

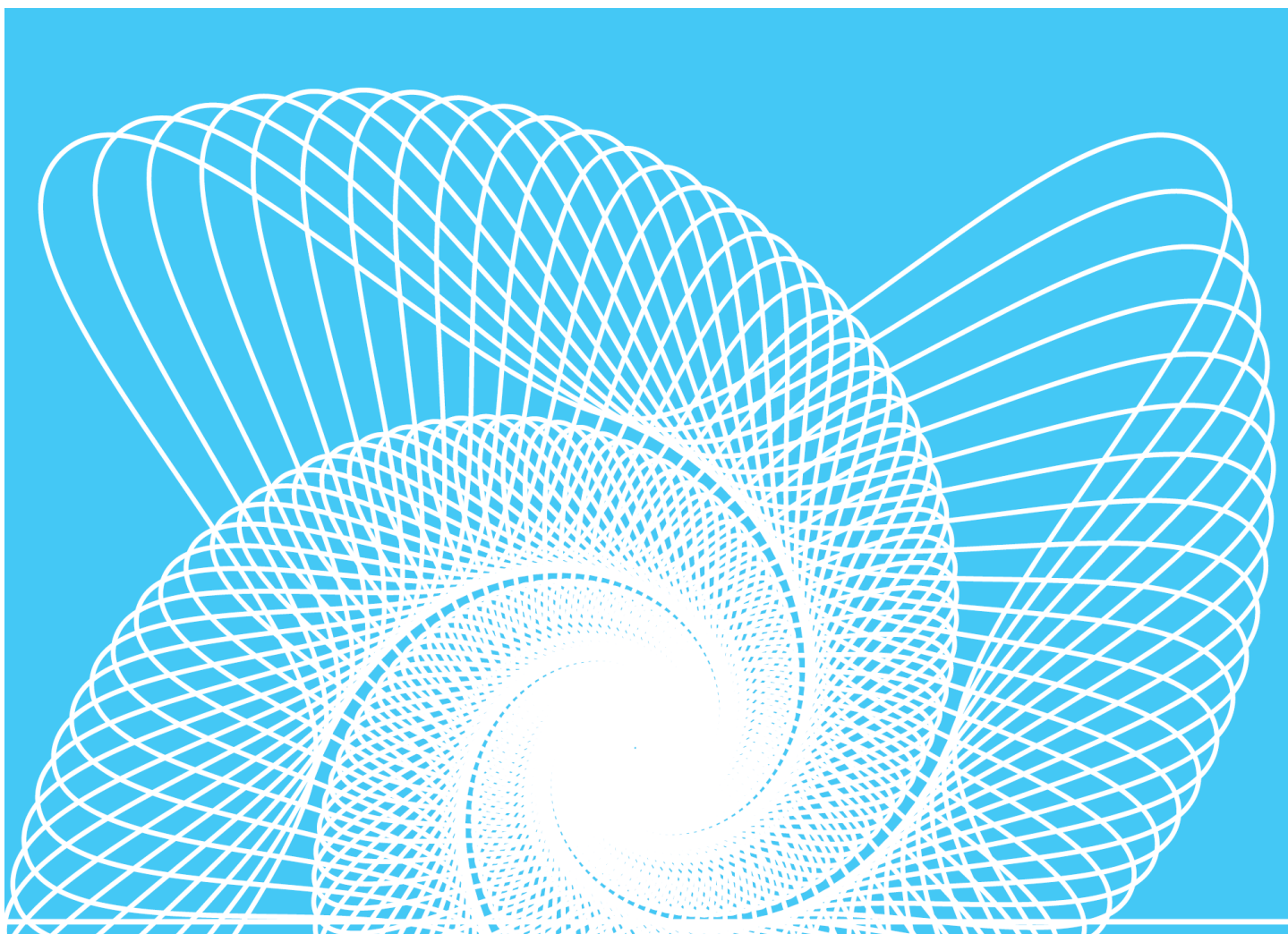


RELEASE DOCUMENTATION

NAUTICUS™ HULL V20

Proven ship design solutions, made for the future

Version: 20.19, January 2022



Reference to part of this report which may lead to misinterpretation is not permissible.

