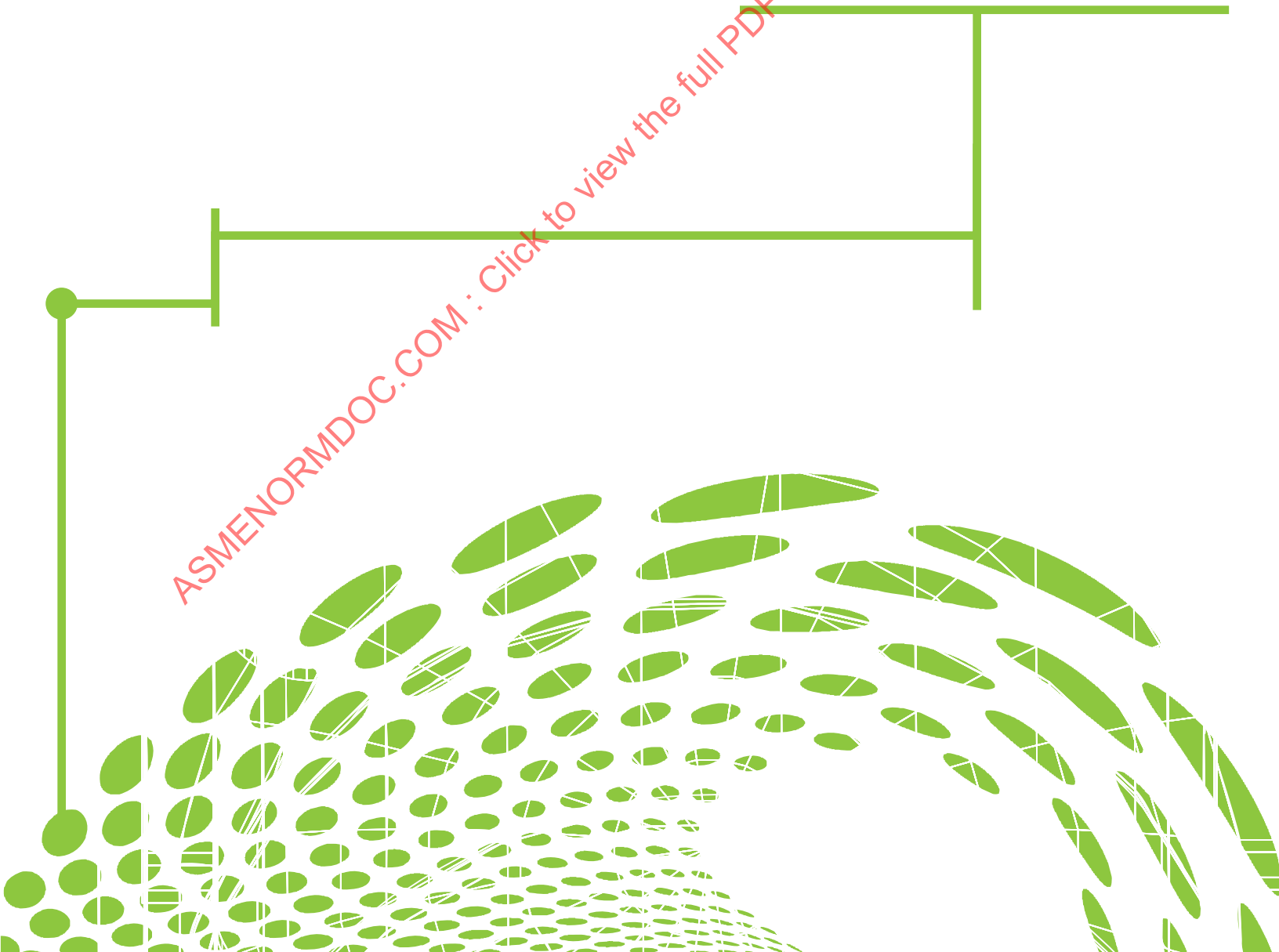




# LOCAL STRESSES IN NOZZLES IN SHELLS AND FORMED HEADS FROM EXTERNAL LOADS

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STP-PT-074

# LOCAL STRESS IN NOZZLES, SHELLS AND FORMED HEADS FROM EXTERNAL HEADS

*Prepared by:*

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ASME STANDARDS  
TECHNOLOGY, LLC

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## FOREWORD

The purpose of this report is to compute local stresses in nozzles and shells in the D/T range from 7 to 2500, the d/D range from 0 to 0.7 and the t/T range from 0.1 to 10. Rules for the evaluation of the local stresses in accordance with ASME BPVC Section VIII - Division 2 - Rules for Construction of Pressure Vessels - Alternative Rules are also provided along with validation comparisons against other correlations, finite element results and test data. Pad reinforced nozzles are considered but little validation is available. Pad reinforced nozzle guidelines should be used with caution.

Many people have graciously provided comments and recommendations during the course of this project, most significantly Chris Hinnant, and Kam Mokhtarian.

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## ABSTRACT

This report contains recommendations and supporting data for rules to compute local stresses in nozzles in shells and formed heads due to external loads and pressure. This report is the outcome of an ASME ST-LLC Research Project No. 07-10 on Nozzle Design Rules (Project No. 07-10). These rules follow the general format used in Part 4 of ASME Boiler and Pressure Vessel Code Section VIII-Rules for Construction of Pressure Vessels Division 2-Alternative Rules (BPVC VIII Section 2).

This report is also considered a continuation of the work done by Paulin Research Group (PRG) for ASME ST-LLC on Research Project No. 07-02, titled “Stress Intensity Factor and K-Factor Alignment for Metallic Pipes” [1]. That research project objective was to align stress intensification and flexibility factors for metallic pipe used in ASME’s Pressure Piping Codes (B31) and BPVC Section III-Rules for Construction of Nuclear Facility Components-Division 1-Subsection NC-Class 2 Component and BPVC Section III-Rules for Construction of Nuclear Facility Components-Division 1-Subsection ND-Class 3 Components. The results were published as “STP-PT-073: Stress Intensity Factor and K-Factor Alignment for Metallic Pipes”. Information contained in numerous Welding Research Council, Inc.’s bulletins are also heavily referenced, most notably WRC 497 [2].

A large series of finite element runs have been performed, following recommended modeling procedures in WRC 497 [2], BPVC VIII-Section 2 Annex 5.A [3], and EPRI 110996 [4], to extend the parameter ranges and geometries evaluated in WRC Bulletins 107 [5], 297 [6] and 497 [2].

Comparisons of regressions and results in WRC 497 [2] and TR 110996 [4] are performed to validate the finite element approach, the parameter range limitations, and the signed maximum error approaches discussed in Appendix 1. Appendix 2 contains the recommended rules and supporting tables. Appendix 3 contains result tables for each of the over 24,000 finite element runs.

The rules in Appendix 2 are intended to provide conservative and consistent guidelines in a broad parameter range for nozzles in vessel shells and formed heads for branch to vessel diameter ratios less than 0.7. Part 5 Rules for Design by Analysis of BPVC VIII-Section 2 are recommended when less conservative results are needed or when other geometries must be considered.

## NOMENCLATURE

$D_m$	mean diameter of vessel at point of nozzle attachment <sup>1</sup>
$d_m$	mean diameter of nozzle <sup>2</sup>
$e$	signed error = $(S_{fe} - S_{correlation}) / S_{correlation}$
$T$	vessel thickness
$t$	nozzle wall thickness <sup>2</sup>
$t_p$	thickness of reinforcing pad
$W$	width of the reinforcing pad (Figure 4.5.1)
$M_i$	in-plane moment
$M_o$	out-of-plane moment
$M_t$	torsion moment
$P$	internal pressure
$R$	mean radius of the vessel $R = D/2$
$S_a$	allowable stress based on the material of construction and design temperature
$S_{correlation}$	stress from regression of finite element data
$S_{fe}$	stress from finite element data
$SF$	stress factor – used to compute the membrane, bending or surface stress quantity of interest

<sup>1</sup> For a spherical or elliptical head,  $D$  is the mean diameter of the vessel attached to the head.

<sup>2</sup> Within the limits of reinforcement  $L_h$  in Figures 4.5.1 and 4.5.2

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## 1 DISCUSSION

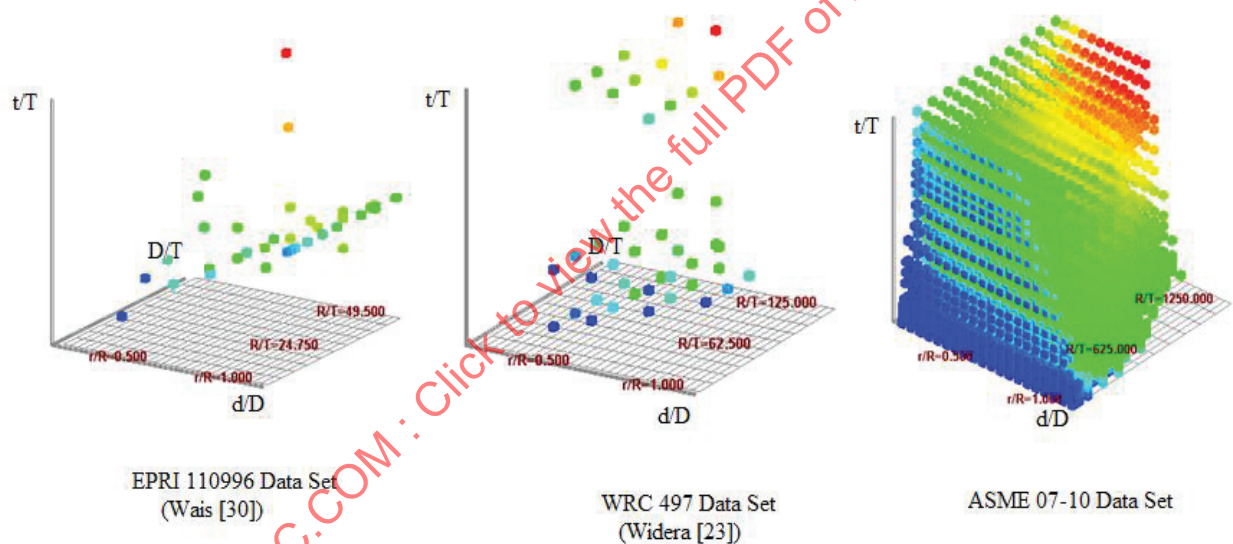
High regression  $R^2$  values are not thought to be adequate indicators for finite element data correlations over the desired parameter ranges and so maximum signed error for each data point is used as the most reliable evaluation tool over the broad parameter range of interest.

When Wais [2] and Widera [4] data sets are evaluated using each other's correlation equations for applicable parameter ranges, maximum signed errors of 54% and 39% are obtained. As might be expected, most of the error occurs where  $D/T$  and  $d/D$  is large, or when  $t/T$  is less than one, but greater than  $d/D$ .

- $d/D$  generic dimensionless nozzle-to-vessel diameter ratio.
- $D/T$  generic dimensionless vessel diameter to thickness ratio.
- $t/T$  generic nozzle thickness to vessel thickness ratio.

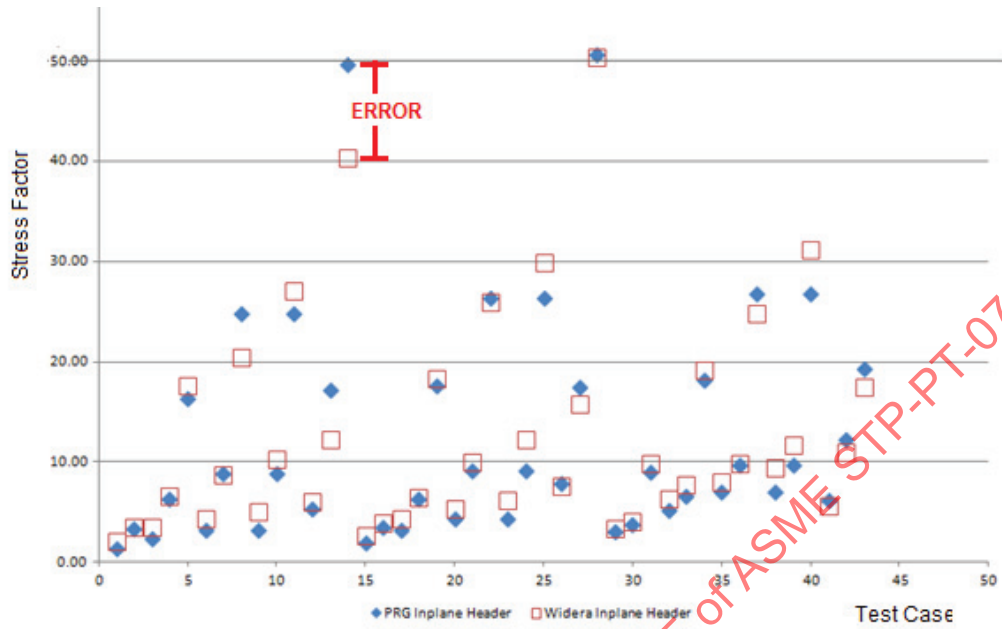
The data bases for the referenced comparison documents are shown in Figure 1-1 below. Each point represents a finite element model in the  $D/T$ ,  $d/D$  and  $t/T$  space.

**Figure 1-1: Data Set Parameter Space Distribution**



Various comparisons of finite element model data and correlation equation results are shown in Figures 1-2 through 1-4 below. Figure 1-2 shows the comparison between PRG FEA data and the Widera [2] FEA data for identical models. Section 6.0 discusses the differences in the two models that appear in the high stress factor (SF) ranges.

Figure 1-2: FEA Model Result Comparison Example



Figures 1-3 and 1-4 below show how the Wais [4] and Widera [2] correlation equations compare to the finite element model results used in the regression. Where the correlation equation under predicts the finite element calculated stress, the results are not conservative.

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Figure 1-3: Wais FEA Data Compared to Wais Correlation Equation (Max Error = 35%)

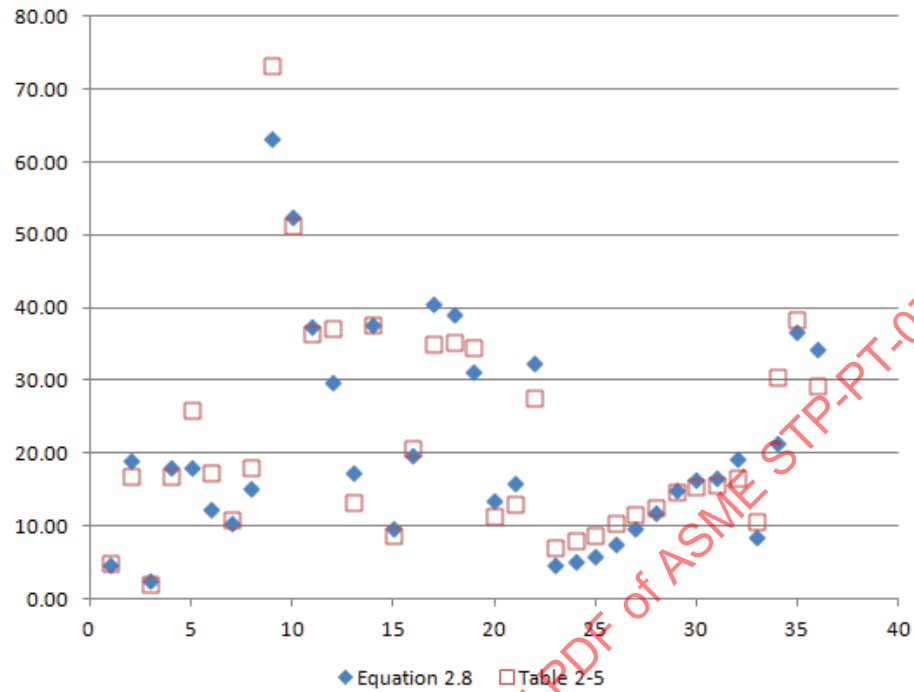
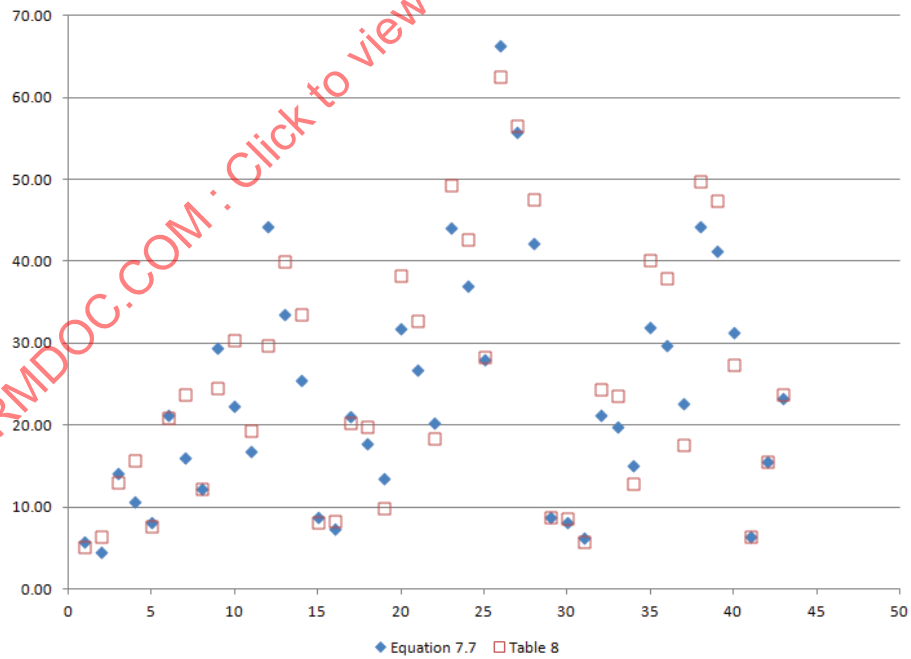


Figure 1-4: Widera FEA Data Compared to Widera Correlation Equation (Max Error = 48.9%)



## 2 SHELL MODELS

References [1], [2], [4], [7], [8], [9], [10], and [11] use shell/plate finite element model correlations to evaluate stresses in branch connections.

Three sets of finite element results were evaluated for this research project, those produced by Wais [4], Widera [2], and PRG [1]. For cases where the Widera models do not match the PRG models, additional studies using other finite element programs and volumetric (brick) analysis were conducted. The Widera models are different from the PRG models by:

- (1) Finite element. Widera [2] used flat, faceted elements. PRG used eight noded, doubly curved reduced integration shell elements [12], [13]. Each element can produce similar results in certain parameter ranges, but different mesh densities are required, and results begin to deviate when  $d/t$  is small. The performance of both shell/plate element types deviates from volumetric analyses when  $d/t$  is small.
- (2) Ref [2] models use constant thickness elements in the penetration line vicinity where membrane plus bending stresses are calculated. PRG uses tapered elements, designed as suggested in Note 1 of BPVC Section VIII- Section 2, Fig. 5.A.9.
- (3) Ref [2] uses elements around the branch with a 7.5 deg. circumferential extent. PRG circumferential extents vary from a maximum of 5.2 deg., down to a minimum in brick models of 2.2 deg.
- (4) Ref [2] in Table 6 on p.51 gives the varying boundary condition lengths as a function of the run pipe diameter  $D$  used in the models. PRG uses similar lengths and boundary conditions, although based on the parameter  $D1.4 T-0.4$ . Wais [4] uses consistent attached model lengths of approximately  $2D$  and as a result has somewhat stiffer models with lower stresses when  $2D$  approaches  $0.5 D1.4T-0.4$ .
- (5) The largest differences between the various finite element models and also between the finite element data and the correlation equation prediction occurs when the stress factors (SFs) are large, which is also when  $D_m/T$  and  $d_m/D_m$  are large. In these cases, the Widera and PRG models differ from the Wais models since Wais used shell lengths on the order of  $2D_m$  on each side of the branch connection. Widera showed that this is not a sufficient length to remove boundary effects and so used  $4D_m$  and  $5D_m$  for the larger  $D_m/T$  models in Ref [2]. There is also some difference in the intersection modeling approach used, but it is thought that the largest differences between the Wais and PRG/Widera finite element models in the large  $D_m/T$  ranges are due to the different boundary condition lengths used in the models. For large  $D_m/T$  ratios and for the  $d/D$  ranges  $0.5 < d/D < 1.0$ , the number of elements around the model circumference can have an influence on the calculated maximum membrane plus bending stress for certain stress factors, and the angle between nodes should likely be less than 7.5-degree for out-of-plane loading through the nozzle.

### 3 CORRELATION ACCURACY

Single source finite element data for nozzles in vessels theoretically should have no experimental error. Any error from correlation equations should be due only to the inaccuracy of the equation fit. Extremely high order equations or large tables can be produced to fit any finite element data set, although the order of the correlation equation quickly becomes unwieldy. The research project's objective was to find ranges of critical parameters and equation forms in those ranges that produced a minimum error in the finite element correlation for all points in the data set. Signed errors are studied, since it is believed that larger conservative errors, where the prediction is greater than the data, can be tolerated more readily than larger non-conservative errors, where the prediction is less than the data, since the overall objective is to produce consistently safe, economic designs.

For fatigue evaluations, a three standard deviation shift based on  $\log(N)$  from the mean of the failure data produces about a two times shift on stress from the mean of the failure data. If the allowable stress is developed using a three standard deviation shift from the mean of the failure data with the objective of producing a 99.7% probability of success, and if the correlation equation developed from the finite element data has points with errors that are too low by half, the calculated allowable stress for that particular point would be about equal to the mean failure of the component and provide zero separation between mean failure and design, or a 50% probability of survival.

Plot 1-8 in Appendix A shows regression artifacts for two of the 30 terms and for two out of the 60 ranges used for those terms. (Table 4.5.10 row 22, and Table 4.5.23 row 20.) It is likely that these two rows should have the coefficients adjusted manually and the plots 1-5 through 1-8 regenerated. The results for 4.5.10 are conservative, and the results for row 4.5.23 are non-conservative. The 4.5.10 coefficient is for inside surface stress in the vessel due to torsion about the nozzle.

#### 3.1 Influence of Nonlinear Behavior

Koves [14] and Bilyd [15] identify nonlinear behavior that affects the pressure capacity of cylindrical intersections for certain geometric parameter ranges. Widera [2] uses the Koves adjustment when computing membrane stresses in the vessel due to external loads, and developed a similar coefficient for membrane stresses in the nozzle. The Bilyd approach was used to influence pressure stresses in Appendix 2. It is, in part, due to the nonlinear behavior in large openings that the limits to  $d_m/D_m$  of 0.7 were established.

Omitting larger  $d_m/D_m$  intersections removes the need to address:

- (1) Cut-back (cat's eye) fabrication issues for size-on-size intersections.
- (2) Maxima in the stress factor curves when  $d_m/D_m=0.75$ .
- (3) Effect of boundary condition lengths. For vessels with large  $D/T$  ratios and large  $d/D$  ratios, it is seldom that sufficient unrestrained vessel lengths are provided along the vessel (or the nozzle) to remove the effect of the boundary condition on stress and displacements. Limiting the value of  $d_m/D_m$  minimizes the effect of the boundary condition lengths and removes the need to consider them in most stress factors
- (4) Effect of loads through the vessel
- (5) Lack of data for size-on-size models when  $t/T$  is greater than 1



Figure 3-1: Courtesy of K&H Fabricators (Smithville Texas) and Chris Hinnant



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#### 4 BRICK COMPARISON FOR WIDERA MODEL #26

Through most parameter ranges the Widera and PRG finite element models compare favorably. Branch-side stress differences are larger than run-side differences, and the largest difference occurs for models where the  $D_m/T$  ratio is larger. There are several reasons these differences might exist, including the finer meshes, tapered intersection models, and doubly curved shell elements used in the PRG models. A non-compatible eleven-noded brick element model of the Widera branch connection model #26 was evaluated and the linearized bending stress at the branch was compared to the shell models to evaluate which of the approaches produced the more consistent stress factors.

The Widera model number 26 has the following characteristics:

$$d_m/D_m = 0.5; D_m/T = 250; t/T = 0.5; (RT)^{1/2} = 11.2 \text{ inch. } (rt)^{1/2} = 5.59 \text{ inch.}$$

The Widera in-plane stress factor for the branch is 13.4, while the PRG equivalent stress factor for the branch is 21.49. The brick model calculation gives a stress factor of 21.74, providing support for the PRG result. The brick model uses 192 non-compatible brick elements around the circumference of the branch, providing a 2-degree circumferential extent per element. The element axial length along the branch adjacent to the fillet is  $(1/2) \times t$ . The radial length along the run is  $3 \times T$ . There are seven nodes through the thickness of the model. In this case, the branch stress factor is the controlling stress at the intersection and so should be found as accurately as possible. PRG brick models require the presence of a small fillet, and a 0.1" fillet was used with the 0.5" branch thickness and the 1.0" run pipe thickness.

The brick finite element model for this analysis is shown below:

**Figure 4-1: Brick Model of Widera Geometry No. 26**

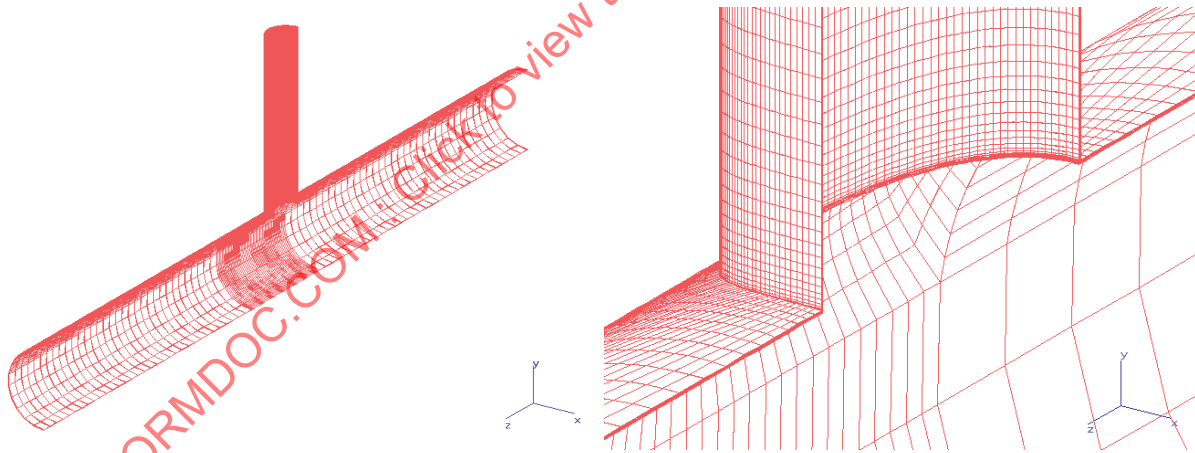


Figure 4-2: Stress Classification Lines in Widera Geometry No. 26

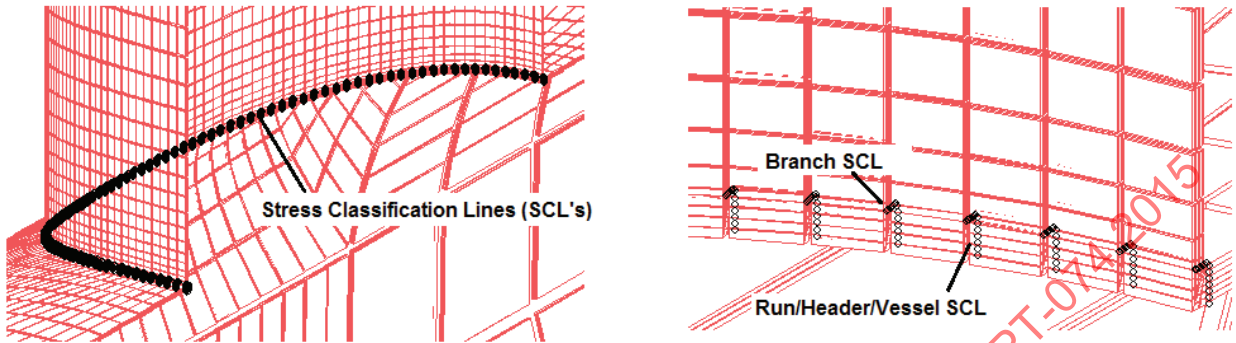


Figure 4-3: Thru-Thickness Stress Results at Critical SCL No. 243

REGION =		243				
Node	Sxx	Syy	Szz	Txy	Tyz	Txz (Global)
1	40.4	2876.5	54.8	-539.9	-13.4	-567.0
97	-193.3	1815.5	-167.8	-401.3	-178.4	-451.8
193	-439.6	888.6	-404.0	-294.8	-295.3	-348.7
289	-695.0	-18.1	-680.8	-234.2	-390.8	-212.0
385	-959.6	-954.7	-1006.8	-225.6	-476.6	-22.3
481	-1127.5	-1975.7	-1224.8	-170.7	-644.2	161.5
577	-1741.4	-4897.4	-2550.1	-834.7	-895.3	1441.7
Node	Sxx	Syy	Szz	Txy	Tyz	Txz (Local)
1	579.2	2880.9	-488.4	-258.5	-497.0	-44.7
97	295.1	1830.9	-671.7	-268.7	-239.8	-52.6
193	-9.2	918.2	-863.9	-262.8	-35.0	-61.1
289	-390.6	52.2	-1055.5	-233.3	180.7	-64.6
385	-872.2	-806.9	-1242.0	-176.8	434.9	-63.0
481	-1213.4	-1758.5	-1356.1	-153.0	760.3	-65.3
577	-3652.9	-3957.0	-1579.1	298.3	2121.5	1.9
	Membrane	Bending	M+B(in)	M+B(out)		
SXX	-621.18	0.00	-621.18	-621.18		
SYY	-50.31	2908.61	-2958.92	2858.30		
SZZ	-1037.13	-518.40	-1555.54	-518.73		
Txy	-179.10	0.00	-179.10	-179.10		
Tyz	318.89	0.00	318.89	318.89		
Txz	-54.64	0.00	-54.64	-54.64		
SUM	1224.09	2908.61	2438.30	3543.10		
Thru Thickness	=	-0.6833	-0.2572	0.6833		
Normal Direction	=	-0.3521	0.9360	0.0003		
Normal Direction	=	-0.6396	-0.2404	-0.7301		

Data for Model No. 26 and calculations for the stress factor are given below:

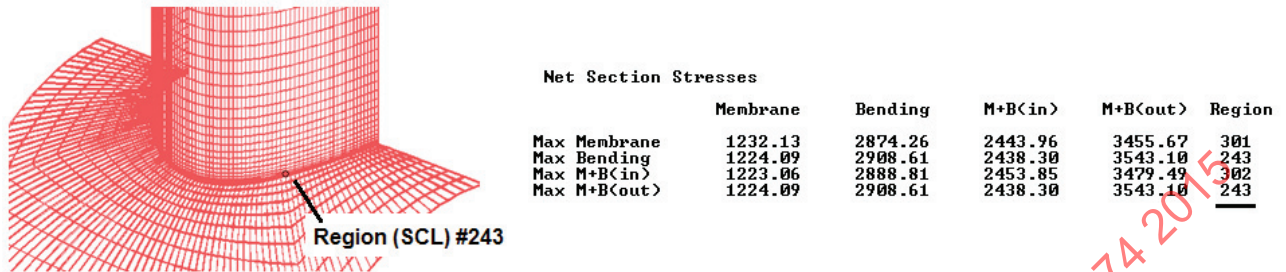
$$Do=251''; T=1''; do=125.5''; t=0.5''; t_{fillet} = 0.1$$

$$Z = (3.1415)(125/2)^2(0.5) = 6135.7 \text{ cu.in.}$$

$$M/Z = 1e6 / 6135.7 = 162.98 \text{ psi}$$

$$\text{Stress Factor} = M+B / (M/Z) = 3543 / 162.98 = \underline{21.739}$$

**Figure 4-4: Stress Classification Line at Location of Largest Surface (M+B) Stress**



**Figure 4-5: FEA and Correlation Equation Comparison for Widera Model No. 26**

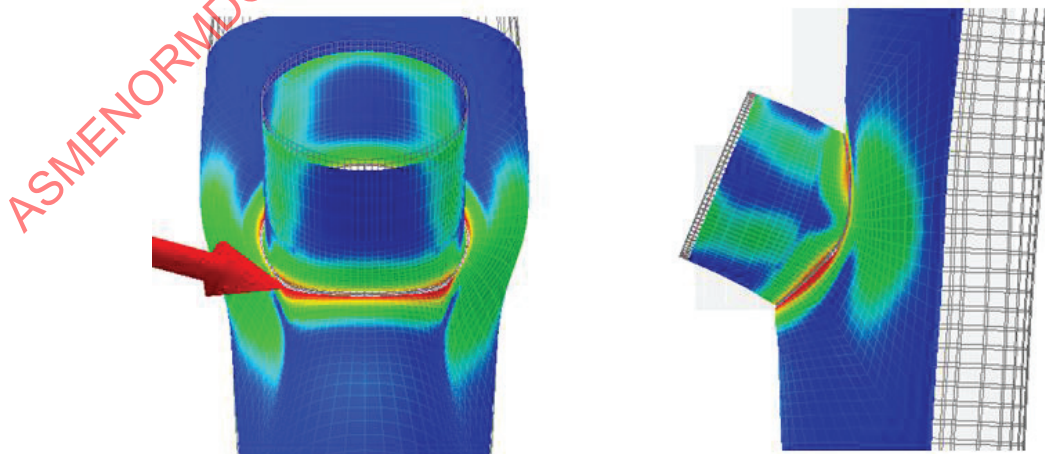
	Widera FEA	PRG Shell FEA	PRG Brick FEA	Widera Correlation EQ. 7.3
<b>Model #26</b>	13.4	21.49	21.739	13.78

It is likely that the Widera results are different for this large D/T branch connection because of:

- (1) Flat, faceted elements, and a 7.5 deg. circumferential element side length
- (2) Constant thickness elements at the penetration line

As can be seen in Figure 1-2, the majority of the models analyzed are insensitive to these characteristics and the Widera results match with the PRG results.

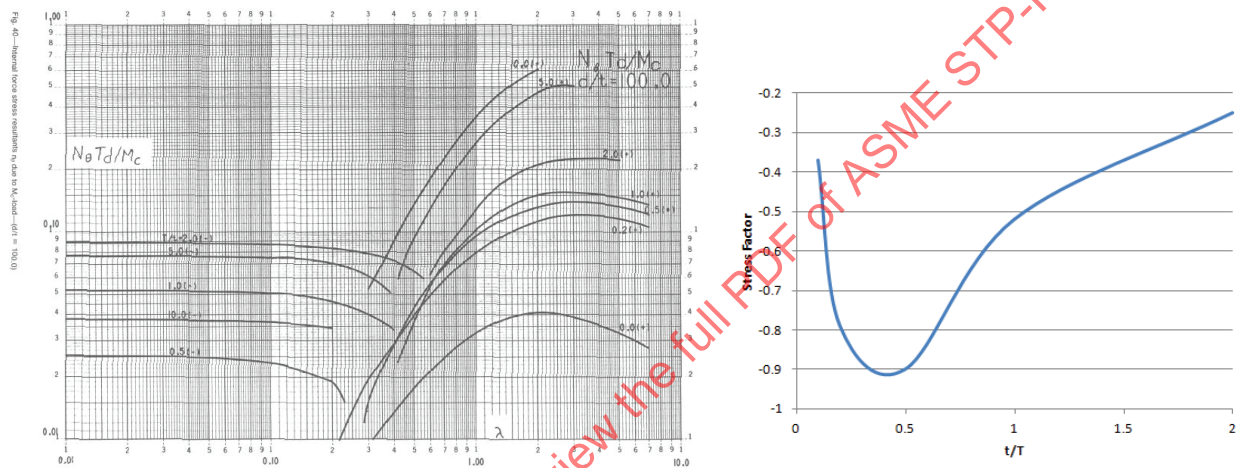
**Figure 4-6: Stress Distribution Due to In-Plane Bending Moment**



## 5 POINTS OF INFLECTION, MAXIMA AND MINIMA

The number of inflection and undulation points in the data set affects the order of the equation required to match the data. Studying the maximum positive signed error in the 5000 plus member PRG database provides a good indication of where existing equations satisfy the maximum error requirement. In the region where the existing equations don't satisfy the maximum allowed error requirement, a different regression is performed. This reduces the maximum error in the newly extracted parameter range, and after an additional regression, also improves the maximum error in the first, reduced size parameter range. Examples of stress factor plots that contain points of inflection and undulation from WRC 107 and 297 are shown in Figures 5-1 through 5-6. Figure 5-7 shows inflection points from finite element data in the low  $t/T$  range where the stress factor (SF) is plotted versus  $D/T$ .

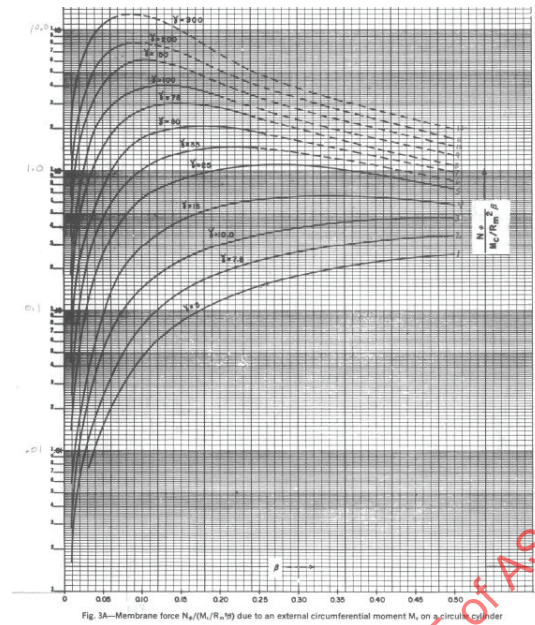
**Figure 5-1: Membrane Stress Factor Due to Circumferential Branch Moment (WRC 297)**



Note: Curve range is  $\lambda = (D/T)^{1/2}(d/D)$ . Curve families are for different values of  $T/t$ . Stress factor vs.  $t/T$  for low  $\lambda$  shown at right. Only in WRC 297 is the parameter of  $T/t$  is used for the dimensionless nozzle-to-vessel diameter ratio in place of the generally used  $t/T$  ratio.

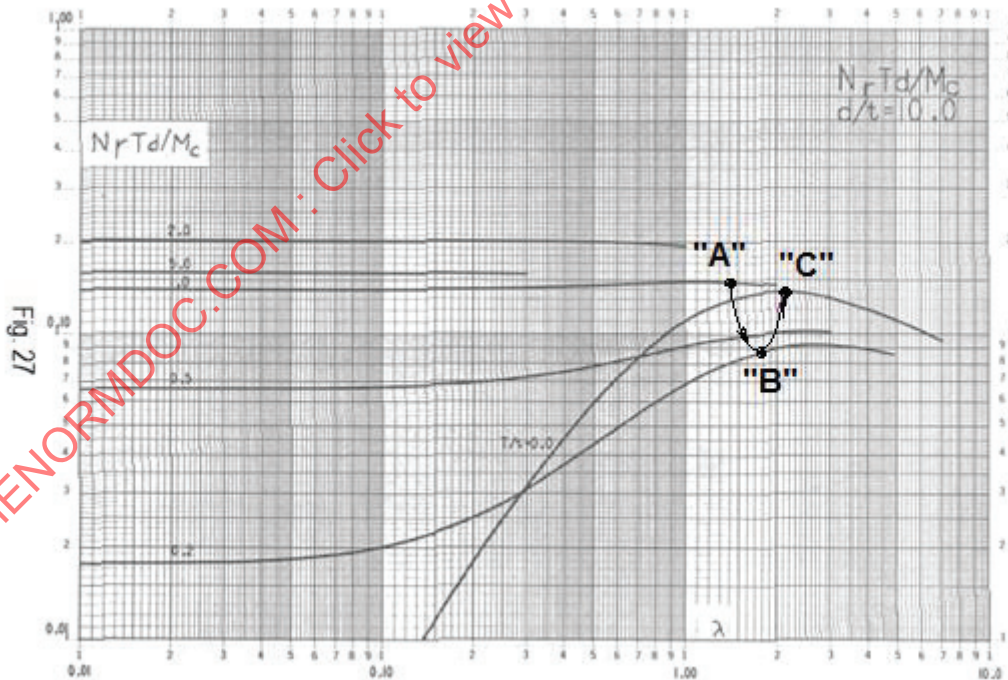


Figure 5-2: Membrane Stress Factor Due to Circumferential Branch Moment (WRC 107)



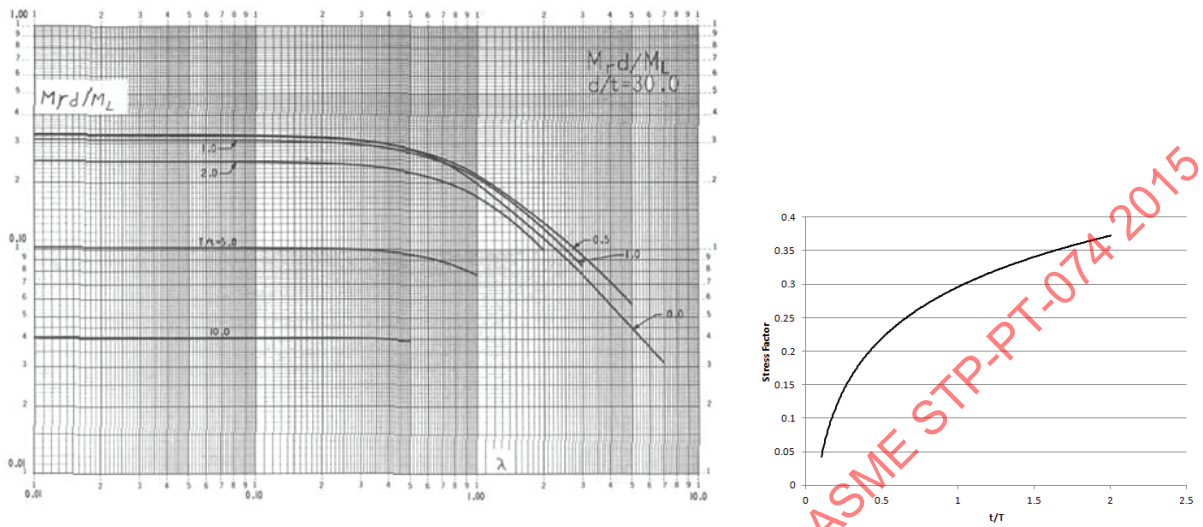
Note: Curve range is  $\beta = 0.875d/D$ . Curve families are for different values of  $\gamma$ .  $\gamma = R/T$

Figure 5-3: Radial Membrane Stress Factor Due to Circumferential Branch Moment



Note: Curve range is  $\lambda = (D/T)^{1/2}(d/D)$ . Curve families are for different values of  $T/t$ . Note how the  $T/t$  curve shows a minimum at point "B". This minimum is also seen in Figure 5-1.

Figure 5-4: Bending Stress Factor Due to Longitudinal Branch Moment



Note: Curve range is  $\lambda = (D/T)^{1/2}(d/D)$ . Curve families are for different values of  $T/t$ . Note how the  $T/t$  curve shows a minimum at point “B”. This minimum is also seen in Figure 5-1. Stress factor vs.  $t/T$  for low  $\lambda$  shown at right.

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Figure 5-5: WRC 297 Fig. 38 Circumferential Membrane Stress Due to Circumferential Moment on Branch

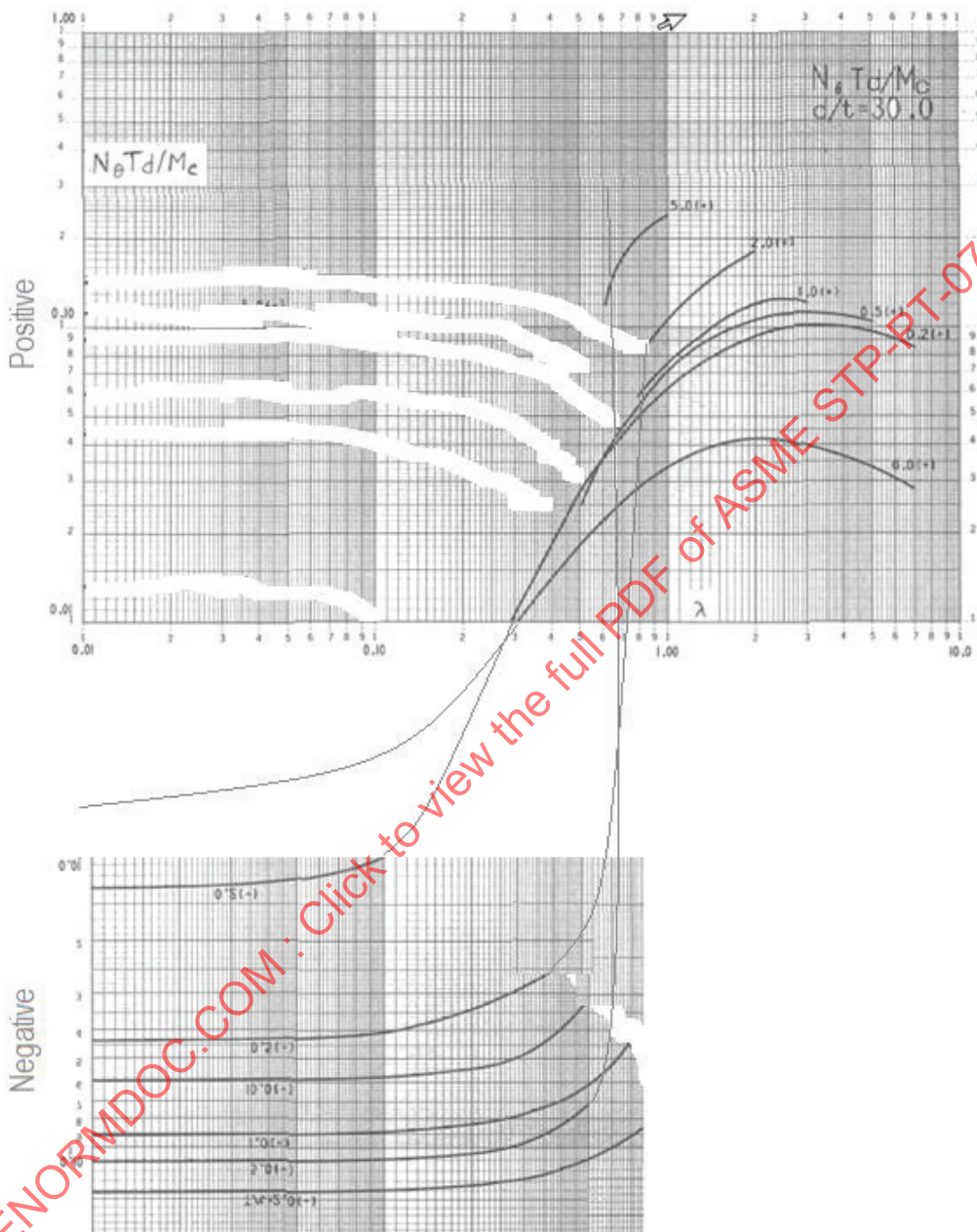




Figure 5-6: WRC 297 Fig. 46 Showing  $t/T$  Maximum at Low  $\lambda$ .

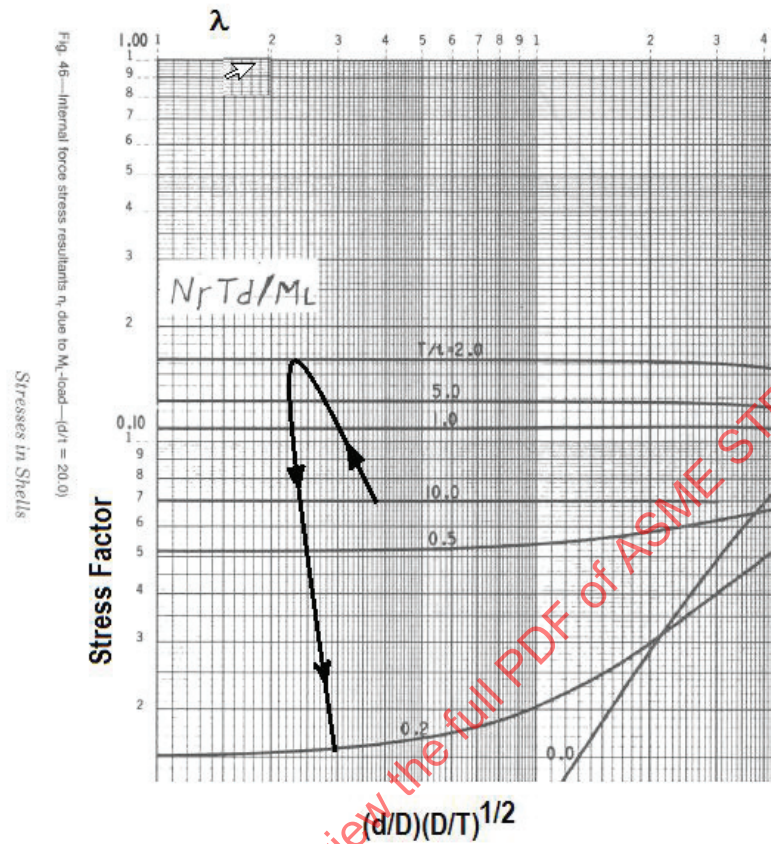
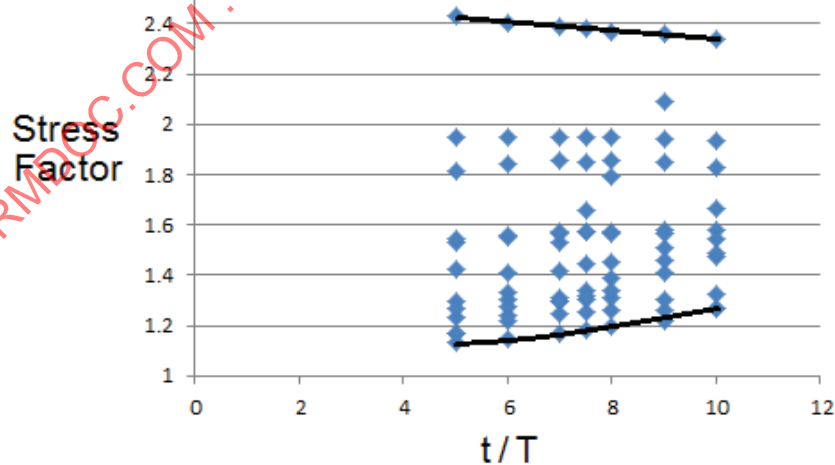
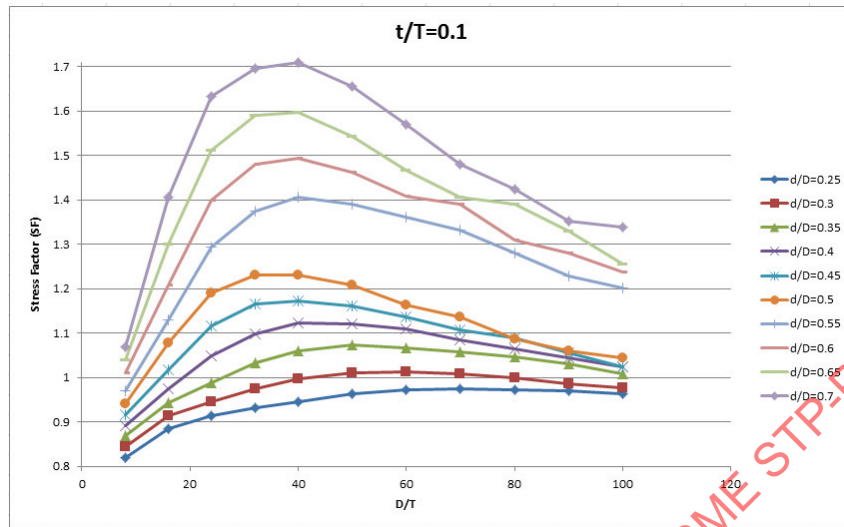


Figure 5-7: Stress Factor Variation in  $t/T$  as a Function of  $D/T$



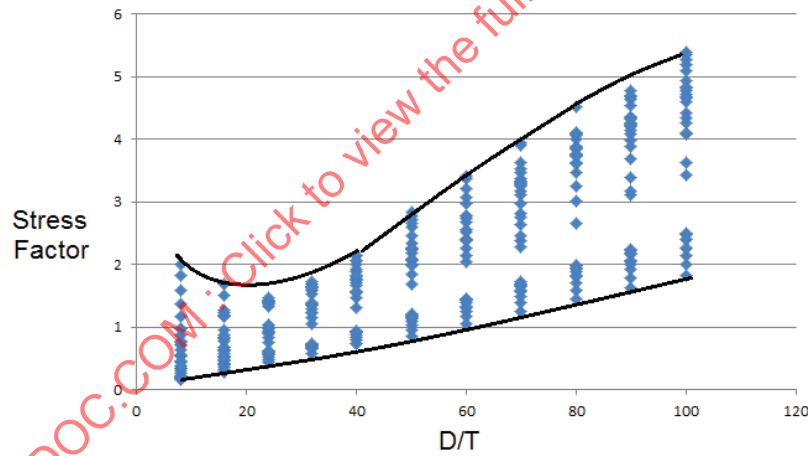
Note: The black lines are for  $D/T$  values varying from 100 to 500. For the low  $D/T$  the stress factor increases as  $t/T$  increases. For high  $D/T$  the stress factor (SF) decreases as  $t/T$  increases. To simulate this behavior, the effect of  $t/T$  may be represented by  $SF = m(t/T)+b$ ;  $m=(a_0/(D/T) - a_1)$

**Figure 5-8: FEA Stress Factor (SF) Inflection Point Locations**



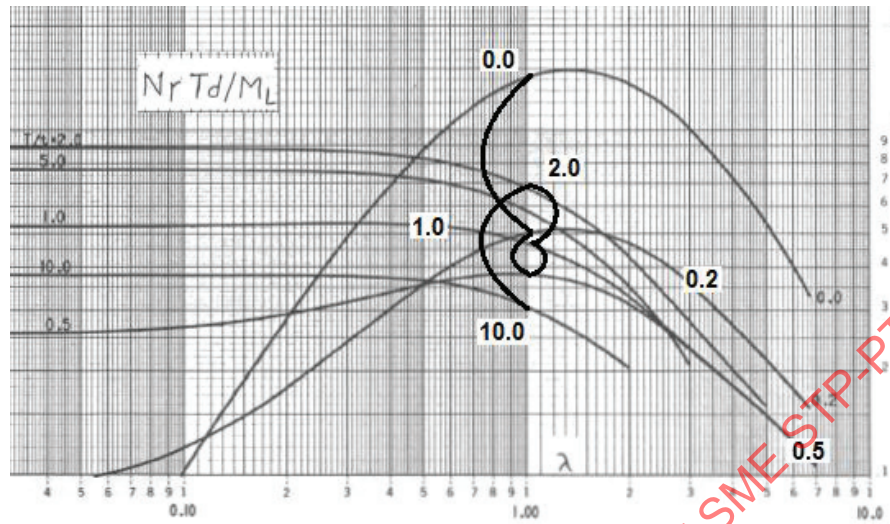
Note: Stress factor is for M+B stress in the branch due to torsional loading (for different d/D ratios).

**Figure 5-9: Stress Factor variation as a Function of D/T**



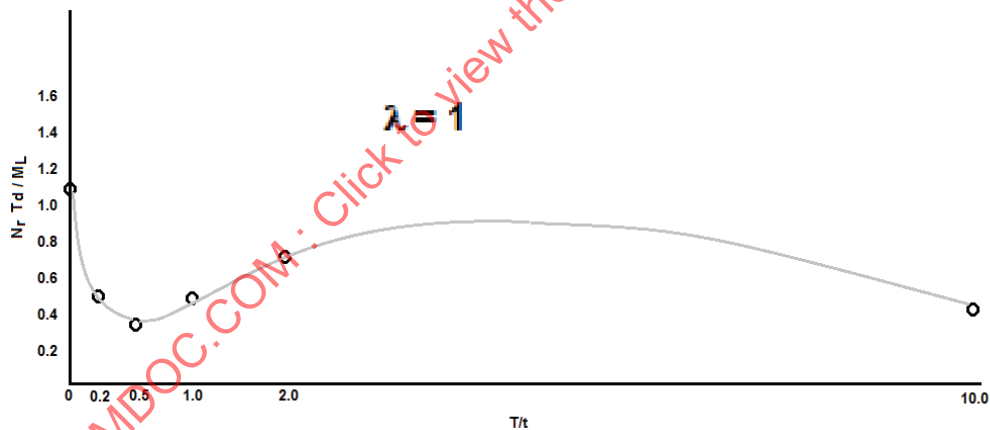
Note: d/D range 0.25 to 0.7. D/T range from 8 to 100, and t/T range from 0.1 to 0.5. In the low d/D range there is not a perceived inflection point in the shape of the curve. In the upper d/D range there is an inflection point in the vicinity of D/T=25.

Figure 5-10: Fig. 49 – Internal Force Stress Resultants  $n_r$  Due to ML – Load For  $d/t=100$  from WRC 297



Note: Dark lines and annotation showing variation in stress factor at  $\lambda=1$ . The stress factor plot for  $\lambda=1$  for varying  $T/t$  is shown in Figure 5-11 below.

Figure 5-11:  $\lambda=1$  Stress Factor in  $T/t$  from Figure 5-10



## APPENDIX 1 – DATA SOURCES AND COMPARISONS

A variety of comparisons between this research project's results and WRC, FEA and EPRI results are included in Appendix 1. In some cases comparisons are made outside of recommended ranges. The recommended ranges for each document are provided in in the following pages and should be addressed when large differences are noted.

Correlation comparisons are provided for results from different sources. All comparisons are provided on a "stress factor" basis, where the "stress factor" is the maximum stress of interest divided by the nominal stress in the nozzle. The maximum stress of interest is either the maximum membrane stress in either the nozzle or the vessel, or the maximum surface stress (membrane + bending) in either the nozzle or the vessel. Nominal stress definitions used are given in Appendix 2 4.5.15.

### Appendix 1 includes:

- (1) WRC 497 Basis Comparisons. The external load and pressure results for the 43 finite element models presented in WRC 497 are compared with results from this research project (Project No. 07-10), WRC 107, WRC 297, WRC 497 (correlation equations), and WRC 368 (pressure). These comparisons are included for each stress component. Some of these models (particularly the  $d/D=1$  models) are outside parameter ranges for the various methods. Parameter ranges for each method are given below.
- (2)  $t/T=1$  Correlation Comparisons. Comparison of axial, in-plane, out-of-plane, torsional and pressure stress factors for 66 geometries. Tables give ratios of results between this research project (Project No. 07-10) and a) WRC107, b) WRC297, c) WRC497, d) EPRI 110996, and e) WRC368. Values are not printed when the comparison is outside of the recommended parameter ranges.
- (3)  $t/T \ll 1$  Correlation Comparisons. Comparison of axial, in-plane, out-of-plane, torsional and pressure stress factors for 66 geometries where the  $t/T$  ratio is either 0.1 or 0.5. Charts are included that show the ratios.
- (4)  $t/T \gg 1$  Correlation Comparisons.
- (5)  $t/T = d/D$  Correlation Comparisons (Pressure optimized nominal wall designs).
- (6) WRC 329 Table 17 Data Comparisons
- (7) Stress Factor Value Plots. This research project's stress factors span many regions in a relatively large  $d/D$ ,  $D/T$  and  $t/T$  space. For some stress factor coefficients, more than 50 equations are needed to adequately regress the stress factor distributions through these regions. These plots are intended to demonstrate that compatibility is present from one region to the next and provide a visual verification of continuity for each of the thirty stress factor equations.
- (8) Pad Reinforcement Stress Factor Comparisons.

Membrane stresses and membrane and bending stresses are computed per the guidelines in each respective WRC bulletin. Nominal stress definitions are per those used in WRC 497 for each WRC document so that a consistent stress factor is produced. Unity factor ratios give this research project (Project No. 07-10) stress factors divided by the reference stress factor.

### Comparison with FEA Results from WRC 497 [4]

The tables in this appendix show comparisons between FEA runs from this research project (Project No. 07-10) and those documented in WRC 497 [4], WRC 107, WRC 297 and WRC 497. Discussions are provided below each table as needed. The results in WRC 497 cover only a subset of the parameter ranges addressed by this research project (Project No. 07-10) and include only axial, in-plane and out-of-plane nozzle loadings. A broader range of comparisons against the PRG data set is provided in the References section herein. This subset of comparisons is provided to demonstrate:

- (a) How typical correlation equations compare to consistently produced finite element results.
- (b) How this research project (Project No. 07-10) results compare to WRC 107, WRC 297 and WRC 497 results in the WRC 497 parameter ranges.
- (c) The variation in elastically calculated stress factors from various industry documents.

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Table	Description
1-1	WRC 497 [4] Tabular Results. Contains membrane + bending (M+B) and membrane only results from WRC 497 FEA analysis of in-plane, out-of-plane, and axial loads on nozzles. This table is a compilation of WRC 497 Tables 7, 8, 9, 10, 11 and 12.
1-2	Membrane + Bending Stress Factor Comparison of Vessel stresses due to In-Plane Nozzle Moments. WRC 497 Table 7 results for stress factors in the vessel: $S_v/S_o$ . Comparisons of this project 07-10 to WRC 107, WRC 297, and WRC 497.
1-3	Membrane + Bending Stress Factor Comparisons of Nozzle stresses due to In-Plane Nozzle Moments. Table 7 results for stress factors in the nozzle: $S_n/S_o$ . Comparisons of this project 07-10 to WRC 297 and WRC 497. (WRC 107 does not produce nozzle stresses.)
1-4	Membrane + Bending Stress Factor Comparisons of Vessel stresses due to Out-of-Plane Nozzle Moments. Table 8 results for stress factors in the vessel: $S_v/S_o$ . Comparisons of this project 07-10 to WRC 107, WRC 297 and WRC 497.
1-5	Membrane + Bending Stress Factor Comparisons of Nozzle stresses due to Out-of-Plane Nozzle Moments. Table 8 results for stress factors in the nozzle: $S_n/S_o$ . Comparisons of this project 07-10 to WRC 297 and WRC 497.
1-6	Membrane + Bending Stress Factor Comparisons of Vessel stresses due to Axial Nozzle Forces. Table 9 results for stress factors in the vessel: $S_v/S_o$ . Comparisons of this project 07-10 to WRC 107, WRC 297 and WRC 497.
1-7	Membrane + Bending Stress Factor Comparisons of Nozzle stresses due to Axial Nozzle Forces. Table 9 results for stress factors in the nozzle: $S_n/S_o$ . Comparisons of this project 07-10 to WRC 297, and WRC 497.
1-8	Eight (8) Membrane Stress Comparisons due to Axial, In-Plane, and Out-of-Plane Nozzle Loads. Results are from Tables 10, 11 and 12. Membrane stress factor comparisons are made only to this project 07-10 membrane results.
1-9 through 1-15	Unity factor tables that give the results from tables 1-1 through 1-8 in terms of the ratio of the calculated value divided by the FEA computed result. The FEA computed result is also provided so that user's will know the size of the comparison stress factor.
1-16	$t/T=1$ Axial, in-plane, out-of-plane, torsional and pressure results. Comparison ratios are provided for WRC 107, WRC 297, WRC 497, WRC 368 and EPRI 110996.
1-17	$t/T \ll 1$ Axial, in-plane, out-of-plane, torsional and pressure results. Comparison ratios are provided for WRC 107, WRC 297, WRC 497, WRC 368 and EPRI 110996.
1-18	$t/T \gg 1$ Axial, in-plane, out-of-plane, torsional and pressure results. Comparison ratios are provided for WRC 107, WRC 297, WRC 497, WRC 368 and EPRI 110996.
1-19	$t/T = d/D$ Axial, in-plane, out-of-plane, torsional and pressure results. Comparison ratios are provided for WRC 107, WRC 297, WRC 497, WRC 368 and EPRI 110996.





**Table 1-2 – Membrane + Bending Vessel Stress Factors due to In-Plane Nozzle Moments**

M+B (Vessel) Table 7 In-Plane Moment Comparison

#	d/D	D/T	t/T	d/t	lambda	Sv/So	07-10	107	297	497
1	0.333	20.	0.333	20.000	1.5637	2.090	1.190	1.238	1.616	1.592
2	0.333	20.	1.000	6.660	1.7128	3.510	2.522	2.951	3.039	3.887
3	0.333	60.	0.333	60.000	2.6224	3.510	2.600	2.569	3.079	2.837
4	0.333	60.	1.000	19.980	2.7085	6.570	6.226	7.025	8.107	6.928
5	0.333	60.	3.000	6.660	2.9667	17.600	14.279	16.352	18.761	16.906
6	0.333	100.	0.333	100.000	3.3633	4.300	3.790	3.148	3.942	3.711
7	0.333	100.	1.000	33.300	3.4300	8.740	9.756	8.905	11.350	9.064
8	0.333	100.	3.000	11.100	3.6300	20.400	22.380	22.613	29.958	22.117
9	0.333	150.	0.333	150.000	4.1056	5.000	4.374	3.720	5.379	4.594
10	0.333	150.	1.000	49.950	4.1600	10.300	11.326	10.733	13.510	11.218
11	0.333	150.	3.000	16.650	4.3233	27.000	30.301	28.661	40.617	27.375
12	0.333	250.	0.333	250.000	5.2863	6.000	6.054	4.356	8.239	6.010
13	0.333	250.	1.000	83.250	5.3284	12.200	16.639	12.770	18.991	14.676
14	0.333	250.	3.000	27.750	5.4549	40.300	44.571	35.749	53.919	35.813
15	0.500	20.	0.500	20.000	2.3479	2.570	1.679	1.949	2.853	2.336
16	0.500	20.	1.000	10.000	2.4597	3.840	2.803	3.394	4.235	4.102
17	0.500	60.	0.500	60.000	3.9375	4.300	3.476	3.709	4.609	4.164
18	0.500	60.	1.000	30.000	4.0021	6.470	6.919	7.031	10.254	7.310
19	0.500	60.	3.000	10.000	4.2603	18.300	15.870	17.201	24.406	17.838
20	0.500	100.	0.500	100.000	5.0500	5.310	5.052	4.522	4.956	5.447
21	0.500	100.	1.000	50.000	5.1000	9.910	10.843	8.767	11.116	9.563
22	0.500	100.	3.000	16.667	5.3000	25.900	24.873	23.319	36.208	23.337
23	0.500	150.	0.500	150.000	6.1645	6.210	5.491	5.451	7.482	6.742
24	0.500	150.	1.000	75.000	6.2054	12.300	11.913	10.684	15.734	11.837
25	0.500	150.	3.000	25.000	6.3687	29.900	32.784	29.625	47.657	28.884
26	0.500	250.	0.500	250.000	7.9373	7.590	7.626	6.637	12.537	8.821
27	0.500	250.	1.000	125.000	7.9689	15.700	17.503	13.123	22.350	15.486
28	0.500	250.	3.000	41.667	8.0954	50.400	47.652	37.648	66.872	37.788
29	0.750	20.	0.750	20.000	3.5218	3.340	2.532	3.949	4.943	3.348
30	0.750	20.	1.000	15.000	3.5777	4.090	3.137	5.112	6.131	4.229
31	0.750	20.	3.000	5.000	4.0249	9.770	6.407	12.546	10.971	10.320
32	0.750	60.	0.750	60.000	5.0063	6.260	5.319	7.021	7.989	5.967
33	0.750	60.	1.000	45.000	5.9386	7.690	6.897	9.262	11.059	7.537
34	0.750	60.	3.000	15.000	6.1968	19.100	15.862	25.620	30.982	18.392
35	0.750	100.	0.750	100.000	7.5750	7.960	8.335	8.634	10.109	7.806
36	0.750	100.	1.000	75.000	7.6000	9.840	10.809	11.437	14.831	9.861
37	0.750	100.	3.000	25.000	7.8000	24.800	24.866	32.622	46.399	24.062
38	0.750	150.	0.750	150.000	9.2468	9.360	8.975	10.563	15.264	9.662
39	0.750	150.	1.000	112.500	9.2672	11.600	12.423	14.023	20.080	12.205
40	0.750	150.	3.000	37.500	9.4305	31.200	33.907	40.649	62.595	29.782
41	1.000	20.	1.000	20.000	4.6957	5.640	3.137	7.020	7.723	6.235
42	1.000	60.	1.000	60.000	7.8751	10.900	6.897	12.482	12.649	11.113

Just outside of allowed range

Well outside of allowed range

Stress factors in Table 1-2 are for stresses in the vessel due to in-plane moments applied through the nozzle. Values in the column labeled Sv/So are from finite element results in WRC 497. Values in the column labeled “497” are from the WRC 497 correlation equations.

Rows 41 through 43 are for size-on-size branch connections. This project (Project No. 07-10) limits extend only to a d/D of 0.7. Rows 29 through 40 are for d/D=0.75. d/D=0.75 is just outside this project (Project No. 07-10) limits. For comparison, in these tables, when d/D exceeds 0.7, it is limited to 0.7. These extensions are not recommended for use, but are included here for comparison. For out-of-plane moment loads on nozzles, a well-known inflection point exists at d/D=0.7 (See WRC 329 [15]).

This project (Project No. 07-10) results for low D/T tend to be low, where results for higher D/T tend to be high. The reduced integration shell elements used in this project (Project No. 07-10) FEA analysis are theoretically expected to give better results in the lower D/T ranges when compared to flat plate elements.

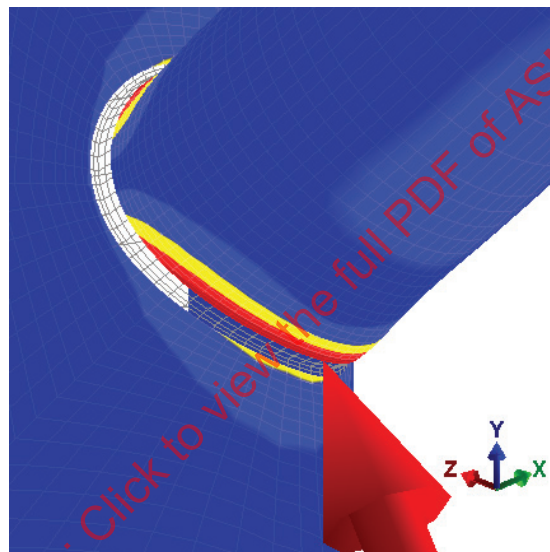


Reviewing row #15, the D/T ratio is 20, and the WRC 297 FEA solution gives 2.57 as the M + B stress factor, while this project (Project No. 07-10) gives 1.68. The stress distribution in this branch connection due to in-plane loading through the branch is shown below, where the high stress is in the nozzle. (The nozzle stress governs the design.) The nozzle stress factors are given in Table 1-3. These collected results are shown below:

**Model #15 – In-Plane Load Membrane + Bending Stress Factor Results**

Stress Location	S <sub>vn</sub> /S <sub>o</sub> (FEA WRC 497)	07-10	WRC107	WRC297	WRC497
Vessel	2.570	1.679	1.949	2.853	2.336
Nozzle	4.310	3.665	<not given>	8.436	4.139

**Model #15 Membrane + Bending Stress Result**



The 2007 version of ASME Section VIII Division 2 changed from a stress intensity basis to an equivalent stress basis – Tresca vs. Von Mises. The stresses calculated from these different methods often vary by about 10% in typical intersection geometries. From WRC 497, (p.48), the stress used is “... the maximum nodal stress intensity (outside or inside surface), excluding the nodes on the intersection curve.” This project (Project No. 07-10) uses the equivalent stress (maximum distortion energy yield criteria) per VIII-2 Eq. 5.1.

Run #28 includes the largest D/T ratio in the WRC 497 run set. This project (Project No. 07-10) stress factor is 47.65 and the FEA result from WRC 497 is 50.4. The correlation from WRC 497 is 37.8. NozzlePRO finite element results give a stress factor of 61.4 using a stress intensity basis and 53.5 using an equivalent stress basis. For run #28, the t/T ratio is 3, and so the high stress is in the vessel, and the vessel stress governs.

Parameter ranges for each reference document used are given below. In some cases referenced documents are used outside of intended ranges for comparison. It can be seen that in some cases, and for some stress factors, an extended use of the document is warranted.

**Limits for Reference Documents**

c WRC 368 Limits:  
c -----  
c 0.523 < lambda < 6.32  
c 19 < D/T < 999  
c 4 < d/t < 999  
c 0.039 < d/D < 0.515  
c 0.388 < S/s < 6.26  
c 0.388 < Dt/dT < 6.26  
c 0.1 < t/T < 3.0  
c All diameters are mean diameters.  $s = Pd/2t$ ,  $S=PD/2T$   
c  $S/s = PD/2T / (Pd/2t) = Dt/dT$   
c  
c Wais and Rodabaugh PVP Vol 383, 1999 Limits: (not used here)  
c -----  
c 0.125 < d/D < 1.0  
c 7.5 < D/T < 99  
c 7.5 < d/t < 198  
c  
c WRC 497 Limits:  
c -----  
c For P, Mi, Mo and Fax:  
c 0.333 <= d/D < 1.0  
c 20 <= D/T < 250  
c d/D < t/T < 3.0  
c  
c For Mt.  
c 0.125 < d/D < 1.0  
c 7.5 < D/T < 99  
c 7.5 < d/t < 198  
c  
c WRC 107 Limits:  
c -----  
c beta = 0.875 do/D or 0.875 ro/Rm . for cylinders in WRC 107  
c d/D < 0.6  
c D/t < 600  
c t/T => 1  
c lambda <= 2.8  
c  
c WRC 297 Limits: (See WRC 297 Section 3.2)  
c -----  
c 20 <= D/T <= 2500  
c 10 <= do/t <= 100  
c do/D <= 0.5  
c lambda <= 10 ; lambda = (do/Dm) \* (Dm/T)^0.5  
c T/t <= 10  
c  
c EPRI 110996 Limits:  
c -----  
c 8.0 < R/T < 50  
c 0.5 < r/t < 50  
c 0.125 < r/R < 1.0  
c 0.211 < t/T < 9  
c 0.5 < r/rp < 1.0  
c  
c ST-LLC 07-10  
c -----  
c 7 < D/T < 2500 (4.5.188)  
c 0.05 < d/D < 0.7 (not sure how to deal with low d/D yet (4.5.189)  
c 0.1 < t/T < 10 (4.5.190)  
c 7 < d/t < 200 (4.5.191)  
c lpr2 = 0 (see Figures 4.5.1 and 4.5.2.) (4.5.192)  
c tp = 1.5T (4.5.193)  
c W = min( (d+t)/2, (RT)0.5 ) (4.5.194)  
c (d/D) (D/T)^0.5 < 10 (4.5.195)

**Table 1-3 – Membrane + Bending Nozzle Stress Factors due to In-Plane Nozzle Moments**

M+B (Nozzle) Table 7 In-Plane Moment Comparison

#	d/D	D/T	t/T	d/t	lambda	Sv/So	07-10	297	497
1	0.333	20.	0.333	20.000	1.5637	3.500	3.900	7.321	3.572
2	0.333	20.	1.000	6.660	1.7128	3.770	2.637	2.957	3.572
3	0.333	60.	0.333	60.000	2.6224	5.750	7.711	12.427	6.027
4	0.333	60.	1.000	19.980	2.7085	6.290	5.809	7.004	6.027
5	0.333	60.	3.000	6.660	2.9667	4.510	3.341	3.322	6.027
6	0.333	100.	0.333	100.000	3.3633	7.790	11.120	17.831	7.688
7	0.333	100.	1.000	33.300	3.4300	8.240	8.554	10.911	7.688
8	0.333	100.	3.000	11.100	3.6300	6.420	4.961	6.116	7.688
9	0.333	150.	0.333	150.000	4.1056	8.430	13.834	22.353	9.325
10	0.333	150.	1.000	49.950	4.1600	9.710	11.653	13.640	9.325
11	0.333	150.	3.000	16.650	4.3233	8.080	7.260	10.092	9.325
12	0.333	250.	0.333	250.000	5.2863	8.590	19.567	31.504	11.894
13	0.333	250.	1.000	83.250	5.3284	11.800	16.856	19.076	11.894
14	0.333	250.	3.000	27.750	5.4549	10.200	10.988	14.562	11.894
15	0.500	20.	0.500	20.000	2.3479	4.310	3.665	8.436	4.139
16	0.500	20.	1.000	10.000	2.4597	3.900	3.012	3.703	4.139
17	0.500	60.	0.500	60.000	3.9375	6.550	7.690	12.763	6.984
18	0.500	60.	1.000	30.000	4.0021	6.290	6.286	9.645	6.984
19	0.500	60.	3.000	10.000	4.2603	5.100	4.354	4.761	6.984
20	0.500	100.	0.500	100.000	5.0500	10.500	11.223	14.527	8.908
21	0.500	100.	1.000	50.000	5.1000	9.350	9.211	11.063	8.908
22	0.500	100.	3.000	16.667	5.3000	7.160	6.325	9.127	8.908
23	0.500	150.	0.500	150.000	6.1645	12.000	14.457	22.433	10.805
24	0.500	150.	1.000	75.000	6.2054	11.200	12.479	15.474	10.805
25	0.500	150.	3.000	25.000	6.3687	8.620	8.457	12.640	10.805
26	0.500	250.	0.500	250.000	7.9373	13.400	20.507	38.249	13.782
27	0.500	250.	1.000	125.000	7.9589	14.200	17.833	20.233	13.782
28	0.500	250.	3.000	41.667	8.0954	11.300	12.192	18.841	13.782
29	0.750	20.	0.750	20.000	3.5218	4.200	3.608	7.406	4.227
30	0.750	20.	1.000	15.000	3.5777	3.950	3.345	5.306	4.227
31	0.750	20.	3.000	5.000	4.0249	3.760	2.574	1.850	4.227
32	0.750	60.	0.750	60.000	5.9063	6.250	7.310	12.559	7.133
33	0.750	60.	1.000	45.000	5.9386	6.110	6.747	10.931	7.133
34	0.750	60.	3.000	15.000	6.1968	6.540	5.592	7.443	7.133
35	0.750	100.	0.750	100.000	7.5750	9.180	10.584	14.974	9.098
36	0.750	100.	1.000	75.000	7.6000	9.010	9.688	14.338	9.098
37	0.750	100.	3.000	25.000	7.8000	7.710	7.960	12.277	9.098
38	0.750	150.	0.750	150.000	9.2468	10.800	14.249	23.098	11.036
39	0.750	150.	1.000	112.500	9.2672	10.700	13.145	18.084	11.036
40	0.750	150.	3.000	37.500	9.4305	9.770	9.907	17.176	11.036
41	1.000	20.	1.000	20.000	4.6957	5.550	3.345	6.835	7.336
42	1.000	60.	1.000	60.000	7.8751	13.800	6.747	12.555	12.379
43	1.000	100.	1.000	100.000	10.1000	21.900	9.688	15.934	15.789

Stress factors in Table 1-3 are for stresses in the nozzle due to an in-plane bending moment applied through the nozzle. (WRC 107 results are omitted since WRC 107 does not produce stresses in the nozzle.) Sn/So in Table 1-3 is from WRC 497 finite element results. The column labeled “497” contains results from the WRC 497 correlation equations.

Rows 41 through 43 are outside of the permitted project (Project No. 07-10) d/D range. These rows are provided for reference.

Rows 29 through 40 are outside of the project (Project No. 07-10) d/D range by 7%. These rows are considered close enough for comparison purposes. For project calculations d/D is set to 0.7 for rows 29 through 40.

**Table 1-4 – Membrane + Bending Vessel Stress Factors due to Out-of-Plane Nozzle Moments**

M+B (Vessel) Table 8 Out-of-Plane Moment Comparison

#	d/D	D/T	t/T	d/t	lambda	Sv/So	07-10	107	297	497
1	0.333	20.	0.333	20.000	1.5637	2.650	1.656	1.802	1.909	1.786
2	0.333	20.	1.000	6.660	1.7128	5.830	5.383	4.518	5.966	6.087
3	0.333	60.	0.333	60.000	2.6224	5.710	4.756	4.790	5.101	4.787
4	0.333	60.	1.000	19.980	2.7085	17.200	15.791	13.422	19.139	16.312
5	0.333	60.	3.000	6.660	2.9667	52.000	46.558	33.524	54.021	55.525
6	0.333	100.	0.333	100.000	3.3633	8.120	7.537	6.666	7.942	7.569
7	0.333	100.	1.000	33.300	3.4300	27.400	25.127	19.219	30.890	25.795
8	0.333	100.	3.000	11.100	3.6300	76.900	81.339	51.513	95.902	87.807
9	0.333	150.	0.333	150.000	4.1056	10.600	10.770	9.407	11.424	10.891
10	0.333	150.	1.000	49.950	4.1600	38.100	35.979	27.474	42.745	37.113
11	0.333	150.	3.000	16.650	4.3233	116.000	125.798	76.205	144.509	126.333
12	0.333	250.	0.333	250.000	5.2863	15.900	16.735	14.292	18.155	17.222
13	0.333	250.	1.000	83.250	5.3284	57.400	56.005	42.207	68.756	58.691
14	0.333	250.	3.000	27.750	5.4549	195.000	216.755	120.606	229.450	199.784
15	0.500	20.	0.500	20.000	2.3479	3.520	3.694	3.044	4.143	3.507
16	0.500	20.	1.000	10.000	2.4597	7.800	6.666	6.678	9.295	7.595
17	0.500	60.	0.500	60.000	3.9375	9.010	8.864	9.517	10.591	9.396
18	0.500	60.	1.000	30.000	4.0021	21.500	19.588	18.344	27.784	20.351
19	0.500	60.	3.000	10.000	4.2603	71.000	63.334	47.950	84.185	69.276
20	0.500	100.	0.500	100.000	5.0500	13.900	14.085	14.147	15.207	14.859
21	0.500	100.	1.000	50.000	5.1000	37.800	31.180	27.711	40.951	32.184
22	0.500	100.	3.000	16.667	5.3000	115.000	110.901	76.808	141.397	109.554
23	0.500	150.	0.500	150.000	6.1645	18.800	20.154	20.035	22.950	21.379
24	0.500	150.	1.000	75.000	6.2054	52.800	44.054	39.516	59.719	46.305
25	0.500	150.	3.000	25.000	6.3687	155.000	171.703	112.294	204.043	157.622
26	0.500	250.	0.500	250.000	7.9373	27.800	31.354	30.647	38.453	33.808
27	0.500	250.	1.000	125.000	7.9689	80.300	69.519	60.780	94.166	73.227
28	0.500	250.	3.000	41.667	8.0954	279.000	296.099	176.404	320.001	249.264
29	0.750	20.	0.750	20.000	3.5218	4.900	5.500	8.070	10.025	5.930
30	0.750	20.	1.000	15.000	3.5777	7.720	7.711	10.447	14.203	8.173
31	0.750	20.	3.000	5.000	4.0249	24.700	22.253	25.640	36.795	27.819
32	0.750	60.	0.750	60.000	5.9063	15.300	16.135	20.500	25.420	15.890
33	0.750	60.	1.000	45.000	5.9336	23.700	22.683	27.043	37.240	21.899
34	0.750	60.	3.000	15.000	6.1968	81.200	81.242	74.802	126.201	74.545
35	0.750	100.	0.750	100.000	7.5750	25.900	25.676	31.302	38.953	25.128
36	0.750	100.	1.000	75.000	7.6000	39.300	36.114	41.465	58.261	34.632
37	0.750	100.	3.000	25.000	7.8000	131.000	142.459	118.267	201.448	117.886
38	0.750	150.	0.750	150.000	9.2468	35.300	36.766	44.303	58.814	36.154
39	0.750	150.	1.000	112.500	9.2672	54.600	51.726	58.812	84.602	49.827
40	0.750	150.	3.000	37.500	9.4305	186.000	220.709	170.487	290.868	169.610
41	1.000	20.	1.000	20.000	4.6957	6.300	7.711	14.347	18.867	6.074
42	1.000	60.	1.000	60.000	7.8751	16.800	22.683	36.444	47.475	16.275
43	1.000	100.	1.000	100.000	10.1000	24.300	36.114	55.648	75.038	25.737

Table 1-4 includes the maximum membrane plus bending stress factors (surface stresses) for out-of-plane moments on branch connections and includes the project (Project No. 07-10) results and results from WRC107, WRC297 and WRC 497. The column labeled Sv/So is taken from finite element results in WRC 497 and the column labeled “497” is from the WRC 497 correlation equations.

In Table 1-4a below, columns N, O, P, and Q contain the ratios between the WRC 497 finite element results and the correlation results from the different methods. The average error and standard deviation is shown at the bottom of the table.

The project (Project No. 07-10) average error and the standard deviation of the average error are close to the correlated solution from WRC 497. The project correlation equations are based only on the project (Project No. 07-10) finite element data set. Since the project correlation results match the WRC 497 finite element results in Table 1-4 roughly as well as the WRC 497 correlation equations match the WRC 497 finite element data, there is likely some consistency through the project (Project No. 07-10) database and correlation equation development.



The project correlations for all parameter ranges, stress factors, equations and terms were developed in an identical manner, using the same finite element models. The finite element results used for the project development are included in the References.

**Table 1-4a – Table 1-4 with Average Error Estimates**

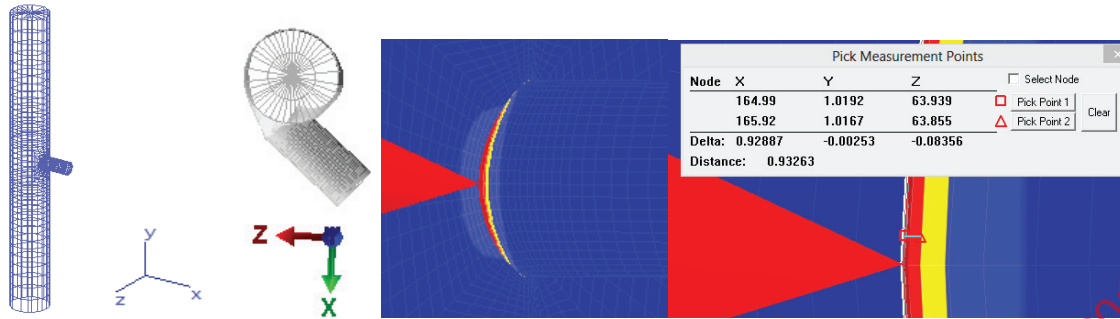
A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	
M*B (Vessel) Table 8 Out-of-Plane Moment Comparison																	
297FEA													AvgRatio				
#	d/D	D/T	t/T	d/t	lambda	Sv/So	_07-10	107	297	497			_07-10	107	297	497	
1	1	0.33	20	0.33	20	1564	2.65	1.656	1.802	1.909	1.786		1.6002	1.4706	1.3882	0.674	
2	2	0.33	20	1	6.66	1.713	5.83	5.383	4.518	5.966	6.087		1.083	1.2904	0.9772	1.0441	
3	3	0.33	60	0.33	60	2.622	5.71	4.756	4.79	5.101	4.787		1.2006	1.1921	1.1194	0.8384	
4	4	0.33	60	1	20	2.709	17.2	15.79	13.42	19.14	16.31		1.0892	1.2815	0.9387	0.9484	
5	5	0.33	60	3	6.66	2.967	52	46.56	33.52	54.02	55.53		1.1169	1.5511	0.9626	1.0678	
6	6	0.33	100	0.33	100	3.363	8.12	7.537	6.666	7.942	7.569		1.0774	1.2181	1.0224	0.9321	
7	7	0.33	100	1	33.3	3.43	27.4	25.13	19.22	30.89	25.8		1.0905	1.4257	0.887	0.9414	
8	8	0.33	100	3	11.1	3.63	76.9	81.34	51.51	95.9	87.81		0.9454	1.4328	0.8019	1.1418	
9	9	0.33	150	0.33	150	4.106	10.6	10.77	9.407	11.42	10.89		0.9842	1.1268	0.9279	1.0275	
10	10	0.33	150	1	50	4.16	38.1	35.98	27.47	42.75	37.11		1.059	1.3868	0.8913	0.9741	
11	11	0.33	150	3	16.7	4.323	116	125.8	76.21	144.5	126.3		0.9221	1.5222	0.8027	1.0891	
12	12	0.33	250	0.33	250	5.286	15.9	16.74	14.29	18.16	17.22		0.9501	1.1125	0.8758	1.0831	
13	13	0.33	250	1	83.3	5.328	57.4	56.01	42.21	68.76	58.69		1.0249	1.36	0.8348	1.0225	
14	14	0.33	250	3	27.8	5.455	195	216.8	120.6	229.5	199.8		0.8996	1.6168	0.8499	1.0245	
15	15	0.5	20	0.5	20	2.348	3.52	3.044	3.694	4.143	3.507		1.1564	0.9529	0.8496	0.9963	
16	16	0.5	20	1	10	2.46	7.8	6.666	6.678	9.295	7.595		1.1701	1.168	0.8392	0.9737	
17	17	0.5	60	0.5	60	3.938	9.01	8.864	9.517	10.59	9.396		1.0165	0.9467	0.8507	1.0428	
18	18	0.5	60	1	30	4.002	21.5	19.59	18.34	27.78	20.35		1.0976	1.172	0.7738	0.9466	
19	19	0.5	60	3	10	4.26	71	63.33	47.95	84.19	69.28		1.121	1.4807	0.8434	0.9757	
20	20	0.5	100	0.5	100	5.05	13.9	14.09	14.15	15.21	14.86		0.9869	0.9825	0.9141	1.069	
21	21	0.5	100	1	50	5.1	37.8	31.18	27.71	40.05	32.18		1.2123	1.3641	0.9438	0.8514	
22	22	0.5	100	3	16.7	5.3	115	110.9	76.81	141.4	109.6		1.037	1.4972	0.8133	0.9526	
23	23	0.5	150	0.5	150	6.165	18.8	20.15	20.04	22.95	21.38		0.9328	0.9384	0.8192	1.1372	
24	24	0.5	150	1	75	6.205	52.8	44.65	39.52	59.72	46.31		1.1824	1.3362	0.8841	0.877	
25	25	0.5	150	3	25	6.369	155	171.7	112.3	204	157.6		0.9027	1.3803	0.7596	1.0169	
26	26	0.5	250	0.5	250	7.937	27.8	31.35	30.65	38.45	33.81		0.8866	0.9071	0.723	1.2161	
27	27	0.5	250	1	125	7.969	80.3	69.52	60.78	94.17	73.23		1.1551	1.3212	0.8527	0.9119	
28	28	0.5	250	3	41.7	8.095	279	296.1	176.4	320	249.3		0.9423	1.5816	0.8719	0.8934	
29	29	0.75	20	0.75	20	3.522	4.9	5.5	8.07	10.03	5.93		0.8909	0.6072	0.4888	1.2102	
30	30	0.75	20	1	15	3.678	7.72	7.711	10.45	14.2	8.173		1.0012	0.739	0.5435	1.0587	
31	31	0.75	20	3	5	4.025	24.7	22.25	25.64	36.8	27.82		1.11	0.9633	0.6713	1.1263	
32	32	0.75	60	0.75	60	5.906	15.3	16.14	20.5	25.42	15.89		0.9482	0.7463	0.6019	1.0386	
33	33	0.75	60	1	45	5.939	23.7	22.68	27.04	37.24	21.9		1.0448	0.8764	0.6364	0.924	
34	34	0.75	60	3	15	6.197	81.2	81.24	74.8	126.2	74.55		0.9395	1.0855	0.6434	0.918	
35	35	0.75	100	0.75	100	7.575	25.9	25.68	31.3	38.95	25.13		1.0087	0.8274	0.6649	0.9702	
36	36	0.75	100	1	75	7.6	39.3	36.11	41.47	58.26	34.63		1.0882	0.9478	0.6746	0.8812	
37	37	0.75	100	3	25	7.8	131	142.5	118.3	201.4	117.9		0.9196	1.1077	0.6503	0.8999	
38	38	0.75	150	0.75	150	9.247	35.3	36.77	44.3	58.81	36.15		0.9601	0.7968	0.6002	1.0242	
39	39	0.75	150	1	113	9.267	54.6	51.73	58.81	84.6	49.83		1.0556	0.9284	0.6454	0.9126	
40	40	0.75	150	3	37.5	9.431	186	220.7	170.5	290.9	169.6		0.8427	1.091	0.6395	0.9119	
41																	
42													Average	1.0428	1.1698	0.811	0.9886
43													STDEV	0.1321	0.2679	0.1667	0.1057
44																	
45																	

**Table 1-5 – Membrane + Bending Nozzle Stress Factors due to Out-of-Plane Nozzle Moments**

M+B (Nozzle) Table 8 Out-of-Plane Moment Comparison

#	d/D	D/T	t/T	d/t	lambda	Sv/So	Ø7-10	297	497
1	0.333	20.	0.333	20.000	1.5637	5.130	6.761	9.713	5.835
2	0.333	20.	1.000	6.660	1.7128	6.410	5.112	5.374	4.423
3	0.333	60.	0.333	60.000	2.6224	13.000	19.717	27.476	14.083
4	0.333	60.	1.000	19.980	2.7085	15.700	15.219	16.809	10.674
5	0.333	60.	3.000	6.660	2.9667	7.640	7.378	6.419	8.093
6	0.333	100.	0.333	100.000	3.3633	20.900	33.722	46.908	21.213
7	0.333	100.	1.000	33.300	3.4300	23.800	24.756	28.776	16.079
8	0.333	100.	3.000	11.100	3.6300	12.200	11.826	12.472	12.191
9	0.333	150.	0.333	150.000	4.1056	24.500	48.459	65.534	29.365
10	0.333	150.	1.000	49.950	4.1600	30.400	36.303	42.275	22.258
11	0.333	150.	3.000	16.650	4.3233	19.400	17.197	20.581	16.875
12	0.333	250.	0.333	250.000	5.2863	29.700	78.535	100.554	44.234
13	0.333	250.	1.000	83.250	5.3284	40.000	59.642	71.598	33.528
14	0.333	250.	3.000	27.750	5.4549	33.500	28.467	36.145	25.420
15	0.500	20.	0.500	20.000	2.3479	8.160	8.461	11.963	8.755
16	0.500	20.	1.000	10.000	2.4597	8.210	6.959	7.785	7.352
17	0.500	60.	0.500	60.000	3.9375	20.200	25.207	33.150	21.131
18	0.500	60.	1.000	30.000	4.0021	19.800	20.224	25.509	17.744
19	0.500	60.	3.000	10.000	4.2603	9.790	9.905	10.702	13.453
20	0.500	100.	0.500	100.000	5.0500	38.300	43.728	51.956	31.831
21	0.500	100.	1.000	50.000	5.1000	32.800	32.652	39.572	26.729
22	0.500	100.	3.000	16.667	5.3000	18.400	15.876	20.147	20.265
23	0.500	150.	0.500	150.000	6.1645	49.300	59.181	78.894	44.063
24	0.500	150.	1.000	75.000	6.2054	42.700	47.600	61.371	37.001
25	0.500	150.	3.000	25.000	6.3687	28.300	23.087	31.424	28.053
26	0.500	250.	0.500	250.000	7.9373	62.500	94.446	132.859	66.373
27	0.500	250.	1.000	125.000	7.9689	56.600	76.366	100.247	55.736
28	0.500	250.	3.000	41.667	8.0954	47.600	37.004	53.309	42.257
29	0.750	20.	0.750	20.000	3.5218	8.700	9.115	15.118	8.808
30	0.750	20.	1.000	15.000	3.5777	8.670	8.441	12.068	8.192
31	0.750	20.	3.000	5.000	4.0249	5.690	4.583	4.115	6.211
32	0.750	60.	0.750	60.000	5.9063	24.300	26.014	42.566	21.258
33	0.750	60.	1.000	45.000	5.9386	23.600	23.583	36.161	19.772
34	0.750	60.	3.000	15.000	6.1968	12.800	12.641	17.472	14.990
35	0.750	100.	0.750	100.000	7.5750	40.100	41.756	69.689	32.022
36	0.750	100.	1.000	75.000	7.6000	37.900	37.586	59.789	29.783
37	0.750	100.	3.000	25.000	7.8000	17.600	20.260	30.884	22.580
38	0.750	150.	0.750	150.000	9.2468	49.700	60.625	105.729	44.328
39	0.750	150.	1.000	112.500	9.2672	47.400	54.294	89.964	41.228
40	0.750	150.	3.000	37.500	9.4305	27.400	29.462	47.653	31.258
41	1.000	20.	1.000	20.000	4.6957	6.320	8.441	16.564	6.421
42	1.000	60.	1.000	60.000	7.8751	15.500	23.583	47.651	15.497
43	1.000	100.	1.000	100.000	10.1000	23.800	37.586	79.682	23.344

The stress factors in the nozzle do not correlate as well as stress factors in the vessel. Model #12 is a good example. d/D=0.333, D/T=250, t/T=d/D=0.333. The high stress will likely be in the nozzle wall since t/T<1, and so the nozzle stresses would govern for this model. The stress factors for this case are 29.7, 78, 100.5 and 44.234, from FEA, this project (Project No. 07-10), WRC 297 and WRC 497 respectively. Error averages, etc. are shown in Table 1-5a below.



The maximum stress shown above drops rapidly away from the branch connection in the nozzle. The length  $(rt)^{0.5} = 2.977$  inch and the stress drops 30% over about a 1 inch meridional length along the nozzle. In early 2013 the Paulin Research Group (PRG) released an “alternate” weld model whose area and inertia were equal to the area and inertia of the simulated fillet, or tapered nozzle. The alternate penetration line models could be less conservative and were made available in the software as an option. The table below shows how the various options affect the stress factor for model #12 in Table 1-5.

**Membrane + Bending Stress Factor for Nozzle Stresses and Out-of-Plane Loads Thru Nozzle**

Approach	Stress Factor
WRC 497 FEA	29.7
WRC 497 Correlation Equation	44.234
ST LLC 07-02 Correlation Equation [70]	78.5
WRC 297	100.554
NozzlePRO Si, Std Weld Model	90.33
NozzlePRO Si, Alt Weld Model	84.89
NozzlePRO Se, Alt Weld model	74.6

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**Table 1-6 – Membrane + Bending Vessel Stress Factors due to Axial Nozzle Forces**

M+B (Vessel) Table 9 Axial Force Comparison

#	d/D	D/T	t/T	d/t	lambda	Sv/So	07-10	107	297	497
1	0.333	20.	0.333	20.000	1.5637	3.260	2.626	3.643	4.488	3.015
2	0.333	20.	1.000	6.660	1.7128	9.920	9.880	9.903	15.866	11.268
3	0.333	60.	0.333	60.000	2.6224	7.790	6.892	7.958	8.477	7.131
4	0.333	60.	1.000	19.980	2.7085	28.800	30.219	23.751	35.773	26.654
5	0.333	60.	3.000	6.660	2.9667	92.300	99.446	70.030	114.297	99.503
6	0.333	100.	0.333	100.000	3.3633	11.400	11.177	13.614	11.977	10.642
7	0.333	100.	1.000	33.300	3.4300	44.800	52.197	40.730	54.966	39.777
8	0.333	100.	3.000	11.100	3.6300	129.000	173.571	120.968	161.117	148.491
9	0.333	150.	0.333	150.000	4.1056	15.300	14.396	20.527	16.725	14.623
10	0.333	150.	1.000	49.950	4.1600	59.700	60.837	61.519	69.488	54.656
11	0.333	150.	3.000	16.650	4.3233	188.000	208.427	183.538	221.453	204.034
12	0.333	250.	0.333	250.000	5.2863	21.700	21.265	33.424	26.611	21.823
13	0.333	250.	1.000	83.250	5.3284	84.500	91.446	100.274	110.372	81.564
14	0.333	250.	3.000	27.750	5.4549	300.000	331.300	299.985	322.152	304.485
15	0.500	20.	0.500	20.000	2.3479	4.420	3.683	5.940	7.546	5.053
16	0.500	20.	1.000	10.000	2.4597	10.200	10.626	11.767	21.477	11.600
17	0.500	60.	0.500	60.000	3.9375	10.900	9.667	16.664	17.467	11.952
18	0.500	60.	1.000	30.000	4.0021	29.300	32.682	33.259	49.717	27.439
19	0.500	60.	3.000	10.000	4.2603	103.000	107.754	98.735	124.378	102.433
20	0.500	100.	0.500	100.000	5.0500	17.200	15.677	28.741	22.902	17.836
21	0.500	100.	1.000	50.000	5.1000	53.000	56.516	57.406	62.320	40.948
22	0.500	100.	3.000	16.667	5.3000	163.000	188.138	171.410	202.147	152.863
23	0.500	150.	0.500	150.000	6.1645	23.000	22.182	44.019	34.336	24.508
24	0.500	150.	1.000	75.000	6.2054	70.000	62.069	87.983	97.954	56.265
25	0.500	150.	3.000	25.000	6.3687	210.000	212.564	263.336	297.258	210.041
26	0.500	250.	0.500	250.000	7.9373	32.200	33.871	72.495	57.227	36.573
27	0.500	250.	1.000	125.000	7.9689	99.800	93.281	144.950	170.437	83.965
28	0.500	250.	3.000	41.667	8.0954	359.000	353.863	434.391	447.145	313.449
29	0.750	20.	0.750	20.000	3.5218	12.000	7.204	13.133	17.014	8.115
30	0.750	20.	1.000	15.000	3.5777	16.100	10.407	17.511	26.602	11.457
31	0.750	20.	3.000	5.000	4.0249	48.300	32.626	52.532	64.970	42.771
32	0.750	60.	0.750	60.000	5.9063	15.100	21.383	36.806	40.154	19.195
33	0.750	60.	1.000	45.000	5.9386	24.700	31.961	49.075	59.061	27.102
34	0.750	60.	3.000	15.000	6.1968	92.800	105.321	147.224	177.672	101.174
35	0.750	100.	0.750	100.000	7.5750	27.000	36.704	63.721	67.296	28.646
36	0.750	100.	1.000	75.000	7.6000	42.600	55.251	84.961	97.954	40.445
37	0.750	100.	3.000	25.000	7.8000	151.000	183.872	254.883	297.258	150.984
38	0.750	150.	0.750	150.000	9.2468	37.300	39.019	97.992	100.944	39.361
39	0.750	150.	1.000	112.500	9.2672	59.800	57.868	130.656	153.394	55.573
40	0.750	150.	3.000	37.500	9.4305	216.000	207.008	391.967	411.662	207.460
41	1.000	20.	1.000	20.000	4.6957	6.820	10.407	23.347	26.305	5.451
42	1.000	60.	1.000	60.000	7.8751	12.400	31.961	65.433	76.214	12.894
43	1.000	100.	1.000	100.000	10.1000	17.400	55.251	113.282	136.350	19.241

Table 1-6 includes the maximum membrane plus bending (M+B) stress factors (surface stresses) in the vessel due to an axial force applied on the nozzle and includes results for this project (07-10) and from WRC107, WRC297 and WRC 497. The column labeled Sv/So is taken from finite element results in WRC 497, and the column labeled “497” is from the WRC 497 correlation equations.

Rows 41 through 43 are outside of the project (07-10) d/D range. These rows are provided for reference. Rows 29 through 40 are outside of the project (07-10) d/D range by 7%. These rows are considered close enough for comparison purposes. For the project (07-10) calculations d/D is set to 0.7 for rows 29 through 40.



**Table 1-7 – Membrane + Bending Nozzle Stress Factors due to Axial Nozzle Forces**

M+B (Nozzle) Table 9 Axial Force Comparison

#	d/D	D/T	t/T	d/t	lambda	Sv/So	07-10	297	497
1	0.333	20.	0.333	20.000	1.5637	6.940	8.554	15.515	8.354
2	0.333	20.	1.000	6.660	1.7128	11.200	9.567	10.637	7.170
3	0.333	60.	0.333	60.000	2.6224	17.000	24.780	44.647	19.107
4	0.333	60.	1.000	19.980	2.7085	26.600	25.837	31.580	16.399
5	0.333	60.	3.000	6.660	2.9667	13.700	16.068	19.487	14.076
6	0.333	100.	0.333	100.000	3.3633	27.100	42.774	68.618	28.070
7	0.333	100.	1.000	33.300	3.4300	39.200	41.416	53.455	24.091
8	0.333	100.	3.000	11.100	3.6300	23.000	23.392	30.361	20.679
9	0.333	150.	0.333	150.000	4.1056	31.500	59.531	88.663	38.092
10	0.333	150.	1.000	49.950	4.1600	47.800	56.081	73.545	32.693
11	0.333	150.	3.000	16.650	4.3233	33.800	31.317	46.402	28.063
12	0.333	250.	0.333	250.000	5.2863	37.500	92.681	128.337	55.961
13	0.333	250.	1.000	83.250	5.3284	60.700	85.974	119.548	48.029
14	0.333	250.	3.000	27.750	5.4549	52.100	49.224	86.723	41.227
15	0.500	20.	0.500	20.000	2.3479	9.630	10.515	16.044	11.146
16	0.500	20.	1.000	10.000	2.4597	11.500	10.430	15.260	10.123
17	0.500	60.	0.500	60.000	3.9375	24.900	31.169	52.554	25.492
18	0.500	60.	1.000	30.000	4.0021	28.100	28.159	47.565	23.151
19	0.500	60.	3.000	10.000	4.2603	15.000	17.536	24.368	19.872
20	0.500	100.	0.500	100.000	5.0500	47.400	53.314	70.891	37.450
21	0.500	100.	1.000	50.000	5.1000	46.000	45.627	65.806	34.011
22	0.500	100.	3.000	16.667	5.3000	25.300	25.427	43.502	29.194
23	0.500	150.	0.500	150.000	6.1645	59.500	72.199	107.241	50.822
24	0.500	150.	1.000	75.000	6.2054	57.400	60.898	105.518	46.154
25	0.500	150.	3.000	25.000	6.3687	38.000	33.949	75.014	39.618
26	0.500	250.	0.500	250.000	7.9373	71.600	112.525	179.391	74.663
27	0.500	250.	1.000	125.000	7.9589	71.600	92.677	186.630	67.805
28	0.500	250.	3.000	41.667	8.0954	58.600	50.627	142.176	58.203
29	0.750	20.	0.750	20.000	3.5218	9.080	10.566	22.198	9.558
30	0.750	20.	1.000	15.000	3.5777	9.690	10.069	20.612	9.183
31	0.750	20.	3.000	5.000	4.0249	7.080	7.850	11.965	7.883
32	0.750	60.	0.750	60.000	5.9063	26.200	29.265	67.819	21.860
33	0.750	60.	1.000	45.000	5.9386	26.700	26.816	61.561	21.003
34	0.750	60.	3.000	15.000	6.1968	15.800	17.856	37.877	18.028
35	0.750	100.	0.750	100.000	7.5750	43.600	45.382	117.536	32.114
36	0.750	100.	1.000	75.000	7.6000	43.000	43.366	105.518	30.855
37	0.750	100.	3.000	25.000	7.8000	21.000	25.665	75.014	26.486
38	0.750	150.	0.750	150.000	9.2468	54.600	65.786	176.792	43.581
39	0.750	150.	1.000	112.500	9.2672	54.000	59.226	167.871	41.872
40	0.750	150.	3.000	37.500	9.4305	27.900	34.074	125.122	35.942
41	1.000	20.	1.000	20.000	4.6957	6.940	10.069	21.176	5.812
42	1.000	60.	1.000	60.000	7.8751	12.800	26.816	81.184	13.291
43	1.000	100.	1.000	100.000	10.1000	18.200	43.366	149.111	19.526

Table 1-7 includes the maximum membrane plus bending stress factors (surface stresses) in the nozzle due to an axial force applied on the nozzle and includes results for this project (07-10) and from WRC297 and WRC 497. The column labeled Sn/So is taken from finite element results in WRC 497, and the column labeled “497” is from the WRC 497 correlation equations.

Rows 41 through 43 are outside of the project (07-10) d/D range. These rows are provided for reference only. Do not use for comparison.

Rows 29 through 40 are outside of the project (07-10) d/D range by 7%. These rows are considered close enough for comparison purposes. For project (07-10) calculations d/D is set to 0.7 for rows 29 through 40. The model in rows 26, 27 and 28 illustrates the potential over conservatism in WRC 297 for nozzle stresses and t/T ratios between 0.5 and 3.

