HEXAGON

CADWORX & ANALYSIS SOLUTIONS

numikon®
ENGINEERING – CONSULTING – DEALERSHIP

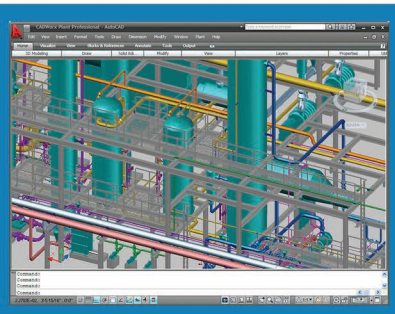
HEXAGON
PPM
Authorized Reseller

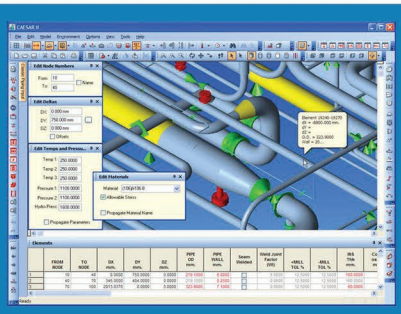
CADWorx
Plant Design Suite

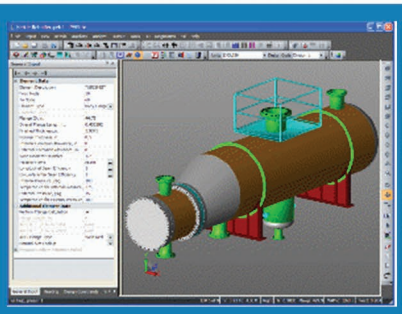
CAESAR II
Pipe Stress Analysis

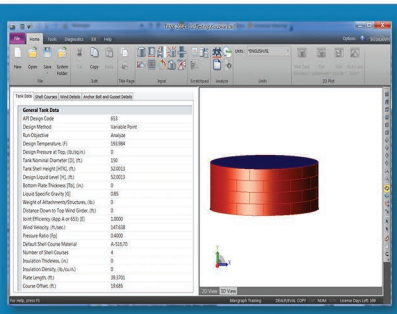
PV Elite
Vessel Analysis

TANK
Tank Analysis









Visual Vessel Design
Vessel Analysis

GT STRUDL
Structural Analysis

Ovlašteni zastupnik tvrtke HEXAGON

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PRODUCT SHEET

CADWORX® PLANT PROFESSIONAL

MOST COMPLETE RANGE OF TOOLS FOR EFFICIENT PLANT DESIGN

Capabilities:

- Intelligent 3D Piping Design
- Specification-driven design
- Efficient specification management
- Dynamic pipe supports
- Detailed bill of materials
- Equipment
- Ducting/cable trays
- Collision checking
- Isogen® isometrics
- Live database links
- Intelligent process diagrams
- Model/P&ID synchronization
- Links to stress analysis
- As-builts from Point Clouds

CADWorx Plant Professional enables efficient plant design for both greenfield and brownfield projects by providing robust tools for creating intelligent 3D plant models. CADWorx offers unparalleled flexibility and productivity to help thousands of corporations execute projects and rapidly create cost-effective deliverables. Leverage point cloud data in combination with easy to use CADWorx Plant Professional to execute brownfield projects with greater accuracy than gathering field data with more manual processes.

Process and Instrumentation Diagrams

CADWorx P&ID software provides productivity tools to create intelligent process diagrams. With CADWorx P&ID Professional, CADWorx 3D plant models can be linked for change management control, making your 3D models synchronized with your P&IDs and avoiding costly field mistakes.

Software Automation Increases Productivity

The auto-routing capabilities of CADWorx allow piping designers to create 3D piping models quickly, accurately, and intuitively. The software allows the designer to focus on design tasks by generating 3D models automatically.

Configurable Piping Rules assist designers during their workflow by automating piping component placement and ensure that project standards are adhered to which improves accuracy and yields cost savings during project execution.

Automatic Isometrics

Isometrics drawings can be produced from piping layouts or project databases. CADWorx Plant Professional includes Isogen® for automated isometric production.

Piping Specifications

Ready-to-use specifications in metric and imperial formats are included. The Specification Editor allows the creation of parametrically-driven piping specifications. Import utilities for Smart Reference Data provide the administrator with dozens of ready to use international specifications.

Database Links

Users can create accurate, user-configurable bills of material in the most popular database formats. The optional live database links in CADWorx provide real-time design status and valuable information backup to project administrators that have a desire to improve accuracy and efficiencies of their designers.

Equipment Modeling

Powerful equipment modeling capabilities are included to provide the most complete plant models. Designers can link to PV Elite to import equipment into their CADWorx Plant models or build their own libraries of equipment to suit the needs of their industry.

Walkthrough Capabilities

CADWorx Design Review is included for model visualization and 3D design coordination. Review layouts, check on model data and then mark-up changes or add questions to the 3D model to send communications back to the designers for more information.

Collision Checking

CADWorx Clash Detection identifies conflicts in the current model and against externally referenced files. Reserve space for installation and usability of components so that you can catch clashes in the 3D model environment, not in the field. Options enable clashes to be reported at any time during the design process.

Ducting and Cable Trays

HVAC ducting and cable tray routines are included. Square, rectangular, round, and oval shapes, with transitions, are available.

Change Management

Automated and intuitive routines make changing piping sizes and specifications quick and easy.

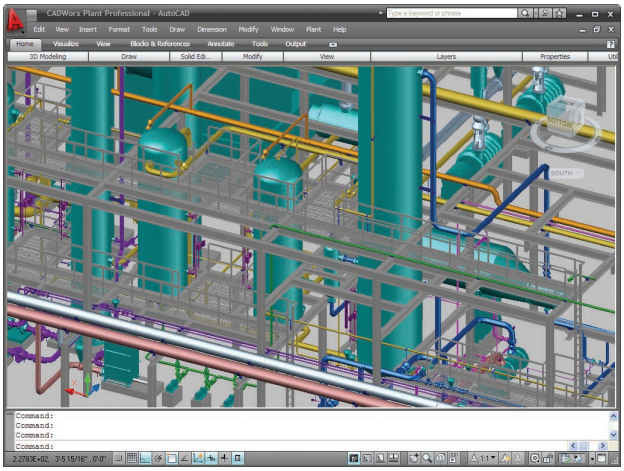
Integration with Analysis Software

CADWorx has links to CAESAR II for pipe stress analysis and PV Elite for equipment analysis, allowing reuse of the 3D model components for a time-saving and accuracy-improving workflow solution.

Technical Specifications

• AutoCAD®-compatible

•BricsCAD®-compatible



CADWorx Plant Professional provides the most full-featured and cutting-edge tools for efficient and accurate design.

ABOUT HEXAGON

Hexagon is a global leader in digital solutions that create Autonomous Connected Ecosystems (ACE). Our industry-specific solutions create smart digital realities that improve productivity and quality across manufacturing, infrastructure, safety and mobility applications.

Hexagon's PPM division empowers its clients to transform unstructured information into a smart digital asset to visualize, build and manage structures and facilities of all complexities, ensuring safe and efficient operation throughout the entire lifecycle.

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PRODUCT SHEET

CADWORX® STRUCTURE

EFFICIENTLY CREATE FULLY INTELLIGENT, 3D STRUCTURAL DESIGNS

Capabilities:

- Intelligent 3D Steel and Concrete Design
- Member Modeling
- Plate Modeling
- Footing and Foundation Modeling
- Slab and Wall Modeling
- Stairs, Ladders, and Hand Rail Arrangements
- Decking and Grating Modeling
- Coping and Mitering
- International Steel Libraries
- Bills of Material
- 2D Output Linked to 3D Model
- Import/Export Integration for Structural Analysis/Detailing
- Weight and Center of Gravity
- Assembly Templates
- Flexible Selection Filters
- Clash Detection

CADWorx® Structure includes the critical tools you need for effective structural design. CADWorx Structure is easy to learn and has reduced the man hours needed to create a structural design as compared to CADWorx Steel by more than 50 percent. Create revenue-earning deliverables more quickly and accurately.

