



Tutorial

# API ISO Norsok

Updated on: 18 Apr 2023

Tested with: SDC Verifier 2023 R1

Ansys version 2022



## Preface

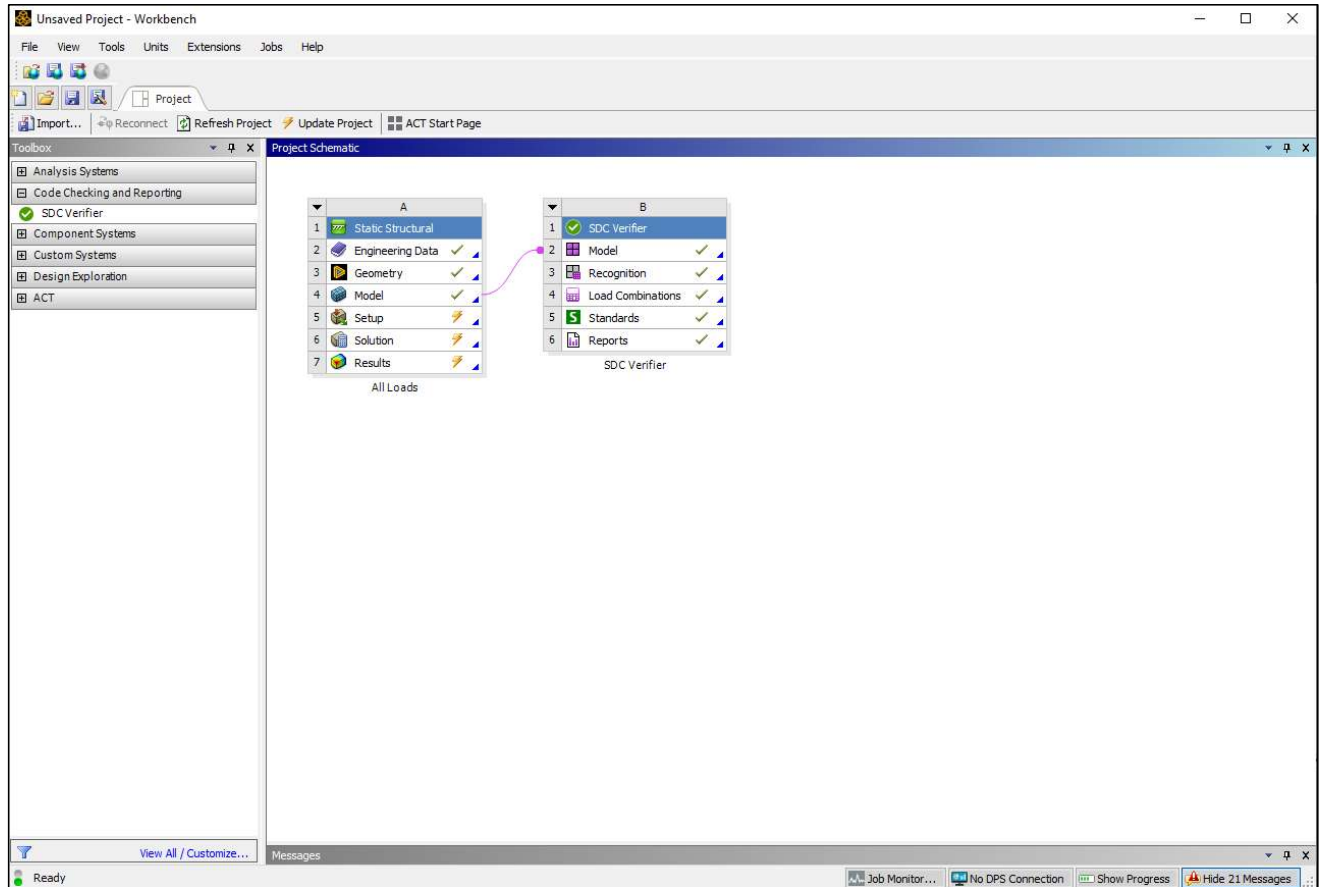
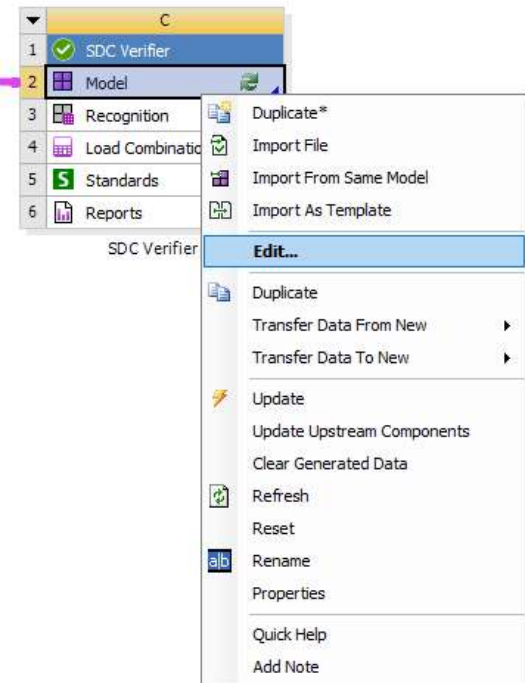
- In this tutorial, API 2A RP/ISO 19902/Norsok N004 Beam Design Checks are reviewed.
- A beam model of a steel frame has been used as a start FEM model.
- Beam member finder was used to recognize beam member length in 3 directions.
- The report was generated with the help of report designer.

# Launch SDC Verifier

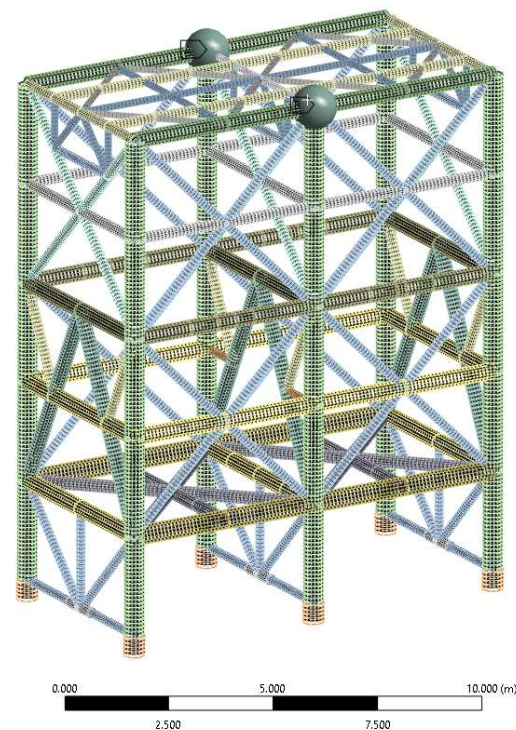
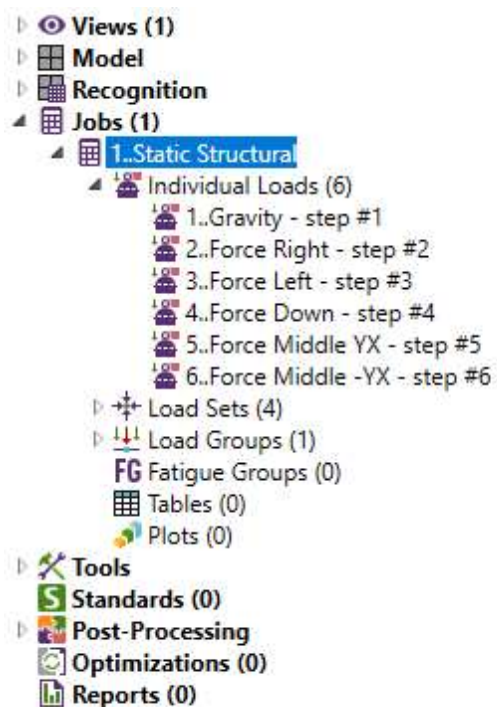


1 Open in Ansys **Workbench**  **AISC360 and Eurocode3.wbpj**

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




# Predefined project

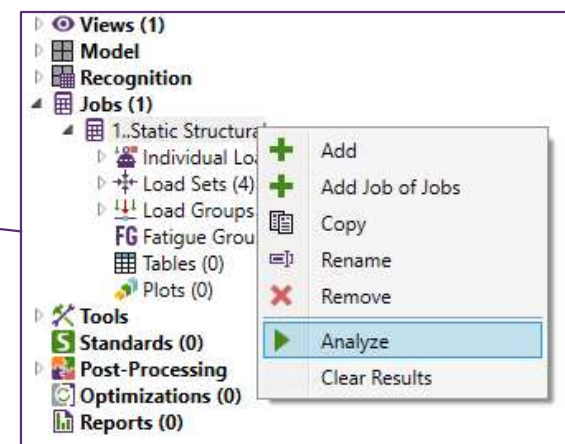
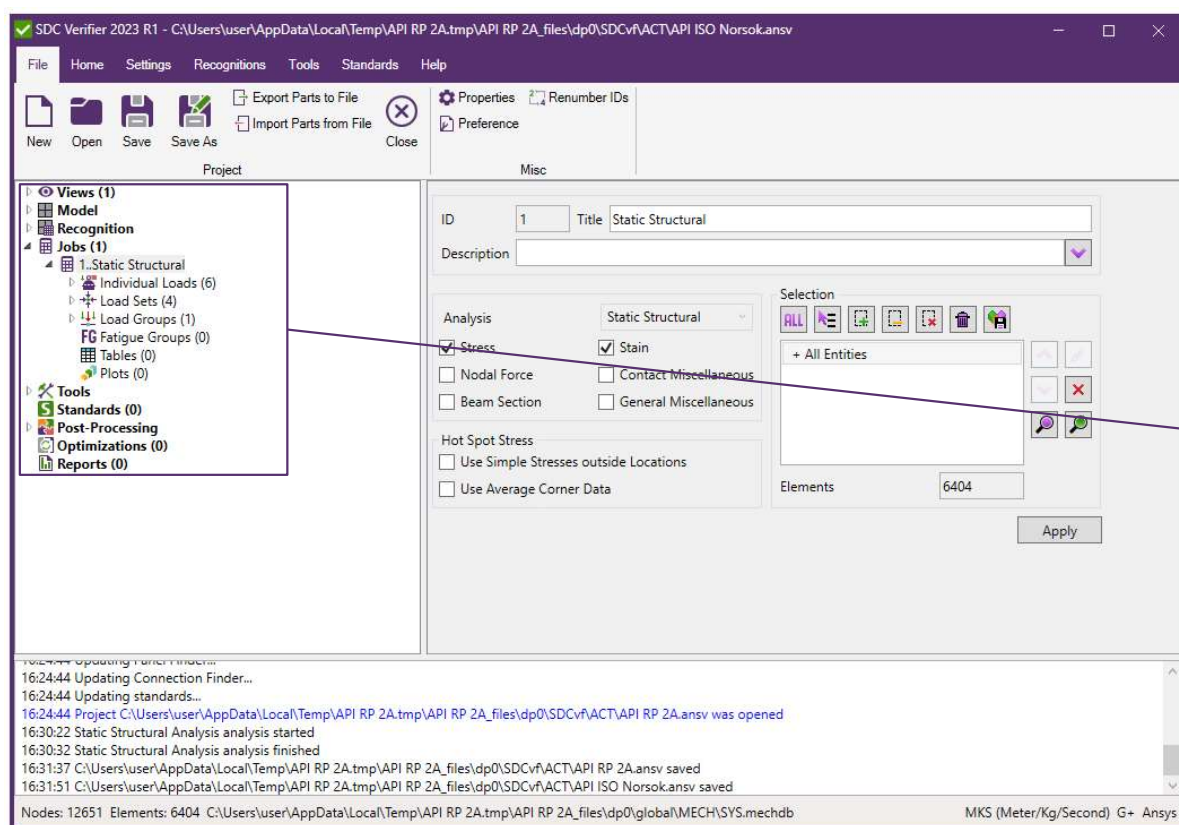


This tutorial uses project with predefined boundary condition, load combinations and load group. The model contains only circular tubes elements.

# Analyze Job

1

Press  and select **Analyze** active job: **1..Static Structural**



1

# Explanation of Joints

Joint - location where different beam members connect. They are used to recognize beam member length by Beam Member Finder Tool.