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**Table 1-8 – Membrane Stress Factors due to Axial, In-Plane, and Out-of-Plane Nozzle Loads**

#	d/D	D/T	t/T	d/t	lambda	----- Axial ----- / -----			----- Inplane ----- / -----			----- Outplane ----- / -----					
						S <sub>mv</sub> /S <sub>o</sub>	Ø7-10	S <sub>mn</sub> /S <sub>o</sub>	Ø7-10	S <sub>mv</sub> /S <sub>o</sub>	Ø7-10	S <sub>mn</sub> /S <sub>o</sub>	Ø7-10	S <sub>mv</sub> /S <sub>o</sub>	Ø7-10	S <sub>mn</sub> /S <sub>o</sub>	Ø7-10
1	0.333	20.	0.333	20.000	1.5637	0.660	1.000	1.240	1.206	0.540	1.000	1.270	1.769	1.660	1.301	2.040	2.474
2	0.333	20.	1.000	6.660	1.7128	1.370	1.000	2.180	1.110	1.300	1.091	1.450	1.351	4.990	2.589	2.150	2.697
3	0.333	60.	0.333	60.000	2.6224	1.790	1.460	2.830	2.203	1.380	1.457	4.140	3.935	2.760	2.618	6.260	5.720
4	0.333	60.	1.000	19.980	2.7085	2.800	2.197	2.370	2.533	2.270	2.035	3.540	3.122	5.930	4.269	6.610	6.054
5	0.333	60.	3.000	6.660	2.9667	8.260	4.971	2.780	1.974	6.110	5.075	2.670	2.364	17.700	11.456	6.020	5.419
6	0.333	100.	0.333	100.000	3.3633	2.460	2.292	3.870	3.073	2.320	2.231	6.890	5.921	4.400	4.316	10.100	8.598
7	0.333	100.	1.000	33.300	3.4300	3.810	3.281	3.560	3.754	3.440	3.032	6.060	4.655	7.220	5.944	10.900	9.057
8	0.333	100.	3.000	11.100	3.6300	11.300	7.623	4.530	3.223	9.560	7.730	5.430	4.142	21.100	15.875	11.000	9.151
9	0.333	150.	0.333	150.000	4.1056	3.020	3.392	4.790	4.091	3.370	3.796	10.300	8.274	6.110	6.919	14.700	11.939
10	0.333	150.	1.000	49.950	4.1600	4.790	4.363	4.820	4.352	5.330	4.407	9.180	6.413	9.530	8.729	15.600	12.556
11	0.333	150.	3.000	16.650	4.3233	14.300	10.591	6.320	5.018	15.100	11.294	8.900	6.576	25.400	22.291	16.500	14.083
12	0.333	250.	0.333	250.000	5.2863	3.750	4.844	6.080	5.522	5.330	6.158	16.300	12.724	8.620	10.864	21.500	18.127
13	0.333	250.	1.000	83.250	5.3284	6.250	6.193	6.770	6.257	9.360	7.419	14.500	9.632	14.500	13.746	22.900	19.055
14	0.333	250.	3.000	27.750	5.4549	18.600	14.163	9.090	7.959	27.300	17.960	15.700	11.985	41.400	31.939	25.300	24.591
15	0.500	20.	0.500	20.000	2.3479	1.020	1.000	1.500	1.392	0.890	1.000	1.960	1.954	3.720	1.371	2.430	4.472
16	0.500	20.	1.000	10.000	2.4597	1.880	1.412	1.510	1.291	1.440	1.522	1.580	1.693	7.440	2.891	2.320	2.568
17	0.500	60.	0.500	60.000	3.9375	2.110	2.078	2.940	2.558	2.200	2.079	6.080	4.414	4.350	2.737	7.600	5.726
18	0.500	60.	1.000	30.000	4.0021	3.500	2.813	2.890	2.752	3.060	2.841	5.000	4.007	8.610	4.184	6.850	5.731
19	0.500	60.	3.000	10.000	4.2603	10.200	6.800	3.480	2.555	8.380	7.226	4.270	3.231	25.600	12.536	5.720	5.374
20	0.500	100.	0.500	100.000	5.0500	3.110	3.265	4.120	3.593	3.830	3.210	10.200	6.670	6.020	4.494	13.000	8.613
21	0.500	100.	1.000	50.000	5.1000	4.520	4.054	4.050	4.030	5.010	4.280	8.260	6.033	10.000	5.824	11.400	8.655
22	0.500	100.	3.000	16.667	5.3000	13.300	10.235	5.310	4.068	14.000	10.954	8.070	5.620	29.800	16.045	10.900	9.000
23	0.500	150.	0.500	150.000	6.1645	4.000	3.973	5.400	5.077	5.480	4.728	14.600	9.342	8.440	7.600	18.200	11.962
24	0.500	150.	1.000	75.000	6.2054	5.450	4.961	5.340	4.782	7.470	6.179	12.100	8.371	11.600	8.891	16.400	12.124
25	0.500	150.	3.000	25.000	6.3687	16.100	11.644	7.150	5.088	21.000	15.191	12.600	8.831	34.500	22.847	16.900	13.792
26	0.500	250.	0.500	250.000	7.9373	5.370	5.791	7.460	6.933	8.410	7.666	22.400	14.397	11.700	11.955	26.200	18.165
27	0.500	250.	1.000	125.000	7.9689	7.080	6.878	7.460	6.859	12.300	10.171	19.000	12.680	15.200	14.505	23.600	18.675
28	0.500	250.	3.000	41.667	8.0954	20.300	15.122	10.200	8.793	36.600	23.756	21.200	15.827	43.500	32.667	25.500	24.002
29	0.750	20.	0.750	20.000	3.5218	2.130	1.539	2.010	1.562	1.570	1.449	2.380	2.229	10.400	2.401	2.570	2.182
30	0.750	20.	1.000	15.000	3.5777	2.740	1.876	2.080	1.445	1.980	1.899	2.300	2.102	10.900	3.332	2.630	2.181
31	0.750	20.	3.000	5.000	4.0249	6.330	3.631	2.200	1.348	3.890	3.873	1.840	1.400	41.900	10.395	2.590	2.313
32	0.750	60.	0.750	60.000	5.9063	3.720	2.931	3.750	2.926	3.320	2.836	6.620	5.267	10.900	2.985	6.430	4.907
33	0.750	60.	1.000	45.000	5.9386	4.850	3.508	3.950	2.904	4.230	3.596	6.060	5.068	14.500	4.041	5.910	4.805
34	0.750	60.	3.000	15.000	6.1968	13.100	8.760	4.410	3.154	10.700	9.649	5.100	4.270	43.400	13.861	4.830	5.124
35	0.750	100.	0.750	100.000	7.5750	4.630	4.122	5.080	4.152	5.410	4.628	11.000	8.121	11.700	4.266	11.100	7.564
36	0.750	100.	1.000	75.000	7.6000	5.970	4.930	5.320	4.209	6.190	5.546	10.000	7.684	15.500	5.580	10.000	7.377
37	0.750	100.	3.000	25.000	7.8000	17.000	13.028	5.830	5.001	16.500	14.556	9.820	7.390	46.400	18.000	8.100	8.168
38	0.750	150.	0.750	150.000	9.2468	5.420	5.038	6.310	5.974	7.850	6.625	15.400	11.304	12.700	7.483	15.900	10.002
39	0.750	150.	1.000	112.500	9.2672	6.990	5.649	6.580	5.290	9.000	7.501	14.400	10.716	16.900	8.926	14.900	10.519
40	0.750	150.	3.000	37.500	9.4305	20.200	12.823	7.870	6.516	23.100	18.326	14.200	11.532	50.100	23.315	13.100	12.191
41	1.000	20.	1.000	20.000	4.6957	3.050	1.876	3.450	1.445	2.910	4.899	2.730	2.102	4.040	3.332	3.920	2.181
42	1.000	60.	1.000	60.000	7.8751	5.110	3.508	6.690	2.904	6.560	3.596	6.550	5.068	6.830	4.041	6.630	4.805
43	1.000	100.	1.000	100.000	10.1000	7.510	4.930	9.550	4.209	9.230	5.546	9.140	7.684	8.620	5.580	8.460	7.377

Tables 1-2 through 1-7 contain stress factors due to surface stresses (stresses due to elemental membrane + bending stresses). Table 1-8 contains the membrane stress factors for in-plane, out-of-plane and axial loads applied through the nozzle.

Rows 41 through 43 are outside of the project (07-10) d/D range. These rows are provided for reference. Rows 29 through 40 are outside of the project (07-10) d/D range by 7%. These rows are considered close enough for comparison purposes. For project (07-10) calculations d/D is set to 0.7 for rows 29 through 40.

**Table 1-9 – Membrane + Bending Vessel Stress Unity Factors due to In-Plane Nozzle Moments**

M+B (Vessel) Table 7 In-Plane Moment Comparison

#	d/D	D/T	t/T	d/t	lambda	Sv/So	07-10	107	297	497
1	0.333	20.	0.333	20.000	1.5637	2.090	0.569	0.592	0.773	0.762
2	0.333	20.	1.000	6.660	1.7128	3.510	0.719	0.841	0.866	1.107
3	0.333	60.	0.333	60.000	2.6224	3.510	0.741	0.732	0.877	0.808
4	0.333	60.	1.000	19.980	2.7085	6.570	0.948	1.069	1.234	1.054
5	0.333	60.	3.000	6.660	2.9667	17.600	0.811	0.929	1.066	0.961
6	0.333	100.	0.333	100.000	3.3633	4.300	0.881	0.732	0.917	0.863
7	0.333	100.	1.000	33.300	3.4300	8.740	1.116	1.019	1.299	1.037
8	0.333	100.	3.000	11.100	3.6300	20.400	1.097	1.108	1.469	1.084
9	0.333	150.	0.333	150.000	4.1056	5.000	0.875	0.744	1.076	0.919
10	0.333	150.	1.000	49.950	4.1600	10.300	1.100	1.042	1.310	1.089
11	0.333	150.	3.000	16.650	4.3233	27.000	1.122	1.062	1.504	1.014
12	0.333	250.	0.333	250.000	5.2863	6.000	1.009	0.726	1.373	1.002
13	0.333	250.	1.000	83.250	5.3284	12.200	1.364	1.047	1.557	1.203
14	0.333	250.	3.000	27.750	5.4549	40.300	1.106	0.887	1.338	0.889
15	0.500	20.	0.500	20.000	2.3479	2.570	0.653	0.758	1.110	0.909
16	0.500	20.	1.000	10.000	2.4597	3.840	0.730	0.884	1.103	1.068
17	0.500	60.	0.500	60.000	3.9375	4.300	0.808	0.863	1.072	0.968
18	0.500	60.	1.000	30.000	4.0021	6.470	1.069	1.087	1.585	1.130
19	0.500	60.	3.000	10.000	4.2603	18.300	0.867	0.940	1.334	0.975
20	0.500	100.	0.500	100.000	5.0500	5.310	0.951	0.852	0.933	1.026
21	0.500	100.	1.000	50.000	5.1000	9.910	1.094	0.885	1.122	0.965
22	0.500	100.	3.000	16.667	5.3000	25.900	0.900	0.900	1.398	0.901
23	0.500	150.	0.500	150.000	6.1645	6.210	0.884	0.878	1.205	1.086
24	0.500	150.	1.000	75.000	6.2054	12.300	0.969	0.869	1.279	0.962
25	0.500	150.	3.000	25.000	6.3687	29.900	1.096	0.991	1.594	0.966
26	0.500	250.	0.500	250.000	7.9373	7.500	1.005	0.874	1.652	1.162
27	0.500	250.	1.000	125.000	7.9689	15.700	1.115	0.836	1.424	0.986
28	0.500	250.	3.000	41.667	8.0954	50.400	0.945	0.747	1.327	0.750
29	0.750	20.	0.750	20.000	3.5218	3.340	0.758	1.182	1.480	1.002
30	0.750	20.	1.000	15.000	3.5777	4.090	0.767	1.250	1.499	1.034
31	0.750	20.	3.000	5.000	4.0249	9.770	0.656	1.284	1.123	1.056
32	0.750	60.	0.750	60.000	5.9063	6.260	0.850	1.122	1.276	0.953
33	0.750	60.	1.000	45.000	5.9386	7.690	0.897	1.204	1.438	0.980
34	0.750	60.	3.000	15.000	6.1968	19.100	0.830	1.341	1.622	0.963
35	0.750	100.	0.750	100.000	7.5750	7.960	1.047	1.085	1.270	0.981
36	0.750	100.	1.000	75.000	7.6000	9.840	1.098	1.162	1.507	1.002
37	0.750	100.	3.000	25.000	7.8000	24.800	1.003	1.315	1.871	0.970
38	0.750	150.	0.750	150.000	9.2468	9.360	0.959	1.129	1.631	1.032
39	0.750	150.	1.000	112.500	9.2672	11.600	1.071	1.209	1.731	1.052
40	0.750	150.	3.000	37.500	9.4305	31.200	1.087	1.303	2.006	0.955
41	1.000	20.	1.000	20.000	4.6957	5.640	0.556	1.245	1.369	1.106
42	1.000	60.	1.000	60.000	7.8751	10.900	0.633	1.145	1.161	1.020

**Just outside of allowed range**

**Well outside of allowed range**

Tables 1-9 through 1-15 give unity factors so that a quick comparison of the correlation solution with the WRC 497 finite element solution can be made. The ratio shown is the correlation value divided by the WRC 497 finite element value. The column titled Sv/So contains the finite element stress factor; each other column to the right of Sv/So contains the ratio:

$$\text{(correlation stress factor)} / \text{(finite element stress factor)}$$

Perfect correlations would have ratios of 1.0. Values less than 1 suggest that the correlation is not as conservative as the WRC 497 finite element data, and values greater than 1 suggest that the correlation result is greater than the WRC 497 finite element data.

**Table 1-10 – Membrane + Bending Nozzle Stress Unity Factors due to In-Plane Nozzle Moments**

M+B (Nozzle) Table 7 In-Plane Moment Comparison

#	d/D	D/T	t/T	d/t	lambda	Sv/So	07-10	297	497
1	0.333	20.	0.333	20.000	1.5637	3.500	1.114	2.092	1.020
2	0.333	20.	1.000	6.660	1.7128	3.770	0.699	0.784	0.947
3	0.333	60.	0.333	60.000	2.6224	5.750	1.341	2.161	1.048
4	0.333	60.	1.000	19.980	2.7085	6.290	0.923	1.114	0.958
5	0.333	60.	3.000	6.660	2.9667	4.510	0.741	0.737	1.336
6	0.333	100.	0.333	100.000	3.3633	7.790	1.342	2.289	0.887
7	0.333	100.	1.000	33.300	3.4300	8.240	1.038	1.324	0.933
8	0.333	100.	3.000	11.100	3.6300	6.420	0.752	0.953	1.197
9	0.333	150.	0.333	150.000	4.1056	8.430	1.491	2.652	1.106
10	0.333	150.	1.000	49.950	4.1600	9.710	1.134	1.405	0.960
11	0.333	150.	3.000	16.650	4.3233	8.080	0.811	1.249	1.154
12	0.333	250.	0.333	250.000	5.2863	8.590	2.022	3.668	1.385
13	0.333	250.	1.000	83.250	5.3284	11.800	1.312	1.617	1.008
14	0.333	250.	3.000	27.750	5.4549	10.200	0.942	1.428	1.166
15	0.500	20.	0.500	20.000	2.3479	4.310	0.850	1.957	0.960
16	0.500	20.	1.000	10.000	2.4597	3.900	0.772	0.950	1.061
17	0.500	60.	0.500	60.000	3.9375	6.550	1.166	1.949	1.066
18	0.500	60.	1.000	30.000	4.0021	6.290	0.999	1.533	1.110
19	0.500	60.	3.000	10.000	4.2603	5.100	0.768	0.934	1.369
20	0.500	100.	0.500	100.000	5.0500	10.500	1.002	1.384	0.848
21	0.500	100.	1.000	50.000	5.1000	9.350	0.967	1.183	0.953
22	0.500	100.	3.000	16.667	5.3000	7.160	0.785	1.275	1.244
23	0.500	150.	0.500	150.000	6.1645	12.000	1.163	1.869	0.900
24	0.500	150.	1.000	75.000	6.2054	11.200	1.047	1.382	0.965
25	0.500	150.	3.000	25.000	6.3687	8.620	0.815	1.466	1.254
26	0.500	250.	0.500	250.000	7.9373	13.400	1.501	2.854	1.028
27	0.500	250.	1.000	125.000	7.9689	14.200	1.147	1.425	0.971
28	0.500	250.	3.000	41.667	8.0954	11.300	0.899	1.667	1.220
29	0.750	20.	0.750	20.000	3.5218	4.200	0.859	1.763	1.006
30	0.750	20.	1.000	15.000	3.5777	3.950	0.847	1.343	1.070
31	0.750	20.	3.000	5.000	4.0249	3.760	0.581	0.492	1.124
32	0.750	60.	0.750	60.000	5.9063	6.250	1.148	2.009	1.141
33	0.750	60.	1.000	45.000	5.9386	6.110	1.075	1.789	1.167
34	0.750	60.	3.000	15.000	6.1968	6.540	0.682	1.138	1.091
35	0.750	100.	0.750	100.000	7.5750	9.180	1.099	1.631	0.991
36	0.750	100.	1.000	75.000	7.6000	9.010	1.018	1.591	1.010
37	0.750	100.	3.000	25.000	7.8000	7.710	0.825	1.592	1.180
38	0.750	150.	0.750	150.000	9.2468	10.800	1.251	2.139	1.022
39	0.750	150.	1.000	112.500	9.2672	10.700	1.153	1.690	1.031
40	0.750	150.	3.000	37.500	9.4305	9.770	0.736	1.758	1.130
41	1.000	20.	1.000	20.000	4.6957	5.550	0.603	1.232	1.322
42	1.000	60.	1.000	60.000	7.8751	13.800	0.476	0.910	0.897



**Table 1-11 – Membrane + Bending Vessel Stress Unity Factors due to Out-of-Plane Nozzle Moments**

M+B (Vessel) Table 8 Out-of-Plane Moment Comparison

#	d/D	D/T	t/T	d/t	lambda	Sv/So	07-10	107	297	497
1	0.333	20.	0.333	20.000	1.5637	2.650	0.625	0.680	0.720	0.674
2	0.333	20.	1.000	6.660	1.7128	5.830	0.923	0.775	1.023	1.044
3	0.333	60.	0.333	60.000	2.6224	5.710	0.833	0.839	0.893	0.838
4	0.333	60.	1.000	19.980	2.7085	17.200	0.918	0.780	1.113	0.948
5	0.333	60.	3.000	6.660	2.9667	52.000	0.895	0.645	1.039	1.068
6	0.333	100.	0.333	100.000	3.3633	8.120	0.928	0.821	0.978	0.932
7	0.333	100.	1.000	33.300	3.4300	27.400	0.917	0.701	1.127	0.991
8	0.333	100.	3.000	11.100	3.6300	76.900	1.058	0.670	1.247	1.142
9	0.333	150.	0.333	150.000	4.1056	10.600	1.016	0.887	1.078	1.027
10	0.333	150.	1.000	49.950	4.1600	38.100	0.944	0.721	1.122	0.974
11	0.333	150.	3.000	16.650	4.3233	116.000	1.084	0.657	1.246	1.089
12	0.333	250.	0.333	250.000	5.2863	15.900	1.052	0.899	1.142	1.083
13	0.333	250.	1.000	83.250	5.3284	57.400	0.976	0.735	1.198	1.022
14	0.333	250.	3.000	27.750	5.4549	195.000	1.112	0.618	1.177	1.025
15	0.500	20.	0.500	20.000	2.3479	3.520	0.865	1.049	1.177	0.996
16	0.500	20.	1.000	10.000	2.4597	7.800	0.855	0.856	1.192	0.974
17	0.500	60.	0.500	60.000	3.9375	9.010	0.984	1.056	1.176	1.043
18	0.500	60.	1.000	30.000	4.0021	21.500	0.911	0.853	1.292	0.947
19	0.500	60.	3.000	10.000	4.2603	71.000	0.892	0.675	1.186	0.976
20	0.500	100.	0.500	100.000	5.0500	13.900	1.013	1.018	1.094	1.069
21	0.500	100.	1.000	50.000	5.1000	37.800	0.825	0.733	1.060	0.851
22	0.500	100.	3.000	16.667	5.3000	115.000	0.964	0.668	1.230	0.953
23	0.500	150.	0.500	150.000	6.1645	18.800	1.072	1.066	1.221	1.137
24	0.500	150.	1.000	75.000	6.2054	52.800	0.846	0.748	1.131	0.877
25	0.500	150.	3.000	25.000	6.3687	155.000	1.108	0.724	1.316	1.017
26	0.500	250.	0.500	250.000	7.9373	27.800	1.128	1.102	1.383	1.216
27	0.500	250.	1.000	125.000	7.9689	80.300	0.866	0.757	1.173	0.912
28	0.500	250.	3.000	41.667	8.0954	279.000	1.061	0.632	1.147	0.893
29	0.750	20.	0.750	20.000	3.5218	4.900	1.122	1.647	2.046	1.210
30	0.750	20.	1.000	15.000	3.5777	7.720	0.999	1.353	1.840	1.059
31	0.750	20.	3.000	5.000	4.0249	24.700	0.901	1.038	1.490	1.126
32	0.750	60.	0.750	60.000	5.9063	15.300	1.055	1.340	1.661	1.039
33	0.750	60.	1.000	45.000	5.9386	23.700	0.957	1.141	1.571	0.924
34	0.750	60.	3.000	15.000	6.1968	81.200	1.001	0.921	1.554	0.918
35	0.750	100.	0.750	100.000	7.5750	25.900	0.991	1.209	1.504	0.970
36	0.750	100.	1.000	75.000	7.6000	39.300	0.919	1.055	1.482	0.881
37	0.750	100.	3.000	25.000	7.8000	131.000	1.087	0.903	1.538	0.900
38	0.750	150.	0.750	150.000	9.2468	35.300	1.042	1.255	1.666	1.024
39	0.750	150.	1.000	112.500	9.2672	54.600	0.947	1.077	1.549	0.913
40	0.750	150.	3.000	37.500	9.4305	186.000	1.187	0.917	1.564	0.912
41	1.000	20.	1.000	20.000	4.6957	6.300	1.224	2.277	2.995	0.964
42	1.000	60.	1.000	60.000	7.8751	16.800	1.350	2.169	2.826	0.969

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**Table 1-12 – Membrane + Bending Nozzle Stress Unity Factors due to Out-of-Plane Nozzle Moments**

M+B (Nozzle) Table 8 Out-of-Plane Moment Comparison

#	d/D	D/T	t/T	d/t	lambda	Sv/So	07-10	297	497
1	0.333	20.	0.333	20.000	1.5637	5.130	1.318	1.893	1.137
2	0.333	20.	1.000	6.660	1.7128	6.410	0.798	0.838	0.690
3	0.333	60.	0.333	60.000	2.6224	13.000	1.517	2.114	1.083
4	0.333	60.	1.000	19.980	2.7085	15.700	0.969	1.071	0.660
5	0.333	60.	3.000	6.660	2.9667	7.640	0.966	0.840	1.059
6	0.333	100.	0.333	100.000	3.3633	20.900	1.614	2.244	1.015
7	0.333	100.	1.000	33.300	3.4300	23.800	1.040	1.209	0.676
8	0.333	100.	3.000	11.100	3.6300	12.200	0.969	1.022	0.999
9	0.333	150.	0.333	150.000	4.1056	24.500	1.978	2.675	1.199
10	0.333	150.	1.000	49.950	4.1600	30.400	1.194	1.391	0.732
11	0.333	150.	3.000	16.650	4.3233	19.400	0.886	1.061	0.870
12	0.333	250.	0.333	250.000	5.2863	29.700	2.644	3.386	1.489
13	0.333	250.	1.000	83.250	5.3284	40.000	1.491	1.790	0.838
14	0.333	250.	3.000	27.750	5.4549	33.500	0.850	1.079	0.759
15	0.500	20.	0.500	20.000	2.3479	8.160	1.037	1.466	1.073
16	0.500	20.	1.000	10.000	2.4597	8.210	0.848	0.948	0.896
17	0.500	60.	0.500	60.000	3.9375	20.200	1.248	1.641	1.046
18	0.500	60.	1.000	30.000	4.0021	19.800	1.021	1.288	0.896
19	0.500	60.	3.000	10.000	4.2603	9.790	1.012	1.093	1.374
20	0.500	100.	0.500	100.000	5.0500	38.300	1.142	1.357	0.831
21	0.500	100.	1.000	50.000	5.1000	32.800	0.995	1.206	0.815
22	0.500	100.	3.000	16.667	5.3000	18.400	0.863	1.095	1.101
23	0.500	150.	0.500	150.000	6.1645	49.300	1.200	1.600	0.894
24	0.500	150.	1.000	75.000	6.2054	42.700	1.115	1.437	0.867
25	0.500	150.	3.000	25.000	6.3687	28.300	0.816	1.110	0.991
26	0.500	250.	0.500	250.000	7.9373	62.500	1.511	2.126	1.062
27	0.500	250.	1.000	125.000	7.9689	56.600	1.349	1.771	0.985
28	0.500	250.	3.000	41.667	8.0954	47.600	0.777	1.120	0.888
29	0.750	20.	0.750	20.000	3.5218	8.700	1.048	1.738	1.012
30	0.750	20.	1.000	15.000	3.5777	8.670	0.974	1.392	0.945
31	0.750	20.	3.000	5.000	4.0249	5.690	0.805	0.723	1.092
32	0.750	60.	0.750	60.000	5.9063	24.300	1.071	1.752	0.875
33	0.750	60.	1.000	45.000	5.9386	23.600	0.999	1.532	0.838
34	0.750	60.	3.000	15.000	6.1968	12.800	0.988	1.365	1.171
35	0.750	100.	0.750	100.000	7.5750	40.100	1.041	1.738	0.799
36	0.750	100.	1.000	75.000	7.6000	37.900	0.992	1.578	0.786
37	0.750	100.	3.000	25.000	7.8000	17.600	1.151	1.755	1.283
38	0.750	150.	0.750	150.000	9.2468	49.700	1.220	2.127	0.892
39	0.750	150.	1.000	112.500	9.2672	47.400	1.145	1.898	0.870
40	0.750	150.	3.000	37.500	9.4305	27.400	1.075	1.739	1.141
41	1.000	20.	1.000	20.000	4.6957	6.320	1.336	2.621	1.016
42	1.000	60.	1.000	60.000	7.8751	15.500	1.521	3.074	1.000

**Table 1-13 – Membrane + Bending Vessel Stress Unity Factors due to Axial Nozzle Forces**

M+B (Vessel) Table 9 Axial Force Comparison

#	d/D	D/T	t/T	d/t	lambda	Sv/So	07-10	107	297	497
1	0.333	20.	0.333	20.000	1.5637	3.260	0.805	1.117	1.377	0.925
2	0.333	20.	1.000	6.660	1.7128	9.920	0.996	0.998	1.599	1.136
3	0.333	60.	0.333	60.000	2.6224	7.790	0.885	1.022	1.088	0.915
4	0.333	60.	1.000	19.980	2.7085	28.800	1.049	0.825	1.242	0.925
5	0.333	60.	3.000	6.660	2.9667	92.300	1.077	0.759	1.238	1.078
6	0.333	100.	0.333	100.000	3.3633	11.400	0.980	1.194	1.051	0.934
7	0.333	100.	1.000	33.300	3.4300	44.800	1.165	0.909	1.227	0.888
8	0.333	100.	3.000	11.100	3.6300	129.000	1.346	0.938	1.249	1.151
9	0.333	150.	0.333	150.000	4.1056	15.300	0.941	1.342	1.093	0.956
10	0.333	150.	1.000	49.950	4.1600	59.700	1.019	1.030	1.164	0.916
11	0.333	150.	3.000	16.650	4.3233	188.000	1.109	0.976	1.178	1.085
12	0.333	250.	0.333	250.000	5.2863	21.700	0.980	1.540	1.226	1.006
13	0.333	250.	1.000	83.250	5.3284	84.500	1.082	1.187	1.306	0.965
14	0.333	250.	3.000	27.750	5.4549	300.000	1.104	1.000	1.074	1.015
15	0.500	20.	0.500	20.000	2.3479	4.420	0.833	1.344	1.707	1.143
16	0.500	20.	1.000	10.000	2.4597	10.200	1.042	1.154	2.106	1.137
17	0.500	60.	0.500	60.000	3.9375	10.900	0.887	1.529	1.603	1.097
18	0.500	60.	1.000	30.000	4.0021	29.300	1.115	1.134	1.697	0.936
19	0.500	60.	3.000	10.000	4.2603	103.000	1.046	0.959	1.208	0.994
20	0.500	100.	0.500	100.000	5.0500	17.200	0.911	1.671	1.331	1.037
21	0.500	100.	1.000	50.000	5.1000	53.000	1.066	1.083	1.176	0.773
22	0.500	100.	3.000	16.667	5.3000	163.000	1.154	1.052	1.240	0.938
23	0.500	150.	0.500	150.000	6.1645	23.000	0.964	1.914	1.493	1.066
24	0.500	150.	1.000	75.000	6.2054	70.000	0.887	1.257	1.399	0.804
25	0.500	150.	3.000	25.000	6.3687	210.000	1.012	1.254	1.416	1.000
26	0.500	250.	0.500	250.000	7.9373	32.200	1.052	2.251	1.777	1.136
27	0.500	250.	1.000	125.000	7.9689	99.800	0.935	1.452	1.708	0.841
28	0.500	250.	3.000	41.667	8.0954	359.000	0.986	1.210	1.246	0.873
29	0.750	20.	0.750	20.000	3.5218	12.000	0.600	1.094	1.418	0.676
30	0.750	20.	1.000	15.000	3.5777	16.100	0.646	1.088	1.652	0.712
31	0.750	20.	3.000	5.000	4.0249	48.300	0.675	1.088	1.345	0.886
32	0.750	60.	0.750	60.000	5.9063	15.100	1.416	2.437	2.659	1.271
33	0.750	60.	1.000	45.000	5.9386	24.700	1.294	1.987	2.391	1.097
34	0.750	60.	3.000	15.000	6.1968	92.800	1.135	1.586	1.915	1.090
35	0.750	100.	0.750	100.000	7.5750	27.000	1.359	2.360	2.492	1.061
36	0.750	100.	1.000	75.000	7.6000	42.600	1.297	1.994	2.299	0.949
37	0.750	100.	3.000	25.000	7.8000	151.000	1.218	1.688	1.969	1.000
38	0.750	150.	0.750	150.000	9.2468	37.300	1.046	2.627	2.706	1.055
39	0.750	150.	1.000	112.500	9.2672	59.800	0.968	2.185	2.565	0.929
40	0.750	150.	3.000	37.500	9.4305	216.000	0.958	1.815	1.906	0.960
41	1.000	20.	1.000	20.000	4.6957	6.820	1.526	3.423	3.857	0.799
42	1.000	60.	1.000	60.000	7.8751	12.400	2.577	5.277	6.146	1.040



**Table 1-14 – Membrane + Bending Nozzle Stress Unity Factors due to Axial Nozzle Forces**

M+B (Nozzle) Table 9 Axial Force Comparison

#	d/D	D/T	t/T	d/t	lambda	Sv/So	07-10	297	497
1	0.333	20.	0.333	20.000	1.5637	6.940	1.233	2.236	1.204
2	0.333	20.	1.000	6.660	1.7128	11.200	0.854	0.950	0.640
3	0.333	60.	0.333	60.000	2.6224	17.000	1.458	2.626	1.124
4	0.333	60.	1.000	19.980	2.7085	26.600	0.971	1.187	0.616
5	0.333	60.	3.000	6.660	2.9667	13.700	1.173	1.422	1.027
6	0.333	100.	0.333	100.000	3.3633	27.100	1.578	2.532	1.036
7	0.333	100.	1.000	33.300	3.4300	39.200	1.057	1.364	0.615
8	0.333	100.	3.000	11.100	3.6300	23.000	1.017	1.320	0.899
9	0.333	150.	0.333	150.000	4.1056	31.500	1.890	2.815	1.209
10	0.333	150.	1.000	49.950	4.1600	47.800	1.173	1.539	0.684
11	0.333	150.	3.000	16.650	4.3233	33.800	0.927	1.373	0.830
12	0.333	250.	0.333	250.000	5.2863	37.500	2.471	3.422	1.492
13	0.333	250.	1.000	83.250	5.3284	60.700	1.416	1.969	0.791
14	0.333	250.	3.000	27.750	5.4549	52.100	0.945	1.665	0.791
15	0.500	20.	0.500	20.000	2.3479	9.630	1.092	1.666	1.157
16	0.500	20.	1.000	10.000	2.4597	11.500	0.907	1.327	0.880
17	0.500	60.	0.500	60.000	3.9375	24.900	1.252	2.111	1.024
18	0.500	60.	1.000	30.000	4.0021	28.100	1.002	1.693	0.824
19	0.500	60.	3.000	10.000	4.2603	15.000	1.169	1.625	1.325
20	0.500	100.	0.500	100.000	5.0500	47.400	1.125	1.496	0.790
21	0.500	100.	1.000	50.000	5.1000	46.000	0.992	1.431	0.739
22	0.500	100.	3.000	16.667	5.3000	25.300	1.005	1.719	1.154
23	0.500	150.	0.500	150.000	6.1645	59.500	1.213	1.802	0.854
24	0.500	150.	1.000	75.000	6.2054	57.400	1.061	1.838	0.804
25	0.500	150.	3.000	25.000	6.3687	38.000	0.893	1.974	1.043
26	0.500	250.	0.500	250.000	7.9373	71.600	1.572	2.505	1.043
27	0.500	250.	1.000	125.000	7.9689	71.600	1.294	2.607	0.947
28	0.500	250.	3.000	41.667	8.0954	58.600	0.864	2.426	0.993
29	0.750	20.	0.750	20.000	3.5218	9.080	1.164	2.445	1.053
30	0.750	20.	1.000	15.000	3.5777	9.690	1.039	2.127	0.948
31	0.750	20.	3.000	5.000	4.0249	7.080	1.109	1.690	1.113
32	0.750	60.	0.750	60.000	5.9063	26.200	1.117	2.588	0.834
33	0.750	60.	1.000	45.000	5.9386	26.700	1.004	2.306	0.787
34	0.750	60.	3.000	15.000	6.1968	15.800	1.130	2.397	1.141
35	0.750	100.	0.750	100.000	7.5750	43.600	1.041	2.696	0.737
36	0.750	100.	1.000	75.000	7.6000	43.000	1.009	2.454	0.718
37	0.750	100.	3.000	25.000	7.8000	21.000	1.222	3.572	1.261
38	0.750	150.	0.750	150.000	9.2468	54.600	1.205	3.238	0.798
39	0.750	150.	1.000	112.500	9.2672	54.000	1.097	3.109	0.775
40	0.750	150.	3.000	37.500	9.4305	27.900	1.221	4.485	1.288
41	1.000	20.	1.000	20.000	4.6957	6.940	1.451	3.051	0.837
42	1.000	60.	1.000	60.000	7.8751	12.800	2.095	6.342	1.038

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**Table 1-15 – Membrane Nozzle and Vessel Stress Unity Factors due to all WRC 497 loads compared to this project (07-10) Correlation Results**

#	d/D	D/T	t/T	d/t	lambda	----- Axial -----			----- Inplane -----			----- Outplane -----					
						Smv/So	07-10	Smn/So	07-10	Smv/So	07-10	Smn/So	07-10	Smv/So	07-10	Smn/So	07-10
1	0.333	20.	0.333	20.000	1.5637	0.660	1.515	1.240	0.972	0.540	1.852	1.270	1.393	1.660	0.783	2.040	1.213
2	0.333	20.	1.000	6.660	1.7128	1.370	0.730	2.180	0.509	1.300	0.839	1.450	0.931	4.990	0.519	2.150	1.254
3	0.333	60.	0.333	60.000	2.6224	1.790	0.815	2.830	0.778	1.300	1.055	4.140	0.951	2.760	0.949	6.260	0.914
4	0.333	60.	1.000	19.980	2.7085	2.800	0.785	2.370	1.069	2.270	0.896	3.540	0.882	5.930	0.720	6.610	0.916
5	0.333	60.	3.000	6.660	2.9667	8.260	0.602	2.780	0.710	6.110	0.831	2.670	0.885	17.700	0.647	6.020	0.900
6	0.333	100.	0.333	100.000	3.3633	2.460	0.932	3.870	0.794	2.320	0.961	6.890	0.859	4.400	0.981	10.100	0.851
7	0.333	100.	1.000	33.300	3.4300	3.810	0.861	3.560	1.055	3.440	0.881	6.060	0.768	7.220	0.823	10.900	0.831
8	0.333	100.	3.000	11.100	3.6300	11.300	0.675	4.530	0.712	9.560	0.809	5.430	0.763	21.100	0.752	11.000	0.832
9	0.333	150.	0.333	150.000	4.1056	3.020	1.123	4.790	0.854	3.370	1.126	10.300	0.803	6.110	1.132	14.700	0.812
10	0.333	150.	1.000	49.950	4.1600	4.790	0.911	4.820	0.903	5.330	0.827	9.180	0.699	9.530	0.916	15.600	0.805
11	0.333	150.	3.000	16.650	4.3233	14.300	0.741	6.320	0.794	15.100	0.748	8.900	0.739	25.400	0.878	16.500	0.854
12	0.333	250.	0.333	250.000	5.2863	3.750	1.292	6.080	0.908	5.330	1.155	16.300	0.781	8.620	1.260	21.500	0.843
13	0.333	250.	1.000	83.250	5.3284	6.250	0.991	6.770	0.924	9.360	0.793	14.500	0.664	14.500	0.948	22.900	0.832
14	0.333	250.	3.000	27.750	5.4549	18.600	0.761	9.090	0.876	27.300	0.658	15.700	0.763	41.400	0.771	25.300	0.972
15	0.500	20.	0.500	20.000	2.3479	1.020	0.980	1.500	0.928	0.890	1.124	1.960	0.997	3.720	0.369	2.430	1.017
16	0.500	20.	1.000	10.000	2.4597	1.880	0.751	1.510	0.855	1.440	1.057	1.580	1.071	7.440	0.389	2.320	1.107
17	0.500	60.	0.500	60.000	3.9375	2.110	0.985	2.940	0.870	2.200	0.945	6.080	0.726	4.350	0.629	7.000	0.753
18	0.500	60.	1.000	30.000	4.0021	3.500	0.804	2.890	0.952	3.060	0.928	5.000	0.801	8.610	0.486	6.850	0.837
19	0.500	60.	3.000	10.000	4.2603	10.200	0.667	3.480	0.728	8.380	0.862	4.270	0.757	25.600	0.490	5.720	0.939
20	0.500	100.	0.500	100.000	5.0500	3.110	1.050	4.120	0.872	3.830	0.838	10.200	0.654	6.020	0.747	13.000	0.663
21	0.500	100.	1.000	50.000	5.1000	4.520	0.897	4.050	0.995	5.010	0.856	8.260	0.730	10.000	0.552	11.400	0.759
22	0.500	100.	3.000	16.667	5.3000	13.300	0.770	5.310	0.766	14.000	0.782	8.070	0.696	29.800	0.565	10.900	0.826
23	0.500	150.	0.500	150.000	6.1645	4.000	0.993	5.400	0.940	5.480	0.863	14.600	0.640	8.440	0.889	18.200	0.657
24	0.500	150.	1.000	75.000	6.2054	5.450	0.910	5.340	0.896	7.470	0.827	12.100	0.692	11.000	0.761	16.400	0.739
25	0.500	150.	3.000	25.000	6.3687	16.100	0.723	7.150	0.812	21.000	0.723	12.600	0.701	34.500	0.662	16.900	0.816
26	0.500	250.	0.500	250.000	7.9373	5.370	1.078	7.460	0.929	8.410	0.912	22.400	0.643	11.700	1.022	26.200	0.693
27	0.500	250.	1.000	125.000	7.9689	7.080	0.971	7.460	0.919	12.300	0.827	19.000	0.667	15.200	0.954	23.600	0.791
28	0.500	250.	3.000	41.667	8.0954	20.300	0.745	10.200	0.862	36.600	0.649	21.200	0.747	33.500	0.731	25.500	0.941
29	0.750	20.	0.750	20.000	3.5218	2.130	0.722	2.010	0.777	1.570	0.923	2.380	0.936	10.400	0.231	2.570	0.849
30	0.750	20.	1.000	15.000	3.5777	2.740	0.685	2.080	0.695	1.980	0.959	2.300	0.914	13.900	0.240	2.630	0.829
31	0.750	20.	3.000	5.000	4.0249	6.330	0.574	2.200	0.613	3.890	0.996	1.840	0.761	41.900	0.248	2.590	0.893
32	0.750	60.	0.750	60.000	5.9063	3.720	0.788	3.750	0.780	3.320	0.854	6.620	0.811	10.900	0.274	6.430	0.763
33	0.750	60.	1.000	45.000	5.9386	4.850	0.723	3.950	0.735	4.230	0.850	6.460	0.836	14.500	0.279	5.910	0.813
34	0.750	60.	3.000	15.000	6.1968	13.100	0.669	4.410	0.715	10.700	0.902	5.100	0.837	43.400	0.319	4.830	1.061
35	0.750	100.	0.750	100.000	7.5750	4.630	0.890	5.080	0.817	5.410	0.856	11.000	0.738	11.700	0.365	11.100	0.681
36	0.750	100.	1.000	75.000	7.6000	5.970	0.826	5.320	0.791	6.190	0.896	10.000	0.768	15.500	0.360	10.000	0.738
37	0.750	100.	3.000	25.000	7.8000	17.000	0.766	5.830	0.858	16.500	0.882	9.020	0.819	46.400	0.390	8.100	1.008
38	0.750	150.	0.750	150.000	9.2468	5.420	0.930	6.310	0.947	7.850	0.844	15.400	0.734	12.700	0.589	15.900	0.679
39	0.750	150.	1.000	112.500	9.2672	6.990	0.808	6.580	0.804	9.000	0.833	14.400	0.744	16.900	0.528	14.900	0.706
40	0.750	150.	3.000	37.500	9.4305	20.200	0.635	7.870	0.828	23.100	0.793	14.200	0.812	50.100	0.465	13.100	0.931
41	1.000	20.	1.000	20.000	4.6957	3.050	0.615	3.450	0.419	2.910	0.653	2.730	0.770	4.040	0.825	3.920	0.556
42	1.000	60.	1.000	60.000	7.8751	5.110	0.687	6.690	0.434	6.660	0.548	6.550	0.774	6.830	0.592	6.630	0.725
43	1.000	100.	1.000	100.000	10.1000	7.510	0.657	9.550	0.441	9.230	0.601	9.140	0.841	8.620	0.647	8.460	0.872

Results are given for each finite element model run in WRC 497 and for each of the three WRC 497 load directions: axial, in-plane, and out-of-plane. The column title Sv/So is the stress factor in the vessel, and Sn/So is the stress factor in the nozzle. The columns labeled 07-10 contain the unity factor, which is the project (07-10) calculated stress factor divided by the WRC 497 finite element result.

Where entries in the 07-10 columns are 1.0, the project (07-10) correlation agrees perfectly with the WRC 497 finite element results.

### General Parameter Comparisons with Various WRC Documents

The following tables give the ratios of the project (07-10) correlation stress factor over the WRC correlation method computed stress factor listed at the top of the column, i.e. the column labeled 107 gives the project (07-10) stress factor divided by the WRC 107 stress factor. Where zero is given, the stress factor is considered out of the range of either the WRC document or this project (07-10) document.

The following tables are developed based on selected parameter ranges, for example, Table 1-16 contains a variety of  $d/D$  and  $D/T$  ratios, but all rows in Table 1-16 are for  $t/T=1$ .

There are no individual finite element runs for data in these tables, they are intended to be comparisons between the various correlation methods only.

Four ranges of geometric parameters are evaluated:

- 1)  $t/T=1$       2) Low  $t/T$       3) High  $t/T$       4)  $t/T = d/D$

The development of each column is based on the surface stress calculation from each of the correlation methods. Once the surface stress is determined, it is divided by the nominal stress as described above, to find the corresponding stress factor.

Charts following each table contain selected comparison results for the previous table.

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Table 1-16 – t/T=1 Comparison of Correlation Results

#	Input					Axial				Inplane				Outplane				Torsion				Pressure					
	d/D	D/T	d/t	t/T	Lamb	107	297	497	110996	107	297	497	110996	107	297	497	110996	107	297	497	110996	107	297	497	368		
1	0.01	20.00	0.20	1.00	0.27	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	
2	0.01	50.00	0.50	1.00	0.21	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	
3	0.01	100.00	1.00	1.00	0.20	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	
4	0.01	150.00	1.50	1.00	0.20	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	
5	0.01	200.00	2.00	1.00	0.21	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	
6	0.01	300.00	3.00	1.00	0.23	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	
7	0.01	350.00	3.50	1.00	0.24	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	
8	0.01	400.00	4.00	1.00	0.25	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	
9	0.01	800.00	8.00	1.00	0.32	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	
10	0.01	1200.00	12.00	1.00	0.38	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	
11	0.01	1750.00	17.50	1.00	0.44	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	
12	0.05	20.00	1.00	1.00	0.45	1.0789	0.0000	0.0000	2.0854	0.0000	0.0000	0.0000	1.9973	0.0000	0.0000	0.0000	4.6189	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	
13	0.05	50.00	2.50	1.00	0.49	1.0297	0.0000	0.0000	1.3130	0.0000	0.0000	0.0000	1.3721	0.0000	0.0000	0.0000	2.7317	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	
14	0.05	100.00	5.00	1.00	0.60	1.1320	0.0000	0.0000	1.0015	0.0000	0.0000	0.0000	1.1535	0.0000	0.0000	0.0000	1.9186	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	
15	0.05	150.00	7.50	1.00	0.69	1.2503	0.0000	0.0000	1.2200	0.0000	0.0000	0.0000	1.1045	0.0000	0.0000	0.0000	1.6516	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	
16	0.05	200.00	10.00	1.00	0.78	1.2632	0.0000	0.0000	1.1132	0.0000	0.0000	0.0000	1.0931	0.0000	0.0000	0.0000	1.5217	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	
17	0.05	300.00	15.00	1.00	0.92	1.2824	0.0000	0.0000	1.0216	0.0000	0.0000	0.0000	1.4830	0.0000	0.0000	0.0000	1.3952	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	
18	0.05	350.00	17.50	1.00	0.99	1.3029	0.0000	0.0000	0.9987	0.0000	0.0000	0.0000	1.4624	0.0000	0.0000	0.0000	1.3598	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	
19	0.05	400.00	20.00	1.00	1.05	1.3301	1.0334	0.0000	0.9996	0.8545	0.0000	0.0000	1.4448	1.0910	0.0000	0.0000	1.3335	1.3335	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
20	0.05	800.00	40.00	1.00	1.45	0.0000	0.9824	0.0000	0.0000	0.9467	0.0000	0.0000	0.0000	1.0265	0.0000	0.0000	0.0000	1.3083	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	
21	0.05	1200.00	60.00	1.00	1.76	0.0000	0.9530	0.0000	0.0000	0.9078	0.0000	0.0000	0.0000	0.9785	0.0000	0.0000	0.0000	1.3923	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	
22	0.05	1750.00	87.50	1.00	2.12	0.0000	0.9884	0.0000	0.0000	0.8498	0.0000	0.0000	0.0000	0.9186	0.0000	0.0000	0.0000	1.6097	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	
23	0.10	20.00	2.00	1.00	0.67	0.9479	0.0000	0.0000	1.4212	0.0000	0.0000	0.0000	1.4985	0.0000	0.0000	0.0000	3.1179	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	
24	0.10	50.00	5.00	1.00	0.85	1.0063	0.0000	0.0000	0.9702	0.0000	0.0000	0.0000	1.1289	0.0000	0.0000	0.0000	1.9186	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	
25	0.10	100.00	10.00	1.00	1.10	1.2423	0.0000	0.0000	0.8521	0.0000	0.0000	0.0000	1.0469	0.0000	0.0000	0.0000	1.5217	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	
26	0.10	150.00	15.00	1.00	1.31	1.2898	0.0000	0.0000	0.9199	0.0000	0.0000	0.0000	1.0659	0.0000	0.0000	0.0000	1.3952	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	
27	0.10	200.00	20.00	1.00	1.48	1.3633	1.0199	0.0000	0.9138	0.8165	0.0000	0.0000	1.1168	0.8201	0.0000	0.0000	1.3587	1.3587	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
28	0.10	300.00	30.00	1.00	1.79	1.4775	1.0084	0.0000	0.9984	0.8530	0.0000	0.0000	1.3443	0.9787	0.0000	0.0000	1.4964	1.4964	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
29	0.10	350.00	35.00	1.00	1.92	1.5181	1.0137	0.0000	1.0410	0.8689	0.0000	0.0000	1.3616	0.9854	0.0000	0.0000	1.5661	1.5661	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
30	0.10	400.00	40.00	1.00	2.05	1.5693	1.0191	0.0000	1.0922	0.8850	0.0000	0.0000	1.3788	0.9886	0.0000	0.0000	1.6281	1.6281	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
31	0.10	800.00	80.00	1.00	2.86	0.0000	0.9822	0.0000	0.0000	0.8367	0.0000	0.0000	0.0000	0.9304	0.0000	0.0000	0.0000	2.0097	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
32	0.10	1200.00	120.00	1.00	3.49	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
33	0.10	1750.00	175.00	1.00	4.21	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
34	0.20	20.00	4.00	1.00	1.12	0.9320	0.0000	0.0000	1.0048	0.0000	0.0000	0.0000	1.2094	0.0000	0.0000	0.0000	2.1226	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
35	0.20	50.00	10.00	1.00	1.56	1.1776	0.0000	0.0000	0.8367	0.0000	0.0000	0.0000	1.0617	0.0000	0.0000	0.0000	1.5217	0.0000	0.1703	1.5450	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
36	0.20	100.00	20.00	1.00	2.10	1.5697	1.0368	0.0000	1.0718	0.9444	0.0000	0.0000	1.2984	0.8944	0.0000	0.0000	1.5720	1.5720	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
37	0.20	150.00	30.00	1.00	2.53	1.3479	0.9484	0.0000	1.0340	0.8761	0.0000	0.0000	1.2549	0.8350	0.0000	0.0000	1.7966	1.7966	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
38	0.20	200.00	40.00	1.00	2.90	0.0000	0.9747	0.0000	0.0000	0.8909	0.0000	0.0000	0.0000	0.8578	0.0000	0.0000	0.0000	1.9307	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
39	0.20	300.00	60.00	1.00	3.52	0.0000	0.9410	0.0000	0.0000	0.8815	0.0000	0.0000	0.0000	0.9195	0.0000	0.0000	0.0000	2.3030	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
40	0.20	350.00	70.00	1.00	3.80	0.0000	0.9488	0.0000	0.0000	0.8992	0.0000	0.0000	0.0000	0.9318	0.0000	0.0000	0.0000	2.4643	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
41	0.20	400.00	80.00	1.00	4.05	0.0000	0.9572	0.0000	0.0000	0.9146	0.0000	0.00															

Chart 1-1 – WRC 107 Stress Factor Comparisons to 07-10 Table 1-16 for t/T=1 Geometry Ranges.

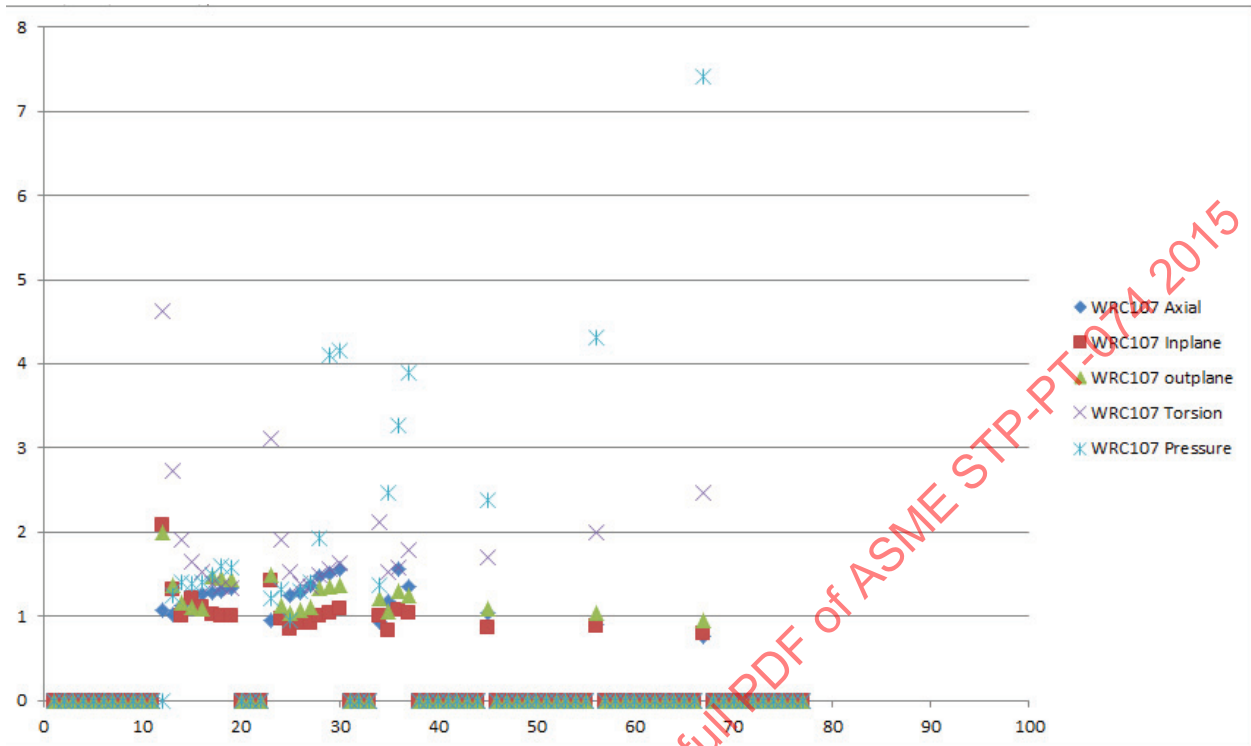


Chart 1-2 – WRC 297 Stress Factor Comparison to 07-10 Table 1-16 for t/T=1 Geometry Ranges

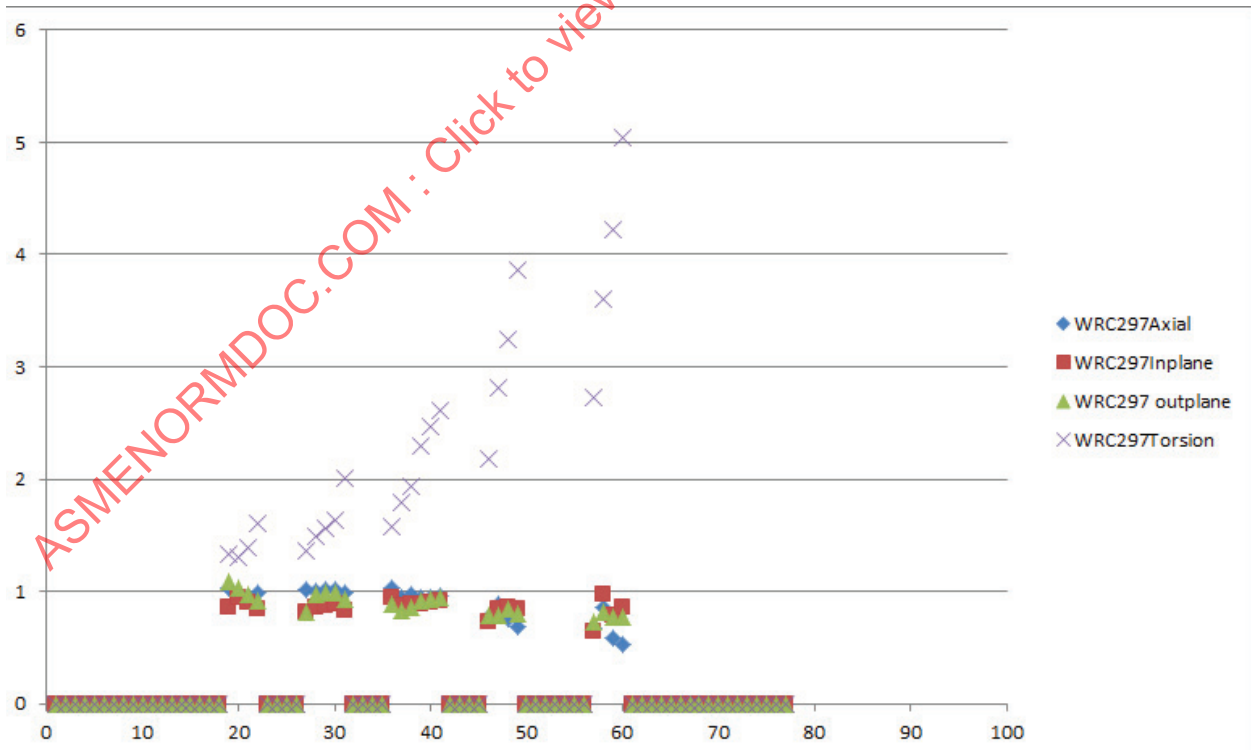




Chart 1-3 – WRC 497 Stress Factor Comparison to 07-10 Table 1-16 for t/T=1 Geometry Range

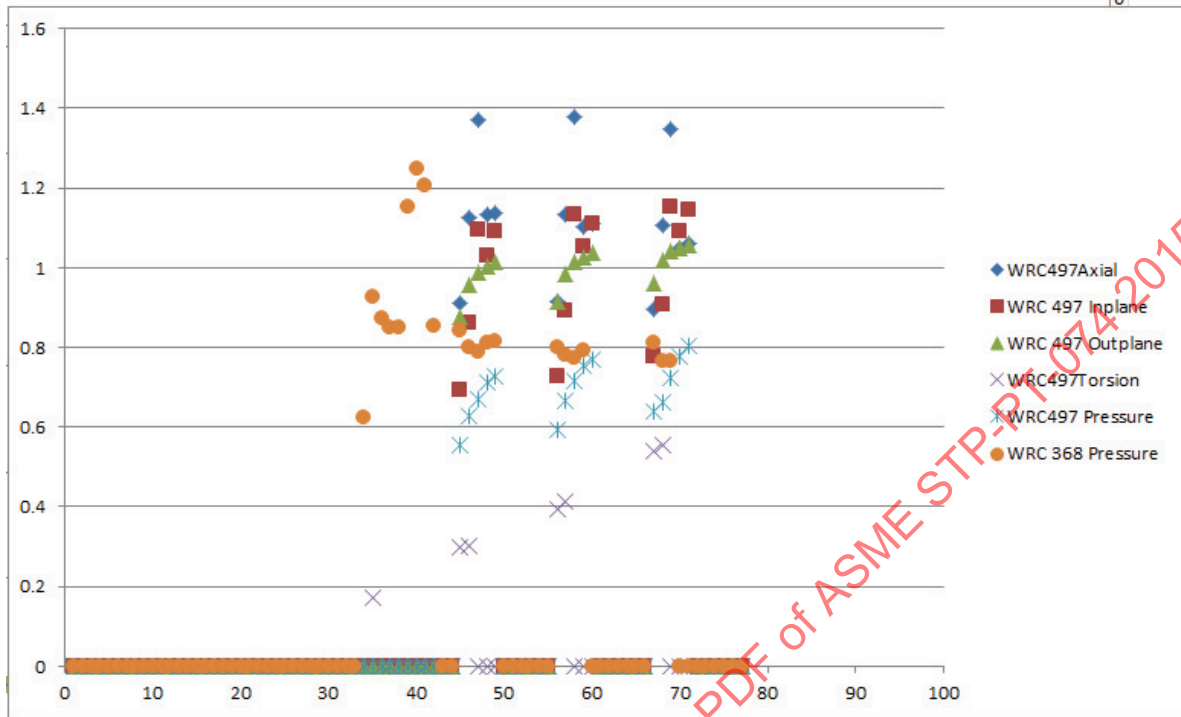


Chart 1-4 – Combination of WRC 497 and WRC 107 Stress Factor Ratios with 07-10 from Table 1-16 for the case where t/T=1. The ratio is 07-10 Stress Factor / WRC Stress factor.

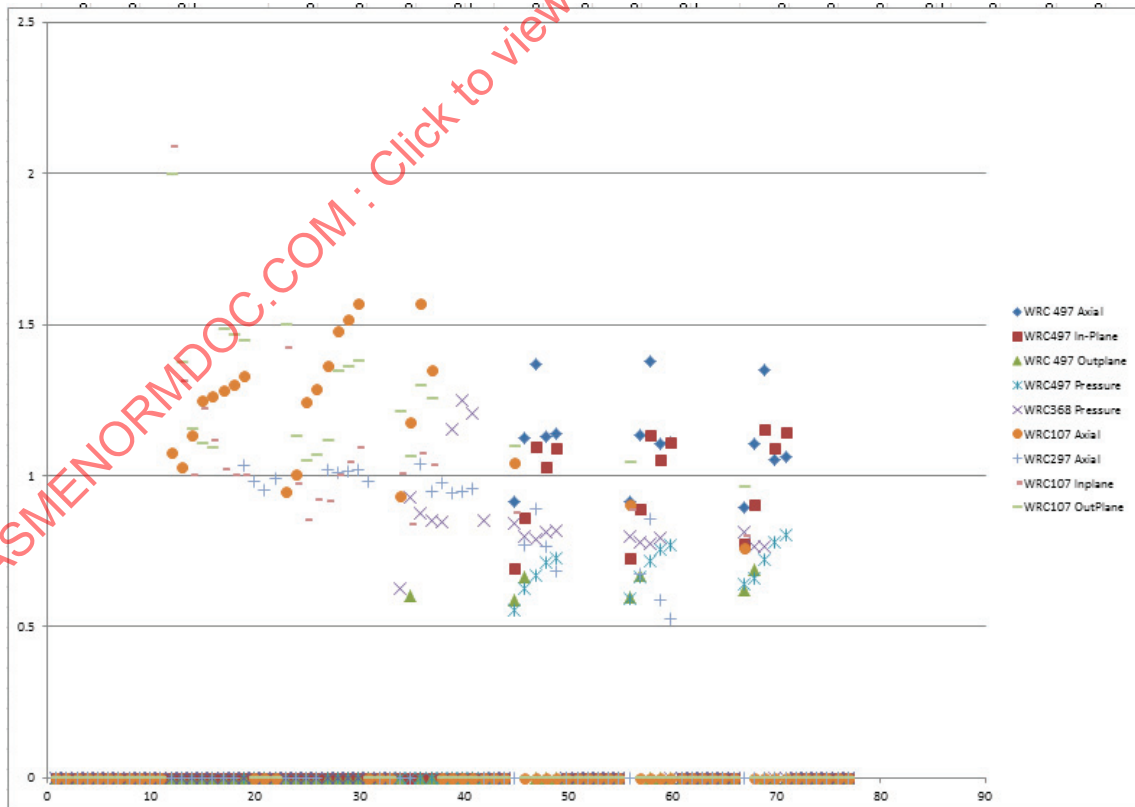






Chart 1-5 – WRC 107 comparisons with 07-10 for low t/T branch connections in Table 1-17.

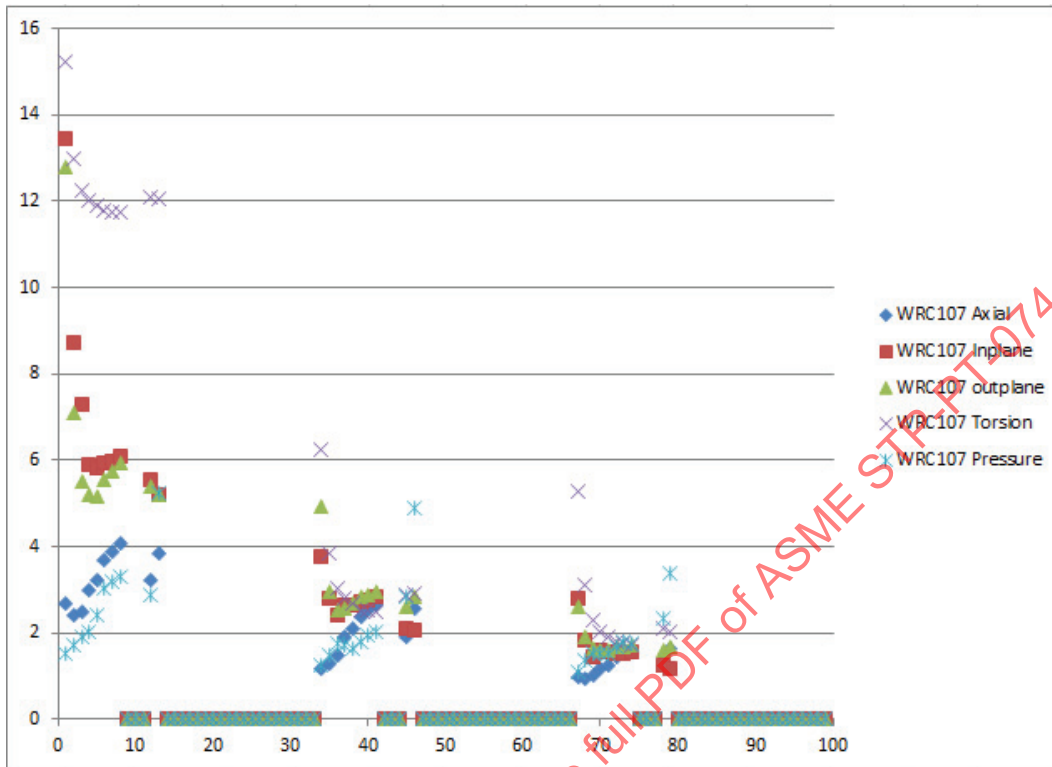


Chart 1-6 – WRC 297 Comparisons in low t/T range for connections in Table 1-17.

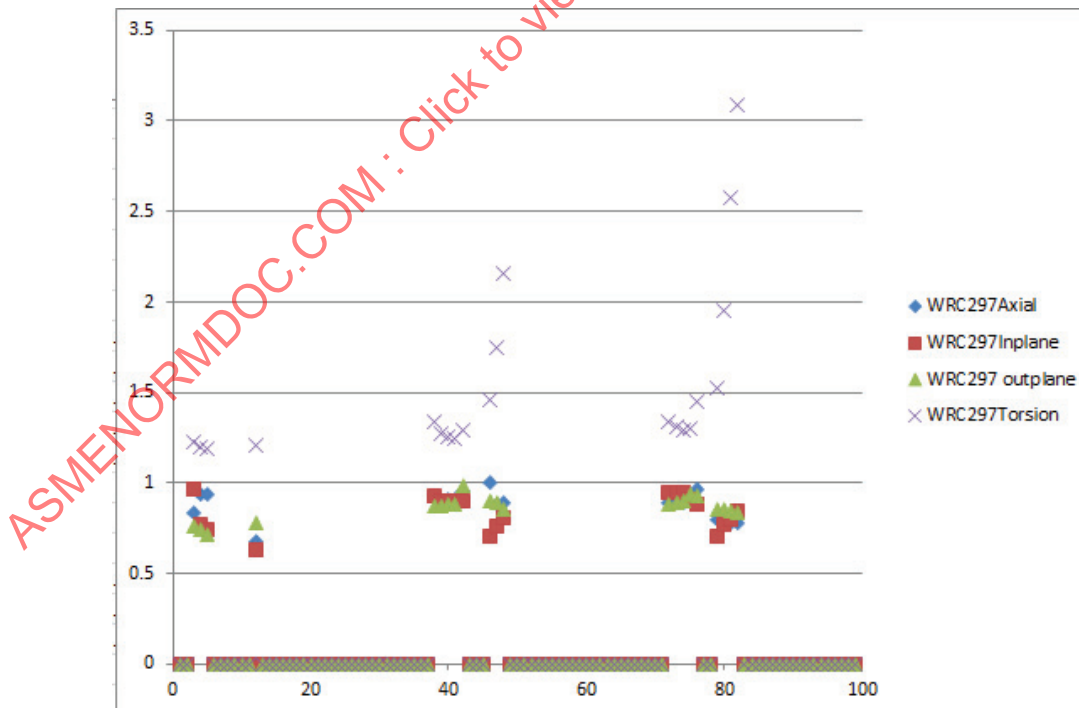
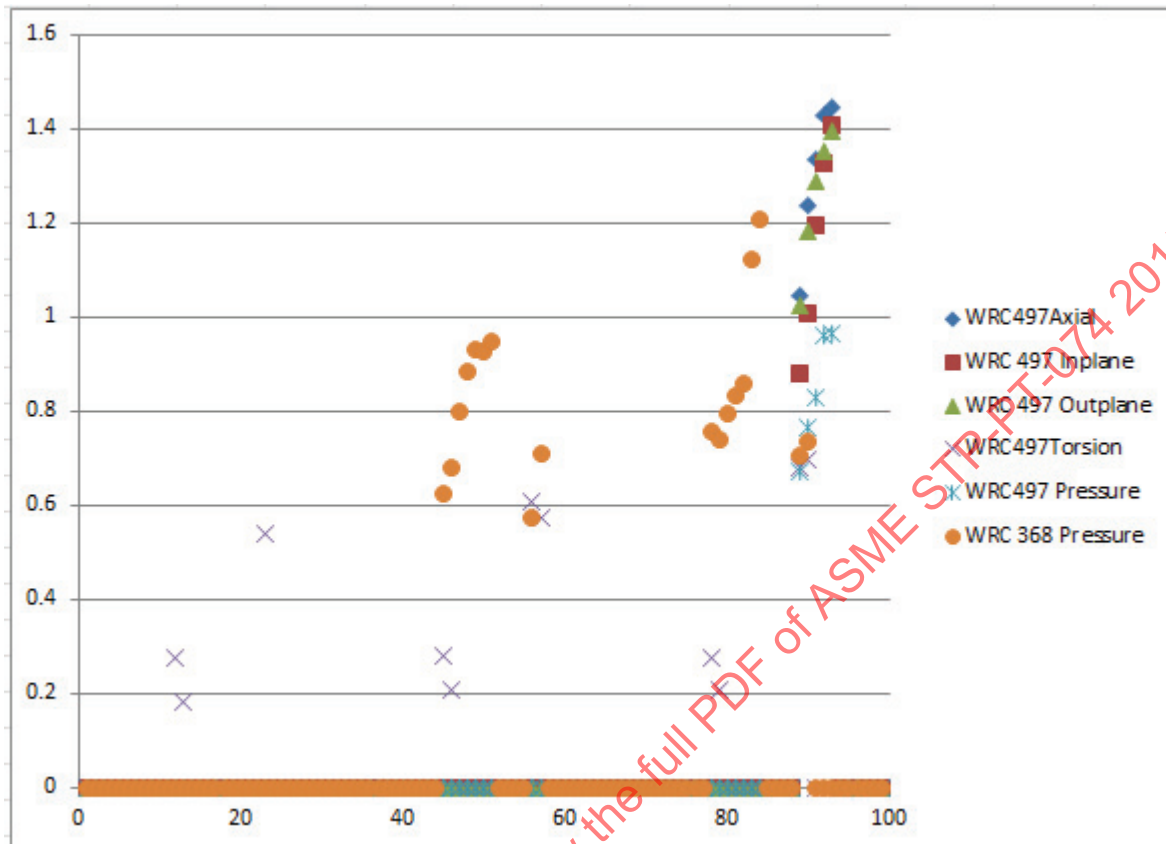


Chart 1-7 – WRC 497 Comparisons in low t/T range for connections in Table 1-17.





STP-PT-074: Local Stress in Nozzles, Shells and Formed Heads from External Heads

Table 1-18 – High t/T Model Comparisons

#	Input				Lamb	Axial				Inplane				Outplane				Torsion				Pressure			
	d/D	D/T	d/t	t/T		107	297	497	110996	107	297	497	110996	107	297	497	110996	107	297	497	110996	107	297	497	368
1	0.05	20.00	0.91	1.10	0.47	1.1075	0.0000	0.0000	0.0000	1.9030	0.0000	0.0000	0.0000	1.8134	0.0000	0.0000	0.0000	4.3995	0.0000	0.0000	0.0000	1.1103	0.0000	0.0000	0.0000
2	0.05	50.00	2.27	1.10	0.51	1.0602	0.0000	0.0000	0.0000	1.3178	0.0000	0.0000	0.0000	1.2859	0.0000	0.0000	0.0000	2.6261	0.0000	0.0000	0.0000	1.2981	0.0000	0.0000	0.0000
3	0.05	100.00	4.55	1.10	0.61	1.1686	0.0000	0.0000	0.0000	0.9960	0.0000	0.0000	0.0000	1.1630	0.0000	0.0000	0.0000	1.8183	0.0000	0.0000	0.0000	1.3743	0.0000	0.0000	0.0000
4	0.05	150.00	6.82	1.10	0.70	1.2950	0.0000	0.0000	0.0000	1.2385	0.0000	0.0000	0.0000	1.1430	0.0000	0.0000	0.0000	1.5494	0.0000	0.0000	0.0000	1.3442	0.0000	0.0000	0.0000
5	0.05	200.00	9.09	1.10	0.78	1.3055	0.0000	0.0000	0.0000	1.1281	0.0000	0.0000	0.0000	1.1471	0.0000	0.0000	0.0000	1.4185	0.0000	0.0000	0.0000	1.3524	0.0000	0.0000	0.0000
6	0.05	300.00	13.64	1.10	0.93	1.3201	0.0000	0.0000	0.0000	1.0323	0.0000	0.0000	0.0000	1.3334	0.0000	0.0000	0.0000	1.2911	0.0000	0.0000	0.0000	1.3932	0.0000	0.0000	0.0000
7	0.05	350.00	15.91	1.10	0.99	1.3407	0.0000	0.0000	0.0000	1.0085	0.0000	0.0000	0.0000	1.3141	0.0000	0.0000	0.0000	1.2774	0.0000	0.0000	0.0000	1.3907	0.0000	0.0000	0.0000
8	0.05	400.00	18.18	1.10	1.06	1.3682	0.0000	0.0000	0.0000	0.9969	0.0000	0.0000	0.0000	1.2996	0.0000	0.0000	0.0000	1.2961	0.0000	0.0000	0.0000	1.3889	0.0000	0.0000	0.0000
9	0.05	800.00	36.36	1.10	1.45	0.0000	1.0083	0.0000	0.0000	0.0000	0.9058	0.0000	0.0000	0.0000	0.9339	0.0000	0.0000	0.0000	1.3958	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
10	0.05	1200.00	54.55	1.10	1.76	0.0000	1.0103	0.0000	0.0000	0.0000	0.9158	0.0000	0.0000	0.0000	0.9126	0.0000	0.0000	0.0000	1.3668	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
11	0.05	1750.00	79.55	1.10	2.12	0.0000	1.0584	0.0000	0.0000	0.0000	0.9038	0.0000	0.0000	0.0000	0.8912	0.0000	0.0000	0.0000	1.8371	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
12	0.33	20.00	6.00	1.10	1.72	1.0270	0.0000	0.0000	0.0000	0.8707	0.0000	0.0000	0.0000	1.0495	0.0000	0.0000	0.0000	1.6799	0.0000	0.0000	0.0000	1.9394	0.0000	0.0000	0.9195
13	0.33	50.00	15.00	1.10	2.49	1.2938	0.0000	0.0000	0.0000	0.8506	0.0000	0.0000	0.7138	1.0942	0.0000	0.0000	0.6666	1.3492	0.0000	0.2735	1.0160	2.7954	0.0000	0.0000	0.8410
14	0.33	100.00	30.00	1.10	3.41	0.0000	0.9760	0.0000	0.0000	0.0000	0.8480	0.0000	0.0000	0.0000	0.8310	0.0000	0.0000	0.0000	2.5898	0.0000	0.0000	0.0000	0.0000	0.0000	0.8105
15	0.33	150.00	45.00	1.10	4.13	0.0000	0.8918	0.0000	0.0000	0.0000	0.8067	0.0000	0.0000	0.0000	0.9029	0.0000	0.0000	0.0000	2.4939	0.0000	0.0000	0.0000	0.0000	0.0000	0.8712
16	0.33	200.00	60.00	1.10	4.74	0.0000	1.0215	0.0000	0.0000	0.0000	0.8805	0.0000	0.0000	0.0000	0.9616	0.0000	0.0000	0.0000	2.9335	0.0000	0.0000	0.0000	0.0000	0.0000	0.8498
17	0.33	300.00	90.00	1.10	5.78	0.0000	0.8353	0.0000	0.0000	0.0000	0.9016	0.0000	0.0000	0.0000	0.9995	0.0000	0.0000	0.0000	4.4211	0.0000	0.0000	0.0000	0.0000	0.0000	0.9166
18	0.33	350.00	105.00	1.10	6.23	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.9522
19	0.33	400.00	120.00	1.10	6.66	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
20	0.33	800.00	240.00	1.10	9.37	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
21	0.33	1200.00	360.00	1.10	11.46	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
22	0.33	1750.00	525.00	1.10	13.83	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
23	0.70	20.00	12.73	1.10	3.38	0.0000	0.0000	0.8825	0.0000	0.0000	0.0000	0.7725	0.7269	0.0000	0.0000	0.9116	0.6302	0.0000	0.0000	0.7833	0.7157	0.0000	0.0000	0.5790	0.7786
24	0.70	50.00	31.82	1.10	5.11	0.0000	0.0000	1.0977	0.0000	0.0000	0.0000	0.8846	0.7342	0.0000	0.0000	1.1156	0.8046	0.0000	0.0000	0.8175	0.6884	0.0000	0.0000	0.6216	0.7563
25	0.70	100.00	63.64	1.10	7.11	0.0000	0.0000	1.3399	0.0000	0.0000	0.0000	1.1264	0.0000	0.0000	0.0000	1.2706	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.7062	0.0000
26	0.70	150.00	95.45	1.10	8.66	0.0000	0.0000	1.1922	0.0000	0.0000	0.0000	1.0736	0.0000	0.0000	0.0000	1.3622	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.8017	0.0000
27	0.70	200.00	127.27	1.10	9.98	0.0000	0.0000	1.3034	0.0000	0.0000	0.0000	1.1427	0.0000	0.0000	0.0000	1.4286	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.8225	0.0000
28	0.70	300.00	190.91	1.10	12.19	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
29	0.70	350.00	222.73	1.10	13.15	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
30	0.70	400.00	254.55	1.10	14.06	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
31	0.70	800.00	509.09	1.10	19.84	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
32	0.70	1200.00	763.64	1.10	24.28	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
33	0.70	1750.00	1113.64	1.10	29.31	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
34	0.05	20.00	0.50	2.00	0.67	1.3228	0.0000	0.0000	0.0000	1.4780	0.0000	0.0000	0.0000	1.1459	0.0000	0.0000	0.0000	3.1179	0.0000	0.0000	0.0000	0.9703	0.0000	0.0000	0.0000
35	0.05	50.00	1.25	2.00	0.64	1.2325	0.0000	0.0000	0.0000	1.3780	0.0000	0.0000	0.0000	1.4454	0.0000	0.0000	0.0000	2.0532	0.0000	0.0000	0.0000	0.9970	0.0000	0.0000	0.0000
36	0.05	100.00	2.50	2.00	0.70	1.3484	0.0000	0.0000	0.0000	1.0756	0.0000	0.0000	0.0000	1.3729	0.0000	0.0000	0.0000	1.3658	0.0000	0.0000	0.0000	1.0217	0.0000	0.0000	0.0000
37	0.05	150.00	3.75	2.00	0.78	1.5064	0.0000	0.0000	0.0000	1.3688	0.0000	0.0000	0.0000	1.3261	0.0000	0.0000	0.0000	1.3669	0.0000	0.0000	0.0000	1.1176	0.0000	0.0000	0.0000
38	0.05	200.00	5.00	2.00	0.85	1.5077	0.0000	0.0000	0.0000	1.2280	0.0000	0.0000	0.0000	1.3062	0.0000	0.0000	0.0000	1.2898	0.0000	0.0000	0.0000	1.1045	0.0000	0.0000	0.0000
39	0.05	300.00	7.50	2.00	0.98	1.4922	0.0000	0.0000	0.0000	1.0923	0.0000	0.0000	0.0000	1.4582	0.0000	0.0000	0.0000	1.1885	0.0000	0.0000	0.0000	1.1164	0.0000	0.0000	0.0000
40	0.05	350.00	8.75	2.00	1.04	1.5125	0.0000	0.0000	0.0000	1.0588	0.0000	0.0000	0.0000	1.4430	0.0000	0.0000	0.0000	1.2339	0.0000	0.0000	0.0000	1.1171	0.0000	0.0000	0.0000
41	0.05	400.00	10.00	2.00	1.10	1.5416	0.0000	0.0000	0.0000	1.0401	0.0000	0.0000	0.0000	1.4303	0.0000	0.0000	0.0000	1.2503	0.0000	0.0000	0.0000	1.0738	0.0000	0.0000	0.0000
42	0.05	800.00	20.00	2.00	1.48	0.0000	1.0372	0.0000	0.0000	0.0000	0.9344	0.0000	0.0000	0.0000	0.9628	0.0000	0.0000	0.0000	1.3708	0.0000	0.0000	0.0000	0.0000	0.6863	0.0000
43	0.05	1200.00	30.00	2.00	1.79	0.0000	1.0976	0.0000	0.0000	0.0000	0.8980	0.0000	0.0000	0.0											

High t/T models

Chart 1-8 – WRC 107 Comparisons with Results from Table 1-18 High t/T Models

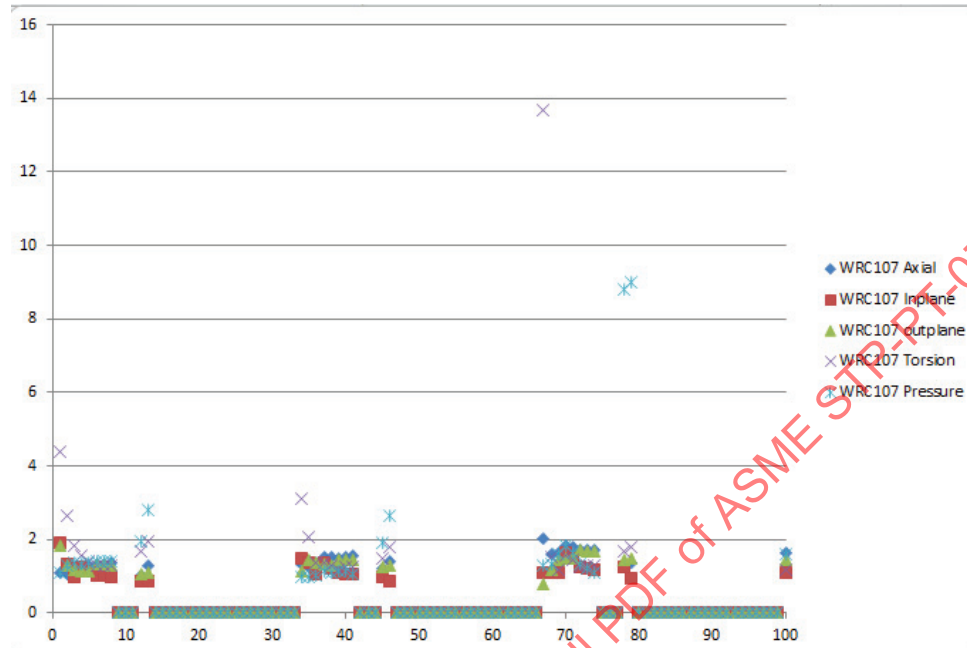
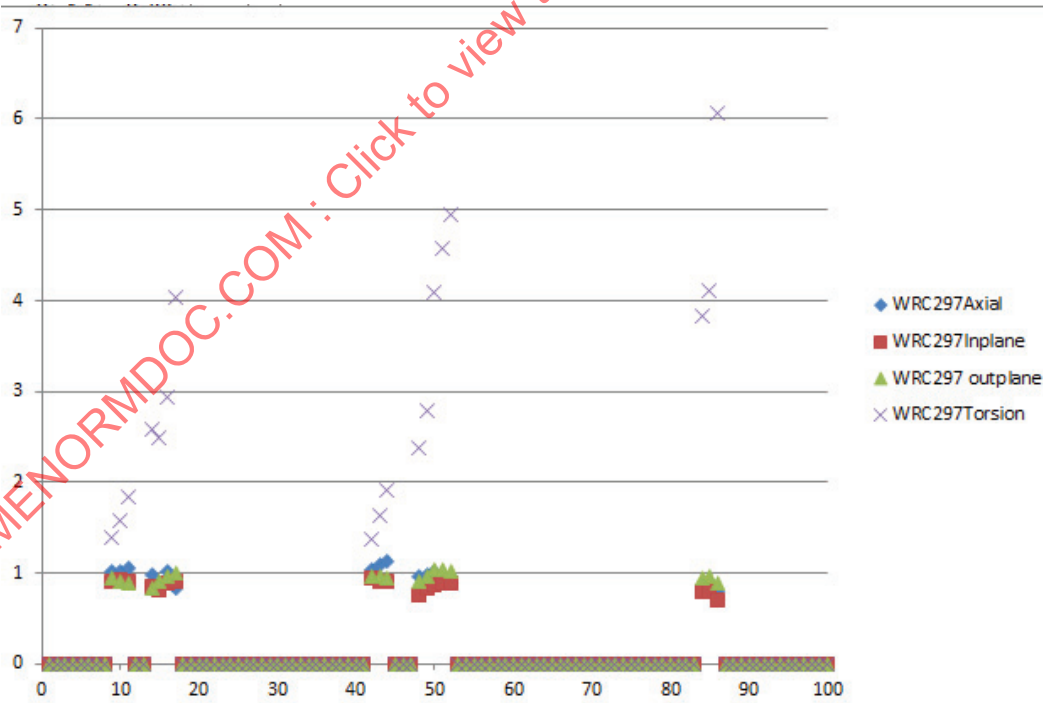
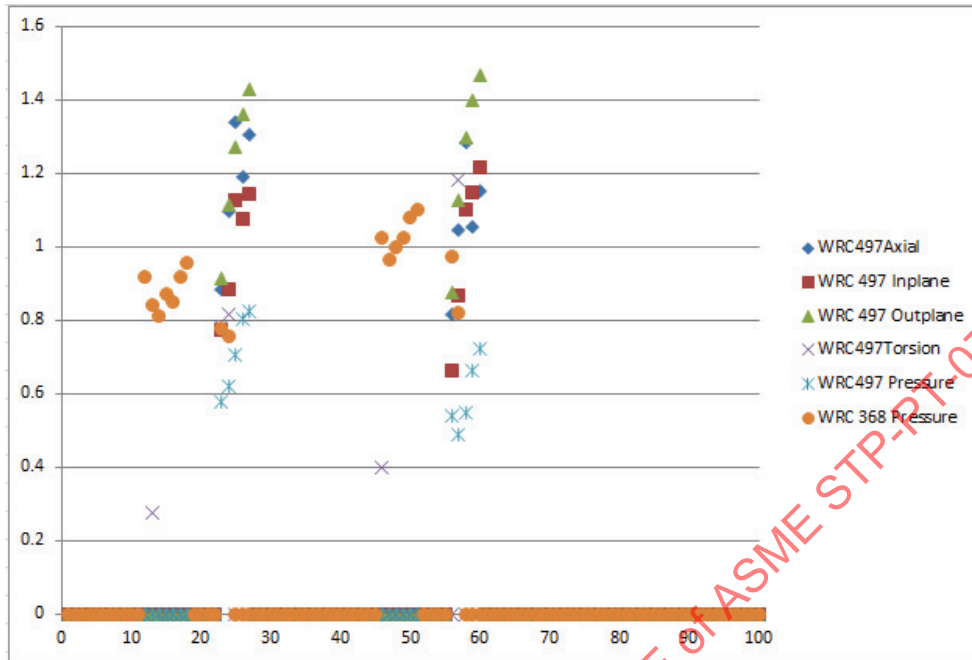


Chart 1-9 – WRC 297 Comparisons with Results from Table 1-18 High t/T Models



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Chart 1-10 – WRC 497 Comparisons with Results from Table 1-18 High t/T Models





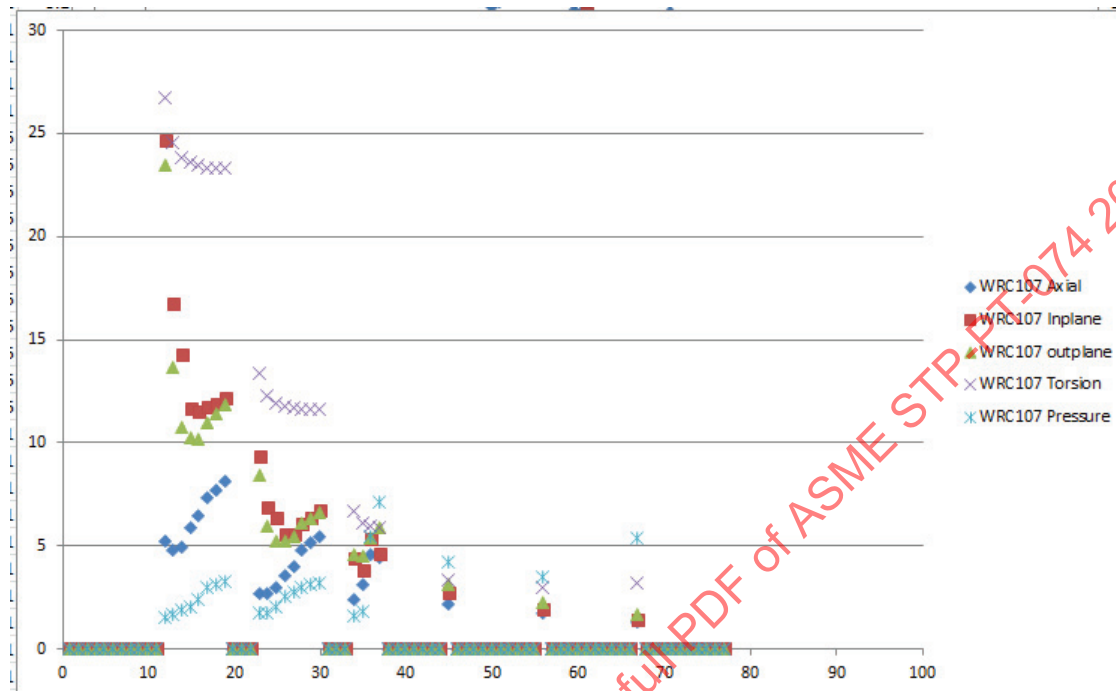
STP-PT-074: Local Stress in Nozzles, Shells and Formed Heads from External Heads

Table 1-19 – t/T = d/D Model Comparisons

#	Input					Axial				Inplane				Outplane				Torsion				Pressure			
	d/D	D/T	d/t	t/T	Lamb	107	297	497	107	297	497	110996	107	297	497	110996	107	297	497	110996	107	297	497	368	
1	0.01	20.00	20.00	0.01	0.05	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
2	0.01	50.00	50.00	0.01	0.07	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
3	0.01	100.00	100.00	0.01	0.10	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
4	0.01	150.00	150.00	0.01	0.12	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
5	0.01	200.00	200.00	0.01	0.14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
6	0.01	300.00	300.00	0.01	0.17	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
7	0.01	350.00	350.00	0.01	0.19	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
8	0.01	400.00	400.00	0.01	0.20	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
9	0.01	800.00	800.00	0.01	0.28	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
10	0.01	1200.00	1200.00	0.01	0.35	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
11	0.01	1750.00	1750.00	0.01	0.42	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
12	0.05	20.00	20.00	0.05	0.23	5.2361	0.0000	0.0000	24.6006	0.0000	0.0000	0.0000	23.4446	0.0000	0.0000	0.0000	26.7022	0.0000	0.0000	0.0000	0.0000	1.5243	0.0000	0.0000	0.0000
13	0.05	50.00	50.00	0.05	0.36	4.7835	0.0000	0.0000	16.7339	0.0000	0.0000	0.0000	13.6426	0.0000	0.0000	0.0000	24.5095	0.0000	0.0000	0.0000	0.0000	1.7158	0.0000	0.0000	0.0000
14	0.05	100.00	100.00	0.05	0.50	4.9643	0.3099	0.0000	14.2692	0.4447	0.0000	0.0000	10.7869	0.3750	0.0000	0.0000	33.8095	1.1896	0.0000	0.0000	0.0000	1.8886	0.3010	0.0000	0.0000
15	0.05	150.00	150.00	0.05	0.62	5.9264	0.0000	0.0000	11.6407	0.0000	0.0000	0.0000	10.2629	0.0000	0.0000	0.0000	23.5710	0.0000	0.0000	0.0000	0.0000	2.0207	0.0000	0.0000	0.0000
16	0.05	200.00	200.00	0.05	0.71	6.4513	0.0000	0.0000	11.5166	0.0000	0.0000	0.0000	10.2146	0.0000	0.0000	0.0000	23.4467	0.0000	0.0000	0.0000	0.0000	2.4161	0.0000	0.0000	0.0000
17	0.05	300.00	300.00	0.05	0.87	7.3479	0.0000	0.0000	11.7374	0.0000	0.0000	0.0000	11.0103	0.0000	0.0000	0.0000	23.3236	0.0000	0.0000	0.0000	0.0000	3.0051	0.0000	0.0000	0.0000
18	0.05	350.00	350.00	0.05	0.94	7.7379	0.0000	0.0000	11.8832	0.0000	0.0000	0.0000	11.4422	0.0000	0.0000	0.0000	23.3100	0.0000	0.0000	0.0000	0.0000	3.1673	0.0000	0.0000	0.0000
19	0.05	400.00	400.00	0.05	1.00	8.1482	0.0000	0.0000	12.1038	0.0000	0.0000	0.0000	11.8177	0.0000	0.0000	0.0000	23.2829	0.0000	0.0000	0.0000	0.0000	3.3031	0.0000	0.0000	0.0000
20	0.05	800.00	800.00	0.05	1.42	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
21	0.05	1200.00	1200.00	0.05	1.73	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
22	0.05	1750.00	1750.00	0.05	2.09	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
23	0.10	20.00	20.00	0.10	0.47	2.6931	0.0000	0.0000	9.2794	0.0000	0.0000	0.0000	8.4463	0.0000	0.0000	0.0000	13.3422	0.0000	0.0000	0.0000	0.0000	1.7730	0.0000	0.0000	0.0000
24	0.10	50.00	50.00	0.10	0.72	2.6772	1.0014	0.0000	6.8154	0.8527	0.0000	0.0000	5.9482	0.8490	0.0000	0.0000	12.2511	1.2250	0.0000	0.0000	0.0000	1.7707	1.0987	0.0000	0.0000
25	0.10	100.00	100.00	0.10	1.01	3.0263	0.8994	0.0000	6.3396	0.7676	0.0000	0.0000	5.2524	0.7863	0.0000	0.0000	11.8977	1.1896	0.0000	0.0000	0.0000	2.0210	0.8275	0.0000	0.0000
26	0.10	150.00	150.00	0.10	1.23	3.5782	0.0000	0.0000	5.5098	0.0000	0.0000	0.0000	5.2630	0.0000	0.0000	0.0000	11.7820	0.0000	0.0000	0.0000	0.0000	2.5290	0.0000	0.0000	0.0000
27	0.10	200.00	200.00	0.10	1.42	4.0318	0.0000	0.0000	5.5421	0.0000	0.0000	0.0000	5.4981	0.0000	0.0000	0.0000	11.7233	0.0000	0.0000	0.0000	0.0000	2.7613	0.0000	0.0000	0.0000
28	0.10	300.00	300.00	0.10	1.74	4.8180	0.0000	0.0000	6.0367	0.0000	0.0000	0.0000	6.1003	0.0000	0.0000	0.0000	11.6652	0.0000	0.0000	0.0000	0.0000	3.0234	0.0000	0.0000	0.0000
29	0.10	350.00	350.00	0.10	1.88	5.1443	0.0000	0.0000	6.3171	0.0000	0.0000	0.0000	6.3694	0.0000	0.0000	0.0000	11.6516	0.0000	0.0000	0.0000	0.0000	3.1194	0.0000	0.0000	0.0000
30	0.10	400.00	400.00	0.10	2.00	5.4982	0.0000	0.0000	6.6700	0.0000	0.0000	0.0000	6.6354	0.0000	0.0000	0.0000	11.6347	0.0000	0.0000	0.0000	0.0000	3.2202	0.0000	0.0000	0.0000
31	0.10	800.00	800.00	0.10	2.83	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
32	0.10	1200.00	1200.00	0.10	3.47	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
33	0.10	1750.00	1750.00	0.10	4.19	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
34	0.20	20.00	20.00	0.20	0.94	2.4359	0.0000	0.0000	4.3633	0.0000	0.0000	1.1951	4.6149	0.0000	0.0000	1.3457	6.6689	0.0000	0.2678	5.4625	1.6051	0.0000	0.0000	0.5044	0.0000
35	0.20	50.00	50.00	0.20	1.44	3.1130	0.8592	0.0000	3.7880	0.6523	0.0000	1.1755	4.4895	0.8164	0.0000	1.4746	6.1256	1.2250	0.1703	3.4548	1.8456	1.2126	0.0000	0.4607	0.0000
36	0.20	100.00	100.00	0.20	2.02	4.6187	0.9443	0.0000	5.3289	0.8116	0.0000	0.0000	5.4194	0.7749	0.0000	0.0000	5.9488	1.1896	0.0000	0.0000	0.0000	5.4813	1.8084	0.0000	0.6104
37	0.20	150.00	150.00	0.20	2.47	4.4306	0.0000	0.0000	4.5630	0.0000	0.0000	0.0000	5.8770	0.0000	0.0000	0.0000	5.8940	0.0000	0.0000	0.0000	0.0000	7.1061	1.8084	0.0000	0.6795
38	0.20	200.00	200.00	0.20	2.84	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.7208	0.0000
39	0.20	300.00	300.00	0.20	3.48	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.8102	0.0000
40	0.20	350.00	350.00	0.20	3.75	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.8274	0.0000
41	0.20	400.00	400.00	0.20	4.01	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.8403	0.0000
42	0.20	800.00	800.00	0.20	5.66	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.9753	0.0000
43	0.20	1200.00	1200.00	0.20	6.93	0.0000	0.0000	0.0000	0.0000																

$$t/T = d/D$$

Chart 1-11 – WRC 107 Comparisons with Models in Table 1-19



Note: As  $d/D$  gets smaller,  $t/T$  gets smaller and the high stress moves into the nozzle neck. Since WRC 107 doesn't compute the stress in the nozzle neck in this case, the project (07-10)/WRC107 stress factor ratios get much larger than 1.0.

Chart 1-12 – WRC 297 Comparisons with Models in Table 1-19

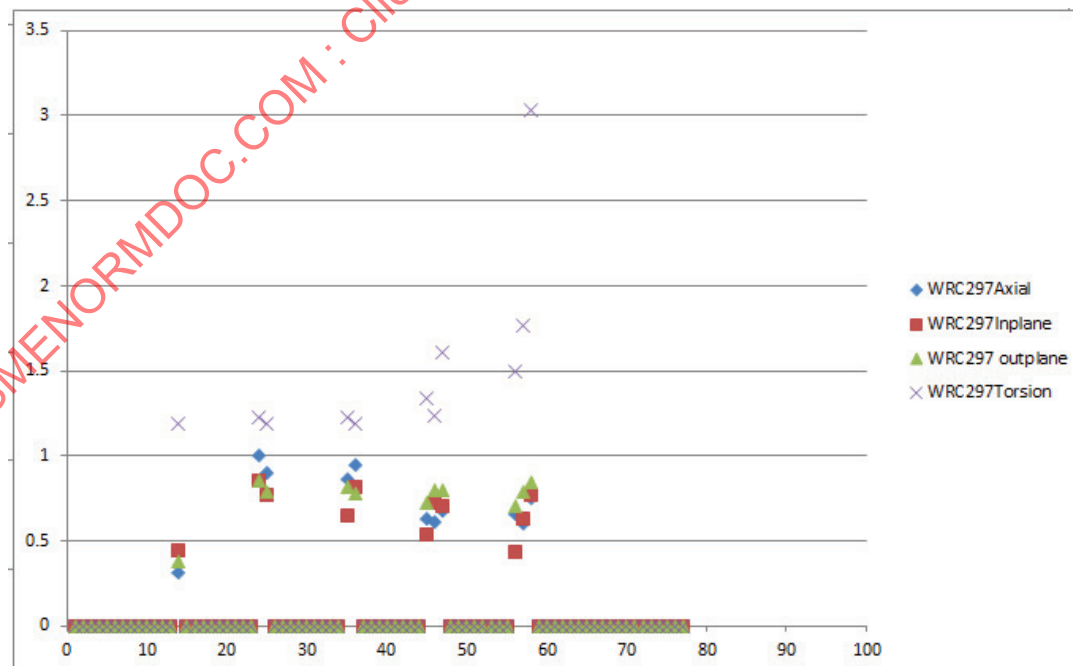
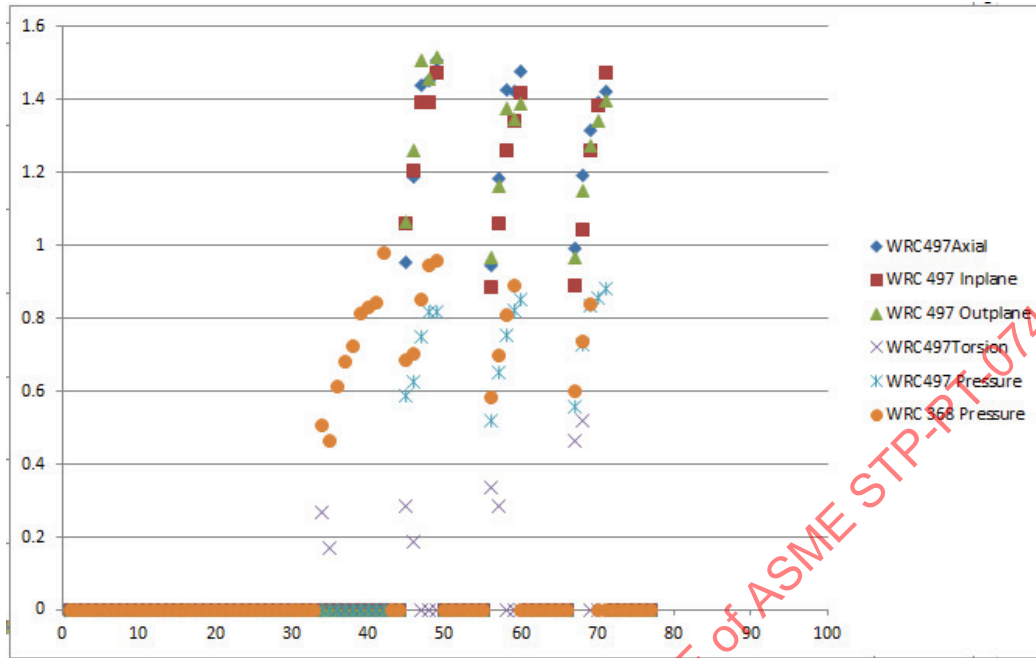


Chart 1-13 – WRC 497 Comparisons with Models in Table 1-19



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Miscellaneous Checks

WRC 329 Table 17 data

#	Input					Axial				Inplane				Outplane			
	d/D	D/T	d/t	t/T	Lamb	107	297	497	107	297	497	110996	107	297	497	110996	
1	0.10	50.	50.	0.10	0.721	2.6772	1.0014	0.0000	6.8154	0.8527	0.0000	0.0000	5.9482	0.8490	0.0000	0.0000	
2	0.10	50.	10.	0.50	0.778	1.3090	0.0000	0.0000	2.1385	0.0000	0.0000	0.0000	2.2662	0.0000	0.0000	0.0000	
3	0.10	50.	2.	3.00	1.131	1.3324	0.0000	0.0000	1.1252	0.0000	0.0000	0.0000	1.4547	0.0000	0.0000	0.0000	
4	0.20	50.	50.	0.20	1.442	3.1130	0.8592	0.0000	3.7880	0.6523	0.0000	1.1756	4.4895	0.8164	0.0000	1.4746	
5	0.20	50.	20.	0.50	1.485	1.7623	0.7713	0.0000	1.8738	0.6019	0.0000	0.9476	2.1614	0.7066	0.0000	0.9992	
6	0.20	50.	10.	1.00	1.556	1.1776	0.0000	0.0000	0.8367	0.0000	0.0000	0.5763	1.0617	0.0000	0.0000	0.6038	
7	0.20	50.	3.	3.00	1.838	1.5489	0.0000	0.0000	0.9317	0.0000	0.0000	0.0000	1.4152	0.0000	0.0000	0.0000	
8	0.10	100.	100.	0.10	1.010	3.0263	0.8994	0.0000	6.3396	0.7676	0.0000	0.0000	5.2524	0.7863	0.0000	0.0000	
9	0.10	100.	50.	0.20	1.020	2.8268	0.7607	0.0000	3.9280	0.6310	0.0000	0.0000	4.2670	0.7284	0.0000	0.0000	
10	0.10	100.	10.	1.00	1.100	1.2423	0.0000	0.0000	0.8521	0.0000	0.0000	0.0000	1.0469	0.0000	0.0000	0.0000	
11	0.10	100.	3.	3.00	1.300	1.5397	0.0000	0.0000	0.9331	0.0000	0.0000	0.0000	1.3947	0.0000	0.0000	0.0000	
12	0.20	100.	100.	0.20	2.020	4.6187	0.9443	0.0000	5.3289	0.8116	0.0000	0.0000	5.4194	0.7749	0.0000	0.0000	
13	0.20	100.	20.	1.00	2.100	1.5697	1.0368	0.0000	1.0718	0.9444	0.0000	0.0000	1.2984	0.8944	0.0000	0.0000	
14	0.20	100.	10.	2.00	2.200	1.7866	0.0000	0.0000	0.9375	0.0000	0.0000	0.0000	1.4685	0.8000	0.0000	0.0000	
15	0.20	100.	4.	5.00	2.500	1.7715	0.0000	0.0000	0.9522	0.0000	0.0000	0.0000	1.6392	0.0000	0.0000	0.0000	
16	0.50	100.	100.	0.50	5.050	0.0000	0.7521	1.4236	0.0000	0.7725	1.2599	0.0000	0.0000	0.8416	1.3738	0.0000	
17	0.50	100.	50.	1.00	5.100	0.0000	0.8588	1.3802	0.0000	0.9755	1.1338	0.0000	0.0000	0.8153	1.0146	0.0000	
18	0.50	100.	10.	5.00	5.500	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	
19	0.50	100.	5.	10.00	6.000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	

#	Input					Torsion				Pressure			
	d/D	D/T	d/t	t/T	Lamb	107	297	497	110996	107	297	497	368
1	0.10	50.	50.	0.10	0.721	12.2511	1.2250	0.0000	0.0000	1.7707	1.0987	0.0000	0.0000
2	0.10	50.	10.	0.50	0.778	3.0434	0.0000	0.0000	0.0000	1.4636	0.0000	0.0000	0.7191
3	0.10	50.	2.	3.00	1.131	1.2200	0.0000	0.0000	0.0000	1.1559	0.0000	0.0000	0.0000
4	0.20	50.	50.	0.20	1.442	6.1256	1.2250	0.1703	3.4546	1.8456	1.2126	0.0000	0.4607
5	0.20	50.	20.	0.50	1.485	2.6670	1.3335	0.1703	2.1850	3.2901	1.5942	0.0000	0.6564
6	0.20	50.	10.	1.00	1.556	1.5217	0.0000	0.1703	1.5450	2.4614	0.0000	0.0000	0.9273
7	0.20	50.	3.	3.00	1.838	1.4241	0.0000	0.0000	0.0000	1.4589	0.0000	0.0000	0.0000
8	0.10	100.	100.	0.10	1.010	11.8977	1.1896	0.0000	0.0000	2.0210	0.8275	0.0000	0.0000
9	0.10	100.	50.	0.20	1.020	6.1256	1.2250	0.0000	0.0000	1.9260	0.7423	0.0000	0.4857
10	0.10	100.	10.	1.00	1.100	1.5217	0.0000	0.0000	0.0000	0.9456	0.0000	0.0000	0.0000
11	0.10	100.	3.	3.00	1.300	1.2475	0.0000	0.0000	0.0000	1.1040	0.0000	0.0000	0.0000
12	0.20	100.	100.	0.20	2.020	5.9488	1.1896	0.0000	0.0000	5.4813	1.0084	0.0000	0.6104
13	0.20	100.	20.	1.00	2.100	1.5720	1.5720	0.0000	0.0000	3.2740	1.9054	0.0000	0.8745
14	0.20	100.	10.	2.00	2.200	1.5605	0.0000	0.0000	0.0000	2.0098	0.0000	0.0000	0.0000
15	0.20	100.	4.	5.00	2.500	1.6364	0.0000	0.0000	0.0000	3.1378	0.0000	0.0000	0.0000
16	0.50	100.	100.	0.50	5.050	0.0000	3.0331	0.0000	0.0000	0.0000	10.3509	0.7530	0.8067
17	0.50	100.	50.	1.00	5.100	0.0000	3.6051	0.0000	0.0000	0.0000	10.3563	0.7169	0.7746
18	0.50	100.	10.	5.00	5.500	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
19	0.50	100.	5.	10.00	6.000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

The above tables are geometries from WRC 329 Table 17 and give the stress factor from this project (07-10) divided by the stress factor from the given reference. A large number of values are outside of either this project (07-10) parameter ranges or the reference material parameter range.

## Edge Case and Summation Comparisons

To test edge cases, 146 finite element models were run at the outside end of the parameter ranges. In a number of cases, runs were made just outside of the allowed parameter ranges to get a sense of how the correlations found in STP-PT-073: Stress Intensity Factor and K-Factor Alignment for Metallic Pipes would perform in these situations. Cases were also run in the  $d/D$  range less than 0.05 to validate the extrapolation method recommendation for these small  $d/D$  nozzles. Six cases were run for each geometry:

- (a) Axial Load
- (b) In-plane bending moment
- (c) Out-of-plane bending moment
- (d) Torsional moment
- (e) Pressure
- (f) Sum of all loads

The sum of all loads together in one load case was performed to attempt to evaluate the adequacy of the combination equations 4.5.201 through 4.5.209. The results shown below indicate the adequacy of the results, although a more extensive set of models could be run and some conservatism likely removed.

The Tables 1a through 1d below are constructed by building reduced integration shell finite element models of nozzle and vessel connections from the data in columns B through G. Reinforcing pads (Fig. 4.5.15) are included when  $t_p > 0$ . All length units are in inches, forces in pounds, moments in inch-pounds, and pressure and stress in psi. No additional weld profiles are included. A remotely runnable, ActiveX version of NozzlePRO 8.6 was used to produce and post-process the finite element results. Guidelines in ASME Section VIII-2 Part 5 were used to construct the models and boundary condition lengths recommended by Widerra in WRC 497 [2] were used. NozzlePRO shell models for reinforcing pads are created using integral pad-shell models with a shifted midsurface radius to accommodate the collective section.

The parameter ranges covered in the model runs are:

Parameter	Min	Max
$d/D$	0.005	0.62
$D/T$	49	2000
$t/T$	0.4	10
$(d/D)(D/T)^{0.5}$	0.2	8.36

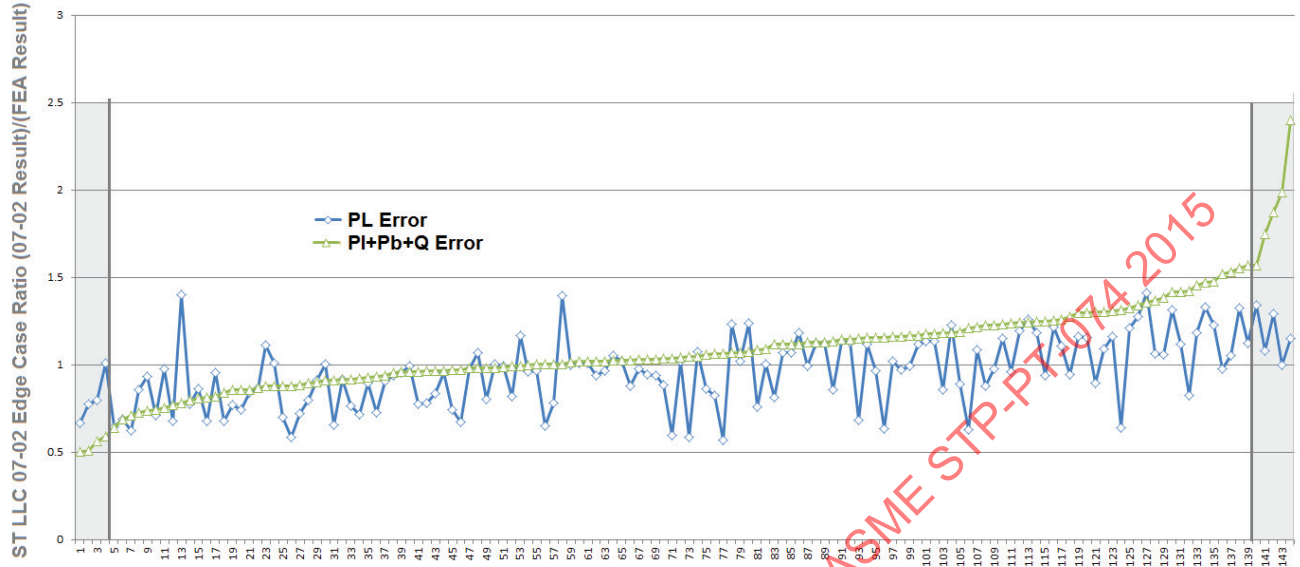
The extracted parameters for comparison are the maximum membrane stress (Eqs. 4.5.201-4.5.203), the maximum inside surface stress (Eqs. 4.5.204-4.5.206), and the maximum outside surface stress (Eqs. 4.5.207-4.5.208). Each maximum is ratioed against the similar maximum taken from the finite element run. For plotting, the maximum of the inside and outside surface stress ratios is used since that will be the value governing the design.