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1 INTRODUCTION

1.1 Purpose of this document

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

It is recommended that the user contact DNV support or the local approval engineers for details about rule implementations in the program and for information about how to use the program for specific ship types.

For information on how to install the program, please see the *Nauticus Hull Installation Guide*, which can be found on our Customer Portal at www.dnv.com/cp.

1.2 Rule sets covered by Nauticus Hull V20.19

DNV Rules for classification: Ships (RU-SHIP)

All editions up to and including July 2021.

DNV Rules for classification: High speed and light craft (RU-HSLC)

July 2019 Edition.

DNV Rules for classification: Offshore Units

Support for prescriptive and FE calculations according to DNVGL-OS-C102 Structural design of offshore ship-shaped units up to and including July 2021, entering into force 1st January 2022.

IACS CSR BC & OT

All editions from January 2015 including January 2021, entering into force 1st July 2021.

NOTE to Pt.1 Ch.8 Sec.4 Buckling requirements for Direct strength analysis: GeniE V 8.2 will be required to apply the rule changes for the FE buckling assessment.

The following rule sets are not covered by Nauticus Hull v20

DNV rules - July 2015 and older

CSR Tank - July 2012 and older

CSR Bulk - July 2012 and older

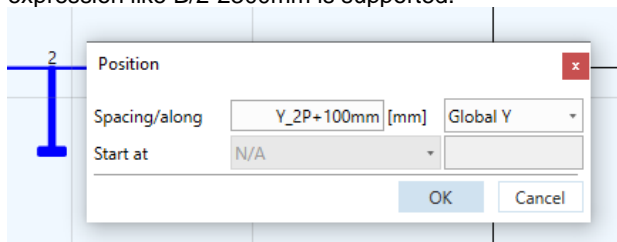
These rules are supported by Nauticus Hull "Classic" January 2018 (separate installation).

2 HIGHLIGHTS OF NEW RELEASE

This updated version of Nauticus Hull V20 has the following main implementations:

General, modelling

- **Parametric 2D-modelling introduced.** Y/Z-grid positions and main particulars like B, D can be used in several modelling dialogs for geometry, plates and stiffeners where a coordinate is entered. Simple mathematical expression like $B/2-2300\text{mm}$ is supported.



Upon accessing the model after Y/Z grid or parameter change, user may let the program update model accordingly or release all references to parameters falling back to the last value of the parameters.

Note that when opening a workspace saved in 20.19 in pre-20.19 versions, the Y/Z-grid will not be available and any references to the Y/Z grid will be invalid, leading to unpredictable arrangement of geometry, plates and stiffeners.

- **Filtering possibility** added to workspace list, list of rule calculation files, stiffener profile list and end connection/shear connection list. The filter option will shorten the list to ease selection of proper item.
- **Modificaiton of spacing between multiple longitudinal stiffeners** is now possible.

Finite Element Assessment

- **FE Fatigue Tool:** Low cycle fatigue assessment, as required for gas fuelled container ships introduced
- **Local Model Load Applier (LMLA) Tool:** For supports of independent tanks, contact forces represented as nodal forces in the cargo hold model can now be distributed as surface loads (lateral and traction) in the local model
- **Export to GeniE:** Transverse bulkheads modelled in Nauticus Hull can be exported to GeniE

3D Beam

- **Tapered beam profiles:** User can create beam profiles with linearly varying cross-sectional dimensions along the length of the beam, that will be taken into account when computing stresses

The Nauticus Hull Classic package (January 2018 V18.5) containing the General Cross Section and PULS tools are no longer distributed with this distribution of Nauticus Hull. Users have to download the package from the customer portal.

