



NAUTICUS HULL

RELEASE DOCUMENT

NAUTICUS HULL
NAUTICUS 3D BEAM
CONTAINER SECURING
FPSO PACKAGE
PULS

JANUARY 2008

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1 Introduction

1.1 Purpose

The purpose of this document is to inform the users about system requirements, new programs and functionalities, enhancements and bug fixes that are implemented in Nauticus Hull since previous release.

Details about the implementations in all programs are not fully covered in this document, and for more information the user should consult the program documentations being a part of the local installations.

For details about rule implementations in the programs, the user should consult the approval engineers for information about how to use the program for specific ship structures.

For information on how to install the program, please consult the **Nauticus Hull Installation Guide.pdf**, which can be found on the root of the installation CD.

1.2 CSR-Tank and CSR-Bulk

CSR-Tank is in this document used as an abbreviation for “IACS Common Structural Rules for Double Hull Oil Tankers”. CSR-Tank is applicable for double hull oil tankers with length $L \geq 150$ m.

CSR-Bulk is in this document used as an abbreviation for “IACS Common Structural Rules for Bulk Carriers”. CSR-Bulk is applicable for bulk carriers with length $L \geq 90$ m.

2 Programs and versions

		Nauticus Hull Rule Check, Pck I	Nauticus Hull Rule Check, Pck I Extended	HSLC)Nauticus High Speed Light Craft (Nauticus	Nauticus HSLC Extended	Nauticus Container Securing	Nauticus Container Securing Extended	PULS	Nauticus Hull Basic, Pck II	Nauticus Hull FEA, Pck III	Nauticus Hull Wave Load Analysis, Pck IV	Nauticus Hull Sea Keeping Analysis
<u>Nauticus Hull Modules</u>												
Nauticus Brix Explorer	10.50	X	X	X	X	X	X		X	X	X	X
Section Scantlings	10.50	X	X	X	X				X	X	X	X
Rudder	10.50	X	X						X	X	X	X
Cross Sections	10.50	X	X	X	X				X	X	X	X
Rule Check XL	10.50	X	X						X	X	X	X
PULS	10.50	X	X						X	X	X	X
3D Beam	10.50		X		X		X		X	X	X	X
HSLC XL	10.50			X	X							
Container Securing	10.50					X	X					
PULS AV	10.50							X				
PULS XL	10.50							X				
Modeller	10.50								X	X	X	X
2D Modeller	10.50								X	X	X	X
Idealiser	10.50									X		X
GeniE	4.0.14									X		X
<u>SESAM Modules</u>												
Manager										X	X	X
Patran-Pre										X	X	
Presel										X	X	
Sestra										X	X	
Cutres										X	X	
Submod										X	X	
Xtract - Stru										X	X	
Waveship											X	X
Wasim											X	X
Wasim_setup											X	
Wasim_solve											X	
Wasim_fourier											X	
Wasim_stru											X	
Wasim_mass											X	
Postresp											X	X

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Postresp Fatigue ext.	X		
Xtract - Animation	X	X	X
Misc. SESAM Utility Programs	X	X	x

Go to <http://www.dnv.com/software/support/index.asp> >> SESAM Status List, for latest versions of SESAM modules.

3 System Information

3.1 Minimum software requirements

Microsoft Office 2000, Excel + Word, Internet Explorer 5.01, or later versions.

3.2 Minimum hardware requirements

Package	Processor CPU/Mhz	Memory MB	Storage GB	Display and Graphics card
Nauticus Hull	1500	2048	10	1024x768 resolution OpenGL hardware accelerator recommended
GeniE	1500	1024		OpenGL

3.3 Operating system requirement

Windows 2000 with Service Pack 4 or Windows XP. File system should be NTFS.

Nauticus Hull January 2008 is not fully compliant with Windows Vista. The software is however tested on 32 bit Vista. No issues are known as long as the program is executed with administrative privileges.

3.4 Decimal Separator

Decimal separator (symbol)

It is required to use . (dot) as decimal separator for the Nauticus Hull programs.

Open Control Panel → *Regional Settings* to inspect and modify the separator symbols.

If changing Decimals Symbol sign given in regional setting from what is default for selected country, change Decimal Symbol both for numeric and *currency* values. Otherwise, the RCXL spreadsheets may produce wrong result.

