



Tutorial

Joint Check

ANSYS[®]

27.11.2020
version 2020.0.2

- ▶ In this tutorial, Joint Check is reviewed in details
- ▶ General Info
- ▶ Connection Types
- ▶ Connection design
- ▶ Joint Checks according to standards
- ▶ The report was generated with the help of report designer.

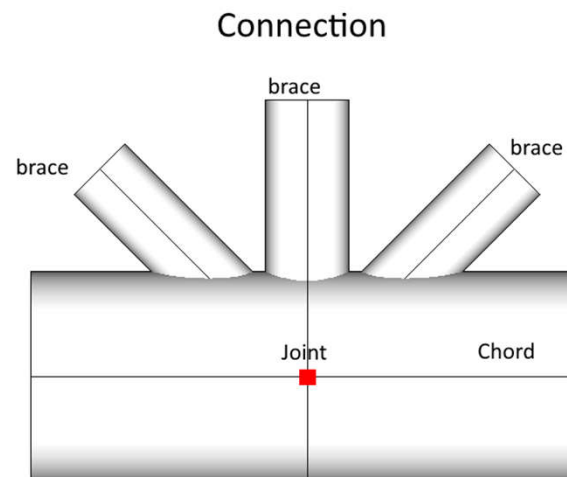
Joint Check – offshore check that verifies strength of tubular structure under tension or compression members according to the standards.

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.

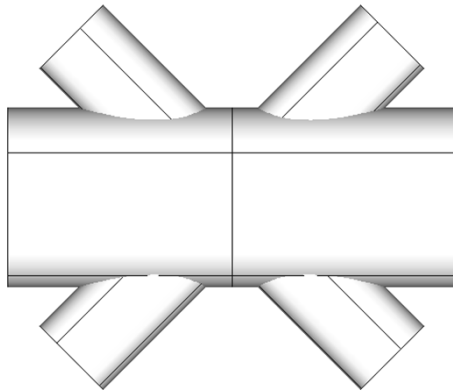
Chord is a set of non-welded elements that form straight line.

Brace is a welded to a chord element.

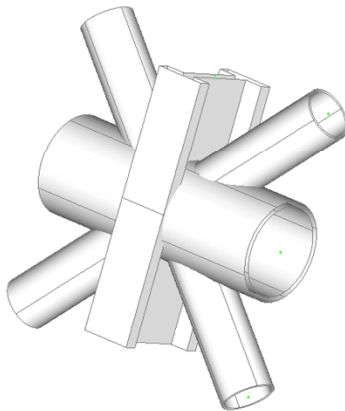


Connection Types

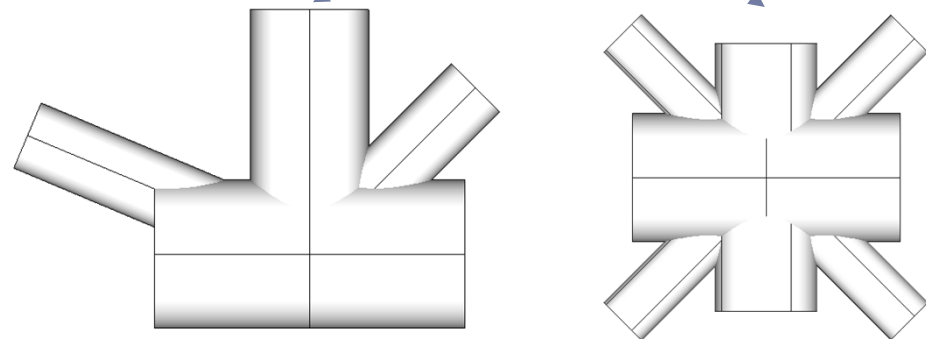
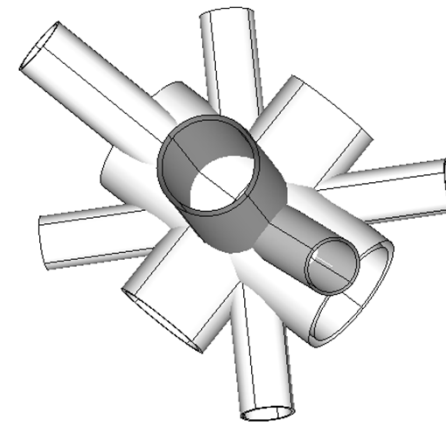
2D Connection. Set of elements of one plane



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



3D Connection. Will be split on 2D Connections



Launch SDC Verifier



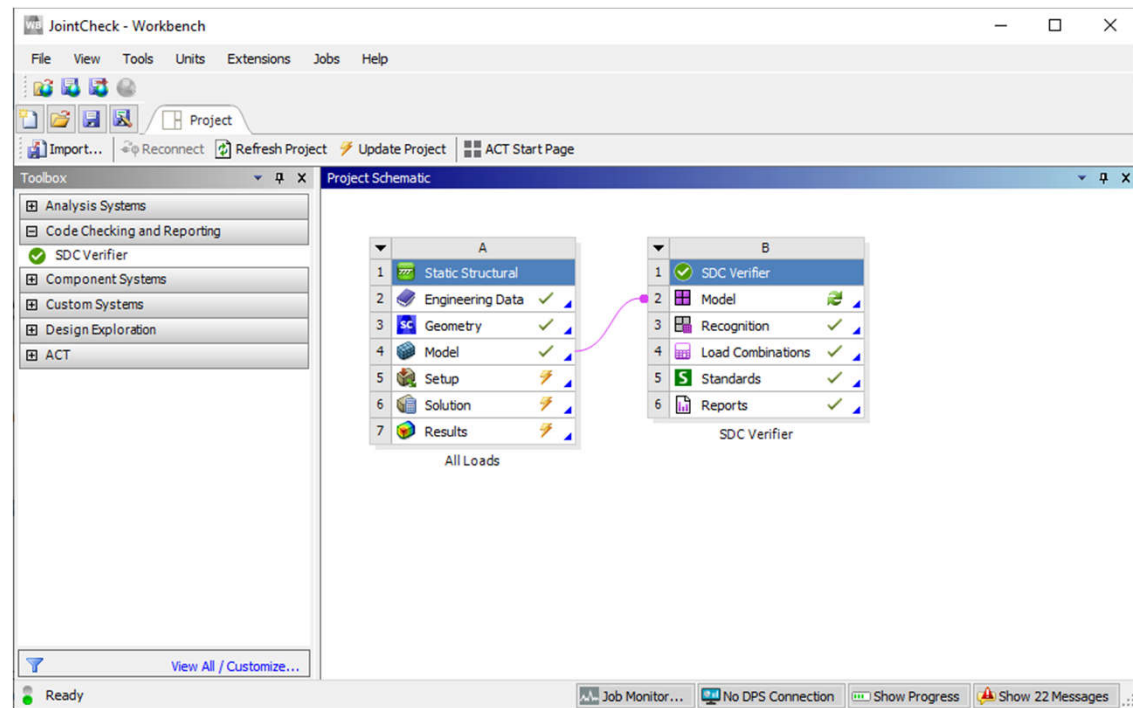
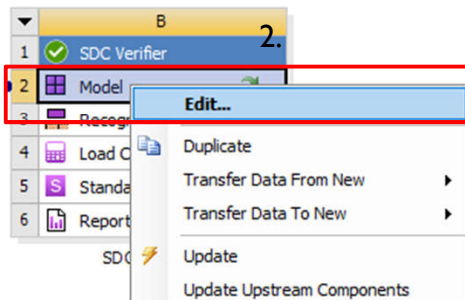
1

Open in **Ansys Workbench**
JointCheck.wbpj

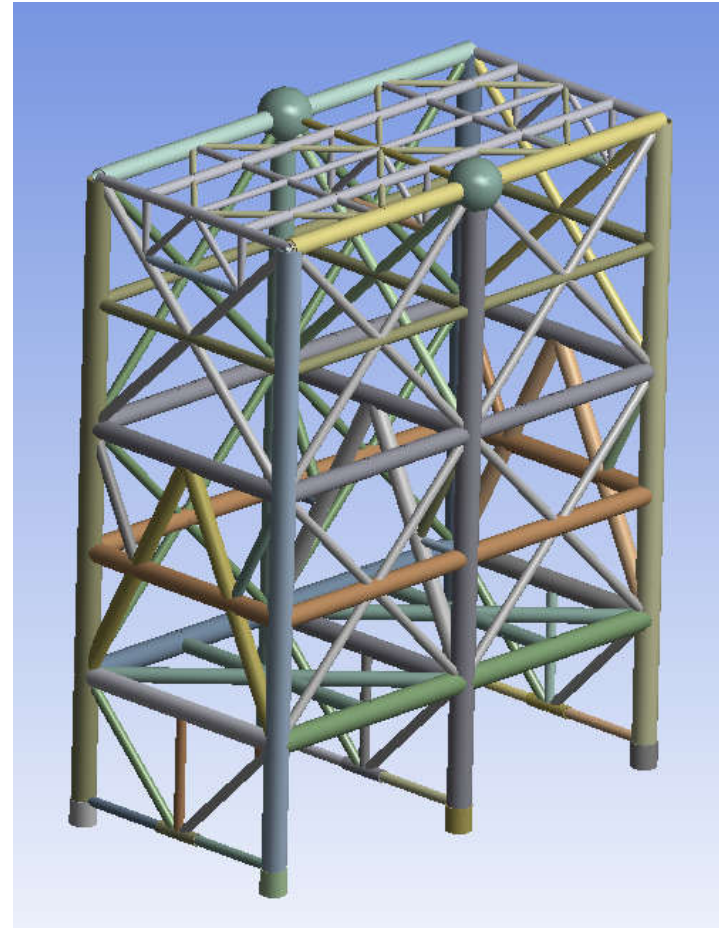
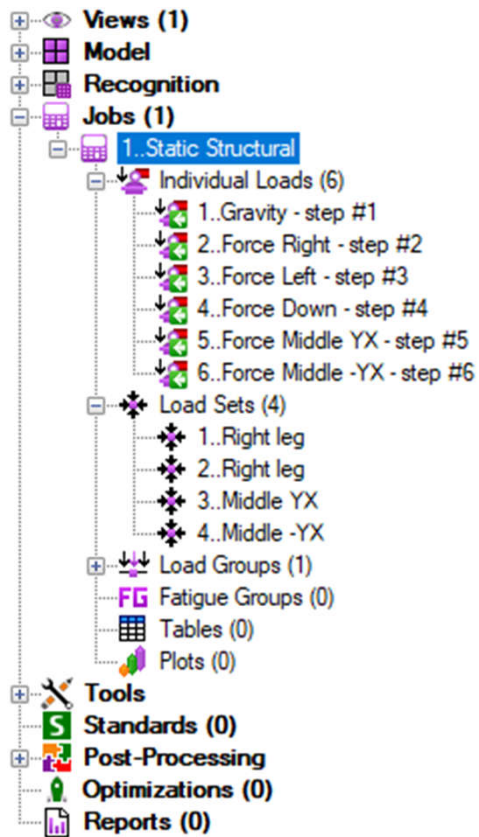


