

# Tanker Repowering



## Characteristics

Ship Type	Tanker
Length	103.35 m
Breath	12.10 m
Engine	(1) Guangzhou Diesel Engine 630 ZCd-4 (1324 KW MC)

Tanker repowering due to original MAN engine fail. New higher power engine, and some different installation space and requirements

Tecnavin S.A. responsibilities:

- Lateral and torsional vibration for Lloyd's register approval.
- New engine foundation design with Lloyd's register compliance
- Alignment procedure for new foundation and engine installation
- Product engineering for automatic parts cutting, prefabrication and assembly plans for exact, easy & fast construction and installation
- FEM analysis for new foundation
- Exhaust gas back pressure calculation
- New engine circuits design



New Guangzhou Engine

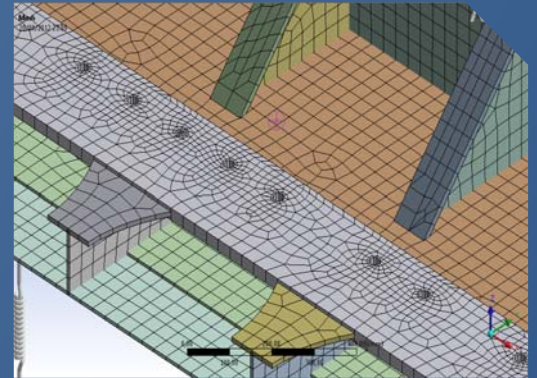
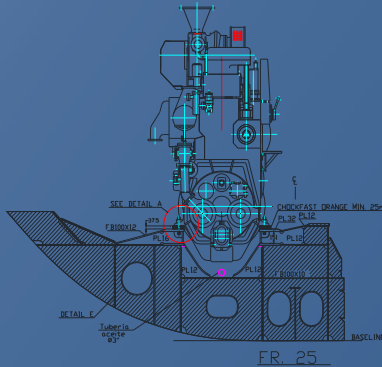
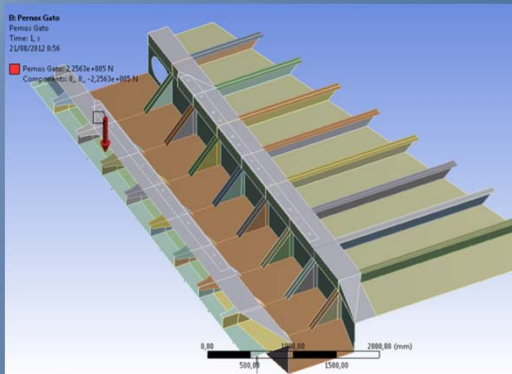


Original MAN Engine

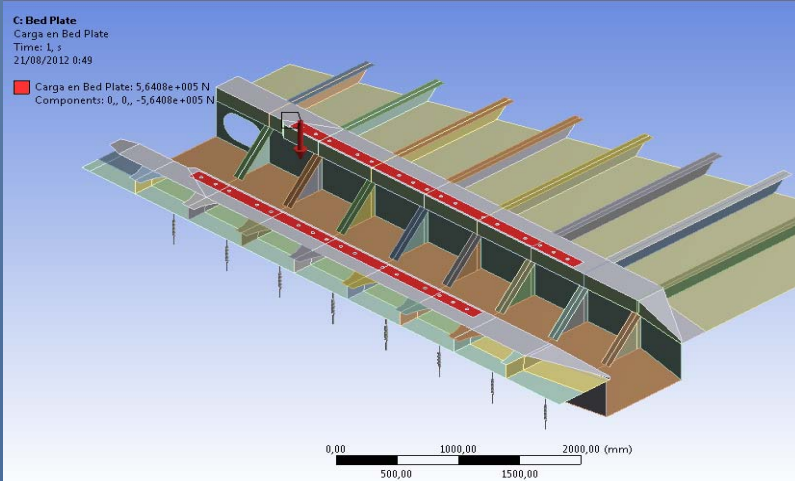
3D modeling

Engine Foundation

Finite Element Model



Applied Loads On Engine Foundation For Finite Element Analysis



Finite Element Analysis results show that materials and thickness selection of structures are appropriate for new Engine loads.