3 ENHANCEMENTS, MODIFICATIONS AND CORRECTIONS

3.1 Enhancements and other modifications

Area	Case #	Description	ID
Rules\DNV		DNV rules - implemented check of sea chest requirements. New compartment type added where blow out pressure can be specified - default 2 bar. Compartment does not need to be included in loading conditions.	322063
Rules\DNV		DNVGL-RU-SHIP Pt.6 Ch.6 Sec.2 [9.4.2] footnote 3) - Minimum web thickness	217854
Rules\CSR		CSR rules. Unit MPa was used several places in results and reports. Changed to N/mm ² .	326682
Ship Data		Ship data parameters like B, D can now be referred to in input dialogs that accepts input of such parameters. The input can be combined with simple mathematical expressions like B/2 - 2750mm.	294349
Ship Data		Y/Z-grid references like L13P, SL12S can now be entered in several input dialogs that accepts coordinates. Y/Z-grid reference can be combined in simple mathematical expression, like L13P+100mm.	294348
Ship Data		Applicable rules - DNV Offshore July 2021. Option for setting operation criteria removed from user interface as it is not valid for that rule edition.	261811
Libraries		Shear connections in way of unsymmetrical stiffener profile - Give distance from flange end to slot opening instead of total distance from profile web to slot opening	92699
Libraries	359457 318956	Filtering functionality added to limit list for selection of profiles, end connections and shear connections.	301070
Hull Girder Loads		Hull girder loads - Combine stillwater bending curves (sag/hog) in one graph, and combine stillwater shear curves (pos/neg) in one graph	276341
Section Scantlings		Added button for Reload of cross-section and transverse bulkhead. Useful when one wish to go back to the last saved state without closing/reopening workspace.	322766
Section Scantlings	375676	Cross-section analysis, warning message now shown if actual span of stiffeners is smaller than specified bending span and shear span.	317655

Section Scantlings	367170	Cross-section analysis results - welding. Throat thickness now also shown together with required welding leg length in result grid.	301905
Section Scantlings	367170	Cross-section analysis results - welding. Value before rounding of welding leg length requirement now also included in result grid.	301904
Section Scantlings	367170	Cross-section analysis results - plates. Value before rounding of plate thickness requirement now also included in result grid.	301903
Section Scantlings		When importing from POSEIDON single skin / double skin is now assigned to the stiffener in Section Scantlings depending on the end connection types.	292979
Section Scantlings		CSR - cross-section analysis results now includes the cross-section properties in the result tree. Previously, these properties were only available in the report.	292799
Section Scantlings		Section Scantlings - Plate fatigue evaluation for typical outfitting details	276705
Section Scantlings		Section Scantlings hull girder rule checks using yield stress from modelled scantlings	276336
Section Scantlings	346286	Report, DNV Offshore rules - compartment loads now included in report.	212980
Section Scantlings	255764 281558 283174 284491 317764 367170	Implemented functionality to modify spacing between multiple selected stiffeners.	116691
Transverse Bulkhead		Transverse bulkhead - added rule info in ribbon as for cross-section	301721
Transverse Bulkhead		Copy/Translate and Move endpoints dialogs blocked graphical operations like pan and zoom. This blocking is now removed.	288171
Transverse Bulkhead		New separate view case "Results"	287800
Transverse Bulkhead		Added stiffener spacing and watertight property for plates to color plot options.	271426
Transverse Bulkhead		Color plot plate properties and EPP results - highlighting objects through legend selection now greys out unselected items for improved visual feedback.	271274
Transverse Bulkhead		Improved idealisation of connection between transverse stiffener end and longitudinal whose web is not in line with transverse stiffeners to avoid slightly tapered EPPs. Typically	268106