2

Double Click on **Model**
or in context menu click *Edit*



Predefined Project



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

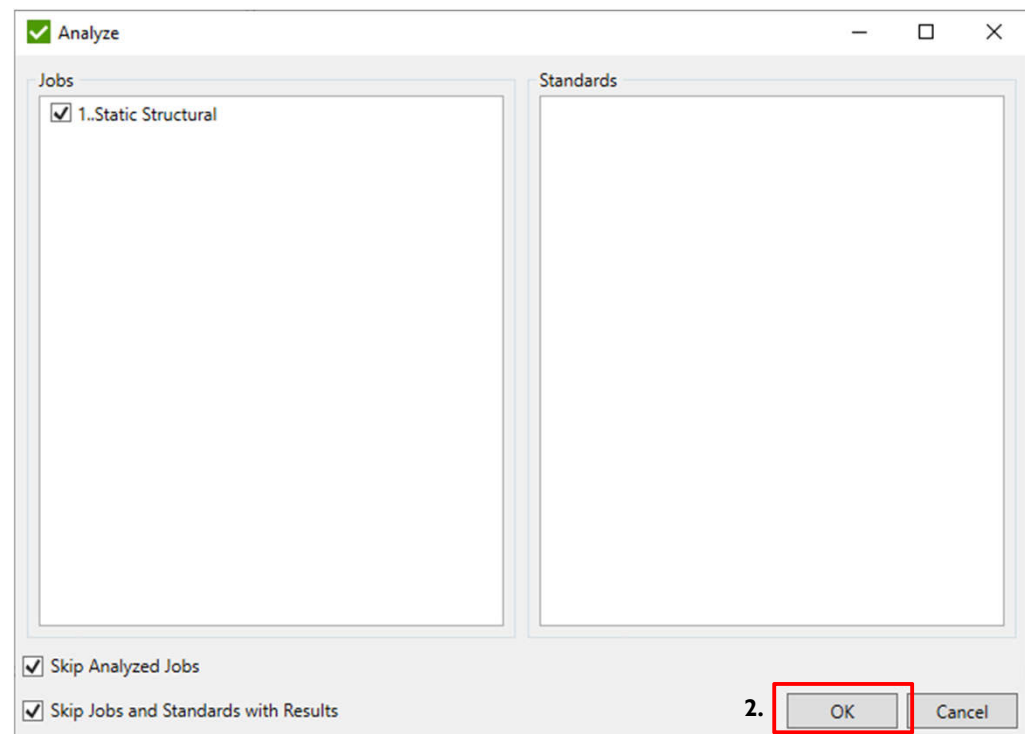
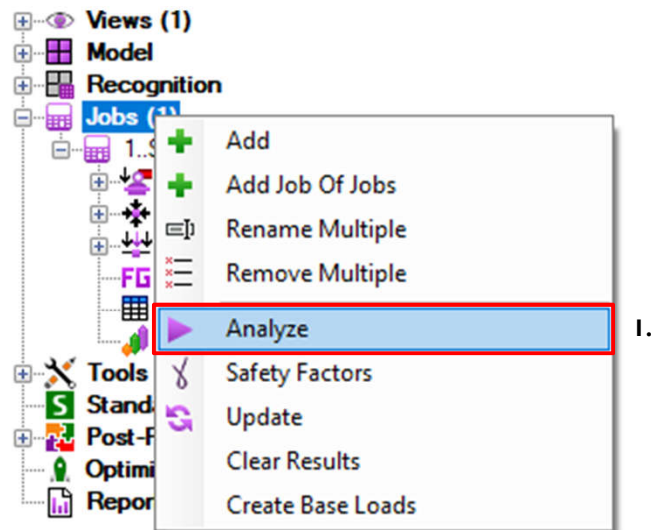
Analyze Job

1

Execute ► **Analyze** from *Static Structural* context menu

2

Press **Ok**



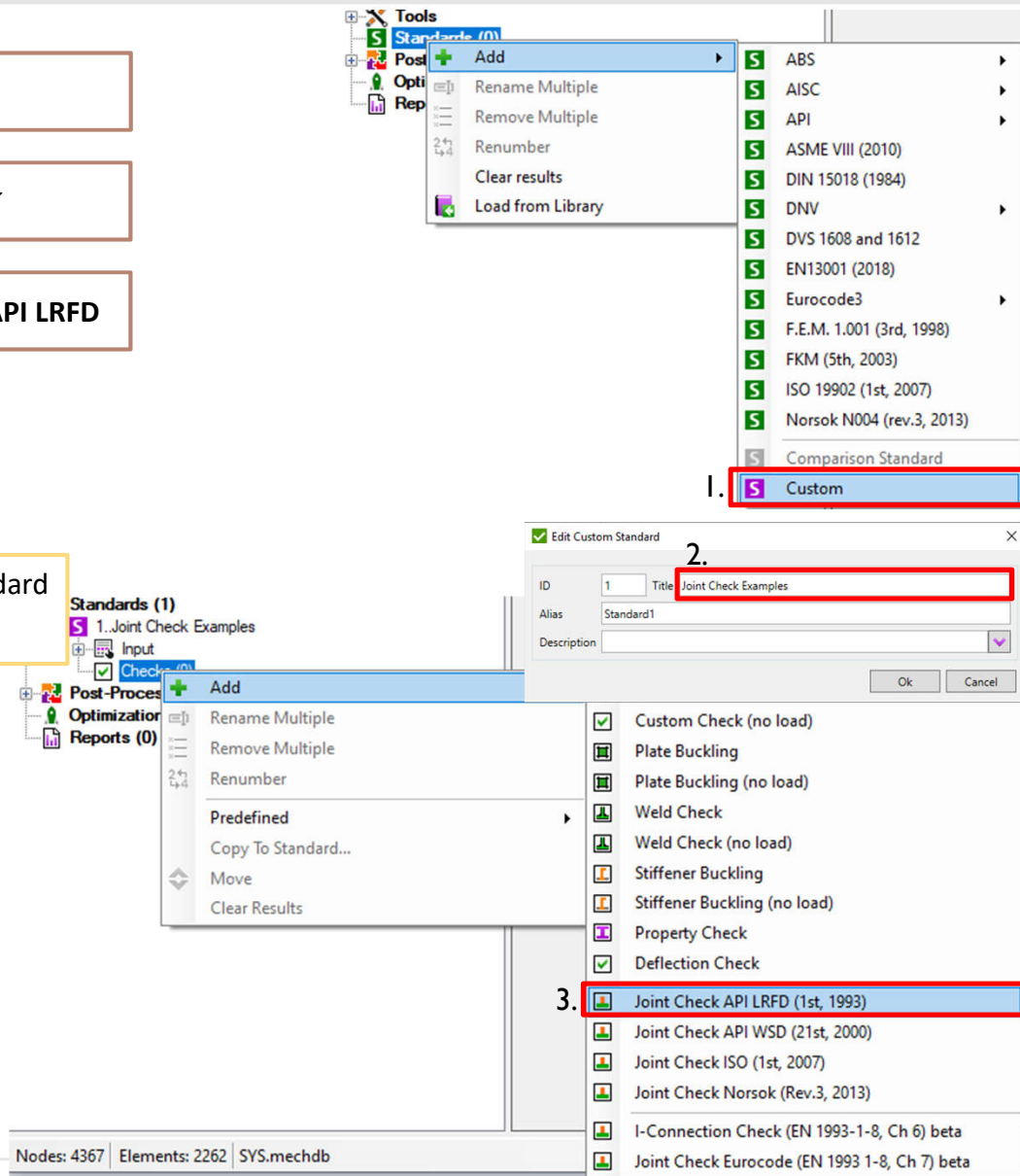
Joint Check API LRFD

1 Execute **Standards->Add->Custom**

2 **Title:** Joint Check Examples. Press *OK*

3 Execute **Checks->Add->Joint Check API LRFD**

Joint Check API LRFD is a part of the standard
API RP 2A LRFD (1st, Jul 1993)



Joint Check Settings

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

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

3. **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 treat as in-plane connection.

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

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

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

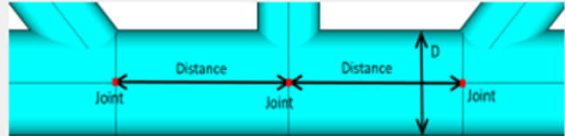
7. Press *Find Connections* to perform recognition.

