



Tutorial

DNV RP-C203 Fatigue (2024)

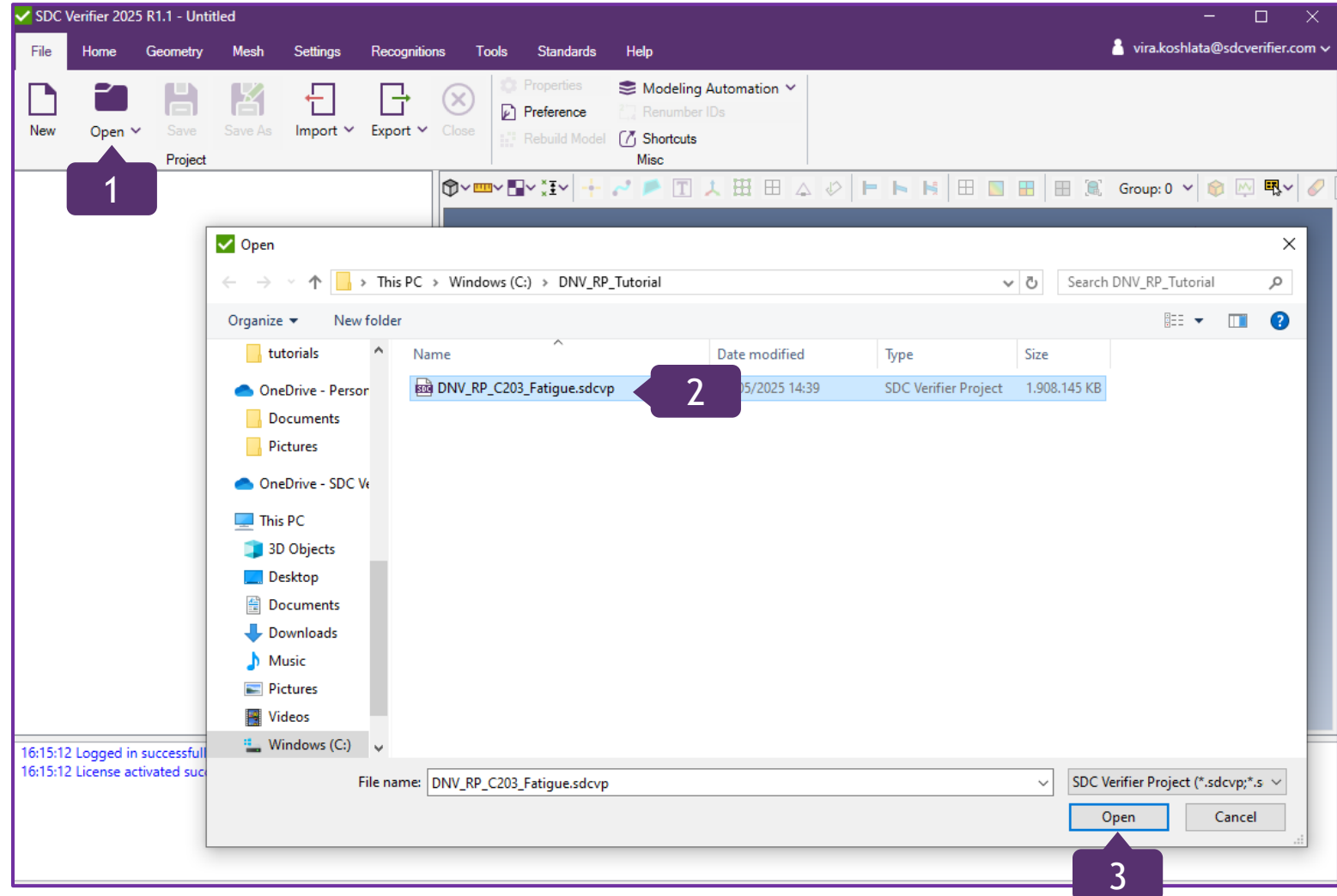
Updated on: May 15th, 2025

Tested with: SDC Verifier 2025 R1.1

- This step-by-step tutorial demonstrates how to implement the fatigue check according to DNV RP-C203 Fatigue (2016) in SDC Verifier.
- DNV RP-C203 Fatigue (2024) detailed review;
- Weld Finder Tool overview;
- Configuring Fatigue parameters in line with the Component specifications;
- Setting up Fatigue Groups;
- Applying the correct SN curve settings;
- Fatigue tables and Criteria plots;
- Report preparation and results

Open the Starter Model

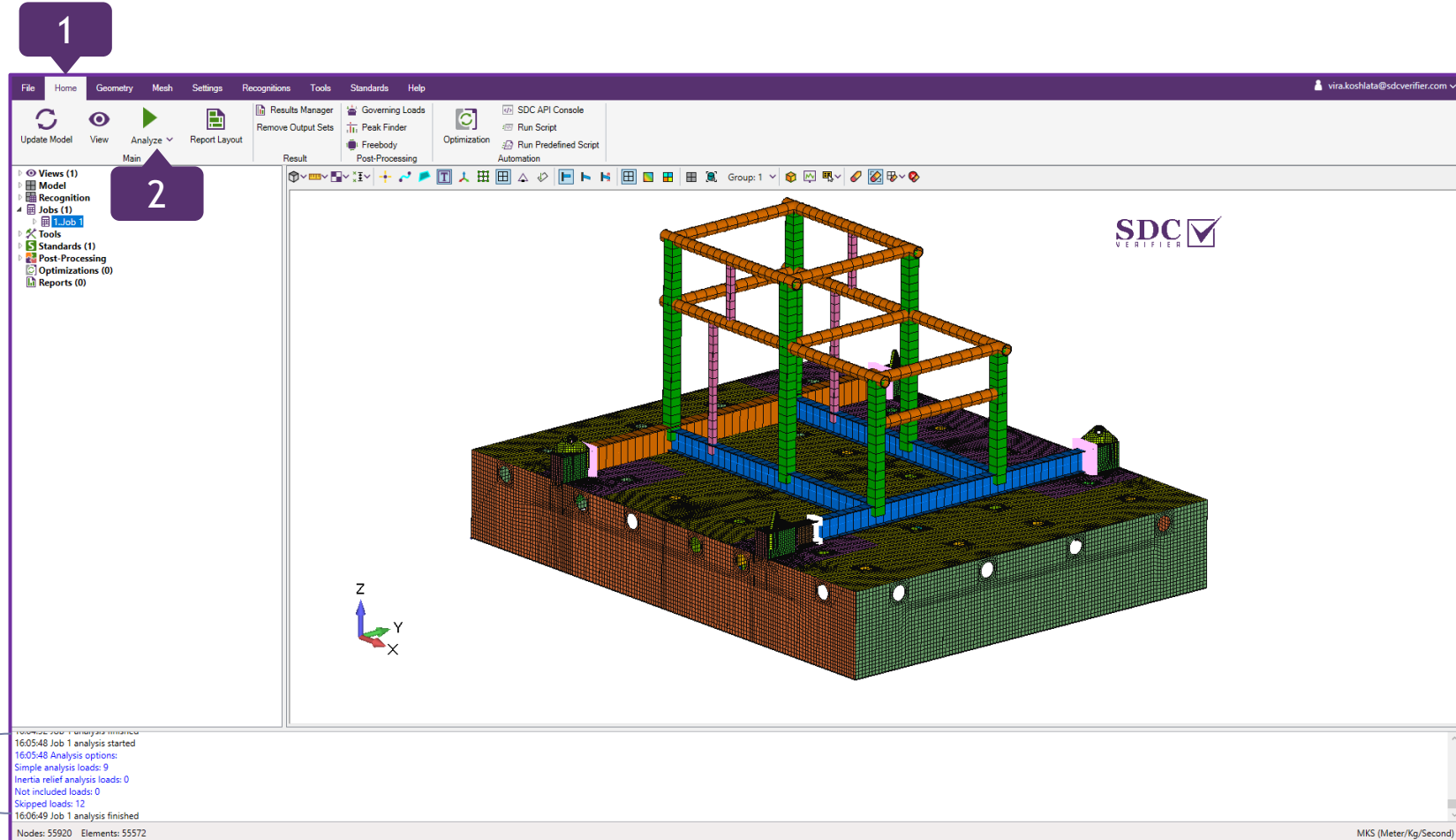
- 1 Launch SDC Verifier
- 2 Open project
DNV_RP_C203_Fatigue.sdcvp
- 3 Press *Open*



Run Analysis

1 Go to *Home* section on the Ribbon

2 Press  on the toolbar to analyze Job



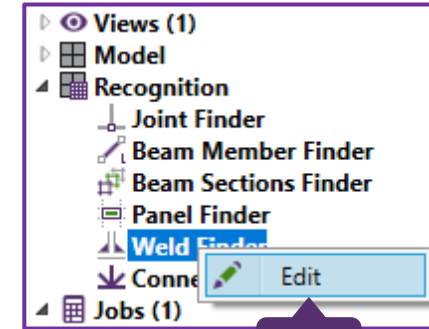
1

In the Model tree => Recognition, select *Weld Finder* and press *Edit*

2

Press *Find*

In SDC Verifier the Weld Finder tool recognizes welds automatically and converts stresses from local element direction into weld direction, which helps to set classification in different weld stress directions.



1

Welds Finder

Welds Weld Strength Settings Hot Spot Stress

Filter: None = Apply Filter Find Weld by ID: Navigate

ID	Title	Tensile Strength (Min) [Pa]	Yield Stress (Min) [Pa]	Is Symmetric	Is Curved	Nodes	Elements	Weld Parts
1	Weld 1 [1.54; 0; 1.1]	360000000	240000000	Yes	No	12	33	3
2	Weld 2 [5.28; 0; 1.1]	360000000	240000000	Yes	No	12	33	3
3	Weld 3 [1.54; 5.51; 1.1]	360000000	240000000	Yes	No	12	33	3
4	Weld 4 [5.28; 5.51; 1.1]	360000000	240000000	Yes	No	12	33	3
5	Weld 5 [4.67; 2.75; 0.95]	360000000	240000000	Yes	No	7	24	4
6	Weld 6 [5.84; 2.75; 0.95]	360000000	240000000	Yes	No	7	24	4
7	Weld 7 [1.43; 0.21; 1.1]	360000000	240000000	Yes	No	23	88	4
8	Weld 8 [1.65; 0.22; 1.1]	360000000	240000000	Yes	No	23	88	4
9	Weld 9 [5.17; 0.43; 1.26]	360000000	240000000	Yes	No	14	39	3
10	Weld 10 [5.39; 0.43; 1.26]	360000000	240000000	Yes	No	14	39	3
11	Weld 11 [1.65; 0.43; 1.26]	360000000	240000000	Yes	No	14	39	3
12	Weld 12 [1.43; 0.43; 1.26]	360000000	240000000	Yes	No	14	39	3
13	Weld 13 [1.65; 0.36; 1.32]	360000000	240000000	No	No	9	32	4
14	Weld 14 [1.43; 5.3; 1.1]	360000000	240000000	Yes	No	23	88	4
15	Weld 15 [1.65; 5.28; 1.1]	360000000	240000000	Yes	No	23	88	4
16	Weld 16 [1.65; 5.08; 1.26]	360000000	240000000	Yes	No	14	39	3
17	Weld 17 [1.43; 5.08; 1.26]	360000000	240000000	Yes	No	14	39	3
18	Weld 18 [1.65; 5.14; 1.32]	360000000	240000000	No	No	9	32	4
19	Weld 19 [5.17; 0.22; 1.1]	360000000	240000000	Yes	No	23	88	4
20	Weld 20 [5.39; 0.21; 1.1]	360000000	240000000	Yes	No	23	88	4
21	Weld 21 [5.17; 0.36; 1.32]	360000000	240000000	No	No	9	32	4
22	Weld 22 [5.17; 5.08; 1.26]	360000000	240000000	Yes	No	14	39	3
23	Weld 23 [5.39; 5.08; 1.26]	360000000	240000000	Yes	No	14	39	3
24	Weld 24 [5.17; 5.29; 1.1]	360000000	240000000	Yes	No	23	88	4
25	Weld 25 [5.39; 5.3; 1.1]	360000000	240000000	Yes	No	23	88	4
26	Weld 26 [5.17; 5.14; 1.32]	360000000	240000000	No	No	9	32	4
27	Weld 27 [5.28; 0.44; 1.26]	360000000	240000000	Yes	No	12	33	3
28	Weld 28 [5.17; 0.21; 1.1]	360000000	240000000	Yes	No	21	60	3
29	Weld 29 [5.17; 0.36; 1.32]	360000000	240000000	Yes	No	21	60	3

Settings Find Set Parameter Check on Weld Design OK Cancel

2

Add, Edit, Combine and Remove Welds

Move Welds. Order is important when one element belongs to 2 Welds

Preview selected Welds

Plot of selected Welds in colors and with labels of IDs

After the recognition is finished, all welds are checked on the design. If all weld parts of single weld are welded or all weld parts are not-welded, they will be included to the list of welds that are recommended to be checked manually:

3

Press *Close*

Note: If a weld consists of only 2 parts (e.g. Angle-weld), all parts will be set as welded but weld will not be included to the list;

Check weld design is essential for Weld Strength checks. As this tutorial is devoted to Fatigue, the window is to be closed.