		applies to vertical stiffeners on transverse bulkhead connected to longitudinals with web oriented normal to a slanted deck.	
Compartments and Loads	365037	Compartments and loads - implemented geometrical sanity check of input for user-defined compartment bounding box and load area definition for UDL and wheel load.	298969
Compartments and Loads		DNV rules - new compartment type "Sea chest" available to facilitate check of sea chest requirements.	281471
FE		Export corrosion additions from Nauticus Hull to GeniE on plate segment level	321360
FE		Export grids from NH to GeniE - Replace the Point Grids with Modelling Grids	321084
FE		LMLA tool for supports of independent tanks - Transfer vertical and horizontal point loads in global model as surface pressures in local model	302364
FE		Section Scantlings and Transverse Bulkheads - Export plate seams	302118
FE	367170	Option to include/exclude export of HGLA sets to GeniE in Rule Loads XML file	301901
FE		FE fatigue tool for crack propagation analysis - Show intermediate stress results	301638
FE		FE fatigue tool - Low cycle fatigue for gas fuelled ships - Rule calculations	294928
FE		FE fatigue tool - Low cycle fatigue for gas fuelled ships - GUI	294927
FE		Add selection of Rule Edition to GeniE	292477
FE		HGLA adjustments of bending moments outside midship region - Adjust to all notes intersecting transverse primary supporting members (tolerance increased).	292372
FE		LMLA tool to be able to handle GeniE LMLA dialogue in Nauticus Hull	289176
FE		Transverse Bulkheads - Export Nauticus Hull model to GeniE	276329
FE		When exporting from NH to GeniE, the model to be created in GeniE shall use Dual Assembly	264688
FE		FE load template for FPSO	261813
Analysis Tools		Rudder - estimated values for PR10 and PR20 is now shown for information in table of intermediate calculation results.	321773
Analysis Tools		In Rule Calculator, reporting to be available for HSLC.	293514

Analysis Tools	359457	Filtering functionality added to limit list of calculations shown in Analyses - Rule Calculation Tools.	291712
Analysis Tools		Rudder report - applied rule and edition now shown in report.	281161
Analysis Tools		Ice class parameters given under Ship data to be automatically copied over to the Excel spreadsheet for Ice class	276763
Analysis Tools		Rule calculator - bow impact. Flare angle and waterline angle used in calculation is now displayed for reference.	276760
Analysis Tools		Rule Calculator - Hull Girder Properties. Updated to allow for reading hull girder cross-section properties, including geometry, from cross-sections that already have been analysed.	276684
Analysis Tools		In Rule Calculator add option to show max envelope accelerations	276349
Analysis Tools		Requirements to strengthening for tug contact as given in DNVGL-RU-SHIP Pt.3 Ch.10 Sec.6 [9] to be implemented in Section Scantlings and Rule Calculator	276332
Analysis Tools		Requirements to strengthening against berthing impact for PSM as given in DNVGL-RU-SHIP Pt.3 Ch.10 Sec.6 [8] to be implemented in Rule Calculator	276331
Analysis Tools		Rule calculator - added export to Excel also for HSLC	222600
Analysis Tools		Rudder - updated according to rule edition July 2021. Inputs for forces B used in bearing calculations have been moved to Moments and Forces section.	132694
3D-Beam	189351 384974	Beam results - Combined stress - SigEff now estimated for other profiles than pipe-, box-, I-, channel-, and L-sections. Note that the calculated stress is to be considered as guidance values. See 3D-Beam manual for more information.	93374
3D-Beam		3D-Beam now supports tapered beams, with linearly varying cross-sectional dimensions along beam's length	276347
Workspace		Different color shown for bullet preceding every cross-sections and transverse bulkhead which are loaded into memory. This will ease visual navigation in browser tree.	92866
Workspace		Setting of Vessel folder will now have a dropdown list (max 10 entries) from which a recently used vessel folder can be selected.	319226
Workspace		Filtering - open workspace. Added filtering possibility for vessel/workspace name to limit the list of workspaces in File Open.	160576