List separator

List separator sign must be different from the decimal separator used. Use comma , or semicolon ;

4 Program Updates

4.1 Brix Explorer

4.1.1 New functionality:

- Vessel filter in ‘*Ongoing Jobs*’ and ‘*Old NH jobs*’ is synchronised and remembered each time the program starts.
- A new tool for editing compartment data is included. In this tool the compartment data are shown in a table with one row for each compartment. The various compartment properties can be changed directly by editing the cells in table. It is also possible to do multi-edit for a selection of compartments/compartment properties.
- A new tool for creating and editing loading conditions and compartment loads is included. The tool has separate tabs for input of prescriptive loads and fatigue loads. The tool has functionality for creating standard loading conditions and compartment loads according to the selected ship type and the rules to be applied. It is also possible for the user to create user defined loads. All the attributes for the loading conditions and the compartment loads can be edited, one by one or by multi-edit.
- A new tool for analysing the results generated in Section Scantlings is included (Cross Section Analyses). It is two tabs, one for specifying the cross sections to be analysed and one for viewing the results. The result view includes both two and three dimensional plots. By using the grid the user can plot thicknesses, pressures etc for plates, stiffeners, LCPs (Load Calculation Point) and EPPs (Elementary Plate Panel). The grid is also used to limit the plot to only show results for specific loading conditions, sea states etc.

4.1.2 Error Corrections:

- More precise warning if several users open the same job.
- Fixed problems with setting vessel ID if omitted first time.
- "Import job from file" does also include files not located at sub directory ‘WFDepot’.
- CSR-Bulk – Load test height (IM 814). The load test height, Z_{st} , is now included in the compartment data tool. Default values according to the rules are calculated when the compartments are generated, and the values can be edited by the user if necessary.
- CSR-Bulk – Generating default loads (IM 816). According to the rules side tanks as void should be calculated as water ballast tanks. WB compartment loads are now created as standard for side tanks as void.
- DNV rules – Compartment load type “General cargo” not relevant (IM 1129). This compartment load type is now removed from the list of available load types.
- Unspecified load attribute values (null) caused crash in Section Scantlings (IM 824). In the new loads tool reasonable default values are calculated for all the load attributes.

4.2 Section Scantlings

4.2.1 New functionality

1) CSR-Bulk, Transverse bulkheads.

Section Scantlings is now calculating requirements for transverse bulkheads according to the CSR-Bulk Rules.

2) CSR-Bulk Rules, new loading conditions tool in Brix Explorer

The CSR-Bulk Rules calculations are now using the new loading conditions tool included in Brix Explorer.

3) Fatigue calculations, new loading conditions tool in Brix Explorer

The fatigue calculations according to CSR-Tank, CSR-Bulk and 1A1 are now using the new loading conditions tool included in Brix Explorer.

4.2.2 Rule changes

1) Hull Girder Ultimate strength (CSR-Bulk) (IM 1093)

Refer to the CSR-Bulk Rules, Rule Change Notice No 1, November 2007.

The changes to the critical buckling stresses σ_{C1} , σ_{C2} , σ_{C4} and σ_{CR5} have been included.

4.2.3 Error corrections

1) Corrosion addition (CSR-Tank) (IM 1094)

For the boundary between water ballast and heated fuel oil tanks, the corrosion addition t_{corr} was not rounded up to the nearest half millimetre.

2) Error in the stress factor f2 (IM 1116)

Relevant for DNV Rules only

Consider a cross section that is denoted as the midship section.

The section is located some distance from the midship position, but is within 0.4L amidships, though.

The still water bending moment curves over the ship length have been given as input in Workflow Manager.

In Section Scantlings, the still water bending moments at the considered cross section have been given as input in the "Bending moments and shear forces" dialog. The given values will override those from the curve at the same position.

In the case above, the design still water bending moments for the midship section (calculated at the midship position) will therefore become different from those at the considered cross section.

The stress factor f2 is based on the design bending moments for the midship section.

The longitudinal strength requirements for the considered cross section are based on the design bending moments given as input for that section.

Resulting error:

The stress factor f2 value became incorrect. Hence the local strength requirements concerning plates and stiffeners were based on the wrong stress factor f2 value.

