

# Erection of vertical vessels

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Online version: <https://nextgen.sant-ambrogio.it/KB733750>

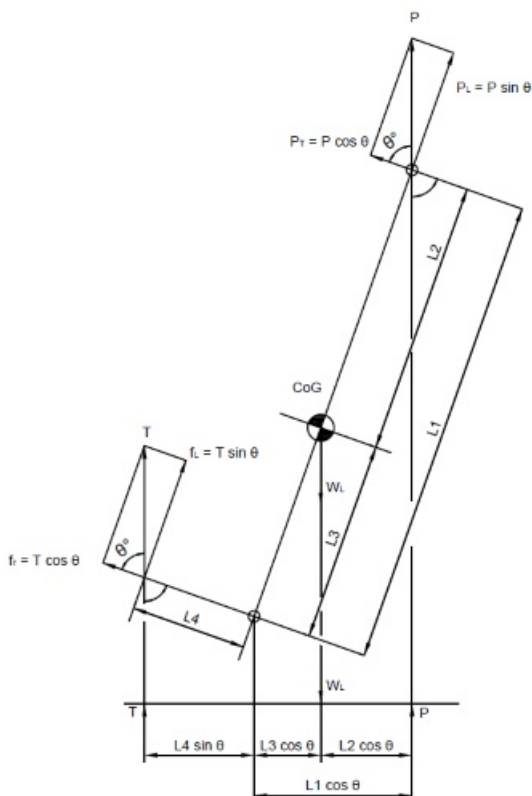
Latest update: 10 gen 2019

The verification of the lifting process consists first of all in checking the stress on the components welded to the vessel, that is:

- Trunnion
- Tailing lug
- Top head/cone lug
- Flange lug
- Lifting lug (only for vertical vessels)

Therefore the first operation to be performed consists in adding to the item the components that will be used during the erection. Note that for the automatic calculation of the forces indicated below the presence of a skirt and/or a tailing lug at the base of the vessel (T - TAIL) and at least one trunnion or a lug in the upper part (P - PICK) is necessary.

The force acting on the components varies according to the angle of inclination  $\theta$ , as shown in the figure:



The erection calculation module automatically calculates the forces when the angle changes and determines the conditions where the loads are greater. The result is presented in tabular form in the calculation report.

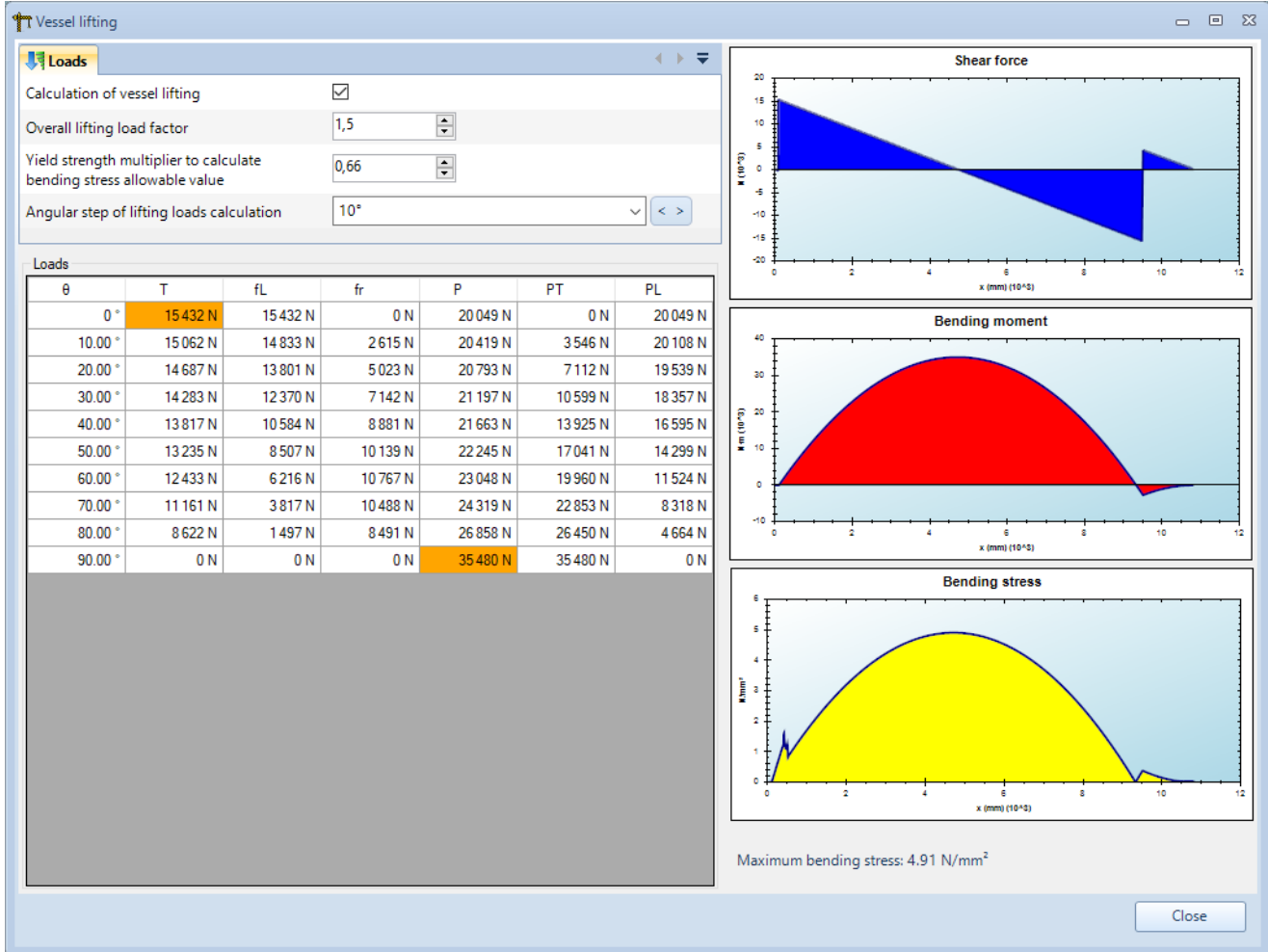
Vertical load				WL =	35 480 N	7 976.32 lbf
				L1 =	9 405.00 mm	370.276 in
				L2 =	4 090.56 mm	161.046 in
				L3 =	5 314.44 mm	209.230 in
				L4 =	625.00 mm	24.606 in
$\theta$	T	fL	fR	P	PL	PT
0 °	15 432 N	15 432 N	0 N	20 049 N	0 N	20 049 N
10.00 °	15 062 N	14 833 N	2 615 N	20 419 N	3 546 N	20 108 N
20.00 °	14 687 N	13 801 N	5 023 N	20 793 N	7 112 N	19 539 N
30.00 °	14 283 N	12 370 N	7 142 N	21 197 N	10 599 N	18 357 N
40.00 °	13 817 N	10 584 N	8 881 N	21 663 N	13 925 N	16 595 N
50.00 °	13 235 N	8 507 N	10 139 N	22 245 N	17 041 N	14 299 N
60.00 °	12 433 N	6 216 N	10 767 N	23 048 N	19 960 N	11 524 N
70.00 °	11 161 N	3 817 N	10 488 N	24 319 N	22 853 N	8 318 N
80.00 °	8 622 N	1 497 N	8 491 N	26 858 N	26 450 N	4 664 N
90.00 °	0 N	0 N	0 N	35 480 N	35 480 N	0 N