3.2 Corrections

Area	Case #	Description	ID
Rules		CSR and DNV rules - wrong value for b_eff1 was used if there was a plate seam adjacent to the stiffener. Program was erroneously using b_eq. Corrected.	311354
Rules	366130	Special requirements for Container ships given in Pt.5 Ch.2 Sec.5 [3]) for WB-3: Wrong stiffener section modulus if the attached plating is extending to a compartment other than container hold.	300361
Rules\DNV	377155	Ice Class - I_shr was used instead of I_bdg for shear effective gross area (A ice gr) for longitudinal frame. Corrected.	317950
Rules\DNV		Minimum thickness for plates - requirement specified in footnote 8) was not considered. Corrected.	314623
Rules\DNV	362058 367170	[CSA-DNVGL] Container, S11A moment of inertia check not included, report part	310260
Rules\DNV	362058 367170	For Container ships with URS 11A, update the I_y R gr requirement according to Pt.5 Ch.2 Sec.4 [2.4.1], and remove the minimum Z R gr according to Pt.3 Ch.5 Sec.2 [1.3]	309456
Rules\DNV	367769	DNV rules - Connection area spreadsheet updated to support the latest rule updates.	302736
Rules\DNV	362058 367170	July 2020 Rule update for hull girder yield strength for Container ships given DNVGL-RU-SHIP Pt.5 Ch.2 Sec.4 [2.4.2] to be correctly implemented.	294504
Rules\DNV		DNVGL, TBHD: Minimum requirement for web (Pt. 3, Ch. 6, Sec. 3, [2.1.1]) calculated differently in RC and TBHD-tool.	292247
Rules\DNV		[Section Scantlings] Sum of "Life time fraction" for future trade loading conditions = 2	176396
Rules\DNV	287439	BWExchange Scenario was calculated, even though "Ballast water exchange by flow-through operation" was turned off.	128393
Rules\CSR	293979 384972	CSR - slenderness coefficient C=125 was used for plates on transverse tank boundaries. Corrected, now using C=100 according to Sec.2 [2.1.1].	330275
Rules\CSR	379607	Connection strength - environment factor f_c used when fuel oil tanks was same as that for cargo tanks. Corrected from 1.1 to 1.0.	322299
Rules\CSR	374829	Transverse stiffener results, utilisation was always shown as 0.0. Corrected, actual utilisation now shown.	314545

Rules\CSR	370038	Analysis - connection strength. Permissible stress of web stiffener was higher than defined in end connection. Corrected.	306931
Rules\CSR		Report, hull girder section modulus. Wrong section modulus was show in report if bottom shell panel was defined as a spline, or not at Z=0.	291767
Rules\CSR	288635	Pressure used for bilge plating requirement in 2.2.2. was considering all design loads sets. Corrected, now checking for SEA-1.	133048
Section Scantlings	382263	Section Scantlings - loss of transverse stiffener when opening workspace. Happened when two transverse stiffeners were connected at the same single girder. Corrected.	326461
Section Scantlings	381791	Copy/paste cross-section gave no result due to an error in handling of single skin girders. Corrected.	325363
Section Scantlings		Undo after editing stiffener position did not work. Corrected.	324548
Section Scantlings	381197	Running analysis failed with message "Index out of range...". Caused by an error in DNV HSLC rule base which is now fixed.	324516
Section Scantlings		Error in determining slenderness requirement for outer shell plate EPPs being defined in the Rules as superstructure have been corrected.	313375
Section Scantlings		Corrected erroneous bow impact angles calculated from hull form. Could be just 0 degrees or 90 degrees wrong. Occurred on various hull forms.	310694
Section Scantlings		Bow Impact - angles read from hull form sometimes turned out to be 90 degrees too large for plates, stiffeners were ok. Corrected.	303476
Section Scantlings	364579	DNV rules - wrong status of t_slend shown in result grid for a side shell plate. Corrected.	298337
Section Scantlings		Built-up T in cross-section imported from POSEIDON showed different section modulus than in POSEIDON. Corrected, related to export/import process.	292981
Section Scantlings	351662	Not able to run stiffener fatigue assessment for unsymmetrical stiffeners with end connection detail 32	281179
Section Scantlings	321080	Hull girder cross-section properties was not shown in report. Corrected.	214723
Section Scantlings		DNV Rules - t_gross was reported in shear flow reports requested for t_net50. Corrected.	134975