✓ Check weld design

Unable to recognize weld parameters automatically. Welds that match one of the following criteria are displayed:

#	Type	Description	Issue
1	Warning	All weld parts in a weld are welded	Continuous parts in real model will be treated as welded
2	Warning	Different weld part lengths in a weld	Different area of the weld that will lead to stress variation
3	Error	Length of any weld part of a weld is zero	Possible mesh disconnectivity. Weld area is 0

ID	Title	Nodes	Elements	Length	Criterion	Welded	Non-Welded
1	Weld 1 [1.54; 0; 1.1]	12	33	0.22	1	3	0
2	Weld 2 [5.28; 0; 1.1]	12	33	0.22	1	3	0
3	Weld 3 [1.54; 5.51; 1.1]	12	33	0.22	1	3	0
4	Weld 4 [5.28; 5.51; 1.1]	12	33	0.22	1	3	0
130	Weld 130 [5.84; 4.89; 1.1]	34	99	1.369995	1	3	0
133	Weld 133 [5.84; 0.61; 1.1]	34	99	1.369995	1	3	0
134	Weld 134 [4.67; 4.88; 1.1]	32	93	1.369997	1	3	0
137	Weld 137 [4.67; 0.63; 1.1]	32	93	1.369997	1	3	0
139	Weld 139 [5.23; 1.37; 1.1]	27	78	1.168006	1	3	0
142	Weld 142 [1.75; 1.37; 1.1]	25	72	1.168001	1	3	0
145	Weld 145 [1.54; 0.43; 1.1]	12	33	0.22	1	3	0
157	Weld 157 [1.65; 0.18; 1.42]	19	56	0.363202	1	3	0
158	Weld 158 [1.17; 0.61; 1.1]	34	99	1.369995	1	3	0
161	Weld 161 [1.17; 4.89; 1.1]	34	99	1.369995	1	3	0
165	Weld 165 [5.28; 0.43; 1.1]	12	33	0.22	1	3	0
168	Weld 168 [1.54; 5.08; 1.1]	12	33	0.22	1	3	0
177	Weld 177 [1.65; 5.33; 1.42]	19	56	0.363202	1	3	0

Set welded parts by elements Set non-welded parts by elements Close

Some Welds with all welded parts were found; this message should be closed

Weld Finder Plotting Functions

1

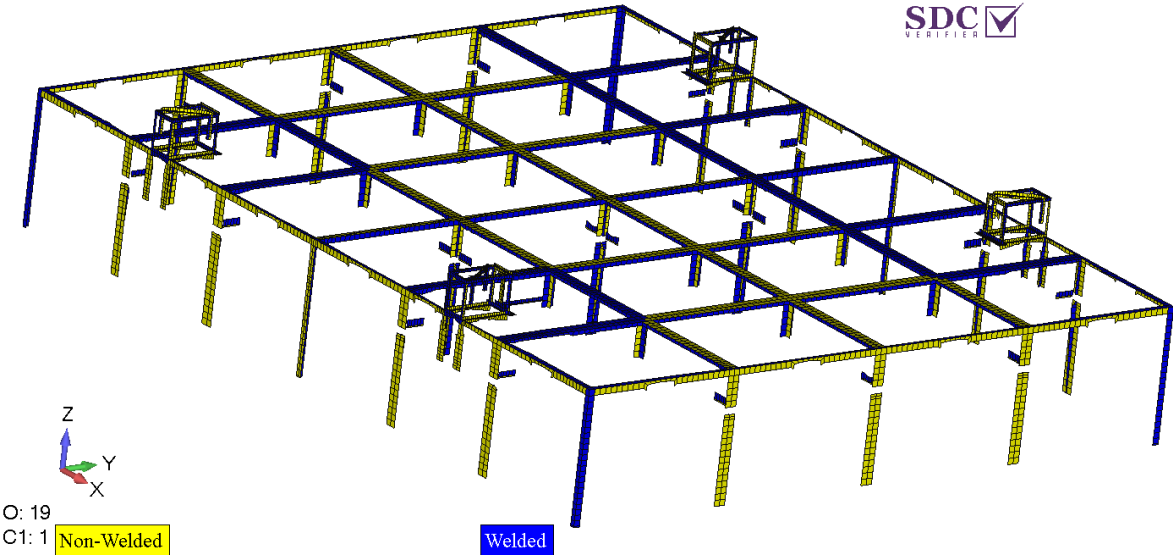
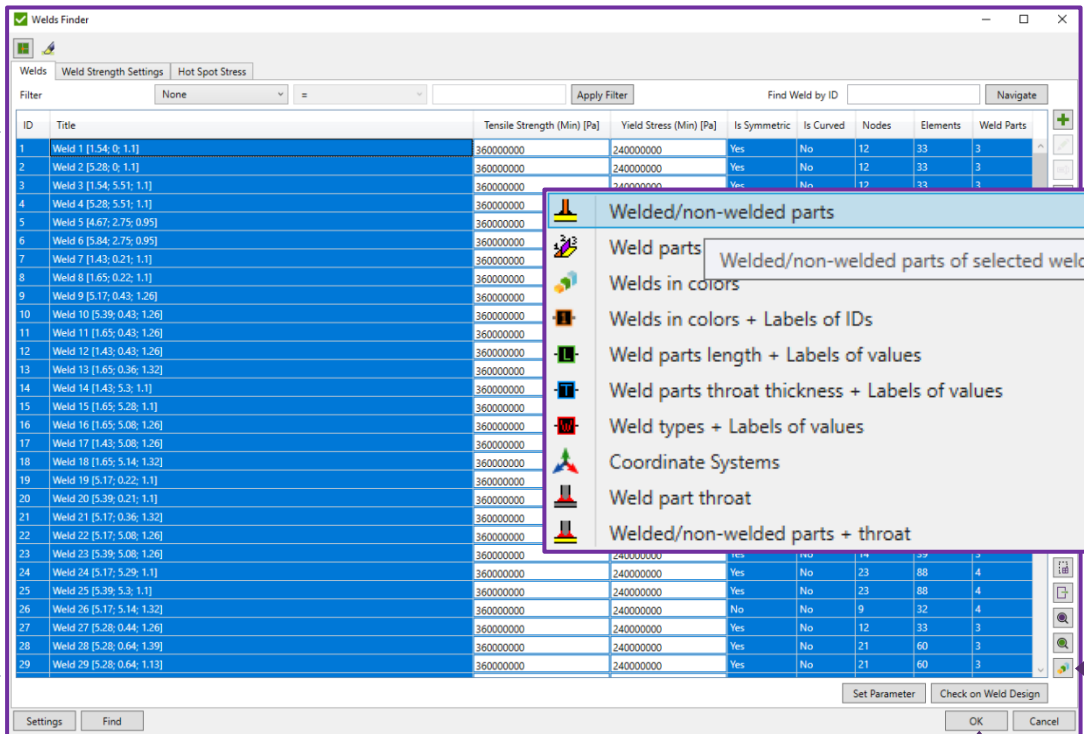
To plot all welds, in Welds Finder select them by combining Ctrl + A

2

Press  and select *Welded/non-welded parts*

3

Press OK



The software offers an extensive variety of Plotting options that can be selected according to the user's objectives.

2

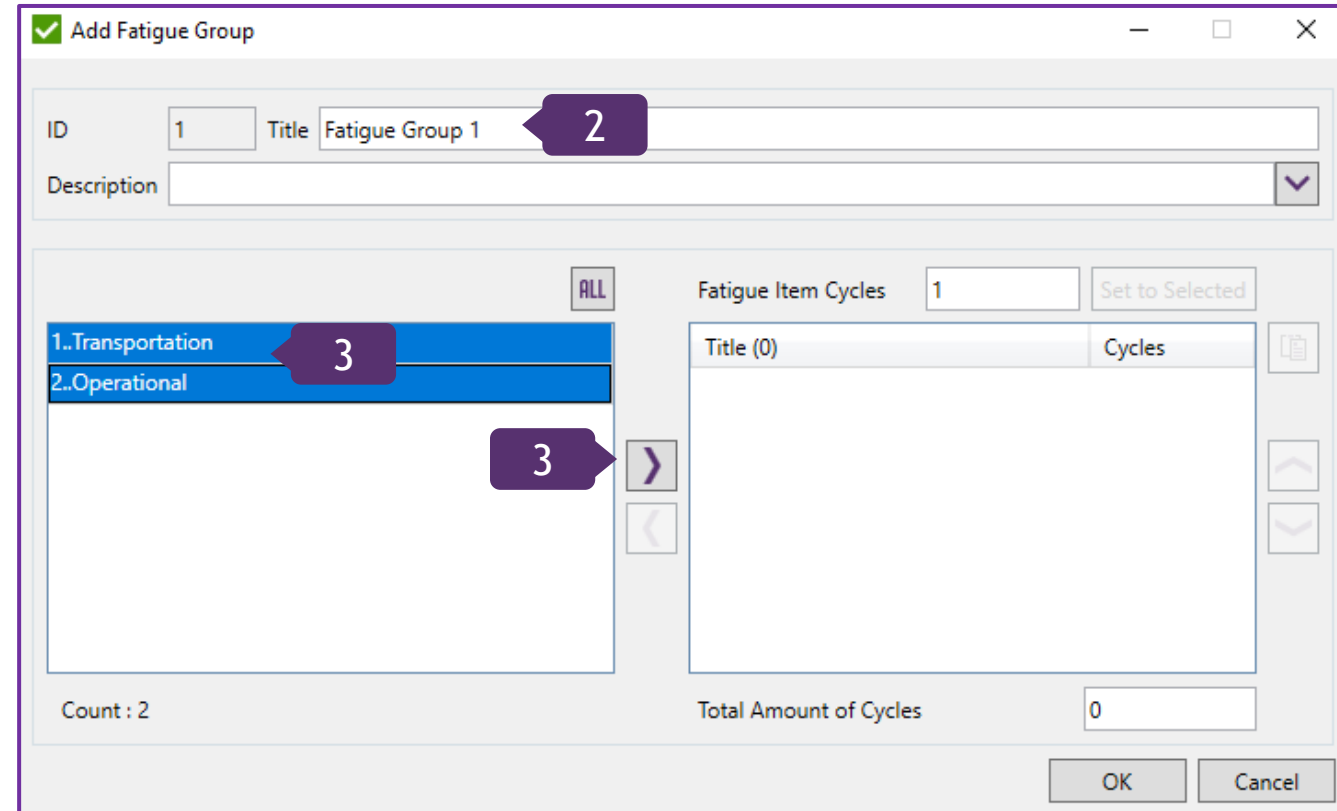
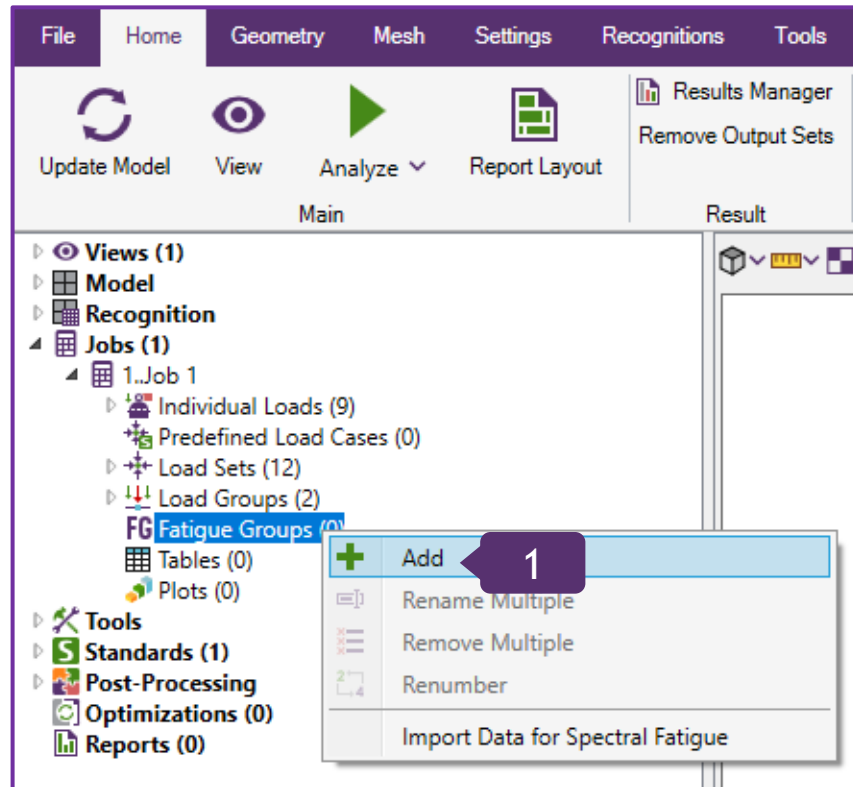
3

Add Fatigue Group (Stress History)

1 In Jobs, execute right click on *Fatigue Groups (0)* and select *Add*

2 Title: *Fatigue Group 1*

3 Select *1..Transportation* and *2..Operational* and press 



Add Fatigue Group (Stress History) (Continuation)

4 In Cycles, insert 300000

5 Press *OK*

✓ Add Fatigue Group

ID: 1 Title: Fatigue Group 1

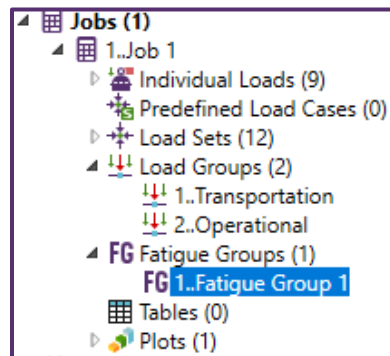
Description:

ALL Fatigue Item Cycles: 1 Set to Selected

Title (2)	Cycles
1..Transportation	300 000
2..Operational	300 000

Count : 0 Total Amount of Cycles: 600 000

OK



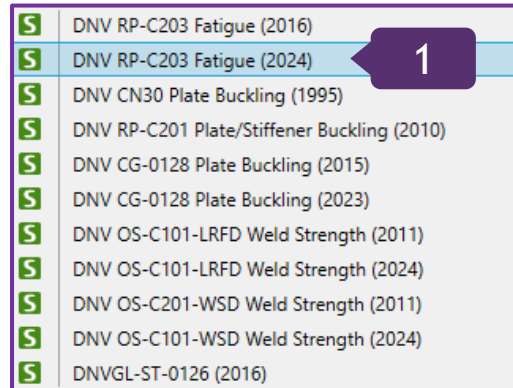
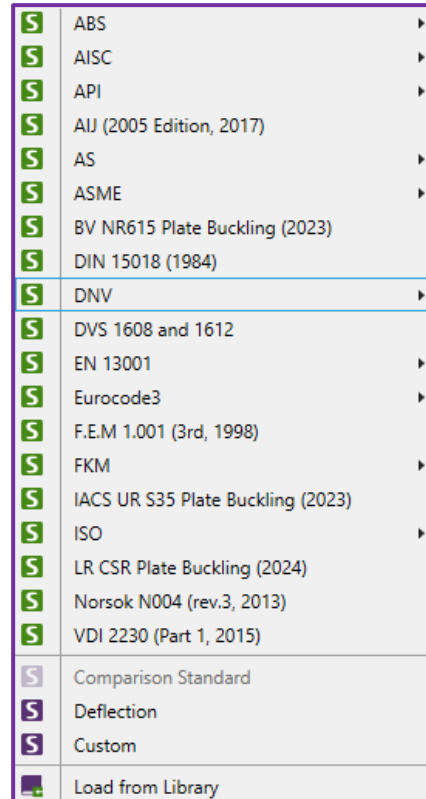
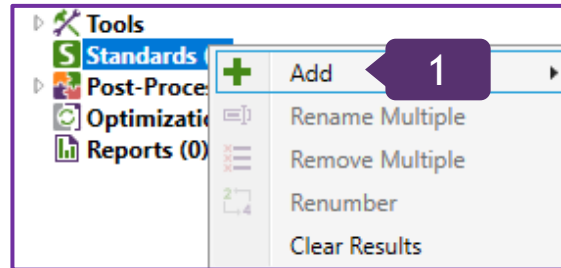
Total number of Cycles is calculated automatically.

Add DNV RP-C203 Fatigue (2016) Standard

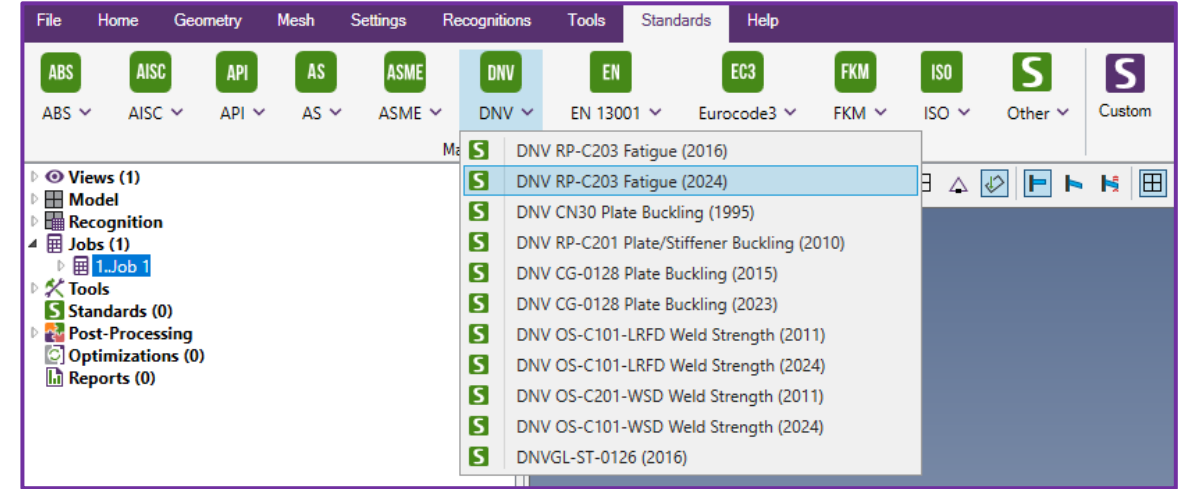
1

Execute right click on Standards and select
Add => DNV => DNV RP-C203 Fatigue (2024)

DNV RP-C203 Recommended Practice: Fatigue design of offshore steel structures, October 2024. Calculations cover environment air (chapter 2.4.4) and seawater with cathodic protection (chapter 2.4.5) based on stress calculation method B (chapter 4.8).



