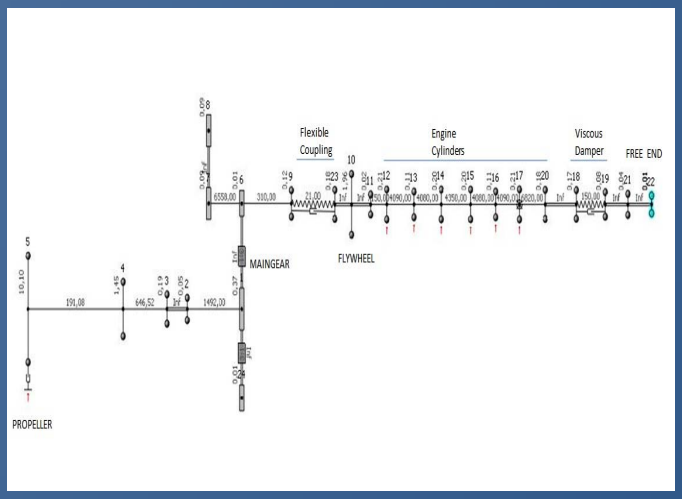
TECNAVIN S.A
Naval Projects

Yacht vibration analysis

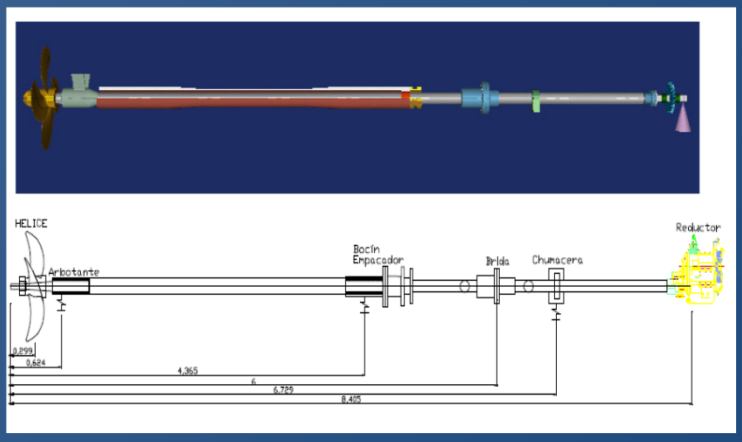
Axial, Lateral & Torsional Vibration Analysis

Type:	Cruiser Yacht
Overall length:	35.40 m
Overall Beam:	7.60 m
Engine:	2xCaterpillar 3406C 440BHP /2100RPM

Axial, lateral & torsional vibration analysis done by presence of a broken shaft and problem with the gearbox.



Torsional model done in TORCAL
TECNAVIN S.A. Software



Propulsion system representation
for lateral vibration analysis

Yacht vibration analysis

Natural frequency's for lateral and torsional analysis

	Orden	Frecuencias naturales no amortiguadas - Lateral Vel. de resonancia de motor, rpm Modo 1	Modo 2	Modo 3
		17.3	36.6	54.39
		Hz	Hz	Hz
MOTOR	0.5			
	1			
	1.5	2,076		
	2	1,557		
	2.5	1,246		
	3	**1,038**		
	3.5	890	1,882	
	4	779	1,647	
	4.5		1,464	
	5		1,318	1,958
	5.5		1,198	1,780
	6		**1,098**	**1,632**
	6.5		1,014	1,506
	7		941	1,399
	7.5		878	1,305
	8		824	1,224
	8.5		775	1,152
	9		732	1,088
	9.5		693	1,031
	10		659	979
	10.5		627	932
	11		599	890
	11.5		573	851
	12			816
PROP	1Z	778.5	1647	
	2Z		823.50	1223.78

	Orden	Frecuencias naturales no amortiguadas - Torsional Velocidad de resonancia de motor, rpm Modo 1	Modo 2	Modo 3	Modo 4	Modo 5
		15.47	46.25	118.8	151.04	213.84
		Hz	Hz	Hz	Hz	Hz
MOTOR	0.5	1,856				
	1	928				
	1.5	619	1,850			
	2		1,387			
	2.5		1,110			
	3		**925**	2376		
	3.5		793	2037		
	4		694	1,782	2266	
	4.5		617	1,584	2,014	
	5			1,426	1,813	
	5.5			1,296	1,648	2,333
	6			**1,188**	**1,510**	**2,138**
	6.5			1,097	1,394	1,974
	7			1,018	1,295	1,833
	7.5			950	1,208	1,711
	8			891	1,133	1,604
	8.5			839	1,066	1,509
	9			792	1,007	1,426
	9.5			750	954	1,351
	10			713	906	1,283
	10.5			679	863	1,222
	11			648	824	1,166
	11.5			620	788	1,116
	12				755	1,069
PROP	1Z	696.15	2081.25			
	2Z		1040.63			

Torsional vibration results from TORCAL software

- 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 found that 2 of the natural frequencies can be excited by the propeller or engine.

