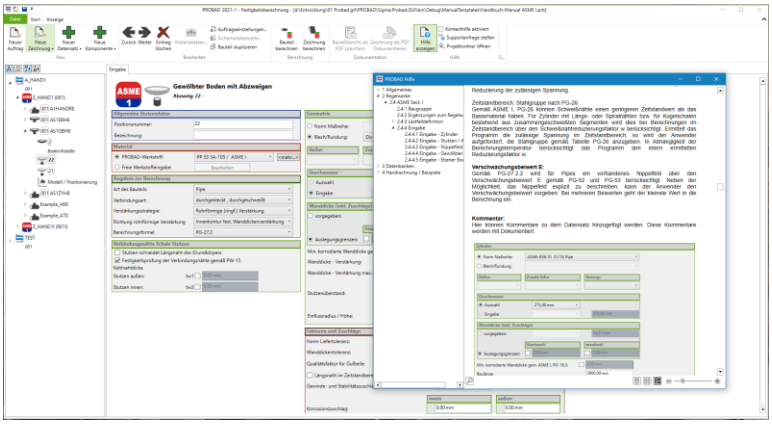
PROBAD

Code-based Strength calculations of Pressure parts



PROBAD 2022-1
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

EN 12952	Water-tube Boilers	Release 4.10
EN 13445	Unfired Pressure Vessels	Release 3.09
EN 13480	Metallic industrial Piping	Release 3.02
EN 1591	Circular Flange Connections	Release 5.06
EN Piping Series	Serial Piping Calculations	Release 4.10
AD 2000	Pressure Vessels	Release 7.10
TRD	Steam Boilers	Release 8.10
WRC 107 / WRC 537	External Nozzle Loads	Release 8.10
WRC 297	External Nozzle Loads	Release 5.10
FEZEN	Material Information System	Release 4.14

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FEZEN – Information System, Version 4.14:

The following new editions of standards and codes were inserted into the material database FEZEN:

Reference Standard EN:

- EN 1563 Edition 04/2019 Founding – Spheroidal graphite cast irons
- EN 10216-5 Edition 04/2021 Seamless, stainless-steel tubes for pressure purpose
- EN 10217-7 Edition 04/2021 Welded, stainless steel tubes for pressure purpose
- EN 10222-2 Edition 08/2021 Steel forgings for pressure purpose, ferritic and martens.
- EN 10222-4 Edition 08/2021 Steel forgings for pressure purpose, weldable fine grain
- EN 10253-2 Edition 08/2021 Butt-welding pipe fittings – Non-alloy and ferritic alloy
- EN 13445-2 Edition 05/2021 Unfired pressure vessels - materials

Reference Standard DIN:

- AD 2000 - W6/2 Edition 03/2021 Copper and copper-wrought alloy

The following modified VdTÜV-Material sheets were entered into the material database FEZEN:

WB 305	WB 305 Supplement	WB 345	WB 352/2
WB 354/2 Supplement	WB 354/3	WB 356/1	WB 356/1 Supplement
WB 357/3 Supplement	WB 399/3	WB 400	WB 400 Supplement
WB 418	WB 421	WB 424	WB 424 Supplement
WB 432/1	WB 432/1 Supplement	WB 432/3	WB 436
WB 436 Supplement	WB 499 Supplement	WB 509/1	WB 510
WB 511/2	WB 511/2 Supplement	WB 546	WB 547
WB 550	WB 550 Supplement	WB 552/2	BW 552/2 Supplement
WB 559/2	WB 563/2		

Dimension Standards:

- By user request the following dimensions standards were entered into the database:
  EN 1092-2 04/1997 Cast iron flanges

- The dimensions database was updated according to the following new editions of standard:
  EN 10253-2 08/2021: Welding fittings

EN 13445: Unfired Pressure Vessels, Release 3.09

New component: Vertical vessels on bracket supports

In the new release the calculation of 'vertical vessels on bracket supports' according to EN 13445-3, chapter 16.10 is now possible.

- Bracket supports of form A-D according to EN 13445-3, figure 16.10-1 can be proved.
- The bracket supports may be with or without reinforcement plate.
- EN 13445-3, chapter 16.10 contains only the proof of the vessel shell.
  Thus the bracket supports and the reinforcement plate, if defined, are proved according to AD 2000 – S3/4 on demand.
- Standard dimensions for the bracket support and the reinforcement plate can be loaded according to DIN 28083.