An alternative way of adding a Standard



Define Environment (Chapter 2.4.4 air)

1 Press  to define *Environment*

2 Environment Type: Air;
Press *OK*


DNV RP-C203 Fatigue (2024)


ID: 1 Title: DNV RP-C203 Fatigue (2024)


Alias: Standard1


Description: Recommended Practice: Fatigue design of offshore steel structures, October 2024

Settings

Environment (Chapter 2.4.4 air, Chapter 2.4.5 seawater)  **1**

Reference Thickness (Chapter 2.4.3) 

SN Curve (Table 2-1 and 2-2) 

Use Stress Factor 1.12 for method B (4.8) 

☐ Use Hot Spot Stress

Add Element Characteristic

ID: 1 Title: Environment

Alias: Environment

Description:

Elemental Selections

Environment Type: Air **2** Apply To Selected To All

Selection	Value
Full Model	Air

Import OK Cancel **2**

2.4.4 S-N curves in air

S-N curves for air environment are given in Table 2-1 and Figure 2-8. The T curve for tubular joints is shown in Table 2-3 and Figure 2-10.

The maximum stress range is that of the B1 curve as shown in Figure 2-8. However, for offshore structures subjected to typical wave and wind loading the main contribution to fatigue damage is in the region $N > 10^6$ cycles and the bilinear S-N curves defined in Table 2-1 can be used.

Table 2-1 S-N curves in air

S-N curve	$N \leq 10^7$ cycles		$N > 10^7$ cycles $\log \bar{a}_2$ $m_2 = 5.0$	Fatigue limit at 10^7 cycles (MPa) *)	Thickness exponent k	Structural stress concentration embedded in the detail (S-N class), see also equation (2.3.2)
	m_1	$\log \bar{a}_1$				
B1	4.0	15.117	17.146	106.97	0	
B2	4.0	14.885	16.856	93.59	0	
C	3.0	12.592	16.320	73.10	0.05	
C1	3.0	12.449	16.081	65.50	0.10	
C2	3.0	12.301	15.835	58.48	0.15	
D	3.0	12.164	15.606	52.63	0.20	1.00
E	3.0	12.010	15.350	46.78	0.20	1.13
F	3.0	11.855	15.091	41.52	0.25	1.27
F1	3.0	11.699	14.832	36.84	0.25	1.43
F3	3.0	11.546	14.576	32.75	0.25	1.61
G	3.0	11.398	14.330	29.24	0.25	1.80
W1	3.0	11.261	14.101	26.32	0.25	2.00
W2	3.0	11.107	13.845	23.39	0.25	2.25
W3	3.0	10.970	13.617	21.05	0.25	2.50

*) see also [2.11]

Another option of Environment Type: Seawater With Cathodic Protection

S-N curves for seawater environment with cathodic protection are given in [Table 2-2](#) and [Figure 2-9](#). The T curve is shown in [Table 2-3](#) and [Figure 2-10](#). For shape of S-N curves see also comment in [\[2.4.4\]](#).

S-N curve	$N \leq 10^6$ cycles		$N > 10^6$ cycles $\log \bar{a}_2$ $m_2 = 5.0$	Fatigue limit at 10^7 cycles (MPa) *)	Thickness exponent k	Structural stress concentration embedded in the detail (S-N class), see also equation (2.3.2)
	m_1	$\log \bar{a}_1$				
B1	4.0	14.917	17.146	106.97	0	
B2	4.0	14.685	16.856	93.59	0	
C	3.0	12.192	16.320	73.10	0.05	
C1	3.0	12.049	16.081	65.50	0.10	
C2	3.0	11.901	15.835	58.48	0.15	
D	3.0	11.764	15.606	52.63	0.20	1.00
E	3.0	11.610	15.350	46.78	0.20	1.13
F	3.0	11.455	15.091	41.52	0.25	1.27
F1	3.0	11.299	14.832	36.84	0.25	1.43
F3	3.0	11.146	14.576	32.75	0.25	1.61
G	3.0	10.998	14.330	29.24	0.25	1.80
W1	3.0	10.861	14.101	26.32	0.25	2.00
W2	3.0	10.707	13.845	23.39	0.25	2.25
W3	3.0	10.570	13.617	21.05	0.25	2.50

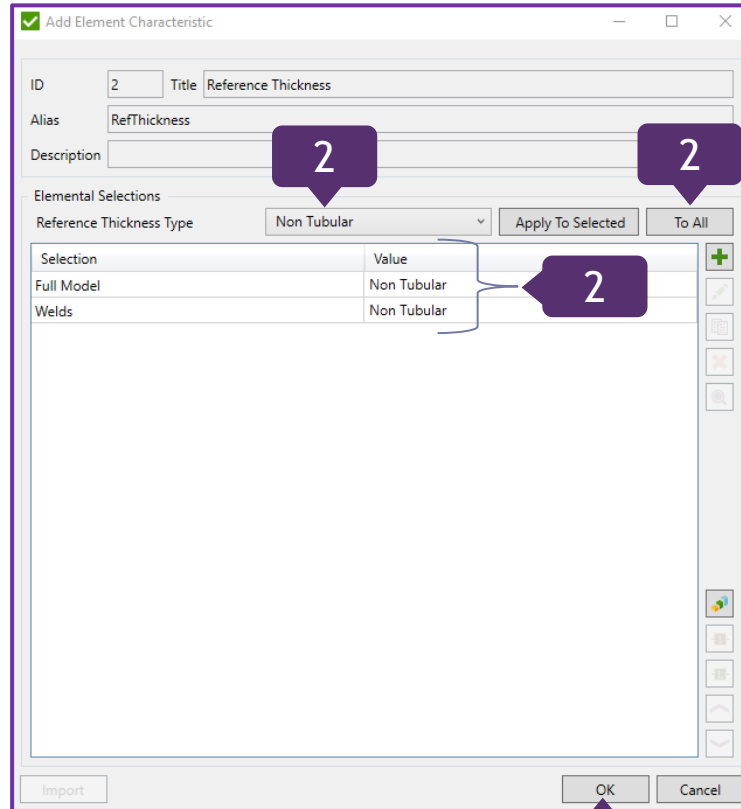
*) see also [2.11]

Define Reference Thickness (Chapter 2.4.3)

1 Press  in *Reference Thickness (Chapter 2.4.3)*

2 Reference Thickness Type => Full Model: *Non Tubular*;
Welds: *Non Tubular*; Press *To All*

3 Press *OK*

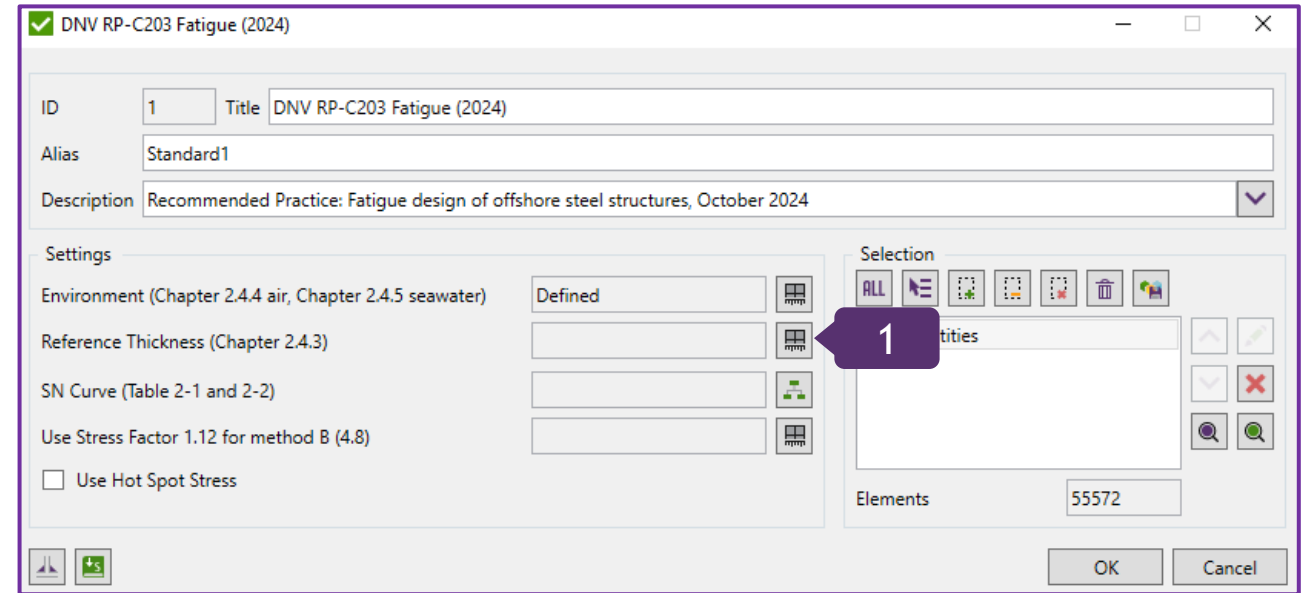


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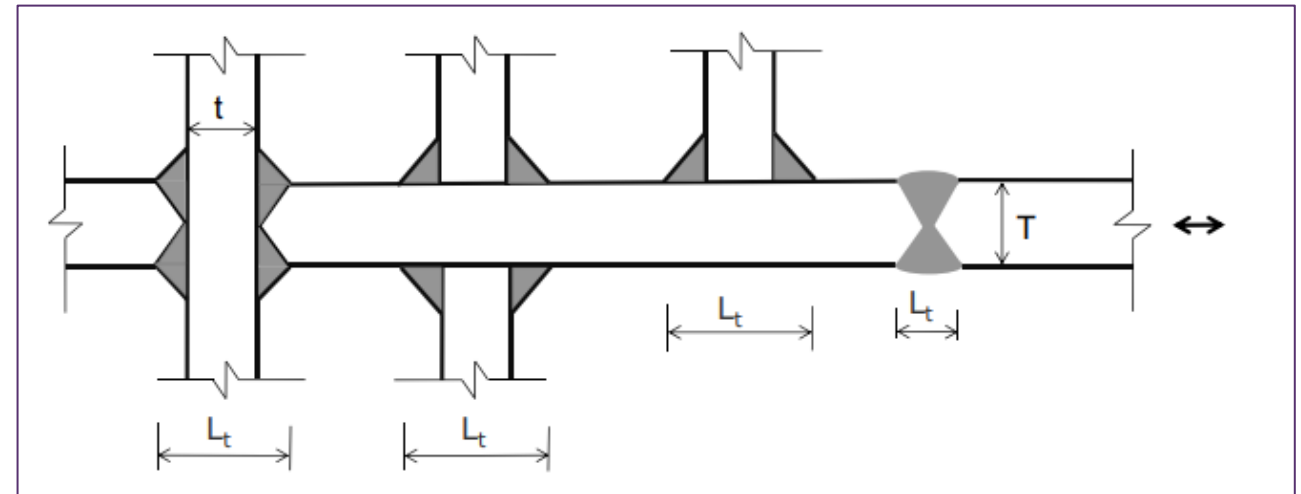
2

2

3



1



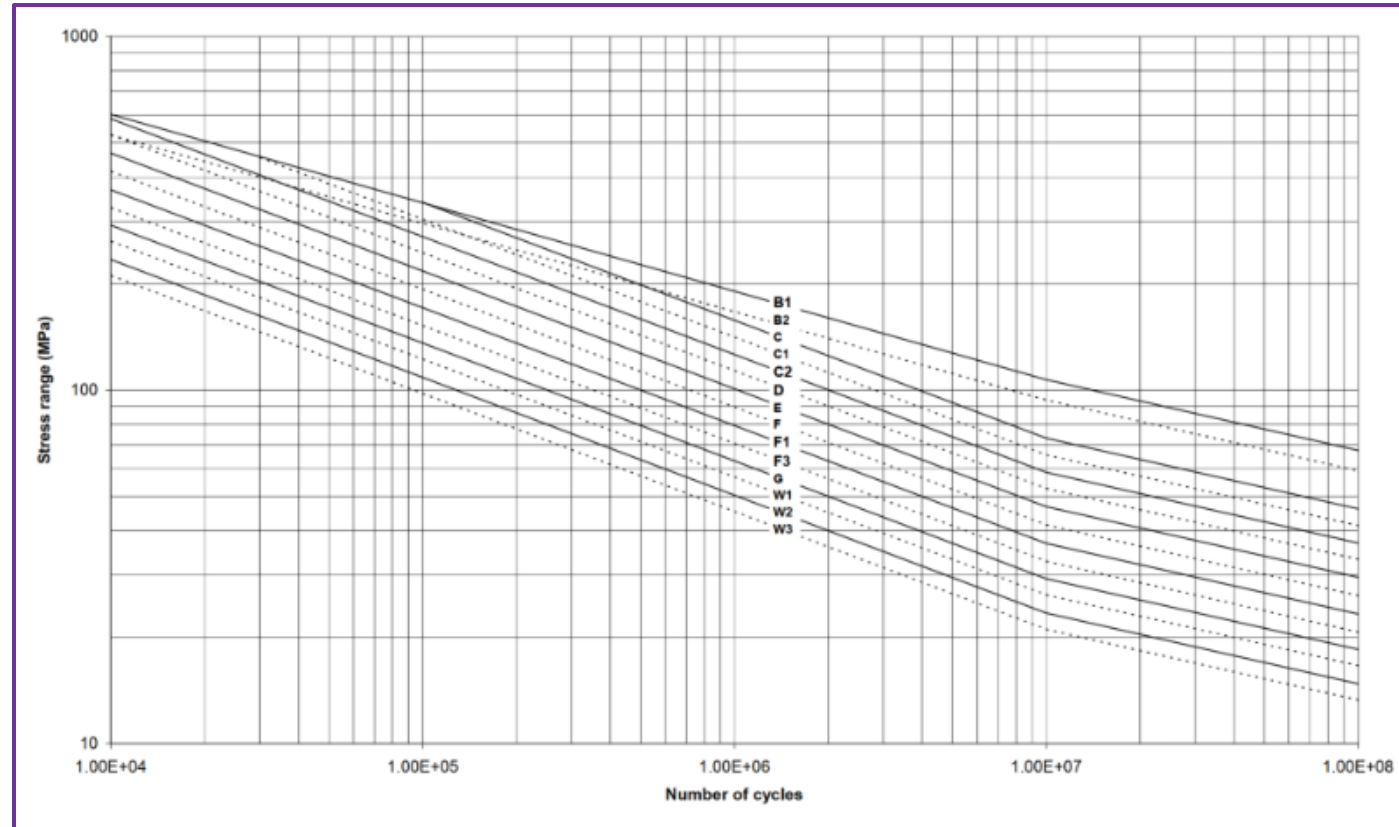
Thickness Factor is calculated based on this formula:

$$\Delta\sigma \left(\frac{t}{t_{\text{ref}}} \right)^K$$

T_{ref} - reference thickness equal to 25 mm for welded connections other than tubular joints. For tubular joints = 16 mm, for bolts = 25 mm.