Transverse Bulkhead	382300	Transverse bulkhead, user-defined span and spacing as well as end fixation setting was not saved when model was saved. Corrected.	326458
Transverse Bulkhead		Deck house front bulkhead analysis - no pressures for certain arrangement. Corrected.	324369
Transverse Bulkhead		Transverse bulkhead - flag for Machinery Casing was not preserved when copying transverse bulkhead. Corrected.	316668
Transverse Bulkhead		Transverse bulkhead - analysis failed if segments in cross-section had position code Deckhouse Side or Superstructure Side assigned. Corrected.	309250
Transverse Bulkhead		Several errors in determining superstructure tier levels for deck house and superstructure panels of model have been corrected.	308600
Transverse Bulkhead		Transverse Bulkheads - Panel position code set to undefined if different position codes on the sub-surfaces. Corrected.	290272
Compartments and Loads	374449	Sloshing data for user-defined compartments was not possible to specify. This was related to that the volume was set to 0 m3 for user-defined compartments. Volumes are now calculated and editable and cells for entering sloshing data available.	314908
FE	384853	External pressures for non-prismatic FE models - Increase number of points in the pressure grids	330311
FE	365039	[FE Manager] "TransverseWebFrame_..." sets are created every frame position. They should be created only for "BM Target Position"	298785
FE		FE - Error for flip_normal command for stringer, when extruding cross-section	291324
FE	350492 358973 358974	[LMLA] 100x bigger point loads & wrong position when doing local analysis for container	277789
FE	348969	[FE Manager] Allow to input Design Vapour Pressure, lower than 25 kN/m2, for membrane LNG tanker	276486
3D Model		Hull form import - IGES, error message "Object reference not set to an instance of an object" was shown numerous times on import of hull form. Error causing this is now corrected.	307473
3D Model		Clipping planes and selection of objects. When clipping planes were active, selection of objects supposed to be revealed by the clipping was not possible. Corrected.	294578
Analysis Tools		Semi-spade rudder, rudder stock calculation. "Error: Type of rudder" was shown, This was a false message and is now removed.	313990

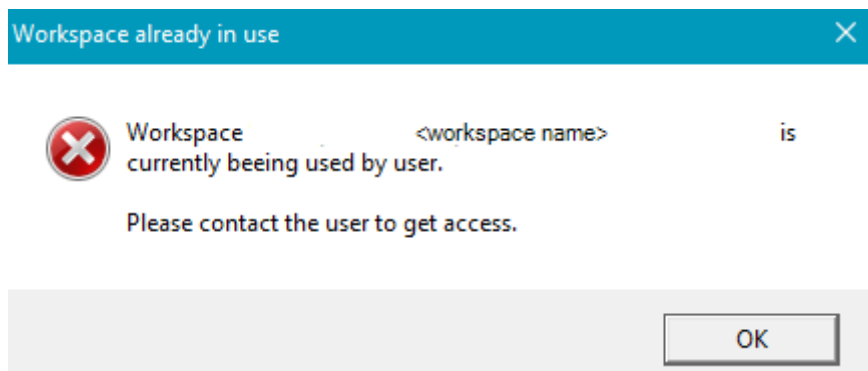
Analysis Tools		Spreadsheets - Profile property spreadsheet ProfProp was missing in RuleCalculationTools_DNVGL rule list. Added.	294122
Analysis Tools		HSLC - Rule Calculator did not shown design pressure and no required plate thickness. Corrected.	293505
Analysis Tools		HSLC - Equipment number. Error when calculating equipment number EN. Corrected.	292968
Analysis Tools		HSLC - Equipment number. Wrong equipment number table was used. Corrected.	289078
Analysis Tools	320119	Buckling strength of shell according to DNVGL-RP-C202. Wrong allowable usage factor for WSD approach was used. Corrected.	212794
3D-Beam	371044	Wrong version number shown in Help About. Corrected.	308608
3D-Beam	363064 363854 275241 385026	3D Beam was showing erroneous profile cross-section graphics. Corrected.	296322

4 LIMITATIONS

4.1 Workspaces – attempt to access by multiple users simultaneously

Nauticus Hull workspaces does not support multi-user simultaneous access.