In the absence of this optional calculation module it is however possible to insert and verify the support components, but the P and T forces must be specified manually. It should be noted that the verification of these components does not normally include the stresses that they impose on the shell, for this calculation we recommend enabling the verification according to [WRC](#).

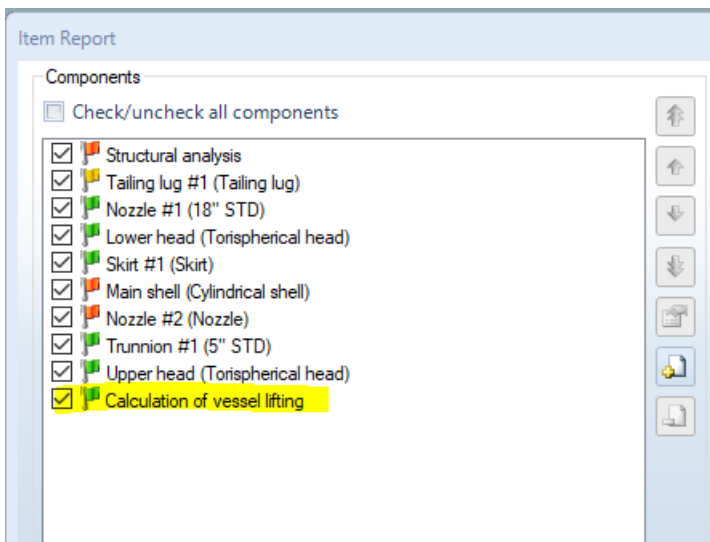
The second check carried out by the lifting calculation module is the calculation of the bending moment and the consequent bending stress which acts on the sections of the column in the initial lifting phase, where the shear force is maximum. This stress is compared with a percentage of the yield strength of the section material, normally equal to 2/3.

Maximum bending stress at $\theta = 0^\circ$			
Component	Bending stress $\sigma$	Allowable $\sigma_{max}$	$\sigma \leq \sigma_{max}$
Skirt #1	1.26 MPa	155.10 MPa	Yes
Lower head	1.61 MPa	155.10 MPa	Yes
Main shell	4.91 MPa	155.10 MPa	Yes
Upper head	0.06 MPa	155.10 MPa	Yes

All the options related to the calculation module can be customized by clicking on the crane icon at the top right.



The section of lifting calculations can be repositioned or disabled in the global report in the same way that you operate on the individual component sections.



Note that most of the calculations and the terminology used are based on chapter 10 of the "Pressure Vessel Design Manual" by D.Moss and M.Basic, fourth edition.