



Tutorial

Joint Check

Updated on: August 8th, 2024

Tested with: SDC for Simcenter 3D 2024 R1.1

Simcenter3D 2306

SDC Verifier is a powerful extension to **Simcenter 3D** with an advanced calculation core for checking structures according to different standards and report generation.

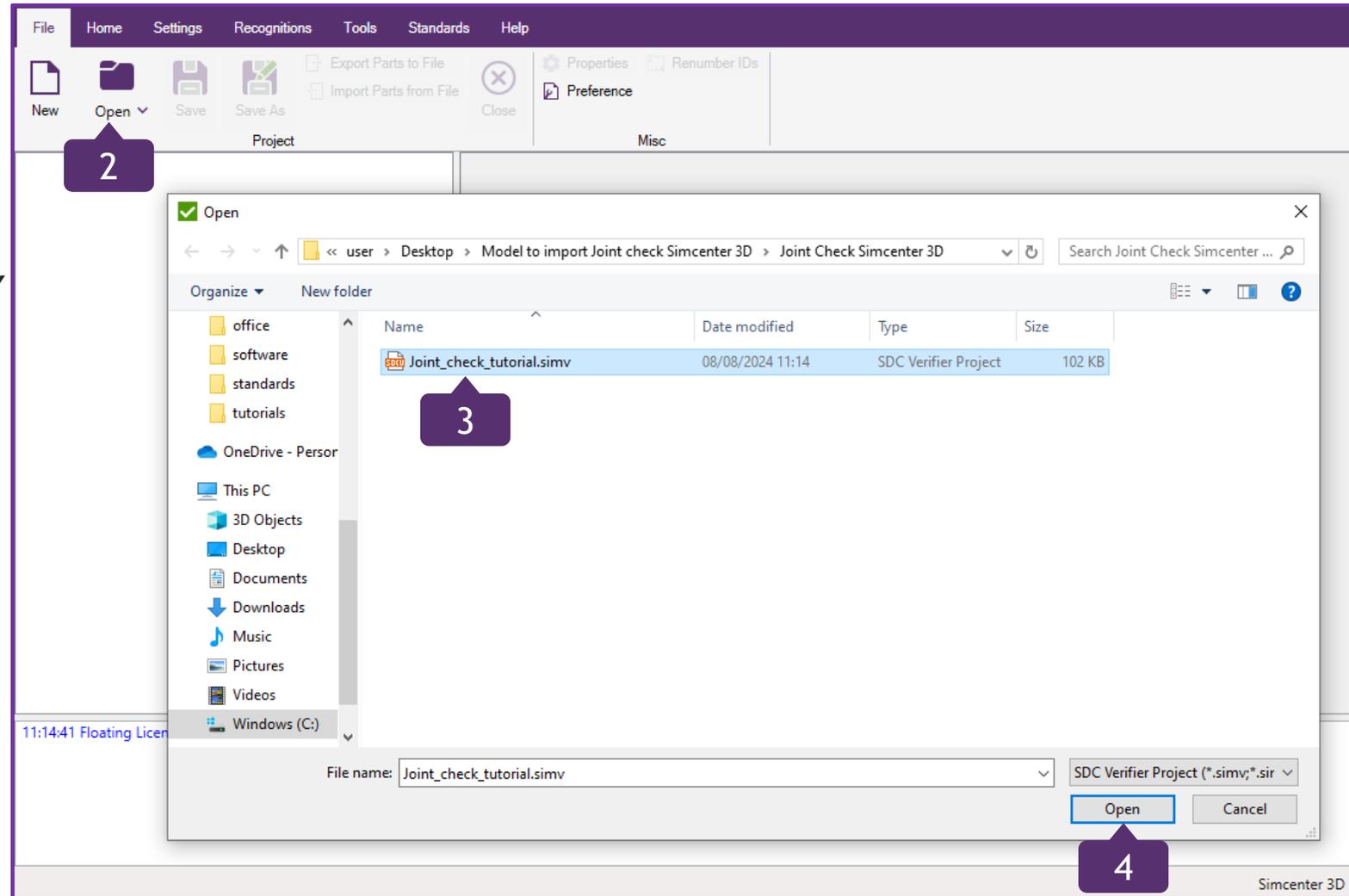
The goal of **SDC Verifier** is to automate all possible routine work and speed up a verification of the engineering projects significantly.

In this tutorial, Joint Check is reviewed in details.

- General Info;
- Connection Types;
- Connection design;
- Joint Checks according to standards;
- Create Plots and Tables;
- Criteria Plot comparison of Joint Checks;
- The functionality of SDC Verifier Report Designer can be checked via the link to a separate tutorial (Slide 37).

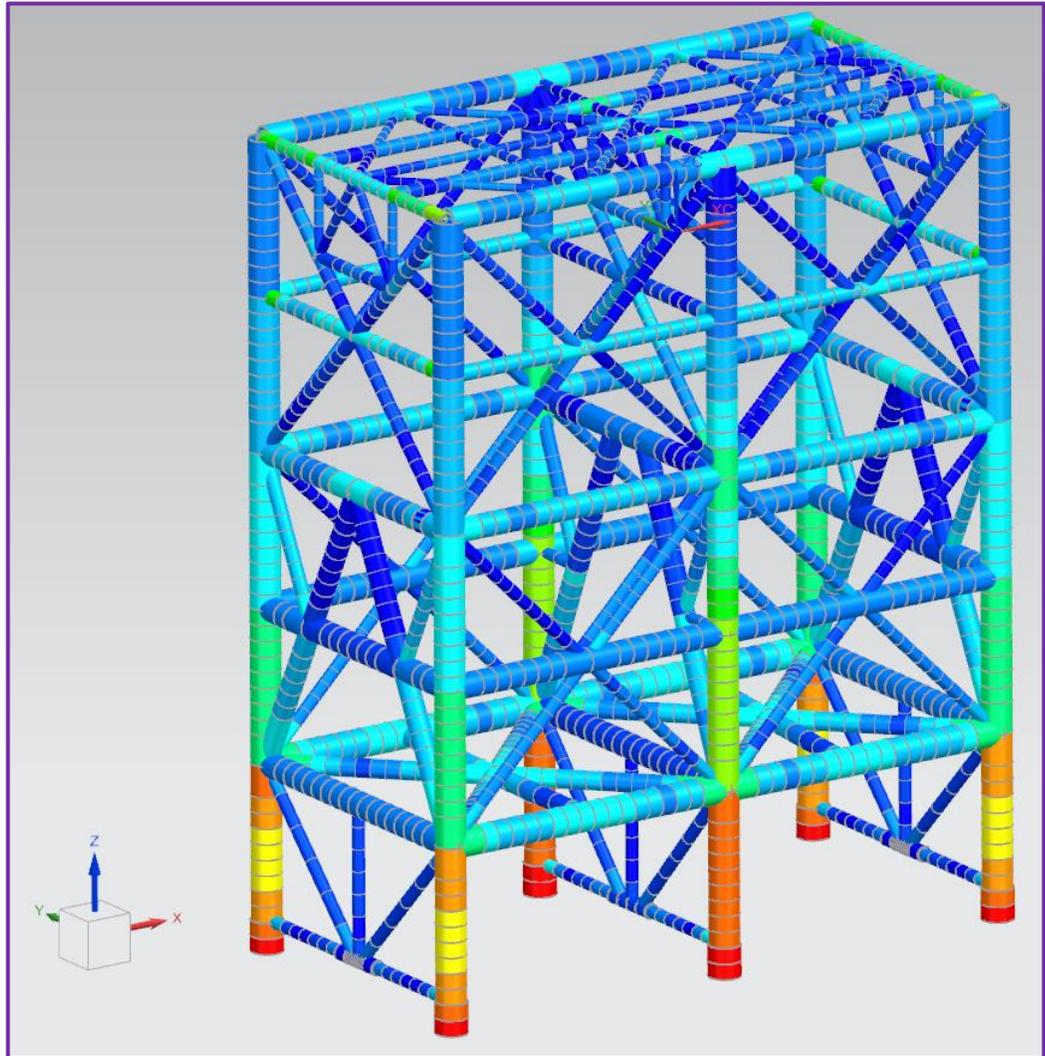
Open the Starter Model

- 1 Launch SDC Verifier for Simcenter 3D
- 2 In *File* section, press *Open*
- 3 Select a project *joint_check_tutorial.simv*
- 4 Press *Open*



This tutorial uses project with predefined boundary conditions. The model contains only circular tube beams.

- ▶ Views (1)
- ▲ Model
 - ▶ Components (0)
 - ▶ Materials (2)
 - ▶ Properties (16)
 - ▶ FEM Loads (6)
 - ▶ Constraints (1)
- ▶ Recognition
- ▲ Jobs (1)
 - ▲ 1..Job 1
 - ▶ Individual Loads (6)
 - ▶ 1..Gravity -9.81
 - ▶ 2..Nodal Force Down
 - ▶ 3..Nodal Force Right
 - ▶ 4..Nodal Force Left
 - ▶ 5..Nodal Force Middle -YZ
 - ▶ 6..Nodal Force Middle YZ
 - ▶ Predefined Load Cases (0)
 - ▶ Load Sets (1)
 - ▶ 1..All loads combination
 - ▶ Load Groups (2)
 - ▶ FG Fatigue Groups (0)
 - ▶ Tables (0)
 - ▶ Plots (0)



1 Go to *Home* section on the Ribbon

2 Press  on the toolbar to analyze Job

The screenshot displays the SDC Verifier software interface. The 'Home' ribbon is selected, and the 'Analyze' button in the toolbar is highlighted with a callout '2'. The 'Jobs' tree on the left shows '1..Job 1' selected. The right panel shows analysis options for 'Linear Static' analysis. The bottom status bar shows 'Job 1 analysis started and finished' with a timestamp of 11:32:28.

Job 1 analysis started
11:32:28 Analysis options:
Simple analysis loads: 6
Inertia relief analysis loads: 0
Not included loads: 0
Skipped loads: 1
11:32:48 Job 1 analysis finished

Nodes: 1929 Elements: 2082 C:\Users\user\Desktop\Model to import Joint check Simcenter 3D\savedModel_joint_s.sim MmKS (Millimeter/Kg/Second) Simcenter 3D

Job 1 analysis started and finished.

Joint Check is an offshore check that verifies strength of tubular structure under tension or compression members according to the standards.

Joint is a node where two or more incline elements are connected.

Connection is a set of elements of the same plane around a joint node.

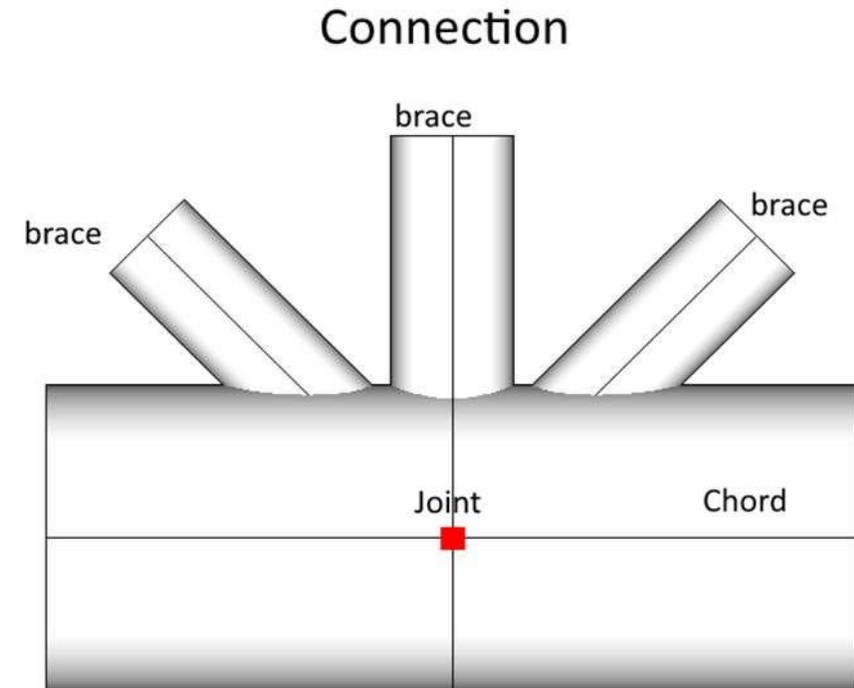
Chord is a set of non-welded elements that form straight line.

Brace is a welded to a chord element.

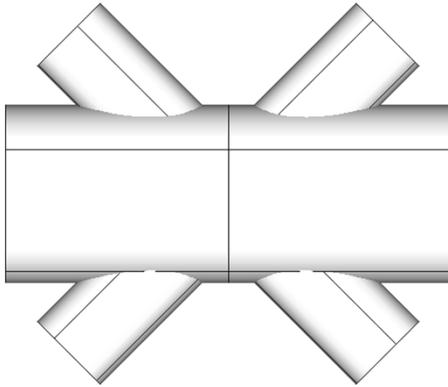
Joint check is based on the connections.

Each connection is a set of elements near joint node. Connections consists of Chord and braces. Brace contains only 1 element with ID defined in brackets (#). Connection can contain braces from both sides of the chord.

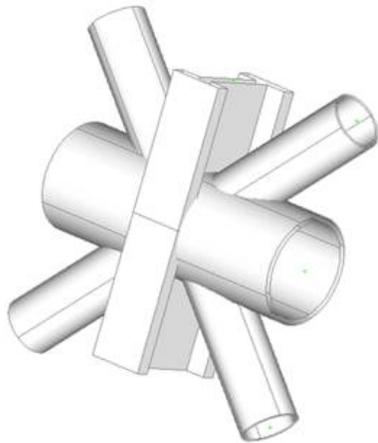
The information is displayed in the second brackets:
U- upper braces; L- lower braces.



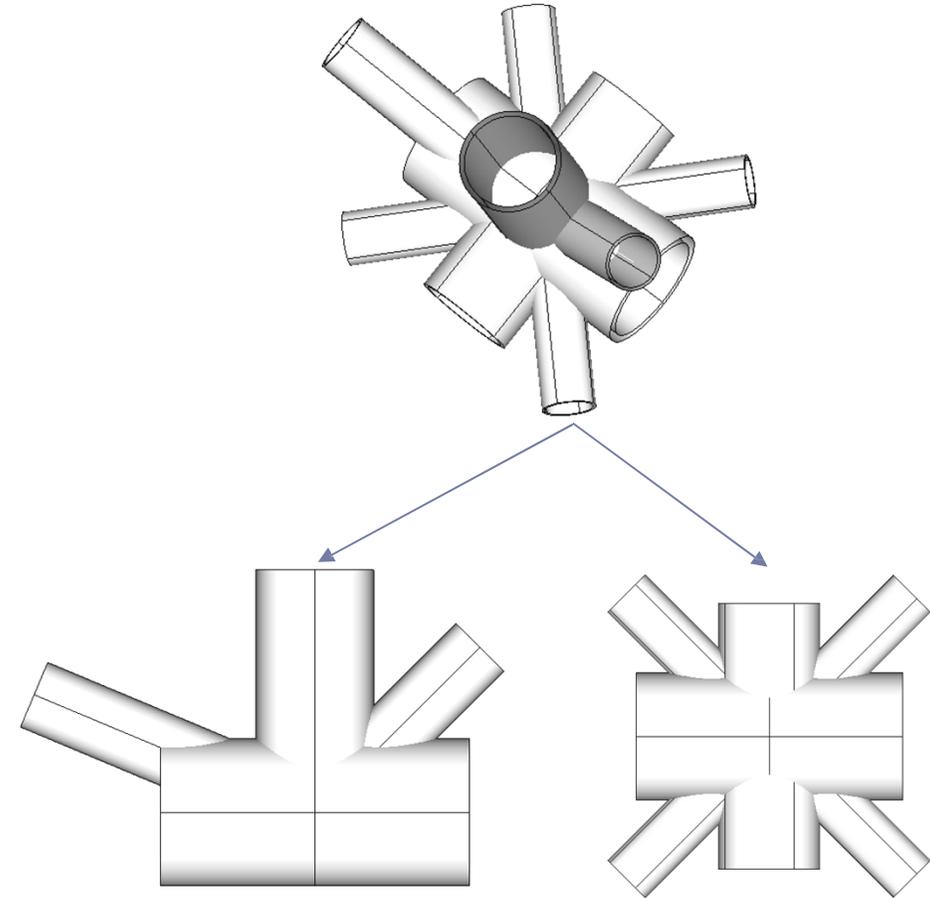
2D Connection. Set of elements of one plane



Connection can include only circular tube shape elements. Otherwise, connection will not be recognized. Example of unrecognized connection:



3D Connection. It will be split on 2D Connections



Add Joint Check API LRFD (1st, 1993)

