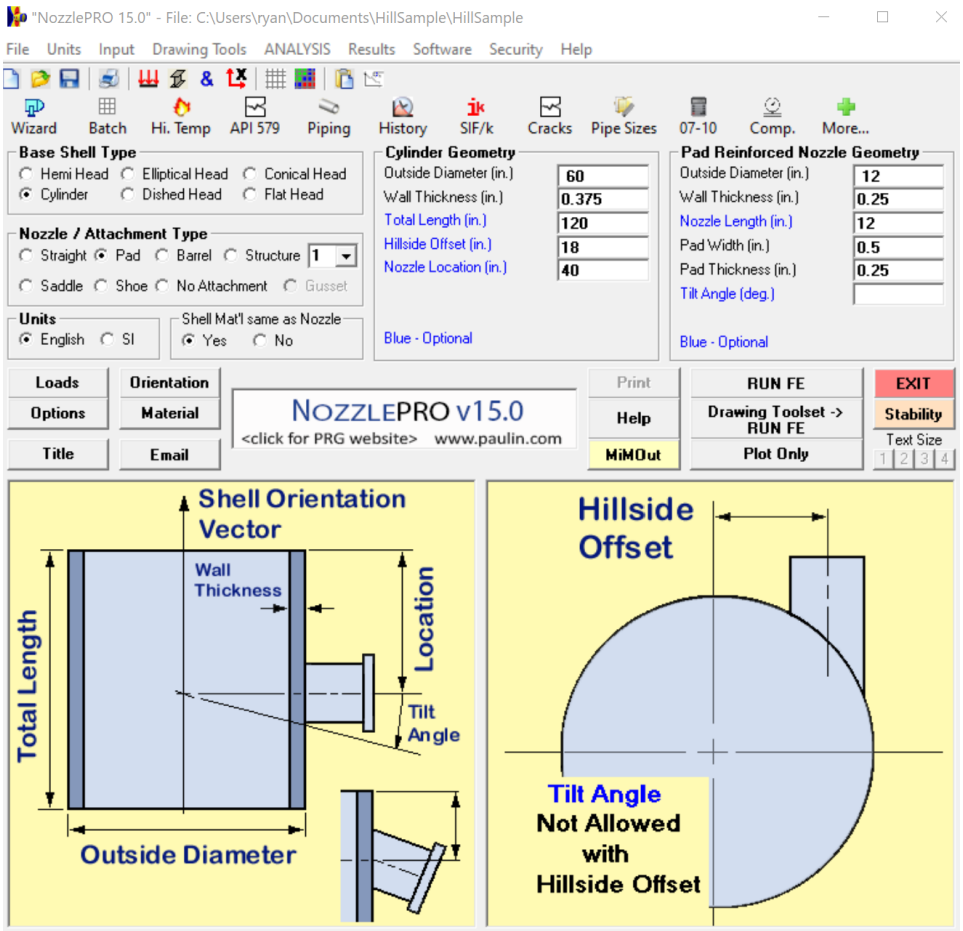
SAMPLE
NozzlePro™ Model

With Inputs and Output/Reports

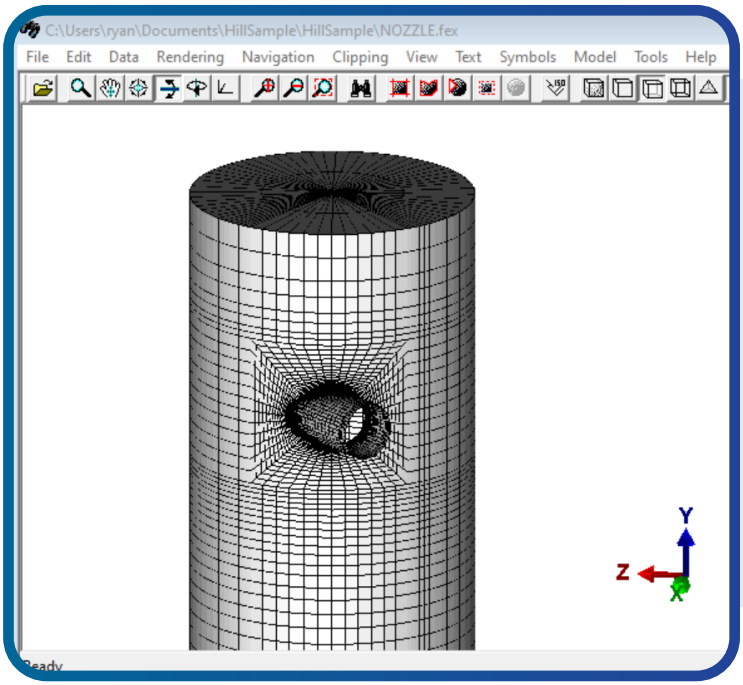
Sample Model Input Parameter Summary:

- Hillside Nozzle with Reinforcement Pad
- Basic Weight and Operating Loads Defined
- Default Carbon Steel Material Properties for Both Shell and Nozzle

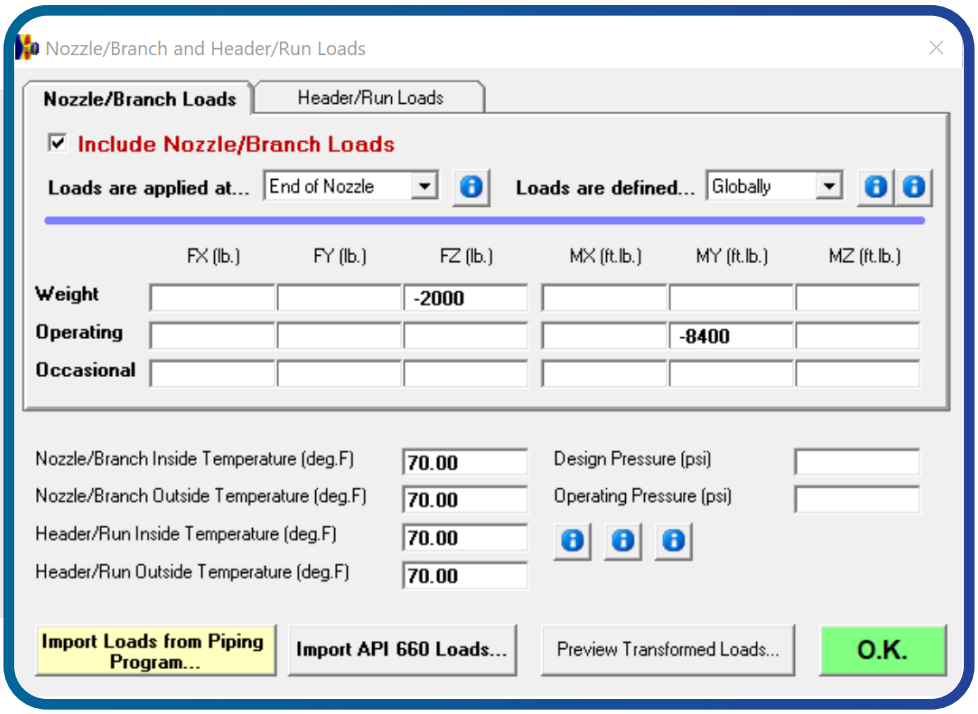
The main NozzlePro input screen for this model is as follows:



Just these few inputs shown above (Base Shell Cylinder Option, Nozzle “Pad” Option and 10 input values) gives us the intelligently constructed mesh shown below. This, along with just a few more pieces of data, should be ready for a complete FEA treatment.

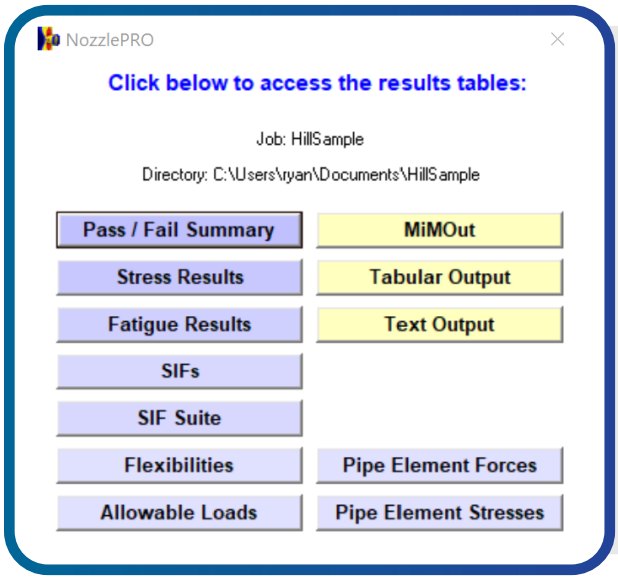


The piping that is attached to this Hillside Nozzle results in the following Static (Weight) and operating loads being applied to this nozzle.