The sorted results are plotted in “Edge Case Chart 1” below. The sorted results for each analysis are included in Edge Case Result Table 1a through 1d. Non-sorted results are included in Edge Case Results Tables 2a through 2e.

The shaded grey ends of Edge Case Chart 1 below show pad reinforced models that are outside of the allowed parameter ranges given in 4.5.15.3.



Edge Case Chart 1 – Sorted Error



(Grey areas at each end of the chart show points that are outside of allowed parameter ranges for pad thickness or width.)

Tabulated sorted results from Edge Case Chart 1 are included in Tables 1a-1d below. Columns Q through S contain stresses computed using Eqs. 4.5.201-4.5.209, and Columns T through V give results from the finite element calculation. Non-sorted results are given in Tables 2a through 2e.

Edge Case Result Table 1a

J	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	NozzlePRO Batch Run Results			W	X	AA	AB	
																				Plmax	M+B(in)	M+B(out)					%PI
1	Model	Do	T	do	t	tp	W	d/D	D/T	t/T	Lam	Fa	Mi	Mo	Mt	P	Plmax	M+B(in)	M+B(out)	Plmax	M+B(in)	M+B(out)	%PI	%M+Bmax			
3	63	100	0.5	60	1	1	5	0.59	199	2	8.36	0	0	1E+06	0	0	3189	16378	21537	4788	38428	42673	0.666	0.505			
4	61	100	0.5	60	1	1	5	0.59	199	2	8.36	30000	0	0	0	0	1684	9964	11380	2433	19659	22224	0.774	0.512			
5	27	100	0.5	20	1	1	5	0.19	199	2	2.69	0	0	110000	0	0	1373	7678	8907	1722	14416	16789	0.737	0.565			
6	25	100	0.5	20	1	1	5	0.19	199	2	2.69	10000	0	0	0	0	1676	6879	9067	1655	13580	15247	1.013	0.535			
7	117	200	0.1	10	1	0.1	2	0.05	1999	10	2.01	0	0	1100	0	0	754	5730	6502	1169	9032	10167	0.645	0.640			
8	86	200	0.1	4	0.1	0	0	0.02	1999	1	0.87	0	2100	0	0	0	10432	39408	35440	15138	57135	62360	0.689	0.630			
9	55	100	1	60	1	1	5	0.6	99	1	5.93	30000	0	0	0	0	1034	4839	5459	1661	6820	7717	0.622	0.709			
10	135	200	0.25	4	0.1	0	0	0.02	799	0.4	0.55	0	0	1100	0	0	4245	14499	13531	4948	19895	19577	0.858	0.729			
11	115	200	0.1	10	1	0.1	2	0.05	1999	10	2.01	1000	0	0	0	0	6280	39877	38743	6731	54045	61950	0.933	0.738			
12	58	100	1	60	1	1	5	0.6	99	1	5.93	0	0	0	2E+06	0	1374	1681	1604	1927	2262	2272	0.713	0.743			
13	113	200	0.1	10	1	0	0	0.05	1999	10	2.01	0	0	0	0	20	23081	21074	19990	23645	27808	27266	0.976	0.758			
14	67	100	2	60	1	1	5	0.6	49	0.5	4.21	30000	0	0	0	0	644	2235	2925	948	3173	3780	0.680	0.774			
15	66	100	0.5	60	1	1	5	0.59	199	2	8.36	30000	2E+06	1E+06	2E+06	60	20661	49510	49772	14737	63361	74152	1.402	0.781			
16	15	100	2	20	1	0	0	0.19	49	0.5	1.36	0	0	110000	0	0	812	2616	3223	1048	3641	4040	0.774	0.798			
17	31	100	2	20	1	1	5	0.19	49	0.5	1.36	10000	0	0	0	0	657	1677	1990	761	2116	2458	0.863	0.809			
18	87	200	0.1	4	0.1	0	0	0.02	1999	1	0.87	0	0	1100	0	0	5465	31327	32656	8024	38550	42517	0.681	0.813			
19	106	200	0.1	10	0.1	0.1	2	0.05	1999	1	2.21	0	0	0	2100	0	273	343	333	285	418	413	0.957	0.821			
20	57	100	1	60	1	1	5	0.6	99	1	5.93	0	0	1E+06	0	0	2145	10434	11305	3148	12382	13836	0.682	0.843			
21	110	200	0.1	10	1	0	0	0.05	1999	10	2.01	0	2100	0	0	0	2989	9303	7895	3884	10847	12989	0.770	0.858			
22	112	200	0.1	10	1	0	0	0.05	1999	10	2.01	0	0	0	2100	0	243	321	299	327	373	388	0.742	0.861			
23	19	100	1	20	1	1	5	0.19	99	1	1.91	10000	0	0	0	0	1088	3800	4033	1294	4414	4895	0.841	0.861			
24	14	100	2	20	1	0	0	0.19	49	0.5	1.36	0	210000	0	0	0	1338	3786	3854	1535	4346	4466	0.872	0.871			
25	63	200	0.1	1	0.1	0.1	0.25	0	1999	1	0.2	0	0	0	0	20	22700	27591	20393	20390	31406	54683	1.113	0.879			
26	45	100	0.5	60	1	0	0	0.59	199	2	8.36	0	0	0	2E+06	0	4732	6918	6719	4731	7867	8221	1.013	0.879			
27	109	200	0.1	10	1	0	0	0.05	1999	10	2.01	1000	0	0	0	0	6129	70039	73539	8727	79477	9013	0.702	0.881			
28	103	200	0.1	10	0.1	0.1	2	0.05	1999	1	2.21	1000	0	0	0	0	11021	65905	63053	18786	74704	71472	0.587	0.882			
29	69	100	2	60	1	1	5	0.6	49	0.5	4.21	0	0	1E+06	0	0	1469	6020	7011	2040	6846	7937	0.720	0.883			
30	85	200	0.1	4	0.1	0	0	0.02	1999	1	0.87	1000	0	0	0	0	23796	102923	93478	29893	114516	124804	0.796	0.899			
31	13	100	2	20	1	0	0	0.19	49	0.5	1.36	10000	0	0	0	0	833	2575	2546	913	2957	3125	0.912	0.901			
32	22	100	1	20	1	1	5	0.19	99	1	1.91	0	0	0	0	0	7407	7407	7407	7395	8457	8133	1.003	0.911			
33	91	200	0.1	4	0.1	0.1	1	0.02	1999	1	0.87	1000	0	0	0	0	16243	82276	84111	24641	90199	96298	0.659	0.912			
34	44	100	0.5	60	1	0	0	0.59	199	2	8.36	0	2E+06	0	0	0	8020	22516	19968	8713	24513	29545	0.920	0.919			
35	111	200	0.1	10	1	0	0	0.05	1999	10	2.01	0	0	1100	0	0	1566	14667	13415	2046	15949	17410	0.765	0.920			
36	56	100	1	60	1	1	5	0.6	99	1	5.93	0	2E+06	0	0	0	2306	6079	5937	3225	6895	7017	0.715	0.922			
37	8	100	0.5	20	1	0	0	0.19	199	2	2.69	0	210000	0	0	0	4937	17314	16660	9523	18645	20440	0.894	0.929			
38	51	100	2	60	1	0	0	0.6	49	0.5	4.21	0	0	1E+06	0	0	1636	7624	8575	2251	8145	9293	0.727	0.936			
39	50	100	2	60	1	0	0	0.6	49	0.5	4.21	0	2E+06	0	0	0	1756	4732	4860	1938	5046	5173	0.906	0.939			
40	9	100	0.5	20	1	0	0	0.19	199	2	2.69	0	0	110000	0	0	2586	26766	29329	2746	28407	30588	0.942	0.959			

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Edge Case Result Table 1b (Continuation of Table 1a)

1	A B C D E F G H I J K L M N O P																Q R S			T U V W X Y AB						
	Model	Do	T	do	t	tp	W	d/D	D/T	t/T	Lam	Fa	Mi	Mo	Mt	P	Plmax	M+B(in)	M+B(out)	Plmax	M+B(in)	M+B(out)	Plmax	M+B(in)	M+B(out)	%PI
41	47	100	0.5	60	1	0	0.59	199	2	8.36	0	0	0	0	0	60	20335	33632	30060	21300	35083	32403	0.955	0.960		
42	70	100	2	60	1	1	5	0.6	49	0.5	4.21	0	0	0	2E+06	0	987	1037	768	991	1079	976	0.936	0.961		
43	123	200	0.5	5	0.2	0	0	0.02	399	0.4	0.48	0	0	0	1100	0	737	3301	3141	949	3429	3517	0.776	0.963		
44	49	100	2	60	1	0	0	0.6	49	0.5	4.21	30000	0	0	0	0	771	3310	4013	985	3544	4165	0.783	0.966		
45	38	200	0.1	10	0.1	0	0	0.05	1999	1	2.21	0	2100	0	0	0	4075	12965	11670	4862	13411	13284	0.838	0.967		
46	53	100	2	60	1	0	0	0.6	49	0.5	4.21	0	0	0	0	60	6321	10772	9950	7248	11226	10266	0.955	0.969		
47	32	200	0.1	4	0.1	0.1	1	0.02	1999	1	0.87	0	2100	0	0	0	8568	38468	35879	1197	39453	36789	0.745	0.975		
48	93	200	0.1	4	0.1	0.1	1	0.02	1999	1	0.87	0	0	0	1100	0	4488	26464	25334	6670	27129	27547	0.673	0.975		
49	74	200	0.1	1	0.1	0	0	0	1999	1	0.2	0	2100	0	0	0	60713	253233	232813	62216	264081	303006	0.976	0.982		
50	119	200	0.1	10	1	0.1	2	0.05	1999	10	2.01	0	0	0	0	20	19990	19990	19990	18624	20333	28998	1.073	0.983		
51	37	200	0.1	10	0.1	0	0	0.05	1999	1	2.21	1000	0	0	0	0	16457	76319	69662	20471	77508	79057	0.804	0.985		
52	40	100	1	60	1	0	0	0.6	99	1	5.93	0	0	0	0	0	2073	2811	2448	2066	2851	2488	1.003	0.986		
53	41	100	1	60	1	0	0	0.6	99	1	5.93	0	0	0	0	0	12832	17988	15423	12906	18157	15741	0.934	0.991		
54	121	200	0.5	5	0.2	0	0	0.02	399	0.4	0.48	1000	0	0	0	0	3194	12542	10879	3992	12596	12300	0.821	0.996		
55	30	100	0.5	20	1	1	5	0.19	199	2	2.69	10000	210000	110000	2E+06	60	17769	30358	29836	15210	30450	39204	1.168	0.997		
56	4	100	1	20	1	0	0	0.19	99	1	1.91	0	0	0	0	0	7776	8457	8014	8104	9375	8029	0.953	0.998		
57	95	200	0.1	4	0.1	0.1	1	0.02	1999	1	0.87	0	0	0	0	20	28858	37829	29372	29815	37726	45648	0.968	1.003		
58	99	200	0.1	10	0.1	0	0	0.05	1999	1	2.21	0	0	0	1100	0	2134	14635	14219	3284	14570	15291	0.850	1.004		
59	39	100	1	60	1	0	0	0.6	99	1	5.93	0	0	0	1E+06	0	2724	13816	14205	3480	13734	15594	0.783	1.006		
60	100	200	0.1	10	0.1	0	0	0.05	1999	1	2.21	0	0	0	0	2100	404	391	378	280	388	378	1.394	1.007		
61	5	100	1	20	1	0	0	0.19	99	1	1.91	0	0	0	0	0	6470	8321	6712	6483	8180	7316	0.938	1.017		
62	101	200	0.1	10	0.1	0	0	0.05	1999	1	2.21	0	0	0	0	20	63223	87819	71826	62689	86143	78446	1.009	1.020		
63	43	100	0.5	60	1	0	0	0.59	199	2	8.36	30000	0	0	0	0	3328	30303	27589	3286	29709	31302	1.010	1.020		
64	141	200	0.25	4	0.1	0.1	1	0.02	799	0.4	0.55	0	0	0	1100	0	3747	8191	14093	3983	13871	13807	0.941	1.021		
65	33	100	2	20	1	1	5	0.19	49	0.5	1.36	0	0	0	0	110000	0	0	789	1904	2862	816	2389	2793	0.967	1.024
66	11	100	0.5	20	1	0	0	0.19	199	2	2.69	0	0	0	0	0	11257	14119	12067	10692	13767	14285	1.053	1.026		
67	7	100	0.5	20	1	0	0	0.19	199	2	2.69	10000	0	0	0	0	2908	23853	25264	2844	23199	25312	1.022	1.028		
68	118	200	0.1	10	1	0.1	2	0.05	1999	10	2.01	0	0	0	0	2100	151	203	190	171	197	199	0.882	1.030		
69	17	100	2	20	1	0	0	0.19	49	0.5	1.36	0	0	0	0	0	3244	4087	3231	3313	3967	3176	0.979	1.030		
70	52	100	2	60	1	0	0	0.6	49	0.5	4.21	0	0	0	0	0	1131	1404	1263	1196	1405	1224	0.946	1.032		
71	32	100	2	20	1	1	5	0.19	49	0.5	1.36	0	210000	0	0	0	1115	3000	3265	185	2901	3315	0.941	1.034		
72	68	100	2	60	1	1	5	0.6	49	0.5	4.21	0	0	0	0	0	1432	4064	4533	1619	3979	4375	0.885	1.036		
73	62	100	0.5	60	1	1	5	0.59	199	2	8.36	0	0	0	0	0	4182	9535	8427	6974	9225	10502	0.600	1.040		
74	28	100	0.5	20	1	1	5	0.19	199	2	2.69	0	0	0	0	0	8943	11299	9940	8764	10838	10698	1.021	1.043		
75	105	200	0.1	10	0.1	0.1	2	0.05	1999	1	2.21	0	0	0	1100	0	1687	12565	12119	2871	12008	11635	0.588	1.046		
76	94	200	0.1	4	0.1	0.1	1	0.02	1999	1	0.87	0	0	0	0	2100	1758	1758	1758	1637	1725	1680	1.074	1.046		
77	21	100	1	20	1	1	5	0.19	99	1	1.91	0	0	0	110000	0	1010	4417	4493	1168	4176	4611	0.865	1.058		
78	3	100	1	20	1	0	0	0.19	99	1	1.91	0	0	0	110000	0	1189	8504	5886	1444	6111	7160	0.824	1.064		
79	134	200	0.25	4	0.1	0	0	0.02	799	0.4	0.55	0	2100	0	0	0	5291	36807	34461	9238	34469	33324	0.573	1.068		
80	88	200	0.1	4	0.1	0	0	0.02	1999	1	0.87	0	0	0	0	2100	2033	1758	1758	1648	1746	1644	1.234	1.070		
81	89	200	0.1	4	0.1	0	0	0.02	1999	1	0.87	0	0	0	0	20	44965	56232	43568	43972	52464	40892	1.023	1.072		
82	120	200	0.1	10	1	0.1	2	0.05	1999	10	2.01	1000	2100	1100	2100	20	27902	67174	62173	22547	62550	100656	1.238	1.074		

Edge Case Result Table 1c (Continuation of Table 1b)

1	A B C D E F G H I J K L M N O P																Q R S			T U V W X Y AB						
	Model	Do	T	do	t	tp	W	d/D	D/T	t/T	Lam	Fa	Mi	Mo	Mt	P	Plmax	M+B(in)	M+B(out)	Plmax	M+B(in)	M+B(out)	Plmax	M+B(in)	M+B(out)	%PI
83	64	100	0.5	60	1	1	5	0.59	199	2	8.36	0	0	0	0	2E+06	0	2901	4282	3662	3814	4243	3954	0.761	1.067	
84	90	200	0.1	4	0.1	0	0	0.02	1999	1	0.87	1000	2100	1100	2100	20	73302	208271	176931	72754	190912	207284	1.008	1.091		
85	2	100	1	20	1	0	0	0.19	99	1	1.91	0	210000	0	0	0	1804	6292	5598	2212	5633	6445	0.816	1.117		
86	34	100	2	20	1	1	5	0.19	49	0.5	1.36	0	0	0	0	0	7407	7407	7407	6905	6623	7573	1.073	1.118		
87	16	100	2	20	1	0	0	0.19	49	0.5	1.36	0	0	0	0	0	7407	7407	7407	6907	6620	7483	1.072	1.119		
88	12	100	0.5	20	1	0	0	0.19	199	2	2.69	10000	210000	110000	2E+06	60	32240	79803	77335	27243	7191	80057	1.183	1.121		
89	38	100	1	60	1	0	0	0.6	99	1	5.93	0	0	0	0	0	3418	7151	8358	3432	7464	7401	0.936	1.129		
90	75	200	0.1	1	0.1	0	0	0	1999	1	0.2	0	0	0	1100	0	35930	155165	183056	31911	142954	162039	1.126	1.130		
91	136	200	0.25	4	0.1	0	0	0.02	799	0.4	0.55	0	0	0	0	2100	1758	1758	1758	1559	1552	1601	1.127	1.133		
92	133	200	0.25	4	0.1	0	0	0.02	799	0.4	0.55	1000	0	0	0	0	14033	66028	61599	16303	58173	55691	0.861	1.135		
93	142	200	0.25	4	0.1	0.1	1	0.02	799	0.4	0.55	0	0	0	0	2100	1758	1758	1758	1549	1534	1614	1.135	1.146		
94	20	100	1	20	1	1	5	0.19	99	1	1.91	0	210000	0	0	0	1657	4679	4689	1468	4974	4360	1.129	1.149		
95	122	200	0.5	5	0.2	0	0	0.02	399	0.4	0.48	0	0	0	0	0	1213	6170	7036	1776	6034	6097	0.683	1.154		
96	37	100	1	60	1	0	0	0.6	99	1	5.93	30000	0	0	0	0	1914	7238	9066	1706	6896	7845	1.122	1.156		
97	137	200	0.25	4	0.1	0	0	0.02	799	0.4	0.55	0	0	0	0	20	16525	24832	20924	17098	23451	18081	0.966	1.157		
98	1																									

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Edge Case Result Table 1d (Continuation of Table 1c)

1	2	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	NozzlePRO Batch Run Results			W	X	AA	AB
																					Pmax	M+B(in)	M+B(out)				
126	140	200	0.25	4	0.1	0.1	1	0.02	799	0.4	0.55	0	2100	0	0	0	4589	31237	23371	788	23713	23311	0.638	1.317			
127	48	100	0.5	60	1	0	0	0.59	199	2	8.36	30000	2E+06	1E+06	2E+06	60	34915	134062	133848	28812	101261	106304	1.212	1.324			
128	78	200	0.1	1	0.1	0	0	0	1999	1	0.2	1000	2100	1100	2100	20	160074	563175	484806	125442	419153	503883	1.276	1.344			
129	81	200	0.1	1	0.1	0.1	0.25	0	1999	1	0.2	0	0	0	1100	0	38796	126922	119635	27416	93347	106359	1.415	1.360			
130	72	100	2	60	1	1	5	0.6	49	0.5	4.21	30000	2E+06	1E+06	2E+06	60	7503	18238	20075	7030	14069	14641	1.067	1.371			
131	131	200	0.5	5	0.2	0.25	1.5	0.02	399	0.4	0.48	0	0	0	0	20	6022	8335	6435	5686	8352	4644	1.059	1.386			
132	24	100	1	20	1	1	5	0.19	99	1	1.91	10000	210000	110000	2E+06	60	12413	19206	20162	9441	13548	14538	1.315	1.418			
133	42	100	1	60	1	0	0	0.6	99	1	5.93	30000	2E+06	1E+06	2E+06	60	18209	40083	40539	16240	28198	29227	1.121	1.421			
134	128	200	0.5	5	0.2	0.25	1.5	0.02	399	0.4	0.48	0	2100	0	0	0	1016	4789	5492	1231	3521	3954	0.825	1.425			
135	73	200	0.1	1	0.1	0	0	0	1999	1	0.2	1000	0	0	0	0	53481	222540	196163	45054	152509	189056	1.187	1.459			
136	36	100	2	20	1	1	5	0.19	49	0.5	1.36	10000	210000	110000	2E+06	60	10304	13122	13088	7724	8993	10102	1.332	1.476			
137	60	100	1	60	1	1	5	0.6	99	1	5.93	30000	2E+06	1E+06	2E+06	60	12226	31344	30900	9947	2193	22346	1.223	1.479			
138	80	200	0.1	1	0.1	0.1	0.25	0	1999	1	0.2	0	2100	0	0	0	51391	253102	237284	52498	168497	189630	0.979	1.520			
139	102	200	0.1	10	0.1	0	0	0.05	1999	1	2.21	1000	2100	1100	2100	20	78742	181422	155356	74654	18288	16026	1.055	1.534			
140	65	100	0.5	60	1	1	5	0.59	199	2	8.36	0	0	0	0	60	13823	20097	17719	10500	12331	12654	1.329	1.554			
141	107	200	0.1	10	0.1	0.1	2	0.05	1999	1	2.21	0	0	0	0	20	41173	70072	56910	36599	44644	30917	1.425	1.570			
142	84	200	0.1	1	0.1	0.1	0.25	0	1999	1	0.2	1000	2100	1100	2100	20	130159	470278	461708	97078	292288	386988	1.341	1.571			
143	144	200	0.25	4	0.1	0.1	1	0.02	799	0.4	0.55	1000	2100	1100	2100	20	27654	11039	10157	25548	63516	6016	1.082	1.748			
144	108	200	0.1	10	0.1	0.1	2	0.05	1999	1	2.21	1000	2100	1100	2100	20	54784	153798	136801	42418	81990	103619	1.232	1.876			
145	143	200	0.25	4	0.1	0.1	1	0.02	799	0.4	0.55	0	0	0	0	20	13637	25321	20518	13804	17586	10502	1.002	1.932			
146	132	200	0.5	5	0.2	0.25	1.5	0.02	399	0.4	0.48	1000	2100	1100	2100	20	7436	22875	20174	6446	9619	9066	1.153	2.403			

Edge Case Result Table 2a (Continuation of Table 1c)

1	2	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V
3	1	100	1	20	1	0	0	10000	0	0	0	0	0	1494	6503	7029	154	5284	6221	0.970	1.231	1.130	
4	2	100	1	20	1	0	0	0	210000	0	0	0	0	1804	6292	5598	2212	5633	6445	0.816	1.117	0.869	
5	3	100	1	20	1	0	0	0	0	0	110000	0	0	1189	6504	5886	1444	6111	7160	0.824	1.064	0.822	
6	4	100	1	20	1	0	0	0	0	0	0	0	2100000	7776	8457	8014	8104	9375	8029	0.959	0.902	0.998	
7	5	100	1	20	1	0	0	0	0	0	0	0	60	6470	8321	6712	6483	8180	7316	0.998	1.017	0.918	
8	6	100	1	20	1	0	0	10000	210000	110000	2100000	60	15010	27033	24964	12893	20842	22908	1.164	1.297	1.090		
9	7	100	0.5	20	1	0	0	10000	0	0	0	0	0	2908	23853	25264	2844	23199	25312	1.022	1.028	0.998	
10	8	100	0.5	20	1	0	0	0	210000	0	0	0	0	4937	17314	16660	5523	18645	20440	0.894	0.929	0.815	
11	9	100	0.5	20	1	0	0	0	0	110000	0	0	0	2586	26766	29329	2746	28407	30588	0.942	0.942	0.959	
12	10	100	0.5	20	1	0	0	0	0	0	0	0	2100000	17369	27116	21508	18513	21663	22935	0.938	1.252	0.938	
13	11	100	0.5	20	1	0	0	0	0	0	0	0	60	11257	14119	12067	10692	13767	14285	1.053	1.026	0.845	
14	12	100	0.5	20	1	0	0	10000	210000	110000	2100000	60	32240	79803	77335	27243	71191	80057	1.183	1.121	0.966		
15	13	100	2	20	1	0	0	10000	0	0	0	0	0	833	2575	2546	913	2857	3125	0.912	0.901	0.815	
16	14	100	2	20	1	0	0	0	210000	0	0	0	0	1338	3786	3854	1535	4346	4466	0.872	0.871	0.863	
17	15	100	2	20	1	0	0	0	0	110000	0	0	0	812	2616	3223	1048	3641	4040	0.774	0.719	0.798	
18	16	100	2	20	1	0	0	0	0	0	0	0	2100000	7407	7407	7407	6907	6620	7483	1.072	1.119	0.990	
19	17	100	2	20	1	0	0	0	0	0	0	0	60	3244	4087	3231	3313	3967	3176	0.979	1.030	1.017	
20	18	100	2	20	1	0	0	10000	210000	110000	2100000	60	11056	15382	14727	9008	12971	13632	1.227	1.186	1.080		
21	19	100	1	20	1	1	5	10000	0	0	0	0	0	1088	3800	4033	1294	4414	4895	0.841	0.861	0.824	
22	20	100	1	20	1	1	5	0	210000	0	0	0	0	1657	4679	4689	1468	4074	4360	1.129	1.149	1.075	
23	21	100	1	20	1	1	5	0	0	110000	0	0	0	1010	4417	4493	1168	4176	4611	0.865	1.058	0.974	
24	22	100	1	20	1	1	5	0	0	0	0	2100000	0	7407	7407	7407	7385	8457	8133	1.003	0.876	0.911	
25	23	100	1	20	1	1	5	0	0	0	0	0	60	4407	5594	6279	3725	5043	5021	1.183	1.109	1.251	
26	24	100	1	20	1	1	5	10000	210000	110000	2100000	60	12413	19206	20162	9441	13548	14538	1.315	1.418	1.387		
27	25	100	0.5	20	1	1	5	10000	0	0	0	0	0	1676	6879	9067	1655	13580	15247	1.013	0.507	0.595	
28	26	100	0.5	20	1	1	5	0	210000	0	0	0	0	2096	6705	6394	3328	5541	6145	0.630	1.210	1.041	
29	27	100	0.5	20	1	1	5	0	0	110000	0	0	0	1373	7678	8907	1722	14416	15769	0.797	0.533	0.565	

STP-PT-074: Local Stress in Nozzles, Shells and Formed Heads from External Heads

Edge Case Result Table 2b (Continuation of Table 2a)

1	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V
2	Model	Do	T	do	t	tp	W	Fa	Mi	Mo	Mt	P	P1max	M+B(in)	M+B(out)	P1max	M+B(in)	M+B(out)	NozzlePRO Batch Run Results			
																			%PI	%M+Bi	%M+Bo	
30	28	100	0.5	20	1	1	5	0	0	0	2100000	0	8943	11299	8940	8764	10838	10698	1.021	1.043	0.836	
31	29	100	0.5	20	1	1	5	0	0	0	0	60	7333	9303	7258	6761	7650	8969	1.085	1.216	0.809	
32	30	100	0.5	20	1	1	5	10000	210000	110000	2100000	60	17769	30358	29836	15210	30450	39204	1.168	0.997	0.761	
33	31	100	2	20	1	1	5	10000	0	0	0	0	657	1677	1990	761	2116	2458	0.863	0.793	0.809	
34	32	100	2	20	1	1	5	0	210000	0	0	0	1115	3000	3265	1185	2901	3315	0.941	1.034	0.985	
35	33	100	2	20	1	1	5	0	0	110000	0	0	789	1904	2862	816	2399	2793	0.967	0.793	1.024	
36	34	100	2	20	1	1	5	0	0	0	2100000	0	7407	7407	7407	6905	6623	7573	1.073	1.118	0.978	
37	35	100	2	20	1	1	5	0	0	0	0	60	2590	3230	2513	2336	3263	1993	1.109	0.990	0.961	
38	36	100	2	20	1	1	5	10000	210000	110000	2100000	60	10304	13122	13088	7734	8893	10102	1.332	1.476	1.296	
39	37	100	1	60	1	0	0	30000	0	0	0	0	1309	7238	9066	1706	6896	7845	0.767	1.050	1.156	
40	38	100	1	60	1	0	0	0	2E+06	0	0	0	3418	7151	8358	3432	7464	7401	0.996	0.958	1.129	
41	39	100	1	60	1	0	0	0	0	1100000	0	0	2724	13816	14205	3480	13734	15534	0.783	1.006	0.914	
42	40	100	1	60	1	0	0	0	0	0	2100000	0	2073	2811	2448	2066	2851	2488	1.003	0.986	0.984	
43	41	100	1	60	1	0	0	0	0	0	0	60	12832	17988	15423	12906	18157	15741	0.994	0.991	0.980	
44	42	100	1	60	1	0	0	30000	2E+06	1100000	2100000	60	18209	40083	40539	16240	28198	29227	1.121	1.421	1.387	
45	43	100	0.5	60	1	0	0	30000	0	0	0	0	3328	30303	27589	3296	29709	31302	1.010	1.020	0.881	
46	44	100	0.5	60	1	0	0	0	2E+06	0	0	0	8020	22516	19988	8713	24513	25545	0.920	0.919	0.872	
47	45	100	0.5	60	1	0	0	0	0	1100000	0	0	6271	65990	73222	6463	60117	62868	0.970	1.098	1.165	
48	46	100	0.5	60	1	0	0	0	0	0	2100000	0	4792	6918	6719	4731	7867	8221	1.013	0.879	0.817	
49	47	100	0.5	60	1	0	0	0	0	0	0	60	20335	33692	30060	21300	35083	32403	0.955	0.960	0.928	
50	48	100	0.5	60	1	0	0	30000	2E+06	1100000	2100000	60	34915	134062	133848	28812	101261	106304	1.212	1.324	1.259	
51	49	100	2	60	1	0	0	30000	0	0	0	0	771	3310	4013	985	3544	4155	0.783	0.934	0.966	
52	50	100	2	60	1	0	0	0	2E+06	0	0	0	1756	4732	4860	1938	5046	5173	0.906	0.938	0.939	
53	51	100	2	60	1	0	0	0	0	1100000	0	0	1636	7624	8575	2251	8145	9293	0.727	0.936	0.923	
54	52	100	2	60	1	0	0	0	0	0	2100000	0	1131	1404	1263	1196	1405	1224	0.946	0.999	1.032	
55	53	100	2	60	1	0	0	0	0	0	0	60	6921	10772	9950	7248	11226	10266	0.955	0.960	0.969	
56	54	100	2	60	1	0	0	30000	2E+06	1100000	2100000	60	9266	23164	23900	9617	19383	19262	0.963	1.195	1.241	

Edge Case Result Table 2c (Continuation of Table 2b)

1	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V
2	Model	Do	T	do	t	tp	W	Fa	Mi	Mo	Mt	P	P1max	M+B(in)	M+B(out)	P1max	M+B(in)	M+B(out)	NozzlePRO Batch Run Results			
																			%PI	%M+Bi	%M+Bo	
57	55	100	1	60	1	1	5	30000	0	0	0	0	958	4839	5459	1661	6820	7717	0.577	0.709	0.707	
58	56	100	1	60	1	1	5	0	2E+06	0	0	0	2306	6079	5997	3225	6595	7017	0.715	0.922	0.855	
59	57	100	1	60	1	1	5	0	0	1100000	0	0	2145	10434	11305	3148	12382	13836	0.682	0.843	0.817	
60	58	100	1	60	1	1	5	0	0	0	2100000	0	1374	1681	1604	1927	2262	2272	0.713	0.743	0.706	
61	59	100	1	60	1	1	5	0	0	0	0	60	9102	14312	12543	7821	10931	9827	1.164	1.309	1.276	
62	60	100	1	60	1	1	5	30000	2E+06	1100000	2100000	60	12226	31344	30900	9947	21193	22346	1.229	1.479	1.383	
63	61	100	0.5	60	1	1	5	30000	0	0	0	0	1884	9964	11380	2433	19659	22224	0.774	0.507	0.512	
64	62	100	0.5	60	1	1	5	0	2E+06	0	0	0	4182	9595	8427	6974	9225	10502	0.600	1.040	0.802	
65	63	100	0.5	60	1	1	5	0	0	1100000	0	0	3189	18378	21537	4788	38428	42673	0.666	0.478	0.505	
66	64	100	0.5	60	1	1	5	0	0	0	2100000	0	2901	4282	3862	3814	4243	3554	0.761	1.009	1.087	
67	65	100	0.5	60	1	1	5	0	0	0	0	60	13923	20097	17719	10500	12931	12654	1.326	1.554	1.400	
68	66	100	0.5	60	1	1	5	30000	2E+06	1100000	2100000	60	20661	49510	49772	14737	63361	74152	1.402	0.781	0.671	
69	67	100	2	60	1	1	5	30000	0	0	0	0	644	2235	2925	948	3173	3780	0.680	0.705	0.774	
70	68	100	2	60	1	1	5	0	2E+06	0	0	0	1432	4064	4533	1619	3979	4375	0.885	1.021	1.036	
71	69	100	2	60	1	1	5	0	0	1100000	0	0	1469	6020	7011	2040	6846	7937	0.720	0.879	0.883	
72	70	100	2	60	1	1	5	0	0	0	2100000	0	987	1037	768	991	1079	976	0.996	0.961	0.787	
73	71	100	2	60	1	1	5	0	0	0	0	60	5665	8748	8766	5179	6694	6752	1.094	1.307	1.298	
74	72	100	2	60	1	1	5	30000	2E+06	1100000	2100000	60	7503	18298	20075	7030	14069	14641	1.067	1.301	1.371	
75	73	200	0.1	1	0.1	0	0	1000	0	0	0	0	53481	222540	198163	45054	152509	189056	1.187	1.459	1.048	
76	74	200	0.1	1	0.1	0	0	0	2100	0	0	0	60713	259233	232813	62216	264081	303006	0.976	0.982	0.768	
77	75	200	0.1	1	0.1	0	0	0	0	1100	0	0	35930	155165	183056	31911	142954	162039	1.126	1.085	1.130	
78	76	200	0.1	1	0.1	0	0	0	0	0	2100	0	33010	33010	33010	28603	26738	31706	1.154	1.235	1.041	
79	77	200	0.1	1	0.1	0	0	0	0	0	0	20	35836	40439	29439	28458	32530	37354	1.259	1.243	0.788	
80	78	200	0.1	1	0.1	0	0	1000	2100	1100	2100	20	160074	563175	484806	125442	419153	503883	1.276	1.344	0.962	
81	79	200	0.1	1	0.1	0.1	0.25	1000	0	0	0	0	37009	163510	177425	33054	139825	179392	1.120	1.169	0.989	
82	80	200	0.1	1	0.1	0.1	0.25	0	2100	0	0	0	51391	253102	237284	52498	166497	189630	0.979	1.520	1.251	
83	81	200	0.1	1	0.1	0.1	0.25	0	0	1100	0	0	38796	126922	119635	27416	93347	106359	1.415	1.360	1.125	



STP-PT-074: Local Stress in Nozzles, Shells and Formed Heads from External Heads

Edge Case Result Table 2d (Continuation of Table 2c)

1	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V
2	Model	Do	T	do	t	tp	W	Fa	Mi	Mo	Mt	P	P1max	M+B(in)	M+B(out)	P1max	M+B(in)	M+B(out)	%PI	%M+Bi	%M+Bo	
84	82	200	0.1	1	0.1	0.1	0.25	0	0	0	0	2100	0	33010	33010	33010	28554	25422	32780	1.156	1.298	1.007
85	83	200	0.1	1	0.1	0.1	0.25	0	0	0	0	20	22700	27591	20393	20390	31406	54683	1.113	0.879	0.373	
86	84	200	0.1	1	0.1	0.1	0.25	1000	2100	1100	2100	20	130159	470278	461708	97078	299288	386098	1.341	1.571	1.196	
87	85	200	0.1	4	0.1	0	0	1000	0	0	0	0	23796	102923	93478	29893	114516	124804	0.796	0.899	0.749	
88	86	200	0.1	4	0.1	0	0	0	2100	0	0	0	10432	39408	35440	15138	57135	62360	0.689	0.690	0.568	
89	87	200	0.1	4	0.1	0	0	0	0	1100	0	0	5465	31327	32656	8024	38550	42517	0.681	0.813	0.768	
90	88	200	0.1	4	0.1	0	0	0	0	0	2100	0	2033	1758	1758	1648	1746	1644	1.234	1.007	1.070	
91	89	200	0.1	4	0.1	0	0	0	0	0	0	20	44965	56232	43568	43972	52464	40892	1.023	1.072	1.065	
92	90	200	0.1	4	0.1	0	0	1000	2100	1100	2100	20	73302	208271	176931	72754	190812	207384	1.008	1.091	0.853	
93	91	200	0.1	4	0.1	0.1	1	1000	0	0	0	0	16243	82276	84111	24641	90199	96288	0.659	0.912	0.874	
94	92	200	0.1	4	0.1	0.1	1	0	2100	0	0	0	8568	38468	35879	11497	39453	36789	0.745	0.975	0.975	
95	93	200	0.1	4	0.1	0.1	1	0	0	1100	0	0	4488	26464	25334	6670	27129	27547	0.673	0.975	0.920	
96	94	200	0.1	4	0.1	0.1	1	0	0	0	2100	0	1758	1758	1758	1637	1725	1680	1.074	1.019	1.046	
97	95	200	0.1	4	0.1	0.1	1	0	0	0	0	20	28858	37829	29972	29815	37726	45648	0.963	1.003	0.657	
98	96	200	0.1	4	0.1	0.1	1	1000	2100	1100	2100	20	53306	166829	158040	44533	134215	172175	1.197	1.243	0.918	
99	97	200	0.1	10	0.1	0	0	1000	0	0	0	0	16457	76319	69662	20471	77508	79057	0.804	0.985	0.881	
100	98	200	0.1	10	0.1	0	0	0	2100	0	0	0	4075	12965	11670	4862	13411	13284	0.838	0.967	0.878	
101	99	200	0.1	10	0.1	0	0	0	0	1100	0	0	2134	14635	14219	3284	14570	15291	0.650	1.004	0.930	
102	100	200	0.1	10	0.1	0	0	0	0	0	2100	0	404	391	378	290	388	378	1.394	1.007	0.999	
103	101	200	0.1	10	0.1	0	0	0	0	0	0	20	63223	87819	71826	62689	86143	70446	1.009	1.019	1.020	
104	102	200	0.1	10	0.1	0	0	1000	2100	1100	2100	20	78742	181422	155356	74654	118288	116026	1.055	1.534	1.339	
105	103	200	0.1	10	0.1	0.1	2	1000	0	0	0	0	11021	65905	63053	18786	74704	71472	0.587	0.882	0.882	
106	104	200	0.1	10	0.1	0.1	2	0	2100	0	0	0	3221	12634	11685	3148	10853	10148	1.023	1.164	1.151	
107	105	200	0.1	10	0.1	0.1	2	0	0	1100	0	0	1687	12565	12119	2871	12008	11635	0.588	1.046	1.041	
108	106	200	0.1	10	0.1	0.1	2	0	0	0	2100	0	273	343	333	285	418	413	0.957	0.821	0.807	
109	107	200	0.1	10	0.1	0.1	2	0	0	0	0	20	41173	70072	56910	36399	44644	38917	1.125	1.570	1.462	
110	108	200	0.1	10	0.1	0.1	2	1000	2100	1100	2100	20	54784	153798	136801	42418	81990	103519	1.292	1.876	1.322	

Edge Case Result Table 2e (Continuation of Table 2f)

1	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V
2	Model	Do	T	do	t	tp	W	Fa	Mi	Mo	Mt	P	P1max	M+B(in)	M+B(out)	P1max	M+B(in)	M+B(out)	%PI	%M+Bi	%M+Bo	
111	109	200	0.1	10	1	0	0	1000	0	0	0	0	6129	70039	73539	8727	79477	90113	0.702	0.881	0.816	
112	110	200	0.1	10	1	0	0	0	2100	0	0	0	2989	9303	7895	3884	10847	12989	0.770	0.858	0.608	
113	111	200	0.1	10	1	0	0	0	0	1100	0	0	1566	14667	13415	2046	15949	17410	0.765	0.920	0.771	
114	112	200	0.1	10	1	0	0	0	0	0	2100	0	243	321	299	327	373	388	0.742	0.861	0.772	
115	113	200	0.1	10	1	0	0	0	0	0	0	20	23081	21074	19990	23645	27808	27266	0.976	0.758	0.733	
116	114	200	0.1	10	1	0	0	1000	2100	1100	2100	20	32593	108485	109097	26753	86578	122634	1.218	1.253	0.890	
117	115	200	0.1	10	1	0.1	2	1000	0	0	0	0	6280	39877	38743	6731	54045	61950	0.933	0.738	0.625	
118	116	200	0.1	10	1	0.1	2	0	2100	0	0	0	1440	5011	4568	2267	4320	5255	0.635	1.160	0.869	
119	117	200	0.1	10	1	0.1	2	0	0	1100	0	0	754	5730	6502	1169	9032	10167	0.645	0.634	0.640	
120	118	200	0.1	10	1	0.1	2	0	0	0	2100	0	151	203	190	171	197	199	0.882	1.030	0.952	
121	119	200	0.1	10	1	0.1	2	0	0	0	0	20	19990	19990	19990	18624	20333	28598	1.073	0.983	0.699	
122	120	200	0.1	10	1	0.1	2	1000	2100	1100	2100	20	27902	67174	62173	22547	62550	100656	1.238	1.074	0.618	
123	121	200	0.5	5	0.2	0	0	1000	0	0	0	0	3194	12542	10879	3892	12596	12300	0.821	0.996	0.884	
124	122	200	0.5	5	0.2	0	0	0	2100	0	0	0	1213	6170	7036	1776	6034	6097	0.683	1.023	1.154	
125	123	200	0.5	5	0.2	0	0	0	0	1100	0	0	737	3301	3141	949	3429	3517	0.776	0.963	0.893	
126	124	200	0.5	5	0.2	0	0	0	0	0	2100	0	580	580	580	511	491	542	1.137	1.181	1.070	
127	125	200	0.5	5	0.2	0	0	0	0	0	0	20	7610	10654	7975	7668	9134	6864	0.992	1.166	1.162	
128	126	200	0.5	5	0.2	0	0	1000	2100	1100	2100	20	9945	30218	26581	11110	23185	20800	0.895	1.303	1.278	
129	127	200	0.5	5	0.2	0.25	1.5	1000	0	0	0	0	2363	9140	7764	2745	7730	8087	0.861	1.182	0.960	
130	128	200	0.5	5	0.2	0.25	1.5	0	2100	0	0	0	1016	4789	5492	1231	3531	3854	0.825	1.356	1.425	
131	129	200	0.5	5	0.2	0.25	1.5	0	0	1100	0	0	612	2428	2282	685	2043	2239	0.894	1.189	1.019	
132	130	200	0.5	5	0.2	0.25	1.5	0	0	0	2100	0	580	580	580	511	492	549	1.136	1.180	1.056	
133	131	200	0.5	5	0.2	0.25	1.5	0	0	0	0	20	6022	8335	6435	5686	8352	4644	1.059	0.998	1.386	
134	132	200	0.5	5	0.2	0.25	1.5	1000	2100	1100	2100	20	7436	22875	20174	6446	9519	9066	1.153	2.403	2.225	
135	133	200	0.25	4	0.1	0	0	1000	0	0	0	0	14033	66028	61599	16303	58173	55691	0.861	1.135	1.106	
136	134	200	0.25	4	0.1	0	0	0	0	2100	0	0	5291	36807	34461	9238	34469	33324	0.573	1.068	1.034	
137	135	200	0.25	4	0.1	0	0	0	0	1100	0	0	4245	14499	13531	4948	19895	19577	0.858	0.729	0.691	
138	136	200	0.25	4	0.1	0	0	0	0	0	2100	0	1758	1758	1758	1559	1552	1601	1.127	1.133	1.098	
139	137	200	0.25	4	0.1	0	0	0	0	0	0	20	16525	24832	20924	17098	23451	18081	0.966	1.059	1.157	
140	138	200	0.25	4	0.1	0	0	1000	2100	1100	2100	20	33359	130460	119588	35342	102159	95423	0.944	1.277	1.253	
141	139	200	0.25	4	0.1	0.1	1	1000	0	0	0	0	11843	52777	48014	13446	42995	42041	0.881	1.228	1.142	
142	140	200	0.25	4	0.1	0.1	1	0	2100	0	0	0	4589	31237	29371	7188	23713	23311	0.638	1.317	1.260	
143	141	200	0.25	4	0.1	0.1	1	0	0	1100	0	0	3747	8191	14093	3983	13871	13807	0.941	0.591	1.021	
144	142	200	0.25	4	0.1	0.1	1	0	0	0	2100	0	1758	1758	1758	1549	1534	1614	1.135	1.146	1.089	
145	143	200	0.25	4	0.1	0.1	1	0	0	0	0	20	13837	25921	20518	13804	17586	1030				



### Continuity Plots

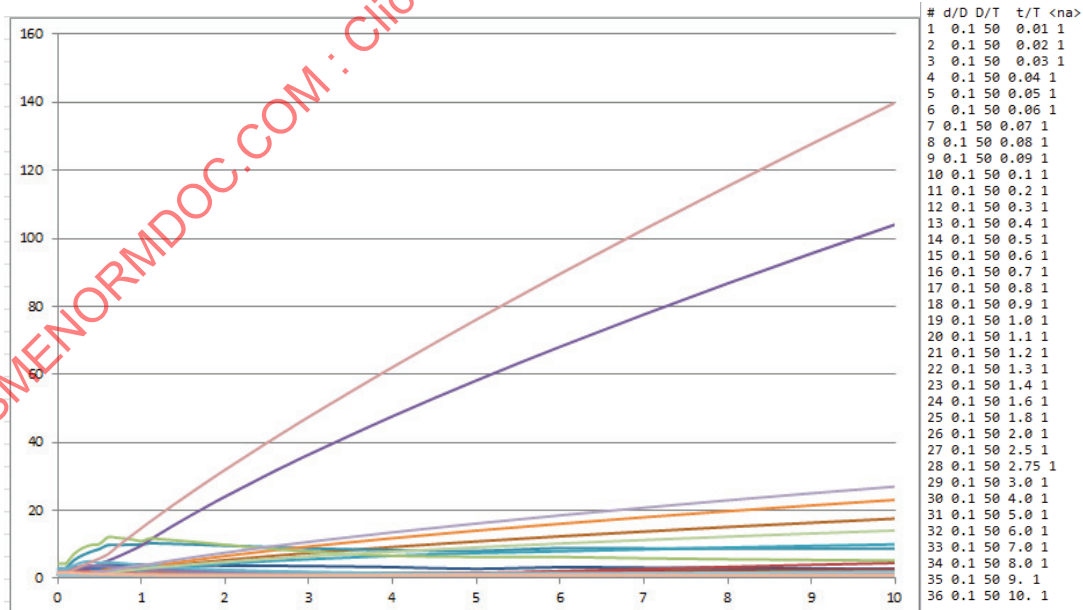
The thirty stress factor equations must each span the parameter range described by the equation limits in 4.5.15.3 (below). Equations for some stress factors were easily found to span the space. Equations for other stress factors did not easily span the parameter space. In these cases, the parameter space was continually subdivided until the desired fit was achieved.

4.5.15.3 These rules are applicable when the nozzle neck thickness is constant within the limits of reinforcement  $L_{rn}$  shown in Figures 4.5.1 and 4.5.2, and when the following parameters are satisfied.

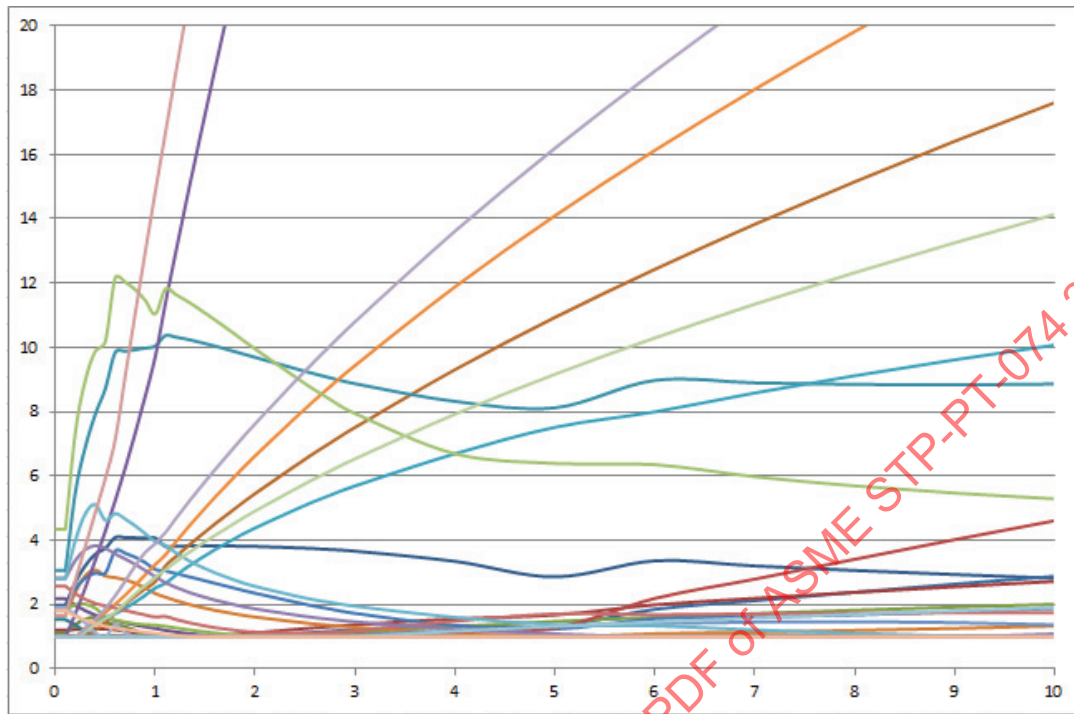
- $7 \leq D_m/T \leq 2500$  (4.5.188)
- $d_m/D_m \leq 0.7$  (4.5.189)
- $0.1 \leq t/T \leq 10$  (4.5.190)
- $7 \leq d_m/t \leq 200$  (4.5.191)
- $L_{rn} = 0$  (see Figures 4.5.1 and 4.5.2) (4.5.192)
- $t_p \leq 1.5T$  (4.5.193)
- $W \geq \min((d_m+t)/2, (RT)^{0.5})$  (4.5.194)
- $(d_m/D_m) (D_m/T)^{0.5} \leq 10$  (4.5.195)

Subdivision of the parameter space was first attempted manually, and then an automated procedure adopted that would continually reduce the space as needed when a regression failed. The plots below were developed to verify that the computerized procedure produced reasonable fits when going from one region to another. In almost all cases, for each of the 30 equations, what is believed to be adequate continuity is observed. The parameter ranges used in each plot are given to the right of each of the plotted results. When the plots extend through a large range, subsequent plots zoom in on smaller areas of the plots to show detail. The first two plots below, for low  $d/D$  and  $D/T$ , show how this procedure works for a particular slice through the three dimensional parameter space.

**Plot 1-1 – Low  $d/D$  and  $D/T$  All Stress Factors as a Function of  $t/T$ ;  $d/D=0.1$ ;  $D/T=50$ ;  $t/T$ =varying**



Plot 1-2 – Same as Plot 1-1 in low SF (stress factor) range



There are 30 equations for different stress factor terms in each plot. The 30 terms are listed below.

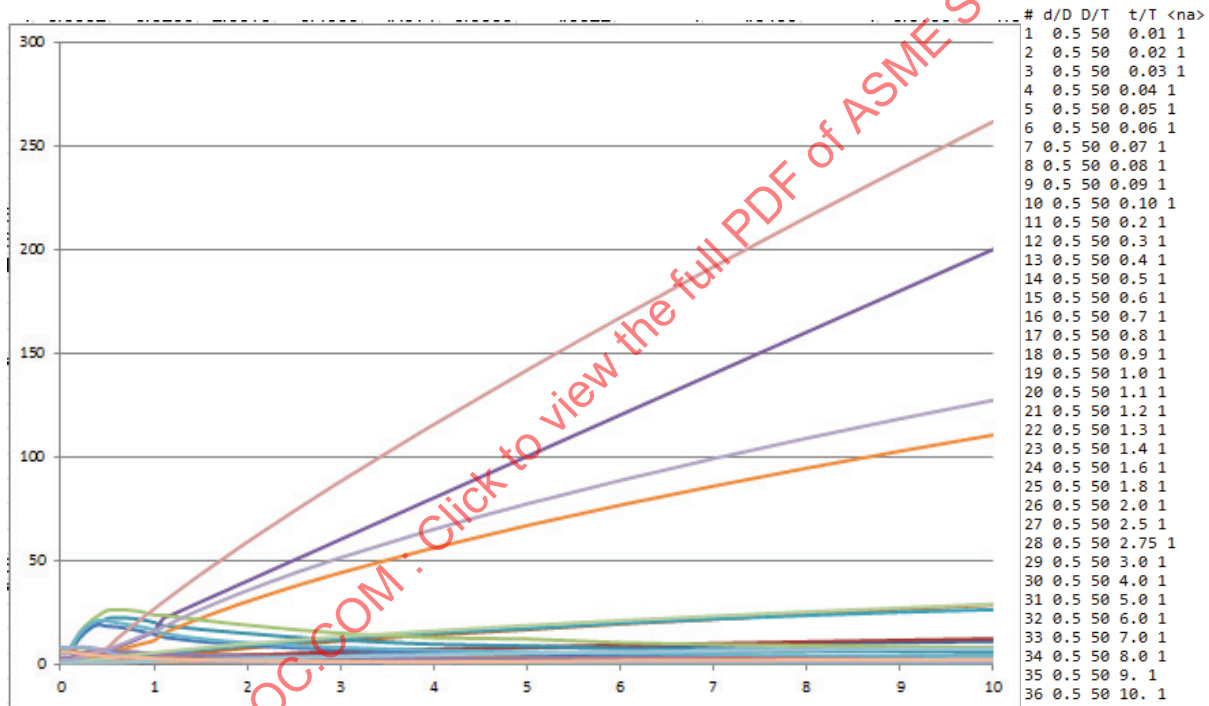
- 1-Membrane stress factor for the branch due to axial load
- 2-Membrane stress factor for the branch due to in-plane moment
- 3-Membrane stress factor for the branch due to out-of-plane moment
- 4-Membrane stress factor for the branch due to torsional moment
- 5-Membrane stress factor for the branch due to pressure
- 6-Membrane stress factor for the run due to axial load
- 7-Membrane stress factor for the run due to in-plane moment
- 8-Membrane stress factor for the run due to out-of-plane moment
- 9-Membrane stress factor for the run due to torsional moment
- 10-Membrane stress factor for the run due to pressure
- 11-Membrane + Bending inside surface stress factor for the branch due to axial load
- 12-Membrane + Bending inside surface stress factor for the branch due to in-plane moment
- 13-Membrane + Bending inside surface stress factor for the branch due to out-of-plane moment
- 14-Membrane + Bending inside surface stress factor for the branch due to torsional moment
- 15-Membrane + Bending inside surface stress factor for the branch due to pressure
- 16-Membrane + Bending inside surface stress factor for the run due to axial load
- 17-Membrane + Bending inside surface stress factor for the run due to in-plane moment
- 18-Membrane + Bending inside surface stress factor for the run due to out-of-plane moment
- 19-Membrane + Bending inside surface stress factor for the run due to torsional moment
- 20-Membrane + Bending inside surface stress factor for the run due to pressure
- 21-Membrane + Bending outside surface stress factor for the branch due to axial load
- 22-Membrane + Bending outside surface stress factor for the branch due to in-plane moment
- 23-Membrane + Bending outside surface stress factor for the branch due to out-of-plane moment
- 24-Membrane + Bending outside surface stress factor for the branch due to torsional moment
- 25-Membrane + Bending outside surface stress factor for the branch due to pressure

- 26-Membrane + Bending outside surface stress factor for the run due to axial load
- 27-Membrane + Bending outside surface stress factor for the run due to in-plane moment
- 28-Membrane + Bending outside surface stress factor for the run due to out-of-plane moment
- 29-Membrane + Bending outside surface stress factor for the run due to torsional moment
- 30-Membrane + Bending outside surface stress factor for the run due to pressure

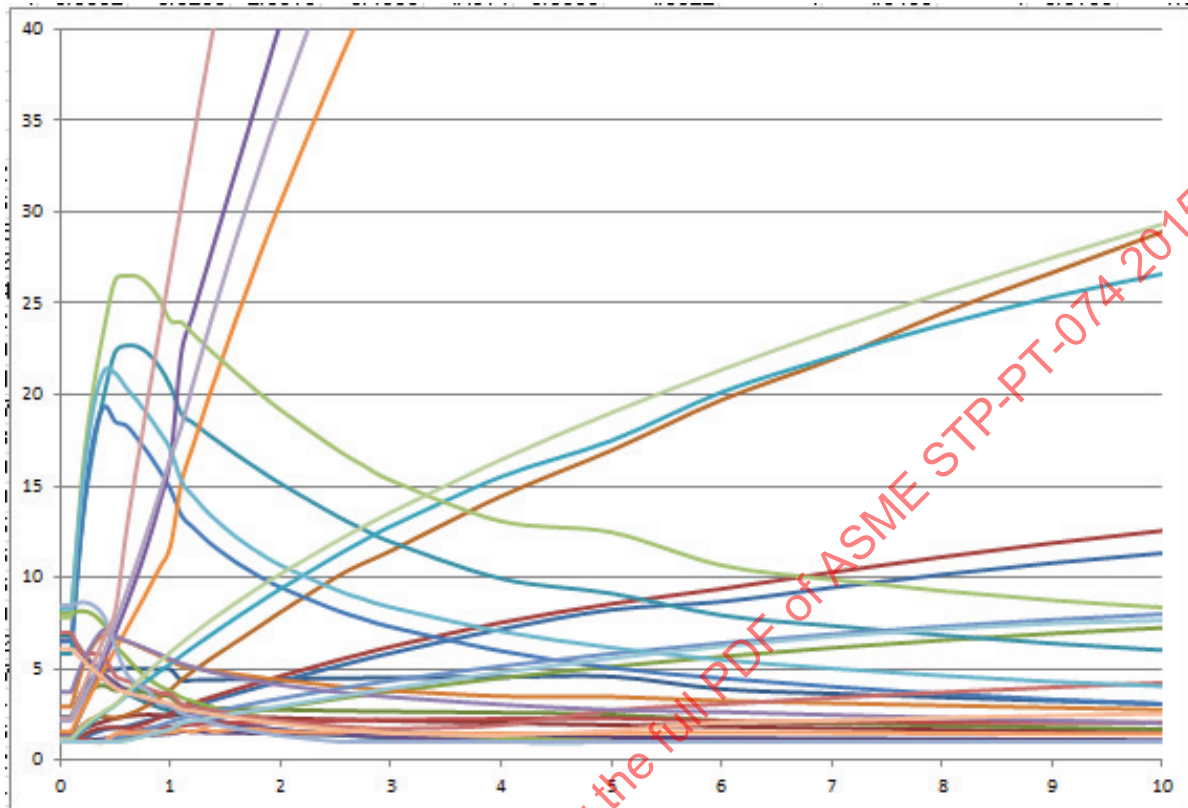
The plots below are intended to demonstrate that there is reasonable continuity between each parameter range. For each of the subsequent plots, two dimensionless parameters are held constant and one varied. The 30 stress factors for the single varying parameter is plotted. Numerical values for each curve can be found by producing any of the coefficients  $C_1$  through  $C_{30}$  in Appendix 2 using the specific parameter range on the right side of each plot.

This approach is used for plots 1-1 through 1-25.

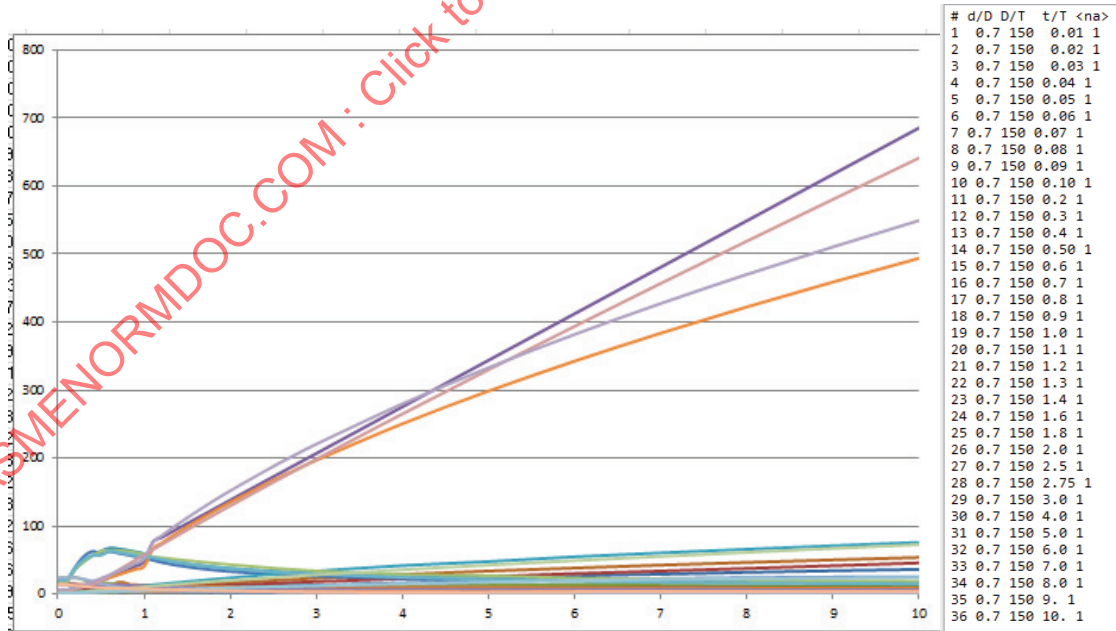
**Plot 1-3 – Varying  $t/T$ ;  $d/D=0.5$ ;  $D/T=50$**



Plot 1-4 – Same as Plot 1-3 in low SF range ( $d/D=0.5$ ;  $D/T=50$ ; varying  $t/T$ )



Plot 1-5 –  $d/D=0.7$ ;  $D/T=150$ ; varying  $t/T$



STP-PT-074: Local Stress in Nozzles, Shells and Formed Heads from External Heads

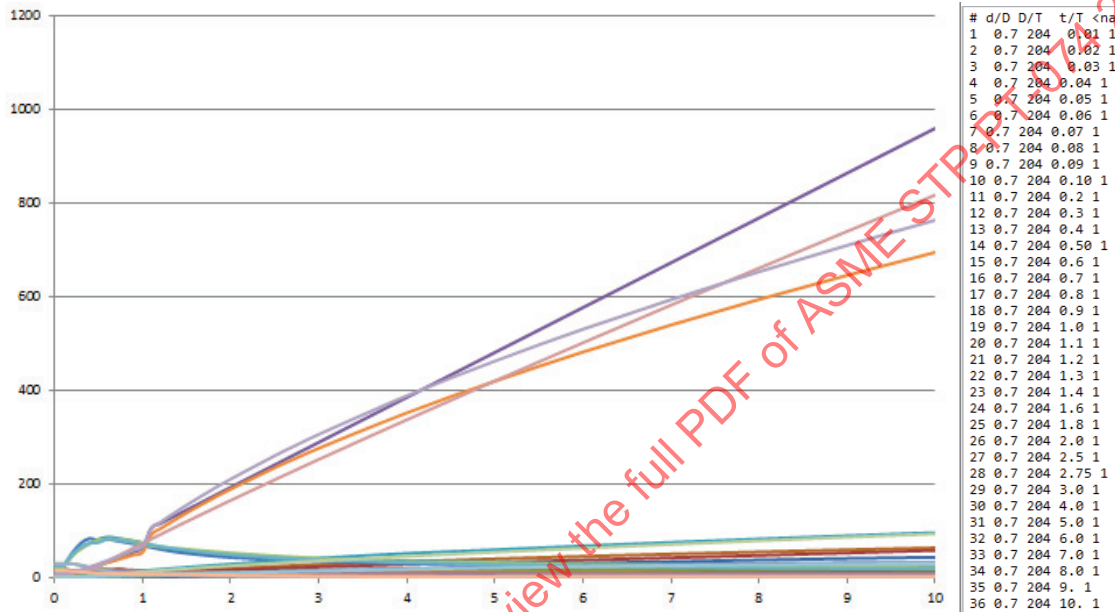
Data for Plots 1-5 through 1-8. t/T given down left. Stress factors for each of the 30 different stress factor equations is given for each value of t/T.

t/T	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z	AA	AB	AC	AD	AE	AF
0.01	5.0492	2.07	5.9625	1.332	15.696	3.6893	1.6661	3.3866	1	15.047	16.895	4.6958	18.354	1.458	23.297	3.9869	1.5495	4.4013	1	14.932	17.3	4.8498	20.565	1.637	24.202	5.0879	1.7836	6.6265	1	14.092
0.02	5.0492	2.07	5.9625	1.332	15.696	3.6893	1.6661	3.3866	1	15.047	16.895	4.6958	18.354	1.458	23.297	3.9869	1.5495	4.4013	1	14.932	17.3	4.8498	20.565	1.637	24.202	5.0879	1.7836	6.6265	1	14.092
0.03	5.0492	2.07	5.9625	1.332	15.696	3.6893	1.6661	3.3866	1	15.047	16.895	4.6958	18.354	1.458	23.297	3.9869	1.5495	4.4013	1	14.932	17.3	4.8498	20.565	1.637	24.202	5.0879	1.7836	6.6265	1	14.092
0.04	5.0492	2.07	5.9625	1.332	15.696	3.6893	1.6661	3.3866	1	15.047	16.895	4.6958	18.354	1.458	23.297	3.9869	1.5495	4.4013	1	14.932	17.3	4.8498	20.565	1.637	24.202	5.0879	1.7836	6.6265	1	14.092
0.05	5.0492	2.07	5.9625	1.332	15.696	3.6893	1.6661	3.3866	1	15.047	16.895	4.6958	18.354	1.458	23.297	3.9869	1.5495	4.4013	1	14.932	17.3	4.8498	20.565	1.637	24.202	5.0879	1.7836	6.6265	1	14.092
0.06	5.0492	2.07	5.9625	1.332	15.696	3.6893	1.6661	3.3866	1	15.047	16.895	4.6958	18.354	1.458	23.297	3.9869	1.5495	4.4013	1	14.932	17.3	4.8498	20.565	1.637	24.202	5.0879	1.7836	6.6265	1	14.092
0.07	5.0492	2.07	5.9625	1.332	15.696	3.6893	1.6661	3.3866	1	15.047	16.895	4.6958	18.354	1.458	23.297	3.9869	1.5495	4.4013	1	14.932	17.3	4.8498	20.565	1.637	24.202	5.0879	1.7836	6.6265	1	14.092
0.08	5.0492	2.07	5.9625	1.332	15.696	3.6893	1.6661	3.3866	1	15.047	16.895	4.6958	18.354	1.458	23.297	3.9869	1.5495	4.4013	1	14.932	17.3	4.8498	20.565	1.637	24.202	5.0879	1.7836	6.6265	1	14.092
0.09	5.0492	2.07	5.9625	1.332	15.696	3.6893	1.6661	3.3866	1	15.047	16.895	4.6958	18.354	1.458	23.297	3.9869	1.5495	4.4013	1	14.932	17.3	4.8498	20.565	1.637	24.202	5.0879	1.7836	6.6265	1	14.092
0.1	5.0492	2.07	5.9625	1.332	15.696	3.6893	1.6661	3.3866	1	15.047	16.895	4.6958	18.354	1.458	23.297	3.9869	1.5495	4.4013	1	14.932	17.3	4.8498	20.565	1.637	24.202	5.0879	1.7836	6.6265	1	14.092
0.2	8.5019	3.219	9.4901	1.936	14.125	6.1252	2.9272	5.5362	1.2587	13.376	36.769	9.5142	39.891	2.791	24.52	7.9796	2.8871	8.4337	1.4323	14.636	36.603	10.001	38.59	1	24.341	7.8505	2.7267	10.0231	1.4228	12.791
0.3	10.355	4.163	11.159	2.379	12.597	7.6734	3.8504	6.5178	1.7307	11.831	48.458	12.147	55.624	3.894	21.356	11.9989	4.1503	12.4773	2.0667	13.947	48.146	11.242	50.7	1	22.221	11.2932	3.4942	14.0319	1.853	11.531
0.4	11.275	4.908	11.58	2.742	11.067	8.3317	4.4349	6.6991	2.1565	10.41	56.78	13.568	62.94	4.87	17.103	16.0873	5.2632	16.5012	2.6429	12.291	56.449	11.958	56.898	2.331	19.019	15.2682	4.1776	18.4984	2.3198	10.231
0.5	11.4	5.455	10.813	3.055	9.5054	7.7638	4.3847	6.1057	2.551	9.112	63.252	14.006	59.119	5.76	18.045	20.3136	6.1605	20.5072	3.2207	10.066	62.956	13.532	57.188	4.328	15.161	19.6928	4.8098	23.3394	2.7979	9.0625
0.6	10.985	5.808	11.765	3.333	6.7183	10.798	4.7639	6.4596	2.9221	7.6354	67.766	14.732	62.69	5.989	15.71	24.7768	7.3087	24.5102	5.636	9.3039	64.503	14.103	63.688	4.687	12.92	27.4452	6.2634	28.5013	3.2872	8.8031
0.7	10.862	5.967	11.449	3.585	6.0782	17.358	4.9367	6.5396	3.2749	6.9579	66.661	14.414	60.403	6.166	13.809	29.6091	8.4327	28.5301	3.2573	9.0509	64.259	13.723	61.707	4.809	10.802	35.1866	7.4513	33.9465	3.7877	8.3452
0.8	10.742	5.933	11.168	3.817	5.5713	15.644	5.1477	6.74	3.6127	6.4333	64.738	14.081	57.952	6.262	12.695	34.9791	9.5406	32.587	5.6175	9.3097	63.045	13.278	59.481	4.861	9.0803	42.8291	8.5923	39.6464	4.2992	7.9612
0.9	10.627	5.707	10.924	4.032	5.1576	8.6652	5.3871	7.0606	3.938	6.0142	62.213	13.734	55.343	6.279	11.258	41.0941	10.834	36.6974	3.2938	8.9778	60.861	12.767	57.01	4.854	7.7552	50.3861	9.6937	45.5788	4.8215	7.6311
1	10.519	5.29	10.716	4.234	4.812	8.9255	5.6486	7.5014	4.2525	5.6714	59.226	13.145	52.578	6.22	8.4455	48.2025	12.423	40.8705	5.7019	8.5405	57.711	12.335	54.294	4.793	6.9243	57.868	10.761	51.7257	5.3547	7.3421
1.1	10.527	6.219	10.875	4.381	4.518	9.5426	6.6355	8.1712	4.8136	5.3093	53.576	12.832	49.955	6.233	8.5088	76.311	13.823	66.224	5.5299	7.9739	54.987	11.286	53.752	4.692	6.2325	65.2829	11.799	76.1739	6.1317	7.242
1.2	10.671	6.241	10.898	4.298	4.2639	10.459	7.037	8.7641	5.1257	4.9964	50.869	12.394	46.874	6.218	7.9326	83.2092	14.991	74.8244	5.93	7.6544	53.551	10.794	51.021	4.497	5.7051	72.6375	12.81	85.6798	6.4805	6.9262
1.3	10.804	6.263	10.923	4.222	4.0417	11.341	7.4125	9.3517	5.4288	4.7197	48.508	12.041	44.265	6.202	7.3975	90.1042	16.152	83.1253	6.3271	7.3431	52.151	10.364	48.631	4.726	5.257	79.9373	13.798	94.8536	6.826	6.6208
1.4	10.926	6.283	10.95	4.151	3.8451	12.193	7.7685	9.9335	5.7234	4.4716	46.43	11.75	42.026	6.185	6.9034	96.9965	17.304	91.1575	6.721	7.0402	50.788	9.9835	46.518	4.493	4.8716	87.1868	14.765	103.731	7.169	6.3255
1.6	11.148	6.322	11.008	4.025	3.5116	13.82	8.4402	11.079	6.2899	4.0408	42.942	11.295	38.383	6.148	6.037	110.774	19.579	106.52	7.4992	6.4598	48.172	9.3446	42.941	4.613	4.2422	101.55	16.643	120.712	7.8473	5.7659
1.8	11.343	6.359	11.072	3.913	3.2381	15.358	9.0787	12.2	6.8292	3.6753	40.132	10.954	35.544	6.111	5.332	124.542	21.806	121.082	8.2644	5.9143	45.704	8.8312	40.014	4.537	3.7498	115.753	18.455	136.81	8.5153	5.2475
2	11.518	6.392	11.14	3.813	3.0083	16.82	9.7002	13.293	7.3444	3.3583	37.826	10.686	33.27	6.074	4.7876	138.302	23.981	134.967	9.0162	5.4046	43.385	8.413	37.566	4.284	3.3539	129.814	20.211	152.161	9.1726	4.7706
2.5	11.888	6.464	11.328	3.603	2.5628	20.214	11.24	15.904	8.5413	2.7196	33.577	10.211	29.168	5.992	4.1258	172.673	29.155	167.293	10.835	4.2928	38.25	7.6623	32.864	4.05	2.6357	164.444	24.401	187.907	10.768	3.7606
2.75	12.046	6.492	11.429	3.514	2.3877	21.797	12.023	17.139	9.0975	2.4642	32.022	10.043	27.673	5.958	2.9126	189.844	31.587	182.41	11.712	3.8267	36.041	7.4005	31.039	4.211	2.3726	181.519	26.406	204.626	11.538	3.3538
3	12.191	6.516	11.532	3.432	2.2348	23.315	12.823	18.326	9.629	2.2439	30.739	9.9071	26.426	5.931	2.6914	207.008	33.907	196.951	12.565	3.4226	34.074	7.1943	29.462	3.834	2.1524	198.454	28.359	220.709	12.29	3.0127
4	12.668	6.566	11.953	3.163	1.7702	28.889	16.254	22.563	11.545	1.6615	27.432	9.6121	22.368	5.893	2.0468	275.595	41.968	250.53	15.739	2.4511	28.641	6.7533	24.797	3.471	1.5416	265.031	35.762	279.981	15.104	2.3097
5	13.039	6.54	12.336	2.955	1.4442	33.866	20.113	25.332	13.186	1.4972	25.895	9.6306	20.818	5.966	1.627	344.096	47.897	298.617	18.508	2.5668	27.149	6.6978	21.693	3.135	1.1707	330.115	42.656	333.19	17.585	2.6687
6	11.117	6.435	12.854	2.786	1.1935	38.412	26.508	30.207	14.61	1.8361	22.283	9.4358	20.732	5.847	1.2474	412.527	54.919	342.736	20.847	3.3096	23.395	6.9078	18.987	3.307	1	394.033	49.17	382.017	19.71	3.1597
7	10.786	6.2																												

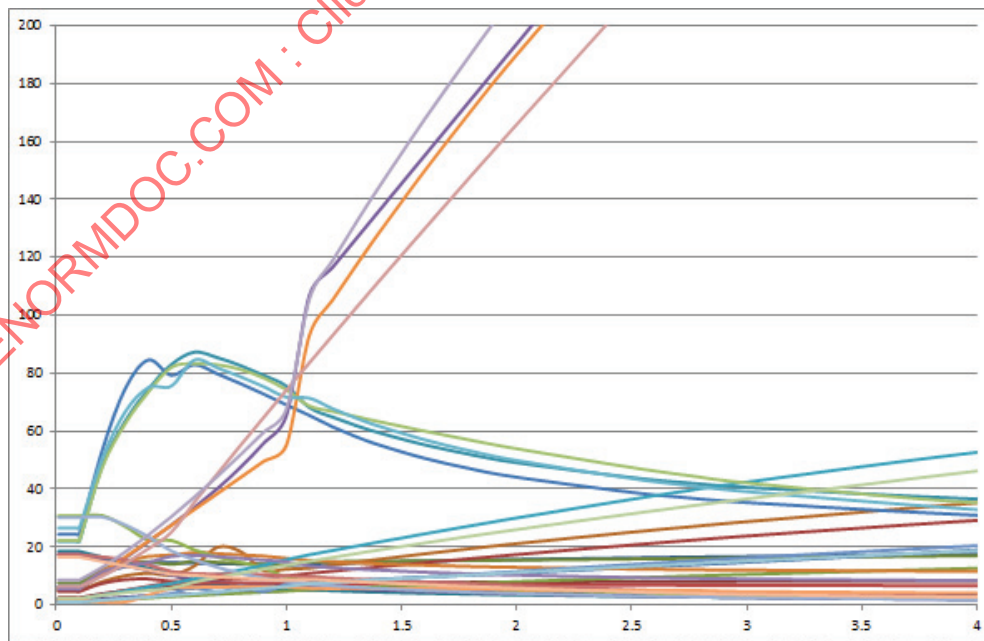


Similar results can be developed for other parameter ranges so that stress factors can be plotted as they move from region to region through the parameter space along double constant parameters in  $d/D$ ,  $D/T$  and  $t/T$  space. The stress factors should be compatible as they leave one region and enter the next adjacent region. The plots below are graphical representations of the compatibility. If readers are interested in numerical comparisons for any of the stress factor plots below, the parameter values in the tables to the right can be used with the  $C_1$  through  $C_{30}$  algorithm in Appendix 2 to produce tables like the one shown on the previous page. Plots 1-9 through 1-25 are intended to provide a visual validation only.

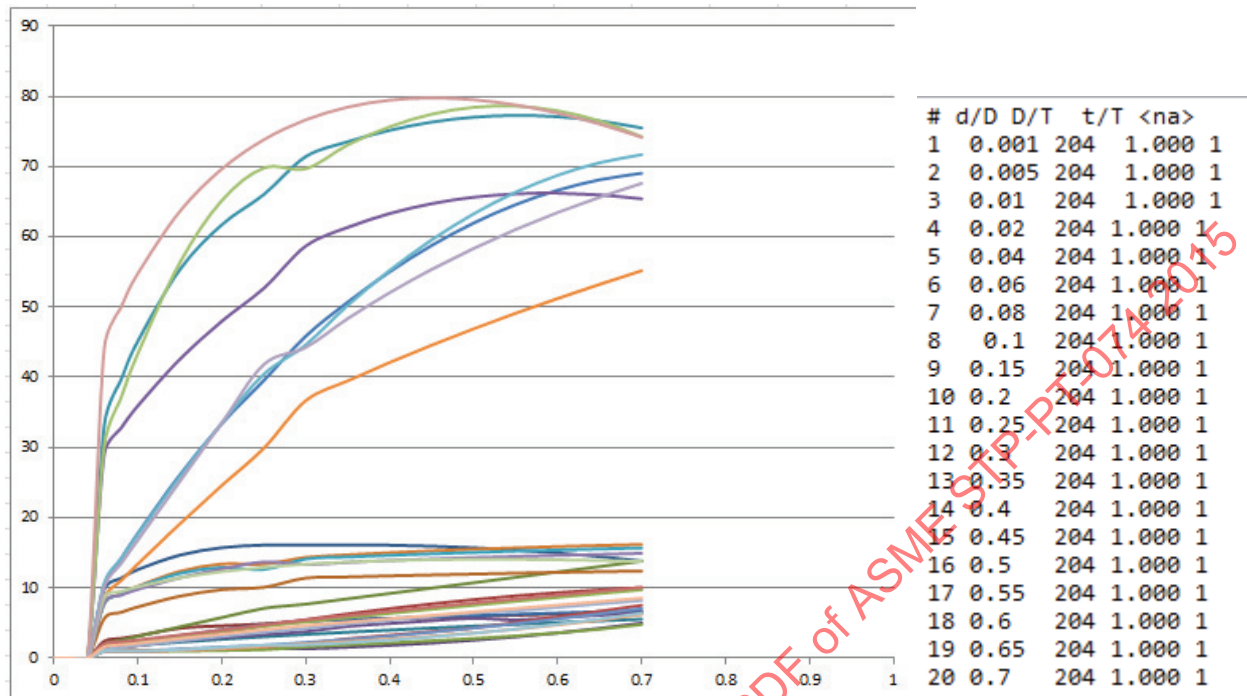
**Plot 1-9 – Results at the maximum lambda range ( $d/D=0.7$ ;  $D/T=204$ ;  $t/T$ =varying)**



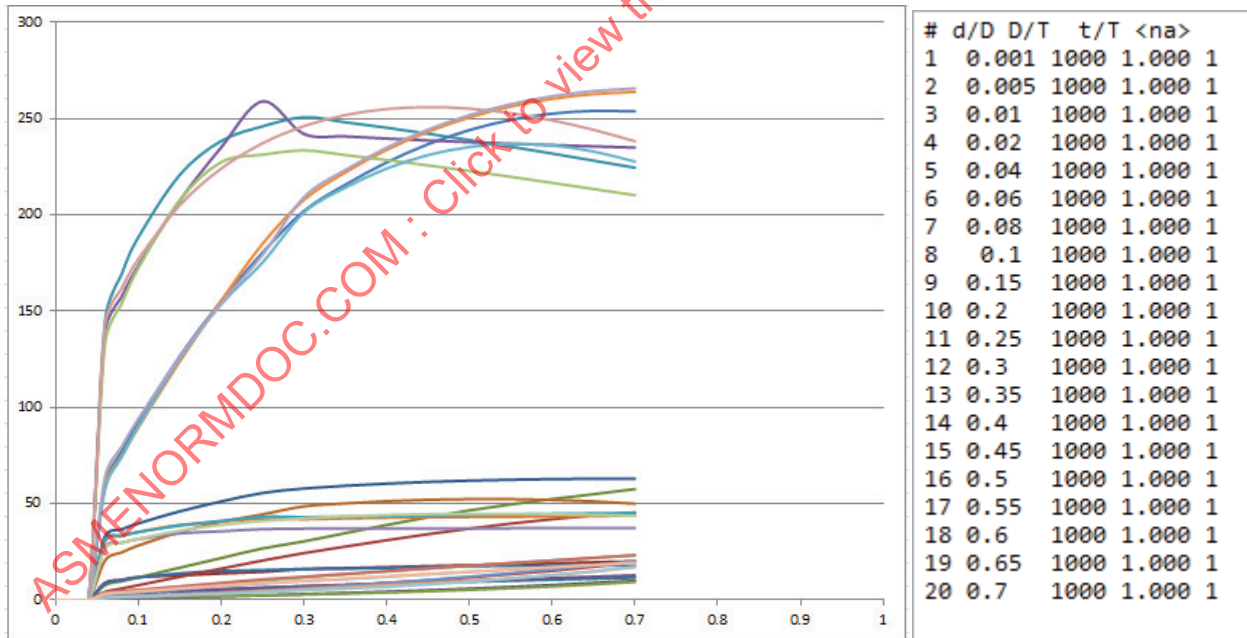
**Plot 1-10 – Close up view of Plot 1-9**



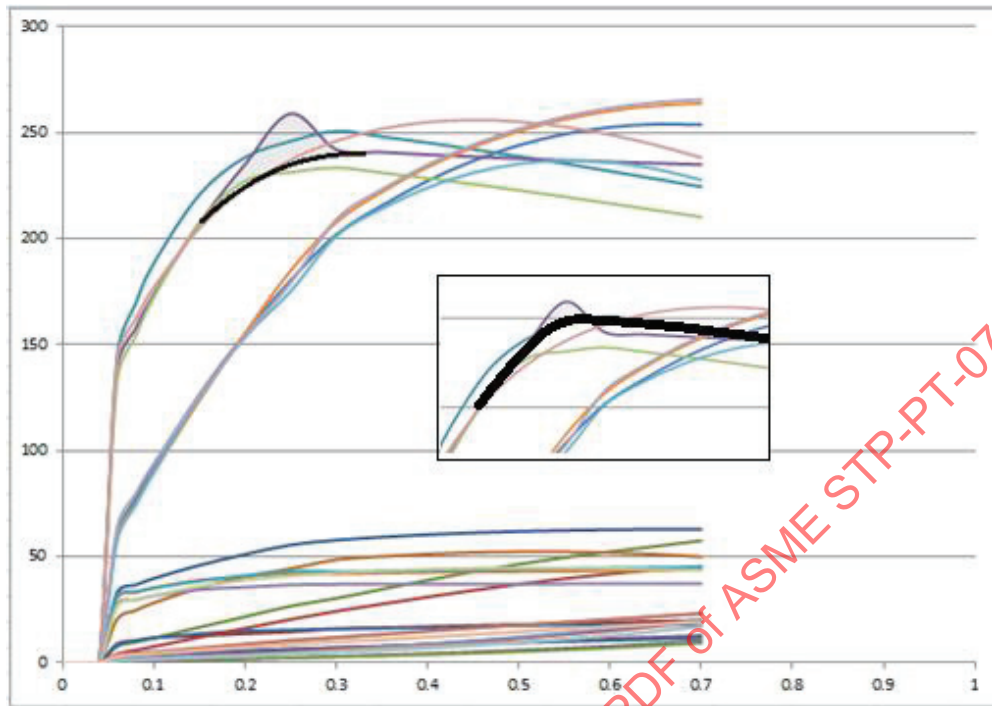
Plot 1-11 – Varying d/D – Fixed value of D/T =204 and t/T=1



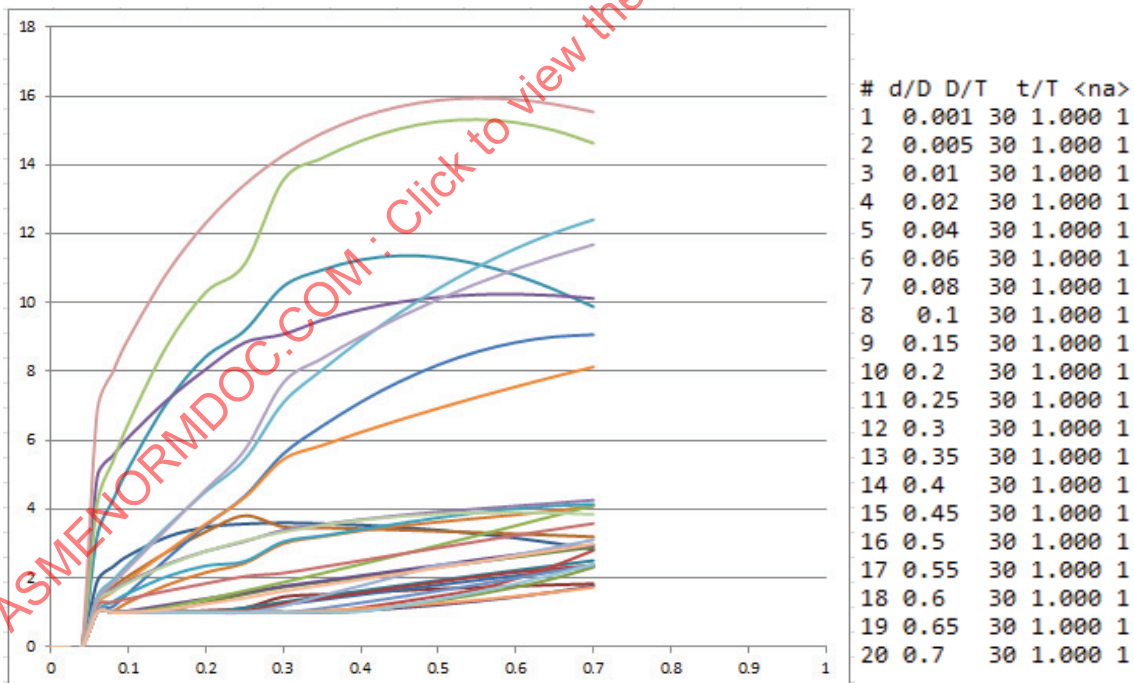
Plot 1-12 – Varying d/D – Fixed value of D/T=1000 and t/T=1



Plot 1-13 – The light grey area shows likely conservative overshoot in area between two regions.

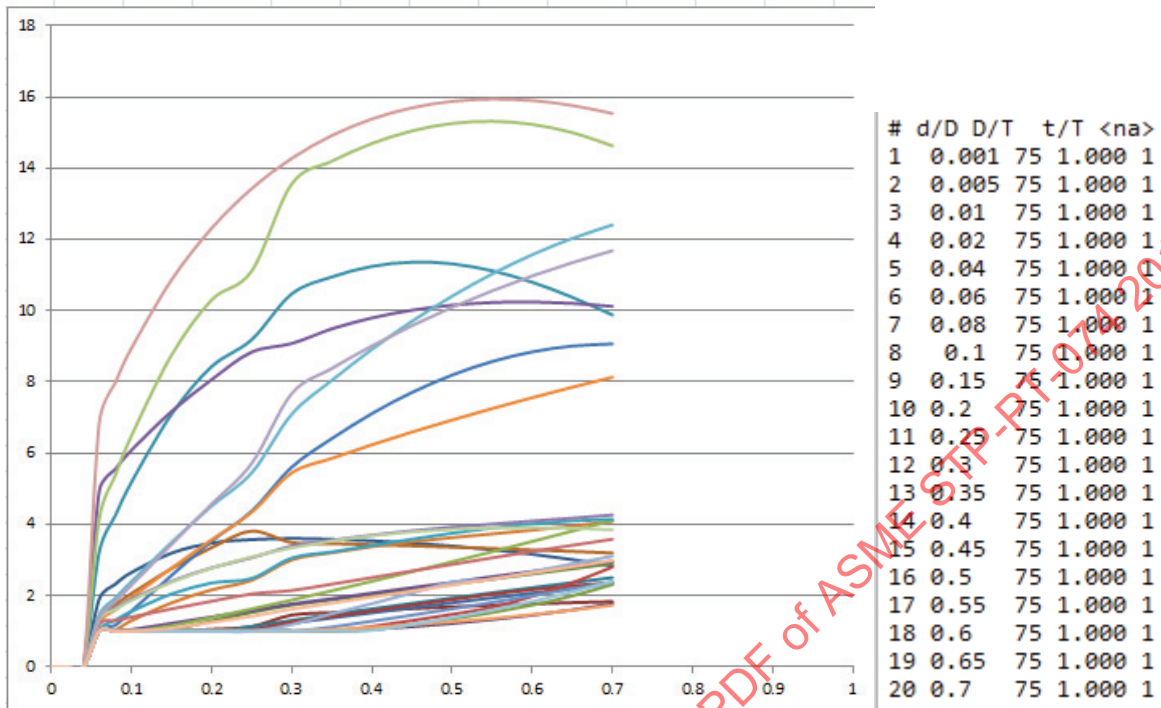


Plot 1-14 – Varying d/D; D/T=30; t/T=1.0

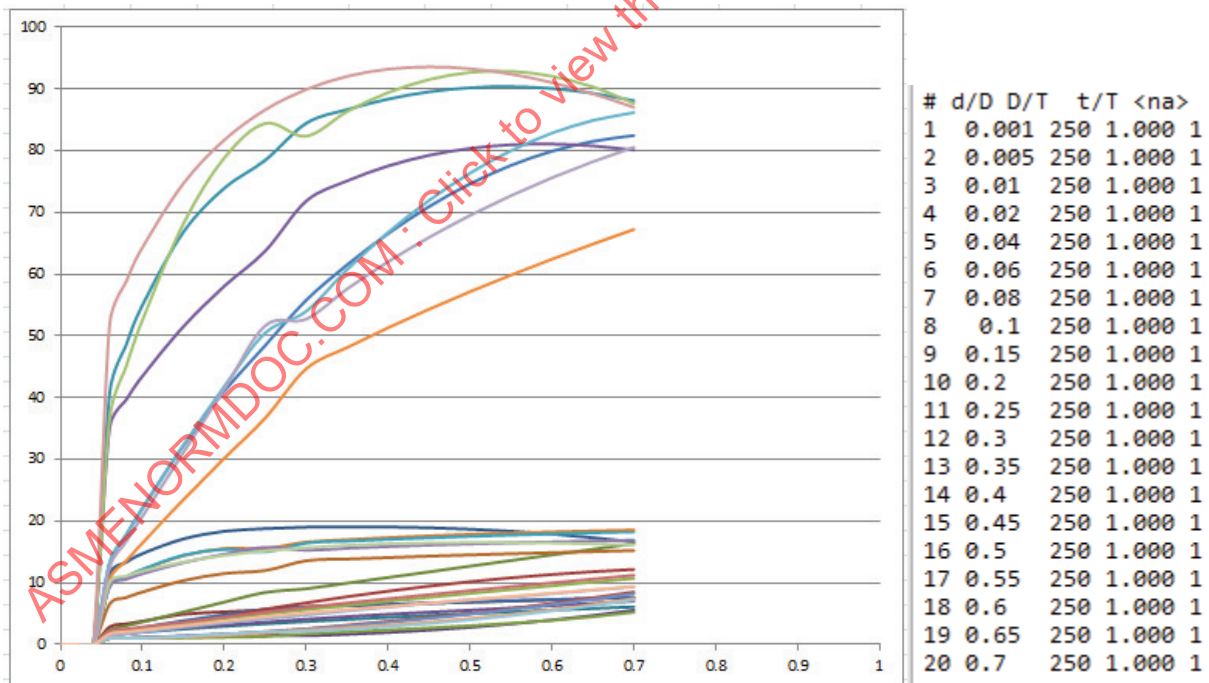


(The small waviness in several of the plots suggests that some slight incompatibility along the line described by the 20 parameters given to the right of the plot. This is not considered significant and suggests there might be a 10% error due to the observed incompatibility.)

Plot 1-15 – Varying d/D; D/T=75; t/T=1

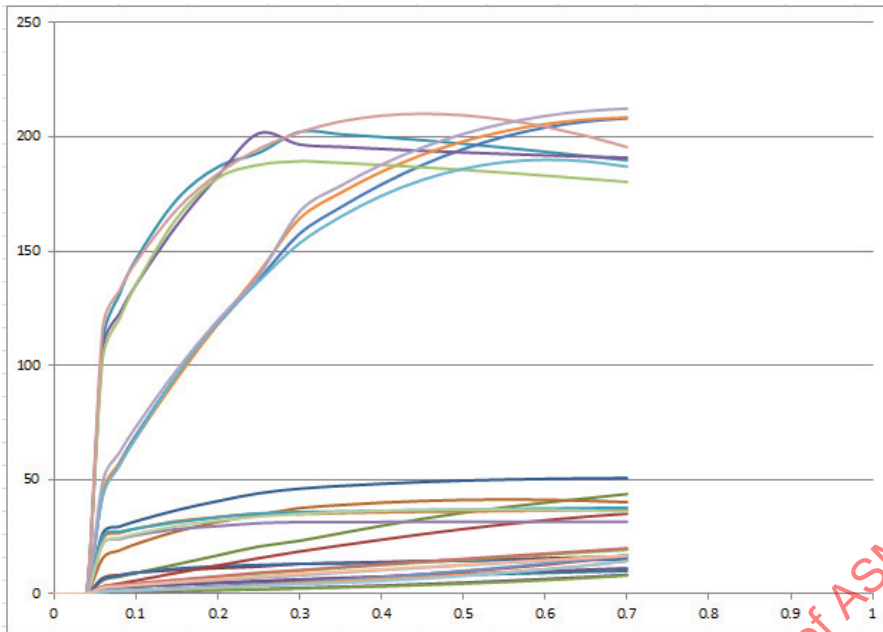


Plot 1-16 – Varying d/D; D/T=250; t/T=1.0



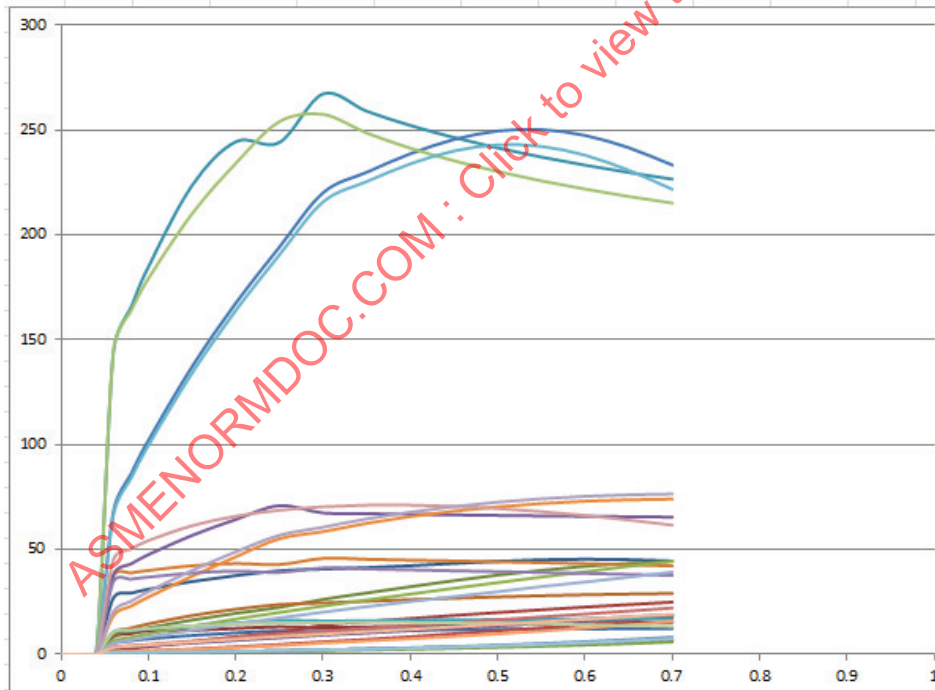


Plot 1-17 – Varying d/D; D/T=750; t/T=1.0



#	d/D	D/T	t/T	<na>
1	0.001	750	1.000	1
2	0.005	750	1.000	1
3	0.01	750	1.000	1
4	0.02	750	1.000	1
5	0.04	750	1.000	1
6	0.06	750	1.000	1
7	0.08	750	1.000	1
8	0.1	750	1.000	1
9	0.15	750	1.000	1
10	0.2	750	1.000	1
11	0.25	750	1.000	1
12	0.3	750	1.000	1
13	0.35	750	1.000	1
14	0.4	750	1.000	1
15	0.45	750	1.000	1
16	0.5	750	1.000	1
17	0.55	750	1.000	1
18	0.6	750	1.000	1
19	0.65	750	1.000	1
20	0.7	750	1.000	1

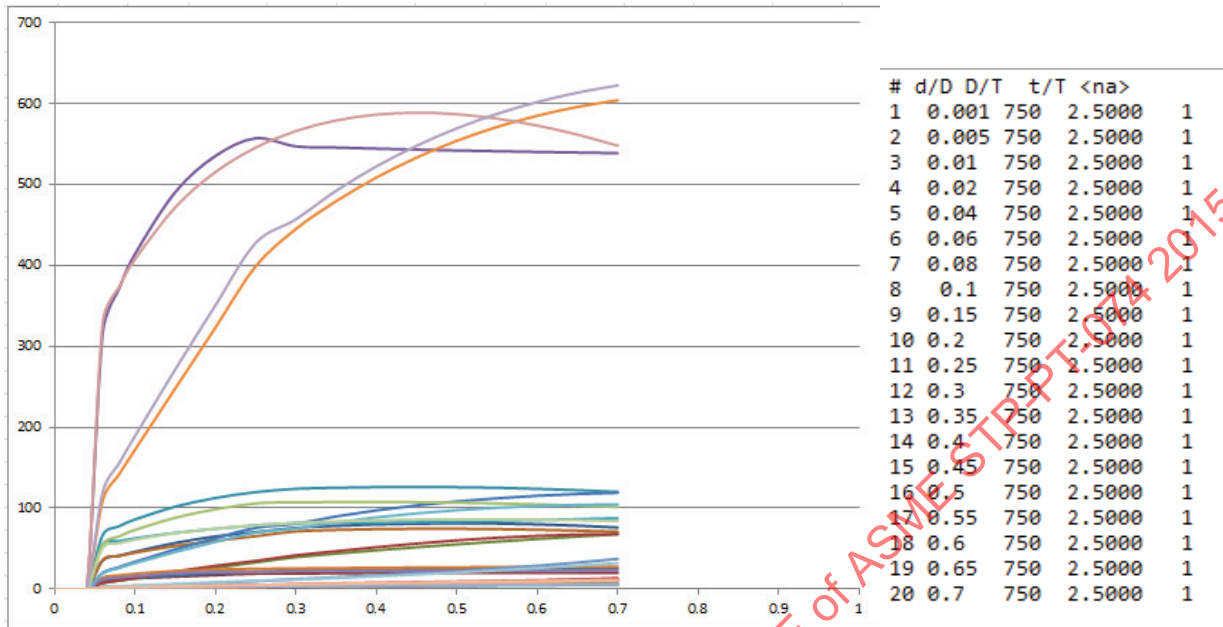
Plot 1-18 Varying d/D; D/T=750; t/T=0.5



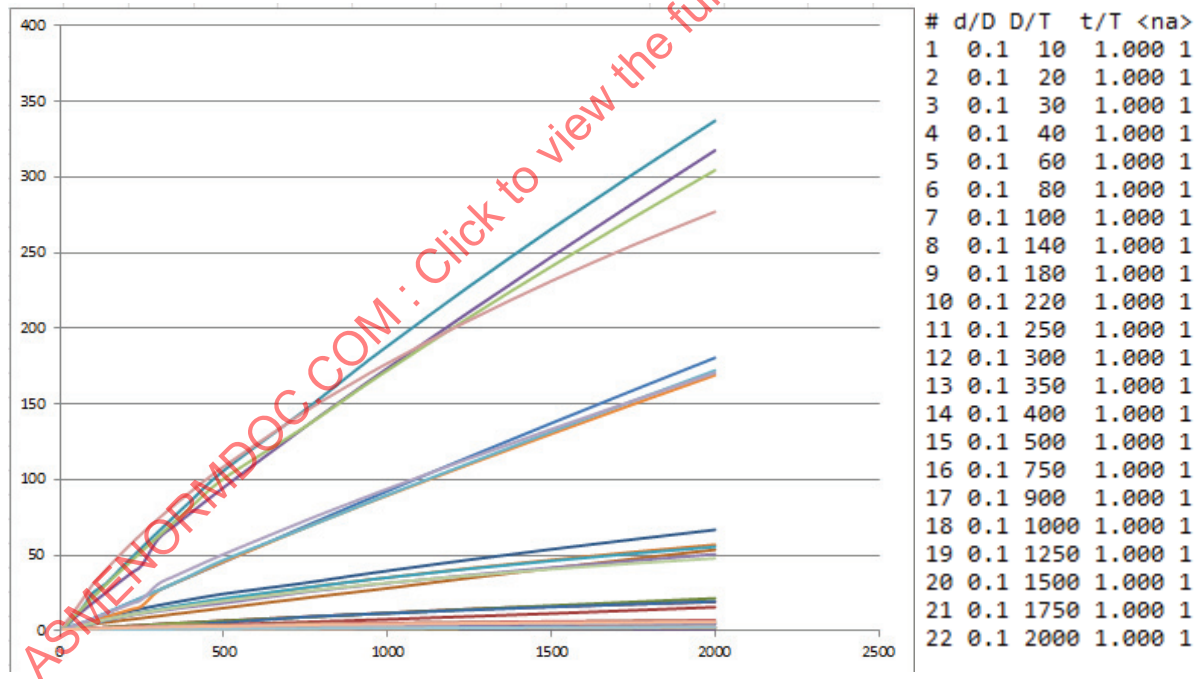
#	d/D	D/T	t/T	<na>
1	0.001	750	0.5000	1
2	0.005	750	0.5000	1
3	0.01	750	0.5000	1
4	0.02	750	0.5000	1
5	0.04	750	0.5000	1
6	0.06	750	0.5000	1
7	0.08	750	0.5000	1
8	0.1	750	0.5000	1
9	0.15	750	0.5000	1
10	0.2	750	0.5000	1
11	0.25	750	0.5000	1
12	0.3	750	0.5000	1
13	0.35	750	0.5000	1
14	0.4	750	0.5000	1
15	0.45	750	0.5000	1
16	0.5	750	0.5000	1
17	0.55	750	0.5000	1
18	0.6	750	0.5000	1
19	0.65	750	0.5000	1
20	0.7	750	0.5000	1



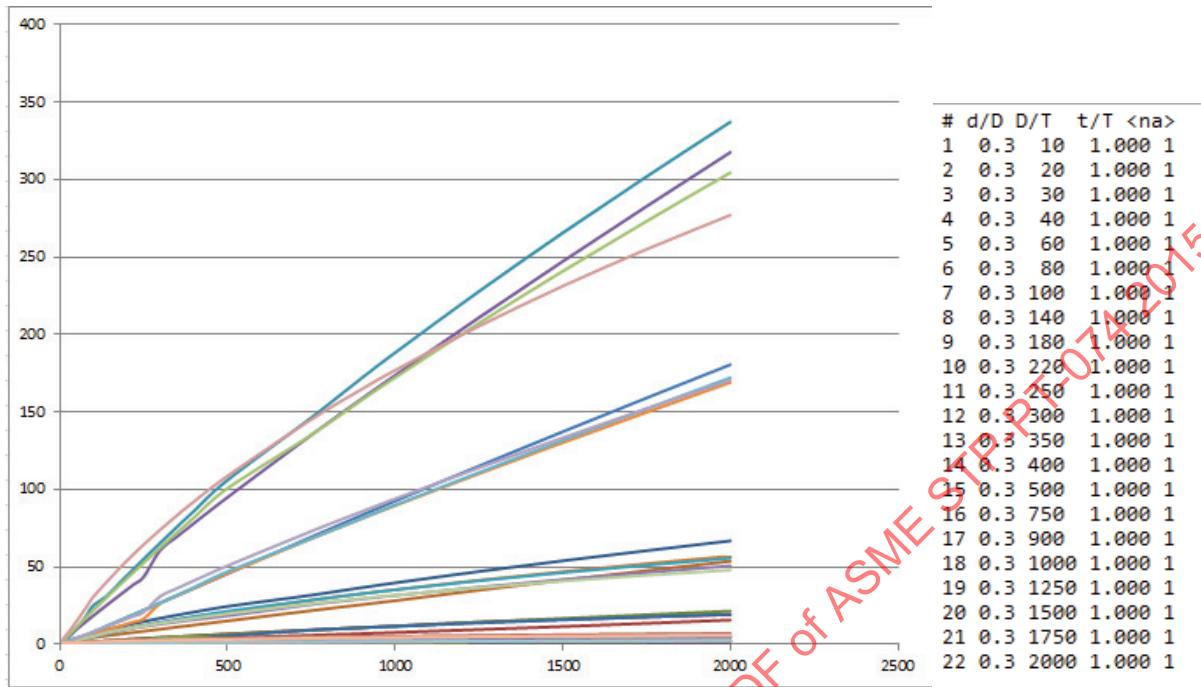
Plot 1-19 – Varying d/D; D/T=750; t/T=2.5



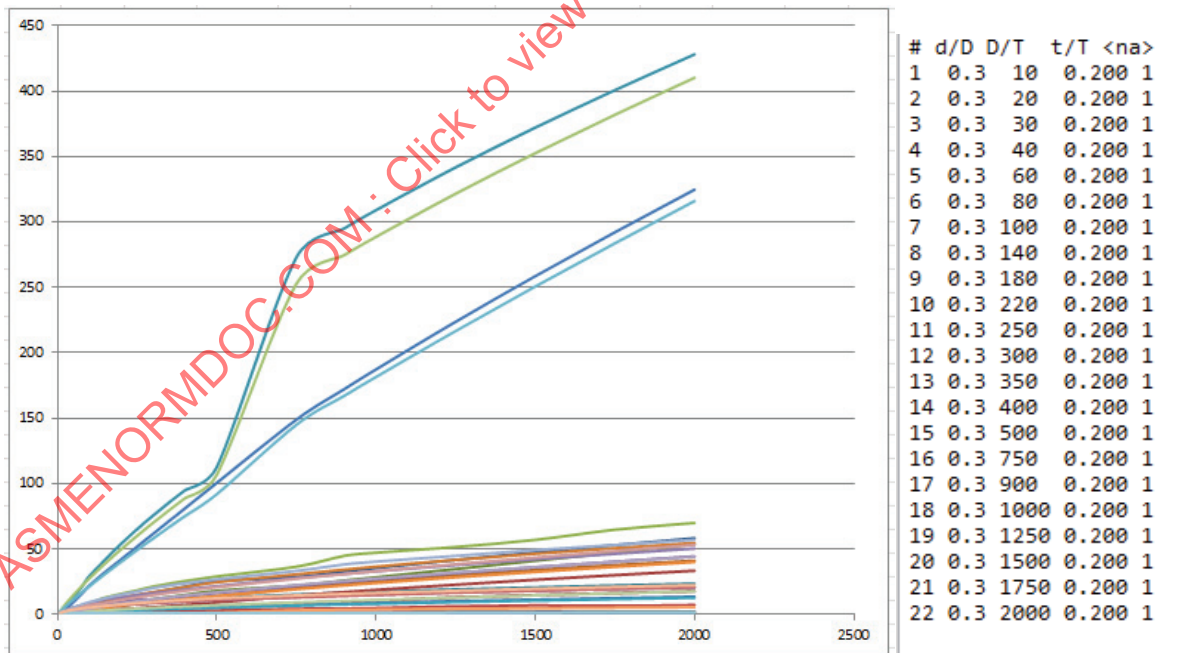
Plot 1-20 – Varying D/T; d/D=0.1; t/T=1.0



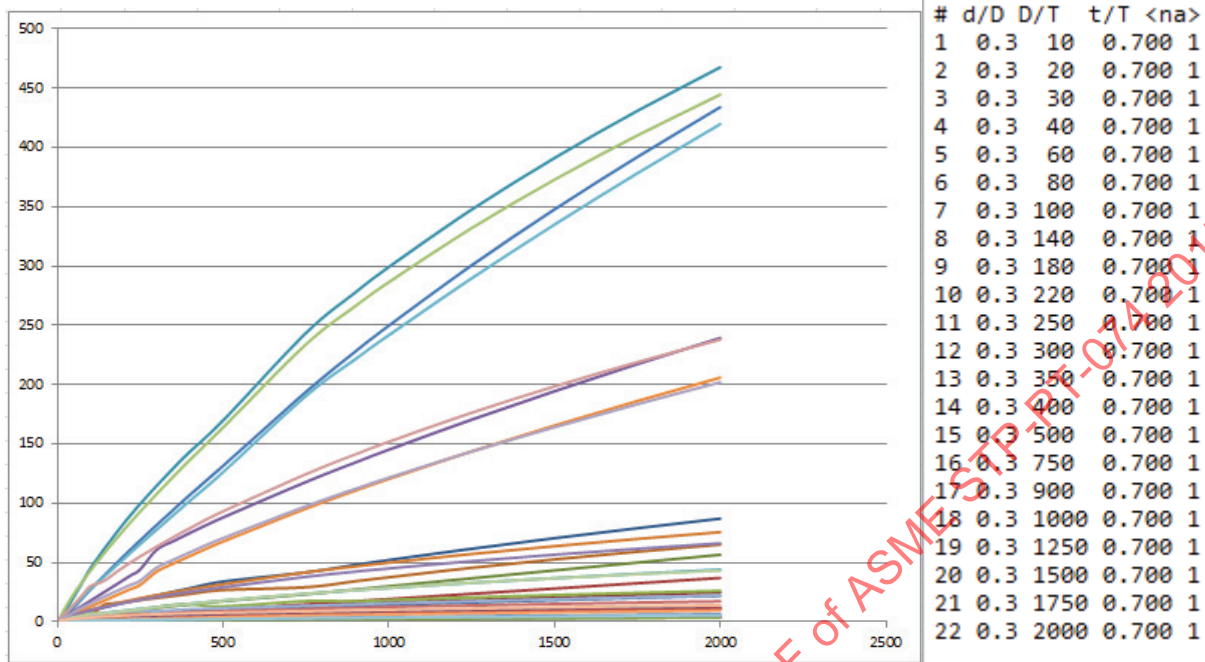
Plot 1-21 – Varying D/T; d/D=0.3; t/T=1.0



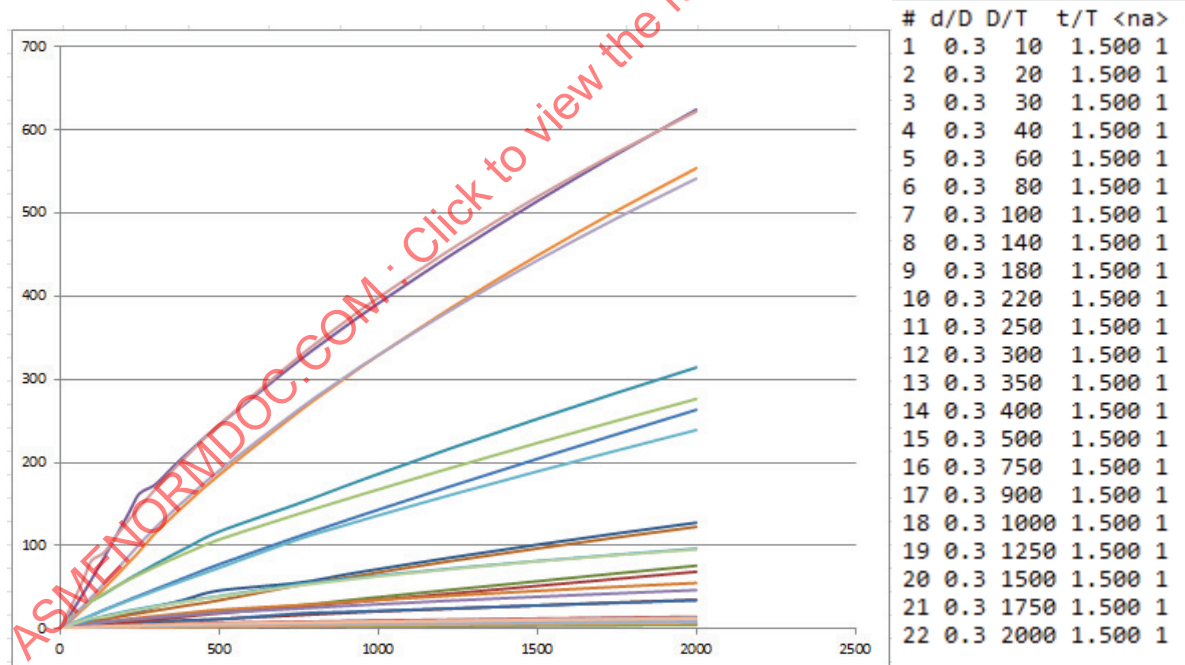
Plot 1-22 – Varying D/T; d/D=0.3; t/T=0.2



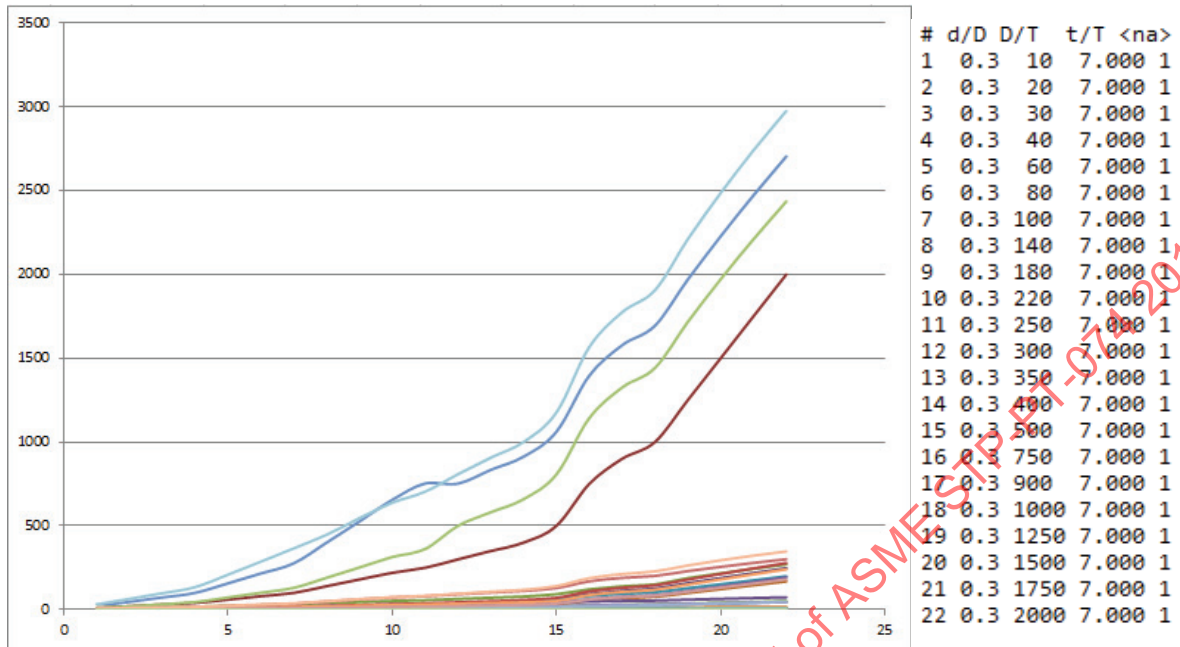
Plot 1-23 – Varying D/T; d/D=0.3; t/T=0.7



Plot 1-24 – Varying D/T; d/D=0.3; t/T=1.5



Plot 1-25 – Varying D/T; d/D=0.3; t/T=7.0



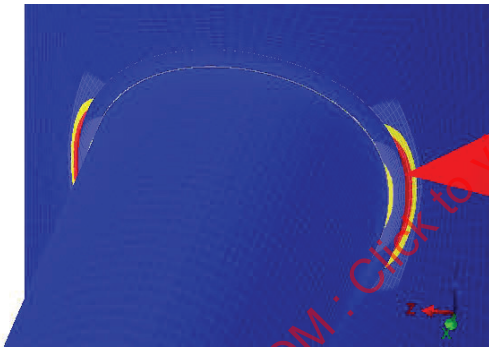
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**Pad Reinforced Model Check Subset**

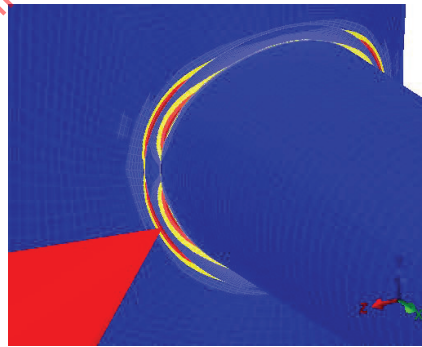
A subset of pad reinforced model checks is shown in this section.

