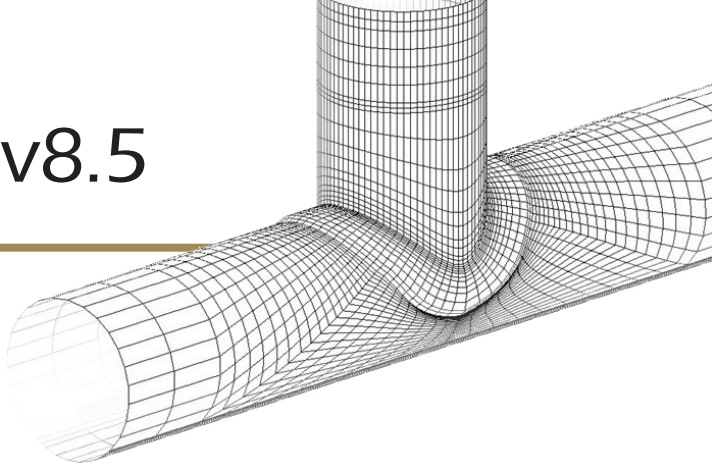
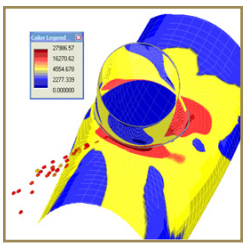
NozzlePRO v8.5





Finite Element Analysis

Moving Beyond WRC & Zick

Finite element technology moves beyond the limitations of WRC107, WR297 and Zick to allow engineers to design safer equipment more efficiently and cost-effectively.

Only **NozzlePRO** allows you to build WRC and Zick geometries with a few clicks of your mouse. When you consider that **NozzlePRO** provides finite element results from the **SAME** information needed to run a WRC or Zick analysis, the advantage is clear.

NozzlePRO v8.5 Updates

Multiple Load Case Multiplier

Include Flexibility Factors with Stiffness Calculation

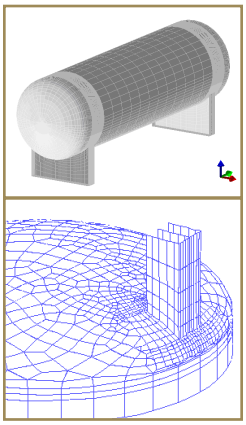
WRC 497 Default Lengths

Making FEA Work for You

NozzlePRO generates graphical and tabular results that clearly represent your system. The graphics can be viewed with DirectX and vividly display the results of pressure, moments, temperature and loads. The interactive toolbox allows the user to disect and manipulate models.

The tabular results give flexibilities and SIFs that can be put back into a piping analysis package, adding greater accuracy and better results.

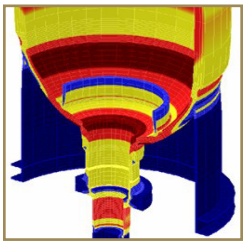
A primary advantage of **NozzlePRO** is the automated ASME Code Compliance reports. There is no need to perform additional post-processing since **NozzlePRO** reports stresses with comparisons to the ASME Section VIII - Division 2 stress categories.



Nozzles, Saddles, Pipe Shoes & Clips

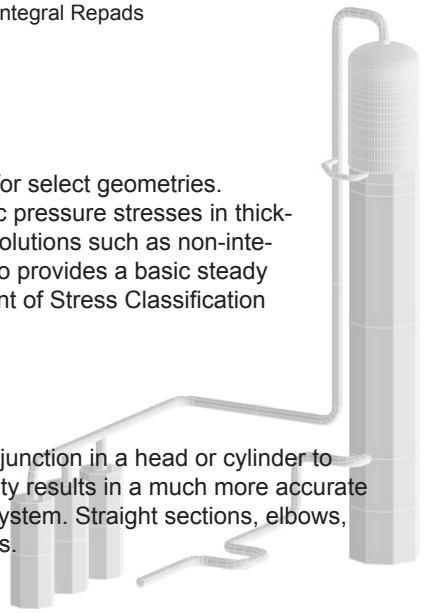
NozzlePRO is designed to quickly and easily evaluate nozzles, saddles, pipe shoes and clips. A variety of head types are allowed including spherical, elliptical, ASME, dished, cylindrical and conical. A minimum number of values must be input to generate the model. The engineer is able to include thermal, weight, operating, occasional, pressure, wind and earthquake loads. Within minutes you will be able to generate the following:

- Nozzles through Blind Flanges in Axisymmetric and Brick Models
- Double Bed Support
- Axisymmetric Horizontal Vessel with Saddles
- Steady State and Transient Heat Transfer for Axisymmetric 2d Elements
- Head Thickness Contours
- Blind or Matching Flange End Conditions for Axisymmetric or Brick Models
- Radiused Welds
- Overturning Moments on Skirts (Brick Models)
- Internal Ring Loads
- Integral and Non-Integral Repads



Axisymmetric and Brick Models

NozzlePRO offers optional axisymmetric and brick modeling capability for select geometries. This functionality was added to permit a more accurate analysis of cyclic pressure stresses in thick-walled intersections; and for geometries not directly amenable to shell solutions such as non-integral repads and overturning moments on skirts. The brick capability also provides a basic steady state and transient heat transfer calculation with the automatic placement of Stress Classification Lines (SCL's) and ASME Code stress evaluations.



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Piping Elements

NozzlePRO permits the user to pipe away from any **NozzlePRO** piping junction in a head or cylinder to evaluate the effect of the thermal expansion on the nozzle. This capability results in a much more accurate evaluation of loads and displacements on the nozzle and in the piping system. Straight sections, elbows, bends, intersections and linear restraints may be included in the analysis.

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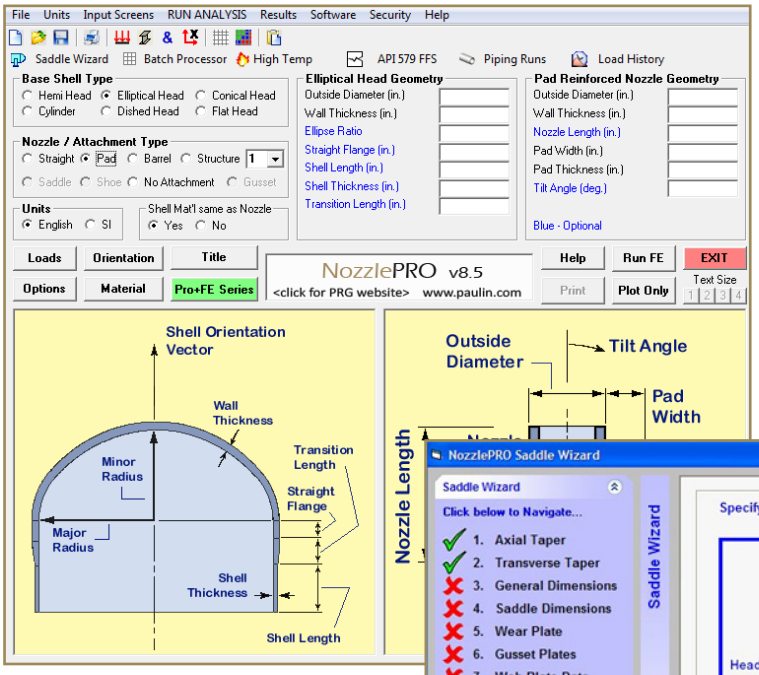
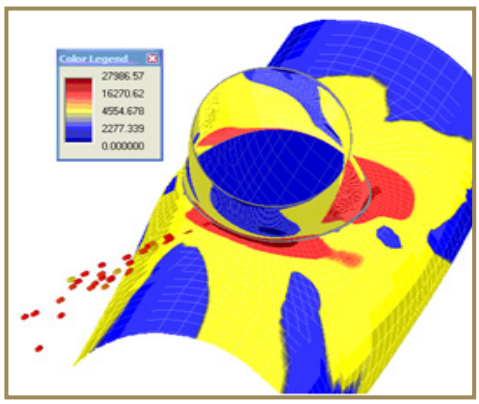
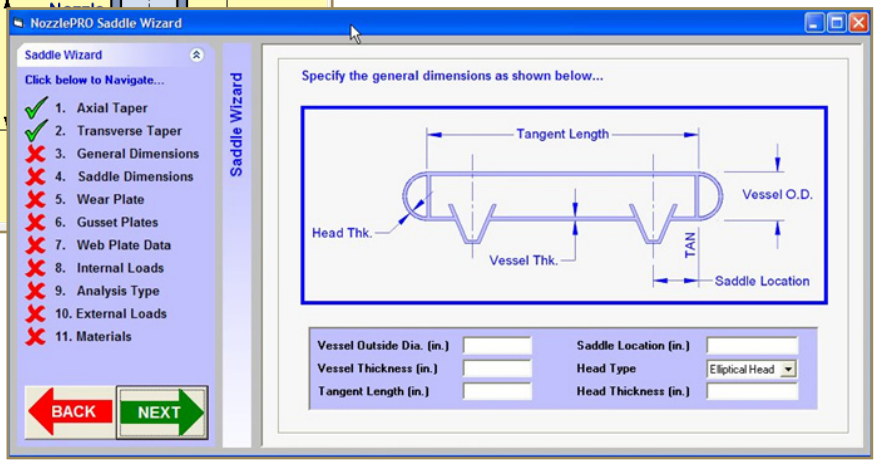
NozzlePRO is straight-forward and easy to use. Interactive window displays provide graphical input instructions, taking the guesswork out of geometry design. Quickly plot your model for visual verification.

