

-Mechanical

4D



CEA TECHNOLOGY



In this brochure you will find the finest CAE software available in the world, selected for you by CEA Technology.

At CEA Technology, we continuously check the various available software programs for their performance and their user-friendliness.

Therefore, we can guarantee that all programs offered in this brochure are of the best quality.

All of the programs have been extensively tested and are used around the world.

Maintenance, updates and support (MUS) contracts on our programs ensures you of the latest versions and technology, and of the support of our engineers.

What kind of company is CEA?

CEA Technology is a leading software developer for software applications in the field of engineering, construction and Plant Life Cycle Management. CEA has been operating since 1987 and aims its efforts at the process and power industries. Through a carefully selected distributor network, CEA Technology ensures its products are a major force in a great number of industries and countries worldwide.

CEA Technology keeps very close contact with its distributors in order to give the highest level of technical support possible. All of CEA Technology's software is constantly being upgraded in order to work in line with the latest technical and engineering standards, and incorporate user feedback.

What is 4D-Mechanical?

4D-Mechanical is a complete suite of engineering software we offer you for all your process and mechanical engineering purposes.

Beside 4D-Mechanical, CEA Technology has two other major Software Solutions Plant-4D and 4D-Explorer. Plant-4D is CEA Technology's software solution for Plant Design. Plant-4D is used for drawing and design of intelligent P&ID's, Piping, generating isometrics, 2D and 3D drawings and intelligent 4D-models which can be used for concurrent engineering and interactive document management by the 4D-Explorer. For more information, see the special Plant-4D and 4D-Explorer brochures.

CodeX, the next generation in pressure vessel engineering software

CEA Technology supplies a set of programs optimizing and verifying the design of pressure vessels, heat exchangers and columns according to the most applied design codes, such as:

- ASME BPV Codes Section VIII div I & division
- ASME/ANSI B16.5 - pipe flanges and flanged fittings
- EN13445 part 3 and Pressure Equipment Directive (P.E.D.)
- PD 5500, Unfired fusion welded pressure vessels
- AD Merkblätter 2000
- Codap 2005
- Dutch rules for construction of unfired pressure vessels (RToD)
- Standards of the Tubular Exchanger Manufacturers Association (TEMA)
- Welding Research Council WRC107/297
- API 650, API 653, API679, etc.

Most of these design codes are covered by only one software tool: CodeX



The Unique CodeX Features:

- Calculation of minimum wall thicknesses
- Verification and assessment of wall thicknesses due to different design codes
- One complete software package for all suitable design codes
- Calculate the effects of multiple load cases at once
- Design calculations are 1 to 1 exchangeable with other design codes
- Work with one and the same database and report layout through all codes
- Improve designs by an easy determination of optimum values which saves material
- Have an inside view through the miscellaneous screen and calculate alternative designs easily
- Available in English, German, French, Spanish and Portuguese, other languages will be added
- Extensive material database with over 4000 materials for different design codes.

EN13445-3
European rules for construction of
Unfired Pressure Vessels

ASME VIII Div. 1
American rules for construction of
Unfired Pressure Vessels



**CODAP
ESPACE**
French rules for construction of
Unfired Pressure Vessels

TEMA
Standards of the Tubular Exchanger
Manufacturers Association

WRC
Bulletin 107
Bulletin 297

**RTOD
SCADES**
Dutch rules for construction of
Unfired Pressure Vessels

-Mechanical

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CodeX enables you to design pressure vessels, heat exchangers and columns in accordance with several design codes. The following element types and itemized details can be optimized, designed and verified.

ELEMENT TYPES

- Cylindrical shells
- Elliptical, spherical, torispherical, conical and flat heads
- Conical sections, including knuckles
- Body flanges
- Skirts with base ring details
- Tube sheets
- Bolted covers

ITEMIZED DETAILS

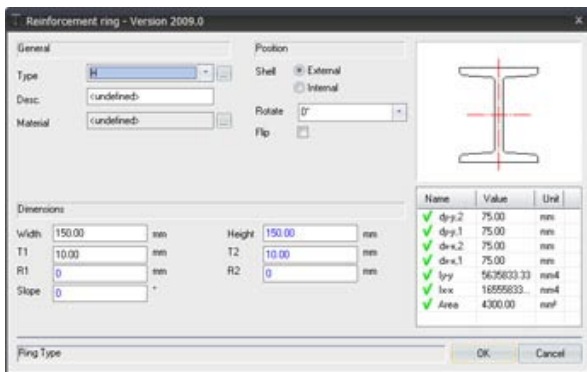
- Stiffening rings
- Nozzles
- Deadweight and applied loads
- Platforms
- Trays and packing details
- Saddles, legs, lugs
- Fluid
- Insulation and lining

base editor

- Create your own databases and use them through all design codes
- Extensive structural steel database for defining ring reinforcements

OUTPUT ACCEPTED BY NOTIFIED BODY

- Show both formulas and final results on the output
- Customize your output and print only the items you need
- Highlight intermediate and final results in red or blue
- Export the output to Microsoft Word
- Define your own report layout and reports titles
- Print input echo, intermediate and final results
- Publish a complete report, vessel summary with centers of gravity, total weights or all details of only parts of your analysis



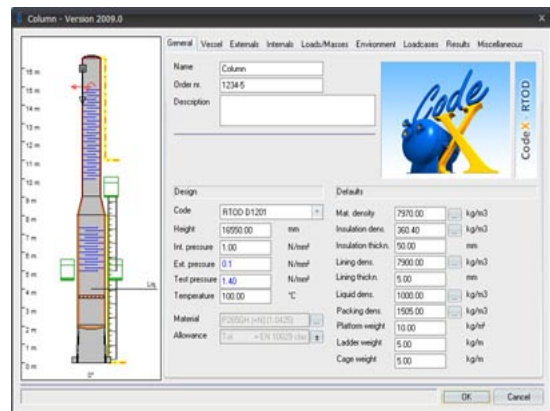
EASY AND USER FRIENDLY INTERFACE

- Graphical interface for fast and efficient modeling
- Requested input values illustrated by screen captures
- Prevent mistakes by a user-friendly input
- Copy and paste elements, design conditions, and other data
- Detect the impact of changed input immediately
- Calculate several alternatives in seconds
- English, SI
- Convenient on-line help

Because all design codes are based on the same core, vessel engineering with the CodeX provides you with one method, one procedure and one layout for all pressure vessel design jobs. Working with the CodeX for all design jobs has the following advantages:

PREVENT MISTAKES BY USING DATABASES

- Extensive material database with over 4000 materials including: Carbon steel, stainless steel, copper, aluminum, etc.
- Material characteristics categorized in different groups for plate and sheet, tubes, forgings, fittings, bolting, etc.
- Search option for finding the right materials
- Additional databases available for heads, pipes, flanges, gaskets and bolts
- Add existing databases with your own data through a data-



Rules for pressure vessels according to ASME VIII

Based on CodeX, ASMEquipment is a powerful, easy-to-use software program that provides engineers, designers, estimators, fabricators and inspectors with complete design capabilities of horizontal vessels, tube sheets and columns. ASMEquipment can be used for a complete vessel or individual component analysis.



