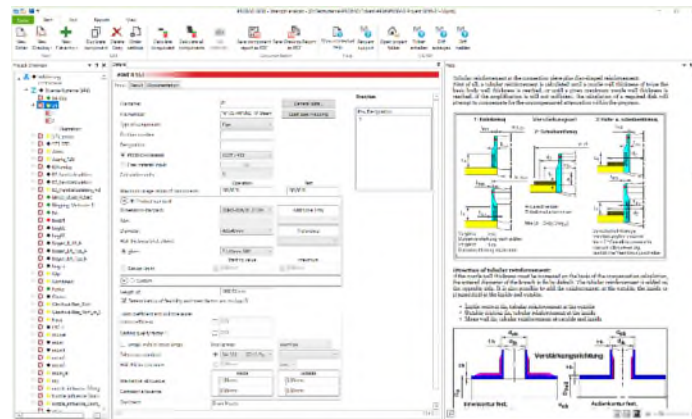




PROBAD

Code-based Strength calculations of Pressure parts



PROBAD 2020.1 New Features and Improvements

The program system PROBAD is checked and modified continuously within the scope of the maintenance agreement.

List of innovations, improvements and corrections of the new PROBAD-Releases

ASME I and ASME VIII/1,	Edition 2019
ASME B31.1 and ASME B31.3 and ASME-Piping Series	Edition 2018 Release 1.10

1.1 Software Development, Sales and Support

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2 Materials

2.1 Materials according to ASME II-D, Edition 2019:

Materials according to ASME B31.1, Appendix A, Edition 2018:

Materials according to ASME B31.3, Appendix A or Appendix K, Edition 2018:

A detailed documentation of all available ASME materials can be found on the PROBAD start interface in folder 'Information' under the name 'ASME PROBAD Material numbers'.

In this document for all materials the corresponding sources and page references from ASME II-D, ASME B31.1, Appendix A and/or ASME B31.3, Appendix A or K are listed.

- Source ASME II-D: The following new materials were added:

PROBAD Number	Nominal Composition	Product Form	Specific. No.	Type/Grade Class
No. 723	Carbon steel	Forging	SA-765	II
No. 450/718	18Cr-8Ni	Seamless Tube	SA-213	TP304L
No. 721/722	18Cr-8Ni	Welded Tube	SA-249	TP304L
No. 716	25Cr-7Ni-4Mo-N	Plate...	SA-240	S32750

- Source ASME B31: The following new materials were added:

PROBAD Number	Nominal Composition	Product Form	Specific. No.	Type/Grade Class
No. 718/450	18Cr-8Ni	Smls. Pipe&Tube	A213	TP304L
No. 433	18Cr-8Ni	Forgings&Fittings	A403	WP304
No. 724/725	16Cr-12Ni-2Mo-Ti	Smls. Pipe&Tube	A312	TP316Ti
No. 719/720	16Cr-12Ni-2Mo-Ti	Smls. Pipe&Tube	A213	TP316Ti
No. 639	9Cr-2W	Fittings	A234	WP92



3 ASME I, Edition 2019, Release 5.01

3.1 ASME I, new Edition 2019

ASME I, Edition 2019 contains the following changes (compared to Edition 2017):

- According to Table PG-26 for C-Mo a weld Strength reduction factor $W = 1.0$ was added for 850°F.
- PG-27.2.3 was deleted in Edition 2019:
Now heavy walled pipes are calculated according to PG-27.2 or Appendix A-317 optionally.
- Flat heads, Type (s) according to PG-31.4:
The formula to determine the upper limit for the M.A.W.P. was modified.

3.2 Nozzles inclined in circumferential direction

Nozzles inclined in circumferential direction can now be described via

- the angle γ to the radial or
- the offset x_1 of the nozzle axis to the parallel through the main shell axis.

3.3 Corrections

- Expanded tubes:
In certain circumstances at expanded tubes the factor e according to PG-27.4.4 was determined incorrectly. This was rectified.
- Pad reinforcement:
In case of reinforcement pads to high a value was determined for the allowable weld loads $W 1-1$ and $W 3-3$. This was corrected.
- Maximum usage ratio:
During determination of the maximum usage ratio the influence between adjacent nozzles and nipple fields was not taken into account. Now also this influence enters into the calculation.



