



Tutorial
API 2A RP/ISO 19902/Norsok N004

19.01.2021
version 2020.0.2

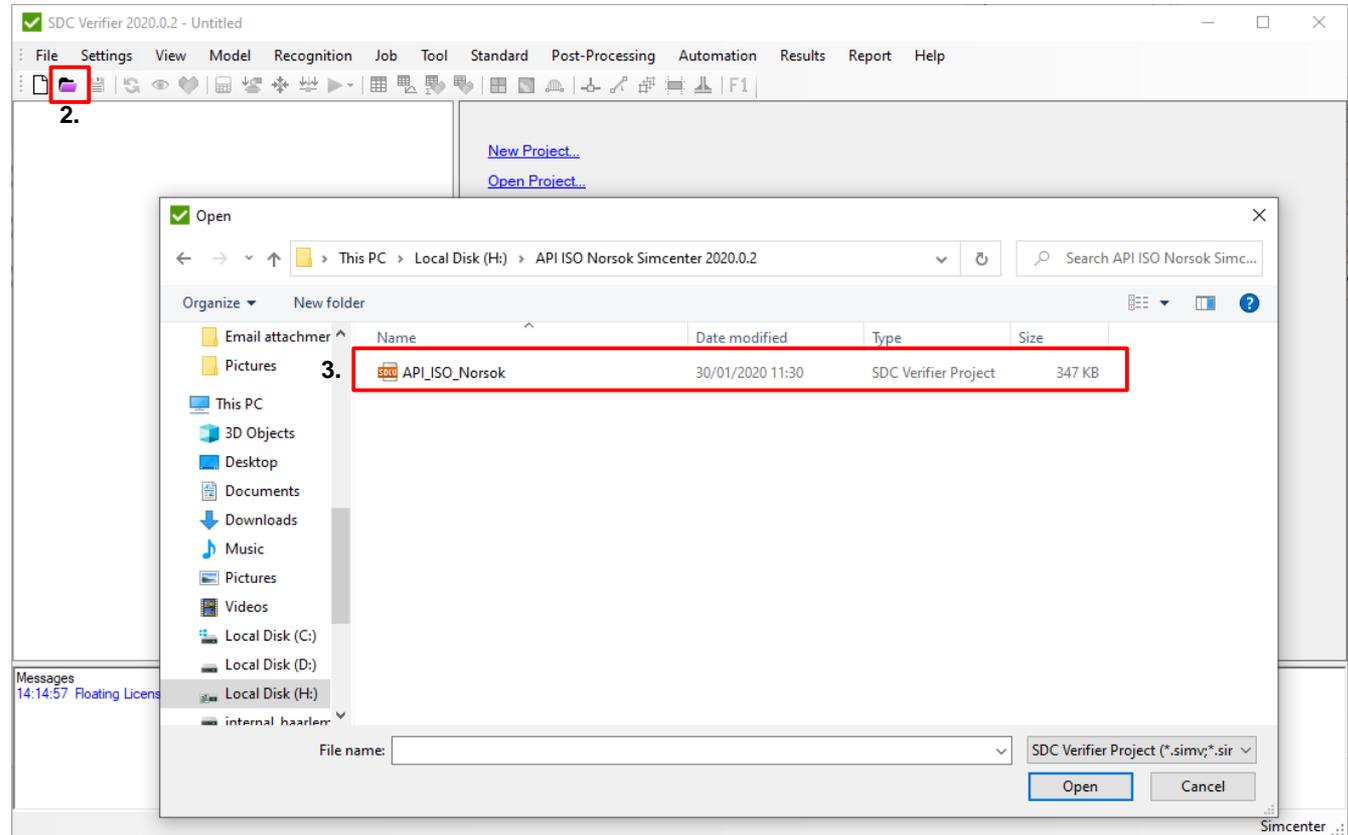
- ▶ In this tutorial, an API 2A RP Beam Design Checks are reviewed in details.
- ▶ A beam model of a steel frame has been used as a start FEM model.
- ▶ Beam member finder was used to recognize beam member length in 3 directions.
- ▶ The report was generated with the help of report designer.

Open Project

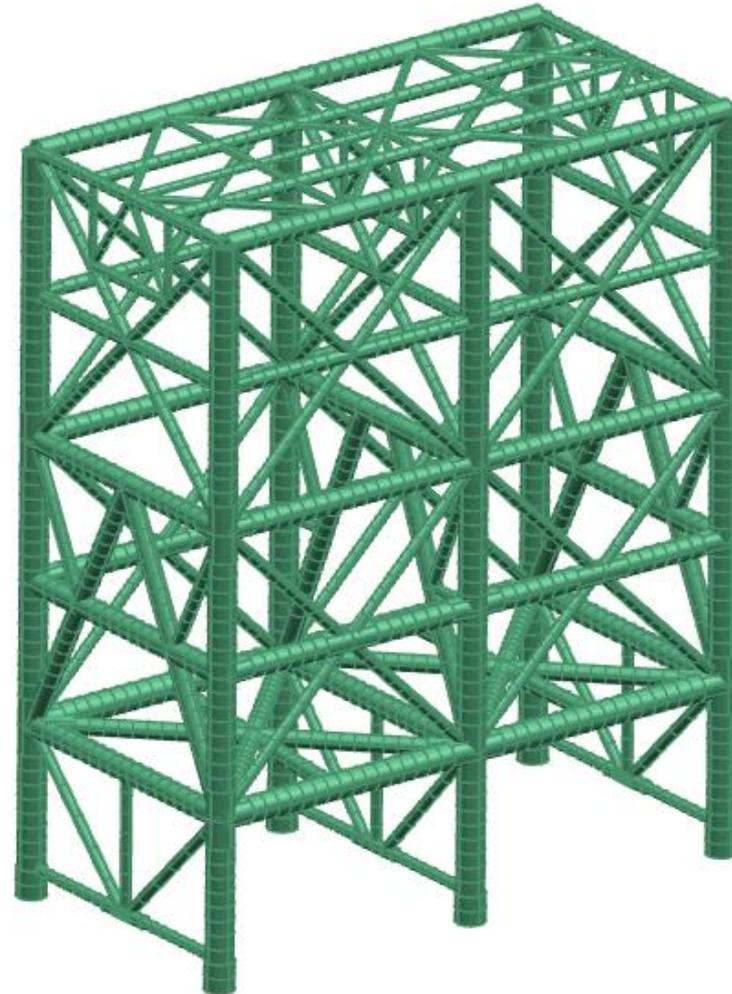
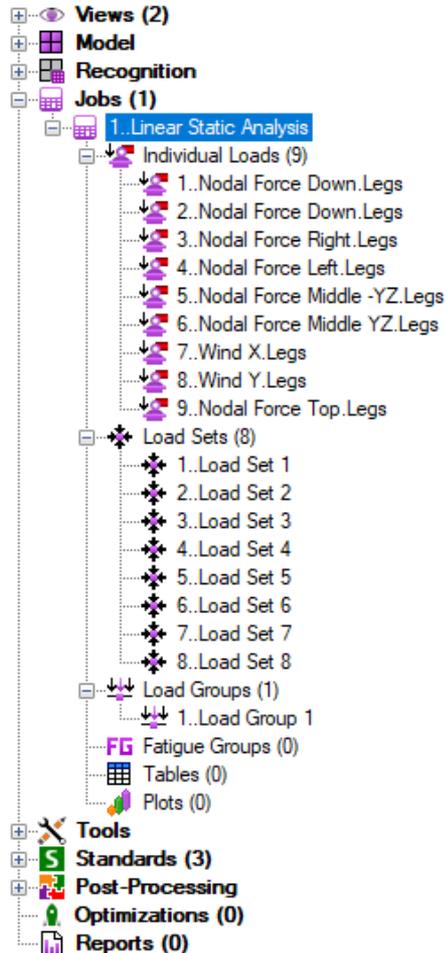
1 Launch **SDC Verifier** 

2 Execute *File - Open Project*.

3 Project: **API RP 2A-LRFD.sdcv**



Predefined project



This tutorial uses predefined project with the following created data: individual loads, load sets and load group. The focus of this tutorial is to check the cylindrical members and create the basic report.

Analyze Job

1

Execute ▶ Analyze active job

The screenshot displays the SDC Verifier 2020.0.2 interface. The main window title is "SDC Verifier 2020.0.2 - H:\API ISO Norsok Simcenter 2020.0.2\API_ISO_Norsok.simv". The menu bar includes File, Settings, View, Model, Recognition, Job, Tool, Standard, Post-Processing, Automation, Results, Report, and Help. The toolbar contains various icons for file operations and analysis. The left sidebar shows a tree view with categories: Views (2), Model, Recognition, Jobs (1), Tools, Standards (3), Post-Processing, Optimizations (0), and Reports (0). The "Jobs (1)" category is expanded, showing "1..Linear Static Analysis" selected. A context menu is open over this job, with "Analyze active job: 1..Linear Static Analysis" highlighted. The main workspace shows the configuration for the "Linear Static Analysis" job. The "Description" field is empty. The "Analysis" dropdown is set to "Linear Static". The "Analysis Options" section includes a "Define..." button and a "Select Loads to be Analyzed (9/9)" button. The "Request Results" section has checkboxes for Displacement, Stress, Applied Force, Reaction Force, Element Force, Strain, Strain Energy, Force Balance, and Constraint Equation Force. The "Analysis Selection" section has a dropdown set to "All Entities". The "Read Results Selection" section also has a dropdown set to "All Entities". The "Solid Stress/Strain" and "Plate Stress/Strain" sections both have dropdowns set to "Corner Results". An "Apply" button is located at the bottom right of the configuration panel. The bottom status bar shows "Nodes: 1923 | Elements: 2080 | H:\API ISO Norsok Simcenter 2020.0.2\scaffold_tutorial_s.sim" and "MmKS (Millimeter/Kg/Second) | Simcenter". A log window at the bottom left shows the following messages: "14:41:54 Connection Properties were read: 0", "14:41:54 Connection Regions were read: 0", "14:41:54 Connectors were read: 0", "14:41:55 '1..Default View' created", "14:41:55 Model H:\API ISO Norsok Simcenter 2020.0.2\scaffold_tutorial_s.sim is opened", and "14:41:55 Not all beam/sub members have the same element orientation (influence on Moment Ratio calculation in Beam Buckling checks), go to the Filter tab in Beam Member Finder tool. Fix elements orientation in the model and rerun the analysis."