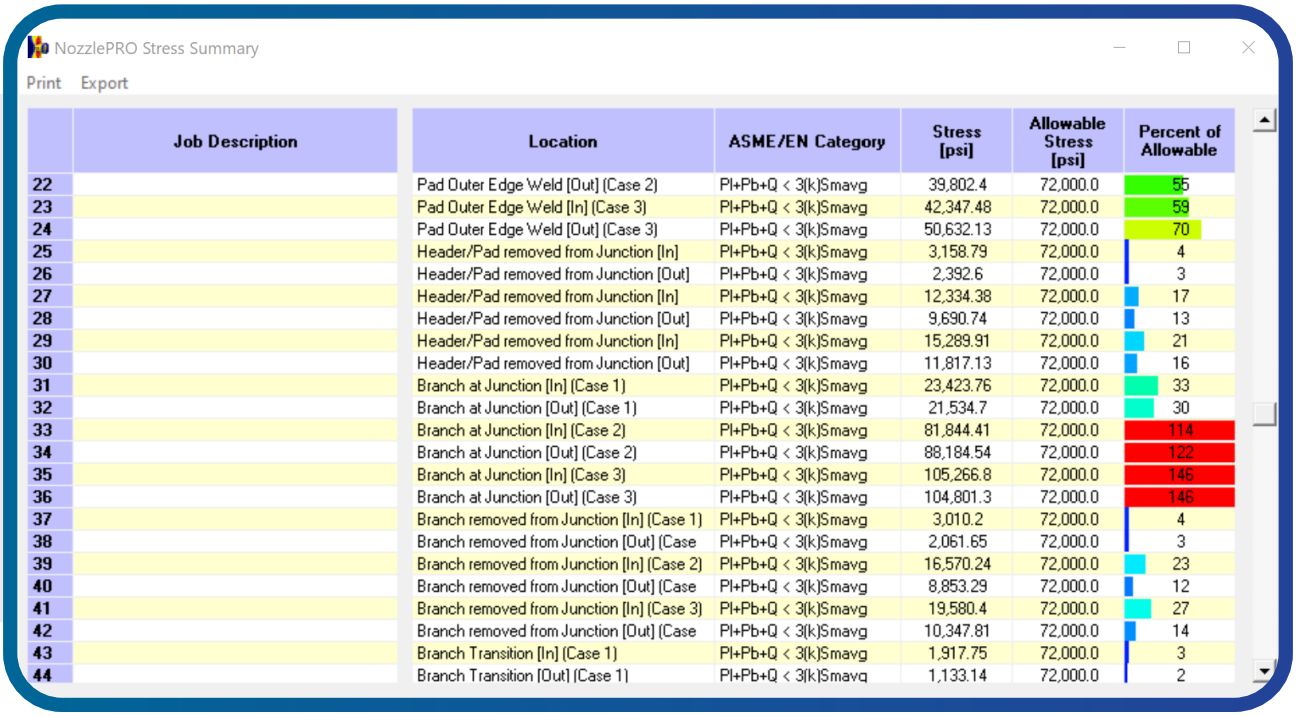
The user then specifies the material properties (from our materials database) for the shell and nozzle and the analysis is ready to be run. The user has a multitude of additional options to control the model or ASME options, but those are beyond the scope of this document. The remainder of this document covers the options the user can choose from to view or document their output/results.

Upon completion of the analysis, the first thing the user sees is this:



The buttons give the user quick access to specific results. The first button simply identifies whether or not any of the calculated stress results fall outside code limits (Pass/Fail). If this indicates "Fail", the user can press the next button to see specific stress results on region – by region basis and how those calculated stress results compare to the Code Limits that apply to that specific region of the model.