**Pad Table 1 – Model Definition**

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
1													Est		Use
2			D/T	d/D	t/T	D	T	Do	t	d	do	tp	PadW	Root (RT)	PadW
3	1		20	0.2	1	100	5	105	5	20	25	5	10	15.81139	10
4	2		50	0.2	1	100	2	102	2	20	22	2	10	10	10
5	3		100	0.2	1	100	1	101	1	20	21	1	10	7.071068	7.07107
6	4		500	0.2	1	100	0.2	100.2	0.2	20	20.2	0.2	10	3.162278	3.16228
7	5		20	0.55	1	100	5	105	5	55	60	5	27.5	15.81139	15.8114
8	6		50	0.55	1	100	2	102	2	55	57	2	27.5	10	10
9	7		100	0.55	1	100	1	101	1	55	56	1	27.5	7.071068	7.07107
10	8		500	0.55	1	100	0.2	100.2	0.2	55	55.2	0.2	27.5	3.162278	3.16228
11	9		20	0.2	3	100	5	105	15	20	35	5	10	15.81139	10
12	10		50	0.2	3	100	2	102	6	20	26	2	10	10	10
13	11		100	0.2	3	100	1	101	3	20	23	1	10	7.071068	7.07107
14	12		500	0.2	3	100	0.2	100.2	0.6	20	20.6	0.2	10	3.162278	3.16228
15	13		20	0.55	3	100	5	105	15	55	70	5	27.5	15.81139	15.8114
16	14		50	0.55	3	100	2	102	6	55	61	2	27.5	10	10
17	15		100	0.55	3	100	1	101	3	55	58	1	27.5	7.071068	7.07107
18	16		500	0.55	3	100	0.2	100.2	0.6	55	55.6	0.2	27.5	3.162278	3.16228
19	Use SCF=2 in NP runs to get Stress Factors instead of Stress Intensification Factors														



**Stress Distribution due to Axial Load  
Model #16**

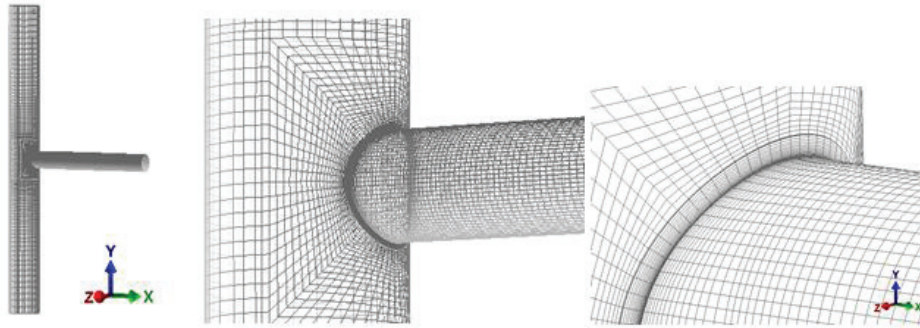


**Stress Distribution due to In-Plane Moment  
Model #16**

The maximum stress factor (Coefficients  $C_1$ - $C_{30}$  used in Eqs. 4.5.201 through 4.5.209) for membrane and surface stresses are collected in the following table. SFm(ax), for example, is the maximum membrane stress factor due to an axial load. This is the maximum of the coefficients  $C_1$  or  $C_6$ .



Typical Finite Element Mesh of Pad Reinforced Geometry



Maximum Stress Factors for Membrane and Surface Stresses from 07-10 Correlations

Do	T	do	t	tp	Wp	SFm(Ax)	SFm(Mi)	SFm(Mo)	SFm(Mt)	SFm(Pr)	SF(Ax)	SF(Mi)	SF(Mo)	SF(Tor)	SF(Pr)
105	5	25	5	5	10	1.837	1	1	1	0.776	4.778	1.914	2.549	1	1.104
102	2	22	2	2	10	3.797	1.341	1.629	1	1.158	12.536	3.652	5.978	1	1.63
101	1	21	1	1	7.071	6.601	2.309	2.704	1	1.524	24.76	6.55	12.135	1.006	2.215
100	0.2	20.2	0.2	0.2	3.162	22.764	6.78	10.166	1.16	2.918	119.239	23.886	69.165	2.015	6.713
105	5	60	5	5	15.811	1.923	1.22	1.442	1	1.415	7.115	2.716	5.437	1.198	1.799
102	2	57	2	2	10	3.578	1.938	2.947	1.263	2.185	18.322	4.881	14.048	1.405	2.885
101	1	56	1	1	7.071	6.158	2.996	5.108	1.613	2.98	34.291	7.982	27.503	1.945	4.526
100	0.2	55.2	0.2	0.2	3.162	24.11	9.239	18.691	3.217	5.611	132.552	25.004	124.841	6.541	16.181
105	5	35	15	5	10	3.059	1	1	1	0.667	11.693	2.576	3.375	1	0.719
102	2	26	6	2	10	5.367	1.38	1.584	1.12	0.698	29.397	5.212	10.008	1.145	0.865
101	1	23	3	1	7.071	8.416	2.572	2.651	1.557	0.821	61.595	9.393	22.524	1.684	1.048
100	0.2	20.6	0.6	0.2	3.162	27.231	10.438	11.491	2.192	1.53	227.029	37.285	125.022	4.397	2.282
105	5	70	15	5	15.811	5.69	1.638	1.778	1.535	0.667	15.12	3.621	7.777	1.651	0.949
102	2	61	6	2	10	7.158	3.409	3.642	2.584	0.997	38.522	7.327	24.265	2.901	1.303
101	1	58	3	1	7.071	9.478	5.817	6.199	3.709	1.415	81.082	13.205	52.88	4.469	1.739
100	0.2	55.6	0.6	0.2	3.162	30.779	12.918	24.094	5.986	2.733	256.289	41.776	232.998	13.388	4.981

FEA Stress Factors (These ten columns correspond to the right ten columns in the table above.)

SFm(ax)	SFm(Mi)	SFm(Mo)	SFm(Mt)	SFm(Pr)	SF(Ax)	SF(Mi)	SF(mo)	SF(Tor)	SF(Pr)
1.685	0.811	0.81	0.764	0.938	4.882	1.56	1.791	1.011	1.557
4.429	1.166	1.52	0.866	0.972	14.6	3.26	5.075	1.025	1.65
8.142	1.981	2.977	0.945	1.229	30.907	5.918	11.756	1.074	1.653
34.177	6.835	16.93	1.26	2.328	136.8	23.6	71.82	2.61	4.326
2.829	1.035	1.445	0.966	1.252	8.247	2.552	4.957	1.176	2.12
5.312	2.185	3.559	1.317	1.85	24.23	5.241	15.145	1.582	2.15
10.614	3.541	7.149	1.833	2.419	48.431	8.941	31.746	2.53	3.493
42.108	8.942	34.09	3.357	4.847	163.598	28.102	143.921	8.478	10.084
2.982	0.701	0.62	0.785	0.885	13.093	1.712	3.726	1.812	1.248
5.028	1.587	1.263	0.953	0.893	30.266	3.446	8.908	1.149	1.232
8.656	3.517	2.907	1.371	0.99	64.122	7.311	22.499	1.527	1.241
35.117	14.808	16.73	2.948	1.322	288.4	28.59	156.88	3.693	1.659
9.835	1.975	1.529	1.383	0.95	14.7	3.818	8.458	2.056	1.313
9.079	4.94	4.26	2.686	1.126	49.29	6.712	31.008	2.825	1.448
13.278	8.49	8.855	4.37	1.336	104.799	11.831	67.7	4.779	1.696
41.977	20.329	37.97	8.866	2.442	376.8	35.9	348.212	11.223	3.575

STP-PT-074: Local Stress in Nozzles, Shells and Formed Heads from External Heads

The ratios of the stress factors from this project (07-10) correlation and the FEA results are shown below for each stress factor column. Values greater than 1.0 are conservative and values less than 1.0 are non-conservative. Finite element results are taken from the NozzlePRO Version 8.6 shell solution of the geometry using no weld lengths and boundary conditions removed from the branch connections by the lengths recommended in Widerra in WRC 497 Part III.

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**Table of 07-10 Stress Factors over FEA Stress Factors for Pad Geometries (4.5.15)**

Model	SFm(ax) Ratio	SFm(Mi) Ratio	SFm(Mo) Ratio	SFm(Mt) Ratio	SFm(Pr) Ratio	SF(Ax) Ratio	SF(Mi) Ratio	SF(mo) Ratio	SF(Tor) Ratio	SF(Pr) Ratio
1	0.9172564	0.8110000	0.8100000	0.7640000	1.2087629	1.0217664	0.8150470	0.7026285	1.0110000	1.4103261
2	1.1664472	0.8695004	0.9330878	0.8660000	0.8393782	1.1646458	0.8926616	0.8489461	1.0250000	1.0122699
3	1.2334495	0.8579472	1.1009615	0.9450000	0.8064304	1.2482633	0.9035115	0.9687680	1.0675944	0.7462754
4	1.5013618	1.0081121	1.6653551	1.0862069	0.7978067	1.2080644	0.9880265	1.0383865	1.2952854	0.6444213
5	1.4711388	0.8483607	1.0020804	0.9660000	0.8848057	1.1591005	0.9396171	0.9117160	0.9816361	1.1784325
6	1.4846283	1.1274510	1.2076688	1.0427553	0.8466819	1.3224539	1.0737554	1.0780894	1.1259786	0.7452340
7	1.7236116	1.1819092	1.3995693	1.1363918	0.8117450	1.4123531	1.1201453	1.1542741	1.3007712	0.7717631
8	1.7464952	0.9678537	1.8236584	1.0435188	0.8638389	1.2342175	1.1239002	1.1528344	1.2961321	0.6232000
9	0.9748284	0.7010000	0.6200000	0.7850000	1.3268366	1.1197298	0.6645963	1.1040000	1.8120000	1.7357441
10	0.9368362	1.1500000	0.7973485	0.8508929	1.2793696	1.0295608	0.6611665	0.8900879	1.0034934	1.4242775
11	1.0285171	1.3674184	1.0965673	0.8805395	1.2058465	1.0410261	0.7783456	0.9988901	0.9067696	1.1841603
12	1.2895964	1.4186626	1.4562701	1.3448905	0.8640523	1.2703223	0.7667963	1.2548191	0.8398908	0.7269939
13	1.7284710	1.2057387	0.8599550	0.9009772	1.4242879	0.9722222	1.0544049	1.0878659	1.2453059	1.3835616
14	1.2683711	1.4491053	1.1696870	1.0394737	1.1293882	1.2795286	0.9160639	1.2778900	0.9738021	1.1112817
15	1.4009285	1.4595152	1.4284562	1.1782152	0.9441696	1.2925064	0.8959485	1.2802572	1.0693667	0.9752731
16	1.3638195	1.5736956	1.5758695	1.4811226	0.8935236	1.4702153	0.8593451	1.4944849	0.8382880	0.7177274
Max	1.7464952	1.57369562	1.8236584	1.481122619	1.424287856	1.4702153	1.1239002	1.4944849	1.812	1.73574409
Min	0.9172564	0.701	0.62	0.764	0.797806717	0.9722222	0.6611665	0.7026285	0.838288	0.62320005

### Shell and Volumetric Finite Element Comparison

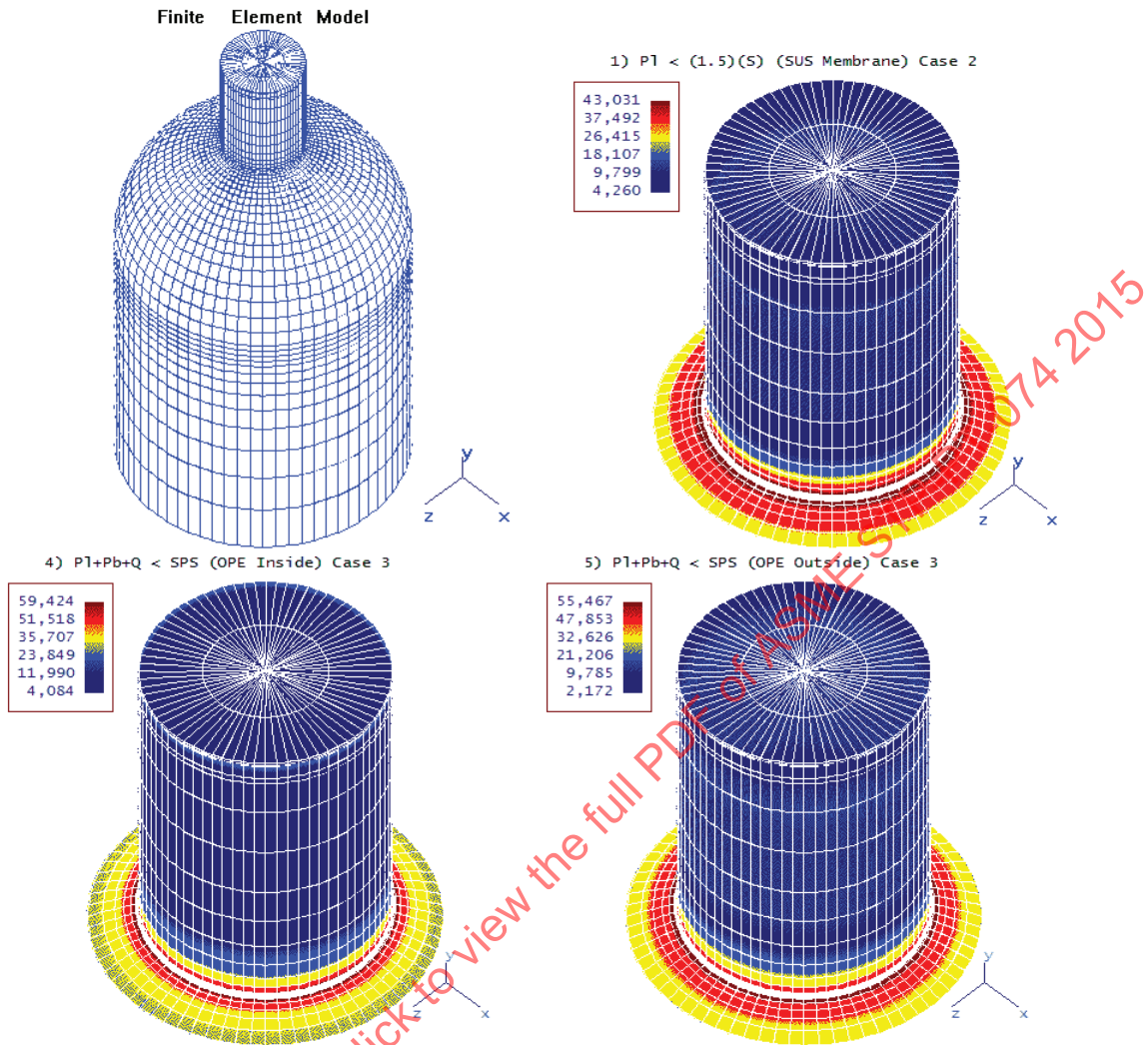
The membrane and surface stresses computed by the method in Appendix 2 are intended to be comparable to shell or volumetric finite element solutions. Where area or volumetric elements are used, stress classification lines must be cut through appropriate nozzle and vessel sections at the penetration line and at the edge of the reinforcing pad. The analysis is performed following guidelines in EPRI 110996, and ASME VIII-2 Part 5 Appendix A where any fillet legs are negligible. When using area or volumetric elements, guidelines for stress classification should follow Kalnins [17].

The following spherical head is used as an example to demonstrate the computation of stress classification lines at nozzle to shell junctions. An axisymmetric area model with pressure loading will be used and compared to the shell solution. The geometry input for the model is shown below and an internal pressure of 500 psi is used to load the model.

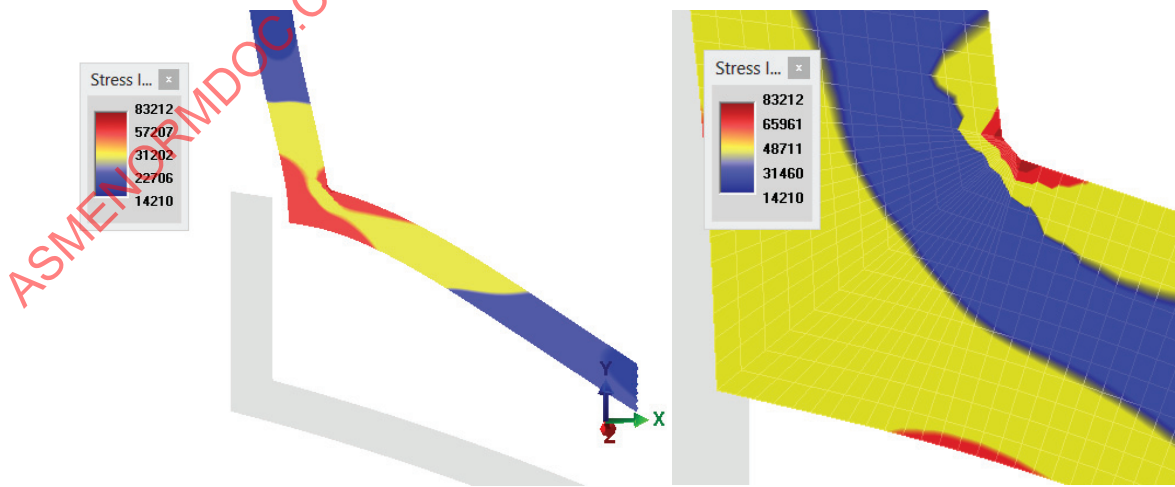
The image shows a software configuration window for finite element analysis. It is divided into three main sections:

- Base Shell Type:** Radio buttons for Hemi Head (selected), Elliptical Head, Conical Head, Cylinder, Dished Head, and Flat Head.
- Nozzle / Attachment Type:** Radio buttons for Straight (selected), Pad, Barrel, Structure, Saddle, Shoe, No Attachment, and Gusset. A dropdown menu is set to '1'.
- Units:** Radio buttons for English (selected) and SI. A checkbox for 'Shell Mat'l same as Nozzle' is checked.
- Hemi Head Geometry:** Input fields for Outside Diameter (48), Wall Thickness (0.375), Taper Length, Shell Length (48), and Shell Thickness.
- Straight Nozzle Geometry:** Input fields for Outside Diameter (14), Wall Thickness (0.375), Nozzle Length (18), and Tilt Angle.

Shell finite element solution results are shown in the following figures.



The highest M+B stress and bending stress is in the shell. The highest membrane stress (P1) is in the nozzle neck. Axisymmetric results are shown below.



Linearized results are shown below for sections through the nozzle and the shell as per [17].



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Section: Top Head at Nozzle

Material# 1 Smc= 20000. Smh= 20000. 1.5Sm= 30000. 3Sm= 60000.  
 Forces: Normal/Hoop/Radial = 0.1245E+06 0.3893E+04 0.2092E+05  
 LOAD CASE: 1  
 Sm= 39296. Sb= 39904. Sn= 60934. S1+S2+S3= 125526. SI= 83212.

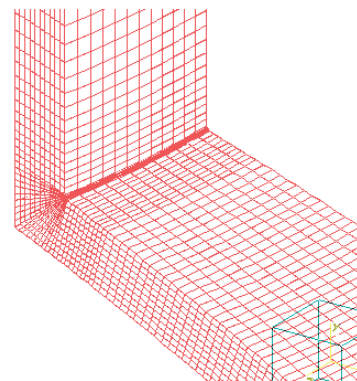
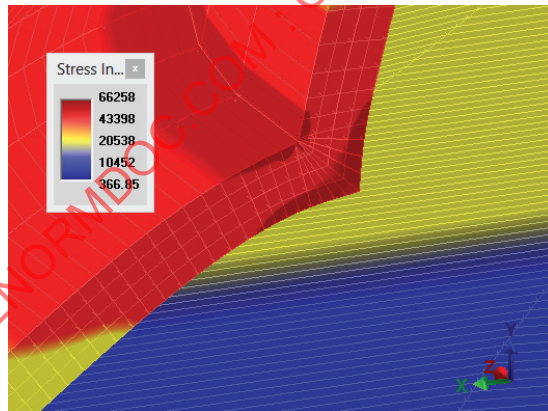
Node	"x"	Sn	St	Sz	Tnt	Se	VM
12894	0.000	-32937.	-697.	32977.	-95.	57088.	57088.
12922	0.031	-25791.	-66.	35193.	-1304.	53076.	53076.
12898	0.063	-18771.	625.	37390.	-2515.	49598.	49598.
12926	0.094	-13257.	2157.	39399.	-2849.	47148.	47148.
12902	0.125	-7702.	3644.	41407.	-3176.	44872.	44872.
12930	0.156	-2624.	5650.	43427.	-2595.	42759.	42759.
12906	0.188	2449.	7651.	45444.	-2040.	40797.	40797.
12955	0.219	8623.	10057.	47897.	-350.	38582.	38582.
12934	0.250	14497.	12437.	50252.	1383.	36906.	36906.
12959	0.282	21315.	15345.	53018.	4636.	35979.	35979.
12938	0.313	24979.	20746.	55588.	7234.	35234.	35234.
12963	0.344	56493.	19596.	64490.	16968.	50834.	50834.
12942	0.375	91553.	15969.	73708.	27335.	83212.	83212.

Section: Top Head Nozzle at Head

Material# 2 Smc= 20000. Smh= 20000. 1.5Sm= 30000. 3Sm= 60000.  
 Forces: Normal/Hoop/Radial = 0.4580E+05 0.5155E+04 0.2157E+05  
 LOAD CASE: 1  
 Sm= 40867. Sb= 29153. Sn= 55913. S1+S2+S3= 107437. SI= 77450.

Node	"x"	Sn	St	Sz	Tnt	Se	VM
13182	0.000	64974.	27103.	68719.	-38334.	77450.	77450.
13203	0.032	38764.	27378.	61076.	-23875.	50907.	50907.
13178	0.064	15025.	25078.	53393.	-11056.	39422.	39422.
13199	0.097	12483.	18701.	50826.	-9420.	39200.	39200.
13174	0.129	7774.	14861.	48380.	-6206.	39075.	39075.
13195	0.161	3562.	11846.	46340.	-4333.	40006.	40006.
13146	0.193	-897.	8858.	44233.	-2462.	41350.	41350.
13170	0.226	-4773.	6472.	42485.	-1309.	42819.	42819.
13142	0.258	-8655.	4095.	40738.	-136.	44414.	44414.
13166	0.290	-12995.	2293.	39024.	1123.	46349.	46349.
13138	0.322	-17361.	489.	37302.	2365.	48453.	48453.
13162	0.355	-22294.	1894.	35523.	4424.	51207.	51207.
13134	0.387	-27252.	-2273.	33737.	6545.	54302.	54302.

Volumetric elements can also be used and stress classification lines cut through similar sections.



Maximum Values for This Load Case:

	Membrane	Bending	M+B(out)	M+B(in)	Region
Max Membrane	45260.50	26470.94	50801.30	54015.51	233
Max Bending	41763.82	34565.18	54056.20	54367.87	207
Max M+B (in)	39374.12	24283.74	59347.21	27530.93	195
Max M+B (out)	43943.69	32222.31	50812.81	57937.11	206



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```

REGION =          195

Node    Sxx      Syy      Szz      Txy      Tyz      Txz (Global)
50365  -11346.9  -2911.9  17279.3  8665.2  -26983.9  5220.5
50368   3416.7    -60.4  26332.9  4884.6  -21616.7  2952.5
50371  14315.4   5453.7  33524.4  1815.4  -18129.9  1113.3
50380  28023.6  14475.1  42963.3  -5173.3  -14129.2  -3077.4
50383  48846.7  44468.8  60134.2  -18204.5  -10718.1  -10874.6

Node    Sxx      Syy      Szz      Txy      Tyz      Txz (Local)
50365    0.0    5076.2   4157.5    0.0   22510.1    0.0
50368    0.0   17647.1  14950.1  16751.6  17163.7   2347.3
50371    0.0   27445.9  23470.9  13115.0  13434.6   2260.9
50380    0.0   41717.5  34560.6   7523.2   7692.3   5557.2
50383    0.0   66741.8  54264.7    0.0   -172.1    0.0

Membrane    Bending    M+B (out)    M+B (in)
SXX         0.00         0.00         0.00         0.00
SYY        30678.87    26368.00    57046.86    4310.87
SZZ        25547.39    21445.15    46992.55    4102.24
Txy         9347.94         0.00     9347.94     9347.94
Tyz        12365.22         0.00    12365.22    12365.22
Txz         2541.41         0.00     2541.41     2541.41

SUM        39374.12    24283.74    59347.21    27530.93

Thru Thickness =    0.2511    0.9561    0.1509
Normal Direction =    0.5150    0.0000   -0.8572
Normal Direction =   -0.8196    0.2930   -0.4924
    