1

Execute right click on *Standards* and select *Add => Custom*

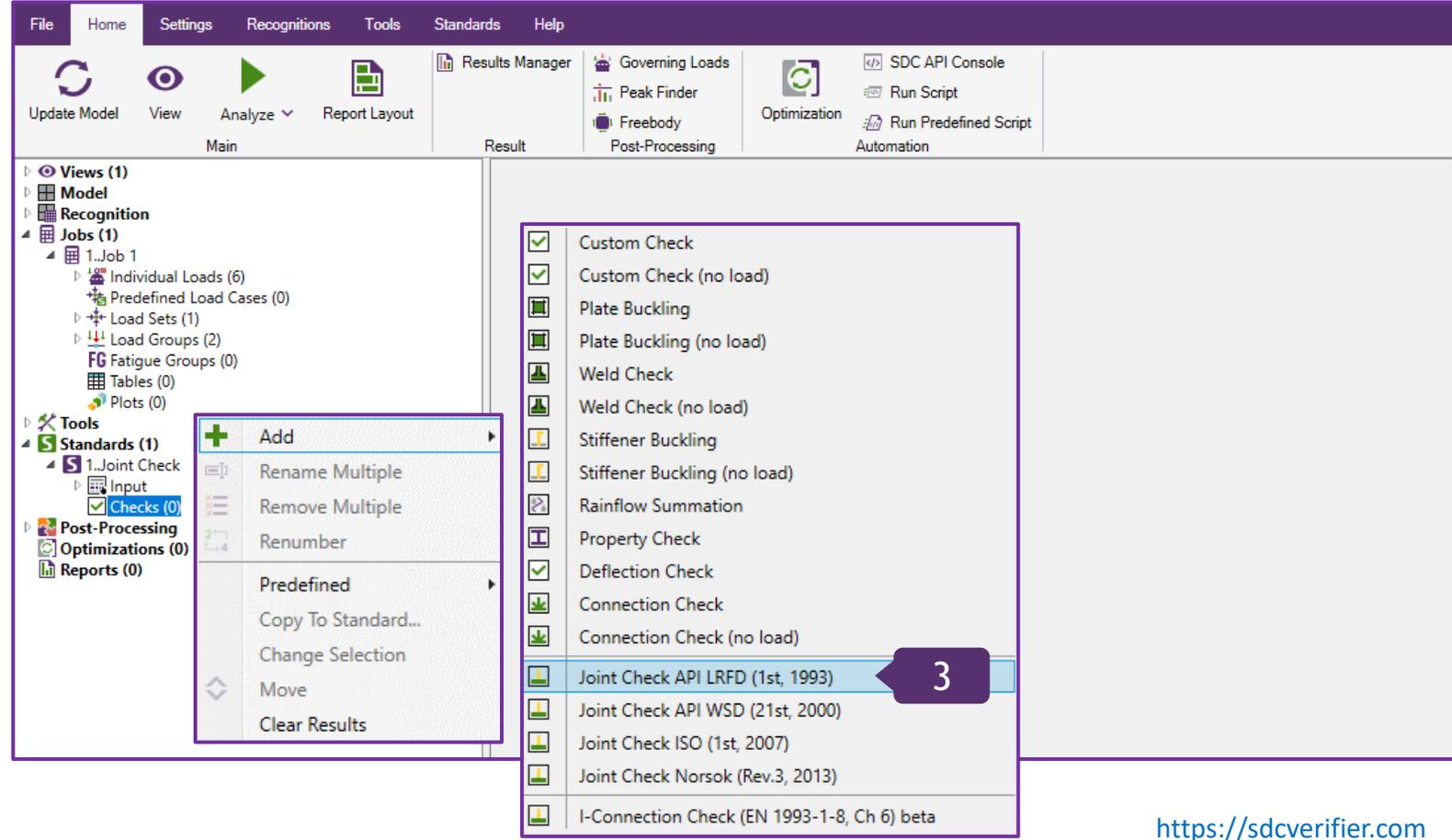
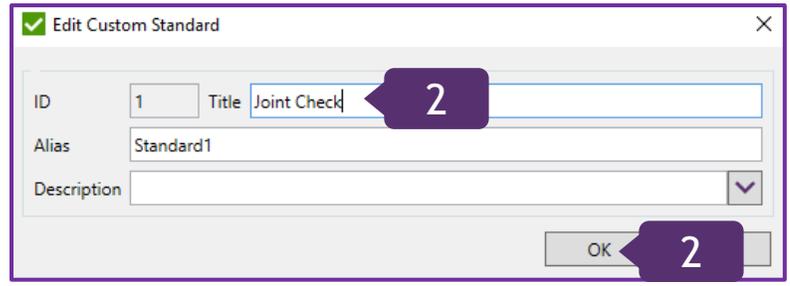
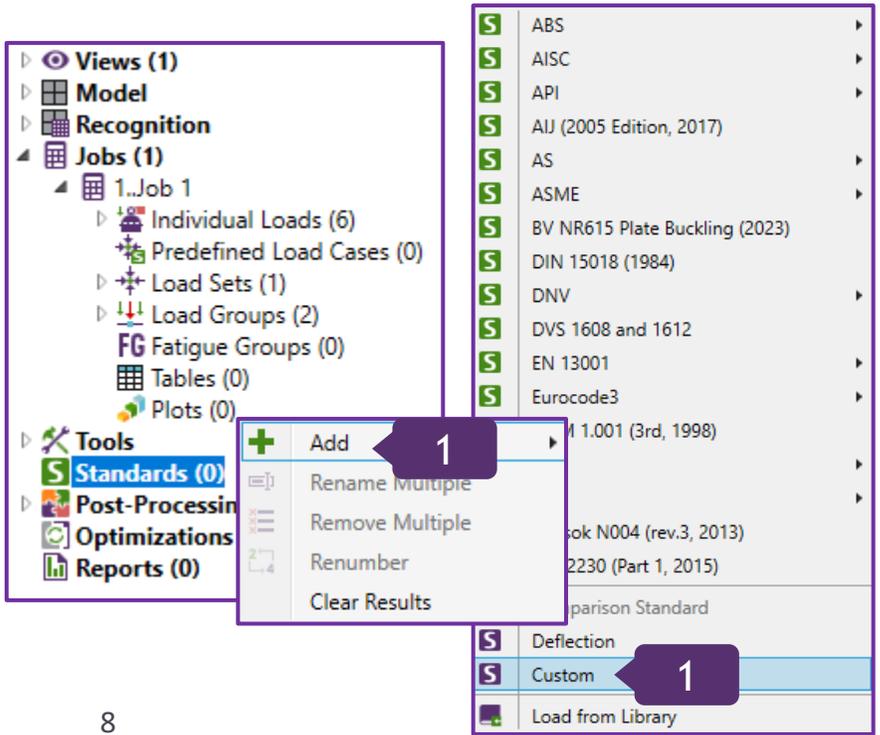
2

Title: *Joint Check*;
Press *OK*

3

In 1..*Joint Check*, execute right click on *Checks (0)* => *Add* => *Joint Check API LRFD (1st, 1993)*

Joint Check API LRFD is a part of the standard API RP 2A-LRFD (1st, Jul 1993). This is the reason why the first step was to create Custom Standard.



1

Press *Find Connections*

Joint Check Settings are common for all available types of joint checks: API, ISO and Norsok.

Joint nodes to be checked. Part of the model can be checked by selecting the required joints.

Maximum distance between joint nodes of one connection. Include connections that are formed by multiple joints. The recommended distance is $D/4$. It is possible to set custom distance.

Angle between braces treated as in one plane. Braces that are located in different planes of one connection with an angle A to each other will be treated as in-plane connection.

Chord maximum curvature angle defines the maximum allowable straightness of the chord. Default angle is 3 degrees.

Forces tolerance is maximum allowable difference between axial tension and compression forces that are perpendicular to the chord from one side of the connection. If forces are balanced, all braces are considered to be K joints.

Calculate all braces as TY. Ignore all loading conditions and set all brace types to TY if turned on.

Joint Check

General

ID: 1 Title: Joint Check 1

Alias: Check 1

Description: ck according to API RP 2A LRFD (1st, 1993)

Joint Nodes to be Checked

Selection: All Entities

Recognition Settings

Maximum Distance between Joint Nodes of one Connection on the Chord:

Use $D/4$ (D - Chord Diameter)

Custom Distance: 0.1

Angle between Braces Treated as in One Plane. $A = [0 \text{ to } 90]$: 15

Chord Maximum Curvature Angle [0 to 15]: 3

Joint Type Recognition Settings

Forces Tolerance, %: 1

Calculate All Braces as TY

Find Connections

1

Select 127..Connection 127;
Press

2

Press *Preview Connection*

3

Press to remove all conditions in Chord and Braces selections

All connections in the list are recommended to be checked as all elements of each connection are of the same diameters and thicknesses. Depending on the welding process, it is possible to modify connection and set chord and braces manually.

Two separate connections will be created automatically for cross type of joint with equal dimensions. With chord parallel and perpendicular.

Joint Check

General
ID: 1 Title: Joint Check 1
Alias: Check1
Description: ck according to API RP 2A LRFD (1st, 1993)
Joint Nodes to be Checked: Selection: All Entities
Recognition Settings: Maximum Distance between Joint Nodes of one Connection on the Chord: Use D/4 (D - Chord Diameter) (0.1)

Check Connections Design

It is recommended to check design of following connections to avoid inappropriate results

ID	Connections
7.	Connection 7
9.	Connection 9
55.	Connection 55
91.	Connection 91
93.	Connection 93
99.	Connection 99
101.	Connection 101
127.	Connection 127

Edit Connection

General
ID: 127 Title: Connection 127

Chord Elements: + 2 Elements(2524, 2523)
Braces: + 4 Elements

Brace or Chord	Angle	Thickness	Diameter	Minimum Fy	Is Overlapped	Resistance coef.
Chord (#2524, 2523)		10	300	0		
Brace (#2500) (U)	39.289366	10	300		No	
Brace (#2521) (U)	90	10	300		Yes	0.9
Brace (#2515) (L)	39.289366	10	300		No	
Brace (#2522) (L)	90	10	300		Yes	0.9

Buttons: Calculate, Set Braces Overlapping, **Preview Connection**, OK, Cancel

3D Model: A 3D rendering of a connection between four pipes, with a callout showing a cross-section of one of the pipes.

Add Chord Elements

1

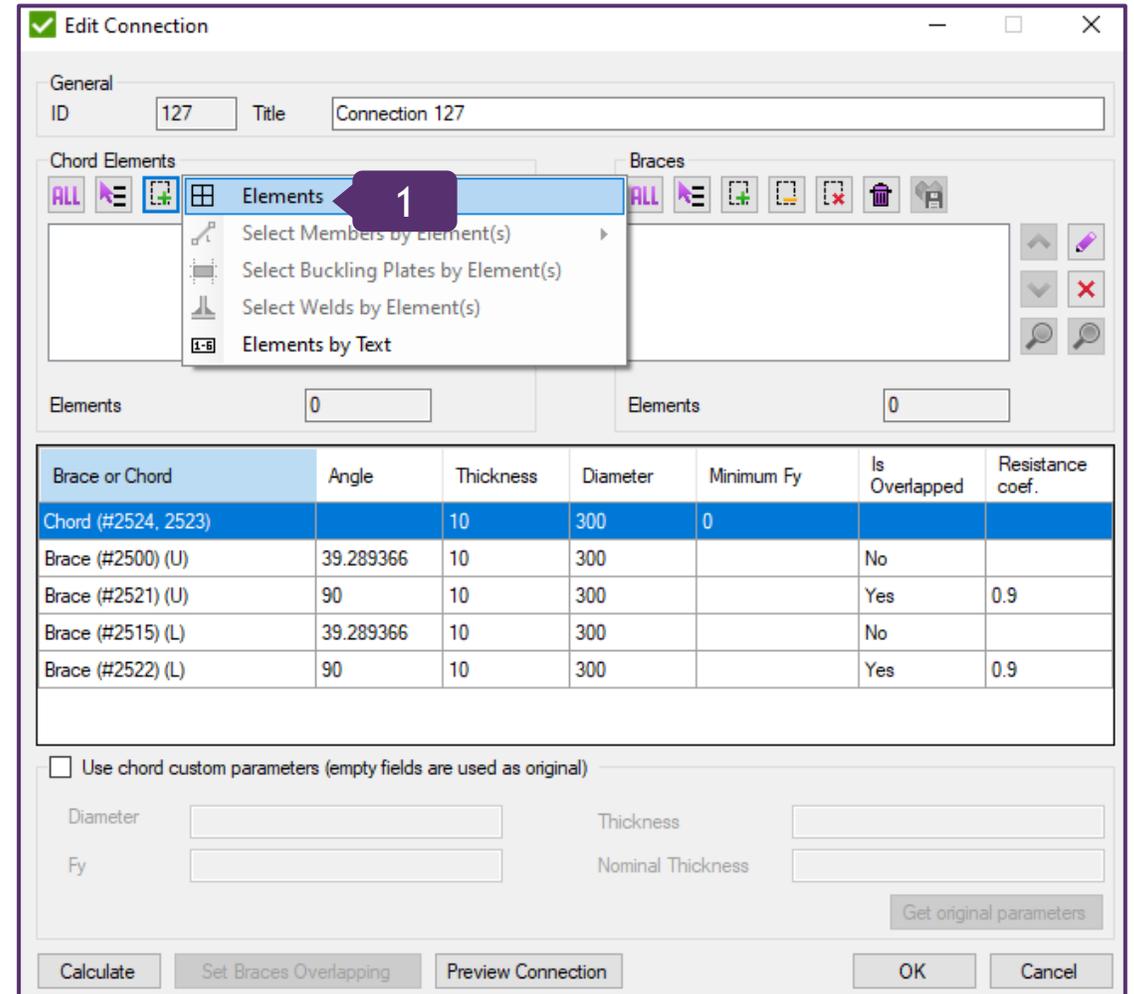
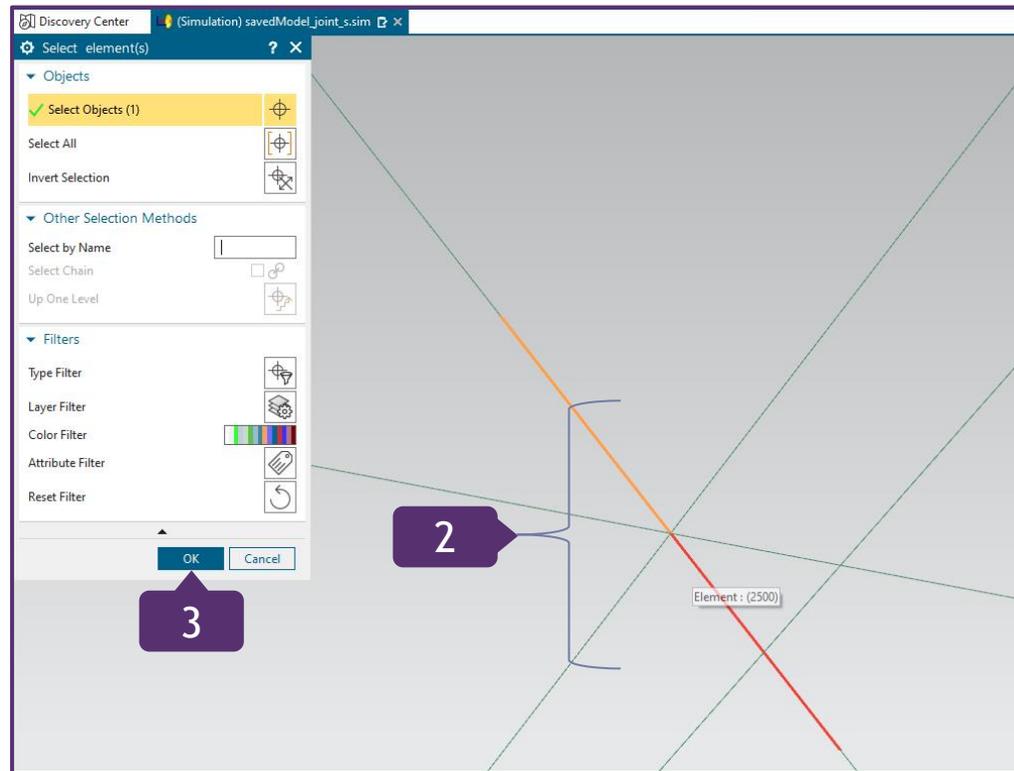
To add entities with Simcenter 3D, press  and select *Elements*

2

In Simcenter 3D, select elements 2515 and 2500;