4 ASME VIII/1, Edition 2019, Rel. 7.09

4.1 ASME VIII/1, new Edition 2019:

ASME VIII/1, Edition 2019 contains the following changes (compared to Edition 2017):

- Tubesheets according to Appendix UHX 12.5.9 / 13.5.8 / 14.5.8:
Now the allowable shear stress τ is additionally limited to $0.533 S_y$, thus $\tau \leq \text{Min}[0.8 S ; 0.533 S_y]$
- Tubesheets according to Appendix A-2:
The factor f_T to account for the increase or decrease of the tube joint strength due to the radial differential thermal expansion at the tube-to-tubesheet joint is now determined internally according to formula $f_T = (P_o + P_T) / P_o$.
- Flanges according to Appendix 2-9 (d):
For splitted loose flange rings the flange rigidity check is omitted.

4.2 Simplified Input for Nipple Fields:

In the new release nipple fields may be entered much easier now:

- The selection field 'Nipple field configuration' is omitted.
- Now the total number of nipple rows (incl. displaced 2nd rows) has to be entered.
- In case of displaced 2nd rows now the actual with longitudinal offset between the nipples of the base row and the nipples of the 2nd row has to be entered.
- The input of the 'Number nc_2 of 2nd rows in circumferential direction' and also the 'Offset in circumferential direction' is omitted.
- Now nipple fields with rhombus pattern can be defined.

4.3 Result Template

In the new release a company specific Word or PDF template may be defined under menu 'Settings > Printer'. On demand the results are created in this template as Word or PDF document.

4.4 Corrections:

- Required and allowable test pressure:
Probably for simultaneous calculations against internal and external pressure the required and allowable test pressure, although requested, were not documented in the results.
- Pad reinforcement:
In case of reinforcement pads to high a value was determined for the allowable weld loads W 1-1 and W 3-3. This was corrected.
- Cylindrical shells under external pressure:
Caused by a bug at high temperature the factor B was determined wrong for the External Pressure Charts NFN-4, NFN-9 and NFN-22. This was corrected.
- Flanges:
By errata the longitudinal stress SH in the hub was determined with substituted diameter B1 even for inside diameter $B \geq 20 g_1$. This was corrected.
This might result in slightly increased longitudinal stresses SH.
- Tubesheets:
In the English documentation of results the part 'required thickness of flange ring' was missing. This was corrected.



5 ASME B31.1, Edition 2018, Rel. 4.02 ASME B31.3, Edition 2018, Rel. 2.02

5.1 ASME B31.3, Edition 2018

ASME B31.3, Edition 2018 contains the following changes (compared to Edition 2016):

- According to ASME B31.3, section 302.3.6 for occasional loads the allowable design stresses may be exceeded by 33%. To calculate such occasional loads the maximum usage ratio can be increased to 133% respectively. In this case the calculation is performed with corresponding increased design stresses. The corresponding helps were revised.
- According to ASME B31.3, Table 302.3.5 the Weld Strength Reduction Factor $W = 1.0$ for carbon steel is only valid up to a temperature $T = 593^{\circ}\text{C}$. The corresponding program was modified.

5.2 Test Loadcase

In the new release the actual usage ratio for the test load case is documented in the results only, if the test pressure is entered explicitly.



6 ASME-Piping Series, Release 1.10

6.1 Calculation against internal and external Pressure:

In the new release it is now possible to enter an internal pressure P_i and an external pressure P_e . In this case in addition to the internal pressure calculation the straight pipes and nozzles are also calculated against external pressure.

6.2 4 Ranges:

In the new release up to 4 ranges can be defined for the single components.

In this way it is now possible, to divide for example the straight pipes into non-overlapping ranges

- seamless, material A
- seamless, material B
- welded, material C
- welded, material D.

Defined ranges are now marked in color in the input panels.

6.3 Documentation of Results:

Wall thicknesses, which did not change compared to the previous table line, are not displayed in the result tables. This is also valid for the diameter and the wall thickness of the main pipe in the nozzle results. This makes it easier to read the results and to recognize differences in wall thicknesses.

On user request in the print-, PDF- or Word-documents the result tables are now completely filled in the new release.

6.4 Nozzle Scheme:

Main pipe and nozzle are now documented with increasing diameters in the nozzle scheme.