Comprehensive Steel Shape Catalogs

International catalogues of steel shape libraries in both imperial and metric units are included with CADWorx Structure, providing the necessary steel shapes for accurately representing steel members in your 3D model. Historical and new country-specific steel manuals can be added quickly when your company enters new markets.

Easy-To-Place Assemblies

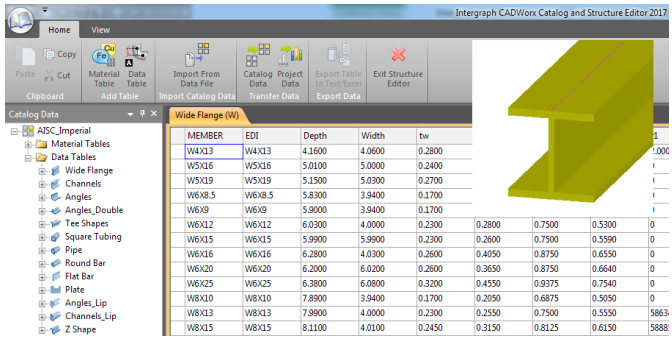
Some of the more detailed work in a structure includes adding secondary steel for access control, and CADWorx Structure provides commands for effortless modeling of these objects. Whether your project includes industry standards or your company has developed its own standard, CADWorx Structure allows the designer to replicate the necessary arrangement of these traffic items. Many customization options are built-in so that these assembly objects can reflect the scenarios encountered in industrial applications. Grating and decking can be rendered to show accurate portrayals of these objects in your 3D model.

Drawings

Designers and engineers can easily create 2D drawings of their 3D models with native dimensioning and annotations. Typical general arrangement drawings include single line-steel and 2D representations that support multiple views.

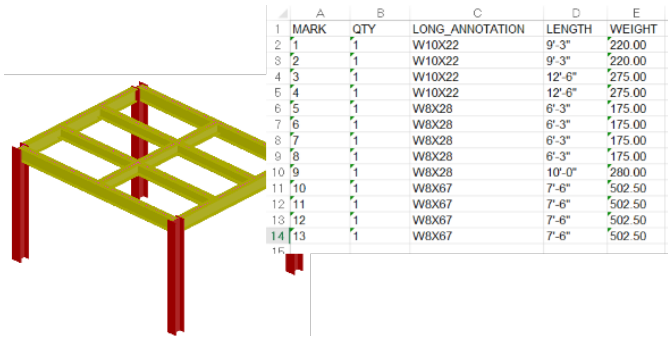
Reuse Your Structural Model

Why spend hours recreating your structural model in order to analyze your structure? Using an industry standard import/export format, the designer can export the structural model to a structural analysis package such as GT STRUDL®, saving many man-hours of rework. Similarly, a designer can export the model to send to a structural detailing contractor and continually update the contractor as changes occur. Any modifications by the engineer or detailer can then be re-imported into the CADWorx Structure model for clash detection.



Bills of Material

Users can create accurate, user-configurable bills of material in the most popular database formats for all of their steel materials in the 3D model. These reports can be used to show total lengths and weights for each size, cut lengths, and selected object lengths and weights. Optionally, a project can be set up to utilize a database format to provide additional reporting capabilities.



	A	B	C	D	E
1	MARK	QTY	LONG_ANNOTATION	LENGTH	WEIGHT
2	1	1	W10X22	9'-3"	220.00
3	2	1	W10X22	9'-3"	220.00
4	3	1	W10X22	12'-6"	275.00
5	4	1	W10X22	12'-6"	275.00
6	5	1	W8X28	6'-3"	175.00
7	6	1	W8X28	6'-3"	175.00
8	7	1	W8X28	6'-3"	175.00
9	8	1	W8X28	6'-3"	175.00
10	9	1	W8X28	10'-0"	280.00
11	10	1	W8X67	7'-6"	502.50
12	11	1	W8X67	7'-6"	502.50
13	12	1	W8X67	7'-6"	502.50
14	13	1	W8X67	7'-6"	502.50

Technical Specifications

- AutoCAD®-compatible
- BrisCAD®-compatible
- Microsoft® Windows®-compatible

ABOUT HEXAGON

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PRODUCT SHEET

3DS NET ORTHOGEN® FOR CADWORX® PLANT PROFESSIONAL

2D PLANS, SECTIONS, AND ELEVATION DRAWINGS

Capabilities:

- Integrated with AutoCAD® and CADWorx®
- Operates on native AutoCAD viewports and xRefs
- Delivered with 40 pre-defined view styles
- Easy repositioning and rotating of labels
- Support for AutoCAD Dimension Elements
- Automatic column grid references
- Fast, high resolution, white space search algorithms

OrthoGen® for CADWorx® Plant Professional enables 2D plans, sections, and elevations drawings to be created automatically from CADWorx Plant Professional 3D models. Even in today's 3D world, annotated and dimensioned orthographic drawings are still a required deliverable. OrthoGen reduces this process from hours to only minutes.

Integrated with AutoCAD® and CADWorx

The OrthoGen integrated drawing interface quickly reads properties directly from CADWorx model files. Because OrthoGen operates within the AutoCAD environment, users can auto-annotate and conduct other 2D embellishments through AutoCAD viewports. OrthoGen also integrates well with existing userdeveloped CADWorx commands, details, standards, and block libraries.

Multiple AutoCAD Viewports and xRefs

OrthoGen enables the use of multiple AutoCAD viewports and utilizes data from xRefs up to three levels deep. Because of this flexibility, users can create drawings representing multiple scales and views. OrthoGen is tightly integrated into the AutoCAD environment and supports the AutoCAD User Coordinate Systems (UCS).

Flexible Settings and Standards Creation

The user interface enables users to select from thousands of option combinations. These combinations can be saved as drawings styles for future individual or group use. In addition, the production mode interface provides easy enforcement of project standards. To ensure user productivity, OrthoGen comes with 40 predefined and editable drawing styles, so users can be up and running in no time.

Easy Label Repositioning and Modification

When using OrthoGen in the CADWorx environment, you can take advantage of basic AutoCAD commands to move and rotate labels. These edits are preserved when running updates on the drawing, eliminating unnecessary rework. Users can also add additional dimensions, hatching, notes, details, and more using basic CADWorx and AutoCAD commands.

Automatic Column Grid References

Creating a single grid model helps to coordinate and automate the placement of grid labels for all drawings on a project. Grid models provide a firm dimensional base that helps eliminate guesswork and the introduction of errors.

Annotations Where You Want Them

The fast, high-resolution, white-space search algorithms enable you to generate orthographic representations that will automatically avoid areas that you do not wish for dimensions or annotations to appear. Commands also help define dimension “edges” on the drawings.

Technical Specifications

• AutoCAD®-compatible

•Microsoft® Windows®-compatible

Application Areas

Process and Plant Design, Piping, Equipment, Steelwork, Petrochemical, Chemical, Power, Offshore, Food, Beverage, Brewing, Pharmaceutical, Water Treatment, Building Services, Shipbuilding, and Architectural.

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PRODUCT SHEET

CADWORX® P&ID PROFESSIONAL

EASY CREATION OF INTELLIGENT PROCESS DIAGRAMS

Capabilities:

- Quick and Intuitive P&ID Creation
- Large, User-modigiable Symbol Library
- Specification-driven P&IDs
- Bi-directional Project Database
- Component Link to Project Documents
- P&ID/Model Synchronization
- Legacy Drawing Conversion
- P&ID Porject Publishing
- Automatic Instrument Loop Diagrams
- CADWorx Internet Publisher

CADWorx P&ID Professional unlocks the power of P&IDs by making diagrams, and the information locked within them, available to all stakeholders.