3

Press *OK*



1

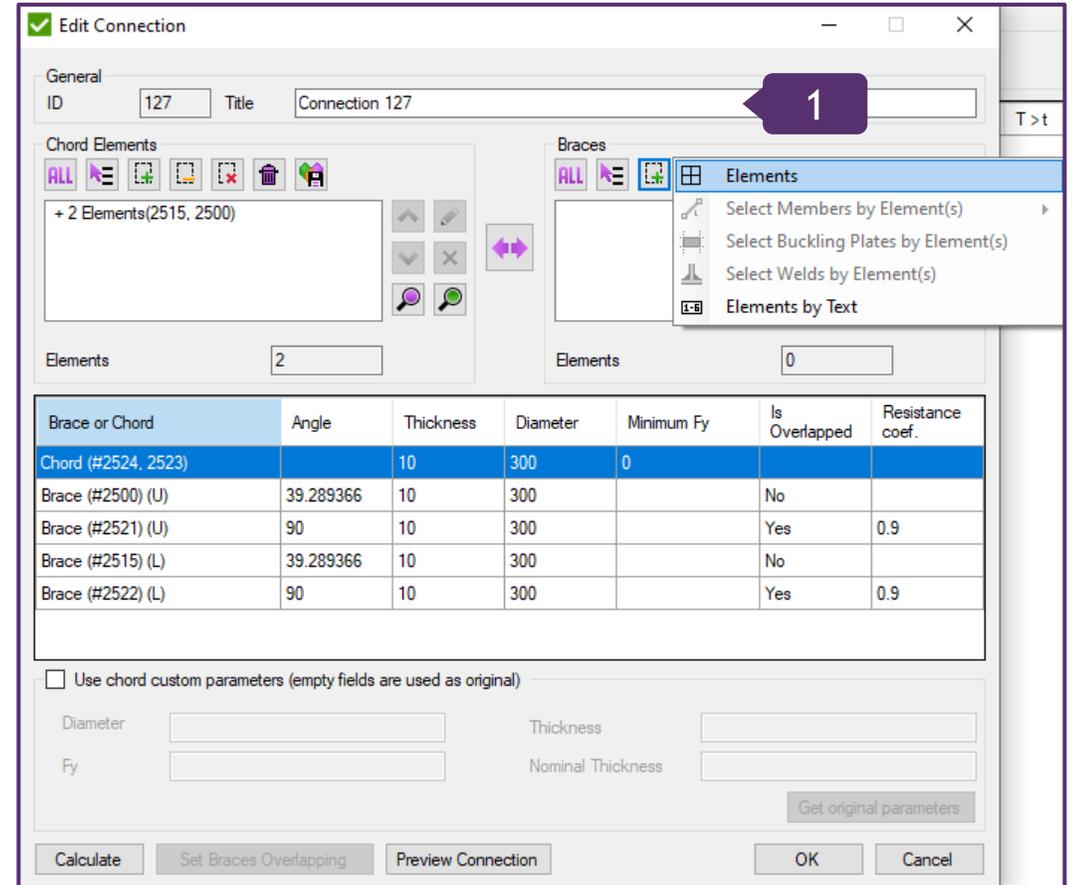
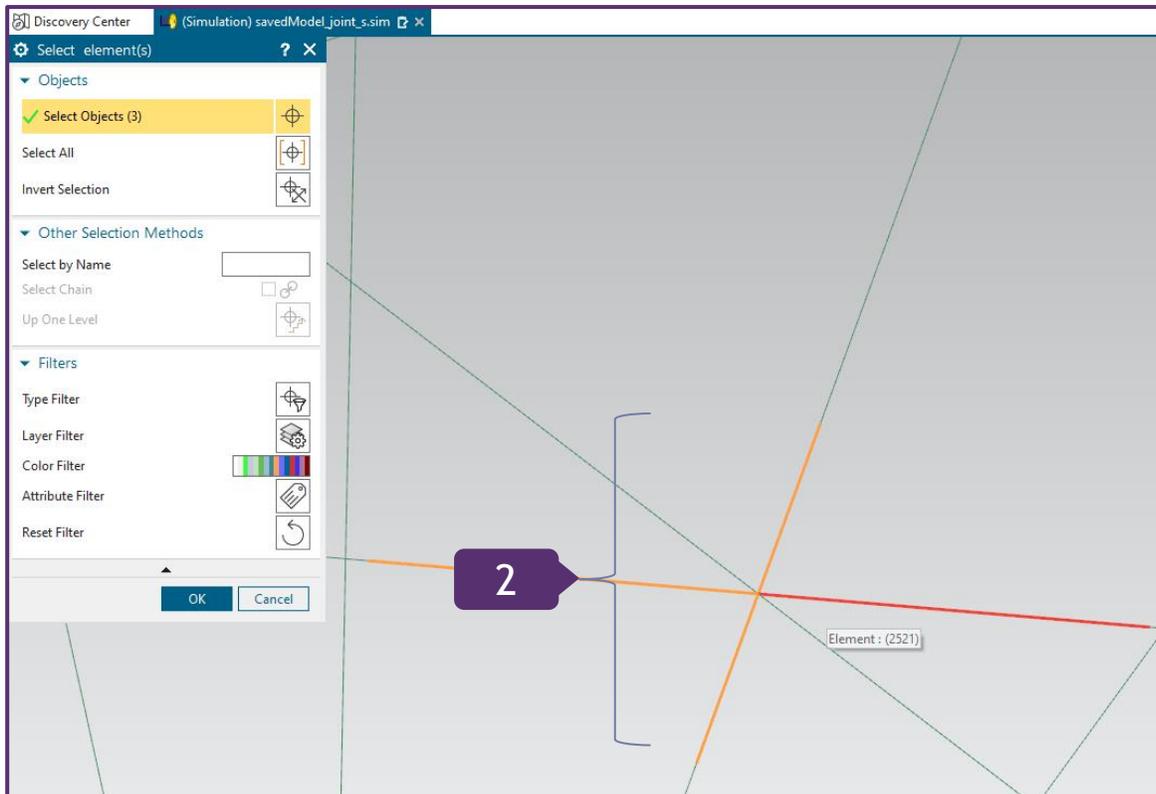
To add entities with Simcenter 3D, press and select *Elements*

2

In Simcenter 3D, select elements 2521, 2522, 2523, 2524

3

Press *OK*



3

1 Press *Calculate*

2 Press *OK*

3 Press *OK*

4 Press *Close*

Brace or Chord	Angle	Thickness	Diameter	Minimum Fy	Is Overlapped	Resistance coef.
Chord (#2524, 2523)		10	300	0		
Brace (#2500) (U)	39.289366	10	300		No	
Brace (#2521) (U)	90	10	300		Yes	0.9
Brace (#2515) (L)	39.289366	10	300		No	
Brace (#2522) (L)	90	10	300		Yes	0.9

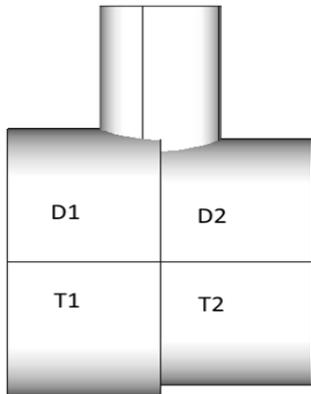
1

3

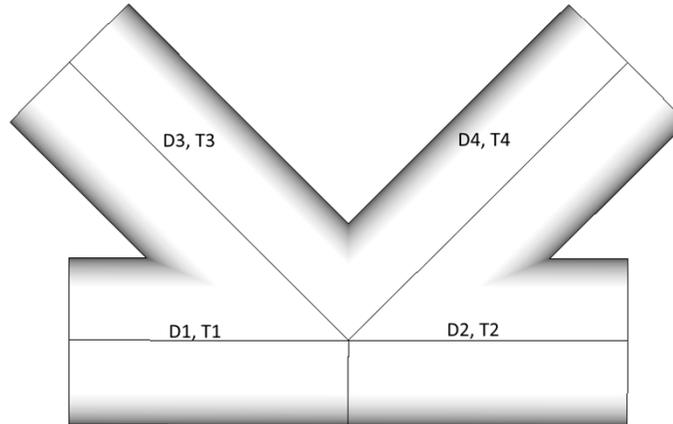
2

4

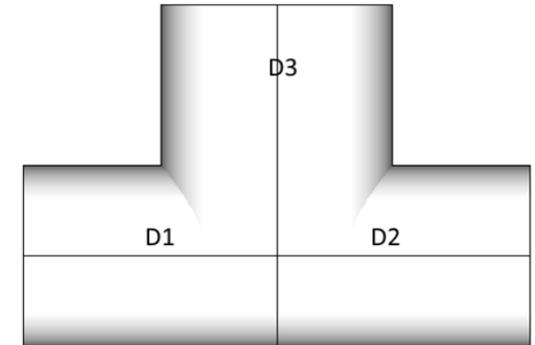
When Chord is formed by elements with different properties around the joint node and $D1 < D2$, $D = \min(D1, D2)$; $T = \min(T1, T2)$ are considered for calculations.



In case when :
 $D1 = D2 = D3 = D4$;
 $T1 = T2 = T3 = T4$;
 When all diameters of connection are equal, Thicknesses are compared. Element with thickness = $T4$ is recognized as chord.



$D1 = D2$, $D1 < D3$. For such case, $D3$ is recognized as chord as it has bigger diameter. Naturally, pipe of bigger diameter cannot be welded to smaller. Such connections are recommended to be checked.



$D1 = D2 = D3 = D4$;
 $T1 = T2 = T3$; $T4 > T1$;
 When all diameters of the connection are equal, thicknesses are compared. Element with thickness = $T4$ is recognized as a chord.

In both cases, such types of connections are recommended to be checked.

Navigation. Fill *Connection ID* and Press *Navigate* to find a connection in the table

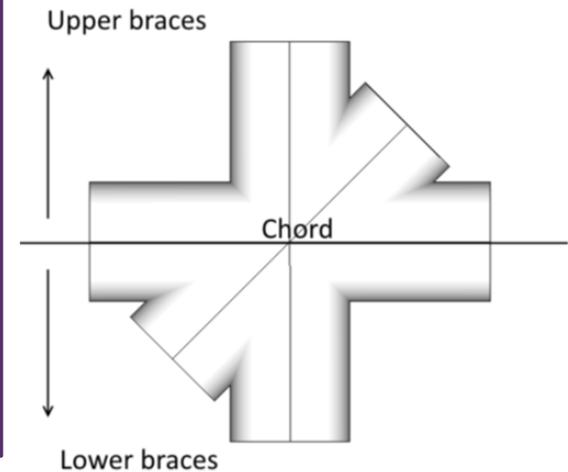
Connection info. Chord, Braces, and their properties

Add, Edit, Preview and Remove selected connections

Selection and recognition settings

The screenshot shows the 'Joint Check' software interface. On the left, there are several settings panels: 'General' (ID: 1, Title: Joint Check 1), 'Navigation' (Connection ID input), 'Joint Nodes to be Checked' (Selection: All Entities), and 'Recognition Settings' (Maximum Distance: 0.1, Angle between Braces: 15, Chord Maximum Curvature Angle: 3). The main area is a table with columns: ID, Title, Brace or Chord, Angle, Thickness, Diameter, T > t, Is Overlapped, and Resistance coef. Row 12 is selected. At the bottom, there are buttons for 'Find Connections', 'Clear Results', 'Set Resistance Coefficients', 'Overall Table', 'Set Brace Load Transfer', 'OK', and 'Cancel'.

ID	Title	Brace or Chord	Angle	Thickness	Diameter	T > t	Is Overlapped	Resistance coef.
1	Connection 1	Chord (#122, 1101) Brace (#368) (U)	90	11	228	8	Yes No	
2	Connection 2	Chord (#122, 1101) Brace (#1046) (U) Brace (#1053) (L)	90	11	228	8	Yes No	
3	Connection 3	Chord (#15, 30) Brace (#912) (U)	90	30	480	20	Yes No	
4	Connection 4	Chord (#15, 30) Brace (#913) (U)	90	30	480	20	Yes No	
5	Connection 5	Chord (#142, 1121) Brace (#372) (U)	90	11	228	8	Yes No	
6	Connection 6	Chord (#142, 1121) Brace (#1038) (U) Brace (#1045) (L)	90	11	228	8	Yes No	
7	Connection 7							
8	Connection 8							
9	Connection 9							
10	Connection 10							
11	Connection 11							
12	Connection 12							
13	Connection 13							
14	Connection 14							
15	Connection 15							

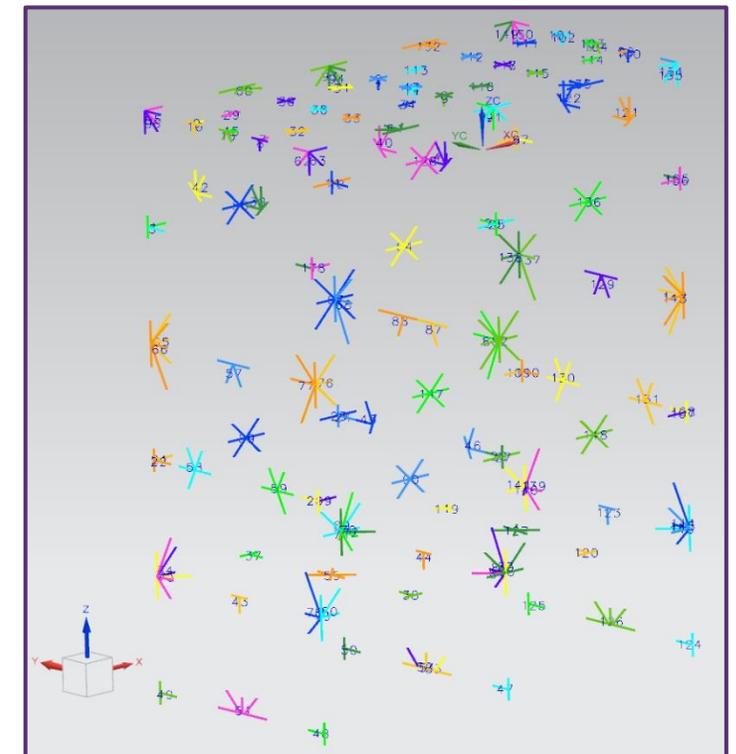
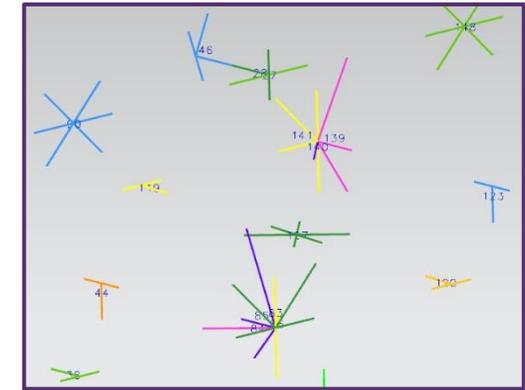


#142,1121 - IDs of related elements in the model.
(U) - Upper (0°-180°) braces (L) - Lower (180°-360°) braces

1 Select all connections in the list (Ctrl + A)

2 Press  to display all connections with labels of IDs

ID	Title	Brace or Chord	Angle	Thickness	Diameter	T > t	Is Overlapped	Resistance coef.
1	Connection 1	Chord (#122, 1101)		11	228			
		Brace (#368) (U)	90	8	150	Yes	No	
2	Connection 2	Chord (#122, 1101)		11	228			
		Brace (#1046) (U)	90	8	160	Yes	No	
		Brace (#1053) (L)	90	8	160	Yes	No	
3	Connection 3	Chord (#15, 30)		30	480			
		Brace (#912) (U)	90	20	252	Yes	No	
4	Connection 4	Chord (#15, 30)		30	480			
		Brace (#913) (U)	90	20	252	Yes	No	
5	Connection 5	Chord (#142, 1121)		11	228			
		Brace (#372) (U)	90	8	150	Yes	No	
6	Connection 6	Chord (#142, 1121)		11	228			
		Brace (#1038) (U)	90	8	160	Yes	No	
		Brace (#1045) (L)	90	8	160	Yes	No	
7	Connection 7							
8	Connection 8							
9	Connection 9							
10	Connection 10							
11	Connection 11							
12	Connection 12							
13	Connection 13							
14	Connection 14							
15	Connection 15							



Set Overlapped Braces and Resistance Coef.

1

Select Connection 51 and press to edit it

2

Press **Set Braces Overlapping**

The resistance coefficient depends on the strength of welds and is used in calculations of overlapping (Section E.3.2 API 2A RP LRFD). Table J 2.5 is taken from the Load and resistance factor design specification for structural steel buildings on December 27, 1999 (AISC). The default value is 0.9. It can be applied to overlapped braces.