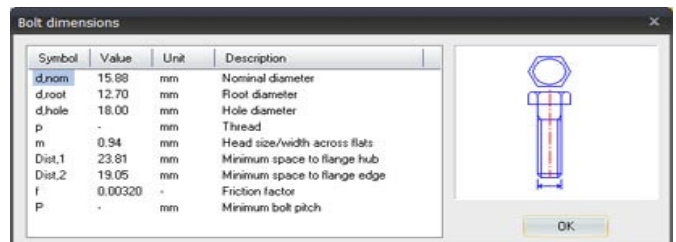
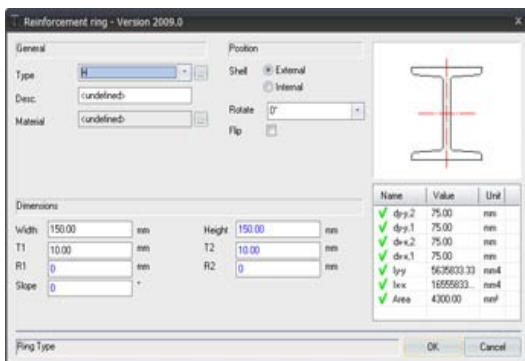
Whether it is a quick check on wall thickness or a comprehensive evaluation of an entire vessel, this software makes design and analysis accurate and fast. ASMEquipment is divided in the following modules:

MODULE I - PRESSURE VESSELS

UG-27 Cylindrical, conical, spherical shells and pipes under internal pressure and stiffener rings
Detailed calculation facilities of stiffening rings, area of reinforcement and moment of inertia:

- Stiffening ring recommended automatically when needed
- Following ring types:
 - flat bar
 - section of two equal leg angles
 - equal leg angle L bar
 - unequal leg angle L bar
 - I-beam/wide flange
 - structural tee
 - user-defined shapes
- optimum ring spacing easily determined
- individual rings sized automatically
- use of material different from shell allowed
- flipped and rotated rings allowed

- UG-32** Knuckled heads with pressure on the concave side
- UG-32/UG-33** Cylinder - cone junction without knuckle
- UG-28** Cylindrical, conical, spherical shells and pipes under external pressure
- UG-33** Heads with pressure on the convex side
- UG-36-42** Openings in curved walls



UG-44

Flange connections:

- ring type integral
- ring type full face gasket
- ring type loose
- weld neck integral
- slip on integral
- lap joint loose
- split loose
- reverse
- pad type
- slotted design
- body flange design
- minimum bolt circle and diameter calculated
- imposed moment considered
- imposed radial force considered

Horizontal cylinder on saddle supports

UG-22

Local loads

MODULE II - HEAT EXCHANGERS

UG-32/UG-33

Dished covers under pressure on the concave and convex side

UG-34

Unstayed flat walls, openings in a flat wall

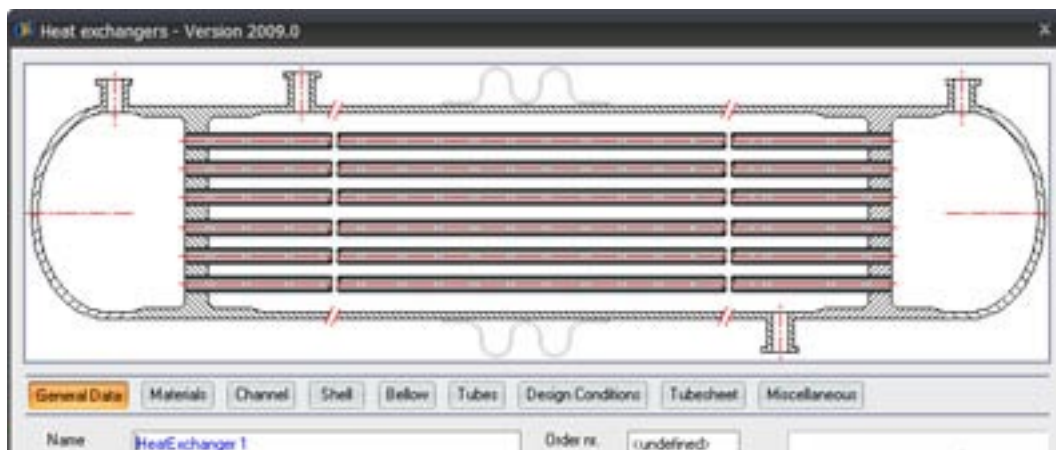
App. AA1

Tube sheets, one circular with U-tubes or bayonet tubes

App. AA2

Tube sheets, two fixed, circular tube sheets

Tube sheets, two circular tube sheets, one fixed and one floating ASME tube sheets are 1 to 1 interchangeable with tube sheets designed in other codes like TEMA tube sheets, EN13445-3, Codap2000, AD2000 and RTOD.



Rules for pressure vessels according to EN13445-3

Module EN13445 is a powerful and easy-to-use software program that provides engineers, designers, manufacturers and inspectors with complete design capabilities for horizontal vessels, heat exchangers, towers and individual vessel components, all in accordance with the P.E.D. for design code EN13445.

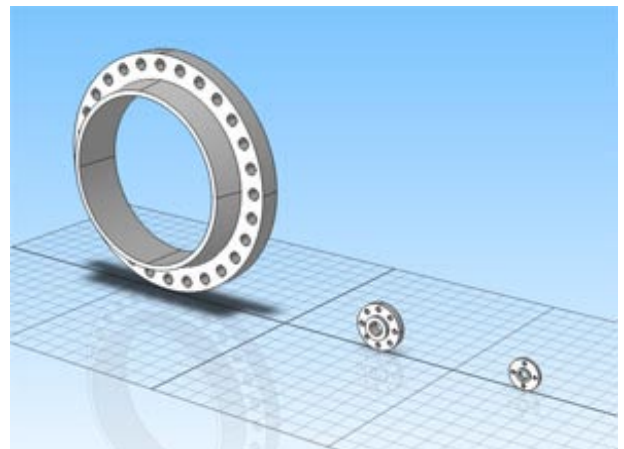
ONE COMPLETE SOFTWARE PACKAGE FOR EN13445:

Module EN13445 is the first complete software package for designing vessels, heat exchangers and towers under the EN13445 part 3. The software is divided into three different sub-modules:

EN13445-3
European rules for construction of
Unfired Pressure Vessels

MODULE I - PRESSURE VESSELS

- C.7 Shells under internal pressure (cylinders, heads, cones and spheres)
- C.8 Shells under external pressure (cylinders, heads, cones and spheres)
 - Ring reinforcements for external pressure
 - Both internal and external reinforcements
 - Flipped or rotated ring reinforcements
 - Ring database for rectangular solids, rectangular hollows, L-bars and T-bars.
- C.9 Nozzles on cylinder, cone, head, flat cover, bolted cover, sphere and combined nozzles
 - 9.5 Isolated and openings in shells
 - 9.6 Multiple openings (groups of openings)
 - 9.7 Openings close to a shell discontinuity
- C.10 Flat heads
 - Types: Circular, elliptical, rectangular and annular plate
 - Edges: welded uniform hub, welded directly or welded relief groove bolted narrow face gasket and bolted full face gasket
 - 10.4 Unpierced circular flat ends welded to cylindrical shells
 - 10.5 Unpierced bolted circular flat ends
 - 10.6 Pierced circular flat ends
 - 10.7 Flat ends of non-circular or annular shape
- C.11 Flanges
 - 11.5 Narrow face gasketed flanges
 - 11.6 Full face flanges with soft ring type gasket
 - 11.7 Seal welded flanges
 - 11.8 Reverse narrow flanges
 - 11.9 Reverse full face flanges
- C.12 Bolted domed ends
 - 12.5 Bolted domed ends with narrow face gaskets
 - 12.6 Bolted domed ends with full face joints
- C.16 Non-pressure loads, saddles and supports
 - 16.8 Horizontal vessels on saddle support



C16/C17 ADDITIONAL NON-PRESSURE LOADS AND FATIGUE ANALYSIS

- 16.4 Local loads on nozzles in spherical shells
- 16.5 Local loads on nozzles in cylindrical shells
- 16.6 Line loads
- 16.7 Lifting eyes
- 17 Simplified assessment of fatigue life

MODULE II - HEAT EXCHANGERS

- C.13 Heat exchanger tube sheets covering the following types:

- U-tubes
- Fixed tube sheets
- Tube sheets with floating heads
- Immersed floating heads
- Internally sealed floating heads
- Externally sealed floating heads

Special features of module II:

- 1 to 1 exchangeability with tube sheet calculations made in other design codes
- Save, reload and run multiple load cases at once
- Automatic calculation of the spring rate of the bellows and the number of tubes
- Calculate several alternatives in seconds

MODULE III - COLUMNS AND VERTICAL VESSELS

- C.16 10-14 Design and calculation of vertical vessels and large towers, including:

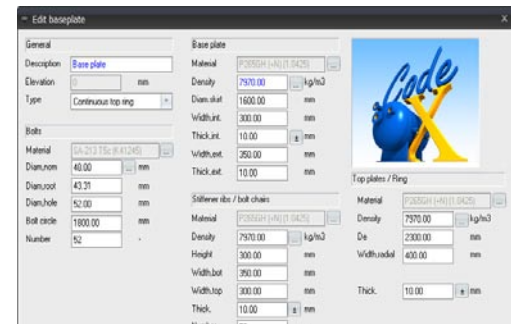
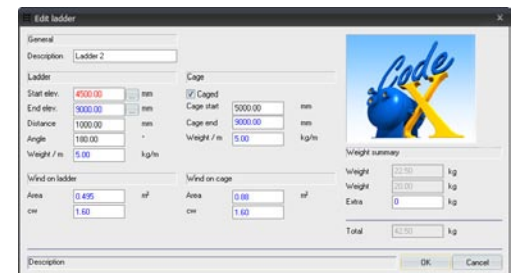
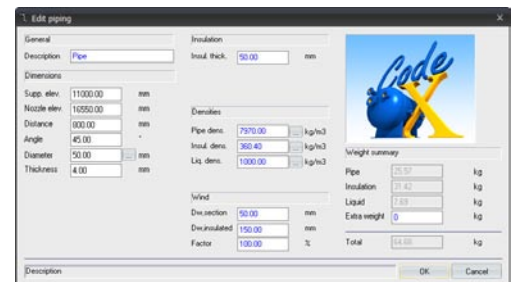
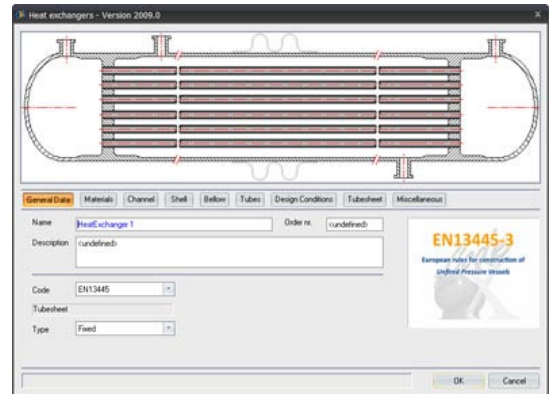
- 16.10 Vertical vessels on bracket support
- 16.11 Vertical vessels with leg support
- 16.12 Vertical vessels with skirt support
- 16.13 Vertical vessels with ring support
- 16.14 Global loads, tall tower analysis including any combinations of external loads like: wind, seismic, internal & external pressure, weight, etc.

Additional features:

- Calculations of trays, stairways and piping and packing beds
- Design of base plate and anchor bolting
- Calculation of effects from global and local loads like mass and external moments
- Earthquake and wind calculations
- Local loads and masses

Extra functionality for the EuroEquipment Columns and vertical vessel module:

- 1 to 1 exchangeability with calculations made in other design codes
- Save, reload and run multiple load cases at once
- Calculate several alternatives in seconds



Rules for pressure vessels according to British Standard; PD5500

This software package performs design and compliance of pressure vessel calculations according to the British Standard, PD5500.

The major advantages:

- 1. Saves Time** - Average time saving of 90% on the time taken to carry out the equivalent hand calculations. Results are presented in a format suitable for direct presentation to client or insurance authority and is recognized and accepted by all leading insurance companies and certifying authorities.
- 2. Improves Accuracy** - computer programs, unlike humans, perform calculations in a consistent manner and once validated, produce consistently accurate results. This consistency also avoids the omission of additional checks required by design codes, easily omitted when carrying out hand calculations, particularly when incorporating design changes.
- 3. Allows Design Optimization** - the speed with which the effect of design changes can be assessed, allows the designer to try several design iterations and minimize material costs.

The software performs design and compliance calculations in accordance with BS5500. A database of material stresses for both codes is provided as an integral part of the package and a dedicated team of software and vessel engineers supports its users. The software provides the following design facilities:

- Design of barrels, dished ends and cones for INTERNAL pressure
- Design of barrels, dished ends and cones for EXTERNAL pressure
- Flange design - Reinforcement of openings
- Stresses due to local loads on shells
- Stresses induced by saddle or ring supports on horizontal vessels
- Wind and earthquake loadings on vertical vessels
- Out of roundness of cylindrical shells (BS5500)

Optional:

- FDA5 (British Standard flange design)
- TSD5 (British Standard tube sheet design)
- TSL5 (British Standard tube sheet layout)



Rules for pressure vessels according to AD-Merkblätter; AD2000

AD 2000 is a software tool selected for people who are involved with the design of pressure vessels, heat exchangers, storage tanks and plants according to the AD-Merkblätter 2000. This piece of engineering software is suitable for both vessel design and component analysis. AD-2000 is also calculating geometric properties such as volumes and centers of gravity and a direct transfer of design data, thus speeding up the complete design process.

Calculation can be according to the following rules:

AD-Merkblätter - Series B

- B1/B9 Cylindrical/spherical shells with openings
- B2/B9 Conical sections with openings
- B3/B9 Formed heads with openings
- B4 Bolted heads - B5 Flat ends and plates
 - Flat ends and plates with/without marginal moment
 - Tubesheets with flanged extension
 - Round fixed tube sheets
 - Round U-tube tube sheets
 - Round floating tube sheets
 - Round tube sheets (fixed with expansion joint)
 - Flanged extensions of tube sheets
- B6 Shells under external pressure
- B7/B8 Flange connections (DIN V2505 included)
 - Slip on flanges
 - Welding neck flanges with/without
 - Loose type flanges calculation
 - Full faced flanges of bolts
 - Reverse flanges
- B9 Reinforcement of adjacent openings
- B10 Thick walled cylinders
- B13 Single/multiple-ply bellows expansion joints

AD-Merkblätter - Series S

- S3/0 Basic Principles (load evaluation not included!)
- S3/1 Vessel on plinths (skirt support)
- S3/2 Horizontal vessels on cradles (saddle support)
- S3/3 Vessels with dished ends on feet (leg support)
- S3/4 Vessels with supporting lugs (brackets)
- S3/5 Vessels with toroidal support
- S3/6 Vessel with connections under additional load

Rules for pressure vessels according to Codap; Formerly known as Espace

A program for the design and verification for (parts of) pressure vessels, heat exchangers and columns according to the French rules of Codap.

