

PROGRAM FOR STRENGTH AND STABILITY CALCULATION OF VESSELS AND APPARATUSES “PASSAT”

The “PASSAT” program is designed for calculation of strength and stability of vessels, apparatuses and their elements for the purpose of evaluation of carrying ability in operating conditions, as well as during testing and assembling process. The program is created for designing, revamping and testing of vessels and apparatuses, as well as for making check calculations of oil-refining, chemical, petrochemical, natural gas, petroleum and other related industries. Program is recommended by Rostekhnadzor (Ref. No. 11-16/2865 dated 06.09.2005).

The program consists of the following modules.

Basic module “PASSAT” calculates strength and stability of horizontal and vertical vessels and apparatuses in accordance with Russian normative documents. A calculation is based on: GOST 14249-89, GOST 25221-82, GOST 26202-84, GOST 24755-89, RD 26-15-88, RD RTM 26-01-96-77, RD 10-249-98, OST 26-01-64-83, RD 26-01-169-89, RD 24-200-21-91 and employs database of Russian materials.

Strength and stability calculation of column vessels taking into account wind and seismic loads is performed via “PASSAT-Columns” module on the basis of GOST R 51273-99, GOST R 51274-99.

“PASSAT-Heat Exchangers” module calculates of shell and tube heat exchangers, including calculation of tubesheets, tubes, pass partitions, shell, expansion bellows, expansion box, floating head.

An additional function provides calculation of nozzle tie-in into shells and dished heads, as well as junctions of string flanges from pressure influence and external loads, in accordance with traditional American and British documents. (“PASSAT-Nozzle” module). A calculation is based on: Strength calculation standards for equipment and pipelines of atomic power plants, ASME Sec.VIII, ASME Sec.II, WRC-107, WRC-297.

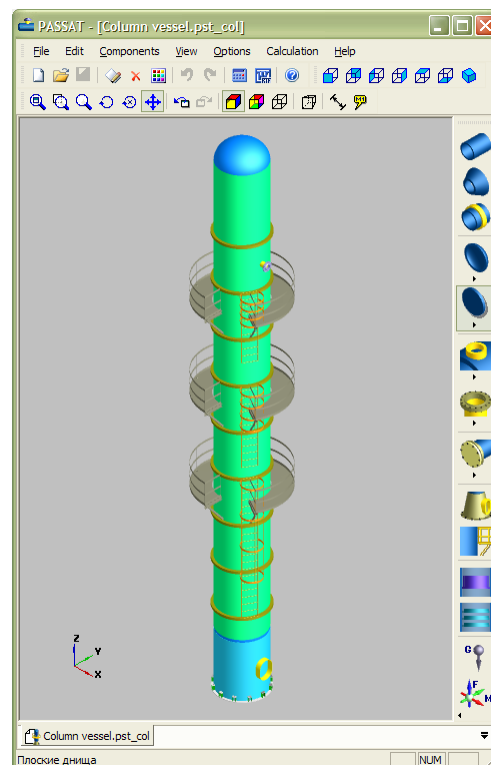
Normative documents and methods used by the program have been brought together and organized in Rostekhpertiza association standard SA 03-004-07, recommended by Rostekhnadzor.

Calculations are made on the element-by-element basis and include the following:

- cylindrical shells (smooth and reinforced by stiffening rings);
- conical transitions;
- welded and detachable heads (spherical, elliptic, torispherical, conical, flat including those with ribs, spherical unbeaded);
- cylindrical shells in places of intersection with saddle supports for horizontal vessels and apparatuses;
- cylindrical shells and heads in places of intersection with supporting lugs and legs for vertical vessels and apparatuses;
- reinforcement of openings;
- tie-ins of nozzles into the shells and dished heads, calculation of nozzle’s fittings;
- flange joints of vessels and apparatuses;
- flange joints of valves and pipelines;
- column vessel elements protection against wind and seismic loads;
- supporting shells and foundations of column vessels.