**TABLE J2.5
Design Strength of Welds**

Types of Weld and Stress [a]	Material	Resistance Factor ϕ	Nominal Strength F_{EM} or F_w	Filler Metal Requirements [b, c]
Complete-Joint-Penetration Groove Weld				
Tension normal to effective area	Base	0.90	F_y	Matching filler metal shall be used. For CVN requirements see footnote [d].
Compression normal to effective area	Base	0.90	F_y	Filler metal with a strength level equal to or less than matching filler metal is permitted to be used.
Tension or compression parallel to axis of weld				
Shear on effective area	Base Weld	0.90 0.80	$0.60F_y$ $0.60F_{Exx}$	
Partial-Joint-Penetration Groove Weld				
Compression normal to effective area	Base	0.90	F_y	Filler metal with a strength level equal to or less than matching filler metal is permitted to be used.
Tension or compression parallel to axis of weld [e]				
Shear parallel to axis of weld	Base Weld	[f] 0.75	[f] $0.60F_{Exx}$	
Tension normal to effective area	Base Weld	0.90 0.80	F_y $0.60F_{Exx}$	
Fillet Welds				
Shear on effective area	Base Weld	[f] 0.75	[f] $0.60F_{Exx}$ [g]	Filler metal with a strength level equal to or less than matching filler metal is permitted to be used.
Tension or compression parallel to axis of weld [e]	Base	0.90	F_y	
Plug or Slot Welds				
Shear parallel to faying surfaces (on effective area)	Base Weld	[f] 0.75	[f] $0.60F_{Exx}$	Filler metal with a strength level equal to or less than matching filler metal is permitted to be used.

The screenshot shows the 'Joint Check' dialog box with the following details:

- General:** ID: 1, Title: Joint Check 1, Alias: Check1, Description: ck according to API RP 2A LRFD (1st, 1993)
- Navigation:** Connection ID: [empty], Navigate button
- Joint Nodes to be Checked:** Selection: All Entities
- Recognition Settings:** Maximum Distance between Joint Nodes of one Connection on the Chord: Use D/4 (D - Chord Diameter) (0.1), Custom Distance
- Diagram:** A 3D model of a joint with 'Distance' and 'D' labels.
- Angle between Braces Treated as in One Plane, A = [0 to 90]:** 15
- Diagram:** A 2D diagram showing 'Brace 1', 'Brace 2', and 'Chord' with angle 'A'.
- Chord Maximum Curvature Angle [0 to 15]:** 3
- Joint Type Recognition Settings:** Forces Tolerance, %: 1, Calculate All Braces as TY
- Edit Connection (Connection 51):**
 - General: ID: 51, Title: Connection 51
 - Chord Elements: + 12 Elements
 - Braces: + 3 Elements (2543, 2427, 2564)
 - Elements: 12 (Chord), 3 (Braces)
 - Table:

Brace or Chord	Angle	Thickness	Diameter	Minimum Fy	Is Overlapped	Resistance coef.
Chord (#863, 2531, 2530, 253...		20	252	0		
Brace (#2543) (U)	45.727515	10	200		No	
Brace (#2427) (U)	90	10	200		Yes	0.9
Brace (#2564) (U)	45.727515	10	200		No	

Buttons at the bottom: Calculate, **Set Braces Overlapping**, Preview Connection, OK, Cancel.

Set Overlapped Braces and Resistance Coef. (Continuation)

3 Press *Set Overlapped (Yes)* to relevant Braces

4 Press *Close*

5 Press *OK*

Overlapped brace conditions:

1. Minimum thickness;
2. Minimum diameter (if thicknesses are equal);
3. Maximum brace angle (if diameters are equal);
4. Random brace is taken in calculations if any condition is satisfied;

Resistance coef.

Brace #	Thickness	Diameter	Brace Angle	Is Overlapped	Resistance coef.
#1 (ElemID = 2543) (U)	10	200	45.727515301...	No	
#2 (ElemID = 2427) (U)	10	200	90	Yes	0.9
#3 (ElemID = 2564) (U)	10	200	45.727515301...	No	

Alternatively, coefficients to multiple connections can be set by pressing *Set Resistance Coefficients* button in Joint Check window.

Find Connections

General
ID: 51 Title: Connection 51

Chord Elements: + 12 Elements
Braces: + 3 Elements(2543, 2427, 2564)

Brace or Chord	Angle	Thickness	Diameter	Minimum Fy	Is Overlapped	Resistance coef.
Chord (#663, 2531, 2530, 253...		20	252	0		
Brace (#2543) (U)	45.727515	10	200		Yes	0.9
Brace (#2427) (U)	90	10	200		Yes	0.9
Brace (#2564) (U)	45.727515	10	200		No	

Use chord custom parameters (empty fields are used as original)

Diameter: Thickness:
Fy: Nominal Thickness:

1 Press OK

Load transfer has an influence on a chord stability. Axial branch capacity is calculated using Can and Nominal chord element parameters (Section E.3.4 API 2A RP LRFD)

Effective length is calculated for each brace separately. It is the minimum distance from the end of the can till the point of intersection of chord and brace multiplied on 2. $L_1, L_2 \leq 1.25D$. If L_1 and L_2 exceed $1.25D$ distance, can will not be recognized. $T_c \geq T$ nominal.

$L = 2 * L_1 = 0.6293$ - effective length for the left brace
 $L = 2 * L_3 = 2 * L_4 = 1$ - effective length for the middle brace
 $L = 2 * L_2 = 0.6293$ - effective length for the right brace
 T nominal = 0.01; $T_c = 0.02$;

E.3.4 Load Transfer Across Chords. Cross joints, launch leg joints, and other joints in which load is transferred across the chord should be designed to resist general collapse. However, for such joints reinforced only by a joint can having increased thickness T_c and length L (for cases where joint cans are centered on the brace of interest L is defined as shown in Figure E.3-6a) and having brace chord diameter ratio less than 0.9, the allowable axial branch load shall be taken as:

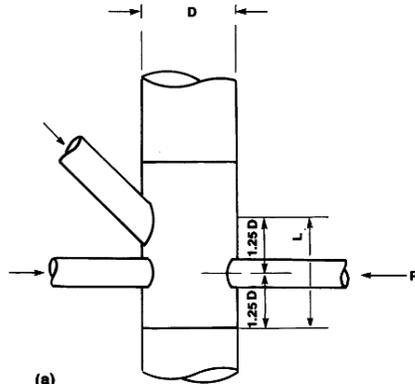


FIG. E.3-6 DEFINITION OF EFFECTIVE CORD LENGTH

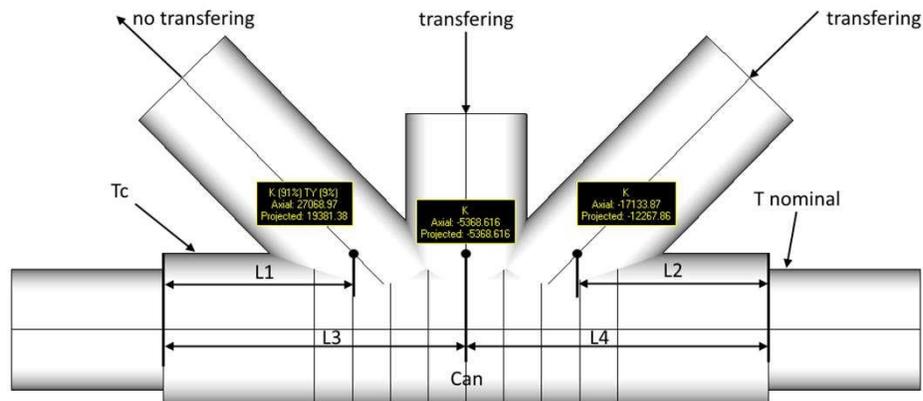
$$P = P(1) + \frac{L}{2.5D} [P(2) - P(1)] \quad \text{for } L < 2.5D \text{ (E.3.4-1a)}$$

$$P = P(2) \quad \text{for } L > 2.5D \text{ (E.3.4-1b)}$$

where:

$P(1) = P_a$ from Equation E.3.1-4a using the nominal chord member thickness

$P(2) = P_a$ from Equation E.3.1-4a using thickness T_c



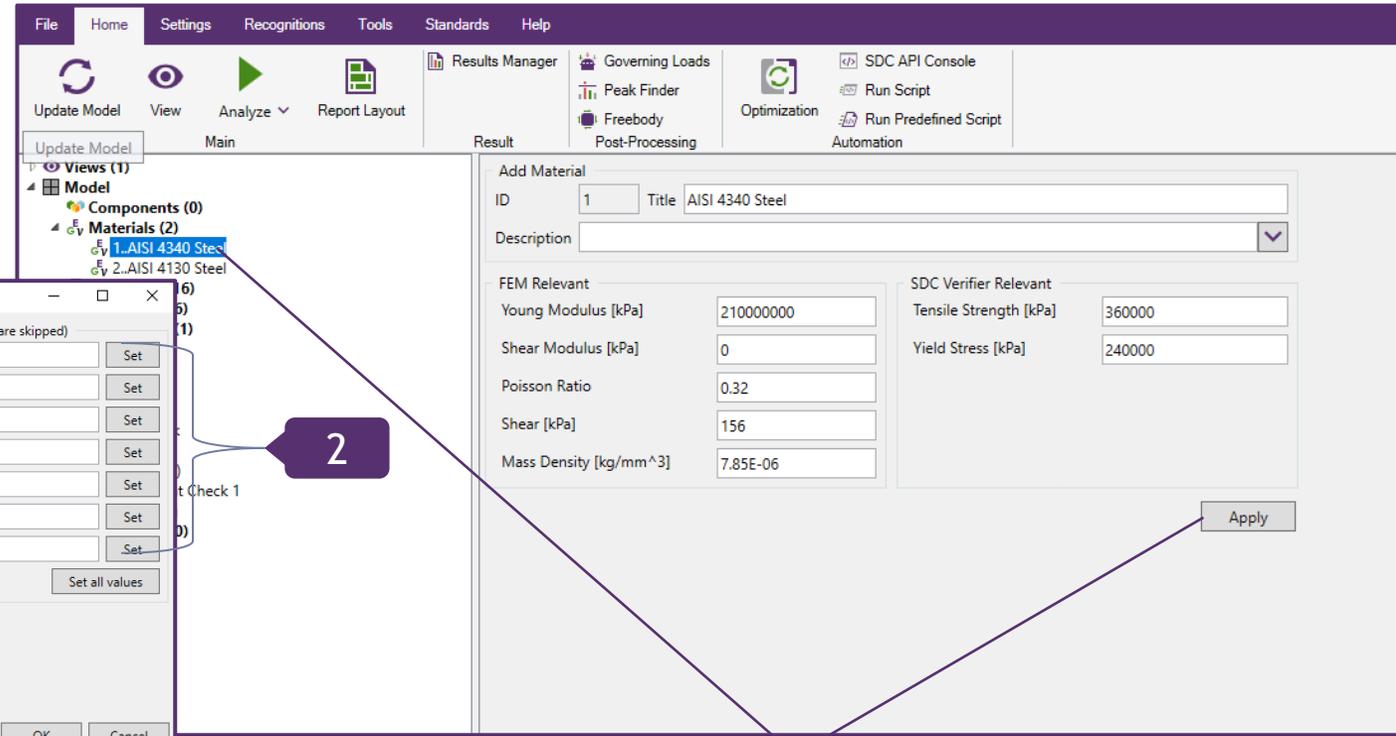
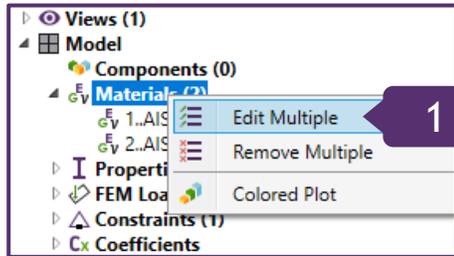
It is possible to set load transfer and effective length manually by pressing **Set brace load transfer** button.

ID	Title	Brace or Chord	Angle	Thickness	Diameter	T > t	Is Overlapped	Resistance coef.
32	Connection 32							
33	Connection 33							
34	Connection 34							
35	Connection 35							
36	Connection 36							
37	Connection 37							
38	Connection 38							
39	Connection 39							
40	Connection 40							
41	Connection 41							
42	Connection 42							
43	Connection 43							
44	Connection 44							
45	Connection 45							
46	Connection 46							
47	Connection 47							
48	Connection 48							
49	Connection 49							
50	Connection 50							
51	Connection 51							
52	Connection 52							
53	Connection 53							
54	Connection 54							
55	Connection 55							
56	Connection 56							
57	Connection 57							
58	Connection 58							
59	Connection 59							
60	Connection 60							

1 In Model section, execute right click on Materials (2) and select Edit Multiple

2 Set required properties and press OK

All results are based on material fatigue parameters Tensile Strength and Yield Stress. Parameters are used to define the allowable static stress of the material. Allowable = $\text{Min}(\text{Yield Stress}, \text{Tensile Strength} * 2 / 3)$. For ISO and Norsok joint checks: Allowable = $\text{Min}(\text{Yield Stress}, \text{Tensile Strength} * 0.8)$.



Materials	Young Modulus [kPa]	Shear Modulus [kPa]	Poisson Ratio	Shear [kPa]	Mass Density [kg/mm^3]	Tensile Strength [kPa]	Yield Stress [kPa]
1..AISI 4340 Steel	210000000	0	0.32	156	7.85E-06	360000	240000
2..AISI 4130 Steel	201000000	0	0.32	0	7.85E-06	360000	240000

Alternatively, it is possible to set values for selected materials in the Main Window. Select material, fill parameters and press Apply.

Joint classification as K, T & Y, or cross (X) should apply to individual braces according to their load pattern for each load case. To be considered a K-joint, the punching load in a brace should be essentially balanced by loads on other braces in the same plane on the same side of the joint. In T and Y joints the punching load is reacted as beam shear in the chord. In cross joints the punching load is carried through the chord to braces on the opposite side. For braces that carry part of their load as K-joints, and part as T & Y or cross joints interpolate based on the portion of each in total. Examples are shown in Figure E.3-2. See Commentary on Joint Classifications.

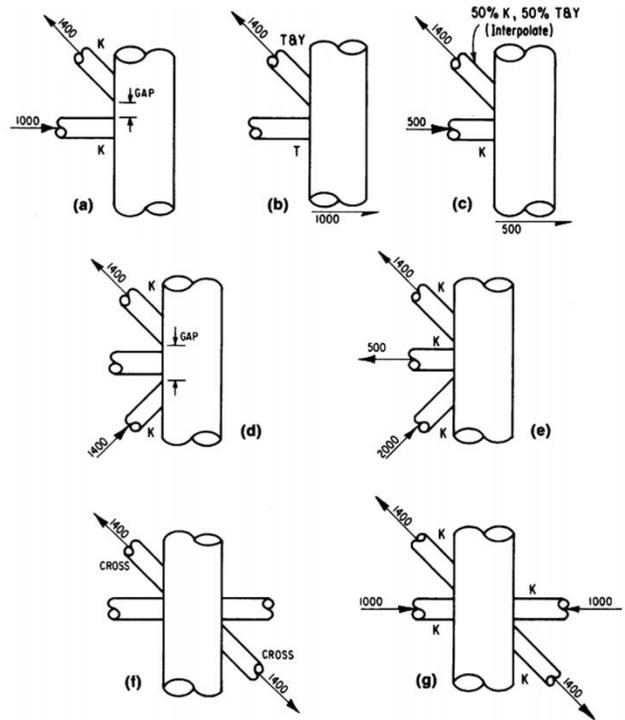


FIG. E.3-2
EXAMPLES OF JOINT CLASSIFICATION

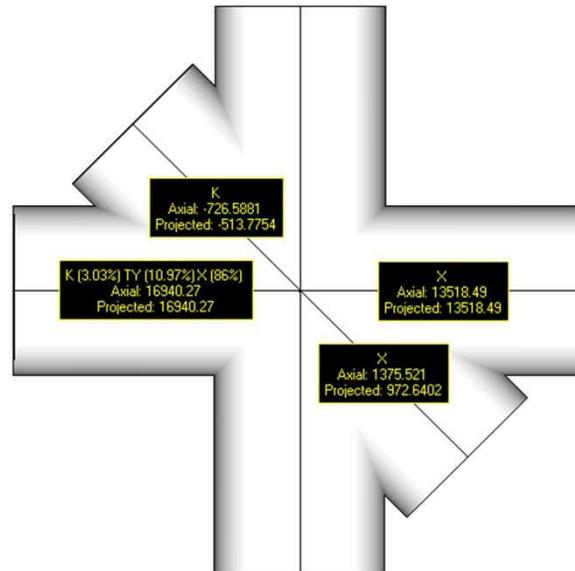
Joint type is based on type of loading. By checking if forces of connection are balanced joint types are classified on K, TY and X (Cross).