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;

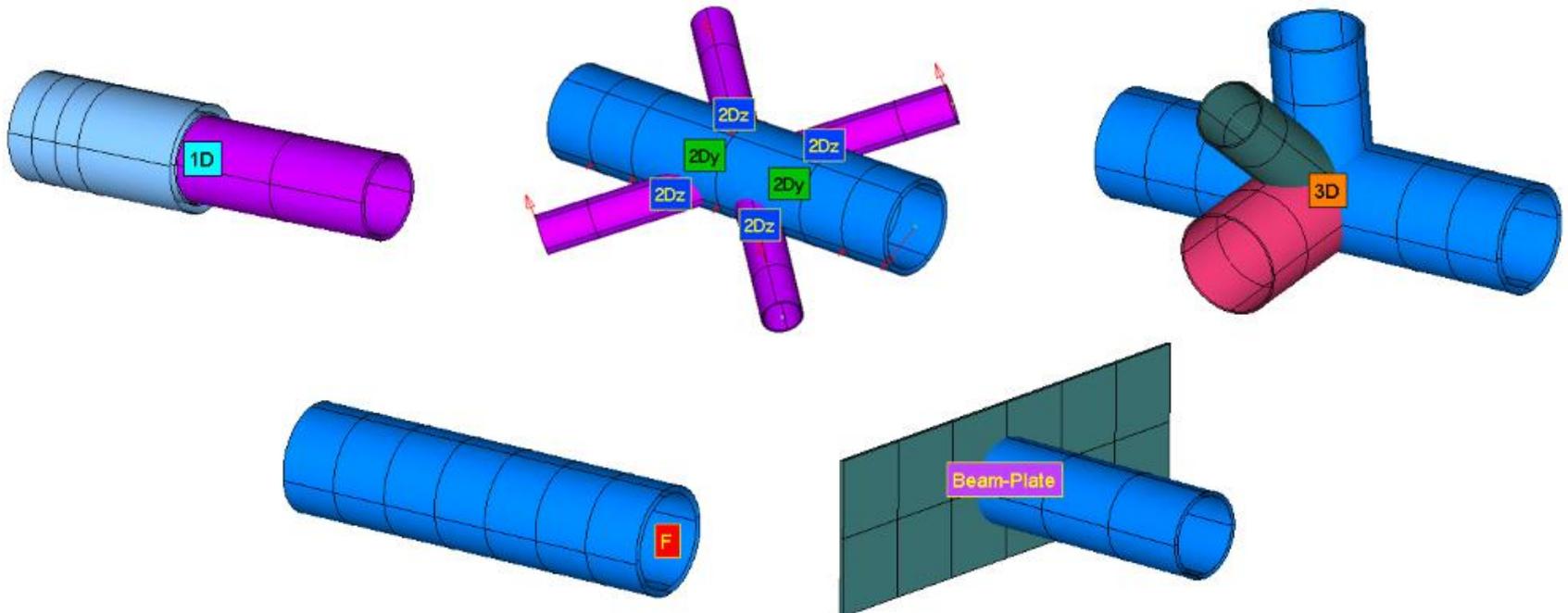
2D Joint – beam members connected in one plane;

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. Settings

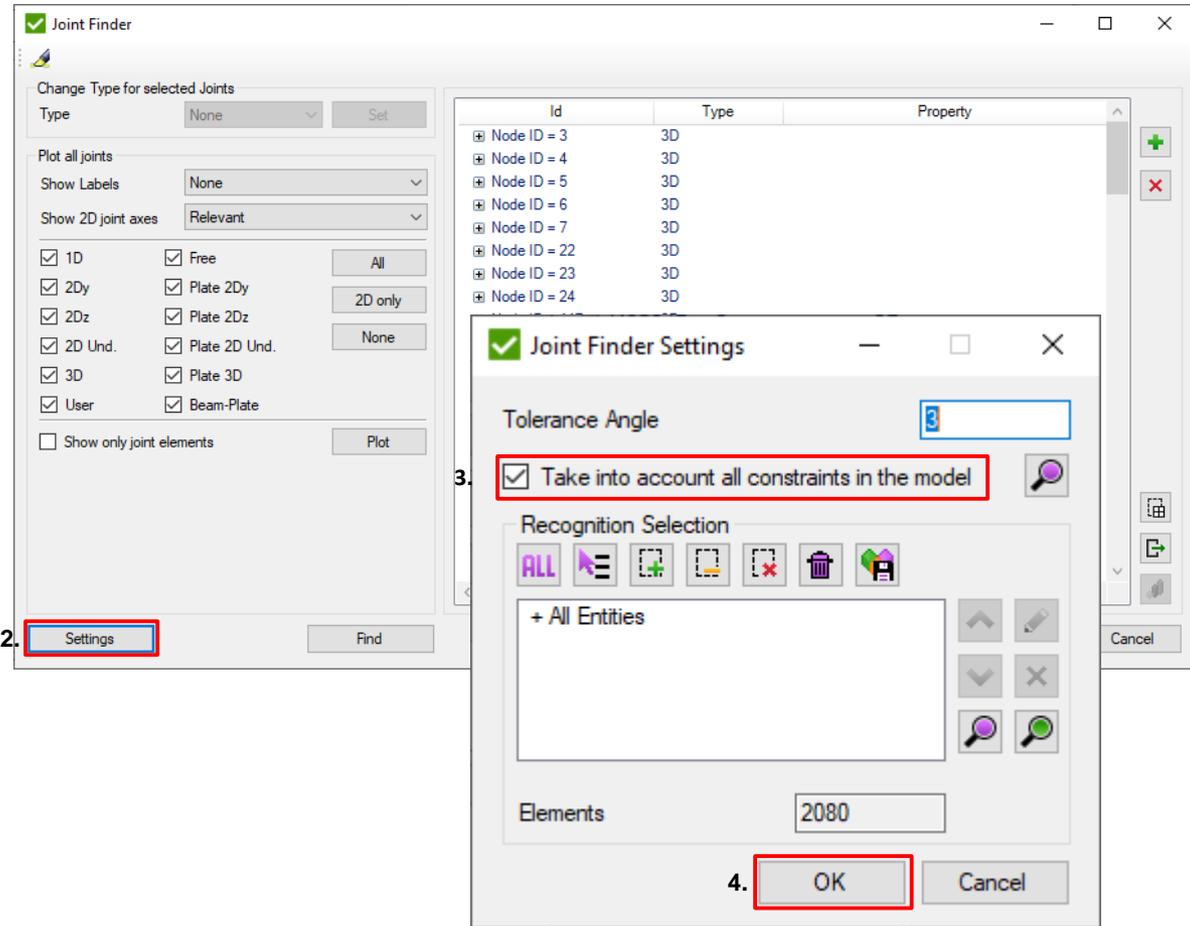
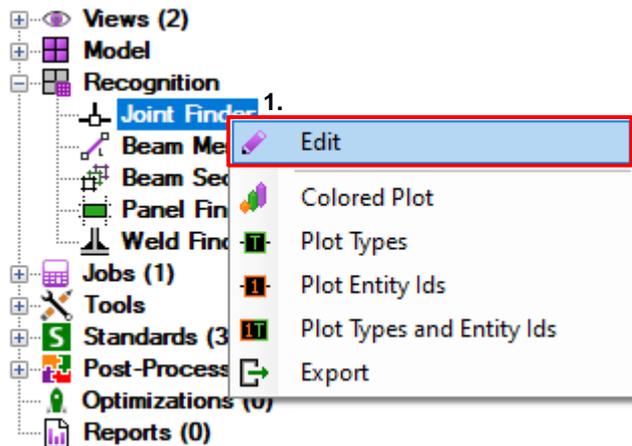
1. Execute *Edit* from *Joint Finder* context menu

2. Press *Settings*.

3. Take into account all constraints in the model: **ON**

4. Press *Ok*.

When performing the joint recognition there are 3 options for existing joints. Default option: Keep only modified– remove all joints except edited by user. Keep all existing options should be used when additional elements were added to the model.



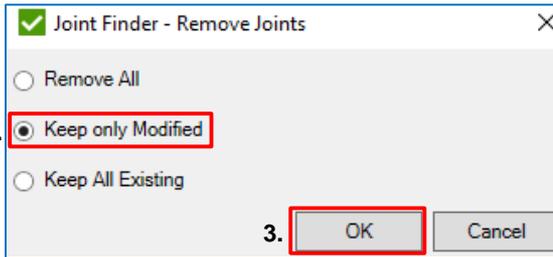
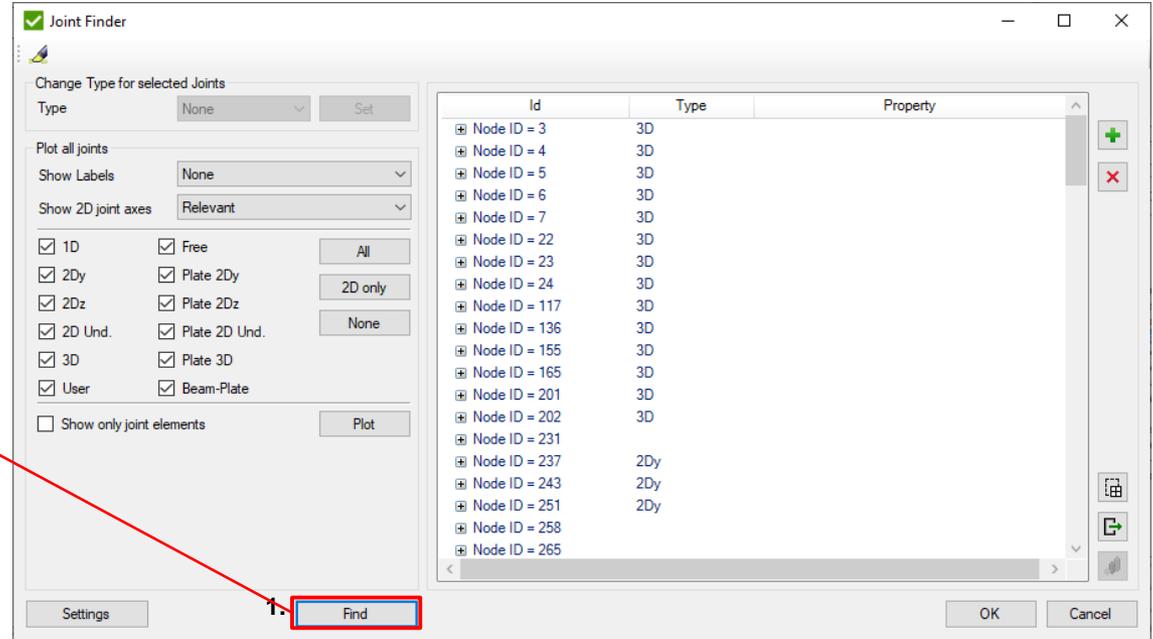
Joint Recognition. Find

1 Press *Find*.

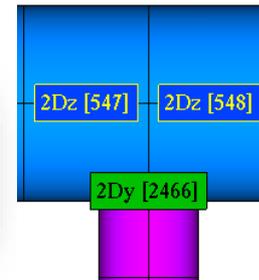
2 Select *Keep Only Modified*

3 Press *Ok*.

When performing the joint recognition there are 3 options for existing joints. Default option: Keep only modified– remove all joints except edited by user. Keep all existing options should be used when additional elements were added to the model.