There are 6 types of Joints:

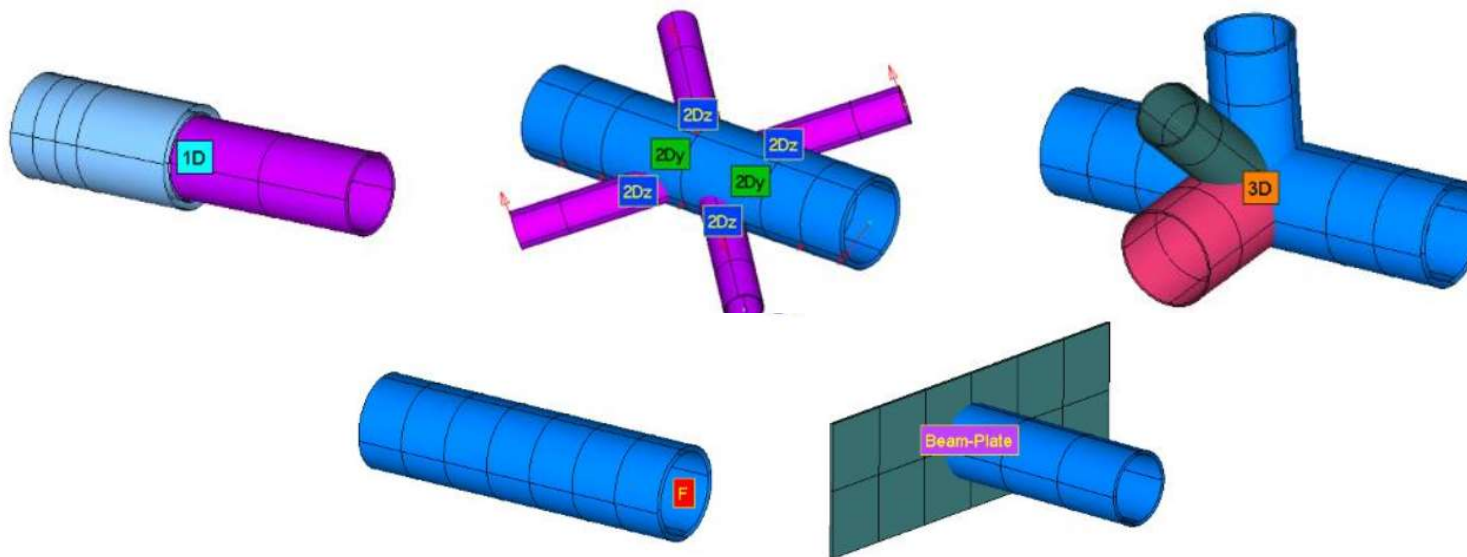
1D Joint - 2 beam members that lie on the curve but with different properties;

2D Joint - beam members connected in one plane;

3D Joint - beam members connected in space;

Free Joint - node which belongs only to one element (free);

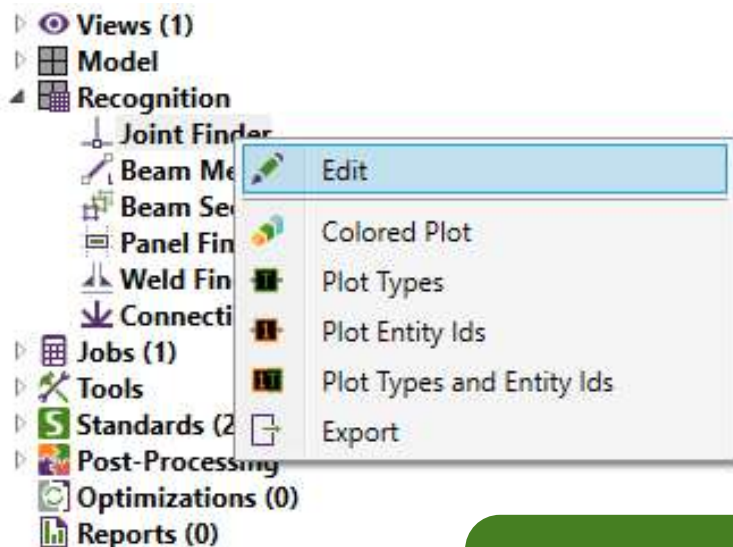
Beam-Plate Joint - beam member connected to plates (perpendicularly); User Defined;



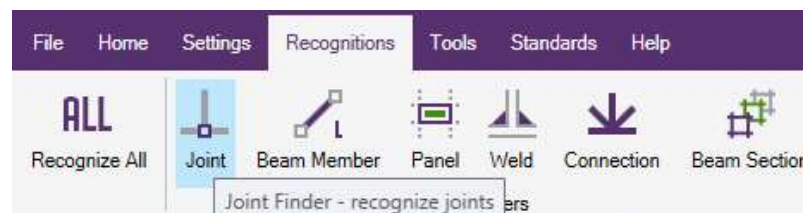
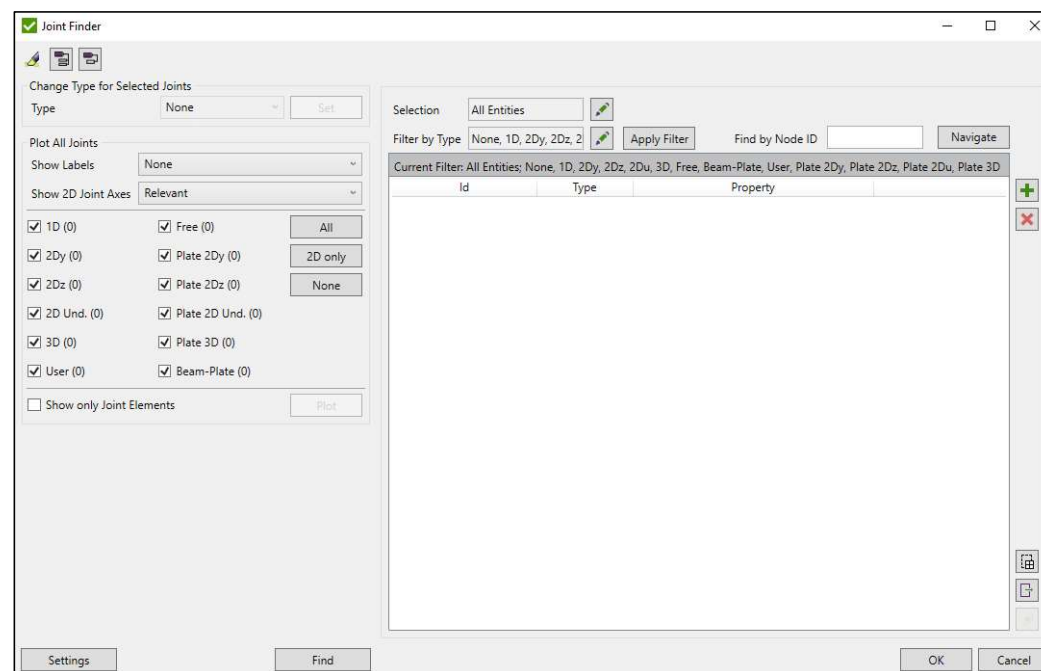
# Joint Recognition

1 Execute **Edit** from **Joint Finder** context menu

2 Press **Find**.



It is possible go to **Recognitions** on Ribbon tab and press **Joint**:



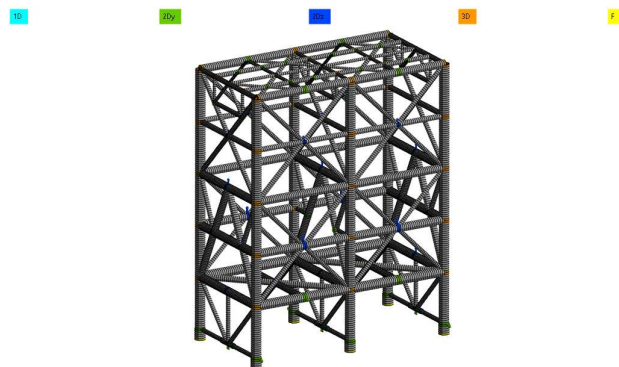


# Joints Plot

1 Select All Joints (Ctrl+A).

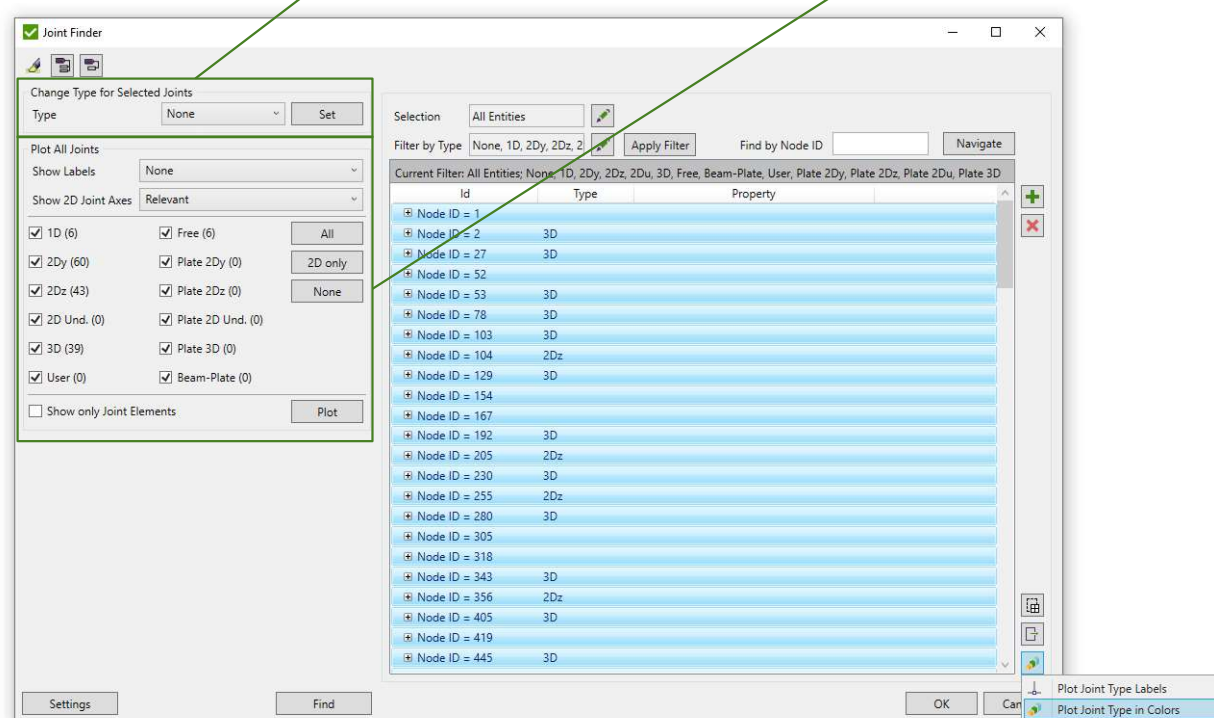
2 Press  and execute  Plot Joint Type in Colors

3 Press **OK**.



Modify Joint Type

Plot Joints of specific type



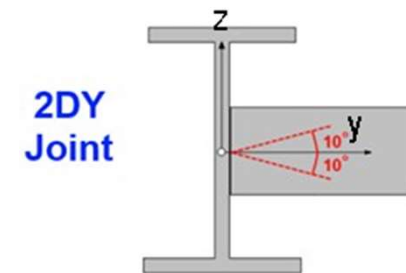
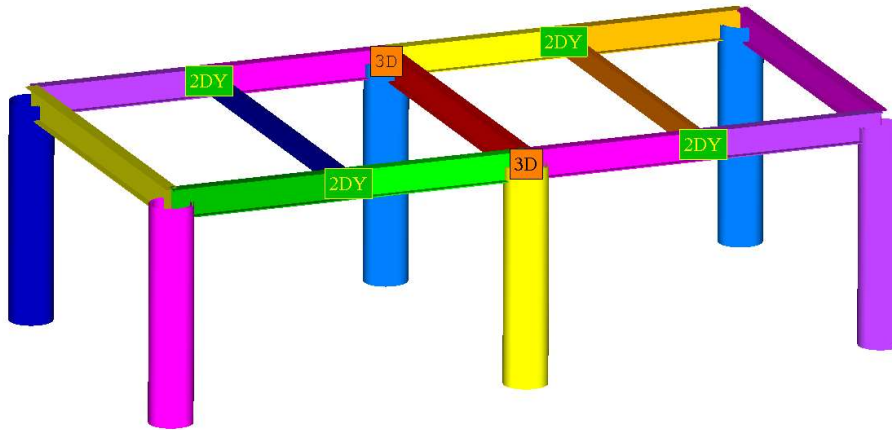
3

2

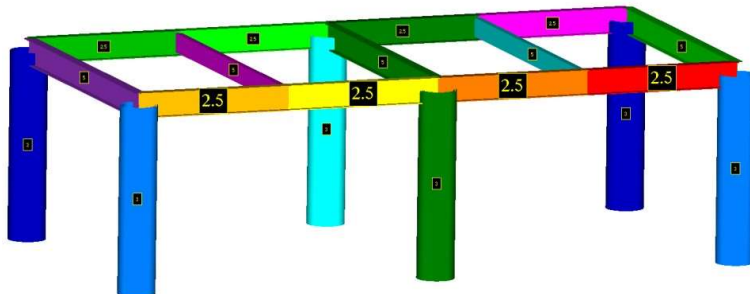


# Beam Member Lengths in 2 directions

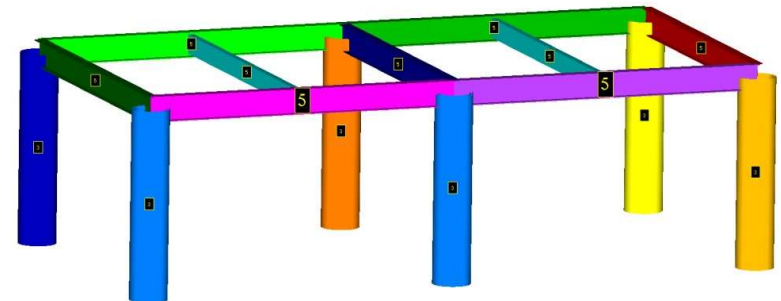
Beam Member Finder recognizes beam members and (buckling) lengths for different directions (Y, Z and Torsional).



