| **17,00** | **28,36** | **1,72** | **0,35** | **40,98** | **0,993** | **67,86 !!** | **7,0** | **7,0** | **4282,7** |

# Propulsion

**23 mar 2018 12:22**
**HydroComp NavCad 2014**

Project ID
Description
File name **nav.hcnc**

## Hull data

| General | | |
|---|---|---|
| Configuration: | | **Monohull** |
| Chine type: | | **Round/multiple** |
| Length on WL: | | **277,195 m** |
| Max beam on WL: | [LWL/BWL 6,119] | **45,300 m** |
| Max molded draft: | [BWL/T 2,559] | **17,700 m** |
| Displacement: | [CB 0,858] | **195606,00 t** |
| Wetted surface: | [CS 2,710] | **19697,9 m2** |

| ITTC-78 (CT) | | |
|---|---|---|
| LCB fwd TR: | [XCB/LWL 0,510] | **141,489 m** |
| LCF fwd TR: | [XCF/LWL 0,490] | **135,706 m** |
| Max section area: | [CX 0,999] | **801,0 m2** |
| Waterplane area: | [CWP 0,924] | **11599,0 m2** |
| Bulb section area: | | **91,0 m2** |
| Bulb ctr below WL: | | **10,300 m** |
| Bulb nose fwd TR: | | **280,600 m** |
| Imm transom area: | [ATR/AX 0,000] | **0,0 m2** |
| Transom beam WL: | [BTR/BWL 0,000] | **0,000 m** |
| Transom immersion: | [TTR/T 0,000] | **0,000 m** |
| Half entrance angle: | | **60,00 deg** |
| Bow shape factor: | [WL flow] | **1,0** |
| Stern shape factor: | [WL flow] | **1,0** |

| Planing | | |
|---|---|---|
| *Proj chine length:* | | ***0,000 m*** |
| *Proj bottom area:* | | ***0,0 m2*** |
| *LCG fwd TR:* | *[XCG/LP 0,000]* | ***0,000 m*** |
| *VCG below WL:* | | ***0,000 m*** |
| *Aft station (fwd TR):* | | ***0,000 m*** |
| *Deadrise:* | | ***0,00 deg*** |
| *Chine beam:* | | ***0,000 m*** |
| *Chine ht below WL:* | | ***0,000 m*** |
| *Fwd station (fwd TR):* | | ***0,000 m*** |
| *Deadrise:* | | ***0,00 deg*** |
| *Chine beam:* | | ***0,000 m*** |
| *Chine ht below WL:* | | ***0,000 m*** |
| *Propulsor type:* | | ***Propeller*** |
| *Max prop diameter:* | | ***8000,0 mm*** |
| *Shaft angle to WL:* | | ***0,00 deg*** |
| *Position fwd TR:* | | ***0,000 m*** |
| *Position below WL:* | | ***0,000 m*** |
| *Transom lift device:* | | ***Flap*** |
| *Device count:* | | ***0*** |
| *Span:* | | ***0,000 m*** |
| *Chord length:* | | ***0,000 m*** |
| *Deflection angle:* | | ***0,00 deg*** |
| *Tow point fwd TR:* | | ***0,000 m*** |
| *Tow point below WL:* | | ***0,000 m*** |

## Propulsor data

| Propulsor | | | |
|---|---|---|---|
| Count: | | **1** | |
| Propulsor type: | | **Propeller series** | |
| Propeller type: | | **FPP** | |
| Propeller series: | | **B Series** | |
| Propeller sizing: | | **By power** | |
| Reference prop: | | | |
| Blade count: | | **5** | |
| Expanded area ratio: | | **0,7967** | **[Size]** |
| Propeller diameter: | | **8000,0 mm** | **[Keep]** |
| Propeller mean pitch: | [P/D 0,7177] | **5741,3 mm** | **[Size]** |
| Hub immersion: | | **5000,0 mm** | |

| Engine/gear | | |
|---|---|---|
| Engine data: | **Generic diesel** | |
| Rated RPM: | **0 RPM** | |
| Rated power: | **0,0 kW** | |
| Gear efficiency: | **1,000** | |
| Load correction: | **Off** | |
| Gear ratio: | **1,000** | **[Keep]** |
| Shaft efficiency: | **0,970** | |

