



Tutorial

DVS1608 and 1612 Fatigue Check

Updated on: April 7th, 2025

Tested with: SDC Verifier for Simcenter 3D 2025 R1

Simcenter3D 2306

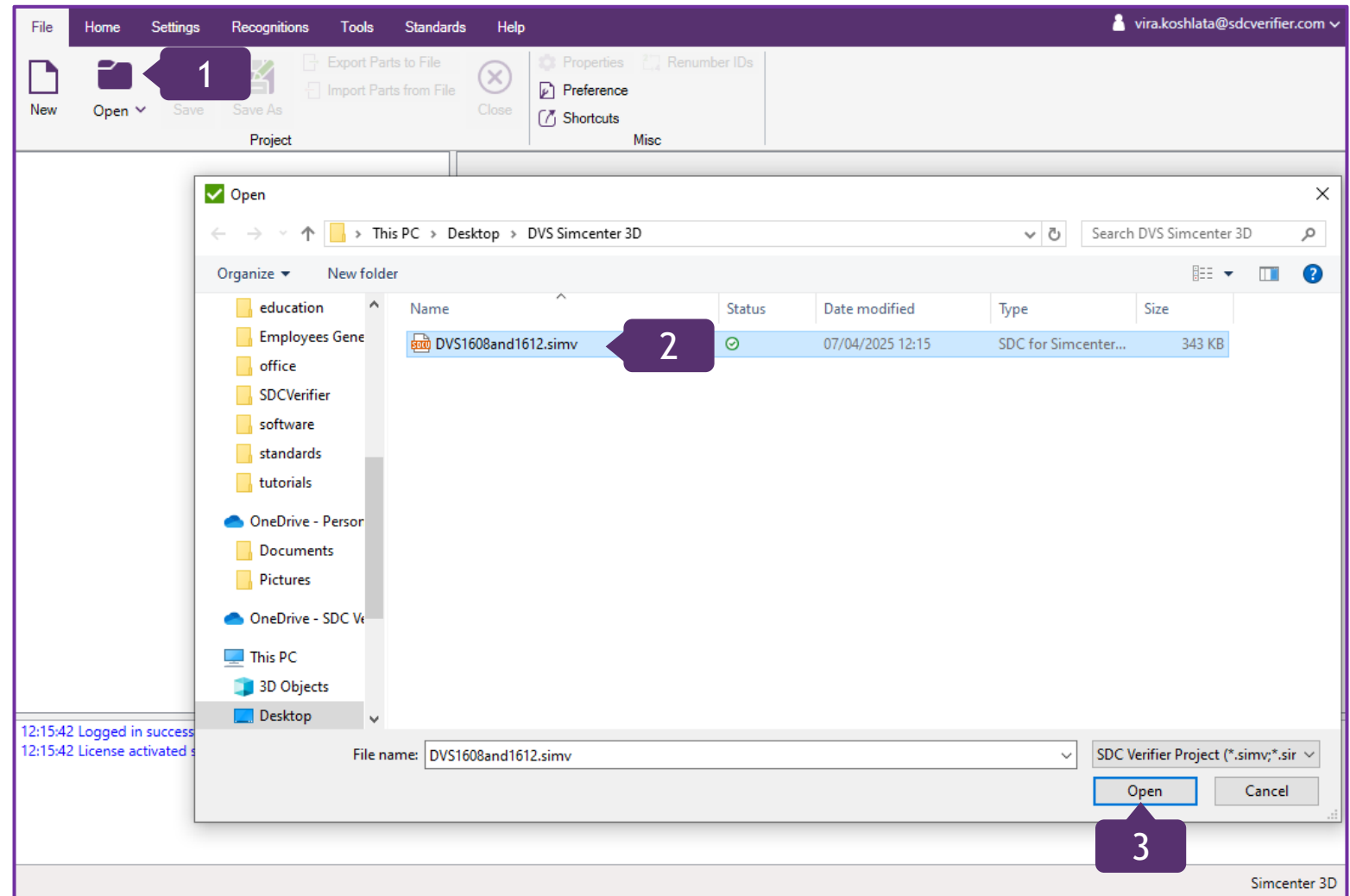
- ▶ This step-by-step tutorial demonstrates how to implement the check according DVS 1608 and DVS 1612 in SDC Verifier.
- ▶ DVS 1608 and DVS 1612 detailed review;
- ▶ Weld Finder Tool overview;
- ▶ Static tables and plots;

Open the Starter Model

1 Launch SDC Verifier for Simcenter 3D
Press *Open*


2 Open project *DVS1608and1612.simv*

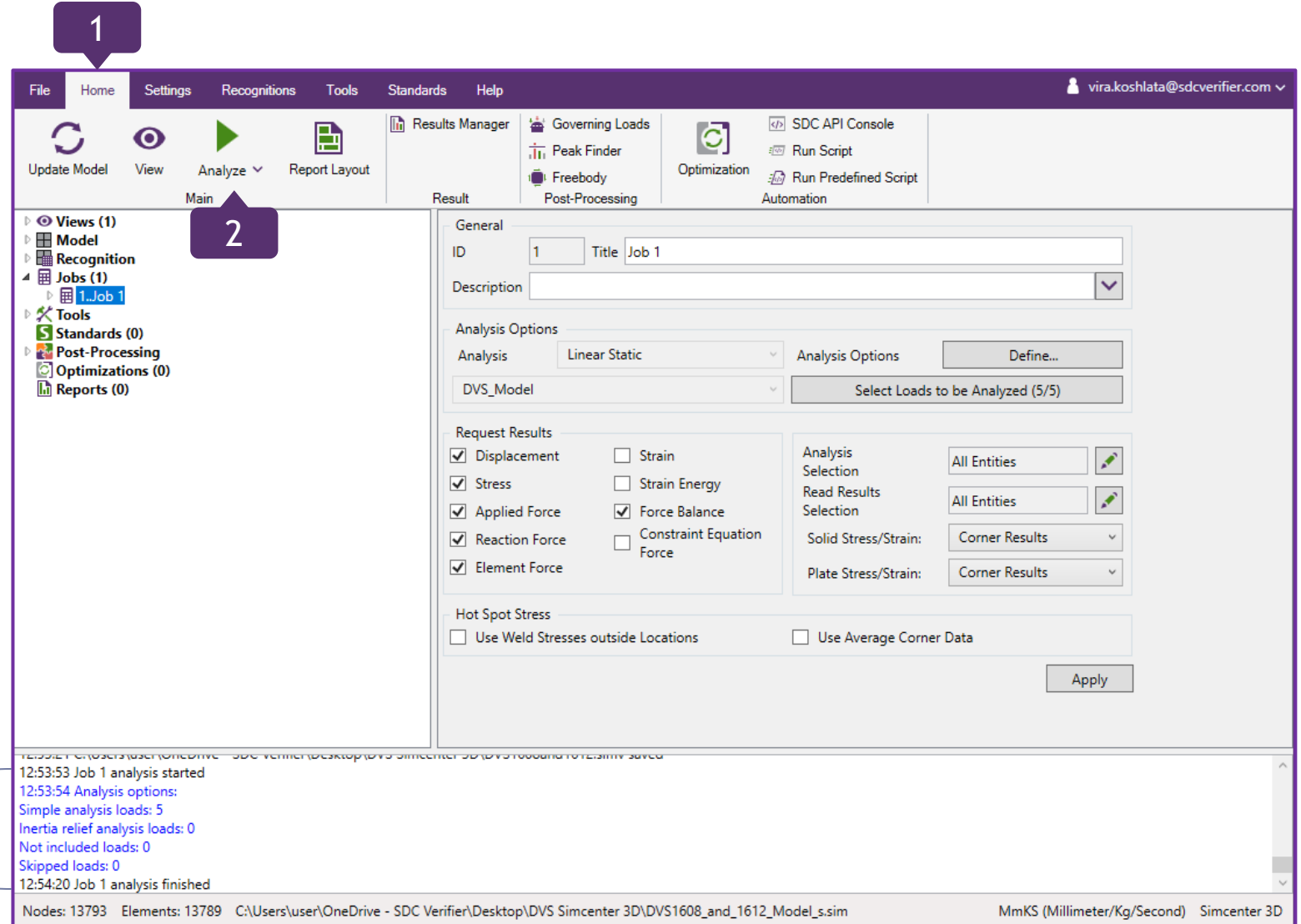
3 Press *Open*



Analyze Job

1 Go to *Home* section on the Ribbon

2 Press  on the toolbar to analyze job



The screenshot shows the SDC Verifier software interface. The **Home** ribbon is selected, and the **Analyze** button (a green play icon) is highlighted with a callout '2'. The left sidebar shows a tree view with 'Jobs (1)' expanded, showing '1.Job 1'. The main panel displays the 'General' and 'Analysis Options' tabs for 'Job 1'. The 'Analysis Options' section shows 'Linear Static' selected for 'Analysis' and 'DVS_Model' for 'DVS_Model'. The 'Request Results' section has checkboxes for 'Displacement', 'Stress', 'Applied Force', 'Reaction Force', 'Element Force', 'Strain', 'Strain Energy', 'Force Balance', and 'Constraint Equation Force'. The 'Hot Spot Stress' section has checkboxes for 'Use Weld Stresses outside Locations' and 'Use Average Corner Data'. The 'Apply' button is at the bottom right. The status bar at the bottom shows 'Nodes: 13793 Elements: 13789' and the file path 'C:\Users\user\OneDrive - SDC Verifier\Desktop\DVS Simcenter 3D\DVS1608_and_1612_Model.s.sim'. A log window at the bottom left shows the analysis progress: '12:53:53 Job 1 analysis started', '12:53:54 Analysis options:', 'Simple analysis loads: 5', 'Inertia relief analysis loads: 0', 'Not included loads: 0', 'Skipped loads: 0', and '12:54:20 Job 1 analysis finished'.

Job 1 analysis started and
Job 1 analysis finished


Nodes: 13793 Elements: 13789 C:\Users\user\OneDrive - SDC Verifier\Desktop\DVS Simcenter 3D\DVS1608_and_1612_Model.s.sim MmKS (Millimeter/Kg/Second) Simcenter 3D

Load Groups. Strength Check

1

Select Load Groups in 1..Job 1 in the model tree

2

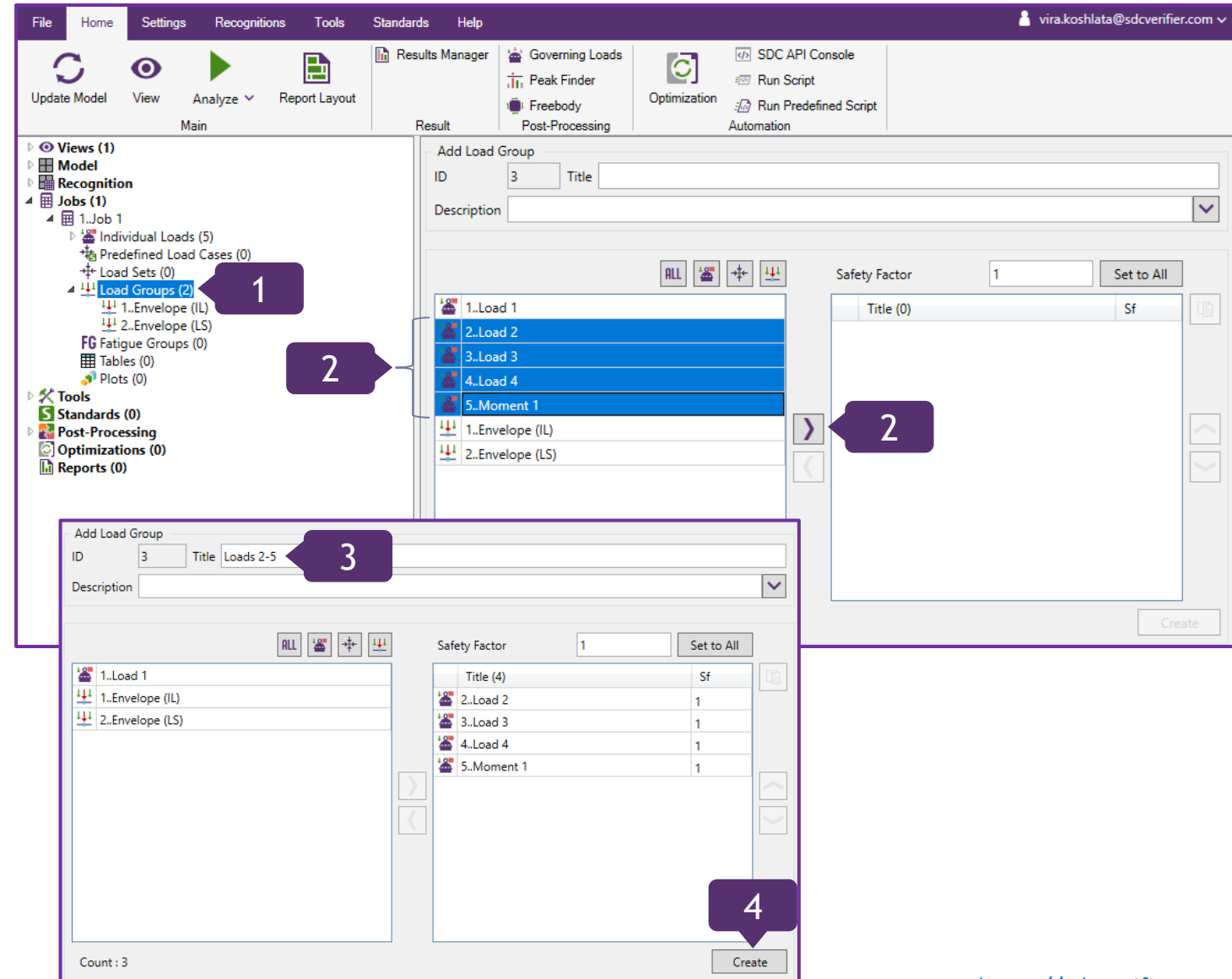
Select individual loads from 2 till 5 and press 

3

Title: *Loads 2-5*

4

Press *Create*



The screenshot shows the SDC Verifier software interface. The 'Add Load Group' dialog is open, showing the following details:

- ID: 3
- Title: Loads 2-5
- Description: (empty)
- Safety Factor: 1
- Set to All: (button)

The 'Safety Factor' table is displayed with the following data:

Title (4)	Sf
2..Load 2	1
3..Load 3	1
4..Load 4	1
5..Moment 1	1

The 'Count : 3' is shown at the bottom left of the dialog. The 'Create' button is at the bottom right.

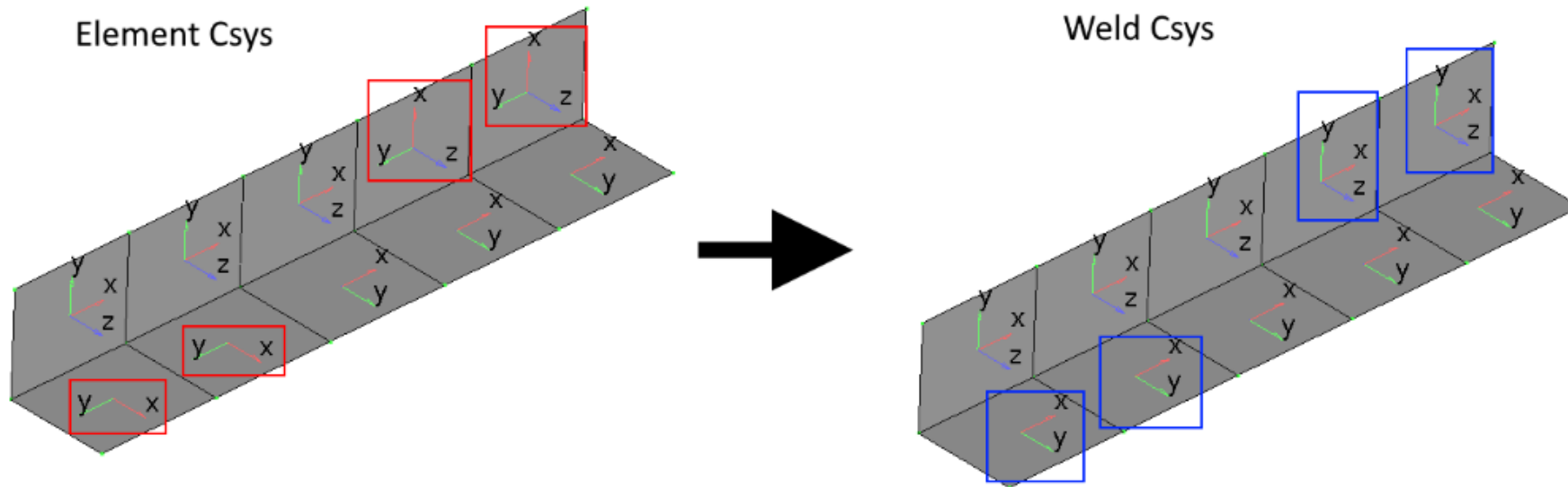
$$\sigma_{nn} = \frac{(\sigma_{xx} + \sigma_{yy})}{2} + \frac{(\sigma_{xx} - \sigma_{yy})}{2} * \cos 2\theta + \tau_{xy} * \sin 2\theta$$
$$\tau_{nt} = -\frac{(\sigma_{xx} - \sigma_{yy})}{2} * \sin 2\theta + \tau_{xy} * \cos 2\theta$$
$$\sigma_{tt} = \frac{(\sigma_{xx} + \sigma_{yy})}{2} - \frac{(\sigma_{xx} - \sigma_{yy})}{2} * \cos 2\theta - \tau_{xy} * \sin 2\theta$$

Stresses for Weld elements are automatically transformed in the direction of the corresponding Weld from Weld Finder Tool, using the wedge method. Stresses are transformed for plate and solid element types.