Length Y - 4 Beam Members with  $L = 2.5$



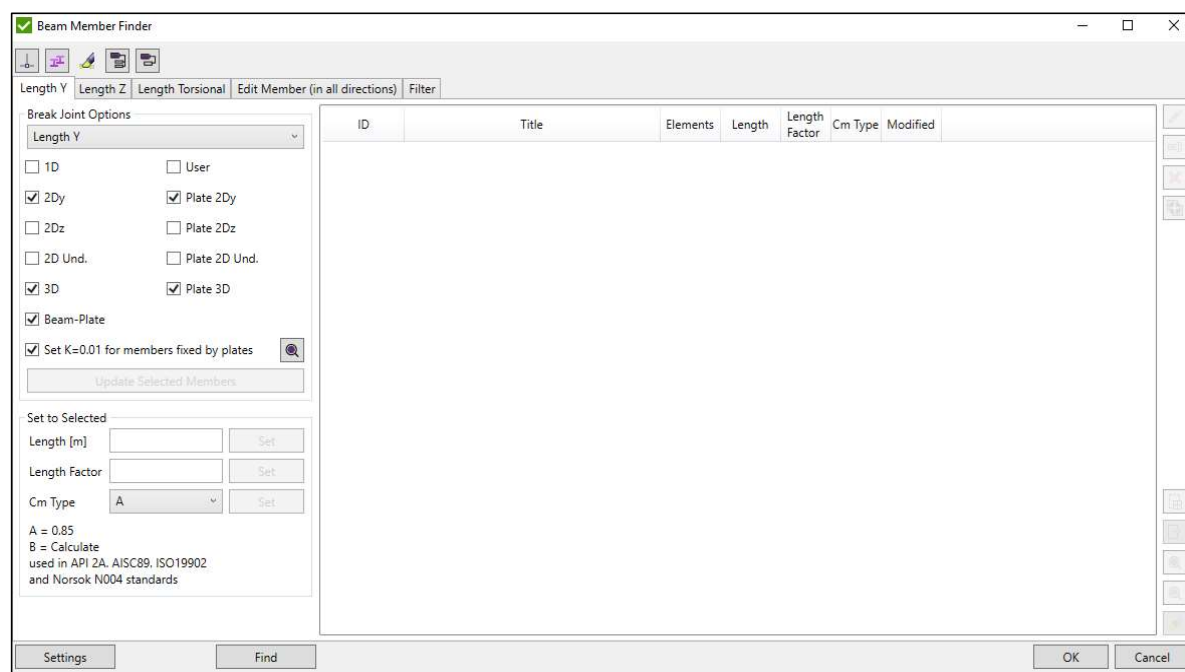
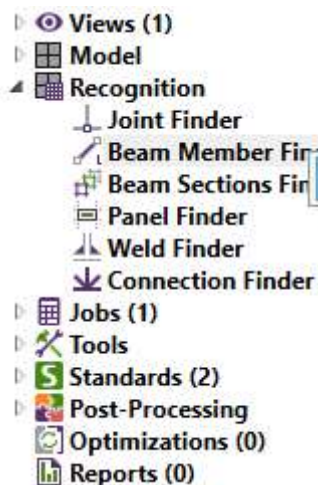
Length Z - 2 Beam Members with  $L = 5$



# Recognize Length

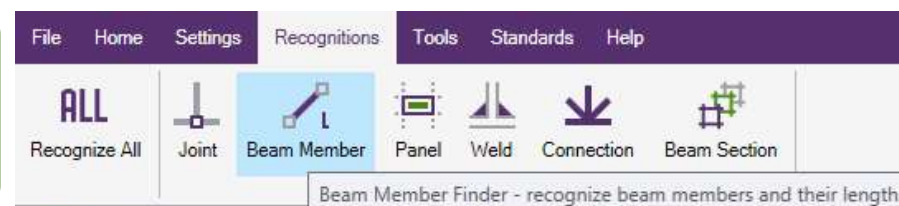
1 Execute **Edit** from **Beam Member Finder** context menu

2 Press **Find**.



Default **Break Joint Options** for Tabs:  
**Length Y:** 2DY, 3D, Plate 2DY, Plate 3D  
**Length Z:** 2DZ, 3D, Plate 2DZ, Plate 3D  
**Length Torsional:** 2DY, 2DZ, 2D Und, 3D

It is possible to open it another way - go to **Recognitions** tab in Ribbon and press **Beam Member**:



# Beam Member Finder interface

Beam Member - a straight line.  
If it contains joints it is split on  
sub members.

Break Options define what  
joints are used to split beam  
members

Change Length/Factor for  
selected beam members

Cm Type is used in API 2A, ISO  
19902 and Norsok N004  
standards

Press Settings to define  
recognition options: selection,  
default title

Press Find to automatically recognize  
Beam Members and Sub Members for all  
3 directions (Y, Z and torsional)

Colored Plot of members with  
labels (ID, Length, Factor or Cm  
Type).

The screenshot shows the 'Beam Member Finder' window. It has a toolbar at the top with icons for selection, deletion, and plotting. Below the toolbar are tabs for 'Length Y', 'Length Z', 'Length Torsional', 'Edit Member (in all directions)', and 'Filter'. The 'Length Y' tab is active. On the left, there are 'Break Joint Options' for Length Y, including checkboxes for 1D, 2Dy, 2Dz, 2D Und., 3D, Beam-Plate, and Set K=0.01 for members fixed by plates. There are also checkboxes for User, Plate 2Dy, Plate 2Dz, Plate 2D Und., and Plate 3D. Below these are input fields for 'Length [m]' and 'Length Factor', and a dropdown for 'Cm Type' (set to 'A'). A 'Set' button is next to each input field. At the bottom left, there is a 'Settings' button. In the center is a table with columns: ID, Title, Elements, Length, Length Factor, Cm Type, Modified, and Joint - NodeID [Joint Type]. The table lists 22 beam members. At the bottom right, there is a 'Find' button and an 'OK' button. A context menu is open over the table, showing options like 'Plot selected members', 'Plot Length Criteria', 'Plot Members ID Labels', etc.

ID	Title	Elements	Length	Length Factor	Cm Type	Modified	Joint - NodeID [Joint Type]
1	Beam Member 1 (Y)	50	5	1	A		1[2Dz]
2	Beam Member 2 (Y)	50	5	1	A		52[2Dz]
3	Beam Member 3 (Y)	100	10				458[2Dy] 405[3D] 507[2Dy]
4	Beam Member 4 (Y)	100	10				556[2Dy] 445[3D] 605[2Dy]
5	Beam Member 5 (Y)	100	10				103[3D] 356[2Dz] 104[2Dz]
6	Beam Member 6 (Y)	51	5	1	A		154[2Dz] 167[2Dz]
7	Beam Member 7 (Y)	100	10				205[2Dz] 230[3D] 255[2Dz]
8	Beam Member 8 (Y)	51	5	1	A		305[2Dz] 318[2Dz]
9	Beam Member 9 (Y)	28	2.795	1	A		
10	Beam Member 10 (Y)	56	5.59				318[2Dy]
11	Beam Member 11 (Y)	56	5.59				305[2Dy]
12	Beam Member 12 (Y)	50	5	1	A		3368[2Dz]
13	Beam Member 13 (Y)	103	10				1176[3D]
14	Beam Member 14 (Y)	50	5	1	A		3518[2Dz]
15	Beam Member 15 (Y)	103	10				
16	Beam Member 16 (Y)	50	5	1	A		
17	Beam Member 17 (Y)	28	2.795	1	A		
18	Beam Member 18 (Y)	56	5.59				
19	Beam Member 19 (Y)	56	5.59				
20	Beam Member 20 (Y)	13	1.25	1	A		
21	Beam Member 21 (Y)	28	2.795	1	A		
22	Beam Member 22 (Y)	56	5.59				

# Beam Member Finder interface

Break Joint Options define which types of joints will be used to split Beam Member on sub members. There are 3 predefined Break Joint Options (Length Y, Length Z, and Torsional) and custom.

Sub members from table on a plot:

**Beam Member Finder**

Length Y Length Z Length Torsional Edit Member (in all directions) Filter

Break Joint Options

Length Y

☐ 1D ☐ User

☒ 2Dy ☒ Plate 2Dy

☐ 2Dz ☐ Plate 2Dz

☐ 2D Und. ☐ Plate 2D Und.

☒ 3D ☒ Plate 3D

☒ Beam-Plate

☒ Set K=0.01 for members fixed by plates

Update Selected Members

Set to Selected

Length [m]  Set

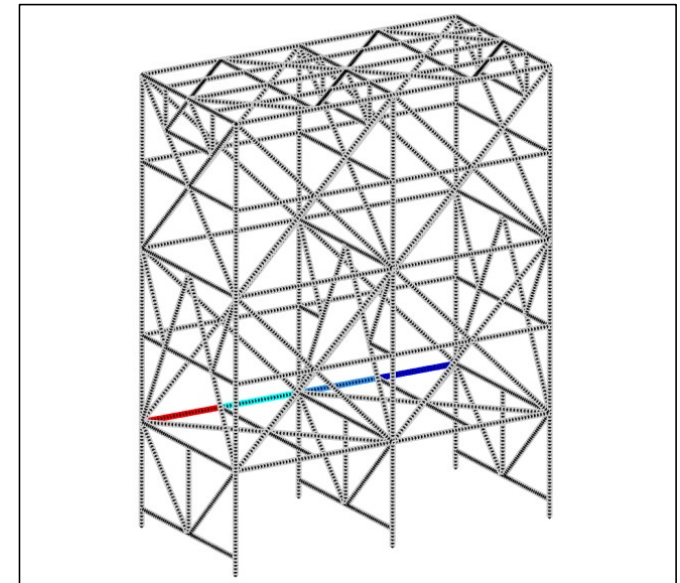
Length Factor  Set

Cm Type  A Set

A = 0.85  
B = Calculate  
used in API 2A, AISI89, ISO19902  
and Norsok N004 standards

ID	Title	Elements	Length	Length Factor	Cm Type	Modified	Joint - ModelID [Joint Type]
1	Beam Member 1 (Y)	50	5	1	A		1[2Dz]
2	Beam Member 2 (Y)	50	5	1	A		52[2Dz]
3	Beam Member 3 (Y)	100	10				458[2Dy] 405[3D] 507[2Dy]
3.1	Beam Member 3.1 (Y)	25	2.5	1	A		
3.2	Beam Member 3.2 (Y)	25	2.5	1	A		
3.3	Beam Member 3.3 (Y)	25	2.5	1	A		
3.4	Beam Member 3.4 (Y)	25	2.5	1	A		
4	Beam Member 4 (Y)	100	10				556[2Dy] 445[3D] 605[2Dy]
5	Beam Member 5 (Y)	100	10				103[3D] 356[2Dz] 104[2Dz]
6	Beam Member 6 (Y)	51	5	1	A		154[2Dz] 167[2Dz]
7	Beam Member 7 (Y)	100	10				205[2Dz] 230[3D] 255[2Dz]
8	Beam Member 8 (Y)	51	5	1	A		305[2Dz] 318[2Dz]
9	Beam Member 9 (Y)	28	2.795	1	A		
10	Beam Member 10 (Y)	56	5.59				318[2Dy]
11	Beam Member 11 (Y)	56	5.59				305[2Dy]
12	Beam Member 12 (Y)	50	5	1	A		3368[2Dz]
13	Beam Member 13 (Y)	103	10				1176[3D]
14	Beam Member 14 (Y)	50	5	1	A		3518[2Dz]
15	Beam Member 15 (Y)	103	10				804[3D]
16	Beam Member 16 (Y)	50	5	1	A		3668[2Dz]
17	Beam Member 17 (Y)	28	2.795	1	A		
18	Beam Member 18 (Y)	56	5.59				3825[2Dy]

Settings Find OK Cancel






# Beam Member's Length Plot

1

Select all Beam Members (Ctrl+A)

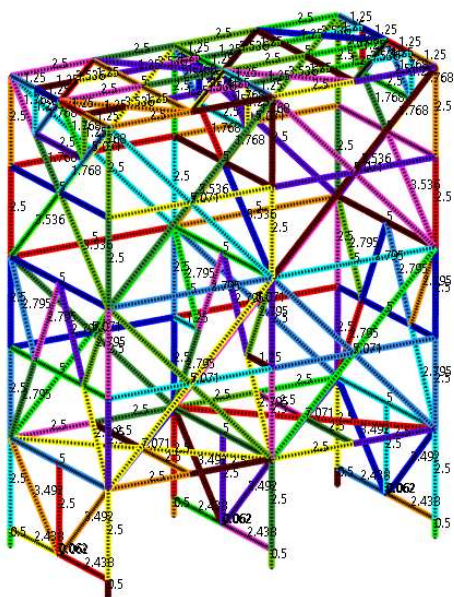
2

Press  and execute

to display **Length Plot**  Plot Length labels

3

Press **OK**.