| Propeller options | |
|---|---|
| Oblique angle corr: | **Off** |
| Shaft angle to WL: | **0,00 deg** |
| Added rise of run: | **0,00 deg** |
| Propeller cup: | **0,0 mm** |
| KTKQ corrections: | **Custom** |
| Scale correction: | **Full ITTC** |
| KT multiplier: | **1,000** |
| KQ multiplier: | **1,000** |
| Blade T/C [0.7R]: | **0,00** |
| Roughness: | **0,00 mm** |
| Cav breakdown: | **On** |

| Design condition | |
|---|---|
| Max prop diam: | **8000,0 mm** |
| Design speed: | **15,80 kt** |
| Reference power: | **27440,0 kW** |
| Design point: | **1,000** |
| Reference RPM: | **89,0** |
| Design point: | **1,030** |

# Propulsion

**23 mar 2018 12:22**
**HydroComp NavCad 2014**

Project ID
Description
File name **nav.hcnc**

## Symbols and values

| | |
|---|---|
| SPEED = | Vessel speed |
| PETOTAL = | Total vessel effective power |
| WFT = | Taylor wake fraction coefficient |
| THD = | Thrust deduction coefficient |
| EFFR = | Relative-rotative efficiency |
| RPMENG = | Engine RPM |
| PBPROP = | Brake power per propulsor |
| FUEL = | Fuel rate per engine |
| LOADENG = | Percentage of engine max available power at given RPM |
| RPMPROP = | Propulsor RPM |
| QPROP = | Propulsor open water torque |
| QENG = | Engine torque |
| PDPROP = | Delivered power per propulsor |
| PSPROP = | Shaft power per propulsor |
| PSTOTAL = | Total vessel shaft power |
| PBTOTAL = | Total vessel brake power |
| TRANSP = | Transport factor |
| EFFO = | Propulsor open-water efficiency |
| EFFG = | Gear efficiency (load corrected) |
| EFFOA = | Overall propulsion efficiency [=PETOTAL/PSTOTAL] |
| MERIT = | Propulsor merit coefficient |
| THRPROP = | Open-water thrust per propulsor |
| DELTHR = | Total vessel delivered thrust |
| J = | Propulsor advance coefficient |
| KT = | Propulsor thrust coefficient [horizontal, if in oblique flow] |
| KQ = | Propulsor torque coefficient |
| KTJ2 = | Propulsor thrust loading ratio |
| KQJ3 = | Propulsor torque loading ratio |
| CTH = | Horizontal component of bare-hull resistance coefficient |
| CP = | Propulsor thrust loading coefficient |
| RNPROP = | Propeller Reynolds number at 0.7R |
| SIGMAV = | Cavitation number of propeller by vessel speed |
| SIGMAN = | Cavitation number of propeller by RPM |
| SIGMA07R = | Cavitation number of blade section at 0.7R |
| TIPSPEED = | Propeller circumferential tip speed |
| MINBAR = | Minimum expanded blade area ratio recommended by selected cavitation criteria |
| PRESS = | Average propeller loading pressure |
| CAVAVG = | Average predicted back cavitation percentage |
| CAVMAX = | Peak predicted back cavitation percentage [if in oblique flow] |
| PITCHFC = | Minimum recommended pitch to avoid face cavitation |
| + = | Design speed indicator |
| * = | Exceeds recommended parameter limit |
| ! = | Exceeds recommended cavitation criteria [warning] |
| !! = | Substantially exceeds recommended cavitation criteria [critical] |
| !!! = | Thrust breakdown is indicated [severe] |
| --- = | Insignificant or not applicable |

# Propulsion

**23 mar 2018 12:27**
**HydroComp NavCad 2014**

Project ID
Description
File name **nav.hcnc**

## Analysis parameters

| **Hull-propulsor interaction** | | **System analysis** | |
|---|---|---|---|
| Technique: | **[Calc] Prediction** | Cavitation criteria: | **Keller eqn** |
| Prediction: | **Holtrop** | Analysis type: | **Free run** |
| Reference ship: | | CPP method: | |
| Max prop diam: | **8000,0 mm** | Engine RPM: | |
| **Corrections** | | Mass multiplier: | |
| Viscous scale corr: | **[On] Custom** | RPM constraint: | |
| Rudder location: | **Behind propeller** | Limit [RPM/s]: | |
| Friction line: | **ITTC-57** | **Water properties** | |
| Hull form factor: | **1,429** | Water type: | **Salt** |
| Corr allowance: | **0,000113** | Density: | **1026,00 kg/m3** |
| Roughness [mm]: | **[Off] 0,00** | Viscosity: | **1,18920e-6 m2/s** |
| Ducted prop corr: | **[Off]** | | |
| Tunnel stern corr: | **[Off]** | | |
| Effective diam: | | | |
| Recess depth: | | | |