K - thickness exponent on fatigue strength as given in Table 2-1, 2-2, 2-3 and 2-4.

The S-N curves are specified by the standard and take into account the type of the material, the connection or connection (welds), the stress direction and the surrounding environment. As an example, see the S-N curves for the air environment from DNVGL-RP-C203 (Edition April 2016).



S-N category depends on the type of constructional detail (non-welded, welded) and stress direction (parallel to the weld, perpendicular to the weld and shear). In the finite element model, the required information is missing and in result, the task of setting a classification can be time-consuming.

SN Curve is directional classification. X - direction is parallel to the weld, Y - perpendicular. First set non-welded curve for full model. Second step is to define SN curve for welds (parallel and perpendicular). For welds intersection (last step) the lowest class between X, Y should be set.

SN curve is recalculated based on principal stress angles and Table F-1 from App. F/F.5 :

Angle φ in Figure F-3	Detail classified as F for stress direction normal to the weld	Detail classified as E for stress direction normal to the weld	S-N curve when using the hot spot stress methodology
0 - 30	F	E	D
30 - 45	E	D	C2
45 - 60	D	C2	C2
60 - 75	C2	C2	C2 ¹⁾
75 - 90	C2 ¹⁾	C2 ¹⁾	C2 ¹⁾

1) A higher S-N curve may be used in special cases. See [Table A-3](#) for further information.

SN Curve Classifications (Continuation); Method B

Standard Data Table

ID: 2 Title: Table F1

Alias: TableF1

Description: Appendix F.5 Table F-1 Classificat

Dimensions: Row Count: 5 Column Count: 14

Headers: Row Description: PrincipalAng Column Description: SNTYPE

Excel Import: Paste Full Table Paste Cells Values

	B1	B2	C	C1	C2	D	E	F	F1	F3
30	1	2	3	4	5	6 D	7 E	8 F	9	10
45	1	2	3	4	5	5 C2	6 D	7 E	9	10
60	1	2	3	4	5	5 C2	5 C2	6 D	9	10
75	1	2	3	4	5	-1 C2*	5 C2	5 C2	9	10
90	-1	-1	-1	-1	-1	-1 C2*	-1 C2*	-1 C2*	-1	-1

Note: SN curve defined for parallel direction (X) is taken as max class to use. E.g. if a user set D curve for X and F curve for Y:

0-30 F
30-45 E
45-60 D
60-75 D
75-90 D

For C2* (-1) is used user defined SN curve.

Stresses are calculated based on Method B from chapter 4.8

Method B. For modelling with shell elements without any weld included in the model the hot spot stress is taken as the stress at the read-out point 0.5t away from the intersection line.

For modelling with three-dimensional elements with the weld included in the model the hot spot stress is taken as the stress at the read-out point 0.5t away from the weld toe.

The effective hot spot stress range is derived as:

$$\Delta\sigma_{eff} = \max \left\{ \begin{array}{l} 1.12\sqrt{\Delta\sigma_{\perp}^2 + 0.81\Delta\tau_{\parallel}^2} \\ 1.12\alpha|\Delta\sigma_1| \\ 1.12\alpha|\Delta\sigma_2| \end{array} \right. \quad (4.8)$$

When the nominal stress S-N curves are used, the stresses extracted from the finite element model may use Method B without inclusion of the 1.12 factors in equation (4.8). By default, factor is used for full model, can be changed in characteristic.

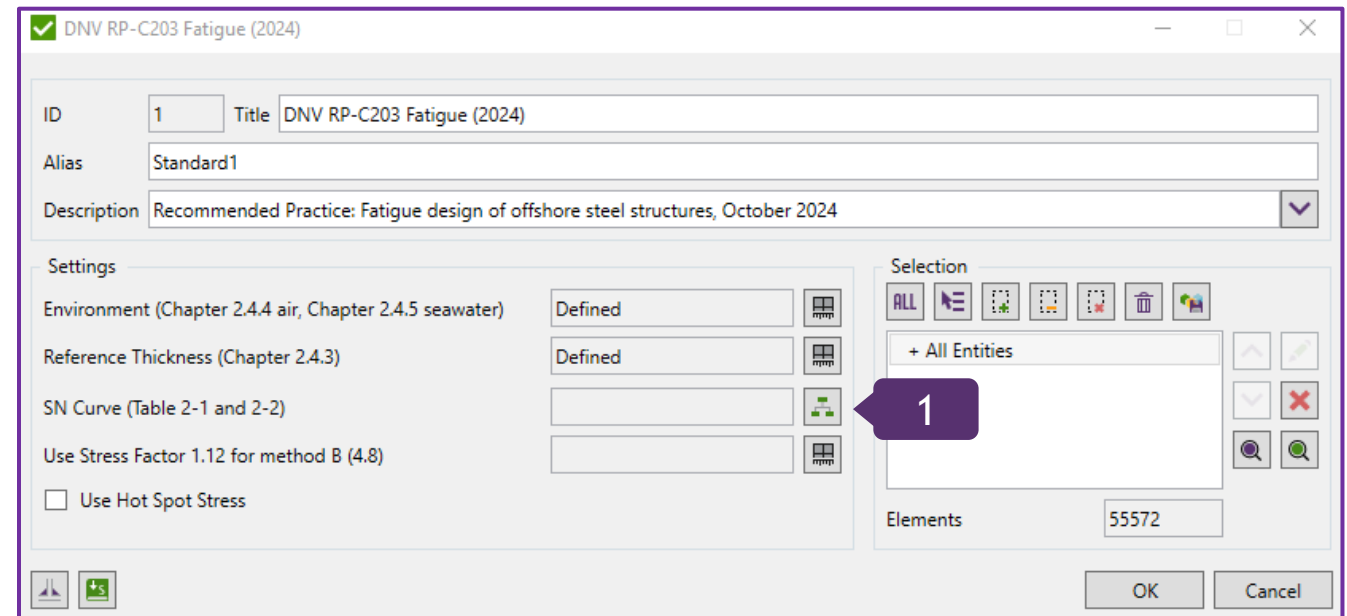
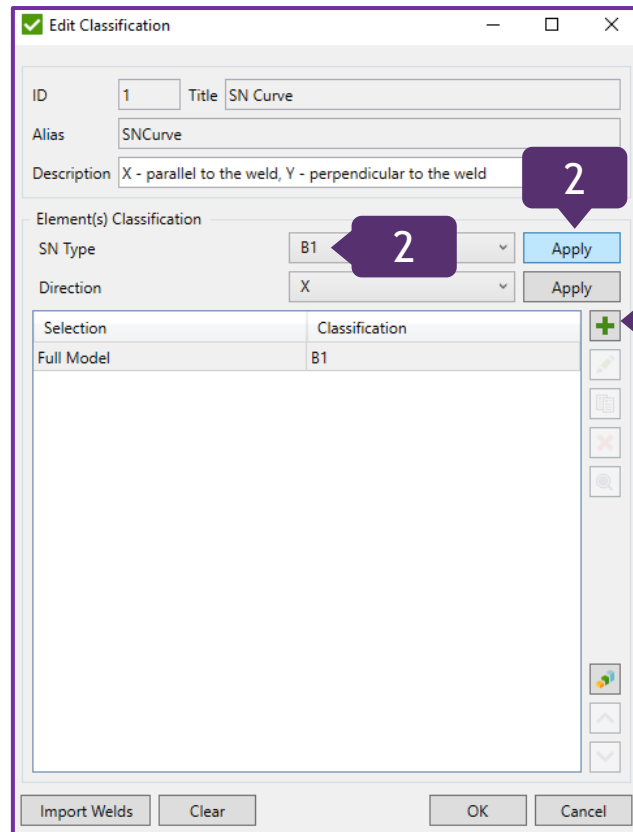
Define SN Curve (Table 2-1 and 2-2)

1 Press  to define *SN Curve*

2 For Full Model - SN Type: *B1*;
Press *Apply*

3 Press  to Edit Condition

The DNV RP-C203 like all direct fatigue damage rule-based codes as Eurocode 3, BS 5400, IIW-1823-07 use S-N curves to calculate direct fatigue damage.



In Classification tool it is possible to assign S-N curve for different selections and in different stress directions in the classification table.

Define SN Curve (Table 2-1 and 2-2) (Continuation)

4 Press *ALL* to add *All Entities*

5 Press *None*

6 Value: *C2*

7 Direction: *XY*

8 Press *OK*

The screenshot shows the 'Classification Condition' dialog box. It has a title bar with a green checkmark and the text 'Classification Condition'. The dialog is divided into several sections. On the left, there is a 'Selection' section with a toolbar containing icons for 'ALL', 'None', 'Value', 'Direction', 'Delete', and 'Add'. Below this is a list box containing '+ All Entities'. To the right of the list box are buttons for 'Add all welds' and 'Add all intersections'. Below these is a text field labeled 'Elements' containing the value '55572'. On the right side of the dialog, there is a 'SN Type' section with two radio buttons: 'One Condition' (selected) and 'Multiple Condition'. Below these are two buttons: 'All' and 'None' (selected). To the right of the 'None' button is a text field containing 'X/Y/XY'. Below this is a 'Value' dropdown menu showing 'C2'. Below the 'Value' dropdown is a 'Direction' section with a list of checkboxes: 'X', 'Y', 'Z', 'XY' (checked), 'YZ', 'ZX', and 'Eqv'. At the bottom right of the dialog are 'OK' and 'Cancel' buttons. Numbered callouts are placed over the dialog: '4' points to the 'ALL' button in the Selection toolbar; '5' points to the 'None' button; '6' points to the 'C2' value in the Value dropdown; '7' points to the 'XY' checkbox in the Direction list; and '8' points to the 'OK' button.

Define SN Curve (Table 2-1 and 2-2) (Continuation 2)

1 Press  to Edit Condition

2 Press *Add all Welds*

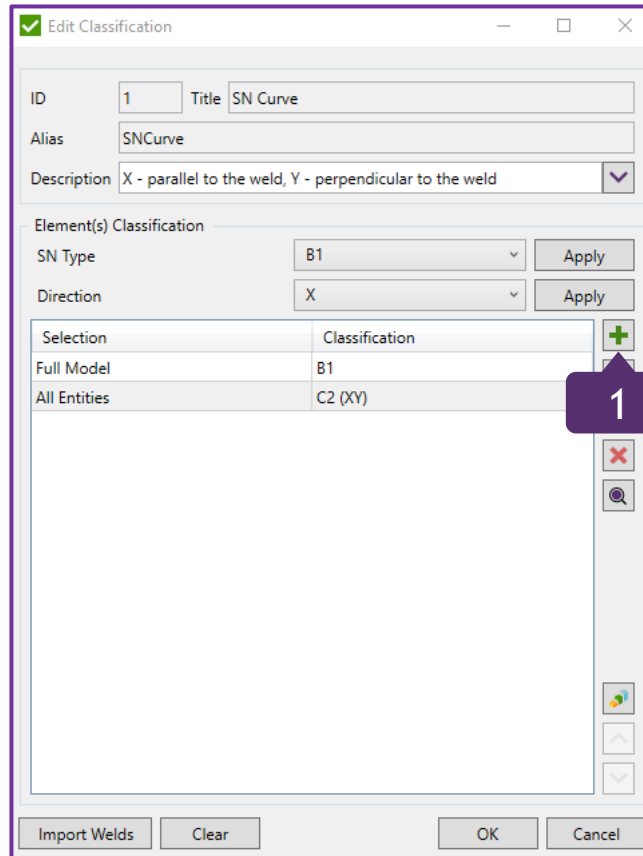
3 Select *Multiple Condition*;
Press *None*

4 X: C1

Y: D

XY: E

5 Press *OK*



Edit Classification

ID: 1 Title: SN Curve

Alias: SNCurve

Description: X - parallel to the weld, Y - perpendicular to the weld

Element(s) Classification

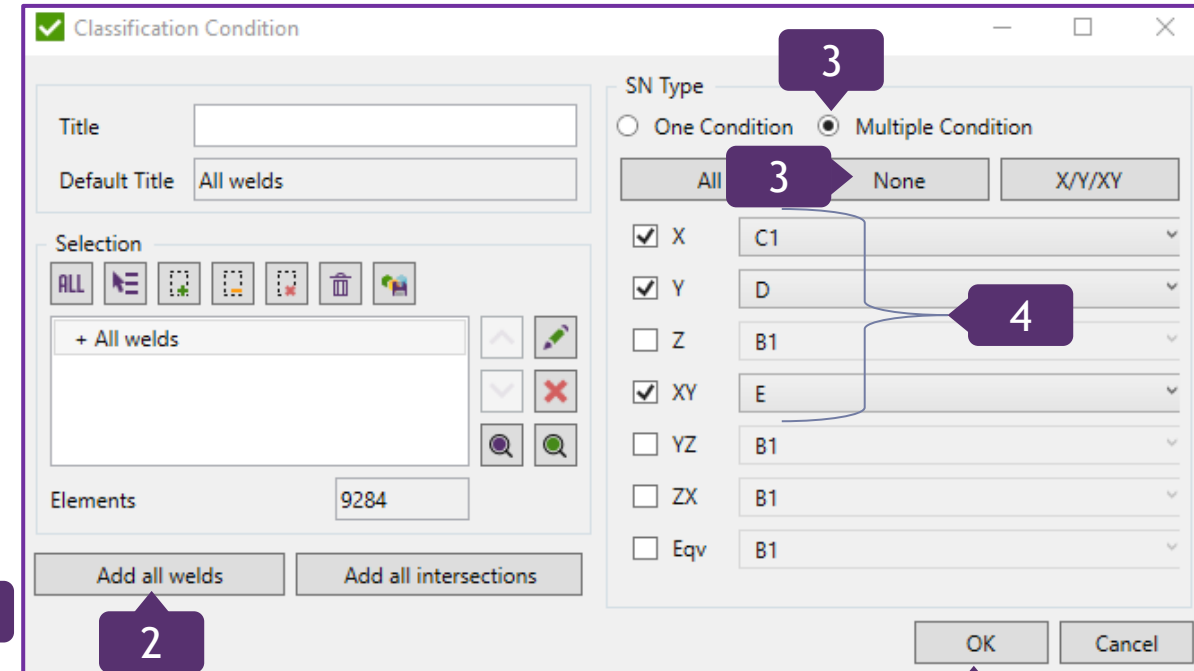
SN Type: B1 Apply

Direction: X Apply

Selection	Classification
Full Model	B1
All Entities	C2 (XY)

Buttons: Import Welds, Clear, OK, Cancel

Annotation 1 points to the '+' button in the bottom right corner of the dialog.



Classification Condition

Title: Default Title: All welds

Selection: + All welds

Elements: 9284

Buttons: Add all welds, Add all intersections

SN Type

☐ One Condition ☒ Multiple Condition

Buttons: All, None, X/Y/XY

Conditions:

Condition	Value
X	C1
Y	D
Z	B1
XY	E
YZ	B1
ZX	B1
Eqv	B1

Buttons: OK, Cancel

Annotations: 2 points to 'Add all welds', 3 points to 'Multiple Condition' and 'None', 4 points to 'C1', 'D', and 'E', 5 points to 'OK'.