Input Screen



DirectX 3-D Viewer





Saddle Wizard

When You Need to Use NozzlePRO

- When there are multiple thermal or operating loads acting on a nozzle.
- When the d/D ratio for a loaded nozzle is greater than 0.5 and WRC 107 or 297 is considered for use.
- When the t/T ratio for a loaded nozzle is less than 1.0 and WRC 107 or 297 is considered for use.
- When the nozzle is pad reinforced and WRC 107 or 297 is considered for use.
- When there are loads acting on a nozzle and run pipe simultaneously.
- When the number of full range pressure cycles is greater than 7000 and the nozzle is subject to external loads.
- When the D/T ratio is greater than 100 and SIFs or flexibilities are needed for a pipe stress program.
- When the D/T ratio is greater than 100 and a dynamic analysis including the nozzle is to be performed using a piping program.
- When a large lug is used in a heavily cyclic service.
- When pad reinforced lugs, clips or other support are placed on the knuckle radius of a dished head. WRT 107 simplifications for pad reinforced rectangular lug attachments are fraught with potentially gross errors.
- When seismic horizontal loads on vessel clips or box supports are to be evaluated.
- When pad reinforced hillside nozzles subject to pressure and external loads.
- When evaluating large run moments, but small branch moments in a piping system.
- When there are overturning moments on skirts.
- When the effect of integral vs. non-integral pad on nozzle in head should be studied.
- When there are different thermal expansion coefficients or temperatures between the header and branch.
- When the loads on nozzles are high because of the assumption that the nozzle connection at the vessel is a rigid anchor. Few connections at vessels are rigid. Even small rotations can significantly reduce the calculated moment and stress. Accurate flexibilities permit the actual moment on the vessel nozzle to be calculated and included in design.
- When there is heat transfer in an axisymmetric model geometry.
- When the effect of adding a radius to weld geometries on nozzles in heads should be investigated.
- When the anlayst needs to run various model types, comparing results to determine the stability and accuracy of the solution. To verify FEA calculations, NozzlePRO allows nozzles in heads to be analyzed with shell, axisymmetric, or brick finite elements.
- When horizontal vessels are saddle supported, with or without wear plates, and including tapered saddles with many design options.
- When evaluating the effects of axial or transverse loads due to internal sloshing, wind loads, seismic loads, or general external loads. **Zick's methods do not consider either axial or transverse loads.**
- When designing pipe shoes for self-weight, liquid weight and axial loads.