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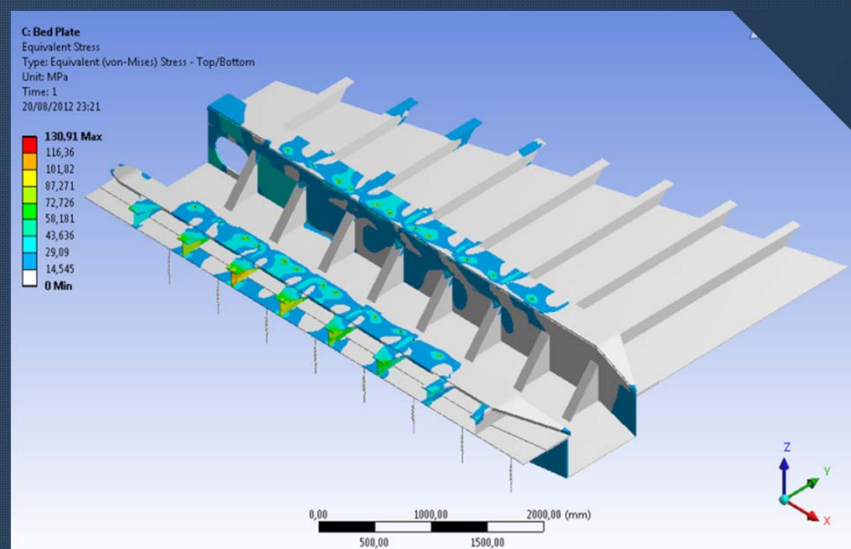
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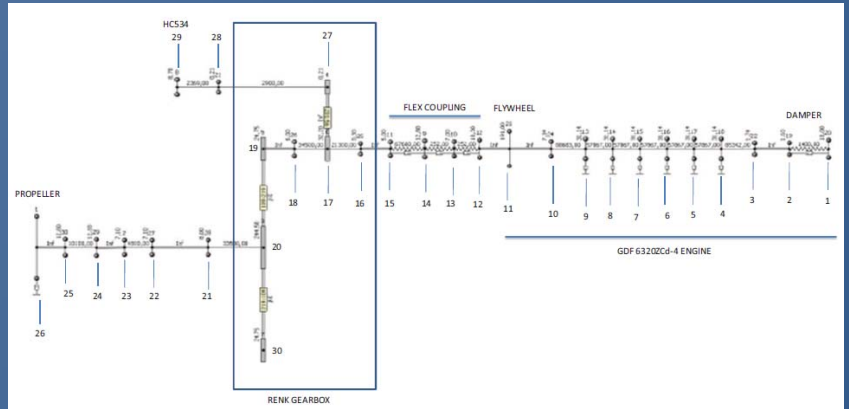
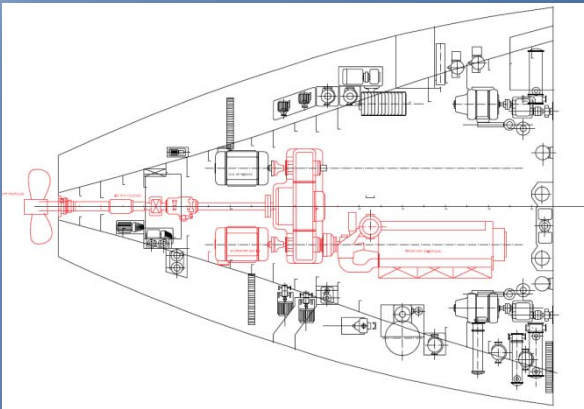
Stress Results



## New System Lateral & Torsional Vibration Analysis

Propulsion system diagram

Torsional analysis model



Torsional vibration results from TORCAL software

Vibration analysis result example

- Inertia - pitch/diameter ratio for controllable pitch propeller
- Vibratory stresses
- Vibratory torque
- Power loss
- Angular deformation
- Analysis of all propulsion components including engine, damper, couplings, gearbox, shafts, etc.
- Analysis of standard and misfiring condition
- Analysis of Classification Societies compliance



