







Recognition

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Checks



Reports

## SDC Verifier

A powerful postprocessor extension for Femap and Simcenter3D which automates the full FEA workflow.



**SDC Verifier** is a powerful post-processor program that is used to verify structures in accordance with required safety standards and generate a report in an efficient and simple way.

SDC Verifier 5 - E:\Tutorials\AISC 360-10\AISC 360.sdcv			-	×
Eile Settings Model Recognition Job Tools Stand	ard Post-Processing Res <u>u</u> lts <u>R</u> eport <u>H</u> e	lp		
Settings	ID       1       Tile       Static Analysis         Description	Select Loads to be Analyzed (6/6)  Analysis Selection Read Results All Entities		
15:51:14         Model E:\Tutorials\JMSC 360-10\u03ec360_v112.modfem is opened           15:51:14         Updating Deam Member Finder           15:51:14         Updating Weld Finder           15:51:14         Updating Weld Finder           15:51:14         Updating Weld Finder           15:51:14         Updating Weld Finder           15:51:14         Updating standards.           15:51:15         Updating standards           15:51:15         Updating beam member finder           15:51:15         Project E:\Tutorials VAISC 360-10/VISC 360 sdcv was opened				<
Nodes: 1725 Elements: 1858 Fem Model: E:\Tutorials\AISC 360-10\	aisc360_v112.modfem			

**Femap / Simcenter** offers an advanced engineering analysis environment for simulation of complex engineering problems. SDC Verifier together with the CAE program makes the calculation procedure more transparent and facilitates checking of a complete set of load cases according to predefined design code rules or own standards. Full model description and all calculations are presented in reports. Consequences of updates to the design can be reviewed and compared with the original design using report regeneration.



The complete verification procedure of the structure is stored. When the design is modified it requires only one-click on the "Regenerate" to rerun all the calculations and regenerate the report.



Reports

**SDC Verifier** implements the following standards for checking large (offshore) lattice structures: AISC/ANSI 360-10, API RP 2A, Eurocode3, ISO 19902 and Norsok N004.



Beam Member Finder recognizes beam members (buckling) lengths automatically for 3 directions (Y, Z and torsional)



Buckling length is calculated between the Joints and does not depend on the model mesh.



Verification of the tubular joints is performed by Joint Check according to the following standards: API RP 2A, Eurocode3, ISO 19902 and Norsok N004.



Brace classification (depends on the load pattern) is calculated for each load situation automatically, which significantly speeds-up the verification process.



**Fatigue** is a progressive structural damage of materials under cyclic loading. SDC Verifier implements the following standards (based on the Palmgren-Miner S-N curves): Eurocode3, F.E.M 1.001 and DIN 15018.



The fatigue damage method is based on different loading patterns (stress history) and calculates fatigue life consumption for each cycle based on the stress variation and the number of load cycles.





The notch group classification or fatigue strength of the welds depends on the quality and the stress direction, along the weld (X), perpendicular to the weld (Y) and the shear (XY). Stresses are converted into weld direction automatically by weld finder.

🗹 Ec	lit Classification	-		×	Detailed Category	Constructional detail
ID Alias Desc Eleme	1     Title     FAT       FAT     FAT	Class			100	
1 2 3 4 5	Full Model All Entities All welds All welds All welds	160           100 (XY, YZ, ZX)           100 (X)           80 (Y)           80 (X, Y, XY)			80	
	ort Welds	ОК	С	ancel	80	>10 mm



SDC Verifier performs a strength check according to DNV-OS-C101/C201. The Weld Finder tool automatically recognizes which plate is welded.



The forces/moments of each element of the weld are summarized into the local weld coordinate system:



**Stiffened Panel Finder** — recognizes automatically sections, panels, plates, stiffeners and girders and their dimensions. This tool is an advanced version of the Panel Finder.



In the figure below are plotted: panels, simple stiffeners (marked in blue) and girders or stiffeners which support also other stiffeners (marked in red).



**Effective Width** — calculate plate effective width for every load situation. Effective width is used in stiffener buckling check according to DNV-RP-C201 2010:



Plate buckling strength is an important aspect in offshore steel construction design. Each plate should be checked as it influences on the strength and stability of the whole construction. In SDC Verifier plates can be checked against buckling according to the ABS 2004/2014 and DNV RP-C201 2010 rules:



ABS 2004 & 2014



## DNV 1995 & 2010

Plate dimensions are required to perform plate buckling check. Panel Finder recognizes X/Y/Z and custom (inclined and curved) section:



Plates with their dimensions are recognized automatically for each section:



Colored plots with labels (dimensions) make it easy to preview the results of the tool. The following plot present buckling plates on a part of the hull (curved section).