Beam Member Finder

Length Y Length Z Length Torsional Edit Member (in all directions) Filter

Break Joint Options

Length Y

☐ 1D ☐ User

☒ 2Dy ☒ Plate 2Dy

☐ 2Dz ☐ Plate 2Dz

☐ 2D Und. ☐ Plate 2D Und.

☒ 3D ☒ Plate 3D

☒ Beam-Plate

☒ Set K=0.01 for members fixed by plates

Update Selected Members

Set to Selected

Length [m]  Set

Length Factor  Set

Cm Type  Set











A = 0.85  
B = Calculate  
used in API 2A, AISI89, ISO19902  
and Norsok N004 standards

ID	Title	Elements	Length	Length Factor	Cm Type	Modified	Joint - NodeID [Joint Type]
1	Beam Member 1 (Y)	50	5	1	A		1[2Dz]
2	Beam Member 2 (Y)	50	5	1	A		52[2Dz]
3	Beam Member 3 (Y)	100	10				458[2Dy] 405[3D] 507[2Dy]
3.1	Beam Member 3.1 (Y)	25	2.5	1	A		
3.2	Beam Member 3.2 (Y)	25	2.5	1	A		
3.3	Beam Member 3.3 (Y)	25	2.5	1	A		
3.4	Beam Member 3.4 (Y)	25	2.5	1	A		
4	Beam Member 4 (Y)	100	10				556[2Dy] 445[3D] 605[2Dy]
5	Beam Member 5 (Y)	100	10				103[3D] 356[2Dz] 104[2Dz]
6	Beam Member 6 (Y)	51	5	1	A		154[2Dz] 167[2Dz]
7	Beam Member 7 (Y)	100	10				205[2Dz] 230[3D] 255[2Dz]
8	Beam Member 8 (Y)	51	5	1	A		305[2Dz] 318[2Dz]
9	Beam Member 9 (Y)	28	2.795	1	A		
10	Beam Member 10 (Y)	56	5.59				318[2Dy]
11	Beam Member 11 (Y)	56	5.59				
12	Beam Member 12 (Y)	50	5	1	A		
13	Beam Member 13 (Y)	103	10				
14	Beam Member 14 (Y)	50	5	1	A		
15	Beam Member 15 (Y)	103	10				
16	Beam Member 16 (Y)	50	5	1	A		
17	Beam Member 17 (Y)	28	2.795	1	A		
18	Beam Member 18 (Y)	56	5.59				

Settings Find

OK

2

-  Plot selected members
-  Plot Length Criteria
-  Plot Members ID Labels
-  Plot Full Members ID Labels
-  Plot Length Labels
-  Plot Cm Type Labels
-  Plot Length Factor Labels
-  Plot Joints for Selected Members
-  Plot Members Y and Z axes
-  Plot Length Labels in Y and Z axes

3

2

**Recommended Practice for  
Planning, Designing and Constructing  
Fixed Offshore Platforms — Load and  
Resistance Factor Design**

API RECOMMENDED PRACTICE 2A-LRFD (RP 2A-LRFD)  
FIRST EDITION, JULY 1, 1993

American Petroleum Institute  
1220 L Street, Northwest  
Washington, DC 20005



This "Recommended Practice for Planning, Designing, and Constructing Fixed Offshore Platforms Load - and Resistance Factor Design" (LRFD) contains the design and engineering design principles and good practices that have been the basis of the API RP2A working strength design (WSD) recommended practice, now in its 20th Edition. The LRFD provisions have been developed from the WSD provisions using reliability based calibration.

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than replace individual engineering judgment.

OFFICIAL PUBLICATION



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# Cm - reduction factors

$$\frac{f_c}{\phi_c F_{cn}} + \frac{1}{\phi_b F_{bn}} \left\{ \left[ \frac{C_{my} f_{by}}{\left(1 - \frac{f_c}{\phi_c F_{ey}}\right)} \right]^2 + \left[ \frac{C_{mz} f_{bz}}{\left(1 - \frac{f_c}{\phi_c F_{ez}}\right)} \right]^2 \right\}^{0.5} \leq 1.0$$

..... (D.3.2-1)

**TABLE D.3-1**  
**EFFECTIVE LENGTH AND BENDING**  
**REDUCTION FACTORS FOR**  
**MEMBER STRENGTH CHECKING**

Situation	Effective Length Factor K	Reduction Factor $C_m^{(1)}$
<b>Superstructure Legs</b>		
Braced	1.0	(a)
Portal (unbraced)	$K^{(2)}$	(a)
<b>Jacket Legs &amp; Piling</b>		
Grouted Composite Section	1.0	(c)
Ungouted Jacket Legs	1.0	(c)
Ungouted Piling Between Shim Points	1.0	(b)
<b>Jacket Braces</b>		
Face-to-face Length of Main Diagonals	0.8	(b) or (c)
Face of Leg to Centerline of Joint Length of K-Braces <sup>(3)</sup>	0.8	(c)
Longer Segment Length of X-Braces <sup>(3)</sup>	0.9	(c)
Secondary Horizontals	0.7	(c)
Deck Truss Chord members	1.0	(a),(b) or (c)
<b>Deck Truss Web Members</b>		
In-Plane Action	0.8	(b)
Out-of-Plane Action	1.0	(a) or (b)

$C_{my}$  and  $C_{mz}$  reduction factors are used in combined axial and bending check. API RP 2A description:

By default  $C_m$  Type is equal to A = 0.85 for all members. It is possible to modify  $C_m$  Type for selected members:

In SDC Verifier B = minimum from (b) and (c)

- $C_{my}$  and  $C_{mz}$  factors for ISO 19902 can be found in the Table 13.5-1 and are used in the formula 13.3-3.
- $C_{my}$  and  $C_{mz}$  factors for Norsok N004 Rev3 can be found in the Table 6-2 and are used in the formula 6.27

## Notes to Table D.3-1:

(1) Use whichever is more applicable to a specific situation. Values of the reduction factor  $C_m$  referred to in the above table are as follows:

(a) 0.85

(b)  $0.6 - 0.4 \left( \frac{M_1}{M_2} \right)$ , no more than 0.85, or less than 0.40, where  $M_1/M_2$  is the ratio of smaller to larger moments at the ends of that portion of the member unbraced in the plane of bending under consideration.  $M_1/M_2$  is positive when the number is bent in reverse curvature, negative when bent in single curvature.

(c)  $1.0 - 0.4 \left( \frac{f_c}{\phi_c F_e} \right)$ , or 0.85, whichever is less

Cm Type

A

Set

A = 0.85

B = Calculate

used in API 2A, AISC89, ISO19902 and Norsok N004 standards

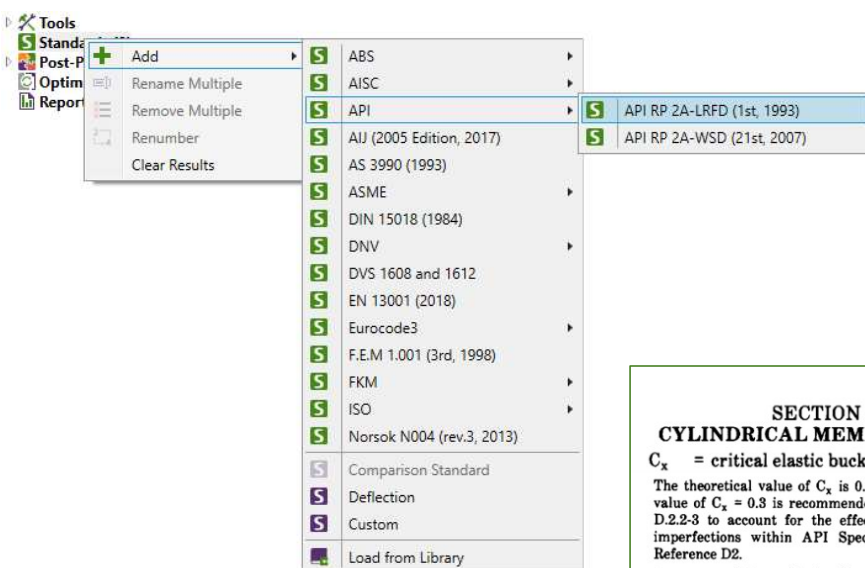


# Add API RP 2A-LRFD standard

1

Execute **Standards** => **Add** => **API RP 2A-LRFD (1st, Jul 1993)**.

API 2A RP standard covers the design checks only cylindrical types of shapes.



## SECTION D CYLINDRICAL MEMBER DESIGN

$C_x$  = critical elastic buckling coefficient

The theoretical value of  $C_x$  is 0.6. However, a reduced value of  $C_x = 0.3$  is recommended for use in Equation D.2.2-3 to account for the effect of initial geometric imperfections within API Spec 2B tolerance limits, Reference D2.

$\phi_t$  = resistance factor for axial tensile strength, 0.95

$\phi_c$  = resistance factor for axial compressive strength, 0.85

$\phi_b$  = resistance factor for bending strength, 0.95.

$\phi_v$  = resistance factor for beam shear strength, 0.95

API RP 2A-LRFD (1st, 1993)

ID: 1 Title: API RP 2A-LRFD (1st, 1993)

Alias: Standard1

Description:

Safety Factors:

Critical Elastic Buckling Coefficient ( $C_x$ ): 0.3

Resistance Factor for Tension ( $F_t$ ): 0.95

Resistance Factor For Compression ( $F_c$ ): 0.85

Resistance Factor For Bending ( $F_b$ ): 0.95

Resistance Factor For Shear ( $F_v$ ): 0.95

Selection:

+ Shape '2..Circular Tube'


Elements: 6404

☐ Use AISC 360-10 for non-tubular shapes

Materials with Yield = 0

OK Cancel

# Define Material Characteristics

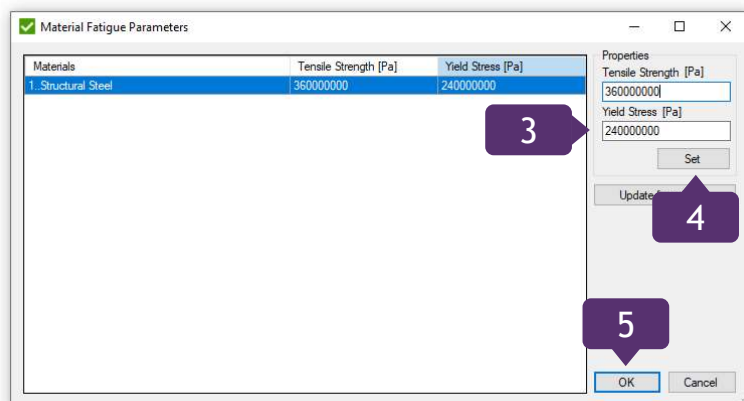
1 Press  to set the material yield stress and tensile strength

2 Tensile Strength: **360e+6**

3 Yield Stress: **240e+6**

4 Press **Set**

5 Press **OK**



Material Fatigue Parameters

Materials	Tensile Strength [Pa]	Yield Stress [Pa]
1. Structural Steel	360000000	240000000