```

The table below includes comparison results for the different model types.

Model	Els thru thick	Pl	Q	M+B	
Head Brick 2d Vol	6	39.3	40	60.9	No Fillet
Nozzle Brick 2d Vol	6	40.8	29	55.9	No Fillet
Nozzle Shell		43			
Shell Shell			38.6	59.4	
Brick 3d Vol	4	45.3	34.5	59.3	0.02 fillet
Brick 3d Vol	10	45.6	37.5	60.1	

- (1) Integration is thru discontinuity at edge of fillet at element nodes.
- (2) 2d Volumetric elements are eight noded.
- (3) 3d Volumetric elements are 11 noded. Internal nodes are condensed out.

## APPENDIX 2 – RECOMMENDED RULES AND SUPPORTING TABLES

### 4.5.15 Local Stresses in Nozzles in Shells and Formed Heads from External Loads

**4.5.15.1** The rules of this paragraph are applicable for the evaluation of pressure in combination with external loads acting on circular radial nozzles in shells and formed heads attached by full penetration welds with or without reinforcing pads where the centerline of the nozzle is radial to the surface of the vessel within 5 degrees as shown in Figure 4.5.3 and 4.5.9.

**4.5.15.2** The criteria is intended to be more conservative than the design-by-analysis approaches given in Part 5. In some cases, pressure loads acceptable per 4.5.5 or 4.5.10 will show to be unacceptable per 4.5.15 even in the absence of external loads. In this case, the acceptability of external loads must be determined by the rules of Part 5.

**4.5.15.3** These rules are applicable when the nozzle neck thickness is constant within the limits of reinforcement  $L_H$  shown in Figure 4.5.1, and when the following parameters are satisfied:

$$7 \leq D_m/T \leq 2500 \quad (4.5.188)$$

$$d_m/D_m \leq 0.7 \quad (4.5.189)$$

$$0.1 \leq t/T \leq 10 \quad (4.5.190)$$

$$7 \leq d_m/t \leq 200 \quad (4.5.191)$$

$$L_{pr2} = 0 \text{ (see Figures 4.5.1 and 4.5.2.)} \quad (4.5.192)$$

$$t_p \leq 1.5T \quad (4.5.193)$$

$$W \geq \min((d_m+t)/2, (RT)^{0.5}) \quad (4.5.194)$$

$$(d_m/D_m)(D_m/T)^{0.5} \leq 10 \quad (4.5.195)$$

**4.5.15.5** For nozzle openings where  $(d_m/D_m)(D_m/T)^{1/2}$  exceeds 10, collapse due to external loads and pressure should be evaluated per 5.4 where  $\beta_{cr}$  is taken from 5.4.1.3 (a) and where  $D_o$  and  $t$  used in Equations 5.12 and 5.13 are the diameter and thickness of the vessel.

**4.5.15.6** A fatigue analysis of the external loads and pressure stresses on the nozzle is required if indicated by 5.5.2.4 STEP 3, STEP 4 or STEP 8. For STEP 8,  $\Delta S_{ML}$  is found from Equation 4.5.196 where  $S_n$ ,  $S_v$  and  $S_v'$  are the largest of the values found from Eqs. 4.5.204 through 4.5.209. Values for the FSRF can be found from Part 5 Tables 5.11 or 5.12.

$$\Delta S_{ML} = \max((FSRF_n)(S_n), (FSRF_v)(S_v), (FSRF_v')(S_v')) \quad (4.5.196)$$

**4.5.15.7** Stresses due to external nozzle loads caused by restrained free end thermal displacements must be classified by the designer. When the nozzle operates in the creep regime or the component is otherwise susceptible to non-recoverable strains or displacements, the stresses due to restrained free end thermal displacements should be considered primary stresses and the membrane allowable stresses in Table 4.5.3 satisfied for Design Load Cases 8, 9 and 10; otherwise the stresses due to restrained free end thermal displacements may be considered secondary stresses and only the Surface Stress requirements for Design Load Cases 8, 9 and 10 in Table 4.5.3 need to be satisfied.

**4.5.15.8** When the lengths  $L_1$  or  $L_2$  in Figure 4.5.14 are less than  $0.4D_m^{1.4}T^{-0.4}$  local stiffening and a lowering of the stress in the nozzle connection may occur as a function of the  $d/D$  ratio and the load direction. When the lengths  $L_1$  or  $L_2$  are less than  $(RT)^{0.5}$  a local discontinuity can exist and stresses may increase. The

magnitude of these effects can be investigated using the methods of Part 5. When the criteria of 4.5.15.3 and 4.5.15.8 are satisfied, the stress in the nozzle connection can be assessed using steps 1 through 6 below.

**STEP 1** Define all relevant loads and load cases. The loads to be considered in the analysis shall include those given in Table 4.5.3. The external axial force acting on the nozzle should not include the force due to pressure thrust. In-plane, out-of-plane, torsional and axial load orientations for external loads acting on cylindrical shells are shown in Figure 4.5.13.

**STEP 2** Compute the membrane stress reduction factor ( $C_v$ ) in Equation 4.5.199.  $C_v$  shall be taken as 1.0 if any of the allowables used in Table 4.5.3 are based on time-dependent material properties.

$$\lambda = \text{MIN}[ 12, (d_m/D_m)(D_m/(T+0.5t_p))^{0.5} ] \quad (4.5.197)$$

$$L_f = \text{max}[ 1, (\lambda/5)^{0.85} ] \quad (4.5.198)$$

$$C_v = 1 / L_f \quad (4.5.199)$$

**STEP 3** For each Design Load Combination in Table 4.5.3, calculate the membrane stresses using Equations 4.5.201 through 4.5.203. Coefficients  $C_1$  through  $C_{10}$  are found by using Tables 4.5.5 through 4.5.14 and the equations in Table 4.5.4. The minimum permitted value for any of the coefficients  $C_1$  through  $C_{10}$  is 1.0. Equation 4.5.203 is only used when a reinforcing pad, as shown in Figure 4.5.15, is present. When  $d_m/D_m < 0.05$ ,  $C_3 = \text{MAX}(C_2, C_3)$ , and  $C_8 = \text{MAX}(C_7, C_8)$ .

$$S_{nm} = 0.8C_5(S_p) + C_1(S_a) + [ (C_2(S_i))^2 + (C_3(S_o))^2 + (C_4(S_t))^2 ]^{0.5} \quad (4.5.201)$$

$$S_{vm} = C_v C_{10}(S_p) + C_6(S_a) + [ (C_7(S_i))^2 + (C_8(S_o))^2 + (C_9(S_t))^2 ]^{0.5} \quad (4.5.202)$$

$$S_{vm}' = C_v C_{10}(S_p) + C_6(S_a) + [ (C_7(S_i))^2 + (C_8(S_o))^2 + (C_9(S_t))^2 ]^{0.5} \quad (4.5.203)$$

**STEP 4** Compare the computed membrane stresses to the allowable membrane stresses given in Table 4.5.3. If any calculated membrane stresses exceed the Table 4.5.3 allowables, the rules of Part 5 Section 5.2 may be used to evaluate the external loads.

**STEP 5** Compute the inside and outside surface stresses using Equations 4.5.204 through 4.5.209 for the Design Load Combination cases in Table 4.5.3. Coefficients  $C_{11}$  through  $C_{30}$  are found in Tables 4.5.15 through 4.5.34. The coefficients  $C_{11}$  through  $C_{30}$  shall always be greater than or equal to 1.0. Equations 4.5.206 and 4.5.209 are only used when a reinforcing pad as shown in Figure 4.5.15 is present.

(Inside)

$$S_n = C_{15}(S_p) + C_{11}(S_a) + [ (C_{12}(S_i))^2 + (C_{13}(S_o))^2 + (C_{14}(S_t))^2 ]^{0.5} \quad (4.5.204)$$

$$S_v = C_{20}(S_p) + C_{16}(S_a) + [ (C_{17}(S_i))^2 + (C_{18}(S_o))^2 + (C_{19}(S_t))^2 ]^{0.5} \quad (4.5.205)$$

$$S_v' = C_{20}(S_p) + C_{16}(S_a) + [ (C_{17}(S_i))^2 + (C_{18}(S_o))^2 + (C_{19}(S_t))^2 ]^{0.5} \quad (4.5.206)$$

(Outside)

$$S_n = C_{25}(S_p) + C_{21}(S_a) + [ (C_{22}(S_i))^2 + (C_{23}(S_o))^2 + (C_{24}(S_t))^2 ]^{0.5} \quad (4.5.207)$$

$$S_v = C_{30}(S_p) + C_{26}(S_a) + [ (C_{27}(S_i))^2 + (C_{28}(S_o))^2 + (C_{29}(S_t))^2 ]^{0.5} \quad (4.5.208)$$

$$S_v' = C_{30}(S_p) + C_{26}(S_a) + [ (C_{27}(S_i))^2 + (C_{28}(S_o))^2 + (C_{29}(S_t))^2 ]^{0.5} \quad (4.5.209)$$

**STEP 6** Compare the computed surface stresses to the Allowable Surface Stresses in Table 4.5.3. If any of the calculated surface stresses exceed the Table 4.5.3 allowables, the rules of Part 5 Section 5.5.6 may be used to evaluate the external loads.

**4.5.15.9** Tables 4.5.5 through 4.5.34 are accessed by starting at the top row and moving down through the table until a row is found that satisfies all parameter ranges that describe the nozzle-vessel connection. The equation coefficients  $a_0$  through  $a_{11}$  and the equation number are taken from this row and used with the appropriate equation in Table 4.5.4 to compute the nominal stress coefficient  $C_i$ . Definitions for the table parameters are given in 4.5.15.11.

**4.5.15.10** When a reinforcing pad is provided as shown in Figure 4.5.15 the following adjustments should be made to Steps 3 through 6:

- (a) For Equations 4.5.201, 4.5.202, 4.5.204, 4.5.205, 4.5.207 and 4.5.208 (Junction):
- i.  $D_m/T$  should be replaced by  $D_m/(T+0.5t_p)$  when  $D_m/T$  appears in any of the applicable equations for  $C_1$  through  $C_{30}$ , and
  - ii.  $t/T$  should be replaced by  $t/(T+0.5t_p)$  when  $t/T$  appears in any of the applicable equations for  $C_1$  through  $C_{30}$ .
- (b) For Equations 4.5.203, 4.5.206 and 4.5.209 (Pad Edge):
- i.  $t/T$  should be replaced by 1.0, and  $d_m/D_m$  should be replaced by  $d_p/D_m$  when  $t/T$  or  $d_m/D_m$  appears in any of the applicable equations for  $C_6$  through  $C_{30}$ .
  - ii. If  $d_p/D_m > 0.7$  then the acceptability of external loads must be determined by the rules of Part 5.
  - iii.  $d_p$  should replace  $d_m$ ,  $T+0.5t_p$  should replace  $t$  when calculating  $S_a$ ,  $S_i$ ,  $S_o$  and  $S_t$ .
  - iv.  $D_m/(2T)$  should replace  $D_m/(2T+t_p)$  when calculating  $S_p$ .
  - v.  $C_6$ ,  $C_{17}$  and  $C_{26}$  should be taken as 1.0.

**4.5.15.11** When  $d/D$  from Table 4.5.2 is less than 0.05,  $C_1$  through  $C_{30}$  can be found using the following extrapolation procedure.

**STEP 1** For all coefficients  $C_1$  through  $C_{30}$ , linearly extrapolate from  $d/D=0.06$  and  $d/D=0.05$  to the actual value of  $d/D$  using Equation 4.5.210 for the coefficient  $C_i$  only if  $C_{i\ 0.05}$  is greater than  $C_{i\ 0.06}$ . If  $C_{i\ 0.06}$  is less than  $C_{i\ 0.05}$ , then use the value at  $C_{i\ 0.05}$  for  $C_i$  at the value of  $d/D$  less than 0.05.

$$C_i = C_{i\ 0.06} - 100(C_{i\ 0.06} - C_{i\ 0.05})(0.06 - d/D) \quad (4.5.210)$$

**STEP 2** Adjust  $C_i$  by the factors given in (a) through (d) below:

- (a) Divide  $C_1$ ,  $C_6$ ,  $C_{11}$ ,  $C_{16}$ ,  $C_{21}$ , and  $C_{26}$  by the factor  $[1 + 0.1376(0.05D/d - 1)]$
- (b) Divide  $C_2$ ,  $C_7$ ,  $C_{12}$ ,  $C_{17}$ ,  $C_{22}$ , and  $C_{27}$  by the factor  $[1 + 0.404(0.05D/d - 1)]$
- (c) Divide  $C_3$  and  $C_8$  by the factor  $[1 + 0.08647(0.05D/d - 1)]$
- (d) Divide  $C_{13}$ ,  $C_{18}$ ,  $C_{23}$ , and  $C_{28}$  by the factor  $[1 + 0.202(0.05D/d - 1)]$

**STEP 3** All factors  $C_1$  through  $C_{30}$  must be greater than or equal to 1.0.

**Table 4.5.2 – Dimensionless Parameter Definition**

			Dimensionless parameters used to access Tables 4.5.4 through 4.5.34.		
Location	Figure	Equation	d/D	D/T	t/T
Pad Reinforced Junction	4.5.15	4.5.201, 4.5.202, 4.5.204, 4.5.205, 4.5.207, 4.5.208	$d_m/D_m$	$D_m/(T+0.5t_p)$	$t/(T+0.5t_p)$
Edge of Pad	4.5.15	4.5.203, 4.5.206, 4.5.209	$d_p/D_m$	$D_m/T$	1.0
Junction (No Pad)	4.5.14	4.5.201, 4.5.202, 4.5.204, 4.5.205, 4.5.207, 4.5.208	$d_m/D_m$	$D_m/T$	t/T

**Table 4.5.3 – Design Load Combinations for Local Stresses in Nozzles in Shells and Formed Heads from External Loads and Pressure (Nomenclature from Table 5.2)**

Design Load Combination (1)	Allowable Membrane Stress	Allowable Surface Stress
1) $P + P_s + D$	1.5S	$S_{ps}$
2) $P + P_s + D + L$	1.5S	$S_{ps}$
3) $P + P_s + D + S_s$	1.5S	$S_{ps}$
4) $0.9P + P_s + D + W$	1.5S	$S_{ps}$
5) $0.9P + P_s + D + 0.7E$	1.5S	$S_{ps}$
6) $0.9P + P_s + D + 0.75(W + L + S_s)$	1.5S	$S_{ps}$
7) $0.9P + P_s + D + 0.75(0.7E + L + S_s)$	1.5S	$S_{ps}$
8) $0.9P + P_s + D + L + T$	1.5S	$S_{ps}$
9) $P + P_s + D + T$	1.5S	$S_{ps}$
10) $D + L + T$	1.5S	$S_{ps}$

Notes

- (1) The parameters used in the Design Load Combination column are defined in Table 5.2.
- (2) In Design Load Combinations 8, 9, and 10, T is the operating temperature and P is the operating pressure.
- (3) The Allowable Membrane Stress evaluation for Design Load Combination cases 8, 9, and 10 is not required when service conditions permit a small amount of plastic deformation.
- (4) If any part of the nozzle or pad geometry passes through a shell weld seam, the allowable membrane stress shall be taken as  $1.5SE_s$ , where  $E_s$  is the shell seam weld joint factor.



### 4.5.15 Nomenclature

$C_1, C_2, \dots, C_3$	stress factor coefficients found in Tables 4.5.4 through 4.5.93.
$C_0$	
$C_{i0.05}$	any of the stress factors $C_1$ through $C_{30}$ found at $d/D = 0.05$ and used for extrapolation
$C_{i0.06}$	any of the stress factors $C_1$ through $C_{30}$ found at $d/D = 0.06$ and used for extrapolation
$C_v$	membrane stress factor.
$d/D$	generic dimensionless nozzle-to-vessel diameter ratio. (See Table 4.5.2.)
$D/T$	generic dimensionless vessel diameter to thickness ratio. (See Table 4.5.2.)
$D_m$	mean diameter of vessel at point of nozzle attachment. For a spherical or elliptical head, $D_m$ is the mean diameter of the vessel attached to the head.
$d_m$	mean diameter of nozzle within the limits of reinforcement $L_h$ in Figures 4.5.1 and 4.5.2.
$d_p$	effective outside diameter of reinforcing pad.
$E_s$	shell weld seam joint efficiency factor.
$F$	axial force (not including axial pressure thrust)
$FSRF_n$	FSRF for the nozzle weld.
$FSRF_v$	FSRF for the vessel weld.
$FSRF_v'$	FSRF for the reinforcing pad edge weld.
$L_{pr2}$	nozzle insert length (See Figures 4.5.1 and 4.5.2.).
$t/T$	generic nozzle thickness to vessel thickness ratio. (See Table 4.5.2.)
$T$	vessel thickness.
$t$	nozzle wall thickness within the limits of reinforcement. $L_h$ in Figures 4.5.1 and 4.5.2.
$t_p$	thickness of reinforcing pad.
$W$	width of the reinforcing pad (Figure 4.5.1).
$L_1, L_2, L_3$	Straight lengths associated with nozzles in cylinders shown in Figure 4.5.14.
$L_f$	lambda factor.
$M_i$	in-plane moment.
$M_o$	out-of-plane moment.
$M_t$	torsion moment.
$P$	internal pressure.
$R$	mean radius of the vessel $R = D_m/2$ .
$S$	allowable stress based on the material of construction and design temperature.
$S_{ps}$	allowable limit on the primary plus secondary stress range (see paragraph 5.5.6).
$S_p$	nominal pressure stress. $S_p =  PD_m/(2T+t_p) $ . (If no pad then $t_p=0$ .)
$S_i$	nominal in-plane bending stress. $S_i =  4M_i/(\pi d_m^2 t) $ .
$S_o$	nominal out-of-plane bending stress. $S_o =  4M_o/(\pi d_m^2 t) $ .
$S_t$	nominal torsional stress. $S_t =  4M_t/(\pi d_m^2 t) $ .
$S_a$	nominal axial stress. $S_a =  F/(\pi d_m t) $ .
$S_v$	maximum surface stress in the vessel due to loading under consideration.
$S_{vm}$	maximum local membrane stress in vessel due to loading under consideration.
$S_n$	maximum surface stress in nozzle due to loading under consideration.
$S_{nm}$	maximum local membrane stress in nozzle due to loading under consideration.
$S_v'$	maximum surface stress in the vessel at the edge of the reinforcing pad.
$S_{vm}'$	maximum membrane stress in the vessel at the edge of the reinforcing pad.
$\Delta S_{ML}$	stress range used in 5.5.2.4 STEP 8.
$\lambda$	vessel parameter; $\lambda = (d_m/D_m)(D_m/T)^{0.5}$ or $(d_m/D_m)(D_m/(T+0.5t_p))^{0.5}$

Figure 4.5.13 – Nozzle External Load Orientations

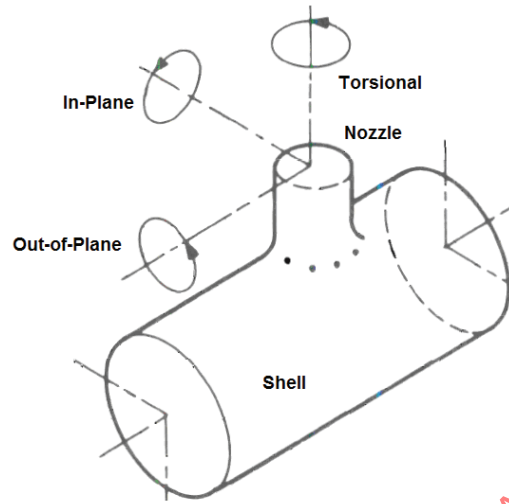
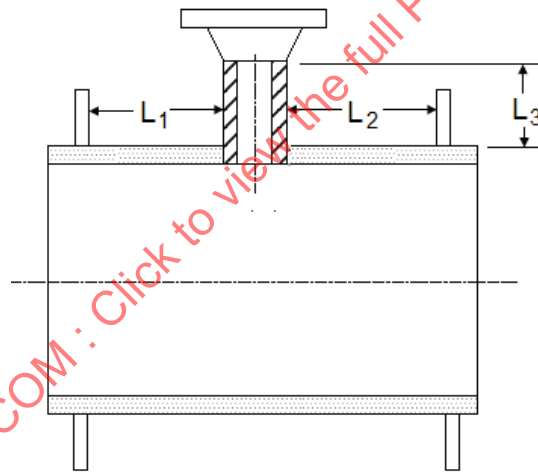
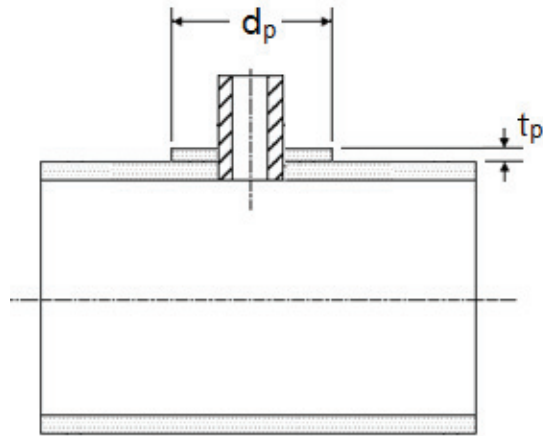


Figure 4.5.14 – Nozzle and Shell Lengths



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Figure 4.5.15 – Reinforcing Pad Dimensions



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**Table 4.5.4 – Stress Factor Coefficient Equations**

Eq	Stress Factor Coefficient, $C_i$
1	$a_0 \left(\frac{d}{D}\right)^{a_1} \left(\frac{D}{T}\right)^{a_2} \left(\frac{t}{T}\right)^{a_3}$
2	$a_0 \left(a_1 \frac{d}{D} + \left(\frac{d}{D}\right)^{a_2}\right) \left(a_3 \frac{D}{T} + \left(\frac{D}{T}\right)^{a_4}\right) \left(a_5 \frac{t}{T} + \left(\frac{t}{T}\right)^{a_6}\right)$
3	$a_0 + a_1 \left(\frac{d}{D}\right)^{a_2} \left(\frac{D}{T}\right)^{a_3} \left(\frac{t}{T}\right)^{a_4}$
4	$a_0 + a_1 \left(\frac{d}{D}\right)^{a_2} \left(\frac{D}{T}\right)^{a_3} \left(a_4 + a_5 \frac{t}{T} - a_6 \left(\frac{t}{T}\right)^{\left(a_7 \frac{d}{D} / \frac{D}{T}\right)} - \left(\frac{t}{T}\right)^3\right)$
5	$a_0 + a_1 \left(\frac{d}{D}\right)^{a_2} \left(\frac{D}{T}\right)^{a_3} \left(a_4 + a_5 \left(\frac{t}{T}\right)^{0.1} - a_6 \left(\frac{t}{T}\right)^{\left(a_7 \frac{d}{D} / \frac{D}{T}\right)} - \left(\frac{t}{T}\right)^3\right)$
6	$a_0 + a_1 \left(\frac{d}{D}\right)^{a_2} \left(a_3 \frac{D}{T} + \left(\frac{D}{T}\right)^{a_4}\right) \left(\frac{t}{T}\right)^{a_5}$
7	$a_0 + a_1 \left(a_2 \frac{d}{D} + \left(\frac{d}{D}\right)^{a_3}\right) \left(a_4 + a_5 \frac{D}{T} + \left(\frac{D}{T}\right)^{a_6}\right) \left(a_7 + \left(\frac{t}{T}\right)^{a_8}\right)$
8	$a_0 \left(\frac{d}{D}\right)^{a_1} \left(\frac{D}{T}\right)^{a_2} \left(a_3 + a_4 \frac{t}{T} + a_5 \left(\frac{t}{T}\right)^2 + a_6 \left(\frac{t}{T}\right)^3 + a_7 \left(\frac{t}{T}\right)^4 + \left(\frac{t}{T}\right)^5\right)$
9	$a_0 \left(a_1 + a_2 \frac{d}{D} + \left(\frac{d}{D}\right)^{a_3}\right) \left(a_4 + a_5 \frac{D}{T} + \left(\frac{D}{T}\right)^{a_6}\right) \left(a_7 \frac{t}{T} + \left(\frac{t}{T}\right)^{a_8}\right)$
10	$a_0 + a_1 \left(\frac{d}{D}\right)^{a_2} \left(\frac{D}{T}\right)^{a_3} \left(a_4 \frac{t}{T} + \left(\frac{t}{T}\right)^{a_5}\right)$
11	$a_0 + a_1 \left(a_2 \frac{d}{D} + \left(\frac{d}{D}\right)^{a_3}\right) \left(a_4 \frac{D}{T} + \left(\frac{D}{T}\right)^{a_5}\right) \left(a_6 \frac{t}{T} + \left(\frac{t}{T}\right)^{a_7}\right)$
12	$\left(a_0 + a_1 \frac{d}{D}\right) \left(a_2 + a_3 \frac{D}{T} + \left(\frac{D}{T}\right)^{a_4}\right) \left(a_5 \frac{t}{T} + a_6 \left(\frac{t}{T}\right)^{a_7} + \left(\frac{t}{T}\right)^3\right)$
13	$a_0 + a_1 \left(\frac{d}{D}\right)^{a_2} \left(\frac{D}{T}\right)^{a_3} \left(a_4 + a_5 \frac{t}{T} - a_6 \left(\frac{t}{T}\right)^{\left(a_7 \frac{d}{D} / \frac{D}{T}\right)} - \left(\frac{1}{D/T}\right) \cos^2 \left(a_8 \frac{t}{T} + a_9\right)\right)$
14	$a_0 \frac{d}{D} \left(\frac{D}{T}\right)^{a_1} + a_2 \left(\frac{t}{T}\right)^{a_3} + a_4 \left(a_5 + \sin \left(a_6 + a_7 \frac{d}{D}\right)\right) \left(a_8 + \left(\frac{D}{T}\right)^{a_9}\right) \left(a_{10} + \sin \left(a_{11} + 0.1 \frac{t}{T}\right)\right)$
15	$a_0 \frac{d}{D} \left(\frac{D}{T}\right)^{a_1} + a_2 \left(\frac{t}{T}\right)^{a_3} + a_4 \left(a_5 + \left(\frac{D}{T}\right)^{a_6}\right) \left(a_7 + \sin \left(a_8 + 0.1 \frac{t}{T}\right)\right)$
16	$a_0 \frac{d}{D} \left(\frac{D}{T}\right)^{a_1} \left(\frac{t}{T}\right)^{a_2} + a_3 \left(\frac{D}{T}\right)^{a_4} \left(\frac{t}{T}\right)^{a_5} + a_6 \frac{D}{T}$

**Table 4.5.5 – C<sub>1</sub> for Nozzles in Cylindrical Shells (Nozzle membrane stress due to Axial load)**

Range	min d/D	max d/D	min D/T	max D/T	min t/T	max t/T	Eq	<i>a<sub>i</sub></i>												
								0	1	2	3	4	5	6	7	8	9	10	11	
1	0.05	0.25	8	500	0.1	0.5	14	-2.197	-0.057	-4.511	1.479	131.021	-0.726	0.979	2.225	14.112	0.854	-0.994	1.470	
2	0.05	0.25	8	500	0.5	1	7	-0.934	13.505	-1.050	0.788	0.077	-0.988	0.999	13.738	-0.115				
3	0.05	0.25	8	500	1	5	14	0.384	0.159	-0.678	0.960	115.426	-0.994	1.477	0.382	4.591	0.842	-0.665	1.049	
4	0.05	0.25	8	500	5	10	14	-1.205	0.879	2.779	-0.516	0.910	-0.941	1.233	0.492	-2.026	0.994	8.180	2.571	
5	0.05	0.25	500	2000	0.1	0.5	4	-0.037	4.269	0.281	0.680	0.504	0.513	0.481	-17.193					
6	0.05	0.25	500	2000	0.5	1	13	4.575	79.380	0.406	0.732	0.073	0.002	0.068	-56.861	-66.382	-24.933			
7	0.05	0.25	500	2000	1	5	14	-0.178	0.930	-0.702	1.876	25.951	-0.960	1.314	0.652	33.376	0.922	-0.707	0.915	
8	0.05	0.25	500	2000	5	10	2	7.168	-0.984	0.946	-0.749	1.041	-0.130	0.384						
9	0.25	0.7	8	500	0.1	0.5	5	0.238	0.279	-0.150	0.834	7.027	3.326	9.427	0.095					
10	0.25	0.7	8	500	0.5	1	14	-17.826	0.765	0.109	4.174	7.330	-0.114	0.117	0.173	0.075	0.769	13.022	1.831	
11	0.25	0.7	8	500	1	5	7	3.818	4.154	-0.929	0.678	-492.746	8.516	1.314	-0.992	0.002				
12	0.25	0.7	8	500	5	10	14	0.003	1.600	6.257	-0.648	0.018	0.980	2.892	-4.702	-45.825	1.125	0.393	1.545	
13	0.25	0.7	500	2000	0.1	0.5	14	0.000	3.146	2818.985	1652.13	28.085	17.569	-3.857	8.984	-6.183	0.684	-0.999	1.526	
14	0.25	0.7	500	2000	0.5	1	14	0.442	0.607	-1.339	619.247	13.400	4.666	2.593	-3.322	-15.130	0.685	1.006	-1.624	
15	0.25	0.7	500	2000	1	5	14	8.345	0.148	5.053	-2.357	876.903	-0.987	1.663	-0.220	-36.389	0.705	-0.882	1.083	
16	0.25	0.7	500	2000	5	10	14	12.144	0.019	191.773	-1.606	39.040	-0.981	1.691	-0.295	-87.036	0.839	-0.336	0.890	

**Table 4.5.6 – C<sub>2</sub> for Nozzles in Cylindrical Shells (Nozzle membrane stress due to In-Plane moment)**

Range	min d/D	max d/D	min D/T	max D/T	min t/T	max t/T	Eq	<i>a<sub>i</sub></i>												
								0	1	2	3	4	5	6	7	8	9	10	11	
1	0.05	0.1	8	100	0.1	1	5	0.593	0.017	1.059	1.437	100.192	5.977	104.286	1.787					
2	0.05	0.1	8	100	1	10	3	0.487	0.026	1.612	1.691	-0.856								
3	0.05	0.1	100	1000	0.1	1	8	0.841	0.552	0.825	0.016	1.614	-4.875	6.633	-4.221					
4	0.05	0.1	100	1000	1	10	14	-0.044	1.334	0.923	-1.409	1.277	0.853	-1.021	0.068	-3.426	1.348	0.323	0.996	
5	0.05	0.1	1000	2000	0.1	1	14	1.261	0.649	0.897	221.382	38.470	1.321	4.711	-62.869	-1.879	0.112	-0.206	2.696	
6	0.05	0.1	1000	2000	1	10	10	3.011	0.170	0.711	1.247	-0.953	0.983							
7	0.1	0.25	8	100	0.1	1	11	0.626	282.033	-0.992	0.997	-0.834	1.104	-0.965	0.899					
8	0.1	0.25	8	100	1	10	15	0.025	1.321	0.580	-0.631	-219.085	-1.006	0.002	-0.291	0.183				
9	0.1	0.25	100	1000	0.1	1	8	0.569	0.266	0.689	0.020	2.214	-5.537	6.587	-3.966					
10	0.1	0.25	100	1000	1	10	14	0.971	0.550	-0.131	0.938	1.600	0.656	-0.706	0.000	-178.826	1.269	-0.722	0.963	
11	0.1	0.25	1000	2000	0.1	1	13	3.852	38.167	0.384	0.687	0.035	0.002	0.031	-138.02	22.214	-6.817			
12	0.1	0.25	1000	2000	1	10	2	1.779	-0.942	0.583	-0.763	0.979	-0.609	0.825						



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Range	min d/D	max d/D	min D/T	max D/T	min t/T	max t/T	Eq	$a_i$												
								0	1	2	3	4	5	6	7	8	9	10	11	
13	0.25	0.7	8	100	0.1	1	14	-0.367	0.644	-0.965	0.983	32.830	0.006	0.261	0.694	5.406	0.738	-0.987	1.468	
14	0.25	0.7	8	100	1	10	11	-0.491	0.812	1.018	0.247	0.041	-0.078	-0.016	-0.097					
15	0.25	0.7	100	1000	0.1	1	14	-0.626	0.438	-1.757	1.291	47.104	1.100	-0.475	-0.979	6.457	0.630	-0.994	1.486	
16	0.25	0.7	100	1000	1	10	14	0.523	0.534	-0.142	0.986	0.053	2.146	2.625	-4.393	-18.605	0.930	-0.751	0.980	
17	0.25	0.7	1000	2000	0.1	1	12	9.938	5.392	-2.542	0.000	0.183	17.674	-17.513	1.146					
18	0.25	0.7	1000	2000	1	10	2	0.566	-0.414	0.261	-0.744	0.974	-0.459	0.724						

Table 4.5.7 – C<sub>3</sub> for Nozzles in Cylindrical Shells (Nozzle membrane stress due to Out-of-Plane moment)

Range	min d/D	max d/D	min D/T	max D/T	min t/T	max t/T	Eq	$a_i$												
								0	1	2	3	4	5	6	7	8	9	10	11	
1	0.05	0.25	8	500	0.1	0.5	4	0.569	1.301	0.884	0.992	0.948	0.414	0.927	0.863					
2	0.05	0.25	8	500	0.5	1	14	0.237	0.886	0.223	88.287	3.582	0.389	0.415	5.885	47.180	0.917	-0.998	1.526	
3	0.05	0.25	8	500	1	5	13	0.381	1.344	1.296	1.093	4.637	0.005	4.528	0.437	6.031	4.333			
4	0.05	0.25	8	500	5	10	14	2.258	0.889	0.703	0.200	1.464	0.683	-0.755	-0.372	-0.630	0.784	8.038	0.467	
5	0.05	0.25	500	2000	0.1	0.5	5	-0.546	1.862	0.637	0.724	1.881	1.309	2.717	-19.026					
6	0.05	0.25	500	2000	0.5	1	15	0.220	0.886	-0.823	822.014	7.038	169.324	0.837	1.001	4.625				
7	0.05	0.25	500	2000	1	5	12	0.000	0.000	-142.303	0.492	0.832	-198.024	709.295	0.597					
8	0.05	0.25	500	2000	5	10	14	1848.737	-0.420	-3.652	0.050	1.371	-0.955	-4.394	-0.765	-1068.636	1.116	-0.272	0.745	
9	0.25	0.7	8	500	0.1	0.5	5	0.407	0.499	0.449	0.880	0.841	1.916	2.207	0.179					
10	0.25	0.7	8	500	0.5	1	15	0.153	0.866	0.158	0.025	11.273	-1.142	0.700	1.005	4.560				
11	0.25	0.7	8	500	1	5	15	0.073	1.043	-5.418	0.978	0.003	16224.89	1.512	0.303	-0.282				
12	0.25	0.7	8	500	5	10	14	-1.073	0.573	-0.182	0.249	0.749	-0.939	1.219	0.197	19.258	1.057	4.888	3.258	
13	0.25	0.7	500	2000	0.1	0.5	14	-116.076	-0.202	-363.898	246.874	10.342	1.172	-0.926	2.878	1207.619	1.077	-0.999	1.531	
14	0.25	0.7	500	2000	0.5	1	14	0.076	0.985	-1.524	217.341	2.125	7.053	6.694	-10.443	111.197	0.886	1.001	4.635	
15	0.25	0.7	500	2000	1	5	4	-2.604	0.001	0.730	0.916	-76.481	78.767	-126.309	-443.709					
16	0.25	0.7	500	2000	5	10	14	-0.223	1.221	-2.381	0.427	0.050	0.128	-0.113	1.091	-12.093	1.191	5.233	0.852	

Table 4.5.8 – C<sub>4</sub> for Nozzles in Cylindrical Shells (Nozzle membrane stress due to Torsional moment)

Range	min d/D	max d/D	min D/T	max D/T	min t/T	max t/T	Eq	$a_i$											
								0	1	2	3	4	5	6	7	8	9	10	11
1	0.05	0.25	8	250	0.1	1	16	0.135	0.554	0.651	0.576	0.039	-0.121	0.000					
2	0.05	0.25	8	250	1	10	2	0.574	0.265	0.137	0.000	0.149	0.000	-0.011					
3	0.05	0.25	250	2000	0.1	1	5	2.358	0.001	1.918	0.875	258.167	304.482	480.869	-11.948				

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Range	min d/D	max d/D	min D/T	max D/T	min t/T	max t/T	Eq	$a_i$													
								0	1	2	3	4	5	6	7	8	9	10	11		
4	0.05	0.25	250	2000	1	10	10	0.788	0.016	1.707	1.090	-0.483	0.724								
5	0.25	0.7	8	250	0.1	1	7	0.832	0.490	0.063	2.910	-3.019	-0.142	0.775	-0.278	0.415					
6	0.25	0.7	8	250	1	10	7	0.743	57.844	0.179	2.714	-1.500	0.005	0.198	-0.932	-0.017					
7	0.25	0.7	250	2000	0.1	1	7	0.576	11.505	0.426	2.324	14.586	-0.501	0.936	-0.993	0.002					
8	0.25	0.7	250	2000	1	10	13	0.364	11.556	1.471	0.657	-0.707	0.000	-0.725	-0.884	0.718	-289.656				

Table 4.5.9 –  $C_5$  for Nozzles in Cylindrical Shells (Nozzle membrane stress due to Pressure)

Range	min d/D	max d/D	min D/T	max D/T	min t/T	max t/T	Eq	$a_i$													
								0	1	2	3	4	5	6	7	8	9	10	11		
1	0.05	0.7	8	100	0.1	0.5	13	0.050	5.365	0.865	0.620	0.488	-0.118	0.302	4.475	-5.886	-0.982				
2	0.05	0.7	8	100	0.5	10	7	0.093	28.401	-0.961	0.992	-0.181	-0.686	0.945	-0.291	-0.477					
3	0.05	0.7	100	2000	0.1	0.5	13	0.390	143.455	0.774	0.439	0.021	-0.018	0.003	138.738	1383.19	-718.715				
4	0.05	0.7	100	2000	0.5	10	2	0.500	0.173	0.535	-0.001	0.467	-0.012	-0.640							

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**Table 4.5.10 – C<sub>6</sub> for Nozzles in Cylindrical Shells (Vessel membrane stress due to Axial load)**

Range							$a_i$												
	min d/D	max d/D	min D/T	max D/T	min t/T	max t/T	Eq	0	1	2	3	4	5	6	7	8	9	10	11
1	0.05	0.25	8	30	0.1	0.5	7	0.063	0.040	7.084	-0.075	11.876	-2.108	1.272	-0.199	0.492			
2	0.05	0.25	8	30	0.5	1	14	-0.886	0.404	0.018	-4.080	131.542	-0.468	0.523	2.309	0.706	0.820	-0.994	1.437
3	0.05	0.25	8	30	1	10	14	26.405	-0.599	-0.632	-1.829	930.485	-0.629	2.344	-3.777	-1.059	0.030	0.399	-0.317
4	0.05	0.25	30	100	0.1	0.5	14	0.043	1.099	-28.027	74.304	0.540	1.138	-0.644	9.991	184.674	1.368	-0.995	1.462
5	0.05	0.25	30	100	0.5	1	6	-1.277	3.189	0.285	0.018	0.108	0.541						
6	0.05	0.25	30	100	1	10	7	0.256	310.356	-0.944	0.714	-1.066	0.001	-0.039	-0.463	0.599			
7	0.05	0.25	100	500	0.1	0.5	7	-0.379	13.927	-0.990	0.983	490.409	9.494	0.890	-0.965	0.010			
8	0.05	0.25	100	500	0.5	1	14	0.090	1.027	-0.231	913.109	25.191	-0.826	-4.275	-2.658	144.906	1.004	1.001	-1.602
9	0.05	0.25	100	500	1	10	14	-335.492	-1.265	0.965	1.010	70.201	-0.992	1.462	0.393	7.441	0.891	-0.163	0.216
10	0.05	0.25	500	1000	0.1	0.5	11	-2.060	502.317	-0.960	0.889	-0.215	0.891	-0.998	0.989				
11	0.05	0.25	500	1000	0.5	1	11	-1.948	16.139	-0.942	0.851	0.003	-0.099	9.650	-1.313				
12	0.05	0.25	500	1000	1	10	3	-10.726	0.855	0.340	0.668	0.586							
13	0.05	0.25	1000	2000	0.1	0.5	11	-2.907	1.849	-0.899	0.800	0.027	0.454	3.782	-0.540				
14	0.05	0.25	1000	2000	0.5	1	14	628.425	-0.477	0.873	744.252	44.788	-0.869	1.097	1.677	-67.725	0.786	0.983	-1.327
15	0.05	0.25	1000	2000	1	10	4	-21.056	0.000	0.304	0.719	2664.926	650.475	967.927	-18856.891				
16	0.25	0.7	8	30	0.1	0.5	1	1.500	0.100	0.000	0.030								
17	0.25	0.7	8	30	0.5	1	14	814.281	-3.552	3.228	1.153	29.233	-0.957	1.459	-0.279	-33.447	1.061	-0.336	0.355
18	0.25	0.7	8	30	1	10	14	7.872	-10.594	-3.676	0.858	10.516	5.937	-2.191	4.068	-0.125	0.038	-0.215	0.229
19	0.25	0.7	30	100	0.1	0.5	11	-0.786	969.288	-0.791	0.604	0.016	-0.350	-0.997	0.971				
20	0.25	0.7	30	100	0.5	1	14	-0.010	1.031	3.251	1.098	4.284	-0.537	1.944	-0.634	-101.257	1.544	1.001	-1.651
21	0.25	0.7	30	100	1	10	13	2.316	0.232	-0.060	1.000	-39.980	0.156	-39.958	0.730	1.815	0.107		
22	0.25	0.7	100	500	0.1	0.5	14	0.042	0.419	-3832930	23.418	655.867	0.209	0.427	1.765	-7.385	0.584	-0.999	1.528
23	0.25	0.7	100	500	0.5	1	13	10.210	22.806	0.303	0.869	-0.270	0.001	-0.273	-2.033	-24.114	33.915		
24	0.25	0.7	100	500	1	10	6	-9.070	5.962	0.043	0.008	0.115	0.552						
25	0.25	0.7	500	1000	0.1	0.5	14	-127.420	-0.362	121.117	0.307	0.960	4.491	0.232	-1.765	-585.721	0.766	-0.888	1.140
26	0.25	0.7	500	1000	0.5	1	14	7.514	0.120	0.706	2510.508	10.237	-0.548	2.092	-1.268	-41.129	0.744	0.872	-1.026
27	0.25	0.7	500	1000	1	10	11	-22.800	16.293	-0.634	0.407	0.007	0.233	-0.054	0.482				
28	0.25	0.7	1000	2000	0.1	0.5	15	3849.717	-0.883	-1305.027	8.889	95.444	-5.982	0.320	0.058	-0.001			
29	0.25	0.7	1000	2000	0.5	1	14	63.124	-0.192	0.532	418.543	188.007	-0.722	1.904	-0.834	-13.158	0.455	0.813	-0.917
30	0.25	0.7	1000	2000	1	10	11	-15.428	3.638	-0.755	0.484	0.016	0.678	-0.562	0.837				

**Table 4.5.11 – C<sub>7</sub> for Nozzles in Cylindrical Shells (Vessel membrane stress due to In-Plane moment)**

Range							Eq	<i>a<sub>i</sub></i>											
	min d/D	max d/D	min D/T	max D/T	min t/T	max t/T		0	1	2	3	4	5	6	7	8	9	10	11
1	0.05	0.25	8	100	0.1	0.5	7	0.036	0.022	0.733	5.467	221.942	67.904	1.437	-0.899	0.033			
2	0.05	0.25	8	100	0.5	1	14	-8.406	0.752	0.060	0.645	3.728	0.209	-0.208	1.383	0.044	0.756	2.606	-1.343
3	0.05	0.25	8	100	1	5	14	-7.504	0.956	-0.015	2.753	1.872	0.122	-0.121	1.013	0.105	0.955	4.945	-1.231
4	0.05	0.25	8	100	5	10	14	0.347	0.965	-1.259	-0.353	1.006	-0.981	1.363	0.664	72.934	1.337	0.506	-0.672
5	0.05	0.25	100	500	0.1	0.5	11	-0.217	2247.473	-0.980	0.993	0.017	-0.035	-0.961	0.897				
6	0.05	0.25	100	500	0.5	1	11	-0.383	1006.368	-0.974	0.987	0.001	-0.677	-1.141	-0.228				
7	0.05	0.25	100	500	1	5	14	1.237	0.010	-0.385	1.182	2.378	-0.790	-4.063	-2.173	5.207	0.806	0.493	-0.478
8	0.05	0.25	100	500	5	10	14	9.236	0.205	-1.001	0.848	30.067	-0.981	1.376	0.831	-6.145	0.801	-0.017	-0.082
9	0.05	0.25	500	2000	0.1	0.5	13	-12.712	500.547	0.217	0.242	0.026	0.005	0.014	-157.509	123.078	-48.299		
10	0.05	0.25	500	2000	0.5	1	7	-8.752	0.165	-0.937	0.497	31.299	-0.839	0.983	5.569	1.598			
11	0.05	0.25	500	2000	1	5	13	-10.538	24.328	0.227	0.490	1.077	0.009	1.036	-20.399	101.500	-137.667		
12	0.05	0.25	500	2000	5	10	14	157978	-1.114	-38.036	1.020	0.318	51.032	5.918	-33.293	18.738	0.348	0.742	-0.794
13	0.25	0.7	8	100	0.1	0.5	14	-0.046	0.781	-461.966	55.795	2647.527	-0.982	1.393	0.157	1.694	0.893	-0.998	1.518
14	0.25	0.7	8	100	0.5	1	14	-3.377	-0.486	-2.803	0.773	1.138	0.472	0.077	0.654	98.983	0.947	-0.924	1.203
15	0.25	0.7	8	100	1	5	14	0.251	0.454	-0.229	1.396	0.819	1.036	-0.585	1.857	1.531	0.776	-0.402	0.405
16	0.25	0.7	8	100	5	10	14	102.774	-2.603	-1.193	0.519	4.292	-0.924	1.221	0.157	22.293	1.022	0.339	0.000
17	0.25	0.7	100	500	0.1	0.5	14	-0.052	0.779	-42336552	27.082	6335.222	-0.967	1.354	0.108	-2.718	0.651	-0.998	1.518
18	0.25	0.7	100	500	0.5	1	11	-8.321	3.675	0.261	0.017	0.002	0.136	0.433	-0.155				
19	0.25	0.7	100	500	1	5	14	236.801	-0.809	-3.538	-0.829	416.720	8.113	-0.398	1.844	-1.045	0.012	1.073	-1.410
20	0.25	0.7	100	500	5	10	14	172.712	-0.446	0.105	1.681	62.681	19.988	8.211	-17.381	-1.210	0.043	-0.516	0.324
21	0.25	0.7	500	2000	0.1	0.5	4	-0.625	1.146	0.112	0.581	0.049	0.657	0.000	-1062.038				
22	0.25	0.7	500	2000	0.5	1	14	2.194	0.117	-0.152	124.594	0.398	51.004	-7.609	17.438	-10.146	0.536	1.016	-1.543
23	0.25	0.7	500	2000	1	5	11	-54.201	60.106	-0.075	0.058	0.000	0.004	0.087	-0.013				
24	0.25	0.7	500	2000	5	10	13	-2.987	4.126	-0.216	0.542	6.375	0.034	6.401	-10.781	-70.362	604.866		

**Table 4.5.12 – C<sub>8</sub> for Nozzles in Cylindrical Shells (Vessel membrane stress due to Out-of-Plane moment)**

Range							Eq	<i>a<sub>i</sub></i>											
	min d/D	max d/D	min D/T	max D/T	min t/T	max t/T		0	1	2	3	4	5	6	7	8	9	10	11
1	0.05	0.25	8	100	0.1	0.5	10	-0.042	-1179.564	0.616	0.587	-1.000	1.000						
2	0.05	0.25	8	100	0.5	1	9	3.615	-0.744	0.130	0.073	-0.049	-0.954	0.992	1.844	-0.349			
3	0.05	0.25	8	100	1	5	14	-14.642	0.879	-0.058	1.588	8.054	-0.144	0.145	0.197	0.007	0.874	9.226	0.330
4	0.05	0.25	8	100	5	10	14	0.857	0.525	-225.261	-5.064	0.795	-0.778	0.883	0.651	-1.784	1.098	0.511	-0.404
5	0.05	0.25	100	500	0.1	0.5	11	0.237	2.048	-0.939	1.014	818.911	1.933	-1.000	0.998				
6	0.05	0.25	100	500	0.5	1	14	-3.752	0.926	0.745	-0.028	1.508	0.251	-0.254	1.014	0.373	0.937	1.649	0.759

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Range							$a_i$												
	min d/D	max d/D	min D/T	max D/T	min t/T	max t/T	Eq	0	1	2	3	4	5	6	7	8	9	10	11
7	0.05	0.25	100	500	1	5	14	15.254	-5.516	0.560	-0.336	0.063	0.981	-1.216	8.531	41.459	1.139	-0.561	0.585
8	0.05	0.25	100	500	5	10	14	15.822	-0.033	-0.634	0.129	0.337	-0.423	0.412	2.350	-21.276	0.983	0.764	-0.624
9	0.05	0.25	500	2000	0.1	0.5	14	2.114	-3.740	-149.714	183.058	8.347	0.890	-2.041	-7.828	256.501	1.135	-0.999	1.539
10	0.05	0.25	500	2000	0.5	1	14	-0.554	0.963	0.118	251.083	0.822	0.018	-3.122	-0.626	45.156	1.007	0.627	0.195
11	0.05	0.25	500	2000	1	5	14	-0.368	1.041	0.198	-116.848	0.253	0.226	-0.235	2.721	66.842	1.081	-0.270	0.729
12	0.05	0.25	500	2000	5	10	14	0.306	0.957	-1.083	0.995	4.720	-0.991	1.439	0.518	687.869	1.064	0.491	-0.715
13	0.25	0.7	8	100	0.1	0.5	5	0.115	0.168	0.833	0.880	14.220	2.995	16.312	-0.084				
14	0.25	0.7	8	100	0.5	1	14	0.000	2.101	-0.141	135.074	500.838	2.457	-1.859	4.358	-1.049	0.110	1.002	-1.617
15	0.25	0.7	8	100	1	5	14	-0.075	1.240	0.058	-0.505	6.617	-0.560	0.598	0.202	1.223	1.036	-0.550	0.797
16	0.25	0.7	8	100	5	10	14	0.289	0.690	-0.041	1.464	4.320	-0.939	1.231	0.194	12.462	1.099	0.252	-0.178
17	0.25	0.7	100	500	0.1	0.5	5	-0.035	0.291	0.772	0.930	0.440	1.647	1.584	-1.005				
18	0.25	0.7	100	500	0.5	1	14	0.130	0.837	-0.780	0.974	18.539	-0.847	1.001	1.121	116.577	1.186	1.001	-1.623
19	0.25	0.7	100	500	1	5	14	0.014	1.134	-1.424	0.749	0.459	-0.169	0.353	1.430	105.528	1.026	-0.663	0.709
20	0.25	0.7	100	500	5	10	14	10.222	0.975	-20.976	-0.895	1.455	-0.344	0.351	-0.300	-0.996	0.979	22.439	1.889
21	0.25	0.7	500	2000	0.1	0.5	5	-4.908	1.232	0.549	0.686	-0.744	1.279	0.007	-719.552				
22	0.25	0.7	500	2000	0.5	1	14	1.128	0.404	0.441	84.620	0.586	0.931	-0.759	3.063	-58.863	1.097	1.005	-1.526
23	0.25	0.7	500	2000	1	5	14	0.063	0.953	0.575	-661.176	0.082	-2.451	-4.744	5.190	331.296	1.104	0.840	4.079
24	0.25	0.7	500	2000	5	10	14	-0.131	0.633	-110.440	-1.143	0.027	2.955	-1.684	4.996	393.529	1.038	1.774	-1.688

Table 4.5.13 –  $C_9$  for Nozzles in Cylindrical Shells (Vessel membrane stress due to Torsional moment)

Range							$a_i$												
	min d/D	max d/D	min D/T	max D/T	min t/T	max t/T	Eq	0	1	2	3	4	5	6	7	8	9	10	11
1	0.05	0.25	8	250	0.1	1	1	0.421	-0.403	0.302	0.810								
2	0.05	0.25	8	250	1	10	7	0.130	0.418	4.044	0.349	-1.021	-0.023	0.524	-0.799	0.242			
3	0.05	0.25	250	2000	0.1	1	16	0.023	0.799	0.279	1.427	-0.106	1.206	0.000					
4	0.05	0.25	250	2000	1	10	6	0.434	0.096	0.623	-0.024	0.600	1.010						
5	0.25	0.7	8	250	0.1	1	7	0.002	69.172	0.513	6.355	-1.014	0.000	0.024	-0.042	0.698			
6	0.25	0.7	8	250	1	10	11	0.130	88.767	0.648	7.672	-0.207	0.772	-0.994	0.999				
7	0.25	0.7	250	2000	0.1	1	7	-0.134	0.317	0.666	4.317	21.300	-0.824	0.982	-0.442	0.225			
8	0.25	0.7	250	2000	1	10	11	-2.524	0.013	196.072	-1.958	0.000	0.177	0.511	-0.101				



**Table 4.5.14 – C<sub>10</sub> for Nozzles in Cylindrical Shells (Vessel membrane stress due to Pressure)**

Range							Eq	<i>a<sub>i</sub></i>											
	min d/D	max d/D	min D/T	max D/T	min t/T	max t/T		0	1	2	3	4	5	6	7	8	9	10	11
1	0.05	0.3	8	30	0.1	0.5	14	106.924	0.027	-11.675	0.018	8.957	0.415	-0.397	-0.286	23.112	-0.398	1.978	0.039
2	0.05	0.3	8	30	0.5	1	7	0.579	0.111	97.082	-0.391	-1.186	0.013	0.156	-0.615	-0.290			
3	0.05	0.3	8	30	1	5	13	0.624	1.083	0.900	0.832	0.892	-0.145	0.562	-8.113	3.070	-1.418		
4	0.05	0.3	8	30	5	10	1	0.085	0.008	0.879	-0.248								
5	0.05	0.3	30	100	0.1	0.5	14	0.021	1.063	1.713	2.431	25.747	0.519	-0.263	2.517	-0.811	0.242	0.100	-3.140
6	0.05	0.3	30	100	0.5	1	11	0.401	0.105	4.851	0.231	-0.069	0.638	-0.122	-0.375				
7	0.05	0.3	30	100	1	5	3	0.759	0.244	0.894	0.710	-1.272							
8	0.05	0.3	30	100	5	10	1	0.784	-0.063	0.006	-0.011								
9	0.05	0.3	100	250	0.1	0.5	13	1.058	2.663	0.783	0.675	0.232	-0.124	0.079	354.787	-11.359	-6.718		
10	0.05	0.3	100	250	0.5	1	11	0.586	0.065	8.646	0.190	-0.019	0.567	-0.115	-0.402				
11	0.05	0.3	100	250	1	5	7	0.819	1.315	1.058	0.747	-8.673	-0.116	0.676	-0.117	-0.943			
12	0.05	0.3	100	250	5	10	3	1.034	0.134	5.404	2.676	-4.786							
13	0.05	0.3	250	500	0.1	0.5	5	1.259	0.613	0.901	0.613	3.364	-2.523	0.252	560.072				
14	0.05	0.3	250	500	0.5	1	11	0.873	0.033	7.500	0.361	-0.413	0.891	0.004	-0.548				
15	0.05	0.3	250	500	1	5	14	0.671	0.489	1.239	-0.972	0.062	-0.631	1.024	-5.579	193.072	0.935	-0.929	1.098
16	0.05	0.3	250	500	5	10	10	1.008	0.002	1.256	2.024	0.000	-3.186						
17	0.05	0.3	500	750	0.1	0.5	5	1.298	0.921	0.915	0.569	3.008	-2.157	0.303	347.956				
18	0.05	0.3	500	750	0.5	1	13	1.063	17.095	0.812	0.519	0.289	-0.021	0.242	42.140	43.309	65.047		
19	0.05	0.3	500	750	1	5	14	0.422	0.549	1.465	-0.946	0.786	-0.422	0.468	-0.624	119.049	0.876	-0.936	1.095
20	0.05	0.3	500	750	5	10	14	-53.871	-0.276	2.445	-0.132	-0.283	-0.946	1.257	-0.190	1795.17	0.407	1.306	3.871
21	0.05	0.3	750	1000	0.1	0.5	14	38.846	0.295	-35.924	47.029	1.606	-0.335	0.343	-0.194	1297.011	0.931	0.320	0.105
22	0.05	0.3	750	1000	0.5	1	14	25.271	0.291	-0.095	280.259	2.188	-0.292	0.305	-1.076	1853.221	0.972	-0.973	1.463
23	0.05	0.3	750	1000	1	5	7	0.835	2.390	-0.995	0.998	735.613	-0.448	1.055	-0.318	-0.514			
24	0.05	0.3	750	1000	5	10	6	1.000	0.011	1.169	1.448	1.123	-1.344						
25	0.05	0.3	1000	1500	0.1	0.5	14	28.101	0.312	-133.034	191.291	9.439	-0.244	0.251	-0.626	55.351	0.568	0.274	0.020
26	0.05	0.3	1000	1500	0.5	1	14	17.582	0.284	-0.115	543.692	2.519	-0.390	0.417	-1.119	2105.295	0.932	-0.986	1.465
27	0.05	0.3	1000	1500	1	5	7	0.839	3.922	-0.954	0.983	4.781	-0.226	0.855	-0.461	-0.361			
28	0.05	0.3	1000	1500	5	10	11	0.947	0.012	0.631	0.804	0.221	0.823	-0.006	-0.703				
29	0.05	0.3	1500	2000	0.1	0.5	14	65.804	0.219	-88.672	134.378	1.594	-0.225	0.230	-0.557	643.137	0.724	0.217	0.127
30	0.05	0.3	1500	2000	0.5	1	14	18.271	0.285	-0.087	237.111	1.626	-0.393	0.424	-1.543	2617.897	0.919	-0.985	1.463
31	0.05	0.3	1500	2000	1	5	14	7.889	-3.352	1.896	-0.395	0.846	-0.984	1.387	0.254	2036.753	1.128	1.026	-2.109
32	0.05	0.3	1500	2000	5	10	11	0.931	0.431	-0.830	0.923	-0.258	0.861	0.000	-0.855				
33	0.3	0.5	8	30	0.1	0.5	13	0.382	4.076	0.737	0.502	0.484	-0.256	0.122	13.796	1.667	2.781		
34	0.3	0.5	8	30	0.5	1	13	0.529	2.923	0.804	0.561	0.446	-0.162	0.107	31.543	1.738	2.255		
35	0.3	0.5	8	30	1	5	7	0.939	4.203	-0.984	1.005	-13.947	2.098	0.754	0.022	-2.487			
36	0.3	0.5	8	30	5	10	1	0.262	1.069	0.711	0.079								
37	0.3	0.5	30	100	0.1	0.5	14	1.920	0.614	0.453	-0.343	5.408	-0.647	0.694	-1.386	0.682	0.705	-0.459	0.568
38	0.3	0.5	30	100	0.5	1	14	1.334	0.533	0.427	-0.668	18.844	-1.063	1.332	-2.474	3.900	0.714	-0.992	1.442

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Range							$a_i$												
	min d/D	max d/D	min D/T	max D/T	min t/T	max t/T	Eq	0	1	2	3	4	5	6	7	8	9	10	11
39	0.3	0.5	30	100	1	5	11	0.623	2.576	-0.855	0.955	-0.368	0.857	-0.012	-1.074				
40	0.3	0.5	30	100	5	10	3	0.983	0.000	3.066	6.192	-7.581							
41	0.3	0.5	100	250	0.1	0.5	13	1.295	1.773	0.816	0.707	0.360	-0.215	0.132	126.467	96.936	-31.192		
42	0.3	0.5	100	250	0.5	1	14	4.277	0.469	-0.100	462.315	3.992	-0.634	0.697	-0.542	828.913	1.242	-0.985	1.462
43	0.3	0.5	100	250	1	5	14	0.235	0.709	1.775	-1.155	1.029	0.744	-2.293	-0.244	64.987	1.042	0.853	4.222
44	0.3	0.5	100	250	5	10	4	1.001	0.000	3.017	2.305	-329.586	90.946	-1790.777	-4914.427				
45	0.3	0.5	250	500	0.1	0.5	5	1.833	0.603	0.900	0.660	2.468	-1.705	0.316	244.888				
46	0.3	0.5	250	500	0.5	1	14	4.952	0.455	-0.036	386.508	1.931	-0.709	0.773	-1.670	655.351	1.063	-0.983	1.459
47	0.3	0.5	250	500	1	5	14	0.051	0.779	2.692	-1.019	1.113	0.688	-0.664	-0.636	-21.088	0.923	-0.963	1.078
48	0.3	0.5	250	500	5	10	15	0.173	0.402	225.808	-4.849	0.007	227.167	0.933	-0.722	1.374			
49	0.3	0.5	500	750	0.1	0.5	13	2.184	12.449	0.972	0.566	0.101	-0.088	0.015	272.049	-617.732	349.213		
50	0.3	0.5	500	750	0.5	1	14	9.999	0.418	0.039	1454.28	1.760	-0.617	0.647	-1.559	975.736	1.016	-0.970	1.456
51	0.3	0.5	500	750	1	5	14	2.109	0.610	0.810	-1.916	1.000	-0.138	0.140	-0.152	326.579	0.985	-0.230	1.066
52	0.3	0.5	500	750	5	10	4	-48.646	0.000	0.020	0.010	-92876.461	-1170.559	-530265	-2.772				
53	0.3	0.5	750	1000	0.1	0.5	13	2.635	6.079	1.031	0.581	0.172	-0.169	0.009	535.130	-471.261	241.911		
54	0.3	0.5	750	1000	0.5	1	14	2.619	0.477	-0.162	1378.021	2.119	-0.564	0.633	-1.156	1550.125	1.070	-0.993	1.464
55	0.3	0.5	750	1000	1	5	14	1.890	0.643	2.325	-0.336	0.898	-0.361	0.369	-0.160	317.818	0.953	0.101	1.040
56	0.3	0.5	750	1000	5	10	9	0.004	0.958	0.866	0.424	467.017	0.008	0.824	0.008	-0.749			
57	0.3	0.5	1000	1500	0.1	0.5	13	2.889	7.738	1.050	0.583	0.161	-0.132	0.035	111.809	-672.301	436.681		
58	0.3	0.5	1000	1500	0.5	1	13	2.689	-26.525	0.974	0.734	0.014	0.003	0.021	-80.349	924.485	-204.305		
59	0.3	0.5	1000	1500	1	5	14	0.254	0.647	2.188	-1.167	3.229	-0.737	0.834	-0.384	-4.688	0.657	-0.762	0.908
60	0.3	0.5	1000	1500	5	10	2	1.461	-0.930	0.893	-0.146	0.781	0.007	-0.801					
61	0.3	0.5	1500	2000	0.1	0.5	13	2.740	1.982	1.013	0.598	0.766	-0.432	0.351	114.802	634.598	43.984		
62	0.3	0.5	1500	2000	0.5	1	11	3.364	6.629	-0.967	1.002	0.006	0.577	0.101	-0.926				
63	0.3	0.5	1500	2000	1	5	14	2.929	0.444	2.990	-1.095	1.025	0.000	0.000	-0.023	1857.113	0.969	0.041	0.792
64	0.3	0.5	1500	2000	5	10	10	1.534	0.072	1.207	1.088	0.000	-2.604						
65	0.5	0.7	8	30	0.1	0.5	5	-0.743	2.335	0.692	0.310	3.387	-2.830	-0.414	10.808				
66	0.5	0.7	8	30	0.5	1	13	0.271	3.493	0.721	0.445	0.486	-0.169	0.080	39.185	1.945	1.960		
67	0.5	0.7	8	30	1	5	14	0.259	0.787	-14.857	0.970	13.963	21.807	3.486	1.200	-0.492	-0.011	0.370	-0.364
68	0.5	0.7	8	30	5	10	2	0.486	0.119	0.581	-0.293	0.685	-0.223	0.577					
69	0.5	0.7	30	100	0.1	0.5	13	1.044	1.462	0.829	0.600	0.728	-0.580	0.101	65.930	3.137	-7.089		
70	0.5	0.7	30	100	0.5	1	14	3.338	0.513	-0.302	2.767	44.387	-1.761	1.135	3.353	0.035	0.559	-0.984	1.461
71	0.5	0.7	30	100	1	5	9	1.092	0.063	-0.455	0.760	2.963	-0.854	0.980	0.000	-0.865			
72	0.5	0.7	30	100	5	10	10	0.274	0.959	0.487	0.526	-0.352	0.387						
73	0.5	0.7	100	250	0.1	0.5	14	1.624	0.601	1.644	-0.016	1.767	-0.809	2.259	2.002	241.288	1.126	-0.982	1.418
74	0.5	0.7	100	250	0.5	1	10	1.186	0.455	0.882	0.514	0.028	-0.743						
75	0.5	0.7	100	250	1	5	14	0.137	0.653	2.045	-1.275	1.629	-1.003	1.631	0.469	66.890	1.069	-0.963	1.099
76	0.5	0.7	100	250	5	10	11	-9.667	1.521	-0.187	0.150	-0.130	0.682	-0.453	0.710				
77	0.5	0.7	250	500	0.1	0.5	13	3.447	6.021	0.931	0.812	0.050	-0.029	0.021	208.471	17.649	-22.190		

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Range							$a_i$												
	min d/D	max d/D	min D/T	max D/T	min t/T	max t/T	Eq	0	1	2	3	4	5	6	7	8	9	10	11
78	0.5	0.7	250	500	0.5	1	10	1.610	0.361	0.921	0.535	0.084	-0.844						
79	0.5	0.7	250	500	1	5	14	0.119	0.680	2.284	-1.266	0.157	-3.224	-1.778	8.242	-7.438	0.753	-0.940	1.047
80	0.5	0.7	250	500	5	10	13	-1564.978	11.490	0.000	0.000	136.078	-0.015	0.189	-1446.20	-180.629	1869.182		
81	0.5	0.7	500	750	0.1	0.5	13	3.466	15.218	1.065	0.613	0.061	-0.057	0.008	268.169	216.417	96.338		
82	0.5	0.7	500	750	0.5	1	10	2.415	0.260	0.998	0.574	0.079	-0.909						
83	0.5	0.7	500	750	1	5	14	0.214	0.831	2.622	-1.200	1.393	-0.940	1.924	0.114	160.633	1.039	-0.310	0.940
84	0.5	0.7	500	750	5	10	2	5.610	-0.988	0.984	-0.181	0.791	-0.019	-0.190					
85	0.5	0.7	750	1000	0.1	0.5	14	1.699	0.517	-44.346	72.331	0.939	-0.117	2.979	0.583	512.097	0.967	0.214	-0.217
86	0.5	0.7	750	1000	0.5	1	14	2.298	0.484	-0.052	231.793	1.533	-1.119	1.894	2.118	1013.503	1.019	-0.993	1.460
87	0.5	0.7	750	1000	1	5	9	0.423	0.025	-0.983	1.032	343.084	-0.061	0.977	-0.046	-0.492			
88	0.5	0.7	750	1000	5	10	11	1.770	0.094	0.432	4.550	-10.089	1.399	0.000	-3.248				
89	0.5	0.7	1000	1500	0.1	0.5	14	1.501	0.515	-42.666	69.534	10.663	-0.945	2.035	1.930	-1.908	0.527	0.329	-0.348
90	0.5	0.7	1000	1500	0.5	1	13	3.085	13.521	1.029	0.579	0.054	-0.040	-0.005	58511.621	310.680	97.443		
91	0.5	0.7	1000	1500	1	5	11	-3.329	0.886	4.856	-0.529	0.001	0.180	-0.035	-0.344				
92	0.5	0.7	1000	1500	5	10	3	1.945	0.016	2.665	1.850	-4.685							
93	0.5	0.7	1500	2000	0.1	0.5	14	6.256	0.312	-70.427	55.210	0.164	-0.833	2.161	1.739	3330.421	0.538	0.402	-0.432
94	0.5	0.7	1500	2000	0.5	1	14	1.351	0.507	-0.164	1503.302	1.358	-1.172	1.741	2.453	1445.883	0.997	-0.996	1.462
95	0.5	0.7	1500	2000	1	5	7	-3.515	1.231	-1.404	1.337	1960.576	0.326	0.877	-1.013	0.005			
96	0.5	0.7	1500	2000	5	10	3	2.041	0.057	2.277	1.588	-4.461							

Table 4.5.15 –  $C_{11}$  for Nozzles in Cylindrical Shells (Nozzle secondary inside stress due to Axial load)

Range							$a_i$												
	min d/D	max d/D	min D/T	max D/T	min t/T	max t/T	Eq	0	1	2	3	4	5	6	7	8	9	10	11
1	0.05	0.25	8	100	0.1	0.5	7	0.719	615.729	1.488	0.912	0.128	-1.050	1.020	-0.965	0.012			
2	0.05	0.25	8	100	0.5	1	14	0.410	1.190	0.234	2.872	0.773	-0.993	1.441	0.683	-5.790	1.422	6.241	-1.253
3	0.05	0.25	8	100	1	5	14	16.000	1.067	-1.434	-1.036	3.050	-0.451	0.470	-2.068	0.132	1.082	1.382	1.054
4	0.05	0.25	8	100	5	10	14	-9.787	0.549	2.471	0.440	3.933	-0.419	0.452	0.530	1.813	0.828	2.422	3.351
5	0.05	0.25	100	500	0.1	0.5	14	2181.485	-1.119	647.262	468.982	680.131	0.156	0.058	6.068	-20.383	0.909	-0.999	1.524
6	0.05	0.25	100	500	0.5	1	14	36.656	1.064	-2.149	-0.573	5.120	-0.293	0.299	-1.147	-0.019	1.070	6.174	-0.281
7	0.05	0.25	100	500	1	5	14	1.760	-6.453	0.853	0.994	4.077	0.238	3.064	-5.721	-5.527	0.863	1.062	-2.037
8	0.05	0.25	100	500	5	10	14	-3.581	0.941	11.315	-0.337	1.054	-0.794	0.923	0.463	-4.209	0.947	14.964	2.667
9	0.05	0.25	500	2000	0.1	0.5	14	-2356.412	-5.131	-56.055	0.600	249.015	0.932	-0.155	7.696	138.896	0.948	-0.999	1.526
10	0.05	0.25	500	2000	0.5	1	11	-30.820	34.831	-1.033	0.718	0.029	0.666	-0.444	0.104				
11	0.05	0.25	500	2000	1	5	11	-9.452	7.124	-0.858	0.619	0.068	0.658	0.057	-0.689				
12	0.05	0.25	500	2000	5	10	14	-3.231	0.869	24.355	-0.704	1.151	-0.785	0.914	0.678	0.827	0.925	5.761	1.213
13	0.25	0.7	8	100	0.1	0.5	7	0.872	221.542	-0.992	0.950	-7.202	-0.223	1.204	-0.935	0.024			

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Range	min d/D	max d/D	min D/T	max D/T	min t/T	max t/T	Eq	$a_i$											
								0	1	2	3	4	5	6	7	8	9	10	11
14	0.25	0.7	8	100	0.5	1	14	0.085	1.366	0.729	1.765	99.352	0.336	0.333	3.702	-4.913	0.912	-0.996	1.510
15	0.25	0.7	8	100	1	5	15	56068.109	-5.453	1.364	0.154	4.696	-5.954	0.887	1.060	10.475			
16	0.25	0.7	8	100	5	10	14	-0.202	0.903	0.015	1.816	3.733	1.028	-1.603	0.182	8.244	1.062	1.825	3.029
17	0.25	0.7	100	500	0.1	0.5	7	1.021	498.180	-0.886	0.621	-8.172	-0.200	0.850	-0.972	0.010			
18	0.25	0.7	100	500	0.5	1	14	11.709	0.274	-66.298	-0.368	7.897	0.854	2.056	-1.711	18.844	0.682	-0.296	2.581
19	0.25	0.7	100	500	1	5	11	-17.056	13.591	-0.597	0.377	0.024	0.413	0.031	-0.505				
20	0.25	0.7	100	500	5	10	14	-0.177	0.961	31.899	-0.466	0.040	1.646	-0.776	3.274	-51.704	0.956	2.429	1.482
21	0.25	0.7	500	2000	0.1	0.5	13	221.055	1019.194	-0.596	0.746	0.027	0.001	0.027	-12.781	7.682	15.920		
22	0.25	0.7	500	2000	0.5	1	14	17.035	0.347	-14.165	133.313	84.434	0.434	0.770	-1.083	-10.005	0.470	0.091	9.234
23	0.25	0.7	500	2000	1	5	14	4.087	1.061	85.153	-1.720	5.168	-0.336	0.346	-0.151	15.442	1.079	3.793	1.295
24	0.25	0.7	500	2000	5	10	14	1.413	0.594	-1.405	1.288	9.062	-0.972	1.713	-0.378	-18.451	0.881	0.333	0.712

Table 4.5.16 –  $C_{12}$  for Nozzles in Cylindrical Shells (Nozzle secondary inside stress due to In-Plane moment)

Range	min d/D	max d/D	min D/T	max D/T	min t/T	max t/T	Eq	$a_i$											
								0	1	2	3	4	5	6	7	8	9	10	11
1	0.05	0.25	8	100	0.1	0.5	14	58.795	-1.586	0.131	-0.726	61.931	0.212	-0.378	7.620	-13.054	1.222	-0.999	1.530
2	0.05	0.25	8	100	0.5	1	9	39.028	-0.010	-0.972	0.903	0.529	-0.918	1.052	-0.783	0.607			
3	0.05	0.25	8	100	1	5	9	2.610	-0.985	0.029	0.004	-2.020	1.811	0.610	0.001	-0.547			
4	0.05	0.25	8	100	5	10	14	-0.364	1.118	-0.199	0.814	1.001	0.529	-0.558	0.125	4.200	1.216	3.344	3.492
5	0.05	0.25	100	500	0.1	0.5	4	-2.752	3.533	0.235	0.745	0.139	0.481	0.118	80.725				
6	0.05	0.25	100	500	0.5	1	14	0.611	0.547	-18.729	-0.587	125.365	-0.486	1.032	2.724	44.315	0.663	1.005	4.579
7	0.05	0.25	100	500	1	5	14	0.090	1.073	7.137	-1.124	424.190	1.001	-1.497	-0.244	-130.120	0.881	1.009	4.314
8	0.05	0.25	100	500	5	10	14	0.320	-0.610	-0.020	0.869	0.766	-0.989	1.419	0.574	-25.951	1.123	2.338	3.248
9	0.05	0.25	500	2000	0.1	0.5	14	-0.023	1.215	110.188	94.502	101.501	1.128	0.010	4.959	28.199	0.872	-0.999	1.531
10	0.05	0.25	500	2000	0.5	1	14	4.427	0.449	-1.598	289.964	22.710	4.442	3.079	-14.915	-14.402	0.594	1.004	4.588
11	0.05	0.25	500	2000	1	5	7	-38.009	0.929	-0.612	0.248	17.360	-0.977	0.998	4.476	-1.743			
12	0.05	0.25	500	2000	5	10	7	-16.375	2.535	-1.007	0.550	249.071	-0.349	0.954	-0.840	-0.014			
13	0.25	0.7	8	100	0.1	0.5	14	16.290	-1.046	114.747	628.678	73.596	15.383	6.051	-10.990	-2.937	0.570	-0.999	1.528
14	0.25	0.7	8	100	0.5	1	14	0.537	0.625	0.022	-0.633	1.823	3.074	3.360	-6.066	-4.374	0.779	-0.937	1.755
15	0.25	0.7	8	100	1	5	15	0.665	0.545	-0.094	0.931	1.029	-4.252	0.881	1.037	4.281			
16	0.25	0.7	8	100	5	10	2	0.001	2488.576	-3.205	0.068	-0.088	-0.025	-0.038					
17	0.25	0.7	100	500	0.1	0.5	5	4.150	0.279	-0.071	0.864	3.324	3.420	5.902	-1.740				
18	0.25	0.7	100	500	0.5	1	14	0.614	0.616	-0.228	84.814	18.530	0.401	1.362	-1.654	-5.127	0.580	-0.941	1.723
19	0.25	0.7	100	500	1	5	14	1.159	0.436	2.691	-2.068	0.243	4.529	2.788	-5.508	-18.954	0.767	1.092	4.293
20	0.25	0.7	100	500	5	10	15	39.986	-0.317	-9.573	0.019	0.124	2.947	0.582	4.607	2.013			
21	0.25	0.7	500	2000	0.1	0.5	14	-0.039	0.887	-1576082	20.886	28.083	42.173	-2.085	4.964	-5.172	0.572	-0.999	1.524

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Range	min d/D	max d/D	min D/T	max D/T	min t/T	max t/T	Eq	$a_i$											
								0	1	2	3	4	5	6	7	8	9	10	11
22	0.25	0.7	500	2000	0.5	1	14	0.948	0.531	-0.757	293.884	21.372	-2.072	-1.604	2.992	-6.921	0.518	0.969	4.771
23	0.25	0.7	500	2000	1	5	14	0.546	0.552	9.467	-2.608	0.354	1.925	1.451	-2.334	-17.457	0.612	1.495	4.396
24	0.25	0.7	500	2000	5	10	15	749.761	-0.827	-1094.604	-415.344	0.104	-19.414	0.684	2.679	2.116			

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**Table 4.5.17 – C<sub>13</sub> for Nozzles in Cylindrical Shells (Nozzle secondary inside stress due to Out-of-Plane moment)**

Range							Eq	<i>a<sub>i</sub></i>											
	min d/D	max d/D	min D/T	max D/T	min t/T	max t/T		0	1	2	3	4	5	6	7	8	9	10	11
1	0.05	0.25	8	100	0.1	0.5	10	0.319	670.232	1.373	1.508	-1.000	0.999						
2	0.05	0.25	8	100	0.5	1	14	-42.137	-8.820	0.000	-29.566	4.962	0.645	-2.361	1.382	1.350	-0.992	1.522	
3	0.05	0.25	8	100	1	5	14	0.754	0.343	-0.227	-1.761	0.720	0.285	-0.295	3.833	-1.827	1.187	1.035	4.219
4	0.05	0.25	8	100	5	10	14	-5.858	0.913	0.595	0.679	1.378	0.318	-0.323	0.604	0.035	0.952	7.196	3.505
5	0.05	0.25	100	500	0.1	0.5	5	-1.244	1.598	0.838	1.082	-1.501	2.192	0.097	67.023				
6	0.05	0.25	100	500	0.5	1	14	1.006	0.791	-1.992	-0.752	14.215	-0.548	-3.729	-2.891	5.778	1.081	1.003	4.470
7	0.05	0.25	100	500	1	5	8	0.000	0.994	1.067	3634.248	-2149.645	577.115	-40.434	-7.569				
8	0.05	0.25	100	500	5	10	11	0.642	28.987	-0.956	1.007	-1.116	1.095	0.000	-0.476				
9	0.05	0.25	500	2000	0.1	0.5	13	-21.828	666.849	0.644	0.792	0.047	0.001	0.043	-24.185	-26.579	-1.168		
10	0.05	0.25	500	2000	0.5	1	11	-11.377	116.628	-0.989	0.991	0.192	0.768	-0.290	-0.193				
11	0.05	0.25	500	2000	1	5	7	-6.761	5.539	-0.997	0.999	3476.79	11.795	1.225	0.420	-1.127			
12	0.05	0.25	500	2000	5	10	14	-0.197	1.176	-0.048	1.579	0.051	-0.310	-3.450	-1.262	91.924	1.201	5.051	3.656
13	0.25	0.7	8	100	0.1	0.5	14	-0.037	1.366	0.001	-2.778	425.014	-0.457	0.420	1.693	-3.141	1.241	-0.999	1.529
14	0.25	0.7	8	100	0.5	1	14	0.205	1.073	0.147	3.090	49.391	-0.668	0.601	1.871	-7.027	1.123	-0.989	1.565
15	0.25	0.7	8	100	1	5	7	0.410	41.286	-0.972	0.993	-1.769	-0.618	1.044	-0.252	-0.424			
16	0.25	0.7	8	100	5	10	14	-6.953	0.893	0.277	0.739	8.255	0.038	-0.038	0.061	0.052	0.913	13.951	3.354
17	0.25	0.7	100	500	0.1	0.5	4	3.809	3.402	0.301	1.001	1.026	0.523	1.041	-0.410				
18	0.25	0.7	100	500	0.5	1	14	1.573	0.673	-5.091	-0.136	40.684	-0.550	0.748	1.624	-8.425	0.918	-0.963	1.668
19	0.25	0.7	100	500	1	5	7	-5.659	124.125	-0.998	0.998	30.655	0.576	0.852	0.442	-0.987			
20	0.25	0.7	100	500	5	10	14	-105384.5	-2.105	-3.374	0.119	0.005	1.310	-0.858	2.809	680.170	1.287	2.540	3.212
21	0.25	0.7	500	2000	0.1	0.5	14	-230.517	-0.727	-190.484	141.763	203.320	7.803	-2.169	6.978	-1.793	0.787	-0.999	1.527
22	0.25	0.7	500	2000	0.5	1	14	11.253	0.419	3.291	-2.700	426.698	0.150	2.644	-2.627	-33.340	0.650	-0.992	1.539
23	0.25	0.7	500	2000	1	5	11	-76.803	199.338	-0.769	0.721	0.003	0.180	0.061	-0.582				
24	0.25	0.7	500	2000	5	10	14	0.139	1.090	-0.015	2.792	0.357	-1.000	1.586	-0.053	17445.711	1.598	5.958	0.681

**Table 4.5.18 – C<sub>14</sub> for Nozzles in Cylindrical Shells (Nozzle secondary inside stress due to Torsional moment)**

Range							Eq	<i>a<sub>i</sub></i>											
	min d/D	max d/D	min D/T	max D/T	min t/T	max t/T		0	1	2	3	4	5	6	7	8	9	10	11
1	0.05	0.3	8	30	0.1	0.5	1	1.000	0.000	0.000	0.000								
2	0.05	0.3	8	30	0.5	1	1	1.000	0.000	0.000	0.000								
3	0.05	0.3	8	30	1	5	4	1.137	-0.029	-1.425	-1.123	-770.879	3.154	-798.459	-0.551				
4	0.05	0.3	8	30	5	10	1	0.036	-0.453	0.493	1.008								
5	0.05	0.3	30	100	0.1	0.5	13	0.902	1.043	2.216	1.451	0.002	0.058	0.021	159.900	-34.379	-4.397		
6	0.05	0.3	30	100	0.5	1	4	0.807	0.011	1.945	1.191	1.017	3.167	0.223	-368.134				

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Range							$a_i$												
	min d/D	max d/D	min D/T	max D/T	min t/T	max t/T	Eq	0	1	2	3	4	5	6	7	8	9	10	11
7	0.05	0.3	30	100	1	5	15	0.052	0.768	0.160	1.897	14.649	0.118	0.111	-0.969	1.570			
8	0.05	0.3	30	100	5	10	14	0.200	0.642	27.795	-2.686	12585.27	1.044	-0.771	-2.748	0.000	-1.494	0.097	-0.447
9	0.05	0.3	100	250	0.1	0.5	2	0.062	102.465	-0.535	-0.134	0.771	-0.962	0.962					
10	0.05	0.3	100	250	0.5	1	14	4160.022	-1.608	0.553	0.464	2.286	1.046	-1.572	2.298	-202.642	1.205	-0.994	-4.776
11	0.05	0.3	100	250	1	5	14	0.181	0.698	1.322	0.330	1.597	0.982	-1.427	-0.506	200.819	0.907	-0.733	0.981
12	0.05	0.3	100	250	5	10	14	-2.095	0.572	1.155	0.390	1.102	0.993	-1.452	0.157	121.196	1.062	5.159	3.260
13	0.05	0.3	250	500	0.1	0.5	13	0.710	8.395	1.613	1.071	0.043	0.005	-0.041	8.373	-51.815	24.460		
14	0.05	0.3	250	500	0.5	1	11	0.703	0.693	0.116	1.841	0.073	0.943	-0.910	0.869				
15	0.05	0.3	250	500	1	5	14	0.909	0.791	0.703	0.254	0.773	0.725	-0.811	-0.282	75.482	0.980	0.581	1.135
16	0.05	0.3	250	500	5	10	14	-0.438	-6.473	0.837	0.243	0.058	0.848	-0.943	-8.962	-29.140	0.729	-0.630	1.084
17	0.05	0.3	500	750	0.1	0.5	13	0.672	16.075	1.509	0.963	-0.054	0.004	-0.056	-6.248	-136.419	63.444		
18	0.05	0.3	500	750	0.5	1	4	0.679	0.024	1.476	0.900	4.709	1.558	2.350	361.099				
19	0.05	0.3	500	750	1	5	7	0.957	1.355	-0.209	1.446	-33.360	-0.385	0.878	1.614	-1.605			
20	0.05	0.3	500	750	5	10	14	-2.284	-2.833	0.786	0.155	0.004	1.008	-1.720	6.983	-15.902	0.815	2.677	3.046
21	0.05	0.3	750	1000	0.1	0.5	13	0.607	7.947	1.380	0.878	0.051	0.011	0.046	51.207	-446.106	155.509		
22	0.05	0.3	750	1000	0.5	1	11	0.748	0.514	-0.335	1.240	-0.222	0.911	-0.726	0.563				
23	0.05	0.3	750	1000	1	5	11	0.931	0.244	-0.350	1.289	-0.639	0.974	0.066	-0.572				
24	0.05	0.3	750	1000	5	10	13	1.032	-2.735	2.414	1.528	0.001	0.000	0.002	-1243.634	-6.338	25.788		
25	0.05	0.3	1000	1500	0.1	0.5	13	0.546	12.223	1.328	0.801	0.046	0.010	0.041	33.658	-157.079	108.385		
26	0.05	0.3	1000	1500	0.5	1	11	0.659	1.112	-0.667	1.084	-0.381	0.923	-0.666	0.467				
27	0.05	0.3	1000	1500	1	5	11	0.821	0.264	-0.335	1.248	-0.645	0.968	0.069	-0.528				
28	0.05	0.3	1000	1500	5	10	14	-8.304	-0.016	1.005	0.122	0.000	0.882	-1.882	-5.619	1634.678	1.068	3.496	2.970
29	0.05	0.3	1500	2000	0.1	0.5	11	0.469	0.448	-0.130	1.221	-0.613	0.958	-0.212	0.584				
30	0.05	0.3	1500	2000	0.5	1	13	0.417	-18.186	1.237	0.745	0.009	0.003	0.020	-100.890	134.529	-1121.502		
31	0.05	0.3	1500	2000	1	5	7	0.659	0.083	-0.306	1.208	-44.568	-0.209	0.856	2.755	-2.422			
32	0.05	0.3	1500	2000	5	10	11	1.010	0.733	-0.980	1.006	0.421	0.984	-0.031	0.024				
33	0.3	0.5	8	30	0.1	0.5	4	-10.192	0.157	0.015	0.057	61.836	6.402	7.810	36.578				
34	0.3	0.5	8	30	0.5	1	7	0.714	0.728	-0.724	1.220	-1.211	0.058	0.713	0.315	1.497			
35	0.3	0.5	8	30	1	5	14	0.825	0.505	7.108	0.990	1.275	0.165	-1.214	-0.632	61.245	0.422	0.302	-0.291
36	0.3	0.5	8	30	5	10	14	-10.419	0.732	1.629	0.737	0.425	-0.736	0.814	-1.733	5.613	1.020	-5.418	6.499
37	0.3	0.5	30	100	0.1	0.5	13	1.004	0.918	3.371	1.496	0.629	0.071	0.641	0.739	-99.374	27.206		
38	0.3	0.5	30	100	0.5	1	13	0.693	3.809	1.827	0.887	0.850	0.006	0.824	1.490	2.263	5.605		
39	0.3	0.5	30	100	1	5	14	0.246	0.658	1.580	0.402	0.933	0.953	-1.756	0.558	67.705	0.748	-0.100	0.405
40	0.3	0.5	30	100	5	10	14	-17.100	0.474	1.624	0.440	1.218	0.560	-0.598	0.881	0.366	0.524	13.996	3.275
41	0.3	0.5	100	250	0.1	0.5	4	0.797	0.018	2.047	1.366	4.145	1.607	4.264	1.623				
42	0.3	0.5	100	250	0.5	1	15	0.097	0.878	1.796	0.795	-0.702	199.823	1.024	1.006	-1.599			
43	0.3	0.5	100	250	1	5	14	194.487	-0.753	-0.289	-0.346	2.537	1.510	-1.097	-3.796	-11.302	0.523	1.111	4.313
44	0.3	0.5	100	250	5	10	13	1.216	77.551	1.822	0.475	-0.028	0.000	-0.037	17.090	0.073	-192.648		
45	0.3	0.5	250	500	0.1	0.5	14	0.057	0.665	-139.919	57.872	1.848	1.862	-2.935	6.532	305.065	1.136	-0.999	1.514

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Range							$a_i$												
	min d/D	max d/D	min D/T	max D/T	min t/T	max t/T	Eq	0	1	2	3	4	5	6	7	8	9	10	11
46	0.3	0.5	250	500	0.5	1	9	1.070	0.009	-0.918	1.045	146.439	0.704	0.875	-0.709	0.599			
47	0.3	0.5	250	500	1	5	7	0.426	0.517	0.537	2.033	-18.993	-0.209	0.785	2.370	-1.396			
48	0.3	0.5	250	500	5	10	7	0.648	1.639	0.443	3.152	-16.647	-0.498	0.902	0.852	-0.427			
49	0.3	0.5	500	750	0.1	0.5	13	0.301	28.636	1.359	0.755	0.027	0.008	0.025	-1.285	12.793	13.988		
50	0.3	0.5	500	750	0.5	1	11	-0.271	0.343	1.437	2.615	-0.403	0.905	-0.655	0.498				
51	0.3	0.5	500	750	1	5	7	-0.275	0.004	1.377	2.040	264.467	0.223	0.902	2.721	-1.518			
52	0.3	0.5	500	750	5	10	14	0.514	0.433	-3.308	-1.965	0.116	1.620	3.034	6.237	-14.249	0.541	1.327	3.309
53	0.3	0.5	750	1000	0.1	0.5	14	-8.232	-0.014	-147.018	90.176	0.844	0.929	-1.183	0.593	542.333	0.940	0.397	-0.342
54	0.3	0.5	750	1000	0.5	1	11	-0.633	0.361	1.500	3.672	-0.455	0.917	-0.618	0.437				
55	0.3	0.5	750	1000	1	5	11	-0.933	0.075	2.555	2.930	-0.187	0.825	0.046	-0.315				
56	0.3	0.5	750	1000	5	10	14	0.440	0.458	2.967	-2.912	1.046	0.697	-0.774	0.013	-74.933	1.025	1.258	2.806
57	0.3	0.5	1000	1500	0.1	0.5	7	-0.917	0.165	1.544	4.983	5.101	-0.034	0.714	0.483	1.078			
58	0.3	0.5	1000	1500	0.5	1	5	-0.392	0.113	1.158	0.559	16.257	-0.906	9.390	-91.417				
59	0.3	0.5	1000	1500	1	5	7	-1.363	0.338	-0.939	1.004	66.237	-0.194	0.862	4.083	-2.196			
60	0.3	0.5	1000	1500	5	10	14	0.151	0.612	-1.906	-0.680	0.826	0.053	-0.053	0.005	905.602	1.065	1.312	2.916
61	0.3	0.5	1500	2000	0.1	0.5	14	-182.656	-0.242	-188.284	103.179	0.064	1.000	-1.074	2.384	2001.885	0.866	0.064	0.063
62	0.3	0.5	1500	2000	0.5	1	11	-1.143	89.189	0.023	11.644	0.002	0.467	-0.557	0.341				
63	0.3	0.5	1500	2000	1	5	4	-2.204	0.001	1.046	0.466	1516.294	48.312	-390.953	-11141.26				
64	0.3	0.5	1500	2000	5	10	14	-6.655	0.308	-7.229	-0.950	0.050	1.933	-2.073	5.413	13.126	0.515	6.698	3.049
65	0.5	0.7	8	30	0.1	0.5	15	0.439	0.561	-0.102	1.053	7.848	-51.051	1.413	0.999	-1.606			
66	0.5	0.7	8	30	0.5	1	13	0.666	12.024	3.147	0.383	0.001	0.173	0.000	-87.971	5.182	-1.539		
67	0.5	0.7	8	30	1	5	15	0.221	1.043	-0.813	-0.561	0.341	-39.939	1.341	-1.075	1.298			
68	0.5	0.7	8	30	5	10	14	-5.870	0.777	-1.052	0.758	0.875	1.009	-1.137	1.518	-0.765	0.777	5.925	3.296
69	0.5	0.7	30	100	0.1	0.5	13	1.000	2.377	2.776	1.078	0.725	0.090	0.739	0.713	-5.405	5.257		
70	0.5	0.7	30	100	0.5	1	13	0.590	7.154	2.117	0.706	0.975	0.011	0.936	0.737	14.887	-0.741		
71	0.5	0.7	30	100	1	5	14	0.353	0.643	3.270	0.338	0.005	0.431	-2.465	1.951	2281.464	1.389	-0.173	0.601
72	0.5	0.7	30	100	5	10	14	1.747	0.278	-0.083	0.663	526.665	0.961	2.991	-9.350	-1.029	0.009	-0.824	0.828
73	0.5	0.7	100	250	0.1	0.5	7	0.912	0.839	0.330	5.390	-15.956	-0.230	0.883	-0.176	0.641			
74	0.5	0.7	100	250	0.5	1	5	-0.838	0.104	1.430	0.549	63.112	5.004	59.930	-5.354				
75	0.5	0.7	100	250	1	5	14	0.880	0.570	-2.836	-0.142	0.123	-7.383	7.372	-13.579	-17.945	0.699	-0.838	1.134
76	0.5	0.7	100	250	5	10	14	5.526	0.171	-2.964	0.052	0.060	-1.588	10.933	-18.190	-108.686	0.903	-0.963	0.703
77	0.5	0.7	250	500	0.1	0.5	14	0.031	0.760	-131.169	57.225	1.982	3.518	-1.053	11.488	318.739	1.103	-0.999	1.515
78	0.5	0.7	250	500	0.5	1	14	-1.811	0.608	0.542	145.921	2.152	1.173	-1.369	1.505	520.219	1.108	-0.975	1.506
79	0.5	0.7	250	500	1	5	7	-0.253	0.791	0.837	3.954	-19.894	-0.299	0.830	3.040	-1.165			
80	0.5	0.7	250	500	5	10	14	1.783	0.574	-7.579	-0.685	0.579	0.950	-1.227	-0.254	143.123	0.972	1.939	0.406
81	0.5	0.7	500	750	0.1	0.5	7	0.717	2.722	0.670	6.157	1900.097	-6.144	1.303	-0.995	0.002			
82	0.5	0.7	500	750	0.5	1	14	0.533	0.677	0.359	552.093	1.201	-1.160	1.401	-4.308	224.608	0.991	1.006	-1.632
83	0.5	0.7	500	750	1	5	7	-1.293	1.724	1.232	3.380	-33.829	-0.344	0.859	3.202	-1.339			
84	0.5	0.7	500	750	5	10	14	0.635	0.373	19.029	-13.982	1.082	1.003	-1.683	0.308	114.639	0.979	1.592	3.174

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Range	min d/D	max d/D	min D/T	max D/T	min t/T	max t/T	Eq	$a_i$											
								0	1	2	3	4	5	6	7	8	9	10	11
85	0.5	0.7	750	1000	0.1	0.5	14	0.111	0.682	-155.714	37.481	4.183	1.005	-1.702	0.331	3168.135	1.195	0.071	-0.075
86	0.5	0.7	750	1000	0.5	1	11	-1.356	1.633	0.424	8.340	-0.155	0.808	-0.662	0.513				
87	0.5	0.7	750	1000	1	5	7	-1.899	0.002	1.236	4.777	992.428	0.654	0.943	3.728	-1.643			
88	0.5	0.7	750	1000	5	10	14	0.272	0.499	-20.108	-24.542	0.358	-1.010	1.731	-0.538	90.218	0.918	-1.560	-0.113
89	0.5	0.7	1000	1500	0.1	0.5	14	0.108	0.654	-174907.297	16.794	740.985	1.060	-1.979	1.053	-3.391	0.293	0.051	-0.054
90	0.5	0.7	1000	1500	0.5	1	11	-0.704	0.923	0.596	6.505	-0.320	0.884	-0.662	0.498				
91	0.5	0.7	1000	1500	1	5	7	-2.426	0.023	1.170	5.428	33.463	-0.217	0.854	4.407	-2.238			
92	0.5	0.7	1000	1500	5	10	14	0.018	0.798	-9.581	-2.068	1.324	1.003	-1.583	0.302	66.125	0.774	1.881	3.048
93	0.5	0.7	1500	2000	0.1	0.5	7	5.244	0.818	0.440	3.951	-59.840	-0.287	0.869	0.193	1.388			
94	0.5	0.7	1500	2000	0.5	1	9	1.896	0.180	-0.776	1.630	13.703	-0.156	0.826	-0.666	0.492			
95	0.5	0.7	1500	2000	1	5	7	0.316	0.024	0.813	4.197	27.040	-0.426	0.923	4.288	-3.067			
96	0.5	0.7	1500	2000	5	10	11	-0.888	2.305	0.758	2.062	0.004	0.222	-0.028	-0.013				

Table 4.5.19 –  $C_{15}$  for Nozzles in Cylindrical Shells (Nozzle secondary inside stress due to Pressure)

Range	min d/D	max d/D	min D/T	max D/T	min t/T	max t/T	Eq	$a_i$											
								0	1	2	3	4	5	6	7	8	9	10	11
1	0.05	0.7	8	30	0.1	0.5	11	0.510	32.750	-0.992	1.001	-0.380	0.799	6.891	-1.273				
2	0.05	0.7	8	30	0.5	1	13	0.587	10.783	1.185	0.424	0.203	-0.069	0.000	-59.962	-6.019	6.844		
3	0.05	0.7	8	30	1	2.5	14	16.793	0.553	-0.190	0.882	26.438	-0.319	0.328	-0.638	0.132	0.577	-0.106	1.285
4	0.05	0.7	8	30	2.5	5	1	0.971	0.543	0.488	-0.807								
5	0.05	0.7	8	30	5	7.5	1	1.459	0.464	0.351	-0.861								
6	0.05	0.7	8	30	7.5	10	1	2.145	0.369	0.226	-0.895								
7	0.05	0.7	30	100	0.1	0.5	5	-0.085	1.688	0.779	0.766	10.215	0.699	10.443	0.363				
8	0.05	0.7	30	100	0.5	1	14	0.584	0.819	0.390	0.435	54.249	-0.652	0.748	-1.095	-2.518	1.032	-0.997	1.454
9	0.05	0.7	30	100	1	2.5	14	16.422	0.640	0.211	-0.770	42.318	-0.203	0.206	-0.452	-0.047	0.644	-0.158	1.296
10	0.05	0.7	30	100	2.5	5	11	0.003	0.963	0.069	0.371	-0.012	0.401	-0.015	-0.591				
11	0.05	0.7	30	100	5	7.5	13	0.246	1.327	0.430	0.426	19.741	-0.021	19.507	-0.052	8.269	-61.508		
12	0.05	0.7	30	100	7.5	10	1	2.584	0.330	0.250	-1.025								
13	0.05	0.7	100	250	0.1	0.5	13	-0.537	36.079	0.799	0.619	0.442	-0.049	0.385	-1.418	74.918	-13.901		
14	0.05	0.7	100	250	0.5	1	13	0.546	100.024	0.813	0.491	0.040	-0.023	0.008	507.318	66.586	-65.015		
15	0.05	0.7	100	250	1	2.5	14	1.999	0.649	0.895	-0.289	1.566	-0.342	0.351	-0.659	243.071	1.147	-0.917	1.315
16	0.05	0.7	100	250	2.5	5	7	0.329	0.485	0.710	0.339	-4.631	-0.269	0.805	-0.164	-0.682			
17	0.05	0.7	100	250	5	7.5	14	35.355	-1.299	1.076	-0.667	1.727	-0.992	1.455	0.101	261.135	1.033	1.106	3.785
18	0.05	0.7	100	250	7.5	10	13	0.288	-0.733	0.413	0.926	0.249	0.000	0.257	1.297	-6.070	109.076		
19	0.05	0.7	250	500	0.1	0.5	11	-1.508	1.967	0.491	0.621	-0.210	0.825	-1.097	0.300				
20	0.05	0.7	250	500	0.5	1	14	14.810	0.605	0.103	287.578	5.236	-0.232	0.235	-0.492	2351.006	1.301	-0.957	1.449

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Range	min d/D	max d/D	min D/T	max D/T	min t/T	max t/T	Eq	$a_i$											
								0	1	2	3	4	5	6	7	8	9	10	11
21	0.05	0.7	250	500	1	2.5	14	7.939	0.585	0.990	-0.229	2.039	-0.185	0.187	-0.328	752.302	1.138	-0.771	1.319
22	0.05	0.7	250	500	2.5	5	7	0.498	0.461	1.963	0.295	-15.352	-0.183	0.770	-0.192	-0.683			
23	0.05	0.7	250	500	5	7.5	14	29.252	-1.013	1.643	-0.702	-0.337	0.980	-1.380	-0.154	686.786	1.143	1.085	3.796
24	0.05	0.7	250	500	7.5	10	14	0.966	-0.257	1.838	-0.776	1.142	-0.993	1.460	0.096	146.292	0.961	1.138	3.464
25	0.05	0.7	500	750	0.1	0.5	11	-2.393	1.420	0.994	0.531	-0.232	0.835	-1.102	0.270				
26	0.05	0.7	500	750	0.5	1	13	0.132	282.237	0.767	0.460	0.016	-0.010	0.002	3330.606	117.562	-153.69		
27	0.05	0.7	500	750	1	2.5	14	7.992	0.569	1.018	-0.379	-1.256	0.203	-2.937	-0.406	1414.54	1.132	-0.793	1.321
28	0.05	0.7	500	750	2.5	5	14	2.369	0.644	2.347	-0.888	0.500	-0.193	0.194	-0.308	140.853	0.910	0.953	0.987
29	0.05	0.7	500	750	5	7.5	14	0.521	-1.380	1.653	-0.659	0.367	-0.986	1.731	-0.115	1415.294	1.152	1.085	3.784
30	0.05	0.7	500	750	7.5	10	14	12.073	-0.799	2.153	-0.828	1.074	-0.991	1.443	0.098	169.611	0.922	1.155	3.467
31	0.05	0.7	750	1000	0.1	0.5	11	-1.999	0.358	0.787	0.600	-0.379	0.892	-0.413	-0.446				
32	0.05	0.7	750	1000	0.5	1	7	0.640	4.149	-0.999	1.000	5467.349	-3.863	1.309	-0.309	-0.955			
33	0.05	0.7	750	1000	1	2.5	11	1.166	140.482	-0.998	1.000	-0.376	0.899	0.007	-1.381				
34	0.05	0.7	750	1000	2.5	5	13	0.724	52.181	0.636	0.456	0.011	-0.002	0.001	-2879.10	-3.702	-41.887		
35	0.05	0.7	750	1000	5	7.5	14	0.001	0.884	1.028	-0.416	1.161	-0.992	1.453	0.105	876.494	1.032	1.063	3.785
36	0.05	0.7	750	1000	7.5	10	14	2.412	-0.512	1.976	-0.762	0.650	-0.988	1.718	-0.111	284.766	0.950	1.142	3.467
37	0.05	0.7	1000	1500	0.1	0.5	13	-0.461	27.470	0.735	0.555	0.113	-0.116	0.009	7342.346	-1577.081	1079.138		
38	0.05	0.7	1000	1500	0.5	1	11	0.642	22.242	-0.974	0.995	-0.012	0.619	-0.152	-1.068				
39	0.05	0.7	1000	1500	1	2.5	7	1.233	2.545	-0.996	0.999	1173.497	1.183	0.856	0.057	-1.465			
40	0.05	0.7	1000	1500	2.5	5	10	0.573	0.454	0.660	0.553	-0.011	-0.912						
41	0.05	0.7	1000	1500	5	7.5	14	0.001	0.866	0.917	-0.369	3.035	-0.978	1.373	0.190	82.453	0.764	1.069	3.785
42	0.05	0.7	1000	1500	7.5	10	7	0.245	0.161	1.415	0.308	12.585	0.003	0.597	-0.022	-1.129			
43	0.05	0.7	1500	2000	0.1	0.5	13	1.013	210.748	0.798	0.567	0.015	-0.018	0.002	38790.711	961.327	-450.818		
44	0.05	0.7	1500	2000	0.5	1	7	0.611	3.569	-0.939	0.989	54.652	-0.163	0.837	-0.354	-0.926			
45	0.05	0.7	1500	2000	1	2.5	11	1.346	45.756	-0.996	0.999	-0.130	0.809	0.012	-1.403				
46	0.05	0.7	1500	2000	2.5	5	7	0.580	0.139	0.062	0.655	27.781	-0.537	0.941	-0.146	-0.735			
47	0.05	0.7	1500	2000	5	7.5	7	0.307	0.056	0.521	0.478	88.674	-0.172	0.854	-0.062	-0.917			
48	0.05	0.7	1500	2000	7.5	10	6	0.352	0.886	0.621	-0.011	0.646	-1.706						

Table 4.5.20 –  $C_{16}$  for Nozzles in Cylindrical Shells (Vessel secondary inside stress due to Axial load)

Range	min d/D	max d/D	min D/T	max D/T	min t/T	max t/T	Eq	$a_i$												
								0	1	2	3	4	5	6	7	8	9	10	11	
1	0.05	0.25	8	250	0.1	1	10	0.189	0.136	0.419	0.941	3.654	2.492							
2	0.05	0.25	8	250	1	10	7	0.400	77.296	-0.994	0.986	-6.094	0.698	0.970	-0.573	0.723				
3	0.05	0.25	250	2000	0.1	1	8	0.589	0.437	0.872	0.016	1.116	-1.856	7.051	-5.374					
4	0.05	0.25	250	2000	1	10	7	-5.948	46.729	-1.022	0.875	-10.026	-0.188	0.871	-0.360	0.801				



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Range							$a_i$												
	min d/D	max d/D	min D/T	max D/T	min t/T	max t/T	Eq	0	1	2	3	4	5	6	7	8	9	10	11
5	0.25	0.7	8	250	0.1	1	2	1.995	-0.846	0.734	0.156	-0.393	4.782	4.453					
6	0.25	0.7	8	250	1	10	2	18.607	-0.503	0.412	-0.996	1.001	6.030	0.962					
7	0.25	0.7	250	2000	0.1	1	8	0.424	-0.035	0.722	0.010	2.582	-5.415	15.265	-9.710				
8	0.25	0.7	250	2000	1	10	8	0.000	-0.018	0.675	-8621.372	30349.689	-3370.853	462.425	-33.759				

Table 4.5.21 – C<sub>17</sub> for Nozzles in Cylindrical Shells (Vessel secondary inside stress due to In-Plane moment)

Range							$a_i$												
	min d/D	max d/D	min D/T	max D/T	min t/T	max t/T	Eq	0	1	2	3	4	5	6	7	8	9	10	11
1	0.05	0.25	8	100	0.1	0.5	14	3078.817	-4.716	-7541.984	47.742	201.277	-0.710	0.776	3.260	-1.830	0.820	-0.998	1.510
2	0.05	0.25	8	100	0.5	1	14	0.655	0.478	0.000	-30.062	74.456	-0.914	1.158	1.923	-2.470	0.980	1.003	-1.552
3	0.05	0.25	8	100	1	5	7	-0.109	24.402	-0.999	0.998	51.554	10.214	1.287	-0.786	0.224			
4	0.05	0.25	8	100	5	10	11	0.188	0.213	-0.908	0.918	7.511	1.293	-0.074	0.560				
5	0.05	0.25	100	500	0.1	0.5	14	2177.994	-1.423	-1120282	21.877	140.853	1.307	3.263	-9.518	-4.614	0.429	-0.995	1.477
6	0.05	0.25	100	500	0.5	1	14	6746.377	-1.435	-0.260	97.399	261.408	-0.628	0.818	3.673	-8.308	0.552	0.999	-1.507
7	0.05	0.25	100	500	1	5	14	68264.477	-1.838	-0.838	-3.631	1432.435	-0.993	1.467	0.425	-10.682	0.636	-0.721	0.813
8	0.05	0.25	100	500	5	10	14	-7222774	-2.886	-2.543	1.107	149.439	-0.995	1.491	0.287	33.948	0.857	0.612	-0.403
9	0.05	0.25	500	2000	0.1	0.5	14	-0.247	0.841	-233.863	62.697	124.887	-0.856	1.049	0.254	12.468	0.793	-0.920	1.209
10	0.05	0.25	500	2000	0.5	1	13	-6.102	124.511	0.192	0.526	0.042	0.015	0.043	-2.395	-455.378	364.369		
11	0.05	0.25	500	2000	1	5	8	0.000	0.251	0.729	-319.057	1442.228	-404.096	102.103	-15.476				
12	0.05	0.25	500	2000	5	10	13	-76.875	1399.418	0.121	0.517	0.005	0.001	0.003	-820.632	9.614	-96.450		
13	0.25	0.7	8	100	0.1	0.5	11	-0.062	81.811	-0.148	0.268	-0.930	0.988	-0.942	0.970				
14	0.25	0.7	8	100	0.5	1	14	0.111	0.267	-3.586	1.002	0.884	10.108	-1.941	4.935	2.749	0.524	0.664	-0.713
15	0.25	0.7	8	100	1	5	14	0.932	0.229	0.125	-0.093	2.497	0.156	0.360	1.917	-3.427	0.878	-0.769	0.862
16	0.25	0.7	8	100	5	10	14	-10.723	-0.248	-2.171	1.004	13.819	-0.945	1.327	0.280	27.601	0.925	0.461	-0.265
17	0.25	0.7	100	500	0.1	0.5	14	-10.276	-0.579	-17.937	2.569	1.577	5.359	-1.979	2.421	163.786	0.926	0.999	-1.512
18	0.25	0.7	100	500	0.5	1	13	0.004	5.680	0.125	0.688	0.284	0.091	0.296	1.822	3.683	15.444		
19	0.25	0.7	100	500	1	5	14	-0.046	0.759	-9.664	0.795	252.013	-0.955	1.422	0.197	5.469	0.585	-0.621	0.686
20	0.25	0.7	100	500	5	10	14	26664.221	-1.538	-126343.203	-6.936	2317.062	-0.985	1.673	-0.178	-3.715	0.334	0.790	-0.523
21	0.25	0.7	500	2000	0.1	0.5	4	-2.207	0.000	0.029	0.605	422.425	3553.032	289.947	1135.124				
22	0.25	0.7	500	2000	0.5	1	14	339.281	-0.864	3.974	2.033	8.100	0.848	0.898	0.524	-9.579	0.537	-0.239	0.234
23	0.25	0.7	500	2000	1	5	7	-3.948	6.695	0.614	-0.156	-3.732	0.001	0.371	-0.511	0.487			
24	0.25	0.7	500	2000	5	10	13	-43.583	628.735	0.028	0.488	0.020	0.001	0.015	-28.465	-37.521	362.183		

**Table 4.5.22 – C<sub>18</sub> for Nozzles in Cylindrical Shells (Vessel secondary inside stress due to Out-of-Plane moment)**

Range							Eq	<i>a<sub>i</sub></i>											
	min d/D	max d/D	min D/T	max D/T	min t/T	max t/T		0	1	2	3	4	5	6	7	8	9	10	11
1	0.05	0.25	8	250	0.1	1	8	0.199	0.876	1.007	0.001	5.161	-10.160	13.180	-6.787				
2	0.05	0.25	8	250	1	10	7	0.083	51.243	-0.742	1.019	0.049	-0.981	1.025	-0.551	0.594			
3	0.05	0.25	250	2000	0.1	1	7	1.567	390.352	-0.986	0.996	-16.217	0.058	0.555	0.058	1.515			
4	0.05	0.25	250	2000	1	10	13	-2.210	1111.780	0.820	0.982	0.033	0.001	0.033	-21.950	12.468	26.705		
5	0.25	0.7	8	250	0.1	1	13	0.135	1.123	0.484	0.962	0.010	0.361	0.017	53.499	-1.976	1.908		
6	0.25	0.7	8	250	1	10	7	0.479	80.611	-0.895	0.967	-0.438	-0.913	1.015	-0.644	0.573			
7	0.25	0.7	250	2000	0.1	1	7	1.791	117.119	-0.988	0.982	-19.556	-0.075	0.805	0.040	1.629			
8	0.25	0.7	250	2000	1	10	7	2.588	227.165	-0.988	0.985	-18.678	-0.232	0.873	-0.418	0.790			

**Table 4.5.23 – C<sub>19</sub> for Nozzles in Cylindrical Shells (Vessel secondary inside stress due to Torsional moment)**

Range							Eq	<i>a<sub>i</sub></i>											
	min d/D	max d/D	min D/T	max D/T	min t/T	max t/T		0	1	2	3	4	5	6	7	8	9	10	11
1	0.05	0.25	8	100	0.1	0.5	1	0.518	0.470	0.302	0.727								
2	0.05	0.25	8	100	0.5	1	12	0.178	2.098	0.020	-0.995	0.999	-11.598	24.344	0.790				
3	0.05	0.25	8	100	1	10	14	-0.073	1.009	-0.028	1.567	-6.997	0.775	-0.898	-0.446	-0.286	0.667	-0.091	0.326
4	0.05	0.25	100	250	0.1	0.5	13	0.151	4.298	0.526	0.540	0.009	0.054	0.016	276.101	-106.497	-8.580		
5	0.05	0.25	100	250	0.5	1	14	-47.154	-1.155	-0.278	2.061	1.230	-0.375	0.435	0.379	223.179	0.881	0.946	-1.232
6	0.05	0.25	100	250	1	10	7	0.433	0.196	46.020	0.365	-9.561	-0.144	0.701	-0.698	0.466			
7	0.05	0.25	250	500	0.1	0.5	13	0.153	11.759	0.577	0.533	0.002	0.018	0.004	845.644	-10.284	3.571		
8	0.05	0.25	250	500	0.5	1	13	0.493	105.386	1.041	0.359	0.001	0.017	0.006	1594.008	88.844	-60.201		
9	0.05	0.25	250	500	1	10	7	0.524	-0.731	3.262	0.904	-16.920	-0.486	0.900	-0.683	0.552			
10	0.05	0.25	500	1000	0.1	0.5	9	1.009	0.124	1.096	1.369	20.953	-0.163	0.800	-0.938	0.999			
11	0.05	0.25	500	1000	0.5	1	11	0.442	109.617	0.036	4.370	0.010	0.321	-0.810	1.096				
12	0.05	0.25	500	1000	1	10	14	-0.449	0.653	-0.056	-5.764	1.530	0.769	-0.800	3.180	-2.265	0.553	-0.156	0.368
13	0.05	0.25	1000	2000	0.1	0.5	7	0.229	19.705	0.002	6.856	135.167	-0.174	0.879	-0.074	0.996			
14	0.05	0.25	1000	2000	0.5	1	7	0.394	0.072	0.237	2.482	243.666	0.001	0.908	-0.060	1.360			
15	0.05	0.25	1000	2000	1	10	14	5734.091	-1.365	-0.164	-2.432	0.976	0.999	-1.053	6.066	-2.808	0.517	-0.255	0.275
16	0.25	0.7	8	100	0.1	0.5	7	-0.015	126.598	0.291	6.375	-1.012	0.000	0.025	0.133	0.871			
17	0.25	0.7	8	100	0.5	1	13	0.285	11.237	1.333	0.502	0.111	0.071	0.121	17.292	0.767	3.494		
18	0.25	0.7	8	100	1	10	11	0.216	15.799	2.428	4.056	-0.828	0.973	-0.973	0.993				
19	0.25	0.7	100	250	0.1	0.5	14	668.246	-1.634	-2.636	340.169	14.864	1.000	-1.583	0.066	3553.007	1.502	0.319	-0.321
20	0.25	0.7	100	250	0.5	1	13	0.0	11.069	1.772	0.817	0.020	0.020	0.026	150.092	3.142	11.038		
21	0.25	0.7	100	250	1	10	14	6280.565	-1.843	0.244	1.025	4.068	1.000	-1.538	0.110	821.489	1.433	-0.539	0.582
22	0.25	0.7	250	500	0.1	0.5	9	0.225	0.030	0.306	3.330	-14.909	-0.252	0.812	5.455	0.476			

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Range	min d/D	max d/D	min D/T	max D/T	min t/T	max t/T	Eq	$a_i$													
								0	1	2	3	4	5	6	7	8	9	10	11		
23	0.25	0.7	250	500	0.5	1	13	0.850	81.947	1.718	0.569	0.003	0.013	0.006	563.441	49.226	-9.058				
24	0.25	0.7	250	500	1	10	7	-0.782	1.249	1.340	5.034	-15.477	-0.230	0.808	-0.539	0.459					
25	0.25	0.7	500	1000	0.1	0.5	2	0.116	0.508	3.196	0.005	0.234	21.754	0.187							
26	0.25	0.7	500	1000	0.5	1	14	-0.118	0.590	0.002	2984.824	34.212	1.001	-1.446	0.590	3.778	0.650	0.920	-1.143		
27	0.25	0.7	500	1000	1	10	7	-1.094	-0.240	1.032	4.908	-13.864	-1.546	1.047	-0.443	0.520					
28	0.25	0.7	1000	2000	0.1	0.5	14	-0.115	0.545	-151.962	101.713	27.771	0.996	-1.456	0.375	7.733	0.639	0.026	0.000		
29	0.25	0.7	1000	2000	0.5	1	7	-0.764	0.173	0.845	4.613	30.427	-0.550	0.943	0.018	1.108					
30	0.25	0.7	1000	2000	1	10	7	-1.108	0.246	1.071	4.096	30.422	-0.590	0.950	-0.398	0.553					

Table 4.5.24 –  $C_{20}$  for Nozzles in Cylindrical Shells (Vessel secondary inside stress due to Pressure)

Range	min d/D	max d/D	min D/T	max D/T	min t/T	max t/T	Eq	$a_i$													
								0	1	2	3	4	5	6	7	8	9	10	11		
1	0.05	0.25	8	100	0.1	0.5	13	0.883	1.805	0.418	0.656	0.316	-0.013	0.196	106.586	-3.275	-1.752				
2	0.05	0.25	8	100	0.5	1	11	0.424	0.429	2.791	0.249	0.005	0.372	-0.269	-0.122						
3	0.05	0.25	8	100	1	5	8	0.001	0.292	0.201	5152.727	-3347.866	968.278	-46.815	-11.525						
4	0.05	0.25	8	100	5	10	14	3.327	0.818	2.269	0.671	0.831	-0.437	0.454	-0.767	1.288	0.900	4.406	3.587		
5	0.05	0.25	100	500	0.1	0.5	13	1.761	24.026	1.055	0.614	0.039	-0.005	0.012	490.301	51.294	-32.081				
6	0.05	0.25	100	500	0.5	1	14	0.730	0.582	-0.854	198.577	1.705	2.744	-0.122	-2.847	289.124	0.662	1.001	4.644		
7	0.05	0.25	100	500	1	5	14	0.152	0.729	0.260	1.473	111.266	-0.091	0.411	2.057	-1.495	0.143	0.949	-2.109		
8	0.05	0.25	100	500	5	10	14	107.657	0.026	-1736.411	-5.421	0.298	-0.815	0.954	-0.210	558.632	0.627	4.369	1.374		
9	0.05	0.25	500	2000	0.1	0.5	4	1.526	0.000	0.933	0.633	5248.781	-183.324	2092.943	964.932						
10	0.05	0.25	500	2000	0.5	1	15	0.933	0.531	-0.192	1420.685	19.831	-1.010	0.008	2.187	-3.034					
11	0.05	0.25	500	2000	1	5	7	0.606	0.124	12.218	0.572	5.949	-0.905	0.991	-0.379	-0.414					
12	0.05	0.25	500	2000	5	10	15	0.623	0.376	416.629	-3.736	66.839	-1.605	0.058	0.829	3.580					
13	0.25	0.7	8	100	0.1	0.5	13	1.193	1.010	0.765	0.510	0.239	-0.070	0.134	13.794	-7.494	10.771				
14	0.25	0.7	8	100	0.5	1	14	0.049	1.031	0.157	2581.533	31.474	2.234	-1.164	2.583	-0.855	0.056	-0.556	2.362		
15	0.25	0.7	8	100	1	5	14	0.093	0.827	0.505	1.005	5.723	-1.008	1.566	-0.227	461.316	1.419	-0.979	1.169		
16	0.25	0.7	8	100	5	10	7	1.888	736.107	-0.956	0.967	-2.838	-0.039	0.454	-1.093	0.071					
17	0.25	0.7	100	500	0.1	0.5	13	2.201	17.802	0.916	0.667	0.046	-0.012	0.021	139.006	36.289	-3.052				
18	0.25	0.7	100	500	0.5	1	13	0.494	7.628	0.782	0.512	0.133	-0.013	0.006	250.635	41.040	-37.799				
19	0.25	0.7	100	500	1	5	14	0.114	0.782	0.102	2.362	47.012	-1.029	1.195	-0.456	-1.596	0.369	-0.865	0.816		
20	0.25	0.7	100	500	5	10	14	17.672	-0.512	0.603	0.800	0.012	1.000	-1.567	0.102	-381721.313	2.273	0.979	3.824		
21	0.25	0.7	500	2000	0.1	0.5	14	1.984	0.480	-27.118	47.347	40.802	-0.755	1.073	-2.237	54.374	0.677	-0.998	1.504		
22	0.25	0.7	500	2000	0.5	1	14	1.912	0.458	-0.310	8.465	272.407	-0.696	1.171	-1.912	0.251	0.288	-0.995	1.478		
23	0.25	0.7	500	2000	1	5	14	6.067	0.556	1.444	-1.059	9.084	-0.288	0.292	-0.458	0.435	0.557	0.410	0.959		
24	0.25	0.7	500	2000	5	10	11	2.935	3.526	-0.980	1.011	-4.317	1.376	0.000	-2.998						

**Table 4.5.25 – C<sub>21</sub> for Nozzles in Cylindrical Shells (Nozzle secondary outside stress due to Axial load)**

Range							Eq	$a_i$											
	min d/D	max d/D	min D/T	max D/T	min t/T	max t/T		0	1	2	3	4	5	6	7	8	9	10	11
1	0.05	0.25	8	500	0.1	0.5	5	0.428	0.658	0.608	1.122	-3.167	4.513	0.205	121.670				
2	0.05	0.25	8	500	0.5	1	14	19496.02	-4.634	-1.347	-0.303	165.377	-0.781	0.932	2.288	0.812	0.924	-0.984	1.530
3	0.05	0.25	8	500	1	5	14	2.768	0.305	-4.473	-0.714	1120.633	-0.994	1.475	0.376	1.213	0.770	1.063	4.212
4	0.05	0.25	8	500	5	10	7	1.637	4160.948	-0.885	0.816	-1.018	0.001	0.010	0.129	-0.937			
5	0.05	0.25	500	2000	0.1	0.5	5	-41.577	4.456	0.337	0.722	-0.778	3.738	1.675	-64.169				
6	0.05	0.25	500	2000	0.5	1	14	308.871	-0.054	5.318	1.310	36.916	-0.663	0.866	3.459	-46.833	0.775	-0.457	2.466
7	0.05	0.25	500	2000	1	5	7	-20.158	1.187	-0.804	0.582	111.488	-0.510	0.978	0.904	-1.566			
8	0.05	0.25	500	2000	5	10	14	0.291	0.983	141.751	-1.459	1.501	-0.995	1.469	0.548	-1021.386	1.333	-0.379	0.980
9	0.25	0.7	8	500	0.1	0.5	7	1.369	762.755	-0.974	0.897	-1.245	-0.707	0.971	-0.891	0.040			
10	0.25	0.7	8	500	0.5	1	14	0.221	0.777	1.013	2.376	258.617	-0.178	0.608	1.953	-3.073	0.801	-0.994	1.510
11	0.25	0.7	8	500	1	5	14	0.871	0.364	1.296	0.111	683.195	-0.979	1.702	-0.241	-3.409	0.692	1.055	4.224
12	0.25	0.7	8	500	5	10	14	1.715	0.335	21.741	-1.744	0.045	11.251	3.952	-7.029	-4.698	0.782	1.494	3.387
13	0.25	0.7	500	2000	0.1	0.5	13	214.492	621.340	-0.665	0.788	0.035	0.001	0.035	-12.711	-7.644	24.911		
14	0.25	0.7	500	2000	0.5	1	14	22.067	0.314	-13.076	163.678	126.983	0.326	0.682	-0.969	-9.905	0.466	-0.066	2.835
15	0.25	0.7	500	2000	1	5	14	3.016	1.095	99.790	-1.558	3.476	-0.263	0.269	-0.144	16.590	1.110	4.539	1.282
16	0.25	0.7	500	2000	5	10	14	-3.169	0.909	-3.693	0.902	0.169	0.581	-0.471	1.374	10.285	0.920	11.566	1.043

**Table 4.5.26 – C<sub>22</sub> for Nozzles in Cylindrical Shells (Nozzle secondary outside stress due to In-Plane moment)**

Range							Eq	$a_i$											
	min d/D	max d/D	min D/T	max D/T	min t/T	max t/T		0	1	2	3	4	5	6	7	8	9	10	11
1	0.05	0.25	8	100	0.1	0.5	14	0.089	0.998	-3.309	1.655	49.391	-0.431	0.669	4.044	24.786	0.981	-0.997	1.510
2	0.05	0.25	8	100	0.5	1	2	2194.547	-1.000	0.999	0.125	0.056	-0.519	0.184					
3	0.05	0.25	8	100	1	5	6	0.088	0.896	0.613	0.168	0.369	-0.629						
4	0.05	0.25	8	100	5	10	14	0.070	1.163	0.049	1.813	11.006	0.015	0.368	1.089	-0.981	0.158	-0.537	2.214
5	0.05	0.25	100	500	0.1	0.5	14	38.527	-0.132	-19.416	39.564	42.758	6.650	5.642	-29.091	-19.653	0.827	-0.999	1.532
6	0.05	0.25	100	500	0.5	1	13	-7.176	50.104	0.226	0.459	0.130	-0.031	0.049	58.001	-147.755	-45.452		
7	0.05	0.25	100	500	1	5	7	-1.661	0.170	-0.857	0.698	129.523	0.003	1.013	0.531	-0.827			
8	0.05	0.25	100	500	5	10	7	-0.842	7.402	-0.996	0.998	1087.906	14.295	1.384	-0.832	-0.036			
9	0.05	0.25	500	2000	0.1	0.5	14	-0.027	1.186	-1021.762	490.312	58.950	1.790	-0.266	5.966	46.518	0.889	-0.999	1.532
10	0.05	0.25	500	2000	0.5	1	14	6.352	0.354	-1.247	282.819	9.416	6.844	3.570	-18.018	-14.444	0.617	1.005	4.570
11	0.05	0.25	500	2000	1	5	14	9.311	-3.212	-13.738	0.486	15.526	-0.989	1.478	0.429	724.740	0.921	1.220	-1.743
12	0.05	0.25	500	2000	5	10	11	-19.860	116.437	-1.103	0.593	0.001	0.039	-0.018	0.042				

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Range	min d/D	max d/D	min D/T	max D/T	min t/T	max t/T	Eq	$a_i$											
								0	1	2	3	4	5	6	7	8	9	10	11
13	0.25	0.7	8	100	0.1	0.5	14	5.294	-0.475	-62128.281	16.518	58.667	11.169	-1.120	7.678	-1.538	0.525	-0.998	1.519
14	0.25	0.7	8	100	0.5	1	14	0.833	0.451	-0.099	1.524	0.832	4.039	2.908	-4.815	1.541	0.888	-0.954	1.676
15	0.25	0.7	8	100	1	5	6	-0.636	1.354	0.333	0.042	0.330	-0.369						
16	0.25	0.7	8	100	5	10	14	0.243	0.468	101.994	-4.100	3.469	-0.993	1.462	0.143	4.802	1.031	0.954	2.214
17	0.25	0.7	100	500	0.1	0.5	14	-0.610	0.444	325.720	0.626	7.625	13.757	1.060	-0.386	-354.687	0.668	-0.992	1.454
18	0.25	0.7	100	500	0.5	1	14	0.687	0.540	0.144	805.916	23.895	1.971	1.716	-2.666	-4.337	0.592	-0.988	1.564
19	0.25	0.7	100	500	1	5	11	-10.722	10.905	-0.205	0.156	0.003	0.144	0.042	-0.323				
20	0.25	0.7	100	500	5	10	14	0.633	0.667	-0.386	0.835	0.021	-0.304	1.767	2.399	-1.496	0.935	2.188	1.827
21	0.25	0.7	500	2000	0.1	0.5	14	-0.024	0.985	-57.084	41.643	11.486	22.014	-1.950	3.845	24.275	0.751	-0.999	1.525
22	0.25	0.7	500	2000	0.5	1	4	-8.604	0.464	0.006	0.457	5.509	-0.847	-0.541	3722.782				
23	0.25	0.7	500	2000	1	5	15	529.588	-0.920	12.137	-2.299	0.777	-16.341	0.604	-0.272	1.030			
24	0.25	0.7	500	2000	5	10	11	6.525	0.786	-0.691	0.255	-0.936	1.002	-0.021	-0.146				

Table 4.5.27 –  $C_{23}$  for Nozzles in Cylindrical Shells (Nozzle secondary outside stress due to Out-of-Plane moment)

Range	min d/D	max d/D	min D/T	max D/T	min t/T	max t/T	Eq	$a_i$												
								0	1	2	3	4	5	6	7	8	9	10	11	
1	0.05	0.25	8	500	0.1	0.5	4	0.699	2.373	0.947	1.228	0.038	0.486	0.045	165.329					
2	0.05	0.25	8	500	0.5	1	14	-511.253	-3.130	0.042	75.388	19.473	-0.185	-3.325	-2.436	5.872	1.107	-0.986	1.553	
3	0.05	0.25	8	500	1	5	1	0.792	0.975	0.994	-0.676									
4	0.05	0.25	8	500	5	10	14	-4.384	0.905	0.979	-0.174	0.440	0.226	-2.912	-1.282	0.297	0.930	8.280	3.520	