Modo de vibración I (17.3 HZ)				
Armónicos	I - 1Z	I - 2Z	I - 3E	I - 6E
RPM motor	779	----------	1038	----------
Modo de vibración II (36.6 HZ)				
Armónicos	II - 1Z	II - 2Z	II - 3E	II - 6E
RPM motor	1647	824	----------	1098

The normal operation of the propeller using the 4 blades does not present coupling between lateral and torsional frequencies.

Modo y orden torsional	I - 1Z	II - 3E
RPM torsional	696	925
Modo y orden lateral	I - 1Z	II - 2Z
RPM lateral	779	824

TECNAVIN S.A.

navser@gye.satnet.net

Phone: 593-4-2441022
593-9-84166936

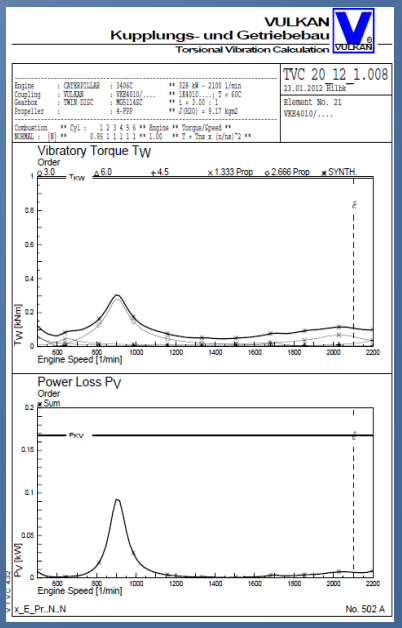
Skype:
Franklin.johnny.dominguez.ruiz.1

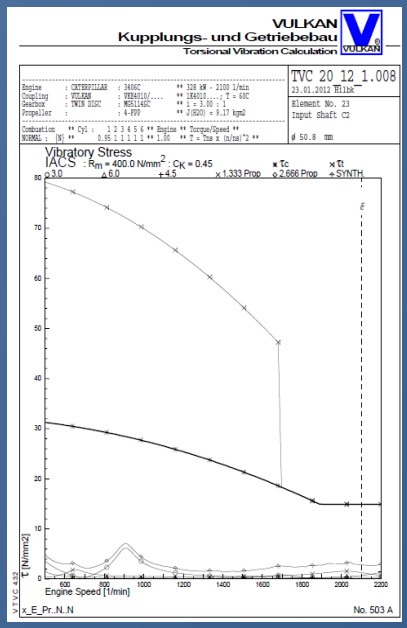
Garcia Goyena 602 & Chimborazo
Guayaquil – Ecuador

www.tecnavin.com

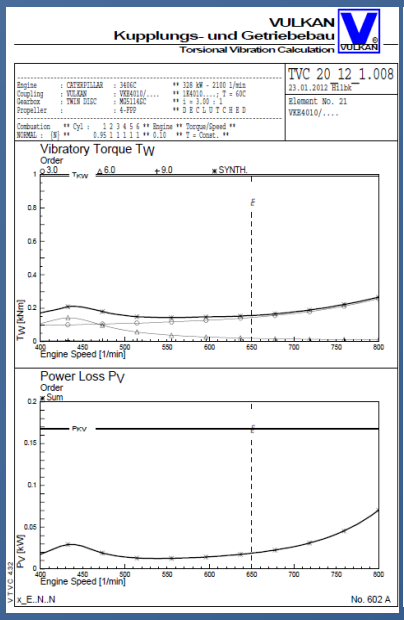
Yacht vibration analysis

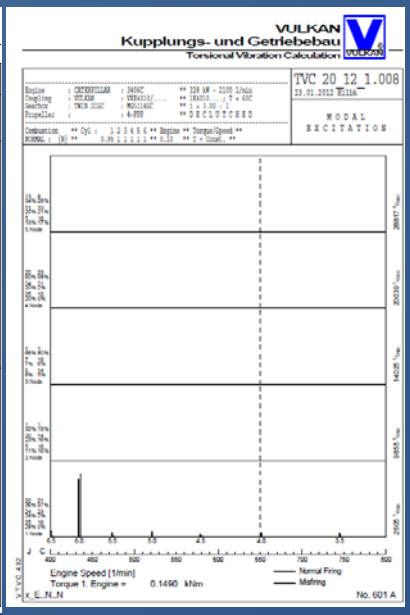
Analysis results with clutched Propeller. Vulkan courtesy





Analysis results with unclutched propeller. Vulkan courtesy





TECNAVIN S.A.

navser@gye.satnet.net

Phone: 593-4-2441022
593-9-84166936

Skype:
Franklin.johnny.dominguez.ruiz.1

Garcia Goyena 602 & Chimborazo
Guayaquil – Ecuador

www.tecnavin.com

Conclusions:

-Recommend to renew flexible coupling in order to eliminate possible fissure
-Recommend not to operate at velocities close to 900 RPM of propulsion.
-Recommend to change the countershaft design to prevent stress concentration