## Prediction method check [Holtrop]

| Parameters | FN [design] | CP | LWL/BWL | BWL/T |
|---|---|---|---|---|
| Value | **0,16** | **0,86** | **6,12** | **2,56** |
| Range | **0,06··0,80** | **0,55··0,85** | **3,90··14,90** | **2,10··4,00** |

## Prediction results [System]

| | HULL-PROPULSOR | | | | ENGINE | | | |
|---|---|---|---|---|---|---|---|---|
| SPEED [kt] | PETOTAL [kW] | WFT | THD | EFFR | RPMENG [RPM] | PBPROP [kW] | FUEL [L/h] | LOADENG [%] |
| **9,00** | **2875,7** | **0,6419** | **0,2277** | **1,0065** | **52** | **4160,2** | **---** | **0,0** |
| **10,00** | **3880,2** | **0,6403** | **0,2277** | **1,0065** | **57** | **5583,1** | **---** | **0,0** |
| **11,00** | **5087,0** | **0,6389** | **0,2277** | **1,0065** | **63** | **7283,3** | **---** | **0,0** |
| **12,00** | **6512,4** | **0,6377** | **0,2277** | **1,0065** | **68** | **9281,3** | **---** | **0,0** |
| **13,00** | **8172,5** | **0,6365** | **0,2277** | **1,0065** | **73** | **11597,4** | **---** | **0,0** |
| **14,00** | **10083,1** | **0,6355** | **0,2277** | **1,0065** | **79** | **14251,4** | **---** | **0,0** |
| **15,00** | **12259,8** | **0,6346** | **0,2277** | **1,0065** | **84** | **17262,5** | **---** | **0,0** |
| **+ 15,80 +** | **14202,9** | **0,6339** | **0,2277** | **1,0065** | **88** | **19941,1** | **---** | **0,0** |
| **16,00** | **14717,7** | **0,6337** | **0,2277** | **1,0065** | **89** | **20649,5** | **---** | **0,0** |
| **17,00** | **18353,0** | **0,6329** | **0,2277** | **1,0065** | **96** | **26147,3** | **---** | **0,0** |

| | POWER DELIVERY | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| SPEED [kt] | RPMPROP [RPM] | QPROP [kN·m] | QENG [kN·m] | PDPROP [kW] | PSPROP [kW] | PSTOTAL [kW] | PBTOTAL [kW] | TRANSP |
| **9,00** | **52** | **747,46** | **747,46** | **4035,4** | **4160,2** | **4160,2** | **4160,2** | **---** |
| **10,00** | **57** | **908,48** | **908,48** | **5415,6** | **5583,1** | **5583,1** | **5583,1** | **---** |
| **11,00** | **63** | **1083,59** | **1083,59** | **7064,8** | **7283,3** | **7283,3** | **7283,3** | **---** |
| **12,00** | **68** | **1272,54** | **1272,54** | **9002,8** | **9281,3** | **9281,3** | **9281,3** | **---** |
| **13,00** | **73** | **1475,09** | **1475,09** | **11249,5** | **11597,4** | **11597,4** | **11597,4** | **---** |
| **14,00** | **79** | **1691,02** | **1691,02** | **13823,9** | **14251,4** | **14251,4** | **14251,4** | **969,4** |
| **15,00** | **84** | **1920,14** | **1920,14** | **16744,6** | **17262,5** | **17262,5** | **17262,5** | **857,5** |
| **+ 15,80 +** | **88** | **2112,80** | **2112,80** | **19342,9** | **19941,1** | **19941,1** | **19941,1** | **781,9** |
| **16,00** | **89** | **2162,26** | **2162,26** | **20030,0** | **20649,5** | **20649,5** | **20649,5** | **764,6** |
| **17,00** | **96** | **2534,57** | **2534,57** | **25362,9** | **26147,3** | **26147,3** | **26147,3** | **641,6** |