K - tension and compression loads are balanced.

TY - tension or compression load goes as shear force in a chord.

X (Cross) - Connection has to contain braces from the both sides to check on cross joint. If balanced forces of all braces of one side and balanced forces of all braces of other side are equal, all braces are classified as X (Cross).

Interpolation - the order of joint type recognition is the following: K -> X (Cross) -> TY. Each brace can have all 3 types of joint type taken as percentage of axial load of brace to summation of all braces loads.



Projected - axial force that is perpendicular to the chord.
 If Projected = 0 - brace type is set to TY.
 If percentage is not mentioned, 100% is taken for the type.

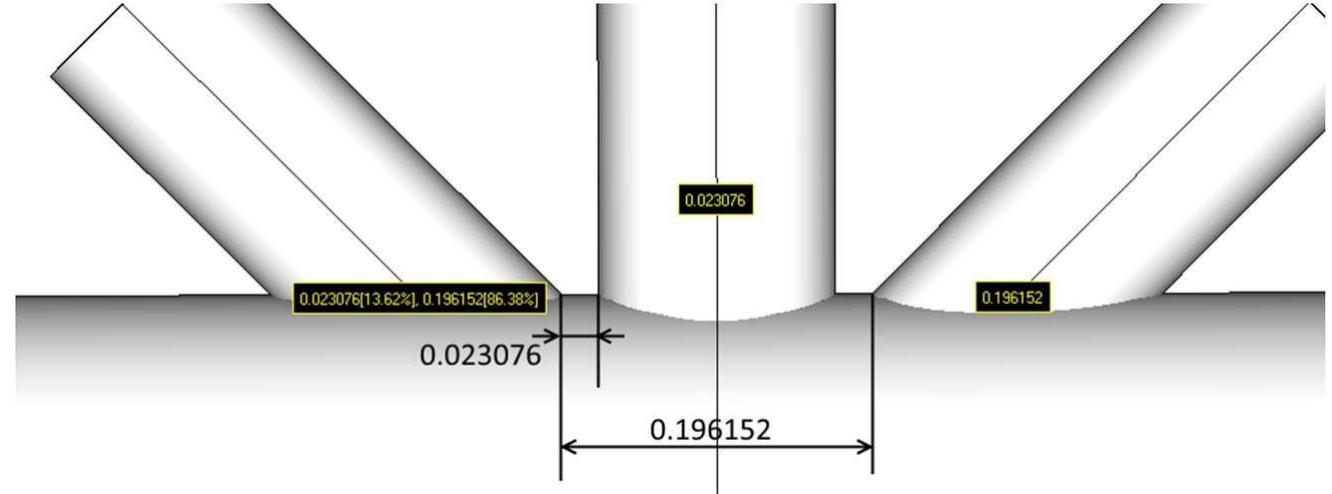
Gap is the distance between two differently loaded braces (tension and compression) on a shell of a chord. Depending on load, it is possible that brace can have two or more gaps to consider. Each gap percentage depends on the percentage of a taken load:

$$percentage = \begin{cases} \frac{projected}{F_{Compression}}, & projected < 0 \\ \frac{projected}{F_{Tension}}, & projected \geq 0 \end{cases}$$

Projected - axial force of the brace, perpendicular to the chord;

F_{Tension} - sum of all positive projected axial forces;

F_{Compression} - sum of all negative projected forces;



Joint Check Expand Table

1

In Standards => 1..Joint Check => Checks (1), execute right click on 1..Joint Check 1 and select *Table (expand/extreme)*

2

Press and select Load Set => 1.. All loads combination; Press OK

3

Filter by Parameter: *Overall Utilization Factor*
Sort by Parameter: *Overall Utilization Factor*

4

Press *Fill Table*

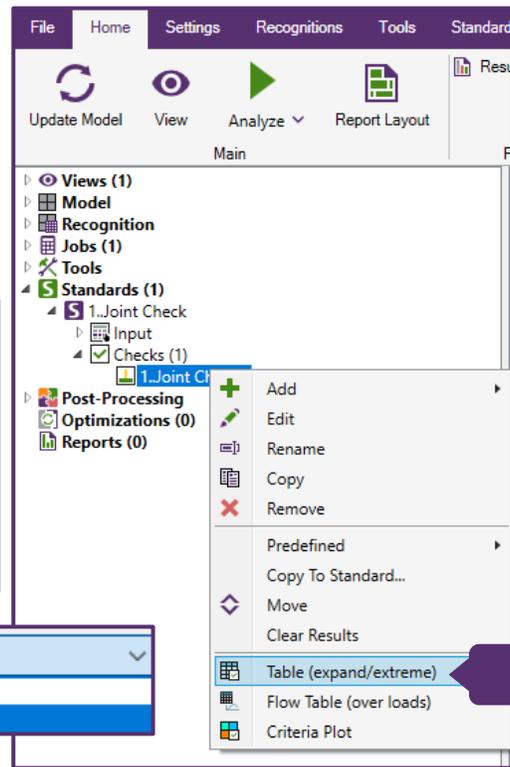
5

Press *OK*

Table build type allows to fill parameters in Columns and connections in Rows and vice versa. Parameters in Rows can be used for a single connection, for example.

Display Parameters in

- Columns
- Rows
- Columns



Connection Id	Brace Number	Angle	Thickness [mm]	Diameter [mm]	Joint Type	Gap	Min Gap > (E.3.1.2)
37	#37.1 (Elem ID = ...)	90	10.00	300.00	TY		Yes
38	#38.1 (Elem ID = ...)	90	10.00	300.00	TY		Yes
119	#119.1 (Elem ID ...)	84.289366	10.00	300.00	TY		Yes
120	#120.1 (Elem ID ...)	84.289366	10.00	300.00	TY		Yes
55	#55.2 (Elem ID = ...)	89.999859	10.00	300.00	TY (2.16%) X (97...		Yes
55	#55.2 (Elem ID = ...)	89.999899	10.00	300.00	X		Yes

Plot Forces - plot original, transformed axial forces and brace joint types;
 Plot Gaps - plot gaps if there is more than one brace in connection;
 Plot Classification - plot brace joint types;

Joint Check Expand Flow Table

1

In Standards => 1..Joint Check => Checks (1), execute right click on 1..Joint Check 1 and select *Flow Table (over loads)*

2

In Loads Count, press  and select *All Loads*

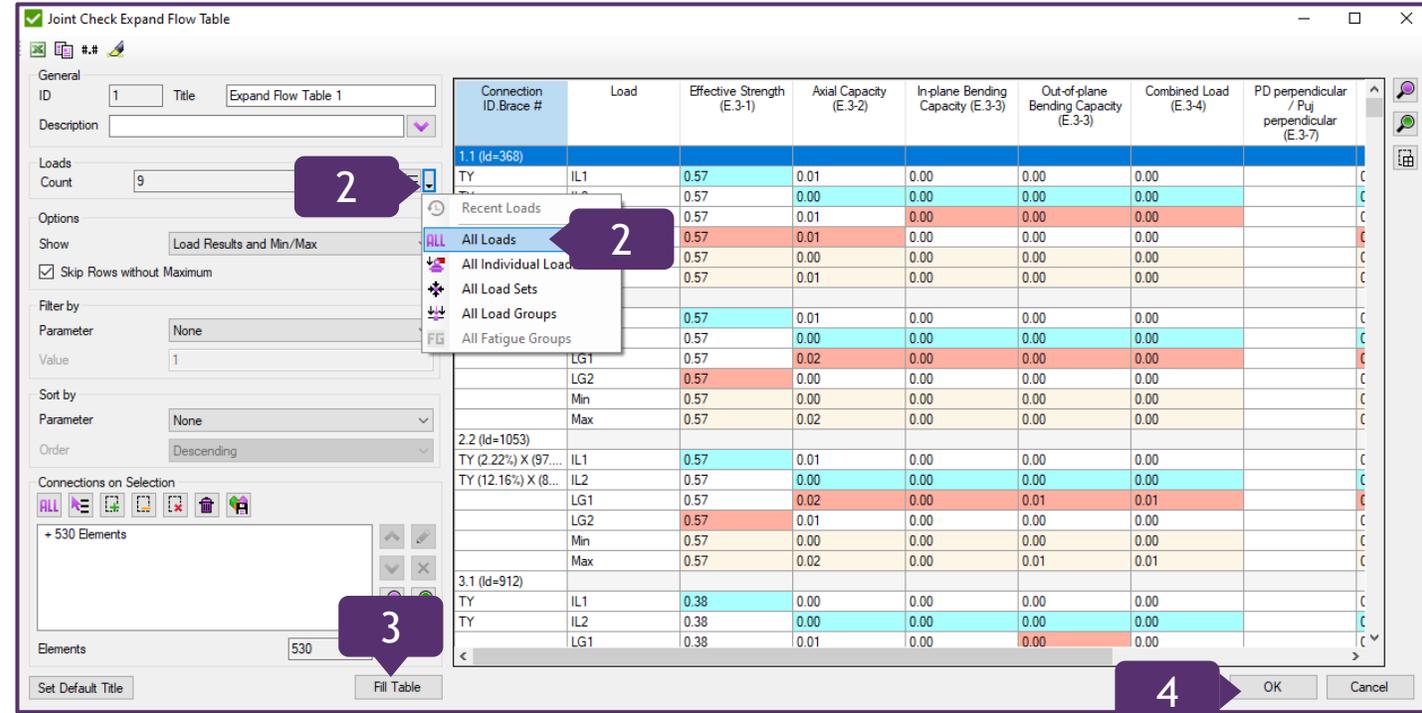
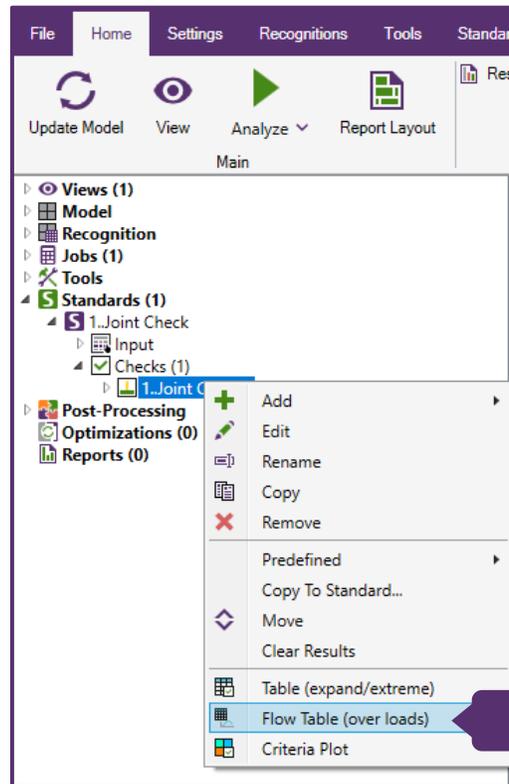
3

Press *Fill Table*

4

Press *OK*

Expand Flow table is used to display multiple load results at once for each selected connection.



Skip rows without maximum refers to the single connection. If load does not cause extreme values on any parameter it will not be displayed.
It is possible to display only Load Results, only Min/Max results or both.

Joint Check Criteria Plot

1

In Standards => 1..Joint Check => Checks (1), execute right click on 1..Joint Check 1 and select *Criteria Plot*

2

Press and select Load Set => 1.. All loads combination; Press OK

3

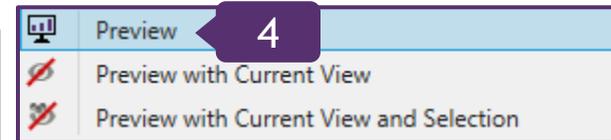
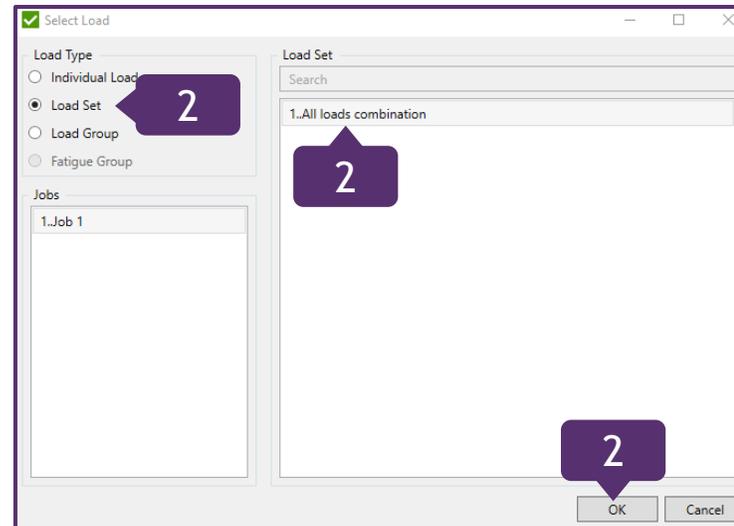
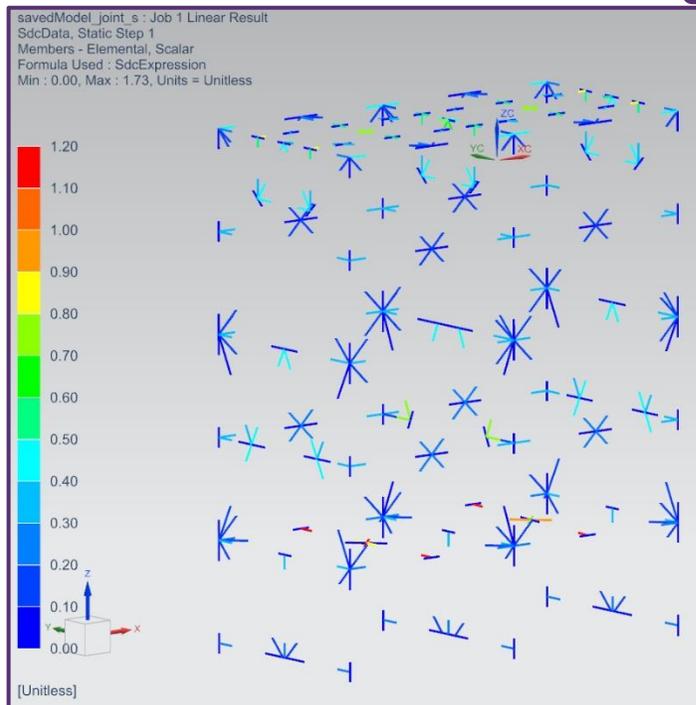
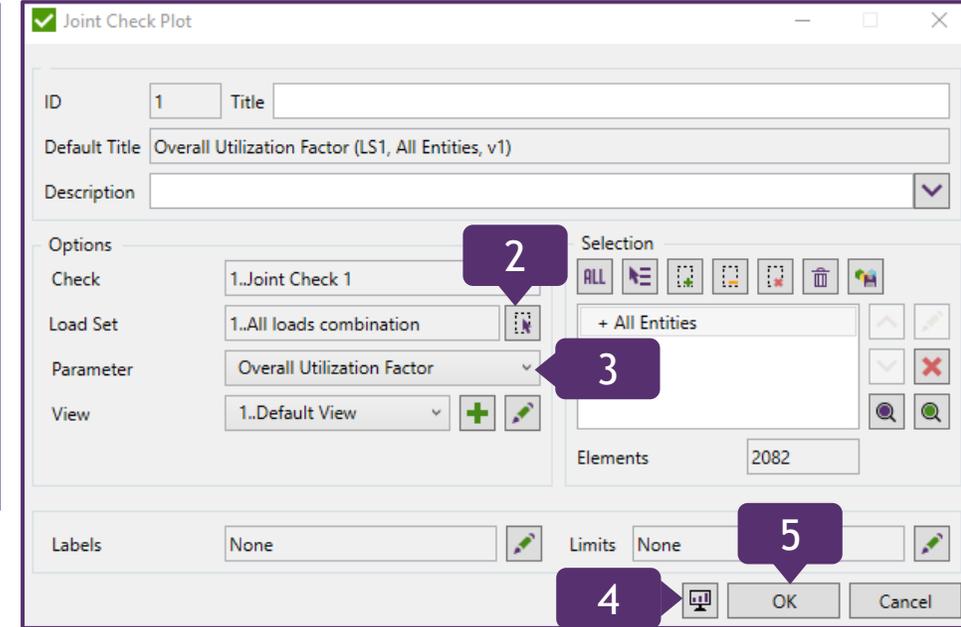
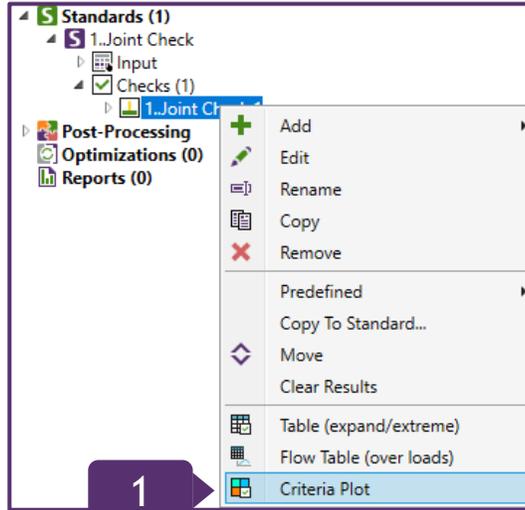
Parameter: Overall Utilization Factor