$\sigma_{xx}, \sigma_{yy}, \tau_{xy}$ – original x,y and shear stress in local element x,y and shear directions

$\sigma_{tt}, \sigma_{nn}, \tau_{nt}$ – transformed x,y and shear stress in weld x,y and shear directions

θ – angle between the element and weld x directions.

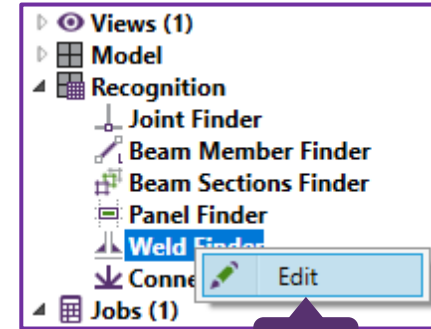


1

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

2

In the Welds Finder window, press *Find*



1

Welds Finder

Welds Weld Strength Settings Hot Spot Stress

Filter None = Apply Filter Find Weld by ID Navigate

ID	Title	Tensile Strength (Min) [kPa]	Yield Stress (Min) [kPa]	Is Symmetric	Is Curved	Nodes	Elements	Weld Parts
1	Weld 1 [8.21; 39.82; 43.65]	460000000	250000000	Yes	No	42	123	3
2	Weld 2 [29.32; 12.5; 43.65]	460000000	250000000	Yes	No	14	39	3
3	Weld 3 [68.21; 39.82; 43.65]	460000000	250000000	Yes	No	42	123	3
4	Weld 4 [68.21; 39.82; 12.4]	460000000	250000000	Yes	No	42	123	3
5	Weld 5 [8.21; 39.82; 12.4]	460000000	250000000	Yes	No	42	123	3
6	Weld 6 [29.32; 12.5; 12.4]	460000000	250000000	Yes	No	14	39	3
7	Weld 7 [29.32; 0; 51.15]	460000000	250000000	Yes	No	9	24	3
8	Weld 8 [29.32; 0; 4.9]	460000000	250000000	Yes	No	9	24	3
9	Weld 9 [17.11; 120; 32.79]	460000000	250000000	Yes	No	15	28	2
10	Weld 10 [17.11; 110; 45.97]	460000000	250000000	Yes	No	11	20	2
11	Weld 11 [17.11; 110; 19.61]	460000000	250000000	Yes	No	11	20	2
12	Weld 12 [17.11; 100; 32.79]	460000000	250000000	Yes	No	15	42	3
13	Weld 13 [36.3; 80; 6.79]	460000000	250000000	Yes	No	41	80	2
14	Weld 14 [36.78; 80; 56.46]	460000000	250000000	Yes	No	41	80	2
15	Weld 15 [-3.45; 80; 31.63]	460000000	250000000	Yes	No	27	52	2
16	Weld 16 [-3.45; 100; 31.63]	460000000	250000000	Yes	No	27	52	2
17	Weld 17 [-3.45; 90; 56.46]	460000000	250000000	Yes	No	11	20	2
18	Weld 18 [-3.45; 90; 6.79]	460000000	250000000	Yes	No	11	20	2
19	Weld 19 [36.94; 100; 56.46]	460000000	250000000	Yes	No	41	80	2
20	Weld 20 [77.2; 90; 56.46]	460000000	250000000	Yes	No	11	20	2
21	Weld 21 [77.2; 100; 31.63]	460000000	250000000	Yes	No	27	52	2
22	Weld 22 [77.2; 90; 6.79]	460000000	250000000	Yes	No	11	20	2
23	Weld 23 [77.2; 80; 31.63]	460000000	250000000	Yes	No	27	52	2
24	Weld 24 [36.94; 100; 6.79]	460000000	250000000	Yes	No	41	80	2
25	Weld 25 [38.96; 100; 19.61]	460000000	250000000	Yes	No	23	66	3
26	Weld 26 [38.96; 100; 45.97]	460000000	250000000	Yes	No	23	66	3
27	Weld 27 [60.82; 100; 32.79]	460000000	250000000	Yes	No	15	42	3
28	Weld 28 [60.82; 100; 32.79]	460000000	250000000	Yes	No	15	28	2
29	Weld 29 [60.82; 100; 32.79]	460000000	250000000	Yes	No	11	20	2

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

Weld Finder Plotting Functions

1

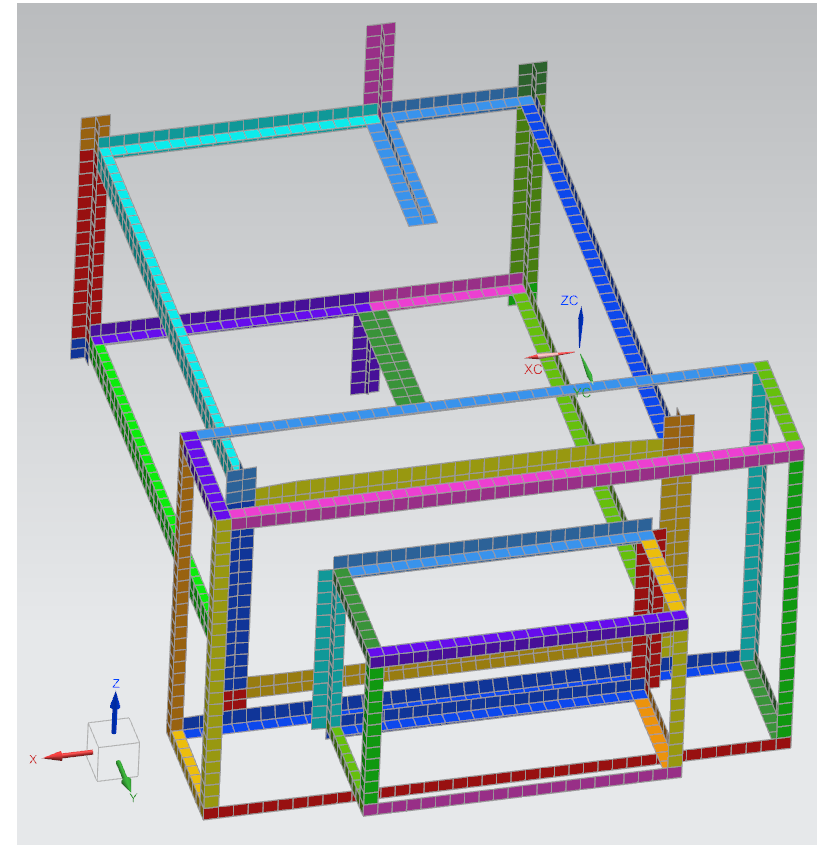
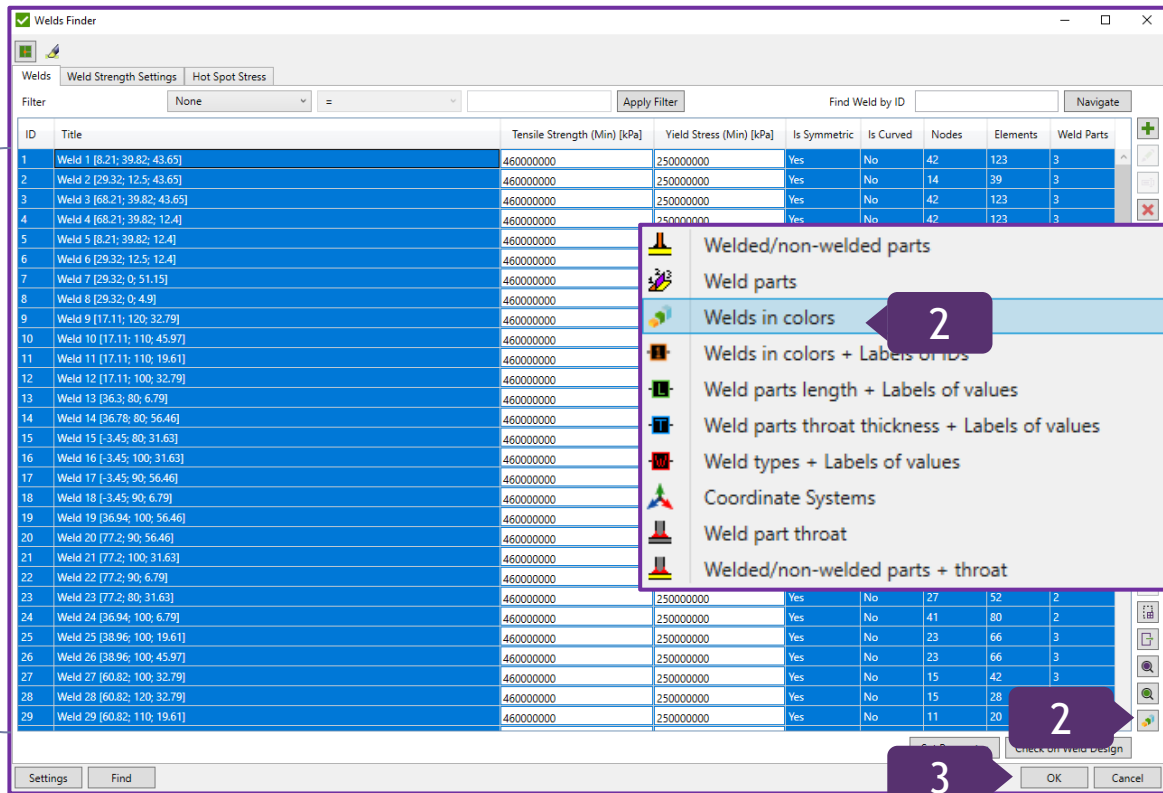
To plot all welds, in Welds Finder select them by combining Ctrl + A

2

Press  and select *Welds in colors*

3

Press OK



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

Add DVS 1608 and 1612 Standard

1

Execute right click on Standards and select *Add* => *DVS 1608 and 1612*

2

Stress Concept: *Nominal*

Nominal Stress Concept

The boosting circuit caused by the component- and welding seam shape is being taken into account with notch type dependent fatigue strength values. In appendix C the typical welded connections are compiled. The assigned fatigue strength values are compiled in the Haigh- and MKJ- diagrams, section 7.2.2. These values apply to the sheet thickness area $1.5 \leq t \leq 10$ mm unless otherwise specified in the tables of appendix C. For the sheet thickness $10 \leq t \leq 90$ mm section 7.1.3, equation 4 should be noted.

The screenshot shows the SDC Verifier software interface. The 'Standards' menu is open, showing a list of standards including ABS, AISC, API, AIJ (2005 Edition, 2017), AS, ASME, BV NR615 Plate Buckling (2023), DIN 15018 (1984), DNV, DVS 1608 and 1612 (highlighted with a red circle and '1'), EN 13001, Eurocode3, F.E.M 1.001 (3rd, 1998), FKM, ISO, Norsok N004 (rev.3, 2013), VDI 2230 (Part 1, 2015), Comparison Standard, Deflection, Custom, and Load from Library. The 'DVS 1608 and 1612' dialog box is open, showing the 'Aluminum Fatigue (DVS 1608)' section with 'Include Aluminum Fatigue' checked and 'Stress Concept (Nominal - Chapter 7.2, Notch - Chapter 7.3)' set to 'Nominal' (highlighted with a red circle and '2'). The 'Steel Fatigue (DVS 1612)' section has 'Include Steel Fatigue' checked. The 'Selection' section shows 'All Entities' selected. The 'Safety Factors' section has 'Use Safety Factor from Standard' selected, with 'Safety Factor (5.4.2, EN12663)' set to 1.15 and 'Safety Factor (5.4.3, EN12663)' set to 1.5. The 'Materials with Yield/Tensile = 0' is set to 0. The 'OK' and 'Cancel' buttons are at the bottom.

Aluminum Fatigue (DVS 1608) and Steel Fatigue (DVS 1612) Options

The implemented Standard DVS 1608 and 1612 allows users to evaluate Fatigue strength with both aluminum and steel materials respectively. This tutorial is devoted to the steel structure, but for the demonstrative purpose, the Aluminum Fatigue steps are also described throughout the 12-22 slides. If the Aluminum Fatigue is not relatable to the user's goal, the steps may be skipped and no results will be attained. For this purpose, the user is advised to uncheck the *Include Aluminum Fatigue (DVS 1608)* section.

✓ DVS 1608 and 1612

ID: 1 Title: DVS 1608 and 1612

Alias: Standard1

Description:

Aluminum Fatigue (DVS 1608)

☒ Include Aluminum Fatigue

Stress Concept (Nominal - Chapter 7.2, Notch - Chapter 7.3): Nominal

Notch Line Type (Appendix C):

Detail Production Type (Chapter 7.2.1):

Breaking Elongation, A50 % (Chapter 7.2.1, Table 4):

Roughness Factor (Chapter 7.2.1):

Bonus Factor (Chapter 7.1.1):

Grinded Welds (Chapter 7.1.2):

Normal Stresses Phase ($f_i(\Phi)$ values between [-1.0; 1.0], Chapter 7.1.4): 1.0

Steel Fatigue (DVS 1612)

☒ Include Steel Fatigue

Material Type (Tables 4.1-4.2):

Line Slope of Notch (Annex B):

Selection

+ All Entities

Elements: 13789

Safety Factors

☐ Use Safety Factor from Load

☒ Use Safety Factor from Standard

Safety Factor (5.4.2, EN12663): 1.15

Safety Factor (5.4.3, EN12663): 1.5

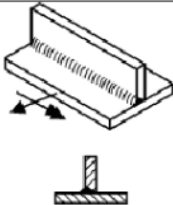
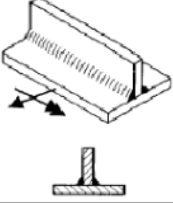
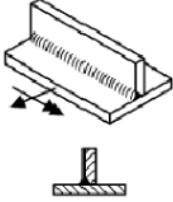
☐ Use Hot Spot Stress

Materials with Yield/Tensile = 0: 0

OK Cancel

Perpendicular the welds (Y-direction)

Table C-1.4. Continuation.