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

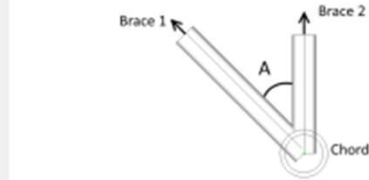
General
ID: 1 Title: Joint Check 1
Alias: Check1
Description: ck according to API RP 2A LRFD (1st, 1993) [v]

1. Joint Nodes to be Checked
Selection: All Entities [v]

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



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



4. Chord Maximum Curvature Angle $[0 \text{ to } 15]$ 3

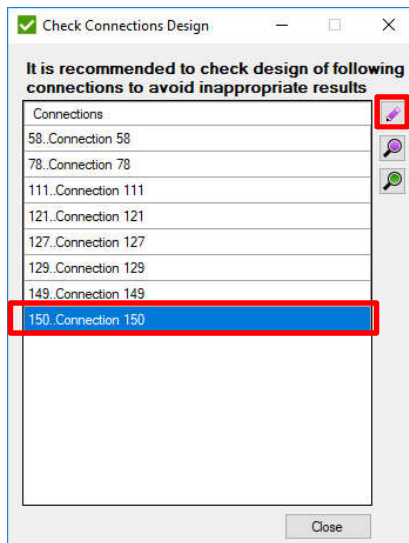
5. Joint Type Recognition Settings
Forces Tolerance, % 1 [v]

6. ☐ Calculate All Braces as TY

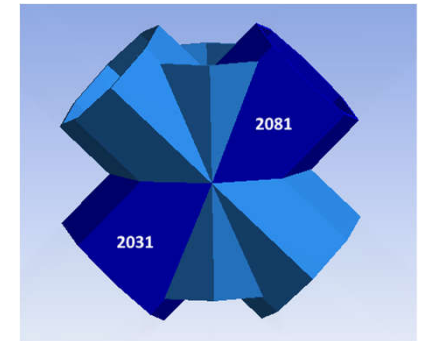
7. Find Connections

Connections design

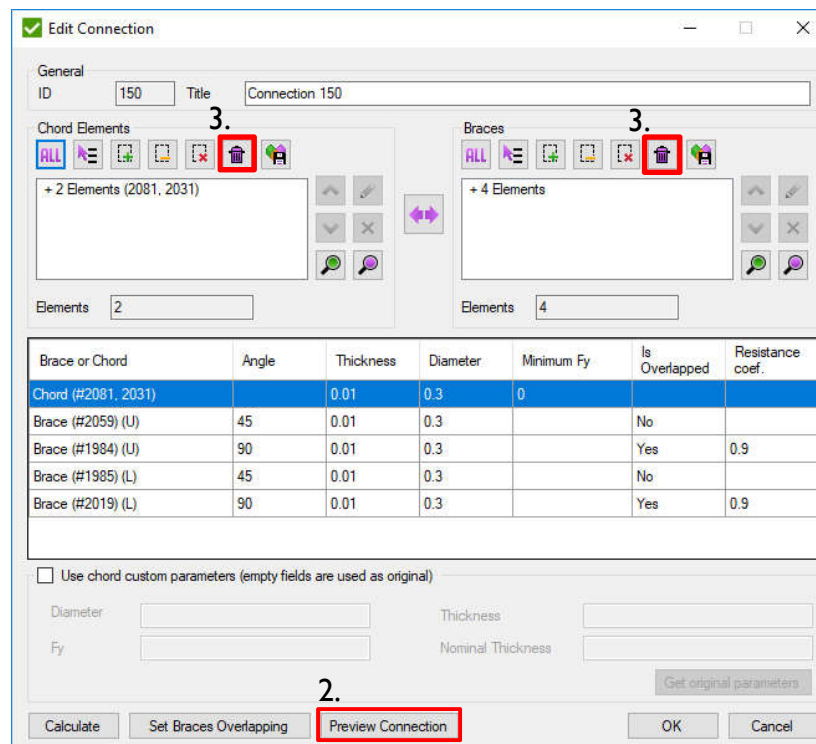
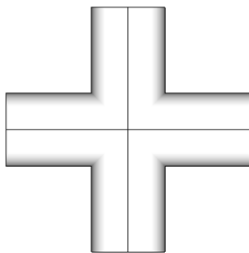
List of connections that are recommended to be checked:



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.



1

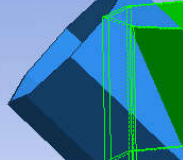
Select Connection 150 and press *Edit* button.

2

Press *Preview Connection*

3

Press *Remove all conditions in chord and braces selection*

- 

Edit Connection

General
 ID: 150 Title: Connection 150

Chord Elements
 [Add] [Remove] [Duplicate] [Delete] [Undo] [Redo] [Zoom In] [Zoom Out]

Braces
 [Add] [Remove] [Duplicate] [Delete] [Undo] [Redo] [Zoom In] [Zoom Out]

Elements: 0

Brace or Chord	Angle	Thickness	Diameter	Minimum Fy	Is Overlapped	Resistance coef.
Chord (#2081, 2031)		0.01	0.3	0		
Brace (#2059) (U)	45	0.01	0.3		No	
Brace (#1984) (U)	90	0.01	0.3		Yes	0.9
Brace (#1985) (L)	45	0.01	0.3		No	
Brace (#2019) (L)	90	0.01	0.3		Yes	0.9

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

Diameter: [] Thickness: []
 Fy: [] Nominal Thickness: []

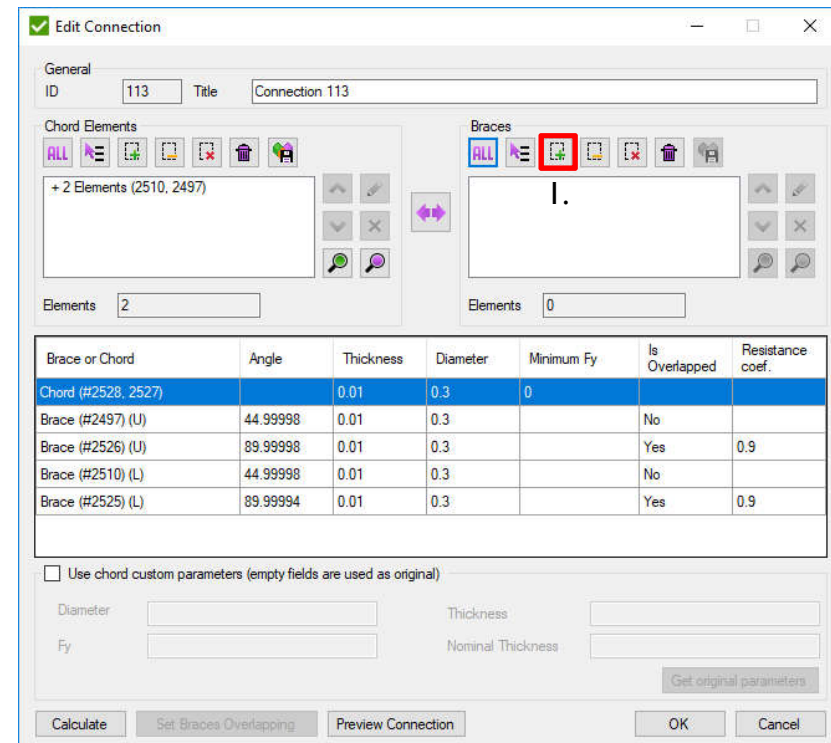
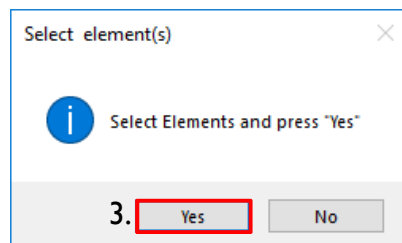
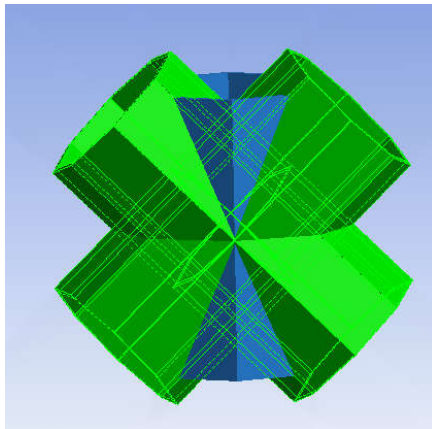
Get original parameters

Calculate Set Braces Overlapping Preview Connection OK Cancel

Entity	Element ID	Element Type	Body
2 Mesh Elements, Summary			
Mesh Element 1	2081	Low Order Beam	Beam (Pipe D300x10)
Mesh Element 2	2031	Low Order Beam	Beam (Pipe D300x10)

Connections design

- 1 Press *Add entities using Ansys*
- 2 Select *Mesh elements ID 2526, 2528, 2525, 2527.*
- 3 Press *Yes*



2.

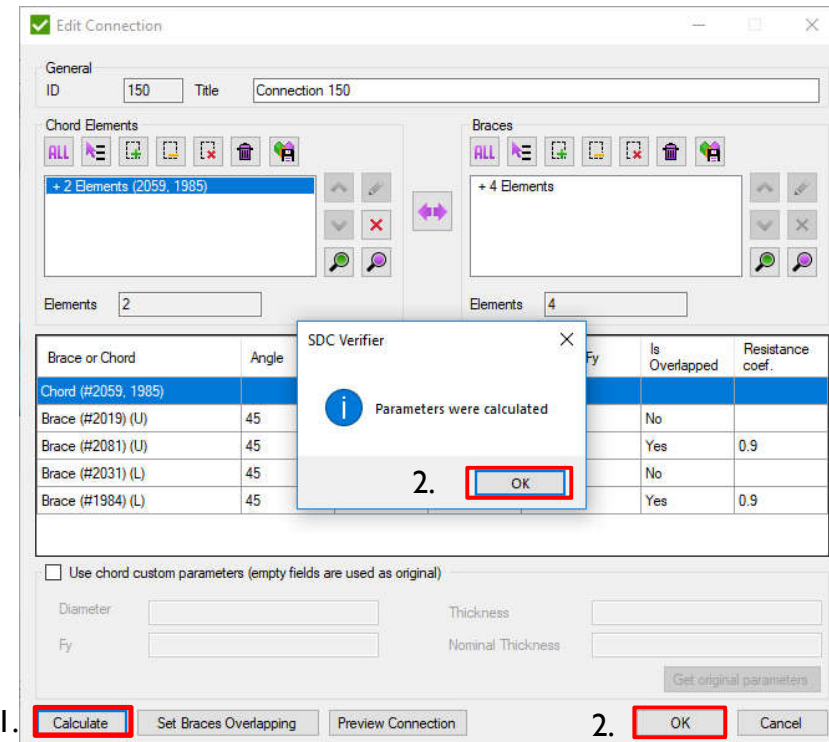
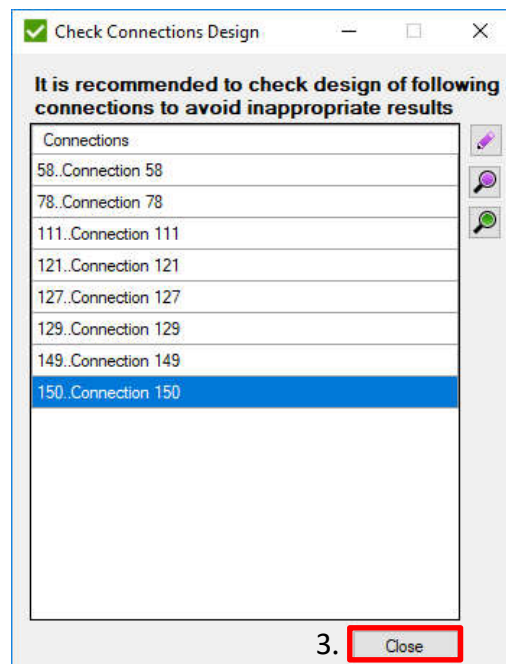
Entity	Element ID	Element Type	Body
4 Mesh Elements, Summary			
Mesh Element 1	2019	Low Order Beam	Beam (Pipe D300x10)
Mesh Element 2	1985	Low Order Beam	Beam (Pipe D300x10)
Mesh Element 3	1984	Low Order Beam	Beam (Pipe D300x10)
Mesh Element 4	2059	Low Order Beam	Beam (Pipe D300x10)