Intelligent Process Diagrams

CADWorx P&ID Professional allows for the quick and easy creation of fully intelligent P&IDs and does so without the need to change the current look and feel of existing drawings, symbols, or corporate standards.

Specification-Driven P&IDs

CADWorx P&ID Professional optionally allows P&ID components to be placed using piping specifications, thereby improving accuracy and enabling component checks against the plant model.

Industry-Standard Symbols

CADWorx P&ID Professional comes with an extensive symbol library. A programming-free interface enables complete access to existing corporate symbols and assemblies, giving them full CADWorx functionality and intelligence.

Bi-Directional Project Databases

CADWorx P&ID Professional permits the creation of user-defined project databases with no database knowledge required. Project databases are bi-directionally linked to project drawings, ensuring both database and drawings are continually in synch.

Project Document Links

CADWorx P&ID Professional enables the linking of any amount of information or number of documents to P&ID components and stores this information in project databases for further processing.

P&ID Project Publishing

CADWorx Internet Publisher allows P&IDs to be effortlessly published so that they can be viewed using Windows® Internet Explorer®. Published projects also allow each component's database information, and any documents linked to them, to be accessed from within the browser. Published projects can be hosted on the Internet, on an intranet, or locally. P&ID and plant model synchronization and intelligent component checking between the CADWorx P&ID Professional and CADWorx Plant Professional models ensures full synchronization between P&ID and model components.

Legacy Drawing Conversaion

CADWorx P&ID Professional includes powerful routines that make it easy to link legacy P&IDs and their components to project databases. This allows these drawings to be used exactly as if they were originally created using CADWorx.

Automatic Instrument Loop Diagrams

CADWorx P&ID Professional uses user-defined templates for the automatic creation of instrument loop diagrams.

Intelligent Datasheet Capabilities

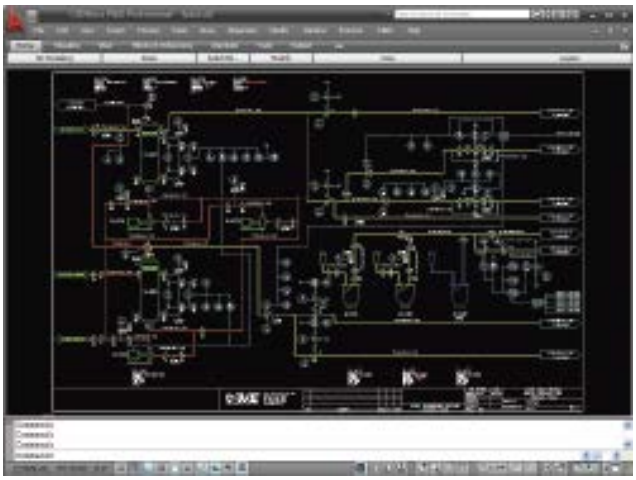
CADWorx Instrument Datasheet and CADWorx Equipment Datasheet modules are included. These modules can be used standalone or may leverage information contained in the CADWorx P&ID Professional project databases.

Technical Specification

- AutoCAD®-compatible
- Microsoft® Windows®-compatible

Application Areas

Process and Plant Design, Piping, Equipment, Petrochemical, Chemical, Power, Offshore, Food, Beverage, Brewing, Pharmaceutical, Water Treatment, Building Services, Shipbuilding and Architectural.



CADWorx P&ID Professional is the most powerful and easiest to use tool for piping and instrument diagramming.

ABOUT HEXAGON'S PPM DIVISION

Hexagon's PPM division is the world's leading provider of asset life cycle solutions for design, construction, and operation of industrial facilities. By transforming unstructured information into a smart digital asset, our clients are empowered to visualize, build, and manage structures and facilities of all complexities, ensuring safe and efficient operation throughout the entire life cycle.

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PRODUCT SHEET

CADWORX® DESIGN REVIEW

WITH CADWORX DESIGN REVIEW, EVERYONE SHARES IN THE BENEFITS OF DESIGN COLLABORATION.

CADWORX Design Review:

- Dynamic Model Updates
- Markup and Redlining
- Realistic Visualizations
- Views & Animations
- Review Custom Date & Isogen Data
- Basic Clipping Options
- Line number & XREF View Palettes

CADWORX Design Review Professional:

- Multiple File Formats
- Measurements with Snapping Options
- Enhanced Clipping Options
- Advanced Model Tree
- Search/Filter by Date
- Centralized Annotations
- Customizing Tool Tips
- Publishing Capability
- Batch Export
- Reporting Capacity

Quicker Review Cycles

Collaborate and review designs quicker and more intuitively. By using 3D, users are able to reduce the need to interpret designs via paper printouts and other non-interactive methods. CADWorx Design Review improves collaboration with tools for markups, design comments and redlining.

Stunning Performance

The intuitive interface of CADWorx Design Review and its performance-based design makes manipulating and moving around even the largest models quick and smooth.

Ideal for Multi-model Designs

There is no need to manually load the separate model files that make up a design. If files are externally referenced, these are automatically included in the review model.

Accurate Visualization

Powerful visualization tools provide settings for color, transparency and model shadows. With flexible selection sets, it is also possible to adjust settings, not only for single components, but for xref's, line numbers etc.—in fact, for any selection set available to the user.

Intelligent Information

Access the same model information as you would within a CADWorx design session. Component names and descriptions, line numbers, weights and other plant design data are all available.

Editable Animations

Creating informative and stunning animations is simple with CADWorx Design Review. Users can set out animation paths and edit the path line at any point. The view direction on any point of the animation path can also be edited in a combination of the six degrees of freedom, plus view angle.

Technical Specifications

- AutoCAD® compatible
- BrisCAD® compatible
- Microsoft® Windows 7, or Windows 10 64-bit only

Application Areas

Process and Plant Design, Piping, Equipment, Steelwork, Petrochemical, Chemical, Power, Offshore, Food, Beverage, Brewing, Pharmaceutical, Water Treatment, Building Services, Shipbuilding, Architectural, and Semiconductor industry.

Interactive Viewing Tools

Explore your 3D Models efficiently and informatively with user friendly volume clipping and 3D cutting planes. Quickly refresh to get the latest updates from your 3D Design environment so that you're always using the most up to date information to make decisions.

Support for BIM

Through CADWorx Design Review, we have IFC Export where user can open exported CADWorx model into BIM collaboration environment.

CADWorx Design Review puts the power of design and model review in the hands of all project stakeholders.

ABOUT HEXAGON PPM

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PRODUCT SHEET

LEICA CLOUDWORX CAD PLUGIN

POINT CLOUD COORDINATION WITH LEICA CLOUDWORX AND CADWORX

Capabilities:

- Large Point Cloud Management
- Leica JetStream Experience
- Intelligent As-Built Workflows
- Advanced Interference Checking
- TruSpace Panoramic Viewer
- Multiple Laser Scan Format Support
- Multi-language Support

Core Solution:

- CloudWorx for AutoCAD® & CADWorx® Plant Professional
- CloudWorx for BricsCAD® & CADWorx® Plant Professional

Optional Solutions:

- Cyclone Modules
- Leica JetStream

Leica CloudWorx CAD plugins used in combination with CADWorx provides the most productive and accurate way to coordinate with point clouds or create as-builts. This powerful combination enables you to perform asset walkdowns and check proposed designs against existing conditions. Locate tie-points, and create intelligent as-builts models easily without leaving the comfort and safety of your office!

Large Point Cloud Management

Quickly and effectively manage vast amounts of point cloud data. “Cut Plane Slices and Half-Space Sections” and/or “Limit Boxes” provide a quick and easy way to navigate point cloud data. Take measurements with familiar CAD measuring tools.