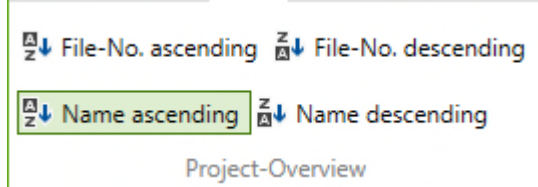
6.5 Corrections:

- Required wall thickness against external pressure:
Up to now the required wall thickness against external pressure was documented without allowance A.
In the new release the required thicknesses external pressure, like for internal pressure calculations, are now documented including the allowance A.
- Cylindrical shells under external pressure:
Caused by a bug at high temperature the factor B was determined wrong for the External Pressure Charts NFN-4, NFN-9 and NFN-22. This was corrected.
- Nozzles under external pressure:
For reinforcement calculations of nozzles under external pressure probably too high an allowable external pressure was determined. This was corrected.

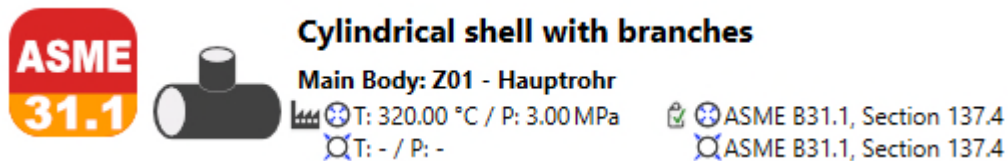
7 Changes to the new interface

7.1 New functions in Release 2020.1

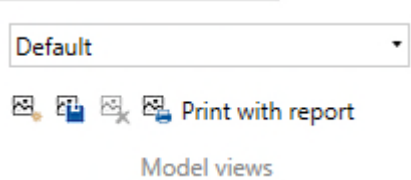
- The project overview can now be sorted by file number or file name.



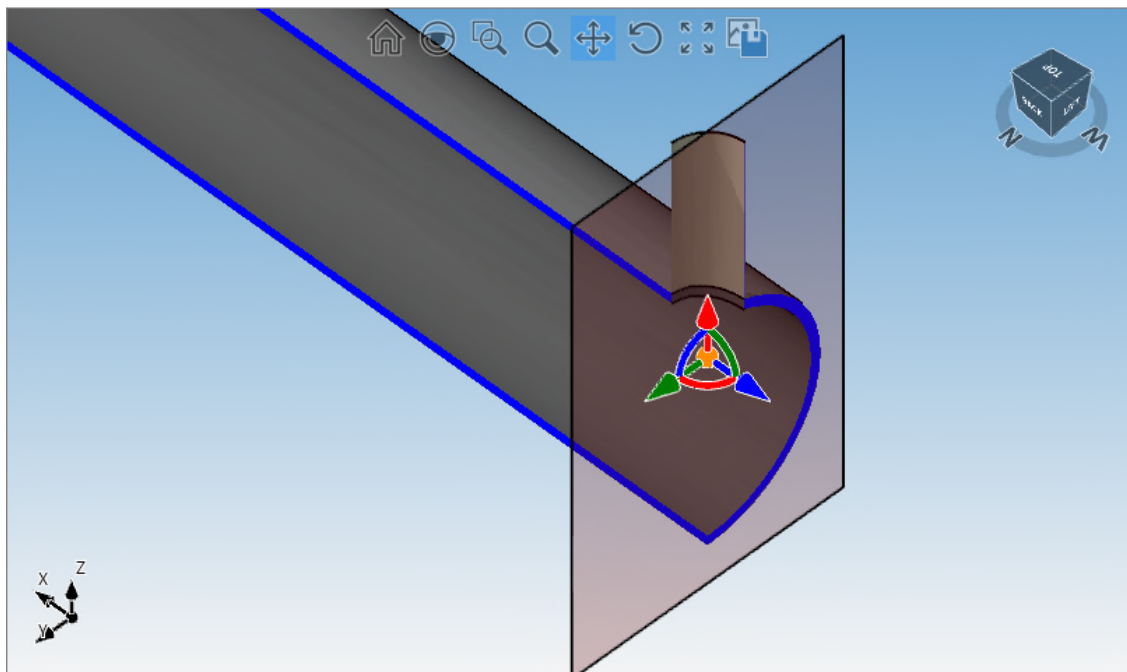
- In the title bar of each data record the assigned operating data is now displayed.



- Different views can now be defined for the 3D model. These views can be provided with a title and description. The views can be called up, saved as images and used in the documentation.