No	Weld formation				Test method and amount of inspection	Weld seam grade according to DIN EN 15085-3	Keeling Curve	m a _{zul} (R = -1)	Inclination exponent of the S-N curve	Notes
	Image	Specification	Type of weld	Weld no according to DIN EN 15085-3						
1.4.4		One-sided welded	Bevel butt joint, Bevel butt joint with fitted fillet weld, Bevel butt joint with backing technique	10a ¹⁾ 10c ¹⁾ 10e ¹⁾	100% zFP-V	CP A	E5	20	3.4	Most stressed area (toe-crack) at seam transition and seam root respectively
1.4.5					10% zFP-V	CP B CP C1	E5-	19.2		
1.4.6					Visual Inspection	CP C2	E6+	18.7		
1.4.7		Two-sided not penetrated	Double-bevel butt joint with broad root face, Double-bevel butt joint with broad root face with fillet weld as backing run, Double fillet weld	9, 11b, 13b	10% zFP-O	CP B CP C1	E5+	20.8	4.3	Most stressed area (toe-crack) at seam transition
1.4.8					Visual Inspection	CP C2	E5	20		
1.4.9					Visual Inspection	CP C2	E6	18		
		One-sided not penetrated	Double-bevel butt joint with broad root face, Double-bevel butt joint with broad root face with fitted fillet weld	11a 11c	Visual Inspection	CP C2	E6	18	3.4	

¹⁾ Bevel butt joint without backing run with secure root fusion, supported by designed production and test procedure measures (To prove by working samples; cf DIN EN 15085)

The fatigue strengths of shear stresses apply to :

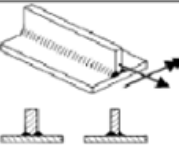
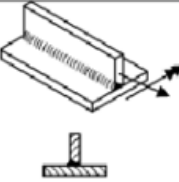
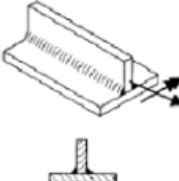
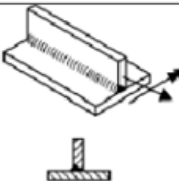
- Line G for through- welded connections,
- Line H for non- through welded connections or fillet welds.

Shear (XY-direction)

Longitude Stressed Single-T Joint Connection

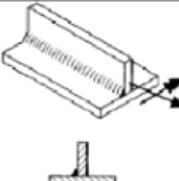
Along the welds (X-direction)

Table C-1.3. Longitude stressed single-T joint connection.

No	Weld formation				Test method and amount of inspection	Weld seam grade according to DIN EN 15085-3	Keeling Curve	r a,zul (R = -1)	Inclination exponent of the S-N curve	Notes
	Image	Specification	Type of weld	Weld no according to DIN EN 15085-3						
1.3.1		Two-sided welded with backing run	Double-bevel butt joint Bevel butt joint with fillet weld as backing run Bevel butt joint with backing run	7, 10b, 10d	100% zFP-V	CP A	C+	33.3	4.3	
1.3.2					10% zFP-V	CP B CP C1	C	32		
1.3.3					Visual Inspection	CP C2	C-	30.7		
1.3.4		One-sided welded	Bevel butt joint Bevel butt joint with fitted fillet weld Bevel butt joint with backing technique	10a ¹⁾ 10c ¹⁾ 10e ¹⁾	100% zFP-V	CP A	C	32	4.3	
1.3.5					10% zFP-V	CP B CP C1	D	29		
1.3.6					Visual Inspection	CP C2	E1	26		
1.3.7		Two-sided not penetrated	Double-bevel butt joint with broad root face Double-bevel butt joint with broad root face with fillet weld as backing run Double fillet weld	9, 11b, 13b	10% zFP-O	CP B CP C1	C	32	4.3	
1.3.8					Visual Inspection	CP C2	C-	30.7		
1.3.9					10% zFP-V	CP B CP C1	D+	30.2		
1.3.10		One-sided not penetrated	Double-bevel butt joint with fitted fillet weld	11c	Visual Inspection	CP C2	D	29	4.3	

¹⁾ Bevel butt joint without backing run with secure root fusion, supported by designed production and test procedure measures (To prove by working samples; cf DIN EN 15085)

Table C-1.3. Continuation

No	Weld formation				Test method and amount of inspection	Weld seam grade according to DIN EN 15085-3	Keeling Curve	r a,zul (R = -1)	Inclination exponent of the S-N curve	Notes
	Image	Specification	Type of weld	Weld no according to DIN EN 15085-3						
1.3.11		One-sided not penetrated	One sided fillet weld ¹⁾	13a ¹⁾	10% zFP-V	CP B CP C1	E4+	23.9	4.3	
1.3.12					Visual Inspection	CP C2	E4	23		

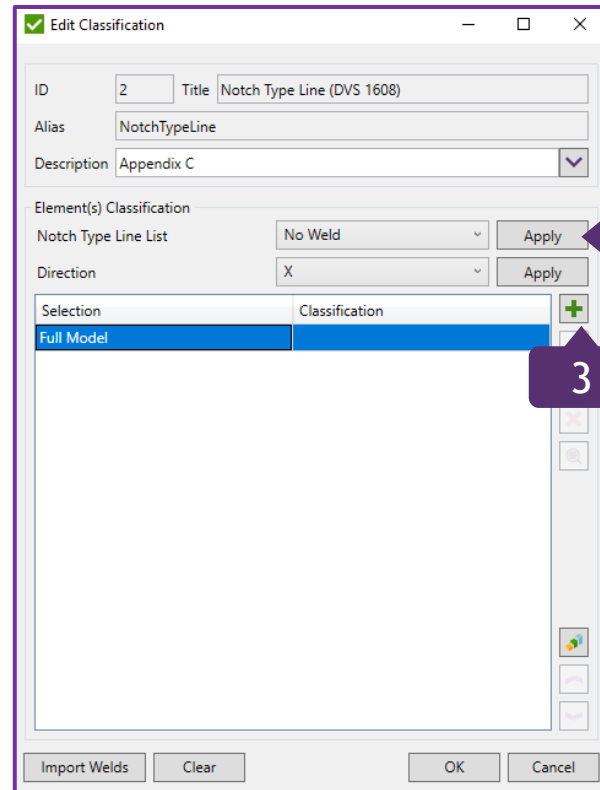
¹⁾ Avoid tensile load along butt joint for vibration stress (Root crack!)

Define Notch Line Type

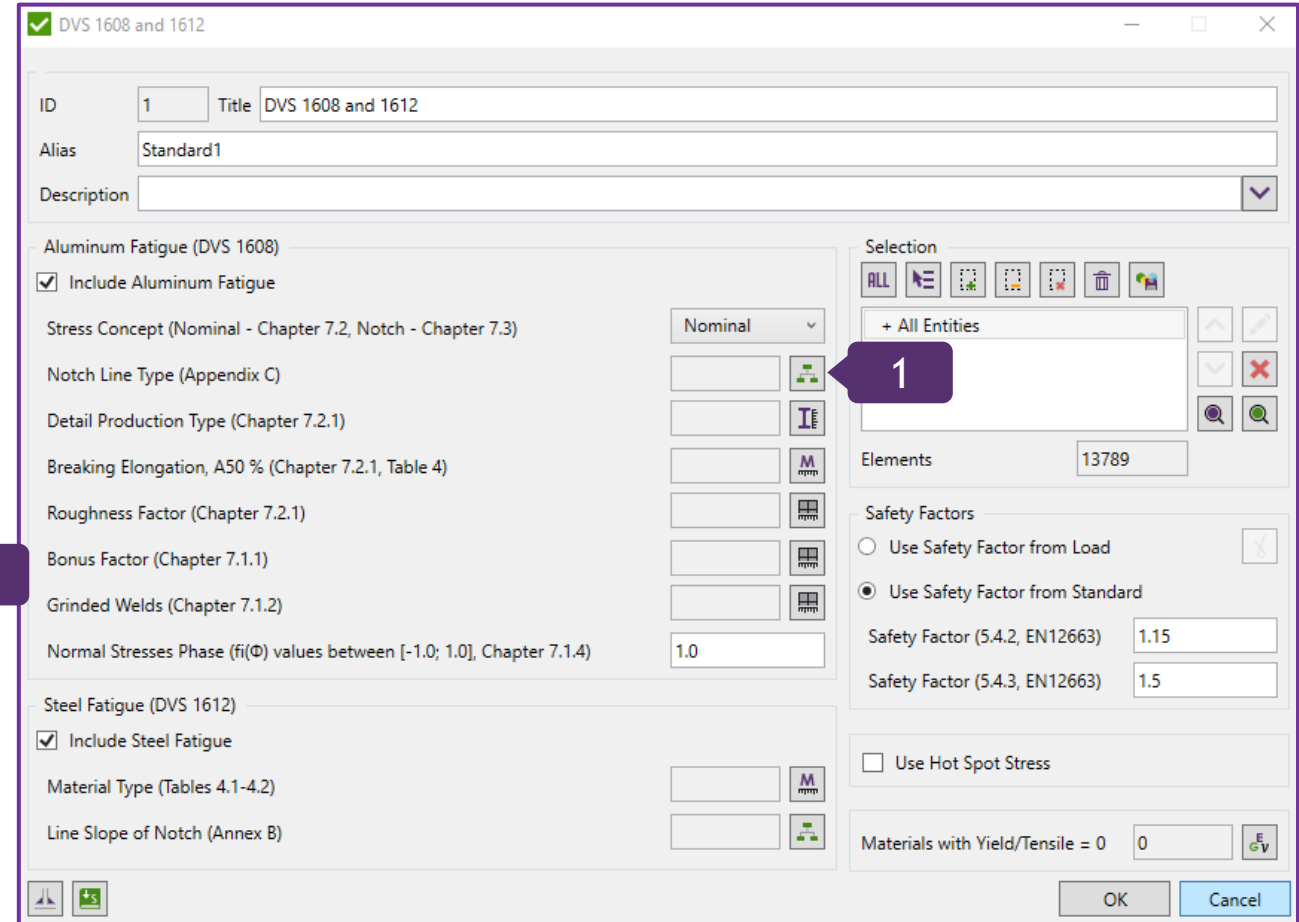
1 Press  in Notch Line type (Appendix C)

2 Notch Type Line List => *No Weld*; *Direction X* and press *Apply*

3 Press  to Edit Condition



The 'Edit Classification' dialog box is shown. It has fields for ID (2), Title (Notch Type Line (DVS 1608)), Alias (NotchTypeLine), and Description (Appendix C). Under 'Element(s) Classification', 'Notch Type Line List' is set to 'No Weld' and 'Direction' is set to 'X', both with 'Apply' buttons. A table below shows 'Full Model' selected under the 'Selection' column. At the bottom are 'Import Welds', 'Clear', 'OK', and 'Cancel' buttons.



The 'DVS 1608 and 1612' dialog box is shown. It has fields for ID (1), Title (DVS 1608 and 1612), Alias (Standard1), and Description. It is divided into two sections: 'Aluminum Fatigue (DVS 1608)' and 'Steel Fatigue (DVS 1612)'. In the Aluminum section, 'Include Aluminum Fatigue' is checked, and 'Stress Concept' is set to 'Nominal'. In the Steel section, 'Include Steel Fatigue' is checked, and 'Material Type' is set to 'M'. On the right, the 'Selection' section shows '+ All Entities' and 'Elements' count as 13789. The 'Safety Factors' section has 'Use Safety Factor from Standard' selected, with values of 1.15 and 1.5. At the bottom are 'OK' and 'Cancel' buttons.

Define Notch Line Type (Continuation)

- 4 Press *Add all Welds*
- 5 Select *Multiple Conditions* options
- 6 Press *X/Y/XY*
- 7 X: E4 plus Y: E6 XY: H Shear
- 8 Press *OK*

Classification Condition

Title:
Default Title: All welds

Selection:

+ All welds

Elements: 2180

Notch Type Line

☐ One Condition ☒ Multiple Condition

<input checked="" type="checkbox"/> X	E4 plus
<input checked="" type="checkbox"/> Y	E6
<input type="checkbox"/> Z	No Weld
<input checked="" type="checkbox"/> XY	H Shear
<input type="checkbox"/> YZ	No Weld
<input type="checkbox"/> ZX	No Weld
<input type="checkbox"/> Eqv	No Weld

Notch Type Line Classification Intersecting Welds

1 Press  to Add Condition

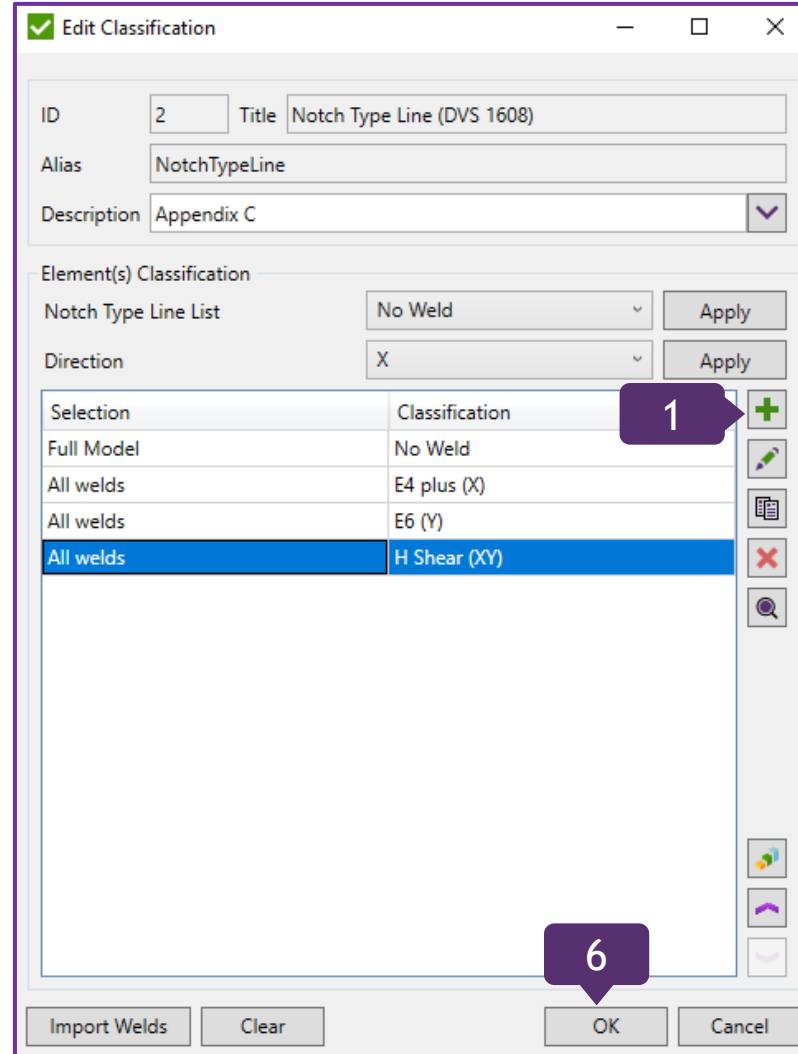
2 Click *Add all intersections*

3 Value: E4 plus

4 Direction: X

5 Press *OK*

6 Press *OK*



Edit Classification

ID: 2 Title: Notch Type Line (DVS 1608)

Alias: NotchTypeLine

Description: Appendix C

Element(s) Classification

Notch Type Line List: No Weld Apply

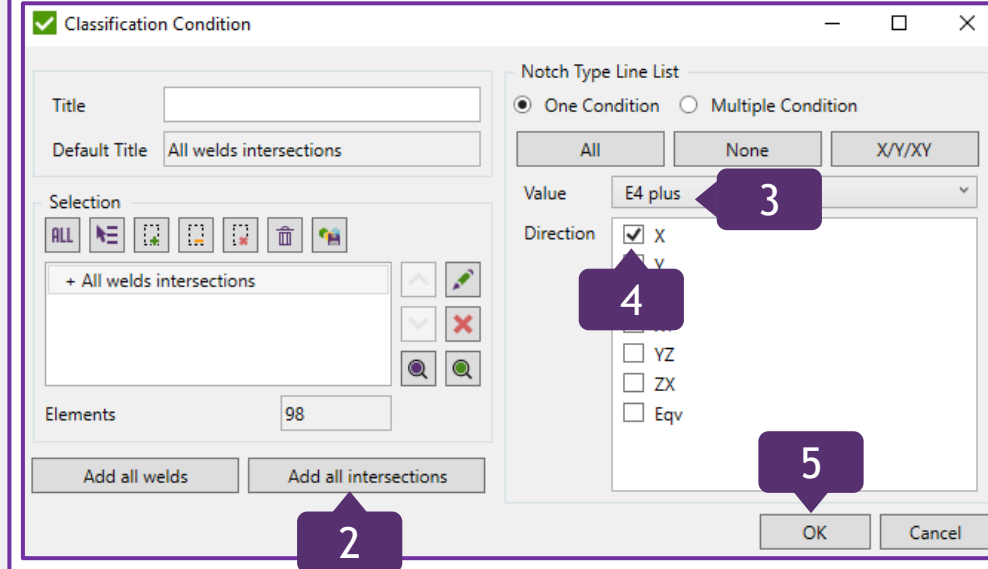
Direction: X Apply

Selection	Classification
Full Model	No Weld
All welds	E4 plus (X)
All welds	E6 (Y)
All welds	H Shear (XY)

Buttons: Import Welds, Clear, OK, Cancel

Number 1 points to the plus icon in the Classification column.