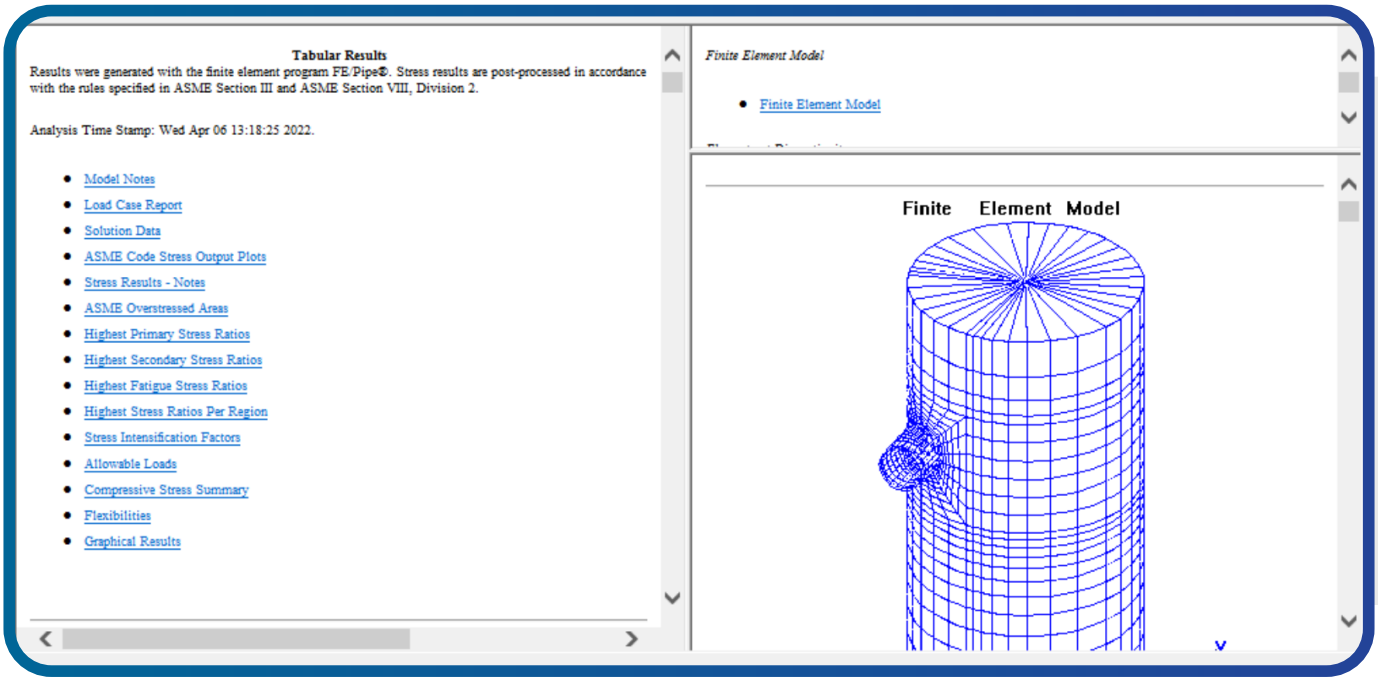
See the figure below.