Connections design

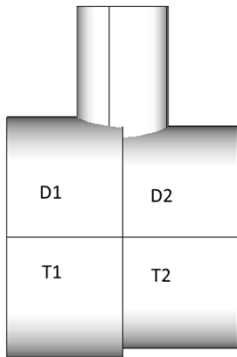
1 Press *Calculate*

2 Select *Ok* twice.

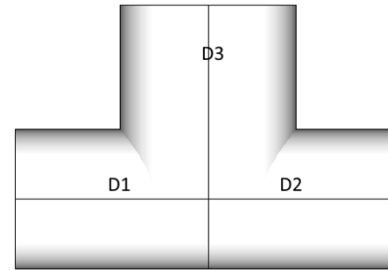
3 Press *Close*



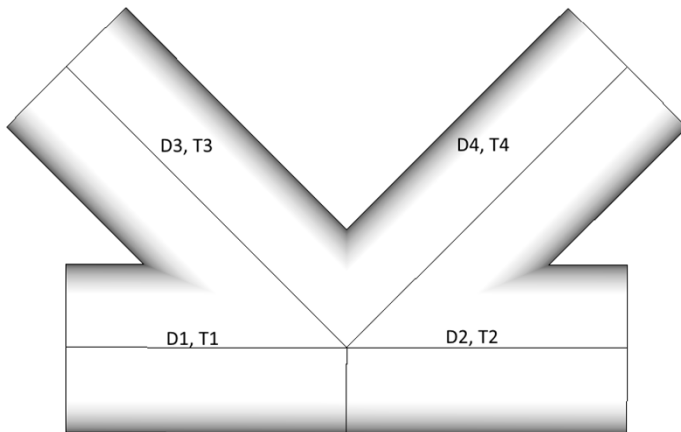
Connections design



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



$D1 = D2$, $D1 < D3$. 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 connection are equal, thicknesses are compared. Element with thickness = $T4$ is recognized as chord.

In case when:
 $D1 = D2 = D3 = D4$;
 $T1 = T2 = T3 = T4$;
When all elements of connection are of the same dimensions, chord is recognized as pair of elements that form straight line. If any pair that match condition is found, random element will be recognized as chord.

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

Joint Check API LRFD

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

Connection info. Chord, Braces and their properties

Add, Edit, Preview and Remove selected connections.

Joint Check

General
ID: 1 Title: Joint Check 1
Alias: Check1
Description:

Navigation
Connection ID: 23 Navigate

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

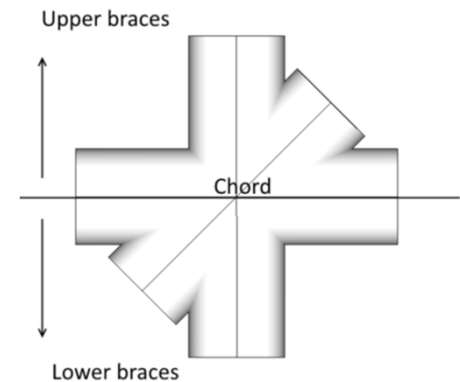
Chord maximum curvature angle $[0 \text{ to } 15]$: 3

Joint type recognition settings
Forces Tolerance, %: 1
☐ Calculate all braces as TY

ID	Title	Brace or Chord	Angle	Thickness	Diameter	T > t	Is Overlapped	Resistance coef.
23	Connection 23	Chord (#1777, 1776)		0.02	0.252			
		Brace (#1772) (U)	44.999759	0.01	0.2	Yes	No	
		Brace (#1775) (U)	44.999759	0.01	0.2	Yes	Yes	0.9
		Brace (#1774) (L)	44.999759	0.01	0.2	Yes	No	
		Brace (#1773) (L)	44.999759	0.01	0.2	Yes	Yes	0.9
24	Connection 24	Chord (#1784, 1780)		0.02	0.252			
		Brace (#1779) (U)	44.999742	0.012	0.22	Yes	No	
		Brace (#1778) (U)	44.999742	0.012	0.22	Yes	Yes	0.9
		Brace (#1783) (L)	44.999759	0.012	0.22	Yes	No	
		Brace (#1782) (L)	44.999759	0.012	0.22	Yes	Yes	0.9
25	Connection 25	Chord (#1822, 1819)		0.02	0.252			
		Brace (#1821) (U)	44.999759	0.01	0.2	Yes	No	
		Brace (#1820) (U)	44.999759	0.01	0.2	Yes	Yes	0.9
		Brace (#1823) (L)	44.999759	0.01	0.2	Yes	No	
		Brace (#1824) (L)	44.999759	0.01	0.2	Yes	Yes	0.9
26	Connection 26	Chord (#1959, 1974)		0.03	0.48			
		Brace (#1890) (U)	90	0.02	0.252	Yes	No	
27	Connection 27	Chord (#1959, 1974)		0.03	0.48			
		Brace (#1897) (U)	90	0.02	0.252	Yes	No	
28	Connection 28	Chord (#994, 1009)		0.03	0.48			
		Brace (#1891) (U)	90	0.02	0.252	Yes	No	
29	Connection 29	Chord (#994, 1009)		0.03	0.48			

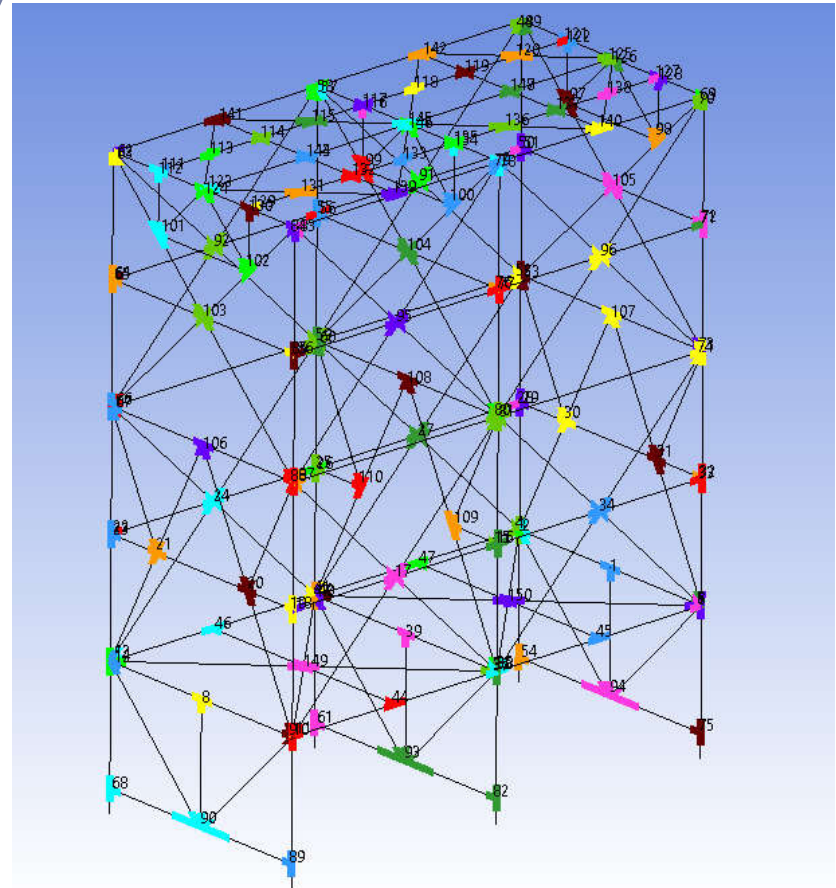
Find Connections Clear Results Set Resistance Coefficients Overall table Set brace load transfer OK Cancel

Selection and recognition settings



#1777,1776 – IDs of related elements in the model.
(U) – Upper (0°-180°) braces
(L) – Lower (180°-360°) braces

140	Connection 140
141	Connection 141
142	Connection 142
143	Connection 143
144	Connection 144
145	Connection 145
146	Connection 146
147	Connection 147
148	Connection 148
149	Connection 149
150	Connection 150
151	Connection 151
152	Connection 152

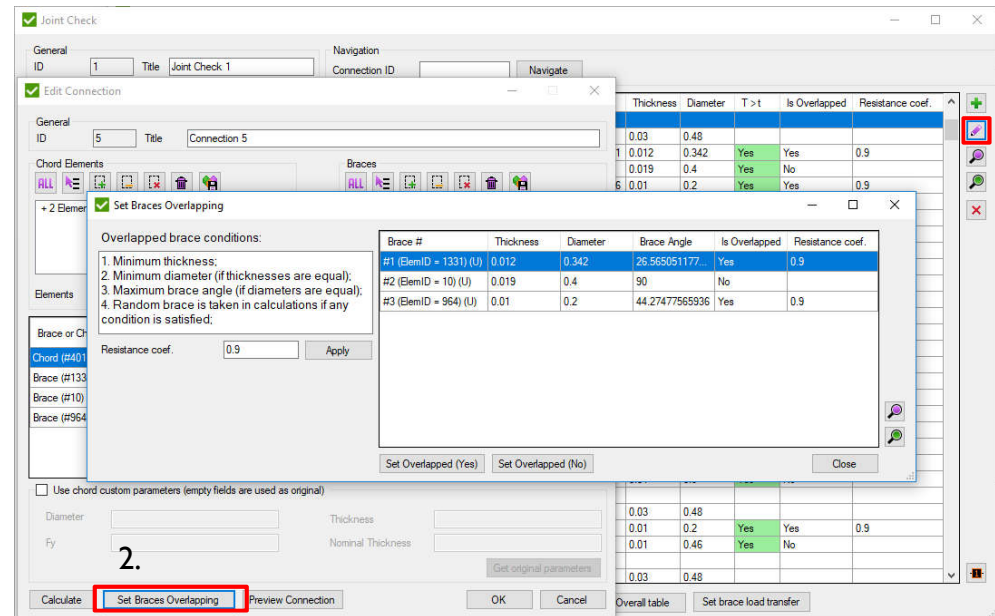


Joint Check API LRFD

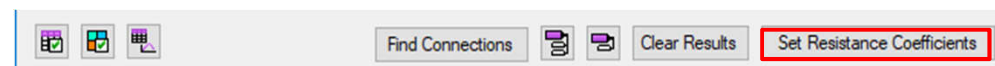
Resistance coefficient depends on the strength of welding and is used in calculations of overlapping (Section E.3.2 API 2A RP LRFD). **Table J 2.5** is taken from **Load and resistance factor design specification for structural steel buildings December, 27 1999 (AISC)**. Default value is 0.9. It can 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_{BM} 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]. Filler metal with a strength level equal to or less than matching filler metal is permitted to be used.
Compression normal to effective area	Base	0.90	F_y	
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	$[f]$ F_y $0.60F_{EXX}$ [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.