Number 6 points to the OK button.



Classification Condition

Title: Default Title: All welds intersections

Selection: ALL, Selection icons, + All welds intersections, Elements: 98

Buttons: Add all welds, Add all intersections

Notch Type Line List

One Condition Multiple Condition

All None X/Y/XY

Value: E4 plus

Direction: ☒ X ☐ Y ☐ YZ ☐ ZX ☐ Eqv

Buttons: OK, Cancel

Number 2 points to the 'Add all intersections' button.

Number 3 points to the 'Value' dropdown.

Number 4 points to the 'Direction' section.

Number 5 points to the 'OK' button.

Selection	Classification
Full Model	No Weld
All welds	E4 plus (X)
All welds	E6 (Y)
All welds	H Shear (XY)
All welds intersections	E4 plus (X)

Define Detail Production Type

1

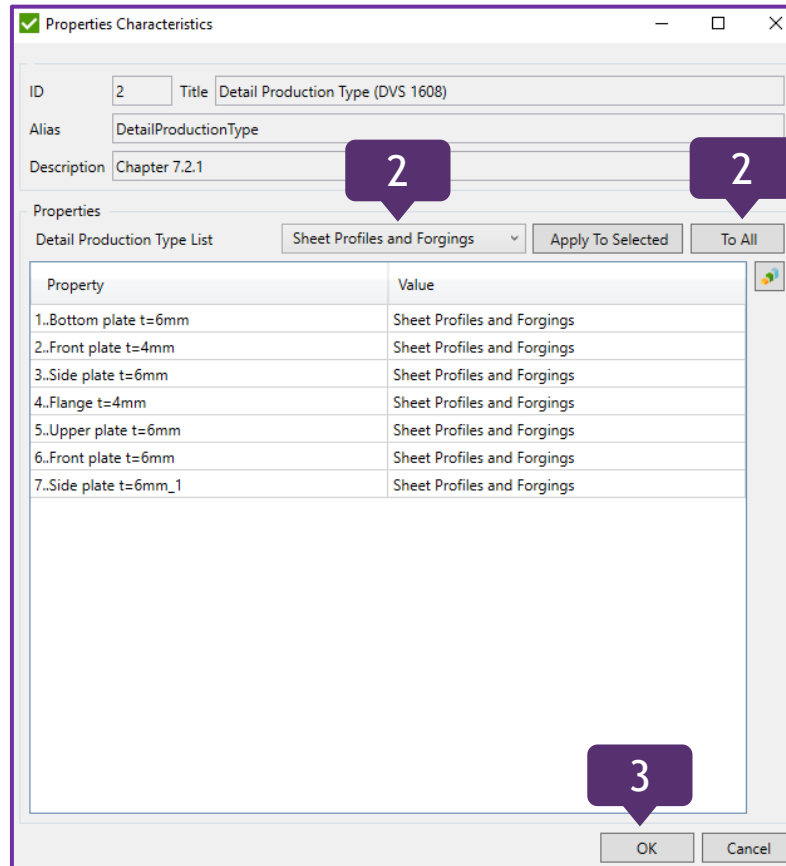
Press  in *Detail Production Type* section

2

Detail Production Type List: *Sheet Profiles and Forgings* and press *To All*

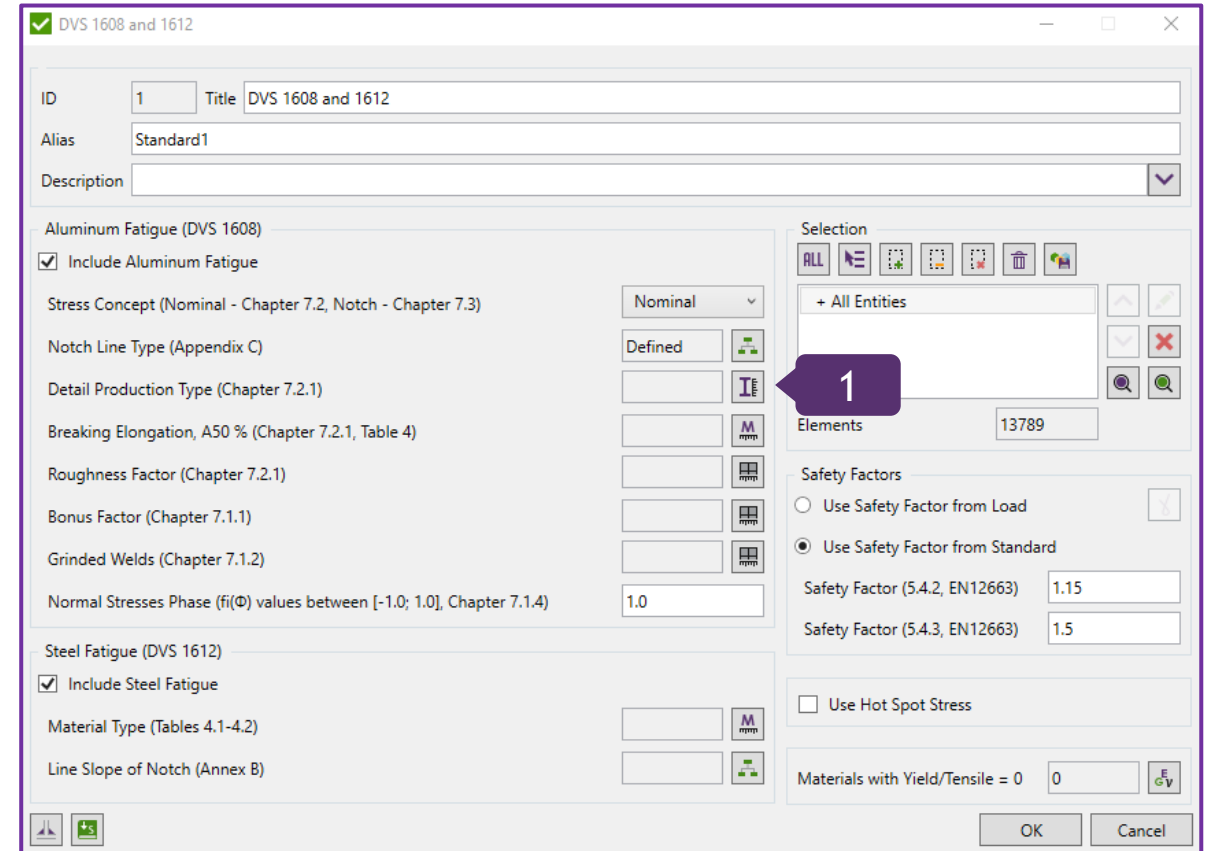
3

Press *OK*



The 'Properties Characteristics' dialog box is shown. It has fields for ID (2), Title (Detail Production Type (DVS 1608)), Alias (DetailProductionType), and Description (Chapter 7.2.1). Below these is a 'Properties' section with a 'Detail Production Type List' dropdown set to 'Sheet Profiles and Forgings'. There are 'Apply To Selected' and 'To All' buttons. A table lists properties and their values, all set to 'Sheet Profiles and Forgings'. At the bottom are 'OK' and 'Cancel' buttons. Callout 1 points to the 'I' icon in the 'Detail Production Type' section. Callout 2 points to the 'To All' button. Callout 3 points to the 'OK' button.

Property	Value
1..Bottom plate t=6mm	Sheet Profiles and Forgings
2..Front plate t=4mm	Sheet Profiles and Forgings
3..Side plate t=6mm	Sheet Profiles and Forgings
4..Flange t=4mm	Sheet Profiles and Forgings
5..Upper plate t=6mm	Sheet Profiles and Forgings
6..Front plate t=6mm	Sheet Profiles and Forgings
7..Side plate t=6mm_1	Sheet Profiles and Forgings



The 'DVS 1608 and 1612' dialog box is shown. It has fields for ID (1), Title (DVS 1608 and 1612), Alias (Standard1), and Description. Below these are sections for 'Aluminum Fatigue (DVS 1608)' and 'Steel Fatigue (DVS 1612)'. The 'Aluminum Fatigue' section has a checked 'Include Aluminum Fatigue' checkbox and various input fields for stress concept, notch line type, detail production type, breaking elongation, roughness factor, bonus factor, grinded welds, and normal stresses phase. The 'Steel Fatigue' section has a checked 'Include Steel Fatigue' checkbox and input fields for material type and line slope of notch. On the right, there is a 'Selection' section with a list of entities (All Entities) and a 'Safety Factors' section with radio buttons for 'Use Safety Factor from Load' and 'Use Safety Factor from Standard', and input fields for safety factors. At the bottom are 'OK' and 'Cancel' buttons. Callout 1 points to the 'I' icon in the 'Detail Production Type' section.

Fatigue strength values for normal stresses:

The fatigue limit σ_{zd} for normal stresses is determined depending on the tensile strength R_m in table 4, the safety factor j_{ges} and the design factor as follows:

$$\sigma_{W,zd} = R_m \cdot 0,26 / (j_{ges} \cdot K_{WK}) \quad (8)$$

For the safety factor j_{ges} the following must be applied:

- for sheets, profiles and forgings $j_{ges} = 1.0$

- for castings $j_{ges} = 1.4 + \left(0.5 - \sqrt{\frac{A_{50}}{50}}\right)$

As Aluminum Materials are not included into this model, it is appropriate to single out the Value of 10 from the A50% and EN AW6082 sections

Table 4. Fatigue limit for normal stress.

Material		Thickness range	Condition	Rm	A ₅₀ %	σ_{Wzd}
EN AW 6005-A	Mould	≤ 5	T6	255	8	51
	Mould	$5 < \leq 10$	T6	250	8	50
EN AW 6060	Mould	≤ 15	T6	170	8	34
EN AW 6082	Mould	≤ 5	T4	205	14	41
	Mould	≤ 5	T6	290	8	58
	Mould	$15 < \leq 40$	T6	310	10	62
EN AW 7020	Mould	≤ 10	T6	250	8	50
	Mould	≤ 15	T6	350	10	70
	Mould	$15 < \leq 40$	T6	350	10	70
EN AW 5454	Sheet	≤ 80	H111	215	12	43
	Sheet	≤ 25	H14	270	2	54
	Sheet	≤ 25	H24/H34	270	4	54
EN AW 5754	Sheet	≤ 100	H111	190	12	38
	Sheet	≤ 25	H14	240	3	48
	Sheet	≤ 25	H24/H34	240	6	48
EN AW 5083	Sheet	≤ 50	H111	275	11	55
	Sheet	$50 < \leq 80$	H111	270	14	54
	Sheet	≤ 40	H12	305	3	61

Define Breaking Elongation

1

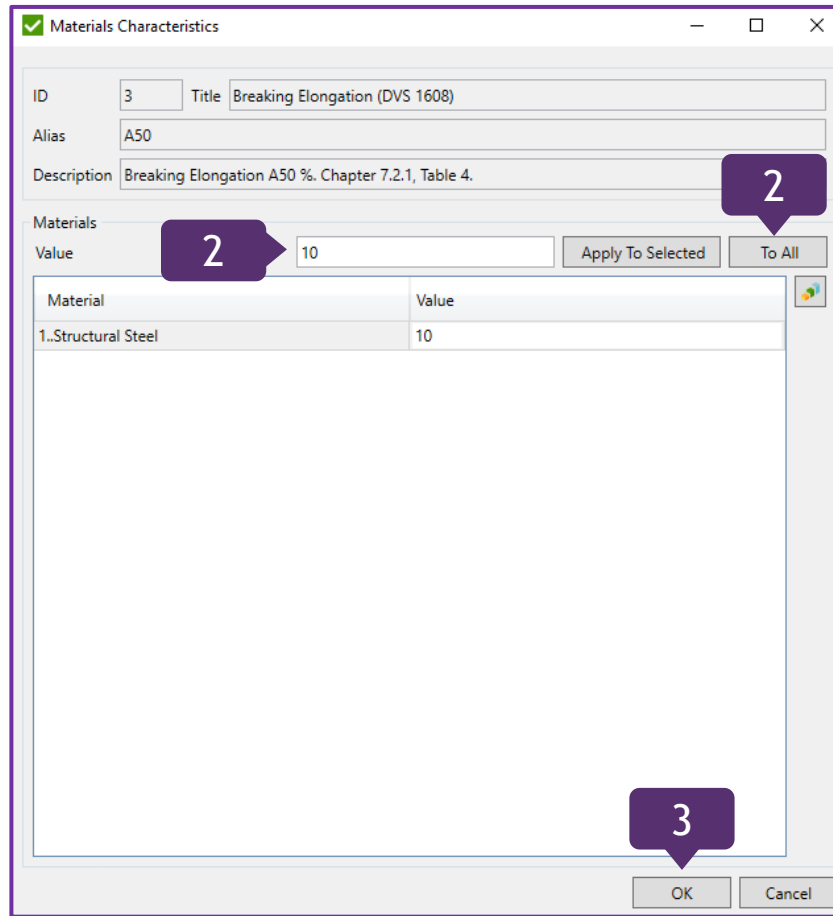
Press  in *Breaking Elongation* section

2

Value: 10 and press *To All*

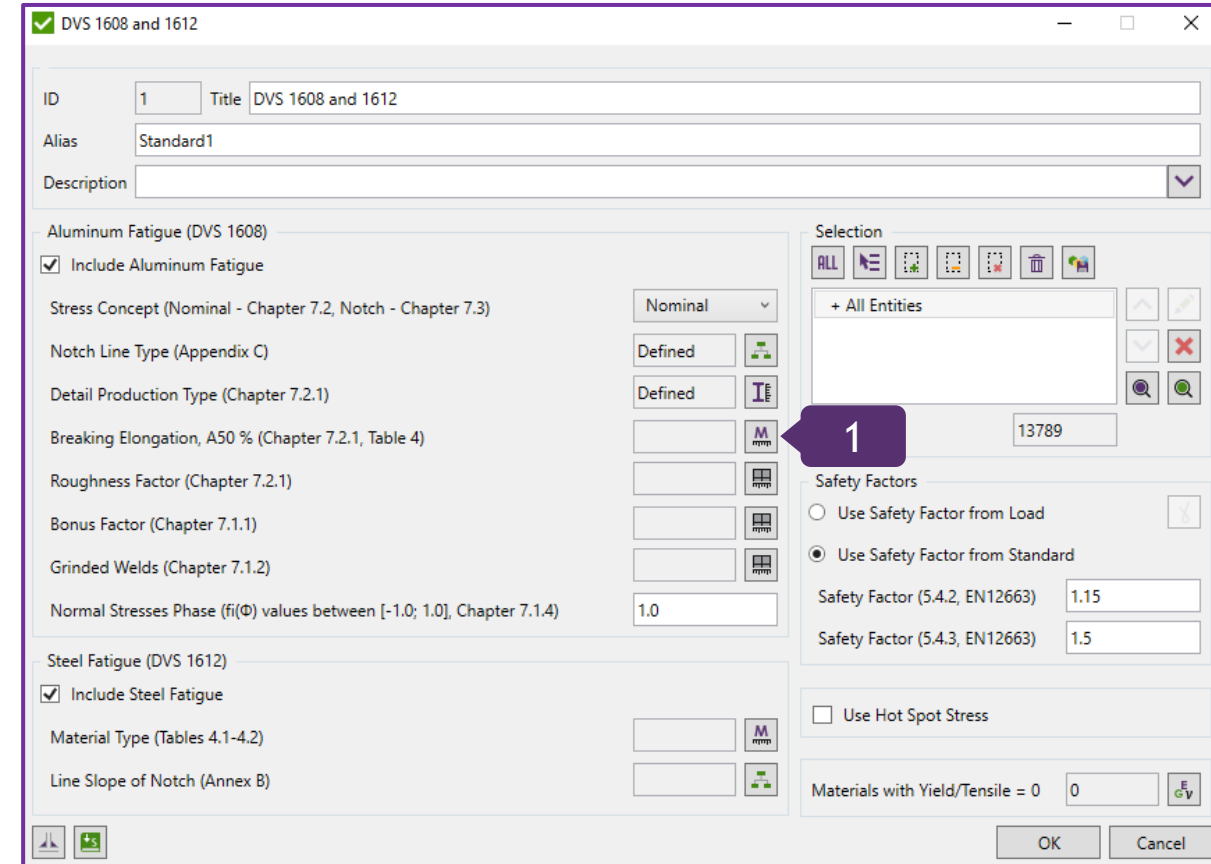
3

Press *OK*



The dialog box 'Materials Characteristics' is shown. It has fields for ID (3), Title (Breaking Elongation (DVS 1608)), Alias (A50), and Description (Breaking Elongation A50 %. Chapter 7.2.1, Table 4.). Below these is a 'Materials' section with a 'Value' field set to 10 and buttons 'Apply To Selected' and 'To All'. A table below shows 'Material' (1..Structural Steel) and 'Value' (10). At the bottom are 'OK' and 'Cancel' buttons. Numbered callouts: 1 points to the material icon in the description, 2 points to the 'Value' field, and 3 points to the 'OK' button.