Vibration analysis conclusions

- Recommend not to operate with 1 cylinder misfiring at high power.
- Recommend to select and install an adequate flexible coupling for this system to avoid restricted operation at 1 cylinder misfiring

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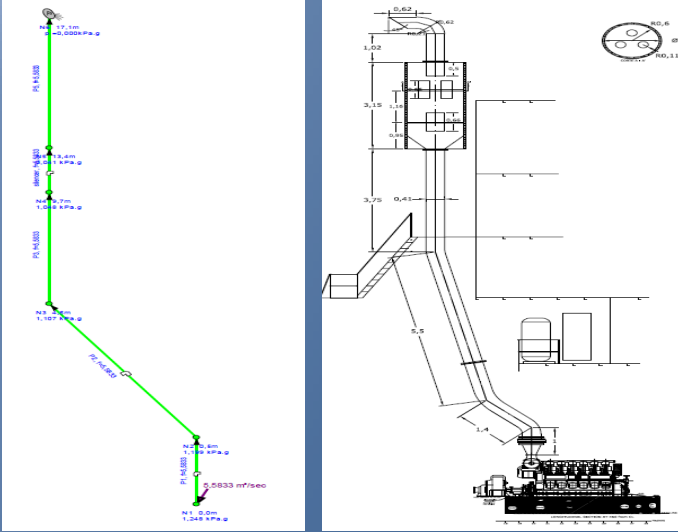
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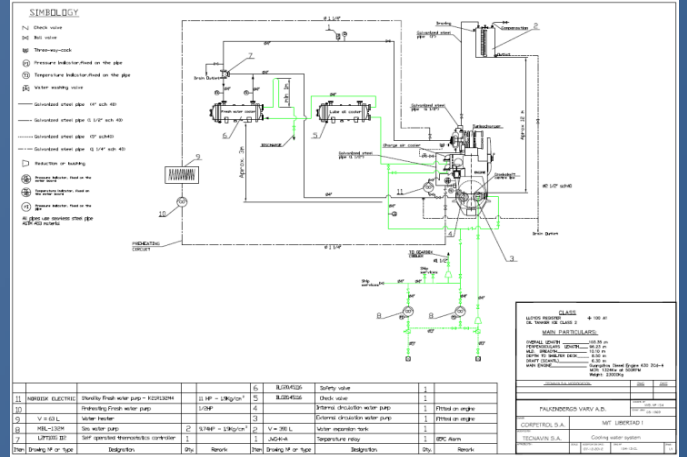
Lloyd's Register Vibration analysis approval

TECNAVIN S.A. Naval Projects		LATERAL & TORSIONAL VIBRATION ANALYSIS REPORT	
<b>SECTION 1 "LATERAL AND TORSIONAL ANALYSIS – NATURAL AND FORCED ANALYSIS – VARIABLE PROPELLER INERTIA"</b>			
FDR No. 12-0911			
<b>STATUS:</b> PRELIMINAR: <input type="checkbox"/> RESTRICTED: <input type="checkbox"/> REVISION: <input checked="" type="checkbox"/>		<b>FINAL REPORT:</b> <input type="checkbox"/> NOT RESTRICTED: <input type="checkbox"/> DATE: 28-09-2012	
<b>AUTORS:</b> SIGNATURE: _____ NAME: JOHNNY DOMINGUEZ R. ING. OFFICE: TECNAVIN S.A.		<b>APROBED FOR EMISION:</b> SIGNATURE: _____ NAME: ING. GERMANICO PISAHERRERA MAD 67920 Date: 08.10.2012 Initials: CGZ	
<b>CLIENT DETAILS:</b> CORPETROL S.A.		A member of the Lloyd's Register group Director: Sopponi, Carmine, Madrid, Office Lloyd's Register	
TEL.F: _____ FAX: _____		This document has been processed electronically	