- Up to 6 sectional planes can now be displayed for the 3D model. The sectional planes can be displayed in any combination. Sectional planes are saved with the current view.





- The calculation documentation was completely revised
 - PDF reports are now no longer a PDF of the text output, but an independent report in a modern layout including a navigable table of contents and defined views.

The left screenshot displays the following data:

Pos. No./Component	Standard	Dimensions	Material name	Type/Class	Page
2317 Headend	DIN EN 10253	450.00 mm x 28.00 mm	A233	B	3
3111 Shell	DIN EN 10253	216.15 mm x 8.50 mm	A233	B	5
3121 Shell	-	200.00 mm	-	-	7

The right screenshot displays a stress analysis table:

Parameter	Value
Room temperature	20.00 MPa
Yield strength	188.19 MPa
Tensile strength	343.70 MPa

- Word reports are now also independent reports with layout and formatting. The format was changed from RFT to Docx.

7.2 New functions since release 04/2019

- Required additional information for head/end standards is now checked during input.
- 3D model for flat ends PG-31 type e, f, g-1, i1, i2 and j have been added
- Reinforcing discs at branches are now shown in the 3D model.
- When positioning nozzles on heads/ends, the system now checks during input whether the nozzle position is on the head/end.
- If during the import of old input files drawings are found in which calculations in SI and US units are stored, these are now divided into two corresponding drawings.
- ASME I: For flat ends with openings and disc-shaped reinforcement the result output has been revised, if the geometrical possibilities of the disc are exhausted.
- ASME I: The maximum cutout diameter, for which no reinforcement calculation is required, is determined alternatively with respect to nominal or net dimension; now $D_i/4$ is also considered alternatively nominal or net.



7.3 Various changes and improvements since release 04/2019

- Manual examples are now documented using the documentation language set for new orders.
- The modeling of torispheric heads has been accelerated.
- The generation of nipple fields for the 3D model has been accelerated.
- The search for the license key has been optimized.
- The update function has been updated.
- The checking of some inputs has been improved.
- Some error messages have been clarified.
- The list of standard dimension series for bends no longer contains sheet metal standards, these are now specified as special standards.

7.4 Bugs fixed since release 04/2019

- The separate help window is now closed together with the main window.
- Some translations of standard names or standard options were corrected.
- The table of contents of the program help has been corrected.
- When importing several files, a file which did not define a test load case might have been assigned the test load case of the previous file.
- For test load cases without temperature specification, a blank value for the temperature was displayed.
- Entries were displayed several times in the list of sheet metal standards for flat ends.
- The database for dished heads did not contain any diameter specifications in some places.
- The nipple configuration was not displayed correctly in the 3D model under all circumstances.
- In the 3D model the angle to the radial was sometimes not considered for branches.
- Torispherical heads may not be displayed correctly in the 3D model.- The number of nozzle/nipple fields and nozzle positions was corrected from 10 to 20 for ASME I.
- When checking network licenses, the wrong module was sometimes checked for.
- When "Rounding" was selected but no rounding was selected, the calculation could fail.
- Nipple fields can now be deleted.
- Parts where the test load case had the highest utilization might not be documented.
- In some cases the calculation was aborted due to a wrong diameter.
- Images in the program help were sometimes not displayed in the correct language.
- Images in the program help could not be displayed in a separate window.
- The "Add Branch" button was deactivated for ASME bends.
- Under certain circumstances the wall thickness of a bend could not be entered.
- An error has been corrected which prevented the nozzle positioning from being used.
- For flat ends type PG31 b-2 the type of component and the calculation formula could not be selected.
- For connection cylinders on flat ends the steel group could not be specified.
- In some cases the input of a wall thickness was required for bends according to special standards, even if it was already entered.
- Measured pipe bends must always be entered completely.
- An error was fixed, which prevented the documentation from being output, if only user-defined material definitions were used.
- The corrosion of nozzles calculated according to ASME I on dished heads was possibly not taken into account.
- When duplicating nozzles, the specified radii of influence may not be correctly duplicated.
- ASME I: No exploitation of the mutual influence between nozzles and nipple fields was determined or documented.
- ASME I: During the recalculation of flat ends, type (p), undefined values '*****' were possibly documented in the output.
- ASME I: When recalculating rolled tubes, the allowance e may not have been determined correctly.



- ASME I: Too high a utilization for influencing nozzles and nipples was documented.
- Incorrectly imported materials for nozzles are now corrected.