It is possible to set overlapped braces and their resistance coef. manually in 1. *Edit Connection* -> 2. *Set Braces Overlapping*. Alternatively set coefficients to multiple connections by pressing *Set Resistance Coefficients* button:



Joint Check API LRFD

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**)

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:

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

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

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

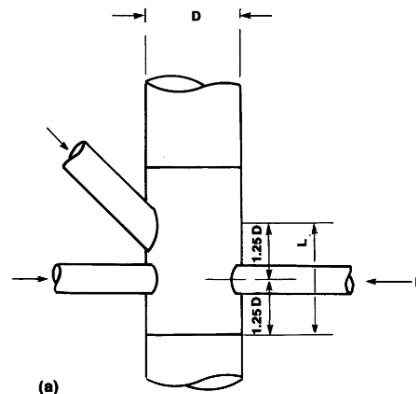
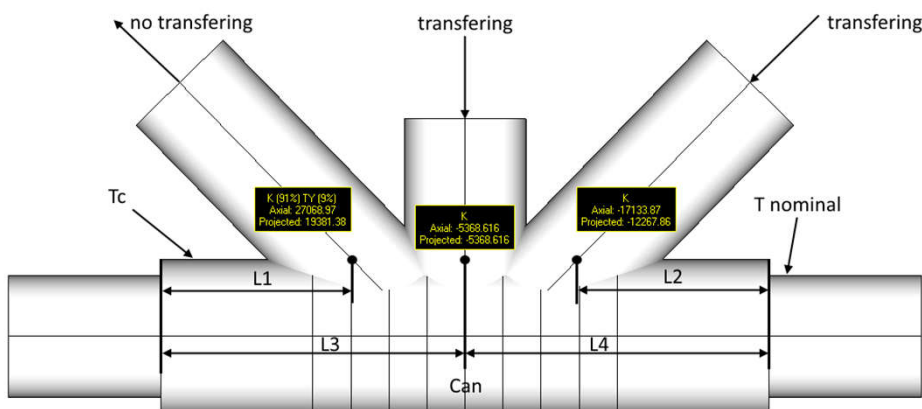


FIG. E.3-6
DEFINITION OF EFFECTIVE CORD LENGTH



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. $L1, L2 \leq 1.25D$. If $L1$ and $L2$ exceed $1.25D$ distance, can will not be recognized.

$T_c \geq T$ nominal.

$L = 2 * L1 = 0.6293$ – effective length for the left brace

$L = 2 * L3 = 2 * L4 = 1$ – effective length for the middle brace

$L = 2 * L2 = 0.6293$ – effective length for the right brace

T nominal = 0.01; $T_c = 0.02$;

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

Set Resistance Coefficients

Overall table

Set brace load transfer

Set braces load transfer

Connection ID	Brace #	Is Load Transfer	Effective Length
7	#01(Elem ID = 2543)	Yes	0.62932
	#11(Elem ID = 2427)	Yes	1
	#21(Elem ID = 2564)	Yes	0.62932
19	#01(Elem ID = 2541)	Yes	0.62932
	#11(Elem ID = 2425)	Yes	1
	#21(Elem ID = 2554)	Yes	0.62932
20	#01(Elem ID = 2442)	Yes	0.273172
21	#01(Elem ID = 2426)	Yes	1
22	#01(Elem ID = 2422)	Yes	0.273172

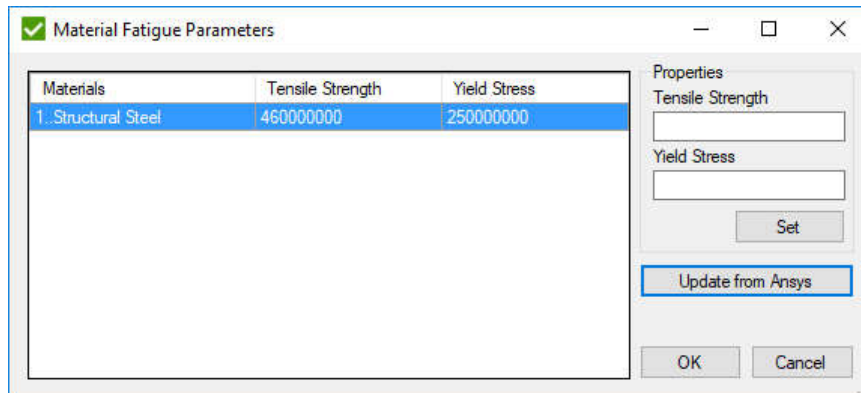
Is Load Transfer Yes

Effective Length

Material Properties

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

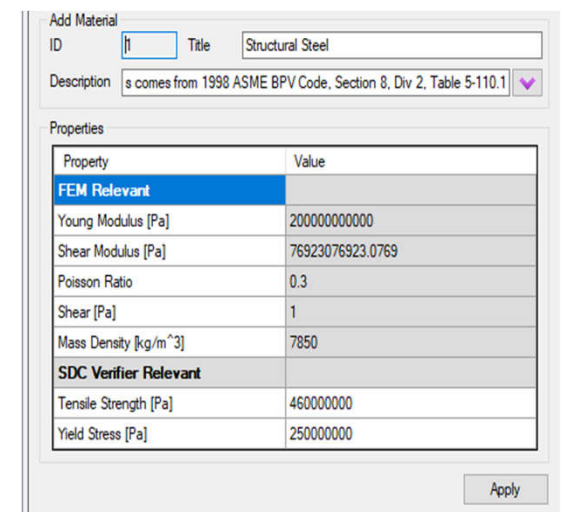
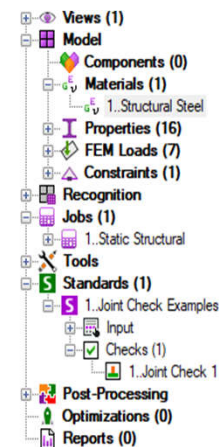
If material parameters are not set, window will be displayed before calculating results:






Set values for Tensile and Yield and press *Set* to selected materials.

Press OK to apply changes and continue calculations, Cancel to discard.

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



- Joint type recognition settings
- Forces Tolerance, %
- ☐ Calculate all braces as TY
-   

Add joint check expand table

General
 ID: 1 Title: Table 1
 Description:
 Selected Load: 1. Load Group 1
 Information Type:
☒ All results (Intermediate results + Calculation factors)
☐ Intermediate results (Forces + Utilization factors)
☐ Utilization factors only
 Table settings:
☒ Show only joints that fail (value >) 1
 Parameter that fails: All
 Sort by parameter: Overall Utilization Factor
 Table build type:
☐ Parameters in rows
☒ Parameters in columns
 Connections:
☒ 1. Connection 1
☒ 2. Connection 2
☒ 3. Connection 3
☒ 4. Connection 4
☒ 5. Connection 5
☒ 6. Connection 6
☒ 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

Connection ID	axial Capacity (E.3-2)	In-plane Bending Capacity (E.3-3)	Out-of-plane Bending Capacity (E.3-3)	Combined Load (E.3-4)	PD perpendicular / Pg perpendicular (E.3-7)	Overall Utilization Factor	ShearUC
44	002794659	0.009500838	0.5110852	0.5110857		1.729323	
45	002794659	0.009500838	0.5110852	0.5110857		1.729323	
46	002794659	0.009500838	0.5110852	0.5110857		1.729323	
47	002794659	0.009500838	0.5110852	0.5110857		1.729323	

Select Load

☒ Select Load

Load Type:
☐ Individual Load
☐ Load Set
☒ Load Group
☐ Fatigue Group

Jobs:
 1. Static Structural

Load Group:
 1. Load Group 1

OK Cancel

Fill Table Plot Forces Plot Gaps Plot Classification OK Cancel

Plot Classification – plot brace joint types

Brace Joint Type

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.