4

Press and then Preview

5

Press OK

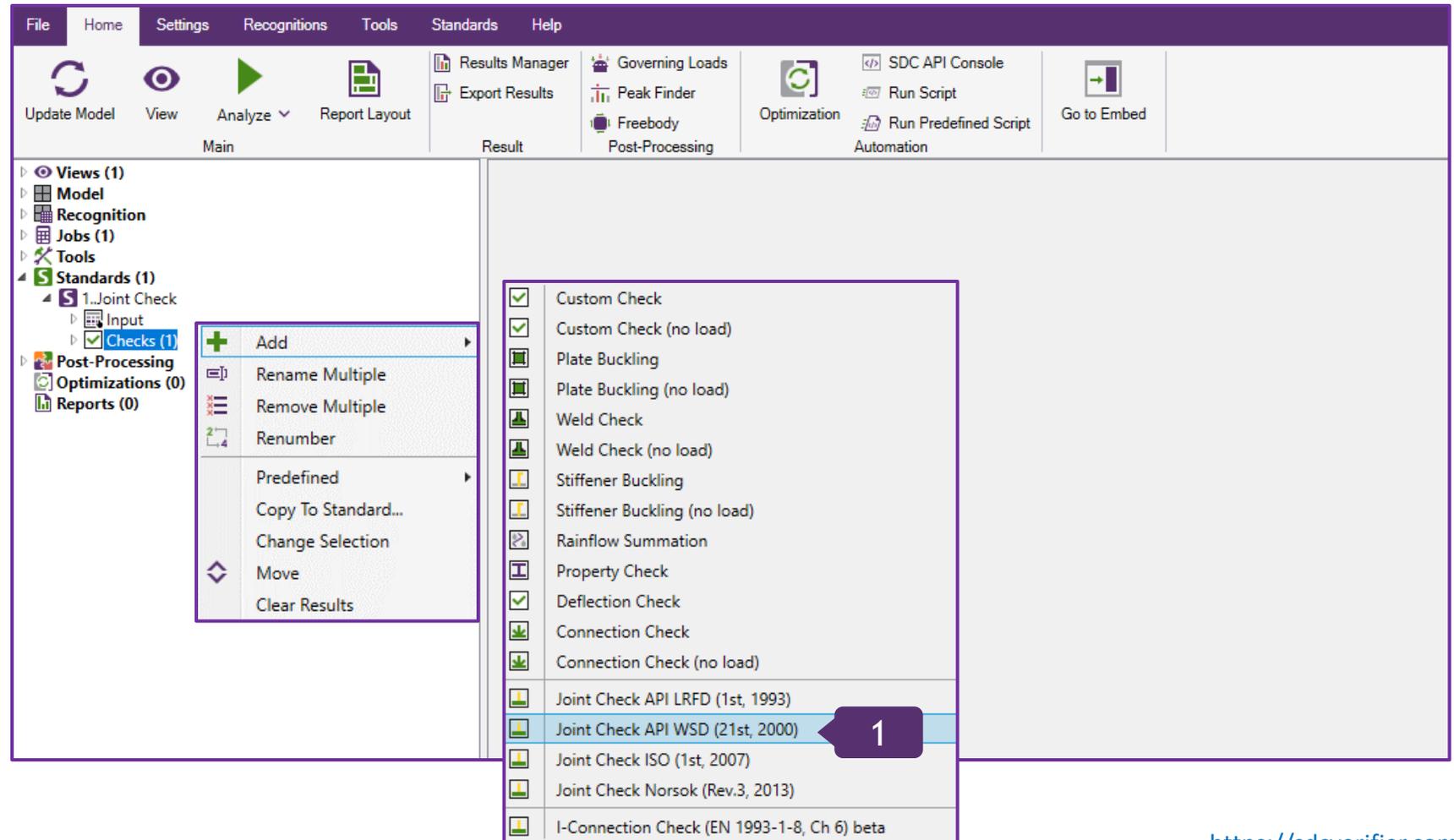


1

In 1..Joint Check, execute right click on Checks (1) => Add => Joint Check API WSD (21st, 2000)

Joint Check API WSD is a part of the Standard API RP WSD (21st, published in 2000).

Joint Check API WSD interface is similar to Joint Check API LRFD.



1 Press *Find Connections*

2 Press *Close*

3 Press *OK*

Joint Check WSD

General
ID: 2 Title: Joint Check API WSD 2
Alias: Check2
Description: k according to API RP 2A WSD (21st, 2000)

Joint Nodes to be Checked
Selection: 1929 Nodes

Recognition Settings
Maximum Distance between Joint Nodes of one Connection on the Chord:
 Use D/4 (D - Chord Diameter)
 Custom Distance: 0.1

Angle between Braces Treated as in One Plane, A = [0 to 90]: 15

Chord Maximum Curvature Angle [0 to 15]: 3

Joint Type Recognition Settings
Forces Tolerance, %: 1
 Calculate All Braces as TY

Stress Increase Factor (SIF)
Design Condition: Normal operation
SIF value: 1

Navigation
Connection ID: [] Navigate

Id	Title	Brace or Chord	Angle	Thickness	Diameter	T > t	Is Overlapping
7..	Connection 7						
9..	Connection 9						
55..	Connection 55						
91..	Connection 91						
93..	Connection 93						
99..	Connection 99						
101..	Connection 101						
127..	Connection 127						

Check Connections Design

It is recommended to check design of following connections to avoid inappropriate results

Connections

- 7..Connection 7
- 9..Connection 9
- 55..Connection 55
- 91..Connection 91
- 93..Connection 93
- 99..Connection 99
- 101..Connection 101
- 127..Connection 127

Close

Find Connections Clear All Results Set Brace Load Transfer Set Resistance Coefficients OK Cancel

The detailed descriptive steps on how to check Connections Design have been presented on slides 10-19.

Joint Check API WSD 2 Criteria Plot

1

In Standards => 1..Joint Check => Checks (2), execute right click on 2..Joint Check API WSD 2 and select *Criteria Plot*

2

Press and select Load Set => 1.. All loads combination; Press *OK*

3

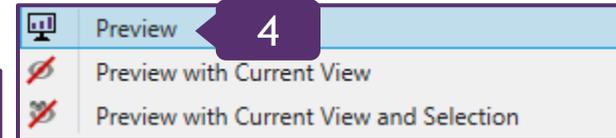
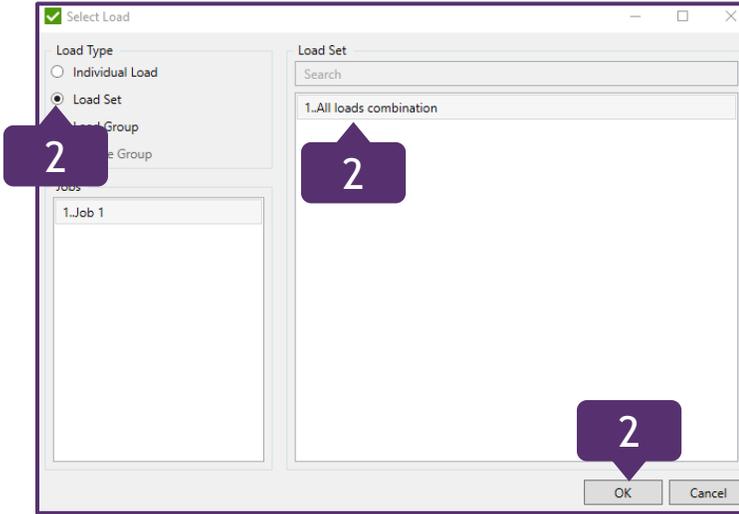
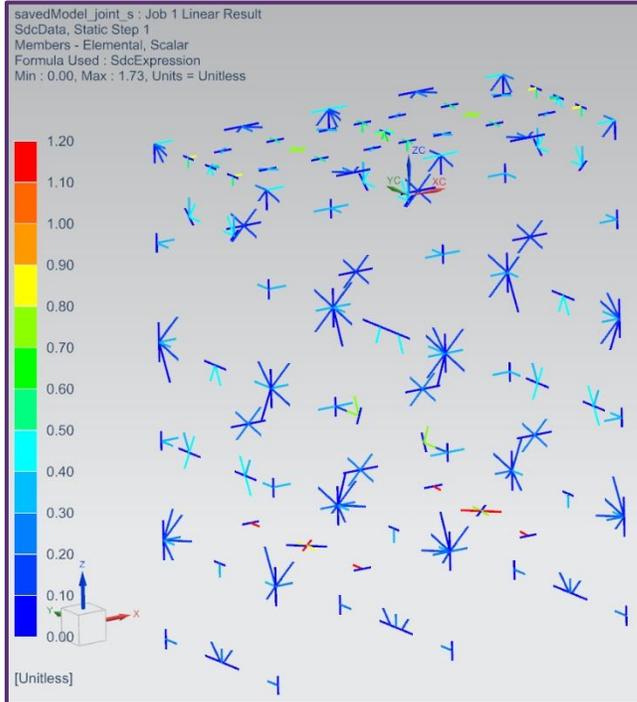
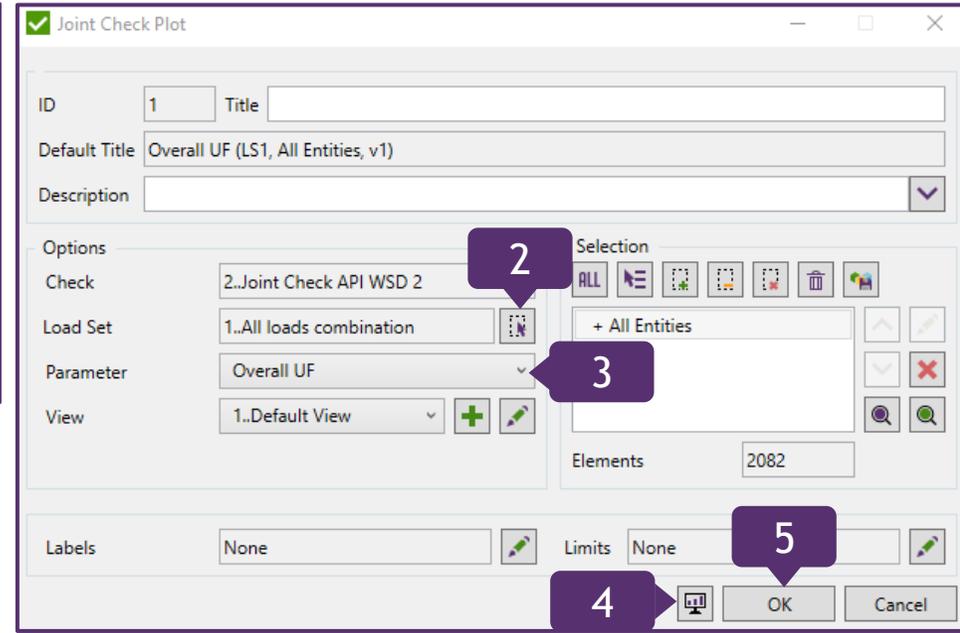
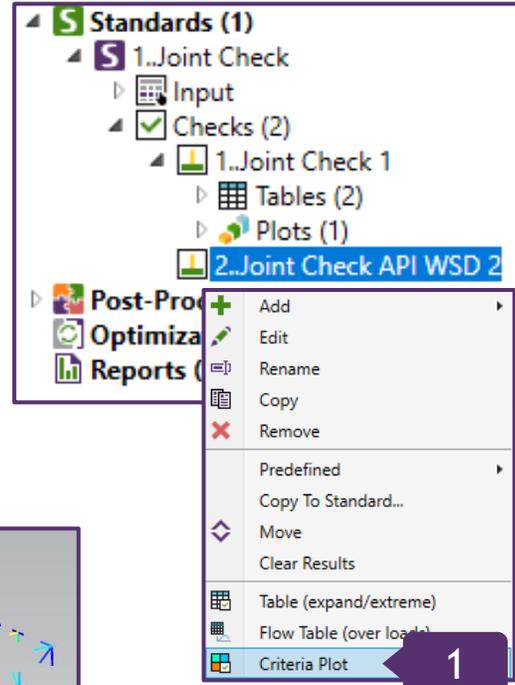
Parameter: *Overall UF*

4

Press and then *Preview*

5

Press *OK*



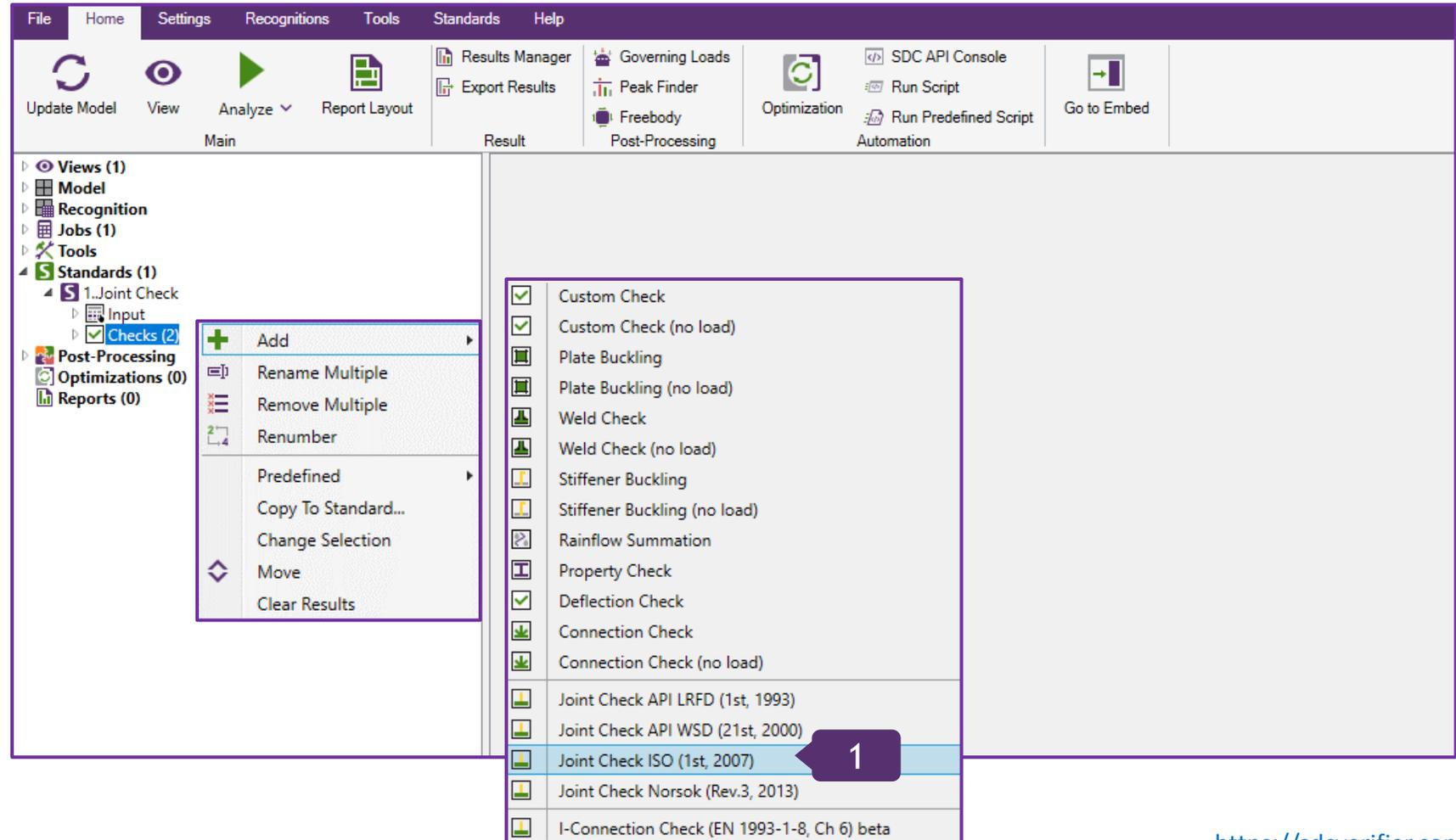
Steps on how to add Table (expand/extreme) and Flow Table (over loads) are described in slides 23 and 25.

