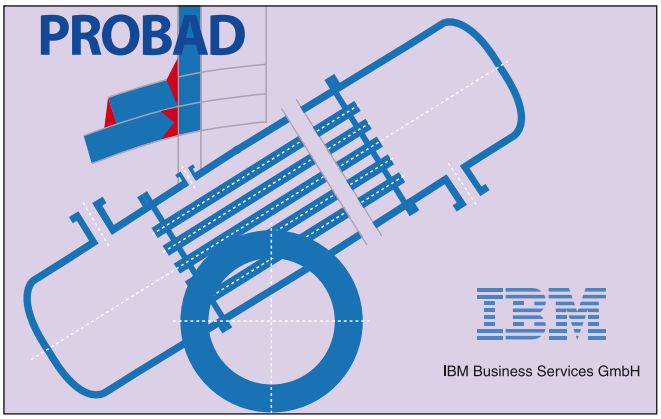
PROBAD
Code-based Strength Calculations of Pressure Parts



PROBAD, the standard program for code-based strength calculations of pressure parts, has been successfully used for years. Well-known companies in the boilers and vessels industry, in plant design and in piping construction are using PROBAD as licensees for designing and re-checking their products. The calculation programs in compliance with the national and international codes run on more than 550 PC's of some 80 licensees. The EN-based modules of PROBAD will increasingly gain in importance along with the publication of the European codes. PROBAD is continuously subject to technical changes and novelties. Based on the various maintenance agreements, IBM BS GmbH is obliged to keep the programs up to date.

The PROBAD system is distinguished by the following features:

- *PROBAD is of modular design; this enables licensing individual program modules.*
- *PROBAD allows not only re-checking defined component dimensions, but also designing or optimizing components.*
- *The system includes the standards of the various codes applicable to dimensions wall thicknesses, tolerances etc.*
- *The dialog system provides convenient help screens, either as text or graphic.*
- *Print output is currently available in German and English for all the PROBAD modules.*
- *PROBAD can be integrated with the customer's specific programs via the CALL function.*

PROBAD – National Codes

AD-2000 Sheets, Series B

- *Cylindrical parts with nozzles and their interactions* *(B1/B6/B9/B10)*
- *Conical parts with nozzles and their interactions* *(B2/B6/B9/B10)*
- *Dished ends and hemispherical heads with nozzles and their interactions* *(B3/B1/B6/B9/B10)*
- *Flat round and square heads or plates with centered nozzle* *(B5)*
- *Welded and flanged tubesheets with or without marginal moment including tubes* *(B5/B1/B6)*
- *Dished covers* *(B4)*
- *Expansion joints* *(B13)*
- *Flanges, single and pair, including bolts* *(DIN 2505 and B7/B4)*
- *Thermal stresses on vessels with tubesheets* *(TEMA)*

AD-2000 Sheets, Series S

- *Vessels with support skirts* *(S3/1)*
- *Horizontal vessels on saddles* *(S3/2)*
- *Vessels with dished ends on feet* *(S3/3)*
- *Vessels with support brackets* *(S3/4)*

TRD

- *Cylindrical parts with nozzles and nipples and their interaction as well as Y-shaped branches* *(TRD 301)*
- *Proof for cyclic stresses* *(301, Anl.1)*
- *Bended tubes and Elbows* *(301, Anl.2)*
- *Dished heads and spherical Shells with nozzles and their interactions as well as Y-shaped braches* *(TRD 303)*
- *Calculation of spherical shells with openings on the hole inside against cyclic loadings* *(303,Anl.1)*
- *Flat heads with central nozzle* *(TRD 305)*
- *Firetubes* *(TRD 306)*
- *Fatigue calculation based on the creep rupture strength* *(TRD 508)*

DIN-/EN-Piping

The PROBAD-Module 'Piping' serves for the serial calculation of standard pressure parts in piping systems:

- *straight pipes*
- *belonging nozzle table*
- *belonging beded pipes*
- *Elbowes*
- *T-Pieces*
- *Reducers*
- *Caps*
- *Flanges*
- *Blinding plates.*

The calculation proof can be done optionally according to the Codes

- *DIN 2413, TRD, AD-2000 or*
- *EN 13480 (Power Piping),*
- *EN 12952 (Wtb), EN 13445 (UFPV)*

for internal or external pressure.

T-Pieces and reducers are proved by integrated rating tables acc. to DIN, flanges by integrated rating tables acc. to EN 1092.

DIN/EN Materials Database FEZEN

The materials database FEZEN contains the strength values for metallic materials. It contains:

- *app. 700 material sheets based mainly on standard data of the DIN code, but also on data of VdTÜV or SEW sheets. Material data deviating from the above standards are taken into account in line with the AD-2000 and TRD codes, however.*
- *app. 1500 materials sheets based on standard data of the EN material code. Material data deviating from the above standards are taken into account in line with the AD-2000 and TRD codes, however.*

This DIN/EN -Database is used as well by the national code modules (AD-2000, TRD) as by WRC 107, WRC 297 and all EN-Modules for the internal determination of the relevant material values. Additional there exists a comparison of the new european material names according to EN 10027 and the old designations according to DIN 17006 and 17007. The materials database FEZEN is revised permanently by IBM BS GmbH.

FEZEN-Information system

This PC-Dialog-System serves for an interactiv use of the materials database FEZEN. At this both single values and all material values can be called. Entering temperature and measures of a work-piece the program determines the actual strength values respectively the allowable stress.