Node ID = 719			
Element ID = 2466	2Dy	14.200x10	
Element ID = 547	2Dz	8.400x19	
Element ID = 548	2Dz	8.400x19	



Joints Plot

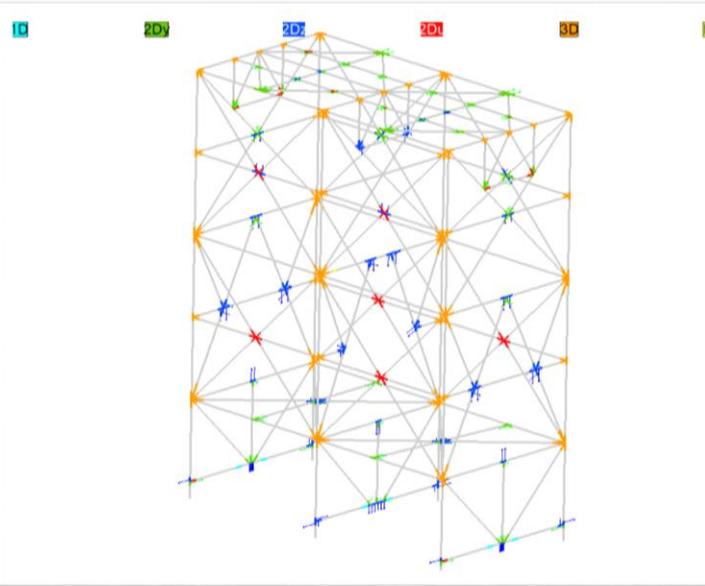
1 Select All Joints (Ctrl+A).

2 Press

3 Press Plot Joint Type in colors

4 Press OK

Id	Type	Property
Node ID = 2323		
Node ID = 2318		
Node ID = 2315		
Node ID = 2314		
Node ID = 2236	3D	
Node ID = 2233	2Du	
Node ID = 2232	2Du	
Node ID = 2227	3D	
Node ID = 2226	3D	
Node ID = 2225	3D	
Node ID = 2222	3D	
Node ID = 2221		
Node ID = 2220	3D	
Node ID = 2219	2Dy	
Node ID = 2218	2Dy	
Node ID = 2217	2Dz	
Node ID = 2216	2Dz	
Node ID = 2215		
Node ID = 2211		
Node ID = 2208		



Plot Joints of specific type:

Plot all joints

Show Labels: None

Show 2D joint axes: Relevant

1D Free

2Dy Plate 2Dy

2Dz Plate 2Dz

2D Und. Plate 2D Und.

3D Plate 3D

User Beam-Plate

Show only joint elements

3. Plot Joint Type Labels

Plot Joint Type in colors

3.

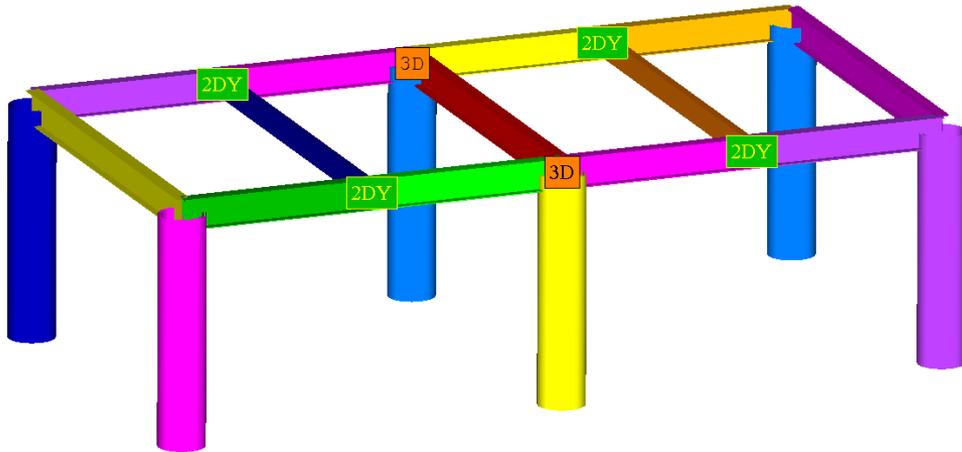
Modify Joint Type:

Change Type for selected Joints

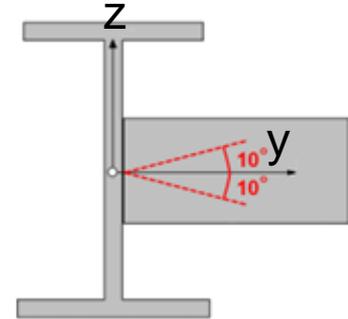
Type: None

Beam Member Lengths in 2 directions

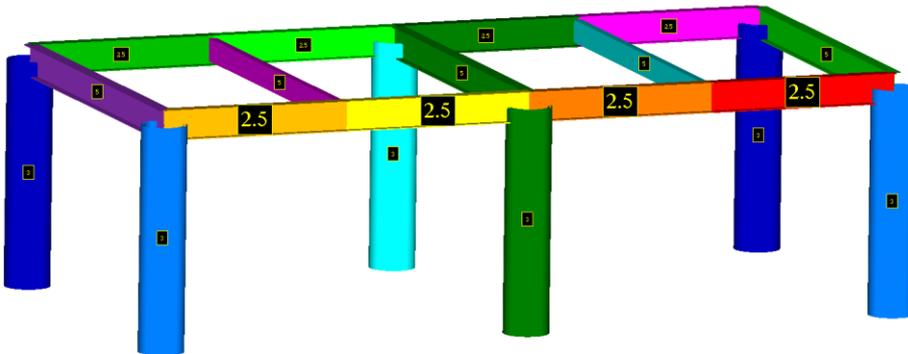
Beam Member Finder recognizes beam members and (buckling) lengths for different directions (Y, Z and Torsional).



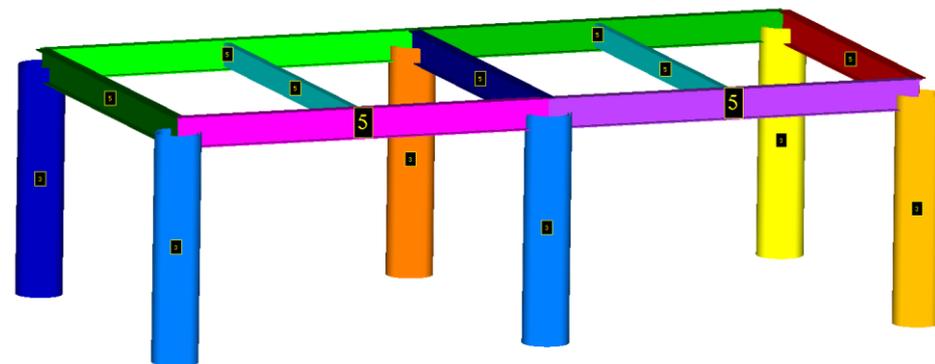
2DY
Joint



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



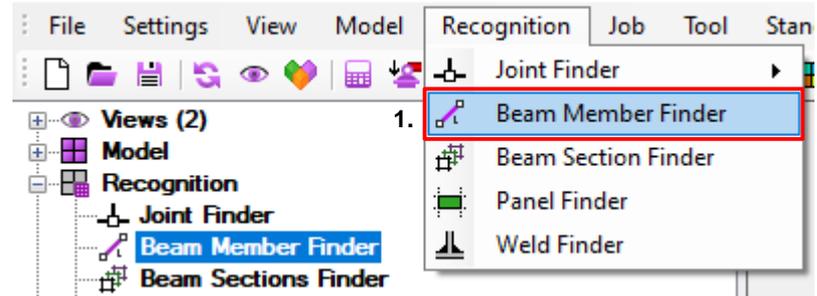
Length Z – 2 Beam Members with $L = 5$



Recognize Length

1 Execute *Recognition – Beam Member Finder*

2 Press *Find*.



The 'Beam Member Finder' dialog box is shown with the 'Length Y' tab selected. It contains a table of beam members and search options on the left.

ID	Title	Elements	Length [mm]	Length Factor	Cm Type	Modified	Joint - NodeID [Joint Type]
1	Beam Member 1 (Y)	47	13000				922 1109[3D] 136[3D] 1108[3D] 117[3D]
2	Beam Member 2 (Y)	47	13000				923 1107[3D] 155[3D] 1104[3D] 4[3D]
3	Beam Member 3 (Y)	47	13000				2041 2225[3D] 1273[3D] 2222[3D] 1122[3D]
4	Beam Member 4 (Y)	47	13000				2040 2227[3D] 1254[3D] 2226[3D] 1235[3D]
5	Beam Member 5 (Y)	47	13000				924[2Dz] 1106[3D] 165[3D] 1105[3D] 22[3D]
6	Beam Member 6 (Y)	47	13000				921[2Dz] 1111[3D] 202[3D] 1110[3D] 201[3D]
7	Beam Member 7 (Y)	16	5000	1	A		2211[2Dz]
8	Beam Member 8 (Y)	16	5000	1	A		
9	Beam Member 9 (Y)	24	5000	1	A		2059[2Dz] 2318[2Dz] 2323[2Dz] 2057[1D] 2044[...]
10	Beam Member 10 (Y)	18	5000	1	A		958[2Dz] 942[2Dz] 957[2Dz] 956[1D] 943[1D]
11	Beam Member 11 (Y)	32	10000				2208[2Dy] 22[3D] 1090[2Dy]
12	Beam Member 12 (Y)	32	10000				2221[2Dz] 201[3D] 1103[2Dz]
13	Beam Member 13 (Y)	16	5000	1	A		1093[2Dz]
14	Beam Member 14 (Y)	24	5000	1	A		926[1D] 2314[2Dz] 941[2Dz] 2315[2Dz] 939[1D]
15	Beam Member 15 (Y)	32	10000				2218[2Dy] 1117[3D] 1100[2Dy]
16	Beam Member 16 (Y)	32	10000				2219[2Dy] 1116[3D] 1101[2Dy]
17	Beam Member 17 (Y)	18	5000				1142[3D] 1125[3D] 1124[3D]
18	Beam Member 18 (Y)	40	10000				1349[2Dy] 1355[2Dy] 1361[2Dy] 3[3D] 243[2Dy]...
19	Beam Member 19 (Y)	40	10000				1369[2Dy] 1376[2Dy] 1383[2Dy] 5[3D] 265[2Dy]...
20	Beam Member 20 (Y)	7	2795.085	1	A		
21	Beam Member 21 (Y)	7	2795.085	1	A		
22	Beam Member 22 (Y)	18	5000				6[3D] 24[3D] 7[3D]
23	Beam Member 23 (Y)	7	2711.549	1	A		
24	Beam Member 24 (Y)	7	2711.549	1	A		
25	Beam Member 25 (Y)	7	2795.085	1	A		
26	Beam Member 26 (Y)	7	2795.085	1	A		

Search options on the left include 'Break Joint Options' (Length Y, 1D, 2D, 3D, Beam-Plate) and 'Set to Selected' (Length [mm], Length Factor, Cm Type). The 'Find' button is highlighted with a red box.