Leica Jetstream Experience

The Leica JetStream point cloud engine provides unmatched productivity gains with greater efficiency in creating final deliverables. Point clouds load at an ultra-high-speed. Even with billions of points, all points are rendered, all the time.

Intelligent As-Built Workflows

CloudWorx shape fitting tools provide size, centerline and orientation data for piping, steelwork, and other assets. With the construction information that is automatically generated by CloudWorx, CADWorx users can rapidly develop an intelligent as-built CADWorx model.

Advanced Interference Checking

Check potential interferences with point clouds in CADWorx. Leica CloudWorx offers design validation tools for automated anti-clash and clash detection routines.

TruSpace Panoramic Viewer

Users often struggle with point cloud manipulation when using CAD point cloud plug-ins. CloudWorx overcomes this with its powerful TruSpace viewing window. TruSpace enables users to manipulate point clouds faster and directly “jump to” nearby scanner locations.

Multiple Laser Scan Format Support

Leica Cyclone point cloud processing software enables point cloud data created in any vendor’s scanning hardware to be converted for use in CloudWorx. CloudWorx accepts Autodesk ReCap (.RCP), and Hexagon Geosystems proprietary .IMP, .LGS and JetStream formats as input. Point cloud data in any other vendor’s format can also be imported and used by CloudWorx.

Multi-Language Support

Both CloudWorx and CADWorx products are available in multiple languages, including English, French, German, Spanish, Italian, and others.

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PRODUCT SHEET

CAESAR II®

THE WORLD'S MOST RESPECTED TOOL FOR PIPE STRESS ANALYSIS

Capabilities:

- Static Analysis
- Dynamic Analysis
- Intuitive Analysis Model Creation
- Design Tools and Wizards
- Load and View Plant Model
- Comprehensive Error Checking
- User-Definable Reports
- Wind and Wave Analysis
- Seismic and Support Settlement Analysis
- 35 International Piping Codes
- Extensive Material Databases
- Steel Databases and Modeling
- Expansion Joint Databases
- Hanger Design and Databases
- Automated Stress Isometric Creation
- Integrates with Intergraph Smart®, and CADWorx® Plant Design Suite
- Results Export to Microsoft® Excel®, Word, and MDB Files

Expedited Piping Input

Experience improved usability in CAESAR II List Input dialogs with valuable performance improvements and a new Search and Replace capability that lets you make quick global changes to your models. Use convenient right-click menus to perform model actions in half the time.

Enhanced 3D Model Display and Graphics

Large-scale improvements to the CAESAR II 3D model include new symbols for displacements, rotations, forces, and moments on the model. In addition, most graphic symbols display outside of the piping with an easy-to-read leader line. Node numbers and annotations display and rotate in front of all piping for complete visibility.

Streamlined Load Case Editor

The redesigned Static Load Case Editor features a Group Edit view where you can select and change values to multiple load cases all at once. The enhanced List View offers easier scrolling and viewing options, as well as filtering on columns, drag-and-drop sorting, and Simpler manipulation of load cases.

You can select cases from the Static Load Case Editor for deletion, and instantly review the impacts to any related (combination) cases. CAESAR II automatically renumbers load cases upon your deletion.

Design Tools and Wizards

Tools and wizards for tasks (such as creating expansion loops or viewing plant models in the analysis space) help bridge the gap between knowledge and experience. CAESAR II takes the guesswork out of producing accurate analysis and recommending practical design changes.

Nuclear Industry Compliance

CAESAR II complies with ASME NQA-1 quality assurance (QA). Subscribe to the CAESAR II QA and Reporting service to stay fully informed about issues and software changes. This notification service ensures that nuclear clients comply with U.S. federal requirements 10 CFR Part 50 App. B. and 10 CFR Part 21.

Advanced Analysis and Reporting

Besides the evaluation of a piping system's response to thermal, deadweight, and pressure loads, CAESAR II analyzes the effects of wind, support settlement, seismic loads, and wave loads. Nonlinear effects, such as support lift-off, gap closure, and friction, are also included. Select the proper springs for supporting systems with large vertical deflections. Dynamic capabilities include modal, harmonic, response spectrum, and time history analysis. Quickly send analysis results to output reports or export to the file format of your choice (MDB, Excel, Word, etc.).

Custom Nozzle Flexibilities

User-defined custom nozzle types let you use third-party tools to calculate nozzle stiffness values for axial, in-plane, out-of-plane, and torsional directions in the piping input. Custom flexibilities are useful for non-standard angled nozzles not addressed by existing nozzle code standards.

Finite Element Analysis

Access third-party tools for finite element analysis from the CAESAR II main menu, including free access to the newly-published ASME B31J-2017 calculations for SIFs and K factors. Quickly send and translate through FEATools™, compare multiple file results, assess the sensitivity of model elements, and evaluate nozzle/branch connections with NozzlePRO™.

Powerful Integration Capabilities

CAESAR II offers robust interfacing with CAD-based software, such as CADWorx Plant and Intergraph Smart® suites, using established industry formats (such as PCF and Isogen®), This lets you bring in data from other systems, carry it on to integrating solutions after analysis, and track support IDs throughout the system. With Intergraph Smart integration, you can view component identifier (GUID) information for restraints and hangers.

Comprehensive Equipment Analysis

The fully-redesigned Equipment Manager for API 610 enables you to associate multiple load conditions with your pump and related nozzles. Experience the user-friendly interface and new comprehensive reports. Analysis capabilities are available for other equipment types with future plans to expand to the easy-to-use manager.

Codes

- ASME B31.1, B31.9 (Power)
- ASME B31.3, w/ Ch. IX (Process)
- ASME B31.4, w/ Ch. XI (Pipeline) and Ch IX (Offshore)
- ASME B31.5 (Power)
- ASME B31.8 (Pipeline), w/ Ch. VIII (Offshore)
- ASME Section II, Class 2 and 3 (Nuclear)
- BS 806 (Process)
- JPI (Process)
- HPGSL (Process)
- CAN Z662 (Pipeline), w/ Ch. 11 (Offshore)
- CODETI (Process, Power)
- TBK 5-6 (Power)
- DNV (Offshore)
- EN 13480-1 (Power, Process)
- ISO 14692 (FRP)
- UKOOA and BS-7159 (FRP)
- PD 8010 Part 1 (Pipeline) Part 2 (Offshore)
- RCC-M C and D (Nuclear)
- Stoomwezen, Swed. Method 1 & 2 (Power)
- Equipment: API 560, 610, 661, 617, PD 5500, HEI, NEMA SM23, B31G, WRC 107/537/297, AISC
- Environmental: ASCE 7, NBC, IBC, UBC (Seismic & Wind), EN 1991 GB 50009, Mexico (Wind) NBR 6123, IS 875, BS 6399, As/Nzs 1170, KHK (HPGSL) L1 and L2 (Seismic)

About Hexagon PPM

Hexagon PPM is the world's leading provider of asset life cycle solutions for design, construction, and operation of industrial facilities. By transforming unstructured informatioan into a smart digital asset, our clients are empowered to visualize, build, and manage structures and facilities of all complexities, ensuring safe and efficient operation throughout the entire life cycle.

Hexagon PPM is part of Hexagon (Nasdaq Stockholm: HEXA B; hexagon.com), a leading global provider of information technology solutions that drive productivity and quality across geospatial and industrial landscapes.