| | EFFICIENCY | | | | THRUST | |
|---|---|---|---|---|---|---|
| SPEED [kt] | EFFO | EFFG | EFFOA | MERIT | THRPROP [kN] | DELTHR [kN] |
| **9,00** | **0,3283** | **1,0000** | **0,6912** | **0,78195** | **804,25** | **621,09** |
| **10,00** | **0,3315** | **1,0000** | **0,6950** | **0,77974** | **976,67** | **754,25** |
| **11,00** | **0,3345** | **1,0000** | **0,6984** | **0,77772** | **1164,02** | **898,93** |
| **12,00** | **0,3372** | **1,0000** | **0,7017** | **0,77585** | **1366,01** | **1054,92** |
| **13,00** | **0,3397** | **1,0000** | **0,7047** | **0,77412** | **1582,36** | **1222,01** |
| **14,00** | **0,3420** | **1,0000** | **0,7075** | **0,77249** | **1812,85** | **1400,00** |
| **15,00** | **0,3442** | **1,0000** | **0,7102** | **0,77096** | **2057,25** | **1588,74** |
| **+ 15,80 +** | **0,3458** | **1,0000** | **0,7122** | **0,7698** | **2262,63** | **1747,35** |
| **16,00** | **0,3462** | **1,0000** | **0,7127** | **0,76952** | **2315,34** | **1788,05** |
| **17,00** | **0,3417** | **1,0000** | **0,7019** | **0,7727** | **2717,40** | **2098,55** |

# Propulsion

**23 mar 2018 12:27**
**HydroComp NavCad 2014**

Project ID
Description
File name **nav.hcnc**

**Prediction results [Propulsor]**

| | PROPULSOR COEFS | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| SPEED [kt] | J | KT | KQ | KTJ2 | KQJ3 | CTH | CP | RNPROP | |
| **9,00** | **0,2396** | **0,2559** | **0,02973** | **4,4559** | **2,1602** | **11,347** | **34,341** | **3,16e7** | |
| **10,00** | **0,2422** | **0,2549** | **0,02963** | **4,3444** | **2,0855** | **11,063** | **33,153** | **3,49e7** | |
| **11,00** | **0,2446** | **0,2539** | **0,02955** | **4,246** | **2,0203** | **10,812** | **32,116** | **3,82e7** | |
| **12,00** | **0,2467** | **0,2531** | **0,02947** | **4,1581** | **1,9626** | **10,588** | **31,199** | **4,14e7** | |
| **13,00** | **0,2487** | **0,2523** | **0,02940** | **4,0787** | **1,911** | **10,386** | **30,378** | **4,47e7** | |
| **14,00** | **0,2506** | **0,2516** | **0,02933** | **4,0065** | **1,8644** | **10,203** | **29,638** | **4,79e7** | |
| **15,00** | **0,2523** | **0,2509** | **0,02927** | **3,9404** | **1,822** | **10,034** | **28,964** | **5,11e7** | |
| **+ 15,80 +** | **0,2536** | **0,2503** | **0,02922** | **3,8913** | **1,7907** | **9,909** | **28,467** | **5,36e7** | |
| **16,00** | **0,2540** | **0,2502** | **0,02921** | **3,8794** | **1,7832** | **9,8789** | **28,348** | **5,43e7** | |
| **17,00** | **0,2503** | **0,2516** | **0,02934** | **4,0157** | **1,8703** | **10,226** | **29,732** | **5,86e7** | |