Beam Member Finder interface

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 [mm] Set

Length Factor Set

Cm Type A Set

A = 0.85
B = Calculate
used in API 2A, AISC89, ISO19902
and Norsok N004 standards

ID	Title	Elements	Length [mm]	Length Factor	Cm Type	Modified	Joint - NodeID [Joint Type]
1	Beam Member 1 (Y)	47	13000				923 1107[3D] 155[3D] 1104[3D] 4[3D]
2	Beam Member 2 (Y)	47	13000				922 1109[3D] 136[3D] 1108[3D] 117[3D]
3	Beam Member 3 (Y)	47	13000				2041 2225[3D] 1273[3D] 2226[3D] 1122[3D]
4	Beam Member 4 (Y)	47	13000				2040 2227[3D] 1254[3D] 2226[3D] 1235[3D]
5	Beam Member 5 (Y)	47	13000				924[2Dz] 1106[3D] 165[3D] 1105[3D] 22[3D]
6	Beam Member 6 (Y)	47	13000				921[2Dz] 1111[3D] 202[3D] 1110[3D] 201[3D]
7	Beam Member 7 (Y)	32	10000				22[3D] 2208[2Dy] 1090[2Dy]
7.1	Beam Member 7.1 (Y)	8	2500	1	A		
7.2	Beam Member 7.2 (Y)	8	2500	1	A		
7.3	Beam Member 7.3 (Y)	8	2500	1	A		
7.4	Beam Member 7.4 (Y)	8	2500	1	A		
8	Beam Member 8 (Y)	16	5000	1	A		1093[2Dz]
9	Beam Member 9 (Y)	24	5000	1	A		926[1D] 2314[2Dz] 941[2Dz] 2315[2Dz] 939[1D]
10	Beam Member 10 (Y)	24	5000	1	A		2059[2Dz] 2318[2Dz] 2323[2Dz] 2057[1D] 2044[...]
11	Beam Member 11 (Y)	18	5000	1	A		958[2Dz] 942[2Dz] 957[2Dz] 956[1D] 943[1D]
12	Beam Member 12 (Y)	16	5000	1	A		2211[2Dz]
13	Beam Member 13 (Y)	16	5000	1	A		
14	Beam Member 14 (Y)	32	10000				2221[2Dz] 201[3D] 1103[2Dz]
15	Beam Member 15 (Y)	32	10000				1116[3D] 1101[2Dy] 2219[2Dy]
16	Beam Member 16 (Y)	32	10000				1100[2Dy] 1117[3D] 2218[2Dy]
17	Beam Member 17 (Y)	7	2711.549	1	A		
18	Beam Member 18 (Y)	7	2711.549	1	A		
19	Beam Member 19 (Y)	7	2795.085	1	A		
20	Beam Member 20 (Y)	7	2795.085	1	A		
21	Beam Member 21 (Y)	18	5000				1124[3D] 1142[3D] 1125[3D]
22	Beam Member 22 (Y)	40	10000				2512[2Dz] 2582[2Dz] 2652[2Dz] 5130[1] 1383[2Dz] 1

Settings Find OK Cancel

Break Options define what joints are used to split beam members

Change Length/Length Factor for selected beam members

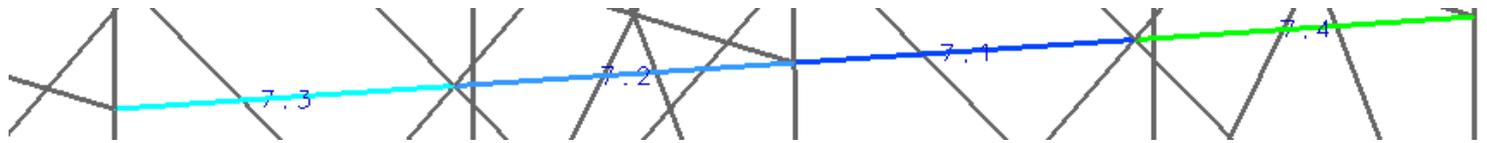
Cm Type is used in API 2A, AISC89, ISO 19902 and Norsok N004 standards

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

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

- Plot selected members
- 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

7	Beam Member 7 (Y)	32	10000				22[3D] 2208[2Dy] 1090[2Dy]
7.1	Beam Member 7.1 (Y)	8	2500	1	A		
7.2	Beam Member 7.2 (Y)	8	2500	1	A		
7.3	Beam Member 7.3 (Y)	8	2500	1	A		
7.4	Beam Member 7.4 (Y)	8	2500	1	A		



Beam Member's Length Plot

1 Select All Beam Members (Ctrl+A)

2 Press

3 Press Plot Length labels

4 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 [mm] Set

Length Factor Set

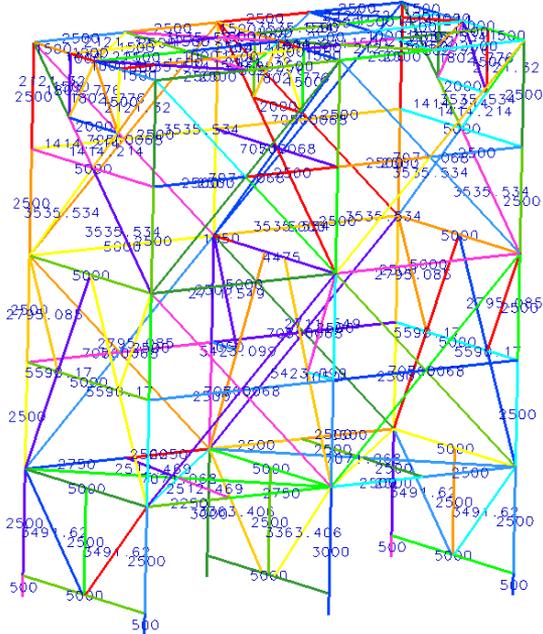
Cm Type Set

A = 0.85
B = Calculate
used in API 2A, AISC89, ISO 19002
and Norsok N004 standards

ID	Title	Elements	Length [mm]	Length Factor	Cm Type	Modified	Joint - NodeID [Joint Type]
1	Beam Member 1 (Y)	47	13000				923 1107[3D] 155[3D] 1104[3D] 4[3D]
2	Beam Member 2 (Y)	47	13000				922 1109[3D] 136[3D] 1108[3D] 117[3D]
3	Beam Member 3 (Y)	47	13000				2041 2225[3D] 1273[3D] 2222[3D] 1122[3D]
4	Beam Member 4 (Y)	47	13000				2040 2227[3D] 1254[3D] 2226[3D] 1235[3D]
5	Beam Member 5 (Y)	47	13000				924[2Dz] 1106[3D] 165[3D] 1105[3D] 22[3D]
6	Beam Member 6 (Y)	47	13000				921[2Dz] 1111[3D] 202[3D] 1110[3D] 201[3D]
7	Beam Member 7 (Y)	32	10000				22[3D] 2208[2Dy] 1090[2Dy]
7.1	Beam Member 7.1 (Y)	8	2500	1	A		
7.2	Beam Member 7.2 (Y)	8	2500	1	A		
7.3	Beam Member 7.3 (Y)	8	2500	1	A		
7.4	Beam Member 7.4 (Y)	8	2500	1	A		
8	Beam Member 8 (Y)	16	5000	1	A		1093[2Dz]
9	Beam Member 9 (Y)	24	5000	1	A		926[1D] 2314[2Dz] 941[2Dz] 2315[2Dz] 939[1D]
10	Beam Member 10 (Y)	24	5000	1	A		2059[2Dz] 2318[2Dz] 2323[2Dz] 2057[1D] 2044[1D]
11	Beam Member 11 (Y)	18	5000	1	A		958[2Dz] 942[2Dz] 957[2Dz] 956[1D] 943[1D]
12	Beam Member 12 (Y)	16	5000	1	A		2211[2Dz]
13	Beam Member 13 (Y)	16	5000	1	A		
14	Beam Member 14 (Y)	32	10000				2221[2Dz] 201[3D] 1103[2Dz]
15	Beam Member 15 (Y)	32	10000				1116[3D] 1101[2Dy] 2219[2Dy]
16	Beam Member 16 (Y)	32	10000				1100[2Dy] 1111[3D] 2218[2Dy]
17	Beam Member 17 (Y)	7	2711.549	1	A		
18	Beam Member 18 (Y)	7	2711.549	1	A		
19	Beam Member 19 (Y)	7	2795.085	1	A		
20	Beam Member 20 (Y)	7	2795.085	1	A		
21	Beam Member 21 (Y)	18	5000				1124[3D] 1142[3D] 1125[3D]

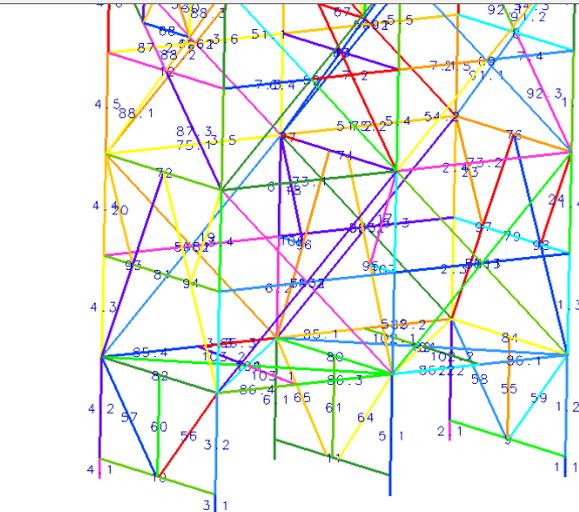
Settings Find

OK Cancel



Also it is possible to display beam members IDs by pressing

Plot Members ID labels



- Plot selected members
- 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

Cm – reduction factors

Cmy and Cmz reduction factors are used in combined axial and bending check:

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

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

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

Cm Type A Set

A = 0.85
B = Calculate
used in API 2A, AISC89, ISO19902
and Norsok N004 standards

A

B

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

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) $0.6 - 0.4 \frac{M_1}{M_2}$, 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) $1.0 - 0.4 \frac{f_c}{\phi_c F_e}$, or 0.85, whichever is less

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

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

API RP*2A-LRFD 93 ■ 0732290 0507612 001 ■

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 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.