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PRODUCT SHEET

PAULIN RESEARCH GROUP

FEATOOLS™ FOR CAESAR II®

Capabilities:

- Apply more applicable SIF and Flexibility Factor Data
- Incorporate Code updates in B31J 2017 and Appendix D
- Improve accuracy of designs and analyses
- Improve analyses of components in cyclic service
- Produce more cost-effective designs
- Reduce design changes and iterations
- Calculate more realistic allowable loads on nozzles
- Analyze components outside of code limits
- No FEA experienced needed

FEATools™ improves the quality of CAESARS II users' analysis for critical service lines by incorporating finite element analysis (FEA) and other empirical sources into the evaluation process. Automatically include coverage of the B31J 2017 ASME B31 Code update in your analysis and generate more accurate SIF and Flexibility Factors for relevant components. By using CAESAR II in combination with FEATools, analyzed systems are neither over- nor under-designed, but designed with consistent safety factors, which also saves time and money.

FEATools from PAULIN Research Group is currently available exclusively through Hexagon.

Higher Accuracy, Lower Costs

Piping analysts know that properly qualified FEA presents the greatest opportunity to produce the most accurate analysis results. However, FEA can be extremely time-intensive and require more technical expertise than is needed for the majority of pipe stress problems. An ideal solution would allow FEA results to be easily and seamlessly incorporated within traditional code-based pipe stress analysis, so that your jobs benefit from the accuracy of FEA and the practicality of code-based analysis. CAESAR II with FEATools provides this solution.

Addressing Code Limitations

There are well-known limitations in piping code accuracy when it comes to piping branch connections. Performing a complete FEA of a piping system can be prohibitively expensive. Instead, using FEA data for branch intersections is one of the most effective and pragmatic uses of FEA technology for code-based pipe stress analysis.

FEA Results and Piping Codes

Piping codes such as ASME B31.3 Appendix D state that, in the absence of more directly applicable data, the engineer should use the stress intensification factor (SIF) and flexibility factor (k factor) data from Appendix D of the code. FEATools uses the results of the latest analysis, research, and testing to supply this "applicable data" to CAESAR II, and it does so seamlessly and intuitively.

Nozzles

FEATools also provides a quick way of calculating nozzle stiffness, allowable loads, and stresses due to user-defined load sets. This more accurate nozzle flexibility reduces stress in the piping system during thermal load cases. This improves on the accuracy of older methods used in the industry for qualifying nozzle loads such as WRC 107 and WRC 297. It addresses nozzles on heads and shells as well as radial, hillside, and lateral nozzles.

When to Use

Accurate SIFs and k factors enable pipe stress analysts to use the built-in flexibility of a piping system to reduce unnecessary redesigns of the system, which often have design constraints or piping code limits. This reduces interdepartmental iterations in the design process and saves valuable time and money. FEA-derived SIFs and k factors are typically recommended in the following piping configurations:

- Systems with large diameter thin-walled pipe (D/T>50)
- Systems that connect to sensitive or rotating equipment
- Systems with operating cycles anticipated to be more than 5000
- Systems with short or stiff piping (where k factors have a large impact)
- Systems that require more accurate spring hanger design
- Systems that use thin-walled welding tees
- Systems where run i-factors control the solution and d/D ratios < 0.5
- Systems with any component that has questionably high calculated stresses

CAESAR II Integration

FEATools supports code-based pipe, pressure vessel, and tank design. It was developed to interact only with CAESAR II. This means that, once calculated, branch SIFs and k factors are not only seamlessly and automatically transferred to the CAESAR II model, but the software retains the data for future analysis.

CAESAR II Workflow

Because FEATools closely matches the way CAESAR II operates, the current workflows remain virtually unchanged. Users can continue to produce the deliverables that they have come to trust. For time efficiency, the software saves each branch FEA calculation in a database so users can reuse those values on subsequent jobs. If a user wants to return to the original model, the software creates the SIF and k factor-adjusted model as a copy, keeping the original intact.

Components

CAESAR II FEA Translator – Applies more relevant SIFs and flexibility (k) factors for branch connections automatically to the **entire** CAESAR II input file so FEA or improved correlation methods can be used. Includes the option for light, medium, or heavy walled tees, laterals, and the effect of weld thickness on SIFs and k factors. Intersection type and dimensions can be changed within the program without going back into CAESAR II without modifying the original model.

FESIF, FE107, FETee, FEBEnd, & PRGiK – Individual component FEA analysis programs for more in-depth analysis of important connections or components in your piping system.

ABOUT HEXAGON

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Hexagon's PPM division empowers its clients to transform unstructured information into a smart digital asset to visualize, build and manage structures and facilities of all complexities, ensuring safe and efficient operation throughout the entire lifecycle.

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PRODUCT SHEET

PAULIN RESEARCH GROUP

NOZZLEPRO™ FOR PV ELITE® AND CAESAR II®

Capabilities:

- FEA analysis of common PVP components
- Analyze:
- Hillside Nozzles
- Nozzles on heads
- High temperature
- Fitness-For-Service (FFS)
- Nozzles w/ attached piping
- Complex loading conditions
- Saddles, Pipe Shoes, Clips
- Components with dimensions that fall outside Code limits
- Axisymmetric and brick models
- Fatigue
- Calculate more accurate SIFs and K-Factors
- Easily use results in PV Elite and CAESAR II®
- Materials Database included
- Full Set of Reporting Tools

NozzlePRO™ is a standalone solution that enables users to quickly and easily perform Finite Element Analysis (FEA) of individual pressure vessel and piping components, without an extensive knowledge of FEA modeling, analysis techniques or theory.

Proven Track Record

NozzlePRO is easy to use and its interactive graphics provide clear and intuitive guides. Take the guesswork out of building the geometry and benefit from on-the-fly plotting for verification. NozzlePRO quickly generates analysis results in graphical and tabular formats and clearly represents system pressures, moments, temperatures, and loads. A powerful interactive toolbox allows you to dissect and manipulate models.

Integrate FEA with CAESAR II and PV Elite

Since NozzlePRO enables FEA results to be seamlessly incorporated within traditional code-based analysis, projects can benefit from the accuracy of FEA and the practicality of code-based analysis. For example, the flexibilities and SIFs results can be easily combined with Intergraph's CAESAR II or PV Elite to improve the overall analysis of piping systems or vessels so they are neither over- nor under-designed.

Extend Beyond Code-Based Analysis

NozzlePRO can analyze components that fall outside code limits. It can also calculate more accurate maximum allowable loads and stresses. Therefore, it is able to accurately establish consistent safety factors for analysis. These more accurate results lead to improved efficiencies in design and help increase the life span of piping systems and associated equipment.

Quickly Build Accurate Analysis Models

Input for components is quick and straightforward while also allowing customization of the mesh and boundary conditions. For even more accurate evaluation of loads and displacements on the nozzle and in the piping system, users can pipe away from a piping junction on a vessel head or cylinder to evaluate the effect of the thermal expansion on a nozzle. Straight sections, elbows, bends, intersections, and linear restraints may all be included in the nozzle analysis.

Results and Analysis Based on Research

Realistic flexibilities in a nozzle typically result in much lower stresses, which then allows for higher allowable loads. The original design code SIF values for intersections were derived from work performed in the 1940s by A.R.C. Markl. Most of these experiments were performed on a single-size piping run. All other SIF values were extrapolated from this piping run.

The SIF values in NozzlePRO are based on the testing done by Markl plus many real-world and finite element calculations performed since those original tests. This means NozzlePRO provides the most comprehensive evaluation of SIFs and K-factors for nozzle connections to date.

Industry-Specific FEA Analysis

A distinguishing feature of NozzlePRO compared to general purpose FEA solutions is that it performs automated code compliance reports for ASME Section VIII – Division 2 stress categories. This saves you time because there is no need to perform additional post-processing or compliance checks.