1

In 1..Joint Check, execute right click on Checks (2) => Add => Joint Check ISO (1st, 2007)

Joint Check ISO is a part of the Standard ISO 19902 (first edition, published 12 DEC 2007).

Joint Check ISO interface is similar to Joint Check API.



1 Press *Find Connections*

2 Press *Close*

3 Press *OK*

Joint Check ISO 3

General
ID: 3 Title: Joint Check ISO 3
Alias: check3
Description: its check according to ISO 19902 (1st, 2007)

Joint Nodes to be Checked
Selection: 1929 Nodes

Recognition Settings
Maximum Distance between Joint Nodes of one Connection on the Chord:
 Use D/4 (D - Chord Diameter)
 Custom Distance: 0.1

Angle between Braces Treated as in One Plane. A = [0 to 90]: 15

Chord Maximum Curvature Angle [0 to 15]: 3

Joint Type Recognition Settings
Forces Tolerance, %: 1
 Calculate All Braces as TY

Resistance Factors
 Recommended Factors from Standard
 User Defined Factors
Gamma R,q: 1.05 Gamma R,j: 1.05

Navigation
Connection ID: [] Navigate

Id	Title	Brace or Chord	Angle	Thickness	Diameter	T > t	Is Overlapping
7..	Connection 7						
9..	Connection 9						
55..	Connection 55						
91..	Connection 91						
93..	Connection 93						
99..	Connection 99						
101..	Connection 101						
127..	Connection 127						

Check Connections Design
It is recommended to check design of following connections to avoid inappropriate results

Connections

- 7..Connection 7
- 9..Connection 9
- 55..Connection 55
- 91..Connection 91
- 93..Connection 93
- 99..Connection 99
- 101..Connection 101
- 127..Connection 127

Buttons: Find Connections, Clear All Results, Set Use Can calculations, Set Critical Joints, Close, OK, Cancel

The detailed descriptive steps on how to check Connections Design have been presented on slides 10-19.

Joint Check ISO 3 Criteria Plot

1

In Standards => 1..Joint Check => Checks (3), execute right click on 2..Joint Check ISO 3 and select *Criteria Plot*

2

Press  and select Load Set => 1.. All loads combination; Press *OK*

3

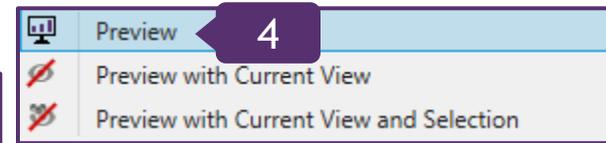
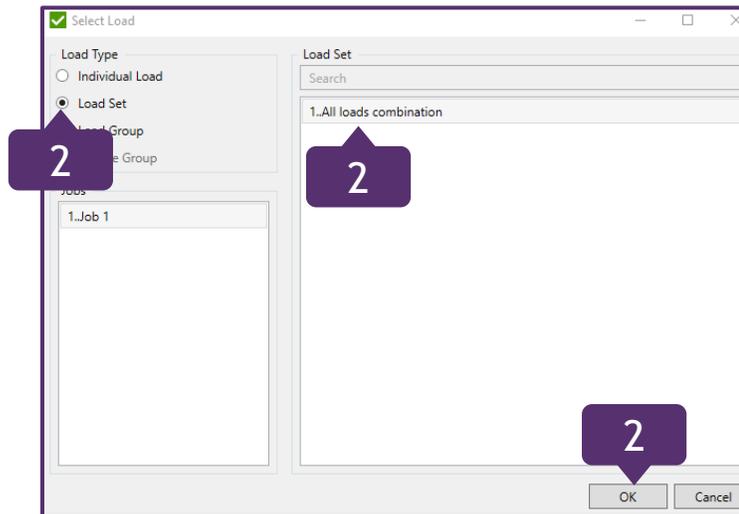
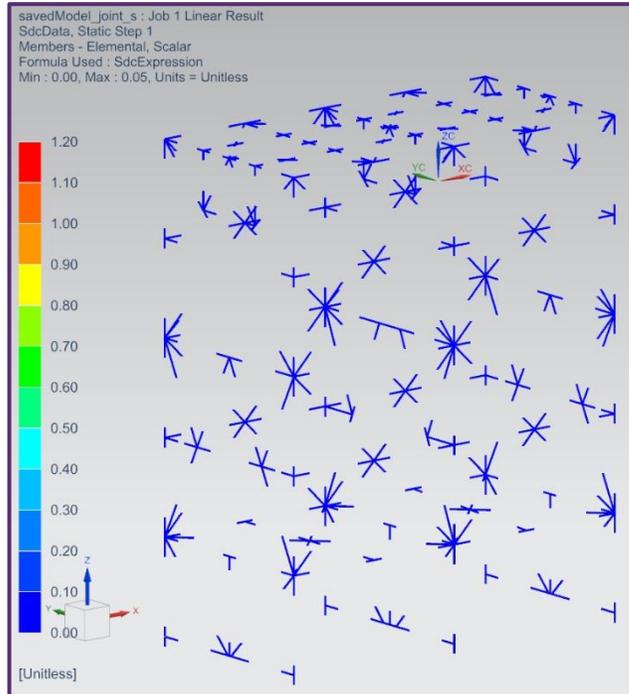
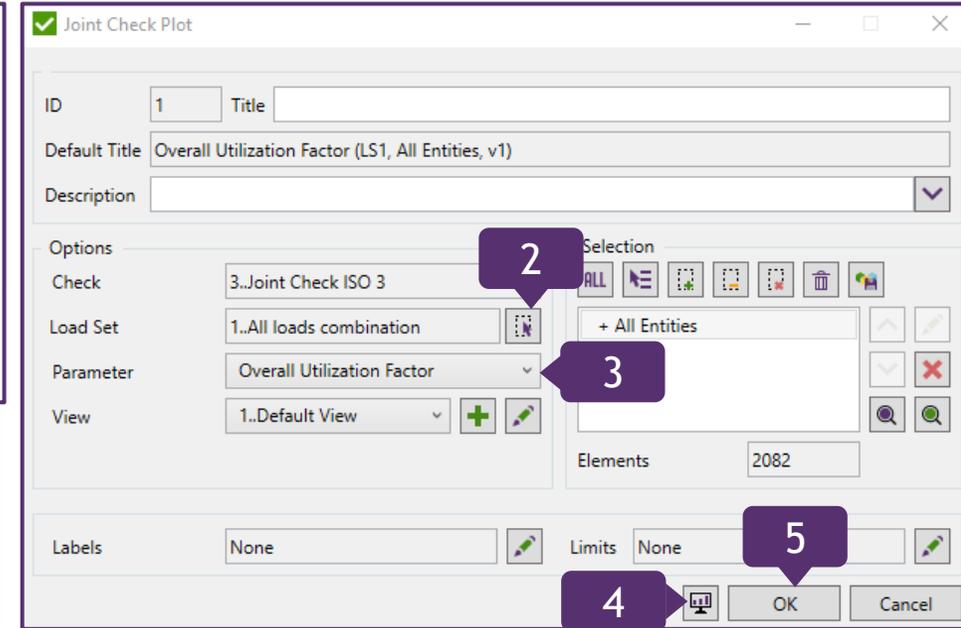
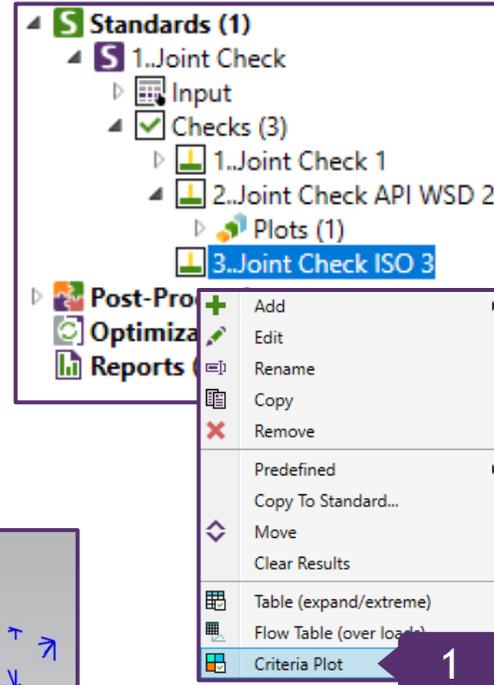
Parameter: *Overall Utilization Factor*

4

Press  and then Preview

5

Press *OK*



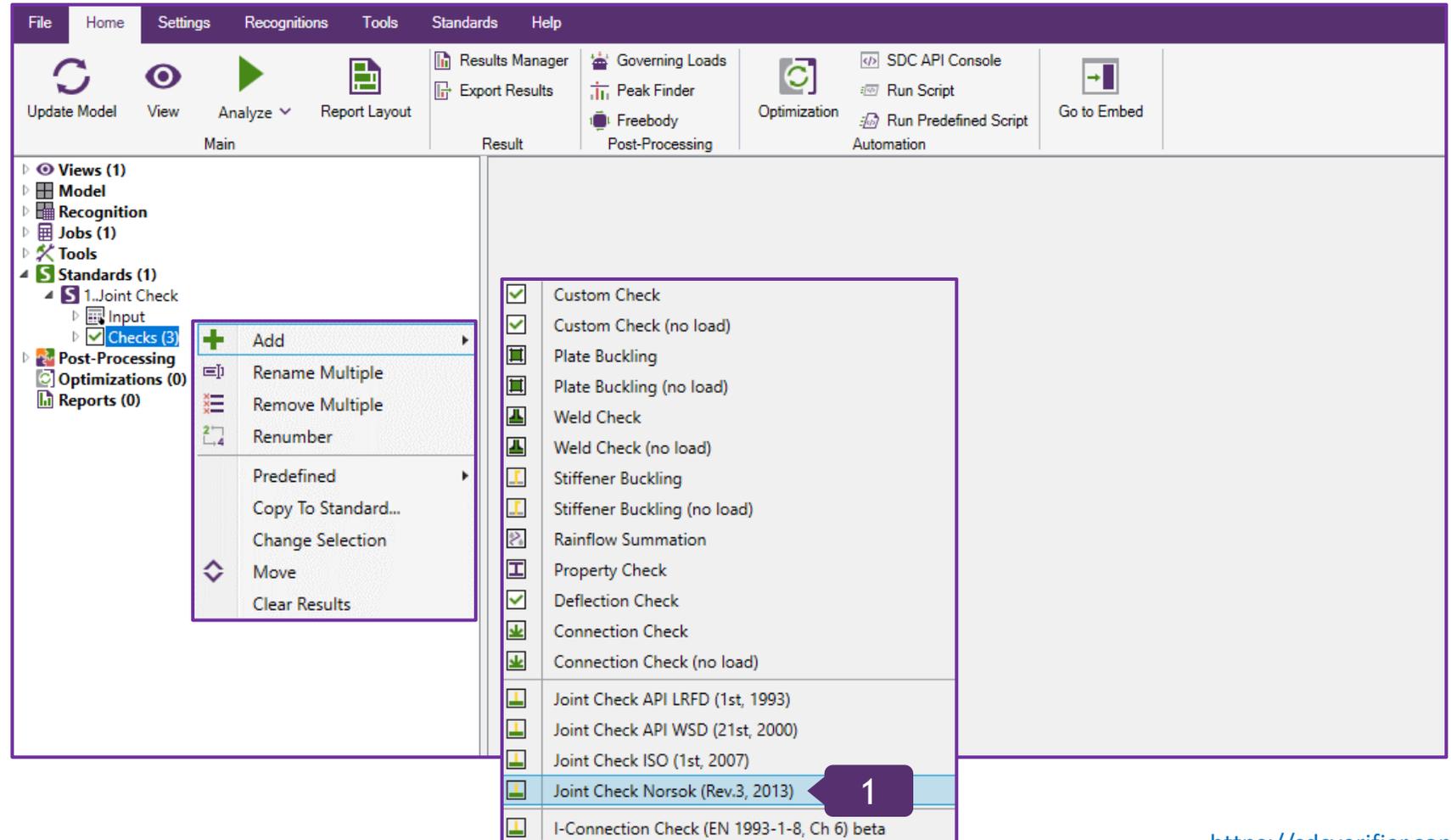
Steps on how to add Table (expand/extreme) and Flow Table (over loads) are described in slides 23 and 25.

1

In 1..Joint Check, execute right click on Checks (3) => Add => Joint Check Norsok (Rev.3, 2013)

Joint Check Norsok is a part of the Standard Norsok N004 (Rev.3, February 2013).

Joint Check Norsok interface is similar to Joint Check API.



Find connections in Joint Check Norsok 4

1 Press *Find Connections*

2 Press *Close*

3 Press *OK*

The screenshot shows the 'Joint Check Norsok' application window. On the left, the 'Find Connections' button is highlighted with a purple circle containing the number '1'. In the center, a 'Check Connections Design' dialog box is open, displaying a list of connections. The 'Close' button at the bottom of this dialog is highlighted with a purple circle containing the number '2'. At the bottom right of the main application window, the 'OK' button is highlighted with a purple circle containing the number '3'. The dialog box contains the following text:

It is recommended to check design of following connections to avoid inappropriate results

Connections
7..Connection 7
9..Connection 9
55..Connection 55
91..Connection 91
93..Connection 93
99..Connection 99
101..Connection 101
127..Connection 127

The detailed descriptive steps on how to check Connections Design have been presented on slides 10-19.

Joint Check Norsok 4 Criteria Plot

1

In Standards => 1..Joint Check => Checks (4), execute right click on 2..Joint Check Norsok 4 and select *Criteria Plot*