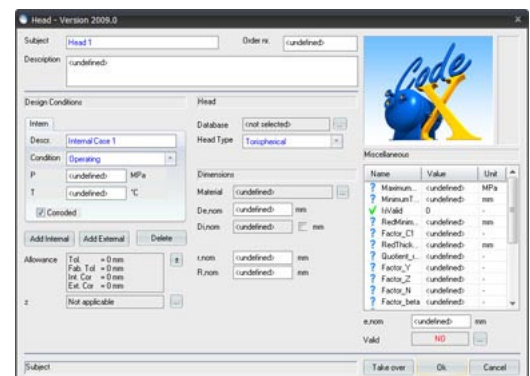
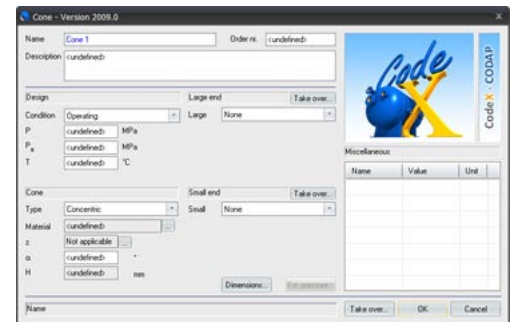
Advantages of CodeX:

- Determine the optimal wall thickness, which will save material
- Quick results and a printout which is accepted by a notified body
- Alternatives can be calculated easily by changing the input
- Both design and verification calculations are possible
- Prevent mistakes by using databases for materials, pipes, flanges, boltings and gaskets
- Interactive screen handling
- Graphic display of nozzle placement on cylinders, heads and cones
- Graphic charts of the material characteristics



Module I Pressure Vessels

- Cylindrical wall under internal pressure (C2.1)
- Conical shells under internal pressure (C2.3)
- Cylinder/cone attachment (sharp-edge and toriconical) (C2.3)
- Heads under internal pressure: NF E 81-102 (GRC, NF E 81-103), elliptical, torispherical, hemispherical, klöpper and korbogen (C3.1)
- Flat heads and dished covers under internal pressure (C3.2/C3.3)
- Cylindrical and conical walls and heads under external pressure (C4)
- Design of stiffening rings for cylinders and cones
- Isolated openings (C5)
- Combined openings (C5)
- Flanges (bolted) (C6)
- databases for flanges and bolts
- Support for horizontal vessels (C9.1)
- support design including design of supporting rings



Module II Heat exchangers

•Heat exchangers (C7), U-type, floating head and fixed tubesheets

- tubesheet calculation
- calculation of flanged tubesheet extension
- including bolting and gasket database

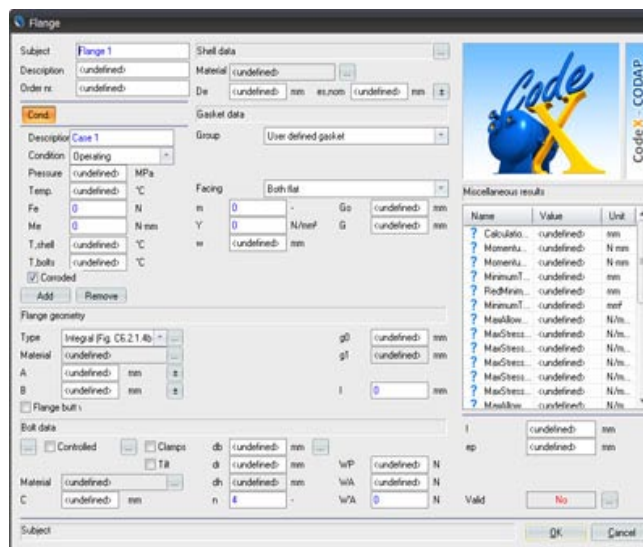
Module III Columns and skirts

•Vertical pressure vessels (C2)

- design and verification of columns
- piping, packed beds, trays, platforms, ladders and external forces
- wind and snow loads
- calculation of critical frequency and seismic influence
- calculation of skirt and anchor plate

•Material database

- including over 800 materials
- including mechanical and physical data related to temperature and thickness



Rules for pressure vessels according to RTOD, formerly Scades

SCADES is the software tool for designing, optimizing and verifying parts of pressure vessels, heat exchangers and columns according to the Dutch Government Rules, in the market known as the Stoomwezen Rules. Scades exists of the following modules:

Module I Pressure vessels

Calculations according to:

D0201	Cylindrical, conical, spherical shells and pipes under internal pressure
D0203	Knuckled heads with pressure on the concave side
D0207	Cylinder - cone junction without knuckle
D0301	Cylindrical, conical, spherical shells and pipes under external pressure
D0303	Heads with pressure on the convex side
D0501	Openings in curved walls
D0701	Flange connections
D1105	Horizontal cylinder on two saddle supports
D1141	Local load

Module II Heat exchangers

Calculations according to:

D0205/D0303	Dished covers under pressure on the concave and convex side
D0401/D0503	Unstayed flat walls, openings in a flat wall
D0403	Tube sheets, one circular with U-tubes or bayonet tubes
D0404	Tube sheets, two fixed, circular tube sheets
D0405	Tube sheets, two circular tube sheets, one fixed and one floating

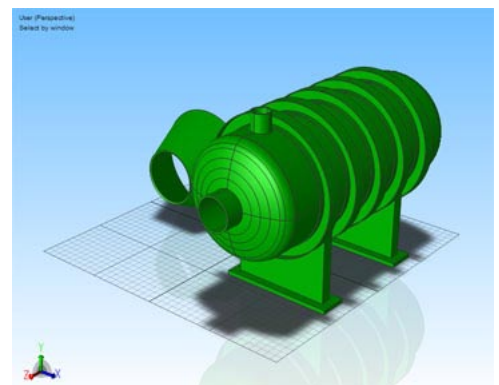
Module III Columns and skirts

Calculations according to:

D1201	Vertical pressure vessels
D1301	Skirt, supporting a vertical pressure vessel
D1302	Anchorage with a circular base ring

Additional features of Scades:

- interactive material database containing 1000 materials
- comprehensive report is prepared by the program
- report is suitable for submission to a certifying authority
- interactive screen handling which offers the possibility to calculate several alternatives in seconds

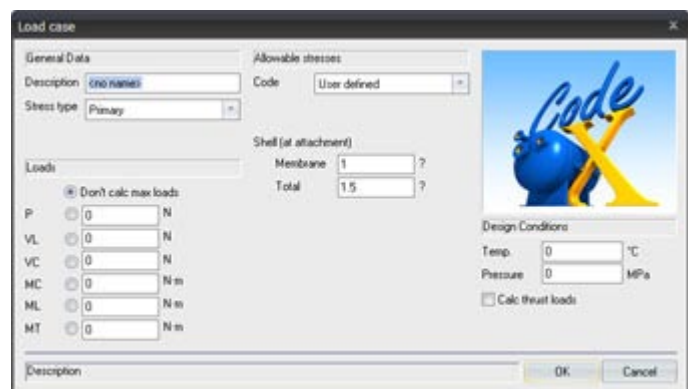
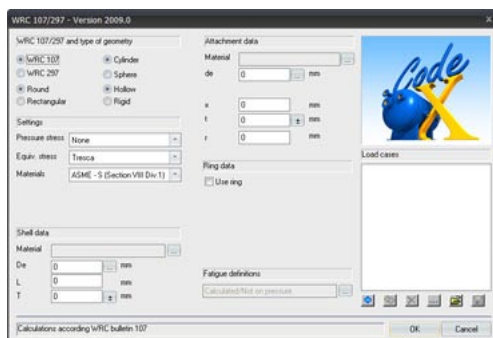


Calculations according to WRC Bulletin, WRC 107/297

WRC107/297 is an engineering software tool for calculation of local stresses on heads and cylinders due to external loads on nozzles. An ultimate software solution to prevent and safeguard the vessel from being overstressed due to sustained and/or thermal loading from the piping system.