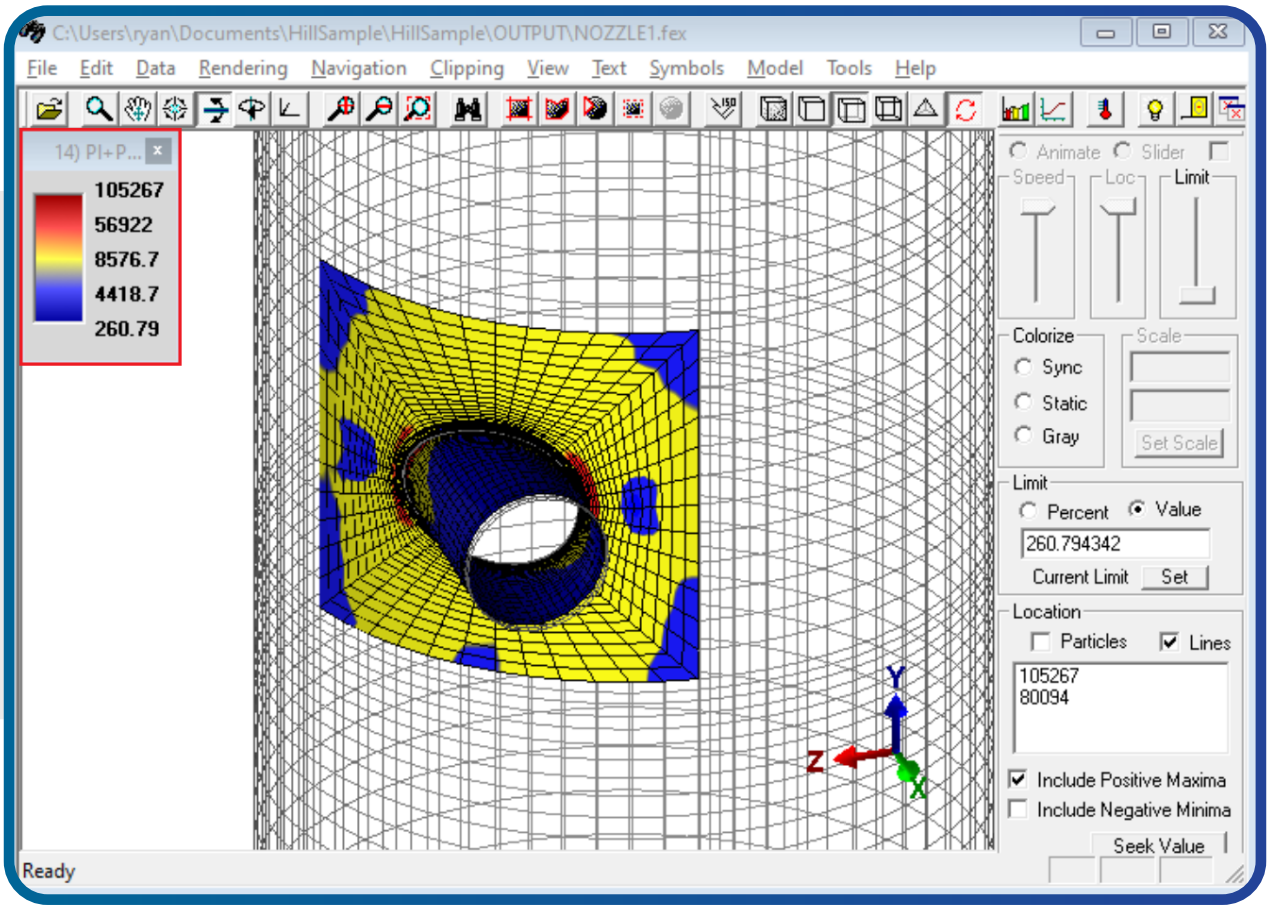


	Job Description	Location	ASME/EN Category	Stress [psi]	Allowable Stress [psi]	Percent of Allowable
22		Pad Outer Edge Weld [Out] (Case 2)	Pl+Pb+Q < 3(k)Smavg	39,802.4	72,000.0	55
23		Pad Outer Edge Weld [In] (Case 3)	Pl+Pb+Q < 3(k)Smavg	42,347.48	72,000.0	59
24		Pad Outer Edge Weld [Out] (Case 3)	Pl+Pb+Q < 3(k)Smavg	50,632.13	72,000.0	70
25		Header/Pad removed from Junction [In]	Pl+Pb+Q < 3(k)Smavg	3,158.79	72,000.0	4
26		Header/Pad removed from Junction [Out]	Pl+Pb+Q < 3(k)Smavg	2,392.6	72,000.0	3
27		Header/Pad removed from Junction [In]	Pl+Pb+Q < 3(k)Smavg	12,334.38	72,000.0	17
28		Header/Pad removed from Junction [Out]	Pl+Pb+Q < 3(k)Smavg	9,690.74	72,000.0	13
29		Header/Pad removed from Junction [In]	Pl+Pb+Q < 3(k)Smavg	15,289.91	72,000.0	21
30		Header/Pad removed from Junction [Out]	Pl+Pb+Q < 3(k)Smavg	11,817.13	72,000.0	16
31		Branch at Junction [In] (Case 1)	Pl+Pb+Q < 3(k)Smavg	23,423.76	72,000.0	33
32		Branch at Junction [Out] (Case 1)	Pl+Pb+Q < 3(k)Smavg	21,534.7	72,000.0	30
33		Branch at Junction [In] (Case 2)	Pl+Pb+Q < 3(k)Smavg	81,844.41	72,000.0	114
34		Branch at Junction [Out] (Case 2)	Pl+Pb+Q < 3(k)Smavg	88,184.54	72,000.0	122
35		Branch at Junction [In] (Case 3)	Pl+Pb+Q < 3(k)Smavg	105,266.8	72,000.0	146
36		Branch at Junction [Out] (Case 3)	Pl+Pb+Q < 3(k)Smavg	104,801.3	72,000.0	146
37		Branch removed from Junction [In] (Case 1)	Pl+Pb+Q < 3(k)Smavg	3,010.2	72,000.0	4
38		Branch removed from Junction [Out] (Case	Pl+Pb+Q < 3(k)Smavg	2,061.65	72,000.0	3
39		Branch removed from Junction [In] (Case 2)	Pl+Pb+Q < 3(k)Smavg	16,570.24	72,000.0	23
40		Branch removed from Junction [Out] (Case	Pl+Pb+Q < 3(k)Smavg	8,853.29	72,000.0	12
41		Branch removed from Junction [In] (Case 3)	Pl+Pb+Q < 3(k)Smavg	19,580.4	72,000.0	27
42		Branch removed from Junction [Out] (Case	Pl+Pb+Q < 3(k)Smavg	10,347.81	72,000.0	14
43		Branch Transition [In] (Case 1)	Pl+Pb+Q < 3(k)Smavg	1,917.75	72,000.0	3
44		Branch Transition [Out] (Case 1)	Pl+Pb+Q < 3(k)Smavg	1,133.14	72,000.0	2