5	0.05	0.25	500	2000	0.1	0.5	13	-19.574	366.918	0.656	0.803	0.171	0.001	0.164	-10.726	-73.862	45.173			
6	0.05	0.25	500	2000	0.5	1	14	86.037	0.139	-2.011	88408.359	105.145	-0.628	0.695	2.933	-131.642	0.928	1.005	4.559	
7	0.05	0.25	500	2000	1	5	7	-5.751	6.499	-0.996	0.998	2229.616	9.727	1.086	0.444	-1.331				
8	0.05	0.25	500	2000	5	10	1	0.091	1.137	1.237	-0.140									
9	0.25	0.7	8	500	0.1	0.5	14	1.916	0.144	-4.294	1.832	274.740	1.520	-0.773	4.152	-2.358	0.903	-0.999	1.525	
10	0.25	0.7	8	500	0.5	1	14	0.738	0.832	-0.028	0.270	2059.165	-0.990	1.424	0.281	-4.830	0.986	-0.985	1.586	
11	0.25	0.7	8	500	1	5	1	0.721	0.725	0.923	-0.599									
12	0.25	0.7	8	500	5	10	14	0.750	0.460	-0.020	1.708	12.450	-0.990	1.434	0.178	-0.141	1.128	1.316	3.670	
13	0.25	0.7	500	2000	0.1	0.5	14	-57.064	-2.089	-202.981	147.958	124.748	8.183	5.415	-7.460	19.407	0.836	-0.999	1.527	
14	0.25	0.7	500	2000	0.5	1	14	21.751	0.950	-38.057	3.137	8.068	-0.364	0.375	-0.295	0.159	0.960	8.815	-0.197	
15	0.25	0.7	500	2000	1	5	11	-67.479	123.231	-0.769	0.703	0.004	0.260	0.065	-0.696					
16	0.25	0.7	500	2000	5	10	14	0.185	1.000	-0.238	1.868	2.832	-0.997	1.500	0.208	1011.932	1.225	0.187	0.094	



**Table 4.5.28 – C<sub>24</sub> for Nozzles in Cylindrical Shells (Nozzle secondary outside stress due to Torsional moment)**

Range	min d/D	max d/D	min D/T	max D/T	min t/T	max t/T	Eq	a <sub>i</sub>														
								0	1	2	3	4	5	6	7	8	9	10	11			
1	0.05	0.25	8	500	0.1	0.5	7	0.930	90.172	-0.173	1.616	0.079	-1.006	1.001	-0.192	0.678						
2	0.05	0.25	8	500	0.5	1	5	0.926	0.011	2.318	1.258	-2.827	4.393	-1.448	965.898							
3	0.05	0.25	8	500	1	5	14	-3.518	-1.205	0.861	0.017	0.916	0.999	-1.588	-0.454	69.099	1.134	1.098	4.127			
4	0.05	0.25	8	500	5	10	3	0.744	0.286	1.037	0.538	-0.500										
5	0.05	0.25	500	2000	0.1	0.5	13	0.766	37.859	1.522	0.793	0.002	0.006	0.000	-2288.205	137.980	-13.314					
6	0.05	0.25	500	2000	0.5	1	4	0.633	0.039	1.389	0.771	24.504	0.224	20.549	-56.678							
7	0.05	0.25	500	2000	1	5	7	0.777	0.225	-0.053	1.456	1.973	-0.901	0.995	0.963	-1.094						
8	0.05	0.25	500	2000	5	10	14	-13.656	-10.708	0.822	0.034	0.000	0.985	-1.668	-4.123	1312.727	1.335	1.323	3.309			
9	0.25	0.7	8	500	0.1	0.5	13	0.925	1.909	1.819	1.215	0.792	0.017	0.793	0.153	-38.607	2.043					
10	0.25	0.7	8	500	0.5	1	11	0.770	219.281	0.386	3.060	0.014	-0.705	-0.986	0.983							
11	0.25	0.7	8	500	1	5	13	0.892	1.231	1.932	0.838	-137.465	-0.013	-137.574	0.014	-333.524	1364.928					
12	0.25	0.7	8	500	5	10	14	0.584	0.369	2.707	1.064	3.241	0.983	-1.523	-0.117	598.577	0.479	0.781	-0.846			
13	0.25	0.7	500	2000	0.1	0.5	7	0.309	28.011	1.201	3.182	-9.128	-0.586	0.944	-0.991	0.003						
14	0.25	0.7	500	2000	0.5	1	11	-0.525	1.192	0.612	6.222	-0.029	0.677	-0.651	0.458							
15	0.25	0.7	500	2000	1	5	14	27.422	0.369	0.938	-5.294	3.328	-0.092	0.091	-0.561	-0.107	0.351	15.292	0.740			
16	0.25	0.7	500	2000	5	10	14	284.118	-0.746	-35.898	-42.962	-12.958	-1.000	1.545	-0.078	-120.587	0.890	1.293	3.320			

**Table 4.5.29 – C<sub>25</sub> for Nozzles in Cylindrical Shells (Nozzle secondary outside stress due to Pressure)**

Range	min d/D	max d/D	min D/T	max D/T	min t/T	max t/T	Eq	a <sub>i</sub>														
								0	1	2	3	4	5	6	7	8	9	10	11			
1	0.05	0.3	8	30	0.1	0.5	13	0.838	57.701	1.739	0.600	0.067	0.045	0.043	21.068	-4.880	2.059					
2	0.05	0.3	8	30	0.5	1	1	0.104	1.500	1.246	-0.941											
3	0.05	0.3	8	30	1	5	3	-5.231	5.507	0.062	0.061	-0.077										
4	0.05	0.3	8	30	5	10	1	0.393	1.168	0.889	-1.181											
5	0.05	0.3	30	100	0.1	0.5	14	5.173	0.155	-1.569	0.617	425.385	-0.437	-3.606	-2.486	-8.108	0.713	-0.998	1.558			
6	0.05	0.3	30	100	0.5	1	13	-0.440	25.951	0.716	0.585	0.088	-0.033	0.035	222.195	8.966	-16.820					
7	0.05	0.3	30	100	1	5	7	-0.204	0.697	-0.283	0.852	-0.888	-0.139	0.762	-0.121	-0.762						
8	0.05	0.3	30	100	5	10	1	0.732	0.641	0.540	-1.269											
9	0.05	0.3	100	250	0.1	0.5	4	-1.777	2.227	0.709	0.545	1.243	-0.754	0.052	-202.960							
10	0.05	0.3	100	250	0.5	1	13	-0.162	50.494	0.740	0.562	0.043	-0.019	0.013	947.302	21.229	-16.517					
11	0.05	0.3	100	250	1	5	11	-0.209	0.202	2.024	0.463	-0.620	0.936	-0.018	-0.757							
12	0.05	0.3	100	250	5	10	1	0.815	0.508	0.482	-1.309											
13	0.05	0.3	250	500	0.1	0.5	11	-1.545	1.055	0.993	0.593	-0.211	0.819	-1.073	0.126							
14	0.05	0.3	250	500	0.5	1	14	2.513	0.672	0.118	202.598	2.960	-0.483	0.505	-1.932	999.729	1.226	-0.991	1.454			

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Range							$a_i$												
	min d/D	max d/D	min D/T	max D/T	min t/T	max t/T	Eq	0	1	2	3	4	5	6	7	8	9	10	11
15	0.05	0.3	250	500	1	5	9	0.517	-0.013	0.899	0.561	-15.532	-0.298	0.837	-0.016	-0.796			
16	0.05	0.3	250	500	5	10	1	0.121	0.742	0.935	-1.554								
17	0.05	0.3	500	750	0.1	0.5	11	-2.243	1.025	1.173	0.534	-0.163	0.795	-1.093	0.155				
18	0.05	0.3	500	750	0.5	1	14	8.607	0.601	-0.016	132.376	3.666	-0.317	0.324	-1.351	2235.088	1.205	-0.983	1.462
19	0.05	0.3	500	750	1	5	11	0.173	0.164	0.661	0.645	-0.484	0.918	-0.017	-0.805				
20	0.05	0.3	500	750	5	10	13	-0.266	1.710	0.575	0.560	0.158	-0.010	0.051	-28.823	-111.527	320.443		
21	0.05	0.3	750	1000	0.1	0.5	13	-1.677	86.075	0.710	0.475	0.057	-0.062	0.002	17543.07	747.707	-58.123		
22	0.05	0.3	750	1000	0.5	1	7	0.516	2.633	-0.998	1.000	5290.674	-7.778	1.326	-0.087	-1.247			
23	0.05	0.3	750	1000	1	5	10	0.263	0.491	0.742	0.549	-0.015	-0.817						
24	0.05	0.3	750	1000	5	10	14	0.001	1.048	18.593	-30.833	0.933	-0.986	1.414	0.263	406.229	0.948	1.051	3.746
25	0.05	0.3	1000	1500	0.1	0.5	13	-1.445	6.450	0.708	0.503	0.592	-0.628	0.040	24475.25	-408.407	356.571		
26	0.05	0.3	1000	1500	0.5	1	11	0.507	12.942	-0.981	0.997	-0.101	0.774	-0.024	-1.307				
27	0.05	0.3	1000	1500	1	5	10	0.383	0.532	0.758	0.535	-0.013	-0.834						
28	0.05	0.3	1000	1500	5	10	3	-0.478	1.088	0.495	0.461	-1.085							
29	0.05	0.3	1500	2000	0.1	0.5	5	-0.768	3.810	0.724	0.540	1.932	-1.554	0.090	33579.09				
30	0.05	0.3	1500	2000	0.5	1	11	0.483	45.557	-0.993	0.999	-0.037	0.693	-0.018	-1.319				
31	0.05	0.3	1500	2000	1	5	10	0.423	0.488	0.759	0.544	-0.011	-0.839						
32	0.05	0.3	1500	2000	5	10	11	-0.374	1.247	-0.379	0.600	0.000	0.467	-0.002	-0.962				
33	0.3	0.5	8	30	0.1	0.5	13	-1.222	10.329	0.675	0.342	2.366	-0.204	2.042	0.369	-5.942	2.166		
34	0.3	0.5	8	30	0.5	1	7	0.246	1.740	-0.989	1.004	73.655	-4.842	1.729	0.003	-1.064			
35	0.3	0.5	8	30	1	5	5	0.573	0.014	2.025	1.791	1.540	1.076	0.534	-2624.288				
36	0.3	0.5	8	30	5	10	1	0.580	0.965	0.715	-1.221								
37	0.3	0.5	30	100	0.1	0.5	14	0.149	1.568	-296.681	8.440	3.606	-1.159	1.204	-3.059	-46.145	1.679	1.007	-1.591
38	0.3	0.5	30	100	0.5	1	13	-0.494	21.178	0.817	0.483	0.168	-0.138	-0.017	3432.70	4.618	3.674		
39	0.3	0.5	30	100	1	5	6	-0.365	1.000	0.712	-0.720	0.951	-0.911						
40	0.3	0.5	30	100	5	10	1	1.381	0.699	0.362	-1.179								
41	0.3	0.5	100	250	0.1	0.5	14	1.214	0.868	-1749.234	10.317	3.672	-0.854	0.962	-2.439	513.611	1.421	1.004	-1.580
42	0.3	0.5	100	250	0.5	1	11	0.601	8.605	-0.957	0.995	-0.084	0.744	-0.154	-1.095				
43	0.3	0.5	100	250	1	5	3	-0.517	0.837	0.574	0.464	-0.868							
44	0.3	0.5	100	250	5	10	1	1.100	0.000	0.000	0.000								
45	0.3	0.5	250	500	0.1	0.5	11	0.811	0.355	22.716	-0.324	0.013	0.399	-1.162	0.211				
46	0.3	0.5	250	500	0.5	1	14	0.301	0.459	0.338	202.465	1.881	-1.994	1.575	-4.083	534.948	1.079	-1.001	1.450
47	0.3	0.5	250	500	1	5	9	0.615	-0.147	0.639	0.414	-14.347	-0.188	0.777	-0.009	-0.906			
48	0.3	0.5	250	500	5	10	14	36.568	-0.637	1.223	-15.343	0.102	4.684	-3.198	9.092	-15.333	0.580	1.039	3.796
49	0.3	0.5	500	750	0.1	0.5	4	-0.826	5.660	0.721	0.546	1.168	-0.079	0.770	19.738				
50	0.3	0.5	500	750	0.5	1	14	0.320	0.552	0.612	313.858	1.669	-2.047	1.580	-3.819	840.409	1.046	-1.000	1.446
51	0.3	0.5	500	750	1	5	5	0.247	0.000	0.882	0.376	33042.898	-26327.641	-5284.412	-4196.911				
52	0.3	0.5	500	750	5	10	3	-0.608	1.236	0.448	0.444	-1.083							
53	0.3	0.5	750	1000	0.1	0.5	11	-1.921	0.141	3.452	0.273	-0.053	0.698	-0.155	-0.578				

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Range							$a_i$												
	min d/D	max d/D	min D/T	max D/T	min t/T	max t/T	Eq	0	1	2	3	4	5	6	7	8	9	10	11
54	0.3	0.5	750	1000	0.5	1	14	0.339	0.554	0.672	5785.09	1.614	-2.055	1.595	-3.760	1063.242	1.030	-1.000	1.447
55	0.3	0.5	750	1000	1	5	6	0.339	0.305	0.733	-0.627	0.948	-1.036						
56	0.3	0.5	750	1000	5	10	3	-0.834	1.490	0.395	0.394	-0.978							
57	0.3	0.5	1000	1500	0.1	0.5	11	-1.217	0.485	3.481	0.318	0.001	0.483	-0.635	-0.386				
58	0.3	0.5	1000	1500	0.5	1	14	0.378	0.549	0.807	5846.212	1.701	-1.742	1.352	-3.073	1457.469	1.026	-1.000	1.447
59	0.3	0.5	1000	1500	1	5	3	0.624	0.496	0.782	0.552	-1.079							
60	0.3	0.5	1000	1500	5	10	7	-0.474	0.008	-0.843	0.863	9236.875	6.403	-0.871	-0.052	-0.837			
61	0.3	0.5	1500	2000	0.1	0.5	11	-2.471	1.028	5.409	0.147	0.002	0.360	-0.873	-0.202				
62	0.3	0.5	1500	2000	0.5	1	14	0.364	0.554	0.927	288.71	1.560	-1.658	1.314	-2.861	2106.547	1.025	-1.000	1.447
63	0.3	0.5	1500	2000	1	5	3	0.992	0.419	0.831	0.576	-1.128							
64	0.3	0.5	1500	2000	5	10	7	-0.274	0.384	-0.666	0.779	18.629	-0.181	0.834	-0.058	-0.848			
65	0.5	0.7	8	30	0.1	0.5	13	-2.420	8.272	0.473	0.363	6.302	-0.190	5.914	0.156	6.318	0.923		
66	0.5	0.7	8	30	0.5	1	14	-0.081	0.873	-1.039	-0.659	1.676	2.377	-1.847	2.924	136.806	1.552	1.003	4.591
67	0.5	0.7	8	30	1	5	7	0.311	1.541	-0.988	1.004	83.706	-3.087	1.712	-0.211	-1.025			
68	0.5	0.7	8	30	5	10	1	0.593	0.787	0.612	-1.137								
69	0.5	0.7	30	100	0.1	0.5	14	0.240	1.813	-1410.806	9.973	2.219	-1.033	1.051	-1.868	-27.824	1.832	1.053	-1.591
70	0.5	0.7	30	100	0.5	1	14	0.655	0.348	-0.028	397.651	52.324	-5.948	-1.843	8.466	-2.825	0.541	-1.001	1.455
71	0.5	0.7	30	100	1	5	3	-0.442	0.668	0.648	0.529	-0.932							
72	0.5	0.7	30	100	5	10	1	1.440	0.602	0.313	-1.137								
73	0.5	0.7	100	250	0.1	0.5	11	2.396	0.003	86786.773	11.520	0.002	-0.582	-1.182	0.332				
74	0.5	0.7	100	250	0.5	1	14	0.899	0.177	0.097	910.285	1.756	-4.084	-0.134	5.364	223.213	1.120	-1.001	1.452
75	0.5	0.7	100	250	1	5	3	-0.394	0.833	0.627	0.477	-0.953							
76	0.5	0.7	100	250	5	10	4	-1.222	0.000	0.634	0.531	375.361	32.779	-374.442	-345.342				
77	0.5	0.7	250	500	0.1	0.5	11	1.294	0.039	1277.879	-5.848	0.004	0.001	-1.155	0.211				
78	0.5	0.7	250	500	0.5	1	14	0.412	0.342	0.117	259.781	1.911	-2.778	0.913	3.511	566.823	1.094	-1.001	1.452
79	0.5	0.7	250	500	1	5	3	-0.270	0.797	0.653	0.485	-0.986							
80	0.5	0.7	250	500	5	10	3	-0.707	1.312	0.458	0.440	-1.077							
81	0.5	0.7	500	750	0.1	0.5	11	-3.532	0.367	54.323	-2.255	0.004	0.268	-1.100	0.192				
82	0.5	0.7	500	750	0.5	1	14	0.317	0.299	0.232	258.883	1.683	-2.992	0.696	4.010	780.027	1.052	-1.001	1.451
83	0.5	0.7	500	750	1	5	7	0.124	0.226	2.080	0.304	-13.420	-0.073	0.691	0.016	-1.101			
84	0.5	0.7	500	750	5	10	14	0.085	0.771	27.979	-2.239	0.060	0.278	-0.285	0.637	15.760	0.815	-0.469	3.505
85	0.5	0.7	750	1000	0.1	0.5	7	-2.559	0.386	5.037	0.026	-0.317	0.001	0.488	-0.425	-0.449			
86	0.5	0.7	750	1000	0.5	1	14	-0.057	0.642	0.232	440.321	1.774	-2.686	0.850	3.809	993.351	1.034	-1.002	1.451
87	0.5	0.7	750	1000	1	5	3	0.628	0.505	0.783	0.556	-1.145							
88	0.5	0.7	750	1000	5	10	3	-0.998	1.663	0.431	0.389	-0.970							
89	0.5	0.7	1000	1500	0.1	0.5	13	-3.081	1.738	0.754	0.516	2.142	-2.176	0.083	6999.621	1061.858	-474.380		
90	0.5	0.7	1000	1500	0.5	1	7	1.133	0.321	12.410	-0.138	-3.222	0.001	0.387	-0.547	-0.751			
91	0.5	0.7	1000	1500	1	5	11	0.730	0.055	2.980	0.326	-0.083	0.760	0.002	-1.169				
92	0.5	0.7	1000	1500	5	10	3	-0.946	1.597	0.451	0.400	-0.996							

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Range							$a_i$												
	min d/D	max d/D	min D/T	max D/T	min t/T	max t/T	Eq	0	1	2	3	4	5	6	7	8	9	10	11
93	0.5	0.7	1500	2000	0.1	0.5	11	-10.370	1.346	1.585	0.357	0.001	0.296	1.108	-0.824				
94	0.5	0.7	1500	2000	0.5	1	11	1.170	0.141	7.451	0.161	0.003	0.466	-0.264	-0.986				
95	0.5	0.7	1500	2000	1	5	6	1.413	0.480	0.848	-0.841	0.983	-1.228						
96	0.5	0.7	1500	2000	5	10	3	-0.899	1.547	0.472	0.410	-1.017							

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**Table 4.5.30 – C<sub>26</sub> for Nozzles in Cylindrical Shells (Vessel secondary outside stress due to Axial load)**

Range							<i>a<sub>i</sub></i>													
	min d/D	max d/D	min D/T	max D/T	min t/T	max t/T	Eq	0	1	2	3	4	5	6	7	8	9	10	11	
1	0.05	0.7	8	100	0.1	0.5	2	0.579	-0.885	0.621	0.186	-0.064	11.645	0.136						
2	0.05	0.7	8	100	0.5	10	7	1.043	1804.891	-0.933	0.858	0.006	-0.997	1.001	-0.388	0.816				
3	0.05	0.7	100	2000	0.1	0.5	7	0.429	120.308	-0.825	0.513	-2.381	0.002	0.247	-0.069	1.425				
4	0.05	0.7	100	2000	0.5	10	7	-1.736	8.385	-0.799	0.566	-3.028	-0.191	0.847	-0.271	0.910				

**Table 4.5.31 – C<sub>27</sub> for Nozzles in Cylindrical Shells (Vessel secondary outside stress due to In-Plane moment)**

Range							<i>a<sub>i</sub></i>													
	min d/D	max d/D	min D/T	max D/T	min t/T	max t/T	Eq	0	1	2	3	4	5	6	7	8	9	10	11	
1	0.05	0.7	8	100	0.1	0.5	11	-0.096	962.936	-1.000	0.999	0.085	0.522	-0.092	0.579					
2	0.05	0.7	8	100	0.5	10	7	0.003	43.191	-0.989	0.977	1.368	-0.644	0.981	-0.365	0.546				
3	0.05	0.7	100	2000	0.1	0.5	11	-0.833	1.111	-0.741	0.399	0.009	0.482	0.727	0.334					
4	0.05	0.7	100	2000	0.5	10	7	0.770	5.475	-0.655	0.459	-0.768	-0.893	0.988	-0.318	0.719				

**Table 4.5.32 – C<sub>28</sub> for Nozzles in Cylindrical Shells (Vessel secondary outside stress due to Out-of-Plane moment)**

Range							<i>a<sub>i</sub></i>													
	min d/D	max d/D	min D/T	max D/T	min t/T	max t/T	Eq	0	1	2	3	4	5	6	7	8	9	10	11	
1	0.05	0.25	8	250	0.1	1	8	0.387	0.995	1.039	0.029	3.149	-8.057	13.701	-8.106					
2	0.05	0.25	8	250	1	10	7	0.049	52.440	-0.784	1.016	0.008	-0.951	1.023	-0.439	0.650				
3	0.05	0.25	250	2000	0.1	1	7	0.251	388.013	-0.989	0.993	-11.607	0.043	0.572	0.115	1.561				
4	0.05	0.25	250	2000	1	10	7	3.503	70.375	-0.942	0.993	-31.680	-0.339	0.938	-0.401	0.805				
5	0.25	0.7	8	250	0.1	1	7	0.075	181.039	-0.983	0.987	-0.551	-0.787	0.980	0.090	1.319				
6	0.25	0.7	8	250	1	10	7	0.926	368.561	-0.966	0.990	-0.475	-0.906	1.006	-0.628	0.574				
7	0.25	0.7	250	2000	0.1	1	7	2.966	55.052	-0.969	0.955	-15.968	-0.049	0.768	0.059	1.676				
8	0.25	0.7	250	2000	1	10	7	7.450	226.303	-0.988	0.986	-17.293	-0.233	0.870	-0.359	0.877				



**Table 4.5.33 – C<sub>29</sub> for Nozzles in Cylindrical Shells (Vessel secondary outside stress due to Torsional moment)**

Range							Eq	$a_i$											
	min d/D	max d/D	min D/T	max D/T	min t/T	max t/T		0	1	2	3	4	5	6	7	8	9	10	11
1	0.05	0.25	8	2000	0.1	0.25	13	0.084	0.883	0.805	0.569	0.177	0.319	0.195	10.519	48.932	-4.765		
2	0.05	0.25	8	2000	0.25	1	14	2.637	0.543	0.196	0.501	4.666	0.150	-0.151	1.267	0.093	0.545	0.376	-0.955
3	0.05	0.25	8	2000	1	10	7	0.279	0.051	8.422	0.885	-0.333	-0.165	0.824	-0.735	0.434			
4	0.25	0.7	8	2000	0.1	0.25	6	0.014	1.475	1.639	0.010	0.270	0.714						
5	0.25	0.7	8	2000	0.25	1	14	0.385	-0.098	0.103	1.723	27.909	1.024	-1.677	0.752	4.144	0.683	0.923	-1.166
6	0.25	0.7	8	2000	1	10	14	-4.897	0.764	-0.096	-49.516	3.541	0.415	-2.717	-0.390	0.190	0.761	3.281	0.497

**Table 4.5.34 – C<sub>30</sub> for Nozzles in Cylindrical Shells (Vessel secondary outside stress due to Pressure)**

Range							Eq	$a_i$											
	min d/D	max d/D	min D/T	max D/T	min t/T	max t/T		0	1	2	3	4	5	6	7	8	9	10	11
1	0.05	0.25	8	500	0.1	0.5	11	0.561	0.729	76.580	-0.182	-0.994	0.999	-0.670	-0.110				
2	0.05	0.25	8	500	0.5	1	11	0.488	0.943	21.299	0.173	-0.989	0.999	-0.153	-0.262				
3	0.05	0.25	8	500	1	5	11	0.680	3.715	1.734	2.622	-0.979	0.998	0.019	-1.021				
4	0.05	0.25	8	500	5	10	7	0.771	0.183	0.045	2.449	-4.514	-0.058	0.620	5.934	1.279			
5	0.05	0.25	500	2000	0.1	0.5	13	0.935	75.421	0.816	0.437	0.033	-0.026	0.003	1087.911	805.456	-248.334		
6	0.05	0.25	500	2000	0.5	1	14	10.936	0.305	-0.244	150.220	13.360	-0.588	0.704	-3.358	88.789	0.573	-0.990	1.485
7	0.05	0.25	500	2000	1	5	14	-3.660	0.233	0.051	-317.925	-3.127	-0.447	0.379	-3.486	2.406	0.418	1.137	4.174
8	0.05	0.25	500	2000	5	10	15	2.050	0.221	0.001	3.042	0.001	1229.059	1.181	0.878	3.280			
9	0.25	0.7	8	500	0.1	0.5	13	0.146	5.069	0.772	0.513	3.644	-0.251	3.340	0.112	1.691	-0.024		
10	0.25	0.7	8	500	0.5	1	2	0.063	7.263	-0.117	-0.069	0.679	-0.039	-0.317					
11	0.25	0.7	8	500	1	5	14	7.647	0.612	0.158	1.129	16.231	-0.289	0.291	-0.446	-0.039	0.608	0.073	1.134
12	0.25	0.7	8	500	5	10	13	-32.014	2.402	0.037	0.013	35.586	0.059	21.965	0.288	4.222	11.498		
13	0.25	0.7	500	2000	0.1	0.5	13	2.920	52.053	0.983	0.550	0.026	-0.022	0.003	790.268	1102.432	-165.220		
14	0.25	0.7	500	2000	0.5	1	7	1.634	0.530	-0.981	0.998	-2.545	0.001	0.474	95.294	-3.766			
15	0.25	0.7	500	2000	1	5	14	1.069	0.564	1.255	-0.418	2.689	-0.703	0.762	-0.990	2.540	0.580	-0.673	0.931

**APPENDIX 3 – FINITE ELEMENT COMPILED RESULTS**

**Table 4.5.35 – Finite Element Compiled Results**

Model								Membrane Stress Factors									
	OD	T	od	t	d/D	D/T	t/T	Branch					Header				
								Axial	In-Plane	Out-of-Plane	Torsional	Pressure	Axial	In-Plane	Out-of-Plane	Torsional	Pressure
1	9	1	0.50	0.1	0.05	8	0.1	1.015	0.805	0.808	0.837	0.487	0.166	0.040	0.039	0.049	1.271
2	9	1	0.65	0.25	0.05	8	0.25	1.003	0.619	0.622	1.014	0.401	0.299	0.061	0.058	0.074	0.961
18	17	1	0.90	0.1	0.05	16	0.1	1.006	0.891	0.888	0.780	0.575	0.161	0.067	0.067	0.065	1.085
19	17	1	1.05	0.25	0.05	16	0.25	1.008	0.765	0.765	0.671	0.298	0.336	0.108	0.106	0.107	0.937
20	17	1	1.30	0.5	0.05	16	0.5	1.014	0.632	0.633	0.614	0.249	0.527	0.141	0.136	0.147	0.851
21	17	1	1.55	0.75	0.05	16	0.75	0.989	0.522	0.528	0.622	0.294	0.651	0.174	0.165	0.176	0.815
35	25	1	1.30	0.1	0.05	24	0.1	1.008	0.927	0.925	0.822	0.453	0.174	0.115	0.126	0.071	1.255
36	25	1	1.45	0.25	0.05	24	0.25	1.043	0.834	0.834	0.724	0.292	0.395	0.179	0.191	0.130	1.094
37	25	1	1.70	0.5	0.05	24	0.5	1.164	0.709	0.710	0.648	0.271	0.623	0.207	0.205	0.186	0.961
38	25	1	1.95	0.75	0.05	24	0.75	1.181	0.619	0.621	0.625	0.225	0.795	0.236	0.231	0.223	0.897
39	25	1	2.20	1	0.05	24	1	1.131	0.558	0.558	0.635	0.224	0.928	0.268	0.259	0.255	0.860
52	33	1	1.70	0.1	0.05	32	0.1	1.020	0.946	0.944	0.837	0.542	0.184	0.129	0.175	0.075	1.391
53	33	1	1.85	0.25	0.05	32	0.25	1.300	0.877	0.877	0.758	0.419	0.415	0.236	0.235	0.148	1.215
54	33	1	2.10	0.5	0.05	32	0.5	1.596	0.765	0.765	0.680	0.379	0.744	0.261	0.291	0.220	1.050
55	33	1	2.35	0.75	0.05	32	0.75	1.699	0.693	0.694	0.643	0.364	0.903	0.294	0.292	0.264	0.965
56	33	1	2.60	1	0.05	32	1	1.696	0.626	0.627	0.640	0.354	1.554	0.327	0.320	0.299	0.911
57	33	1	2.85	1.25	0.05	32	1.25	1.650	0.582	0.582	0.621	0.317	1.839	0.348	0.341	0.333	0.841
69	41	1	2.10	0.1	0.05	40	0.1	1.110	0.966	0.966	0.847	0.684	0.196	0.119	0.132	0.077	1.507
70	41	1	2.25	0.25	0.05	40	0.25	1.623	0.901	0.901	0.788	0.545	0.447	0.286	0.260	0.157	1.319
71	41	1	2.50	0.5	0.05	40	0.5	2.067	0.805	0.804	0.706	0.475	0.817	0.307	0.373	0.246	1.127
72	41	1	2.75	0.75	0.05	40	0.75	2.221	0.729	0.730	0.663	0.452	1.464	0.345	0.367	0.302	1.026
73	41	1	3.00	1	0.05	40	1	2.234	0.676	0.677	0.651	0.437	1.831	0.380	0.381	0.342	0.959
74	41	1	3.25	1.25	0.05	40	1.25	2.224	0.619	0.619	0.642	0.400	2.191	0.402	0.401	0.378	0.859
86	51	1	2.60	0.1	0.05	50	0.1	1.284	0.977	0.971	0.855	0.869	0.217	0.125	0.172	0.079	1.629
87	51	1	2.75	0.25	0.05	50	0.25	2.058	0.922	0.919	0.808	0.713	0.519	0.337	0.342	0.168	1.432
88	51	1	3.00	0.5	0.05	50	0.5	2.651	0.839	0.838	0.735	0.605	0.920	0.352	0.472	0.273	1.224
89	51	1	3.25	0.75	0.05	50	0.75	2.837	0.780	0.780	0.687	0.568	1.694	0.402	0.459	0.342	1.095
90	51	1	3.50	1	0.05	50	1	2.847	0.730	0.731	0.658	0.546	2.156	0.441	0.454	0.392	1.015
91	51	1	3.75	1.25	0.05	50	1.25	2.856	0.679	0.680	0.640	0.495	2.611	0.468	0.476	0.434	0.916
92	51	1	4.50	2	0.05	50	2	2.598	0.567	0.567	0.632	0.367	3.757	0.562	0.568	0.537	0.889
103	61	1	3.10	0.1	0.05	60	0.1	1.474	0.985	0.980	0.861	1.042	0.247	0.128	0.193	0.081	1.732
104	61	1	3.25	0.25	0.05	60	0.25	2.501	0.943	0.964	0.823	0.870	0.586	0.386	0.341	0.175	1.529

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Model								Membrane Stress Factors									
	OD	T	od	t	d/D	D/T	t/T	Branch					Header				
								Axial	In-Plane	Out-of-Plane	Torsional	Pressure	Axial	In-Plane	Out-of-Plane	Torsional	Pressure
105	61	1	3.50	0.5	0.05	60	0.5	3.215	0.877	0.904	0.758	0.727	1.019	0.390	0.537	0.293	1.306
106	61	1	3.75	0.75	0.05	60	0.75	3.414	0.809	0.809	0.712	0.673	1.912	0.452	0.495	0.376	1.158
107	61	1	4.00	1	0.05	60	1	3.414	0.766	0.766	0.680	0.642	2.459	0.499	0.525	0.436	1.067
108	61	1	4.25	1.25	0.05	60	1.25	3.426	0.722	0.722	0.664	0.584	3.000	0.524	0.549	0.485	0.945
109	61	1	5.00	2	0.05	60	2	3.214	0.602	0.603	0.651	0.441	4.370	0.629	0.644	0.598	0.880
110	61	1	5.50	2.5	0.05	60	2.5	3.026	0.566	0.566	0.670	0.368	5.133	0.704	0.726	0.664	0.917
120	71	1	3.60	0.1	0.05	70	0.1	1.671	0.993	0.987	0.866	1.216	0.287	0.130	0.167	0.082	1.822
121	71	1	3.75	0.25	0.05	70	0.25	2.941	1.046	1.075	0.833	1.014	0.607	0.311	0.437	0.182	1.613
122	71	1	4.00	0.5	0.05	70	0.5	3.759	0.996	1.032	0.775	0.839	1.353	0.563	0.601	0.311	1.378
123	71	1	4.25	0.75	0.05	70	0.75	3.959	0.858	0.899	0.732	0.769	2.109	0.500	0.556	0.405	1.215
124	71	1	4.50	1	0.05	70	1	3.948	0.778	0.778	0.700	0.729	2.743	0.553	0.593	0.475	1.115
125	71	1	4.75	1.25	0.05	70	1.25	3.956	0.748	0.747	0.682	0.663	3.367	0.579	0.621	0.532	0.982
126	71	1	5.50	2	0.05	70	2	3.754	0.640	0.638	0.655	0.505	4.950	0.696	0.722	0.658	0.890
127	71	1	6.00	2.5	0.05	70	2.5	3.602	0.601	0.601	0.676	0.426	5.825	0.774	0.805	0.726	0.889
128	71	1	6.50	3	0.05	70	3	3.455	0.556	0.556	0.710	0.363	6.596	0.857	0.899	0.792	0.951
137	81	1	4.10	0.1	0.05	80	0.1	1.868	0.998	0.993	0.869	1.367	0.333	0.177	0.236	0.083	1.902
138	81	1	4.25	0.25	0.05	80	0.25	3.370	1.158	1.195	0.840	1.147	0.758	0.320	0.343	0.185	1.687
139	81	1	4.50	0.5	0.05	80	0.5	4.285	1.121	1.162	0.787	0.943	1.486	0.528	0.654	0.325	1.443
140	81	1	4.75	0.75	0.05	80	0.75	4.478	0.965	1.012	0.748	0.857	2.290	0.518	0.614	0.429	1.279
141	81	1	5.00	1	0.05	80	1	4.455	0.821	0.870	0.721	0.806	3.006	0.583	0.659	0.509	1.159
142	81	1	5.25	1.25	0.05	80	1.25	4.456	0.776	0.776	0.698	0.733	3.709	0.627	0.694	0.575	1.019
143	81	1	6.00	2	0.05	80	2	4.259	0.670	0.670	0.667	0.561	5.497	0.762	0.803	0.716	0.913
144	81	1	6.50	2.5	0.05	80	2.5	4.115	0.623	0.623	0.682	0.476	6.484	0.847	0.888	0.788	0.910
145	81	1	7.00	3	0.05	80	3	3.992	0.591	0.591	0.713	0.408	7.357	0.933	0.985	0.855	0.927
154	91	1	4.60	0.1	0.05	90	0.1	2.063	1.010	1.033	0.872	1.505	0.387	0.177	0.254	0.083	1.974
155	91	1	4.75	0.25	0.05	90	0.25	3.794	1.279	1.322	0.846	1.269	0.852	0.329	0.362	0.190	1.753
156	91	1	5.00	0.5	0.05	90	0.5	4.791	1.249	1.294	0.799	1.039	1.619	0.493	0.652	0.337	1.501
157	91	1	5.25	0.75	0.05	90	0.75	4.974	1.074	1.124	0.765	0.937	2.459	0.550	0.666	0.451	1.330
158	91	1	5.50	1	0.05	90	1	4.939	0.912	0.967	0.736	0.877	3.250	0.624	0.722	0.540	1.200
159	91	1	5.75	1.25	0.05	90	1.25	4.933	0.792	0.854	0.713	0.796	4.025	0.674	0.762	0.614	1.055
160	91	1	6.50	2	0.05	90	2	4.735	0.702	0.702	0.678	0.610	6.002	0.825	0.881	0.770	0.929
161	91	1	7.00	2.5	0.05	90	2.5	4.596	0.646	0.639	0.688	0.518	7.112	0.919	0.974	0.848	0.910
162	91	1	7.50	3	0.05	90	3	4.477	0.606	0.606	0.713	0.446	8.080	1.013	1.073	0.917	0.905
163	91	1	8.50	4	0.05	90	4	4.306	0.535	0.523	0.786	0.341	9.740	1.204	1.302	1.050	0.993
171	101	1	5.10	0.1	0.05	100	0.1	2.258	1.064	1.091	0.874	1.631	0.440	0.177	0.277	0.084	2.040
172	101	1	5.25	0.25	0.05	100	0.25	4.211	1.407	1.454	0.850	1.382	0.942	0.343	0.482	0.193	1.812
173	101	1	5.50	0.5	0.05	100	0.5	5.281	1.380	1.426	0.808	1.127	1.734	0.519	0.687	0.347	1.554
174	101	1	5.75	0.75	0.05	100	0.75	5.449	1.184	1.236	0.778	1.011	2.613	0.581	0.714	0.469	1.376

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Model								Membrane Stress Factors									
	OD	T	od	t	d/D	D/T	t/T	Branch					Header				
								Axial	In-Plane	Out-of-Plane	Torsional	Pressure	Axial	In-Plane	Out-of-Plane	Torsional	Pressure
175	101	1	6.00	1	0.05	100	1	5.403	1.005	1.062	0.750	0.942	3.479	0.664	0.783	0.567	1.238
176	101	1	6.25	1.25	0.05	100	1.25	5.390	0.872	0.941	0.727	0.854	4.314	0.723	0.828	0.648	1.088
177	101	1	7.00	2	0.05	100	2	5.195	0.725	0.725	0.688	0.654	6.480	0.889	0.960	0.822	0.946
178	101	1	7.50	2.5	0.05	100	2.5	5.059	0.671	0.671	0.694	0.556	7.704	0.994	1.060	0.906	0.915
179	101	1	8.00	3	0.05	100	3	4.941	0.629	0.627	0.713	0.480	8.765	1.090	1.164	0.979	0.884
180	101	1	9.00	4	0.05	100	4	4.769	0.571	0.571	0.782	0.370	10.588	1.292	1.399	1.113	0.976
188	251	1	12.60	0.1	0.05	250	0.1	4.947	2.135	2.180	0.881	2.831	1.472	0.457	0.315	0.088	2.702
189	251	1	12.75	0.25	0.05	250	0.25	9.692	3.422	3.500	0.864	2.451	2.166	0.715	0.588	0.215	2.383
190	251	1	13.00	0.5	0.05	250	0.5	11.353	3.276	3.233	0.858	1.931	3.279	0.885	0.939	0.421	2.040
191	251	1	13.25	0.75	0.05	250	0.75	11.137	2.777	2.650	0.855	1.678	4.497	1.079	1.240	0.610	1.819
192	251	1	13.50	1	0.05	250	1	10.911	2.399	2.236	0.846	1.526	6.026	1.336	1.443	0.779	1.646
193	251	1	13.75	1.25	0.05	250	1.25	10.857	2.122	1.986	0.837	1.376	7.466	1.570	1.593	0.936	1.441
194	251	1	14.50	2	0.05	250	2	11.146	1.710	1.584	0.809	1.048	11.613	2.198	2.022	1.326	1.134
195	251	1	15.00	2.5	0.05	250	2.5	11.338	1.586	1.429	0.794	0.890	14.129	2.631	2.308	1.531	1.071
196	251	1	15.50	3	0.05	250	3	11.436	1.514	1.316	0.783	0.766	16.481	3.043	2.589	1.700	1.034
197	251	1	16.50	4	0.05	250	4	11.410	1.414	1.165	0.770	0.588	20.739	3.821	3.120	1.961	0.982
198	251	1	17.50	5	0.05	250	5	11.234	1.352	1.076	0.772	0.470	24.507	4.579	3.621	2.161	0.950
199	251	1	18.50	6	0.05	250	6	10.989	1.309	1.020	0.789	0.389	27.936	5.310	4.119	2.332	0.931
200	251	1	19.50	7	0.05	250	7	10.727	1.273	0.986	0.818	0.331	31.095	6.125	4.628	2.483	0.961
201	251	1	20.00	7.5	0.05	250	7.5	10.553	1.260	0.966	0.837	0.308	32.683	6.512	4.905	2.556	0.975
202	251	1	20.50	8	0.05	250	8	10.456	1.253	0.965	0.861	0.288	33.944	6.896	5.127	2.569	0.988
203	251	1	21.50	9	0.05	250	9	10.219	1.235	0.953	0.919	0.255	36.760	7.669	5.676	2.771	1.007
204	251	1	22.50	10	0.05	250	10	10.023	1.224	0.955	0.992	0.230	39.367	8.468	6.253	2.916	1.020
205	501	1	25.10	0.1	0.05	500	0.1	8.740	3.878	4.029	0.877	3.911	2.447	1.317	0.945	0.090	3.375
206	501	1	25.25	0.25	0.05	500	0.25	16.884	6.320	6.511	0.883	3.346	4.515	2.119	1.279	0.227	2.944
207	501	1	25.50	0.5	0.05	500	0.5	18.988	5.969	5.660	0.910	2.560	5.772	2.322	1.203	0.462	2.480
208	501	1	25.75	0.75	0.05	500	0.75	18.237	5.210	4.445	0.919	2.193	7.677	2.616	1.663	0.687	2.220
209	501	1	26.00	1	0.05	500	1	17.980	4.807	3.724	0.920	1.985	9.981	3.032	1.976	0.886	2.026
210	501	1	26.25	1.25	0.05	500	1.25	18.147	4.542	3.312	0.917	1.798	12.183	3.373	2.266	1.109	1.809
211	501	1	27.00	2	0.05	500	2	19.998	4.377	2.797	0.903	1.384	18.504	4.689	3.223	1.678	1.341
212	501	1	27.50	2.5	0.05	500	2.5	21.212	4.401	2.688	0.894	1.179	22.330	5.495	3.933	1.968	1.226
213	501	1	28.00	3	0.05	500	3	22.092	4.416	2.646	0.884	1.015	25.999	6.216	4.649	2.261	1.169
214	501	1	29.00	4	0.05	500	4	22.965	4.382	2.640	0.866	0.775	33.142	9.447	6.057	2.757	1.111
215	501	1	30.00	5	0.05	500	5	23.085	4.277	2.653	0.849	0.614	40.077	10.042	7.413	3.161	1.068
216	501	1	31.00	6	0.05	500	6	22.819	4.144	2.654	0.836	0.503	46.682	13.165	8.688	3.269	1.031
217	501	1	32.00	7	0.05	500	7	22.378	3.998	2.643	0.826	0.422	52.912	14.864	9.858	3.529	1.003
218	501	1	32.50	7.5	0.05	500	7.5	22.115	3.926	2.635	0.823	0.389	55.998	15.671	10.460	3.645	0.991
219	501	1	33.00	8	0.05	500	8	21.834	3.854	2.624	0.821	0.361	59.041	17.247	11.049	3.754	0.981

STP-PT-074: Local Stress in Nozzles, Shells and Formed Heads from External Heads

Model								Membrane Stress Factors									
	OD	T	od	t	d/D	D/T	t/T	Branch					Header				
								Axial	In-Plane	Out-of-Plane	Torsional	Pressure	Axial	In-Plane	Out-of-Plane	Torsional	Pressure
220	501	1	34.00	9	0.05	500	9	21.297	3.722	2.608	0.820	0.315	64.715	18.898	12.142	3.955	0.964
221	501	1	35.00	10	0.05	500	10	20.736	3.376	2.579	0.823	0.278	70.181	20.464	13.193	4.136	0.951
223	751	1	37.75	0.25	0.05	750	0.25	22.773	8.723	9.180	0.889	3.925	7.980	3.645	2.384	0.219	3.362
224	751	1	38.00	0.5	0.05	750	0.5	25.213	8.255	7.716	0.916	2.959	8.594	4.027	1.374	0.479	2.796
225	751	1	38.25	0.75	0.05	750	0.75	24.264	7.450	6.021	0.924	2.520	11.165	4.523	1.913	0.711	2.503
226	751	1	38.50	1	0.05	750	1	24.216	7.220	5.065	0.925	2.282	14.307	5.234	2.405	0.940	2.297
227	751	1	38.75	1.25	0.05	750	1.25	24.848	7.140	4.555	0.957	2.077	17.269	5.817	2.991	1.166	2.076
228	751	1	39.50	2	0.05	750	2	28.706	7.574	4.156	0.952	1.621	25.747	7.588	4.582	1.806	1.550
229	751	1	40.00	2.5	0.05	750	2.5	31.106	7.898	4.239	0.949	1.387	30.662	9.452	5.781	2.204	1.354
230	751	1	40.50	3	0.05	750	3	32.904	8.117	4.390	0.944	1.196	35.238	11.309	6.931	2.576	1.250
231	751	1	41.50	4	0.05	750	4	34.878	8.263	4.676	0.932	0.912	44.273	12.768	9.132	3.240	1.192
232	751	1	42.50	5	0.05	750	5	35.443	8.161	4.869	0.918	0.720	53.518	15.361	11.229	3.804	1.149
233	751	1	43.50	6	0.05	750	6	35.274	7.938	4.974	0.903	0.586	62.699	17.836	13.387	3.975	1.111
234	751	1	44.50	7	0.05	750	7	34.727	7.657	5.020	0.890	0.489	71.839	24.738	15.576	4.371	1.081
235	751	1	45.00	7.5	0.05	750	7.5	34.394	7.518	5.018	0.883	0.450	76.219	25.632	16.583	4.546	1.066
236	751	1	45.50	8	0.05	750	8	34.021	7.371	5.006	0.878	0.416	80.431	28.503	17.545	4.711	1.052
237	751	1	46.50	9	0.05	750	9	33.228	7.082	4.983	0.867	0.360	88.972	31.318	19.550	5.010	1.028
238	751	1	47.50	10	0.05	750	10	32.410	6.813	4.946	0.859	0.317	97.132	33.967	21.427	5.280	1.008
240	1001	1	50.25	0.25	0.05	1000	0.25	27.858	10.721	11.563	0.900	4.371	10.333	5.100	2.677	0.225	3.711
241	1001	1	50.50	0.5	0.05	1000	0.5	30.659	10.239	9.599	0.933	3.264	11.383	5.698	1.795	0.490	3.055
242	1001	1	50.75	0.75	0.05	1000	0.75	29.664	9.506	7.479	0.944	2.773	14.631	6.450	2.358	0.691	2.734
243	1001	1	51.00	1	0.05	1000	1	29.989	9.515	6.357	0.947	2.514	18.654	7.476	3.089	0.973	2.518
244	1001	1	51.25	1.25	0.05	1000	1.25	31.231	9.707	5.824	0.949	2.298	22.541	8.367	3.891	1.147	2.293
245	1001	1	52.00	2	0.05	1000	2	37.363	10.908	5.763	0.986	1.814	33.384	10.903	6.471	1.784	1.744
246	1001	1	52.50	2.5	0.05	1000	2.5	41.020	11.595	6.140	0.986	1.561	39.363	12.695	8.166	2.190	1.479
247	1001	1	53.00	3	0.05	1000	3	43.818	12.076	6.582	0.985	1.349	44.804	14.302	9.779	2.576	1.349
248	1001	1	54.00	4	0.05	1000	4	47.028	12.510	7.299	0.992	1.031	55.204	17.460	12.856	3.288	1.249
249	1001	1	55.00	5	0.05	1000	5	48.109	12.479	7.734	0.969	0.812	66.067	25.309	15.789	3.918	1.206
250	1001	1	56.00	6	0.05	1000	6	48.064	12.206	7.965	0.957	0.658	77.328	30.186	18.623	4.475	1.172
251	1001	1	57.00	7	0.05	1000	7	47.443	11.816	8.059	0.944	0.546	88.769	34.788	21.350	4.968	1.139
252	1001	1	57.50	7.5	0.05	1000	7.5	47.013	11.607	8.073	0.938	0.502	94.419	36.967	22.685	5.193	1.124
253	1001	1	58.00	8	0.05	1000	8	46.531	11.393	8.069	0.931	0.463	100.161	39.075	24.245	5.407	1.109
254	1001	1	59.00	9	0.05	1000	9	45.509	10.939	8.038	0.919	0.399	111.236	43.720	27.230	5.814	1.085
255	1001	1	60.00	10	0.05	1000	10	44.450	10.517	7.921	0.908	0.350	122.044	47.582	29.941	6.171	1.061
257	1251	1	62.75	0.25	0.05	1250	0.25	32.486	12.465	13.813	0.909	4.738	12.688	6.471	3.435	0.230	4.014
258	1251	1	63.00	0.5	0.05	1250	0.5	35.609	12.053	11.338	0.904	3.516	14.097	7.308	2.444	0.471	3.279
259	1251	1	63.25	0.75	0.05	1250	0.75	34.652	11.422	8.882	0.960	2.983	18.098	8.316	3.166	0.748	2.931
260	1251	1	63.50	1	0.05	1250	1	35.455	11.244	7.661	0.966	2.708	23.021	9.686	4.138	0.946	2.706



STP-PT-074: Local Stress in Nozzles, Shells and Formed Heads from External Heads

Model								Membrane Stress Factors									
	OD	T	od	t	d/D	D/T	t/T	Branch					Header				
								Axial	In-Plane	Out-of-Plane	Torsional	Pressure	Axial	In-Plane	Out-of-Plane	Torsional	Pressure
261	1251	1	63.75	1.25	0.05	1250	1.25	37.395	11.704	7.155	0.970	2.485	27.844	10.437	5.195	1.178	2.479
262	1251	1	64.50	2	0.05	1250	2	45.844	14.226	7.525	1.010	1.981	41.132	13.802	8.623	1.847	1.912
263	1251	1	65.00	2.5	0.05	1250	2.5	50.912	15.338	8.315	1.015	1.711	48.353	16.032	10.826	2.281	1.618
264	1251	1	65.50	3	0.05	1250	3	54.785	16.121	9.121	1.017	1.485	54.604	17.991	12.924	2.700	1.429
265	1251	1	66.50	4	0.05	1250	4	59.355	16.909	10.390	1.027	1.138	66.575	25.061	16.912	3.487	1.294
266	1251	1	67.50	5	0.05	1250	5	61.052	17.005	11.140	1.023	0.896	78.268	31.658	20.657	4.202	1.250
267	1251	1	68.50	6	0.05	1250	6	61.173	16.710	11.548	1.000	0.724	91.182	37.976	24.328	4.847	1.217
268	1251	1	69.50	7	0.05	1250	7	60.463	15.904	11.682	0.989	0.599	104.609	43.944	27.815	5.429	1.187
269	1251	1	70.00	7.5	0.05	1250	7.5	59.954	15.637	11.699	0.983	0.549	111.313	46.815	29.521	5.699	1.172
270	1251	1	70.50	8	0.05	1250	8	59.369	15.356	11.655	0.977	0.506	118.138	49.596	31.103	5.955	1.158
271	1251	1	71.50	9	0.05	1250	9	58.089	15.080	11.622	0.965	0.435	131.842	55.011	34.679	6.434	1.131
272	1251	1	72.50	10	0.05	1250	10	56.765	14.507	11.540	0.954	0.379	144.757	60.088	38.504	6.868	1.106
274	1501	1	75.25	0.25	0.05	1500	0.25	36.782	14.053	15.917	0.900	5.055	14.940	7.765	5.527	0.234	4.283
275	1501	1	75.50	0.5	0.05	1500	0.5	40.205	13.735	13.043	0.915	3.732	16.760	8.848	3.183	0.481	3.476
276	1501	1	75.75	0.75	0.05	1500	0.75	39.384	12.800	10.256	0.921	3.166	21.521	10.114	4.072	0.724	3.106
277	1501	1	76.00	1	0.05	1500	1	40.677	13.294	8.979	0.927	2.877	27.335	11.803	5.304	0.964	2.873
278	1501	1	76.25	1.25	0.05	1500	1.25	43.327	14.075	8.536	0.988	2.647	33.111	11.836	6.656	1.204	2.642
279	1501	1	77.00	2	0.05	1500	2	54.242	16.970	9.459	1.009	2.128	48.968	16.598	10.935	1.896	2.063
280	1501	1	77.50	2.5	0.05	1500	2.5	60.736	19.018	10.688	1.040	1.846	57.441	19.239	13.671	2.350	1.754
281	1501	1	78.00	3	0.05	1500	3	65.732	20.112	11.884	1.045	1.607	64.670	21.532	16.266	2.794	1.503
282	1501	1	79.00	4	0.05	1500	4	71.807	21.317	13.769	1.055	1.236	78.358	29.643	21.089	3.641	1.334
283	1501	1	80.00	5	0.05	1500	5	74.218	21.125	14.911	1.055	0.974	91.477	37.628	25.640	4.424	1.287
284	1501	1	81.00	6	0.05	1500	6	74.562	20.912	15.499	1.050	0.786	104.523	45.411	29.959	5.142	1.255
285	1501	1	82.00	7	0.05	1500	7	73.814	20.393	15.730	1.044	0.649	119.502	52.822	34.213	5.800	1.227
286	1501	1	82.50	7.5	0.05	1500	7.5	73.206	20.064	15.793	1.021	0.594	127.306	54.980	35.084	6.252	1.213
287	1501	1	83.00	8	0.05	1500	8	72.509	19.755	15.777	1.016	0.546	135.120	58.546	37.275	6.400	1.200
288	1501	1	84.00	9	0.05	1500	9	70.979	19.058	15.693	0.955	0.468	150.688	65.362	41.822	6.951	1.173
289	1501	1	85.00	10	0.05	1500	10	69.349	18.349	15.542	0.994	0.407	166.566	71.711	46.838	7.458	1.148
291	1751	1	87.75	0.25	0.05	1750	0.25	40.766	15.447	17.855	0.907	5.334	17.014	8.931	5.172	0.241	4.515
292	1751	1	88.00	0.5	0.05	1750	0.5	44.512	14.784	14.624	0.927	3.924	19.394	10.246	3.181	0.510	3.648
293	1751	1	88.25	0.75	0.05	1750	0.75	43.875	14.506	11.653	0.935	3.328	24.907	11.803	4.105	0.740	3.258
294	1751	1	88.50	1	0.05	1750	1	45.743	13.557	10.324	0.945	3.029	31.657	12.289	5.415	0.986	3.019
295	1751	1	88.75	1.25	0.05	1750	1.25	49.119	14.441	9.949	1.006	2.794	38.351	14.256	6.916	1.224	2.787
296	1751	1	89.50	2	0.05	1750	2	62.515	20.032	11.500	1.036	2.261	56.849	19.519	11.889	1.934	2.197
297	1751	1	90.00	2.5	0.05	1750	2.5	70.418	22.593	13.186	1.063	1.969	66.666	22.358	15.102	2.404	1.876
298	1751	1	90.50	3	0.05	1750	3	76.622	24.066	14.846	1.071	1.718	74.850	24.014	18.142	2.866	1.612
299	1751	1	91.50	4	0.05	1750	4	84.310	25.663	17.386	1.077	1.326	89.244	29.167	23.665	3.757	1.370
300	1751	1	92.50	5	0.05	1750	5	87.544	26.108	18.984	1.082	1.047	103.242	36.950	28.891	4.594	1.319

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Model								Membrane Stress Factors									
	OD	T	od	t	d/D	D/T	t/T	Branch					Header				
								Axial	In-Plane	Out-of-Plane	Torsional	Pressure	Axial	In-Plane	Out-of-Plane	Torsional	Pressure
301	1751	1	93.50	6	0.05	1750	6	88.202	25.444	19.787	1.080	0.845	117.780	49.441	33.932	5.369	1.285
302	1751	1	94.50	7	0.05	1750	7	87.447	24.920	20.229	1.075	0.696	134.114	58.063	39.171	6.219	1.256
303	1751	1	95.00	7.5	0.05	1750	7.5	86.740	24.563	20.316	1.072	0.637	142.584	62.241	41.781	6.560	1.243
304	1751	1	95.50	8	0.05	1750	8	85.941	24.154	20.350	1.068	0.585	151.230	66.224	44.418	6.885	1.231
305	1751	1	96.50	9	0.05	1750	9	84.170	23.368	20.224	0.989	0.499	168.591	74.940	49.312	7.383	1.208
306	1751	1	97.50	10	0.05	1750	10	82.226	22.533	20.239	0.977	0.433	186.433	82.533	55.499	7.952	1.183
309	2001	1	100.50	0.5	0.05	2000	0.5	48.612	16.259	16.113	0.937	4.095	21.915	11.608	3.822	0.514	3.814
310	2001	1	100.75	0.75	0.05	2000	0.75	48.198	14.544	12.993	0.949	3.474	28.232	13.413	4.917	0.752	3.404
311	2001	1	101.00	1	0.05	2000	1	50.648	15.333	11.651	0.963	3.165	35.897	14.016	6.458	1.002	3.158
312	2001	1	101.25	1.25	0.05	2000	1.25	54.798	16.479	11.336	0.977	2.926	43.538	16.279	8.172	1.245	2.922
313	2001	1	102.00	2	0.05	2000	2	70.655	23.023	13.623	1.062	2.382	64.611	22.322	14.085	1.972	2.322
314	2001	1	102.50	2.5	0.05	2000	2.5	80.093	25.447	15.844	1.084	2.081	75.853	24.392	17.847	2.453	1.991
315	2001	1	103.00	3	0.05	2000	3	87.526	27.849	17.927	1.094	1.821	85.098	27.301	21.344	2.932	1.639
316	2001	1	104.00	4	0.05	2000	4	96.861	29.928	21.208	1.104	1.411	100.922	32.928	27.750	3.862	1.405
317	2001	1	105.00	5	0.05	2000	5	100.987	30.563	23.248	1.105	1.115	115.921	40.590	33.625	4.744	1.349
318	2001	1	106.00	6	0.05	2000	6	102.007	30.428	24.438	1.105	0.900	131.262	54.888	39.434	5.570	1.313
319	2001	1	107.00	7	0.05	2000	7	101.285	29.398	25.025	1.102	0.741	148.070	64.552	45.375	6.342	1.285
320	2001	1	107.50	7.5	0.05	2000	7.5	100.567	29.027	25.045	1.100	0.677	157.277	69.314	48.116	6.708	1.272
321	2001	1	108.00	8	0.05	2000	8	99.690	28.985	25.179	1.097	0.622	166.638	73.893	51.195	7.058	1.259
322	2001	1	109.00	9	0.05	2000	9	97.638	27.679	25.017	1.091	0.530	185.886	82.906	56.972	7.729	1.142
323	2001	1	110.00	10	0.05	2000	10	95.401	26.759	24.880	1.007	0.458	205.369	91.613	63.149	8.353	1.123
326	2251	1	113.00	0.5	0.05	2250	0.5	52.630	17.619	17.654	0.948	4.249	24.407	12.893	4.511	0.519	3.966
327	2251	1	113.25	0.75	0.05	2250	0.75	52.469	16.130	14.462	0.962	3.606	31.510	14.337	5.818	0.762	3.538
328	2251	1	113.50	1	0.05	2250	1	55.481	17.052	13.080	0.981	3.290	40.107	15.665	7.579	1.017	3.285
329	2251	1	113.75	1.25	0.05	2250	1.25	60.355	18.384	12.953	1.001	3.046	48.654	18.179	9.643	1.264	3.046
330	2251	1	114.50	2	0.05	2250	2	78.796	25.891	16.307	1.090	2.494	72.343	25.029	16.791	2.005	2.438
331	2251	1	115.00	2.5	0.05	2250	2.5	89.695	28.788	18.582	1.111	2.185	85.072	27.434	20.685	2.496	2.097
332	2251	1	115.50	3	0.05	2250	3	98.322	31.594	21.184	1.124	1.917	95.630	30.552	24.767	2.988	1.702
333	2251	1	116.50	4	0.05	2250	4	109.466	34.116	25.200	1.130	1.490	112.661	36.134	31.940	3.951	1.436
334	2251	1	117.50	5	0.05	2250	5	114.480	34.995	27.680	1.126	1.180	128.603	44.258	38.443	4.872	1.377
335	2251	1	118.50	6	0.05	2250	6	116.029	34.903	29.259	1.128	0.953	145.072	59.920	45.014	5.746	1.338
336	2251	1	119.50	7	0.05	2250	7	115.440	34.293	30.008	1.126	0.785	162.119	70.545	51.557	6.561	1.309
337	2251	1	120.00	7.5	0.05	2250	7.5	114.646	33.869	30.070	1.124	0.717	172.170	75.932	54.523	6.954	1.204
338	2251	1	120.50	8	0.05	2250	8	113.734	33.416	30.341	1.123	0.657	181.590	81.065	58.248	7.329	1.194
339	2251	1	121.50	9	0.05	2250	9	111.379	32.020	30.177	1.118	0.559	202.461	91.124	64.662	8.048	1.173
340	2251	1	122.50	10	0.05	2250	10	108.844	30.929	29.729	1.112	0.482	224.521	100.844	71.071	8.722	1.152
343	2501	1	125.50	0.5	0.05	2500	0.5	56.551	17.561	19.245	0.959	4.388	26.906	14.100	5.242	0.522	4.105
344	2501	1	125.75	0.75	0.05	2500	0.75	56.539	17.509	15.988	0.976	3.726	34.791	14.230	6.796	0.783	3.660

STP-PT-074: Local Stress in Nozzles, Shells and Formed Heads from External Heads

Model								Membrane Stress Factors									
	OD	T	od	t	d/D	D/T	t/T	Branch					Header				
								Axial	In-Plane	Out-of-Plane	Torsional	Pressure	Axial	In-Plane	Out-of-Plane	Torsional	Pressure
345	2501	1	126.00	1	0.05	2500	1	60.175	18.748	14.469	1.000	3.404	44.211	17.265	8.737	1.031	3.401
346	2501	1	126.25	1.25	0.05	2500	1.25	65.855	20.332	14.841	1.022	3.158	53.749	20.058	11.314	1.280	3.162
347	2501	1	127.00	2	0.05	2500	2	86.679	28.737	18.152	1.088	2.597	80.037	26.211	18.750	2.036	2.545
348	2501	1	127.50	2.5	0.05	2500	2.5	99.119	32.004	21.385	1.142	2.282	94.028	30.469	23.602	2.536	2.196
349	2501	1	128.00	3	0.05	2500	3	109.004	35.165	24.536	1.159	2.006	105.508	32.912	28.275	3.038	1.765
350	2501	1	129.00	4	0.05	2500	4	121.980	38.125	29.269	1.169	1.564	124.510	39.112	36.300	4.030	1.467
351	2501	1	130.00	5	0.05	2500	5	128.125	39.279	32.424	1.160	1.241	141.440	52.892	43.583	4.986	1.402
352	2501	1	131.00	6	0.05	2500	6	130.097	39.310	34.258	1.148	1.004	158.701	64.539	50.665	5.892	1.360
353	2501	1	132.00	7	0.05	2500	7	129.663	38.732	35.125	1.149	0.827	176.677	76.259	57.565	6.751	1.330
354	2501	1	132.50	7.5	0.05	2500	7.5	128.889	38.284	35.561	1.147	0.755	185.930	81.955	61.434	7.163	1.233
355	2501	1	133.00	8	0.05	2500	8	127.864	37.732	35.497	1.145	0.692	195.782	87.531	64.751	7.562	1.223
356	2501	1	134.00	9	0.05	2500	9	125.337	36.640	35.444	1.141	0.588	217.876	98.646	72.116	8.323	1.202
357	2501	1	135.00	10	0.05	2500	10	122.479	35.121	35.274	1.136	0.506	241.020	109.253	79.729	9.046	1.180
358	9	1	0.90	0.1	0.1	8	0.1	1.012	0.901	0.901	0.813	0.847	0.158	0.068	0.067	0.065	1.064
359	9	1	1.05	0.25	0.1	8	0.25	1.001	0.766	0.766	0.671	0.387	0.315	0.109	0.107	0.107	0.903
360	9	1	1.30	0.5	0.1	8	0.5	1.013	0.633	0.633	0.612	0.302	0.491	0.145	0.140	0.139	0.809
361	9	1	1.55	0.75	0.1	8	0.75	0.995	0.526	0.525	0.623	0.339	0.593	0.179	0.173	0.184	0.774
375	17	1	1.70	0.1	0.1	16	0.1	1.012	0.952	0.952	0.853	0.887	0.169	0.138	0.172	0.076	1.401
376	17	1	1.85	0.25	0.1	16	0.25	1.145	0.874	0.874	0.776	0.493	0.376	0.201	0.264	0.149	1.191
377	17	1	2.10	0.5	0.1	16	0.5	1.351	0.774	0.775	0.680	0.416	0.622	0.267	0.296	0.225	1.034
378	17	1	2.35	0.75	0.1	16	0.75	1.420	0.684	0.684	0.642	0.387	0.798	0.305	0.306	0.274	0.944
379	17	1	2.60	1	0.1	16	1	1.405	0.625	0.626	0.640	0.369	1.466	0.341	0.338	0.311	0.892
380	17	1	2.85	1.25	0.1	16	1.25	1.357	0.572	0.572	0.637	0.328	1.714	0.366	0.363	0.349	0.825
392	25	1	2.50	0.1	0.1	24	0.1	1.108	0.978	0.964	0.871	0.951	0.199	0.158	0.160	0.080	1.649
393	25	1	2.65	0.25	0.1	24	0.25	1.617	0.920	0.915	0.822	0.733	0.462	0.283	0.367	0.166	1.433
394	25	1	2.90	0.5	0.1	24	0.5	2.048	0.834	0.832	0.741	0.608	0.712	0.349	0.452	0.275	1.200
395	25	1	3.15	0.75	0.1	24	0.75	2.193	0.773	0.773	0.689	0.562	1.516	0.400	0.465	0.348	1.078
396	25	1	3.40	1	0.1	24	1	2.203	0.699	0.698	0.663	0.535	1.917	0.447	0.465	0.401	0.995
397	25	1	3.65	1.25	0.1	24	1.25	2.203	0.671	0.671	0.647	0.478	2.294	0.477	0.490	0.446	0.884
398	25	1	4.40	2	0.1	24	2	1.951	0.559	0.559	0.634	0.351	3.210	0.578	0.599	0.558	0.839
409	33	1	3.30	0.1	0.1	32	0.1	1.315	0.990	0.980	0.881	1.208	0.251	0.147	0.193	0.083	1.847
410	33	1	3.45	0.25	0.1	32	0.25	2.140	0.956	1.006	0.847	0.986	0.550	0.282	0.465	0.178	1.611
411	33	1	3.70	0.5	0.1	32	0.5	2.738	0.896	0.962	0.780	0.806	0.940	0.407	0.590	0.310	1.356
412	33	1	3.95	0.75	0.1	32	0.75	2.911	0.811	0.842	0.733	0.731	1.805	0.488	0.610	0.405	1.191
413	33	1	4.20	1	0.1	32	1	2.915	0.773	0.768	0.699	0.689	2.322	0.534	0.585	0.475	1.089
414	33	1	4.45	1.25	0.1	32	1.25	2.922	0.737	0.737	0.678	0.620	2.817	0.575	0.617	0.534	0.954
415	33	1	5.20	2	0.1	32	2	2.717	0.624	0.620	0.645	0.462	4.038	0.690	0.736	0.664	0.858
416	33	1	5.70	2.5	0.1	32	2.5	2.547	0.572	0.572	0.683	0.384	4.702	0.766	0.835	0.736	0.860

STP-PT-074: Local Stress in Nozzles, Shells and Formed Heads from External Heads

Model								Membrane Stress Factors									
	OD	T	od	t	d/D	D/T	t/T	Branch					Header				
								Axial	In-Plane	Out-of-Plane	Torsional	Pressure	Axial	In-Plane	Out-of-Plane	Torsional	Pressure
417	33	1	6.20	3	0.1	32	3	2.388	0.524	0.524	0.702	0.322	5.278	0.849	0.946	0.807	0.913
426	41	1	4.10	0.1	0.1	40	0.1	1.536	0.998	0.992	0.888	1.460	0.319	0.153	0.224	0.084	2.013
427	41	1	4.25	0.25	0.1	40	0.25	2.663	1.109	1.192	0.862	1.220	0.670	0.305	0.458	0.186	1.759
428	41	1	4.50	0.5	0.1	40	0.5	3.402	1.074	1.167	0.803	0.989	1.105	0.426	0.708	0.335	1.481
429	41	1	4.75	0.75	0.1	40	0.75	3.582	0.929	1.027	0.762	0.884	2.057	0.553	0.627	0.449	1.289
430	41	1	5.00	1	0.1	40	1	3.575	0.800	0.889	0.733	0.824	2.682	0.609	0.695	0.537	1.173
431	41	1	5.25	1.25	0.1	40	1.25	3.576	0.753	0.785	0.707	0.740	3.287	0.662	0.742	0.611	1.022
432	41	1	6.00	2	0.1	40	2	3.374	0.685	0.685	0.665	0.556	4.793	0.807	0.880	0.766	0.890
433	41	1	6.50	2.5	0.1	40	2.5	3.213	0.624	0.621	0.683	0.468	5.617	0.894	0.985	0.844	0.854
434	41	1	7.00	3	0.1	40	3	3.074	0.586	0.586	0.713	0.398	6.325	0.980	1.101	0.916	0.879
443	51	1	5.10	0.1	0.1	50	0.1	1.817	1.024	1.088	0.893	1.736	0.421	0.160	0.262	0.086	2.191
444	51	1	5.25	0.25	0.1	50	0.25	3.306	1.324	1.440	0.872	1.481	0.844	0.325	0.473	0.194	1.914
445	51	1	5.50	0.5	0.1	50	0.5	4.193	1.308	1.427	0.819	1.193	1.569	0.530	0.835	0.360	1.611
446	51	1	5.75	0.75	0.1	50	0.75	4.365	1.132	1.253	0.791	1.053	2.334	0.593	0.728	0.492	1.412
447	51	1	6.00	1	0.1	50	1	4.344	0.969	1.087	0.765	0.970	3.085	0.691	0.822	0.600	1.263
448	51	1	6.25	1.25	0.1	50	1.25	4.335	0.843	0.968	0.739	0.869	3.809	0.762	0.888	0.691	1.101
449	51	1	7.00	2	0.1	50	2	4.127	0.726	0.726	0.690	0.652	5.642	0.946	1.063	0.883	0.937
450	51	1	7.50	2.5	0.1	50	2.5	3.966	0.686	0.686	0.696	0.550	6.656	1.053	1.185	0.974	0.885
451	51	1	8.00	3	0.1	50	3	3.820	0.645	0.645	0.716	0.471	7.529	1.152	1.312	1.051	0.865
452	51	1	9.00	4	0.1	50	4	3.596	0.566	0.557	0.787	0.358	9.005	1.373	1.587	1.194	0.921
460	61	1	6.10	0.1	0.1	60	0.1	2.096	1.124	1.208	0.896	1.979	0.538	0.196	0.300	0.085	2.347
461	61	1	6.25	0.25	0.1	60	0.25	3.930	1.552	1.699	0.877	1.711	1.038	0.346	0.522	0.200	2.046
462	61	1	6.50	0.5	0.1	60	0.5	4.939	1.545	1.681	0.835	1.372	1.764	0.585	0.891	0.378	1.722
463	61	1	6.75	0.75	0.1	60	0.75	5.095	1.334	1.467	0.811	1.200	2.586	0.656	0.816	0.527	1.509
464	61	1	7.00	1	0.1	60	1	5.059	1.145	1.274	0.786	1.096	3.441	0.774	0.936	0.651	1.353
465	61	1	7.25	1.25	0.1	60	1.25	5.041	0.997	1.140	0.765	0.980	4.264	0.857	1.025	0.759	1.171
466	61	1	8.00	2	0.1	60	2	4.840	0.752	0.860	0.715	0.733	6.390	1.084	1.243	0.989	0.977
467	61	1	8.50	2.5	0.1	60	2.5	4.680	0.709	0.740	0.712	0.618	7.572	1.214	1.388	1.095	0.927
468	61	1	9.00	3	0.1	60	3	4.530	0.686	0.686	0.721	0.529	8.625	1.338	1.534	1.182	0.896
469	61	1	10.00	4	0.1	60	4	4.268	0.619	0.619	0.770	0.405	10.390	1.676	1.830	1.332	0.891
470	61	1	11.00	5	0.1	60	5	4.103	0.563	0.563	0.852	0.323	11.841	2.061	2.151	1.475	0.944
477	71	1	7.10	0.1	0.1	70	0.1	2.371	1.233	1.336	0.897	2.196	0.654	0.243	0.331	0.086	2.486
478	71	1	7.25	0.25	0.1	70	0.25	4.532	1.783	1.957	0.879	1.916	1.223	0.410	0.581	0.205	2.163
479	71	1	7.50	0.5	0.1	70	0.5	5.651	1.780	1.929	0.845	1.528	1.964	0.631	0.715	0.393	1.817
480	71	1	7.75	0.75	0.1	70	0.75	5.778	1.535	1.671	0.825	1.327	2.819	0.725	0.895	0.555	1.593
481	71	1	8.00	1	0.1	70	1	5.728	1.322	1.451	0.805	1.206	3.753	0.857	1.035	0.692	1.426
482	71	1	8.25	1.25	0.1	70	1.25	5.701	1.153	1.301	0.785	1.075	4.668	0.954	1.150	0.815	1.233
483	71	1	9.00	2	0.1	70	2	5.525	0.863	1.001	0.737	0.802	7.063	1.223	1.424	1.084	1.013

STP-PT-074: Local Stress in Nozzles, Shells and Formed Heads from External Heads

Model								Membrane Stress Factors									
	OD	T	od	t	d/D	D/T	t/T	Branch					Header				
								Axial	In-Plane	Out-of-Plane	Torsional	Pressure	Axial	In-Plane	Out-of-Plane	Torsional	Pressure
484	71	1	9.50	2.5	0.1	70	2.5	5.377	0.836	0.871	0.730	0.675	8.410	1.434	1.593	1.207	0.957
485	71	1	10.00	3	0.1	70	3	5.228	0.760	0.775	0.731	0.578	9.603	1.625	1.757	1.305	0.920
486	71	1	11.00	4	0.1	70	4	4.954	0.664	0.650	0.760	0.442	11.657	2.029	2.091	1.468	0.879
487	71	1	12.00	5	0.1	70	5	4.729	0.608	0.589	0.822	0.354	13.370	2.433	2.429	1.612	0.919
488	71	1	13.00	6	0.1	70	6	4.584	0.593	0.546	0.911	0.293	14.835	2.896	2.790	1.758	0.955
494	81	1	8.10	0.1	0.1	80	0.1	2.641	1.346	1.466	0.898	2.392	0.769	0.295	0.363	0.087	2.614
495	81	1	8.25	0.25	0.1	80	0.25	5.114	2.013	2.213	0.879	2.101	1.436	0.489	0.621	0.208	2.269
496	81	1	8.50	0.5	0.1	80	0.5	6.323	2.008	2.168	0.851	1.667	2.158	0.681	0.785	0.405	1.902
497	81	1	8.75	0.75	0.1	80	0.75	6.424	1.734	1.865	0.837	1.440	3.038	0.801	0.963	0.578	1.668
498	81	1	9.00	1	0.1	80	1	6.357	1.499	1.618	0.819	1.302	4.050	0.947	1.127	0.727	1.492
499	81	1	9.25	1.25	0.1	80	1.25	6.325	1.312	1.456	0.801	1.159	5.028	1.063	1.262	0.862	1.288
500	81	1	10.00	2	0.1	80	2	6.185	1.072	1.136	0.759	0.863	7.654	1.467	1.592	1.168	1.045
501	81	1	10.50	2.5	0.1	80	2.5	6.061	0.963	0.999	0.748	0.726	9.150	1.701	1.790	1.310	0.986
502	81	1	11.00	3	0.1	80	3	5.921	0.883	0.896	0.744	0.621	10.499	1.926	1.985	1.422	0.945
503	81	1	12.00	4	0.1	80	4	5.647	0.782	0.761	0.759	0.474	12.817	2.389	2.356	1.600	0.897
504	81	1	13.00	5	0.1	80	5	5.388	0.719	0.682	0.801	0.380	14.769	2.873	2.720	1.750	0.897
505	81	1	14.00	6	0.1	80	6	5.199	0.683	0.638	0.869	0.315	16.509	3.340	3.108	1.896	0.935
506	81	1	15.00	7	0.1	80	7	5.132	0.651	0.618	0.963	0.268	18.019	3.918	3.509	2.044	0.960
507	81	1	15.50	7.5	0.1	80	7.5	5.031	0.638	0.614	1.015	0.248	18.660	4.119	3.704	2.121	0.970
511	91	1	9.10	0.1	0.1	90	0.1	2.906	1.463	1.599	0.899	2.573	0.885	0.355	0.398	0.088	2.731
512	91	1	9.25	0.25	0.1	90	0.25	5.677	2.238	2.468	0.878	2.268	1.605	0.576	0.682	0.213	2.366
513	91	1	9.50	0.5	0.1	90	0.5	6.967	2.232	2.400	0.857	1.791	2.349	0.730	0.831	0.416	1.978
514	91	1	9.75	0.75	0.1	90	0.75	7.034	1.928	2.052	0.846	1.540	3.252	0.884	1.025	0.597	1.735
515	91	1	10.00	1	0.1	90	1	6.952	1.677	1.777	0.830	1.387	4.329	1.068	1.209	0.757	1.553
516	91	1	10.25	1.25	0.1	90	1.25	6.914	1.473	1.601	0.814	1.234	5.367	1.241	1.365	0.904	1.339
517	91	1	11.00	2	0.1	90	2	6.822	1.206	1.267	0.779	0.917	8.201	1.696	1.755	1.243	1.067
518	91	1	11.50	2.5	0.1	90	2.5	6.730	1.094	1.125	0.766	0.771	9.854	2.003	1.994	1.404	1.014
519	91	1	12.00	3	0.1	90	3	6.611	1.014	1.018	0.758	0.659	11.335	2.268	2.214	1.531	0.968
520	91	1	13.00	4	0.1	90	4	6.335	0.914	0.874	0.762	0.502	13.907	2.776	2.629	1.726	0.913
521	91	1	14.00	5	0.1	90	5	6.068	0.843	0.788	0.789	0.401	16.102	3.308	3.032	1.887	0.885
522	91	1	15.00	6	0.1	90	6	5.818	0.796	0.736	0.840	0.333	18.059	3.810	3.443	2.035	0.916
523	91	1	16.00	7	0.1	90	7	5.642	0.761	0.710	0.913	0.284	19.766	4.394	3.855	2.182	0.943
524	91	1	16.50	7.5	0.1	90	7.5	5.571	0.745	0.704	0.958	0.264	20.559	4.610	4.070	2.257	0.953
525	91	1	17.00	8	0.1	90	8	5.524	0.739	0.698	1.007	0.247	21.352	4.834	4.297	2.334	0.961
528	101	1	10.10	0.1	0.1	100	0.1	3.163	1.580	1.732	0.899	2.740	1.001	0.417	0.437	0.088	2.841
529	101	1	10.25	0.25	0.1	100	0.25	6.220	2.461	2.720	0.876	2.422	1.791	0.672	0.723	0.216	2.457
530	101	1	10.50	0.5	0.1	100	0.5	7.580	2.451	2.623	0.862	1.903	2.544	0.819	0.865	0.425	2.049
531	101	1	10.75	0.75	0.1	100	0.75	7.614	2.120	2.231	0.852	1.630	3.460	0.977	1.081	0.614	1.797



STP-PT-074: Local Stress in Nozzles, Shells and Formed Heads from External Heads

Model								Membrane Stress Factors									
	OD	T	od	t	d/D	D/T	t/T	Branch					Header				
								Axial	In-Plane	Out-of-Plane	Torsional	Pressure	Axial	In-Plane	Out-of-Plane	Torsional	Pressure
532	101	1	11.00	1	0.1	100	1	7.517	1.855	1.931	0.839	1.464	4.600	1.193	1.285	0.784	1.609
533	101	1	11.25	1.25	0.1	100	1.25	7.478	1.637	1.741	0.825	1.302	5.694	1.392	1.462	0.940	1.388
534	101	1	12.00	2	0.1	100	2	7.441	1.343	1.393	0.797	0.966	8.737	1.952	1.919	1.310	1.098
535	101	1	12.50	2.5	0.1	100	2.5	7.385	1.231	1.248	0.783	0.812	10.504	2.281	2.188	1.490	1.039
536	101	1	13.00	3	0.1	100	3	7.290	1.151	1.140	0.773	0.693	12.108	2.590	2.439	1.633	0.991
537	101	1	14.00	4	0.1	100	4	7.032	1.046	0.991	0.769	0.527	14.933	3.169	2.906	1.849	0.930
538	101	1	15.00	5	0.1	100	5	6.747	0.978	0.899	0.784	0.420	17.379	3.759	3.351	2.021	0.898
539	101	1	16.00	6	0.1	100	6	6.468	0.926	0.842	0.820	0.348	19.541	4.303	3.781	2.173	0.898
540	101	1	17.00	7	0.1	100	7	6.243	0.881	0.808	0.876	0.296	21.508	4.890	4.235	2.322	0.927
541	101	1	17.50	7.5	0.1	100	7.5	6.144	0.871	0.798	0.913	0.276	22.375	5.127	4.456	2.396	0.937
542	101	1	18.00	8	0.1	100	8	6.052	0.854	0.789	0.952	0.258	23.258	5.394	4.690	2.472	0.946
543	101	1	19.00	9	0.1	100	9	5.973	0.824	0.791	1.048	0.228	24.836	5.941	5.144	2.550	0.960
545	251	1	25.10	0.1	0.1	250	0.1	6.525	3.117	3.651	0.888	4.456	2.391	1.409	0.964	0.102	4.025
546	251	1	25.25	0.25	0.1	250	0.25	12.870	5.191	6.050	0.887	3.903	4.600	2.353	1.421	0.227	3.433
547	251	1	25.50	0.5	0.1	250	0.5	14.876	5.161	5.472	0.918	2.935	5.015	2.620	1.078	0.460	2.773
548	251	1	25.75	0.75	0.1	250	0.75	14.461	4.675	4.471	0.959	2.444	6.468	2.876	1.539	0.687	2.421
549	251	1	26.00	1	0.1	250	1	14.273	4.441	3.855	0.966	2.167	8.297	3.260	1.958	0.902	2.182
550	251	1	26.25	1.25	0.1	250	1.25	14.364	4.255	3.512	0.967	1.929	10.043	3.541	2.385	1.111	1.927
551	251	1	27.00	2	0.1	250	2	15.600	3.786	3.149	0.958	1.442	15.113	5.188	3.695	1.791	1.401
552	251	1	27.50	2.5	0.1	250	2.5	16.375	3.828	3.102	0.949	1.213	18.214	6.370	4.564	2.153	1.275
553	251	1	28.00	3	0.1	250	3	16.901	3.839	3.104	0.939	1.034	21.185	7.519	5.395	2.473	1.210
554	251	1	29.00	4	0.1	250	4	17.308	3.770	3.121	0.917	0.778	26.921	9.653	6.962	3.012	1.129
555	251	1	30.00	5	0.1	250	5	17.181	3.640	3.112	0.895	0.610	32.344	11.679	8.378	3.147	1.072
556	251	1	31.00	6	0.1	250	6	16.815	3.479	3.077	0.877	0.496	37.506	13.411	9.682	3.468	1.027
557	251	1	32.00	7	0.1	250	7	16.336	3.324	3.024	0.862	0.414	42.458	14.996	10.913	3.741	0.992
558	251	1	32.50	7.5	0.1	250	7.5	16.071	3.246	2.993	0.856	0.382	44.737	15.738	11.459	3.863	0.843
559	251	1	33.00	8	0.1	250	8	15.824	3.166	2.965	0.852	0.353	47.066	16.447	12.021	3.979	0.842
560	251	1	34.00	9	0.1	250	9	15.320	3.020	2.904	0.847	0.307	51.430	17.786	13.065	4.191	0.840
561	251	1	35.00	10	0.1	250	10	14.825	2.900	2.842	0.848	0.271	55.783	19.041	14.097	4.385	0.839
562	501	1	50.10	0.1	0.1	500	0.1	10.866	4.815	6.348	0.879	6.116	4.580	2.784	2.039	0.103	5.291
563	501	1	50.25	0.25	0.1	500	0.25	21.114	8.232	10.471	0.921	5.251	8.876	4.815	3.135	0.248	4.485
564	501	1	50.50	0.5	0.1	500	0.5	23.933	8.387	9.249	0.982	3.851	10.393	5.505	2.506	0.507	3.533
565	501	1	50.75	0.75	0.1	500	0.75	23.273	7.156	7.538	1.005	3.168	11.914	6.135	3.087	0.764	3.065
566	501	1	51.00	1	0.1	500	1	23.497	7.237	6.655	1.017	2.805	14.930	5.989	3.932	0.998	2.777
567	501	1	51.25	1.25	0.1	500	1.25	24.340	7.444	6.288	1.023	2.518	17.877	6.778	4.848	1.231	2.498
568	501	1	52.00	2	0.1	500	2	28.646	8.405	6.617	1.038	1.927	26.235	9.529	7.711	1.918	1.860
569	501	1	52.50	2.5	0.1	500	2.5	31.181	8.937	7.160	1.074	1.635	30.935	11.914	9.526	2.356	1.548
570	501	1	53.00	3	0.1	500	3	33.019	9.269	7.677	1.074	1.399	35.209	14.300	11.221	2.776	1.414

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Model								Membrane Stress Factors									
	OD	T	od	t	d/D	D/T	t/T	Branch					Header				
								Axial	In-Plane	Out-of-Plane	Torsional	Pressure	Axial	In-Plane	Out-of-Plane	Torsional	Pressure
571	501	1	54.00	4	0.1	500	4	34.940	10.187	8.403	1.065	1.052	43.504	18.928	14.361	3.545	1.295
572	501	1	55.00	5	0.1	500	5	35.370	9.994	8.764	1.007	0.819	52.054	23.267	17.243	4.222	1.157
573	501	1	56.00	6	0.1	500	6	35.051	9.630	8.884	0.988	0.658	60.935	27.261	19.962	4.815	1.192
574	501	1	57.00	7	0.1	500	7	34.366	9.198	8.861	0.873	0.543	69.751	30.927	22.499	5.336	0.852
575	501	1	57.50	7.5	0.1	500	7.5	33.963	8.966	8.814	0.866	0.498	74.157	32.646	23.940	5.574	0.850
576	501	1	58.00	8	0.1	500	8	33.541	8.746	8.755	0.860	0.458	78.550	34.296	25.385	5.799	0.848
577	501	1	59.00	9	0.1	500	9	32.654	8.323	8.608	0.849	0.394	87.261	37.411	28.212	6.204	0.845
578	501	1	60.00	10	0.1	500	10	31.763	7.908	8.429	0.840	0.344	95.617	40.284	30.851	6.591	0.843
580	751	1	75.25	0.25	0.1	750	0.25	27.865	10.418	14.258	0.933	6.172	12.614	6.763	5.145	0.290	5.265
581	751	1	75.50	0.5	0.1	750	0.5	31.399	10.054	12.556	0.976	4.480	14.009	7.896	3.451	0.546	4.095
582	751	1	75.75	0.75	0.1	750	0.75	30.874	9.878	10.361	0.995	3.671	17.426	7.739	4.259	0.833	3.540
583	751	1	76.00	1	0.1	750	1	31.809	10.289	9.398	1.073	3.254	21.772	9.003	5.472	1.060	3.216
584	751	1	76.25	1.25	0.1	750	1.25	33.684	10.856	9.178	1.091	2.938	26.106	10.270	6.839	1.308	2.920
585	751	1	77.00	2	0.1	750	2	41.595	12.900	10.613	1.135	2.287	38.167	13.289	11.264	2.055	2.230
586	751	1	77.50	2.5	0.1	750	2.5	46.161	15.041	11.991	1.149	1.957	44.702	14.494	14.052	2.550	1.876
587	751	1	78.00	3	0.1	750	3	49.575	15.781	13.239	1.164	1.684	50.403	17.395	16.630	3.031	1.607
588	751	1	79.00	4	0.1	750	4	53.409	16.408	15.020	1.165	1.273	60.614	23.305	21.298	3.950	1.396
589	751	1	80.00	5	0.1	750	5	54.610	16.337	15.987	1.156	0.991	70.479	29.154	25.652	4.796	1.254
590	751	1	81.00	6	0.1	750	6	54.404	15.913	16.396	1.154	0.793	81.355	34.788	29.860	5.567	1.190
591	751	1	82.00	7	0.1	750	7	53.515	15.324	16.477	1.144	0.650	92.993	40.116	34.000	6.267	1.146
592	751	1	82.50	7.5	0.1	750	7.5	52.922	14.997	16.422	1.138	0.594	98.709	47.801	37.121	6.613	1.238
593	751	1	83.00	8	0.1	750	8	52.305	14.676	16.340	0.944	0.545	104.808	50.437	39.033	6.926	0.859
594	751	1	84.00	9	0.1	750	9	50.988	14.000	16.096	0.926	0.465	116.804	55.463	42.792	7.510	0.855
595	751	1	85.00	10	0.1	750	10	49.671	13.361	15.792	0.911	0.403	128.707	60.204	47.005	8.047	0.853
597	1001	1	100.25	0.25	0.1	1000	0.25	33.803	12.056	17.625	0.961	6.902	16.352	8.172	7.126	0.328	5.927
598	1001	1	100.50	0.5	0.1	1000	0.5	38.023	12.318	15.538	1.020	4.979	18.227	9.689	4.955	0.570	4.568
599	1001	1	100.75	0.75	0.1	1000	0.75	37.826	12.373	13.065	1.049	4.072	22.751	10.159	6.070	0.856	3.935
600	1001	1	101.00	1	0.1	1000	1	39.589	13.113	12.155	1.128	3.615	28.434	11.863	7.750	1.114	3.580
601	1001	1	101.25	1.25	0.1	1000	1.25	42.577	14.042	12.169	1.157	3.277	34.166	13.443	9.640	1.372	3.268
602	1001	1	102.00	2	0.1	1000	2	54.196	17.145	14.867	1.230	2.583	50.120	16.362	15.736	2.161	2.537
603	1001	1	102.50	2.5	0.1	1000	2.5	60.948	19.890	17.182	1.258	2.225	58.684	18.605	19.571	2.686	2.150
604	1001	1	103.00	3	0.1	1000	3	66.090	21.065	19.252	1.270	1.925	66.027	21.162	23.072	3.204	1.824
605	1001	1	104.00	4	0.1	1000	4	72.175	22.303	22.275	1.267	1.465	78.395	28.238	29.266	4.218	1.490
606	1001	1	105.00	5	0.1	1000	5	74.429	22.393	24.005	1.245	1.143	89.777	35.361	34.879	5.173	1.404
607	1001	1	106.00	6	0.1	1000	6	74.543	21.932	24.848	1.228	0.914	101.425	42.387	40.316	6.075	1.248
608	1001	1	107.00	7	0.1	1000	7	73.516	21.235	25.108	1.221	0.748	114.054	52.762	45.694	6.907	1.199
609	1001	1	107.50	7.5	0.1	1000	7.5	72.798	20.839	25.087	1.217	0.681	121.130	56.495	48.350	7.300	1.182
610	1001	1	108.00	8	0.1	1000	8	71.995	20.434	25.029	1.212	0.624	128.040	60.296	51.068	7.677	1.167

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Model								Membrane Stress Factors									
	OD	T	od	t	d/D	D/T	t/T	Branch					Header				
								Axial	In-Plane	Out-of-Plane	Torsional	Pressure	Axial	In-Plane	Out-of-Plane	Torsional	Pressure
611	1001	1	109.00	9	0.1	1000	9	70.220	19.590	24.704	1.201	0.530	142.922	67.549	56.386	8.392	0.861
612	1001	1	110.00	10	0.1	1000	10	68.415	18.750	24.320	1.190	0.457	157.785	74.451	62.206	9.057	0.858
614	1251	1	125.25	0.25	0.1	1250	0.25	39.254	13.226	20.751	0.987	7.515	19.966	9.813	9.173	0.366	6.495
615	1251	1	125.50	0.5	0.1	1250	0.5	44.184	14.425	18.402	1.066	5.400	22.285	10.682	6.524	0.641	4.973
616	1251	1	125.75	0.75	0.1	1250	0.75	44.378	12.728	15.720	1.106	4.412	27.967	12.423	7.992	0.901	4.273
617	1251	1	126.00	1	0.1	1250	1	47.046	13.617	14.902	1.183	3.920	35.014	14.557	10.167	1.165	3.890
618	1251	1	126.25	1.25	0.1	1250	1.25	51.189	14.721	15.248	1.222	3.566	42.124	16.530	12.611	1.440	3.564
619	1251	1	127.00	2	0.1	1250	2	66.561	21.155	19.375	1.326	2.836	61.998	19.880	20.494	2.294	2.801
620	1251	1	127.50	2.5	0.1	1250	2.5	75.509	24.319	22.540	1.368	2.456	72.702	22.540	25.272	2.863	2.390
621	1251	1	128.00	3	0.1	1250	3	82.467	25.899	25.525	1.391	2.134	81.715	24.659	29.778	3.425	2.017
622	1251	1	129.00	4	0.1	1250	4	91.021	27.568	29.895	1.394	1.633	96.368	32.479	37.503	4.509	1.594
623	1251	1	130.00	5	0.1	1250	5	94.557	27.895	32.495	1.369	1.279	109.302	40.620	44.407	5.527	1.468
624	1251	1	131.00	6	0.1	1250	6	95.178	27.500	33.860	1.315	1.024	122.111	51.419	50.923	6.473	1.408
625	1251	1	132.00	7	0.1	1250	7	94.179	26.720	34.390	1.284	0.837	134.903	60.677	56.654	7.584	1.244
626	1251	1	132.50	7.5	0.1	1250	7.5	93.345	26.276	34.440	1.281	0.763	142.007	65.001	59.935	8.017	1.221
627	1251	1	133.00	8	0.1	1250	8	92.376	25.790	34.410	1.277	0.698	149.636	69.446	63.247	8.432	1.339
628	1251	1	134.00	9	0.1	1250	9	90.218	24.795	34.089	1.268	0.591	166.333	77.853	69.867	9.218	1.314
629	1251	1	135.00	10	0.1	1250	10	87.921	23.988	33.574	1.258	0.508	183.621	86.444	76.499	9.947	0.867
631	1501	1	150.25	0.25	0.1	1500	0.25	44.364	14.873	23.700	1.014	8.048	23.431	11.082	11.167	0.402	6.996
632	1501	1	150.50	0.5	0.1	1500	0.5	49.953	16.388	21.121	1.112	5.768	26.230	12.451	8.126	0.694	5.329
633	1501	1	150.75	0.75	0.1	1500	0.75	50.637	14.775	18.293	1.185	4.709	33.039	14.558	9.964	0.946	4.569
634	1501	1	151.00	1	0.1	1500	1	54.234	15.968	17.677	1.237	4.187	41.474	17.121	12.665	1.217	4.162
635	1501	1	151.25	1.25	0.1	1500	1.25	59.520	17.386	18.342	1.287	3.817	49.981	19.480	15.672	1.505	3.824
636	1501	1	152.00	2	0.1	1500	2	78.694	24.922	23.904	1.445	3.058	73.847	23.231	25.311	2.406	3.033
637	1501	1	152.50	2.5	0.1	1500	2.5	89.862	28.396	28.158	1.505	2.660	86.676	26.298	31.297	3.012	2.602
638	1501	1	153.00	3	0.1	1500	3	98.669	30.401	32.014	1.531	2.319	97.418	28.724	36.733	3.614	2.190
639	1501	1	154.00	4	0.1	1500	4	109.835	32.401	37.729	1.525	1.785	114.076	36.397	45.266	4.892	1.692
640	1501	1	155.00	5	0.1	1500	5	114.835	32.966	41.288	1.468	1.403	128.195	46.322	53.250	6.046	1.524
641	1501	1	156.00	6	0.1	1500	6	116.117	32.642	43.191	1.401	1.126	142.038	56.721	60.712	7.134	1.456
642	1501	1	157.00	7	0.1	1500	7	115.272	31.881	44.058	1.339	0.921	156.584	67.016	68.183	8.153	1.412
643	1501	1	157.50	7.5	0.1	1500	7.5	114.420	31.382	44.286	1.336	0.839	164.194	72.158	72.032	8.636	1.394
644	1501	1	158.00	8	0.1	1500	8	113.345	30.875	44.239	1.334	0.767	171.996	77.272	75.703	9.104	1.379
645	1501	1	159.00	9	0.1	1500	9	110.836	29.765	44.002	1.326	0.649	188.581	87.315	83.474	9.994	1.354
646	1501	1	160.00	10	0.1	1500	10	108.123	28.592	43.472	1.317	0.557	208.061	96.497	91.418	10.825	1.331
649	1751	1	175.50	0.5	0.1	1750	0.5	55.519	18.274	23.761	1.157	6.100	29.913	14.110	9.501	0.751	5.664
650	1751	1	175.75	0.75	0.1	1750	0.75	56.722	16.637	20.827	1.229	4.975	38.024	16.506	11.633	0.991	4.841
651	1751	1	176.00	1	0.1	1750	1	61.255	18.138	20.393	1.296	4.427	47.805	19.387	14.774	1.267	4.407
652	1751	1	176.25	1.25	0.1	1750	1.25	67.712	19.898	21.427	1.358	4.042	57.692	19.815	18.308	1.565	4.056

STP-PT-074: Local Stress in Nozzles, Shells and Formed Heads from External Heads

Model								Membrane Stress Factors									
	OD	T	od	t	d/D	D/T	t/T	Branch					Header				
								Axial	In-Plane	Out-of-Plane	Torsional	Pressure	Axial	In-Plane	Out-of-Plane	Torsional	Pressure
653	1751	1	177.00	2	0.1	1750	2	90.613	28.684	28.562	1.574	3.257	85.357	26.984	29.702	2.525	3.239
654	1751	1	177.50	2.5	0.1	1750	2.5	104.002	32.241	33.749	1.653	2.843	100.411	29.291	36.661	3.178	2.791
655	1751	1	178.00	3	0.1	1750	3	114.706	34.610	38.486	1.694	2.486	112.849	32.304	42.982	3.834	2.350
656	1751	1	179.00	4	0.1	1750	4	128.594	37.273	45.725	1.692	1.923	132.167	39.951	53.749	5.123	1.787
657	1751	1	180.00	5	0.1	1750	5	135.183	37.644	50.260	1.638	1.516	147.805	50.488	62.901	6.362	1.577
658	1751	1	181.00	6	0.1	1750	6	137.284	37.455	52.846	1.561	1.220	162.622	61.460	71.375	7.537	1.499
659	1751	1	182.00	7	0.1	1750	7	136.740	36.680	54.099	1.483	0.999	178.053	72.781	79.730	8.645	1.449
660	1751	1	182.50	7.5	0.1	1750	7.5	135.853	36.177	54.388	1.446	0.910	186.207	78.262	84.024	9.175	1.430
661	1751	1	183.00	8	0.1	1750	8	134.719	35.635	54.485	1.409	0.832	194.546	83.925	88.257	9.688	1.413
662	1751	1	184.00	9	0.1	1750	9	131.953	34.448	54.274	1.378	0.704	212.157	94.792	96.956	10.669	1.386
663	1751	1	185.00	10	0.1	1750	10	128.862	33.191	53.678	1.370	0.603	231.125	105.440	105.737	11.590	1.362
666	2001	1	200.50	0.5	0.1	2000	0.5	60.827	17.490	26.364	1.204	6.398	33.628	15.659	11.123	0.803	5.955
667	2001	1	200.75	0.75	0.1	2000	0.75	62.597	18.498	23.353	1.274	5.216	42.937	18.377	13.649	1.036	5.082
668	2001	1	201.00	1	0.1	2000	1	68.110	20.329	23.137	1.352	4.643	54.055	21.656	17.286	1.319	4.627
669	2001	1	201.25	1.25	0.1	2000	1.25	75.700	22.381	24.550	1.427	4.246	65.311	22.068	21.404	1.605	4.265
670	2001	1	202.00	2	0.1	2000	2	102.332	32.097	33.123	1.704	3.438	96.860	28.947	34.521	2.442	3.428
671	2001	1	202.50	2.5	0.1	2000	2.5	117.980	35.764	39.614	1.802	3.009	114.092	32.914	42.863	3.028	2.964
672	2001	1	203.00	3	0.1	2000	3	130.579	38.501	45.092	1.855	2.638	128.339	36.196	49.953	3.973	2.500
673	2001	1	204.00	4	0.1	2000	4	147.284	41.625	53.696	1.865	2.049	150.252	43.250	62.175	5.330	1.879
674	2001	1	205.00	5	0.1	2000	5	155.594	42.339	59.482	1.811	1.621	167.452	54.187	72.758	6.641	1.613
675	2001	1	206.00	6	0.1	2000	6	158.554	42.190	62.653	1.729	1.307	183.340	65.807	82.115	7.894	1.536
676	2001	1	207.00	7	0.1	2000	7	158.380	41.430	64.391	1.641	1.072	199.719	77.580	91.500	9.083	1.479
677	2001	1	207.50	7.5	0.1	2000	7.5	157.584	40.918	64.739	1.597	0.977	208.130	83.529	95.967	9.653	1.457
678	2001	1	208.00	8	0.1	2000	8	156.388	40.357	64.852	1.555	0.894	217.072	89.655	100.637	10.206	1.439
679	2001	1	209.00	9	0.1	2000	9	153.436	39.140	64.760	1.476	0.756	235.384	101.480	110.077	11.268	1.412
680	2001	1	210.00	10	0.1	2000	10	149.990	37.878	64.237	1.417	0.647	255.152	113.092	120.051	12.271	1.388
683	2251	1	225.50	0.5	0.1	2250	0.5	65.867	19.044	28.705	1.280	6.671	37.235	17.144	12.662	0.854	6.224
684	2251	1	225.75	0.75	0.1	2250	0.75	68.243	20.364	25.768	1.340	5.438	47.773	20.214	15.634	1.084	5.304
685	2251	1	226.00	1	0.1	2250	1	74.836	22.444	25.844	1.408	4.841	60.188	23.869	19.806	1.374	4.830
686	2251	1	226.25	1.25	0.1	2250	1.25	83.619	24.877	27.657	1.491	4.433	72.783	24.229	24.504	1.626	4.458
687	2251	1	227.00	2	0.1	2250	2	113.882	35.464	37.869	1.835	3.603	108.221	32.264	39.544	2.510	3.600
688	2251	1	227.50	2.5	0.1	2250	2.5	131.690	39.465	45.141	1.952	3.162	127.681	36.556	48.775	3.103	3.124
689	2251	1	228.00	3	0.1	2250	3	146.193	42.453	51.682	2.016	2.778	143.676	39.562	56.968	4.004	2.639
690	2251	1	229.00	4	0.1	2250	4	165.858	45.867	62.061	2.039	2.166	168.222	46.400	71.021	5.517	1.968
691	2251	1	230.00	5	0.1	2250	5	175.869	47.097	68.287	1.987	1.718	187.190	57.551	82.171	6.893	1.670
692	2251	1	231.00	6	0.1	2250	6	179.759	46.952	72.652	1.898	1.388	204.096	69.705	93.080	8.183	1.571
693	2251	1	232.00	7	0.1	2250	7	180.132	46.227	74.794	1.801	1.141	221.198	82.248	103.127	9.476	1.506
694	2251	1	232.50	7.5	0.1	2250	7.5	179.335	45.652	75.353	1.754	1.040	230.020	88.463	108.174	10.081	1.482

STP-PT-074: Local Stress in Nozzles, Shells and Formed Heads from External Heads

Model								Membrane Stress Factors									
	OD	T	od	t	d/D	D/T	t/T	Branch					Header				
								Axial	In-Plane	Out-of-Plane	Torsional	Pressure	Axial	In-Plane	Out-of-Plane	Torsional	Pressure
695	2251	1	233.00	8	0.1	2250	8	178.288	45.081	75.416	1.707	0.952	239.182	94.823	112.835	10.672	1.463
696	2251	1	234.00	9	0.1	2250	9	175.190	43.875	75.685	1.617	0.805	257.267	107.322	122.290	12.032	1.429
697	2251	1	235.00	10	0.1	2250	10	171.476	42.496	75.114	1.537	0.690	277.414	119.698	132.683	13.136	1.405
700	2501	1	250.50	0.5	0.1	2500	0.5	70.860	20.612	31.222	1.323	6.922	40.822	18.572	14.291	0.904	6.473
701	2501	1	250.75	0.75	0.1	2500	0.75	73.833	22.054	28.144	1.358	5.640	52.517	21.987	17.621	1.131	5.508
702	2501	1	251.00	1	0.1	2500	1	81.348	24.465	28.501	1.464	5.024	66.298	25.948	22.382	1.427	5.016
703	2501	1	251.25	1.25	0.1	2500	1.25	91.534	27.114	30.826	1.565	4.605	80.307	26.274	27.664	1.728	4.636
704	2501	1	252.00	2	0.1	2500	2	125.215	38.569	42.369	1.962	3.755	119.525	35.398	44.404	2.576	3.759
705	2501	1	252.50	2.5	0.1	2500	2.5	145.410	43.012	50.815	2.095	3.302	141.042	40.059	54.761	3.176	3.270
706	2501	1	253.00	3	0.1	2500	3	161.786	46.424	58.433	2.179	2.907	158.892	43.347	64.096	4.211	2.545
707	2501	1	254.00	4	0.1	2500	4	184.193	50.204	71.500	2.214	2.274	186.250	49.475	81.237	5.685	2.056
708	2501	1	255.00	5	0.1	2500	5	196.085	51.655	78.063	2.163	1.808	206.953	60.813	92.759	7.006	1.713
709	2501	1	256.00	6	0.1	2500	6	201.172	51.792	82.792	2.074	1.463	223.479	73.134	102.634	8.492	1.598
710	2501	1	257.00	7	0.1	2500	7	201.864	51.000	85.375	1.970	1.204	241.314	86.066	113.589	9.871	1.527
711	2501	1	257.50	7.5	0.1	2500	7.5	201.423	50.343	86.049	1.914	1.099	250.381	92.605	118.784	10.544	1.501
712	2501	1	258.00	8	0.1	2500	8	200.303	49.779	86.504	1.864	1.007	259.744	99.457	124.106	11.188	1.479
713	2501	1	259.00	9	0.1	2500	9	197.108	48.345	86.274	1.761	0.852	280.145	112.611	134.812	12.457	1.444
714	2501	1	260.00	10	0.1	2500	10	193.124	46.874	86.238	1.671	0.731	301.009	125.440	146.637	13.708	1.418
715	9	1	1.30	0.1	0.15	8	0.1	1.007	0.936	0.926	0.850	1.205	0.151	0.106	0.122	0.072	1.244
716	9	1	1.45	0.25	0.15	8	0.25	1.012	0.834	0.834	0.744	0.486	0.327	0.165	0.178	0.135	1.050
717	9	1	1.70	0.5	0.15	8	0.5	1.002	0.709	0.709	0.648	0.326	0.527	0.216	0.217	0.197	0.910
718	9	1	1.95	0.75	0.15	8	0.75	0.990	0.624	0.623	0.623	0.281	0.655	0.250	0.251	0.238	0.845
719	9	1	2.20	1	0.15	8	1	1.003	0.561	0.561	0.634	0.259	0.741	0.286	0.287	0.276	0.807
732	17	1	2.50	0.1	0.15	16	0.1	1.038	0.980	0.967	0.887	1.333	0.187	0.176	0.212	0.081	1.693
733	17	1	2.65	0.25	0.15	16	0.25	1.420	0.920	0.920	0.838	0.805	0.394	0.232	0.382	0.171	1.456
734	17	1	2.90	0.5	0.15	16	0.5	1.762	0.834	0.832	0.753	0.640	0.644	0.342	0.452	0.283	1.204
735	17	1	3.15	0.75	0.15	16	0.75	1.882	0.763	0.763	0.698	0.581	1.434	0.406	0.442	0.361	1.074
736	17	1	3.40	1	0.15	16	1	1.890	0.707	0.707	0.664	0.547	1.799	0.456	0.484	0.419	0.991
737	17	1	3.65	1.25	0.15	16	1.25	1.886	0.670	0.670	0.663	0.485	2.144	0.488	0.514	0.468	0.873
738	17	1	4.40	2	0.15	16	2	1.653	0.556	0.556	0.636	0.352	2.951	0.588	0.633	0.589	0.855
749	25	1	3.70	0.1	0.15	24	0.1	1.272	0.996	0.987	0.902	1.458	0.268	0.141	0.198	0.085	2.022
750	25	1	3.85	0.25	0.15	24	0.25	2.039	0.992	1.090	0.876	1.168	0.556	0.288	0.501	0.187	1.746
751	25	1	4.10	0.5	0.15	24	0.5	2.591	0.945	1.061	0.809	0.938	0.922	0.410	0.645	0.334	1.450
752	25	1	4.35	0.75	0.15	24	0.75	2.746	0.824	0.938	0.759	0.834	1.784	0.506	0.643	0.447	1.256
753	25	1	4.60	1	0.15	24	1	2.749	0.772	0.815	0.726	0.775	2.305	0.584	0.667	0.533	1.139
754	25	1	4.85	1.25	0.15	24	1.25	2.751	0.740	0.740	0.699	0.690	2.803	0.633	0.713	0.605	0.987
755	25	1	5.60	2	0.15	24	2	2.543	0.653	0.653	0.655	0.509	4.020	0.763	0.856	0.757	0.855
756	25	1	6.10	2.5	0.15	24	2.5	2.391	0.606	0.606	0.699	0.424	4.665	0.841	0.966	0.835	0.855

STP-PT-074: Local Stress in Nozzles, Shells and Formed Heads from External Heads

Model								Membrane Stress Factors									
	OD	T	od	t	d/D	D/T	t/T	Branch					Header				
								Axial	In-Plane	Out-of-Plane	Torsional	Pressure	Axial	In-Plane	Out-of-Plane	Torsional	Pressure
757	25	1	6.60	3	0.15	24	3	2.244	0.559	0.559	0.729	0.356	5.220	0.918	1.086	0.911	0.865
766	33	1	4.90	0.1	0.15	32	0.1	1.530	1.001	1.059	0.910	1.798	0.375	0.166	0.244	0.085	2.287
767	33	1	5.05	0.25	0.15	32	0.25	2.666	1.209	1.372	0.893	1.511	0.735	0.318	0.605	0.197	1.975
768	33	1	5.30	0.5	0.15	32	0.5	3.384	1.193	1.364	0.832	1.210	1.394	0.523	0.810	0.368	1.638
769	33	1	5.55	0.75	0.15	32	0.75	3.542	1.038	1.209	0.797	1.058	2.081	0.588	0.726	0.507	1.402
770	33	1	5.80	1	0.15	32	1	3.532	0.896	1.057	0.771	0.969	2.737	0.689	0.828	0.620	1.266
771	33	1	6.05	1.25	0.15	32	1.25	3.524	0.803	0.942	0.744	0.860	3.368	0.757	0.902	0.717	1.094
772	33	1	6.80	2	0.15	32	2	3.312	0.714	0.714	0.687	0.635	4.951	0.933	1.091	0.914	0.920
773	33	1	7.30	2.5	0.15	32	2.5	3.142	0.674	0.674	0.696	0.532	5.817	1.030	1.221	1.007	0.861
774	33	1	7.80	3	0.15	32	3	2.976	0.623	0.622	0.720	0.453	6.562	1.120	1.355	1.085	0.869
775	33	1	8.80	4	0.15	32	4	2.740	0.560	0.560	0.794	0.341	7.789	1.433	1.637	1.235	0.887
783	41	1	6.10	0.1	0.15	40	0.1	1.793	1.068	1.193	0.915	2.100	0.491	0.219	0.287	0.087	2.513
784	41	1	6.25	0.25	0.15	40	0.25	3.281	1.441	1.665	0.900	1.813	0.931	0.381	0.581	0.204	2.165
785	41	1	6.50	0.5	0.15	40	0.5	4.138	1.445	1.661	0.846	1.446	1.550	0.594	0.898	0.393	1.792
786	41	1	6.75	0.75	0.15	40	0.75	4.283	1.259	1.464	0.825	1.251	2.344	0.669	0.833	0.553	1.555
787	41	1	7.00	1	0.15	40	1	4.257	1.091	1.283	0.799	1.133	3.111	0.790	0.970	0.688	1.384
788	41	1	7.25	1.25	0.15	40	1.25	4.238	0.953	1.153	0.778	1.003	3.853	0.873	1.075	0.807	1.191
789	41	1	8.00	2	0.15	40	2	4.020	0.790	0.875	0.727	0.737	5.762	1.098	1.327	1.056	0.975
790	41	1	8.50	2.5	0.15	40	2.5	3.844	0.715	0.753	0.719	0.618	6.813	1.240	1.485	1.166	0.916
791	41	1	9.00	3	0.15	40	3	3.677	0.670	0.667	0.728	0.527	7.741	1.418	1.642	1.257	0.869
792	41	1	10.00	4	0.15	40	4	3.386	0.610	0.599	0.776	0.400	9.286	1.730	1.953	1.411	0.877
793	41	1	11.00	5	0.15	40	5	3.201	0.561	0.561	0.860	0.316	10.580	2.090	2.282	1.560	0.901
800	51	1	7.60	0.1	0.15	50	0.1	2.122	1.201	1.371	0.917	2.433	0.649	0.300	0.331	0.089	2.759
801	51	1	7.75	0.25	0.15	50	0.25	4.024	1.735	2.030	0.901	2.142	1.192	0.500	0.606	0.213	2.368
802	51	1	8.00	0.5	0.15	50	0.5	5.028	1.753	2.016	0.862	1.698	1.859	0.679	1.022	0.416	1.952
803	51	1	8.25	0.75	0.15	50	0.75	5.142	1.531	1.763	0.846	1.454	2.637	0.908	0.945	0.597	1.693
804	51	1	8.50	1	0.15	50	1	5.093	1.336	1.547	0.828	1.305	3.508	0.926	1.119	0.754	1.504
805	51	1	8.75	1.25	0.15	50	1.25	5.062	1.171	1.397	0.810	1.152	4.360	1.062	1.264	0.897	1.290
806	51	1	9.50	2	0.15	50	2	4.862	0.976	1.091	0.761	0.843	6.635	1.446	1.618	1.208	1.036
807	51	1	10.00	2.5	0.15	50	2.5	4.695	0.872	0.955	0.750	0.705	7.911	1.657	1.819	1.347	0.968
808	51	1	10.50	3	0.15	50	3	4.525	0.795	0.853	0.749	0.600	9.037	1.854	2.008	1.456	0.919
809	51	1	11.50	4	0.15	50	4	4.202	0.705	0.717	0.768	0.456	10.973	2.267	2.373	1.629	0.869
810	51	1	12.50	5	0.15	50	5	3.939	0.637	0.638	0.818	0.363	12.593	2.778	2.732	1.780	0.867
811	51	1	13.50	6	0.15	50	6	3.750	0.607	0.593	0.898	0.300	13.989	3.105	3.095	1.932	0.901
812	51	1	14.50	7	0.15	50	7	3.673	0.582	0.577	0.999	0.253	15.174	3.499	3.468	2.091	0.923
817	61	1	9.10	0.1	0.15	60	0.1	2.447	1.340	1.552	0.918	2.729	0.798	0.391	0.389	0.091	2.976
818	61	1	9.25	0.25	0.15	60	0.25	4.739	2.024	2.388	0.898	2.429	1.455	0.639	0.662	0.219	2.545
819	61	1	9.50	0.5	0.15	60	0.5	5.863	2.049	2.354	0.869	1.912	2.152	0.781	0.844	0.433	2.088



STP-PT-074: Local Stress in Nozzles, Shells and Formed Heads from External Heads

Model								Membrane Stress Factors									
	OD	T	od	t	d/D	D/T	t/T	Branch					Header				
								Axial	In-Plane	Out-of-Plane	Torsional	Pressure	Axial	In-Plane	Out-of-Plane	Torsional	Pressure
820	61	1	9.75	0.75	0.15	60	0.75	5.939	1.794	2.043	0.861	1.624	2.910	1.037	1.036	0.630	1.810
821	61	1	10.00	1	0.15	60	1	5.866	1.583	1.792	0.847	1.449	3.871	1.148	1.247	0.805	1.608
822	61	1	10.25	1.25	0.15	60	1.25	5.824	1.430	1.625	0.832	1.276	4.811	1.328	1.432	0.967	1.377
823	61	1	11.00	2	0.15	60	2	5.665	1.164	1.298	0.795	0.931	7.377	1.787	1.889	1.336	1.079
824	61	1	11.50	2.5	0.15	60	2.5	5.526	1.057	1.155	0.782	0.777	8.853	2.107	2.144	1.507	1.016
825	61	1	12.00	3	0.15	60	3	5.366	0.981	1.046	0.774	0.661	10.179	2.362	2.377	1.638	0.962
826	61	1	13.00	4	0.15	60	4	5.046	0.876	0.896	0.775	0.500	12.475	2.833	2.803	1.837	0.897
827	61	1	14.00	5	0.15	60	5	4.744	0.812	0.803	0.800	0.398	14.438	3.325	3.214	2.001	0.865
828	61	1	15.00	6	0.15	60	6	4.477	0.759	0.745	0.849	0.329	16.136	3.757	3.622	2.153	0.872
829	61	1	16.00	7	0.15	60	7	4.295	0.700	0.713	0.923	0.279	17.628	4.203	4.023	2.309	0.897
830	61	1	16.50	7.5	0.15	60	7.5	4.245	0.690	0.703	0.968	0.259	18.370	4.430	4.239	2.389	0.906
831	61	1	17.00	8	0.15	60	8	4.264	0.681	0.698	1.018	0.240	19.005	4.656	4.444	2.405	0.914
834	71	1	10.60	0.1	0.15	70	0.1	2.764	1.481	1.734	0.918	2.996	0.945	0.484	0.443	0.094	3.171
835	71	1	10.75	0.25	0.15	70	0.25	5.424	2.301	2.738	0.894	2.683	1.719	0.791	0.744	0.225	2.705
836	71	1	11.00	0.5	0.15	70	0.5	6.649	2.334	2.677	0.876	2.097	2.478	0.931	0.911	0.419	2.208
837	71	1	11.25	0.75	0.15	70	0.75	6.682	2.054	2.307	0.871	1.770	3.174	1.076	1.114	0.643	1.913
838	71	1	11.50	1	0.15	70	1	6.588	1.827	2.022	0.860	1.573	4.213	1.331	1.358	0.846	1.700
839	71	1	11.75	1.25	0.15	70	1.25	6.539	1.630	1.839	0.851	1.383	5.228	1.553	1.581	1.024	1.457
840	71	1	12.50	2	0.15	70	2	6.438	1.357	1.497	0.827	1.008	8.046	2.174	2.138	1.445	1.133
841	71	1	13.00	2.5	0.15	70	2.5	6.339	1.253	1.351	0.812	0.840	9.705	2.522	2.458	1.646	1.057
842	71	1	13.50	3	0.15	70	3	6.209	1.205	1.240	0.801	0.714	11.205	2.838	2.744	1.803	1.001
843	71	1	14.50	4	0.15	70	4	5.898	1.073	1.083	0.789	0.539	13.824	3.481	3.253	2.034	0.926
844	71	1	15.50	5	0.15	70	5	5.571	0.996	0.981	0.798	0.427	16.104	3.973	3.726	2.216	0.887
845	71	1	16.50	6	0.15	70	6	5.272	0.934	0.913	0.826	0.352	18.107	4.467	4.174	2.375	0.883
846	71	1	17.50	7	0.15	70	7	5.014	0.885	0.871	0.874	0.298	19.914	4.963	4.619	2.466	0.873
847	71	1	18.00	7.5	0.15	70	7.5	4.917	0.862	0.854	0.905	0.277	20.784	5.342	4.844	2.543	0.882
848	71	1	18.50	8	0.15	70	8	4.827	0.844	0.843	0.940	0.259	21.601	5.600	5.074	2.622	0.891
849	71	1	19.50	9	0.15	70	9	4.748	0.772	0.829	1.040	0.229	23.050	6.012	5.530	2.777	0.904
850	71	1	20.50	10	0.15	70	10	4.730	0.754	0.826	1.131	0.202	24.442	6.510	6.007	2.941	0.914
851	81	1	12.10	0.1	0.15	80	0.1	3.075	1.619	1.915	0.917	3.241	1.102	0.579	0.520	0.096	3.350
852	81	1	12.25	0.25	0.15	80	0.25	6.078	2.564	3.078	0.888	2.911	1.979	0.949	0.863	0.231	2.851
853	81	1	12.50	0.5	0.15	80	0.5	7.394	2.603	2.986	0.882	2.260	2.814	1.091	0.967	0.431	2.316
854	81	1	12.75	0.75	0.15	80	0.75	7.382	2.302	2.558	0.878	1.898	3.436	1.231	1.181	0.665	2.005
855	81	1	13.00	1	0.15	80	1	7.269	2.067	2.241	0.881	1.681	4.541	1.528	1.455	0.858	1.783
856	81	1	13.25	1.25	0.15	80	1.25	7.215	1.854	2.041	0.878	1.477	5.604	1.797	1.704	1.072	1.532
857	81	1	14.00	2	0.15	80	2	7.186	1.557	1.690	0.855	1.075	8.668	2.511	2.379	1.539	1.180
858	81	1	14.50	2.5	0.15	80	2.5	7.140	1.475	1.545	0.839	0.897	10.479	2.987	2.758	1.769	1.098
859	81	1	15.00	3	0.15	80	3	7.042	1.395	1.436	0.825	0.760	12.135	3.381	3.099	1.951	1.036

STP-PT-074: Local Stress in Nozzles, Shells and Formed Heads from External Heads

Model								Membrane Stress Factors									
	OD	T	od	t	d/D	D/T	t/T	Branch					Header				
								Axial	In-Plane	Out-of-Plane	Torsional	Pressure	Axial	In-Plane	Out-of-Plane	Torsional	Pressure
860	81	1	16.00	4	0.15	80	4	6.759	1.273	1.279	0.807	0.573	15.070	4.080	3.695	2.219	0.955
861	81	1	17.00	5	0.15	80	5	6.427	1.190	1.173	0.804	0.453	17.639	4.697	4.232	2.420	0.907
862	81	1	18.00	6	0.15	80	6	6.094	1.118	1.098	0.817	0.372	19.911	5.270	4.732	2.519	0.839
863	81	1	19.00	7	0.15	80	7	5.787	1.059	1.044	0.847	0.314	22.026	5.826	5.231	2.679	0.851
864	81	1	19.50	7.5	0.15	80	7.5	5.651	1.031	1.023	0.867	0.292	23.017	6.100	5.477	2.758	0.861
865	81	1	20.00	8	0.15	80	8	5.536	0.996	1.010	0.893	0.272	23.913	6.370	5.715	2.836	0.870
866	81	1	21.00	9	0.15	80	9	5.319	0.952	0.983	0.954	0.240	25.697	7.122	6.216	2.782	0.883
867	81	1	22.00	10	0.15	80	10	5.244	0.934	0.969	1.033	0.215	27.354	7.684	6.724	2.937	0.893
868	91	1	13.60	0.1	0.15	90	0.1	3.373	1.754	2.094	0.915	3.468	1.166	0.672	0.561	0.098	3.515
869	91	1	13.75	0.25	0.15	90	0.25	6.700	2.816	3.406	0.883	3.119	2.209	1.109	0.732	0.214	2.987
870	91	1	14.00	0.5	0.15	90	0.5	8.097	2.861	3.284	0.885	2.406	3.095	1.262	1.014	0.442	2.416
871	91	1	14.25	0.75	0.15	90	0.75	8.044	2.542	2.799	0.897	2.012	3.699	1.402	1.242	0.683	2.089
872	91	1	14.50	1	0.15	90	1	7.915	2.306	2.452	0.903	1.777	4.864	1.696	1.542	0.886	1.858
873	91	1	14.75	1.25	0.15	90	1.25	7.860	2.087	2.236	0.900	1.561	5.992	2.004	1.828	1.079	1.602
874	91	1	15.50	2	0.15	90	2	7.914	1.760	1.878	0.880	1.135	9.231	2.854	2.592	1.617	1.218
875	91	1	16.00	2.5	0.15	90	2.5	7.926	1.674	1.738	0.865	0.947	11.200	3.397	3.044	1.878	1.133
876	91	1	16.50	3	0.15	90	3	7.870	1.606	1.634	0.850	0.803	13.000	3.865	3.443	2.084	1.068
877	91	1	17.50	4	0.15	90	4	7.623	1.490	1.483	0.827	0.604	16.225	4.688	4.145	2.392	0.983
878	91	1	18.50	5	0.15	90	5	7.290	1.389	1.377	0.817	0.476	19.083	5.400	4.764	2.617	0.930
879	91	1	19.50	6	0.15	90	6	6.945	1.315	1.298	0.819	0.390	21.635	6.059	5.329	2.723	0.840
880	91	1	20.50	7	0.15	90	7	6.598	1.230	1.236	0.835	0.329	23.991	6.872	5.872	2.669	0.840
881	91	1	21.00	7.5	0.15	90	7.5	6.437	1.213	1.209	0.848	0.304	25.108	7.189	6.148	2.748	0.841
882	91	1	21.50	8	0.15	90	8	6.305	1.170	1.193	0.866	0.284	26.121	7.492	6.399	2.824	0.850
883	91	1	22.50	9	0.15	90	9	6.049	1.132	1.156	0.908	0.250	28.221	8.102	6.948	2.979	0.864
884	91	1	23.50	10	0.15	90	10	5.851	1.088	1.132	0.972	0.223	30.137	8.694	7.492	3.135	0.875
885	101	1	15.10	0.1	0.15	100	0.1	3.664	1.880	2.268	0.914	3.680	1.303	0.767	0.614	0.100	3.670
886	101	1	15.25	0.25	0.15	100	0.25	7.295	3.053	3.726	0.883	3.309	2.390	1.268	0.913	0.219	3.115
887	101	1	15.50	0.5	0.15	100	0.5	8.770	3.104	3.571	0.892	2.539	3.420	1.433	1.038	0.451	2.508
888	101	1	15.75	0.75	0.15	100	0.75	8.673	2.774	3.029	0.914	2.116	3.959	1.579	1.292	0.666	2.167
889	101	1	16.00	1	0.15	100	1	8.532	2.540	2.654	0.921	1.865	5.187	1.859	1.622	0.910	1.929
890	101	1	16.25	1.25	0.15	100	1.25	8.480	2.320	2.424	0.920	1.638	6.366	2.206	1.938	1.112	1.667
891	101	1	17.00	2	0.15	100	2	8.627	1.974	2.064	0.903	1.192	9.786	3.228	2.800	1.688	1.259
892	101	1	17.50	2.5	0.15	100	2.5	8.699	1.898	1.932	0.888	0.993	11.870	3.799	3.315	1.974	1.134
893	101	1	18.00	3	0.15	100	3	8.692	1.833	1.835	0.872	0.842	13.817	4.340	3.776	2.206	1.101
894	101	1	19.00	4	0.15	100	4	8.485	1.716	1.694	0.847	0.632	17.320	5.294	4.586	2.461	1.008
895	101	1	20.00	5	0.15	100	5	8.157	1.606	1.591	0.831	0.498	20.440	6.281	5.292	2.721	0.952
896	101	1	21.00	6	0.15	100	6	7.799	1.510	1.509	0.826	0.407	23.269	7.062	5.934	2.677	0.841
897	101	1	22.00	7	0.15	100	7	7.427	1.438	1.441	0.833	0.342	25.902	7.781	6.538	2.854	0.840

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Model								Membrane Stress Factors									
	OD	T	od	t	d/D	D/T	t/T	Branch					Header				
								Axial	In-Plane	Out-of-Plane	Torsional	Pressure	Axial	In-Plane	Out-of-Plane	Torsional	Pressure
898	101	1	22.50	7.5	0.15	100	7.5	7.239	1.400	1.410	0.839	0.316	27.121	8.120	6.839	2.938	0.840
899	101	1	23.00	8	0.15	100	8	7.080	1.365	1.384	0.851	0.294	28.346	8.460	7.129	3.019	0.840
900	101	1	24.00	9	0.15	100	9	6.787	1.289	1.345	0.881	0.258	30.606	9.113	7.704	3.176	0.847
901	101	1	25.00	10	0.15	100	10	6.529	1.247	1.310	0.921	0.230	32.785	9.743	8.296	3.334	0.858
902	251	1	37.60	0.1	0.15	250	0.1	7.262	3.322	4.614	0.885	5.910	3.157	1.957	1.578	0.132	5.360
903	251	1	37.75	0.25	0.15	250	0.25	14.359	5.708	7.811	0.918	5.192	6.060	3.393	2.533	0.262	4.523
904	251	1	38.00	0.5	0.15	250	0.5	16.633	5.821	7.203	0.990	3.814	7.057	3.883	1.902	0.516	3.510
905	251	1	38.25	0.75	0.15	250	0.75	16.172	5.130	5.991	1.022	3.100	7.979	4.111	2.542	0.761	2.998
906	251	1	38.50	1	0.15	250	1	16.118	5.141	5.322	1.038	2.708	9.981	4.239	3.067	1.056	2.681
907	251	1	38.75	1.25	0.15	250	1.25	16.408	5.135	5.012	1.046	2.392	11.913	4.735	3.746	1.246	2.373
908	251	1	39.50	2	0.15	250	2	18.416	5.512	5.027	1.054	1.773	17.571	7.212	5.863	1.917	1.708
909	251	1	40.00	2.5	0.15	250	2.5	19.612	5.706	5.257	1.051	1.484	20.942	8.903	7.181	2.333	1.470
910	251	1	40.50	3	0.15	250	3	20.432	5.803	5.476	1.082	1.259	24.162	10.546	8.420	2.721	1.337
911	251	1	41.50	4	0.15	250	4	21.140	5.289	5.756	1.022	0.937	30.484	13.622	10.668	3.409	1.189
912	251	1	42.50	5	0.15	250	5	21.090	5.774	5.845	0.997	0.727	36.767	16.375	12.840	3.988	0.956
913	251	1	43.50	6	0.15	250	6	20.694	5.472	5.818	0.883	0.585	42.875	18.829	14.964	4.477	0.853
914	251	1	44.50	7	0.15	250	7	20.139	5.160	5.721	0.868	0.484	48.936	21.022	17.007	4.898	0.849
915	251	1	45.00	7.5	0.15	250	7.5	19.830	5.008	5.657	0.859	0.444	51.872	22.032	17.970	5.087	0.847
916	251	1	45.50	8	0.15	250	8	19.526	4.523	5.589	0.854	0.409	54.697	22.994	18.874	5.266	0.846
917	251	1	46.50	9	0.15	250	9	18.901	4.341	5.443	0.847	0.353	60.388	25.170	20.671	5.595	0.844