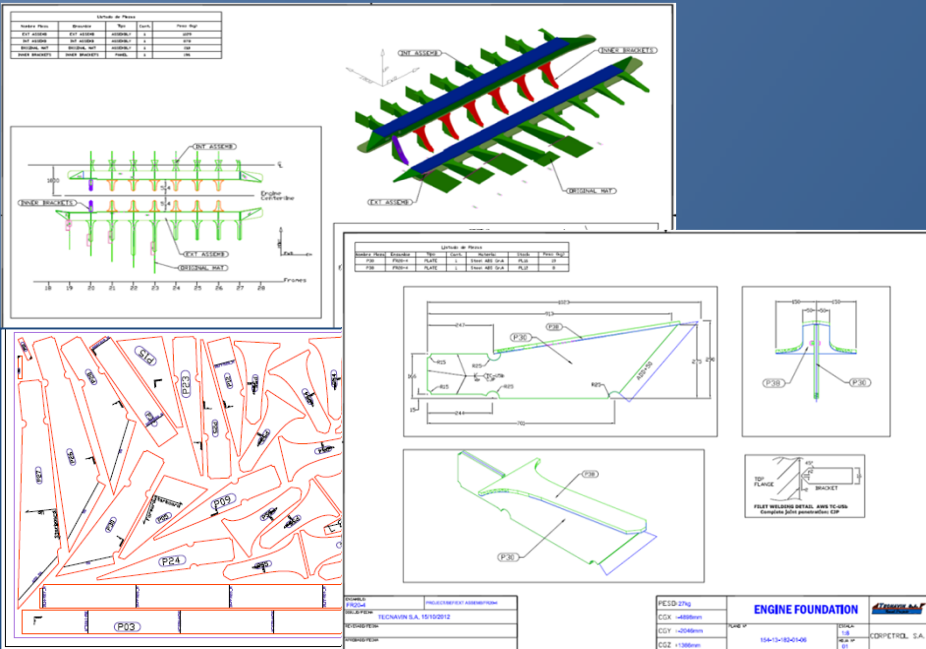
## Exhaust gas backpressure calculation



## Engine feed circuits design



## Assembly plans & CNC cutting



- Assembly drawings for easy and exact installation.
- Plasma CNC cutting codes for automatic parts prefabrication and identification.
- Optimization and control on material waste.
- Provide exact parts on fabrication with identification.

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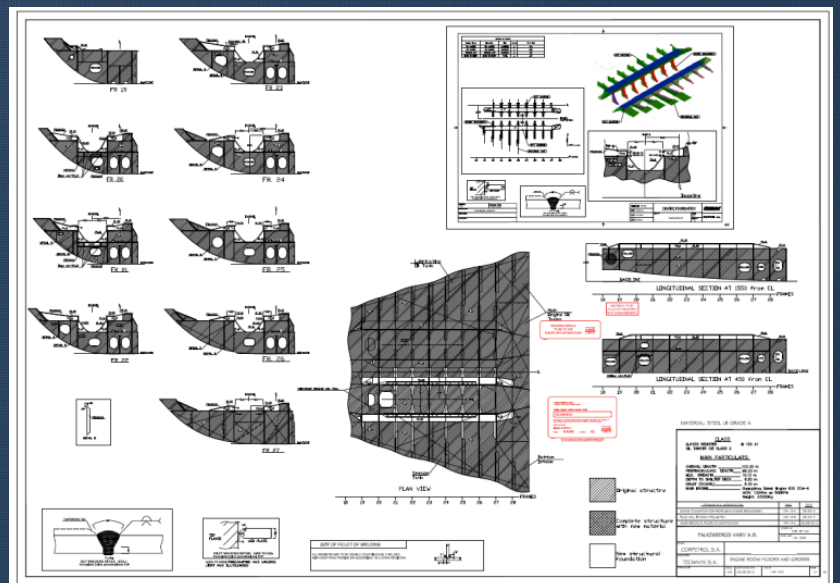
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## New foundation plans approved by Lloyd's Register