API RP*2A-LRFD 93 ■ 0732290 0507613 T48 ■

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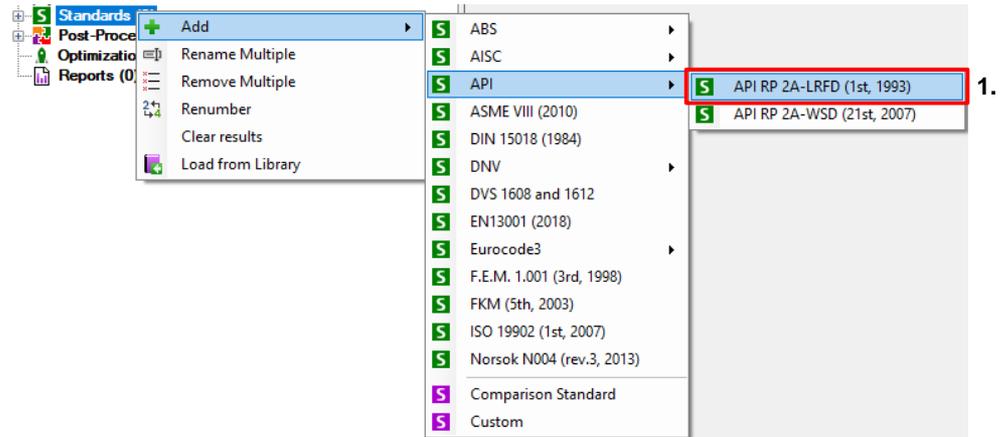
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Add API RP 2A-LRFD standard

1

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



SECTION D CYLINDRICAL MEMBER DESIGN

C_x = critical elastic buckling coefficient

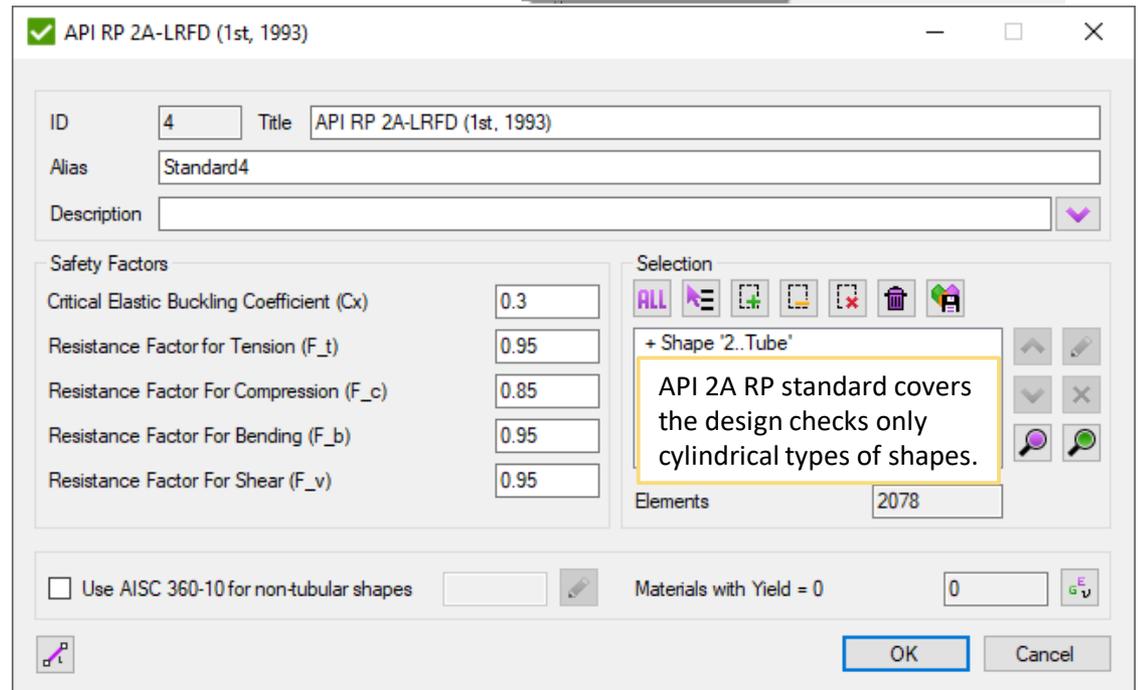
The theoretical value of C_x is 0.6. However, a reduced value of $C_x = 0.3$ is recommended for use in Equation D.2.2-3 to account for the effect of initial geometric imperfections within API Spec 2B tolerance limits, Reference D2.

ϕ_t = resistance factor for axial tensile strength, 0.95

ϕ_c = resistance factor for axial compressive strength, 0.85

ϕ_b = resistance factor for bending strength, 0.95.

ϕ_v = resistance factor for beam shear strength, 0.95



Define Material Characteristics

1

Press  to set the material yield stress and tensile strength

2

Select All Materials (Ctrl+A)

3

Tensile Strength: **360e+3 [kPa]**

4

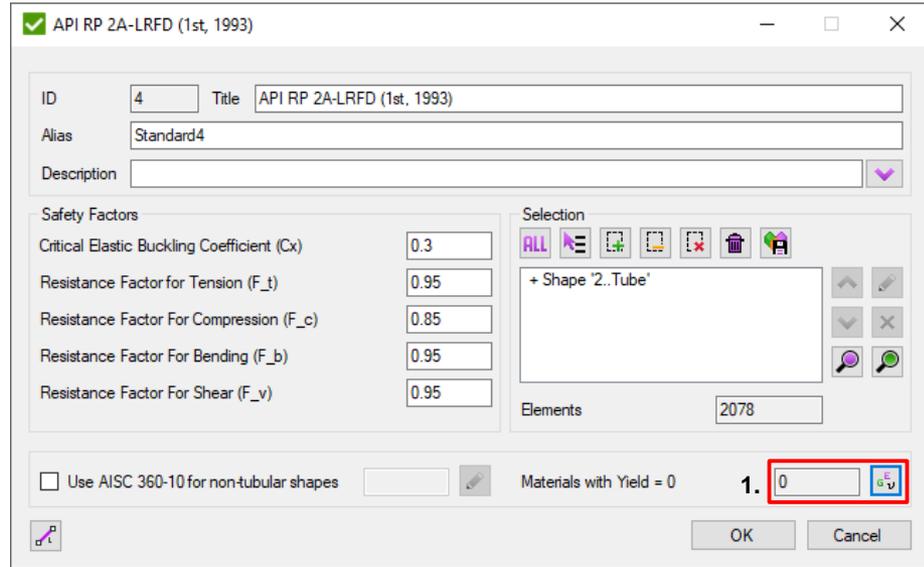
Yield Stress: **240e+3 [kPa]**

5

Press *Set*

6

Press *OK*



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

ID: 4 Title: API RP 2A-LRFD (1st, 1993)

Alias: Standard4

Description: [Empty]

Safety Factors

Critical Elastic Buckling Coefficient (Cx): 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

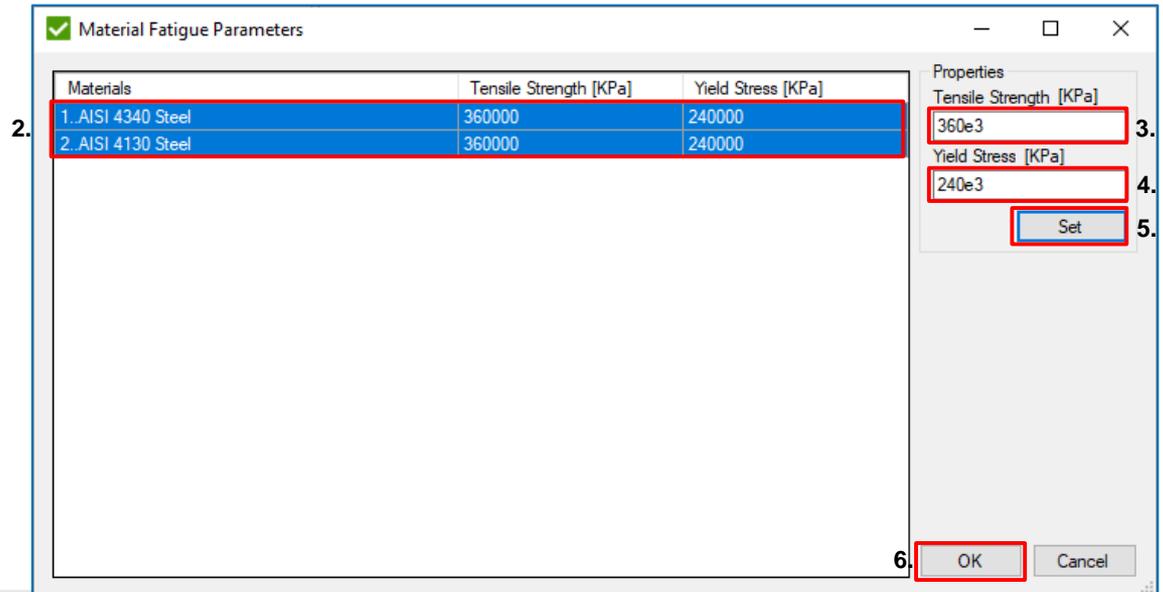
+ Shape '2..Tube'

Elements: 2078

Use AISC 360-10 for non-tubular shapes

Materials with Yield = 0: 1. 0 

OK Cancel



Material Fatigue Parameters

Materials	Tensile Strength [KPa]	Yield Stress [KPa]
1..AISI 4340 Steel	360000	240000
2..AISI 4130 Steel	360000	240000