Define SN Curve (Table 2-1 and 2-2) (Continuation 3)

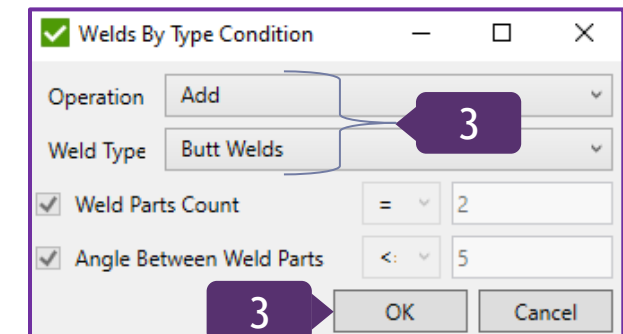
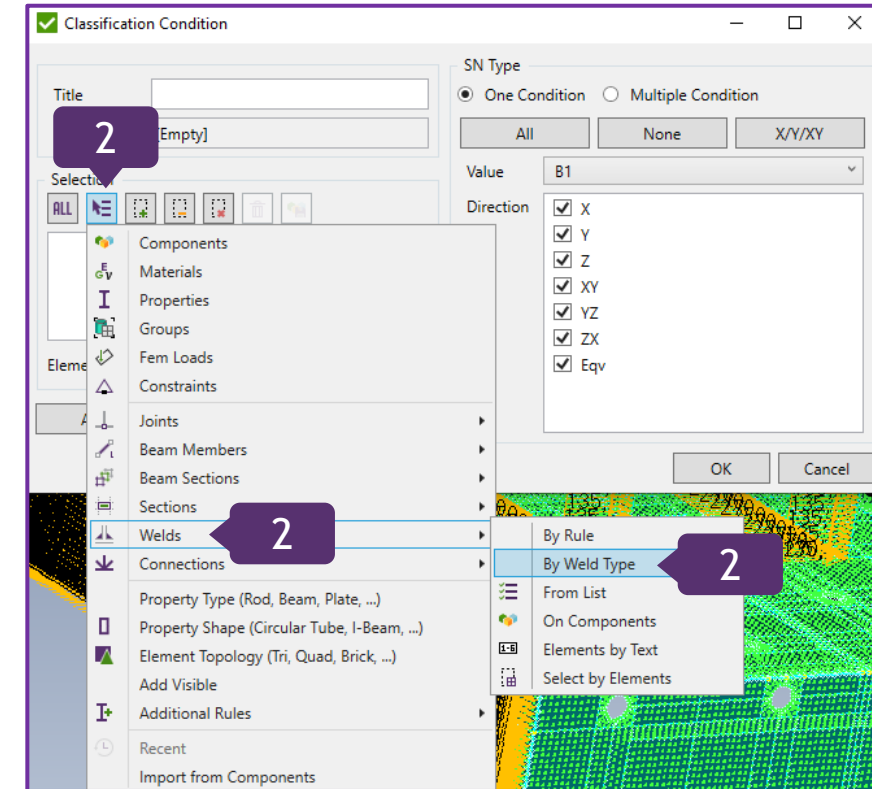
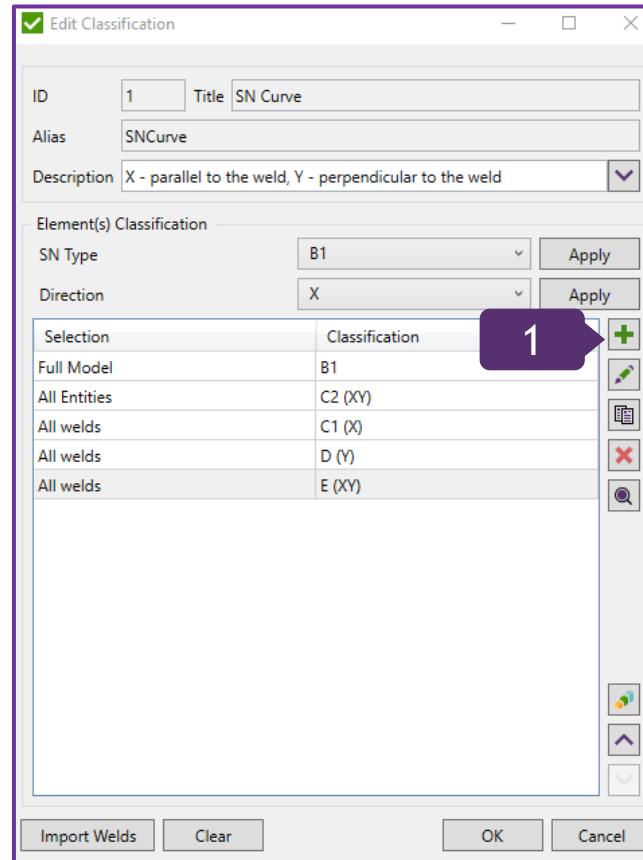
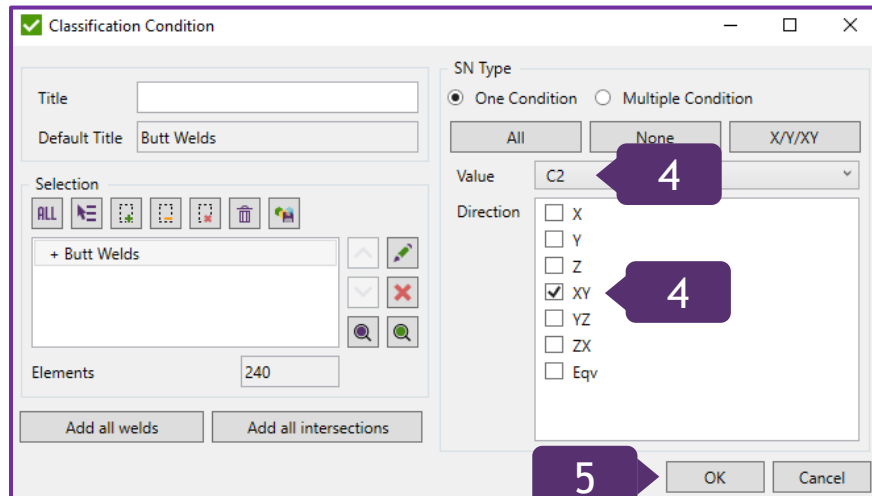
1 Press  to Edit Condition

2 In Selection, press  and select **Welds** → **By Weld Type**

3 Operation: **Add**;
Weld Type: **Butt Welds**;
Press **OK**

4 Value: **C2**;
Direction: **XY**

5 Press **OK**



SDC
VERIFIER

- | Selection | Classification |
|-------------------------|----------------|
| Full Model | B1 |
| All Entities | C2 (XY) |
| All welds | C1 (X) |
| All welds | D (Y) |
| All welds | E (XY) |
| Butt Welds | C2 (XY) |
| All welds intersections | D (X) |

<https://sdcverifier.com>

Plot SN Curve Labels in X Direction

1

Press  to plot with Values

2

Select *Labels* => *X*

3

Press *OK*

Edit Classification

ID: 1 Title: SN Curve

Alias: SNCurve


Description: X - parallel to the weld, Y - perpendicular to the weld

Element(s) Classification

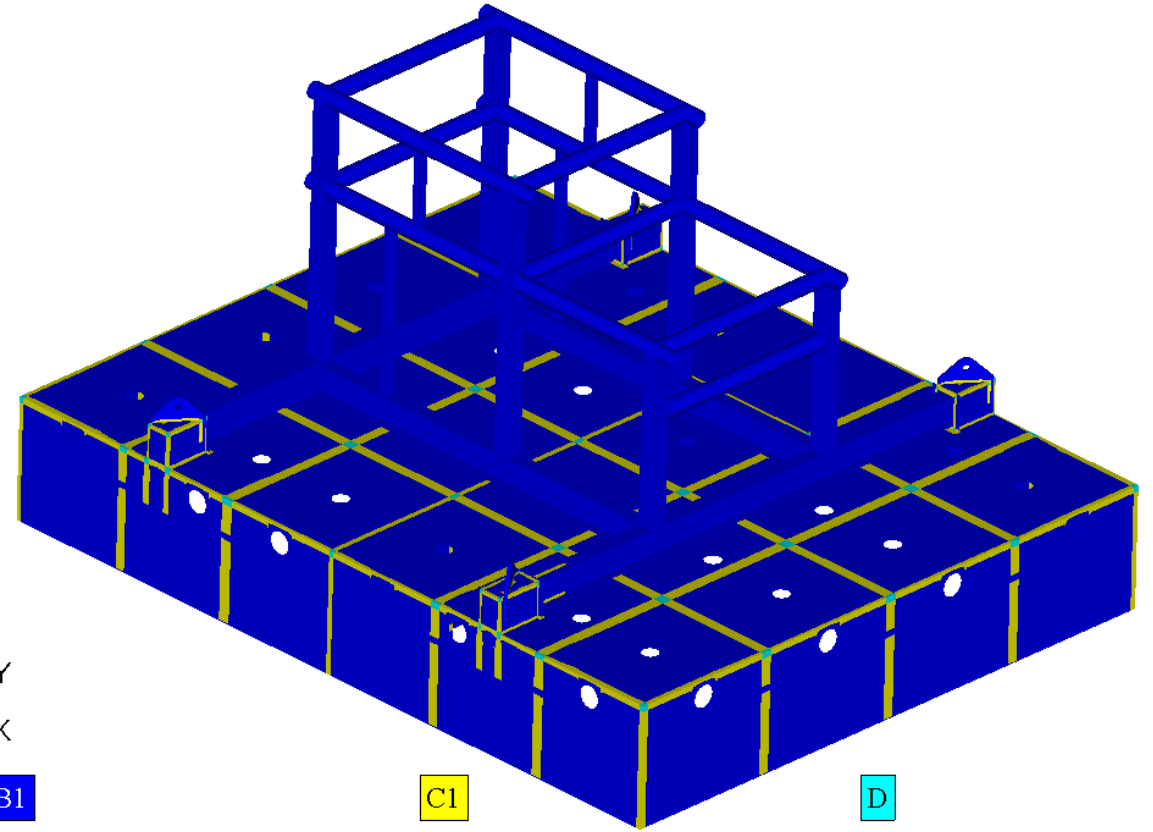
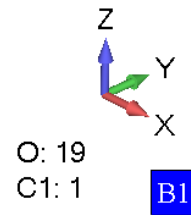
SN Type: B1 Apply

Direction: X Apply

Selection	Classification
Full Model	B1
All Entities	C2 (XY)
All welds	C1 (X)
All welds	E (XY)
All welds	D (Y)
Butt Welds	C2 (XY)
All welds intersections	D (X)

1 

3 OK Cancel



Values
Labels
Selection

X
Y
Z
XY
YZ
ZX
Equivalent

Welds classification (X direction)

Weld Strength in the X direction (parallel to the weld)

✓ Edit Classification

ID1TitleSN Curve

AliasSN Curve

DescriptionX - parallel to the weld, Y - perpendicular to the weld

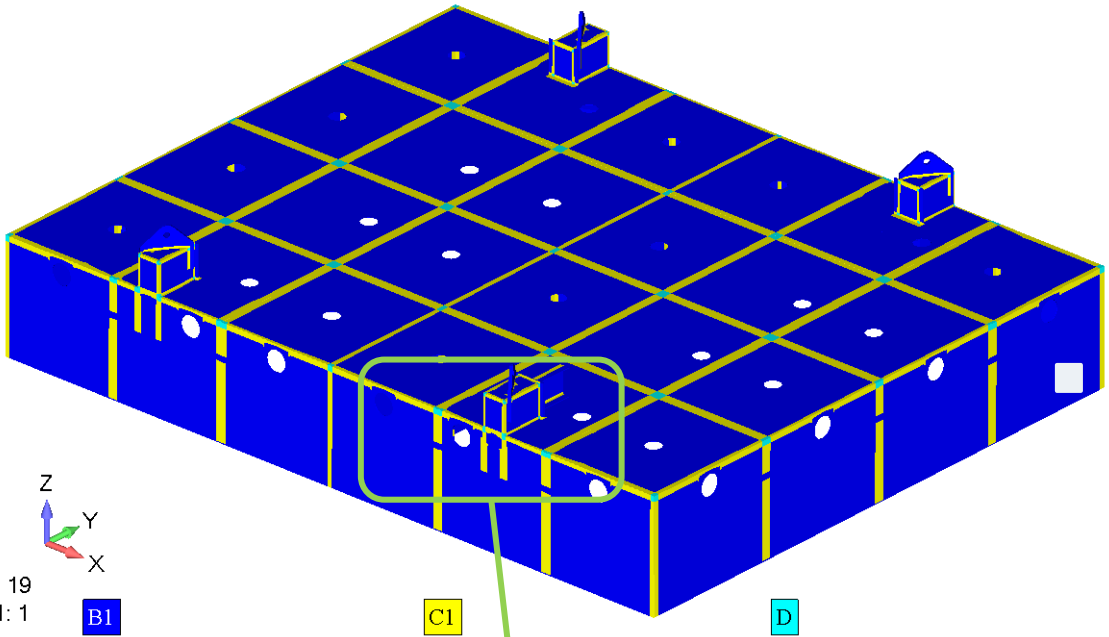
Element(s) Classification

SN TypeB1Apply

DirectionXApply

Selection	Classification
Full Model	B1
All Entities	C2 (XY)
All welds	C1 (X)
All welds	E (XY)
All welds	D (Y)
Butt Welds	C2 (XY)
All welds intersections	D (X)

Detail category	Constructional details	Description
B1	1. 	1. Rolled or extruded plates and flats
	2. 	2. Rolled sections



C1	3. 	3. Automatic fillet or butt welds carried out from both sides but containing stop-start positions. 4. Automatic butt welds made from one side only, with a backing bar, but without start-stop positions.
----	--------	--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------

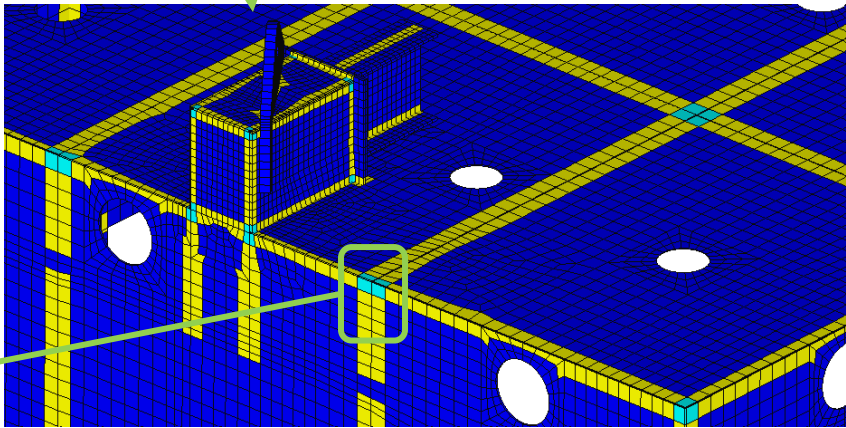


Plate Intersections

Welds classification (Y and XY directions)

Weld Strength in the Y direction (perpendicular to the weld)

✓ Edit Classification

ID1TitleSN Curve

AliasSNCurve

DescriptionX - parallel to the weld, Y - perpendicular to the weld

Element(s) Classification

SN TypeB1Apply

DirectionXApply

Selection	Classification
Full Model	B1
All Entities	C2 (XY)
All welds	C1 (X)
All welds	E (XY)
All welds	D (Y)
Butt Welds	C2 (XY)
All welds intersections	D (X)

4.