Additional Benefits and Use Cases

NozzlePRO can be used in a variety of tasks. The software provides extra value and accuracy to help you analyze stresses on nozzles or evaluate allowable loads on nozzles that have multiple thermal or operating loads, are in cyclic service, or have pad-reinforcements. NozzlePRO also supports FEA of pad-reinforced lugs, clips, or other supports that are placed on the knuckle radius of a dished head. NozzlePRO also allows for:

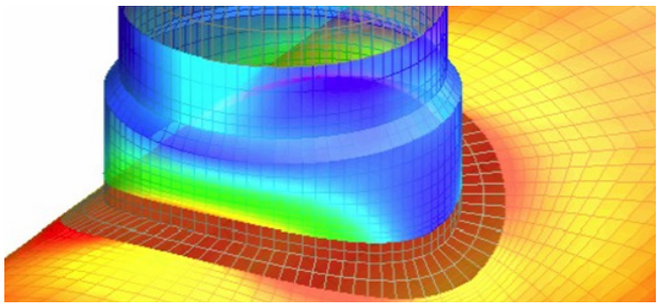
- The analysis of horizontal vessels with saddle supports (such as the Zick replacement)
- ASME Section III, Part NH requirements (high-temperature service)
- FFS analysis (API 579).
- Evaluation of overturning moments on vessel skirts
- Determining the effect of an integral vs. non-integral pad on a nozzle located on a head
- The designing of pipe shoes for self-weight, liquid weight, and axial loads
- Improved WRC 107/297 analysis for nozzles and attachments

Technical Specifications

Microsoft® Windows®-compatible.

Application Areas

Process and Plant Design, Piping, Vessels, Exchangers, Tanks (Nozzles), Equipment, Steelwork, Petrochemical, Chemical, Power, Offshore, Food, Beverage, Brewing, Pharmaceutical, Water Treat¬ment, Building Services, Shipbuilding, and Architectural.



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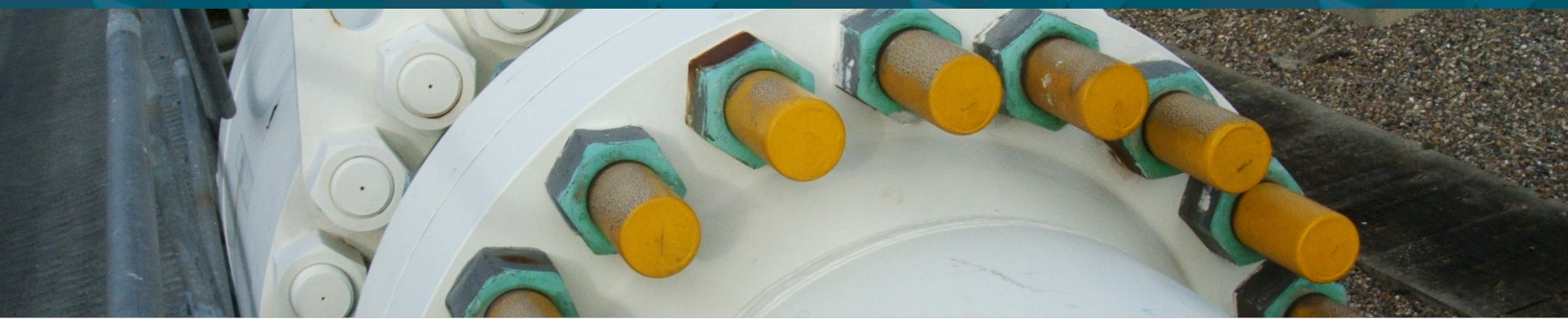


PV ELITE®

VESSEL AND HEAT EXCHANGER DESIGN, ANALYSIS, AND EVALUATION

Capabilities:

- Vessel Design and Analysis
- Exchanger Design and Analysis
- Tubesheet Design and Analysis
- Rectangular and Non-Circular Vessel Analysis
- Individual Component Analysis
- Cutting-edge Graphics
- Design Tools and Wizards
- Comprehensive Error Checking
- Saddle, Leg, and Skirt Design
- Analysis for Horizontal Shipping of Vertical Vessels
- User-definable Reports
- Wind Analysis
- Seismic Analysis
- International Vessel Codes
- Extensive Material Databases
- Steel Databases and Modeling
- Links to CADWorx® Plant Professional

PV Elite® is your complete solution for vessel and heat exchanger design, analysis, and evaluation. Users of PV Elite users have confidently designed equipment for the most extreme uses and have done so quickly, accurately, and profitably.

Data Collection

PV Elite makes defining pressure boundary conditions for vessels and exchangers easy, even for load sets that require significant data input. PV Elite streamlines data entry by breaking the input down into sensible subsets. Help on any input item is only a keystroke away.

Graphics

PV Elite's graphical representation of analysis models helps ensure confidence in the input and results. With PV Elite, you can view and manipulate analysis models with complete ease.

Analysis Options

PV Elite performs calculations in accordance with ASME Section VIII Divisions 1 & 2, PD 5500, and EN 13445. Rules from API 579 (Fitness for Service) are also included for evaluating the current state and remaining life of existing vessels.

Output and Reports

To simplify inspection requirements, PV Elite lists the most important equations, such as required thickness and maximum allowable working pressure (MAWP), and also groups results by type (e.g., internal pressure, external pressure, bending stress, nozzles, and flanges). It summarizes overall results where it identities the element or detail controlling the overall vessel MAWP.

Materials and Codes

PV Elite is a global package with international code rules plus extensive region-specific content. Vessel material definitions, piping and steel component data, local wind loads, and local seismic loads of many regional markets are all included.

Interfaces

PV Elite interfaces with other popular software packages for finite element analysis, foundation design, and drafting. PV Elite also shares a bi-directional link to CADWorx® Plant Professional.

Technical Specifications

• AutoCAD®-compatible

•Microsoft® Windows®-compatible

Application Areas

• Beverage

• Brewing

• Chemical

•Equipment

• Food

• Offshore

• Petrochemical

• Pharmaceutical

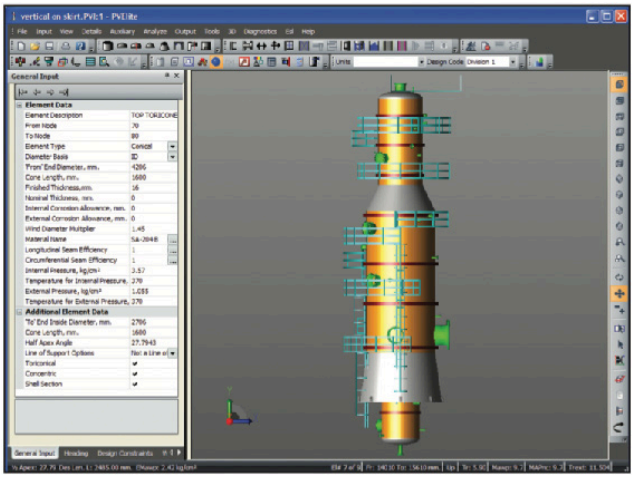
• Piping

• Power

• Process and Plant Design

• Shipbuilding

• Water Treatment



PV Elite is an efficient analysis tool for a wide range of applications.