Properties

Tensile Strength [KPa]: 360e3

Yield Stress [KPa]: 240e3

Set

OK Cancel

Extreme table for bending check

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

2 Press to select load

3 Load Type: **Load Group**

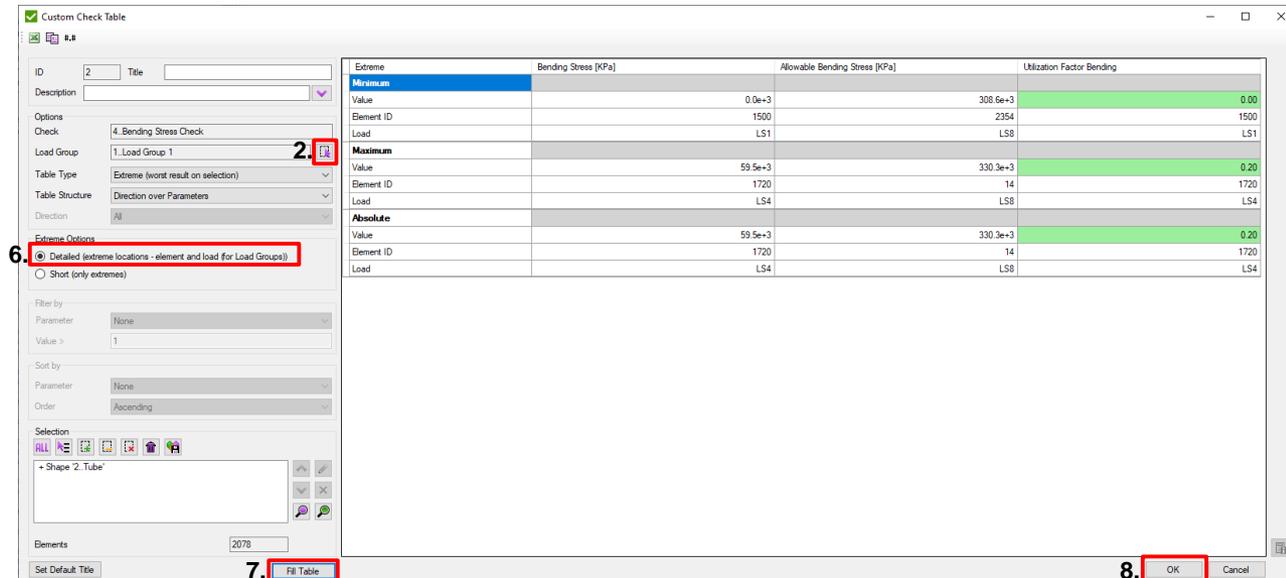
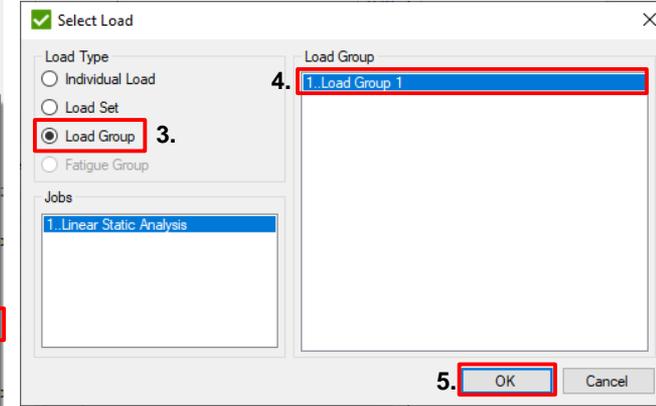
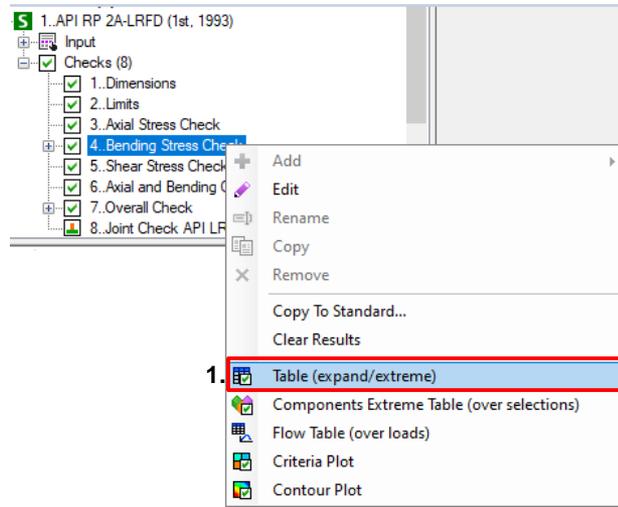
4 Load: **1..Load Group 1**

5 Press *OK*

6 Extreme Options: **Detailed**

7 Press *Fill Table*

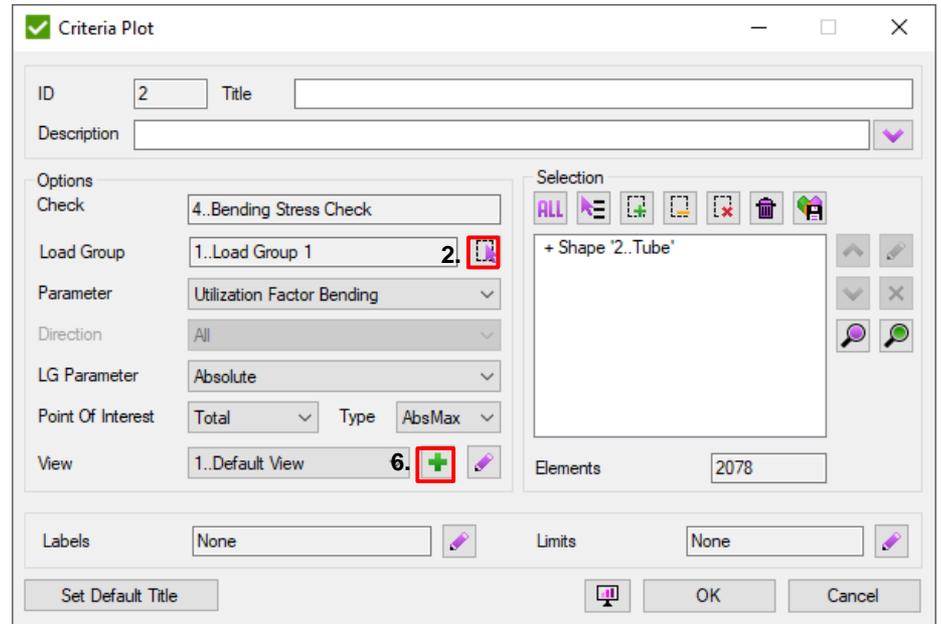
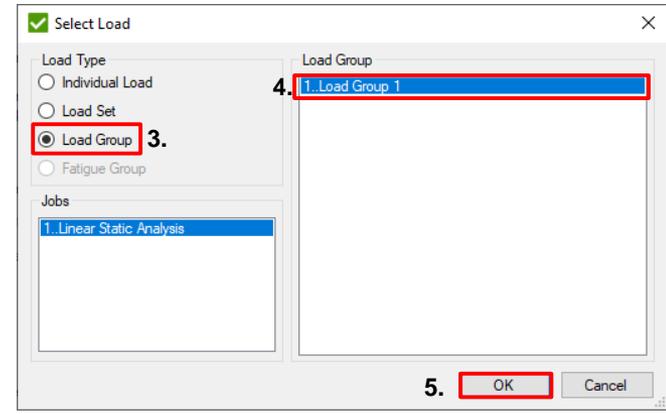
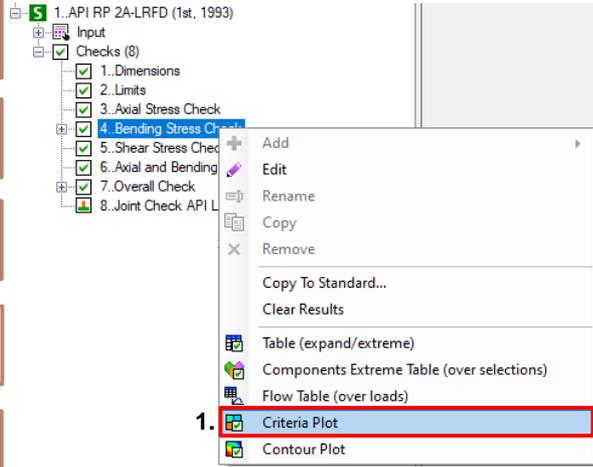
8 Press *OK*



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.

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 Simcenter as shown on the picture

3 Press *Get*

4 Color Display: **Banded**

5 Select: **Use local limits. Max: 0.48**

6 Press *OK*

View

ID: 3 Title: Isometric

Description: []

Location
Origin X: 2353.06 Origin Y: 7639.54 Origin Z: 629.61

Rotation Matrix
XX: -0.87 XY: -0.49 XZ: -0.03
YX: 0.22 YY: -0.45 YZ: 0.87
ZX: -0.44 ZY: 0.75 ZZ: 0.50

Scale: 1.27E-002

Settings
Rendering Style: Shaded with Edge
Edges: External
Edges Color: Silver Gray
 Lighted
Color Display: Banded
 Show Cross Section and Plate Thickness
 Show Deformation
 Show undeformed model
Legend Text Color: Deep Steel
 Automatic Font Scaling
Text Scale Factor: []
Legend Header: Customized
Legend Position: Left
Legend Limits
 Use limits from legend settings
 Use local limits
Mode: Min Max
Min: 0
Max: 0.48
Number of levels: 12
Format: General

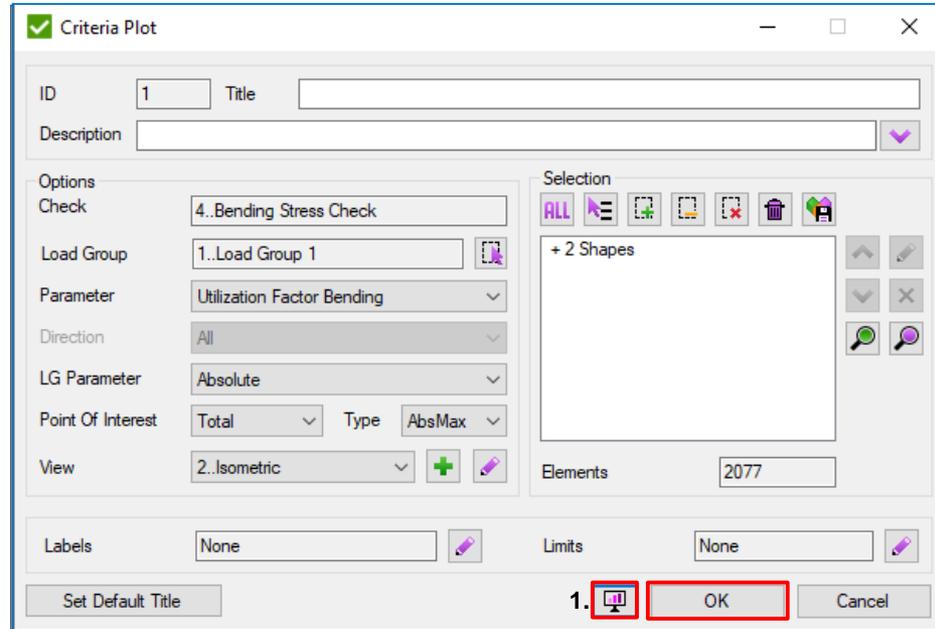
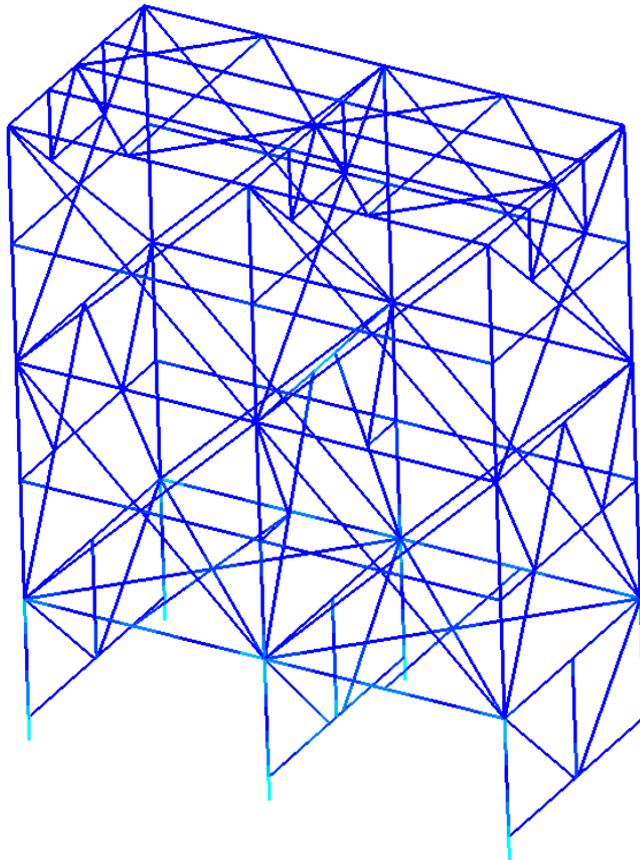
Preview