4. Transverse splices in plates and flats.
5. Transverse splices in rolled sections or welded plate girders
6. Transverse splices in plates or flats tapered in width or in thickness where the slope is not greater than 1:4.

E

6. and 7.
6. Continuous fillet welds transmitting a shear flow, such as web to flange welds in plate girders. For continuous full penetration butt weld in shear use Category C2.
7. Fillet welded lap joint.

O: 19
C1: 1

B1

40

Weld Strength in the XY direction (shear)

✓ Edit Classification

ID1TitleSN Curve

AliasSNCurve

DescriptionX - parallel to the weld, Y - perpendicular to the weld

Element(s) Classification

SN TypeB1Apply

DirectionXApply

Selection	Classification
Full Model	B1
All Entities	C2 (XY)
All welds	C1 (X)
All welds	E (XY)
All welds	D (Y)
Butt Welds	C2 (XY)
All welds intersections	D (X)

O: 19
C1: 1

C2

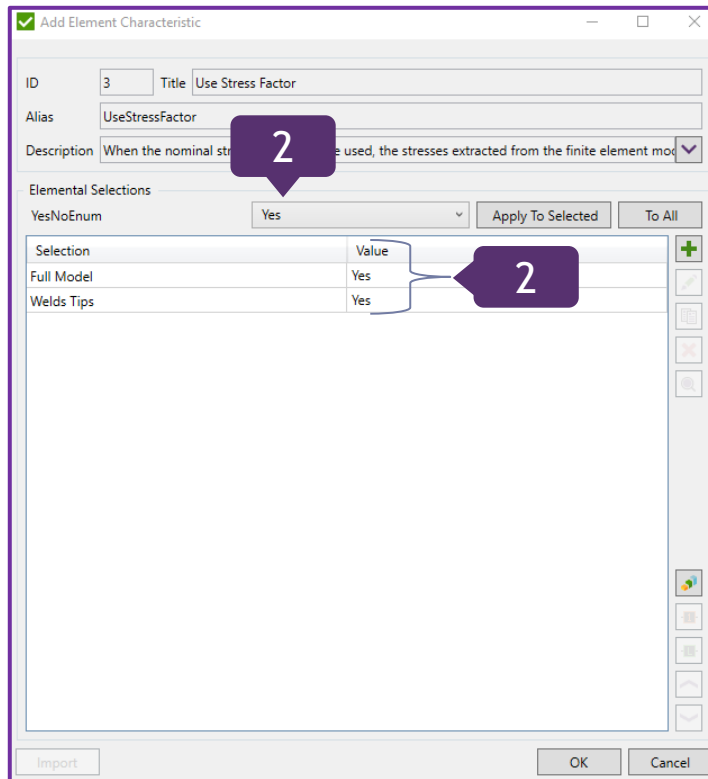
Define Use Stress Factor 1.12 for method B (4.8)

1 Press  in *Use Stress Factor 1.12 for method B (4.8)*

2 YesNoEnum => Full Model: Yes;
Welds Tips: Yes

3 Press OK

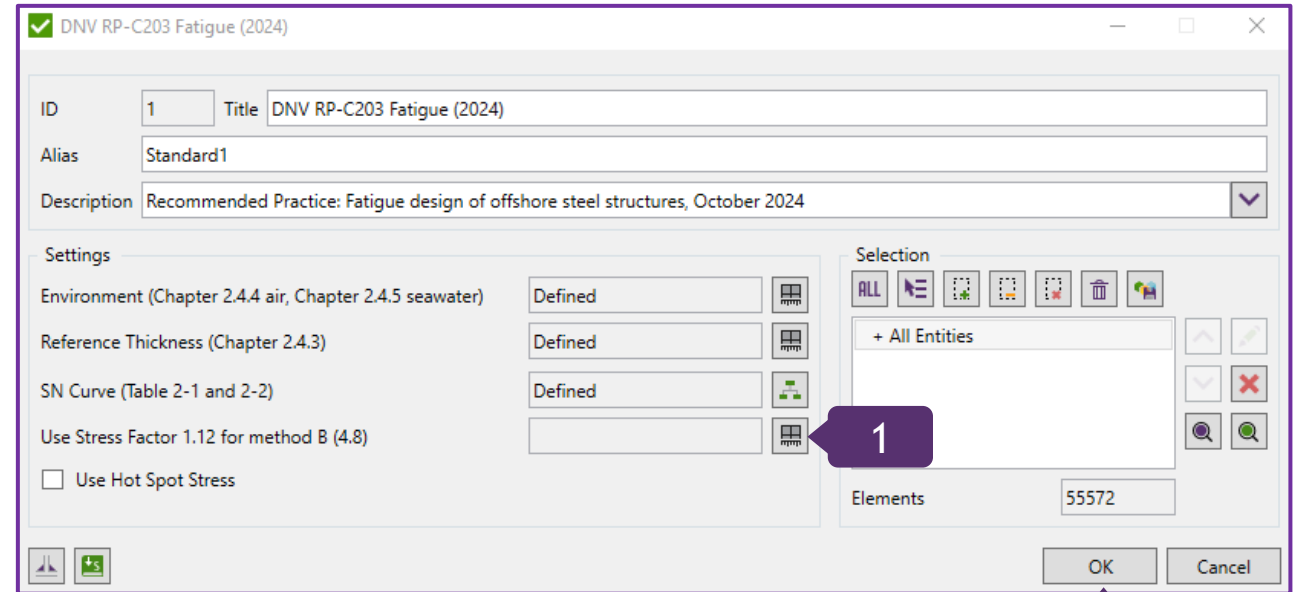
4 Press OK



Selection	Value
Full Model	Yes
Welds Tips	Yes

The Standard was added

- Standards (1)
 - 1..DNV RP-C203 Fatigue (2024)
 - Input
 - Checks (1)
 - 1..Fatigue



Method B

For modelling with shell elements without any weld included in the model the hot spot stress is taken as the stress at the read out point 0.5t away from the intersection line.

For modelling with three-dimensional elements with the weld included in the model the hot spot stress is taken as the stress at the read out point 0.5t away from the weld toe.

The effective hot spot stress range is derived as

$$\Delta\sigma_{eff} = \max \begin{cases} 1.12\sqrt{\Delta\sigma_1^2 + 0.81\Delta\tau_{II}^2} \\ 1.12\alpha|\Delta\sigma_1| \\ 1.12\alpha|\Delta\sigma_2| \end{cases} \quad (4.3.4)$$

Create Extreme Table

1 Execute right click on 1..Fatigue and select *Table (expand/extreme)*

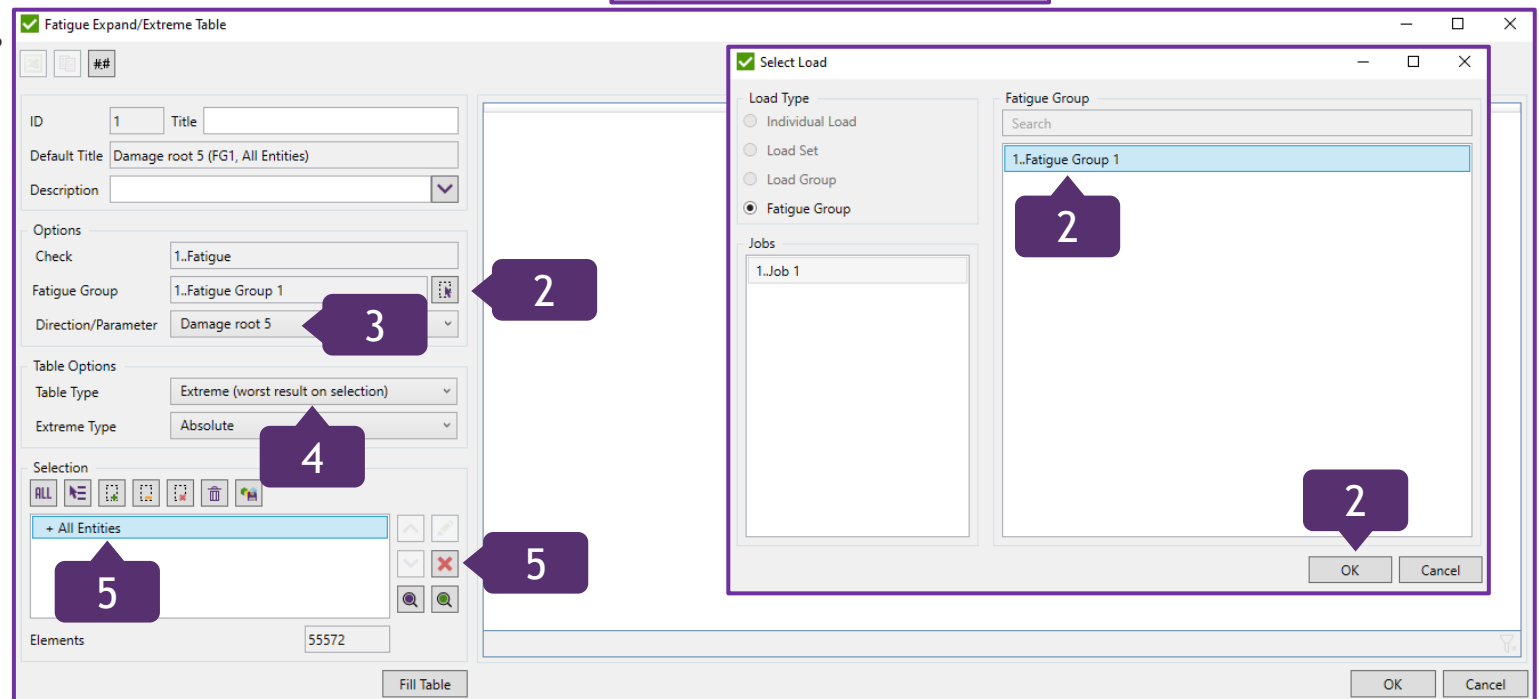
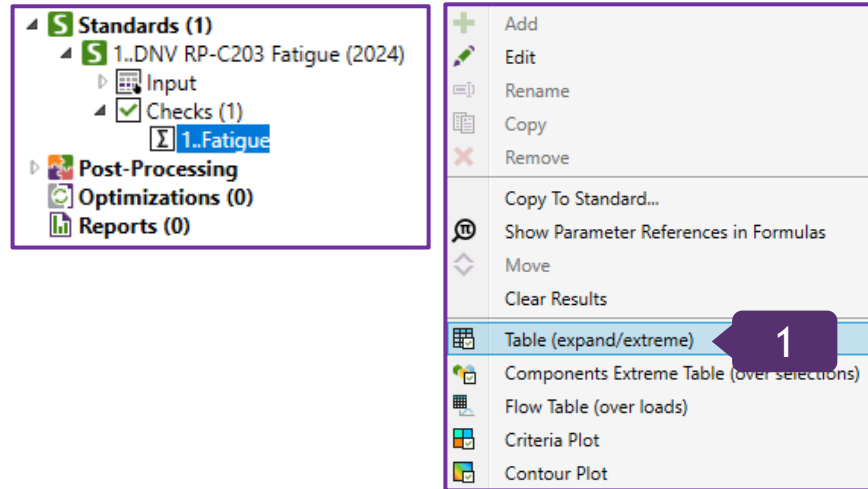
2 Load Group: *Fatigue Group* and press *OK*

Fatigue check supports only Load Groups. If only one load group exist in the project it will be selected automatically.

3 Direction/Parameter: *Fatigue Damage*

4 Table Type: *Extreme (worst results on selection)*

5 Select *+All Entities* and press  to remove them



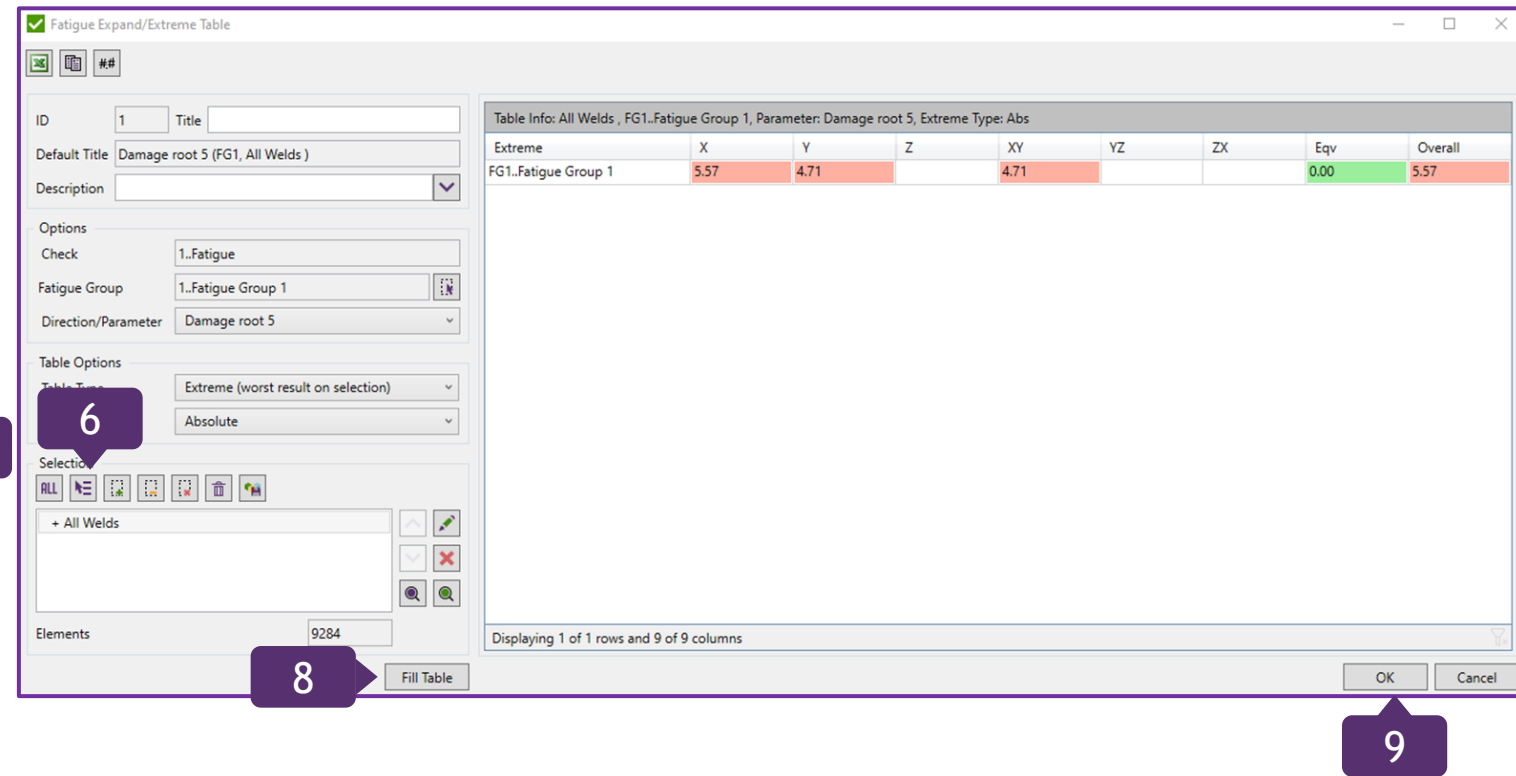
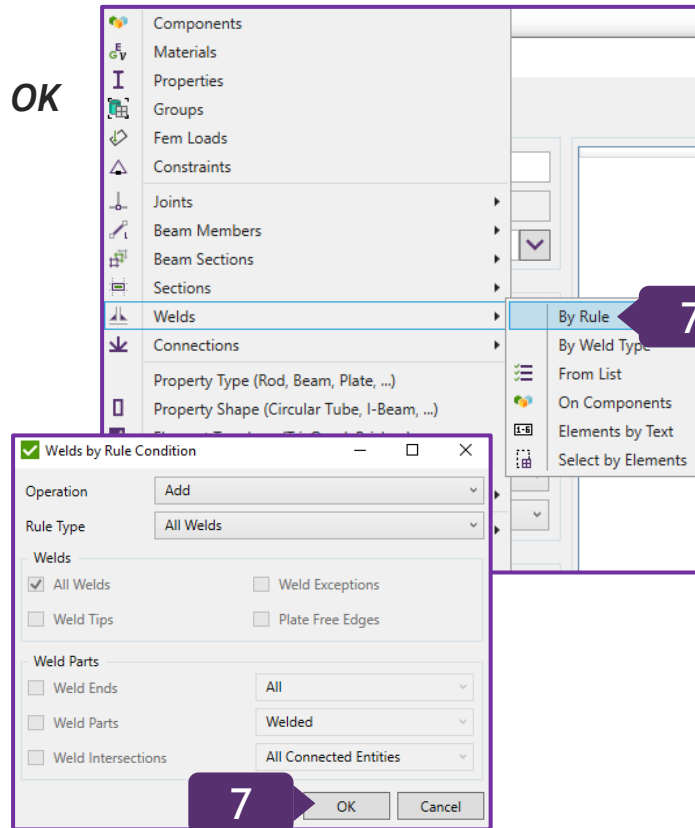
Create Extreme Table (Continuation)

