



## 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:

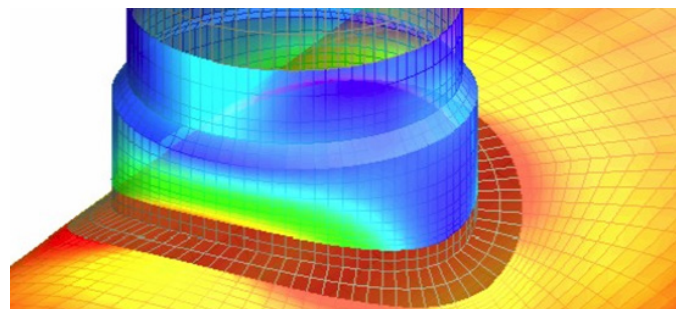
- The analysis of horizontal vessels with saddle supports (such as the Zick replacement)
- ASME Section III, Part NH requirements (high-temperature service)
- FFS analysis (API 579).
- Evaluation of overturning moments on vessel skirts
- Determining the effect of an integral vs. non-integral pad on a 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 Treatment, Building Services, Shipbuilding, and Architectural.



## 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.

Hexagon (Nasdaq Stockholm: HEXA B) has approximately 19,000 employees in 50 countries and net sales of approximately 3.5bn EUR. Learn more at [hexagon.com](http://hexagon.com) and follow us @HexagonAB.