Recognition is based on mesh connectivity and can be performed on any structure build using plate (shell) elements:



Results can be presented over sections (frames/longitudinals/decks) and results which are above the limit are highlighted with red:

## Buckling(LS2, 5 Sections)

Standard Load Set Search Type	10Plate Buckling DNV 2010 2Load Set 2 Related To Last		Check Sections	1Plai 5	te Buckling (I	Element Avg)	)
Section Title		Stress X in plate direction	Stress Y in plate direction	Stress XY in plate direction	Equivalen t Stress	Buckling Factor Combined	Buckling Factor Overall
1Section X 1 (X =	= 70) [MaxID=86]	-62.0e+6	-38.3e+6	-38.4e+6	85.8e+6	0.952	0.976
2Section X 2 (X =	= 71.68) [MaxID=10]	-7.2e+6	-31.6e+6	-8.1e+6	31.9e+6	0.335	0.579
3Section X 3 (X =	= 73.36) [MaxID=63]	-57.0e+6	-42.5e+6	-44.3e+6	92.3e+6	1.034	1.017
4Section X 4 (X =	= 75.04) [MaxID=9]	-7.2e+6	-31.5e+6	-8.1e+6	31.9e+6	0.334	0.578
5Section X 5 (X =	= 76.72) [MaxID=67]	-63.7e+6	-38.9e+6	-39.2e+6	87.8e+6	0.993	0.996
Max over Sections	; [3 / 63]	-57.0e+6	-42.5e+6	-44.3e+6	92.3e+6	1.034	1.017

Preparing a full calculation report is one of the most time-consuming parts of the project. An engineer has to make the same routine processes to create calculation report from project to project. SDC Verifier allows the process of report generation to be done automatically, reducing time expenses.

Description of materials and properties data (including mass overview). Elements related to material/property are highlighted:



Description of applied loads and constrains, mass overview over materials/properties/groups:

Count 72 nodes	ОО <del>Г</del> Тх Ту Т2	Title 1stainless steel 2steel 3HPL 4line connection material 5perforated stainless steel. h 0bottom frame stainless steel.	5 2 6 0 prizontal 2	ements Mass 971 06.8 93 0.7 1365 294.6 0.0 105 17.1		Gravity Center [1.48; -49.34; 10.80] [1.52; -49.32; 10.49] [1.41; -49.24; 17.08] [0.00; 0.00; 0.00]
72 nodes	Tx Ty Tz	1.stailess steel 2.steel 3.HPL 4.line connection material 5.perforated stailess steel. h 0.bottom frame stailess steel	5 2 6 0 prizontal 2	971 06.8 33 0.7 1365 294.6 0.0 105 17 1		[1.48; -49.34; 10.80] [1.52; -49.32; 16.49] [1.41; -49.24; 17.08] [0.00; 0.00; 0.00]
		3HPL 4line connection material 5perforated stainless steel. h 6bottom frame stainless steel	6 0 prizontal 2	1365 294.6 0.0 195 17.1		[1.41; -49.24; 17.08] [0.00; 0.00; 0.00]
		4line connection material 5perforated stainless steel. h 0bottom frame stainless steel	0 orizontal 2	0.0		[0.00; 0.00; 0.00]
		5perforated stainless steel. h 6bottom frame stainless steel	orizontal 2	105 17.1		
		6bottom frame stainless steel		10.1		[1.33; -49.44; 16.36]
			1	0710 174.4		[1.43; -49.23; 15.82]
CONTRACTOR CONTRACTOR CONTRACTOR		7front HPL covering	2	277 8.9		[1.41; -49.80; 16.25]
The second secon		8side HPL covering	4	38 8.3		[0.40; -49.35; 17.91]
Property of the party of the pa		Mass Elements Overall	2	1285 580.0		[0.00; 0.00; 0.00]
		Properties Sum	mary			
		Title	Elements	Material	Mass	Gravity Center
		1bolt dia6mm	176	2steel	0.4	[1.50; -49.30; 16.74
		2t=08 steel angles	3359	1stainless steel	58.0	[1.48; -49.33; 16.86
CINERAL CONTRACTOR		4Plate t=12	32209	3.HPL	124.1	[1.40; -49.24; 18.78
Contraction of the second s		t=12	1218	3HFL	4.0	[1.00; -48.32; 10.07
		8plate t=5. bottom frame	10716	6bottom frame stainless steel	174.4	[1.43; -49.23; 15.82
		9bolt dia4mm	97	2steel	0.1	[1.53; -49.34; 16.0]
		10. bolt dia 14mm	10	2steel	0.2	[1.55; -49.36; 16.07
and the second se		11. plate t=4mm	103	1stainless steel	0.4	[1.71; -49.75; 10.34
	e	12. upper covering Frate t= 12	20317	1 staiolass steel	0.0	[1.42, -49.11, 17.00
		14plate t=2mm perforated	2195	5perforated stainless steel. horizontal	17.1	[1.33; -49.44; 16.3
		15plate t=2mm small beam	2252	1stainless steel	5.1	[1.34; -49.43; 16.58
		21. front middle covering Plate t=12	2277	7front HPL covering	8.9	[1.41; -49.80; 16.2]
		t=12	438	sside HPL covering	0.3	[0.40; -49.30; 17.9
		25top upper covering Plate t=12	3681	3nrL	26.4	[1.40; -49.33; 18.11
		26. front upper covering Plate t=12	3720	3HPL	20.8	[1.38; -49.76; 17.5]
		27support plate t=12	197	1stainless steel	3.3	[1.55; -49.36; 16.05
			Overall         Overall <td< td=""><td>Overal         2 Veral         8           Overal         4         8           Overal         100         100           Overa         100         100      <tr< td=""><td>Owned     But of the second plane       1. obt diadem     10       1. obt diadem     10</td><td>Overall         Excel         Other           1         both angle Plate         121         5         0         &lt;</td></tr<></td></td<>	Overal         2 Veral         8           Overal         4         8           Overal         100         100           Overa         100         100 <tr< td=""><td>Owned     But of the second plane       1. obt diadem     10       1. obt diadem     10</td><td>Overall         Excel         Other           1         both angle Plate         121         5         0         &lt;</td></tr<>	Owned     But of the second plane       1. obt diadem     10       1. obt diadem     10	Overall         Excel         Other           1         both angle Plate         121         5         0         <