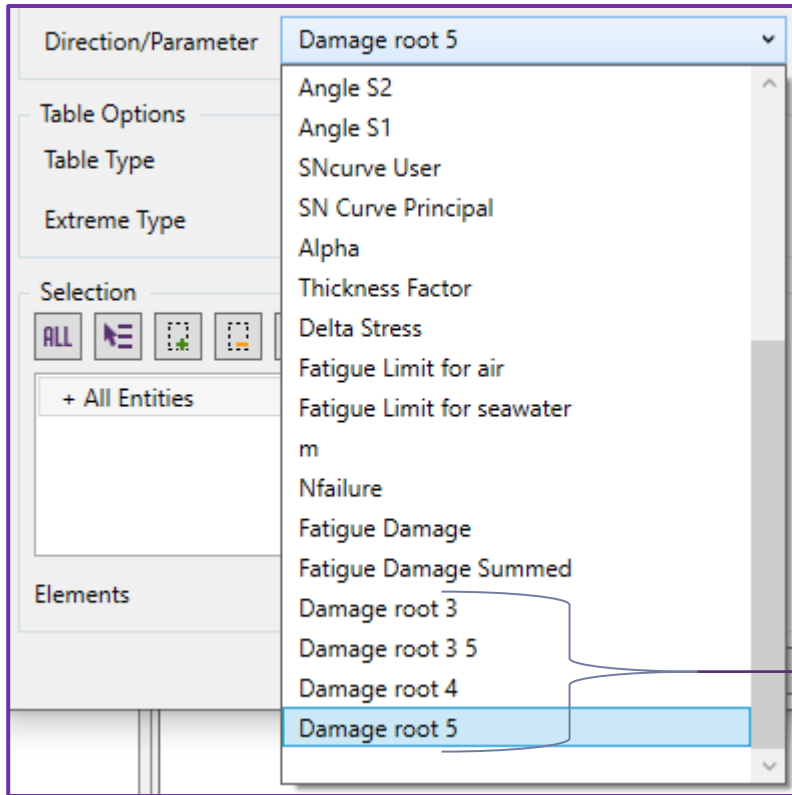
6 In *Selection*, press 

7 Select *Welds* => *By Rule* and press *OK*

8 Press *Fill Table*

9 Press *OK*





```
Parameter = m (m)
Description: Slope from figure 2-8 in air, figure 2-9 in seawater
All: if(Delta_stress.Overall > if(Environment = EnvironmentType.Air, FL10, FL1), SNTTable(SNcurvePrincipal, m1column), SNTTable(SNcurvePrincipal, m2column))

Parameter = Nfailure (Nfailure)
Description: Amount of cycles to failure
All: switch(Environment, EnvironmentType.Air, 10M / pow(Delta_stress.Overall / FL10, m), EnvironmentType.SeawaterWithCathodicProtection, 1M / pow(Delta_stress.Overall / FL1, m))

Parameter = Fd (Fatigue Damage)
All: ItemNumberOfCycles / Nfailure

Summation = FdSummed (Fatigue Damage Summed)
All: Fd
Equivalent: Max(me.x, me.y, me.xy)
Overall: Max(me.x, me.y, me.xy)

Fatigue Group Parameter = Fd root 3 (Damage root 3)
Description: This parameter is used to estimate stress overshoots for m = 3
All: root(Fdsummed, 3)
Eqv: 0
Overall: AbsMax(me.x, me.y, me.z, me.xy, me.yz, me.zx)

Fatigue Group Parameter = Fd root 4 (Damage root 4)
Description: This parameter is used to estimate stress overshoots for m = 4
All: root(Fdsummed, 4)
Eqv: 0
Overall: AbsMax(me.x, me.y, me.z, me.xy, me.yz, me.zx)

Fatigue Group Parameter = Fd root 5 (Damage root 5)
Description: This parameter is used to estimate stress overshoots for m = 5
All: root(Fdsummed, 5)
Eqv: 0
Overall: AbsMax(me.x, me.y, me.z, me.xy, me.yz, me.zx)
```

When calculating Fatigue Damage (and later Fatigue Damage Summed), the formulas according to Standards usually include raising the power of “m” (the slope of the SN Curve).

Damage root X parameters allow engineers to check for more practical results (how much it is required to lower the stresses in order to obtain acceptable results.)

Create Criteria Plot for All Welds

1 Execute right click on 1..Fatigue and select Criteria Plot

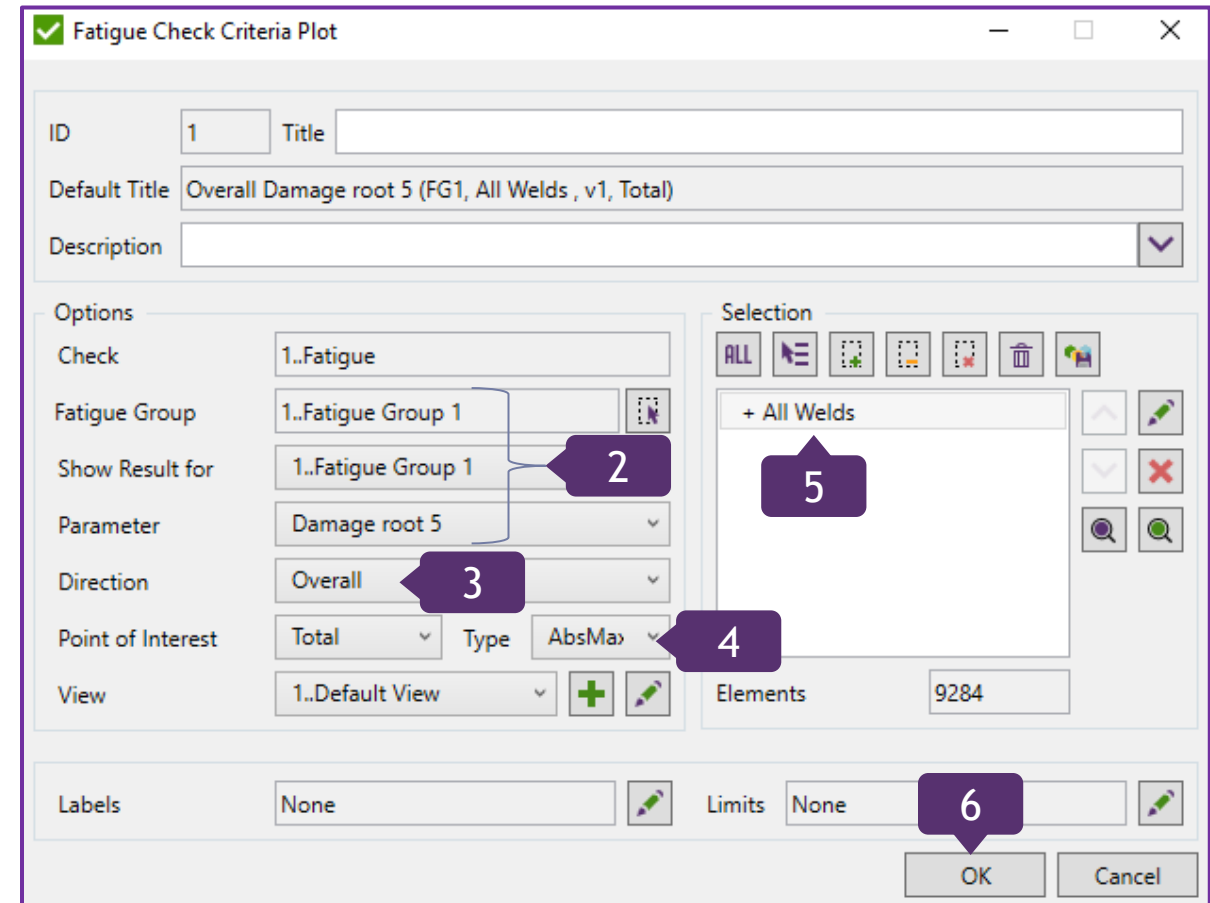
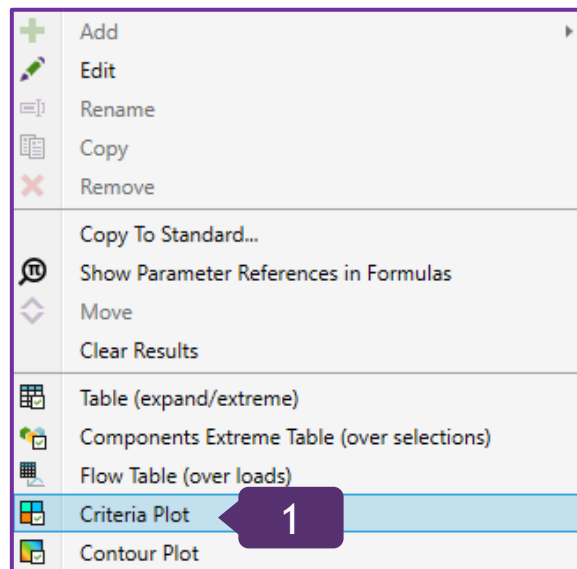
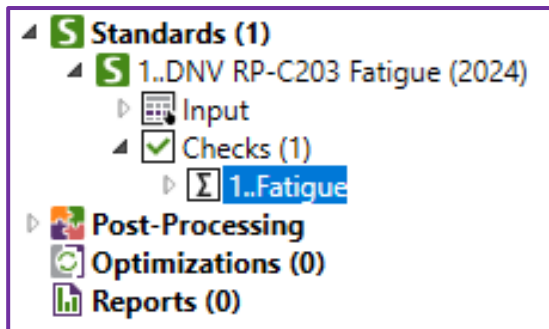
2 Load Group and Show Results for:
1..Fatigue Group 1;
Parameter: *Damage root 5*