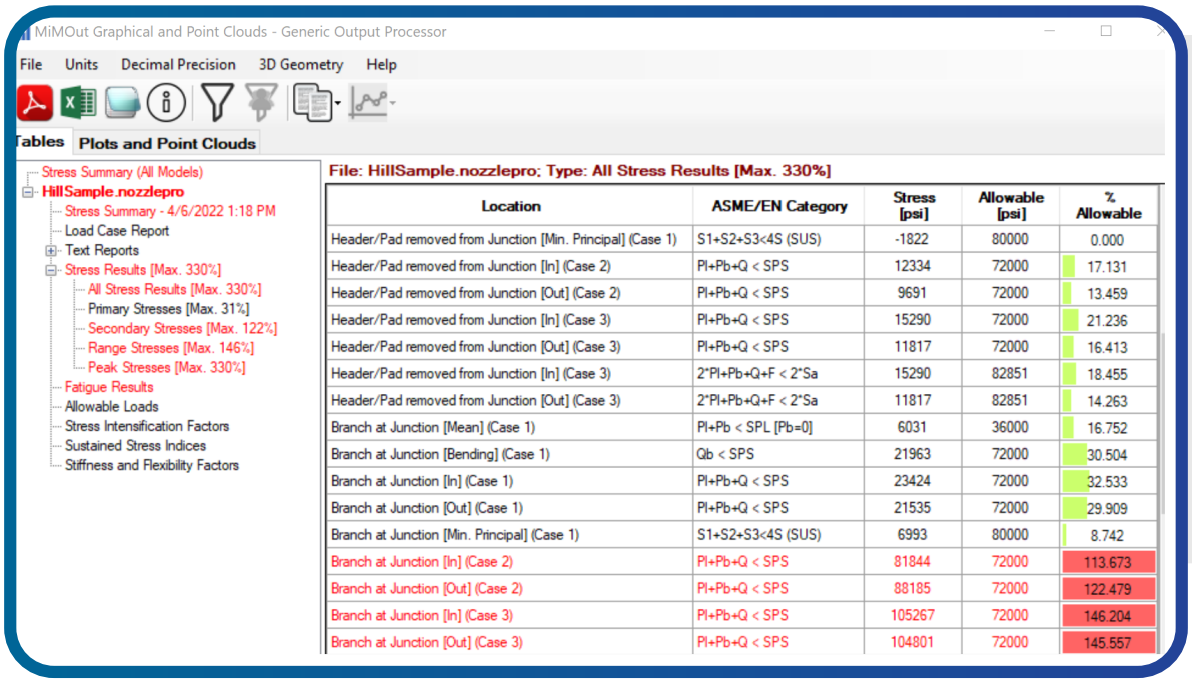
This was scrolled down to the items that caused this model to "Fail" the Code Limit checks. This shows the percent allowable stress that was calculated for that region of the model. The user can use this specific information to either modify the design, or work to see if the applied loads can be reduced such that the calculated stress falls within the Code Limits.

The user also gets a full text-based output summary and a collection of 3D stress plots that show the specific regions and load cases analyzed with stress results. The table of contents for the tabular results are shown in the first image below (on the left) and the standard NozzlePro output also includes 3D stress plots shown below.