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NozzlePRO Plus

NozzlePRO PLUS includes access to MatPRO.

MatPRO is primarily a material properties database for ASME Sec. II Part D and ASME B31 materials and includes calculators for:

- API 579 Fitness for Service
- High Temperature Creep-Fatigue Interaction (ASME Section III Subsection NH)
- Fatigue Life Estimation

MatPRO is useful when combined with NozzlePRO and is a valuable tool for everyday use in piping or vessel engineering. The immediate availability of all material properties and the additional calculation features make it a useful tool for a variety of tasks.

- Extensive materials database for roughly 10 codes/years.
- Time saving advantages such as “linked” materials properties.
- You no longer need to manually look-up the yield, tensile, expansion coefficient, elastic modulus, or fatigue curve.
- All these properties are automatically “linked” to each material specification.
- Section II stress table notes are automatically available for each specification.
- Ability to generate temperature dependent property plots for nearly any material property and specification.
- Fatigue calculations which include ASME, BS 5500, EN 13445, etc.
- Fitness for service calculations for local thin areas and crack-like flaws in accordance API 579.
- High temperature compliance checks in accordance with ASME Section III, Part NH.

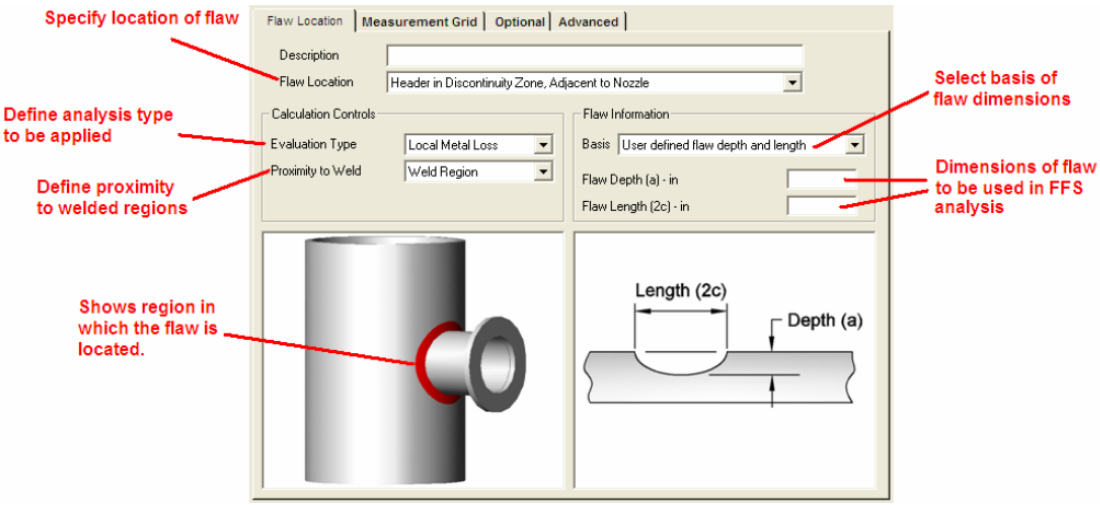
The Fatigue Calculator provides side-by-side comparisons with other Codes and makes it easy to examine “what if” scenarios. This feature provides engineers with an understanding of how accurate their fatigue calculations are.

NozzlePRO FFS

NozzlePRO FFS includes access to MatPRO and Advanced Fitness for Service Applications.

Local thin areas and crack like flaws may be evaluated for most Nozzle/PRO geometries using the Nozzle/PRO Fitness for Service input form. Fitness for service evaluations are conducted using API 579 methodologies for Level 2 & Level 3 checks. Up to ten flaws may be defined for each model.

The Flaw Location input sheet provides input to define the location, type, and geometry of the flaw.



A Pass/Fail summary of the FFS calculations is provided in the FFS Results Summary report. This report provides a quick review of the calculation results for each of the user defined flaws.

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