**Results** contain plots and tables. It is possible to view detailed results for each entity, extreme results on selection and advanced tables to compare load results:



A complete setup of reports, with headings and bookmarks, enable quick navigation through the reports.



With help of Report designer, it is possible to completely control structure of the report and easily preview and modify it. A variety of tools helps to create quickly huge amount of plots and tables.

**Peak Finder** finds all peak zones based on output results and presents them using a special plot and a summary table. The peaks for any simple FEA results as stresses, strains or displacements can be found but also all available results from the SDC Verifier checks (Fatigue, Beam Bucking, etc.)



Zone	Value	Zone	Value
Zone 1 (Elements: 2)	1.45	Zone 5 (Elements: 15)	1.41
Zone 2 (Elements: 2)	1.44	Zone 6 (Elements: 1)	1.21
Zone 3 (Elements: 2)	1.43	Zone 7 (Elements: 3)	1.09
Zone 4 (Elements: 2)	1.42	Zone 8 (Elements: 1)	1.01

**Governing loads** tool extracts the critical loads out of a large group of load combinations. Instead of checking all the situations focus on important ones and reduce calculation time.



The checks in SDC Verifier are completely customizable. With the help of a formula editor user-defined formulas can be created based on results, model properties and recognized dimensions.



The following example performs verification of bolted connections. Axial Force of bolts is compared with bolt design resistance:

🗹 Add Custom Check			
ID 7 Title Bolts Check Alias Bolts Description	Options ✓ Calculate Resu ✓ Calculate Resu Load Calculation	ts over Directions ts over Points All Loads	~
Show Parameter Description	Selection	Property'99Bolt_M20'	<b>\$</b>
Parameters (2) / Replacements (0)			
All: miu * (Fpc - 0.8 * Fted) / Hamma_m3 Parameter = Uf (Utilization factor) All: abs(FAxial) / Fsrd			
10 10 🔨 🖳 🔀 🖬		ОК	Cancel

In SDC Verifier it is possible to apply complicated loads: buoyancy, tank ballast and wind. **Buoyancy** – a water pressure acting on a construction (e.g. ship hull) including wave parameters.



**Tank Ballast** – fluid level based on a mass content transferred into a pressure level on a tank surface. **Wind** – height dependent pressure applied to the model taking into account the element area exposed to the wind direction.



Wave and current loads - apply force and pressure based on wave parameters (height, length, crest, amplitude, etc.):





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