| | CAVITATION | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| SPEED [kt] | SIGMAV | SIGMAN | SIGMA07R | TIPSPEED [m/s] | MINBAR | PRESS [kPa] | CAVAVG [%] | CAVMAX [%] | PITCHFC [mm] |
| **9,00** | **106,33** | **6,11** | **1,25** | **21,74** | **0,460** | **20,08** | **2,0** | **2,0** | **4326,6** |
| **10,00** | **85,37** | **5,01** | **1,02** | **24,00** | **0,516** | **24,39** | **2,0** | **2,0** | **4333,8** |
| **11,00** | **70,01** | **4,19** | **0,86** | **26,25** | **0,576** | **29,07** | **2,0** | **2,0** | **4340,3** |
| **12,00** | **58,42** | **3,56** | **0,73** | **28,48** | **0,641** | **34,11** | **2,0** | **2,0** | **4346,2** |
| **13,00** | **49,47** | **3,06** | **0,62** | **30,70** | **0,711** | **39,51** | **2,5** | **2,5** | **4351,8** |
| **14,00** | **42,42** | **2,66** | **0,54** | **32,91** | **0,786** | **45,27** | **3,2** | **3,2** | **4357,0** |
| **15,00** | **36,76** | **2,34** | **0,48** | **35,11** | **0,865** | **51,37** | **4,0** | **4,0** | **4361,8** |
| **+ 15,80 +** | **33,01** | **2,12** | **0,43** | **36,86** | **0,931** | **56,50 !** | **4,8** | **4,8** | **4365,5** |
| **16,00** | **32,16** | **2,07** | **0,42** | **37,29** | **0,948** | **57,82 !** | **5,0** | **5,0** | **4366,4** |
| **17,00** | **28,36** | **1,78** | **0,36** | **40,29** | **1,078** | **67,86 !!** | **7,0** | **7,0** | **4356,3** |

# Propulsion

**23 mar 2018 12:27**
**HydroComp NavCad 2014**

Project ID
Description
File name **nav.hcnc**

## Hull data

| General | | |
|---|---|---|
| Configuration: | | **Monohull** |
| Chine type: | | **Round/multiple** |
| Length on WL: | | **277,195 m** |
| Max beam on WL: | [LWL/BWL 6,119] | **45,300 m** |
| Max molded draft: | [BWL/T 2,559] | **17,700 m** |
| Displacement: | [CB 0,858] | **195606,00 t** |
| Wetted surface: | [CS 2,710] | **19697,9 m2** |

| ITTC-78 (CT) | | |
|---|---|---|
| LCB fwd TR: | [XCB/LWL 0,510] | **141,489 m** |
| LCF fwd TR: | [XCF/LWL 0,490] | **135,706 m** |
| Max section area: | [CX 0,999] | **801,0 m2** |
| Waterplane area: | [CWP 0,924] | **11599,0 m2** |
| Bulb section area: | | **91,0 m2** |
| Bulb ctr below WL: | | **10,300 m** |
| Bulb nose fwd TR: | | **280,600 m** |
| Imm transom area: | [ATR/AX 0,000] | **0,0 m2** |
| Transom beam WL: | [BTR/BWL 0,000] | **0,000 m** |
| Transom immersion: | [TTR/T 0,000] | **0,000 m** |
| Half entrance angle: | | **60,00 deg** |
| Bow shape factor: | [WL flow] | **1,0** |
| Stern shape factor: | [WL flow] | **1,0** |

| Planing | | |
|---|---|---|
| *Proj chine length:* | | ***0,000 m*** |
| *Proj bottom area:* | | ***0,0 m2*** |
| *LCG fwd TR:* | *[XCG/LP 0,000]* | ***0,000 m*** |
| *VCG below WL:* | | ***0,000 m*** |
| *Aft station (fwd TR):* | | ***0,000 m*** |
| *Deadrise:* | | ***0,00 deg*** |
| *Chine beam:* | | ***0,000 m*** |
| *Chine ht below WL:* | | ***0,000 m*** |
| *Fwd station (fwd TR):* | | ***0,000 m*** |
| *Deadrise:* | | ***0,00 deg*** |
| *Chine beam:* | | ***0,000 m*** |
| *Chine ht below WL:* | | ***0,000 m*** |
| *Propulsor type:* | | ***Propeller*** |
| *Max prop diameter:* | | ***8000,0 mm*** |
| *Shaft angle to WL:* | | ***0,00 deg*** |
| *Position fwd TR:* | | ***0,000 m*** |
| *Position below WL:* | | ***0,000 m*** |
| *Transom lift device:* | | ***Flap*** |
| *Device count:* | | ***0*** |
| *Span:* | | ***0,000 m*** |
| *Chord length:* | | ***0,000 m*** |
| *Deflection angle:* | | ***0,00 deg*** |
| *Tow point fwd TR:* | | ***0,000 m*** |
| *Tow point below WL:* | | ***0,000 m*** |