New component: Vertical vessels on supporting legs

In the new release the calculation of 'vertical vessels on supporting legs' according to EN 13445-3, chapter 16.11 is now possible.

- Vertical and also non-vertical supporting legs can be proved.
- The supporting legs may be with or without reinforcement plate.
- EN 13445-3, chapter 16.11 contains only the proof of the vessel shell.
  Thus the supporting legs and the reinforcement plate, if defined, are proved according to AD 2000 – S3/3 on demand.
- Standard dimensions for the bracket support and the reinforcement plate can be loaded according to DIN 28081.

EN 13445-3, new Edition 05/2021:

Local loads at nozzles in spherical shells:
Now in addition to the axial force FZ and the bending moment MB also a shear force FS and a torque moment MZ acting at the nozzle can be entered. The resulting shear stress tao is taken into account during the proof of the local loads according to EN 13445-3, 16.4.5-16.4.7.

Local loads at nozzles in cylindrical shells:
Now in addition to then axial force FZ and the bending moments MX and MY also a shear forces FX and FY and the torque moment MZ acting at the nozzle can be entered. The resulting shear stress tao is taken into account during the proof of the local loads according to EN 13445-3, 16.5.5-16.5.7.

Vessels at lifting lugs:
Now by default shocks during the lifting of the load are taken into account via a shock factor gamma = 1.5 (up to now 1.6) according to EN 13445-3, Formel (16.7-1).

Simplified proof for cyclic loading:
According to EN 13445-3, section 17 in addition to transient pressure also significant thermal loads can be taken into account now.

Nozzles:

For nozzles connected to the shell via fillet welds the corresponding reinforcement area Afw is taken into account during the proof of the reinforcement of the opening according to EN 13445-3. If the thickness of the fillet weld is not entered, a minimum thickness is set internally. In this case a corresponding hint is displayed now.

Additions / corrections:

- For torispherical heads, a too small required wall thickness ek for the knuckle may have been documented in the results. This has been corrected.

EN 13480: Metallic industrial Piping, Release 3.02

Unreinforced openings:

According to EN 13480-3, section 8.4.2 no reinforcement is necessary for small openings.
But up to now for 2 adjacent small openings the common reinforcement was proved, if the effective length ls on the main pipe intersects.
Now according to section 8.5.1 this proof is omitted, if the center distance of the small openings is greater than the sum of its inside diameters.

Additions / corrections:

- Now also the allowable stress of the main pipe at the opening is documented in the results.
- Now on reducers nozzles can also be placed parallel to the cone axis via the input of the angle psi = 0°.
- In the small run-out area of the cone, a too large required wall thickness e2 and so a too low maximum allowable pressure was determined. This has been corrected.
- For torispherical heads, a too small required wall thickness ek for the knuckle may have been documented in the results. This has been corrected.
- Now for flat ends with relief groove in creep range a warning is displayed according to EN 13480-3, section 7.2.3.4.
- For butt welded flat ends, a too low usage ratio was determined under certain circumstances. This has been corrected.
- L-shaped stiffening profiles according to EN 10056-1 can now also be calculated.

User-Interface

The EN 13480 module is now available in the revised user interface. The classic user interface will be maintained until the next release in 2023, after which the calculation according to EN 13480 will be possible exclusively with the new user interface.
A complete change log of the new user interface to release 2021-1 is listed in the document ASME_Changes_2022-01.

EN 12952: Water-Tube Boilers, Release 4.10

Part-through bores:

In the new release ‘part-through bores’ according to EN 12952-3, figure 8.2-4 can be calculated now.
In this case the bore diameter d1 and the height h1 of the bore must be entered.

Additions / corrections:

- For austinites, the safety factors were previously selected on the basis of the minimum elongation at fracture A = minimum {longitudinal, transverse, tangential fracture}.
  Now, according to EN 12952-3, 6.3.3, only the transverse fracture is taken into account.

- Additionally defined axial forces on cylindrical shells were previously not taken into account when determining the maximum permissible temperature. This has been corrected.

EN 1591: Circular Flange Connections, Release 5.06

Gasket materials:

- The PROBAD database of gasket materials was updated to www.gasketdata.org, state 01/2021.
  Additionally gasket characteristics according to www.esadata.org are available now.

- The list to select the gasket materials was revised. Now it contains the full designation of the gasket, however without specification of the manufacturer. This has to be entered as filter before selecting the gasket material.