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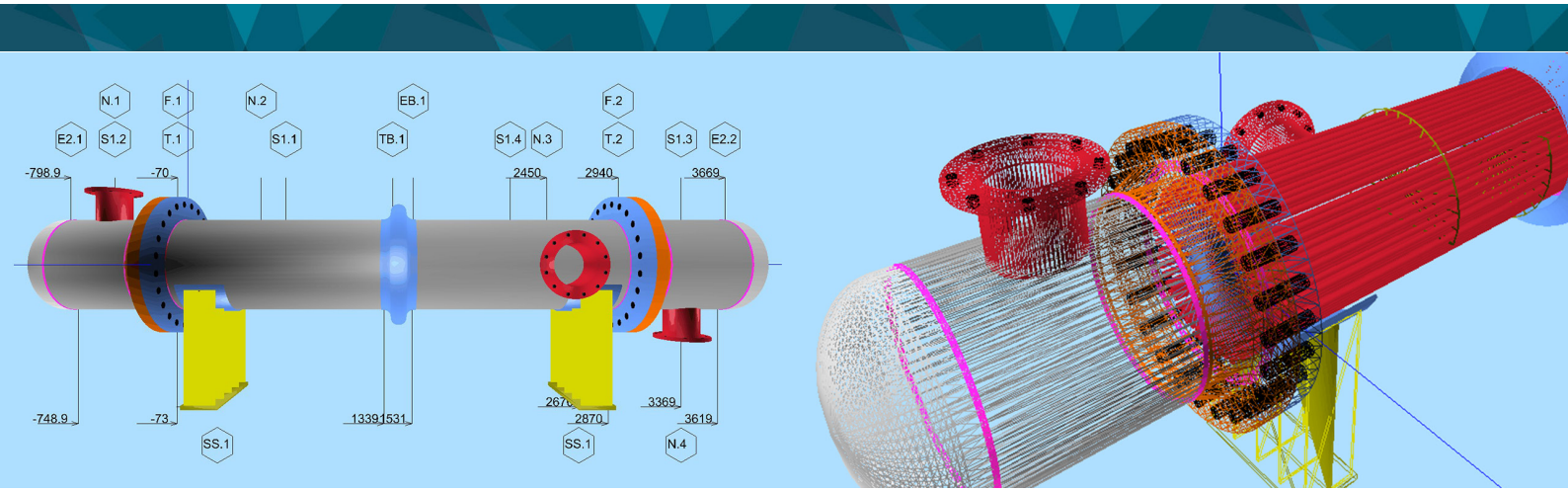

VISUAL VESSEL DESIGN

A COMPREHENSIVE PRESSURE VESSEL, SHELL & TUBE EXCHANGER AND BOILER DESIGN & ANALYSIS SOLUTION

Benefits:

- 2D Integrated Vessel Drafting Utility
- 3D Drawing Utility
- Flexible Printout
- Utilization Charts
- Integrated Databases
- Tube Layout
- External Loads Module
- VVD Code Assistant (Help on Technical Issues)
- Section-sensitive Online Help
- Report Generator
    - Weight and Volume
    - Center of Gravity
    - MAWP New and Cold
    - MAWP Hot and Corroded
    - Minimum Required Test Pressure
    - Maximum Test Pressure Allowed
    - Bill of Material
    - Foundation Loading
    - NDT Requirements
    - Impact Test Requirements
    - Nozzle List
    - Nozzle Loads

Intergrated Databases

Visual Vessel Design has a comprehensive collection of dimensional and physical properties that minimizes manual entry of values and helps streamline data entry.

Tube Layouts

Visual Vessel Design allows the designer to easily perform a highly optimized tube layout by offering true flexibility in accommodating tube patterns and passes of all kinds.

Utilization Charts

The utilization charts provide the user with instant feedback on the utilization of each component. With Visual Vessel Design, users have immediate insight into the maximum utilization of each component in selected vessels.

Materials Library

Visual Vessel Design includes a material library with data for more than 3,500 different materials referenced to the ASME, BSI, EN, and NGS standards.

External Loads Module

This feature allows for the calculation of the loading on the support and the foundation loading for all load cases and for all types of support, including skirt, leg, bracket, and saddle support. External loads can include seismic loads, wind loads, dead loads, live loads on platforms, acceleration loads, nozzle loads, and blast/explosion loads.

Report Generation

Visual Vessel Design generates reports that are data-rich and can include graphical elements and equations, with utilization charts, which additionally provide an instant overview of the calculation results.

General Arrangement (GA) Drawing Module

The GA Drawing module enables you to easily select drawings and tables that you want to include in your general arrangements. Drawings are saved in both an AutoCAD® DXF and PDF file format.

2D & 3D Drafting Utility

Visual Vessel Design can easily provide visualization of the design in both 3D and 2D with all components at their proper location relative to the global base coordinate system. The 2D drawing module allows single components, complete vessels, or any selected groups of components to be drawn on the screen or printed to scale. The included 3D modeler allows users to easily recognize dimensional input errors as they occur.

Advanced Flange Design

Visual Vessel Design includes the sophisticated flange design methods from EN1591 and EN13445 Annex G. This enables users to easily design both standard and non-standard flanges that can take into account external loading and the effect of thermal expansion. This method also determines the flange rotation, meausres deflection, and calculates the minimum required bolting torque.

Technical Specifications

- Microsoft® Windows®-compatible

Application Areas

- Beverage
- Brewing
- Chemical
- Food
- Offshore
- Petrochemical
- Pharmaceutical
- Power
- Water Treatment

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TANK®

COMPREHENSIVE DESIGN, ANALYSIS AND EVALUATION FOR OIL STORAGE TANKS

Capabilities:

- Steel Oil Storage Tank Design
- Analysis Output and Reports
- Complete Unit Flexibility
- API Standards 579, 620, 650, and 653
- API 2000 and 2002 4.3 for Venting
- Allowable Fluid Heights
- Nozzle Loads and Flexibilities
- Carbon and Stainless Steel
- Extensive Material Databases
- Wind Loads and Anchorage
- Seismic and Support Settlement Loads
- Shell Course Thicknesses
- Supported Cone Roofs
- Cone, Dome, and Umbrella Roof Thicknesses

Data Collection

The menu-driven interface of TANK enabler the quick definition of input and functions for the accurate analysis of oil storage tanks to American Petroleum Institute (API) standards.

Increased flexibility is provided by allowing you to select any unit combination for analyses or to produce reports. In addition, unitfies are completely user-definable, so engineers are not bound by program default settings. Even existing jobs can be converted to any existing unit format.

User Interface

The user interface in TANK presents only what is needed at each point of information gathering. Therefore, you are not burdened with “out-of-sequence” requirements for information required for analysis. You are asked only for what is needed, when it is needed.

Analysis Options and Codes

TANK performs calculations in accordance with the latest API Standards 579, 620, 650, and 653. Analysis can also take into account wind, seismic, and settlement conditions, plus calculate air venting requirements to API 2000 Section 4.3.

Output and Reports

After completing an analysis, you can view the results in a tabular report or as a graphic diagram with associated data. For convenience in verifying the results, the output reports reference code sections used where applicable.

Material Databases

TANK includes many databases integral to the package, which make it easy to select standard data for accurate analysis. A number of U.S. and international structural steel databases are provided. API materials are available.

Quick, Context-Sensitive Help

TANK's context-sensitive help provides instant technical assistance at the point of input. Pertinent information is presented relative to each selected item, including code references and technical advice. Built-in search makes for rapid navigation.

Equations and Substitutions

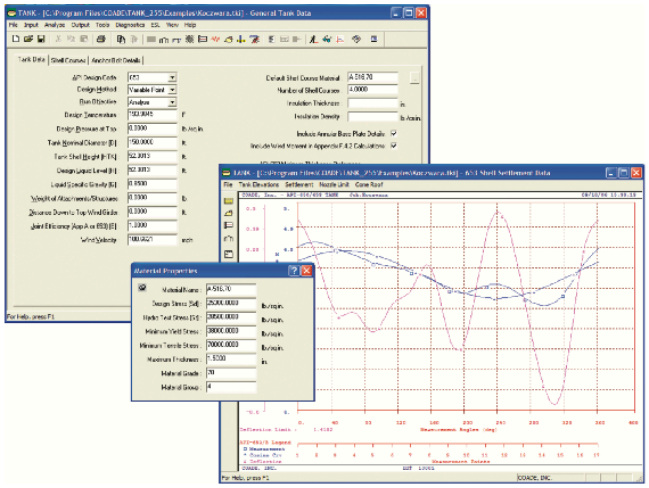
The software provides equations and substitutions, making it easier for you to verify the accuracy of your calculations.