Properties

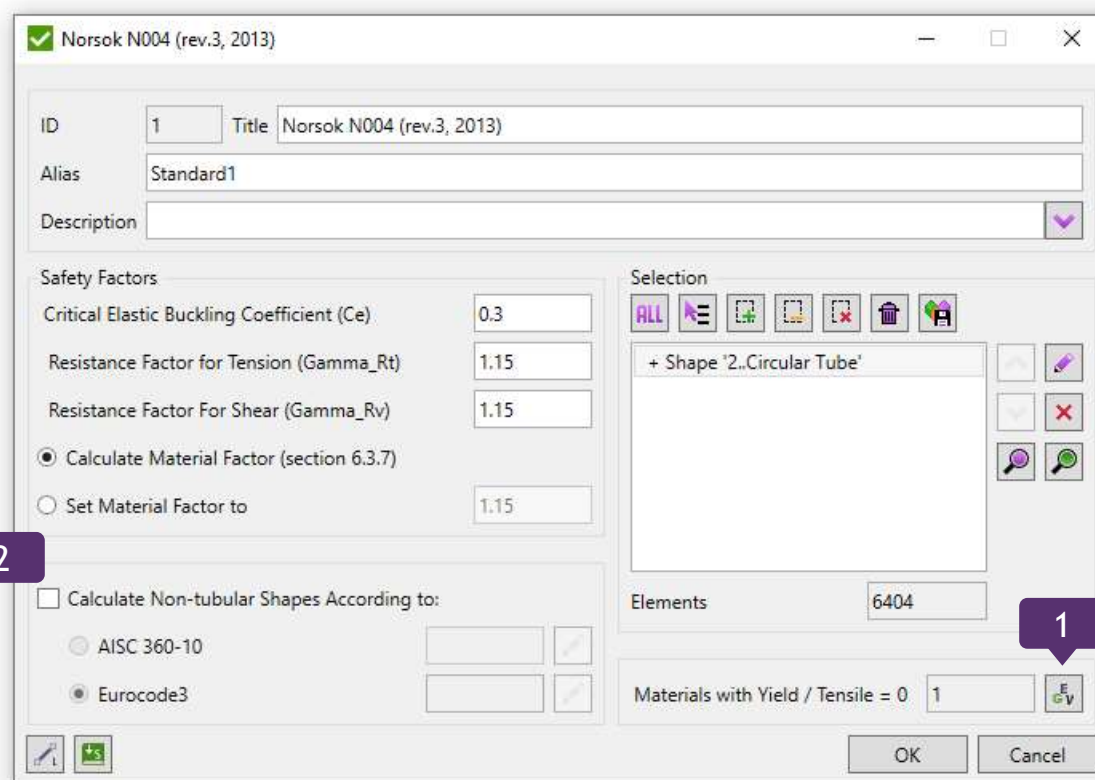
Tensile Strength [Pa]

Yield Stress [Pa]

**3** **Set**

**4** **Update**

**5** **OK** **Cancel**



Norsok N004 (rev.3, 2013)

ID  Title

Alias

Description

Safety Factors

Critical Elastic Buckling Coefficient (Ce)

Resistance Factor for Tension (Gamma\_Rt)

Resistance Factor For Shear (Gamma\_Rv)

☒ Calculate Material Factor (section 6.3.7)


☐ Set Material Factor to

☐ Calculate Non-tubular Shapes According to:

☐ AISC 360-10


☒ Eurocode3

Selection

**1** **ALL** 

+ Shape '2..Circular Tube'

Elements

Materials with Yield / Tensile = 0  

**2** **OK** **Cancel**

# Extreme table for bending check

1

Execute **Table** from **Bending Stress Check** context menu

2

Press  to select load

3

Load Type: Load Group

4

Load: 1..Load Group 1

5

Press **OK**

6

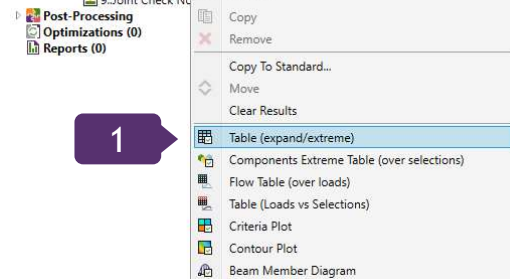
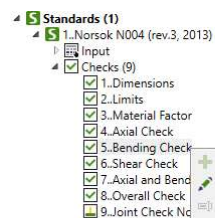
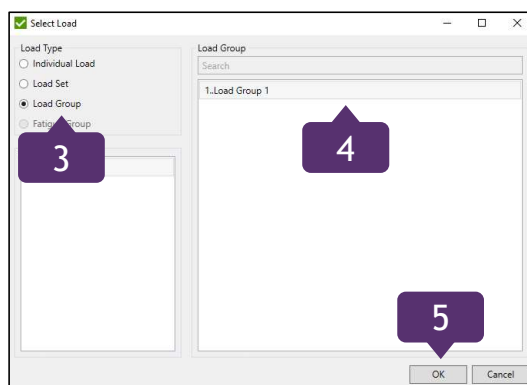
Extreme Options: **Detailed**

7

Press **Fill Table**

8

Press **OK**



Overall Check contains results from all checks. With the help of one table/plot it is possible to verify if the model passes the checks ( $< 1$ ). Overall Utilization Factor = worst Uf among all checks.


ID	Title	Extreme	Bending Moment [N]	Bending Strength [N]	Bending Moment Resistance [N]	Utilization Factor
1		Maximum	0.00	308388256.00	22125.36	0.00
	Element ID		2960	455	5211	2960
	Load		IL4	IL6	IL6	IL4
	Load Group		1..Load Group 1			
	Direction		All			
	Table Structure		Direction over Parameters			
	Expand/Extreme Options		Table Type			
			Extreme (worst result on selection)			
			Detailed (extreme locations - element and load for Load Groups)			
			Short (only extremes)			
			Filter by			
			Parameter			
			Value >			
			Sort by			
			Parameter			
			Order			
			Selection			
			+ Shape '2. Circular Tube'			
			Elements			
			6404			
			Set Default Title			
			Fill Table			

# Criteria Plot for Bending Stress Check

1

Execute **Criteria Plot** from **Bending Stress Check** context menu

2

Press  to select load

3

Load Type: Load Group

4

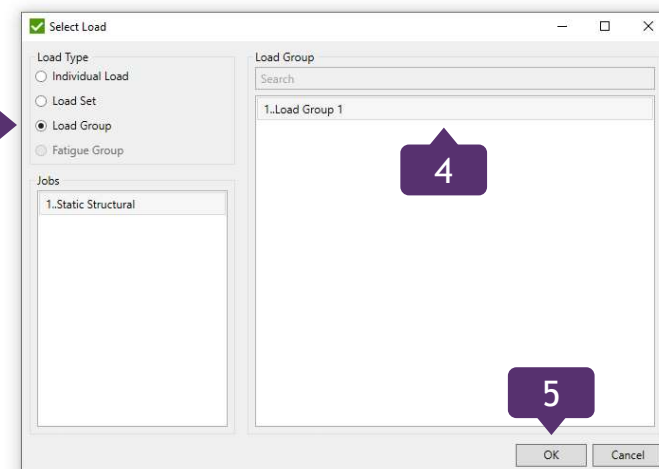
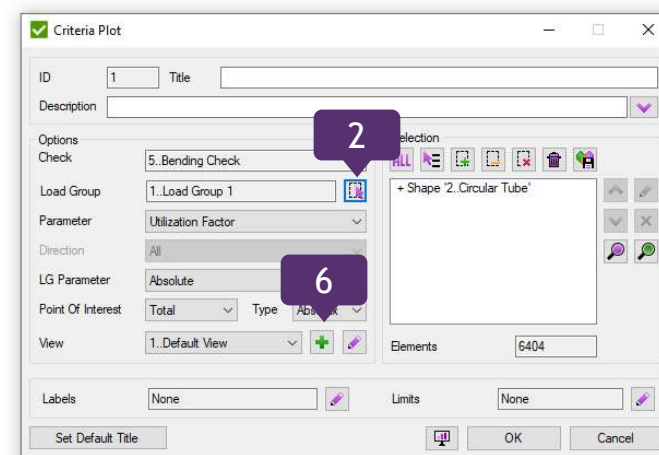
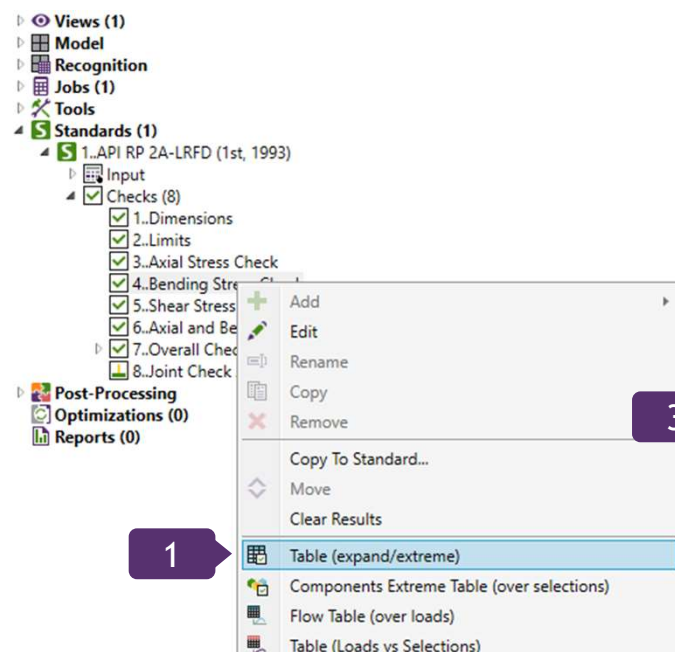
Load: 1..Load Group 1

5

Press **OK**

6

Press to add view 



# Plot. Create View

1

Title: *Isometric*

2

Orient model in Ansys Mechanical as shown on the picture

3

Press *Get*

4

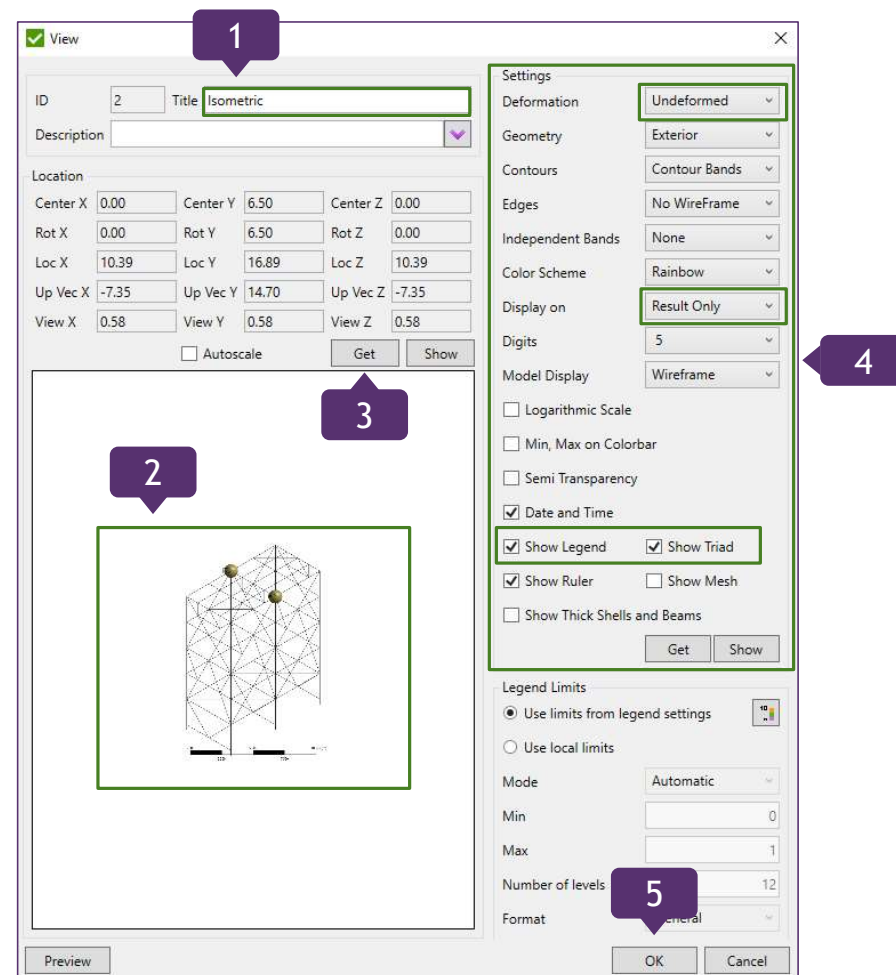
Set parameters from notice 4

5

Press *OK*


4

Deformation: **Undeformed**  
Display on: **Result Only** Show  
Legend: **On**  
Show Triad: **On**