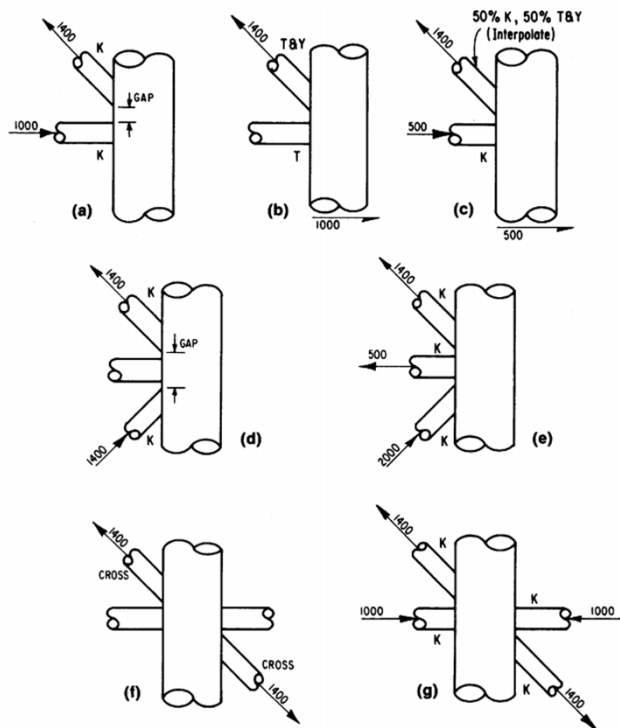


FIG. E.3-2
EXAMPLES OF JOINT CLASSIFICATION

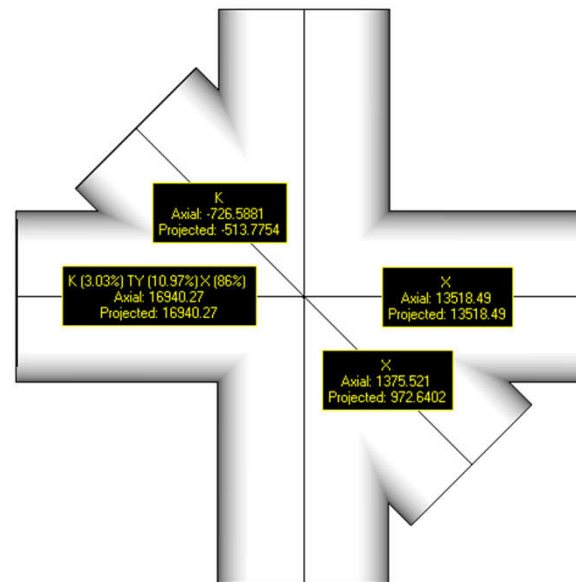
Joint type is based on type of loading. By checking if forces of connection are balanced joint types are classified on K, TY and X (Cross).

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 then all braces are classified as X (Cross).

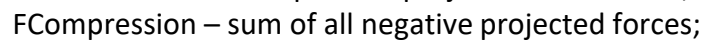
Interpolation – the order of joint type recognition is following: K -> X (Cross) -> TY. Each brace can have all 3 types of joint type taken as percentage of axial load of brace to summation of all braces loads.



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.



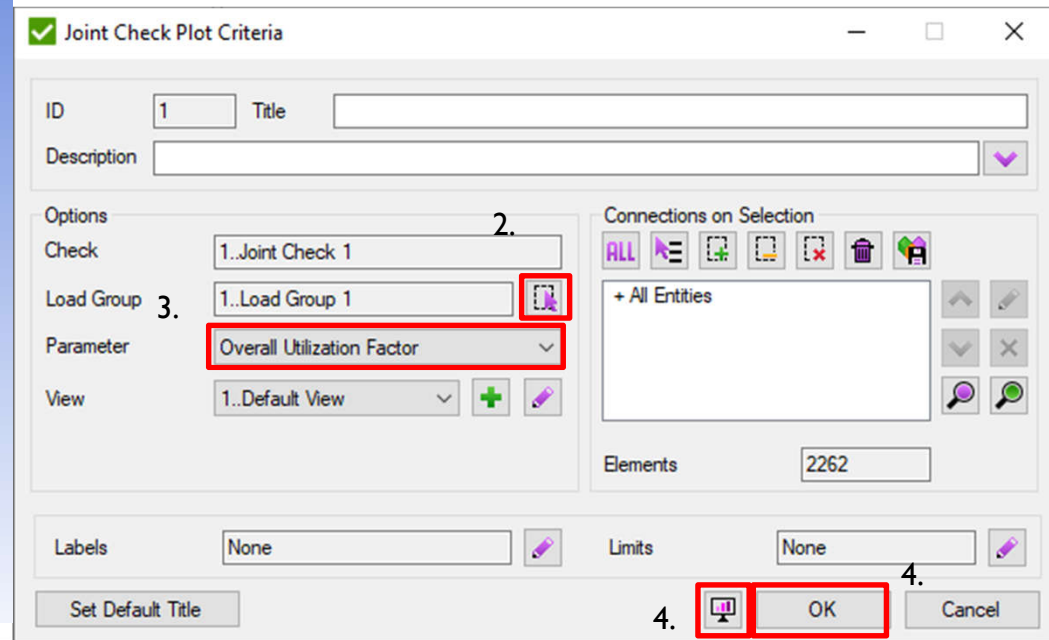
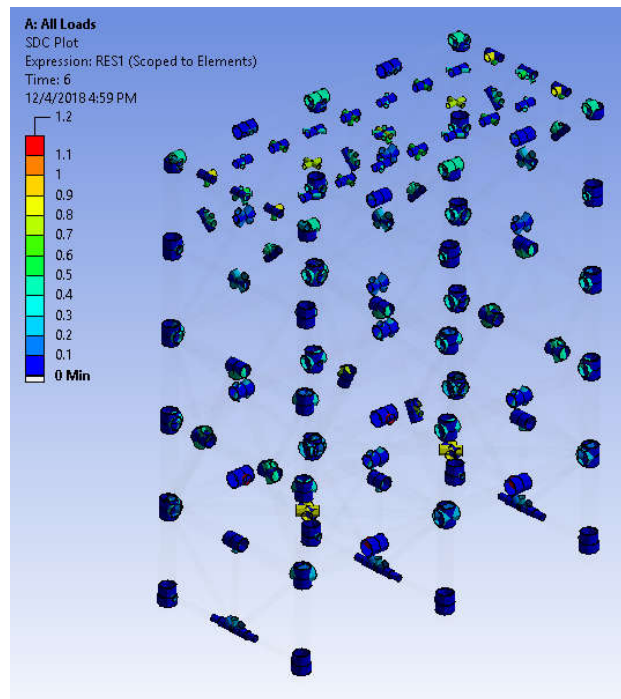
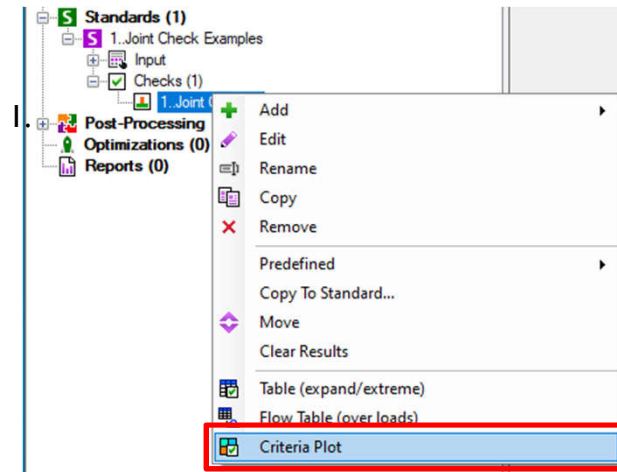
Joint Check Criteria Plot

1 Execute **Joint Check 1->Criteria Plot** 

2 *Select Load: Load Group'1..Load Group 1'*

3 *Parameter : Overall Utilization Factor*

4 Press  . Press **OK**



Joint Check Expand Flow Table

1 Press Add Expand Flow Table

2 Select all Load Sets

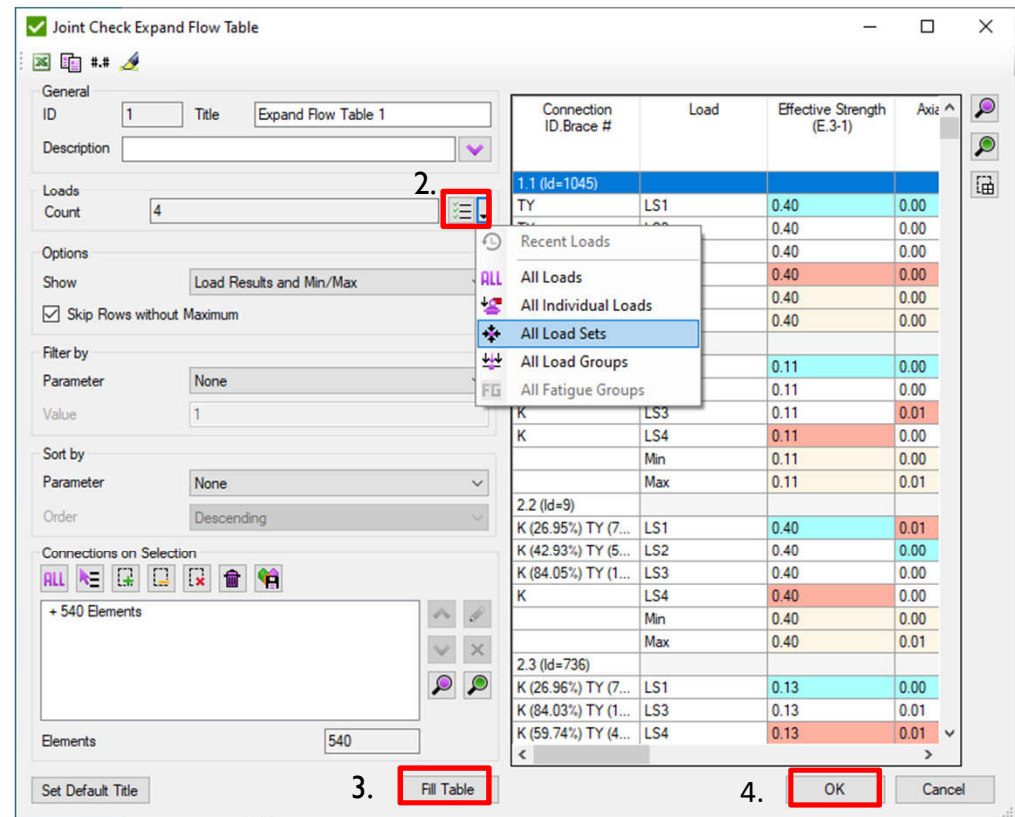
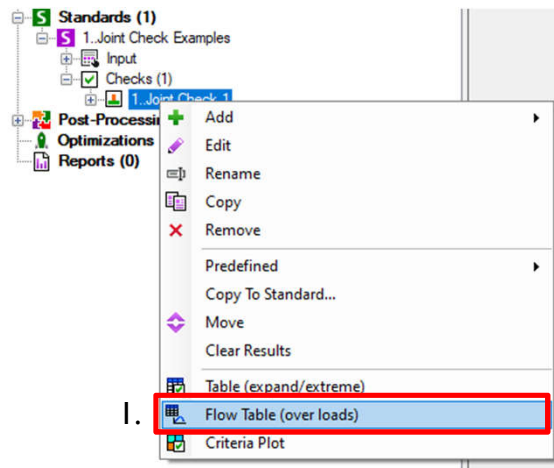
3 Press Fill Table

4 Press OK

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

Skip rows without maximum – for 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 ISO

Joint Check ISO interface is similar to Joint Check API.