Technical Specification

- AutoCAD®-compatible
- Microsoft® Windows®-compatible

Technical Specification

- Chemical
- Equipment
- Petrochemical
- Piping
- Power
- Process and Plant Design
- Water Treatment



TANK's intuitive interface employs user-defined materials and units and produces clear and accurate analysis reports.

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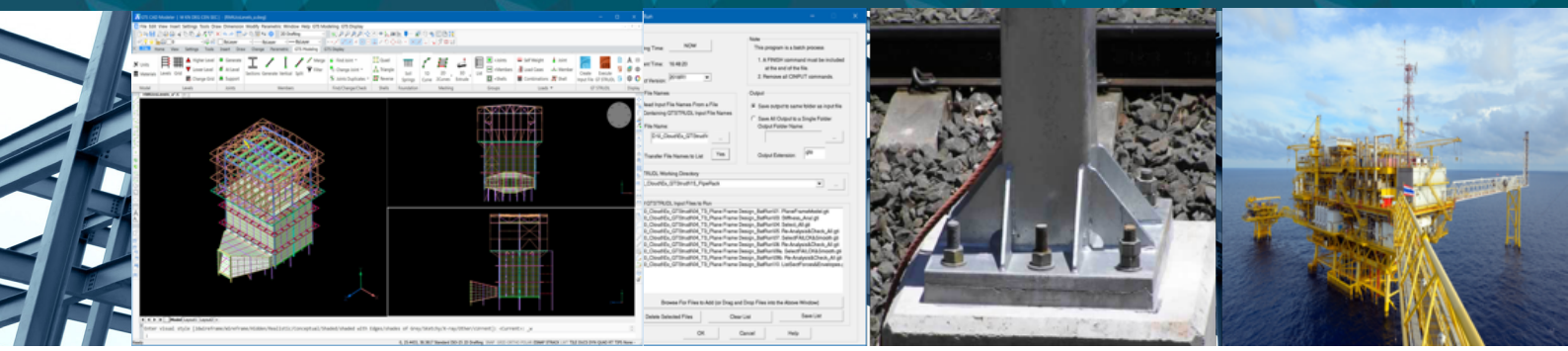


GT STRUDL®
STRUCTURAL MODELING, ANALYSIS & DESIGN

Capabilities:

- Linear and nonlinear static and dynamic analysis.
- High-performance static and dynamic analysis equation solvers.
- Base plate modeling and analysis.
- Multimaterial beam and FEA analysis.
- Offshore structural analysis and design.
- User control of the iterative analysis and design process.
- Database management of all model data and analysis results.
- Ability to leverage company engineering standards.
- Comprehensive and detailed user documentation.
- Specification-driven design.
- Reinforced concrete design.
- Modeling on AutoCAD® and BricsCAD®.

GT STRUDL® supports your modeling, analysis, and design requirements for comprehensive steel and concrete designs. Take advantage of powerful documentation and intuitive design tools for 3D visualization. Complementary modeling environments offer essential tools for fast and productive system analysis. Boost accuracy by eliminating component design and manual drawing. Plus, benefit from workshare collaboration to enhance quality and gain detailed insight into your projects.

For efficiency and collaboration, GT STRUDL delivers a durable, proven, and reliable solution, backed by a proven track record of more than 30 years in a variety of industries, such as Public Utilities, Manufacturing, Civil Works, Heavy Construction, Commercial/Resdential Building, Offshore Engineering, Ship Design, A/E/C Consulting, Government Agencies, and Academia.

Comprehensive Solution

GT STRUDL offers fully integrated and database-driven software for beam and general finite element analysis and comprehensive structural engineering design. The solution includes 10 functional areas that operate seamlessly with one another, combined with amazingly fast computational speed, GT STRUDL provides virtually unlimited power and flexibility for projects of any size or complexity.

Interoperability

GT STRUDL is natively interoperable with Intergraph Smart® solutions and CADWorx® Structure. This enables structural data-rich models created outside of GT STRUDL to fully leverage the power of GT STRUDL. It is also interoperable with third-party solutions through CIS/2 and GTI files. Reduce duplication of effort to save time and ensure data accuracy.

Quality Assurance

Since 1983, the GT STRUDL QA/QC program has been in full compliance with applicable provisions of the U.S. NRC's 10CFR21 and 10CFR50 Appendix B regulations. In addition, GT STRUDL QA procedures conform to the ASME NQA-1- 2008, including the 2009 Addenda Subpart 2.7 (NQA-1a-2009).

Steel & Concrete Structure Modeling

- Physical member definitions, labels, inquiry, and display.
- Nonlinear spring elements, support and member end springs, tension, and compression-only members, large sag catenary, and parabolic cables.
- Nonlinear fiber element plastic hinge and plastic zone member models.
- Friction-bearing, base-isolation elements.
- Integer and alphanumeric naming of joints, members, finite elements, and loading conditions.

Finite Element Analysis Using Plates, Shells & Solid Elements

GT STRUDL includes all the tools necessary for FEA of a broad range of structural projects, from the simplest to the most complex.

- Linear and nonlinear static and dynamic analysis.
- High-performance equation solvers.
- Maximum response harmonic analysis.
- Steady state time history dynamic analysis.
- Nonlinear pushover analysis.

Load Specifications & Generation

- Seismic and wind load generators per ASCE 7-05/7-10.
- Area load generator.
- Response spectrum analysis.
- Gupta and Lindley-Yow mode combination methodologies.
- Broad range of user-specified damping properties.
- Composite modal damping ratio calculations.

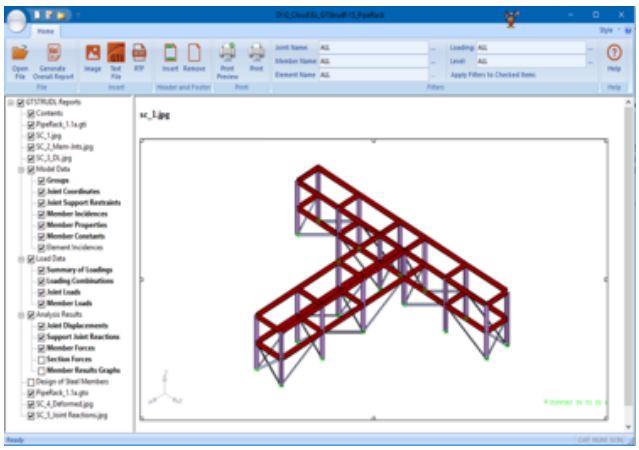
Design Codes

- **AISC**: 14th, 13th, 9th, N690, 341 & Older Editions; ASD/LRFD Methods.
- **British**: BS5950 & BS449.
- **AISI**: AISI89 for Unistrut Sections.
- **ASCE**: ASCE 7-05 & ASCE 7-10 Wind & Seismic Load Provisions; ASCE 52 Guide for Design of Steel Transmission Towers* & ASCE/SEI 48-05 Steel Pole Structures.
- **ASME**: Boiler & Pressure Vessel Code, Section III, Rules for Construction of Nuclear Facility Components, Div. 1-Subsection NF.
- **Eurocode**: EC3 plus National Annexes*.
- **Canadian**: CSA S16 & CAN.
- **Indian**: IS800.
- **Chinese**: GB (GuoBiao Standards).
- **Offshore**: ISO 19902, APIWSD (RP 2A-WSD) & Older Editions, NS 3472E.

*PreRelease Feature

Report Generation

- Interactively generate custom reports of model and load data, results, and figures.
- Move sections within the report from hierarchical tree display using the interactive interface.
- Filter by joints, members, elements, and loadings.
- Take advantage of customer footers, customer headers, and summary of loads.
- Save/Restore options on filters, order, and checklist.



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