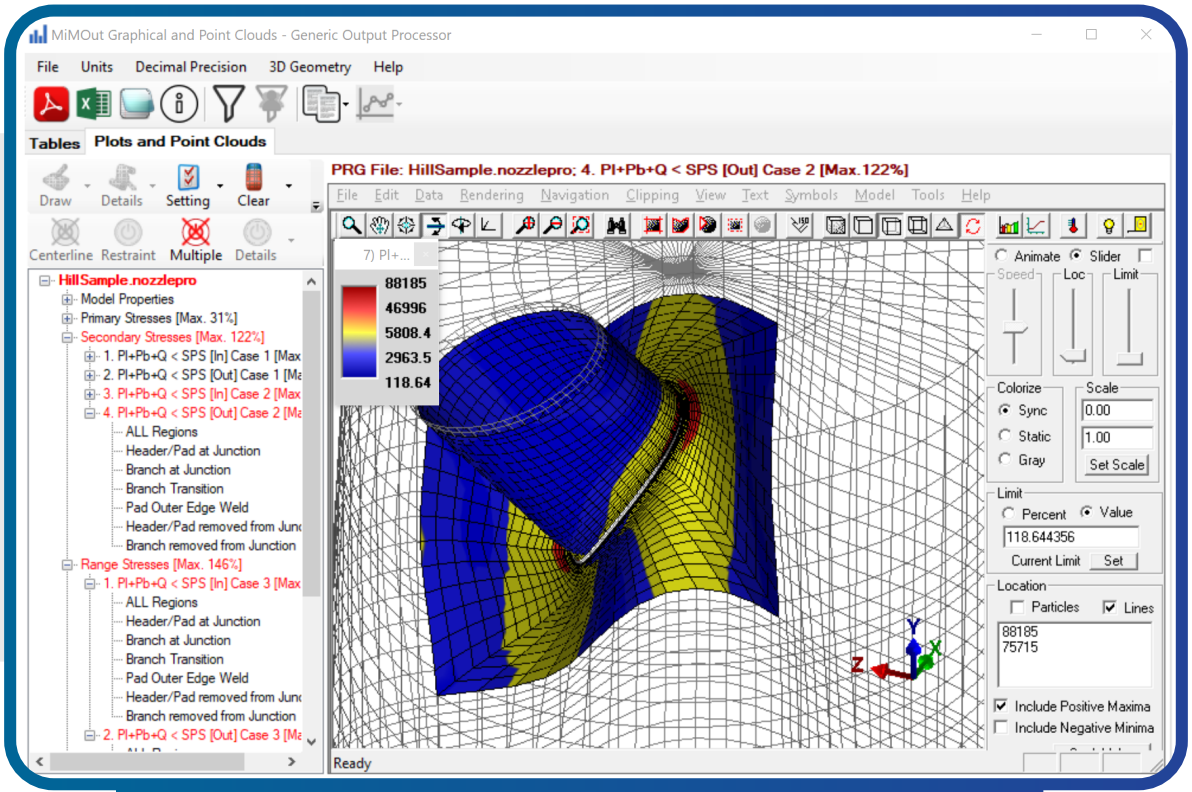




The user can also create a custom graphic output using the MiMout reporting tool:



Location	ASME/EN Category	Stress [psi]	Allowable [psi]	% Allowable
Header/Pad removed from Junction [Min. Principal] (Case 1)	S1+S2+S3<4S (SUS)	-1822	80000	0.000
Header/Pad removed from Junction [In] (Case 2)	PI+Pb+Q < SPS	12334	72000	17.131
Header/Pad removed from Junction [Out] (Case 2)	PI+Pb+Q < SPS	9691	72000	13.459
Header/Pad removed from Junction [In] (Case 3)	PI+Pb+Q < SPS	15290	72000	21.236
Header/Pad removed from Junction [Out] (Case 3)	PI+Pb+Q < SPS	11817	72000	16.413
Header/Pad removed from Junction [In] (Case 3)	2*PI+Pb+Q+F < 2*Sa	15290	82851	18.455
Header/Pad removed from Junction [Out] (Case 3)	2*PI+Pb+Q+F < 2*Sa	11817	82851	14.263
Branch at Junction [Mean] (Case 1)	PI+Pb < SPL [Pb=0]	6031	36000	16.752
Branch at Junction [Bending] (Case 1)	Qb < SPS	21963	72000	30.504
Branch at Junction [In] (Case 1)	PI+Pb+Q < SPS	23424	72000	32.533
Branch at Junction [Out] (Case 1)	PI+Pb+Q < SPS	21535	72000	29.909
Branch at Junction [Min. Principal] (Case 1)	S1+S2+S3<4S (SUS)	6993	80000	8.742
Branch at Junction [In] (Case 2)	PI+Pb+Q < SPS	81844	72000	113.673
Branch at Junction [Out] (Case 2)	PI+Pb+Q < SPS	88185	72000	122.479
Branch at Junction [In] (Case 3)	PI+Pb+Q < SPS	105267	72000	146.204
Branch at Junction [Out] (Case 3)	PI+Pb+Q < SPS	104801	72000	145.557