- Calculate maximum allowable loads, which gives the possibility to analyse a given situation with an unknown factor (force or moment)
- Both design and analysis mode, creating the advantage to be flexible
- Allowable stresses according to ASME section I DIV 1 and DIV 2, Codap, BS5500 and RToD. Calculate according to the material database of the American, French, British and Dutch allowable stresses
- Stresses due to pressure can be calculated in several ways, giving you a powerful tool to use different methods to calculate pressure stress (e.g. Nominal, Farr and ASME)
- Automatic calculation of stresses at reinforcing pads, no additional calculations necessary
- Extensive material and piping database, pick a material from the powerful database, these material data will be carried forward into the program
- View the WRC curves/charts
- Modify values from the curves, WRC program uses the curves defined by WRC
- Modify these values so that user-defined calculations are possible
- User-defined load case database for standard load cases, a set of load cases can be stored
- Fast access to common load cases, which gives uniformity and speed to the calculations
- Calculate multiple loadcases at once
- Two methods of calculating equivalent stresses (Tresca/Von Mises), making the program usable according to the two equivalent stress methods. This feature will give the user many more possibilities and flexibility
- Both SI and Metric units



Pipe Stress® Engineering

In this part CEA Technology offers you a professional solution for a combination of piping design and pipe stress engineering, the analysis and design of pipe specs and piping components.

4D Pipestress®, a unique solution for piping and pipe stress engineering

4D Pipestress® is an integrated software solution for piping design and pipe stress analysis. In this product, two professional engineering solutions - Plant-4D and Triflex Windows® - are merged into one unique product. Plant-4D users can import their piping designs into Triflex Windows®, to do a stress analysis and Triflex Windows® users can import their stress models into the Plant-4D environment to generate the design drawings. The complete integration of piping design and pipe stress analysis ensures a cost reduction of 50% with handover data from pipe stress analysis to piping design and vice versa. Furthermore, the generation of 2D and 3D drawings, automatic generation of isometrics and bills of materials are time saving and failure preventing benefits.

Triflex Windows®, the fast growing standard for pipe stress engineering

Triflex Windows® is the 'engine' for the pipe stress analysis part in 4D Pipestress®. Triflex Windows® is the fast growing standard for pipe stress engineering and has the following features and benefits:

- Advanced graphics and modeling features for faster model input
- Automatic handling of skewed piping with restraints and mitered elbows
- Code to midpoint of valves & flanges
- Multiple restraint directions can be entered on the same data screen as geometry & physical properties
- Multiple in-line pumps and modeling of jacketed piping
- Anchor element allows different stiffness in all directions on one screen with option to automatically calculate anchor displacement
- Built-in buoyancy with offshore riser design code
- ASME Section III analysis for calculation of nozzle & branch connection stress & flexibilities
- Stress Intensification Factor (SIF) & flexibility factor equations included in analysis
- Filters allow for effective sorting of output data, sorting accomplished by double-clicking on the column headers that the user wishes to sort
- Nozzle release option at equipment connection for spring hanger sizing
- Tilt Option - allows for skewing of directional restraints, limit stops and friction
- Calculate the distance between any two nodes
- Both SI and Metric units
- Multiple job batch processing
- Factor (SIF) calculator and library
- Cold spring elements
- Bend/intersection Stress Intensification
- Automatic buried pipe modeling
- Extensive On-Line help

Static Analysis Capabilities

Triflex Windows® can perform static analysis and has the following special capabilities for this:

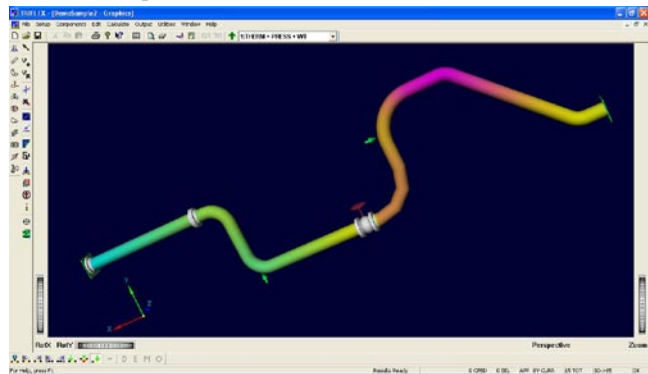
Interactive Graphics and List Editing Input Format

Lets you view and edit data in a multiple element spreadsheet. This format is often preferred because of its block-edit features such as Rotate, Duplicate, Mirror, Delete and Node Renumbering.

Wide Selection of Restraint Types

Triflex Windows® provides the widest range of support types for boundary conditions:

- Anchors with or without displacements
- Single or double acting translational
- Single or double acting rotational
- Translational with bi-linear stiffness
- Snubbers
- Guides and limit stops
- Bottomed-out springs
- Tie rod assemblies
- Gaps and friction
- Connecting nodes for nodal interdependence
- Large rotation rod supports



Extensive Spring Hanger Selection Options

Triflex Windows® include extensive built-in manufacturer catalogs for hanger selection. This permits hanger selections to multiple thermal cases and standard or extended load ranges. It selects the appropriate spring support based on a variety of operating and installation conditions.

Extensive User-modifiable Material, Flange and Valve Databases

- provides a comprehensive database with temperature-dependent allowable stresses included
- Include built-in length and weight information and provides the ability to add your own data

ASCE Wind Load Generation

Applies and analyses wind load according to American Society of Civil Engineers (ASCE) #7

Thermal Bowing

Provides consideration of thermal gradient effects

Structural Steel Modeling Triflex Windows

includes the capability for modeling structural steel and the use of structural steel databases from many international standards.

Dynamic Analysis Capabilities

Triflex Windows® has the ability to perform dynamic analyses based on different forms and theories. The following types of dynamic analyses can be performed and visualized in Triflex Windows®.

- Mode Shape and Natural Frequency Calculations
- Harmonic Forces and Displacements
- Shock Spectrum Analysis and Independent Support Motion
- Force Spectrum Analysis
- Modal Time History Analysis
- Animation of Dynamic Response
- Static/Dynamic Load Combinations
- Relief Valve Load Synthesis and Force Spectrum

Supported Piping Codes

Triflex Windows® can do Code Compliance with the following piping codes: **B31.1** - ASME Power Piping Code; **B31.3** - ASME Process Piping Code; **B31.4** - ASME Pipeline Transportation Systems for Liquid Hydrocarbons and Other Liquid Codes; **B31.5** - ASME Refrigeration Piping and Heat Transfer Component Code; **B31.8** - ASME Gas Transmission & Distribution Systems Code (DOT Guidelines); **NAVY** - US Navy - General Specifications for Ships, Section 505; **CLAS2** - ASME Section III - Division 1 (Subsection NC) - Class 2; **CLAS3** - ASME Section III - Division 1 (Subsection ND) - Class 3; **SPC1** - Swedish Piping Code (Method 1, Section 9.4); **SPC2** - Swedish Piping Code (Method 2, Section 9.5); **TBK** - Norwegian General Rules for Piping Systems (Section 10.5); **DNV** - (Det Norske Veritas) - DNV for Submarine Pipeline Systems, 1981; **DNV** - (Det Norske Veritas) - DNV for Submarine Pipeline Systems, 1996; **OS-F101** - Rules for Submarine Pipeline Systems, 2000 (Alternative); **NPD** - Submarine Pipe and Risers, 1984 Norwegian Petroleum Directorate; **STOL** - Design Specifications, Offshore Installations F-sd-101 Statoil; **POLI** - Polska Norma PN-79 / M34033 Steam and Water Piping; **SNIP** - 2.05-06-85 FSU Transmission Piping Code; **BS7159** - British Standard Code for Glass Reinforced Plastic Piping; **BS8010** - British Standard Piping Code; **UKOOA** - UK Offshore Operator Association; **RToD** - Dutch rules for pressure vessels, known as Stoomwezen® rules; **EURO** - European Standard EN 13480-3; **Z662** - Canadian Gas Transportation; **RCC-M** - Section C & D - French Nuclear Power; **CODETI** - French piping code; **FDBR** - German piping code; **IGE/TD/12** - UK Gas

