NozzlePRO v12.1

Finite Element Analysis provides the right answer.

Finite

Element

Analysis

Pressure Vessel & Piping Engineers

ASME Sec. VIII Div. 2 2007 Edition, A08 Addenda

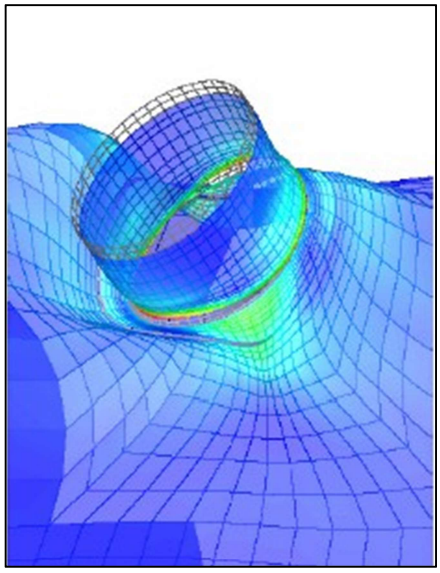
Fast, Accurate and Easy to Understand Results

Template-Based Design Tools

Code Compliance Reports

NozzlePRO addresses many needs of PVP engineers working in today's market.

Typical pressure vessel design codes, such as ASME Section VIII, cannot address all design cases. For instance, external loads on nozzles are not addressed within the Code. In such cases, engineers need to go outside of the Code and apply recognized design procedures such as finite element analysis using NozzlePRO. Simplified calculation methods commonly used in the PVP industry such as WRC 107/297 are based on limited test data and are known to be inaccurate in many cases. NozzlePRO provides realistic answers for all cases.



NozzlePRO is designed to quickly and easily evaluate nozzles, saddles, pipe shoes an clips. A variety of head types are allowed including spherical, elliptical, ASME, dished, cylindrical and conical.

NozzlePRO offers optional axisymmetric and brick modeling capability for select geometries, permitting a more accurate analysis of cyclic pressure stresses in thick-walled geometries.

NozzlePRO permits the user to pipe away from any NozzlePRO piping junction into a head or cylinder. Straight sections, elbows, bends, intersections and linear restraints may be included in the analysis.

New Features in Version 12.1

Model Generation

New Drawing Tools allow for graphical "CAD-like" modification of shell model details and addition of model components.
Interactive Output Processing – MimOut Multiple models can be reviewd simultaneously on a region-by-region basis. All reports can be sent to Word or Excel.

Analysis & the Codes

Support for ASME VIII-2 Part 5 Nonlinear Analysis
MultiCore SuperNode Solver (4-to-8 times faster)
Automatic Generation of B31.d SSIs or B31.1 replacement for .75i per B31J
Updated Allowable Load Algorithm for Pipe Shoes & Saddles
Steady State & Transient Thermal Gradient of Pipe Shoes, Saddles & Structural Elements
Directives for EN13445 Local Stress Analysis
Automatic Nonlinear Calculation of ASME VIII
ASME B31J Nozzle Stress Calculations (STP-PT-074) – use PRGiK

Plasticity Solution

Reinhart Elastic-Plastic Ratcheting Evaluation
Twice Yield Fatigue Evaluation
Automatic Nonlinear Calculation of ASME VIII-2 Para 5.3.3.1 ep/eL ratio
Automatic Collapse & Twice Elastic Analysis
All shell templates can be analyzed using the VIII-2 Part 5 Nonlinear Solver.

Fitness for Service

Latest Version of API-579 / FFS-1 & Enhanced Local Thickness Modeling
J Integral Calculations
RSF Factor for Elastic FFS

Miscellaneous

Pipe Shoe Library provided by Piping Technology & Products

NozzlePRO v12.1

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WHEN 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.
- When there is heat transfer in axisymmetric model geometry.
- When the effect of adding a radius to weld geometries on nozzles in heads should be investigated.
- When the analyst needs to run various model types, comparing results to determine the stability and accuracy of the solution.
- 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.

FITNESS FOR SERVICE

NozzlePRO performs Level 1, Level 2, and Level 3-Type API 579 calculations. The local thinning area approach is employed to satisfy the Level 3-Type analysis. Multiple flaws are allowed in the analysis. PRG has added J Integral calculations and RSF Factor for elastic FFS.

CRACK PREDICTION TOOL

PRG ran a series of fatigue tests tracking crack propagation. This data, in conjunction with past theories of crack initiation and propagation were used to develop an algorithm based on the stress level to predict the mean cycles to through wall crack. If the elastic Level 3 analysis fails, then an elastic-plastic method can be used to satisfy the code (based on ASME Section VII-2 Part 5.

NOZZLEPRO INCLUDED MODULE

MATPRO is PRG's materials database which includes high temperature curves, allowable stress plots, NH reporting, creep-fatigue interaction diagrams, elastic-plastic stress strain curves, and fatigue curves generated as a function of creep temperature.

NOZZLEPRO SERVICE PLAN MODULES

These modules were designed to add increased ease-of-use & design for the most common analysis needs and are included with an active NozzlePRO v12.0 service plan.

FE107 v2.7 uses FEA technology to provide stress analysis of nozzle connections on piping and pressure vessels. Output is compared directly to WRC 107 and WRC 297 results.

FESIF v2.7 is an FEA based program that automatically calculates stress intensification factors (SIFs) and flexibility factors for a wide variety of piping intersections not covered by the B31 piping codes.

FETEE v1.5 evaluates i-factors, k-factors and loads for FEA models of contoured fittings.