OK Cancel

Display Plot

1 Press  to display plot

2 Press *OK*

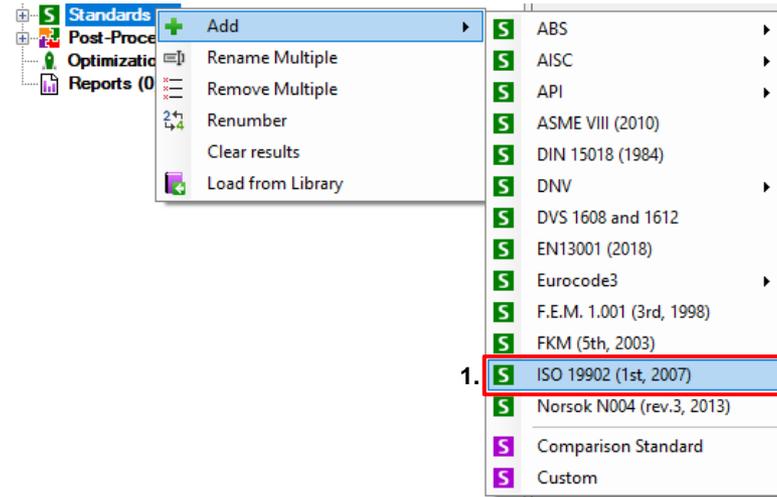


2.

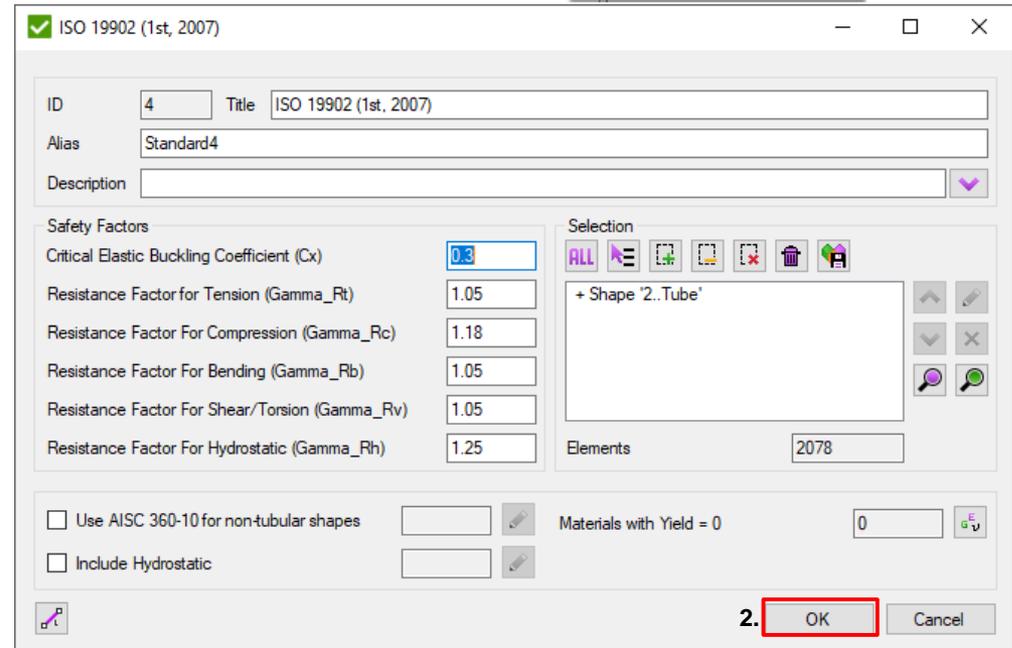
Add ISO 19902 standard

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

2 Press *OK*



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 .



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, $\gamma_{R,b} = 1,05$;

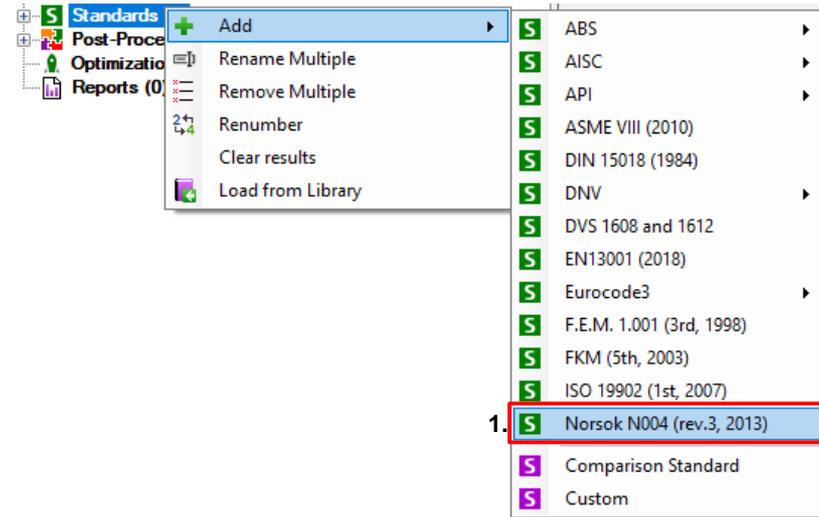
$\gamma_{R,v}$ is the partial resistance factor for shear strength, $\gamma_{R,v} = 1,05$;

$\gamma_{R,h}$ is the partial resistance factor for hoop buckling strength, $\gamma_{R,h} = 1,25$.

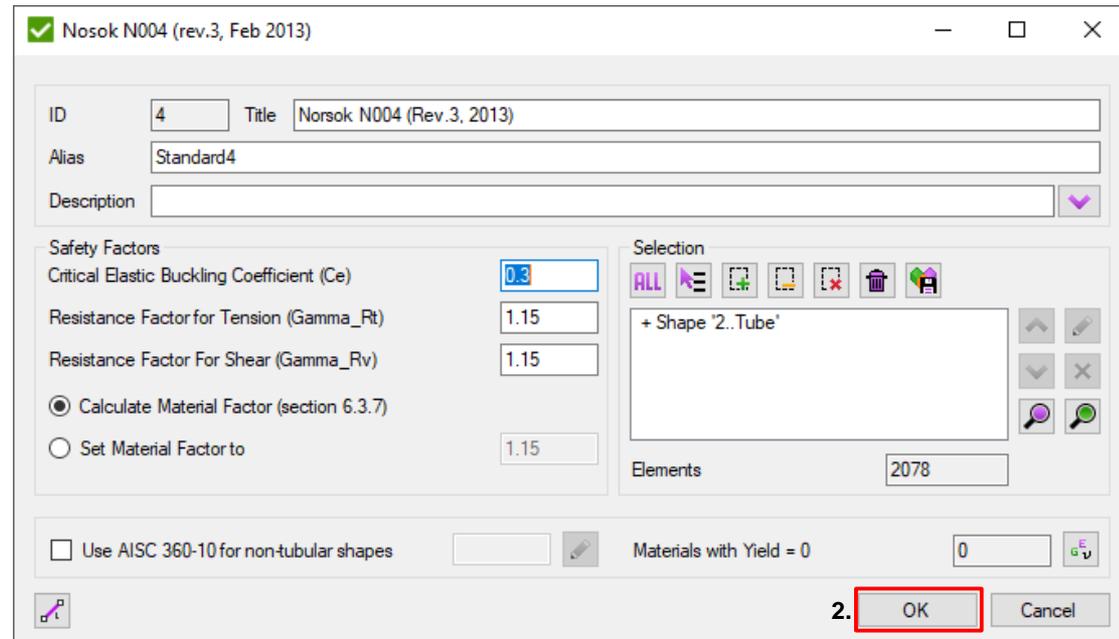
Add Norsok N004 standard

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

2 Press *OK* twice



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 U_f among all checks < 1 .



Add Norsok N004 standard

$$\begin{aligned} C_e &= \text{critical elastic buckling coefficient} = 0.3 \\ \gamma_{R,t} &= \text{material factor for tension} = 1.15 \\ \gamma_{R,v} &= \text{material factor for shear} = 1.15 \\ \gamma_M &= \text{see section 6.3.7} \\ \gamma_M &= 1.15 \quad \text{for } \bar{\lambda}_s < 0.5 \\ \gamma_M &= 0.85 + 0.60\bar{\lambda}_s \quad \text{for } 0.5 \leq \bar{\lambda}_s \leq 1.0 \\ \gamma_M &= 1.45 \quad \text{for } \bar{\lambda}_s > 1.0 \end{aligned} \tag{6.22}$$

where

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

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.