# Criteria plot for overall check

1

Execute  from **Overall Check** context menu

2

Press  to select load

3

Load Type: Load Group

4

Load: 1..Load Group 1

5

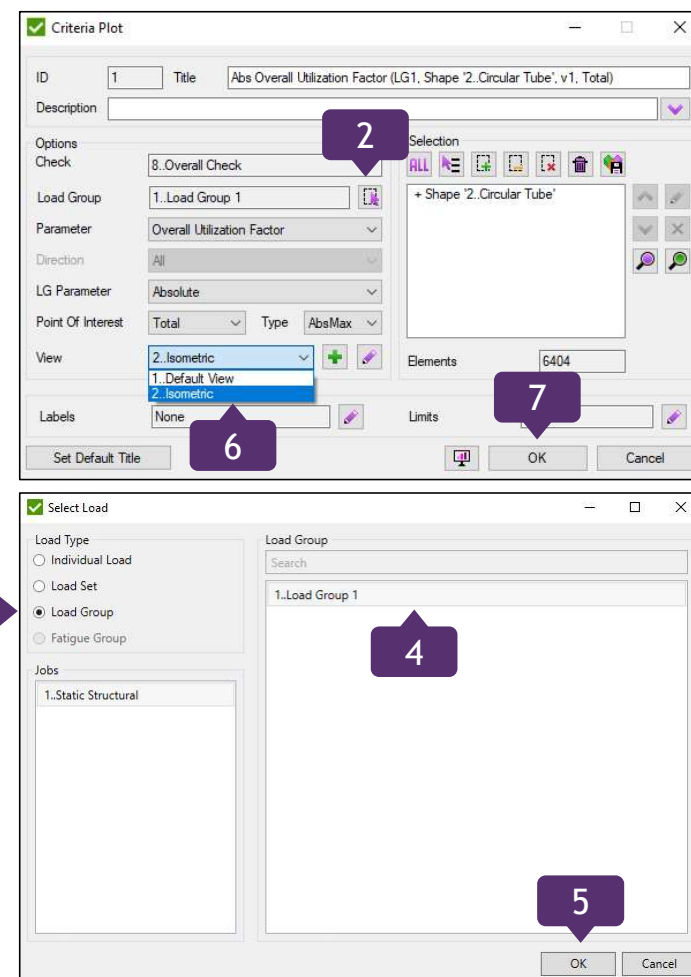
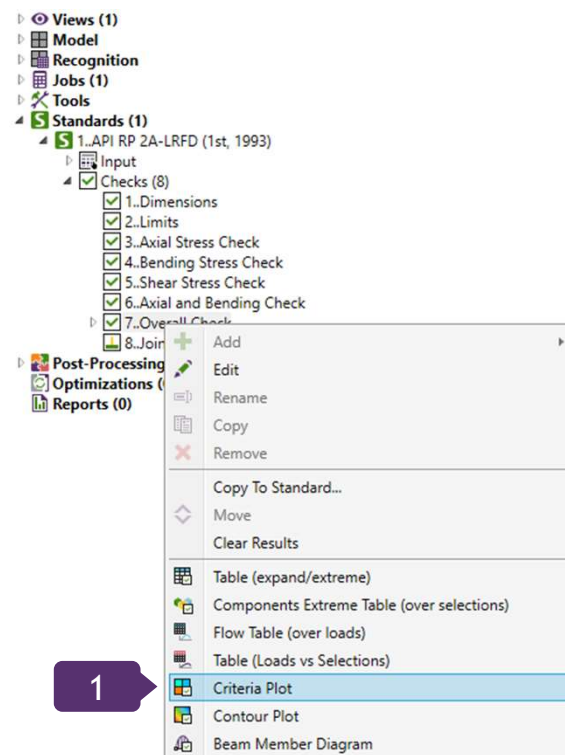
Press **OK**

6

Select **Isometric** view

7

Press **OK**

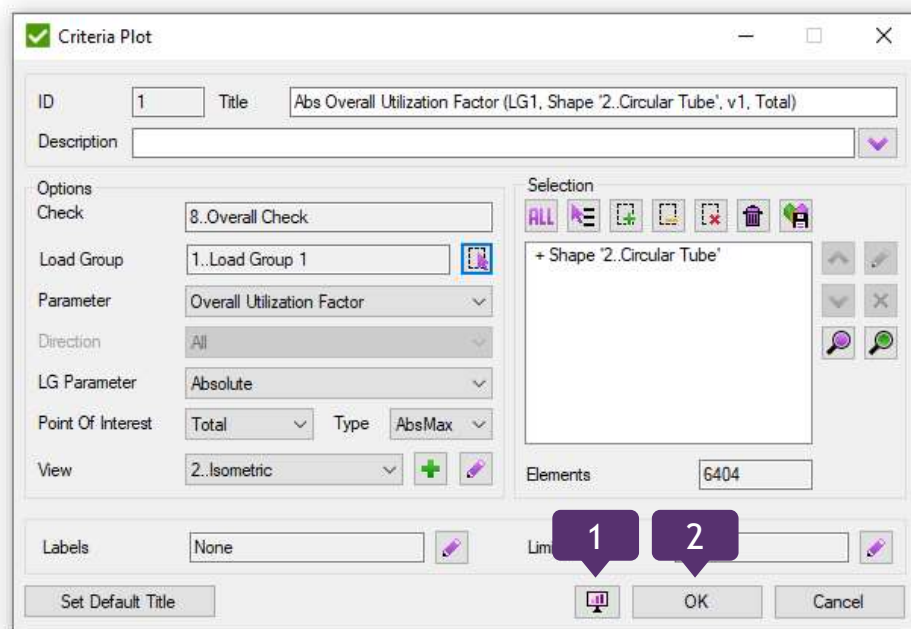




# Display Plot

1 Press  to display plot

2 Press **OK**



## A: All Loads

Abs Overall Utilization Factor (LG1, Shape '2..Circular Tube', v1, Total)

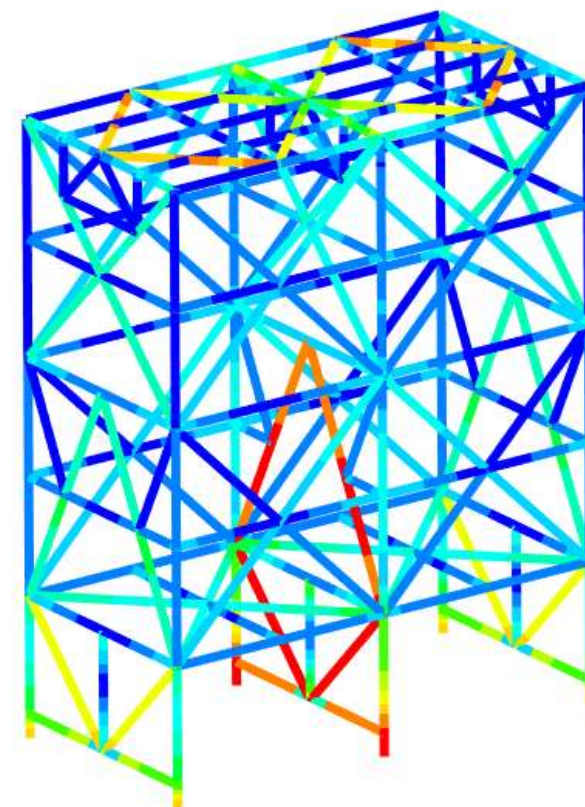
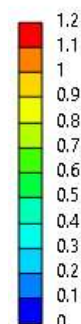
Expression: RES6 (Scoped to Elements)

Time: 6 s

Max: 1.8256

Min: 0.0056152

4/14/2023 11:27 AM





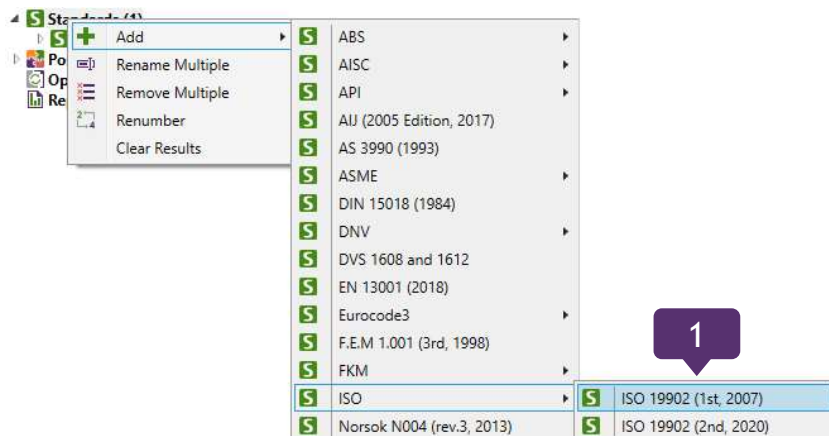
# Add ISO 19902 standard

1

Execute **Standards => Add => ISO 19902 (1st, Dec 2007)**

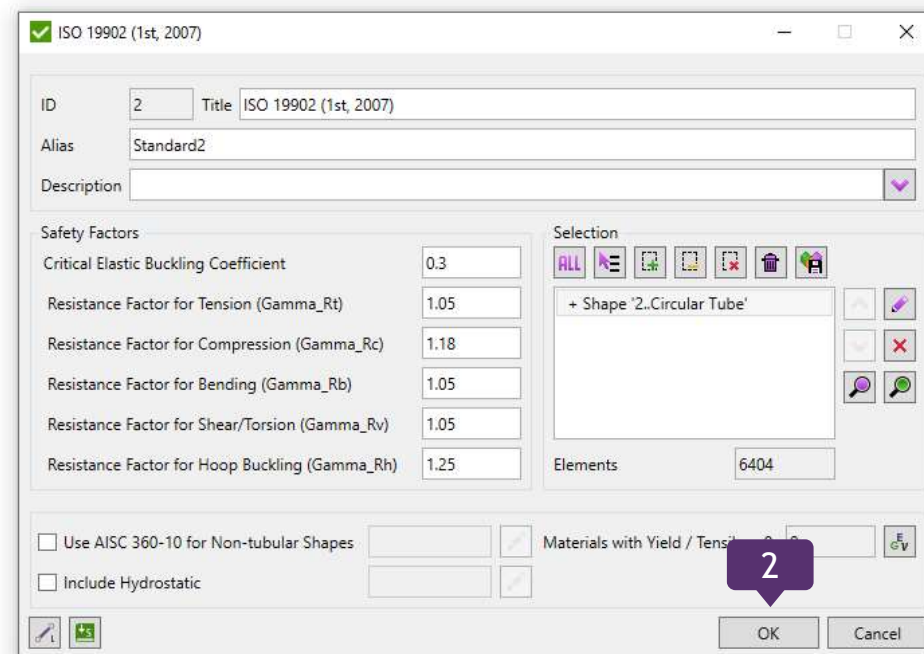
2

Press **OK**



1

ISO 19902 procedure is similar to API 2A RP. In overall check it is possible to verify if the structure passes all checks : Overall Utilization Factor = worst  $U_f$  among all checks  $< 1$ . Add extreme table and criteria plot for '1..Load Group 1' the same as for API standard.



2

$C_x$  is the elastic critical buckling coefficient, see below;

The theoretical value of  $C_x$  for an ideal tubular is 0.6. However, a reduced value of  $C_x = 0.3$  should be used in Equation (13.2-10) to account for the effect of initial geometric imperfections within the tolerance limits given in Clause 21. A reduced value of  $C_x = 0.3$  is implicit in the value of  $f_{xe}$  used in Equations (13.2-8) and (13.2-9).

$\gamma_{R,t}$  is the partial resistance factor for axial tensile strength,  $\gamma_{R,t} = 1.05$ .

$\gamma_{R,c}$  is the partial resistance factor for axial compressive strength,  $\gamma_{R,c} = 1.18$ .

$\gamma_{R,b}$  is the partial resistance factor for bending strength,  $\gamma_{R,b} = 1.05$ ;

$\gamma_{R,v}$  is the partial resistance factor for shear strength,  $\gamma_{R,v} = 1.05$ ;

$\gamma_{R,h}$  is the partial resistance factor for hoop buckling strength,  $\gamma_{R,h} = 1.25$ .

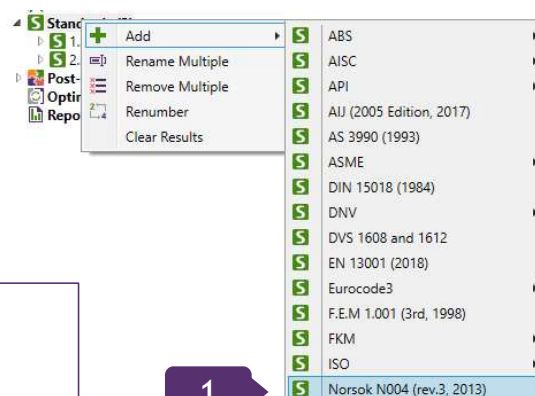
# Add Norsok N004 standard

1

Execute **Standards** => **Add** => **Norsok N004 (rev.3, Feb 2013)**.

2

Press **OK**



1

Norsok N004 procedure is similar to API 2A RP. In overall check it is possible to verify if the structure passes all checks : Overall Utilization Factor = worst Uf among all checks < 1.