Rotating Equipment Compliance Reports

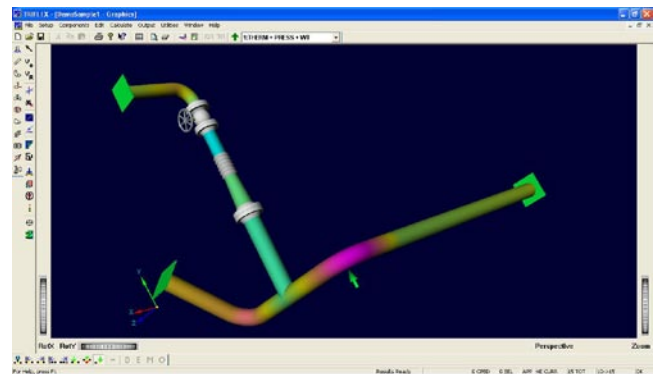
Triflex Windows® can generate the following rotating equipment compliance reports:

- NEMA SM/23 - rotating equipment report
- API Std. 617 - centrifugal compressors
- API Std. 610 - centrifugal pumps
- NEMA SM23 - steam turbines
- NEMA SM24 - steam turbines
- ROT - user customized report using vendor supplied allowable
- Filters allow for effective sorting of output data

Output & Analysis Reports

Triflex Windows® output modules provide you with interactive flexibility:

- Code compliance report with minimum wall thickness
- Forces and moments
- Graphic animation
- Mod shapes and frequencies animation
- Orient, locate, zoom, move and rotate with node data and elements displayed
- Deflected shapes & color-coded stress for display or print
- Individual load case listings of displacement
- Local forces and moments
- Graphics which show displaced shapes, forces, moments, stresses and animated motions



Import/Export Capabilities

- Triflex has input interfaces for Plant-4D, Intergraph PDS, PDMS for geometry and physical properties transfer - Triflex can export to Excel format or tab-delimited TXT files as well. This allows database applications such as Access or ORACLE to import the results directly from 4D Pipestress® into their proprietary format (column header names are also exported)
- Triflex has the ability to import files from other frequently used pipe stress solutions like Caesar II - Graphics can be exported to high-quality image files in the JPEG, BMP and PS (PostScript) format
- Triflex can export directly to PCF. These files can be read by I-Sketch and then converted to any other format that is available - Triflex can export the 3D model of your piping system to any program that can read the DXF format

Engineering software for storage tanks

TRI*TANK650

TRI*TANK650(tm) designs or re-rates cylindrical tanks with sloped or flat bottoms in accordance with API 650 Standard, 'Welded Steel Tanks for Oil Storage', 8th, 9th or 10th editions. Wind and seismic loads can be applied in the re-rating or design modes and the allowable criteria of several different wind and seismic standards can be applied.

Applications

- Provides technical compliance and documentation for regulatory authorities
- Designs new tanks and re-rates existing tanks
- Calculates shell plate thickness and weights

Advantages

The advantages of using these programs include:

- Saves time and costs in meeting technical compliance and documentation for regulatory authorities
- The reliability of design calculations is greatly improved
- Assists in standardization of the design process and procedures through the use of a proven engineered template approach to the design process
- Decreases the amount of time required for tank design by adding 'what-if' design and re-rating capability
- Enhances productivity by evaluating alternative tank designs prior to fabrication Output
- Shows API equations with variable defined and substituted for engineering verification
- A summary page for each major set of calculations is presented showing calculated values of shell design, wind loads, etc. - Find feature allows the user to go to desired location(s)
- All Output reports can be browsed, printed and exported to HTML or TXT files

Capabilities

- Calculates thickness using variable design point method, one-foot methods and methods stated in Appendix A & F of API Standard 650
- Provides option to use roof design guidelines from either API Standard 620 or 650 for conical, domed and umbrella roofs - Provides optional sloped or flat bottoms
- Provides wind loading per ASCE 7-93, NBC (Canada), UBC, API Standard 650 or user-defined wind load
- Provides seismic loading per API Standard 650 or NBC code requirements
- Calculates tank stability for wind & seismic loads
- Includes API Standard 650 Appendix M for design & rating of tanks up to 500 °F
- Considers internal pressure per API Standard 650 - Calculates uplift for forces & moments for chair design
- Optimizes the number & size of anchor bolts required by using built-in anchor bolt material properties
- Calculates minimum wall thickness of nozzles. - Performs re-pad calculations in accordance with the API 620 & 650 Standards - Calculates cross sectional area required for roof compression rings & wind girders
- Provides the ability to re-rate or to design shell stiffening rings per API Standard 650
- Provides built-in API Standard 650 material database that can be supplemented by the user for nonstandard materials
- Calculates MAWP & maximum liquid heights for each pressure bearing component when re-rate option is selected
- Enables the user to specify different heights for each course
- Considers ladders, platforms, stairways, stiffening rings, insulation weight, wind and seismic calculations

Software for pipe class design

CEA Systems supplies software for pipe specs and design of piping components according to ASME/ANSI and other design codes.

MAR

Piping system component program according to ASME/ANSI

These programs have the following features:

- a powerful tool for pipe class design
- the program designs or verifies piping system components
- components are pipes and stubons
- program calculates sizes, MAWP and maximum allowable testing pressure
- program uses databases for materials and pipe schedules, ANSI flange rating and branch tables
- program can handle large number of components
- input is possible by means of a neutral file
- calculation is possible for a large number of different design conditions in one run
- the program can be an important aid for establishing the pipe class in piping systems
- with the program DEM, user may define his own pipe size and schedules and material databases

MSR

Piping system component program according to RToD

These programs have the following features:

- a powerful tool for pipe class design
- the program designs or verifies piping system components
- components are pipes, elbows, reducers, caps and branches like tees, weldolets and stubons
- program calculates sizes, MAWP and maximum allowable testing pressure
- program uses databases for materials and pipe schedules, reducers and bends
- weldolets, tees, caps, ANSI flange rating and branch tables
- program can handle large number of components
- input is possible by means of a neutral file
- calculation is possible for a large number of different design conditions in one run
- the program can be an important aid for establishing the pipe class in piping systems
- with the program MDE, user may define his own pipe size, schedules and tees
- reducers, weldolets and material databases

MDE, DEM

Software which allow you to build your own databases in MSR and MAR for:

- materials, pipes, elbows, reducers, stubons, tees, weldolets and caps

Finite Element Method for piping and vessels, FE/PIPE

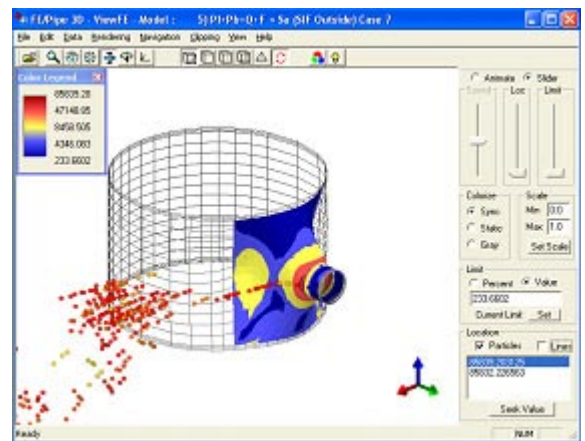
FE/Pipe is a specialized finite element program developed for the piping and pressure vessel markets. It was created for the engineer who does not have time to work with a general-purpose FEA program. The primary focus of FE/Pipe development is to create a software package that quickly and easily allows modeling of complex structures using standard design geometries. FE/Pipe is a rapidly developing program, currently in use at 300+ companies analyzing simple nozzle geometries to the world's largest vacuum tower. FE/Pipe Templates allow users to custom design and analyze job specific structures without the need of learning finite element theory. FE/Pipe is a feature rich software package and each month more customers discover how they can benefit the use FE/Pipe. The current FE/Pipe features are listed below:

- Automatic calculation of allowable loads on nozzles. FE/Pipe generates a table of allowable loads on any nozzle. The table includes the maximum individually and the maximum simultaneously applied value of the load.
- TRIFLEX interfaces that allow beam models to be read into the FE/Pipe beam analyzer and to interact with FE/Pipe shell models.
- A Standard lifting lug design calculator is included that recommends the size of lifting lug, the amount of weld required and whether a brace or strong back is required to reduce the moments on the lug.
- An axisymmetric/plane stress/plane strain model template which provides ASME code throughthickness integration for calculation of section membrane and bending stresses.
- An automatic fixed tube/tube sheet axisymmetric modeler that provides cross section stress integrations, stress break-downs according to primary or secondary stress calculations and autogenerated angle, cross or tee shapes with optional radiuses. Also tube sheet allowable stress according to ASME VIII div.1 App. A Finally, tube allowable loads according to TEMA RCB 7.24.
- Input in the nozzle/plate, and cylinders-heads-plates template which allows the user to include the effects of varying fluid elevations to properly simulate the effect of fluctuating pressure with depth, this is required for simulating the Zick saddle analysis.
- Rotation of databases allows all intersection models to be oriented in the global coordinate system and included with other multiple nozzles or straight head bend models.
- Input and analysis for simplified code guidance for plasticity and creep.
- Harmonic excitation analysis of shell structures such as acoustic bottle vibration studies and wind dynamic calculations.
- Pressure stiffening analysis giving users the effect of pressure on SIFs (Stress Intensification Factors) and stiffness at nozzle intersections.
- AISC Structural steel database allowing users to model angles, double angles, channels and tee geometries.
- Symmetric and non-symmetric brick models that analyze flanges and bolts with external moments.
- Spherical shell models that include options for non-penetrating tank legs and crown caps.
- Shell modeling with an option to auto-connect beam endpoints to closest shell model.
- Gussets can be added to reinforce nozzles for simulation of plastic rib reinforced nozzles and mixer nozzle supports.
- Header, shell and pad modeling with alternate plate meshing to improve large plate constructions, SIFs and stiffness for run moments through the header and individual close plate surface joining.
- Oval miter section modeling options and straight edge miter sections.

Nozzle/Pro

Nozzle/Pro is designed specifically for the instances where excessive conservatism or dangerous designs might result from dated and often inadequate, simplified techniques. Nozzle/Pro is 'sharpening the pencil' and eliminating uncertainty in a calculation. In cases where WRC 107 estimates a result within plus or minus 150%, Nozzle/Pro can and will produce a result within 15%.

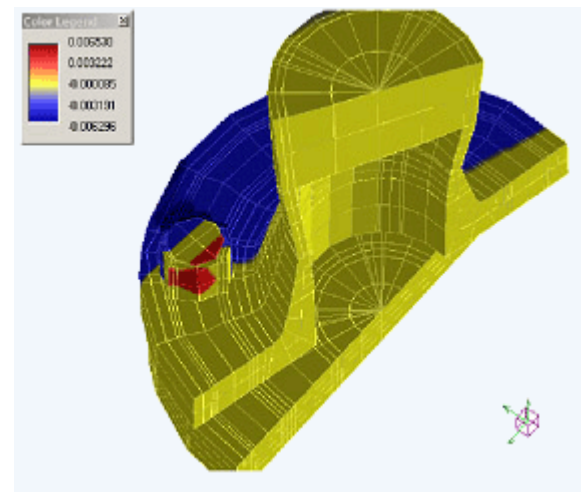
- Nozzle/Pro is easier to use and far more accurate than WRC 107
- Nozzle/Pro produces stresses in straight, pad reinforced or barrel reinforced nozzles, and structural attachments in spherical, dished, elliptical, flat or conical heads and cylinders using the finite element method
- Nozzle/Pro is also automatically used by Compress, PV Elite, Code Calc and Central Project Manager. If you have one of these products, you can automatically produce finite element results using Nozzle/Pro
- Nozzle/Pro produces 3D-models and 'inspector ready' reports in an easy to read HTML format that can be reviewed by anyone with an Internet browser



AXI Pro

AXI/Pro is a powerful, easy to use axisymmetric and brick finite element modeler. Bolts, nuts and holes may be included in the 3D brick models so that users can see the results of hole spacing on the stress distributions. Dimensionally accurate flange models including studs and nuts are generated automatically for six major flange standards.

- Predicts liquid or gas leakage through the flange when subject to external loads, pressure or loose bolts
- Has ANSI, API and DIN flange dimensional data base
- Performs an ASME Appendix 2, BFJ, EN 13445 Annex G (European rules) and FEA compliance checks on flanges
- Determines best suited bolt-up method for the leak tightness needed
- Predicts yearly total leakage reports for a series of flanges so that OSHA or DOT compliance report evaluations can be prepared
- Analyzes stresses in the flanges and bolts according to a 3D: FEA analysis, ASME Appendix 2, BFJ and EN13445 Annex G
- Evaluate the effect of loosening a single bolt or series of bolts
- Analyze large heat exchanger flanges with any number or bolts

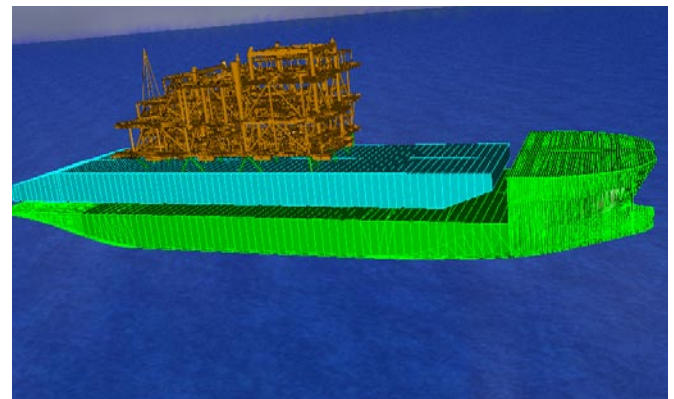
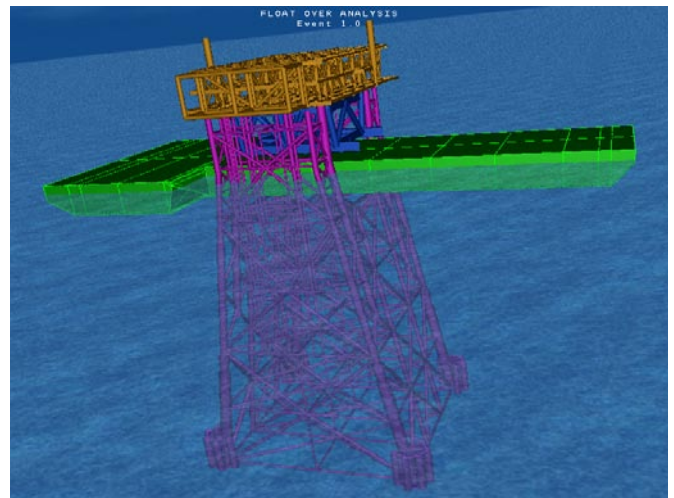


MOSES

Moses is a general purpose simulation program for the analysis of almost anything which will be placed in the ocean. It has many features, not all of which everyone needs to accomplish their task. As a result, there are several different capabilities of MOSES which can be bought separately.