Note that the longitudinal strength requirements concerning the hull girder were not influenced by this error.

The error has been corrected.

For cases like that described above, the design bending moments for the midship section will now be the same as those given as input for the considered cross section. Hence the stress factor f_2 is now consistent with the design bending moments for the considered cross section.

3) Changes to the calculation of the hull girder ultimate capacity (HULS) (IM 834)

Refer to the Single Step method in CSR-Tank Rules, Appendix A/2.1.

Before calculating the hull girder ultimate bending moment capacity (HULS), a buckling check of the structural elements is made, using the PULS method. The resulting critical buckling stresses are used in the HULS calculation.

For structural elements where the yield stresses of the plate and its connected stiffeners are different, the "mean" yield stress of the two was previously used in the buckling strength calculations.

Now the lowest yield stress of the two is used instead.

If the yield stress of any plate and its connected stiffeners is uniform, the changes will have no effect on the HULS capacity.

Otherwise, the bending moment capacity M_u will now become a little bit lower than before.

4) Acceleration parameters T_r , GM and k_r (IM 1159)

In Workflow Manager, the period of roll, T_r , may be given as input together with the liquid/bulk loads. However, in Section Scantlings the given value was disregarded, and the standard value acc. to DNV Rules was applied instead.

The error has been corrected.

5) Corrosion addition in deep tanks (IM 1160)

For compartments that are given the type "Deep tank" as input, the corrosion addition for girders and stringers became incorrect.

The error has been corrected.

6) 1A1 Fatigue calculations, Fatigue loads dialog (IM 1141)

The relative deflections and double hull bending stresses given in the fatigue loads dialog were not used correctly in the fatigue calculations. This error has now been corrected. The dialog is used for 1A1 simplified and component stochastic analyses.

7) CSR-Bulk, correction of fatigue calculation routines (IM 1131)

For fatigue calculations only half of the fuel oil tanks are to be filled. The filling height is reduced in the loading tool in Brix Explorer. The z_b -value for heeled tank (CSR-Bulk, Ch 4, Sec 6, 2.2.1) is modified to be equal to the filling height. The centre of gravity for full tank is used.

4.2.4 Changes to the Results Report

Information concerning the ballast water management

Previously, the results report included no information concerning ballast tanks that are designed for ballast water exchange by means of the flow-through method.

In the output table "Compartment data III", the item "Designed for BWE?" has now been included in the third column.

The option concerning ballast water exchange by means of the flow-through method, has a significant influence on the scantlings requirements.

4.2.5 Limitations

CSR-Bulk Rules

- The calculations are only valid in the cargo hold area.
- Limited support for vessels with length less than 150 meters.
- Limited support for calculations of transverse bulkheads with flooded holds.
- The filling height will be calculated according to Ch. 4 Sec. 6 [1.1.2] when “Heavy bulk” load type is selected. The heavy bulk calculations do not support filling heights less than the hopper height at side. Where the cargo volume is such that the cargo filling height at side is not exceeding the hopper sloping plate, the filling height will not be calculated correctly. The calculated hC for such cases will be $hC = hHPL + h2$.

CSR-Tank fatigue loads

- The calculation routines for CSR-Tank fatigue in Section Scantlings supports only one load per compartment. This means that it can not be specified loads for a compartment in both full load and ballast condition.
- Whether the load is used in ballast or full load condition is determined by the position of the analysed structure and not by the specified load condition in Brix Explorer.

1A1 fatigue calculation for bulk carriers

Fatigue calculation of bulk carriers according to Class Note 30.7 is not fully implemented, and should not be used.

4.3 Rule Check XL

4.3.1 Updated Tools

- 1) **Nauticus HSLC**
Structural Response of Sandwich Panels
Stiffened Single Skin Construction

4.3.2 Changes and corrections

- 1) **General**
The warning period for licence check is reduced from 30 days to 10 days.
- 2) **CSR Tank and CSR Bulk**
Changed name of CSR-Tank_EffFlange.xls to CSR-Tank_EffBreadth.xls.
In CSR-Tank_PriSupMemb.xls it is now possible to evaluate several primary members.