Specific region selected with exaggerated deformation shown for model discussion/validation.

Brief examples of the tabular data that is produced are shown below (includes model input data and the overstressed regions of the tabulated data report).

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Model Notes
Model Notes

    Input Echo:

    Model Type                    : Cylindrical Shell

    Parent Geometry

           Parent Outside Diam.   :      60.000 in.
           Thickness              :       0.375 in.

    Parent Properties:

           Cold Allowable         :     20000.0 psi
           Hot  Allowable         :     20000.0 psi
           Material ID #1         :  Low Carbon Steel
           Ultimate Tensile (Amb) :     65000.0 psi
           Yield Strength (Amb)   :     36000.0 psi
           Yield Strength (Hot)   :     36000.0 psi
           Elastic Modulus (Amb)  :  29000000.0 psi
           Poissons Ratio         :       0.300
           Expansion Coefficient  :  0.6000E-05 in./in./deg.
           Weight Density         :  0.0000E+00 lb./cu.in.(NOT USED)

    Hillside Offset Distance      :      18.000 in.

    Nozzle Geometry

           Nozzle Outside Diam.   :      12.000 in.
           Thickness              :       0.250 in.
           Length                 :      12.000 in.
           RePad Width            :       0.500 in.
           RePad Thickness        :       0.250 in.
           Nozzle Tilt Angle      :       0.000 deg.
           Distance from Top      :      40.000 in.
           Distance from Bottom   :      80.000 in.

    Nozzle Properties

           Cold Allowable         :     20000.0 psi
           Hot  Allowable         :     20000.0 psi
           Material ID #1         :  Low Carbon Steel
           Ultimate Tensile (Amb) :     65000.0 psi
           Yield Strength (Amb)   :     36000.0 psi
           Yield Strength (Hot)   :     36000.0 psi
           Elastic Modulus (Amb)  :  29000000.0 psi
           Poissons Ratio         :       0.300
           Expansion Coefficient  :  0.6000E-05 in./in./deg.
           Weight Density         :  0.0000E+00 lb./cu.in. (NOT USED)

    Design Operating Cycles       :       7000.

    Ambient Temperature (Deg.)    :       70.00

    Pressure                      :         0.0 psi

    User Defined Load Input Echo for the ATTACHMENT:

    Loads are given at the End of Nozzle

    Loads are defined in Global Coordinates
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Forces(lb.) Moments (ft-lb)

Load Case	FX	FY	FZ	MX	MY	MZ
WEIGHT:	0.0	0.0	-2000.0	0.0	0.0	0.0
OPER:	0.0	0.0	0.0	0.0	-8400.0	0.0

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Highest Secondary Stress Ratios $X

In combination case 3 the max range stress divided by the max component stress is 1.58. The case tensor components are in some directions additive and so the combination case will have HIGHER stresses than the largest of any of the individual cases by more than 50%.

Load Case	Combined/Max (Inside)	Combined/Max (Outside)
3	1.575	1.443

Header/Pad at Junction

Pl+Pb+Q	SPS	Primary+Secondary (Outer) Load Case 3
29,881 psi	72,000 psi	Min Prin. Stress = -20533. (92% Neg, 20% NegHi)
		Plot Reference:
		15) Pl+Pb+Q < SPS (EXP,Outside) Case 3
41%		

Branch at Junction

Pl+Pb+Q	SPS	Primary+Secondary (Inner) Load Case 3
105,267 psi	72,000 psi	Min Prin. Stress = -67974. (98% Neg, 29% NegHi)
		Plot Reference:
		14) Pl+Pb+Q < SPS (EXP,Inside) Case 3
146%		

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