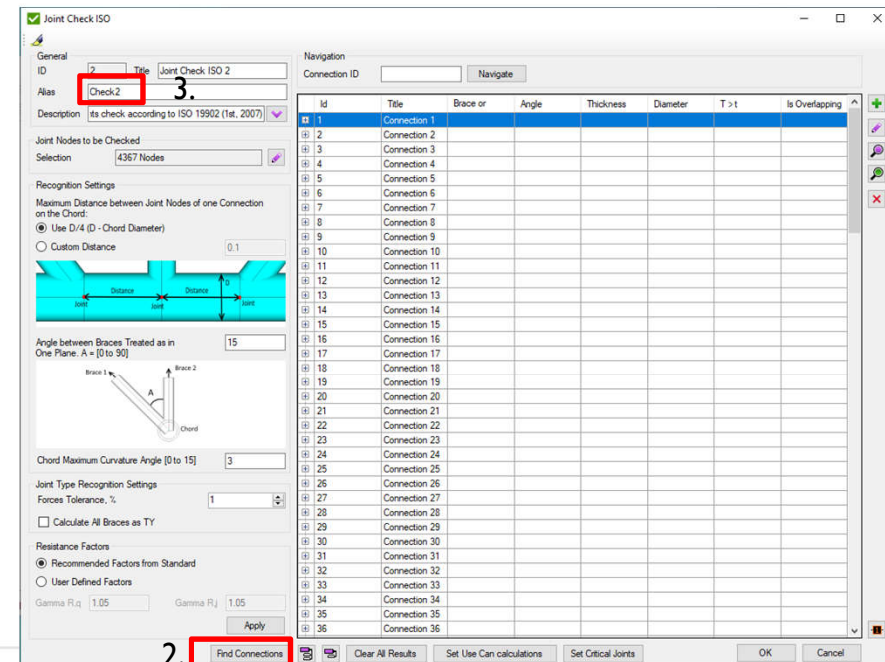
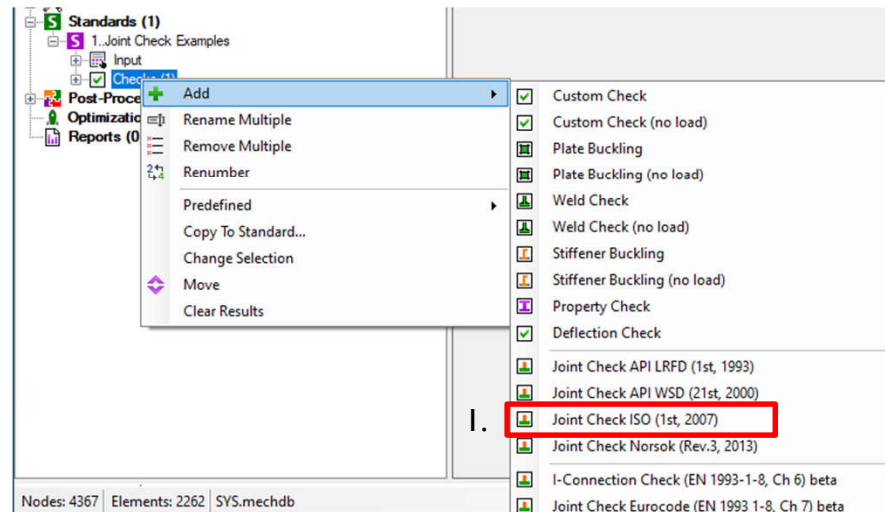
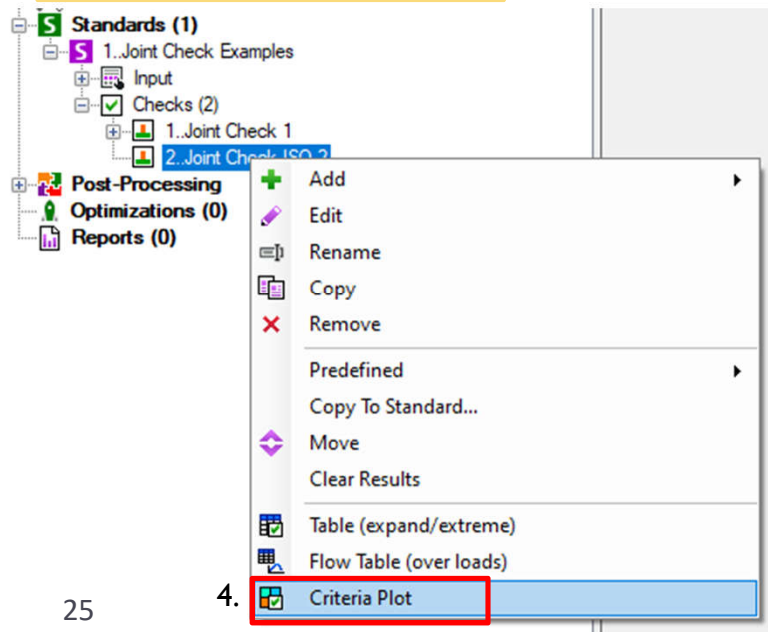
1. Execute **Checks->Add->Joint Check ISO**

2. Press *Find Connections*

3. Alias: **Check2**

4. Execute **Joint Check ISO 2->Criteria Plot** 

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

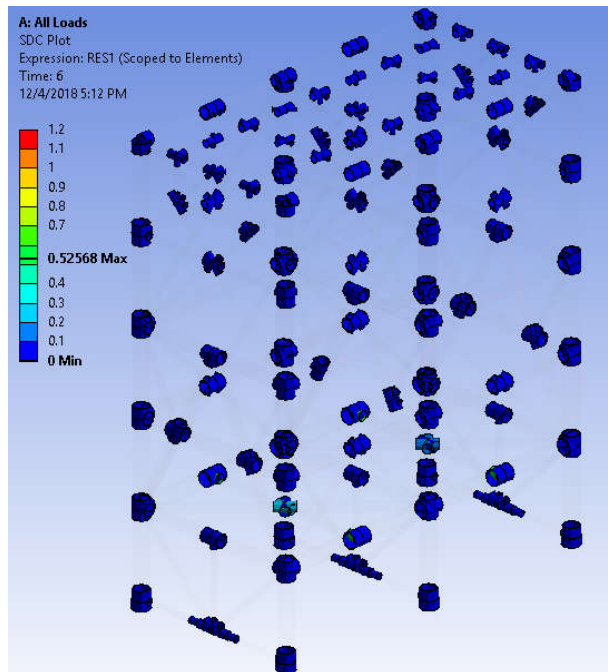


Joint Check ISO

1 Select Load: Load Group '1..Load Group 1'

2 Parameter : Overall Utilization Factor

3 Press . Press OK



Joint Check Plot Criteria

ID: 1 Title:

Description:

Options

Check: 2..Joint Check ISO 2 1.

Load Group: 1..Load Group 1 1.

Parameter: 2. Overall Utilization Factor

View: 1..Default View

Connections on Selection

ALL


+ All Entities

Elements: 2262

Labels: None

Limits: None 4.

Set Default Title

3.  OK Cancel

Joint Check Norsok

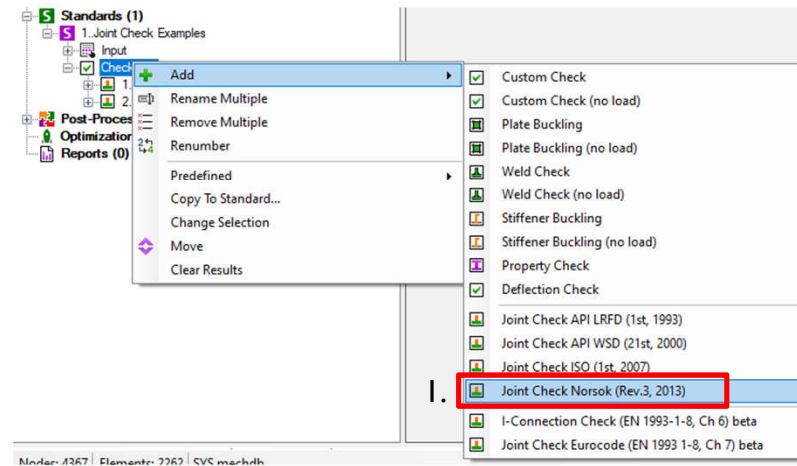
Joint Check Norsok interface is similar to Joint Check API

1 Execute **Checks->Add->Joint Check Norsok**

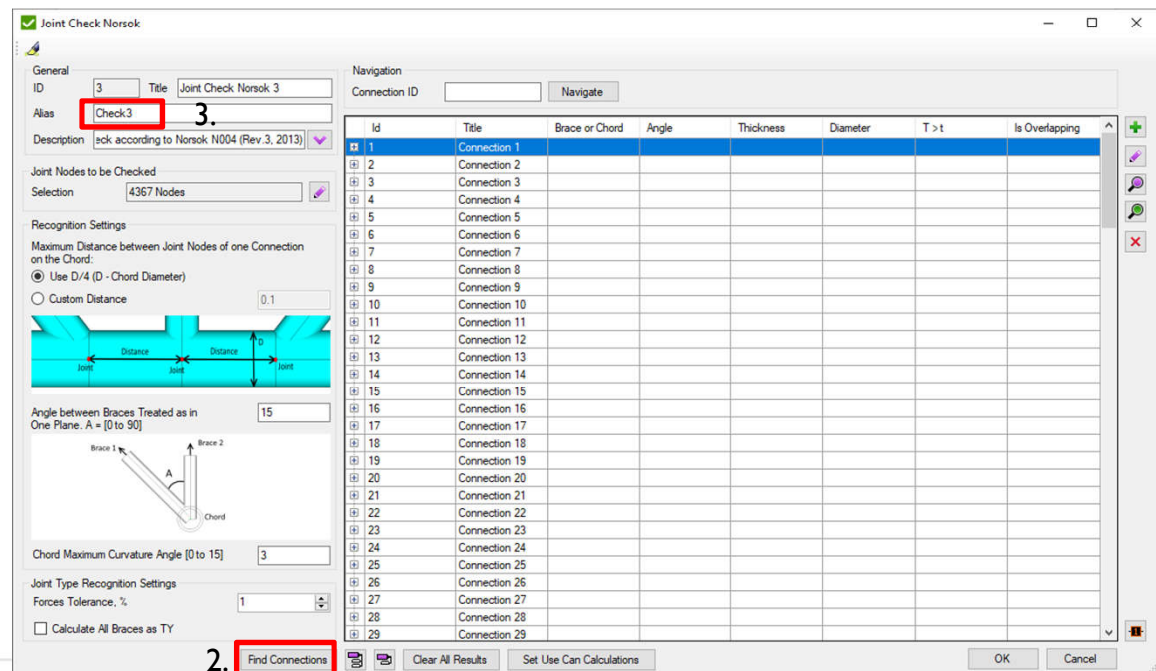
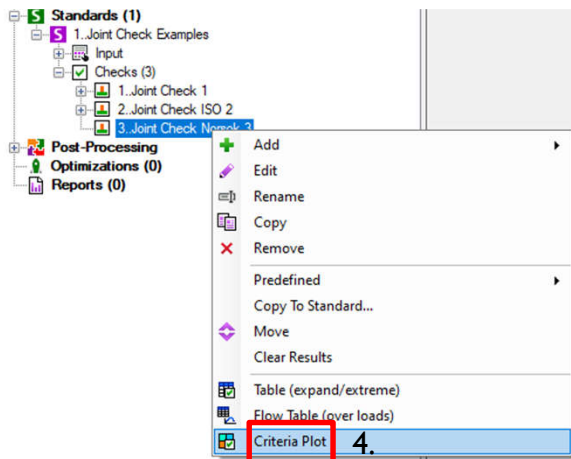
2 Press *Find Connections*