$C_e$  = critical elastic buckling coefficient = 0.3  
 $\gamma_{R,t}$  = material factor for tension = 1.15  
 $\gamma_{R,v}$  = material factor for shear = 1.15  
 $\gamma_M$  = see section 6.3.7

$$\gamma_M = 1.15 \quad \text{for } \bar{\lambda}_s < 0.5 \quad (6.22)$$

$$\gamma_M = 0.85 + 0.60\bar{\lambda}_s \quad \text{for } 0.5 \leq \bar{\lambda}_s \leq 1.0$$

$$\gamma_M = 1.45 \quad \text{for } \bar{\lambda}_s > 1.0$$

where

$$\bar{\lambda}_s = \frac{|\sigma_{c,sd}|}{f_{cl}} \cdot \lambda_c + \left( \frac{\sigma_{p,sd}}{f_h} \right)^2 \cdot \lambda_h \quad (6.23)$$

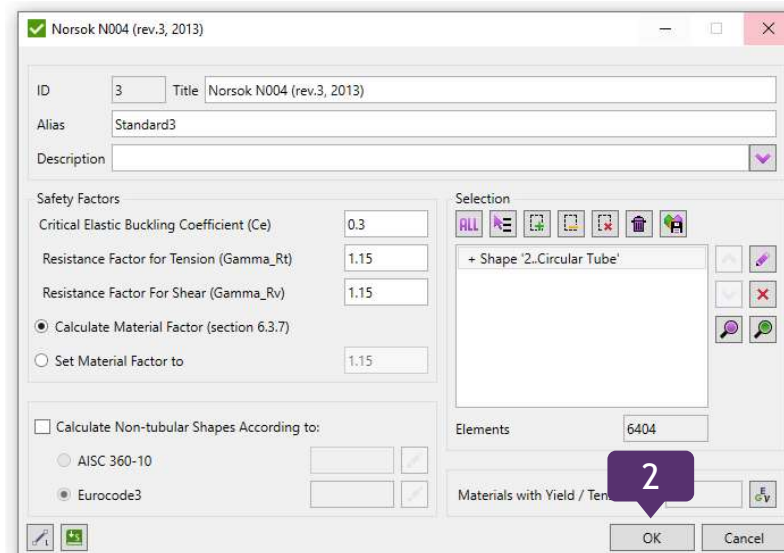
where  $f_{cl}$  is calculated from Equation (6.6) or Equation (6.7) whichever is appropriate and  $f_h$  from Equation (6.17), Equation (6.18), or Equation (6.19) whichever is appropriate.

$$\lambda_c = \sqrt{\frac{f_y}{f_{cle}}}, \quad \text{and} \quad \lambda_h = \sqrt{\frac{f_y}{f_{he}}} \quad (6.24)$$

$f_{cle}$  and  $f_{he}$  is obtained from Equation (6.8), and Equation (6.20) respectively.  
 $\sigma_{p,sd}$  is obtained from Equation (6.16) and

$$\sigma_{c,sd} = \frac{N_{sd}}{A} + \frac{\sqrt{M_{y,sd}^2 + M_{z,sd}^2}}{W} \quad (6.25)$$

$N_{sd}$  is negative if in tension.



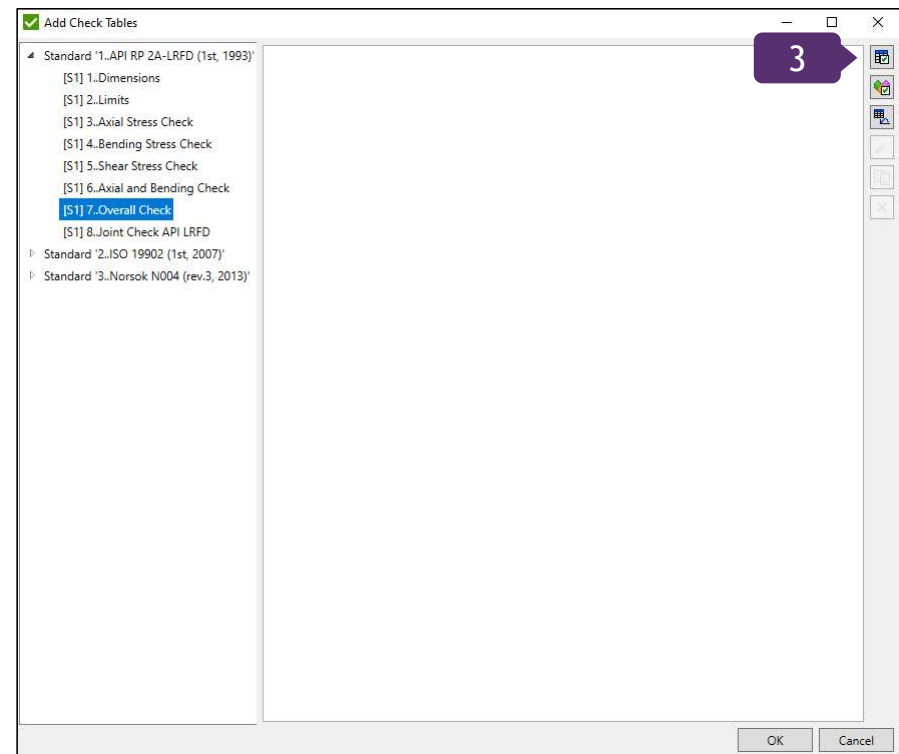
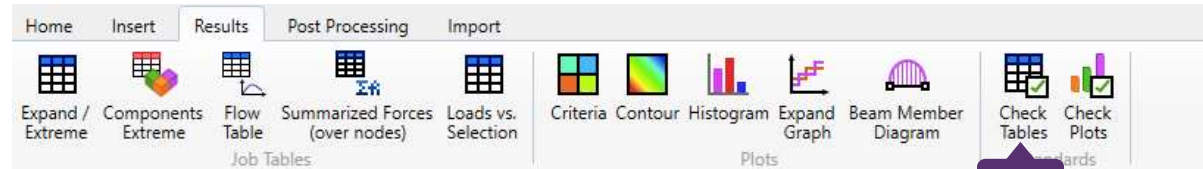
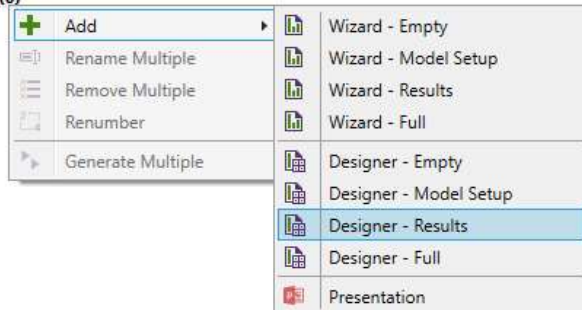
2

# Report - Tables

1 Execute **Reports** => **Add** => **Designer Results**

2 **Results** => **Check Tables**. Select **Overall Check** and press **Add Check Tables**

Post-Processing  
Optimizations (0)  
Reports (0)



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;
- *Full* - Model Setup + Results + all tables created in Job.

# Report - Tables

- 1 Select **Load Group 1**
- 2 Apply **All Entities**
- 3 Select **Detailed**
- 4 Press **Ok**
- 5 Repeat 1-4 step for Standard **ISO 19902** and **Norsok N004**

## ✓ Add Check Tables

- Standard '1..API RP 2A-LRFD (1st, 1993)'
- Standard '2..ISO 19902 (1st, 2007)'
- Standard '3..Norsok N004 (rev.3, 2013)'

The screenshot shows the 'Custom Check Table' dialog box. It has several sections: 'Loads' with a 'Count' dropdown set to 'LG1..Load Group 1' (callout 1); 'Options' with 'Table Type' set to 'Extreme (worst result on selection)' and 'Table Structure' set to 'Direction over Parameters'; 'Extreme Options' with 'Detailed (extreme locations - element and and load(for Load Groups))' selected (callout 3); 'Filter by' with 'Parameter' set to 'None' and 'Value >' set to '1'; 'Sort by' with 'Parameter' set to 'None' and 'Order' set to 'Descending'; and 'Directions' with 'All' selected. On the right, there is a 'Selections (1) (Elements)' section with a list box containing 'All Entities' (callout 2) and a toolbar with icons for adding, removing, and searching. At the bottom right, there are 'OK' and 'Cancel' buttons (callout 4).