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

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

$$\sigma_{c,Sd} = \frac{N_{Sd}}{A} + \frac{\sqrt{M_{y,Sd}^2 + M_{z,Sd}^2}}{W} \tag{6.25}$$

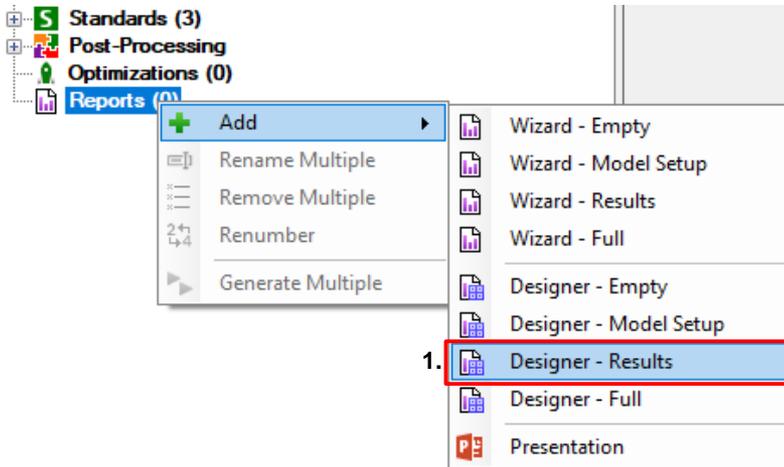
N_{Sd} is negative if in tension.

Report

1 Execute *Add - Designer - Results* from Reports context menu.

2 Exclude all checks

3 Press *Generate*



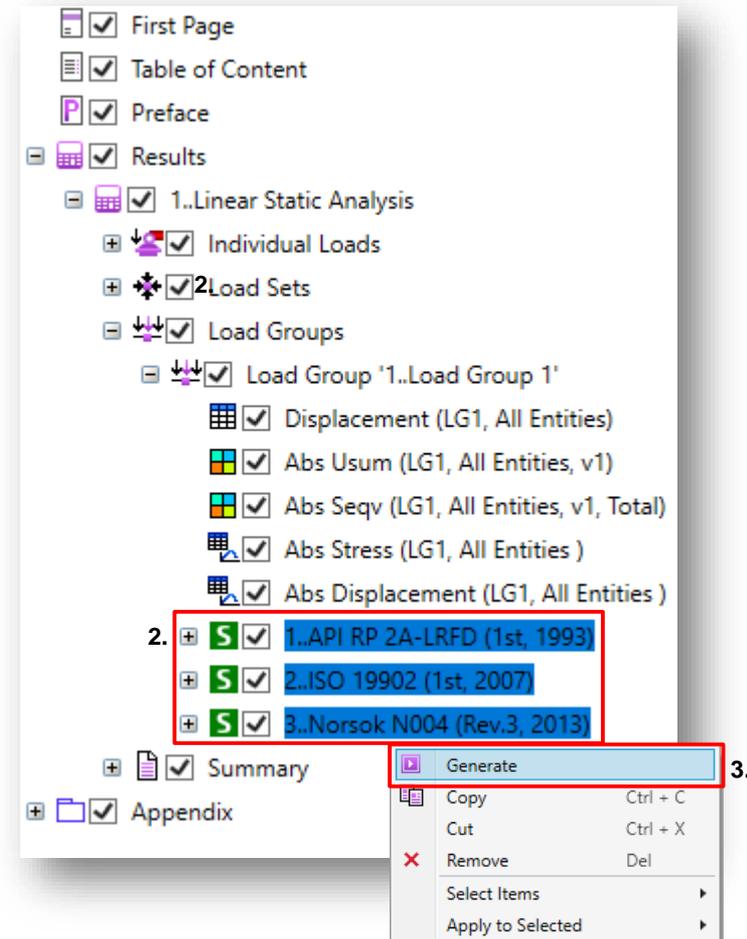
There are 4 templates of the reports:

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.



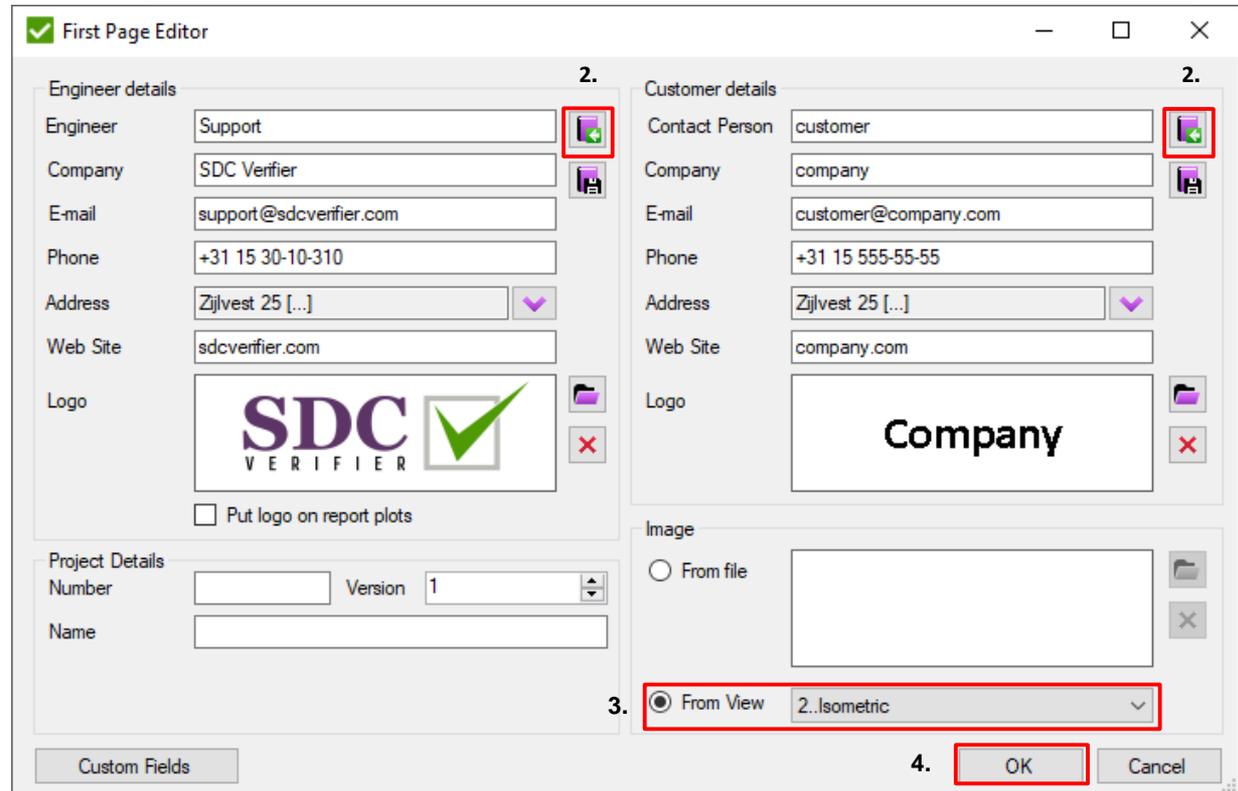
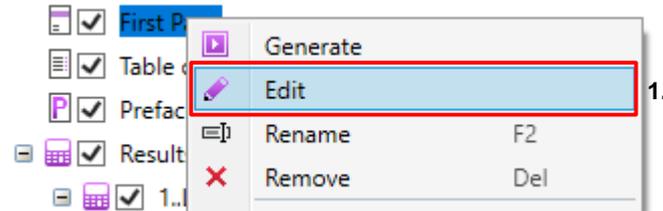
Report. First Page

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*.



The 'First Page Editor' dialog box is shown. It has two columns: 'Engineer details' and 'Customer details'. Both columns have a '2.' next to them. The 'Image' section at the bottom has a '3.' next to the 'From View' radio button and a dropdown menu showing '2..Isometric'. The 'OK' button is highlighted with a red box and has a '4.' next to it.

Field	Value
Engineer	Support
Company	SDC Verifier
E-mail	support@sdcverifier.com
Phone	+31 15 30-10-310
Address	Zijlvest 25 [...]
Web Site	sdcverifier.com
Logo	
Project Details Number	
Project Details Version	1
Project Details Name	
Contact Person	customer
Company	company
E-mail	customer@company.com
Phone	+31 15 555-55-55
Address	Zijlvest 25 [...]
Web Site	company.com
Logo	Company
Image	From View: 2..Isometric

Report exported to Microsoft Word

Press to generate complete report.

Generate
Export to Word
Export to PDF

Generate

Press to export to Word.

Norsok N004

ISO 19902

API 2A RP

First page

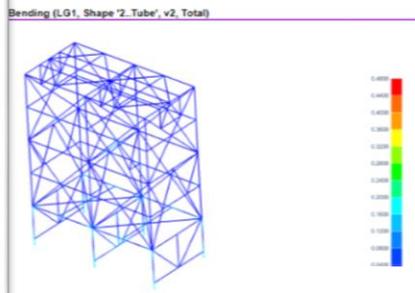
Report

Prepared by: SDC Verifier
+31 15 30-10-310
sdcverifier.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

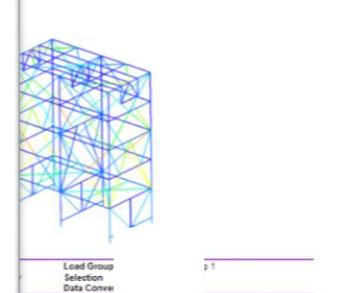
Engineer: Support
Customer: customer
Project Number:
Version: 1
Date: 19/01/2021

Check Selection	Check	Point Parameter	Total Absolute Utilization Factor
[S] 4. Bending Stress Check Shape '2. Tube'		View	2. Isometric
Minimum			
0.0e+3	300.0e+3		0.00
1500	313		1500
LS1	LSB		LS1
59.5e+3	330.3e+3		0.20
1720	1858		1720
LS4	LSB		LS4
59.5e+3	330.3e+3		0.20
1720	1858		1720
LS4	LSB		LS4



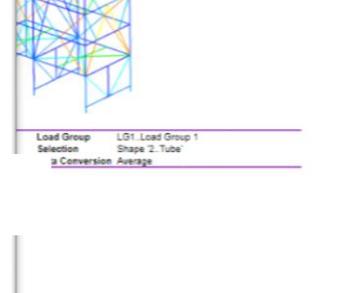
Bending Stress Check (Group 1 Tube)	Point Parameter View	Total Absolute Utilization Factor
		2. Isometric

Category	Displacement	Uz [mm]	Usun [mm]	Rz	Ry	Rz	Rsum
4	Extreme	-0.04	4.53	0.00	0.00	0.00	0.00



Absolute Shear Uf	Absolute Shear Torsional Uf	Absolute Axial and Bending Uf	Overall Utilization Factor
0.13	1.07	0.31	1.07

Absolute Shear Uf	Absolute Shear Torsional Uf	Absolute Axial and Bending Uf	Overall Utilization Factor
0.13	1.07	0.31	1.07



Absolute Shear Uf	Absolute Shear Torsional Uf	Absolute Axial and Bending Uf	Overall Utilization Factor
0.15	0.12	0.90	0.90