Material	Value
1..Structural Steel	10



The dialog box 'DVS 1608 and 1612' is shown. It has fields for ID (1), Title (DVS 1608 and 1612), Alias (Standard1), and Description. Below are sections for 'Aluminum Fatigue (DVS 1608)' and 'Steel Fatigue (DVS 1612)'. The 'Aluminum Fatigue' section has a checked 'Include Aluminum Fatigue' box and various input fields. The 'Steel Fatigue' section has a checked 'Include Steel Fatigue' box and input fields. On the right, there is a 'Selection' area with a list of entities, a 'Safety Factors' section with radio buttons and input fields, and a 'Materials with Yield/Tensile = 0' section. A numbered callout 1 points to the material icon in the 'Breaking Elongation, A50 %' field. At the bottom are 'OK' and 'Cancel' buttons.

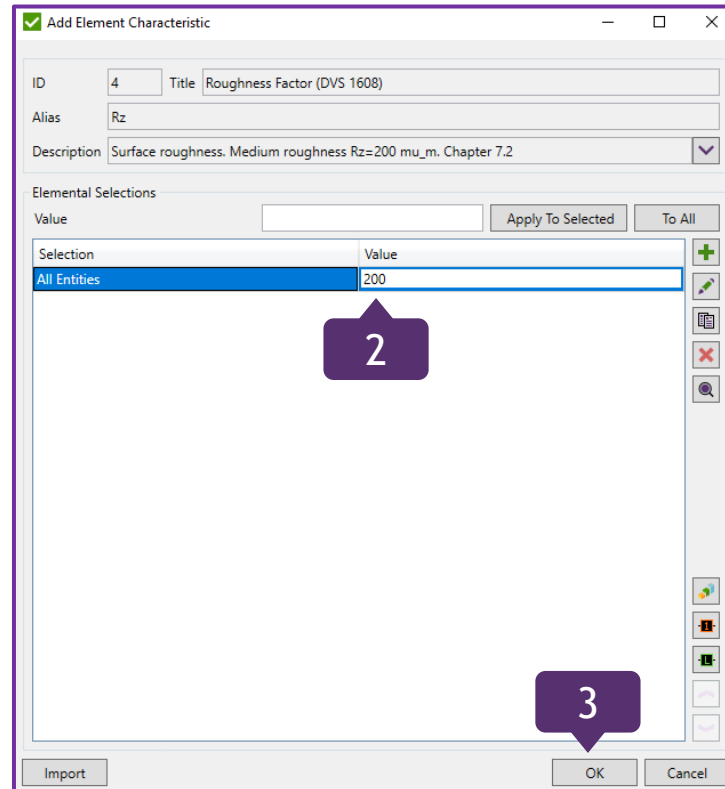
- for castings $i_{ges} = 1,4 + \left(0,5 - \sqrt{\frac{A_{50}}{50}}\right)$

Define Roughness Factor

1 Press  in Roughness Factor section

2 All Entities - Value: 200

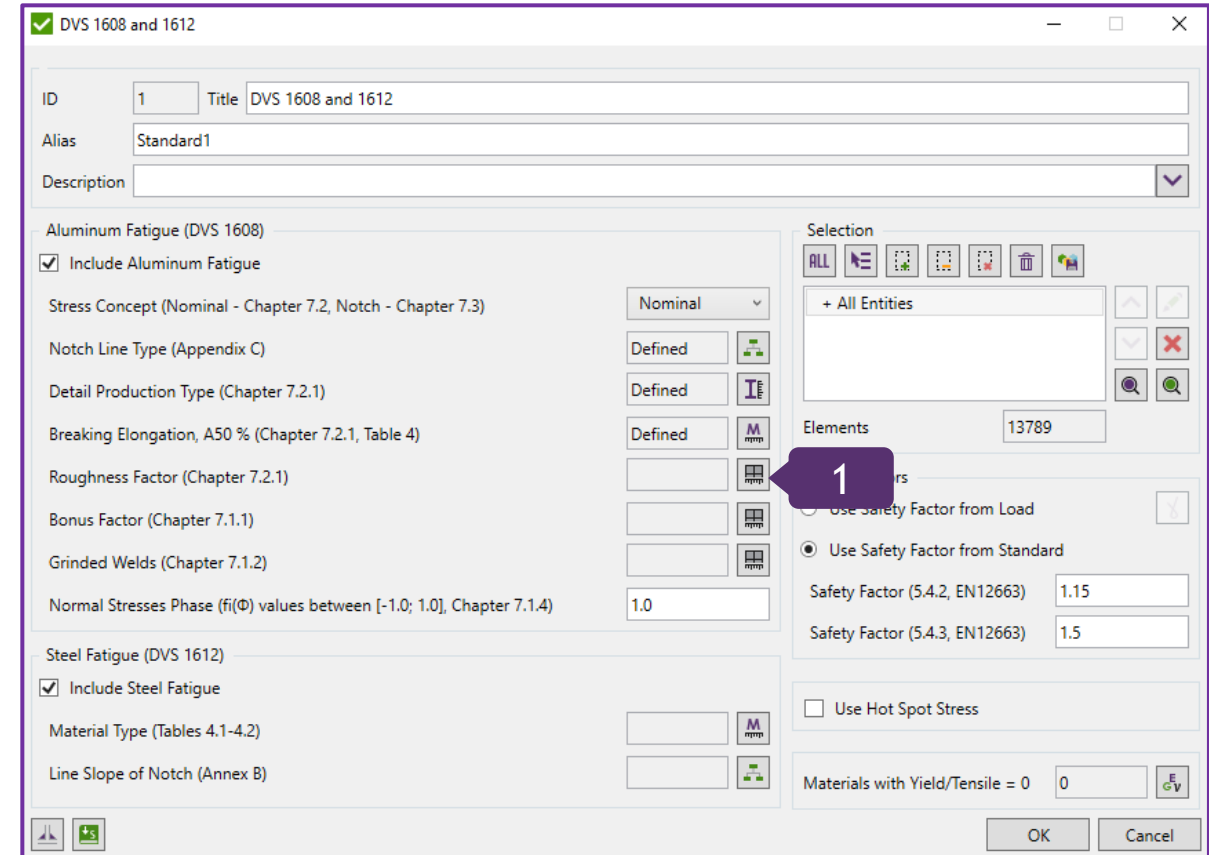
3 Press OK



The dialog box 'Add Element Characteristic' is shown. It has fields for ID (4), Title (Roughness Factor (DVS 1608)), Alias (Rz), and Description (Surface roughness. Medium roughness Rz=200 mu_m. Chapter 7.2). Below these are 'Elemental Selections' with a table:

Selection	Value
All Entities	200

Buttons 'Apply To Selected' and 'To All' are next to the table. At the bottom are 'Import', 'OK', and 'Cancel' buttons. A purple callout '2' points to the value '200' in the table, and a purple callout '3' points to the 'OK' button.



The dialog box 'DVS 1608 and 1612' is shown. It has fields for ID (1), Title (DVS 1608 and 1612), Alias (Standard1), and Description. Below these are sections for 'Aluminum Fatigue (DVS 1608)' and 'Steel Fatigue (DVS 1612)'. The 'Aluminum Fatigue' section has a checked 'Include Aluminum Fatigue' checkbox and several input fields for stress concepts, notch line types, detail production types, breaking elongation, roughness factor, bonus factor, and grinded welds. The 'Steel Fatigue' section has a checked 'Include Steel Fatigue' checkbox and input fields for material type and line slope of notch. On the right, there is a 'Selection' section with a list of elements (13789) and a 'Safety Factor' section with radio buttons for 'Use Safety Factor from Load' and 'Use Safety Factor from Standard', and input fields for safety factors (1.15 and 1.5). At the bottom are 'OK' and 'Cancel' buttons. A purple callout '1' points to the 'Roughness Factor' input field in the Aluminum Fatigue section.

For cast materials:

$$K_{WK} = \frac{1}{K_{R,\sigma}}$$

With the roughness factor K_R , for a medium roughness

$Rz=200\mu m$

$$K_{R,\sigma} = 1 - 0,2 \cdot \lg(R_z) \cdot \lg\left(2 \cdot \frac{R_m}{133}\right)$$

Define Bonus Factor

1 Press  in Bonus Factor section

2 In Elemental Selections, YesNoEnum: Yes and press *To All*

3 Press OK

7.1.1 Medium voltage sensitivity of welded components

Provided that the provisions of DIN EN 15085 are met, for welded rail vehicle aluminum alloy joints the following values of the medium voltage selectivity must be applied considering the medium- and residual stress selectivity:

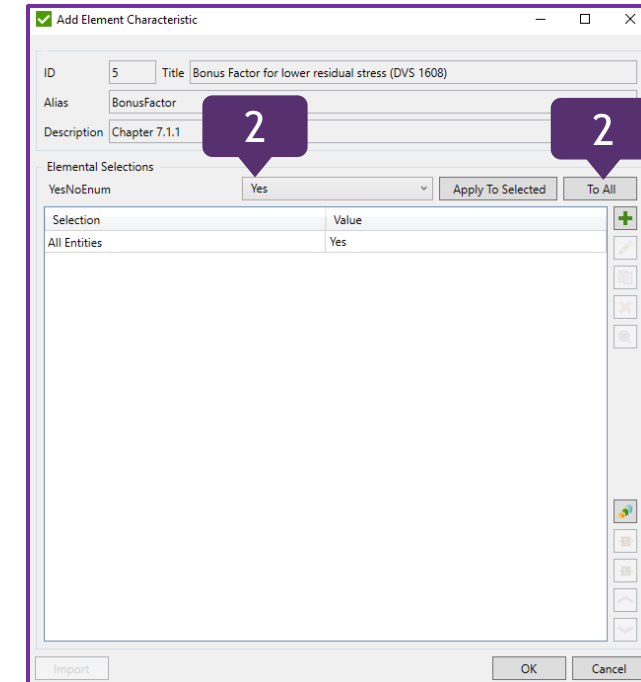
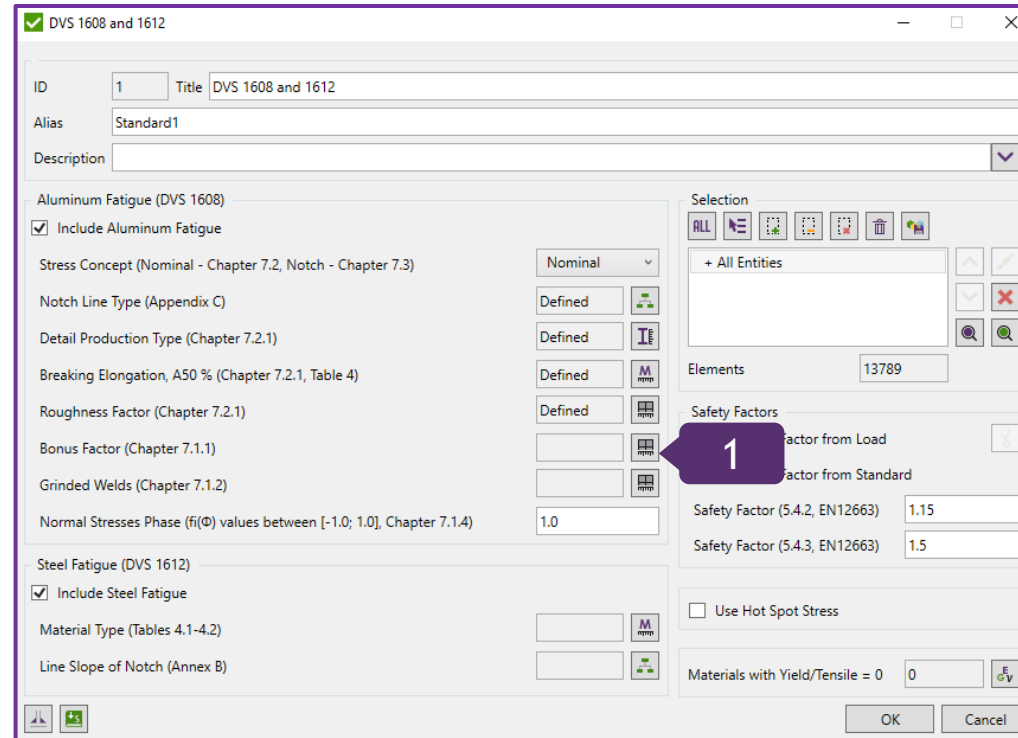
- medium stress selectivity as a result of the normal stress:

$$M\sigma = 0.5$$

- medium stress selectivity as a result of shear stress:

$$M\tau = 0.09$$

If in the area of the welding joint for the entire series a too low residual tension stress or residual compressive stress condition is proven, a bonus factor for the fatigue strength can be initiated. The bonus factor for lower residual stress arises by increasing the medium voltage sensitivity for normal voltages from $M\sigma$ to 1.0 and the medium voltage for shear stresses from $M\tau$ to 0.17. In the case of an R-ratio of 0.5 or more, then again the same strength values as described in section 7.2.2 or 7.3. apply.



Define Grinded Welds

1 Press  in Grinded Welds section

2 In Elemental Selections, YesNoEnum: Yes and press *To All*

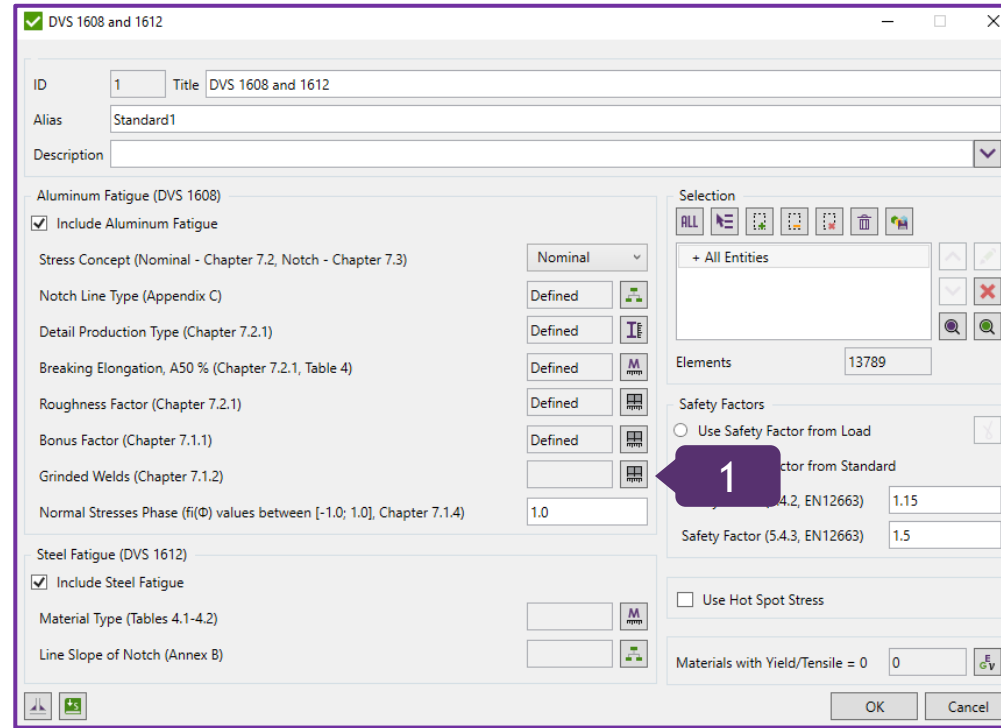
3 Press *OK*

7.1.2 Measures to increase fatigue strength of welded components

As a measure to improve the fatigue strength by subsequent processing of the welding seam a low on notch effected grinding of the seam transition is recommended: In this case the fatigue strength value must be increased by 30% - this corresponds a bonus factor of $f_{\text{Bonus}} = 1.3$.