918	251	1	47.50	10	0.15	250	10	18.298	4.102	5.289	0.773	0.309	65.910	26.926	22.368	5.893	0.843
919	501	1	75.10	0.1	0.15	500	0.1	11.853	4.678	7.760	0.893	8.123	5.918	3.288	3.347	0.175	7.177
920	501	1	75.25	0.25	0.15	500	0.25	23.187	8.325	13.163	0.966	6.974	11.398	5.884	5.486	0.346	6.046
921	501	1	75.50	0.5	0.15	500	0.5	26.566	8.788	12.067	1.042	5.021	13.603	6.842	4.521	0.621	4.594
922	501	1	75.75	0.75	0.15	500	0.75	26.193	8.762	10.208	1.139	4.040	15.059	7.129	5.508	0.888	3.888
923	501	1	76.00	1	0.15	500	1	26.902	8.044	9.402	1.169	3.530	18.778	8.217	6.889	1.166	3.489
924	501	1	76.25	1.25	0.15	500	1.25	28.378	8.441	9.287	1.196	3.149	22.379	9.182	8.355	1.444	3.137
925	501	1	77.00	2	0.15	500	2	34.628	11.234	10.809	1.256	2.400	32.487	12.119	12.948	2.268	2.357
926	501	1	77.50	2.5	0.15	500	2.5	38.196	12.040	12.164	1.274	2.035	38.185	15.093	15.789	2.800	1.965
927	501	1	78.00	3	0.15	500	3	40.793	13.051	13.331	1.277	1.739	42.496	15.090	16.784	3.312	1.669
928	501	1	79.00	4	0.15	500	4	43.525	13.391	14.927	1.264	1.301	51.066	19.920	21.288	4.263	1.404
929	501	1	80.00	5	0.15	500	5	44.179	13.186	15.712	1.250	1.005	59.535	25.948	25.436	5.110	1.281
930	501	1	81.00	6	0.15	500	6	43.760	12.730	15.976	1.239	0.800	68.764	34.743	30.578	6.058	1.104
931	501	1	82.00	7	0.15	500	7	42.870	12.176	15.935	1.225	0.654	78.602	39.585	34.317	6.753	0.866
932	501	1	82.50	7.5	0.15	500	7.5	42.339	11.862	15.843	1.217	0.597	83.741	41.871	36.101	7.072	0.865
933	501	1	83.00	8	0.15	500	8	41.781	11.571	15.723	1.011	0.547	88.494	44.067	37.919	7.372	0.864
934	501	1	84.00	9	0.15	500	9	40.643	11.004	15.415	0.990	0.466	98.830	48.216	41.828	7.929	0.861
935	501	1	85.00	10	0.15	500	10	39.509	10.427	15.051	0.970	0.404	108.847	52.086	45.961	8.487	0.860

STP-PT-074: Local Stress in Nozzles, Shells and Formed Heads from External Heads

Model								Membrane Stress Factors									
	OD	T	od	t	d/D	D/T	t/T	Branch					Header				
								Axial	In-Plane	Out-of-Plane	Torsional	Pressure	Axial	In-Plane	Out-of-Plane	Torsional	Pressure
937	751	1	112.75	0.25	0.15	750	0.25	30.537	10.378	17.696	1.030	8.231	16.536	7.746	8.665	0.479	7.227
938	751	1	113.00	0.5	0.15	750	0.5	35.018	11.649	16.354	1.168	5.872	17.802	8.872	6.014	0.741	5.417
939	751	1	113.25	0.75	0.15	750	0.75	35.104	10.547	14.126	1.236	4.706	22.045	10.148	7.169	0.990	4.551
940	751	1	113.50	1	0.15	750	1	36.871	11.235	13.411	1.292	4.115	27.348	11.720	9.003	1.290	4.083
941	751	1	113.75	1.25	0.15	750	1.25	39.769	12.030	13.668	1.337	3.692	32.647	11.801	11.083	1.606	3.697
942	751	1	114.50	2	0.15	750	2	50.708	16.419	17.054	1.456	2.863	47.469	15.610	17.818	2.569	2.838
943	751	1	115.00	2.5	0.15	750	2.5	56.936	18.031	19.679	1.498	2.451	55.437	17.018	21.970	3.212	2.338
944	751	1	115.50	3	0.15	750	3	61.638	18.990	21.982	1.515	2.110	62.063	19.464	25.705	3.844	2.012
945	751	1	116.50	4	0.15	750	4	67.026	19.870	25.250	1.456	1.592	72.983	25.697	32.210	5.053	1.588
946	751	1	117.50	5	0.15	750	5	68.826	19.576	27.026	1.412	1.234	82.897	32.816	38.024	6.173	1.387
947	751	1	118.50	6	0.15	750	6	68.681	19.085	27.811	1.392	0.982	93.092	39.755	43.625	7.198	1.292
948	751	1	119.50	7	0.15	750	7	67.556	18.675	28.001	1.356	0.800	104.156	46.494	49.192	8.136	1.183
949	751	1	120.00	7.5	0.15	750	7.5	66.796	18.296	27.936	1.351	0.728	110.403	49.741	52.020	8.573	1.159
950	751	1	120.50	8	0.15	750	8	65.965	17.902	27.804	1.344	0.665	116.779	52.938	54.839	8.991	0.532
951	751	1	121.50	9	0.15	750	9	64.220	17.109	27.397	1.331	0.563	129.925	59.066	60.534	9.775	0.537
952	751	1	122.50	10	0.15	750	10	62.452	16.326	26.874	1.316	0.484	143.432	64.921	66.995	10.496	0.545
954	1001	1	150.25	0.25	0.15	1000	0.25	37.036	12.461	21.828	1.095	9.233	21.240	9.346	11.677	0.564	8.166
955	1001	1	150.50	0.5	0.15	1000	0.5	42.584	12.648	20.297	1.279	6.555	23.044	11.151	8.371	0.855	6.075
956	1001	1	150.75	0.75	0.15	1000	0.75	43.310	13.223	17.874	1.337	5.242	28.772	12.868	10.006	1.090	5.085
957	1001	1	151.00	1	0.15	1000	1	46.276	14.273	17.405	1.414	4.587	35.775	13.020	12.544	1.376	4.562
958	1001	1	151.25	1.25	0.15	1000	1.25	50.624	15.484	18.168	1.482	4.130	42.836	14.948	15.451	1.681	4.148
959	1001	1	152.00	2	0.15	1000	2	66.276	21.059	23.497	1.660	3.239	62.556	19.392	24.606	2.674	3.231
960	1001	1	152.50	2.5	0.15	1000	2.5	75.257	23.021	27.480	1.771	2.791	73.133	21.784	30.253	3.374	2.674
961	1001	1	153.00	3	0.15	1000	3	82.188	24.375	30.968	1.799	2.415	81.799	23.289	35.285	4.078	2.150
962	1001	1	154.00	4	0.15	1000	4	90.569	25.683	36.066	1.772	1.838	95.420	30.369	43.868	5.545	1.752
963	1001	1	155.00	5	0.15	1000	5	93.927	25.823	39.015	1.693	1.432	106.883	38.126	51.262	6.839	1.590
964	1001	1	156.00	6	0.15	1000	6	94.345	25.407	40.482	1.601	1.142	117.601	45.962	57.567	8.118	1.377
965	1001	1	157.00	7	0.15	1000	7	93.187	24.608	40.957	1.509	0.930	129.662	53.947	64.470	9.300	1.296
966	1001	1	157.50	7.5	0.15	1000	7.5	92.283	23.530	41.006	1.466	0.845	135.957	57.864	68.005	9.860	1.214
967	1001	1	158.00	8	0.15	1000	8	91.265	23.074	40.915	1.449	0.772	142.478	61.710	71.530	10.399	1.191
968	1001	1	159.00	9	0.15	1000	9	88.964	22.113	40.466	1.437	0.652	157.673	69.331	78.774	11.421	0.519
969	1001	1	160.00	10	0.15	1000	10	86.574	21.188	39.802	1.424	0.558	173.797	76.587	86.092	12.374	0.520
971	1251	1	187.75	0.25	0.15	1250	0.25	43.178	14.257	25.767	1.196	10.092	25.894	10.747	14.843	0.646	9.000
972	1251	1	188.00	0.5	0.15	1250	0.5	49.680	14.795	24.095	1.371	7.138	28.003	13.186	10.564	0.969	6.648
973	1251	1	188.25	0.75	0.15	1250	0.75	51.119	15.668	21.510	1.450	5.698	35.265	15.266	12.630	1.190	5.540
974	1251	1	188.50	1	0.15	1250	1	55.306	17.079	21.313	1.537	4.987	43.932	15.732	15.817	1.482	4.966
975	1251	1	188.75	1.25	0.15	1250	1.25	61.136	18.645	22.573	1.628	4.500	52.706	18.114	19.457	1.775	4.526
976	1251	1	189.50	2	0.15	1250	2	81.456	23.360	30.015	1.866	3.558	77.266	23.467	31.054	2.667	3.563

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Model								Membrane Stress Factors									
	OD	T	od	t	d/D	D/T	t/T	Branch					Header				
								Axial	In-Plane	Out-of-Plane	Torsional	Pressure	Axial	In-Plane	Out-of-Plane	Torsional	Pressure
977	1251	1	190.00	2.5	0.15	1250	2.5	93.187	27.876	35.400	2.055	3.080	90.458	26.077	38.176	3.236	2.966
978	1251	1	190.50	3	0.15	1250	3	102.383	29.617	40.140	2.105	2.677	101.168	27.928	44.501	3.834	2.378
979	1251	1	191.50	4	0.15	1250	4	113.982	31.367	47.154	2.094	2.051	117.474	34.154	55.083	5.822	1.907
980	1251	1	192.50	5	0.15	1250	5	119.102	31.660	51.374	2.011	1.605	130.391	42.353	63.960	7.291	1.673
981	1251	1	193.50	6	0.15	1250	6	120.343	31.197	53.593	1.902	1.284	142.614	50.993	72.084	8.693	1.446
982	1251	1	194.50	7	0.15	1250	7	119.369	30.361	54.547	1.787	1.048	155.568	59.829	80.219	10.018	1.526
983	1251	1	195.00	7.5	0.15	1250	7.5	118.417	29.904	54.688	1.735	0.953	162.340	64.265	84.285	10.652	1.504
984	1251	1	195.50	8	0.15	1250	8	117.262	27.994	54.646	1.684	0.870	169.492	68.517	88.423	11.263	1.488
985	1251	1	196.50	9	0.15	1250	9	114.579	26.962	54.278	1.588	0.734	184.380	77.145	96.913	12.434	1.179
986	1251	1	197.50	10	0.15	1250	10	111.627	25.922	53.502	1.516	0.628	201.752	85.507	105.617	13.534	0.513
988	1501	1	225.25	0.25	0.15	1500	0.25	48.925	14.070	29.423	1.264	10.846	30.223	11.976	17.793	0.721	9.718
989	1501	1	225.50	0.5	0.15	1500	0.5	56.416	16.843	27.665	1.468	7.653	32.870	15.058	12.874	1.074	7.149
990	1501	1	225.75	0.75	0.15	1500	0.75	58.591	18.006	25.053	1.534	6.102	41.598	15.665	15.489	1.289	5.942
991	1501	1	226.00	1	0.15	1500	1	64.039	19.782	25.171	1.657	5.341	51.934	18.351	19.396	1.595	5.326
992	1501	1	226.25	1.25	0.15	1500	1.25	71.340	21.739	27.014	1.774	4.827	62.431	20.940	23.865	1.900	4.863
993	1501	1	227.00	2	0.15	1500	2	96.312	29.312	36.497	2.071	3.838	91.814	27.560	37.880	2.767	3.857
994	1501	1	227.50	2.5	0.15	1500	2.5	110.784	32.288	43.340	2.336	3.336	107.672	30.608	46.603	3.378	3.230
995	1501	1	228.00	3	0.15	1500	3	122.294	34.400	49.344	2.406	2.908	120.553	30.171	54.276	3.993	2.585
996	1501	1	229.00	4	0.15	1500	4	137.176	36.595	58.353	2.416	2.240	139.864	37.756	67.024	6.084	2.056
997	1501	1	230.00	5	0.15	1500	5	144.253	37.067	63.931	2.331	1.760	154.525	46.227	77.478	7.651	1.753
998	1501	1	231.00	6	0.15	1500	6	146.413	36.612	66.985	2.206	1.412	167.805	55.361	86.858	9.166	1.645
999	1501	1	232.00	7	0.15	1500	7	145.798	35.722	68.397	2.077	1.155	181.420	64.668	95.938	10.611	1.575
1000	1501	1	232.50	7.5	0.15	1500	7.5	144.876	32.885	68.729	2.015	1.051	188.708	69.342	100.619	11.300	1.551
1001	1501	1	233.00	8	0.15	1500	8	143.639	32.363	68.749	1.954	0.960	196.144	74.082	105.161	11.977	1.531
1002	1501	1	234.00	9	0.15	1500	9	140.596	31.325	68.398	1.838	0.811	211.183	83.453	113.760	13.373	1.498
1003	1501	1	235.00	10	0.15	1500	10	137.177	30.208	67.604	1.729	0.693	228.500	92.845	123.744	14.610	1.378
1006	1751	1	263.00	0.5	0.15	1750	0.5	62.867	18.770	31.168	1.554	8.119	37.590	16.763	15.199	1.174	7.604
1007	1751	1	263.25	0.75	0.15	1750	0.75	65.792	20.252	28.690	1.654	6.467	47.786	17.787	18.482	1.389	6.308
1008	1751	1	263.50	1	0.15	1750	1	72.526	22.382	28.995	1.777	5.661	59.765	20.926	22.980	1.710	5.651
1009	1751	1	263.75	1.25	0.15	1750	1.25	81.315	24.693	31.277	1.918	5.123	71.951	23.886	28.171	2.029	5.167
1010	1751	1	264.50	2	0.15	1750	2	110.866	32.945	43.073	2.439	4.091	106.120	31.513	44.883	2.906	4.122
1011	1751	1	265.00	2.5	0.15	1750	2.5	128.050	36.429	51.334	2.609	3.565	124.629	35.052	55.146	3.521	3.474
1012	1751	1	265.50	3	0.15	1750	3	141.843	39.012	58.384	2.698	3.116	139.478	33.477	63.267	4.134	2.805
1013	1751	1	266.50	4	0.15	1750	4	160.146	41.605	69.645	2.726	2.410	161.649	41.256	78.253	5.394	2.196
1014	1751	1	267.50	5	0.15	1750	5	169.250	42.237	76.604	2.645	1.901	177.839	49.788	90.114	7.999	1.823
1015	1751	1	268.50	6	0.15	1750	6	172.539	41.826	80.579	2.518	1.530	192.009	59.086	100.616	9.621	1.696
1016	1751	1	269.50	7	0.15	1750	7	172.354	39.032	82.544	2.371	1.254	206.334	68.841	110.713	11.180	1.619
1017	1751	1	270.00	7.5	0.15	1750	7.5	171.468	38.523	83.053	2.298	1.142	213.792	73.766	115.808	11.932	1.591

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Model								Membrane Stress Factors									
	OD	T	od	t	d/D	D/T	t/T	Branch					Header				
								Axial	In-Plane	Out-of-Plane	Torsional	Pressure	Axial	In-Plane	Out-of-Plane	Torsional	Pressure
1018	1751	1	270.50	8	0.15	1750	8	170.157	37.964	83.207	2.227	1.044	221.634	79.028	120.940	12.669	1.567
1019	1751	1	271.50	9	0.15	1750	9	166.936	36.017	82.939	2.092	0.882	238.548	88.915	131.454	14.087	1.531
1020	1751	1	272.50	10	0.15	1750	10	163.196	34.801	82.261	1.970	0.755	256.619	99.045	142.520	15.431	1.407
1023	2001	1	300.50	0.5	0.15	2000	0.5	69.147	20.589	34.580	1.647	8.550	42.184	18.419	17.242	1.275	8.030
1024	2001	1	300.75	0.75	0.15	2000	0.75	72.881	22.298	31.893	1.760	6.803	53.765	19.734	20.867	1.487	6.640
1025	2001	1	301.00	1	0.15	2000	1	80.772	24.733	32.767	1.895	5.954	67.324	23.200	26.167	1.821	5.943
1026	2001	1	301.25	1.25	0.15	2000	1.25	91.025	27.419	35.762	2.059	5.394	81.181	26.566	32.228	2.081	5.435
1027	2001	1	302.00	2	0.15	2000	2	125.109	35.073	49.532	2.670	4.321	120.028	35.076	51.171	3.041	4.353
1028	2001	1	302.50	2.5	0.15	2000	2.5	145.064	40.460	58.974	2.870	3.774	141.179	32.391	62.645	3.658	3.692
1029	2001	1	303.00	3	0.15	2000	3	161.149	43.230	67.745	2.982	3.306	158.385	36.617	73.199	4.281	2.985
1030	2001	1	304.00	4	0.15	2000	4	182.884	46.233	80.927	3.032	2.566	183.706	44.610	90.206	5.540	2.336
1031	2001	1	305.00	5	0.15	2000	5	194.141	47.025	89.363	2.955	2.030	201.795	53.264	103.692	8.267	1.893
1032	2001	1	306.00	6	0.15	2000	6	198.599	46.388	94.311	2.821	1.638	217.007	62.589	115.398	9.969	1.750
1033	2001	1	307.00	7	0.15	2000	7	198.917	45.403	97.005	2.666	1.345	232.039	72.734	126.719	11.614	1.658
1034	2001	1	307.50	7.5	0.15	2000	7.5	198.189	42.928	97.658	2.590	1.226	239.903	77.566	132.221	12.412	1.625
1035	2001	1	308.00	8	0.15	2000	8	196.984	42.316	97.773	2.509	1.122	248.075	82.898	137.581	13.195	1.598
1036	2001	1	309.00	9	0.15	2000	9	193.579	40.878	97.729	2.359	0.949	265.596	93.187	149.019	14.706	1.558
1037	2001	1	310.00	10	0.15	2000	10	189.482	39.474	97.220	2.219	0.812	284.707	103.507	161.366	16.145	1.529
1040	2251	1	338.00	0.5	0.15	2250	0.5	75.194	22.311	37.919	1.744	8.948	46.673	19.884	19.514	1.365	8.419
1041	2251	1	338.25	0.75	0.15	2250	0.75	79.763	24.270	35.281	1.859	7.116	59.669	21.647	23.705	1.584	6.951
1042	2251	1	338.50	1	0.15	2250	1	89.000	27.140	36.520	2.014	6.227	74.852	25.533	29.673	1.864	6.219
1043	2251	1	338.75	1.25	0.15	2250	1.25	100.559	30.090	39.956	2.197	5.644	90.349	29.208	36.496	2.199	5.693
1044	2251	1	339.50	2	0.15	2250	2	139.272	38.705	56.000	2.899	4.535	133.808	38.728	58.007	3.181	4.579
1045	2251	1	340.00	2.5	0.15	2250	2.5	161.870	44.057	67.093	3.126	3.968	157.619	35.217	71.205	3.810	3.901
1046	2251	1	340.50	3	0.15	2250	3	180.208	47.187	76.788	3.258	3.482	177.132	39.691	82.849	4.426	3.151
1047	2251	1	341.50	4	0.15	2250	4	205.406	50.597	92.239	3.332	2.711	205.570	47.891	102.202	5.688	2.470
1048	2251	1	342.50	5	0.15	2250	5	218.806	51.507	102.155	3.259	2.150	225.597	56.373	117.341	8.507	1.963
1049	2251	1	343.50	6	0.15	2250	6	224.467	50.958	108.056	3.122	1.738	241.938	65.847	130.264	10.278	1.798
1050	2251	1	344.50	7	0.15	2250	7	225.423	49.910	111.167	2.959	1.430	257.853	75.730	142.407	12.001	1.694
1051	2251	1	345.00	7.5	0.15	2250	7.5	224.917	49.259	112.070	2.870	1.305	265.588	81.072	148.155	12.840	1.657
1052	2251	1	345.50	8	0.15	2250	8	223.551	48.546	112.554	2.790	1.195	274.372	86.339	154.394	13.662	1.627
1053	2251	1	346.50	9	0.15	2250	9	220.233	45.572	112.712	2.623	1.012	290.762	96.506	165.076	15.338	1.576
1054	2251	1	347.50	10	0.15	2250	10	215.736	43.942	111.995	2.466	0.867	310.811	107.917	178.051	16.877	1.542
1057	2501	1	375.50	0.5	0.15	2500	0.5	81.235	24.005	41.063	1.833	9.321	51.059	21.291	21.633	1.455	8.786
1058	2501	1	375.75	0.75	0.15	2500	0.75	86.453	26.213	38.398	1.962	7.409	65.462	23.494	26.397	1.679	7.242
1059	2501	1	376.00	1	0.15	2500	1	97.009	29.381	40.462	2.133	6.481	82.186	27.710	33.458	1.971	6.475
1060	2501	1	376.25	1.25	0.15	2500	1.25	109.979	32.634	44.262	2.336	5.877	99.391	31.827	40.832	2.321	5.934
1061	2501	1	377.00	2	0.15	2500	2	153.024	42.184	62.458	3.119	4.733	147.451	42.274	64.898	3.326	4.783



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Model								Membrane Stress Factors									
	OD	T	od	t	d/D	D/T	t/T	Branch					Header				
								Axial	In-Plane	Out-of-Plane	Torsional	Pressure	Axial	In-Plane	Out-of-Plane	Torsional	Pressure
1062	2501	1	377.50	2.5	0.15	2500	2.5	178.232	47.549	74.852	3.373	4.147	173.881	38.085	79.557	3.958	4.095
1063	2501	1	378.00	3	0.15	2500	3	198.982	51.136	86.117	3.524	3.643	195.260	42.858	91.941	4.568	3.336
1064	2501	1	379.00	4	0.15	2500	4	227.656	54.887	103.483	3.623	2.843	226.965	51.032	113.342	5.801	2.594
1065	2501	1	380.00	5	0.15	2500	5	243.381	55.991	115.038	3.558	2.260	248.561	59.531	129.903	8.750	2.024
1066	2501	1	381.00	6	0.15	2500	6	250.318	55.730	121.916	3.413	1.831	265.955	68.944	143.239	10.603	1.842
1067	2501	1	382.00	7	0.15	2500	7	251.979	54.653	125.720	3.240	1.509	282.216	78.679	156.858	12.407	1.723
1068	2501	1	382.50	7.5	0.15	2500	7.5	251.476	53.972	126.756	3.152	1.378	290.622	84.015	163.232	13.285	1.681
1069	2501	1	383.00	8	0.15	2500	8	250.248	52.782	127.429	3.061	1.263	299.119	89.747	169.585	14.146	1.647
1070	2501	1	384.00	9	0.15	2500	9	246.703	51.177	128.110	2.886	1.071	317.540	100.387	183.078	15.837	1.595
1071	2501	1	385.00	10	0.15	2500	10	242.296	48.371	127.274	2.714	0.918	337.740	111.530	196.133	17.454	1.559
1072	9	1	1.70	0.1	0.2	8	0.1	1.006	0.956	0.942	0.881	1.606	0.166	0.132	0.144	0.076	1.424
1073	9	1	1.85	0.25	0.2	8	0.25	1.011	0.874	0.872	0.798	0.649	0.331	0.197	0.251	0.153	1.184
1074	9	1	2.10	0.5	0.2	8	0.5	1.131	0.778	0.778	0.680	0.497	0.536	0.271	0.286	0.238	1.007
1075	9	1	2.35	0.75	0.2	8	0.75	1.169	0.692	0.692	0.642	0.439	0.677	0.314	0.329	0.294	0.915
1076	9	1	2.60	1	0.2	8	1	1.151	0.631	0.631	0.638	0.406	1.377	0.352	0.367	0.340	0.858
1077	9	1	2.85	1.25	0.2	8	1.25	1.107	0.577	0.577	0.618	0.355	1.592	0.379	0.396	0.382	0.827
1089	17	1	3.30	0.1	0.2	16	0.1	1.109	0.994	0.972	0.915	1.705	0.225	0.131	0.206	0.086	1.991
1090	17	1	3.45	0.25	0.2	16	0.25	1.614	0.943	0.993	0.886	1.110	0.469	0.269	0.437	0.186	1.702
1091	17	1	3.70	0.5	0.2	16	0.5	2.019	0.873	0.954	0.809	0.876	0.658	0.391	0.574	0.330	1.372
1092	17	1	3.95	0.75	0.2	16	0.75	2.149	0.806	0.845	0.755	0.776	1.579	0.479	0.579	0.439	1.207
1093	17	1	4.20	1	0.2	16	1	2.158	0.760	0.760	0.715	0.719	2.022	0.549	0.628	0.521	1.091
1094	17	1	4.45	1.25	0.2	16	1.25	2.159	0.728	0.728	0.688	0.635	2.439	0.593	0.671	0.588	0.949
1095	17	1	5.20	2	0.2	16	2	1.969	0.635	0.635	0.677	0.460	3.433	0.708	0.811	0.734	0.824
1096	17	1	5.70	2.5	0.2	16	2.5	1.810	0.581	0.581	0.699	0.377	3.950	0.780	0.921	0.815	0.875
1097	17	1	6.20	3	0.2	16	3	1.666	0.525	0.525	0.721	0.314	4.377	0.890	1.038	0.881	0.882
1106	25	1	4.90	0.1	0.2	24	0.1	1.376	1.001	1.050	0.929	1.926	0.354	0.177	0.232	0.087	2.406
1107	25	1	5.05	0.25	0.2	24	0.25	2.302	1.143	1.347	0.916	1.581	0.654	0.321	0.565	0.202	2.059
1108	25	1	5.30	0.5	0.2	24	0.5	2.911	1.128	1.344	0.849	1.259	1.033	0.525	0.791	0.382	1.686
1109	25	1	5.55	0.75	0.2	24	0.75	3.054	0.988	1.200	0.807	1.093	1.932	0.589	0.741	0.531	1.430
1110	25	1	5.80	1	0.2	24	1	3.048	0.859	1.056	0.784	0.994	2.538	0.691	0.854	0.653	1.282
1111	25	1	6.05	1.25	0.2	24	1.25	3.040	0.798	0.943	0.756	0.875	3.119	0.759	0.935	0.757	1.102
1112	25	1	6.80	2	0.2	24	2	2.831	0.715	0.715	0.692	0.638	4.572	0.931	1.138	0.964	0.878
1113	25	1	7.30	2.5	0.2	24	2.5	2.661	0.677	0.677	0.701	0.532	5.364	1.024	1.273	1.059	0.854
1114	25	1	7.80	3	0.2	24	3	2.486	0.636	0.636	0.724	0.452	6.023	1.195	1.406	1.140	0.869
1115	25	1	8.80	4	0.2	24	4	2.241	0.559	0.559	0.801	0.331	7.127	1.377	1.690	1.294	0.894
1123	33	1	6.50	0.1	0.2	32	0.1	1.659	1.049	1.219	0.935	2.320	0.494	0.253	0.293	0.091	2.742
1124	33	1	6.65	0.25	0.2	32	0.25	2.986	1.411	1.718	0.924	1.996	0.900	0.429	0.583	0.212	2.339
1125	33	1	6.90	0.5	0.2	32	0.5	3.757	1.426	1.725	0.863	1.588	1.478	0.621	0.958	0.410	1.908

STP-PT-074: Local Stress in Nozzles, Shells and Formed Heads from External Heads

Model								Membrane Stress Factors									
	OD	T	od	t	d/D	D/T	t/T	Branch					Header				
								Axial	In-Plane	Out-of-Plane	Torsional	Pressure	Axial	In-Plane	Out-of-Plane	Torsional	Pressure
1126	33	1	7.15	0.75	0.2	32	0.75	3.884	1.253	1.531	0.845	1.359	2.230	0.822	0.881	0.595	1.640
1127	33	1	7.40	1	0.2	32	1	3.857	1.096	1.353	0.821	1.220	2.957	0.823	1.040	0.747	1.449
1128	33	1	7.65	1.25	0.2	32	1.25	3.835	0.962	1.221	0.800	1.070	3.680	0.930	1.171	0.884	1.236
1129	33	1	8.40	2	0.2	32	2	3.614	0.817	0.935	0.748	0.775	5.530	1.203	1.470	1.166	0.992
1130	33	1	8.90	2.5	0.2	32	2.5	3.432	0.732	0.807	0.738	0.646	6.543	1.398	1.642	1.287	0.922
1131	33	1	9.40	3	0.2	32	3	3.256	0.690	0.711	0.742	0.548	7.444	1.556	1.805	1.382	0.875
1132	33	1	10.40	4	0.2	32	4	2.956	0.637	0.636	0.782	0.415	8.945	1.894	2.131	1.543	0.880
1133	33	1	11.40	5	0.2	32	5	2.716	0.583	0.583	0.857	0.329	10.158	2.290	2.456	1.697	0.884
1134	33	1	12.40	6	0.2	32	6	2.603	0.524	0.519	0.957	0.267	11.151	2.546	2.784	1.860	0.890
1140	41	1	8.10	0.1	0.2	40	0.1	1.948	1.165	1.396	0.938	2.669	0.638	0.342	0.360	0.095	3.028
1141	41	1	8.25	0.25	0.2	40	0.25	3.653	1.679	2.085	0.923	2.356	1.141	0.566	0.675	0.220	2.575
1142	41	1	8.50	0.5	0.2	40	0.5	4.555	1.712	2.084	0.878	1.863	1.726	0.715	1.057	0.439	2.089
1143	41	1	8.75	0.75	0.2	40	0.75	4.651	1.511	1.839	0.865	1.580	2.491	0.967	0.995	0.641	1.795
1144	41	1	9.00	1	0.2	40	1	4.600	1.346	1.627	0.849	1.406	3.318	1.020	1.199	0.818	1.584
1145	41	1	9.25	1.25	0.2	40	1.25	4.563	1.239	1.478	0.833	1.229	4.136	1.169	1.374	0.981	1.348
1146	41	1	10.00	2	0.2	40	2	4.353	0.999	1.167	0.787	0.886	6.333	1.595	1.789	1.336	1.063
1147	41	1	10.50	2.5	0.2	40	2.5	4.176	0.904	1.025	0.776	0.737	7.574	1.812	2.015	1.490	0.983
1148	41	1	11.00	3	0.2	40	3	3.996	0.830	0.917	0.771	0.625	8.672	2.009	2.220	1.608	0.927
1149	41	1	12.00	4	0.2	40	4	3.659	0.740	0.769	0.781	0.472	10.553	2.495	2.612	1.790	0.882
1150	41	1	13.00	5	0.2	40	5	3.363	0.667	0.679	0.821	0.375	12.101	2.803	2.969	1.948	0.838
1151	41	1	14.00	6	0.2	40	6	3.150	0.629	0.626	0.889	0.309	13.478	3.246	3.341	2.105	0.860
1152	41	1	15.00	7	0.2	40	7	3.009	0.605	0.597	0.983	0.259	14.575	3.554	3.702	2.267	0.882
1153	41	1	15.50	7.5	0.2	40	7.5	3.070	0.593	0.591	1.038	0.236	15.089	3.738	3.889	2.353	0.890
1157	51	1	10.10	0.1	0.2	50	0.1	2.307	1.316	1.617	0.938	3.058	0.814	0.459	0.423	0.099	3.339
1158	51	1	10.25	0.25	0.2	50	0.25	4.455	1.997	2.529	0.916	2.745	1.458	0.756	0.791	0.234	2.830
1159	51	1	10.50	0.5	0.2	50	0.5	5.493	2.049	2.510	0.885	2.151	2.126	0.893	0.911	0.456	2.280
1160	51	1	10.75	0.75	0.2	50	0.75	5.538	1.818	2.196	0.883	1.807	2.791	1.129	1.110	0.668	1.956
1161	51	1	11.00	1	0.2	50	1	5.455	1.633	1.945	0.872	1.596	3.719	1.307	1.365	0.885	1.727
1162	51	1	11.25	1.25	0.2	50	1.25	5.402	1.485	1.776	0.860	1.393	4.639	1.516	1.594	1.074	1.467
1163	51	1	12.00	2	0.2	50	2	5.229	1.294	1.445	0.838	1.001	7.186	2.097	2.157	1.510	1.130
1164	51	1	12.50	2.5	0.2	50	2.5	5.082	1.191	1.296	0.823	0.831	8.661	2.406	2.462	1.709	1.051
1165	51	1	13.00	3	0.2	50	3	4.918	1.106	1.181	0.811	0.703	9.991	2.682	2.733	1.860	0.987
1166	51	1	14.00	4	0.2	50	4	4.575	0.975	1.018	0.801	0.529	12.298	3.168	3.213	2.082	0.906
1167	51	1	15.00	5	0.2	50	5	4.248	0.889	0.910	0.811	0.419	14.296	3.720	3.654	2.256	0.840
1168	51	1	16.00	6	0.2	50	6	3.972	0.804	0.838	0.844	0.344	15.998	4.164	4.069	2.417	0.841
1169	51	1	17.00	7	0.2	50	7	3.722	0.745	0.790	0.898	0.292	17.549	4.595	4.486	2.519	0.849
1170	51	1	17.50	7.5	0.2	50	7.5	3.623	0.735	0.772	0.934	0.271	18.247	4.808	4.692	2.602	0.858
1171	51	1	18.00	8	0.2	50	8	3.538	0.724	0.759	0.975	0.253	18.961	5.020	4.914	2.686	0.866

STP-PT-074: Local Stress in Nozzles, Shells and Formed Heads from External Heads

Model								Membrane Stress Factors									
	OD	T	od	t	d/D	D/T	t/T	Branch					Header				
								Axial	In-Plane	Out-of-Plane	Torsional	Pressure	Axial	In-Plane	Out-of-Plane	Torsional	Pressure
1172	51	1	19.00	9	0.2	50	9	3.540	0.705	0.742	1.071	0.221	20.141	5.444	5.332	2.860	0.878
1174	61	1	12.10	0.1	0.2	60	0.1	2.660	1.466	1.835	0.936	3.406	0.997	0.576	0.495	0.103	3.613
1175	61	1	12.25	0.25	0.2	60	0.25	5.219	2.299	2.953	0.907	3.082	1.775	0.954	0.912	0.244	3.055
1176	61	1	12.50	0.5	0.2	60	0.5	6.372	2.371	2.911	0.892	2.394	2.510	1.099	0.991	0.438	2.445
1177	61	1	12.75	0.75	0.2	60	0.75	6.362	2.122	2.529	0.892	1.996	3.081	1.284	1.204	0.700	2.094
1178	61	1	13.00	1	0.2	60	1	6.248	1.922	2.241	0.901	1.755	4.091	1.562	1.504	0.936	1.849
1179	61	1	13.25	1.25	0.2	60	1.25	6.183	1.728	2.053	0.900	1.529	5.089	1.832	1.782	1.146	1.579
1180	61	1	14.00	2	0.2	60	2	6.072	1.520	1.712	0.882	1.097	7.921	2.532	2.489	1.652	1.199
1181	61	1	14.50	2.5	0.2	60	2.5	5.971	1.426	1.566	0.866	0.910	9.607	3.002	2.886	1.894	1.109
1182	61	1	15.00	3	0.2	60	3	5.838	1.360	1.451	0.851	0.769	11.145	3.371	3.230	2.081	1.042
1183	61	1	16.00	4	0.2	60	4	5.514	1.251	1.284	0.829	0.577	13.856	4.023	3.831	2.353	0.950
1184	61	1	17.00	5	0.2	60	5	5.173	1.158	1.168	0.823	0.455	16.226	4.593	4.359	2.555	0.843
1185	61	1	18.00	6	0.2	60	6	4.844	1.048	1.082	0.833	0.373	18.294	5.112	4.845	2.654	0.843
1186	61	1	19.00	7	0.2	60	7	4.542	0.984	1.017	0.860	0.315	20.217	5.602	5.323	2.822	0.844
1187	61	1	19.50	7.5	0.2	60	7.5	4.439	0.957	0.996	0.881	0.292	21.067	5.840	5.549	2.906	0.845
1188	61	1	20.00	8	0.2	60	8	4.294	0.934	0.973	0.906	0.272	21.937	6.074	5.786	2.990	0.846
1189	61	1	21.00	9	0.2	60	9	4.158	0.892	0.939	0.967	0.239	23.533	6.537	6.260	3.162	0.850
1190	61	1	22.00	10	0.2	60	10	4.029	0.812	0.913	1.061	0.214	24.945	7.393	6.736	3.103	0.860
1191	71	1	14.10	0.1	0.2	70	0.1	3.002	1.608	2.049	0.898	3.724	1.084	0.692	0.569	0.108	3.860
1192	71	1	14.25	0.25	0.2	70	0.25	5.942	2.578	3.360	0.896	3.380	2.080	1.152	1.056	0.253	3.259
1193	71	1	14.50	0.5	0.2	70	0.5	7.198	2.664	3.290	0.894	2.605	2.897	1.312	1.066	0.455	2.592
1194	71	1	14.75	0.75	0.2	70	0.75	7.137	2.402	2.844	0.918	2.159	3.374	1.439	1.285	0.726	2.216
1195	71	1	15.00	1	0.2	70	1	6.998	2.204	2.522	0.932	1.891	4.452	1.775	1.624	0.947	1.958
1196	71	1	15.25	1.25	0.2	70	1.25	6.924	1.969	2.318	0.935	1.647	5.518	2.096	1.948	1.203	1.678
1197	71	1	16.00	2	0.2	70	2	6.891	1.745	1.973	0.920	1.181	8.581	2.964	2.788	1.766	1.258
1198	71	1	16.50	2.5	0.2	70	2.5	6.852	1.675	1.835	0.903	0.979	10.462	3.522	3.282	2.051	1.126
1199	71	1	17.00	3	0.2	70	3	6.762	1.619	1.728	0.887	0.827	12.170	3.989	3.700	2.275	1.089
1200	71	1	18.00	4	0.2	70	4	6.471	1.509	1.567	0.860	0.619	15.250	4.799	4.440	2.601	0.992
1201	71	1	19.00	5	0.2	70	5	6.128	1.405	1.447	0.843	0.486	17.949	5.487	5.066	2.750	0.845
1202	71	1	20.00	6	0.2	70	6	5.778	1.307	1.352	0.840	0.397	20.380	6.194	5.635	2.935	0.842
1203	71	1	21.00	7	0.2	70	7	5.428	1.204	1.273	0.850	0.334	22.598	6.771	6.177	2.852	0.843
1204	71	1	21.50	7.5	0.2	70	7.5	5.281	1.172	1.245	0.860	0.309	23.653	7.042	6.441	2.935	0.843
1205	71	1	22.00	8	0.2	70	8	5.140	1.139	1.217	0.865	0.288	24.604	7.313	6.698	3.022	0.844
1206	71	1	23.00	9	0.2	70	9	4.912	1.083	1.169	0.911	0.253	26.510	7.833	7.223	3.192	0.846
1207	71	1	24.00	10	0.2	70	10	4.718	1.036	1.131	0.974	0.225	28.296	8.607	7.744	3.364	0.849
1208	81	1	16.10	0.1	0.2	80	0.1	3.332	1.743	2.257	0.897	4.017	1.252	0.803	0.646	0.112	4.086
1209	81	1	16.25	0.25	0.2	80	0.25	6.630	2.837	3.750	0.892	3.649	2.349	1.347	1.182	0.261	3.447
1210	81	1	16.50	0.5	0.2	80	0.5	7.980	2.940	3.655	0.908	2.791	3.272	1.526	1.153	0.470	2.727

STP-PT-074: Local Stress in Nozzles, Shells and Formed Heads from External Heads

Model								Membrane Stress Factors									
	OD	T	od	t	d/D	D/T	t/T	Branch					Header				
								Axial	In-Plane	Out-of-Plane	Torsional	Pressure	Axial	In-Plane	Out-of-Plane	Torsional	Pressure
1211	81	1	16.75	0.75	0.2	80	0.75	7.867	2.669	3.143	0.945	2.302	3.676	1.662	1.355	0.702	2.327
1212	81	1	17.00	1	0.2	80	1	7.711	2.478	2.786	0.960	2.011	4.814	1.977	1.732	0.980	2.057
1213	81	1	17.25	1.25	0.2	80	1.25	7.636	2.208	2.571	0.964	1.751	5.933	2.385	2.095	1.206	1.768
1214	81	1	18.00	2	0.2	80	2	7.700	1.992	2.232	0.952	1.255	9.210	3.447	3.071	1.864	1.311
1215	81	1	18.50	2.5	0.2	80	2.5	7.727	1.928	2.105	0.938	1.040	11.242	4.080	3.648	2.184	1.172
1216	81	1	19.00	3	0.2	80	3	7.685	1.880	2.009	0.920	0.878	13.118	4.653	4.157	2.442	1.078
1217	81	1	20.00	4	0.2	80	4	7.445	1.768	1.862	0.890	0.656	16.523	5.647	5.035	2.707	0.849
1218	81	1	21.00	5	0.2	80	5	7.100	1.656	1.743	0.867	0.515	19.560	6.485	5.791	2.994	0.846
1219	81	1	22.00	6	0.2	80	6	6.732	1.557	1.643	0.854	0.419	22.312	7.219	6.462	2.907	0.844
1220	81	1	23.00	7	0.2	80	7	6.372	1.412	1.559	0.853	0.352	24.875	7.880	7.083	3.103	0.844
1221	81	1	23.50	7.5	0.2	80	7.5	6.192	1.398	1.521	0.858	0.325	26.045	8.192	7.374	3.190	0.844
1222	81	1	24.00	8	0.2	80	8	6.022	1.361	1.485	0.834	0.302	27.181	8.495	7.674	3.282	0.845
1223	81	1	25.00	9	0.2	80	9	5.742	1.285	1.427	0.870	0.264	29.397	9.355	8.247	3.459	0.847
1224	81	1	26.00	10	0.2	80	10	5.490	1.226	1.375	0.912	0.234	31.459	9.866	8.826	3.633	0.850
1225	91	1	18.10	0.1	0.2	90	0.1	3.651	1.870	2.464	0.896	4.289	1.405	0.910	0.738	0.116	4.296
1226	91	1	18.25	0.25	0.2	90	0.25	7.280	3.079	4.127	0.891	3.893	2.607	1.536	1.427	0.247	3.622
1227	91	1	18.50	0.5	0.2	90	0.5	8.717	3.200	4.002	0.927	2.960	3.582	1.740	0.983	0.483	2.852
1228	91	1	18.75	0.75	0.2	90	0.75	8.563	2.924	3.430	0.967	2.430	3.986	1.886	1.426	0.720	2.430
1229	91	1	19.00	1	0.2	90	1	8.394	2.745	3.046	0.985	2.119	5.171	2.192	1.831	0.926	2.149
1230	91	1	19.25	1.25	0.2	90	1.25	8.321	2.413	2.814	0.989	1.845	6.356	2.620	2.235	1.202	1.853
1231	91	1	20.00	2	0.2	90	2	8.495	2.261	2.488	0.980	1.324	9.837	3.835	3.345	1.948	1.358
1232	91	1	20.50	2.5	0.2	90	2.5	8.597	2.183	2.380	0.966	1.097	11.980	4.571	3.995	2.301	1.213
1233	91	1	21.00	3	0.2	90	3	8.609	2.145	2.300	0.950	0.926	14.010	5.245	4.594	2.592	1.116
1234	91	1	22.00	4	0.2	90	4	8.420	2.044	2.170	0.918	0.690	17.715	6.415	5.621	2.899	0.857
1235	91	1	23.00	5	0.2	90	5	8.090	1.927	2.057	0.893	0.540	21.053	7.401	6.502	3.214	0.848
1236	91	1	24.00	6	0.2	90	6	7.713	1.803	1.955	0.873	0.439	24.084	8.255	7.268	3.128	0.846
1237	91	1	25.00	7	0.2	90	7	7.335	1.693	1.863	0.866	0.368	26.961	9.012	7.996	3.334	0.845
1238	91	1	25.50	7.5	0.2	90	7.5	7.148	1.643	1.820	0.862	0.339	28.310	9.365	8.338	3.436	0.846
1239	91	1	26.00	8	0.2	90	8	6.970	1.559	1.781	0.866	0.315	29.616	9.704	8.672	3.533	0.846
1240	91	1	27.00	9	0.2	90	9	6.612	1.500	1.704	0.844	0.274	32.038	10.592	9.307	3.722	0.848
1241	91	1	28.00	10	0.2	90	10	6.316	1.423	1.644	0.878	0.243	34.415	11.157	9.936	3.901	0.850
1242	101	1	20.10	0.1	0.2	100	0.1	3.956	1.990	2.661	0.895	4.545	1.591	1.014	0.830	0.120	4.494
1243	101	1	20.25	0.25	0.2	100	0.25	7.902	3.309	4.497	0.891	4.118	3.039	1.721	1.568	0.252	3.788
1244	101	1	20.50	0.5	0.2	100	0.5	9.418	3.446	4.338	0.943	3.113	4.037	1.949	1.033	0.495	2.970
1245	101	1	20.75	0.75	0.2	100	0.75	9.227	3.170	3.708	0.986	2.547	4.300	2.109	1.490	0.736	2.527
1246	101	1	21.00	1	0.2	100	1	9.053	2.820	3.295	1.006	2.217	5.551	2.372	1.928	0.949	2.235
1247	101	1	21.25	1.25	0.2	100	1.25	8.996	2.654	3.054	1.013	1.931	6.774	2.845	2.365	1.157	1.932
1248	101	1	22.00	2	0.2	100	2	9.282	2.537	2.746	1.007	1.387	10.433	4.206	3.601	1.860	1.401

STP-PT-074: Local Stress in Nozzles, Shells and Formed Heads from External Heads

Model								Membrane Stress Factors									
	OD	T	od	t	d/D	D/T	t/T	Branch					Header				
								Axial	In-Plane	Out-of-Plane	Torsional	Pressure	Axial	In-Plane	Out-of-Plane	Torsional	Pressure
1249	101	1	22.50	2.5	0.2	100	2.5	9.461	2.441	2.659	0.993	1.149	12.697	5.046	4.332	2.404	1.250
1250	101	1	23.00	3	0.2	100	3	9.531	2.409	2.599	0.978	0.970	14.851	5.814	5.004	2.726	1.150
1251	101	1	24.00	4	0.2	100	4	9.404	2.313	2.493	0.945	0.722	18.846	7.164	6.195	3.074	0.873
1252	101	1	25.00	5	0.2	100	5	9.088	2.191	2.388	0.916	0.564	22.454	8.306	7.198	3.428	0.850
1253	101	1	26.00	6	0.2	100	6	8.697	2.062	2.283	0.894	0.458	25.797	9.286	8.102	3.335	0.847
1254	101	1	27.00	7	0.2	100	7	8.297	1.940	2.184	0.879	0.382	28.925	10.155	8.921	3.572	0.847
1255	101	1	27.50	7.5	0.2	100	7.5	8.103	1.882	2.137	0.798	0.353	30.409	10.553	9.316	3.670	0.847
1256	101	1	28.00	8	0.2	100	8	7.905	1.829	2.093	0.807	0.327	31.847	10.934	9.682	3.775	0.847
1257	101	1	29.00	9	0.2	100	9	7.521	1.696	2.007	0.828	0.284	34.644	11.840	10.421	3.976	0.849
1258	101	1	30.00	10	0.2	100	10	7.181	1.635	1.928	0.852	0.251	37.194	12.477	11.103	4.166	0.851
1259	251	1	50.10	0.1	0.2	250	0.1	7.677	3.263	5.273	0.887	7.331	3.766	2.184	2.204	0.172	6.636
1260	251	1	50.25	0.25	0.2	250	0.25	15.143	5.652	9.105	0.964	6.374	7.076	3.886	3.503	0.371	5.586
1261	251	1	50.50	0.5	0.2	250	0.5	17.628	5.938	8.592	1.080	4.625	8.397	4.469	2.815	0.608	4.237
1262	251	1	50.75	0.75	0.2	250	0.75	17.254	5.830	7.305	1.130	3.700	9.204	4.580	3.564	0.904	3.556
1263	251	1	51.00	1	0.2	250	1	17.357	5.946	6.648	1.157	3.200	11.361	5.206	4.442	1.171	3.158
1264	251	1	51.25	1.25	0.2	250	1.25	17.857	5.476	6.422	1.177	2.812	13.470	5.760	5.362	1.444	2.796
1265	251	1	52.00	2	0.2	250	2	20.535	6.096	6.913	1.211	2.074	19.590	8.538	8.246	2.233	2.025
1266	251	1	52.50	2.5	0.2	250	2.5	22.065	6.375	7.458	1.215	1.734	23.133	10.513	10.025	2.723	1.673
1267	251	1	53.00	3	0.2	250	3	23.107	6.531	7.919	1.208	1.466	26.439	12.438	11.669	3.178	1.486
1268	251	1	54.00	4	0.2	250	4	24.021	7.324	8.491	1.215	1.085	32.923	16.293	14.641	3.983	1.289
1269	251	1	55.00	5	0.2	250	5	23.998	7.053	8.691	1.031	0.837	39.484	19.788	17.292	4.670	1.026
1270	251	1	56.00	6	0.2	250	6	23.536	6.693	8.667	0.999	0.668	46.194	22.631	19.690	5.408	0.865
1271	251	1	57.00	7	0.2	250	7	22.902	6.314	8.526	0.975	0.549	52.775	25.344	22.404	5.909	0.863
1272	251	1	57.50	7.5	0.2	250	7.5	22.561	6.121	8.426	0.964	0.503	56.033	26.600	23.734	6.143	0.862
1273	251	1	58.00	8	0.2	250	8	22.211	5.935	8.318	0.955	0.462	59.376	27.796	25.083	6.384	0.861
1274	251	1	59.00	9	0.2	250	9	21.510	5.568	8.083	0.939	0.397	65.685	30.030	27.525	6.832	0.861
1275	251	1	60.00	10	0.2	250	10	20.833	5.269	7.833	0.926	0.346	71.710	32.072	29.830	7.239	0.650
1276	501	1	100.10	0.1	0.2	500	0.1	12.431	4.522	8.724	0.920	10.124	7.047	3.425	4.581	0.247	9.094
1277	501	1	100.25	0.25	0.2	500	0.25	24.434	8.434	15.207	1.084	8.599	13.624	6.252	7.745	0.535	7.615
1278	501	1	100.50	0.5	0.2	500	0.5	28.318	8.655	14.419	1.250	6.112	14.385	7.387	6.258	0.813	5.646
1279	501	1	100.75	0.75	0.2	500	0.75	28.274	8.853	12.522	1.315	4.844	17.695	8.385	7.458	1.064	4.681
1280	501	1	101.00	1	0.2	500	1	29.466	9.386	11.873	1.379	4.191	21.847	8.420	9.215	1.392	4.158
1281	501	1	101.25	1.25	0.2	500	1.25	31.446	9.954	12.021	1.430	3.720	25.932	9.420	11.127	1.732	3.729
1282	501	1	102.00	2	0.2	500	2	39.283	11.827	14.689	1.548	2.826	37.354	13.203	17.133	2.763	2.810
1283	501	1	102.50	2.5	0.2	500	2.5	43.672	13.873	16.747	1.585	2.397	43.627	16.565	20.802	3.444	2.298
1284	501	1	103.00	3	0.2	500	3	46.856	14.459	18.489	1.595	2.048	48.998	19.933	24.116	4.108	1.886
1285	501	1	104.00	4	0.2	500	4	50.254	14.861	20.868	1.501	1.528	58.182	26.532	29.942	5.361	1.561
1286	501	1	105.00	5	0.2	500	5	51.103	14.638	22.049	1.470	1.177	66.540	32.803	35.082	6.498	1.381

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Model								Membrane Stress Factors									
	OD	T	od	t	d/D	D/T	t/T	Branch					Header				
								Axial	In-Plane	Out-of-Plane	Torsional	Pressure	Axial	In-Plane	Out-of-Plane	Torsional	Pressure
1287	501	1	106.00	6	0.2	500	6	50.638	13.854	22.475	1.441	0.933	74.870	38.675	39.920	7.521	1.193
1288	501	1	107.00	7	0.2	500	7	49.550	13.567	22.450	1.406	0.757	83.688	44.804	43.850	8.616	1.133
1289	501	1	107.50	7.5	0.2	500	7.5	48.900	13.240	22.330	1.398	0.689	88.824	47.512	46.124	9.051	1.109
1290	501	1	108.00	8	0.2	500	8	48.218	12.926	22.165	1.389	0.630	94.228	50.122	48.425	9.466	0.534
1291	501	1	109.00	9	0.2	500	9	46.819	12.295	21.738	1.371	0.534	105.009	55.098	53.085	10.234	0.541
1292	501	1	110.00	10	0.2	500	10	45.448	11.673	21.225	1.352	0.460	115.902	59.740	58.586	10.936	0.550
1294	751	1	150.25	0.25	0.2	750	0.25	32.212	10.853	20.497	1.207	10.172	19.495	8.157	11.863	0.681	9.108
1295	751	1	150.50	0.5	0.2	750	0.5	37.543	11.525	19.618	1.419	7.170	20.751	10.108	8.430	1.011	6.670
1296	751	1	150.75	0.75	0.2	750	0.75	38.239	12.100	17.406	1.501	5.656	25.694	10.335	9.900	1.239	5.489
1297	751	1	151.00	1	0.2	750	1	40.800	13.029	16.992	1.591	4.894	31.694	11.944	12.267	1.528	4.870
1298	751	1	151.25	1.25	0.2	750	1.25	44.510	14.034	17.705	1.676	4.365	37.732	13.426	14.977	1.814	4.392
1299	751	1	152.00	2	0.2	750	2	57.805	17.071	22.835	1.887	3.371	54.599	17.129	23.730	2.695	3.376
1300	751	1	152.50	2.5	0.2	750	2.5	65.282	19.699	26.549	1.963	2.886	63.542	18.812	29.058	3.696	2.777
1301	751	1	153.00	3	0.2	750	3	70.950	20.716	29.751	2.039	2.484	70.779	20.245	33.766	4.469	2.229
1302	751	1	154.00	4	0.2	750	4	77.539	20.936	34.262	1.994	1.874	82.077	26.121	41.741	5.991	1.793
1303	751	1	155.00	5	0.2	750	5	79.845	20.945	36.736	1.891	1.452	91.703	32.379	48.649	7.441	1.536
1304	751	1	156.00	6	0.2	750	6	79.769	19.834	37.863	1.774	1.153	101.428	38.890	55.228	8.796	1.387
1305	751	1	157.00	7	0.2	750	7	78.464	19.150	38.154	1.660	0.936	111.727	45.388	61.759	10.052	1.245
1306	751	1	157.50	7.5	0.2	750	7.5	77.570	18.763	38.079	1.604	0.850	117.418	48.498	65.102	10.642	0.513
1307	751	1	158.00	8	0.2	750	8	76.578	18.355	37.927	1.560	0.775	123.901	51.661	68.476	11.212	0.506
1308	751	1	159.00	9	0.2	750	9	74.452	17.573	37.400	1.539	0.654	136.963	57.761	75.313	12.285	0.499
1309	751	1	160.00	10	0.2	750	10	72.285	16.796	36.697	1.522	0.558	151.172	63.689	83.074	13.390	0.497
1311	1001	1	200.25	0.25	0.2	1000	0.25	39.230	11.671	25.357	1.325	11.457	24.797	9.749	15.675	0.807	10.319
1312	1001	1	200.50	0.5	0.2	1000	0.5	45.882	14.105	24.439	1.580	8.032	26.767	12.412	11.497	1.189	7.505
1313	1001	1	200.75	0.75	0.2	1000	0.75	47.472	14.984	22.090	1.667	6.319	33.436	13.096	13.590	1.413	6.150
1314	1001	1	201.00	1	0.2	1000	1	51.473	16.317	22.022	1.798	5.466	41.393	15.214	16.840	1.723	5.453
1315	1001	1	201.25	1.25	0.2	1000	1.25	56.900	17.793	23.372	1.922	4.890	49.442	17.150	20.549	2.026	4.933
1316	1001	1	202.00	2	0.2	1000	2	75.598	21.884	31.089	2.224	3.810	71.798	21.972	32.039	2.888	3.832
1317	1001	1	202.50	2.5	0.2	1000	2.5	86.233	25.059	36.527	2.456	3.281	83.678	21.257	39.205	3.503	3.189
1318	1001	1	203.00	3	0.2	1000	3	94.452	26.460	41.244	2.510	2.840	93.180	24.177	45.499	4.119	2.567
1319	1001	1	204.00	4	0.2	1000	4	104.515	27.543	48.049	2.488	2.161	107.338	30.221	55.913	6.471	2.011
1320	1001	1	205.00	5	0.2	1000	5	108.662	26.406	51.974	2.371	1.684	118.433	36.880	64.595	8.112	1.761
1321	1001	1	206.00	6	0.2	1000	6	109.323	25.872	53.950	2.233	1.342	128.971	43.922	72.586	9.676	1.660
1322	1001	1	207.00	7	0.2	1000	7	108.066	25.139	54.684	2.081	1.092	140.202	51.214	80.548	11.149	1.597
1323	1001	1	207.50	7.5	0.2	1000	7.5	107.047	24.494	54.746	2.016	0.991	146.161	54.688	84.566	11.852	1.483
1324	1001	1	208.00	8	0.2	1000	8	105.830	24.018	54.624	1.943	0.904	152.494	58.302	88.704	12.531	0.515
1325	1001	1	209.00	9	0.2	1000	9	103.153	23.090	54.119	1.821	0.761	166.432	65.397	97.097	13.825	0.500
1326	1001	1	210.00	10	0.2	1000	10	100.271	22.168	53.270	1.713	0.650	182.483	72.410	105.802	15.036	0.490



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Model								Membrane Stress Factors									
	OD	T	od	t	d/D	D/T	t/T	Branch					Header				
								Axial	In-Plane	Out-of-Plane	Torsional	Pressure	Axial	In-Plane	Out-of-Plane	Torsional	Pressure
1328	1251	1	250.25	0.25	0.2	1250	0.25	45.835	13.467	30.039	1.450	12.554	29.910	11.329	19.616	0.926	11.389
1329	1251	1	250.50	0.5	0.2	1250	0.5	53.768	16.447	29.112	1.746	8.772	32.493	14.453	14.346	1.358	8.230
1330	1251	1	250.75	0.75	0.2	1250	0.75	56.209	17.623	26.593	1.859	6.887	40.837	15.606	17.023	1.582	6.714
1331	1251	1	251.00	1	0.2	1250	1	61.664	19.346	27.012	2.003	5.955	50.688	18.171	21.158	1.915	5.944
1332	1251	1	251.25	1.25	0.2	1250	1.25	68.815	21.184	28.959	2.162	5.336	60.691	20.586	25.774	2.240	5.386
1333	1251	1	252.00	2	0.2	1250	2	92.845	26.516	39.363	2.554	4.187	88.578	26.571	40.717	3.117	4.146
1334	1251	1	252.50	2.5	0.2	1250	2.5	106.551	29.733	46.526	2.882	3.621	103.432	24.839	49.777	3.732	3.554
1335	1251	1	253.00	3	0.2	1250	3	117.337	31.485	52.778	2.965	3.145	115.331	27.900	57.742	4.348	2.853
1336	1251	1	254.00	4	0.2	1250	4	131.081	33.186	61.999	2.969	2.408	132.685	34.112	70.729	6.827	2.224
1337	1251	1	255.00	5	0.2	1250	5	137.265	33.158	67.539	2.849	1.886	145.455	40.817	81.291	8.600	1.869
1338	1251	1	256.00	6	0.2	1250	6	138.904	32.579	70.505	2.690	1.509	156.930	48.127	90.734	10.313	1.742
1339	1251	1	257.00	7	0.2	1250	7	137.900	30.743	71.724	2.524	1.230	168.170	55.551	99.019	12.003	1.659
1340	1251	1	257.50	7.5	0.2	1250	7.5	136.825	30.145	71.912	2.439	1.118	174.568	59.358	103.693	12.796	1.632
1341	1251	1	258.00	8	0.2	1250	8	135.520	29.643	71.938	2.351	1.021	181.145	63.267	108.387	13.566	1.610
1342	1251	1	259.00	9	0.2	1250	9	132.363	28.491	71.470	2.204	0.860	195.415	71.007	118.184	15.038	0.508
1343	1251	1	260.00	10	0.2	1250	10	128.863	27.248	70.573	2.062	0.734	211.692	79.040	128.391	16.431	0.494
1345	1501	1	300.25	0.25	0.2	1500	0.25	52.193	15.150	34.684	1.567	13.555	34.790	12.763	23.456	1.040	12.348
1346	1501	1	300.50	0.5	0.2	1500	0.5	61.272	18.612	33.696	1.899	9.432	37.984	16.308	17.159	1.517	8.879
1347	1501	1	300.75	0.75	0.2	1500	0.75	64.624	20.077	31.113	2.041	7.394	47.989	17.922	20.446	1.745	7.215
1348	1501	1	301.00	1	0.2	1500	1	71.528	22.154	31.870	2.195	6.390	59.697	20.922	25.385	2.104	6.379
1349	1501	1	301.25	1.25	0.2	1500	1.25	80.408	24.405	34.594	2.393	5.732	71.628	23.723	31.008	2.364	5.782
1350	1501	1	302.00	2	0.2	1500	2	109.669	30.768	47.630	2.879	4.518	104.907	24.723	48.967	3.346	4.499
1351	1501	1	302.50	2.5	0.2	1500	2.5	126.466	33.827	56.546	3.283	3.919	122.712	28.256	59.863	3.965	3.628
1352	1501	1	303.00	3	0.2	1500	3	139.780	36.159	64.349	3.396	3.413	136.975	31.645	69.429	4.572	3.137
1353	1501	1	304.00	4	0.2	1500	4	157.252	38.238	76.046	3.430	2.626	157.506	37.784	84.974	5.819	2.420
1354	1501	1	305.00	5	0.2	1500	5	165.609	38.578	83.198	3.319	2.065	171.962	44.423	97.269	9.031	1.967
1355	1501	1	306.00	6	0.2	1500	6	168.361	38.023	87.365	3.148	1.657	184.299	51.655	108.035	10.880	1.814
1356	1501	1	307.00	7	0.2	1500	7	167.756	36.687	89.113	2.950	1.355	196.641	59.593	118.415	12.656	1.720
1357	1501	1	307.50	7.5	0.2	1500	7.5	166.745	36.095	89.441	2.860	1.233	203.243	63.444	123.550	13.515	1.685
1358	1501	1	308.00	8	0.2	1500	8	165.334	35.474	89.588	2.761	1.127	210.199	67.410	128.809	14.357	1.659
1359	1501	1	309.00	9	0.2	1500	9	161.834	33.599	89.169	2.588	0.950	225.182	75.634	139.724	15.972	1.520
1360	1501	1	310.00	10	0.2	1500	10	157.847	32.391	88.249	2.413	0.812	241.345	84.249	151.088	17.509	0.502
1362	1751	1	350.25	0.25	0.2	1750	0.25	58.338	16.692	39.177	1.688	14.522	39.222	14.022	26.971	1.140	13.210
1363	1751	1	350.50	0.5	0.2	1750	0.5	68.575	20.619	38.146	2.054	10.036	43.284	17.153	20.055	1.662	9.471
1364	1751	1	350.75	0.75	0.2	1750	0.75	72.794	22.403	35.493	2.211	7.857	54.959	20.176	24.052	1.907	7.678
1365	1751	1	351.00	1	0.2	1750	1	81.072	24.830	36.911	2.397	6.789	68.530	23.564	30.087	2.291	6.783
1366	1751	1	351.25	1.25	0.2	1750	1.25	91.617	27.448	40.113	2.618	6.095	82.352	26.802	36.515	2.564	6.158
1367	1751	1	352.00	2	0.2	1750	2	126.078	34.833	55.835	3.195	4.819	120.930	27.935	57.580	3.583	4.828

STP-PT-074: Local Stress in Nozzles, Shells and Formed Heads from External Heads

Model								Membrane Stress Factors									
	OD	T	od	t	d/D	D/T	t/T	Branch					Header				
								Axial	In-Plane	Out-of-Plane	Torsional	Pressure	Axial	In-Plane	Out-of-Plane	Torsional	Pressure
1368	1751	1	352.50	2.5	0.2	1750	2.5	145.841	38.373	66.442	3.667	4.190	141.686	31.924	70.369	4.204	3.895
1369	1751	1	353.00	3	0.2	1750	3	161.814	40.813	75.851	3.811	3.657	158.379	35.343	81.613	4.807	3.375
1370	1751	1	354.00	4	0.2	1750	4	183.024	43.215	89.819	3.872	2.824	182.347	41.517	99.592	6.028	2.613
1371	1751	1	355.00	5	0.2	1750	5	193.693	43.551	100.538	3.763	2.227	198.729	47.922	113.954	9.376	2.060
1372	1751	1	356.00	6	0.2	1750	6	197.621	42.834	104.397	3.587	1.793	212.042	54.990	125.817	11.323	1.886
1373	1751	1	357.00	7	0.2	1750	7	197.552	41.778	106.648	3.380	1.469	224.239	62.795	136.693	13.253	1.769
1374	1751	1	357.50	7.5	0.2	1750	7.5	196.540	41.140	107.185	3.274	1.338	231.074	66.727	142.357	14.177	1.726
1375	1751	1	358.00	8	0.2	1750	8	195.145	40.468	107.384	3.164	1.224	238.199	71.050	148.004	15.079	1.697
1376	1751	1	359.00	9	0.2	1750	9	191.411	39.106	107.254	2.970	1.034	253.649	79.279	160.018	16.832	1.649
1377	1751	1	360.00	10	0.2	1750	10	187.031	37.210	106.383	2.781	0.884	271.099	88.014	172.809	18.501	0.512
1380	2001	1	400.50	0.5	0.2	2000	0.5	75.646	22.522	42.600	2.212	10.597	48.395	18.854	22.722	1.801	10.022
1381	2001	1	400.75	0.75	0.2	2000	0.75	80.680	24.540	39.851	2.384	8.286	61.676	22.192	27.336	2.059	8.100
1382	2001	1	401.00	1	0.2	2000	1	90.387	27.299	41.459	2.596	7.157	77.038	25.973	33.996	2.381	7.148
1383	2001	1	401.25	1.25	0.2	2000	1.25	102.514	30.244	45.599	2.837	6.430	92.734	29.597	41.607	2.763	6.491
1384	2001	1	402.00	2	0.2	2000	2	142.047	38.616	64.132	3.503	5.095	136.553	31.025	65.813	3.820	5.161
1385	2001	1	402.50	2.5	0.2	2000	2.5	164.934	42.643	76.324	4.029	4.437	160.245	35.134	80.232	4.446	4.426
1386	2001	1	403.00	3	0.2	2000	3	183.463	45.454	87.306	4.201	3.879	179.304	38.886	93.075	5.041	3.619
1387	2001	1	404.00	4	0.2	2000	4	208.503	48.258	104.069	4.292	3.004	206.577	44.987	113.853	6.236	2.790
1388	2001	1	405.00	5	0.2	2000	5	221.494	48.734	117.223	4.194	2.375	224.793	51.259	129.862	6.699	2.154
1389	2001	1	406.00	6	0.2	2000	6	226.789	48.031	122.107	4.009	1.916	238.945	58.174	143.254	11.741	1.946
1390	2001	1	407.00	7	0.2	2000	7	227.253	46.752	124.441	3.793	1.574	252.492	65.717	155.808	13.735	1.814
1391	2001	1	407.50	7.5	0.2	2000	7.5	226.397	45.957	125.095	3.681	1.436	259.368	69.719	162.061	14.705	1.772
1392	2001	1	408.00	8	0.2	2000	8	224.935	45.034	125.298	3.566	1.313	266.817	73.958	168.157	15.662	1.734
1393	2001	1	409.00	9	0.2	2000	9	221.025	43.525	125.815	3.350	1.112	282.766	82.414	181.847	17.514	1.679
1394	2001	1	410.00	10	0.2	2000	10	216.192	41.890	124.531	3.130	0.953	300.576	91.288	194.910	19.297	1.641
1397	2251	1	450.50	0.5	0.2	2250	0.5	82.540	24.382	47.029	2.368	11.120	53.402	20.502	25.565	1.930	10.537
1398	2251	1	450.75	0.75	0.2	2250	0.75	88.449	26.717	44.127	2.560	8.689	68.287	24.212	30.853	2.139	8.500
1399	2251	1	451.00	1	0.2	2250	1	99.438	29.750	46.521	2.798	7.504	85.442	28.395	38.716	2.558	7.497
1400	2251	1	451.25	1.25	0.2	2250	1.25	113.231	33.139	51.082	3.054	6.743	102.930	32.358	47.048	2.956	6.810
1401	2251	1	452.00	2	0.2	2250	2	157.778	42.339	71.797	3.797	5.354	151.882	34.108	73.847	4.058	5.403
1402	2251	1	452.50	2.5	0.2	2250	2.5	183.469	46.823	85.730	4.377	4.669	178.466	38.719	90.153	4.696	4.683
1403	2251	1	453.00	3	0.2	2250	3	204.635	49.924	98.772	4.578	4.088	199.887	42.439	105.144	5.283	3.827
1404	2251	1	454.00	4	0.2	2250	4	233.503	53.105	117.883	4.695	3.174	230.799	48.461	128.613	6.420	2.958
1405	2251	1	455.00	5	0.2	2250	5	248.851	53.812	133.895	4.609	2.514	251.100	54.534	146.554	9.971	2.241
1406	2251	1	456.00	6	0.2	2250	6	255.557	53.059	139.908	4.420	2.032	266.286	61.205	161.319	12.088	2.017
1407	2251	1	457.00	7	0.2	2250	7	256.788	51.561	143.049	4.194	1.673	280.380	68.609	175.285	14.156	1.869
1408	2251	1	457.50	7.5	0.2	2250	7.5	256.031	50.859	143.443	4.068	1.527	287.798	72.510	181.891	15.186	1.813
1409	2251	1	458.00	8	0.2	2250	8	254.685	50.013	143.745	3.950	1.398	295.168	76.581	188.516	16.181	1.769

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Model								Membrane Stress Factors									
	OD	T	od	t	d/D	D/T	t/T	Branch					Header				
								Axial	In-Plane	Out-of-Plane	Torsional	Pressure	Axial	In-Plane	Out-of-Plane	Torsional	Pressure
1410	2251	1	459.00	9	0.2	2250	9	250.595	48.218	143.610	3.710	1.186	310.526	84.967	200.811	18.187	1.701
1411	2251	1	460.00	10	0.2	2250	10	245.336	46.452	142.942	3.484	1.018	329.189	93.934	216.035	20.068	1.661
1414	2501	1	500.50	0.5	0.2	2500	0.5	89.450	26.003	51.529	2.511	11.616	58.180	22.010	28.067	2.057	11.024
1415	2501	1	500.75	0.75	0.2	2500	0.75	95.977	28.652	48.395	2.729	9.067	74.658	26.000	33.983	2.287	8.873
1416	2501	1	501.00	1	0.2	2500	1	108.233	31.917	50.815	2.983	7.826	93.542	30.562	42.335	2.728	7.813
1417	2501	1	501.25	1.25	0.2	2500	1.25	123.717	35.692	56.383	3.272	7.036	112.871	28.409	51.927	3.150	7.101
1418	2501	1	502.00	2	0.2	2500	2	173.107	45.756	79.815	4.087	5.595	166.829	37.084	81.715	4.296	5.673
1419	2501	1	502.50	2.5	0.2	2500	2.5	201.892	50.754	95.596	4.709	4.884	196.281	41.938	99.910	4.943	4.929
1420	2501	1	503.00	3	0.2	2500	3	225.524	54.187	110.017	4.936	4.281	220.177	45.709	116.327	5.526	4.044
1421	2501	1	504.00	4	0.2	2500	4	258.177	57.790	138.358	5.087	3.330	254.402	52.122	142.344	6.663	3.123
1422	2501	1	505.00	5	0.2	2500	5	276.071	58.572	150.605	5.005	2.643	276.490	57.782	162.085	10.235	2.332
1423	2501	1	506.00	6	0.2	2500	6	284.167	57.859	157.453	4.816	2.140	292.933	64.006	178.302	12.424	2.076
1424	2501	1	507.00	7	0.2	2500	7	285.992	56.377	161.095	4.579	1.765	307.270	71.383	192.752	14.581	1.907
1425	2501	1	507.50	7.5	0.2	2500	7.5	285.514	55.577	161.872	4.459	1.613	314.592	75.105	199.944	15.637	1.846
1426	2501	1	508.00	8	0.2	2500	8	284.049	54.630	161.873	4.324	1.480	322.154	79.128	206.533	16.684	1.803
1427	2501	1	509.00	9	0.2	2500	9	279.909	52.612	162.022	4.078	1.257	338.834	87.662	221.879	18.730	1.725
1428	2501	1	510.00	10	0.2	2500	10	274.612	50.838	161.106	3.830	1.081	357.441	149.196	236.834	20.709	1.680
1429	9	1	2.10	0.1	0.25	8	0.1	1.005	0.975	0.951	0.908	2.131	0.169	0.149	0.166	0.080	1.612
1430	9	1	2.25	0.25	0.25	8	0.25	1.073	0.901	0.896	0.843	0.831	0.330	0.217	0.303	0.168	1.324
1431	9	1	2.50	0.5	0.25	8	0.5	1.238	0.806	0.804	0.734	0.631	0.538	0.312	0.352	0.275	1.107
1432	9	1	2.75	0.75	0.25	8	0.75	1.304	0.728	0.728	0.676	0.551	0.746	0.367	0.404	0.348	0.987
1433	9	1	3.00	1	0.25	8	1	1.306	0.679	0.679	0.650	0.506	1.520	0.411	0.449	0.404	0.912
1434	9	1	3.25	1.25	0.25	8	1.25	1.284	0.630	0.630	0.622	0.438	1.780	0.440	0.480	0.451	0.843
1446	17	1	4.10	0.1	0.25	16	0.1	1.156	1.002	0.982	0.941	2.145	0.271	0.151	0.193	0.087	2.296
1447	17	1	4.25	0.25	0.25	16	0.25	1.737	0.979	1.146	0.927	1.406	0.511	0.290	0.484	0.200	1.954
1448	17	1	4.50	0.5	0.25	16	0.5	2.170	0.940	1.132	0.852	1.113	0.677	0.472	0.677	0.373	1.583
1449	17	1	4.75	0.75	0.25	16	0.75	2.298	0.844	1.015	0.796	0.967	1.674	0.534	0.672	0.512	1.341
1450	17	1	5.00	1	0.25	16	1	2.304	0.803	0.894	0.764	0.883	2.172	0.621	0.764	0.621	1.199
1451	17	1	5.25	1.25	0.25	16	1.25	2.303	0.765	0.793	0.732	0.774	2.648	0.678	0.828	0.710	1.029
1452	17	1	6.00	2	0.25	16	2	2.118	0.683	0.683	0.670	0.558	3.803	0.818	1.002	0.890	0.833
1453	17	1	6.50	2.5	0.25	16	2.5	1.937	0.634	0.634	0.721	0.462	4.402	0.932	1.120	0.976	0.852
1454	17	1	7.00	3	0.25	16	3	1.785	0.580	0.576	0.752	0.388	4.910	1.008	1.244	1.056	0.906
1463	25	1	6.10	0.1	0.25	24	0.1	1.438	1.000	1.157	0.953	2.364	0.429	0.236	0.268	0.094	2.798
1464	25	1	6.25	0.25	0.25	24	0.25	2.461	1.258	1.582	0.948	1.973	0.749	0.405	0.609	0.216	2.376
1465	25	1	6.50	0.5	0.25	24	0.5	3.090	1.268	1.596	0.876	1.569	1.334	0.605	0.887	0.425	1.919
1466	25	1	6.75	0.75	0.25	24	0.75	3.212	1.121	1.431	0.855	1.340	2.020	0.801	0.864	0.610	1.635
1467	25	1	7.00	1	0.25	24	1	3.197	0.985	1.271	0.827	1.200	2.678	0.778	1.024	0.767	1.426
1468	25	1	7.25	1.25	0.25	24	1.25	3.181	0.952	1.147	0.801	1.047	3.319	0.857	1.145	0.904	1.218

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Model								Membrane Stress Factors									
	OD	T	od	t	d/D	D/T	t/T	Branch					Header				
								Axial	In-Plane	Out-of-Plane	Torsional	Pressure	Axial	In-Plane	Out-of-Plane	Torsional	Pressure
1469	25	1	8.00	2	0.25	24	2	2.967	0.767	0.870	0.748	0.751	4.958	1.128	1.426	1.178	0.967
1470	25	1	8.50	2.5	0.25	24	2.5	2.787	0.719	0.744	0.738	0.624	5.852	1.279	1.589	1.292	0.857
1471	25	1	9.00	3	0.25	24	3	2.616	0.684	0.684	0.747	0.529	6.634	1.440	1.749	1.385	0.876
1472	25	1	10.00	4	0.25	24	4	2.297	0.613	0.613	0.794	0.398	7.895	1.846	2.048	1.543	0.907
1473	25	1	11.00	5	0.25	24	5	2.094	0.565	0.565	0.879	0.306	8.908	2.081	2.351	1.702	0.921
1480	33	1	8.10	0.1	0.25	32	0.1	1.736	1.100	1.359	0.958	2.806	0.580	0.342	0.342	0.100	3.197
1481	33	1	8.25	0.25	0.25	32	0.25	3.175	1.547	2.017	0.947	2.452	1.049	0.569	0.732	0.227	2.709
1482	33	1	8.50	0.5	0.25	32	0.5	3.955	1.586	2.034	0.895	1.943	1.534	0.722	1.017	0.451	2.175
1483	33	1	8.75	0.75	0.25	32	0.75	4.045	1.417	1.812	0.878	1.640	2.309	0.981	1.014	0.675	1.852
1484	33	1	9.00	1	0.25	32	1	4.002	1.304	1.615	0.863	1.451	3.080	1.201	1.230	0.867	1.623
1485	33	1	9.25	1.25	0.25	32	1.25	3.968	1.188	1.471	0.847	1.261	3.847	1.178	1.412	1.043	1.372
1486	33	1	10.00	2	0.25	32	2	3.751	0.966	1.161	0.805	0.899	5.902	1.600	1.841	1.417	1.066
1487	33	1	10.50	2.5	0.25	32	2.5	3.570	0.933	1.016	0.794	0.745	7.049	1.802	2.067	1.574	0.978
1488	33	1	11.00	3	0.25	32	3	3.385	0.851	0.904	0.788	0.630	8.067	1.982	2.268	1.691	0.916
1489	33	1	12.00	4	0.25	32	4	3.050	0.733	0.751	0.796	0.474	9.797	2.432	2.650	1.872	0.887
1490	33	1	13.00	5	0.25	32	5	2.742	0.652	0.656	0.834	0.376	11.219	2.773	3.004	2.030	0.908
1491	33	1	14.00	6	0.25	32	6	2.526	0.613	0.596	0.902	0.309	12.438	3.109	3.357	2.191	0.842
1492	33	1	15.00	7	0.25	32	7	2.374	0.592	0.562	0.997	0.259	13.431	3.441	3.701	2.335	0.859
1493	33	1	15.50	7.5	0.25	32	7.5	2.320	0.581	0.552	1.053	0.237	13.889	3.607	3.884	2.429	0.867
1497	41	1	10.10	0.1	0.25	40	0.1	2.038	1.223	1.562	0.907	3.201	0.737	0.451	0.413	0.107	3.543
1498	41	1	10.25	0.25	0.25	40	0.25	3.869	1.821	2.435	0.939	2.863	1.316	0.749	0.787	0.241	2.991
1499	41	1	10.50	0.5	0.25	40	0.5	4.770	1.883	2.445	0.897	2.251	1.891	0.882	1.136	0.477	2.384
1500	41	1	10.75	0.75	0.25	40	0.75	4.814	1.683	2.163	0.896	1.882	2.561	1.143	1.132	0.703	2.028
1501	41	1	11.00	1	0.25	40	1	4.737	1.540	1.931	0.887	1.654	3.415	1.322	1.395	0.940	1.779
1502	41	1	11.25	1.25	0.25	40	1.25	4.685	1.412	1.771	0.878	1.434	4.296	1.529	1.644	1.146	1.501
1503	41	1	12.00	2	0.25	40	2	4.489	1.253	1.443	0.862	1.018	6.686	2.104	2.225	1.610	1.139
1504	41	1	12.50	2.5	0.25	40	2.5	4.324	1.156	1.290	0.847	0.842	8.068	2.395	2.527	1.815	1.052
1505	41	1	13.00	3	0.25	40	3	4.148	1.082	1.170	0.834	0.711	9.302	2.661	2.800	1.967	0.981
1506	41	1	14.00	4	0.25	40	4	3.796	0.978	0.998	0.821	0.533	11.449	3.125	3.274	2.187	0.888
1507	41	1	15.00	5	0.25	40	5	3.479	0.854	0.883	0.828	0.421	13.292	3.536	3.697	2.361	0.844
1508	41	1	16.00	6	0.25	40	6	3.209	0.780	0.804	0.859	0.346	14.819	3.921	4.090	2.524	0.846
1509	41	1	17.00	7	0.25	40	7	2.952	0.725	0.748	0.912	0.293	16.253	4.437	4.497	2.647	0.848
1510	41	1	17.50	7.5	0.25	40	7.5	2.856	0.713	0.727	0.946	0.272	16.850	4.628	4.701	2.736	0.850
1511	41	1	18.00	8	0.25	40	8	2.767	0.702	0.709	0.988	0.254	17.428	4.818	4.888	2.827	0.843
1512	41	1	19.00	9	0.25	40	9	2.629	0.685	0.684	1.086	0.221	18.502	5.534	5.295	3.017	0.855
1514	51	1	12.60	0.1	0.25	50	0.1	2.416	1.373	1.810	0.907	3.593	0.859	0.585	0.508	0.114	3.913
1515	51	1	12.75	0.25	0.25	50	0.25	4.699	2.144	2.932	0.912	3.306	1.688	0.978	0.959	0.264	3.298
1516	51	1	13.00	0.5	0.25	50	0.5	5.729	2.237	2.926	0.903	2.572	2.332	1.125	0.885	0.501	2.608

STP-PT-074: Local Stress in Nozzles, Shells and Formed Heads from External Heads

Model								Membrane Stress Factors									
	OD	T	od	t	d/D	D/T	t/T	Branch					Header				
								Axial	In-Plane	Out-of-Plane	Torsional	Pressure	Axial	In-Plane	Out-of-Plane	Torsional	Pressure
1517	51	1	13.25	0.75	0.25	50	0.75	5.705	2.023	2.570	0.911	2.131	2.862	1.323	1.254	0.746	2.213
1518	51	1	13.50	1	0.25	50	1	5.588	1.848	2.300	0.931	1.861	3.808	1.630	1.580	1.008	1.942
1519	51	1	13.75	1.25	0.25	50	1.25	5.515	1.717	2.120	0.936	1.611	4.770	1.911	1.886	1.242	1.649
1520	51	1	14.50	2	0.25	50	2	5.369	1.518	1.782	0.923	1.141	7.512	2.650	2.654	1.800	1.229
1521	51	1	15.00	2.5	0.25	50	2.5	5.248	1.441	1.632	0.906	0.942	9.131	3.065	3.068	2.063	1.129
1522	51	1	15.50	3	0.25	50	3	5.099	1.381	1.512	0.890	0.794	10.600	3.430	3.421	2.262	1.052
1523	51	1	16.50	4	0.25	50	4	4.762	1.265	1.333	0.862	0.593	13.227	4.054	4.050	2.545	0.848
1524	51	1	17.50	5	0.25	50	5	4.421	1.173	1.203	0.849	0.467	15.494	4.584	4.586	2.752	0.847
1525	51	1	18.50	6	0.25	50	6	4.106	1.092	1.106	0.853	0.382	17.489	5.057	5.069	2.864	0.848
1526	51	1	19.50	7	0.25	50	7	3.803	0.978	1.029	0.873	0.322	19.286	5.497	5.531	3.036	0.850
1527	51	1	20.00	7.5	0.25	50	7.5	3.694	0.919	0.999	0.889	0.298	20.133	5.708	5.764	3.126	0.852
1528	51	1	20.50	8	0.25	50	8	3.546	0.885	0.972	0.921	0.278	20.925	6.402	5.987	3.216	0.853
1529	51	1	21.50	9	0.25	50	9	3.411	0.832	0.924	0.985	0.244	22.407	6.804	6.456	3.401	0.857
1530	51	1	22.50	10	0.25	50	10	3.263	0.807	0.887	1.032	0.218	23.747	7.193	6.897	3.592	0.860
1531	61	1	15.10	0.1	0.25	60	0.1	2.788	1.520	2.054	0.907	3.987	1.056	0.714	0.611	0.121	4.238
1532	61	1	15.25	0.25	0.25	60	0.25	5.484	2.433	3.402	0.908	3.690	2.042	1.203	1.138	0.278	3.571
1533	61	1	15.50	0.5	0.25	60	0.5	6.629	2.551	3.378	0.908	2.842	2.777	1.372	0.952	0.502	2.804
1534	61	1	15.75	0.75	0.25	60	0.75	6.542	2.327	2.950	0.951	2.338	3.170	1.503	1.359	0.779	2.374
1535	61	1	16.00	1	0.25	60	1	6.387	2.103	2.644	0.975	2.033	4.199	1.883	1.739	1.024	2.084
1536	61	1	16.25	1.25	0.25	60	1.25	6.302	1.958	2.448	0.982	1.759	5.234	2.227	2.098	1.315	1.778
1537	61	1	17.00	2	0.25	60	2	6.228	1.787	2.115	0.973	1.246	8.246	3.154	3.045	1.952	1.308
1538	61	1	17.50	2.5	0.25	60	2.5	6.166	1.736	1.977	0.957	1.028	10.074	3.685	3.571	2.270	1.163
1539	61	1	18.00	3	0.25	60	3	6.061	1.684	1.867	0.939	0.866	11.763	4.155	4.027	2.517	1.117
1540	61	1	19.00	4	0.25	60	4	5.759	1.573	1.694	0.906	0.645	14.800	4.953	4.823	2.870	0.864
1541	61	1	20.00	5	0.25	60	5	5.413	1.456	1.559	0.881	0.505	17.475	5.844	5.493	3.023	0.850
1542	61	1	21.00	6	0.25	60	6	5.065	1.355	1.448	0.869	0.412	19.887	6.453	6.092	3.238	0.850
1543	61	1	22.00	7	0.25	60	7	4.718	1.268	1.356	0.840	0.346	22.095	7.004	6.650	3.423	0.852
1544	61	1	22.50	7.5	0.25	60	7.5	4.573	1.190	1.314	0.854	0.320	23.091	7.450	6.911	3.517	0.854
1545	61	1	23.00	8	0.25	60	8	4.452	1.125	1.279	0.867	0.297	24.034	7.692	7.160	3.304	0.856
1546	61	1	24.00	9	0.25	60	9	4.209	1.095	1.218	0.910	0.260	25.921	8.143	7.682	3.493	0.859
1547	61	1	25.00	10	0.25	60	10	4.005	1.042	1.163	0.968	0.232	27.656	8.571	8.215	3.684	0.863
1548	71	1	17.60	0.1	0.25	70	0.1	3.150	1.653	2.287	0.906	4.359	1.243	0.832	0.703	0.126	4.519
1549	71	1	17.75	0.25	0.25	70	0.25	6.232	2.698	3.851	0.900	4.031	2.384	1.415	1.272	0.290	3.809
1550	71	1	18.00	0.5	0.25	70	0.5	7.480	2.839	3.805	0.933	3.078	3.169	1.615	1.531	0.518	2.974
1551	71	1	18.25	0.75	0.25	70	0.75	7.331	2.613	3.308	0.985	2.517	3.475	1.727	1.443	0.788	2.513
1552	71	1	18.50	1	0.25	70	1	7.156	2.371	2.968	1.012	2.183	4.575	2.150	1.872	1.037	2.209
1553	71	1	18.75	1.25	0.25	70	1.25	7.057	2.202	2.756	1.021	1.888	5.664	2.558	2.279	1.316	1.892
1554	71	1	19.50	2	0.25	70	2	7.082	2.066	2.445	1.016	1.337	8.912	3.726	3.392	2.075	1.373

STP-PT-074: Local Stress in Nozzles, Shells and Formed Heads from External Heads

Model								Membrane Stress Factors									
	OD	T	od	t	d/D	D/T	t/T	Branch					Header				
								Axial	In-Plane	Out-of-Plane	Torsional	Pressure	Axial	In-Plane	Out-of-Plane	Torsional	Pressure
1555	71	1	20.00	2.5	0.25	70	2.5	7.090	2.032	2.326	1.001	1.103	10.919	4.405	4.029	2.441	1.220
1556	71	1	20.50	3	0.25	70	3	7.039	1.989	2.234	0.983	0.929	12.802	5.015	4.601	2.735	1.117
1557	71	1	21.50	4	0.25	70	4	6.786	1.883	2.077	0.947	0.690	16.210	6.054	5.565	3.019	0.855
1558	71	1	22.50	5	0.25	70	5	6.440	1.764	1.942	0.917	0.539	19.244	6.918	6.389	3.327	0.853
1559	71	1	23.50	6	0.25	70	6	6.078	1.648	1.824	0.895	0.438	22.028	7.658	7.115	3.208	0.853
1560	71	1	24.50	7	0.25	70	7	5.725	1.542	1.719	0.826	0.367	24.613	8.312	7.778	3.421	0.854
1561	71	1	25.00	7.5	0.25	70	7.5	5.558	1.484	1.672	0.838	0.339	25.748	8.709	8.072	3.527	0.856
1562	71	1	25.50	8	0.25	70	8	5.395	1.449	1.628	0.847	0.314	26.927	8.998	8.386	3.631	0.858
1563	71	1	26.50	9	0.25	70	9	5.102	1.323	1.545	0.872	0.274	29.095	9.531	8.981	3.831	0.861
1564	71	1	27.50	10	0.25	70	10	4.844	1.254	1.477	0.912	0.243	31.207	10.005	9.574	4.026	0.865
1565	81	1	20.10	0.1	0.25	80	0.1	3.499	1.778	2.519	0.904	4.703	1.442	0.948	0.823	0.132	4.794
1566	81	1	20.25	0.25	0.25	80	0.25	6.936	2.942	4.281	0.898	4.338	2.660	1.622	1.470	0.303	4.040
1567	81	1	20.50	0.5	0.25	80	0.5	8.284	3.109	4.214	0.958	3.288	3.623	1.853	1.344	0.536	3.137
1568	81	1	20.75	0.75	0.25	80	0.75	8.088	2.883	3.651	1.014	2.676	3.826	1.966	1.539	0.786	2.645
1569	81	1	21.00	1	0.25	80	1	7.897	2.581	3.280	1.043	2.315	4.955	2.371	1.992	1.021	2.325
1570	81	1	21.25	1.25	0.25	80	1.25	7.805	2.475	3.058	1.054	2.003	6.105	2.832	2.451	1.329	1.998
1571	81	1	22.00	2	0.25	80	2	7.935	2.343	2.770	1.053	1.420	9.550	4.131	3.715	2.175	1.431
1572	81	1	22.50	2.5	0.25	80	2.5	8.021	2.328	2.679	1.040	1.172	11.710	4.909	4.462	2.583	1.270
1573	81	1	23.00	3	0.25	80	3	8.025	2.296	2.608	1.023	0.986	13.738	5.611	5.126	2.918	1.164
1574	81	1	24.00	4	0.25	80	4	7.835	2.196	2.478	0.986	0.731	17.476	6.818	6.276	3.251	0.886
1575	81	1	25.00	5	0.25	80	5	7.502	2.061	2.349	0.952	0.570	20.856	7.820	7.266	3.609	0.853
1576	81	1	26.00	6	0.25	80	6	7.125	1.940	2.226	0.925	0.462	23.945	8.675	8.127	3.894	0.852
1577	81	1	27.00	7	0.25	80	7	6.750	1.808	2.110	0.818	0.386	26.844	9.618	8.908	3.706	0.853
1578	81	1	27.50	7.5	0.25	80	7.5	6.574	1.760	2.057	0.827	0.356	28.198	9.977	9.271	3.833	0.854
1579	81	1	28.00	8	0.25	80	8	6.381	1.707	2.005	0.829	0.330	29.504	10.320	9.628	3.943	0.855
1580	81	1	29.00	9	0.25	80	9	6.061	1.598	1.911	0.858	0.287	32.056	10.936	10.317	4.152	0.859
1581	81	1	30.00	10	0.25	80	10	5.751	1.440	1.820	0.880	0.253	34.448	11.543	10.990	4.364	0.867
1582	91	1	22.60	0.1	0.25	90	0.1	3.827	1.895	2.743	0.902	5.113	1.626	1.059	0.925	0.138	5.051
1583	91	1	22.75	0.25	0.25	90	0.25	7.604	3.170	4.699	0.897	4.618	3.108	1.822	1.652	0.314	4.257
1584	91	1	23.00	0.5	0.25	90	0.5	9.046	3.361	4.606	0.976	3.478	4.075	2.018	1.460	0.552	3.289
1585	91	1	23.25	0.75	0.25	90	0.75	8.816	2.979	3.982	1.019	2.819	4.181	2.202	1.634	0.812	2.768
1586	91	1	23.50	1	0.25	90	1	8.613	2.842	3.579	1.049	2.435	5.372	2.578	2.124	1.058	2.434
1587	91	1	23.75	1.25	0.25	90	1.25	8.530	2.748	3.348	1.061	2.108	6.566	3.088	2.619	1.293	2.097
1588	91	1	24.50	2	0.25	90	2	8.792	2.619	3.099	1.086	1.497	10.188	4.552	4.028	2.261	1.484
1589	91	1	25.00	2.5	0.25	90	2.5	8.959	2.624	3.040	1.074	1.235	12.469	5.443	4.866	2.707	1.316
1590	91	1	25.50	3	0.25	90	3	9.025	2.605	2.996	1.058	1.038	14.634	6.255	5.640	3.082	1.205
1591	91	1	26.50	4	0.25	90	4	8.898	2.504	2.897	1.021	0.769	18.679	7.664	6.981	3.466	0.909
1592	91	1	27.50	5	0.25	90	5	8.582	2.381	2.778	0.889	0.599	22.355	8.837	8.127	3.875	0.856



STP-PT-074: Local Stress in Nozzles, Shells and Formed Heads from External Heads

Model								Membrane Stress Factors									
	OD	T	od	t	d/D	D/T	t/T	Branch					Header				
								Axial	In-Plane	Out-of-Plane	Torsional	Pressure	Axial	In-Plane	Out-of-Plane	Torsional	Pressure
1593	91	1	28.50	6	0.25	90	6	8.192	2.229	2.651	0.955	0.484	25.778	9.839	9.145	4.199	0.854
1594	91	1	29.50	7	0.25	90	7	7.799	2.102	2.526	0.816	0.404	28.998	10.794	10.064	3.997	0.855
1595	91	1	30.00	7.5	0.25	90	7.5	7.610	2.037	2.467	0.823	0.372	30.516	11.217	10.491	4.108	0.856
1596	91	1	30.50	8	0.25	90	8	7.411	1.975	2.408	0.830	0.344	31.984	11.610	10.900	4.231	0.857
1597	91	1	31.50	9	0.25	90	9	7.045	1.851	2.297	0.845	0.299	34.826	12.326	11.684	4.469	0.860
1598	91	1	32.50	10	0.25	90	10	6.685	1.747	2.197	0.865	0.264	37.446	13.137	12.438	4.691	0.868
1599	101	1	25.10	0.1	0.25	100	0.1	4.147	2.004	2.962	0.901	5.434	1.824	1.162	1.058	0.144	5.292
1600	101	1	25.25	0.25	0.25	100	0.25	8.233	3.381	5.098	0.901	4.876	3.427	2.011	1.800	0.290	4.460
1601	101	1	25.50	0.5	0.25	100	0.5	9.773	3.596	4.987	0.995	3.652	4.090	2.235	1.673	0.567	3.432
1602	101	1	25.75	0.75	0.25	100	0.75	9.513	3.216	4.300	1.039	2.950	4.547	2.436	1.765	0.835	2.882
1603	101	1	26.00	1	0.25	100	1	9.317	3.099	3.873	1.071	2.545	5.798	2.772	2.249	1.090	2.535
1604	101	1	26.25	1.25	0.25	100	1.25	9.262	3.020	3.641	1.086	2.204	7.039	3.329	2.782	1.336	2.191
1605	101	1	27.00	2	0.25	100	2	9.654	2.895	3.430	1.085	1.568	10.830	4.949	4.332	2.161	1.527
1606	101	1	27.50	2.5	0.25	100	2.5	9.910	2.920	3.410	1.072	1.294	13.217	5.950	5.266	2.657	1.266
1607	101	1	28.00	3	0.25	100	3	10.036	2.913	3.396	1.058	1.088	15.520	6.870	6.139	3.044	1.241
1608	101	1	29.00	4	0.25	100	4	9.974	2.829	3.333	1.016	0.805	19.816	8.480	7.654	3.660	0.931
1609	101	1	30.00	5	0.25	100	5	9.673	2.694	3.227	0.909	0.626	23.798	9.829	8.980	4.121	0.858
1610	101	1	31.00	6	0.25	100	6	9.280	2.533	3.099	0.891	0.505	27.507	10.980	10.150	3.952	0.856
1611	101	1	32.00	7	0.25	100	7	8.863	2.382	2.964	0.816	0.420	30.999	11.983	11.209	4.257	0.856
1612	101	1	32.50	7.5	0.25	100	7.5	8.655	2.309	2.898	0.824	0.387	32.659	12.441	11.705	4.395	0.857
1613	101	1	33.00	8	0.25	100	8	8.453	2.250	2.833	0.828	0.358	34.308	12.877	12.183	4.512	0.858
1614	101	1	34.00	9	0.25	100	9	8.061	2.118	2.709	0.831	0.310	37.428	13.698	13.085	4.764	0.861
1615	101	1	35.00	10	0.25	100	10	7.688	2.000	2.592	0.844	0.273	40.448	14.738	13.963	5.007	0.869
1616	251	1	62.60	0.1	0.25	250	0.1	7.909	3.124	5.765	0.908	8.761	4.239	2.273	2.749	0.222	7.937
1617	251	1	62.75	0.25	0.25	250	0.25	15.618	5.605	10.146	1.029	7.520	8.032	4.058	4.589	0.473	6.658
1618	251	1	63.00	0.5	0.25	250	0.5	18.294	6.321	9.803	1.192	5.399	9.501	4.893	3.784	0.739	4.966
1619	251	1	63.25	0.75	0.25	250	0.75	18.005	5.795	8.464	1.258	4.270	10.209	5.229	4.597	1.039	4.110
1620	251	1	63.50	1	0.25	250	1	18.278	5.993	7.850	1.312	3.665	12.542	5.895	5.487	1.370	3.627
1621	251	1	63.75	1.25	0.25	250	1.25	18.954	6.192	7.711	1.346	3.209	14.779	5.996	6.595	1.701	3.205
1622	251	1	64.50	2	0.25	250	2	22.207	6.957	8.666	1.406	2.358	21.192	9.336	10.104	2.673	2.326
1623	251	1	65.00	2.5	0.25	250	2.5	24.015	7.332	9.504	1.415	1.969	24.873	11.587	12.273	3.289	1.896
1624	251	1	65.50	3	0.25	250	3	25.239	7.519	10.195	1.409	1.663	28.175	13.788	14.248	3.869	1.626
1625	251	1	66.50	4	0.25	250	4	26.299	8.084	11.042	1.379	1.225	34.611	17.956	17.780	4.911	1.372
1626	251	1	67.50	5	0.25	250	5	26.261	7.810	11.351	1.348	0.939	41.276	21.751	20.977	5.796	1.156
1627	251	1	68.50	6	0.25	250	6	25.731	7.427	11.348	1.331	0.746	48.031	25.164	23.941	6.545	0.876
1628	251	1	69.50	7	0.25	250	7	25.005	7.016	11.171	1.104	0.610	55.038	28.248	27.165	7.186	0.875
1629	251	1	70.00	7.5	0.25	250	7.5	24.605	6.800	11.039	1.085	0.557	58.431	30.260	28.764	7.653	0.559
1630	251	1	70.50	8	0.25	250	8	24.207	6.602	10.898	1.074	0.512	61.912	31.689	30.505	7.931	0.565

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Model								Membrane Stress Factors									
	OD	T	od	t	d/D	D/T	t/T	Branch					Header				
								Axial	In-Plane	Out-of-Plane	Torsional	Pressure	Axial	In-Plane	Out-of-Plane	Torsional	Pressure
1631	251	1	71.50	9	0.25	250	9	23.431	6.209	10.588	1.049	0.438	68.693	34.354	33.575	8.439	0.578
1632	251	1	72.50	10	0.25	250	10	22.683	5.880	10.257	1.029	0.381	75.364	36.813	36.601	8.900	0.589
1633	501	1	125.10	0.1	0.25	500	0.1	12.767	4.530	9.553	0.968	12.077	7.896	3.500	5.674	0.329	10.970
1634	501	1	125.25	0.25	0.25	500	0.25	25.202	7.867	16.959	1.222	10.160	15.351	6.514	9.722	0.707	9.130
1635	501	1	125.50	0.5	0.25	500	0.5	29.556	9.386	16.513	1.458	7.145	16.002	8.104	7.876	1.049	6.646
1636	501	1	125.75	0.75	0.25	500	0.75	29.832	9.791	14.614	1.555	5.592	19.693	8.326	9.259	1.292	5.421
1637	501	1	126.00	1	0.25	500	1	31.426	10.399	14.120	1.650	4.798	24.142	9.491	11.336	1.600	4.772
1638	501	1	126.25	1.25	0.25	500	1.25	33.848	11.126	14.534	1.729	4.240	28.560	10.554	13.635	1.983	4.266
1639	501	1	127.00	2	0.25	500	2	42.907	13.195	18.215	1.916	3.210	40.894	13.736	20.883	3.146	3.126
1640	501	1	127.50	2.5	0.25	500	2.5	47.920	14.136	20.892	1.974	2.723	47.541	17.321	25.257	3.916	2.621
1641	501	1	128.00	3	0.25	500	3	51.569	15.451	23.138	1.990	2.327	53.075	20.943	29.163	4.665	2.117
1642	501	1	129.00	4	0.25	500	4	55.486	15.295	26.176	1.949	1.736	62.201	28.088	35.899	6.083	1.705
1643	501	1	130.00	5	0.25	500	5	56.468	15.140	27.686	1.804	1.335	70.331	34.921	41.802	7.813	1.470
1644	501	1	131.00	6	0.25	500	6	55.933	14.347	28.248	1.683	1.055	78.410	41.373	47.332	9.093	1.277
1645	501	1	132.00	7	0.25	500	7	54.651	13.657	28.227	1.592	0.855	87.045	47.917	51.985	9.817	1.182
1646	501	1	132.50	7.5	0.25	500	7.5	53.897	13.780	28.094	1.584	0.776	92.109	50.897	54.644	10.321	0.511
1647	501	1	133.00	8	0.25	500	8	53.092	13.456	27.890	1.573	0.708	97.403	53.768	57.316	10.799	0.507
1648	501	1	134.00	9	0.25	500	9	51.455	12.644	27.375	1.551	0.597	108.301	59.262	62.570	11.692	0.505
1649	501	1	135.00	10	0.25	500	10	49.851	12.201	26.766	1.531	0.512	119.403	64.470	69.189	12.510	0.507
1651	751	1	187.75	0.25	0.25	750	0.25	33.382	10.242	23.037	1.423	12.058	21.669	8.527	14.608	0.903	10.938
1652	751	1	188.00	0.5	0.25	750	0.5	39.411	12.462	22.604	1.714	8.407	23.079	10.801	10.662	1.320	7.870
1653	751	1	188.25	0.75	0.25	750	0.75	40.678	13.181	20.426	1.834	6.547	28.520	11.525	12.430	1.552	6.370
1654	751	1	188.50	1	0.25	750	1	43.849	14.250	20.282	1.967	5.612	35.039	13.259	15.266	1.871	5.596
1655	751	1	188.75	1.25	0.25	750	1.25	48.241	15.442	21.404	2.096	4.980	41.623	14.913	18.533	2.170	5.024
1656	751	1	189.50	2	0.25	750	2	63.305	18.768	28.094	2.414	3.825	59.921	15.775	29.046	3.078	3.778
1657	751	1	190.00	2.5	0.25	750	2.5	71.702	20.293	32.734	2.527	3.273	69.505	18.293	35.377	3.642	2.990
1658	751	1	190.50	3	0.25	750	3	78.052	21.783	36.718	2.575	2.818	77.123	20.622	40.949	5.092	2.559
1659	751	1	191.50	4	0.25	750	4	85.469	22.444	42.251	2.607	2.127	88.508	25.665	50.134	6.865	2.000
1660	751	1	192.50	5	0.25	750	5	88.099	21.766	45.297	2.473	1.647	97.680	31.113	57.897	8.573	1.780
1661	751	1	193.50	6	0.25	750	6	88.022	21.122	46.675	2.307	1.307	106.766	36.858	65.207	10.187	1.678
1662	751	1	194.50	7	0.25	750	7	86.545	20.317	47.042	2.133	1.060	116.503	42.800	72.496	11.691	0.530
1663	751	1	195.00	7.5	0.25	750	7.5	85.500	19.903	46.974	2.054	0.960	122.065	45.790	75.708	12.469	0.518
1664	751	1	195.50	8	0.25	750	8	84.336	19.480	46.782	1.982	0.875	128.355	48.826	79.514	13.160	0.507
1665	751	1	196.50	9	0.25	750	9	81.898	18.659	46.172	1.848	0.735	141.024	54.494	87.256	14.468	0.490
1666	751	1	197.50	10	0.25	750	10	79.383	17.886	45.355	1.733	0.627	154.490	60.168	96.121	15.683	0.480
1668	1001	1	250.25	0.25	0.25	1000	0.25	40.843	12.335	28.763	1.603	13.605	27.244	10.271	19.310	1.075	12.435
1669	1001	1	250.50	0.5	0.25	1000	0.5	48.386	15.157	28.372	1.967	9.440	29.622	13.059	14.206	1.563	8.880
1670	1001	1	250.75	0.75	0.25	1000	0.75	50.687	16.196	26.024	2.110	7.330	36.959	14.399	16.686	1.806	7.147

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Model								Membrane Stress Factors									
	OD	T	od	t	d/D	D/T	t/T	Branch					Header				
								Axial	In-Plane	Out-of-Plane	Torsional	Pressure	Axial	In-Plane	Out-of-Plane	Torsional	Pressure
1671	1001	1	251.00	1	0.25	1000	1	55.482	17.671	26.311	2.268	6.278	45.610	16.664	20.531	2.160	6.267
1672	1001	1	251.25	1.25	0.25	1000	1.25	61.807	19.249	28.235	2.450	5.582	54.364	18.704	24.938	2.487	5.635
1673	1001	1	252.00	2	0.25	1000	2	82.732	23.810	38.004	2.895	4.323	78.634	19.593	39.047	3.367	4.314
1674	1001	1	252.50	2.5	0.25	1000	2.5	94.511	25.907	44.711	3.064	3.718	91.372	22.382	47.588	3.972	3.451
1675	1001	1	253.00	3	0.25	1000	3	103.588	27.257	50.429	3.289	3.217	101.437	24.769	55.004	4.573	2.963
1676	1001	1	254.00	4	0.25	1000	4	114.787	28.404	58.642	3.265	2.448	115.873	29.767	67.000	7.378	2.277
1677	1001	1	255.00	5	0.25	1000	5	119.402	28.393	63.373	3.125	1.907	126.468	35.204	76.751	9.285	1.917
1678	1001	1	256.00	6	0.25	1000	6	120.148	27.512	65.749	2.923	1.519	136.245	41.098	85.629	11.121	1.785
1679	1001	1	257.00	7	0.25	1000	7	118.735	26.499	66.631	2.722	1.236	146.538	47.312	94.349	12.862	1.702
1680	1001	1	257.50	7.5	0.25	1000	7.5	117.541	25.933	66.689	2.633	1.122	152.097	50.521	98.814	13.696	1.675
1681	1001	1	258.00	8	0.25	1000	8	116.132	25.391	66.557	2.525	1.022	157.964	53.905	103.382	14.501	0.524
1682	1001	1	259.00	9	0.25	1000	9	113.086	24.382	65.966	2.360	0.859	171.103	60.238	112.797	16.044	0.502
1683	1001	1	260.00	10	0.25	1000	10	109.785	23.406	65.004	2.198	0.732	187.076	66.854	122.032	17.569	0.485
1685	1251	1	312.75	0.25	0.25	1250	0.25	47.924	14.210	34.419	1.790	15.028	32.279	11.792	23.684	1.230	13.746
1686	1251	1	313.00	0.5	0.25	1250	0.5	56.918	17.555	34.028	2.208	10.340	35.765	14.638	17.656	1.784	9.763
1687	1251	1	313.25	0.75	0.25	1250	0.75	60.163	18.937	31.533	2.376	8.012	44.970	17.002	20.886	2.055	7.822
1688	1251	1	313.50	1	0.25	1250	1	66.511	20.798	32.243	2.576	6.857	55.682	19.686	25.728	2.433	6.845
1689	1251	1	313.75	1.25	0.25	1250	1.25	74.659	22.816	34.961	2.788	6.104	66.546	22.212	31.277	2.708	6.165
1690	1251	1	314.50	2	0.25	1250	2	101.353	28.456	47.858	3.357	4.750	96.670	23.285	48.962	3.708	4.776
1691	1251	1	315.00	2.5	0.25	1250	2.5	116.478	31.080	56.571	3.582	4.100	112.559	26.157	59.625	4.312	3.858
1692	1251	1	315.50	3	0.25	1250	3	128.321	32.812	64.109	3.700	3.558	125.115	28.837	68.908	4.899	3.321
1693	1251	1	316.50	4	0.25	1250	4	143.420	34.322	75.103	3.895	2.722	142.796	33.723	83.769	7.783	2.445
1694	1251	1	317.50	5	0.25	1250	5	150.222	34.294	82.965	3.744	2.131	155.003	38.880	95.662	9.839	2.045
1695	1251	1	318.50	6	0.25	1250	6	152.001	33.477	85.569	3.543	1.705	165.446	44.575	105.936	11.844	1.878
1696	1251	1	319.50	7	0.25	1250	7	150.835	32.337	86.853	3.309	1.391	176.230	51.007	116.275	13.767	1.774
1697	1251	1	320.00	7.5	0.25	1250	7.5	149.609	31.711	86.876	3.187	1.264	182.035	54.164	121.101	14.699	1.738
1698	1251	1	320.50	8	0.25	1250	8	148.072	31.096	86.912	3.086	1.154	188.080	57.517	126.292	15.603	1.709
1699	1251	1	321.50	9	0.25	1250	9	144.475	29.808	86.327	2.873	0.971	201.538	64.087	137.119	17.343	0.518
1700	1251	1	322.50	10	0.25	1250	10	140.532	28.603	85.310	2.677	0.829	217.596	107.207	148.437	18.985	0.497
1702	1501	1	375.25	0.25	0.25	1500	0.25	54.754	15.942	40.044	1.979	16.340	37.204	13.148	27.930	1.368	14.917
1703	1501	1	375.50	0.5	0.25	1500	0.5	65.113	19.788	39.635	2.440	11.153	41.613	16.630	21.182	1.984	10.559
1704	1501	1	375.75	0.75	0.25	1500	0.75	69.226	21.466	36.948	2.640	8.627	52.665	19.425	25.241	2.288	8.436
1705	1501	1	376.00	1	0.25	1500	1	77.159	23.663	38.126	2.865	7.380	65.387	22.558	31.125	2.705	7.375
1706	1501	1	376.25	1.25	0.25	1500	1.25	87.073	26.041	41.653	3.109	6.575	78.321	20.244	37.872	3.003	6.648
1707	1501	1	377.00	2	0.25	1500	2	119.431	32.764	57.688	3.798	5.134	114.167	26.651	59.193	4.060	5.196
1708	1501	1	377.50	2.5	0.25	1500	2.5	137.744	35.901	68.174	4.078	4.442	133.205	30.331	71.826	4.668	4.200
1709	1501	1	378.00	3	0.25	1500	3	152.360	37.986	77.771	4.236	3.863	148.307	33.101	83.280	5.239	3.625
1710	1501	1	379.00	4	0.25	1500	4	171.374	39.893	91.609	4.479	2.968	169.472	37.658	101.220	8.117	2.684

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Model								Membrane Stress Factors									
	OD	T	od	t	d/D	D/T	t/T	Branch					Header				
								Axial	In-Plane	Out-of-Plane	Torsional	Pressure	Axial	In-Plane	Out-of-Plane	Torsional	Pressure
1711	1501	1	380.00	5	0.25	1500	5	180.557	39.941	102.370	4.340	2.331	183.237	42.470	114.467	10.297	2.166
1712	1501	1	381.00	6	0.25	1500	6	183.479	39.110	105.956	4.122	1.871	194.465	47.882	126.250	12.439	1.964
1713	1501	1	382.00	7	0.25	1500	7	182.729	37.846	107.340	3.860	1.531	205.557	53.966	137.473	14.514	1.838
1714	1501	1	382.50	7.5	0.25	1500	7.5	181.529	37.141	107.378	3.732	1.394	211.417	57.180	143.013	15.524	1.794
1715	1501	1	383.00	8	0.25	1500	8	179.854	36.409	107.212	3.619	1.275	217.767	60.534	148.551	16.506	1.758
1716	1501	1	384.00	9	0.25	1500	9	175.879	34.990	106.977	3.362	1.077	231.654	104.367	160.893	18.414	1.706
1717	1501	1	385.00	10	0.25	1500	10	171.395	33.581	105.971	3.146	0.921	248.190	116.424	173.600	20.229	0.511
1720	1751	1	438.00	0.5	0.25	1750	0.5	73.018	21.857	45.281	2.675	11.899	47.213	18.480	24.452	2.057	11.288
1721	1751	1	438.25	0.75	0.25	1750	0.75	78.080	23.792	42.352	2.895	9.188	60.054	21.641	29.242	2.510	8.989
1722	1751	1	438.50	1	0.25	1750	1	87.395	22.120	43.975	3.157	7.856	74.748	25.162	36.180	2.886	7.848
1723	1751	1	438.75	1.25	0.25	1750	1.25	99.100	29.099	48.335	3.434	7.003	89.691	22.902	44.069	3.294	7.076
1724	1751	1	439.50	2	0.25	1750	2	136.909	36.748	67.392	4.225	5.481	131.156	30.382	68.880	4.411	5.573
1725	1751	1	440.00	2.5	0.25	1750	2.5	158.487	40.392	80.194	4.561	4.750	153.303	33.858	83.900	5.031	4.796
1726	1751	1	440.50	3	0.25	1750	3	175.808	42.830	91.336	4.754	4.139	170.915	36.807	96.963	5.587	3.925
1727	1751	1	441.50	4	0.25	1750	4	198.860	45.151	108.405	5.027	3.189	195.544	41.528	118.184	8.418	2.908
1728	1751	1	442.50	5	0.25	1750	5	210.330	45.319	121.803	4.898	2.513	211.408	46.050	133.757	10.677	2.278
1729	1751	1	443.50	6	0.25	1750	6	214.607	44.456	126.571	4.673	2.024	223.531	51.043	147.308	12.920	2.051
1730	1751	1	444.50	7	0.25	1750	7	214.301	43.100	127.817	4.409	1.662	235.018	56.749	158.899	15.113	1.901
1731	1751	1	445.00	7.5	0.25	1750	7.5	213.195	42.291	128.637	4.255	1.516	241.091	59.930	165.829	16.181	1.848
1732	1751	1	445.50	8	0.25	1750	8	211.580	41.521	128.528	4.135	1.387	247.503	97.827	172.123	17.230	1.804
1733	1751	1	446.50	9	0.25	1750	9	207.279	39.897	127.905	3.851	1.174	261.648	111.076	185.227	19.931	1.742
1734	1751	1	447.50	10	0.25	1750	10	202.276	38.351	126.901	3.602	1.005	278.752	124.090	199.198	21.970	0.525
1737	2001	1	500.50	0.5	0.25	2000	0.5	80.765	23.797	51.029	2.899	12.622	52.594	20.189	27.649	2.232	11.968
1738	2001	1	500.75	0.75	0.25	2000	0.75	86.569	22.271	47.797	3.143	9.711	67.202	23.704	33.247	2.723	9.504
1739	2001	1	501.00	1	0.25	2000	1	97.255	24.548	49.812	3.440	8.298	83.799	23.001	41.187	3.127	8.285
1740	2001	1	501.25	1.25	0.25	2000	1.25	110.739	27.077	54.801	3.753	7.401	100.712	25.456	50.093	3.589	7.472
1741	2001	1	502.00	2	0.25	2000	2	153.879	40.505	77.008	4.641	5.803	147.680	33.756	78.422	4.764	5.898
1742	2001	1	502.50	2.5	0.25	2000	2.5	178.641	44.599	91.787	5.025	5.036	172.887	37.845	95.526	5.393	5.101
1743	2001	1	503.00	3	0.25	2000	3	198.694	47.389	104.872	5.255	4.397	193.020	40.951	110.554	5.942	4.203
1744	2001	1	504.00	4	0.25	2000	4	225.791	50.072	130.937	5.548	3.400	221.140	45.325	134.281	8.692	3.198
1745	2001	1	505.00	5	0.25	2000	5	239.805	50.408	140.911	5.428	2.687	238.918	49.513	151.735	11.027	2.391
1746	2001	1	506.00	6	0.25	2000	6	245.279	49.525	147.604	5.188	2.169	251.906	54.092	167.626	13.366	2.133
1747	2001	1	507.00	7	0.25	2000	7	245.662	48.053	149.558	4.920	1.784	263.643	59.474	180.542	15.665	1.959
1748	2001	1	507.50	7.5	0.25	2000	7.5	244.689	47.240	150.022	4.763	1.628	269.805	95.870	187.286	16.792	1.906
1749	2001	1	508.00	8	0.25	2000	8	243.003	46.389	150.185	4.617	1.492	276.353	103.021	194.262	18.471	1.874
1750	2001	1	509.00	9	0.25	2000	9	238.542	44.648	149.735	4.331	1.264	291.305	117.104	208.949	20.715	1.772
1751	2001	1	510.00	10	0.25	2000	10	233.026	42.731	147.931	4.068	1.085	309.574	131.037	223.356	22.877	1.723
1754	2251	1	563.00	0.5	0.25	2250	0.5	88.435	25.671	56.679	3.125	13.307	57.750	21.790	30.889	2.392	12.603

STP-PT-074: Local Stress in Nozzles, Shells and Formed Heads from External Heads

Model								Membrane Stress Factors									
	OD	T	od	t	d/D	D/T	t/T	Branch					Header				
								Axial	In-Plane	Out-of-Plane	Torsional	Pressure	Axial	In-Plane	Out-of-Plane	Torsional	Pressure
1755	2251	1	563.25	0.75	0.25	2250	0.75	94.855	24.345	53.101	3.385	10.204	74.116	25.668	37.333	2.869	9.995
1756	2251	1	563.50	1	0.25	2250	1	106.891	26.961	55.306	3.721	8.716	92.601	25.168	46.174	3.380	8.702
1757	2251	1	563.75	1.25	0.25	2250	1.25	121.859	29.847	61.250	4.066	7.776	111.393	27.902	56.403	3.858	7.855
1758	2251	1	564.50	2	0.25	2250	2	170.509	44.159	86.723	5.034	6.110	163.714	37.022	88.455	5.114	6.225
1759	2251	1	565.00	2.5	0.25	2250	2.5	198.478	48.660	103.574	5.473	5.315	192.054	41.156	107.783	5.768	5.396
1760	2251	1	565.50	3	0.25	2250	3	220.999	51.744	118.112	5.736	4.644	214.623	44.795	124.431	6.307	4.445
1761	2251	1	566.50	4	0.25	2250	4	252.045	54.808	148.913	5.915	3.599	246.439	49.187	151.311	8.942	3.390
1762	2251	1	567.50	5	0.25	2250	5	268.672	55.241	160.333	5.931	2.849	266.238	53.032	170.726	11.336	2.515
1763	2251	1	568.50	6	0.25	2250	6	275.621	54.363	167.859	5.693	2.303	280.328	57.218	187.848	13.749	2.208
1764	2251	1	569.50	7	0.25	2250	7	276.645	52.857	172.308	5.413	1.897	292.647	91.978	204.190	16.666	2.019
1765	2251	1	570.00	7.5	0.25	2250	7.5	275.781	51.968	168.877	5.251	1.733	298.735	100.041	206.458	17.740	1.960
1766	2251	1	570.50	8	0.25	2250	8	274.122	51.060	171.256	5.097	1.589	305.690	107.561	216.575	19.069	1.926
1767	2251	1	571.50	9	0.25	2250	9	269.491	49.137	171.947	4.802	1.349	320.572	122.482	232.378	21.418	1.803
1768	2251	1	572.50	10	0.25	2250	10	263.529	47.289	168.984	4.517	1.159	340.114	137.197	247.271	23.682	1.746
1771	2501	1	625.50	0.5	0.25	2500	0.5	95.986	24.508	62.665	3.334	13.952	62.734	23.340	33.920	2.540	13.210
1772	2501	1	625.75	0.75	0.25	2500	0.75	102.980	26.363	58.642	3.620	10.668	80.759	27.498	41.157	3.063	10.452
1773	2501	1	626.00	1	0.25	2500	1	116.160	29.260	61.246	3.976	9.108	101.079	26.490	51.109	3.620	9.091
1774	2501	1	626.25	1.25	0.25	2500	1.25	132.823	32.271	67.598	4.359	8.128	121.759	30.155	62.224	4.143	8.202
1775	2501	1	627.00	2	0.25	2500	2	186.263	47.475	95.817	5.430	6.404	179.359	40.270	97.485	5.460	6.501
1776	2501	1	627.50	2.5	0.25	2500	2.5	217.351	52.450	114.835	5.908	5.576	210.639	45.011	118.969	6.127	5.637
1777	2501	1	628.00	3	0.25	2500	3	242.692	55.873	131.355	6.210	4.878	235.940	48.235	137.493	6.677	4.691
1778	2501	1	629.00	4	0.25	2500	4	280.008	59.297	166.625	6.423	3.786	271.397	53.192	167.274	9.156	3.586
1779	2501	1	630.00	5	0.25	2500	5	296.927	59.895	180.501	6.353	3.001	293.540	56.461	189.434	11.630	2.641
1780	2501	1	631.00	6	0.25	2500	6	305.444	58.989	188.511	6.139	2.430	308.877	60.209	207.232	14.111	2.296
1781	2501	1	632.00	7	0.25	2500	7	307.337	57.438	192.241	5.860	2.004	321.724	96.313	223.052	17.128	2.079
1782	2501	1	632.50	7.5	0.25	2500	7.5	306.624	56.521	192.840	5.714	1.832	327.962	104.069	230.550	18.278	2.011
1783	2501	1	633.00	8	0.25	2500	8	304.979	55.520	193.699	5.560	1.681	335.996	111.763	239.084	19.616	1.974
1784	2501	1	634.00	9	0.25	2500	9	300.107	53.521	193.322	5.260	1.428	352.096	127.254	255.431	21.895	1.825
1785	2501	1	635.00	10	0.25	2500	10	293.975	51.517	189.143	4.968	1.228	372.751	142.622	268.854	24.420	1.766
1786	9	1	2.50	0.1	0.3	8	0.1	1.006	0.986	0.956	0.933	2.409	0.189	0.160	0.180	0.084	1.809
1787	9	1	2.65	0.25	0.3	8	0.25	1.120	0.920	0.914	0.884	1.022	0.339	0.231	0.342	0.182	1.515
1788	9	1	2.90	0.5	0.3	8	0.5	1.309	0.835	0.833	0.781	0.763	0.542	0.343	0.413	0.311	1.209
1789	9	1	3.15	0.75	0.3	8	0.75	1.389	0.763	0.764	0.721	0.661	1.296	0.410	0.475	0.402	1.062
1790	9	1	3.40	1	0.3	8	1	1.401	0.722	0.722	0.669	0.604	1.631	0.462	0.529	0.469	0.967
1791	9	1	3.65	1.25	0.3	8	1.25	1.393	0.665	0.665	0.657	0.522	1.930	0.497	0.566	0.524	0.843
1792	9	1	4.40	2	0.3	8	2	1.215	0.552	0.552	0.658	0.364	2.999	0.601	0.713	0.663	0.851
1803	17	1	4.90	0.1	0.3	16	0.1	1.182	1.004	1.027	0.965	2.592	0.315	0.181	0.267	0.094	2.613
1804	17	1	5.05	0.25	0.3	16	0.25	1.806	1.037	1.288	0.963	1.695	0.539	0.326	0.511	0.215	2.210

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Model								Membrane Stress Factors									
	OD	T	od	t	d/D	D/T	t/T	Branch					Header				
								Axial	In-Plane	Out-of-Plane	Torsional	Pressure	Axial	In-Plane	Out-of-Plane	Torsional	Pressure
1805	17	1	5.30	0.5	0.3	16	0.5	2.248	1.019	1.292	0.902	1.347	0.864	0.532	0.728	0.414	1.771
1806	17	1	5.55	0.75	0.3	16	0.75	2.367	0.902	1.168	0.841	1.157	1.732	0.690	0.765	0.583	1.474
1807	17	1	5.80	1	0.3	16	1	2.371	0.820	1.038	0.803	1.042	2.276	0.676	0.891	0.720	1.307
1808	17	1	6.05	1.25	0.3	16	1.25	2.368	0.793	0.929	0.771	0.906	2.797	0.744	0.980	0.834	1.109
1809	17	1	6.80	2	0.3	16	2	2.183	0.701	0.701	0.709	0.647	4.081	0.917	1.192	1.052	0.861
1810	17	1	7.30	2.5	0.3	16	2.5	1.998	0.665	0.658	0.716	0.536	4.766	1.040	1.328	1.147	0.860
1811	17	1	7.80	3	0.3	16	3	1.841	0.623	0.621	0.739	0.452	5.340	1.113	1.458	1.208	0.931
1812	17	1	8.80	4	0.3	16	4	1.575	0.555	0.555	0.809	0.328	6.202	1.474	1.710	1.378	0.844
1820	25	1	7.30	0.1	0.3	24	0.1	1.471	1.007	1.249	0.976	2.788	0.483	0.294	0.305	0.104	3.191
1821	25	1	7.45	0.25	0.3	24	0.25	2.543	1.335	1.786	0.974	2.349	0.826	0.495	0.636	0.232	2.696
1822	25	1	7.70	0.5	0.3	24	0.5	3.169	1.364	1.814	0.909	1.866	1.363	0.683	0.912	0.467	2.150
1823	25	1	7.95	0.75	0.3	24	0.75	3.269	1.232	1.634	0.885	1.577	2.070	0.924	0.974	0.688	1.817
1824	25	1	8.20	1	0.3	24	1	3.245	1.157	1.463	0.860	1.397	2.758	1.126	1.175	0.878	1.580
1825	25	1	8.45	1.25	0.3	24	1.25	3.223	1.056	1.332	0.843	1.209	3.448	1.066	1.342	1.051	1.331
1826	25	1	9.20	2	0.3	24	2	3.012	0.857	1.031	0.797	0.855	5.232	1.426	1.711	1.397	1.026
1827	25	1	9.70	2.5	0.3	24	2.5	2.832	0.826	0.889	0.789	0.707	6.219	1.591	1.907	1.536	0.935
1828	25	1	10.20	3	0.3	24	3	2.654	0.750	0.782	0.787	0.597	7.083	1.752	2.088	1.640	0.910
1829	25	1	11.20	4	0.3	24	4	2.342	0.662	0.662	0.804	0.449	8.529	2.088	2.425	1.805	0.916
1830	25	1	12.20	5	0.3	24	5	2.055	0.599	0.594	0.858	0.355	9.684	2.326	2.738	1.947	0.938
1831	25	1	13.20	6	0.3	24	6	1.870	0.556	0.556	0.918	0.284	10.484	2.873	3.009	2.110	0.864
1832	25	1	14.20	7	0.3	24	7	1.760	0.510	0.511	1.035	0.239	11.229	3.146	3.316	2.296	0.864
1837	33	1	9.70	0.1	0.3	32	0.1	1.777	1.127	1.474	0.915	3.285	0.645	0.416	0.383	0.114	3.652
1838	33	1	9.85	0.25	0.3	32	0.25	3.267	1.624	2.265	0.966	2.886	1.140	0.694	0.774	0.254	3.081
1839	33	1	10.10	0.5	0.3	32	0.5	4.033	1.685	2.300	0.913	2.279	1.625	0.822	0.816	0.496	2.438
1840	33	1	10.35	0.75	0.3	32	0.75	4.087	1.529	2.058	0.906	1.904	2.344	1.123	1.133	0.755	2.059