- The designation of the gasket material is documented fully in the results now.
  The manufacturer and also the source for the gasket specifics are documented separately now.

Strip-of for bolts in blind holes:

By default for bolts in blind holes the correction factor cB is determined according to EN 1591-1, formula (127).
In the new release on demand the term ‘l5t x fF /(0.8 x dB0 x fB)’ in formula (127) is replaced by the ratio ‘l5t / m(min)’, where m(min) is determined according to the method of Dose.

Additions / corrections:

- Also, for unlimited leakage rate, the maximum allowable pressure is now determined exactly.

- If too small a tightening torque Mt0, spec was specified, the program may crash. This bug has been fixed.

- On the screens for free input of material properties, the corresponding calculation temperatures for the individual components and load cases are now displayed correctly.

- Input value 'Proportion of media force as additional force' was documented in the results with the wrong unit '%'. This has been corrected.

- Under special circumstances a nonsensical warning *W 2240* was displayed concerning the available clamping length of the bolts. This has been corrected.

AD 2000: Pressure Vessels, Release 7.10

Flanges with full-facing gasket:

Up to now only flange connections with mean gasket diameter dD inside the bolt circle diameter dt could be calculated.
Now also flange connections with full-facing gasket can be proved according to DIN V 2505.

Loose flanges:

Up to now as support point for a loose ring (without defining the corresponding stub) the inside diameter diL of the loose ring was supposed.
In the new release the outer contact diameter daF has to be entered explicitly.

Additions / corrections:

- According to AD-B3, Edition 06/2021, section 2.6 for dished heads of Kloepper or Korbbogen type only in case of a long skirt the thickness of the skirt is proved according to AD-B1.

- For flange connections with an O-ring gasket, the bolt forces are now increased in accordance with AD-B7, Table 1, footnote e) by the ratio of the lever arms y1 / y2 in the case of metallic contact between the flange outside diameter and the bolt circle diameter.

- For supporting elements according to AD-S3/1 to AD-S3/4, the minus tolerance of the wall thickness may have been determined incorrectly. This has been corrected.

- For bracket supports the graphic helps were revised and the symbols in the helps and result documentation were standardized.

DIN/EN-Piping Series, Release 4.10

Check of additional temperature values:

Additionally to the design point (calculation pressure and calculation temperature) up to 100 further temperature values can be defined in the new release via the switch ‚Check other temperature values'.
In this case the maximum allowable internal and/or external pressure of the total piping series is determined for this check points.
If the correspondent pressure P für a temperature value is entered additionally, also the actual usage ratio is calculated for this load combination.
The results are documented in a summary table.

Bended pipes and elbows:

Up to now different ranges of pipe bends and elbows were not allowed to contain identical diameters. In the new Release this is only true for straight pipes.
So now in one calculation for example 2D-bends can be defined in one range and 3D-bends in another range with the same diameter range.

T-Fittings:

Now for T-fittings the distance x between nozzle and end of main pipe is checked.
If x is smaller than the minimum value according to EN 13445-3, 9.7.2.1 or EN 13480-3, 8.3.2, it is pointed out via a hint, that the T-fitting should not be connected directly to a dished or flat head, large end of a reducer, flange or expansion joint.

Additions / Corrections:

- When calling the 'Individual branch selection' for the first time, the loading of all diameter combinations of the straight pipes can now be switched off.
- Under special circumstances, an individually selected direction of reinforcement was ignored during individual branch selection. This has been corrected.
- The results table for branches was sometimes split on several output pages.
  This has been corrected.
- For bended pipes deviating wall thickness can also be specified for special diameters.
- For austenitic elbows a too low allowable design stress might have been determined.
  This has been corrected.
- For caps, a too small required wall thickness eck for the knuckle may have been documented in the results. This has been corrected.

WRC 107: Local Stresses at cylindrical and spherical Shells, Release 8.10
WRC 297: Local Stresses at cylindrical Shells, Release 5.10

Additions / corrections:

- Now, instead of AD 2000-S4, the overlay of primary and secondary stresses is evaluated in reference to the international code EN 13445, Annex C.7.2 and C.7.3.

TRD: Technical rules for steam boilers, Release 8.10

Additions / corrections:

- Problems with display of helps were fixed.

- The English material data sheets contained German texts in some places.
  This has been corrected.