## Propulsor data

| Propulsor | | | |
|---|---|---|---|
| Count: | | **1** | |
| Propulsor type: | | **Propeller series** | |
| Propeller type: | | **FPP** | |
| Propeller series: | | **B Series** | |
| Propeller sizing: | | **By power** | |
| Reference prop: | | | |
| Blade count: | | **6** | |
| Expanded area ratio: | | **0,7967** | **[Size]** |
| Propeller diameter: | | **8000,0 mm** | **[Keep]** |
| Propeller mean pitch: | [P/D 0,7177] | **5741,3 mm** | **[Size]** |
| Hub immersion: | | **5000,0 mm** | |

| Engine/gear | | |
|---|---|---|
| Engine data: | **Generic diesel** | |
| Rated RPM: | **0 RPM** | |
| Rated power: | **0,0 kW** | |
| Gear efficiency: | **1,000** | |
| Load correction: | **Off** | |
| Gear ratio: | **1,000** | **[Keep]** |
| Shaft efficiency: | **0,970** | |

| Propeller options | |
|---|---|
| Oblique angle corr: | **Off** |
| Shaft angle to WL: | **0,00 deg** |
| Added rise of run: | **0,00 deg** |
| Propeller cup: | **0,0 mm** |
| KTKQ corrections: | **Custom** |
| Scale correction: | **Full ITTC** |
| KT multiplier: | **1,000** |
| KQ multiplier: | **1,000** |
| Blade T/C [0.7R]: | **0,00** |
| Roughness: | **0,00 mm** |
| Cav breakdown: | **On** |

| Design condition | |
|---|---|
| Max prop diam: | **8000,0 mm** |
| Design speed: | **15,80 kt** |
| Reference power: | **27440,0 kW** |
| Design point: | **1,000** |
| Reference RPM: | **89,0** |
| Design point: | **1,030** |

# Propulsion

**23 mar 2018 12:27**
**HydroComp NavCad 2014**

Project ID
Description
File name **nav.hcnc**

## Symbols and values

| | |
|---|---|
| SPEED = | Vessel speed |
| PETOTAL = | Total vessel effective power |
| WFT = | Taylor wake fraction coefficient |
| THD = | Thrust deduction coefficient |
| EFFR = | Relative-rotative efficiency |
| RPMENG = | Engine RPM |
| PBPROP = | Brake power per propulsor |
| FUEL = | Fuel rate per engine |
| LOADENG = | Percentage of engine max available power at given RPM |
| RPMPROP = | Propulsor RPM |
| QPROP = | Propulsor open water torque |
| QENG = | Engine torque |
| PDPROP = | Delivered power per propulsor |
| PSPROP = | Shaft power per propulsor |
| PSTOTAL = | Total vessel shaft power |
| PBTOTAL = | Total vessel brake power |
| TRANSP = | Transport factor |
| EFFO = | Propulsor open-water efficiency |
| EFFG = | Gear efficiency (load corrected) |
| EFFOA = | Overall propulsion efficiency [=PETOTAL/PSTOTAL] |
| MERIT = | Propulsor merit coefficient |
| THRPROP = | Open-water thrust per propulsor |
| DELTHR = | Total vessel delivered thrust |
| J = | Propulsor advance coefficient |
| KT = | Propulsor thrust coefficient [horizontal, if in oblique flow] |
| KQ = | Propulsor torque coefficient |
| KTJ2 = | Propulsor thrust loading ratio |
| KQJ3 = | Propulsor torque loading ratio |
| CTH = | Horizontal component of bare-hull resistance coefficient |
| CP = | Propulsor thrust loading coefficient |
| RNPROP = | Propeller Reynolds number at 0.7R |
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| + = | Design speed indicator |
| * = | Exceeds recommended parameter limit |
| ! = | Exceeds recommended cavitation criteria [warning] |
| !! = | Substantially exceeds recommended cavitation criteria [critical] |
| !!! = | Thrust breakdown is indicated [severe] |
| --- = | Insignificant or not applicable |

# 9 ANEXO IV "BUQUE BASE EAGLE SAN ANTONIO"

# EAGLE SAN ANTONIO