2

Press and select Load Set => 1.. All loads combination; Press OK

3

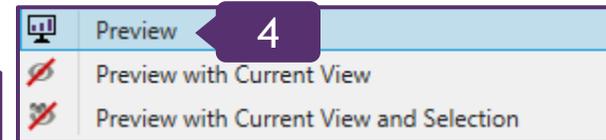
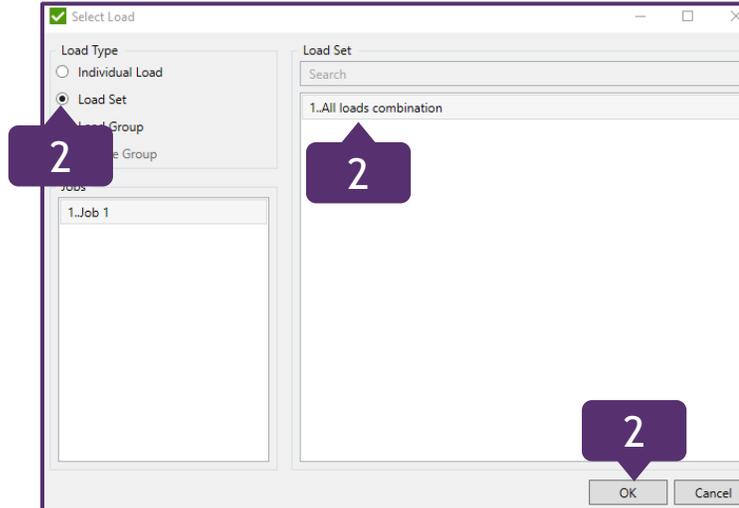
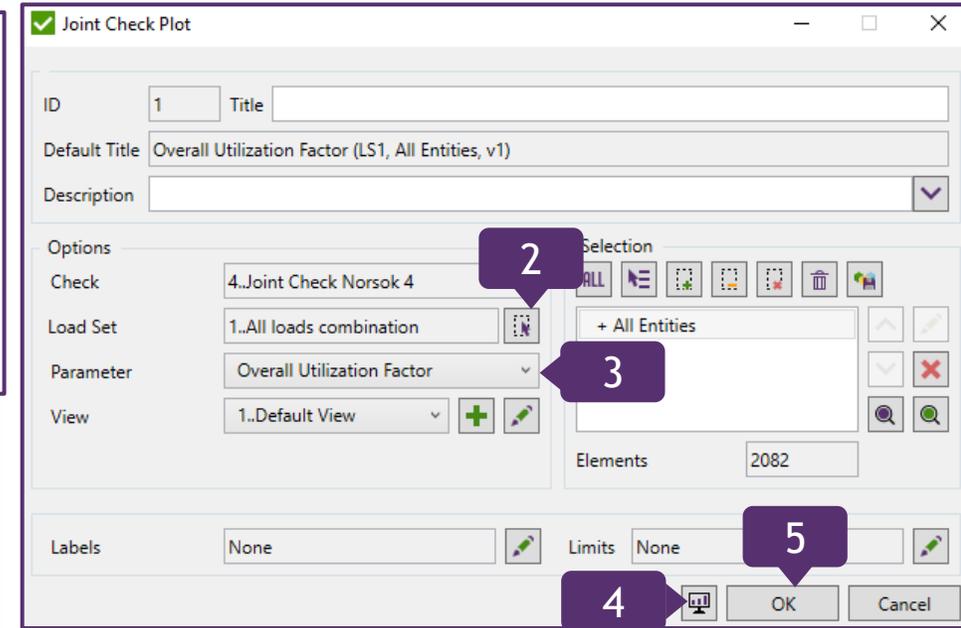
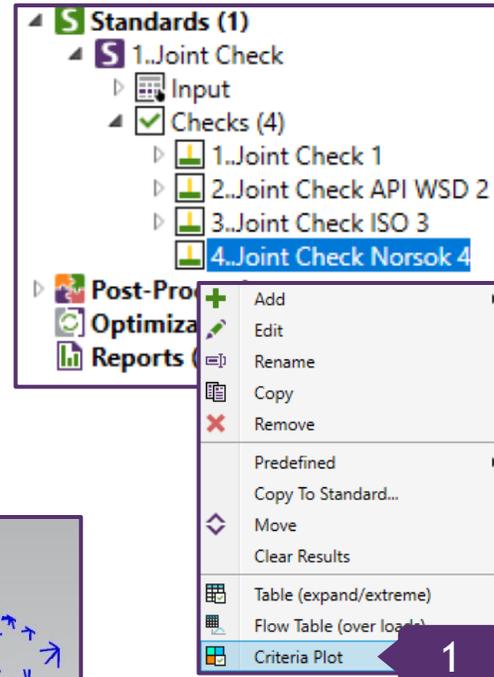
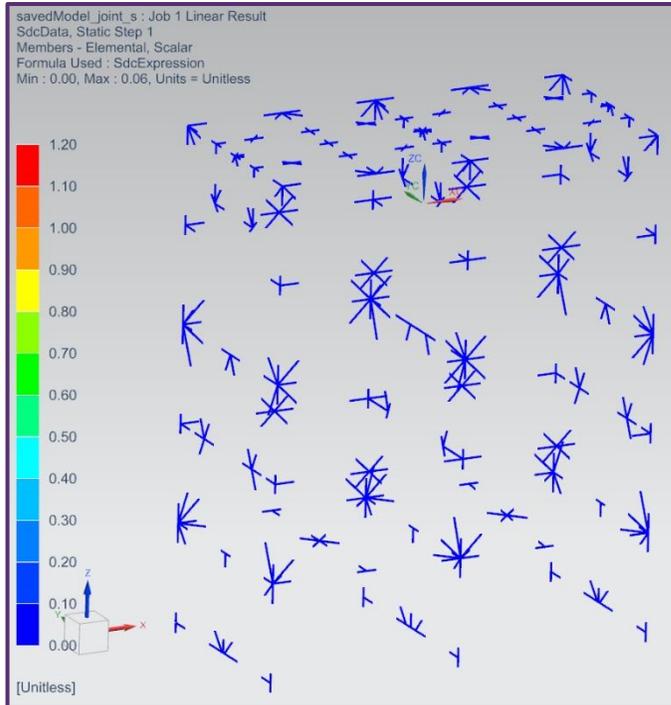
Parameter: *Overall Utilization Factor*

4

Press and then Preview

5

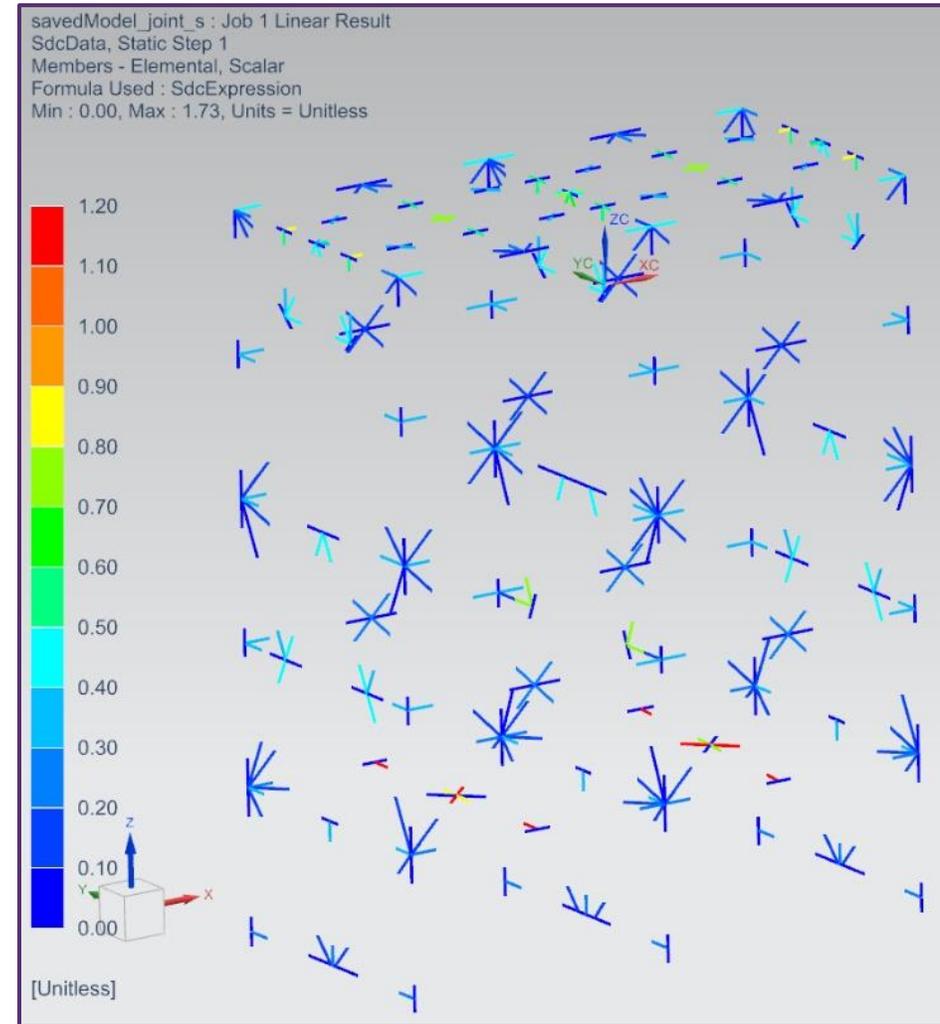
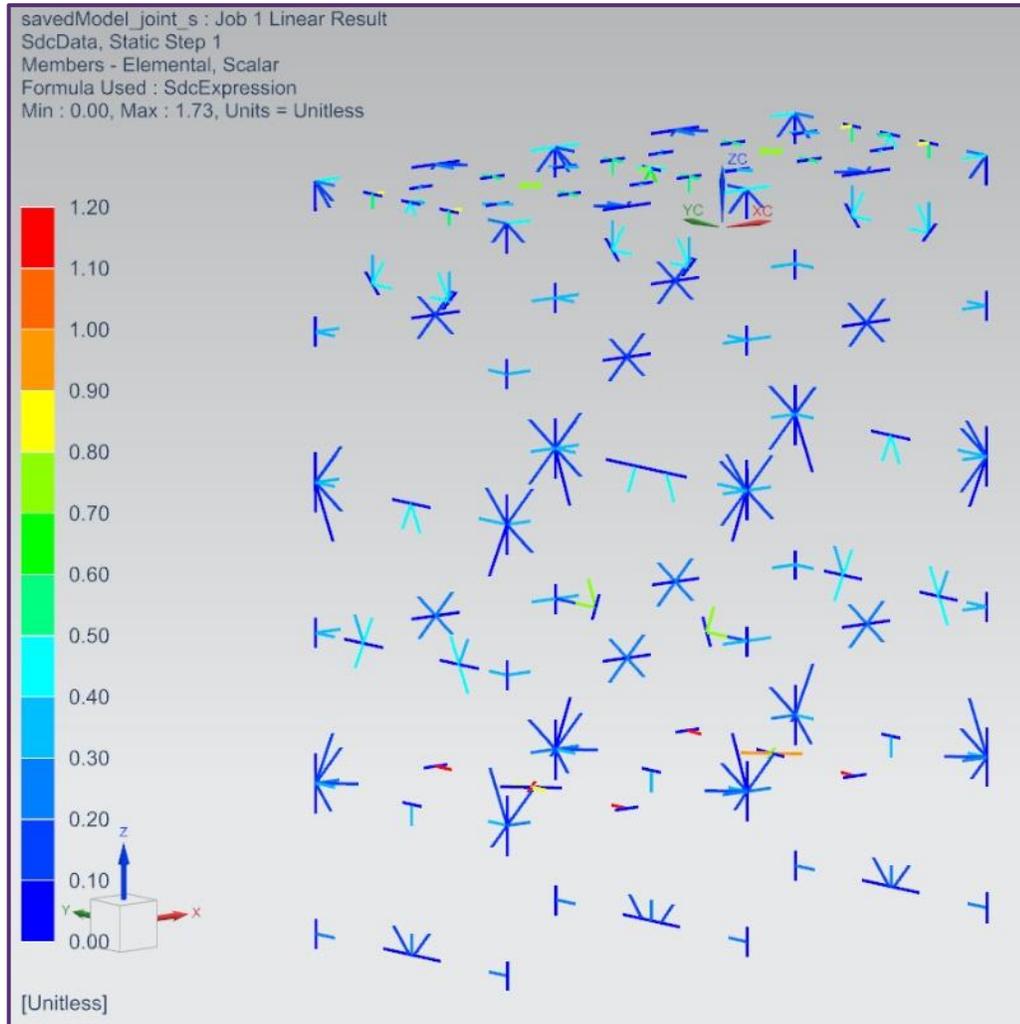
Press OK



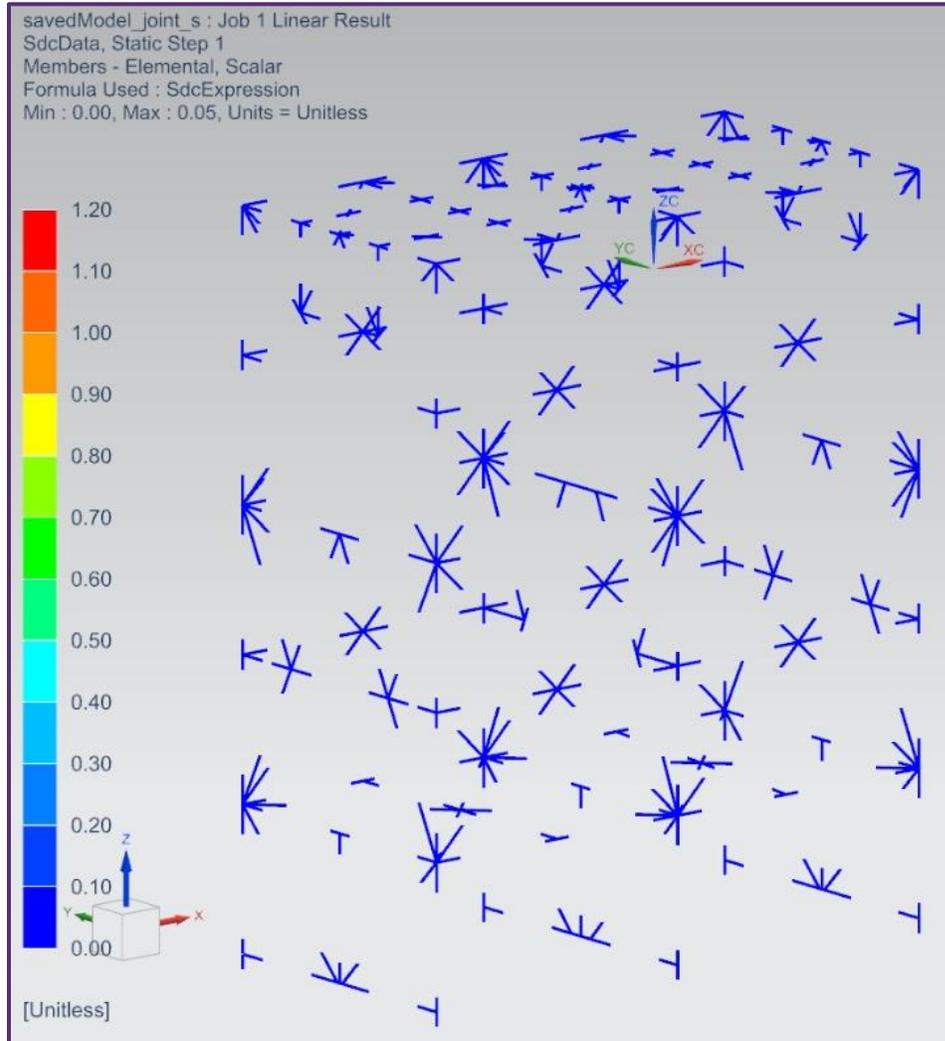
Steps on how to add Table (expand/extreme) and Flow Table (over loads) are described in slides 23 and 25.

Joint Check 1

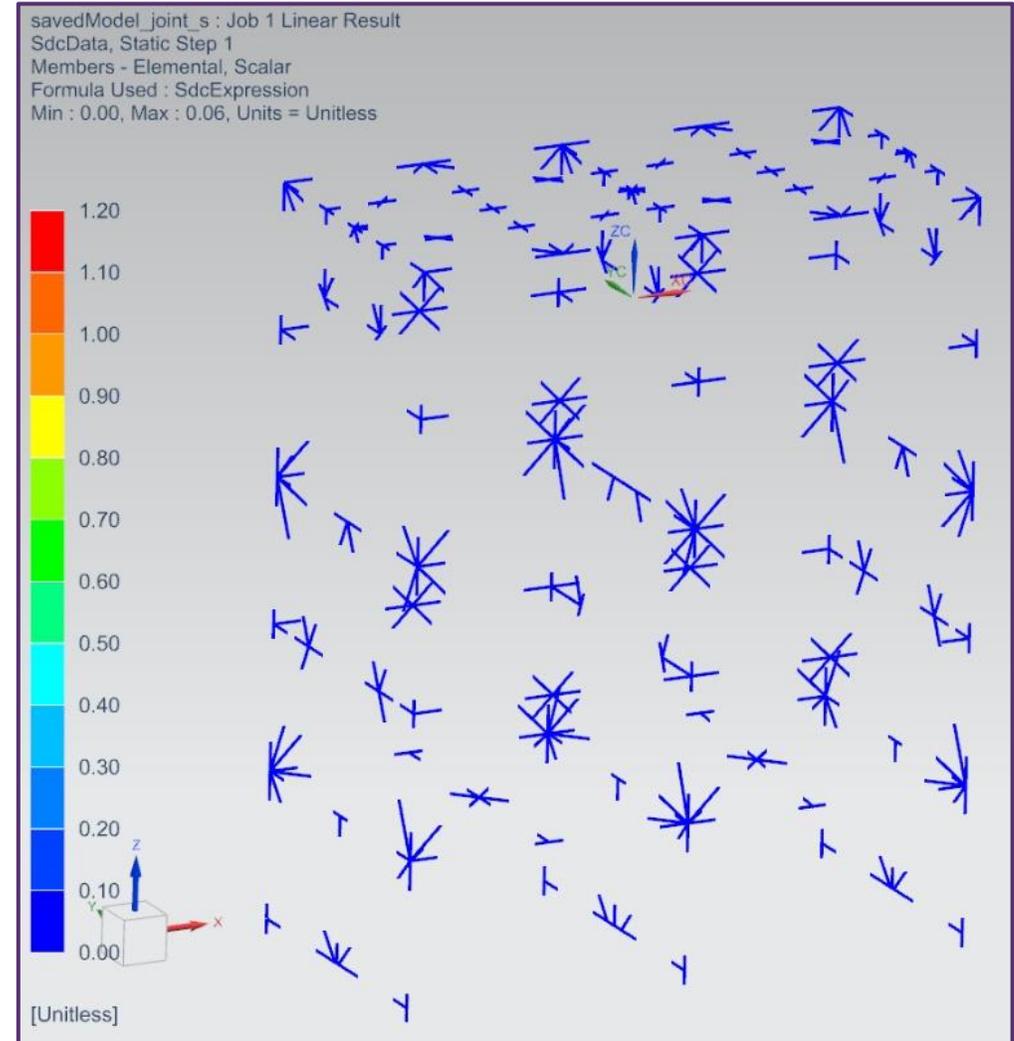
Joint Check API WSD 2



Joint Check ISO 3



Joint Check Norsok 4



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/>