FEZEN-Interface

The materials database FEZEN can be evaluated via an Interface-program in form of a DLL by customer's specific programs.

PROBAD – European Codes

EN 12952 Water Tube Boiler

For the PROBAD module 'EN Water Tube Boilers' (EN 12952), the following components are available for strength calculations due to internal pressure and temperature:

- *Cylindrical parts with nozzles and nipple fields as well as their interactions*
- *Cylindrical shells with Y-branches*
- *Bended tubes and elbows*
- *Square tubes*
- *Spherical shells and dished heads with nozzles as well as their interactions*
- *Spherical shells with Y-branches*
- *Unstayed flat ends with centered nozzle*
- *Calculation of the fatigue strength due to cyclic internal pressure or combined cyclic changes due to internal pressure and temperature*
- *Creep fatigue calculation*

EN 1591 Flange connections

The PROBAD module 'EN 1591 Flange Design' serves for re-checking or designing flanged joints in line with the EN 1591. For DIN and EN based standard flanges, dimensions for flanges, bolts and gaskets and clamping parts (washers, expansion sleeves, Hytorc-Discs resp. Hytorc-Expansion nuts) are stored in a database and can always be retrieved into convenient, easy-to-use input panels. It is also possible to enter non-standard measures. For the given loads (pressures, temperatures, forces and moments) the usage ratios are determined for:

- *the flanges including the connection, if available (cylindrical, conical, spherical, hemispherical shell, dished head)*
- *the bolts*
- *the gasket in consideration of the parameters according to EN 1591-2.*

In one single calculation step the flange connection is proved for the assembly condition and for up to 9 subsequent conditions. Special verifications e.g. via entering the nominal tighten torque, the bolt force or the minimum usage ratio of the bolts are possible.

EN 13445 Unfired Pressure Vessels

The PROBAD module 'EN 13445 Unfired Pressure Vessels' serves for strength calculations of the following parts under internal and/or external pressure:

- *Cylindrical components with nozzles and their interactions*
- *Dished heads, hemispherical and spherical heads with nozzles as well as their interactions*
- *Conical shells with nozzles as well as their interactions*
- *Flat circular and non-circular heads and plates with centered nozzle*
- *Horizontal vessels on saddles resp. ring supports*

Further modules are in work or in planning.

EN 13480 Metallic Piping

The PROBAD module 'EN 13480 Metallic Piping' serves for strength calculations of the following parts under internal and/or external pressure :

- *Cylindrical components with nozzles and their interactions*
- *Pipe bends and elbows*
- *Dished ends and hemispherical ends with nozzles as well as their interactions*
- *Reducers with nozzles as well as their interactions*
- *Circular flat ends and plates with openings*

Further modules are in work or in planning.

PROBAD – American Codes

ASME VIII/1, Div. 1

The PROBAD module 'ASME Section VIII, Div. 1' allows strength calculations of the following parts under internal and/or external pressure:

- *Cylindrical parts with nozzles*
- *Conical shells and ends with nozzles*
- *Dished ends and hemispherical ends with nozzles*
- *Flat unstayed ends with centered nozzle*
- *Dished covers with flanges (spherical dished covers)*
- *Flanges, single and pair, including bolts under internal pressure*
- *Tubesheets for heat exchangers according to ASME*
- *Tubesheets for heat exchangers according to TEMA*

ASME I

The PROBAD module 'ASME Section 1' is used to calculate the strength of the parts under internal pressure:

- *Cylindrical shells with nozzles and nipple fields*
- *Dished ends and hemispherical ends* with nozzles
- *Flat circular and non-circular ends with centered nozzle*

ASME B31.1

The PROBAD module 'ASME B31.1 – Power Piping' includes the following parts for pipes unter internal pressure in plant design and boilers industry:

- *Straight tubes with branches or tees*
- *Elbows and bent tubes*

ASME Materials Database

The PROBAD modules based on the ASME codes is connected to a materials database with approximately 300 ASME steels. Alternatively, either the allowable stresses or the stress values can be defined for a material on the input panels. The ASME-materials database can be evaluated via an Interface-program in form of a DLL by customer's specific programs.

WRC 107

The PROBAD module 'WRC 107' is required for calculating stresses resulting from local loads (forces or moments) on cylindrical shells (attachment forms: circular massive, square massive or tubular) and on spherical shells (attachment forms: circular massive and square massive). Load-case combinations are also possible for individual load-cases, including combinations in line with ASME Section III, Classes 1 and 2.

For tube plugs and nozzles an additional proof of the attachment both in and out of the intersection region can be demanded.

WRC 297

The 'WRC 297' module serves for analyzing nozzle stresses in cylindrical shells and nozzles with or without pad reinforcement resulting from global loads (pressure, longitudinal force,bending moment) and local loads (3-axial forces or moments).

The following calculations are enabled by WRC 297:

- *Re-checking of existing geometries*
- *Design of the shell thickness or of the nozzle and pad thickness one of the force or moment components*
- *Stresses resulting from global/local loads can be analyzed in compliance with the 'AD-S3/0', 'AD-S4', 'BS 5500' codes or on the basis of 'freely defined values'.*

Our Services

We offer a modular solution:

Licensing of the PROBAD modules according to the price list as

- *network licence*
- *single-user-licence*
- *company licences or combined group licences available*

Update services through maintenance contracts. This guarantees an up-to-date documention of calculations.

Further Informations

Fore more information and a personally contact please get in touch with us under:

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