$\sigma_{\text{Fatigue, Grinding}} = f_{\text{Bonus}} \cdot \sigma_{\text{Fatigue}}$

Sources of error such as incomplete fusions or cracks must be avoided before grinding (according to DIN EN ISO 10 042). The fatigue strength increased by the bonus factor must not be



DVS 1608 and 1612

ID: 1 Title: DVS 1608 and 1612

Alias: Standard1

Description:

Aluminum Fatigue (DVS 1608)

☒ Include Aluminum Fatigue

Stress Concept (Nominal - Chapter 7.2, Notch - Chapter 7.3): Nominal

Notch Line Type (Appendix C): Defined

Detail Production Type (Chapter 7.2.1): Defined

Breaking Elongation, A50 % (Chapter 7.2.1, Table 4): Defined

Roughness Factor (Chapter 7.2.1): Defined

Bonus Factor (Chapter 7.1.1): Defined

Grinded Welds (Chapter 7.1.2): 1.0

Normal Stresses Phase ($f_i(\Phi)$ values between [-1.0; 1.0], Chapter 7.1.4): 1.0

Steel Fatigue (DVS 1612)

☒ Include Steel Fatigue

Material Type (Tables 4.1-4.2):

Line Slope of Notch (Annex B):

Selection: + All Entities

Elements: 13789

Safety Factors

☐ Use Safety Factor from Load

☐ Use Safety Factor from Standard

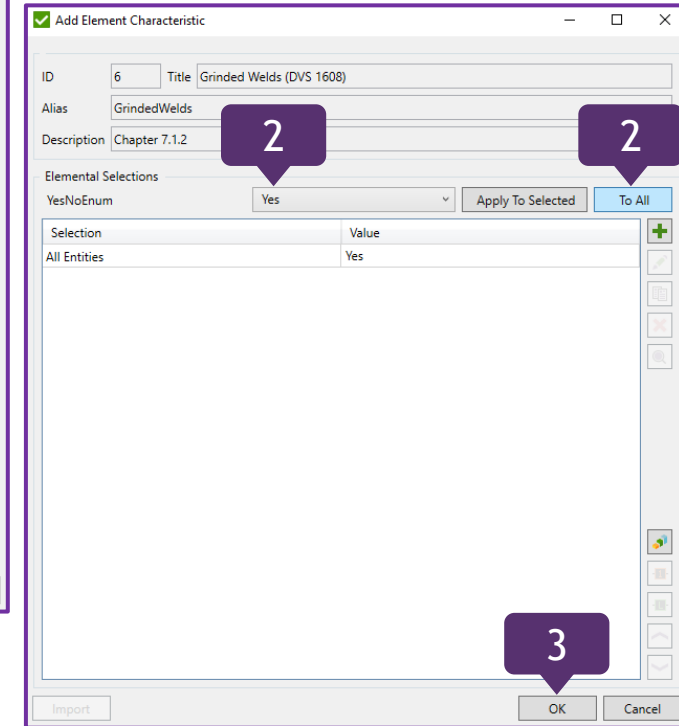
Safety Factor (5.4.2, EN12663): 1.15

Safety Factor (5.4.3, EN12663): 1.5

☐ Use Hot Spot Stress

Materials with Yield/Tensile = 0: 0

OK Cancel



Add Element Characteristic

ID: 6 Title: Grinded Welds (DVS 1608)

Alias: GrindedWelds

Description: Chapter 7.1.2

Elemental Selections

YesNoEnum: Yes

Apply To Selected To All

Selection	Value
All Entities	Yes


Import OK Cancel

Select Material Type (Steel Fatigue)

- 1

Normal Stresses Phase ($f_i(\Phi)$) values between $[-1.0; 1.0]$, Chapter 7.1.4): 1.0

A simple approach to lie on the safe side is to attach the factor (Φ) = +1 in the equation (6).
- 2

Press  in Material Type section
- 3

In Materials, Material Type List: S355 and press *To All*
- 4

Press *OK*

DVS 1608 and 1612

ID1TitleDVS 1608 and 1612

AliasStandard1

Description

Aluminum Fatigue (DVS 1608)

☒ Include Aluminum Fatigue

Stress Concept (Nominal - Chapter 7.2, Notch - Chapter 7.3)

Notch Line Type (Appendix C)

Detail Production Type (Chapter 7.2.1)

Breaking Elongation, A50 % (Chapter 7.2.1, Table 4)

Roughness Factor (Chapter 7.2.1)

Bonus Factor (Chapter 7.1.1)

Grinded Welds (Chapter 7.1.2)

Normal Stresses Phase ($f_i(\Phi)$) values between $[-1.0; 1.0]$, Chapter 7.1.4)

Steel Fatigue (DVS 1612)

☒ Include Steel Fatigue

Material Type (Tables 4.1-4.2)

Line Slope of Notch (Annex B)

Nominal

Defined

Defined

Defined

Defined

Defined

1.0

Materials with Yield/Tensile = 00

Selection

+ All Entities

Elements13789

Safety Factors

☐ Use Safety Factor from Load

☒ Use Safety Factor from Standard

Safety Factor (5.4.2, EN12663)1.15

Safety Factor (5.4.3, EN12663)1.5

Stress

OK

Cancel

Materials Characteristics

ID1TitleMaterial Type (DVS 1612)

AliasMaterialType

DescriptionTables 4.1-4.2

Materials

Material Type ListS355

Apply To Selected

To All

Material

Value

1.Structural SteelS355

OK

Cancel

Table 4.1 Exponent x in Equation (4) to Equation (5) for Slope Lines of Notch from A to D.

Line	A +	A	A-	AB +	AB	AB-	B +	B	B-	C +	C	C-	D +	D	D-
S355	-1	0	1	2	3	4	5	6	7	8	9	10	11	12	13
S235	4,33	5	5,67	6,33	7	7,67	8,33	9	9,67	10,33	11	11,67	12,33	13	13,67

Table 4.2 Exponent x in Equation (4) to Equation (5) for Slope Lines of Notch from E1 to F2.

DVS 1612 Page 7

Line	E + 1	E1	E1-	E4 +	E4	E4-	E5 +	E5	E5-	E6 +	E6	E6-	F1 +	F1	F1-	F2	F3
S355	14	15	16	17	18	19	20	twenty	twenty	twenty	twenty	twenty	25	26	27	28	33,7
S235																	41

Base material on Normal Stress and Shear Stress

Base material:

- Line **A** \neq blast cleaning, otherwise unaffected.
- Line **A**: with rolled surface, without blast cleaning, otherwise unaffected.
- Line **AB**: heat affected (thermal insulation, all grades)

Welded joints:

- Line **B** to **F3**: see tables in Annex B

Line **G** \neq Base material:

- Blast cleaning, otherwise unaffected,
- With rolled surface, without blast cleaning, otherwise unaffected,
- Heat affected (thermal insulation, all grades).

Line **G**: Penetrated butt joints

Line **G**–: Non-penetrated butt joints

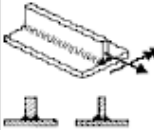
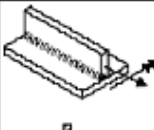
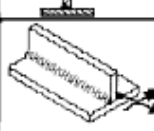
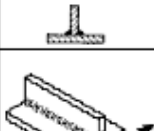
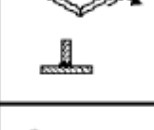
Line **H** \neq Penetrated T-shaped joints

Line **H**: Non-penetrated T-shaped joints on both sides

Line **H**–: Non-penetrated T-shaped joints on one side

Along the welds (X-direction)

Table B-1.3. Longitudinal Stress T-shaped Joints.

S/N	Formation of Joint and Weld					Type and Scope of Test	Weld Performance Class according to DIN EN 15085-3	Slope Line of Notch	Remarks
	Sketch	Description	Weld Type	Weld No. according to DIN EN 15085-3	Machined Weld Surface				
1.3.1		Full penetration on both sides, with welding layer on the reverse side	DHV weld	7 10b	Yes	10% ZiP-V	CP B and CP C1	B	
1.3.2			HV weld with fillet weld, as welding layer on the reverse side			Visual inspection	CP C2	B-	
1.3.3			HV weld with welding layer on the reverse side	10d	No	10% ZiP-V	CP B and CP C1	C	
1.3.4						Visual inspection	CP C2	C-	
1.3.5		Full penetration on one side	HV weld	10a ¹⁾ 10c ¹⁾	Yes	10% ZiP-V	CP B and CP C1	B	
1.3.6						HV weld with fillet weld	Visual inspection	CP C2	
1.3.7			HV weld with welding pool	10e ¹⁾	No	10% ZiP-V	CP B and CP C1	C	
1.3.8						Visual inspection	CP C2	C-	
1.3.9		Incomplete penetration on both sides	DHY weld	9 11b 13b	Yes	10% ZiP-O	CP B and CP C1	B	
1.3.10			HY weld with fillet weld, as welding layer on the reverse side			Visual inspection	CP C2	B-	
1.3.11			Double fillet weld		No	10% ZiP-O	CP B and CP C1	C	
1.3.12						Visual inspection	CP C2	C-	
1.3.13		Incomplete penetration on one side	HY weld with fillet weld	11c	Yes	10% ZiP-O	CP B CP C1	C+	
1.3.14						Visual inspection	CP C2	C	
1.3.15					No	10% ZiP-O	CP B CP C1	D+	
1.3.16						Visual inspection	CP C2	D	
1.3.17		Incomplete penetration on one side	Double-sided fillet weld ²⁾	13a ²⁾	Yes	10% ZiP-O	CP B CP C1	E1+	
1.3.18						Visual inspection	CP C2	E1	

Transversal Stress T-shaped Joints, Loaded by Running Belt

Perpendicular the welds (Y-direction)

Table B-1.4. Transversal Stress T-shaped Joints Loaded by Running Belt.

S/N	Formation of Joint and Weld					Type and Scope of Test	Weld Performance Class according to DIN EN 15085-3	Slope Line of Notch	Remarks
	Sketch	Description	Weld Type	Weld No. according to DIN EN 15085-3	Machined Weld Surface				
1.4.1		Full penetration on both sides, with welding layer on the reverse side	DHY weld	10b	Yes	10% ZfP-V	CP B and CP C1	C1 ¹⁾	Position with the maximum stress (crack position) on the weld toe
1.4.2			HV weld with fillet weld, 47			Visual inspection	CP C2	C-	
1.4.3			HV weld with welding layer on the reverse side		No	10% ZfP-V	CP B and CP C1	E5+	
1.4.4			HV weld with welding layer on the reverse side			Visual inspection	CP C2	E5 ²⁾	
1.4.5		Full penetration on one side	HV weld	10a ²⁾ 10c ¹⁾ 10e ²⁾	No	10% ZfP-V	CP B and CP C1	E5-	Position with the maximum stress (crack position) on the weld toe or the weld root
1.4.6			HV weld with fillet weld HV weld with welding pool			Visual inspection	CP C2	E6+	
1.4.7		Incomplete penetration on both sides	DHY weld	11a 11b 13b	Yes	10% ZfP-C	CP B and CP C1	C1 ¹⁾	Position with the maximum stress (crack position) on the weld toe
1.4.8			HY weld with fillet weld, 49			Visual inspection	CP C2	C-	
1.4.9			Double fillet weld		No	10% ZfP-C	CP B and CP C1	E5+	
1.4.10			Double fillet weld			Visual inspection	CP C2	E5	

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1.4.11		Incomplete penetration on one side	HY weld HY weld with fillet weld	11a 11c	No	Visual inspection	CP C2	E6	
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Shear (XY-direction)

Line **G** ≠ Base material:

- Blast cleaning, otherwise unaffected,
- With rolled surface, without blast cleaning, otherwise unaffected,
- Heat affected (thermal insulation, all grades).

Line **G**: Penetrated butt joints

Line **G**–: Non-penetrated butt joints

Line **H** ≠ Penetrated T-shaped joints

Line **H**: Non-penetrated T-shaped joints on both sides

Line **H**–: Non-penetrated T-shaped joints on one side

Define Line Slope of Notch (Annex B)

1

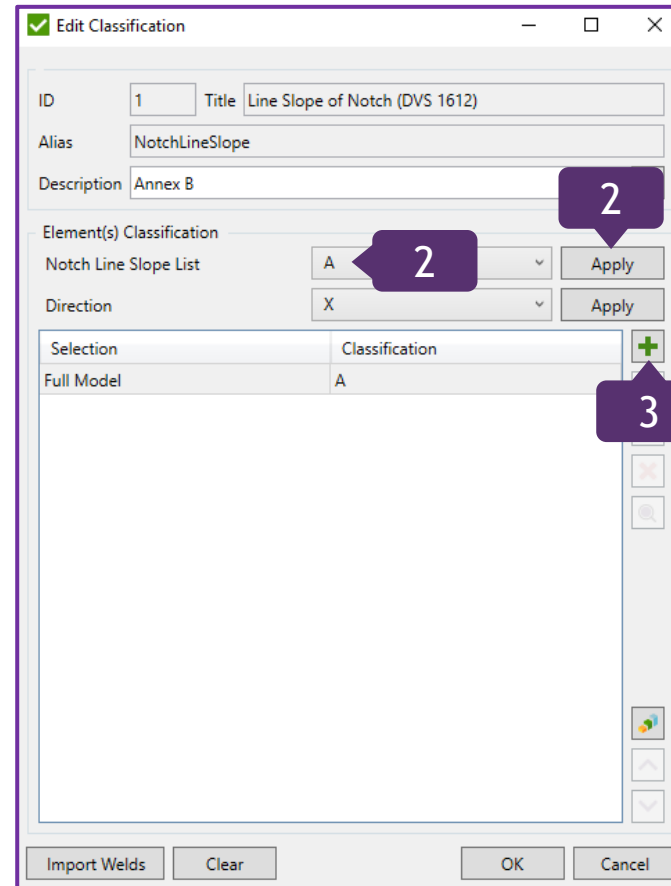
Press  in Line Slope of Notch (Annex B) section

2

Notch Type Slope List => A and Direction: X;
Press *Apply*

3

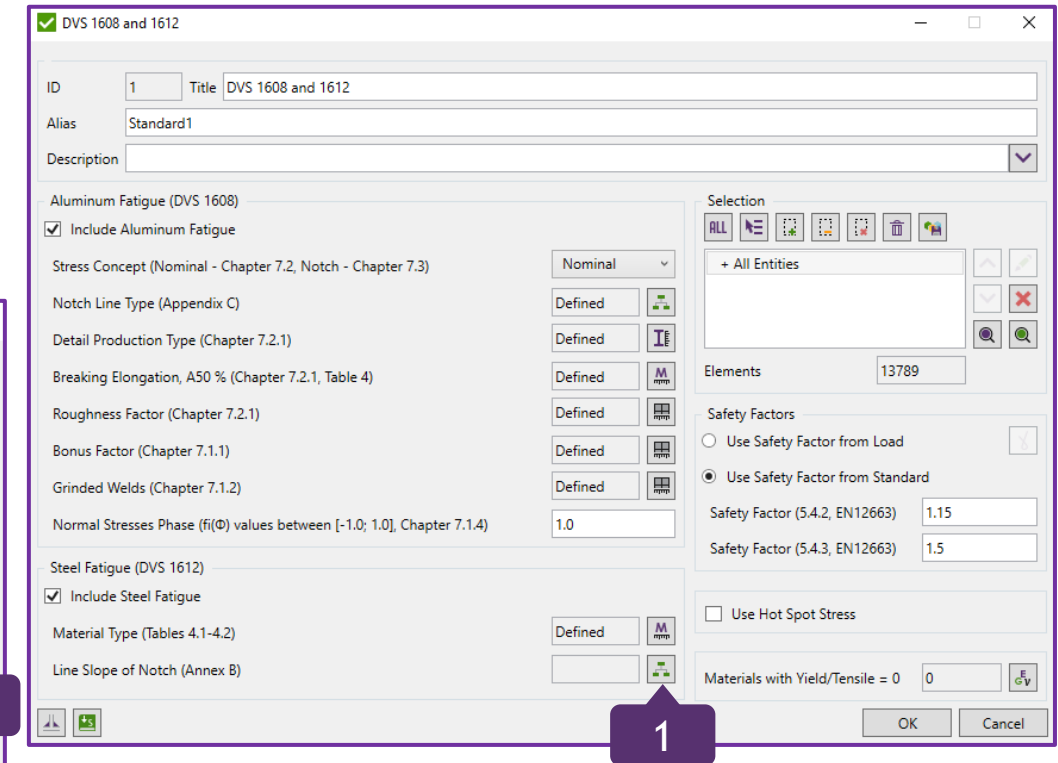
Press  to Edit Condition



1

2

3



1

2

3

Define Line Slope of Notch (Annex B) (Continuation)