When trying to access a workspace that is currently opened by another user, a message will be shown on attempt to open the workspace:



In such a situation, the user locking the workspace will need to close the workspace before anyone else can open it. If this is caused by an abnormal program termination (crash, PC shutdown etc.), the blocking user can open and close (with or without save) the workspace to release it.

The locking system is controlled by a history file located in <Vessel folder>_NHServer\<Vessel folder name>\<Vessel ID>\<workspace name>\<workspace name>.nhx.history. Under certain circumstances, this file may contain information that does not reflect the actual status, e.g. if workspace is closed in an abnormal way. In such cases, the history file can be deleted to restore access to the workspace.

<Vessel folder name> is by default "Vessels"

<Vessel folder> is by default "C:\DNVGL\Workspaces\NauticusHull\Vessels". Can be changed under *File - Options*.

4.2 Rule Calculator: Corrugated bulkhead for CSR BC & OT

The corrosion calculation covers the second part of Pt1 Ch3 Sec3 Table1 Note6, if there is no topside. If there is topside, then the upper part corrosion must be entered manually.

Pt1 Ch3 Sec3 Table1 Note6:

Upper part of the cargo holds corresponds to an area above the connection between the topside and the inner hull or side shell.

If there is no topside, the upper part corresponds to the upper third of the cargo hold height (where a plane bulkhead is fitted in way of a dry bulk cargo hold, the upper part of the bulkhead is defined in the same manner).

4.3 3D-Beam

Nauticus Hull V20 includes 3D Beam with enhancements and corrections as given above. However, older versions of 3D Beam may be installed with previous versions of Nauticus Hull (version 18.15 and older).

Are you using latest version? The updated version of 3D Beam is located here:

C:\Program Files\DNV\NauticusHull 20.19.2112\3D-Beam\3D-Beam.exe

When opening 3D Beam from within **Analyses | Rule calculation tools** inside a NH 20 workspace, the correct version will be used. If you want to start 3D Beam directly from the start menu, shortcut named *3D-Beam 20.19* should be used.

Opening models create by earlier versions

When opening a 3D-Beam model analysed with previous versions of 3D Beam, the analysis should be re-executed to ensure consistent results.

General: 'Ghost' loads and resetting of default load widths

When moving and copying of structure with loads, then sometimes the relation between loads and structure is disturbed. This results in some ghost loads that are not visible, but disturb the calculation. Sharp bends in deformation plot where a smooth curve is expected is an indication of presence of ghost loads.

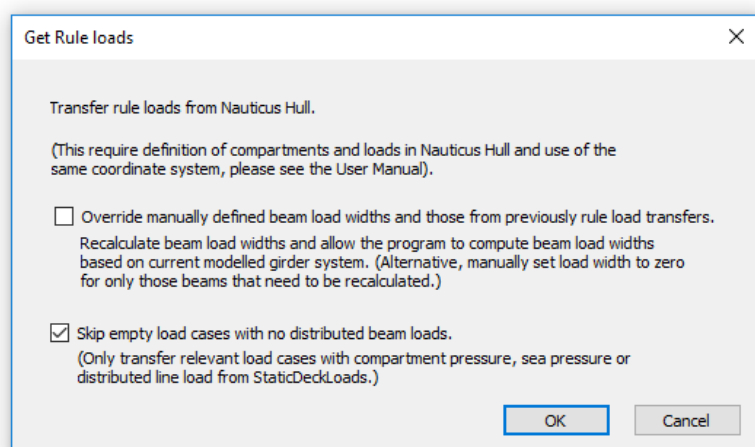
This can be rectified by exporting model to an xml-file and import this file into a new empty model. The ghost loads will then become visible and correctly included in the calculation.