Functional capabilities of the program:

- automatic estimation of design values such as weight, gauge lengths, characteristics of reinforcing rings (both in cylindrical shells and in saddle supports), circumferences chords lengths, etc;
- estimation of effective thicknesses (including those of external pressure), as well as assumed values for pressure, forces and moments;
- when changing geometrical parameters or loading conditions in the element, an automatic change in adjacent elements of the whole model will occur after a warning — in such a way the model’s integrity is maintained;



- selection of used materials from database with an opportunity of its replenishment, at that allowable stress values of elasticity modulus, etc. are inserted and changed automatically by the program when changing material, temperature or wall thickness;
- flange joint parameters selection from database of standard flanges;
- calculation of apparatuses with arbitrary number of supports, with analysis of movements and series tripping of "out-of-service" supports as per SA 03-004-07 procedure;
- determination of fundamental period of vibration for column vessels with arbitrary number of elements;
- automatic estimation of position and characteristics of the most hazardous cross-section of the supporting shell.

Usability:

- 3D graphic display of geometry with possibility of editing color both for separate elements and for the model as a whole;
- "wire frame" and "transparent" view making possible to see internal elements;
- if a user hasn't entered all data necessary for calculation or has done it improperly, the program would display a warning message until all data is defined;
- Output of loading and displacement diagrams while calculating vessels on saddle supports;
- Output of loading and displacement diagrams while calculating column apparatuses;
- Units setting (SI, ISS, "British", etc.);
- Output, preview and printout of full report based on calculation results of model elements with intermediate calculation results.

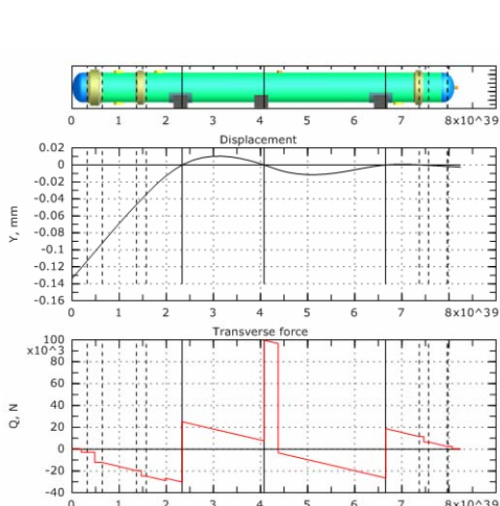
Additional calculation procedures:

- strength calculation of junction point between radial nozzles and vessel (apparatus) as per WRC-107/297;
- Calculation of pressure, external forces, moments and temperature stresses for valves and apparatus flange joints as per RD 26-15-88 and ASME;
- Calculation of loads on supports with taking into consideration weight of exterior and interior elements of apparatus and external loads on apparatus;
- Calculation of oval nozzles;
- Calculation of detachable flat bottoms;
- Calculation of combined skirt supports of column vessels.

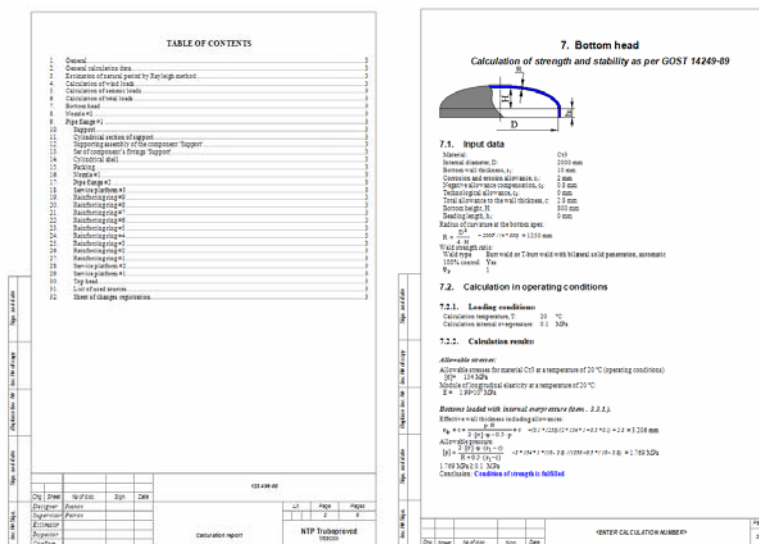
Initial data will be as follows: Type, geometrical adjectives, material of vessel and apparatus's components, type and allocation of supports, test type, loading rates. Selection of features of the materials used is made from the database, which might be corrected and updated by the user.

Calculation results will be issued in the form of complete report on the model's components, including all intermediate calculations, generated in MS Word format as per ESKD.

The program runs in Windows 2000/XP. Minimum PC requirements — Pentium 3 processor; 128 MB RAM, video adapter with minimum resolution 1024x768 and color depth 16 bits or higher.



Force, moment and displacement diagrams.



Parts of calculation report in MS Word.