4 Press *Add all Welds*

5 Select *Multiple Condition* option

6 Press *X/Y/XY*

7 For All welds: X: *E1 plus* Y: *E6* XY: *H minus Shear*

8 Press *OK*

Classification Condition

Title

Default Title All welds

Selection

+ All welds

Elements 2180

Add all welds Add all intersections

Notch Line Slope

☐ One Condition ☒ Multiple Condition

All None X/Y/XY

☒ X E1 plus

☒ Y E6

☐ Z A plus

☒ XY H minus Shear

☐ YZ A plus

☐ ZX A plus

☐ Eqv A plus

OK Cancel

Line Slope of Notch Intersecting Welds

1 Press  to Add Condition

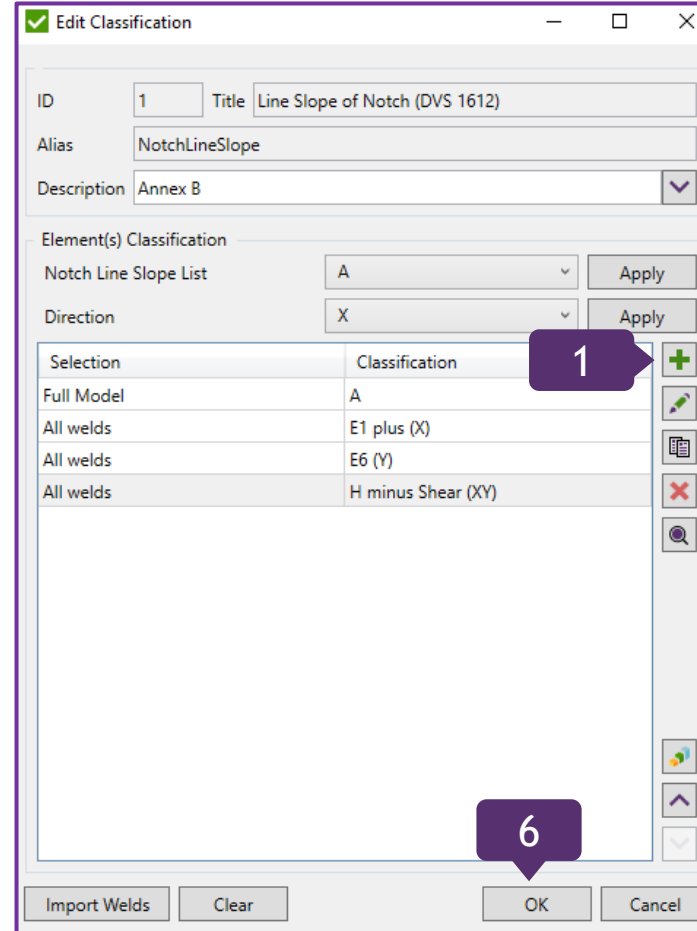
2 Click Add all intersections

3 Value: E6

4 Direction: X

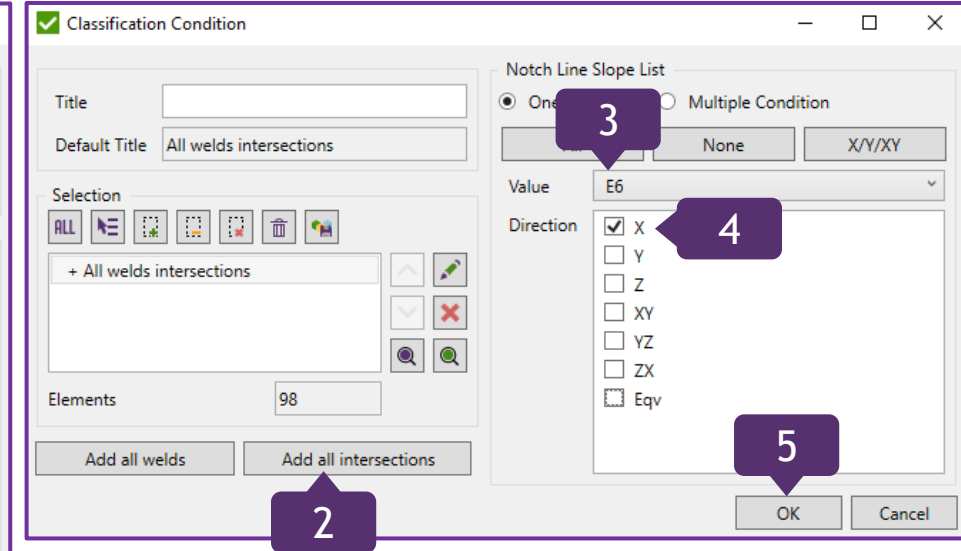
5 Press OK

6 Press OK



The 'Edit Classification' dialog box is shown. It has fields for ID (1), Title (Line Slope of Notch (DVS 1612)), Alias (NotchLineSlope), and Description (Annex B). Below these are dropdowns for 'Notch Line Slope List' (A) and 'Direction' (X), each with an 'Apply' button. A table lists classifications for 'Full Model', 'All welds', and 'All welds'. A green '+' button is next to the table. At the bottom are 'Import Welds', 'Clear', 'OK', and 'Cancel' buttons.

Selection	Classification
Full Model	A
All welds	E1 plus (X)
All welds	E6 (Y)
All welds	H minus Shear (XY)



The 'Classification Condition' dialog box is shown. It has fields for Title and Default Title (All welds intersections). Below are 'Add all welds' and 'Add all intersections' buttons. To the right is a 'Notch Line Slope List' section with radio buttons for 'One' (selected) and 'Multiple Condition'. Below this are 'None' and 'X/Y/XY' buttons. A 'Value' dropdown is set to 'E6'. A 'Direction' section has checkboxes for X (checked), Y, Z, XY, YZ, ZX, and Eqv. At the bottom are 'OK' and 'Cancel' buttons.

Selection	Classification
Full Model	A
All welds	E1 plus (X)
All welds	E6 (Y)
All welds	H minus Shear (XY)
All welds intersections	E6 (X)

Select Safety Factors

1

In Safety Factors, select *Use Safety Factor from Standard*

2

Safety Factor (5.4.2, EN12663): 1.15;
Safety Factor (5.4.3, EN12663): 1.5

3

Press *OK*

Also, it is possible to use different
Safety Factor for different Loads.

DVS 1608 and 1612

ID: 1 Title: DVS 1608 and 1612

Alias: Standard1

Description:

Aluminum Fatigue (DVS 1608)

☒ Include Aluminum Fatigue

Stress Concept (Nominal - Chapter 7.2, Notch - Chapter 7.3): Nominal

Notch Line Type (Appendix C): Defined

Detail Production Type (Chapter 7.2.1): Defined

Breaking Elongation, A50 % (Chapter 7.2.1, Table 4): Defined

Roughness Factor (Chapter 7.2.1): Defined

Bonus Factor (Chapter 7.1.1): Defined

Grinded Welds (Chapter 7.1.2): Defined

Normal Stresses Phase (fi(Φ) values between [-1.0; 1.0], Chapter 7.1.4): 1.0

Steel Fatigue (DVS 1612)

☒ Include Steel Fatigue

Material Type (Tables 4.1-4.2): Defined

Line Slope of Notch (Annex B): Defined

Selection

+ All Entities

Elements: 13789

Safety Factors

☐ Use Safety Factor from Load

☒ Use Safety Factor from Standard

Safety Factor (5.4.2, EN12663): 1.15

Safety Factor (5.4.3, EN12663): 1.5

☐ Use Hot Spot Stress

Materials with Yield/Tensile = 0: 0

OK Cancel

4.3 Proof of fatigue strength

The fatigue strength for weld joints is proved here by nominal stresses. For the increase in stress caused by the construction and weld shape, the fatigue strength values related to the slope lines of notch will be taken into account. In Annex B, typical welded joints of railway vehicle construction are summarized as the construction catalog. The associated fatigue strength values are shown in MKJ diagrams of Section 4.4.

The relevant nominal stresses are obtained from the average sizes based on the connected cross sections at the position with the maximum stress or at the crack position. When the stress is performed with numerical computation methods, eg: determined by using the finite element method (FEM) or measured by strain gauges (DMS), the nominal stress usually keeps a certain distance from the weld. The distance depends on the modeling set during FEM calculation (geometric construction) and the mesh generation (including element type and size as well as network gradation). For sheared welds, the approximate value for the distance to the weld toe is 1 to 1.5 times the plate thickness.

In the proof of fatigue strength, the normal stress transverse to and longitudinal to the crack (σ_{\perp} and σ_{\parallel}) and the shear stress (τ) longitudinal to the crack shall be considered.

The proof of fatigue strength can be carried out in according to DIN 15018 and the proof of fatigue strength shall be performed separately for each component firstly:

$$\frac{\sigma_{\parallel}}{\sigma_{\parallel, \text{zul}}} \leq 1, \quad \frac{\sigma_{\perp}}{\sigma_{\perp, \text{zul}}} \leq 1, \quad \frac{\tau}{\tau_{\text{zul}}} \leq 1 \quad (1)$$

$\sigma_{\parallel, \text{zul}}$, $\sigma_{\perp, \text{zul}}$, and τ_{zul} are taken as the allowable fatigue strength values in MKJ diagrams of Section 4.4 and applicable to the sheets with a thickness range of $2 \leq t \leq 10$ mm, unless otherwise specified in Table B-1.1 to Table B-9 of Annex B. For sheets with a thickness range of $10 < t \leq 90$ mm, the fatigue strength values in MKJ diagrams shall be reduced according to the following equation:

$$\sigma_{\parallel, \text{zul}} = \sigma_{\parallel, \text{zul}}^{\text{MKJ}} (10 \text{ mm} / t)^{\psi} \quad (2)$$

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This is also applicable to the allowable value of $\sigma_{\perp, \text{zul}}$ and that of τ_{zul} .

For multiple stress components, the proof of fatigue strength shall be performed for multi-axial stress or combined stress additionally:

$$\left(\frac{\sigma_{\parallel}}{\sigma_{\parallel, \text{zul}}} \right)^2 + \left(\frac{\sigma_{\perp}}{\sigma_{\perp, \text{zul}}} \right)^2 - \frac{\sigma_{\parallel}}{|\sigma_{\parallel, \text{zul}}|} \cdot \frac{\sigma_{\perp}}{|\sigma_{\perp, \text{zul}}|} + \left(\frac{\tau}{\tau_{\text{zul}}} \right)^2 \leq 1,1 \quad (3)$$

The proof of fatigue strength can be performed by other recognized approaches with the fatigue strength values given in this Directive, where the aforementioned wall thickness shall be considered.

If the highest stress occurs at the weld toe, the normal stress shall be subject to the stress in the cross section of the sheet. For non-fully connected joints or non-penetrated welded joints, the weld cross-section and the weld toe shall be checked based on the nominal stress, unless it is proved that the maximum stress occurs at the weld toe. In this case, the calculated thickness of weld based on DIN EN 15085-3 must be considered.

4.4.2 Allowable values for proof of fatigue strength- MKJ diagram

The allowable fatigue strength values are shown in MKJ diagrams for welded joints and the base material of S355 and S235 steels in response to the stress ratio and the slope line of notch, with the maximum stress or upper limit stress provided. The fatigue strength values are also applicable to other steels used in railway vehicles.

For steels with yield limit values between S235 and S355, the fatigue strength values for the slope lines of notch from A to D shall be converted according to the ratio of yield limit values of the two kinds of steels. For steels with yield limit higher than S355, the fatigue strength for the base material (slope line of notch: A) shall be increased proportionally based on the tensile strength of S355. The fatigue strength values of S355 are applicable for other slope lines of notch (from AB to F3).

The allowable fatigue strength values given in MKJ diagrams include a safety factor of 1.5 (based on the mean value) and correspond approximately to the probability of survival $P \bar{U} = 99.5\%$. It is applicable to load changes more than $2 \cdot 10^6$.

Fatigue strength curves given in MKJ diagrams are limited by the load capacity which is decisive for the static strength analysis. That is, the maximum allowable standard or shear stresses obtained from MKJ diagrams shall not be greater than the allowable stress value of the static strength.

To Create Extreme Table

1

Execute **Table (expand/extreme)** in Standards => Steel Fatigue Check (DVS 1612) context menu

2

Load Group: **3..Loads 2-5** and press **OK**

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

3

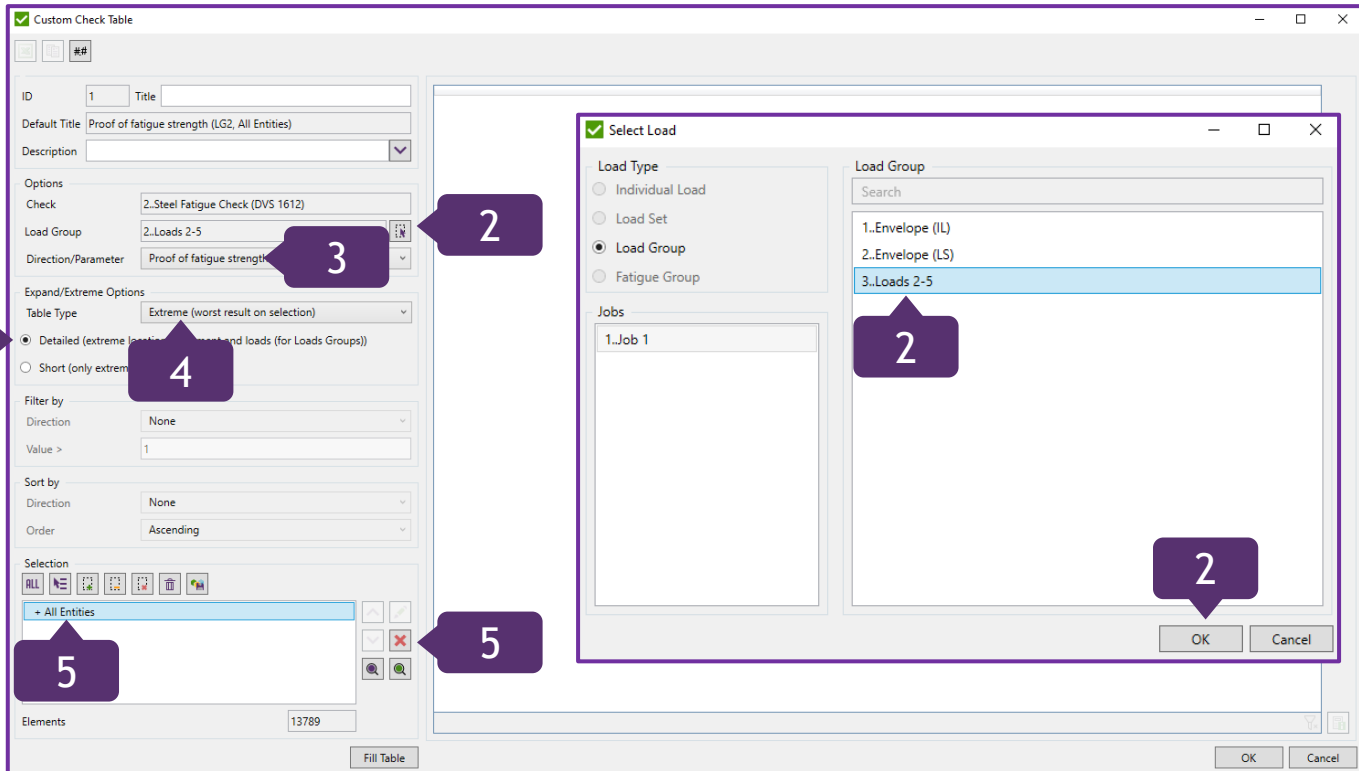
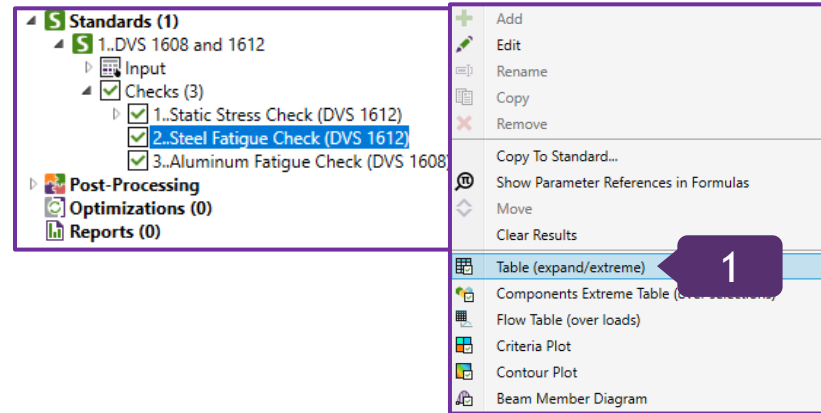
Direction/Parameter: **Proof of fatigue strength**