4.4 Modelling And Analysis

4.4.1 New functionality

- A new tool for generating/editing FEA loads according to CSR-Bulk is included.

4.4.2 Error Corrections

1) Error creating compartment loads (IM 1102)

When compartments are generated in the 3D model, the program will try to map the 3D compartments to corresponding compartments in Workflow. If no suitable compartment is found in Workflow, the user can create a new compartment directly in the Modeller. When compartment loads were created for a compartment created in this way, an error occurred and no compartment load was created. This error is now corrected.

2) ABC CSR-Tank - New procedures for calculation of stresses in centroid of plate element (IM 1143)

New procedures for calculating stresses in the centroid of a plate element are implemented:

Tau-XY: The middle result point of the plate element is used.

Sigma-X and Sigma-Y: The middle result point of the plate element is used. If the result point is in tension ($\sigma > 0$), the value is set to zero

3) ABC CSR-Tank – Incorrect allowable usage factor (IM 459)

Data exported from the ABC to PULS contained incorrect allowable usage factor in S (harbour) conditions. Allowable according to CSR is 0.8 but the ABC exported this as 1.0. This error is now corrected.

4) DNV rules - Improved support for FE analysis of ore carriers (IM 1052)

- The breadth of the cargo hold, b_f , was not calculated correctly for holds with slanted longitudinal bulkheads which resulted in incorrect bulk/ore loads. This is now corrected.
- The top level cargo surface, h_c , for bulk cargo expanded to fill the hold was not calculated correctly for cargo holds without top wing tank arrangement. In such cases h_c is now taken as the top of the hatch coaming.

- Bulk loads are now applied to internal watertight plates in a cargo hold. Internal plates are plates that are located inside the cargo hold but that are not part of the compartment boundary.

5) CSR-Tank – Incorrect green sea load on the weather deck (IM 1257)

In some cases the green sea pressure load on weather deck was not calculated correctly (20% higher than required according to the rules). This error is now corrected.

4.53D Beam

4.5.1 Updates and corrections

- "Export...":

- New option when exporting to .xml:

- For re-use by 3D Beam only. E.g. for appending parts.

- For use by Genie. Information not supported by Genie is omitted.

- Combined stresses according to von Mises:

- Corrected shear due to torsion for L-profiles

4.6PULS

4.6.1 New functionality

Added new element: K3 – Corrugated panels

PULS is a computerised buckling code for thin-walled plate constructions. It assesses the elastic buckling stresses and ultimate load bearing capacities under combined loads of stiffened and unstiffened plates.

The newly developed K3 element applies the non-linear large deflection plate theory of Marguerre and von Karman. Discretization of the buckling displacements follows the Rayleigh-Ritz method using Fourier series expansions across the plate and stiffener surfaces. Energy principles are used for establishing the algebraic non-linear equilibrium equations and incremental perturbation techniques are used for solving these. Hot spot stress control using the redistributed membrane stresses in a selection of critical locations determines the ultimate strength allowing for overcritical strength.

The local buckling model treats flanges and webs as discrete elements including all relevant effects such as load shedding and rotational restraints between flange and web. This is combined with the results from an orthotropic version of the same theory which is used for calculation of the global buckling mode.

Field of application: Different variations of symmetrical corrugated panels such as bulkheads, offshore living quarters, etc.

Loads: Buckling Strength (BS) and Ultimate Capacity (UC) can be estimated for global bending loads and in-plane loads.

The global bending loads can be applied as a linearly varying bending stress over the corrugation height and as shear stress in the webs of the corrugation. Alternatively a lateral pressure can be applied and the equivalent bending stress will be calculated based on beam theory.

In-plane loads include uniform longitudinal compression/tension and uniform shear, and all possible combinations of these.

Boundary conditions: For all load combinations simply supported out-of-plane (free to rotate but laterally fixed) and constrained in-plane (straight but movable in-plane) edges are by default assumed along all

four boundaries. Alternative boundary conditions for the edges perpendicular to the corrugations may be specified by the user.

PULS K3 element is implemented in the Advanced Viewer (AV) user interface. This provides 3D graphical presentation of buckling modes, membrane stress redistributions, load interaction curves etc.

5Known Issues

Known issues, program errors and limitations are found in the online **Status List**:

[Nauticus Hull status list](#)