3 Alias: **Check3**

4 Execute **Joint Check Norsok 2->Criteria Plot**



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



Joint Check Norsok

1

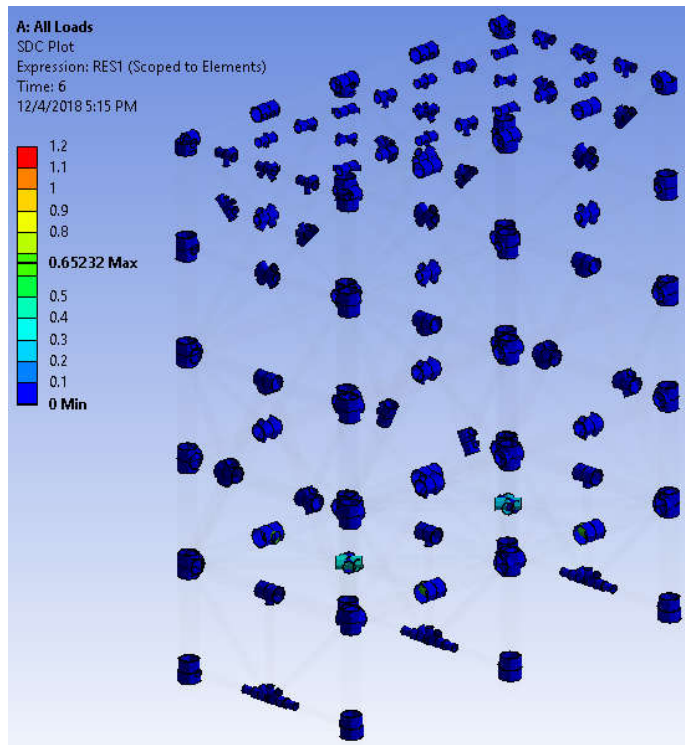
Select Load: Load Group '1..Load Group 1'

2

Parameter : Overall Utilization Factor

3

Press Preview plot. Press OK



Joint Check Plot Criteria

ID 1 Title

Description

Options

Check 3..Joint Check Norsok 3

Load Group 1..Load Group 1 1.

Parameter 2 Overall Utilization Factor

View 1..Default View

Connections on Selection

+ All Entities

Elements 2262

Labels None

Limits None 4.

Set Default Title

3. Preview OK Cancel

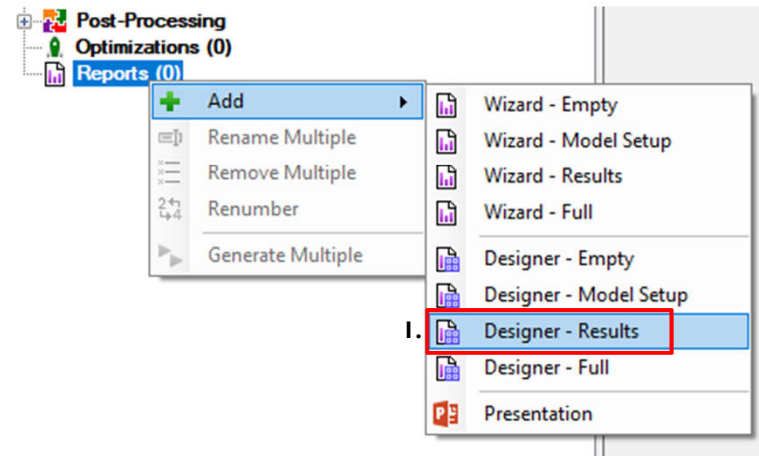
Report

1

Execute *Reports* => *Add* =>
Designer – Results.

2

Exclude Tables in the Joint Check
API



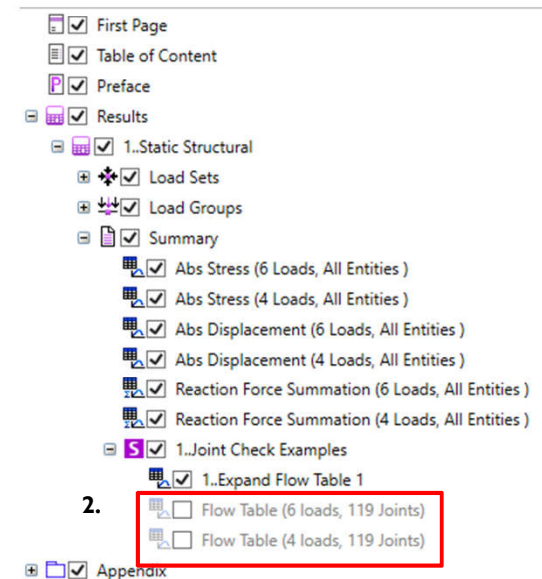
There are 4 templates of the reports:

Empty – only first page and preface items are included;

Model Setup – description of the model data (materials, properties, components, boundary conditions) is included;

Results – for each load extreme displacement tables, stress and displacement plots are included. Predefined tables: sum of reaction forces, stresses/displacements summary tables. In addition all standards are included with a set of tables/plots created in the project;

Full – Model Setup + Results + all tables/plots created in jobs.

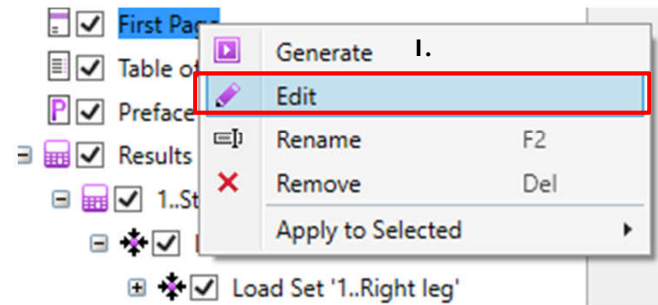


Report. First Page

1 Right click on *First Page* => *Edit*.

2 Fill in information about project.

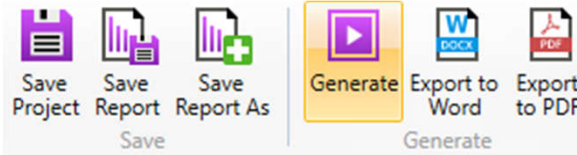
3 Press *OK*.

A screenshot of the 'First Page Editor' dialog box. The dialog is divided into several sections: 'Engineer details' with fields for Engineer (Support), Company (SDC Verifier), E-mail (support@sdcverifier.com), Phone (+31 15 30-10-310), Address (Zijlvest 25 [...]), Web Site (sdcverifier.com), and Logo (SDC Verifier logo); 'Customer details' with fields for Contact Person (customer), Company (company), E-mail (customer@company.com), Phone (+31 15 555-55-55), Address (Zijlvest 25 [...]), Web Site (company.com), and Logo (Company logo); 'Project Details' with fields for Number, Version (1), and Name (New Project); and 'Image' with radio buttons for 'From file' and 'From View' (1..Default View). The 'OK' button is highlighted with a red rectangle.

Report exported to Microsoft Word



Press  to generate complete report.



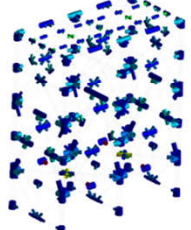
Press  to export to Word.

15/02/2018 Page 3 of 5

1..Joint Check 1

Value
152
1
0.1
15

Factor (LS1, 152 Connections, 1..Default View)



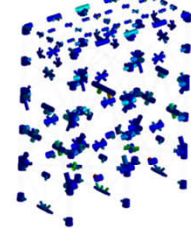
1..Joint Check 1 Load Set LS1_All Steps
Overall Utilization Factor Connections 152
Default View

15/02/2018 Page 4 of 5

2..Joint Check ISO 2

Value
152
1
0.1
15

Factor (LS1, 152 Connections, 1..Default View)



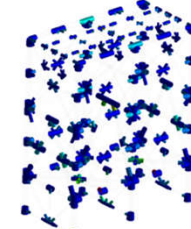
1) 2..Joint Check ISO 2 Load Set LS1_All Steps
Overall Utilization Factor Connections 152
Default View

15/02/2018 Page 5 of 5

3..Joint Check Norsok 3

Value
152
1
0.1
15

Factor (LS1, 152 Connections, 1..Default View)



1) 3..Joint Check Norsok 3 Load Set LS1_All Steps
Overall Utilization Factor Connections 152
Default View

Report

Prepared by: SDC Verifier
+31 15 30-10-310
sdoverifier.com
Zijlvest 25
2011 VB Haarlem
The Netherlands

Prepared for: company
+31 15 555-55-55
company.com
Zijlvest 25
2011 VB Haarlem
The Netherlands

Engineer: Support
Customer: company
Project Number: 1
Version: 1
Date: 15/02/2018

Joint Check API

Joint Check ISO

Joint Check Norsok

First page

Prepared By SDC Verifier Prepared For Company