Best practice might be to finish most of the structural modelling before applying loads.

DNV: Get rule loads – load width

If “Get Rule loads...” has been run, and the stiffener direction is changed or some structure is moved, then the default load width needs to be manually set back to zero before the next “Get Rule loads...”.

Alternatively, check the override manually defined load widths and those from previous run option in the new Get Rule loads dialog:



This is required in order to have new default load widths calculated correctly.

Load widths may be inspected in the Beam tabcard:

Beam	Name	Start Node	End Node	Length [mm]	Load width [m]	Mass [kg]
13		13	15	210	995	27
17		16	32	500	995	65
38		32	14	1000	995	130
46		37	38	1000	825	130
48		39	37	500	825	65
Output Beams Nodes Profiles Beam loads Node loads Beam						

DNV: Get rule loads – abnormal termination on repeated use

In some situations, abnormal termination of 3D Beam may be experienced when repeated use of *Get rule loads*. To avoid this, delete all dynamic load cases by use of **Loadcase Manager** before repeated call to Get rule loads. As Loadcase Manager does not support multiple selection, the quickest way to delete the load cases is to select the last load case and click Delete repeatedly until all dynamic loadcases are removed.

4.4 Minimum thickness on end bulkheads of superstructure and deckhouse walls

- For the mentioned member a possible discrepancy between the plate and EPP thickness value in the minimum thickness result table exists. The plate values are the correct one. This will be cleaned up in the next release.
- TBHD, DNVGL, OSV+ and standby vessel: rules according Pt. 5, Ch. 9, Sec 2, 3.4.3 are not implemented

5 TECHNICAL NOTES

5.1 Hardware requirements

Minimum Memory	Recommended Memory	Minimum free Storage	Minimum Screen resolution
16 GB	32 GB or more	8 GB	1280 x1024

5.2 Operating system requirement

- Windows 10.

5.3 Software requirements

- Excel and Word from Microsoft Office 2010 with SP2 or newer.
- Microsoft .NET Framework 4.8.

6 OTHER PRODUCT INFORMATION

6.1 Programs and versions

The following programs are available in this release:

Program Version
 Nauticus Hull V2020.19
 Application version manager
 GeniE64
 License manager
 Sesam converters 64
 Sesam manager
 Sestra64
 Submod

Version number of Sesam component in the FEA package can be found in file *PackageContents.xml* located together with the installation.

6.2 Usage of open source/free distributable libraries

Library	Purpose	Public licence	Source
IxMilia/Iges	Read/Write IGES files	Apache License 2.0	GitHub
HDF5	Read/Write HDF5 files	https://support.hdfgroup.org/ftp/HDF5/releases/COPYING	https://portal.hdfgroup.org
Live Geometry	2D viewer	Microsoft Public License (Ms-PL)	https://archive.codeplex.com/?p=livegeometry
AvalonEdit	Text editor	MIT	https://github.com/icsharpcode/AvalonEdit
AutoFac	IoC container	MIT	https://github.com/autofac/Autofac
Log4Net	Message log	Apache License 2.0	https://logging.apache.org/log4net/



6.3 Software Support

Email: Software.Support@dnv.com

Web: [Technical software support](#)

Customer Portal

- download of
 - new or old releases
 - release documents
 - installation guides
 - user manuals
- registration and follow-up of support request
- Knowledge base / FAQ's



About DNV

DNV is a global quality assurance and risk management company. Driven by our purpose of safeguarding life, property and the environment, we enable our customers to advance the safety and sustainability of their business. Operating in more than 100 countries, our professionals are dedicated to helping customers in the maritime, oil & gas, power and renewables and other industries to make the world safer, smarter and greener.