# Report - Plots

1

Execute **Results** => **Check Plots**

2

Select Standard **API RP 2A-LRFD** and press **Add Criteria Plot**

3

Select **Load Group 1**

4

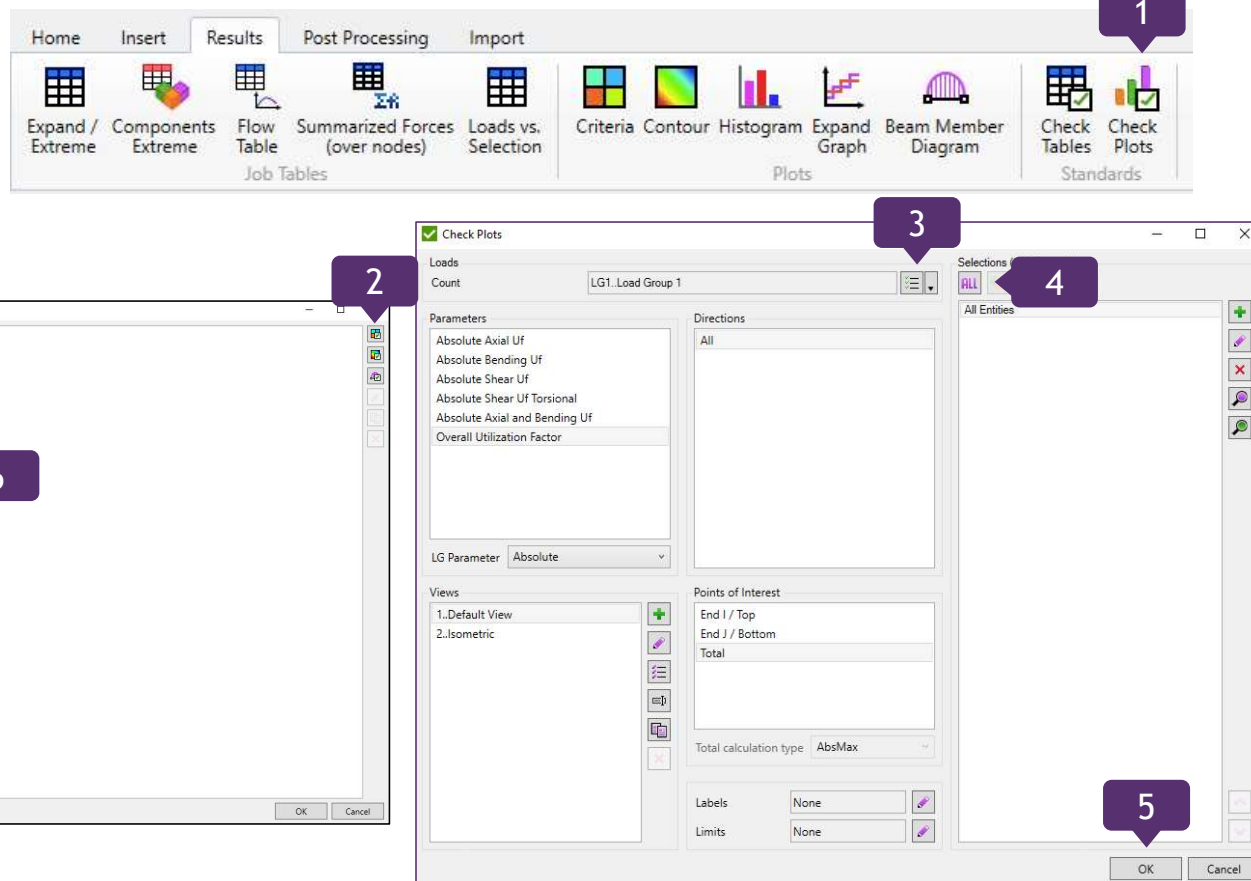
Select **All Entities**

5

Press **OK**

6

Repeat 1-5 step for Standards **ISO 19902** and **Norsok N004**



# Report - Plots

1

Select plot in **API RP 2A-LRFD** => **Abs UF Utilization Factor**

2

Select **Break Page Before** and press **No**

3

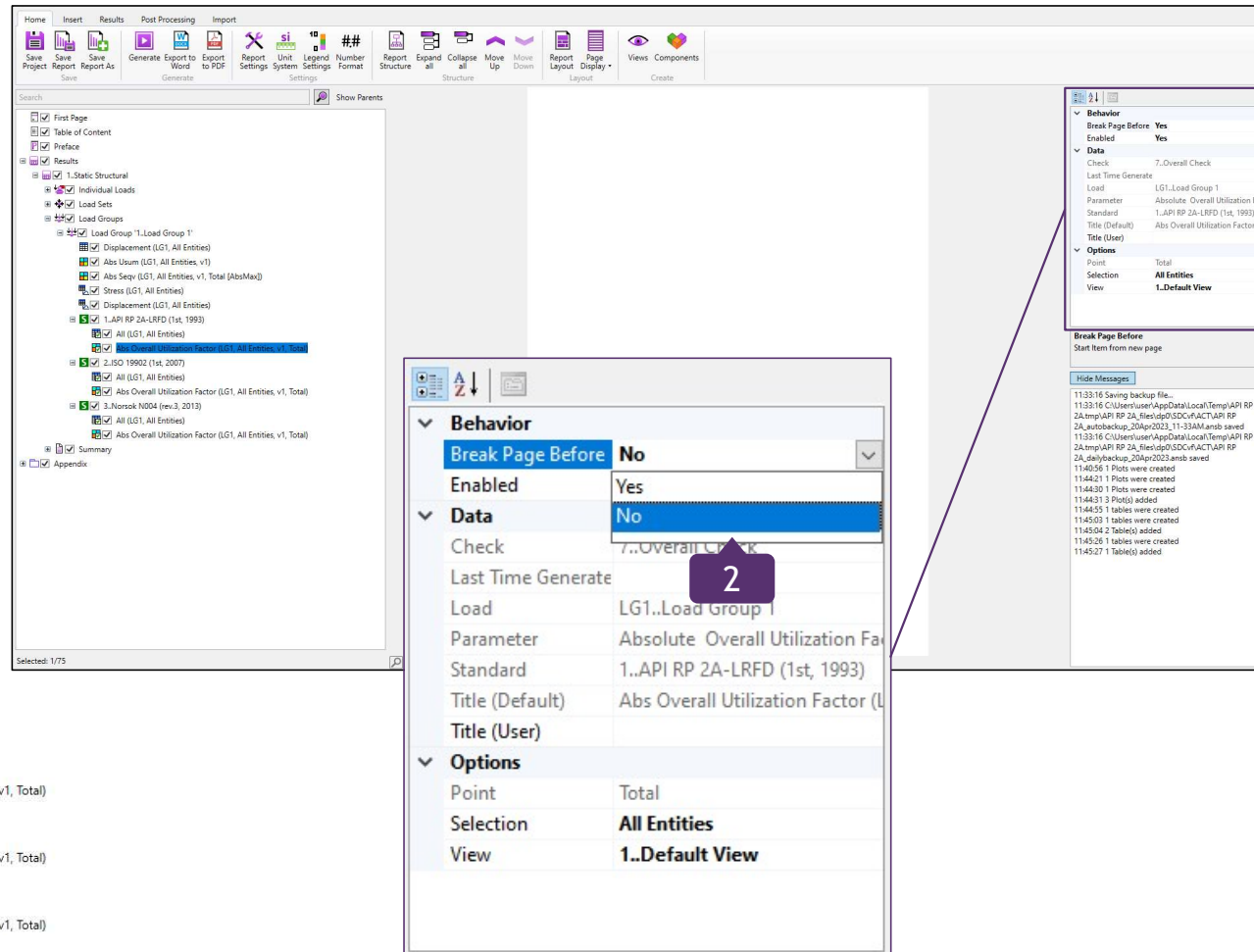
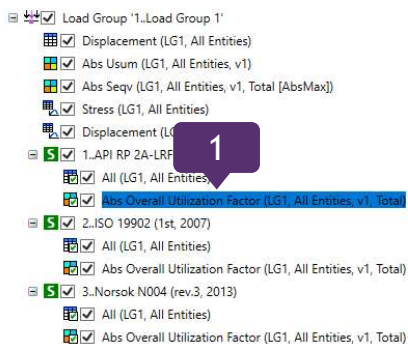
Select plot in **API RP 2A-LRFD** => **Abs UF Utilization Factor**

4

Select **Break Page Before** and press **No**


5

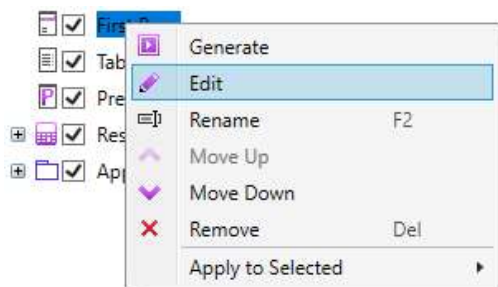
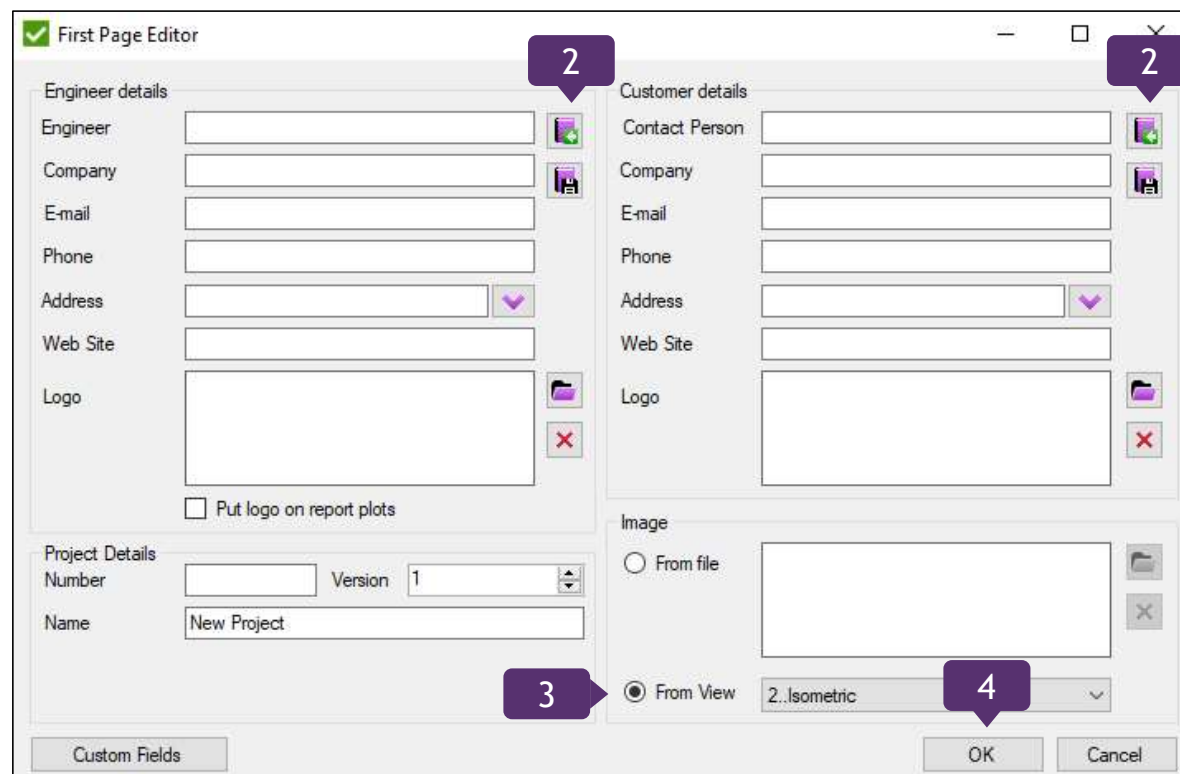
Repeat 1-4 step for Standards **ISO 19902** and **Norsok N004**





# Report. First Page

- 1 Right click on *First Page* => *Edit*
- 2 Press  to load engineer and customer info from library
- 3 Select Image From View and pick '*2..Isometric*'.
- 4 Press **OK**.

A screenshot of the 'First Page Editor' dialog box. The dialog is divided into several sections: Engineer details, Customer details, Project Details, and Image. Annotations are as follows:
 

- Annotation 1: Points to the 'Edit' option in the context menu.
- Annotation 2: Points to the library icon (a small green square with a white 'L') next to the Engineer and Customer details fields.
- Annotation 3: Points to the 'From View' radio button in the Image section.
- Annotation 4: Points to the dropdown menu showing '2..Isometric' in the Image section.

 The 'Project Details' section includes fields for Number, Version (set to 1), and Name (set to 'New Project'). The 'Image' section has a large empty box for the image and a 'Put logo on report plots' checkbox. At the bottom are 'Custom Fields', 'OK', and 'Cancel' buttons.

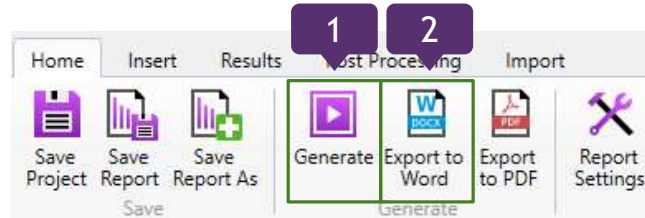


# Report exported to Microsoft Word



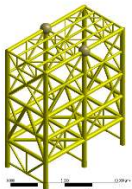
1 Press to generate complete report

2 Press to export to Word



## Report

New Project



Prepared by:

SDC Verifier

+31 15 30-10-310  
sdcsverifier.com

Zijlvest 25  
2011 VB Haarlem  
The Netherlands

Prepared for:

company

+31 15 355-55-55  
company.com

Zijlvest 25  
2011 VB Haarlem  
The Netherlands

Engineer:

Customer:

Project Number:

Version:

Date:

Support:

customer

1

14/04/2023

### 1..API RP 2A-LRFD (1st, 1993)

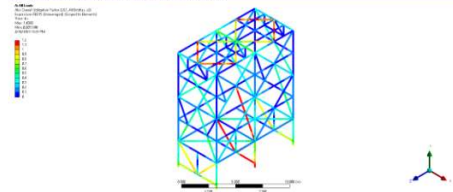
Unit System

Current Unit System = MKS (Meter/Kg/Second). It is used in calculations for the following standards: API RP 2A, ISO 19902, Norsok N004, DIN 15018, FEM 1.001 and Eurocode3.

All (LG1, All Entities)

Standard	1..API RP 2A-LRFD (1st, 1993)	Check Selection	[S1] 7..Overall Check
Load Group	LG1..Load Group 1		All Entities
Extreme	Absolute Axial UF	Absolute Bending UF	Absolute Shear UF
Value	0.00	0.00	0.00
Element ID	4821	2954	2779
Load	IL4	IL4	IL4
Maximum	Absolute Shear UF	Absolute Axial and Bending UF	Overall Utilization Factor
Value	1.24	1.00	1.00
Element ID	2661	6390	3405
Load	IL5	IL5	IL5
Absolute	Absolute	Absolute	Absolute
Value	1.24	1.00	1.00
Element ID	2661	6390	3405
Load	IL5	IL5	IL5

Abs Overall Utilization Factor (LG1, All Entities, v2)



Check Parameter	[S1] 7..Overall Check	Load Group Selection	LG1..Load Group 1
View	Absolute Overall Utilization Factor	Data Conversion	All Entities
	2..Isometric		No Averaging

### 2..ISO 19902 (1st, 2007)

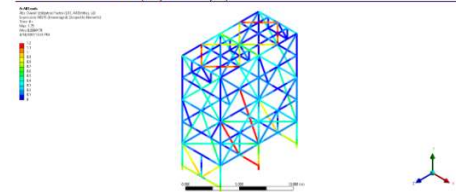
Unit System

Current Unit System = MKS (Meter/Kg/Second). It is used in calculations for the following standards: API RP 2A, ISO 19902, Norsok N004, DIN 15018, FEM 1.001 and Eurocode3.

All (LG1, All Entities)

Standard	2..ISO 19902 (1st, 2007)	Check Selection	[S2] 9..Overall Check
Load Group	LG1..Load Group 1		All Entities
Extreme	Axial Um	Bending Um	Shear Um
Value	0.00	0.00	0.00
Element ID	4821	2954	2779
Load	IL4	IL4	IL4
Maximum	Shear Torsional Um	Axial and Bending Um	Overall Utilization Factor
Value	1.24	0.99	1.04
Element ID	2661	6390	3405
Load	IL5	IL5	IL5
Absolute	Absolute	Absolute	Absolute
Value	1.24	0.99	1.04
Element ID	2661	6390	3405
Load	IL5	IL5	IL5

Abs Overall Utilization Factor (LG1, All Entities, v2)



Check Parameter	[S2] 9..Overall Check	Load Group Selection	LG1..Load Group 1
View	Absolute Overall Utilization Factor	Data Conversion	All Entities
	2..Isometric		No Averaging

### 3..Norsok N004 (rev.3, 2013)

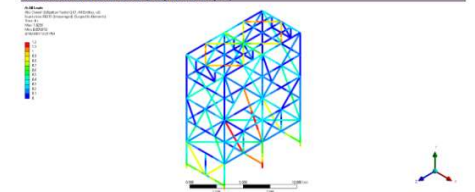
Unit System

Current Unit System = MKS (Meter/Kg/Second). It is used in calculations for the following standards: API RP 2A, ISO 19902, Norsok N004, DIN 15018, FEM 1.001 and Eurocode3.

All (LG1, All Entities)

Standard	3..Norsok N004 (rev.3, 2013)	Check Selection	[S3] 8..Overall Check
Load Group	LG1..Load Group 1		All Entities
Extreme	Absolute Axial UF	Absolute Bending UF	Absolute Shear UF
Value	0.00	0.00	0.00
Element ID	4821	2954	2779
Load	IL4	IL4	IL4
Maximum	Absolute Shear UF	Absolute Axial and Bending UF	Overall Utilization Factor
Value	1.24	1.00	1.00
Element ID	2661	6390	3405
Load	IL5	IL5	IL5
Absolute	Absolute	Absolute	Absolute
Value	1.24	1.00	1.00
Element ID	2661	6390	3405
Load	IL5	IL5	IL5

Abs Overall Utilization Factor (LG1, All Entities, v2)



Check Parameter	[S3] 8..Overall Check	Load Group Selection	LG1..Load Group 1
View	Absolute Overall Utilization Factor	Data Conversion	All Entities
	2..Isometric		No Averaging