## Alignment Procedure

Provisional structure for alignment

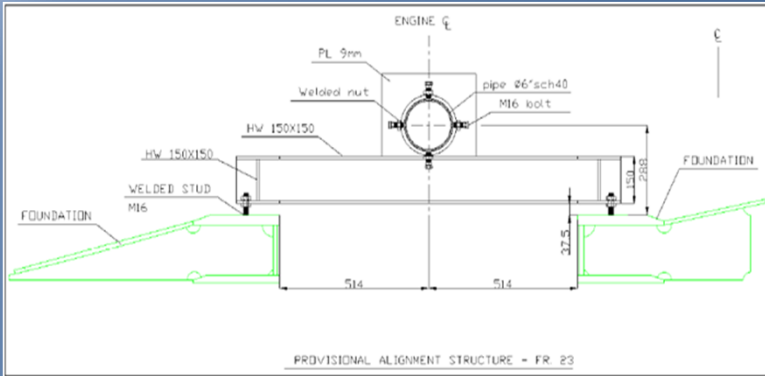
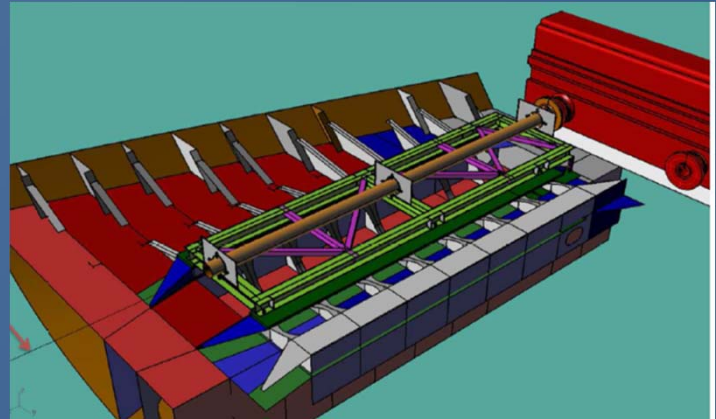


Fig. 3. Vista transversal de estructura provisional para alineamiento



### SAG/GAP control

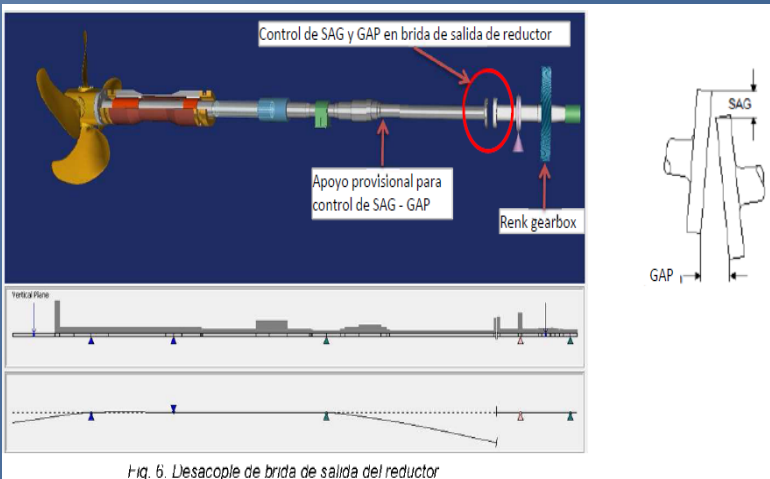


Fig. 6. Desacople de brida de salida del reductor

- This alignment procedure guarantee the correct position and operation of new engine during ship travel.
- It's been considered thermal growth and hull deflection to a correct alignment.
- Engine and coupling Manufactures recommendations are used in order to correct procedure.

### Propulsive calculation

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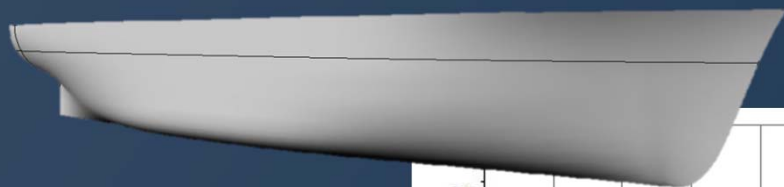
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Ship speed and performance estimation using 3D model and specialized software.