3 Direction: *Overall*

4 Point of interest: Total; Type: *AbsMax*

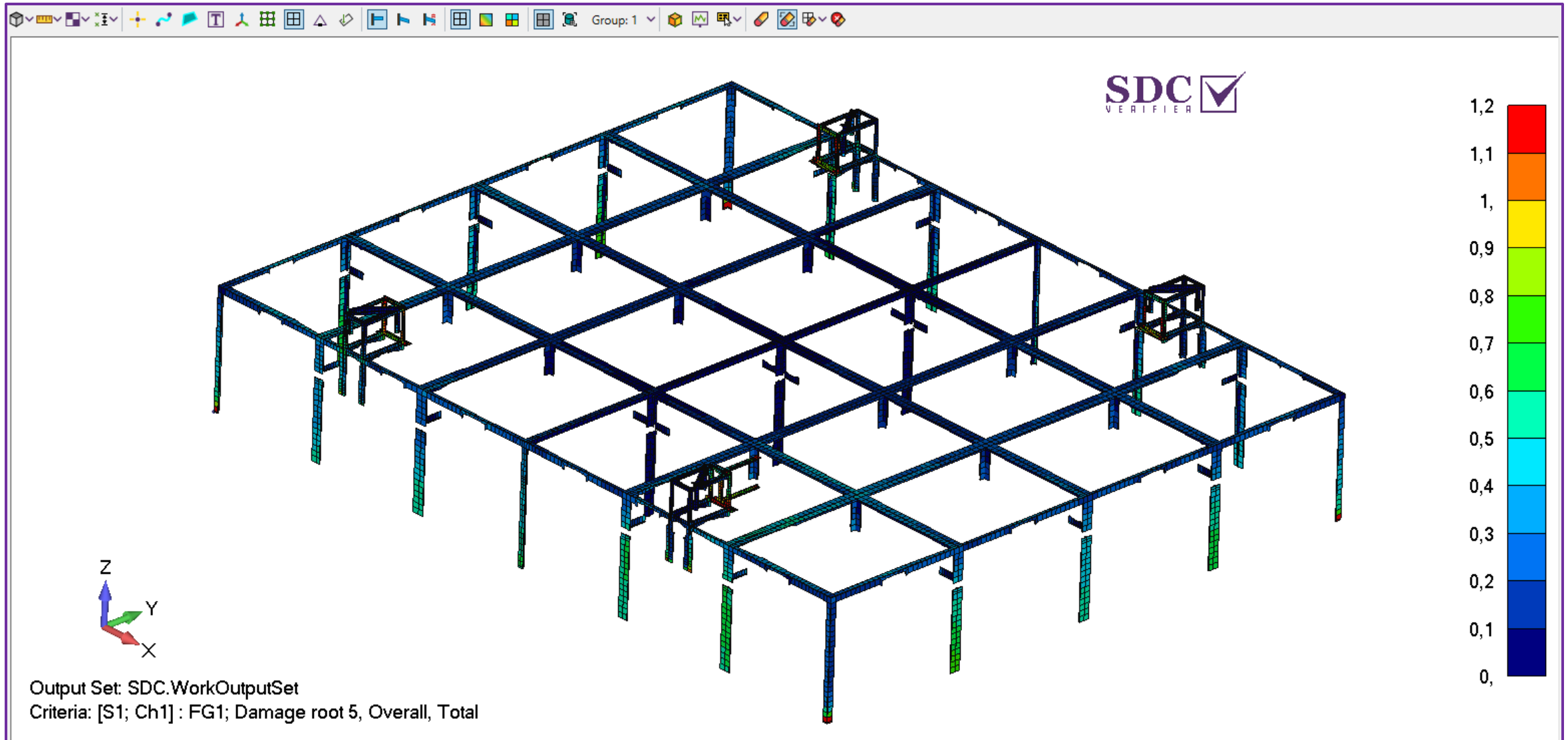
5 Selection: + *All Welds*

6 Press *OK*




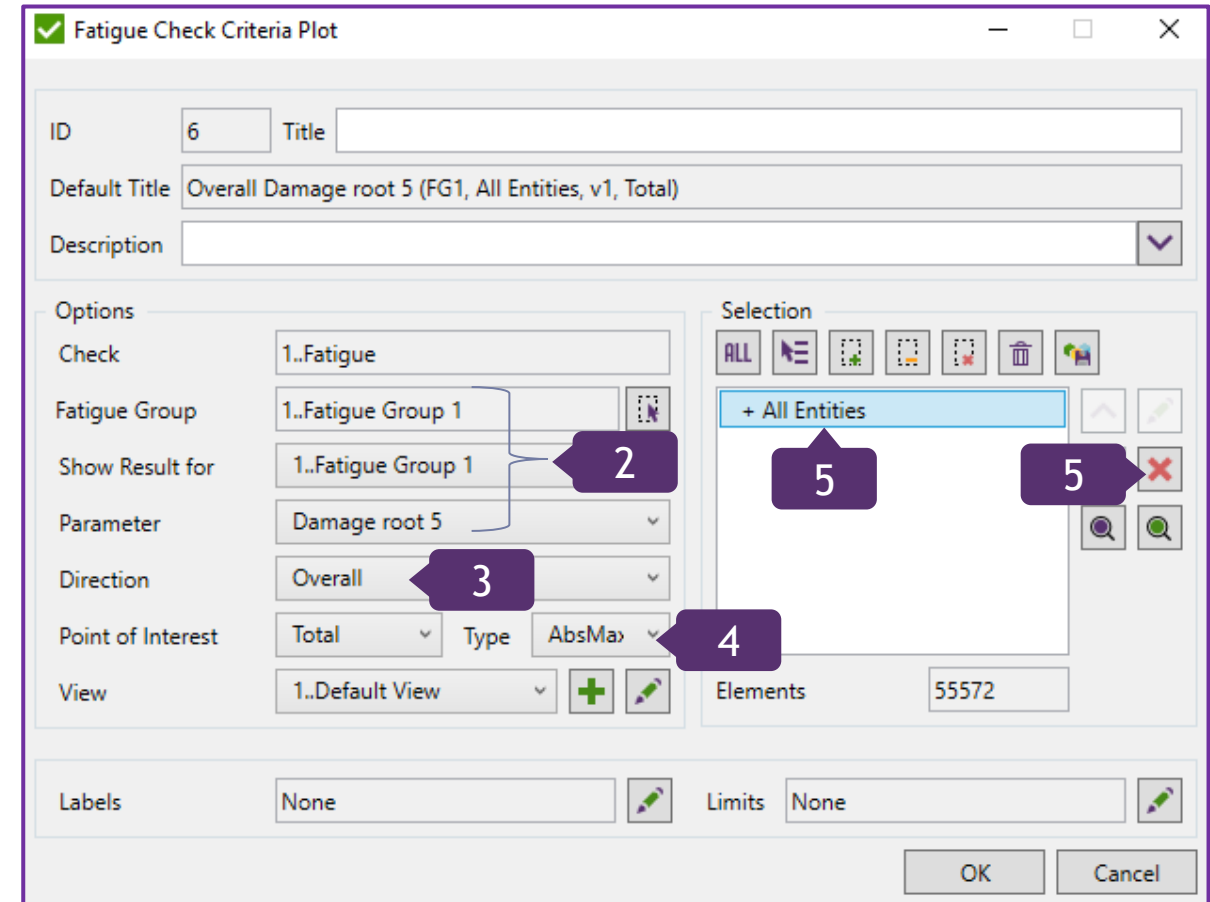
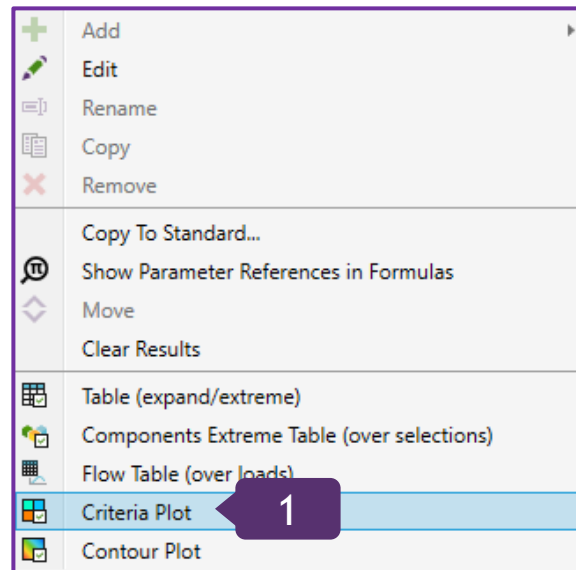
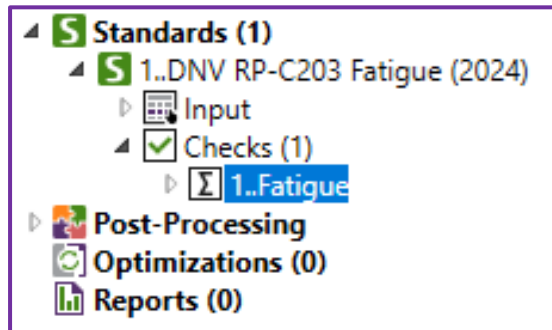
Point of interest = AbsMax Total is an absolute maximum of utilization factors among all point of interest.

Criteria Plot Results for All Welds



Create Criteria Plot for Property Shape (Plate)

- 1 Execute right click on 1..Fatigue and select Criteria Plot
- 2 Load Group and Show Results for: 1..Fatigue Group 1; Parameter: *Damage root 5*
- 3 Direction: *Overall*
- 4 Point of interest: Total; Type: *AbsMax*
- 5 Select *+All Entities* and press  to remove them



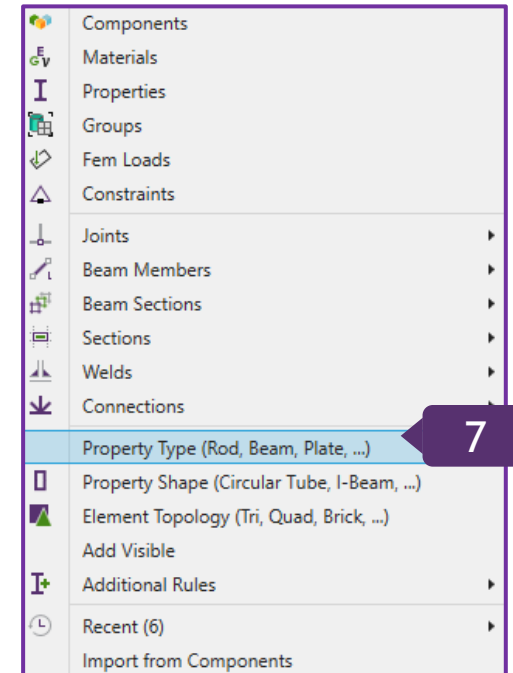
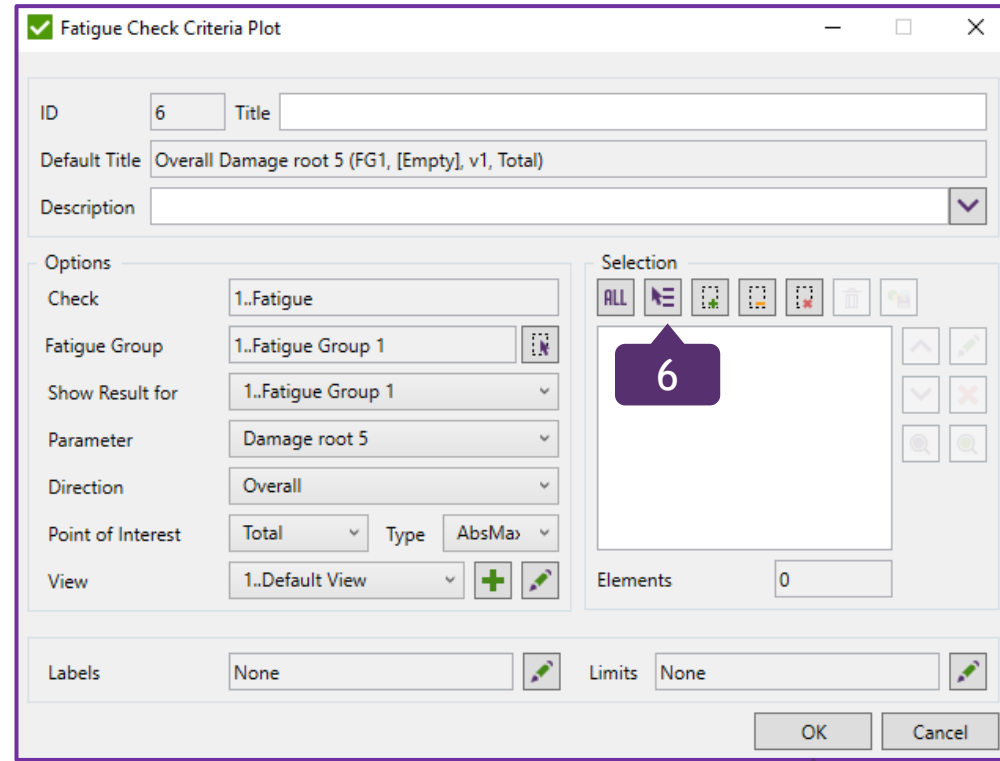
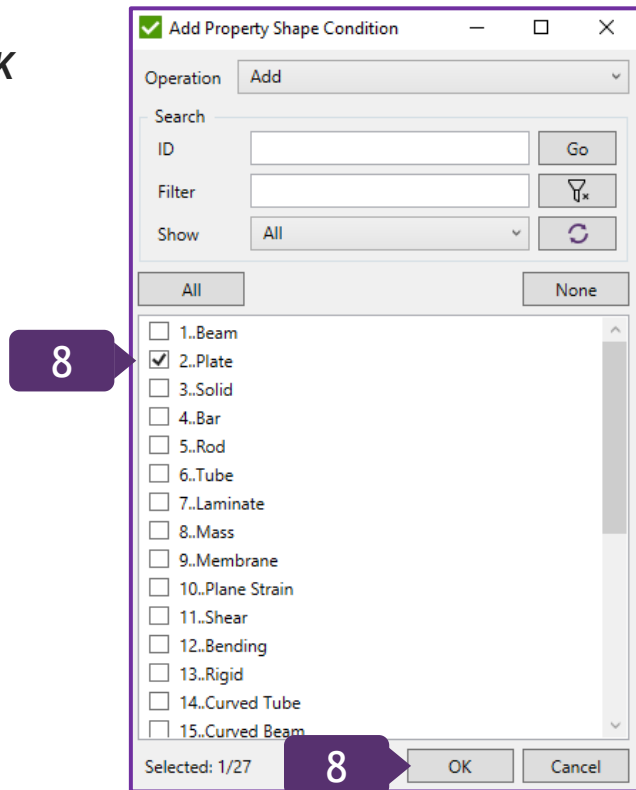
Create Criteria Plot for Property Shape (Plate) (Continuation)

6 In Selection, press 

7 Select *Property Type (Rod, Beam, Plate,...)*

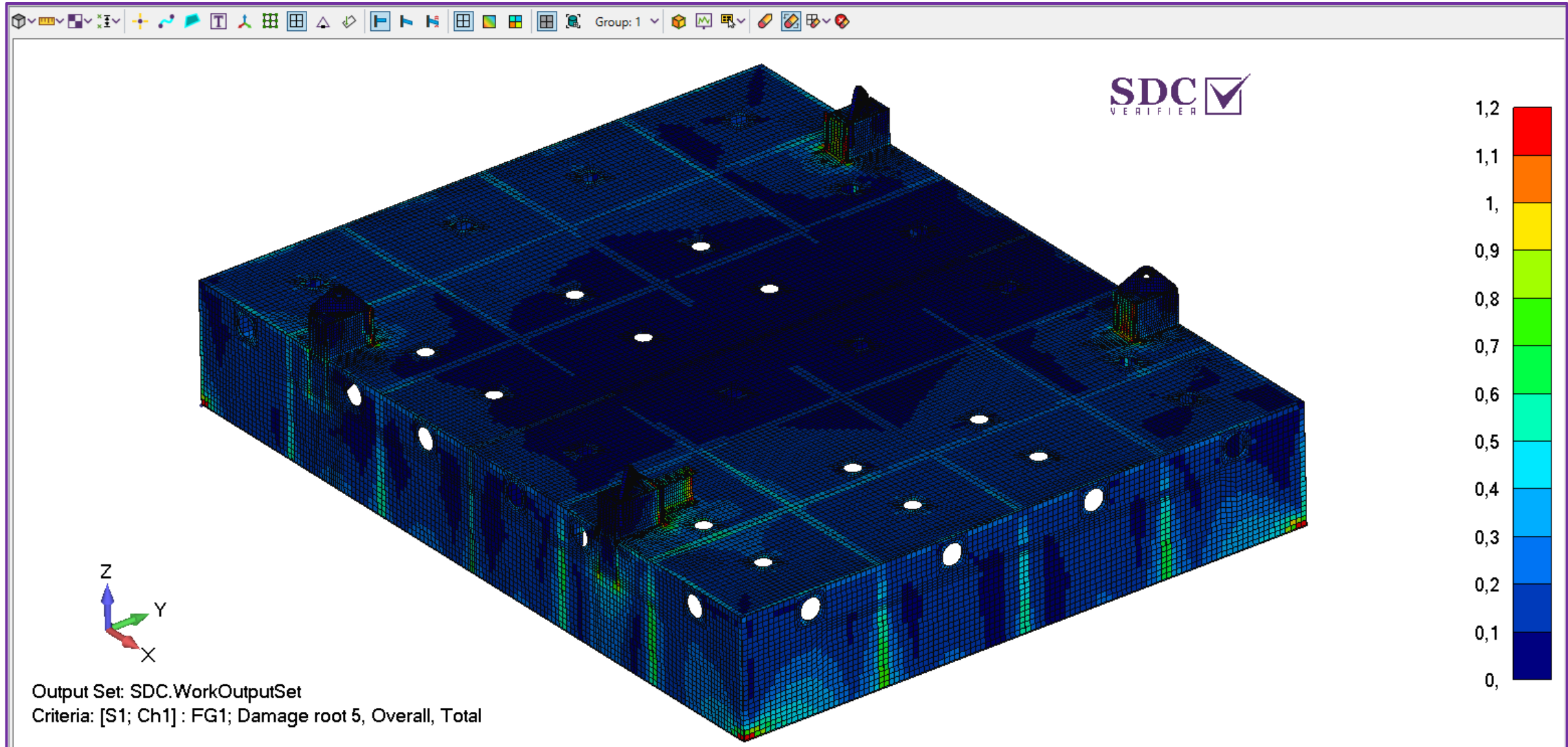
8 Select 2..Plate and press OK

9 Press OK



Criteria Plot type shows that each element is coloured, based on a single output value for the element.

Criteria Plot Results for Property Shape (Plate)



To learn how to obtain reports, please check a separate Tutorial that depicts the functionality of SDC Verifier Report Designer. It may be downloaded via this link:

<https://sdcverifier.com/tutorials/report-designer/>