General Capabilities

- Powerful command language enables the user to create macros and take advantage of the modeling capabilities.
 - MOSES is a complete offshore engineer's toolbox. It offers the flexibility to create new models, document them, and assess their validity - all with one single program.
 - Looping Options - Blocks of data can be entered automatically, rather than manually.
 - Conditional Execution - Routines that execute only when data changes.
 - Variable Definitions - specific data can be defined as a variable which can then be plugged into other models or used in later operations.
 - Macro Capability - user-defined macro mean commands do not have to be repeated.
 - Model Generation of a structure is treated as one or more hulls and a set of tubular and/or plate elements which are assembled into a single body. Generation options and interactive graphics allow easy modeling of unusual shapes, semi-submersibles and tension leg platforms.
 - Extensive Vessel Library is supplied.
 - Automatic mesh generation of hydrostatic, hydrodynamic and plate meshes. The program refines a coarse mesh and calculates the intersection, union and difference of defined polygons used for mesh generation.
 - Versatile Graphics Capabilities enable the user to interactively generate X-Y graphs of results and 3D views of models.
 - Post processing of results is easy and can be customized by the user through macros, macros in batches and interactive modes.
 - SI, English or Metric units can be used, seamlessly switching from one system to another.
 - Vortex shedding in wind or water is computed.
-
- Automatic ballasting computes the ballast necessary to maintain equilibrium, given vessel configuration (draft, trim and heel) and loads.
 - Tanks can also be ballasted interactively, automatically correcting system weight and inertia.
 - Minimum ballast movement required to achieve a new vessel configuration is calculated.
 - Jacket load out calculations are made using the above computations.



Process Engineering

Fluid or gas networks can range from a single pipe to any complex arrangement of components and pipes. CEA Technology provides you with a software program for designing and optimizing these kind of pipe networks and provides the engineer with the ability to easily optimize the solution approach for any specific problem in this area.

The predefined component types are pipes, manual valves, pumps, non-return valves, reducers, sprinklers, orifice plates, flow controllers, pressure controllers, closed circuit components, junction components and network entry and exit points, such as tanks, boreholes or pipe takeoffs, accumulators, reciprocating pumps and compressors, rotating positive displacement pumps, cyclones, shell and tube exchangers, plate exchangers, cooling towers, jacketed vessels, bursting discs, 3-way valves, knock-out pots, etc. and more.

Beside the predefined components, it is possible to change and add new components, such as filters, pumps, heat exchangers or flow meters. An overview of features is listed below.

- Extensive database with fluids and gasses fully defined for accurate calculations in the liquid, vapor and 2-phase regions, also the possibility to add new fluids.
- Hundreds of pumps, control valves, manual valves, sprinklers, relief valves, pipe data etc. from a wide variety of manufacturers. - Interactive designing, connectivity and data is checked continuously.
- enables the effect of changes to be immediately available for evaluation
- configurable tables and flow sheet in various sizes - immediate graphical output
- European, American units or user-defined units.
- Excellent report facilities: report designer to determine report layout and bi-directional link with Excel.
- Model, analyse and design almost any type of liquid or gas flow system.
- Construction of the fluid network is in a familiar flow sheet format - design your network with minimum effort and maximum flexibility.
- Flow sheet, data entry and various views of the calculation results are continually updated and visually available on one screen-shot - ideal for iterative scenarios.
- Engineering hints and build errors of the network, as they occur.
- Changing the design or operating conditions on any component is easily managed.
- Proven calculation reliability saves time and money
- Any number of fluids within the same network.

Total Heat Balance

This means you need only specify fluid temperatures at boundary components, all other temperatures are calculated. Pressure changes, heat loss or gain from the surroundings and heat exchange made via the new heat exchange components may be included into the heat balance.

Calculation capability expanded via plug-ins

Examples are auto-equipment selection, auto-equipment sizing, 2-phase gas liquid calculations, twophase solid liquid calculations, non-Newtonian flow calculations, extended and real-time analysis, etc.

Latest Calculation Techniques

Gas calculations make no simplifying assumptions of ideality, adiabatic or isothermal processes, etc. Pressure losses are determined by solving the momentum and physical property equations simultaneously. This means more accurate results, particularly at higher Mach numbers. There are many methods available for physical property prediction, using the very latest techniques and EOS models.

Miscellaneous

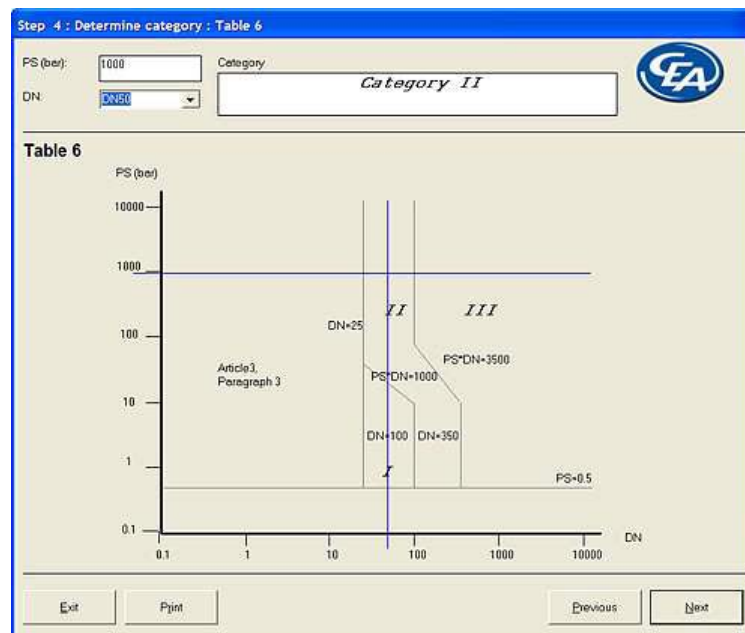
Classification of Pressure Vessels, P.E.D. Classifier

The program enables quick and accurate establishing of the right modules of the Pressure Equipment Directive to the new European Pressure Equipment Directive.

With specifications of pressure equipment (pressure vessels, piping system, steam generator, assemblies, etc.), the category and applicable modules (as shown in the P.E.D. Annex II) can simply be determined.

Features: - Quick and easy classifying of pressure equipment like: pressure vessels, piping, steam generators and others - Quick access to the PED which is included in several languages - Review of the different modules of the PED which gives the responsibilities of the maker and

Notified Body (PED Annex III) - Includes all the PED Tables for different situations - Available in several languages - Very user-friendly software



-Mechanical

4D

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Professional support by www.cea-int.com

On www.cea-int.com customers, partners and dealers can get professional support. Each customer will get their own user name and password for a private domain on our website. Here you can download, the latest versions of the software, patches and support issues. There is also a user forum for communication with other users, uploading technical issues and downloading the latest version of CEA News.

As a leading engineering software developer, CEA Technology provides its customers with the latest engineering information about international standards and other issues. Also support for all our software solutions is centralized in a knowledge base, which can be approached through this internet site and has the advantage that we can deliver our customers immediate and accurate support in every time zone.

The screenshot shows the homepage of the CEA Technology website. The navigation menu at the top includes: Home, Corporate, Software Solutions, News, Events, Clients, Success stories, Careers, Service, Downloads, Contact, and Extranet Login. The main content area features a large banner for 'Plant-4D' and '4D-Mechanical' software, with sub-headers: 'The Next Generation of Plant Engineering Design Software' and 'Software Solutions for Process, Piping and Pressure Vessel Engineering'. Below the banner is a 'LATEST NEWS' section with a 'Code X' graphic and a photo of a trade show booth. On the right side, there is a 'SEARCH' box, 'MARKETS' section stating 'CEA Technology successfully provides solutions for multiple industries.', and 'PREVIEWS' section with links: 'Download Plant-4D software', 'Preview 4D-Mechanical software', and 'Download brochure 4D-Explorer'. A 'Registration' link is also present. The footer contains four columns: 'CLIENTS' (Click for an overview of our clients), 'SEMINARS' (Click for an overview of upcoming seminars), 'CONTACT US' (Contact us directly), and 'NEWSLETTER' (Get the latest news and events in your mail). The footer also includes the copyright notice: 'Copyright © 2008 CEA Engineering Software (Slovakia) Webdesign by Pochini'.

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