4

Table Type: **Extreme; Detailed (extreme locations-element and load (for Load Groups)) - ON**

5

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



Create Extreme Table (Continuation)

6

In Custom Check Table in *Selection* => press 

7

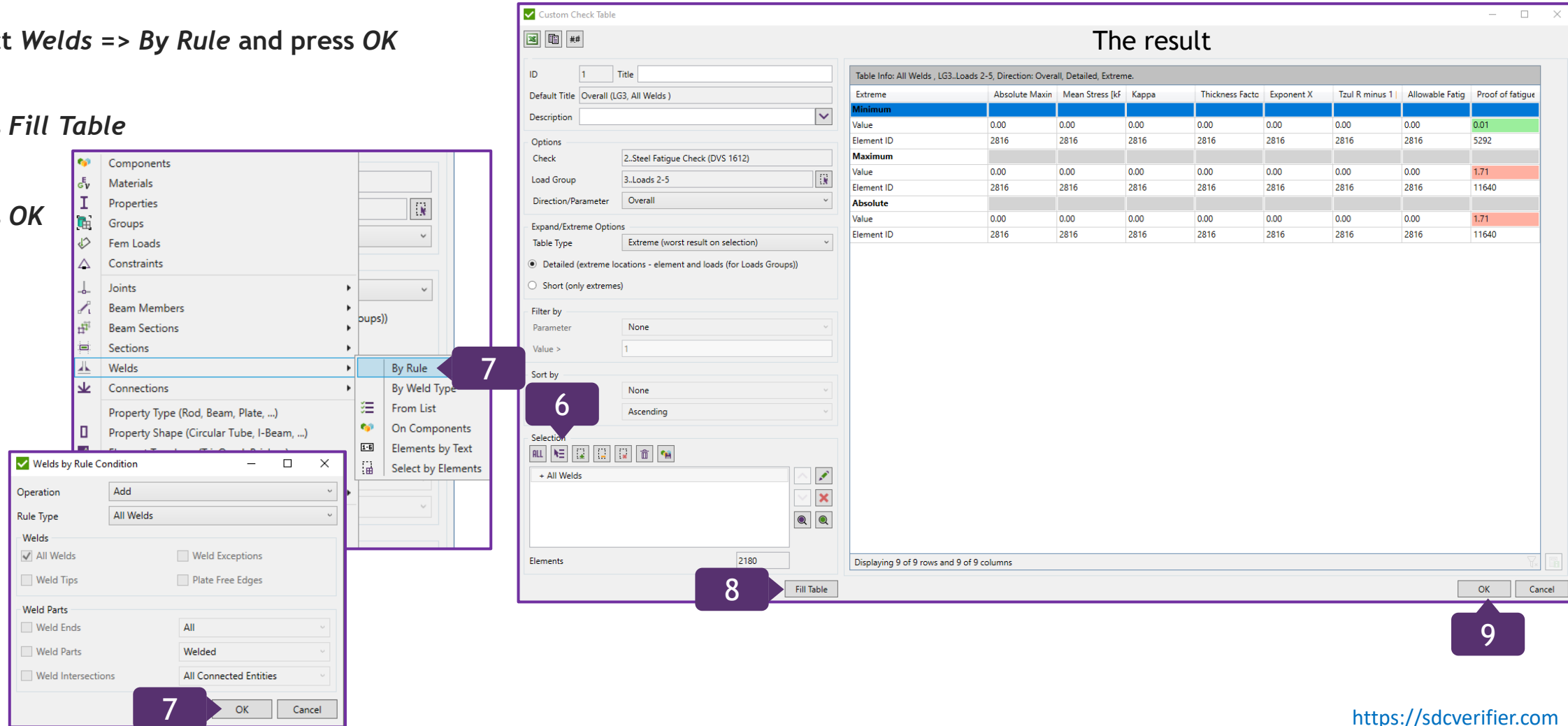
Select *Welds* => *By Rule* and press *OK*

8

Press *Fill Table*

9

Press *OK*



Custom Check Table

ID: 1 Title:
Default Title: Overall (LG3, All Welds)
Description:
Options:
Check: 2.Steel Fatigue Check (DVS 1612)
Load Group: 3.Loads 2-5
Direction/Parameter: Overall
Expand/Extreme Options:
Table Type: Extreme (worst result on selection)
Detailed (extreme locations - element and loads (for Loads Groups))
Short (only extremes)
Filter by:
Parameter: None
Value >: 1
Sort by:
None
Ascending
Selection:
+ All Welds
Elements: 2180
Fill Table

The result

Table Info: All Welds, LG3.Loads 2-5, Direction: Overall, Detailed, Extreme.

Extreme	Absolute Maxin	Mean Stress [kF	Kappa	Thickness Facto	Exponent X	Tzul R minus 1	Allowable Fatig	Proof of fatigue
Minimum								
Value	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01
Element ID	2816	2816	2816	2816	2816	2816	2816	5292
Maximum								
Value	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.71
Element ID	2816	2816	2816	2816	2816	2816	2816	11640
Absolute								
Value	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.71
Element ID	2816	2816	2816	2816	2816	2816	2816	11640



Displaying 9 of 9 rows and 9 of 9 columns

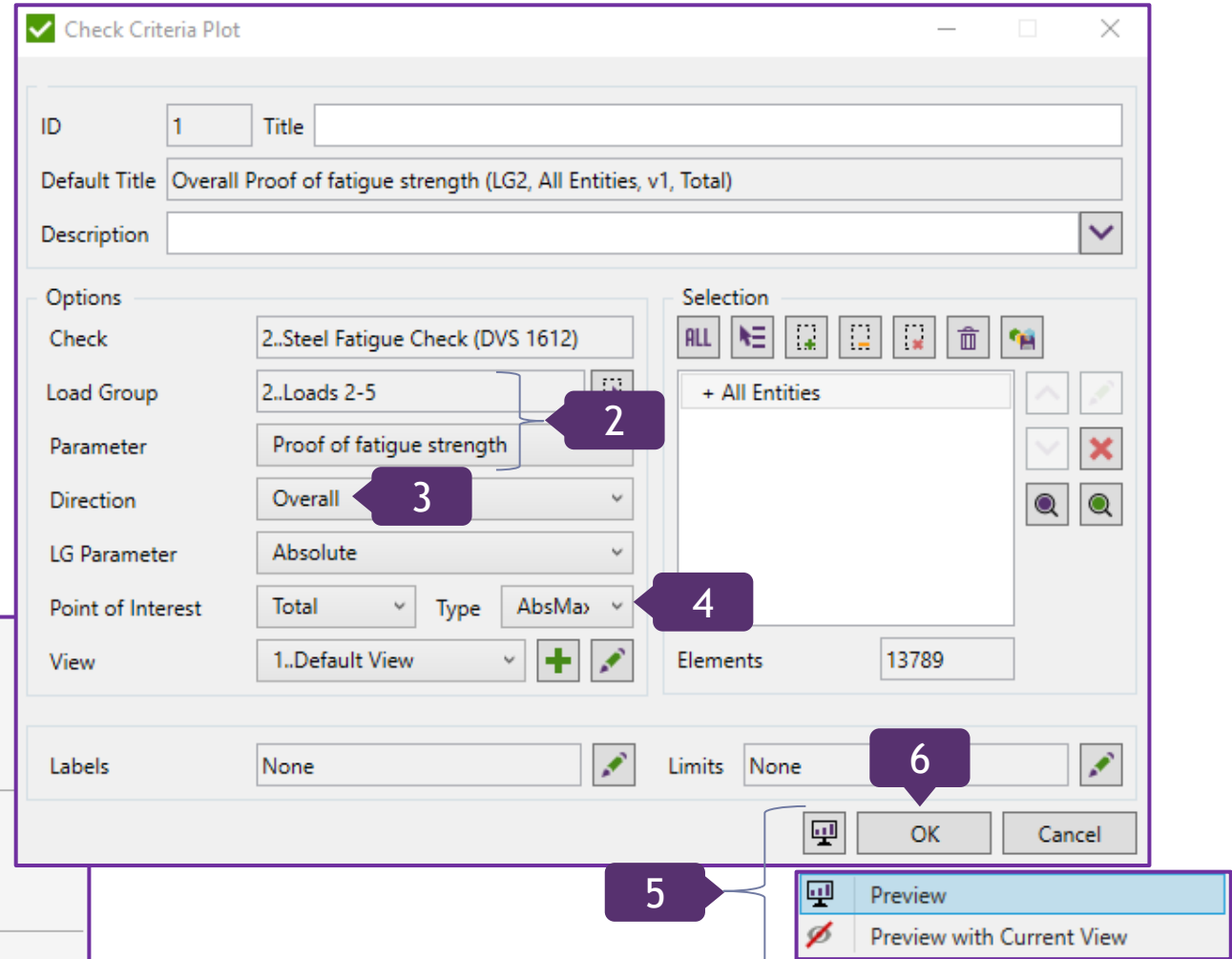
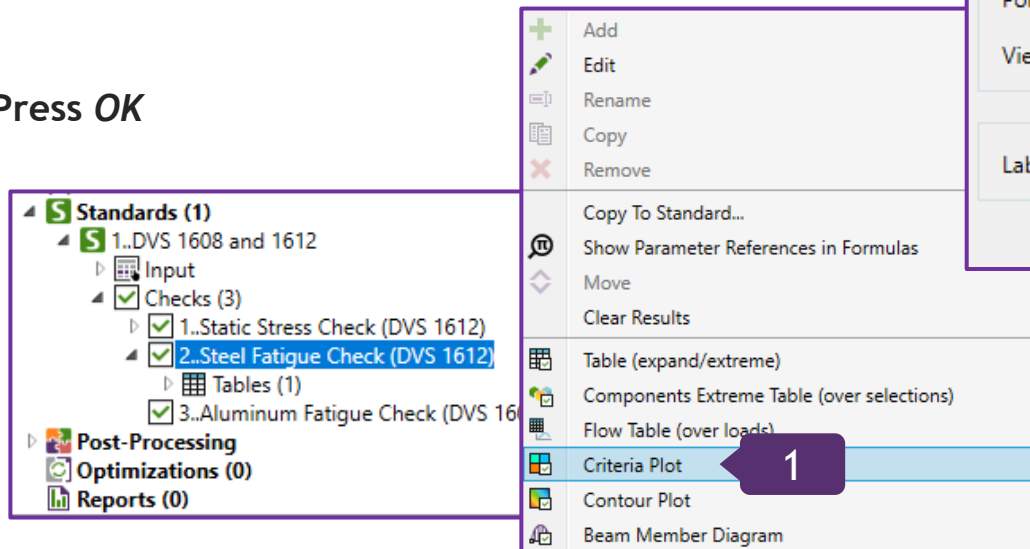
OK Cancel

Welds by Rule Condition

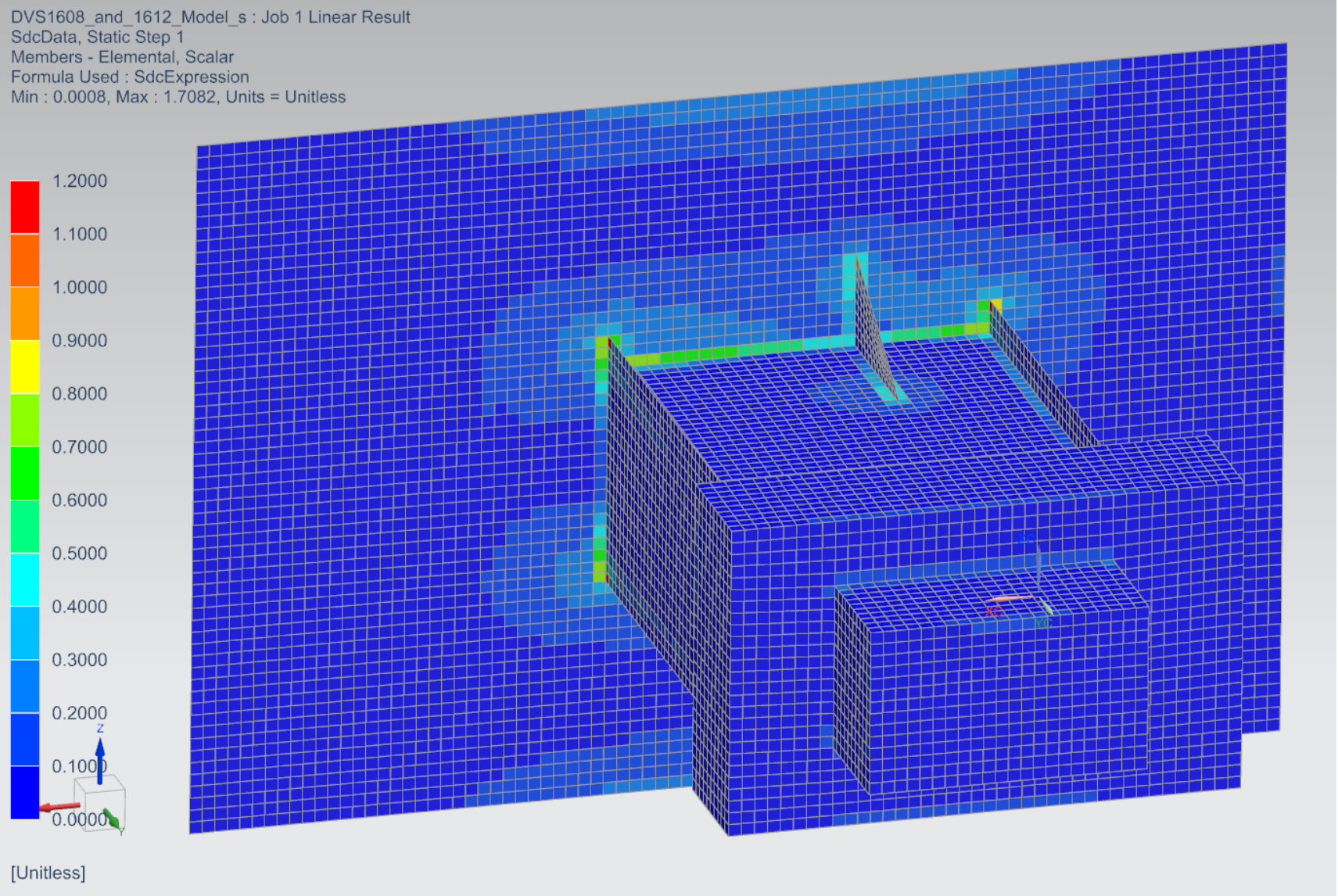
Operation: Add
Rule Type: All Welds
Welds:
☒ All Welds
☐ Weld Exceptions
☐ Weld Tips
☐ Plate Free Edges
Weld Parts:
☐ Weld Ends: All
☐ Weld Parts: Welded
☐ Weld Intersections: All Connected Entities
OK Cancel

Create Criteria Plot

- 1 Execute  **Criteria Plot** in Fatigue Check context menu
- 2 Load Group: 2..Loads 2-5;
Parameter: *Proof of fatigue strength*
- 3 Direction: *Overall*
- 4 Point of interest: Total; Type: *AbsMax*
- 5 Press  and then *Preview* and *OK*
- 6 Press *OK*



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



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/>