1841	33	1	10.60	1	0.3	32	1	4.027	1.421	1.850	0.897	1.669	3.145	1.393	1.402	0.985	1.795
1842	33	1	10.85	1.25	0.3	32	1.25	3.984	1.305	1.699	0.889	1.440	3.954	1.476	1.639	1.201	1.506
1843	33	1	11.60	2	0.3	32	2	3.777	1.176	1.371	0.878	1.013	6.142	1.957	2.189	1.670	1.129
1844	33	1	12.10	2.5	0.3	32	2.5	3.602	1.086	1.215	0.863	0.835	7.397	2.218	2.476	1.867	1.034
1845	33	1	12.60	3	0.3	32	3	3.421	1.017	1.092	0.850	0.704	8.516	2.449	2.728	2.009	0.959
1846	33	1	13.60	4	0.3	32	4	3.074	0.884	0.914	0.835	0.527	10.446	2.847	3.169	2.214	0.912
1847	33	1	14.60	5	0.3	32	5	2.773	0.797	0.796	0.844	0.416	12.057	3.337	3.561	2.379	0.848
1848	33	1	15.60	6	0.3	32	6	2.523	0.729	0.714	0.877	0.342	13.409	3.683	3.923	2.517	0.851
1849	33	1	16.60	7	0.3	32	7	2.289	0.675	0.657	0.939	0.283	14.366	3.970	4.218	2.681	0.813
1850	33	1	17.10	7.5	0.3	32	7.5	2.214	0.658	0.640	0.978	0.262	14.862	4.113	4.391	2.771	0.821
1851	33	1	17.60	8	0.3	32	8	2.139	0.646	0.629	1.020	0.243	15.317	4.269	4.566	2.863	0.828
1852	33	1	18.60	9	0.3	32	9	2.060	0.633	0.629	1.091	0.215	16.175	4.515	4.922	3.056	0.839
1854	41	1	12.10	0.1	0.3	40	0.1	2.089	1.248	1.695	0.916	3.733	0.737	0.535	0.479	0.123	4.042



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Model								Membrane Stress Factors									
	OD	T	od	t	d/D	D/T	t/T	Branch					Header				
								Axial	In-Plane	Out-of-Plane	Torsional	Pressure	Axial	In-Plane	Out-of-Plane	Torsional	Pressure
1855	41	1	12.25	0.25	0.3	40	0.25	3.971	1.903	2.722	0.926	3.344	1.471	0.898	0.934	0.273	3.408
1856	41	1	12.50	0.5	0.3	40	0.5	4.848	1.977	2.753	0.915	2.616	2.001	1.037	0.889	0.522	2.677
1857	41	1	12.75	0.75	0.3	40	0.75	4.842	1.788	2.449	0.920	2.165	2.583	1.298	1.260	0.803	2.256
1858	41	1	13.00	1	0.3	40	1	4.742	1.671	2.207	0.945	1.886	3.479	1.627	1.592	1.060	1.969
1859	41	1	13.25	1.25	0.3	40	1.25	4.678	1.611	2.039	0.954	1.624	4.385	1.861	1.895	1.310	1.661
1860	41	1	14.00	2	0.3	40	2	4.498	1.418	1.704	0.945	1.140	6.908	2.547	2.630	1.886	1.225
1861	41	1	14.50	2.5	0.3	40	2.5	4.349	1.348	1.546	0.928	0.938	8.395	2.921	3.019	2.144	1.120
1862	41	1	15.00	3	0.3	40	3	4.181	1.289	1.418	0.910	0.790	9.740	3.245	3.354	2.333	1.036
1863	41	1	16.00	4	0.3	40	4	3.834	1.181	1.227	0.881	0.589	12.103	3.792	3.928	2.595	0.908
1864	41	1	17.00	5	0.3	40	5	3.505	1.078	1.089	0.866	0.463	14.137	4.256	4.422	2.788	0.852
1865	41	1	18.00	6	0.3	40	6	3.211	0.952	0.986	0.870	0.379	15.896	4.671	4.862	2.915	0.855
1866	41	1	19.00	7	0.3	40	7	2.954	0.885	0.906	0.892	0.319	17.448	5.487	5.284	3.095	0.860
1867	41	1	19.50	7.5	0.3	40	7.5	2.844	0.850	0.874	0.911	0.296	18.172	5.675	5.497	3.191	0.862
1868	41	1	20.00	8	0.3	40	8	2.740	0.823	0.844	0.934	0.276	18.851	5.861	5.707	3.287	0.808
1869	41	1	21.00	9	0.3	40	9	2.552	0.779	0.814	1.000	0.238	19.689	5.460	5.990	3.451	0.812
1870	41	1	22.00	10	0.3	40	10	2.398	0.748	0.787	1.073	0.213	20.729	5.930	6.382	3.635	0.826
1871	51	1	15.10	0.1	0.3	50	0.1	2.486	1.396	1.964	0.916	4.206	0.950	0.674	0.597	0.131	4.452
1872	51	1	15.25	0.25	0.3	50	0.25	4.815	2.207	3.259	0.921	3.836	1.844	1.142	1.108	0.303	3.755
1873	51	1	15.50	0.5	0.3	50	0.5	5.812	2.333	3.280	0.920	2.966	2.450	1.309	1.355	0.549	2.928
1874	51	1	15.75	0.75	0.3	50	0.75	5.729	2.141	2.900	0.973	2.432	2.884	1.537	1.392	0.825	2.461
1875	51	1	16.00	1	0.3	50	1	5.580	1.968	2.617	1.007	2.107	3.851	1.926	1.782	1.130	2.150
1876	51	1	16.25	1.25	0.3	50	1.25	5.491	1.884	2.435	1.020	1.813	4.844	2.276	2.154	1.409	1.825
1877	51	1	17.00	2	0.3	50	2	5.366	1.729	2.107	1.015	1.271	7.707	3.197	3.108	2.093	1.323
1878	51	1	17.50	2.5	0.3	50	2.5	5.268	1.681	1.961	0.998	1.045	9.436	3.714	3.629	2.422	1.206
1879	51	1	18.00	3	0.3	50	3	5.137	1.630	1.843	0.979	0.879	11.037	4.081	4.087	2.676	1.118
1880	51	1	19.00	4	0.3	50	4	4.818	1.520	1.652	0.940	0.653	13.889	4.821	4.852	3.024	0.857
1881	51	1	20.00	5	0.3	50	5	4.479	1.401	1.502	0.910	0.512	16.398	5.430	5.508	3.266	0.857
1882	51	1	21.00	6	0.3	50	6	4.152	1.242	1.379	0.893	0.417	18.645	6.223	6.086	3.390	0.859
1883	51	1	22.00	7	0.3	50	7	3.848	1.155	1.279	0.891	0.350	20.639	6.821	6.596	3.582	0.863
1884	51	1	22.50	7.5	0.3	50	7.5	3.691	1.117	1.233	0.895	0.323	21.569	7.054	6.849	3.680	0.866
1885	51	1	23.00	8	0.3	50	8	3.583	1.085	1.192	0.901	0.300	22.434	7.278	7.090	3.780	0.868
1886	51	1	24.00	9	0.3	50	9	3.365	1.009	1.122	0.946	0.263	24.139	7.682	7.590	3.677	0.811
1887	51	1	25.00	10	0.3	50	10	3.176	0.955	1.073	0.995	0.234	25.695	8.069	8.087	3.890	0.814
1888	61	1	18.10	0.1	0.3	60	0.1	2.870	1.531	2.225	0.915	4.671	1.169	0.805	0.728	0.141	4.832
1889	61	1	18.25	0.25	0.3	60	0.25	5.612	2.480	3.768	0.909	4.264	2.250	1.377	1.280	0.323	4.077
1890	61	1	18.50	0.5	0.3	60	0.5	6.722	2.636	3.777	0.952	3.262	2.962	1.538	1.067	0.571	3.155
1891	61	1	18.75	0.75	0.3	60	0.75	6.566	2.371	3.322	1.013	2.656	3.199	1.746	1.517	0.835	2.645
1892	61	1	19.00	1	0.3	60	1	6.381	2.227	3.007	1.046	2.292	4.234	2.198	1.961	1.139	2.311

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Model								Membrane Stress Factors									
	OD	T	od	t	d/D	D/T	t/T	Branch					Header				
								Axial	In-Plane	Out-of-Plane	Torsional	Pressure	Axial	In-Plane	Out-of-Plane	Torsional	Pressure
1893	61	1	19.25	1.25	0.3	60	1.25	6.274	2.149	2.808	1.072	1.972	5.291	2.613	2.391	1.416	1.970
1894	61	1	20.00	2	0.3	60	2	6.228	2.041	2.505	1.073	1.383	8.427	3.745	3.546	2.255	1.404
1895	61	1	20.50	2.5	0.3	60	2.5	6.196	2.011	2.383	1.057	1.137	10.349	4.396	4.198	2.648	1.241
1896	61	1	21.00	3	0.3	60	3	6.117	1.971	2.283	1.037	0.955	12.164	4.972	4.774	2.957	1.131
1897	61	1	22.00	4	0.3	60	4	5.844	1.864	2.107	0.996	0.708	15.444	5.942	5.752	3.397	0.860
1898	61	1	23.00	5	0.3	60	5	5.508	1.743	1.955	0.959	0.553	18.370	6.736	6.578	3.552	0.859
1899	61	1	24.00	6	0.3	60	6	5.162	1.624	1.820	0.840	0.449	21.010	7.528	7.294	3.827	0.860
1900	61	1	25.00	7	0.3	60	7	4.833	1.437	1.702	0.858	0.376	23.440	8.166	7.945	3.638	0.864
1901	61	1	25.50	7.5	0.3	60	7.5	4.671	1.387	1.648	0.868	0.347	24.605	8.454	8.257	3.751	0.866
1902	61	1	26.00	8	0.3	60	8	4.519	1.342	1.598	0.879	0.322	25.705	8.747	8.559	3.870	0.872
1903	61	1	27.00	9	0.3	60	9	4.245	1.339	1.504	0.903	0.280	27.764	9.259	9.138	4.086	0.877
1904	61	1	28.00	10	0.3	60	10	4.013	1.194	1.422	0.934	0.249	29.716	9.743	9.715	4.303	0.815
1905	71	1	21.10	0.1	0.3	70	0.1	3.242	1.655	2.479	0.913	5.101	1.390	0.928	0.869	0.150	5.183
1906	71	1	21.25	0.25	0.3	70	0.25	6.369	2.729	4.254	0.906	4.649	2.640	1.599	1.476	0.341	4.373
1907	71	1	21.50	0.5	0.3	70	0.5	7.586	2.913	4.247	0.985	3.520	3.464	1.787	1.460	0.593	3.360
1908	71	1	21.75	0.75	0.3	70	0.75	7.370	2.645	3.720	1.048	2.850	3.528	1.945	1.627	0.872	2.809
1909	71	1	22.00	1	0.3	70	1	7.155	2.510	3.371	1.084	2.453	4.625	2.444	2.124	1.136	2.456
1910	71	1	22.25	1.25	0.3	70	1.25	7.050	2.415	3.167	1.101	2.111	5.729	2.920	2.600	1.386	2.102
1911	71	1	23.00	2	0.3	70	2	7.102	2.350	2.901	1.097	1.483	9.107	4.248	3.948	2.384	1.475
1912	71	1	23.50	2.5	0.3	70	2.5	7.145	2.340	2.812	1.079	1.219	11.202	5.032	4.723	2.834	1.301
1913	71	1	24.00	3	0.3	70	3	7.122	2.311	2.738	1.057	1.023	13.197	5.733	5.426	3.198	1.186
1914	71	1	25.00	4	0.3	70	4	6.909	2.211	2.591	0.941	0.757	16.850	6.923	6.624	3.535	0.881
1915	71	1	26.00	5	0.3	70	5	6.581	2.082	2.441	0.917	0.590	20.131	7.902	7.621	3.916	0.862
1916	71	1	27.00	6	0.3	70	6	6.224	1.937	2.299	0.840	0.478	23.163	8.730	8.508	4.218	0.863
1917	71	1	28.00	7	0.3	70	7	5.872	1.732	2.166	0.853	0.398	26.030	9.469	9.320	3.999	0.866
1918	71	1	28.50	7.5	0.3	70	7.5	5.695	1.674	2.103	0.845	0.367	27.274	9.818	9.677	4.124	0.869
1919	71	1	29.00	8	0.3	70	8	5.531	1.707	2.045	0.866	0.340	28.661	10.331	10.059	4.244	0.875
1920	71	1	30.00	9	0.3	70	9	5.216	1.518	1.934	0.886	0.296	31.086	10.934	10.750	4.483	0.880
1921	71	1	31.00	10	0.3	70	10	4.924	1.505	1.829	0.906	0.261	33.359	11.491	11.409	4.710	0.886
1922	81	1	24.10	0.1	0.3	80	0.1	3.596	1.769	2.719	0.911	5.501	1.582	1.033	0.975	0.156	5.465
1923	81	1	24.25	0.25	0.3	80	0.25	7.084	2.956	4.710	0.905	4.988	3.008	1.795	1.656	0.350	4.612
1924	81	1	24.50	0.5	0.3	80	0.5	8.405	3.119	4.691	1.012	3.751	3.887	2.020	1.679	0.611	3.535
1925	81	1	24.75	0.75	0.3	80	0.75	8.145	2.907	4.099	1.087	3.023	3.914	2.195	1.743	0.909	2.952
1926	81	1	25.00	1	0.3	80	1	7.924	2.793	3.724	1.121	2.597	5.060	2.636	2.288	1.206	2.584
1927	81	1	25.25	1.25	0.3	80	1.25	7.822	2.709	3.512	1.137	2.236	6.203	3.177	2.806	1.500	2.220
1928	81	1	26.00	2	0.3	80	2	7.993	2.656	3.296	1.141	1.574	9.766	4.714	4.329	2.491	1.539
1929	81	1	26.50	2.5	0.3	80	2.5	8.126	2.666	3.251	1.123	1.294	12.005	5.625	5.219	2.988	1.355
1930	81	1	27.00	3	0.3	80	3	8.162	2.650	3.209	1.101	1.086	14.139	6.448	6.028	3.403	1.234

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Model								Membrane Stress Factors									
	OD	T	od	t	d/D	D/T	t/T	Branch					Header				
								Axial	In-Plane	Out-of-Plane	Torsional	Pressure	Axial	In-Plane	Out-of-Plane	Torsional	Pressure
1931	81	1	28.00	4	0.3	80	4	8.014	2.558	3.098	0.972	0.802	18.115	7.863	7.441	3.800	0.927
1932	81	1	29.00	5	0.3	80	5	7.704	2.422	2.960	0.945	0.623	21.762	9.031	8.660	4.245	0.865
1933	81	1	30.00	6	0.3	80	6	7.324	2.278	2.809	0.925	0.504	25.125	10.020	9.721	4.594	0.866
1934	81	1	31.00	7	0.3	80	7	6.951	2.135	2.663	0.855	0.419	28.307	10.878	10.682	4.331	0.868
1935	81	1	31.50	7.5	0.3	80	7.5	6.762	2.064	2.591	0.861	0.386	29.799	11.269	11.115	4.470	0.871
1936	81	1	32.00	8	0.3	80	8	6.575	2.000	2.522	0.855	0.357	31.263	11.912	11.559	4.601	0.876
1937	81	1	33.00	9	0.3	80	9	6.229	1.784	2.397	0.878	0.310	34.064	12.618	12.364	4.860	0.882
1938	81	1	34.00	10	0.3	80	10	5.915	1.760	2.278	0.880	0.273	36.692	13.264	13.123	5.105	0.889
1939	91	1	27.10	0.1	0.3	90	0.1	3.936	1.876	2.960	0.909	5.994	1.792	1.140	1.113	0.176	5.763
1940	91	1	27.25	0.25	0.3	90	0.25	7.759	3.168	5.155	0.920	5.304	3.390	1.991	1.858	0.366	4.861
1941	91	1	27.50	0.5	0.3	90	0.5	9.184	3.249	5.121	1.047	3.960	3.974	2.251	1.848	0.630	3.709
1942	91	1	27.75	0.75	0.3	90	0.75	8.896	3.121	4.466	1.115	3.179	4.303	2.451	1.904	0.923	3.091
1943	91	1	28.00	1	0.3	90	1	8.676	3.075	4.066	1.151	2.727	5.484	2.838	2.427	1.241	2.706
1944	91	1	28.25	1.25	0.3	90	1.25	8.590	2.928	3.849	1.170	2.351	6.695	3.430	3.008	1.547	2.333
1945	91	1	29.00	2	0.3	90	2	8.905	2.961	3.691	1.178	1.658	10.412	5.150	4.688	2.578	1.597
1946	91	1	29.50	2.5	0.3	90	2.5	9.122	2.993	3.692	1.163	1.364	12.784	6.214	5.692	3.116	1.326
1947	91	1	30.00	3	0.3	90	3	9.222	2.988	3.687	1.142	1.144	15.036	7.189	6.618	3.574	1.278
1948	91	1	31.00	4	0.3	90	4	9.138	2.903	3.620	1.001	0.844	19.315	8.882	8.242	4.027	0.943
1949	91	1	32.00	5	0.3	90	5	8.841	2.752	3.497	0.970	0.655	23.290	10.121	9.668	4.544	0.867
1950	91	1	33.00	6	0.3	90	6	8.461	2.607	3.345	0.949	0.528	26.963	11.277	10.912	4.942	0.868
1951	91	1	34.00	7	0.3	90	7	8.063	2.435	3.187	0.846	0.439	30.443	12.281	12.029	4.638	0.870
1952	91	1	34.50	7.5	0.3	90	7.5	7.868	2.372	3.110	0.861	0.403	32.101	12.740	12.559	4.794	0.872
1953	91	1	35.00	8	0.3	90	8	7.673	2.298	3.034	0.853	0.373	33.748	13.477	13.078	4.950	0.878
1954	91	1	36.00	9	0.3	90	9	7.301	2.061	2.888	0.875	0.323	36.838	14.298	13.999	5.216	0.884
1955	91	1	37.00	10	0.3	90	10	6.937	2.040	2.748	0.886	0.284	39.795	15.041	14.934	5.481	0.821
1956	101	1	30.10	0.1	0.3	100	0.1	4.259	1.976	3.191	0.907	6.350	1.999	1.239	1.229	0.185	6.053
1957	101	1	30.25	0.25	0.3	100	0.25	8.400	3.361	5.579	0.936	5.605	3.622	2.174	1.990	0.380	5.105
1958	101	1	30.50	0.5	0.3	100	0.5	9.933	3.495	5.537	1.070	4.161	4.414	2.473	2.014	0.647	3.881
1959	101	1	30.75	0.75	0.3	100	0.75	9.622	3.375	4.821	1.141	3.331	4.730	2.542	2.115	0.949	3.228
1960	101	1	31.00	1	0.3	100	1	9.413	3.346	4.398	1.178	2.848	5.958	3.025	2.656	1.238	2.821
1961	101	1	31.25	1.25	0.3	100	1.25	9.361	3.183	4.179	1.200	2.456	7.212	3.665	3.206	1.517	2.439
1962	101	1	32.00	2	0.3	100	2	9.837	3.265	4.093	1.212	1.738	11.086	5.547	5.024	2.655	1.670
1963	101	1	32.50	2.5	0.3	100	2.5	10.143	3.310	4.143	1.200	1.430	13.554	6.726	6.149	3.231	1.453
1964	101	1	33.00	3	0.3	100	3	10.308	3.326	4.180	1.180	1.199	15.922	7.820	7.163	3.484	1.317
1965	101	1	34.00	4	0.3	100	4	10.295	3.239	4.165	1.030	0.884	20.455	9.613	9.014	4.247	0.987
1966	101	1	35.00	5	0.3	100	5	10.007	3.095	4.058	0.996	0.684	24.701	11.169	10.640	4.818	0.916
1967	101	1	36.00	6	0.3	100	6	9.611	2.924	3.903	0.971	0.551	28.693	12.498	12.077	5.265	0.870
1968	101	1	37.00	7	0.3	100	7	9.194	2.751	3.736	0.952	0.457	32.460	13.651	13.374	4.924	0.872

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Model								Membrane Stress Factors									
	OD	T	od	t	d/D	D/T	t/T	Branch					Header				
								Axial	In-Plane	Out-of-Plane	Torsional	Pressure	Axial	In-Plane	Out-of-Plane	Torsional	Pressure
1969	101	1	37.50	7.5	0.3	100	7.5	8.983	2.682	3.650	0.864	0.420	34.268	14.178	13.985	5.095	0.874
1970	101	1	38.00	8	0.3	100	8	8.776	2.606	3.566	0.943	0.388	36.063	15.013	14.585	5.265	0.879
1971	101	1	39.00	9	0.3	100	9	8.376	2.439	3.403	0.876	0.335	39.517	15.956	15.687	5.568	0.885
1972	101	1	40.00	10	0.3	100	10	7.971	2.291	3.241	0.891	0.294	42.742	16.809	16.727	5.841	0.823
1973	251	1	75.10	0.1	0.3	250	0.1	8.015	3.045	6.185	0.926	10.123	4.670	2.297	3.303	0.283	9.261
1974	251	1	75.25	0.25	0.3	250	0.25	15.886	5.716	11.025	1.121	8.633	8.958	4.097	5.625	0.597	7.740
1975	251	1	75.50	0.5	0.3	250	0.5	18.721	6.158	10.866	1.340	6.133	10.531	5.103	4.907	0.902	5.682
1976	251	1	75.75	0.75	0.3	250	0.75	18.539	6.244	9.510	1.427	4.805	11.006	5.690	5.416	1.182	4.642
1977	251	1	76.00	1	0.3	250	1	18.946	6.505	8.938	1.506	4.100	13.413	5.844	6.617	1.562	4.067
1978	251	1	76.25	1.25	0.3	250	1.25	19.792	6.801	8.899	1.556	3.579	15.752	6.419	7.910	1.943	3.590
1979	251	1	77.00	2	0.3	250	2	23.506	7.693	10.285	1.653	2.624	22.445	9.974	12.019	3.072	2.540
1980	251	1	77.50	2.5	0.3	250	2.5	25.542	8.062	11.381	1.658	2.190	26.208	12.369	14.523	3.795	2.094
1981	251	1	78.00	3	0.3	250	3	26.895	8.272	12.268	1.652	1.848	29.492	14.720	16.506	4.543	1.760
1982	251	1	79.00	4	0.3	250	4	28.054	8.467	13.352	1.596	1.357	35.746	19.317	20.502	5.815	1.463
1983	251	1	80.00	5	0.3	250	5	27.983	8.205	13.757	1.524	1.037	42.375	23.540	24.147	6.906	1.248
1984	251	1	81.00	6	0.3	250	6	27.359	7.819	13.764	1.481	0.820	49.288	27.369	27.578	7.834	1.134
1985	251	1	82.00	7	0.3	250	7	26.529	7.428	13.559	1.458	0.668	56.270	30.842	31.335	8.630	0.529
1986	251	1	82.50	7.5	0.3	250	7.5	26.086	7.253	13.409	1.444	0.609	59.885	32.471	33.298	8.987	0.532
1987	251	1	83.00	8	0.3	250	8	25.637	7.057	13.238	1.206	0.558	63.484	34.027	35.250	9.321	0.535
1988	251	1	84.00	9	0.3	250	9	24.777	6.729	12.864	1.171	0.476	70.422	36.955	38.923	9.933	0.543
1989	251	1	85.00	10	0.3	250	10	23.945	6.431	12.462	1.142	0.413	77.521	40.333	42.663	10.670	0.546
1990	501	1	150.10	0.1	0.3	500	0.1	12.964	4.543	10.337	1.032	13.830	8.551	3.530	6.663	0.418	12.810
1991	501	1	150.25	0.25	0.3	500	0.25	25.656	8.230	18.548	1.399	11.669	16.495	6.769	11.595	0.896	10.605
1992	501	1	150.50	0.5	0.3	500	0.5	30.407	9.973	18.451	1.726	8.135	17.304	8.523	9.387	1.311	7.609
1993	501	1	150.75	0.75	0.3	500	0.75	31.009	10.453	16.568	1.848	6.300	21.186	9.111	10.928	1.569	6.121
1994	501	1	151.00	1	0.3	500	1	32.934	11.180	16.219	1.974	5.364	25.835	10.394	13.288	1.866	5.345
1995	501	1	151.25	1.25	0.3	500	1.25	35.716	11.929	16.869	2.090	4.721	30.473	11.452	15.919	2.300	4.763
1996	501	1	152.00	2	0.3	500	2	45.660	14.227	21.463	2.354	3.562	43.373	14.371	24.230	3.613	3.514
1997	501	1	152.50	2.5	0.3	500	2.5	51.132	15.216	24.689	2.436	3.022	50.210	18.009	29.223	4.476	2.714
1998	501	1	153.00	3	0.3	500	3	55.098	15.790	27.353	2.459	2.582	55.805	21.568	33.636	5.313	2.345
1999	501	1	154.00	4	0.3	500	4	59.337	16.343	30.939	2.399	1.927	64.724	29.079	41.134	7.162	1.866
2000	501	1	155.00	5	0.3	500	5	60.387	15.787	32.715	2.229	1.480	72.463	36.286	47.622	8.722	1.715
2001	501	1	156.00	6	0.3	500	6	59.749	15.223	33.369	2.061	1.168	80.145	43.116	53.697	10.133	1.339
2002	501	1	157.00	7	0.3	500	7	58.305	14.578	33.357	1.905	0.944	88.443	49.548	59.684	11.405	1.277
2003	501	1	157.50	7.5	0.3	500	7.5	57.425	14.243	33.185	1.835	0.855	93.792	53.079	61.874	12.204	0.510
2004	501	1	158.00	8	0.3	500	8	56.515	13.928	32.946	1.769	0.779	98.925	56.128	64.875	12.779	0.502
2005	501	1	159.00	9	0.3	500	9	54.642	13.292	32.348	1.739	0.655	109.870	61.960	70.879	13.848	0.492
2006	501	1	160.00	10	0.3	500	10	52.822	12.736	31.641	1.714	0.560	120.888	67.519	78.371	14.828	0.487

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Model								Membrane Stress Factors									
	OD	T	od	t	d/D	D/T	t/T	Branch					Header				
								Axial	In-Plane	Out-of-Plane	Torsional	Pressure	Axial	In-Plane	Out-of-Plane	Torsional	Pressure
2008	751	1	225.25	0.25	0.3	750	0.25	34.143	10.682	25.428	1.673	13.886	22.848	8.794	16.986	1.140	12.731
2009	751	1	225.50	0.5	0.3	750	0.5	40.801	13.148	25.470	2.090	9.597	24.788	10.833	12.741	1.654	9.034
2010	751	1	225.75	0.75	0.3	750	0.75	42.503	13.974	23.297	2.247	7.397	30.624	12.448	14.804	1.934	7.211
2011	751	1	226.00	1	0.3	750	1	46.178	15.133	23.395	2.405	6.289	37.523	14.227	18.076	2.271	6.278
2012	751	1	226.25	1.25	0.3	750	1.25	51.041	16.359	24.906	2.588	5.551	44.486	15.898	21.840	2.598	5.613
2013	751	1	227.00	2	0.3	750	2	67.379	19.925	32.981	3.019	4.239	63.700	16.760	33.899	3.459	4.248
2014	751	1	227.50	2.5	0.3	750	2.5	76.391	21.510	38.443	3.173	3.625	73.651	18.784	41.106	4.048	3.374
2015	751	1	228.00	3	0.3	750	3	83.191	22.476	43.056	3.239	3.120	81.439	20.881	47.359	5.706	2.881
2016	751	1	229.00	4	0.3	750	4	91.119	23.126	49.496	3.202	2.355	92.669	25.014	57.579	7.714	2.114
2017	751	1	230.00	5	0.3	750	5	93.886	22.818	52.941	3.059	1.824	101.299	29.554	65.998	9.670	1.898
2018	751	1	231.00	6	0.3	750	6	93.697	22.084	54.444	2.884	1.447	109.452	34.548	73.364	11.564	1.770
2019	751	1	232.00	7	0.3	750	7	92.009	21.197	54.867	2.649	1.172	118.859	39.778	81.247	13.317	0.548
2020	751	1	232.50	7.5	0.3	750	7.5	90.839	20.735	54.770	2.544	1.062	124.178	42.470	85.303	14.147	0.532
2021	751	1	233.00	8	0.3	750	8	89.532	20.241	54.543	2.442	0.967	130.137	45.311	89.444	14.946	0.518
2022	751	1	234.00	9	0.3	750	9	86.782	19.368	53.857	2.258	0.811	142.556	50.528	98.011	16.463	0.496
2023	751	1	235.00	10	0.3	750	10	83.932	18.526	52.897	2.100	0.689	155.917	82.888	108.268	17.870	0.481
2025	1001	1	300.25	0.25	0.3	1000	0.25	42.002	12.816	32.190	1.949	15.812	28.455	10.485	22.085	1.351	14.504
2026	1001	1	300.50	0.5	0.3	1000	0.5	50.312	15.897	32.292	2.432	10.812	31.635	13.279	16.879	1.877	10.222
2027	1001	1	300.75	0.75	0.3	1000	0.75	53.096	17.046	29.885	2.631	8.308	39.527	15.364	19.804	2.275	8.114
2028	1001	1	301.00	1	0.3	1000	1	58.467	15.465	30.452	2.830	7.054	48.675	17.650	24.244	2.663	7.048
2029	1001	1	301.25	1.25	0.3	1000	1.25	65.308	17.012	32.845	3.059	6.237	57.916	15.971	29.319	2.943	6.307
2030	1001	1	302.00	2	0.3	1000	2	87.843	24.999	44.440	3.651	4.794	83.346	20.924	45.454	3.933	4.850
2031	1001	1	302.50	2.5	0.3	1000	2.5	100.367	27.138	52.179	3.876	4.117	96.568	23.458	55.095	4.514	3.893
2032	1001	1	303.00	3	0.3	1000	3	110.021	28.502	58.771	3.984	3.558	106.869	25.330	63.410	5.072	3.335
2033	1001	1	304.00	4	0.3	1000	4	121.844	29.529	68.197	3.984	2.705	121.213	29.229	76.772	8.262	2.339
2034	1001	1	305.00	5	0.3	1000	5	126.654	29.271	74.624	3.829	2.108	131.218	33.399	87.400	10.419	2.057
2035	1001	1	306.00	6	0.3	1000	6	127.321	28.442	76.512	3.664	1.680	139.851	38.157	96.282	12.543	1.886
2036	1001	1	307.00	7	0.3	1000	7	125.651	27.340	77.075	3.384	1.366	149.292	43.384	105.667	14.545	1.782
2037	1001	1	307.50	7.5	0.3	1000	7.5	124.332	26.777	77.099	3.280	1.240	154.649	46.162	110.452	15.506	1.748
2038	1001	1	308.00	8	0.3	1000	8	122.707	26.205	76.925	3.170	1.132	160.347	76.055	115.349	16.983	1.720
2039	1001	1	309.00	9	0.3	1000	9	119.334	25.062	76.290	2.895	0.952	173.871	85.817	125.699	18.848	0.516
2040	1001	1	310.00	10	0.3	1000	10	115.529	24.006	75.091	2.682	0.811	188.398	95.251	136.468	20.608	0.496
2042	1251	1	375.25	0.25	0.3	1250	0.25	49.506	14.724	38.959	2.203	17.539	33.557	11.953	26.936	1.540	16.068
2043	1251	1	375.50	0.5	0.3	1250	0.5	59.318	18.350	39.071	2.770	11.880	37.982	15.461	20.858	2.145	11.269
2044	1251	1	375.75	0.75	0.3	1250	0.75	63.047	17.131	36.372	2.993	9.107	47.857	17.941	24.681	2.596	8.905
2045	1251	1	376.00	1	0.3	1250	1	70.018	18.647	37.412	3.261	7.726	59.153	16.858	30.290	2.953	7.719
2046	1251	1	376.25	1.25	0.3	1250	1.25	78.824	20.363	40.676	3.509	6.838	70.602	19.063	36.684	3.355	6.913
2047	1251	1	377.00	2	0.3	1250	2	107.251	29.586	55.795	4.247	5.277	102.104	24.570	56.864	4.419	5.372

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Model								Membrane Stress Factors									
	OD	T	od	t	d/D	D/T	t/T	Branch					Header				
								Axial	In-Plane	Out-of-Plane	Torsional	Pressure	Axial	In-Plane	Out-of-Plane	Torsional	Pressure
2048	1251	1	377.50	2.5	0.3	1250	2.5	123.225	32.244	65.856	4.543	4.544	118.540	27.438	68.927	5.001	4.348
2049	1251	1	378.00	3	0.3	1250	3	135.698	33.970	74.454	4.697	3.937	131.467	29.691	79.334	5.531	3.738
2050	1251	1	379.00	4	0.3	1250	4	151.544	35.397	87.040	4.736	3.008	149.056	33.390	95.947	8.704	2.611
2051	1251	1	380.00	5	0.3	1250	5	158.527	35.230	96.473	4.580	2.355	160.595	37.111	108.655	11.010	2.210
2052	1251	1	381.00	6	0.3	1250	6	160.228	34.313	99.325	4.347	1.887	170.054	41.386	119.763	13.273	1.997
2053	1251	1	382.00	7	0.3	1250	7	158.838	33.078	100.147	4.090	1.542	179.464	72.137	129.803	15.954	1.861
2054	1251	1	382.50	7.5	0.3	1250	7.5	157.483	32.402	100.054	3.961	1.402	185.014	77.750	135.182	17.056	1.814
2055	1251	1	383.00	8	0.3	1250	8	155.714	31.734	99.822	3.832	1.281	191.024	83.374	140.717	18.138	1.778
2056	1251	1	384.00	9	0.3	1250	9	151.666	30.395	99.118	3.590	1.080	204.134	94.317	152.525	20.216	0.538
2057	1251	1	385.00	10	0.3	1250	10	147.249	29.085	97.931	3.362	0.922	220.546	105.068	164.873	22.189	0.513
2059	1501	1	450.25	0.25	0.3	1500	0.25	56.875	16.505	45.945	2.468	19.121	38.191	13.262	31.252	1.711	17.479
2060	1501	1	450.50	0.5	0.3	1500	0.5	68.023	18.381	45.956	3.087	12.883	43.940	17.445	24.724	2.394	12.212
2061	1501	1	450.75	0.75	0.3	1500	0.75	72.622	19.661	42.925	3.358	9.827	55.737	20.313	29.468	2.844	9.615
2062	1501	1	451.00	1	0.3	1500	1	80.941	21.481	44.418	3.644	8.330	69.107	19.451	36.313	3.323	8.319
2063	1501	1	451.25	1.25	0.3	1500	1.25	91.613	23.521	48.489	3.977	7.377	82.675	22.025	43.940	3.756	7.455
2064	1501	1	452.00	2	0.3	1500	2	125.792	33.779	67.070	4.819	5.712	120.104	28.770	68.117	4.906	5.836
2065	1501	1	452.50	2.5	0.3	1500	2.5	145.112	36.933	79.395	5.177	4.933	139.988	31.586	82.596	5.499	5.008
2066	1501	1	453.00	3	0.3	1500	3	160.431	39.006	90.052	5.377	4.284	155.467	34.006	95.080	6.010	4.102
2067	1501	1	454.00	4	0.3	1500	4	180.360	40.817	110.720	5.464	3.288	176.488	37.536	114.743	9.086	2.870
2068	1501	1	455.00	5	0.3	1500	5	189.706	40.793	118.256	5.309	2.583	189.498	40.786	129.443	11.503	2.355
2069	1501	1	456.00	6	0.3	1500	6	192.661	39.824	122.420	5.072	2.075	199.633	64.996	142.433	14.337	2.100
2070	1501	1	457.00	7	0.3	1500	7	191.630	38.459	124.143	4.787	1.700	209.941	77.204	154.852	16.759	1.957
2071	1501	1	457.50	7.5	0.3	1500	7.5	190.159	37.722	123.823	4.641	1.549	215.604	83.301	160.470	17.940	1.922
2072	1501	1	458.00	8	0.3	1500	8	188.282	36.963	123.274	4.494	1.416	221.884	89.365	166.234	19.112	1.834
2073	1501	1	459.00	9	0.3	1500	9	183.863	35.440	122.391	4.216	1.196	235.982	101.299	179.573	21.348	1.768
2074	1501	1	460.00	10	0.3	1500	10	178.793	33.984	121.036	3.954	1.023	252.055	113.231	192.536	23.524	0.529
2077	1751	1	525.50	0.5	0.3	1750	0.5	76.454	20.617	53.024	3.393	13.806	49.583	19.294	28.469	2.626	13.077
2078	1751	1	525.75	0.75	0.3	1750	0.75	81.709	22.066	49.473	3.683	10.487	63.250	18.898	34.142	3.137	10.266
2079	1751	1	526.00	1	0.3	1750	1	91.475	24.154	51.223	4.028	8.887	78.641	21.908	42.100	3.654	8.869
2080	1751	1	526.25	1.25	0.3	1750	1.25	103.866	26.550	56.237	4.386	7.872	94.252	24.870	51.085	4.143	7.951
2081	1751	1	527.00	2	0.3	1750	2	143.603	37.682	78.207	5.385	6.119	137.358	32.481	79.180	5.390	6.237
2082	1751	1	527.50	2.5	0.3	1750	2.5	166.243	41.286	92.890	5.801	5.293	160.627	35.634	96.063	6.000	5.383
2083	1751	1	528.00	3	0.3	1750	3	184.340	43.704	105.573	6.045	4.606	178.848	38.210	110.634	6.502	4.433
2084	1751	1	529.00	4	0.3	1750	4	209.485	45.895	130.906	6.178	3.544	203.416	41.688	133.321	9.432	3.356
2085	1751	1	530.00	5	0.3	1750	5	220.236	45.966	140.995	6.040	2.791	218.860	44.477	151.038	11.937	2.496
2086	1751	1	531.00	6	0.3	1750	6	224.327	44.979	145.593	5.779	2.247	229.922	68.738	164.841	14.927	2.200
2087	1751	1	532.00	7	0.3	1750	7	223.837	43.517	147.472	5.471	1.845	240.660	81.681	177.962	17.472	2.033
2088	1751	1	532.50	7.5	0.3	1750	7.5	222.558	42.718	147.703	5.309	1.682	246.533	88.163	184.549	18.716	1.995



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Model								Membrane Stress Factors									
	OD	T	od	t	d/D	D/T	t/T	Branch					Header				
								Axial	In-Plane	Out-of-Plane	Torsional	Pressure	Axial	In-Plane	Out-of-Plane	Torsional	Pressure
2089	1751	1	533.00	8	0.3	1750	8	220.581	41.884	147.499	5.152	1.539	252.580	94.630	191.281	19.941	1.962
2090	1751	1	534.00	9	0.3	1750	9	215.791	40.213	146.327	4.839	1.303	267.166	110.460	205.307	22.326	1.802
2091	1751	1	535.00	10	0.3	1750	10	210.232	38.602	144.455	4.543	1.116	284.345	123.528	220.385	24.614	1.748
2094	2001	1	600.50	0.5	0.3	2000	0.5	84.732	22.768	60.115	3.695	14.677	54.950	20.971	32.296	2.848	13.905
2095	2001	1	600.75	0.75	0.3	2000	0.75	90.548	24.348	56.031	4.007	11.116	70.445	20.875	38.983	3.418	10.882
2096	2001	1	601.00	1	0.3	2000	1	101.577	26.723	58.068	4.391	9.404	87.769	24.274	48.128	3.983	9.394
2097	2001	1	601.25	1.25	0.3	2000	1.25	115.588	29.441	63.957	4.794	8.334	105.353	27.614	58.499	4.519	8.422
2098	2001	1	602.00	2	0.3	2000	2	160.751	41.324	89.319	5.921	6.498	154.154	36.084	90.569	5.866	6.657
2099	2001	1	602.50	2.5	0.3	2000	2.5	186.548	45.352	106.197	6.403	5.628	180.585	40.001	109.353	6.502	5.725
2100	2001	1	603.00	3	0.3	2000	3	207.435	48.085	120.893	6.690	4.903	201.530	42.341	125.961	6.998	4.743
2101	2001	1	604.00	4	0.3	2000	4	236.980	50.636	151.386	6.868	3.781	230.306	45.802	152.101	9.752	3.599
2102	2001	1	605.00	5	0.3	2000	5	249.930	50.840	163.108	6.738	2.983	247.342	48.276	171.734	12.783	2.619
2103	2001	1	606.00	6	0.3	2000	6	255.429	49.855	168.962	6.468	2.406	260.166	72.152	187.246	15.462	2.286
2104	2001	1	607.00	7	0.3	2000	7	255.533	48.290	171.267	6.141	1.979	271.309	85.654	201.257	18.107	2.103
2105	2001	1	607.50	7.5	0.3	2000	7.5	254.346	47.434	171.138	5.968	1.805	276.347	92.489	207.756	19.405	2.062
2106	2001	1	608.00	8	0.3	2000	8	252.406	46.541	171.564	5.794	1.654	283.632	102.204	215.546	20.691	2.026
2107	2001	1	609.00	9	0.3	2000	9	247.419	44.735	170.437	5.454	1.402	298.532	116.239	230.503	23.197	1.966
2108	2001	1	610.00	10	0.3	2000	10	241.335	42.972	168.340	5.126	1.203	315.690	130.035	248.447	25.613	1.773
2111	2251	1	675.50	0.5	0.3	2250	0.5	92.880	24.887	67.531	3.986	15.492	60.076	22.550	35.821	3.071	14.688
2112	2251	1	675.75	0.75	0.3	2250	0.75	99.116	26.644	62.713	4.325	11.712	77.330	22.567	43.457	3.688	11.452
2113	2251	1	676.00	1	0.3	2250	1	111.297	29.176	64.934	4.742	9.888	96.540	26.526	53.778	4.320	9.873
2114	2251	1	676.25	1.25	0.3	2250	1.25	126.862	32.206	71.338	5.195	8.770	116.023	30.179	65.195	4.904	8.851
2115	2251	1	677.00	2	0.3	2250	2	177.172	44.781	99.996	6.445	6.851	170.502	39.071	101.150	6.333	6.954
2116	2251	1	677.50	2.5	0.3	2250	2.5	206.258	49.186	119.382	6.980	5.941	199.841	43.381	122.880	7.022	6.063
2117	2251	1	678.00	3	0.3	2250	3	229.725	52.242	136.071	7.314	5.181	223.378	46.343	141.621	7.535	5.048
2118	2251	1	679.00	4	0.3	2250	4	263.743	55.126	171.561	7.532	4.002	256.381	49.894	170.961	10.011	3.816
2119	2251	1	680.00	5	0.3	2250	5	278.801	55.414	184.848	7.416	3.163	276.728	61.282	192.736	13.196	2.795
2120	2251	1	681.00	6	0.3	2250	6	285.958	54.425	191.163	7.140	2.555	290.136	75.241	209.043	15.815	2.401
2121	2251	1	682.00	7	0.3	2250	7	286.609	52.837	195.629	6.794	2.104	300.922	92.171	225.929	18.681	2.167
2122	2251	1	682.50	7.5	0.3	2250	7.5	285.442	51.894	196.363	6.609	1.921	307.891	98.331	233.792	20.038	2.122
2123	2251	1	683.00	8	0.3	2250	8	283.713	50.948	195.503	6.429	1.761	314.096	106.851	239.334	21.373	2.081
2124	2251	1	684.00	9	0.3	2250	9	278.475	48.993	194.427	6.060	1.495	329.133	121.537	256.968	23.720	2.016
2125	2251	1	685.00	10	0.3	2250	10	272.028	47.136	193.806	5.705	1.284	345.892	135.928	278.358	26.511	1.964
2128	2501	1	750.50	0.5	0.3	2500	0.5	100.983	26.874	75.116	4.264	16.274	64.922	24.045	39.248	3.284	15.433
2129	2501	1	750.75	0.75	0.3	2500	0.75	107.411	28.711	69.410	4.624	12.274	83.940	24.601	47.820	3.948	11.991
2130	2501	1	751.00	1	0.3	2500	1	120.652	31.569	71.746	5.079	10.348	104.921	28.697	59.298	4.624	10.326
2131	2501	1	751.25	1.25	0.3	2500	1.25	137.782	34.938	78.842	5.595	9.179	126.315	32.676	71.968	5.259	9.260
2132	2501	1	752.00	2	0.3	2500	2	193.009	47.909	110.966	6.940	7.185	186.191	42.897	111.816	6.787	7.358

STP-PT-074: Local Stress in Nozzles, Shells and Formed Heads from External Heads

Model								Membrane Stress Factors									
	OD	T	od	t	d/D	D/T	t/T	Branch					Header				
								Axial	In-Plane	Out-of-Plane	Torsional	Pressure	Axial	In-Plane	Out-of-Plane	Torsional	Pressure
2133	2501	1	752.50	2.5	0.3	2500	2.5	225.129	52.812	132.265	7.539	6.236	218.561	47.530	135.697	7.490	6.298
2134	2501	1	753.00	3	0.3	2500	3	251.318	56.153	150.845	7.911	5.443	244.796	50.332	156.285	7.995	5.470
2135	2501	1	754.00	4	0.3	2500	4	289.431	59.385	191.595	8.180	4.211	281.477	53.751	189.045	10.349	4.032
2136	2501	1	755.00	5	0.3	2500	5	307.235	59.800	206.533	8.073	3.332	304.314	63.893	212.897	13.588	2.960
2137	2501	1	756.00	6	0.3	2500	6	315.649	58.799	214.780	7.795	2.695	318.929	78.140	231.483	16.282	2.497
2138	2501	1	757.00	7	0.3	2500	7	317.361	57.125	218.569	7.431	2.222	332.156	94.892	248.878	19.224	2.224
2139	2501	1	757.50	7.5	0.3	2500	7.5	316.325	56.199	220.655	7.243	2.029	339.026	102.368	259.731	20.616	2.175
2140	2501	1	758.00	8	0.3	2500	8	314.500	55.179	220.666	7.042	1.862	345.643	111.062	268.781	21.993	2.134
2141	2501	1	759.00	9	0.3	2500	9	309.194	53.148	216.652	6.653	1.582	359.764	124.614	283.435	24.700	2.143
2142	2501	1	760.00	10	0.3	2500	10	302.196	51.118	216.233	6.274	1.361	377.821	141.381	305.488	27.017	2.008
2143	9	1	2.90	0.1	0.35	8	0.1	1.011	0.996	0.960	0.956	2.972	0.195	0.121	0.188	0.089	2.012
2144	9	1	3.05	0.25	0.35	8	0.25	1.149	0.934	0.928	0.923	1.196	0.436	0.241	0.368	0.196	1.679
2145	9	1	3.30	0.5	0.35	8	0.5	1.350	0.857	0.856	0.840	0.895	0.710	0.365	0.467	0.346	1.314
2146	9	1	3.55	0.75	0.35	8	0.75	1.437	0.797	0.797	0.759	0.758	1.353	0.444	0.539	0.456	1.138
2147	9	1	3.80	1	0.35	8	1	1.457	0.740	0.740	0.705	0.691	1.721	0.506	0.606	0.536	1.020
2148	9	1	4.05	1.25	0.35	8	1.25	1.457	0.697	0.697	0.678	0.596	2.052	0.547	0.650	0.589	0.867
2149	9	1	4.80	2	0.35	8	2	1.253	0.586	0.590	0.682	0.410	3.687	0.659	0.808	0.740	0.790
2150	9	1	5.30	2.5	0.35	8	2.5	1.113	0.531	0.528	0.706	0.336	5.081	0.753	0.946	0.839	0.785
2160	17	1	5.70	0.1	0.35	16	0.1	1.195	1.004	1.084	0.989	3.127	0.356	0.213	0.285	0.103	2.927
2161	17	1	5.85	0.25	0.35	16	0.25	1.835	1.078	1.414	0.996	1.998	0.584	0.371	0.516	0.225	2.469
2162	17	1	6.10	0.5	0.35	16	0.5	2.272	1.076	1.434	0.932	1.579	0.945	0.592	0.759	0.456	1.959
2163	17	1	6.35	0.75	0.35	16	0.75	2.382	0.959	1.303	0.873	1.343	1.777	0.786	0.851	0.656	1.609
2164	17	1	6.60	1	0.35	16	1	2.385	0.939	1.168	0.834	1.199	2.350	0.954	1.008	0.821	1.416
2165	17	1	6.85	1.25	0.35	16	1.25	2.381	0.858	1.052	0.806	1.035	2.907	0.794	1.123	0.961	1.194
2166	17	1	7.60	2	0.35	16	2	2.203	0.748	0.784	0.751	0.731	4.301	1.039	1.383	1.220	0.905
2167	17	1	8.10	2.5	0.35	16	2.5	2.019	0.703	0.703	0.753	0.603	5.050	1.151	1.532	1.324	0.940
2168	17	1	8.60	3	0.35	16	3	1.837	0.659	0.659	0.760	0.501	5.658	1.301	1.668	1.390	0.838
2169	17	1	9.60	4	0.35	16	4	1.578	0.590	0.590	0.804	0.372	6.923	1.620	1.935	1.557	0.906
2170	17	1	10.60	5	0.35	16	5	1.373	0.534	0.528	0.897	0.291	9.292	1.848	2.289	1.758	0.846
2177	25	1	8.50	0.1	0.35	24	0.1	1.481	1.020	1.327	0.921	3.237	0.514	0.343	0.324	0.118	3.576
2178	25	1	8.65	0.25	0.35	24	0.25	2.567	1.379	1.957	0.998	2.710	0.886	0.575	0.662	0.260	3.016
2179	25	1	8.90	0.5	0.35	24	0.5	3.174	1.422	2.004	0.930	2.152	1.374	0.759	0.785	0.511	2.380
2180	25	1	9.15	0.75	0.35	24	0.75	3.254	1.333	1.814	0.907	1.804	2.098	1.040	1.102	0.767	1.997
2181	25	1	9.40	1	0.35	24	1	3.224	1.238	1.637	0.893	1.584	2.811	1.282	1.318	0.994	1.730
2182	25	1	9.65	1.25	0.35	24	1.25	3.200	1.136	1.498	0.879	1.362	3.530	1.210	1.521	1.202	1.442
2183	25	1	10.40	2	0.35	24	2	2.998	1.036	1.179	0.865	0.953	5.422	1.705	1.977	1.624	1.082
2184	25	1	10.90	2.5	0.35	24	2.5	2.823	0.943	1.026	0.853	0.784	6.487	1.913	2.213	1.789	0.977
2185	25	1	11.40	3	0.35	24	3	2.648	0.867	0.906	0.842	0.660	7.426	2.097	2.422	1.907	0.918

STP-PT-074: Local Stress in Nozzles, Shells and Formed Heads from External Heads

Model								Membrane Stress Factors									
	OD	T	od	t	d/D	D/T	t/T	Branch					Header				
								Axial	In-Plane	Out-of-Plane	Torsional	Pressure	Axial	In-Plane	Out-of-Plane	Torsional	Pressure
2186	25	1	12.40	4	0.35	24	4	2.330	0.758	0.737	0.838	0.494	9.015	2.420	2.793	2.083	0.942
2187	25	1	13.40	5	0.35	24	5	2.011	0.673	0.632	0.858	0.383	10.192	2.522	3.092	2.222	0.866
2188	25	1	14.40	6	0.35	24	6	1.802	0.620	0.592	0.906	0.314	11.237	3.168	3.404	2.393	0.868
2189	25	1	15.40	7	0.35	24	7	1.642	0.594	0.548	1.013	0.265	12.092	3.433	3.710	2.595	0.923
2190	25	1	15.90	7.5	0.35	24	7.5	1.575	0.583	0.532	1.063	0.246	12.467	3.567	3.861	2.671	0.928
2191	25	1	16.40	8	0.35	24	8	1.529	0.583	0.518	1.121	0.224	13.194	3.621	4.175	2.806	0.834
2194	33	1	11.30	0.1	0.35	32	0.1	1.787	1.138	1.568	0.925	3.740	0.690	0.474	0.440	0.131	4.092
2195	33	1	11.45	0.25	0.35	32	0.25	3.291	1.661	2.473	0.953	3.299	1.230	0.796	0.852	0.289	3.453
2196	33	1	11.70	0.5	0.35	32	0.5	4.024	1.734	2.531	0.929	2.599	1.681	0.925	0.892	0.542	2.703
2197	33	1	11.95	0.75	0.35	32	0.75	4.045	1.606	2.278	0.930	2.154	2.356	1.252	1.245	0.837	2.265
2198	33	1	12.20	1	0.35	32	1	3.973	1.509	2.065	0.952	1.875	3.185	1.568	1.569	1.106	1.965
2199	33	1	12.45	1.25	0.35	32	1.25	3.927	1.492	1.908	0.965	1.608	4.023	1.699	1.853	1.365	1.645
2200	33	1	13.20	2	0.35	32	2	3.731	1.302	1.570	0.960	1.120	6.322	2.277	2.527	1.936	1.201
2201	33	1	13.70	2.5	0.35	32	2.5	3.569	1.236	1.407	0.943	0.920	7.655	2.584	2.873	2.177	1.091
2202	33	1	14.20	3	0.35	32	3	3.393	1.179	1.273	0.925	0.773	8.857	2.983	3.173	2.347	1.002
2203	33	1	15.20	4	0.35	32	4	3.051	1.077	1.074	0.895	0.576	10.937	3.450	3.678	2.580	0.920
2204	33	1	16.20	5	0.35	32	5	2.748	0.941	0.934	0.883	0.453	12.693	3.848	4.113	2.757	0.926
2205	33	1	17.20	6	0.35	32	6	2.433	0.857	0.824	0.890	0.365	14.019	4.073	4.446	2.893	0.812
2206	33	1	18.20	7	0.35	32	7	2.220	0.802	0.756	0.928	0.307	15.278	4.375	4.805	3.070	0.814
2207	33	1	18.70	7.5	0.35	32	7.5	2.129	0.775	0.726	0.956	0.285	15.841	4.514	4.982	3.162	0.815
2208	33	1	19.20	8	0.35	32	8	2.044	0.754	0.701	0.986	0.265	16.380	4.649	5.162	3.255	0.816
2209	33	1	20.20	9	0.35	32	9	1.889	0.715	0.666	1.054	0.231	17.360	5.033	5.527	3.454	0.830
2210	33	1	21.20	10	0.35	32	10	1.767	0.697	0.669	1.142	0.207	18.178	5.331	5.874	3.712	0.817
2211	41	1	14.10	0.1	0.35	40	0.1	2.103	1.253	1.801	0.927	4.237	0.794	0.594	0.548	0.142	4.519
2212	41	1	14.25	0.25	0.35	40	0.25	3.992	1.931	2.957	0.937	3.801	1.557	1.007	1.025	0.324	3.816
2213	41	1	14.50	0.5	0.35	40	0.5	4.829	2.048	3.018	0.931	2.963	2.062	1.159	0.977	0.579	2.966
2214	41	1	14.75	0.75	0.35	40	0.75	4.781	1.881	2.701	0.987	2.433	2.594	1.435	1.388	0.887	2.480
2215	41	1	15.00	1	0.35	40	1	4.663	1.815	2.455	1.024	2.105	3.484	1.803	1.758	1.186	2.154
2216	41	1	15.25	1.25	0.35	40	1.25	4.592	1.736	2.285	1.040	1.804	4.428	2.053	2.125	1.480	1.815
2217	41	1	16.00	2	0.35	40	2	4.423	1.581	1.950	1.038	1.254	7.050	2.827	3.005	2.173	1.305
2218	41	1	16.50	2.5	0.35	40	2.5	4.290	1.531	1.790	1.020	1.029	8.615	3.247	3.465	2.488	1.184
2219	41	1	17.00	3	0.35	40	3	4.136	1.481	1.659	0.999	0.863	10.051	3.833	3.879	2.719	1.088
2220	41	1	18.00	4	0.35	40	4	3.801	1.374	1.449	0.840	0.641	12.575	4.473	4.544	3.027	0.861
2221	41	1	19.00	5	0.35	40	5	3.475	1.271	1.290	0.857	0.502	14.771	5.168	5.112	3.243	0.862
2222	41	1	20.00	6	0.35	40	6	3.181	1.120	1.166	0.880	0.410	16.709	5.673	5.621	3.384	0.815
2223	41	1	21.00	7	0.35	40	7	2.884	1.031	1.061	0.918	0.338	18.131	5.381	5.982	3.567	0.817
2224	41	1	21.50	7.5	0.35	40	7.5	2.770	0.996	1.021	0.919	0.313	18.880	5.553	6.182	3.661	0.818
2225	41	1	22.00	8	0.35	40	8	2.652	0.968	0.988	0.928	0.291	19.586	5.717	6.397	3.755	0.819

STP-PT-074: Local Stress in Nozzles, Shells and Formed Heads from External Heads

Model								Membrane Stress Factors									
	OD	T	od	t	d/D	D/T	t/T	Branch					Header				
								Axial	In-Plane	Out-of-Plane	Torsional	Pressure	Axial	In-Plane	Out-of-Plane	Torsional	Pressure
2226	41	1	23.00	9	0.35	40	9	2.458	0.913	0.927	0.977	0.255	20.938	6.271	6.812	3.952	0.835
2227	41	1	24.00	10	0.35	40	10	2.291	0.873	0.875	1.029	0.227	22.099	6.596	7.224	4.146	0.839
2228	51	1	17.60	0.1	0.35	50	0.1	2.495	1.394	2.087	0.926	4.551	1.029	0.737	0.702	0.156	5.001
2229	51	1	17.75	0.25	0.35	50	0.25	4.836	2.218	3.532	0.929	4.341	2.006	1.261	1.251	0.355	4.228
2230	51	1	18.00	0.5	0.35	50	0.5	5.787	2.369	3.588	0.975	3.343	2.597	1.420	1.094	0.617	3.259
2231	51	1	18.25	0.75	0.35	50	0.75	5.652	2.185	3.192	1.048	2.720	2.886	1.718	1.543	0.910	2.715
2232	51	1	18.50	1	0.35	50	1	5.480	2.103	2.910	1.091	2.341	3.862	2.161	1.987	1.258	2.361
2233	51	1	18.75	1.25	0.35	50	1.25	5.381	2.029	2.727	1.114	2.005	4.879	2.563	2.417	1.585	2.001
2234	51	1	19.50	2	0.35	50	2	5.268	1.924	2.417	1.119	1.394	7.833	3.633	3.534	2.401	1.409
2235	51	1	20.00	2.5	0.35	50	2.5	5.189	1.893	2.279	1.075	1.143	9.654	4.232	4.170	2.802	1.276
2236	51	1	20.50	3	0.35	50	3	5.078	1.853	2.163	0.978	0.958	11.334	4.754	4.711	3.108	1.124
2237	51	1	21.50	4	0.35	50	4	4.780	1.748	1.961	0.946	0.709	14.360	5.621	5.622	3.528	0.866
2238	51	1	22.50	5	0.35	50	5	4.453	1.564	1.792	0.863	0.554	17.030	6.327	6.378	3.688	0.867
2239	51	1	23.50	6	0.35	50	6	4.132	1.447	1.647	0.878	0.450	19.454	6.997	7.047	3.938	0.871
2240	51	1	24.50	7	0.35	50	7	3.822	1.352	1.521	0.895	0.377	21.664	7.636	7.652	4.156	0.820
2241	51	1	25.00	7.5	0.35	50	7.5	3.685	1.302	1.467	0.907	0.348	22.676	7.887	7.932	4.267	0.821
2242	51	1	25.50	8	0.35	50	8	3.550	1.260	1.413	0.918	0.323	23.653	8.125	8.226	4.375	0.822
2243	51	1	26.50	9	0.35	50	9	3.284	1.211	1.323	0.939	0.277	24.917	8.145	8.499	4.260	0.826
2244	51	1	27.50	10	0.35	50	10	3.084	1.115	1.252	0.952	0.245	26.540	8.753	9.012	4.496	0.845
2245	61	1	21.10	0.1	0.35	60	0.1	2.886	1.519	2.360	0.924	5.294	1.254	0.859	0.840	0.165	5.398
2246	61	1	21.25	0.25	0.35	60	0.25	5.634	2.474	4.064	0.915	4.811	2.392	1.486	1.393	0.378	4.569
2247	61	1	21.50	0.5	0.35	60	0.5	6.698	2.621	4.118	1.017	3.665	3.075	1.680	1.474	0.647	3.502
2248	61	1	21.75	0.75	0.35	60	0.75	6.485	2.420	3.648	1.105	2.961	3.204	1.904	1.687	0.953	2.912
2249	61	1	22.00	1	0.35	60	1	6.273	2.381	3.333	1.151	2.540	4.233	2.418	2.194	1.265	2.535
2250	61	1	22.25	1.25	0.35	60	1.25	6.147	2.315	3.138	1.168	2.176	5.300	2.902	2.667	1.663	2.161
2251	61	1	23.00	2	0.35	60	2	6.125	2.262	2.879	1.164	1.515	8.547	4.204	4.032	2.574	1.497
2252	61	1	23.50	2.5	0.35	60	2.5	6.115	2.250	2.777	1.142	1.241	10.558	4.951	4.795	3.049	1.314
2253	61	1	24.00	3	0.35	60	3	6.055	2.221	2.687	1.027	1.040	12.442	5.612	5.474	3.427	1.193
2254	61	1	25.00	4	0.35	60	4	5.813	2.122	2.512	0.989	0.768	15.906	6.717	6.641	3.962	0.883
2255	61	1	26.00	5	0.35	60	5	5.490	1.915	2.340	0.962	0.598	19.012	7.617	7.613	4.119	0.871
2256	61	1	27.00	6	0.35	60	6	5.152	1.787	2.183	0.884	0.485	21.858	8.376	8.459	4.424	0.874
2257	61	1	28.00	7	0.35	60	7	4.833	1.664	2.039	0.895	0.404	24.477	9.256	9.219	4.167	0.824
2258	61	1	28.50	7.5	0.35	60	7.5	4.670	1.609	1.970	0.902	0.373	25.718	9.567	9.570	4.316	0.825
2259	61	1	29.00	8	0.35	60	8	4.518	1.555	1.908	0.911	0.345	26.899	9.862	9.929	4.447	0.826
2260	61	1	30.00	9	0.35	60	9	4.234	1.463	1.790	0.925	0.301	29.166	10.412	10.554	4.698	0.830
2261	61	1	31.00	10	0.35	60	10	3.939	1.404	1.683	0.941	0.261	30.464	10.589	10.870	4.996	0.850
2262	71	1	24.60	0.1	0.35	70	0.1	3.259	1.634	2.627	0.921	5.768	1.480	0.978	0.988	0.196	5.788
2263	71	1	24.75	0.25	0.35	70	0.25	6.398	2.706	4.579	0.926	5.231	2.815	1.702	1.693	0.403	4.900

STP-PT-074: Local Stress in Nozzles, Shells and Formed Heads from External Heads

Model								Membrane Stress Factors									
	OD	T	od	t	d/D	D/T	t/T	Branch					Header				
								Axial	In-Plane	Out-of-Plane	Torsional	Pressure	Axial	In-Plane	Out-of-Plane	Torsional	Pressure
2264	71	1	25.00	0.5	0.35	70	0.5	7.569	2.821	4.625	1.065	3.947	3.622	1.936	1.657	0.674	3.734
2265	71	1	25.25	0.75	0.35	70	0.75	7.296	2.709	4.083	1.149	3.171	3.557	2.101	1.841	0.987	3.097
2266	71	1	25.50	1	0.35	70	1	7.061	2.657	3.737	1.198	2.714	4.636	2.659	2.378	1.316	2.698
2267	71	1	25.75	1.25	0.35	70	1.25	6.938	2.598	3.541	1.216	2.327	5.758	3.206	2.921	1.641	2.309
2268	71	1	26.50	2	0.35	70	2	7.014	2.594	3.338	1.221	1.623	9.202	4.745	4.464	2.709	1.575
2269	71	1	27.00	2.5	0.35	70	2.5	7.083	2.603	3.283	1.201	1.330	11.373	5.663	5.367	3.246	1.382
2270	71	1	27.50	3	0.35	70	3	7.081	2.586	3.228	1.174	1.114	13.446	6.486	6.188	3.685	1.253
2271	71	1	28.50	4	0.35	70	4	6.901	2.494	3.092	1.030	0.821	17.283	7.753	7.605	4.340	0.938
2272	71	1	29.50	5	0.35	70	5	6.592	2.362	2.929	0.999	0.638	20.779	8.856	8.809	4.528	0.874
2273	71	1	30.50	6	0.35	70	6	6.242	2.214	2.761	0.976	0.515	24.007	10.241	9.853	4.887	0.877
2274	71	1	31.50	7	0.35	70	7	5.892	1.991	2.599	0.900	0.429	27.020	10.853	10.791	4.578	0.829
2275	71	1	32.00	7.5	0.35	70	7.5	5.721	1.924	2.521	0.902	0.395	28.444	11.231	11.252	4.729	0.829
2276	71	1	32.50	8	0.35	70	8	5.559	1.862	2.447	0.907	0.366	29.840	11.587	11.646	4.860	0.830
2277	71	1	33.50	9	0.35	70	9	5.234	1.748	2.306	0.921	0.317	32.482	12.249	12.457	5.148	0.833
2278	71	1	34.50	10	0.35	70	10	4.935	1.645	2.178	0.931	0.280	34.969	13.101	13.183	5.417	0.855
2279	81	1	28.10	0.1	0.35	80	0.1	3.613	1.739	2.883	0.919	6.207	1.712	1.086	1.152	0.208	6.149
2280	81	1	28.25	0.25	0.35	80	0.25	7.116	2.916	5.067	0.938	5.612	3.245	1.903	1.946	0.419	5.205
2281	81	1	28.50	0.5	0.35	80	0.5	8.399	3.093	5.106	1.100	4.199	3.722	2.179	1.979	0.698	3.947
2282	81	1	28.75	0.75	0.35	80	0.75	8.089	2.992	4.501	1.187	3.359	3.944	2.272	1.975	1.023	3.266
2283	81	1	29.00	1	0.35	80	1	7.839	2.956	4.126	1.239	2.870	5.066	2.879	2.562	1.334	2.846
2284	81	1	29.25	1.25	0.35	80	1.25	7.732	2.878	3.930	1.261	2.463	6.238	3.482	3.175	1.699	2.444
2285	81	1	30.00	2	0.35	80	2	7.934	2.922	3.795	1.272	1.723	9.862	5.211	4.894	2.822	1.655
2286	81	1	30.50	2.5	0.35	80	2.5	8.091	2.951	3.795	1.254	1.412	12.172	6.264	5.919	3.412	1.440
2287	81	1	31.00	3	0.35	80	3	8.155	2.948	3.786	1.227	1.182	14.383	7.147	6.862	3.914	1.301
2288	81	1	32.00	4	0.35	80	4	8.032	2.863	3.693	1.068	0.870	18.562	8.733	8.541	4.358	0.975
2289	81	1	33.00	5	0.35	80	5	7.739	2.725	3.545	1.032	0.674	22.399	10.471	9.965	4.894	0.877
2290	81	1	34.00	6	0.35	80	6	7.378	2.469	3.371	1.006	0.543	25.967	11.659	11.223	5.311	0.880
2291	81	1	35.00	7	0.35	80	7	7.003	2.318	3.195	0.986	0.452	29.344	12.407	12.354	4.940	0.833
2292	81	1	35.50	7.5	0.35	80	7.5	6.822	2.243	3.110	0.980	0.415	30.952	12.859	12.896	5.109	0.833
2293	81	1	36.00	8	0.35	80	8	6.644	2.174	3.025	0.913	0.384	32.506	13.284	13.379	5.269	0.834
2294	81	1	37.00	9	0.35	80	9	6.297	2.039	2.863	0.917	0.333	35.503	14.070	14.354	5.562	0.837
2295	81	1	38.00	10	0.35	80	10	5.957	1.922	2.710	0.906	0.293	38.375	15.065	15.215	5.858	0.859
2296	91	1	31.60	0.1	0.35	90	0.1	3.952	1.836	3.133	0.917	6.621	1.931	1.187	1.303	0.219	6.488
2297	91	1	31.75	0.25	0.35	90	0.25	7.796	3.080	5.534	0.961	5.961	3.675	2.091	2.214	0.440	5.489
2298	91	1	32.00	0.5	0.35	90	0.5	9.197	3.356	5.572	1.131	4.430	4.198	2.412	2.183	0.718	4.144
2299	91	1	32.25	0.75	0.35	90	0.75	8.861	3.262	4.903	1.222	3.530	4.373	2.538	2.201	1.055	3.422
2300	91	1	32.50	1	0.35	90	1	8.620	3.183	4.507	1.277	3.012	5.548	3.083	2.758	1.378	2.983
2301	91	1	32.75	1.25	0.35	90	1.25	8.536	3.155	4.312	1.301	2.587	6.745	3.737	3.390	1.690	2.571

STP-PT-074: Local Stress in Nozzles, Shells and Formed Heads from External Heads

Model								Membrane Stress Factors									
	OD	T	od	t	d/D	D/T	t/T	Branch					Header				
								Axial	In-Plane	Out-of-Plane	Torsional	Pressure	Axial	In-Plane	Out-of-Plane	Torsional	Pressure
2302	91	1	33.50	2	0.35	90	2	8.898	3.251	4.260	1.318	1.815	10.537	5.642	5.292	2.916	1.742
2303	91	1	34.00	2.5	0.35	90	2.5	9.141	3.289	4.318	1.303	1.489	12.967	6.822	6.470	3.552	1.494
2304	91	1	34.50	3	0.35	90	3	9.268	3.307	4.352	1.277	1.246	15.298	7.839	7.513	3.794	1.346
2305	91	1	35.50	4	0.35	90	4	9.216	3.228	4.319	1.105	0.915	19.744	10.002	9.429	4.613	1.009
2306	91	1	36.50	5	0.35	90	5	8.928	3.087	4.186	1.066	0.708	23.887	11.635	11.087	5.223	0.934
2307	91	1	37.50	6	0.35	90	6	8.549	2.917	4.008	1.035	0.570	27.799	13.021	12.562	5.701	0.882
2308	91	1	38.50	7	0.35	90	7	8.156	2.642	3.821	1.013	0.472	31.518	13.915	13.901	5.269	0.838
2309	91	1	39.00	7.5	0.35	90	7.5	7.957	2.562	3.725	1.004	0.434	33.247	14.442	14.505	5.456	0.837
2310	91	1	39.50	8	0.35	90	8	7.769	2.483	3.633	0.915	0.401	34.901	14.940	15.094	5.635	0.838
2311	91	1	40.50	9	0.35	90	9	7.388	2.336	3.450	0.898	0.347	38.288	15.858	16.243	5.967	0.840
2312	91	1	41.50	10	0.35	90	10	7.029	2.193	3.279	0.908	0.305	41.326	17.007	17.260	6.276	0.655
2313	101	1	35.10	0.1	0.35	100	0.1	4.280	1.927	3.377	0.916	7.026	2.146	1.281	1.457	0.229	6.812
2314	101	1	35.25	0.25	0.35	100	0.25	8.444	3.271	5.985	0.980	6.284	4.095	2.229	2.370	0.460	5.757
2315	101	1	35.50	0.5	0.35	100	0.5	9.958	3.606	6.019	1.161	4.642	4.673	2.507	2.384	0.737	4.329
2316	101	1	35.75	0.75	0.35	100	0.75	9.610	3.528	5.294	1.255	3.687	4.827	2.789	2.445	1.084	3.568
2317	101	1	36.00	1	0.35	100	1	9.391	3.441	4.877	1.311	3.143	6.050	3.273	3.053	1.418	3.111
2318	101	1	36.25	1.25	0.35	100	1.25	9.340	3.428	4.683	1.339	2.703	7.303	3.974	3.661	1.742	2.689
2319	101	1	37.00	2	0.35	100	2	9.877	3.576	4.719	1.362	1.903	11.248	6.041	5.701	2.801	1.825
2320	101	1	37.50	2.5	0.35	100	2.5	10.223	3.648	4.843	1.349	1.562	13.752	7.320	6.964	3.390	1.547
2321	101	1	38.00	3	0.35	100	3	10.415	3.666	4.929	1.324	1.307	16.197	8.486	8.162	3.940	1.386
2322	101	1	39.00	4	0.35	100	4	10.417	3.595	4.953	1.142	0.959	20.870	10.888	10.288	4.840	1.040
2323	101	1	40.00	5	0.35	100	5	10.148	3.445	4.850	1.098	0.740	25.323	12.744	12.178	5.523	0.962
2324	101	1	41.00	6	0.35	100	6	9.750	3.264	4.669	1.064	0.594	29.493	14.325	13.869	6.059	0.884
2325	101	1	42.00	7	0.35	100	7	9.328	3.087	4.468	1.040	0.492	33.425	15.372	15.394	5.571	0.842
2326	101	1	42.50	7.5	0.35	100	7.5	9.115	2.976	4.364	1.030	0.452	35.400	15.980	16.125	5.775	0.841
2327	101	1	43.00	8	0.35	100	8	8.909	2.888	4.263	1.019	0.417	37.201	16.552	16.794	5.971	0.842
2328	101	1	44.00	9	0.35	100	9	8.499	2.633	4.060	1.005	0.360	40.897	17.607	18.140	6.333	0.843
2329	101	1	45.00	10	0.35	100	10	8.114	2.480	3.869	0.926	0.316	44.389	18.912	19.377	6.678	0.643
2330	251	1	87.60	0.1	0.35	250	0.1	8.034	3.046	6.524	0.957	11.163	4.994	2.341	3.844	0.357	10.527
2331	251	1	87.75	0.25	0.35	250	0.25	15.997	5.412	11.794	1.233	9.679	9.642	4.318	6.630	0.735	8.788
2332	251	1	88.00	0.5	0.35	250	0.5	18.962	6.462	11.819	1.520	6.838	11.325	5.385	5.684	1.095	6.375
2333	251	1	88.25	0.75	0.35	250	0.75	18.895	6.631	10.462	1.643	5.315	11.636	5.605	6.181	1.378	5.149
2334	251	1	88.50	1	0.35	250	1	19.423	6.932	9.946	1.739	4.510	14.073	6.324	7.494	1.758	4.483
2335	251	1	88.75	1.25	0.35	250	1.25	20.397	7.210	9.999	1.810	3.925	16.461	6.910	8.928	2.169	3.950
2336	251	1	89.50	2	0.35	250	2	24.475	8.251	11.776	1.945	2.872	23.282	10.366	13.504	3.402	2.797
2337	251	1	90.00	2.5	0.35	250	2.5	26.656	8.654	13.096	1.954	2.397	27.064	12.924	16.285	4.188	2.170
2338	251	1	90.50	3	0.35	250	3	28.107	8.856	14.153	1.943	2.022	30.366	15.443	18.789	5.183	1.892
2339	251	1	91.50	4	0.35	250	4	29.313	8.863	15.431	1.867	1.483	36.617	20.243	23.227	6.658	1.538



STP-PT-074: Local Stress in Nozzles, Shells and Formed Heads from External Heads

Model								Membrane Stress Factors									
	OD	T	od	t	d/D	D/T	t/T	Branch					Header				
								Axial	In-Plane	Out-of-Plane	Torsional	Pressure	Axial	In-Plane	Out-of-Plane	Torsional	Pressure
2340	251	1	92.50	5	0.35	250	5	29.178	8.604	15.898	1.768	1.130	43.144	24.881	26.936	7.588	1.263
2341	251	1	93.50	6	0.35	250	6	28.463	8.255	15.914	1.674	0.891	50.059	29.015	30.802	9.138	0.532
2342	251	1	94.50	7	0.35	250	7	27.515	7.859	15.679	1.602	0.723	57.112	32.788	35.215	10.083	0.516
2343	251	1	95.00	7.5	0.35	250	7.5	27.024	7.689	15.506	1.578	0.658	60.736	34.554	37.442	10.506	0.514
2344	251	1	95.50	8	0.35	250	8	26.527	7.488	15.304	1.556	0.602	64.233	35.031	39.543	10.900	0.514
2345	251	1	96.50	9	0.35	250	9	25.573	7.131	14.885	1.515	0.512	71.255	39.452	43.792	11.621	0.517
2346	251	1	97.50	10	0.35	250	10	24.677	6.825	14.429	1.474	0.443	78.142	42.416	47.814	12.268	0.522
2347	501	1	175.10	0.1	0.35	500	0.1	13.009	4.529	11.030	1.115	15.664	8.939	3.601	7.439	0.515	14.603
2348	501	1	175.25	0.25	0.35	500	0.25	25.925	8.491	20.069	1.621	13.135	17.251	6.938	13.119	1.097	12.053
2349	501	1	175.50	0.5	0.35	500	0.5	31.009	10.417	20.291	2.038	9.093	18.252	8.528	10.784	1.567	8.549
2350	501	1	175.75	0.75	0.35	500	0.75	31.857	10.977	18.427	2.209	6.983	22.255	9.702	12.489	1.886	6.798
2351	501	1	176.00	1	0.35	500	1	34.028	11.752	18.216	2.356	5.905	27.029	10.959	15.109	2.212	5.891
2352	501	1	176.25	1.25	0.35	500	1.25	37.062	12.543	19.088	2.512	5.176	31.785	12.123	18.019	2.630	5.231
2353	501	1	177.00	2	0.35	500	2	47.649	14.970	24.519	2.861	3.889	44.973	12.999	27.255	4.157	3.883
2354	501	1	177.50	2.5	0.35	500	2.5	53.382	15.981	28.205	2.968	3.297	51.861	15.876	32.770	5.170	3.001
2355	501	1	178.00	3	0.35	500	3	57.538	16.550	31.229	2.996	2.818	57.392	19.481	37.578	6.159	2.583
2356	501	1	179.00	4	0.35	500	4	61.935	16.820	35.245	2.912	2.104	65.977	29.601	45.679	8.027	1.984
2357	501	1	180.00	5	0.35	500	5	62.945	16.445	37.195	2.749	1.615	73.261	37.259	52.624	10.098	1.803
2358	501	1	181.00	6	0.35	500	6	62.170	15.817	37.890	2.570	1.273	80.573	44.328	59.169	11.753	1.699
2359	501	1	182.00	7	0.35	500	7	60.545	15.113	37.851	2.399	1.027	89.176	51.008	65.621	13.516	1.385
2360	501	1	182.50	7.5	0.35	500	7.5	59.581	14.752	37.662	2.324	0.930	94.161	54.205	68.881	14.310	0.524
2361	501	1	183.00	8	0.35	500	8	58.543	14.416	37.377	2.251	0.846	99.309	53.474	71.438	14.778	0.511
2362	501	1	184.00	9	0.35	500	9	56.469	13.753	36.678	1.968	0.709	109.391	59.374	77.961	16.009	0.494
2363	501	1	185.00	10	0.35	500	10	54.447	13.151	35.895	1.912	0.604	120.369	65.010	85.969	17.134	0.484
2365	751	1	262.75	0.25	0.35	750	0.25	34.673	11.015	27.888	2.003	15.732	23.497	8.906	18.938	1.383	14.494
2366	751	1	263.00	0.5	0.35	750	0.5	41.812	13.622	28.363	2.521	10.767	25.945	11.387	14.688	1.969	10.179
2367	751	1	263.25	0.75	0.35	750	0.75	43.810	12.635	26.179	2.719	8.225	32.070	13.035	17.074	2.369	8.029
2368	751	1	263.50	1	0.35	750	1	47.751	13.369	26.446	2.927	6.941	39.211	12.214	20.752	2.745	6.935
2369	751	1	263.75	1.25	0.35	750	1.25	52.974	14.647	28.298	3.146	6.097	46.403	13.694	24.970	3.037	6.172
2370	751	1	264.50	2	0.35	750	2	70.120	20.665	37.576	3.706	4.631	66.272	17.672	38.355	3.963	4.696
2371	751	1	265.00	2.5	0.35	750	2.5	79.510	22.269	43.752	3.901	3.955	76.370	19.342	46.296	4.519	3.744
2372	751	1	265.50	3	0.35	750	3	86.551	23.240	48.899	3.983	3.402	84.121	21.095	53.107	6.334	3.193
2373	751	1	266.50	4	0.35	750	4	94.662	23.835	56.003	3.934	2.566	94.820	24.304	63.708	8.582	2.261
2374	751	1	267.50	5	0.35	750	5	97.403	23.466	59.777	3.745	1.987	102.809	27.904	72.629	10.786	1.999
2375	751	1	268.50	6	0.35	750	6	97.082	22.667	61.452	3.506	1.576	110.811	31.966	80.918	13.250	1.843
2376	751	1	269.50	7	0.35	750	7	95.117	21.724	61.743	3.269	1.276	120.013	57.727	89.291	15.319	1.754
2377	751	1	270.00	7.5	0.35	750	7.5	93.825	21.235	61.624	3.152	1.157	125.286	62.020	93.666	16.305	0.554
2378	751	1	270.50	8	0.35	750	8	92.397	20.719	61.356	3.044	1.054	130.678	66.229	98.094	17.260	0.538

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Model								Membrane Stress Factors									
	OD	T	od	t	d/D	D/T	t/T	Branch					Header				
								Axial	In-Plane	Out-of-Plane	Torsional	Pressure	Axial	In-Plane	Out-of-Plane	Torsional	Pressure
2379	751	1	271.50	9	0.35	750	9	89.318	19.810	60.555	2.834	0.884	142.842	74.432	107.674	19.053	0.512
2380	751	1	272.50	10	0.35	750	10	86.151	18.924	59.416	2.657	0.752	155.961	82.242	118.892	20.734	0.493
2382	1001	1	350.25	0.25	0.35	1000	0.25	42.827	13.172	35.677	2.339	18.017	28.844	10.521	24.226	1.632	16.555
2383	1001	1	350.50	0.5	0.35	1000	0.5	51.726	14.759	36.307	2.980	12.178	32.890	13.822	19.353	2.329	11.550
2384	1001	1	350.75	0.75	0.35	1000	0.75	54.729	15.686	33.773	3.220	9.265	41.159	15.944	22.766	2.799	9.060
2385	1001	1	351.00	1	0.35	1000	1	60.385	16.972	34.531	3.484	7.808	50.602	15.301	27.764	3.191	7.804
2386	1001	1	351.25	1.25	0.35	1000	1.25	67.659	18.407	37.382	3.782	6.868	60.116	17.192	33.452	3.566	6.950
2387	1001	1	352.00	2	0.35	1000	2	91.029	25.638	50.590	4.495	5.239	86.424	22.111	51.101	4.603	5.350
2388	1001	1	352.50	2.5	0.35	1000	2.5	103.970	27.778	59.221	4.774	4.491	99.955	24.005	61.603	5.153	4.562
2389	1001	1	353.00	3	0.35	1000	3	113.907	29.115	66.553	4.912	3.877	110.321	25.804	70.630	6.720	3.710
2390	1001	1	354.00	4	0.35	1000	4	125.995	30.101	76.929	4.910	2.946	124.098	28.730	84.910	9.167	2.573
2391	1001	1	355.00	5	0.35	1000	5	130.809	29.781	84.316	4.716	2.298	133.282	31.728	96.035	11.883	2.184
2392	1001	1	356.00	6	0.35	1000	6	131.263	28.856	86.235	4.445	1.834	141.541	54.743	105.992	14.309	1.975
2393	1001	1	357.00	7	0.35	1000	7	129.325	27.724	86.546	4.152	1.494	150.768	64.791	115.860	16.653	1.848
2394	1001	1	357.50	7.5	0.35	1000	7.5	127.751	27.082	86.276	4.010	1.357	156.038	69.751	120.947	17.792	1.804
2395	1001	1	358.00	8	0.35	1000	8	126.044	26.505	86.037	3.866	1.238	161.736	74.648	126.153	18.911	1.769
2396	1001	1	359.00	9	0.35	1000	9	122.190	25.330	85.117	3.593	1.041	174.592	84.249	137.179	21.056	0.536
2397	1001	1	360.00	10	0.35	1000	10	118.225	24.244	83.923	3.353	0.887	188.757	93.560	149.653	23.058	0.512
2399	1251	1	437.75	0.25	0.35	1250	0.25	50.711	15.114	43.806	2.691	20.032	33.672	12.010	29.281	1.858	18.402
2400	1251	1	438.00	0.5	0.35	1250	0.5	61.133	17.441	44.477	3.413	13.450	39.219	15.991	23.700	2.658	12.749
2401	1251	1	438.25	0.75	0.35	1250	0.75	64.946	18.554	41.476	3.693	10.174	49.517	15.821	28.144	3.158	9.951
2402	1251	1	438.50	1	0.35	1250	1	72.117	20.138	42.582	4.016	8.567	61.145	18.181	34.407	3.664	8.551
2403	1251	1	438.75	1.25	0.35	1250	1.25	81.224	21.935	46.329	4.377	7.542	72.876	20.474	41.530	4.097	7.621
2404	1251	1	439.50	2	0.35	1250	2	110.578	30.092	63.392	5.260	5.788	105.428	26.349	63.817	5.246	5.920
2405	1251	1	440.00	2.5	0.35	1250	2.5	127.000	32.751	74.713	5.620	4.976	122.320	28.535	77.131	5.804	5.075
2406	1251	1	440.50	3	0.35	1250	3	139.784	34.440	84.085	5.812	4.309	135.055	30.457	88.286	7.119	4.151
2407	1251	1	441.50	4	0.35	1250	4	155.905	35.776	102.203	5.859	3.289	152.775	33.162	105.908	9.652	2.888
2408	1251	1	442.50	5	0.35	1250	5	162.919	35.555	108.690	5.663	2.575	163.586	35.585	119.401	12.569	2.359
2409	1251	1	443.50	6	0.35	1250	6	164.363	34.567	111.467	5.362	2.062	172.300	59.368	130.786	15.166	2.096
2410	1251	1	444.50	7	0.35	1250	7	162.678	33.284	112.136	5.036	1.685	181.885	70.390	141.985	17.686	1.991
2411	1251	1	445.00	7.5	0.35	1250	7.5	161.138	32.593	111.983	4.867	1.533	187.138	77.788	147.684	18.908	1.873
2412	1251	1	445.50	8	0.35	1250	8	159.207	31.904	111.535	4.704	1.400	192.806	83.429	153.555	20.101	1.827
2413	1251	1	446.50	9	0.35	1250	9	154.802	30.518	110.310	4.384	1.181	205.866	94.565	165.954	22.432	1.761
2414	1251	1	447.50	10	0.35	1250	10	149.900	29.209	108.819	4.062	1.008	221.238	105.374	180.617	24.672	0.534
2416	1501	1	525.25	0.25	0.35	1500	0.25	58.413	16.882	52.076	3.021	21.894	37.914	13.595	33.825	2.083	20.100
2417	1501	1	525.50	0.5	0.35	1500	0.5	70.170	19.962	52.775	3.812	14.612	45.075	17.953	28.013	2.976	13.856
2418	1501	1	525.75	0.75	0.35	1500	0.75	74.646	21.241	49.153	4.144	11.011	57.334	18.119	33.524	3.545	10.766
2419	1501	1	526.00	1	0.35	1500	1	83.098	23.114	50.582	4.539	9.255	71.014	20.903	41.121	4.089	9.234

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Model								Membrane Stress Factors									
	OD	T	od	t	d/D	D/T	t/T	Branch					Header				
								Axial	In-Plane	Out-of-Plane	Torsional	Pressure	Axial	In-Plane	Out-of-Plane	Torsional	Pressure
2420	1501	1	526.25	1.25	0.35	1500	1.25	93.977	25.268	55.196	4.935	8.152	84.856	23.593	49.679	4.605	8.230
2421	1501	1	527.00	2	0.35	1500	2	129.015	34.130	76.098	5.984	6.280	123.371	29.892	76.403	5.876	6.439
2422	1501	1	527.50	2.5	0.35	1500	2.5	148.749	37.255	89.826	6.422	5.412	143.628	32.920	92.214	6.461	5.529
2423	1501	1	528.00	3	0.35	1500	3	164.342	39.295	101.692	6.667	4.694	159.378	35.012	105.878	7.493	4.547
2424	1501	1	529.00	4	0.35	1500	4	185.391	40.979	124.680	6.765	3.595	180.595	37.556	126.730	10.084	3.424
2425	1501	1	530.00	5	0.35	1500	5	193.960	40.856	132.877	6.576	2.822	193.444	51.070	142.344	13.184	2.528
2426	1501	1	531.00	6	0.35	1500	6	196.485	39.842	137.022	6.257	2.266	203.047	63.352	155.645	15.911	2.215
2427	1501	1	532.00	7	0.35	1500	7	195.306	38.430	137.916	5.894	1.856	211.586	77.331	167.566	18.582	2.083
2428	1501	1	532.50	7.5	0.35	1500	7.5	193.619	37.681	137.848	5.707	1.691	218.154	83.377	173.844	19.885	2.043
2429	1501	1	533.00	8	0.35	1500	8	191.580	36.896	137.507	5.523	1.546	224.148	89.401	180.371	21.165	2.008
2430	1501	1	534.00	9	0.35	1500	9	186.705	35.352	135.982	5.162	1.306	237.512	101.395	195.004	23.647	1.949
2431	1501	1	535.00	10	0.35	1500	10	181.195	33.856	134.094	4.821	1.118	253.300	113.144	211.715	26.012	1.743
2434	1751	1	613.00	0.5	0.35	1750	0.5	78.945	22.320	61.279	4.202	15.694	50.558	19.707	32.372	3.275	14.895
2435	1751	1	613.25	0.75	0.35	1750	0.75	83.898	23.768	56.893	4.559	11.789	64.683	20.306	39.007	3.905	11.520
2436	1751	1	613.50	1	0.35	1750	1	93.544	25.910	58.588	4.985	9.887	80.338	23.475	48.006	4.516	9.872
2437	1751	1	613.75	1.25	0.35	1750	1.25	106.086	28.415	64.003	5.429	8.712	96.221	26.551	57.961	5.091	8.887
2438	1751	1	614.50	2	0.35	1750	2	146.468	37.830	88.617	6.673	6.733	140.502	34.282	88.740	6.493	6.910
2439	1751	1	615.00	2.5	0.35	1750	2.5	169.439	41.402	104.836	7.185	5.811	163.967	37.166	107.121	7.114	5.944
2440	1751	1	615.50	3	0.35	1750	3	187.803	43.744	118.726	7.482	5.048	182.494	39.445	122.824	7.856	4.921
2441	1751	1	616.50	4	0.35	1750	4	213.063	45.824	147.238	7.634	3.875	207.579	41.980	147.535	10.857	3.709
2442	1751	1	617.50	5	0.35	1750	5	223.948	45.768	156.877	7.451	3.049	222.774	54.166	164.916	13.736	2.675
2443	1751	1	618.50	6	0.35	1750	6	227.811	44.728	162.037	7.121	2.453	233.530	69.148	179.563	16.572	2.334
2444	1751	1	619.50	7	0.35	1750	7	227.005	43.239	163.778	6.729	2.013	243.679	81.903	193.249	19.369	2.165
2445	1751	1	620.00	7.5	0.35	1750	7.5	225.427	42.397	164.057	6.526	1.836	249.051	88.290	200.941	20.740	2.121
2446	1751	1	620.50	8	0.35	1750	8	223.375	40.748	163.488	6.324	1.680	255.256	94.754	208.681	22.092	2.083
2447	1751	1	621.50	9	0.35	1750	9	218.226	39.877	161.909	5.926	1.422	269.045	107.479	225.260	24.718	2.020
2448	1751	1	622.50	10	0.35	1750	10	212.136	37.566	160.335	5.542	1.218	285.112	120.049	244.236	27.251	1.967
2451	2001	1	700.50	0.5	0.35	2000	0.5	87.649	24.612	70.009	4.577	16.707	55.702	21.350	36.372	3.560	15.865
2452	2001	1	700.75	0.75	0.35	2000	0.75	92.856	26.214	64.798	4.960	12.514	71.626	22.387	44.170	4.231	12.302
2453	2001	1	701.00	1	0.35	2000	1	103.537	28.598	66.561	5.433	10.474	89.178	25.914	54.450	4.924	10.556
2454	2001	1	701.25	1.25	0.35	2000	1.25	117.586	31.404	72.829	5.960	9.233	106.947	29.371	65.949	5.557	9.428
2455	2001	1	702.00	2	0.35	2000	2	163.109	41.309	100.997	7.323	7.153	156.676	38.012	101.277	7.092	7.354
2456	2001	1	702.50	2.5	0.35	2000	2.5	189.152	45.276	119.653	7.907	6.180	183.547	41.264	122.225	7.753	6.323
2457	2001	1	703.00	3	0.35	2000	3	210.229	47.935	135.685	8.257	5.374	204.729	43.766	140.129	8.208	5.480
2458	2001	1	704.00	4	0.35	2000	4	239.646	50.285	168.873	8.464	4.135	233.189	46.326	167.278	11.378	3.974
2459	2001	1	705.00	5	0.35	2000	5	252.772	50.345	181.025	8.294	3.258	251.396	59.380	187.543	14.259	2.854
2460	2001	1	706.00	6	0.35	2000	6	258.210	49.289	187.062	7.954	2.625	263.502	72.826	204.872	17.172	2.452
2461	2001	1	707.00	7	0.35	2000	7	258.001	46.578	189.462	7.540	2.158	274.229	86.097	221.123	20.076	2.237

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Model								Membrane Stress Factors									
	OD	T	od	t	d/D	D/T	t/T	Branch					Header				
								Axial	In-Plane	Out-of-Plane	Torsional	Pressure	Axial	In-Plane	Out-of-Plane	Torsional	Pressure
2462	2001	1	707.50	7.5	0.35	2000	7.5	256.565	45.768	189.607	7.321	1.969	279.847	92.805	229.238	21.505	2.189
2463	2001	1	708.00	8	0.35	2000	8	254.476	44.935	187.858	7.104	1.804	285.937	99.517	234.829	22.919	2.182
2464	2001	1	709.00	9	0.35	2000	9	248.989	43.204	187.779	6.673	1.529	300.111	112.819	255.676	25.673	2.123
2465	2001	1	710.00	10	0.35	2000	10	242.420	41.520	185.940	6.257	1.312	316.627	126.048	275.856	28.332	2.074
2468	2251	1	788.00	0.5	0.35	2250	0.5	96.064	26.847	79.060	4.940	17.667	60.554	20.747	40.319	3.830	16.773
2469	2251	1	788.25	0.75	0.35	2250	0.75	101.369	28.525	72.706	5.346	13.203	78.221	24.337	49.220	4.579	12.984
2470	2251	1	788.50	1	0.35	2250	1	113.037	31.172	74.420	5.857	11.025	97.584	28.247	60.762	5.311	11.125
2471	2251	1	788.75	1.25	0.35	2250	1.25	128.518	34.232	81.376	6.415	9.726	117.375	31.644	73.588	6.041	9.935
2472	2251	1	789.50	2	0.35	2250	2	178.789	43.101	113.118	7.948	7.548	172.592	41.578	113.173	7.673	7.762
2473	2251	1	790.00	2.5	0.35	2250	2.5	207.971	48.876	134.133	8.601	6.527	202.427	45.244	136.533	8.381	6.678
2474	2251	1	790.50	3	0.35	2250	3	231.728	51.797	152.648	8.999	5.681	226.221	47.975	156.895	8.848	5.799
2475	2251	1	791.50	4	0.35	2250	4	265.141	54.506	190.970	9.258	4.377	259.199	50.596	187.978	11.766	4.212
2476	2251	1	792.50	5	0.35	2250	5	280.794	54.672	205.514	9.105	3.454	279.361	62.504	211.705	14.739	3.012
2477	2251	1	793.50	6	0.35	2250	6	287.853	53.619	211.926	8.754	2.787	291.560	76.292	231.276	17.739	2.552
2478	2251	1	794.50	7	0.35	2250	7	288.165	50.569	214.833	8.321	2.294	304.413	89.907	248.329	20.714	2.327
2479	2251	1	795.00	7.5	0.35	2250	7.5	286.916	49.712	215.114	8.093	2.094	308.562	95.046	256.970	22.200	2.281
2480	2251	1	795.50	8	0.35	2250	8	284.952	48.831	214.850	7.861	1.920	316.683	103.918	267.188	23.675	2.239
2481	2251	1	796.50	9	0.35	2250	9	279.350	47.033	212.027	7.403	1.629	328.316	117.754	283.754	26.547	2.174
2482	2251	1	797.50	10	0.35	2250	10	272.210	45.236	211.603	6.956	1.400	345.072	131.607	305.861	29.313	2.119
2485	2501	1	875.50	0.5	0.35	2500	0.5	104.526	28.973	88.511	5.288	18.584	65.159	22.337	44.197	4.078	17.639
2486	2501	1	875.75	0.75	0.35	2500	0.75	109.830	30.758	80.735	5.718	13.854	84.496	26.225	54.092	4.898	13.627
2487	2501	1	876.00	1	0.35	2500	1	122.210	33.646	82.246	6.264	11.588	105.588	30.493	66.888	5.683	11.663
2488	2501	1	876.25	1.25	0.35	2500	1.25	138.984	36.956	89.917	6.900	10.221	127.204	34.614	81.168	6.438	10.414
2489	2501	1	877.00	2	0.35	2500	2	194.076	46.636	125.071	8.540	7.920	187.367	44.491	124.841	8.233	8.135
2490	2501	1	877.50	2.5	0.35	2500	2.5	225.953	52.253	148.540	9.269	6.854	220.303	49.040	150.832	8.994	7.019
2491	2501	1	878.00	3	0.35	2500	3	252.325	55.482	168.059	9.715	5.969	246.806	52.030	172.081	9.475	6.080
2492	2501	1	879.00	4	0.35	2500	4	289.607	58.465	212.530	10.030	4.606	283.736	54.884	207.959	12.224	4.448
2493	2501	1	880.00	5	0.35	2500	5	308.063	58.768	227.311	9.889	3.638	306.446	65.999	234.437	15.201	3.161
2494	2501	1	881.00	6	0.35	2500	6	316.469	57.702	237.296	9.533	2.939	321.754	78.571	258.931	18.267	2.681
2495	2501	1	882.00	7	0.35	2500	7	317.859	55.998	239.972	9.086	2.421	333.488	93.718	277.028	21.318	2.393
2496	2501	1	882.50	7.5	0.35	2500	7.5	316.497	54.207	240.414	8.846	2.212	340.053	100.796	285.831	22.841	2.339
2497	2501	1	883.00	8	0.35	2500	8	314.649	53.158	240.352	8.601	2.029	347.324	107.943	297.283	24.360	2.294
2498	2501	1	884.00	9	0.35	2500	9	308.861	51.056	237.576	8.112	1.724	358.491	122.275	313.661	27.306	2.221
2499	2501	1	885.00	10	0.35	2500	10	301.507	48.957	236.148	7.638	1.482	378.190	136.542	338.984	30.196	2.166
2500	9	1	3.30	0.1	0.4	8	0.1	1.015	1.004	0.964	0.979	3.396	0.200	0.128	0.174	0.095	2.219
2501	9	1	3.45	0.25	0.4	8	0.25	1.165	0.944	0.944	0.961	1.378	0.386	0.256	0.384	0.212	1.847
2502	9	1	3.70	0.5	0.4	8	0.5	1.369	0.873	0.907	0.882	1.029	0.777	0.416	0.498	0.383	1.451
2503	9	1	3.95	0.75	0.4	8	0.75	1.460	0.816	0.820	0.789	0.869	1.395	0.532	0.598	0.511	1.224

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Model								Membrane Stress Factors									
	OD	T	od	t	d/D	D/T	t/T	Branch					Header				
								Axial	In-Plane	Out-of-Plane	Torsional	Pressure	Axial	In-Plane	Out-of-Plane	Torsional	Pressure
2504	9	1	4.20	1	0.4	8	1	1.487	0.768	0.768	0.742	0.788	1.836	0.542	0.678	0.605	1.080
2505	9	1	4.45	1.25	0.4	8	1.25	1.492	0.729	0.729	0.704	0.676	2.428	0.591	0.740	0.669	0.925
2506	9	1	5.20	2	0.4	8	2	1.316	0.634	0.634	0.695	0.464	4.504	0.723	0.916	0.828	0.792
2507	9	1	5.70	2.5	0.4	8	2.5	1.188	0.573	0.573	0.720	0.380	5.792	0.828	1.052	0.921	0.788
2508	9	1	6.20	3	0.4	8	3	1.066	0.520	0.516	0.746	0.332	6.928	0.954	1.189	1.034	0.900
2517	17	1	6.50	0.1	0.4	16	0.1	1.196	1.001	1.132	1.013	3.583	0.391	0.242	0.298	0.115	3.238
2518	17	1	6.65	0.25	0.4	16	0.25	1.832	1.103	1.522	1.027	2.281	0.610	0.413	0.512	0.250	2.728
2519	17	1	6.90	0.5	0.4	16	0.5	2.254	1.112	1.557	0.957	1.807	1.184	0.652	0.700	0.502	2.148
2520	17	1	7.15	0.75	0.4	16	0.75	2.357	1.081	1.424	0.904	1.527	1.811	0.878	0.931	0.733	1.788
2521	17	1	7.40	1	0.4	16	1	2.363	1.000	1.283	0.863	1.351	2.404	1.065	1.114	0.926	1.522
2522	17	1	7.65	1.25	0.4	16	1.25	2.362	0.918	1.164	0.841	1.160	2.992	0.944	1.259	1.092	1.278
2523	17	1	8.40	2	0.4	16	2	2.197	0.772	0.877	0.787	0.810	4.477	1.183	1.568	1.396	0.948
2524	17	1	8.90	2.5	0.4	16	2.5	1.996	0.730	0.730	0.784	0.656	5.252	1.453	1.727	1.486	0.848
2525	17	1	9.40	3	0.4	16	3	1.842	0.688	0.677	0.800	0.553	5.944	1.578	1.882	1.582	0.840
2526	17	1	10.40	4	0.4	16	4	1.577	0.621	0.613	0.826	0.412	8.197	1.714	2.235	1.766	0.847
2527	17	1	11.40	5	0.4	16	5	1.366	0.576	0.576	0.886	0.323	11.004	2.101	2.570	1.972	0.873
2528	17	1	12.40	6	0.4	16	6	1.193	0.523	0.518	0.984	0.262	13.305	2.310	2.880	2.216	0.943
2534	25	1	9.70	0.1	0.4	24	0.1	1.479	1.023	1.390	0.932	3.707	0.566	0.382	0.362	0.135	3.948
2535	25	1	9.85	0.25	0.4	24	0.25	2.549	1.397	2.100	1.019	3.055	0.918	0.641	0.716	0.296	3.336
2536	25	1	10.10	0.5	0.4	24	0.5	3.127	1.448	2.169	0.949	2.427	1.416	0.832	0.848	0.558	2.611
2537	25	1	10.35	0.75	0.4	24	0.75	3.189	1.384	1.975	0.932	2.022	2.118	1.151	1.209	0.851	2.176
2538	25	1	10.60	1	0.4	24	1	3.158	1.297	1.796	0.938	1.764	2.853	1.428	1.455	1.116	1.876
2539	25	1	10.85	1.25	0.4	24	1.25	3.137	1.313	1.653	0.944	1.509	3.593	1.672	1.691	1.362	1.552
2540	25	1	11.60	2	0.4	24	2	2.952	1.146	1.320	0.943	1.046	5.578	1.947	2.239	1.864	1.138
2541	25	1	12.10	2.5	0.4	24	2.5	2.786	1.056	1.155	0.928	0.858	6.700	2.183	2.513	2.056	1.019
2542	25	1	12.60	3	0.4	24	3	2.548	0.981	0.995	0.848	0.709	7.648	2.231	2.730	2.142	0.920
2543	25	1	13.60	4	0.4	24	4	2.239	0.863	0.811	0.860	0.529	9.325	2.879	3.136	2.347	0.863
2544	25	1	14.60	5	0.4	24	5	1.974	0.782	0.691	0.888	0.416	10.701	3.167	3.481	2.522	0.868
2545	25	1	15.60	6	0.4	24	6	1.760	0.724	0.617	0.929	0.341	11.837	3.453	3.794	2.696	0.937
2546	25	1	16.60	7	0.4	24	7	1.588	0.673	0.589	0.991	0.286	13.168	4.121	4.264	2.933	0.813
2547	25	1	17.10	7.5	0.4	24	7.5	1.495	0.665	0.565	1.027	0.264	13.704	4.260	4.462	3.015	0.811
2548	25	1	17.60	8	0.4	24	8	1.433	0.658	0.553	1.070	0.247	14.208	4.392	4.660	3.124	0.815
2549	25	1	18.60	9	0.4	24	9	1.304	0.648	0.526	1.171	0.220	15.113	4.721	5.045	3.460	0.826
2551	33	1	12.90	0.1	0.4	32	0.1	1.785	1.135	1.641	0.937	4.230	0.648	0.514	0.485	0.150	4.505
2552	33	1	13.05	0.25	0.4	32	0.25	3.260	1.664	2.641	0.954	3.695	1.280	0.869	0.920	0.344	3.813
2553	33	1	13.30	0.5	0.4	32	0.5	3.952	1.749	2.728	0.946	2.906	1.684	1.003	0.968	0.613	2.961
2554	33	1	13.55	0.75	0.4	32	0.75	3.948	1.658	2.471	0.995	2.393	2.364	1.369	1.359	0.926	2.463
2555	33	1	13.80	1	0.4	32	1	3.870	1.663	2.257	1.040	2.070	3.201	1.721	1.719	1.237	2.128

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Model								Membrane Stress Factors									
	OD	T	od	t	d/D	D/T	t/T	Branch					Header				
								Axial	In-Plane	Out-of-Plane	Torsional	Pressure	Axial	In-Plane	Out-of-Plane	Torsional	Pressure
2556	33	1	14.05	1.25	0.4	32	1.25	3.824	1.588	2.099	1.052	1.768	4.059	1.913	2.044	1.540	1.780
2557	33	1	14.80	2	0.4	32	2	3.648	1.433	1.757	0.981	1.221	6.436	2.583	2.828	2.214	1.267
2558	33	1	15.30	2.5	0.4	32	2.5	3.495	1.383	1.586	0.961	1.000	7.834	2.935	3.239	2.498	1.144
2559	33	1	15.80	3	0.4	32	3	3.329	1.333	1.444	0.877	0.838	9.098	3.235	3.587	2.696	0.950
2560	33	1	16.80	4	0.4	32	4	2.924	1.205	1.198	0.894	0.612	11.186	3.681	4.118	2.896	0.849
2561	33	1	17.80	5	0.4	32	5	2.634	1.108	1.046	0.904	0.480	13.036	4.067	4.595	3.103	0.816
2562	33	1	18.80	6	0.4	32	6	2.385	0.988	0.933	0.918	0.392	14.621	4.429	5.006	3.295	0.821
2563	33	1	19.80	7	0.4	32	7	2.156	0.924	0.845	0.937	0.330	16.005	4.743	5.387	3.479	0.823
2564	33	1	20.30	7.5	0.4	32	7.5	2.058	0.899	0.809	0.965	0.305	16.620	4.888	5.570	3.574	0.825
2565	33	1	20.80	8	0.4	32	8	1.968	0.870	0.773	0.987	0.284	17.227	5.227	5.762	3.674	0.837
2566	33	1	21.80	9	0.4	32	9	1.803	0.830	0.717	1.037	0.249	18.293	5.524	6.117	3.874	0.784
2567	33	1	22.80	10	0.4	32	10	1.649	0.797	0.673	1.098	0.224	19.246	5.814	6.470	4.163	0.794
2568	41	1	16.10	0.1	0.4	40	0.1	2.113	1.244	1.888	0.938	4.775	0.839	0.637	0.613	0.166	4.992
2569	41	1	16.25	0.25	0.4	40	0.25	3.952	1.928	3.153	0.946	4.239	1.663	1.087	1.211	0.380	4.233
2570	41	1	16.50	0.5	0.4	40	0.5	4.740	2.058	3.248	0.981	3.296	2.135	1.235	1.083	0.636	3.262
2571	41	1	16.75	0.75	0.4	40	0.75	4.658	1.918	2.926	1.068	2.690	2.590	1.544	1.516	0.978	2.707
2572	41	1	17.00	1	0.4	40	1	4.530	1.917	2.678	1.121	2.314	3.508	1.959	1.948	1.321	2.341
2573	41	1	17.25	1.25	0.4	40	1.25	4.457	1.844	2.513	1.138	1.975	4.459	2.273	2.344	1.664	1.970
2574	41	1	18.00	2	0.4	40	2	4.306	1.733	2.185	1.127	1.363	7.161	3.357	3.371	2.480	1.375
2575	41	1	18.50	2.5	0.4	40	2.5	4.184	1.698	2.025	1.027	1.114	8.796	3.864	3.916	2.854	1.242
2576	41	1	19.00	3	0.4	40	3	4.042	1.656	1.889	1.006	0.933	10.286	4.299	4.381	3.125	0.946
2577	41	1	20.00	4	0.4	40	4	3.725	1.556	1.663	0.888	0.691	12.946	5.015	5.159	3.480	0.832
2578	41	1	21.00	5	0.4	40	5	3.332	1.403	1.456	0.926	0.531	15.063	5.308	5.721	3.646	0.872
2579	41	1	22.00	6	0.4	40	6	3.056	1.304	1.319	0.930	0.432	17.083	5.576	6.274	3.868	0.827
2580	41	1	23.00	7	0.4	40	7	2.811	1.215	1.207	0.940	0.362	18.858	6.388	6.755	4.065	0.829
2581	41	1	23.50	7.5	0.4	40	7.5	2.698	1.182	1.159	0.948	0.335	19.665	6.588	6.968	4.166	0.831
2582	41	1	24.00	8	0.4	40	8	2.593	1.143	1.115	0.957	0.311	20.442	6.774	7.184	4.266	0.833
2583	41	1	25.00	9	0.4	40	9	2.397	1.090	1.034	0.994	0.272	21.883	6.909	7.619	4.473	0.850
2584	41	1	26.00	10	0.4	40	10	2.202	0.997	0.967	1.026	0.241	23.184	7.235	8.037	4.686	0.855
2585	51	1	20.10	0.1	0.4	50	0.1	2.495	1.378	2.183	0.936	5.159	1.083	0.769	0.780	0.202	5.496
2586	51	1	20.25	0.25	0.4	50	0.25	4.788	2.197	3.750	0.935	4.828	2.083	1.328	1.401	0.415	4.666
2587	51	1	20.50	0.5	0.4	50	0.5	5.683	2.340	3.849	1.042	3.703	2.647	1.513	1.221	0.700	3.571
2588	51	1	20.75	0.75	0.4	50	0.75	5.506	2.194	3.448	1.148	2.995	2.870	1.856	1.693	1.022	2.957
2589	51	1	21.00	1	0.4	50	1	5.319	2.220	3.167	1.206	2.565	3.857	2.356	2.186	1.400	2.562
2590	51	1	21.25	1.25	0.4	50	1.25	5.216	2.155	2.993	1.227	2.188	4.889	2.819	2.663	1.776	2.171
2591	51	1	22.00	2	0.4	50	2	5.116	2.096	2.708	1.220	1.511	7.919	4.061	3.956	2.727	1.489
2592	51	1	22.50	2.5	0.4	50	2.5	5.048	2.080	2.579	1.192	1.234	9.801	4.757	4.669	3.198	1.336
2593	51	1	23.00	3	0.4	50	3	4.953	2.051	2.467	1.072	1.032	11.546	5.362	5.294	3.557	1.172



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Model								Membrane Stress Factors									
	OD	T	od	t	d/D	D/T	t/T	Branch					Header				
								Axial	In-Plane	Out-of-Plane	Torsional	Pressure	Axial	In-Plane	Out-of-Plane	Torsional	Pressure
2594	51	1	24.00	4	0.4	50	4	4.680	1.883	2.259	1.031	0.763	14.703	6.236	6.346	4.054	0.873
2595	51	1	25.00	5	0.4	50	5	4.367	1.763	2.069	0.918	0.594	17.525	7.016	7.224	4.229	0.878
2596	51	1	26.00	6	0.4	50	6	3.973	1.650	1.871	0.952	0.474	19.759	7.491	7.848	4.532	0.833
2597	51	1	27.00	7	0.4	50	7	3.698	1.546	1.734	0.954	0.396	21.989	8.043	8.479	4.759	0.835
2598	51	1	27.50	7.5	0.4	50	7.5	3.569	1.494	1.671	0.957	0.365	23.044	8.295	8.768	4.871	0.836
2599	51	1	28.00	8	0.4	50	8	3.443	1.453	1.611	0.958	0.338	24.020	8.532	9.061	4.981	0.839
2600	51	1	29.00	9	0.4	50	9	3.206	1.370	1.503	0.965	0.295	25.910	9.210	9.600	4.848	0.858
2601	51	1	30.00	10	0.4	50	10	2.999	1.299	1.407	1.008	0.261	27.643	9.634	10.122	5.107	0.865
2602	61	1	24.10	0.1	0.4	60	0.1	2.883	1.494	2.471	0.934	5.967	1.331	0.893	0.957	0.220	5.974
2603	61	1	24.25	0.25	0.4	60	0.25	5.588	2.434	4.316	0.941	5.347	2.552	1.555	1.693	0.448	5.072
2604	61	1	24.50	0.5	0.4	60	0.5	6.591	2.595	4.418	1.105	4.050	3.212	1.782	2.035	0.736	3.857
2605	61	1	24.75	0.75	0.4	60	0.75	6.332	2.499	3.942	1.209	3.253	3.185	2.064	1.870	1.078	3.184
2606	61	1	25.00	1	0.4	60	1	6.102	2.513	3.633	1.271	2.777	4.209	2.629	2.422	1.425	2.761
2607	61	1	25.25	1.25	0.4	60	1.25	5.978	2.458	3.450	1.294	2.371	5.309	3.164	2.958	1.778	2.351
2608	61	1	26.00	2	0.4	60	2	5.958	2.451	3.230	1.299	1.641	8.602	4.642	4.471	2.915	1.584
2609	61	1	26.50	2.5	0.4	60	2.5	5.963	2.457	3.150	1.272	1.341	10.669	5.501	5.366	3.470	1.418
2610	61	1	27.00	3	0.4	60	3	5.919	2.438	3.072	1.131	1.121	12.642	6.167	6.144	3.918	1.247
2611	61	1	28.00	4	0.4	60	4	5.704	2.265	2.896	1.084	0.826	16.226	7.717	7.467	4.546	0.936
2612	61	1	29.00	5	0.4	60	5	5.399	2.135	2.707	1.050	0.642	19.482	8.779	8.593	4.752	0.830
2613	61	1	30.00	6	0.4	60	6	5.068	2.000	2.524	1.025	0.519	22.484	9.452	9.573	5.107	0.840
2614	61	1	31.00	7	0.4	60	7	4.667	1.883	2.323	0.972	0.425	24.750	9.670	10.206	4.795	0.841
2615	61	1	31.50	7.5	0.4	60	7.5	4.523	1.818	2.245	0.972	0.391	25.986	9.986	10.590	4.950	0.842
2616	61	1	32.00	8	0.4	60	8	4.384	1.767	2.177	0.971	0.362	27.233	10.287	10.944	5.101	0.844
2617	61	1	33.00	9	0.4	60	9	4.117	1.660	2.040	0.975	0.315	29.488	11.111	11.614	5.395	0.865
2618	61	1	34.00	10	0.4	60	10	3.880	1.567	1.926	1.006	0.277	31.629	11.738	12.255	5.675	0.873
2619	71	1	28.10	0.1	0.4	70	0.1	3.259	1.601	2.750	0.931	6.512	1.576	1.007	1.130	0.235	6.415
2620	71	1	28.25	0.25	0.4	70	0.25	6.349	2.649	4.850	0.957	5.808	2.978	1.734	1.929	0.479	5.441
2621	71	1	28.50	0.5	0.4	70	0.5	7.463	2.881	4.957	1.153	4.355	3.361	1.960	2.326	0.772	4.114
2622	71	1	28.75	0.75	0.4	70	0.75	7.143	2.796	4.410	1.262	3.478	3.536	2.251	2.039	1.125	3.388
2623	71	1	29.00	1	0.4	70	1	6.888	2.801	4.074	1.327	2.963	4.617	2.874	2.641	1.467	2.939
2624	71	1	29.25	1.25	0.4	70	1.25	6.762	2.757	3.892	1.356	2.533	5.752	3.473	3.240	1.853	2.514
2625	71	1	30.00	2	0.4	70	2	6.842	2.803	3.748	1.367	1.758	9.255	5.162	4.963	3.063	1.684
2626	71	1	30.50	2.5	0.4	70	2.5	6.933	2.827	3.729	1.343	1.437	11.487	6.281	5.987	3.692	1.451
2627	71	1	31.00	3	0.4	70	3	6.948	2.820	3.693	1.309	1.201	13.615	7.224	6.934	4.209	1.308
2628	71	1	32.00	4	0.4	70	4	6.792	2.736	3.565	1.133	0.882	17.604	8.822	8.547	4.969	0.981
2629	71	1	33.00	5	0.4	70	5	6.500	2.507	3.386	1.092	0.684	21.234	10.121	9.919	5.161	0.837
2630	71	1	34.00	6	0.4	70	6	6.159	2.359	3.192	1.064	0.552	24.603	10.966	11.127	5.586	0.846
2631	71	1	35.00	7	0.4	70	7	5.821	2.218	3.004	0.958	0.459	27.774	11.882	12.210	5.937	0.847

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Model								Membrane Stress Factors									
	OD	T	od	t	d/D	D/T	t/T	Branch					Header				
								Axial	In-Plane	Out-of-Plane	Torsional	Pressure	Axial	In-Plane	Out-of-Plane	Torsional	Pressure
2632	71	1	35.50	7.5	0.4	70	7.5	5.650	2.142	2.913	1.035	0.422	29.267	12.298	12.708	5.335	0.848
2633	71	1	36.00	8	0.4	70	8	5.412	2.086	2.788	0.986	0.384	30.043	12.633	12.816	5.584	0.849
2634	71	1	37.00	9	0.4	70	9	5.105	1.963	2.630	0.985	0.333	32.661	12.982	13.657	5.908	0.870
2635	71	1	38.00	10	0.4	70	10	4.808	1.859	2.488	0.982	0.293	35.129	13.610	14.423	6.209	0.878
2636	81	1	32.10	0.1	0.4	80	0.1	3.615	1.697	3.016	0.930	7.003	1.815	1.110	1.303	0.250	6.824
2637	81	1	32.25	0.25	0.4	80	0.25	7.077	2.833	5.366	0.990	6.229	3.462	1.933	2.255	0.500	5.782
2638	81	1	32.50	0.5	0.4	80	0.5	8.303	3.156	5.473	1.195	4.629	3.861	2.205	2.280	0.815	4.350
2639	81	1	32.75	0.75	0.4	80	0.75	7.946	3.031	4.862	1.309	3.681	3.945	2.445	2.221	1.165	3.573
2640	81	1	33.00	1	0.4	80	1	7.681	3.083	4.501	1.377	3.131	5.053	3.096	2.857	1.523	3.102
2641	81	1	33.25	1.25	0.4	80	1.25	7.563	3.052	4.317	1.410	2.679	6.224	3.752	3.507	1.867	2.664
2642	81	1	34.00	2	0.4	80	2	7.788	3.151	4.269	1.429	1.866	9.907	5.699	5.429	3.007	1.787
2643	81	1	34.50	2.5	0.4	80	2.5	7.959	3.192	4.311	1.407	1.526	12.268	6.891	6.588	3.871	1.518
2644	81	1	35.00	3	0.4	80	3	8.035	3.195	4.326	1.404	1.275	14.553	7.979	7.676	4.453	1.361
2645	81	1	36.00	4	0.4	80	4	7.938	3.121	4.253	1.179	0.935	18.856	9.847	9.564	4.938	1.023
2646	81	1	37.00	5	0.4	80	5	7.659	2.876	4.094	1.133	0.723	22.826	11.386	11.192	5.565	0.942
2647	81	1	38.00	6	0.4	80	6	7.309	2.718	3.898	1.100	0.582	26.562	12.412	12.643	6.058	0.852
2648	81	1	39.00	7	0.4	80	7	6.941	2.561	3.691	1.075	0.483	30.068	13.502	13.930	6.462	0.852
2649	81	1	39.50	7.5	0.4	80	7.5	6.766	2.476	3.592	1.066	0.444	31.804	13.999	14.545	5.738	0.853
2650	81	1	40.00	8	0.4	80	8	6.585	2.500	3.491	1.057	0.410	33.381	14.466	15.102	5.926	0.855
2651	81	1	41.00	9	0.4	80	9	6.145	2.270	3.258	1.070	0.349	35.530	14.818	15.689	6.385	0.874
2652	81	1	42.00	10	0.4	80	10	5.841	2.144	3.089	0.995	0.306	38.398	16.290	16.611	6.716	0.643
2653	91	1	36.10	0.1	0.4	90	0.1	3.951	1.787	3.275	0.928	7.448	2.044	1.205	1.471	0.264	7.206
2654	91	1	36.25	0.25	0.4	90	0.25	7.760	3.027	5.853	1.015	6.610	3.880	2.118	2.507	0.527	6.100
2655	91	1	36.50	0.5	0.4	90	0.5	9.109	3.422	5.968	1.235	4.879	4.364	2.443	2.516	0.851	4.568
2656	91	1	36.75	0.75	0.4	90	0.75	8.732	3.301	5.296	1.351	3.865	4.397	2.712	2.469	1.200	3.745
2657	91	1	37.00	1	0.4	90	1	8.471	3.359	4.910	1.423	3.283	5.548	3.302	3.086	1.571	3.253
2658	91	1	37.25	1.25	0.4	90	1.25	8.388	3.352	4.740	1.460	2.813	6.730	4.004	3.768	1.951	2.803
2659	91	1	38.00	2	0.4	90	2	8.777	3.496	4.788	1.487	1.967	10.580	6.125	5.906	2.961	1.895
2660	91	1	38.50	2.5	0.4	90	2.5	9.044	3.557	4.902	1.468	1.610	13.059	7.450	7.173	3.667	1.578
2661	91	1	39.00	3	0.4	90	3	9.181	3.570	4.971	1.457	1.344	15.442	8.675	8.360	4.258	1.408
2662	91	1	40.00	4	0.4	90	4	9.139	3.497	4.961	1.225	0.984	20.012	10.807	10.539	5.213	1.061
2663	91	1	41.00	5	0.4	90	5	8.864	3.356	4.824	1.173	0.759	24.344	12.338	12.435	5.933	0.988
2664	91	1	42.00	6	0.4	90	6	8.496	3.181	4.626	1.122	0.610	28.364	13.793	14.105	6.489	0.857
2665	91	1	43.00	7	0.4	90	7	8.109	2.988	4.409	1.105	0.505	32.218	15.064	15.650	6.948	0.857
2666	91	1	43.50	7.5	0.4	90	7.5	7.910	2.807	4.297	1.079	0.464	34.033	15.641	16.364	6.106	0.858
2667	91	1	44.00	8	0.4	90	8	7.715	2.727	4.185	1.068	0.428	35.834	16.188	17.010	6.314	0.860
2668	91	1	45.00	9	0.4	90	9	7.350	2.673	3.971	1.068	0.370	39.203	17.530	18.305	6.711	0.623
2669	91	1	46.00	10	0.4	90	10	6.902	2.423	3.717	1.084	0.319	41.384	18.277	18.809	7.190	0.630

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Model								Membrane Stress Factors									
	OD	T	od	t	d/D	D/T	t/T	Branch					Header				
								Axial	In-Plane	Out-of-Plane	Torsional	Pressure	Axial	In-Plane	Out-of-Plane	Torsional	Pressure
2670	101	1	40.10	0.1	0.4	100	0.1	4.274	1.871	3.526	0.928	7.880	2.265	1.293	1.635	0.276	7.571
2671	101	1	40.25	0.25	0.4	100	0.25	8.419	3.229	6.331	1.042	6.973	4.342	2.294	2.834	0.551	6.399
2672	101	1	40.50	0.5	0.4	100	0.5	9.890	3.683	6.453	1.272	5.110	4.923	2.696	2.807	0.840	4.790
2673	101	1	40.75	0.75	0.4	100	0.75	9.503	3.565	5.720	1.391	4.035	4.848	2.967	2.791	1.228	3.913
2674	101	1	41.00	1	0.4	100	1	9.275	3.628	5.323	1.465	3.425	6.044	3.464	3.458	1.620	3.396
2675	101	1	41.25	1.25	0.4	100	1.25	9.220	3.649	5.157	1.507	2.938	7.292	4.235	4.130	2.005	2.932
2676	101	1	42.00	2	0.4	100	2	9.796	3.839	5.306	1.542	2.062	11.290	6.520	6.326	3.065	1.988
2677	101	1	42.50	2.5	0.4	100	2.5	10.166	3.919	5.492	1.525	1.690	13.854	7.969	7.738	3.778	1.635
2678	101	1	43.00	3	0.4	100	3	10.369	3.940	5.622	1.506	1.411	16.343	9.321	9.052	4.412	1.452
2679	101	1	44.00	4	0.4	100	4	10.391	3.870	5.687	1.452	1.031	21.137	11.706	11.476	5.456	1.096
2680	101	1	45.00	5	0.4	100	5	10.110	3.720	5.574	1.212	0.794	25.730	13.456	13.623	6.259	1.022
2681	101	1	46.00	6	0.4	100	6	9.717	3.539	5.375	1.169	0.636	30.012	15.111	15.533	6.884	0.862
2682	101	1	47.00	7	0.4	100	7	9.293	3.351	5.144	1.135	0.526	34.205	16.561	17.292	7.400	0.861
2683	101	1	47.50	7.5	0.4	100	7.5	9.078	3.259	5.022	1.124	0.482	36.168	17.219	18.101	7.625	0.862
2684	101	1	48.00	8	0.4	100	8	8.878	3.166	4.907	1.097	0.445	38.099	17.849	18.922	6.668	0.864
2685	101	1	49.00	9	0.4	100	9	8.474	2.993	4.672	1.096	0.384	42.009	19.368	20.455	7.101	0.610
2686	101	1	50.00	10	0.4	100	10	8.079	2.832	4.444	1.082	0.337	45.649	20.448	21.860	7.493	0.616
2687	251	1	100.10	0.1	0.4	250	0.1	8.014	3.037	6.822	1.009	12.549	5.195	2.325	4.199	0.429	11.797
2688	251	1	100.25	0.25	0.4	250	0.25	15.987	5.559	12.478	1.379	10.731	9.974	4.434	7.282	0.877	9.795
2689	251	1	100.50	0.5	0.4	250	0.5	19.063	6.715	12.681	1.739	7.520	11.949	5.554	6.833	1.318	7.036
2690	251	1	100.75	0.75	0.4	250	0.75	19.076	6.939	11.335	1.893	5.803	12.074	5.985	7.031	1.615	5.634
2691	251	1	101.00	1	0.4	250	1	19.716	7.272	10.887	2.017	4.898	14.508	6.714	8.312	1.984	4.876
2692	251	1	101.25	1.25	0.4	250	1.25	20.778	7.580	11.024	2.111	4.251	16.908	7.197	9.864	2.466	4.287
2693	251	1	102.00	2	0.4	250	2	25.109	8.698	13.158	2.289	3.106	23.861	10.739	14.839	3.903	3.045
2694	251	1	102.50	2.5	0.4	250	2.5	27.389	9.109	14.682	2.317	2.592	27.657	13.389	17.845	4.826	2.343
2695	251	1	103.00	3	0.4	250	3	28.888	9.302	15.877	2.301	2.187	30.924	16.050	20.550	5.701	2.025
2696	251	1	104.00	4	0.4	250	4	30.092	9.266	17.308	2.182	1.602	37.049	21.137	25.314	7.279	1.721
2697	251	1	105.00	5	0.4	250	5	29.892	8.971	17.832	2.047	1.218	43.373	25.821	29.613	9.021	1.319
2698	251	1	106.00	6	0.4	250	6	29.070	8.570	17.841	1.918	0.957	50.129	30.091	33.707	10.429	1.181
2699	251	1	107.00	7	0.4	250	7	28.020	8.150	17.570	1.806	0.775	57.259	33.994	38.583	11.651	0.519
2700	251	1	107.50	7.5	0.4	250	7.5	27.461	7.988	17.364	1.753	0.704	60.907	34.457	41.097	12.198	0.512
2701	251	1	108.00	8	0.4	250	8	26.914	7.794	17.147	1.726	0.643	64.545	38.058	43.571	12.720	0.507
2702	251	1	109.00	9	0.4	250	9	25.861	7.432	16.670	1.675	0.545	71.749	39.684	48.343	12.568	0.506
2703	251	1	110.00	10	0.4	250	10	24.884	7.088	16.171	1.630	0.470	78.653	44.665	52.888	13.249	0.507
2704	501	1	200.10	0.1	0.4	500	0.1	12.989	4.442	11.699	1.225	17.610	9.171	3.629	8.015	0.625	16.442
2705	501	1	200.25	0.25	0.4	500	0.25	26.054	8.713	21.570	1.884	14.594	17.602	6.998	14.316	1.306	13.491
2706	501	1	200.50	0.5	0.4	500	0.5	31.353	10.740	22.116	2.418	10.039	18.864	8.889	12.089	1.901	9.473
2707	501	1	200.75	0.75	0.4	500	0.75	32.359	10.024	20.241	2.623	7.648	22.933	10.076	13.957	2.278	7.454

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Model								Membrane Stress Factors									
	OD	T	od	t	d/D	D/T	t/T	Branch					Header				
								Axial	In-Plane	Out-of-Plane	Torsional	Pressure	Axial	In-Plane	Out-of-Plane	Torsional	Pressure
2708	501	1	201.00	1	0.4	500	1	34.688	10.565	20.148	2.792	6.427	27.748	9.560	16.801	2.614	6.415
2709	501	1	201.25	1.25	0.4	500	1.25	37.898	11.389	21.235	2.991	5.610	32.554	10.633	19.978	2.972	5.675
2710	501	1	202.00	2	0.4	500	2	48.851	15.456	27.393	3.433	4.195	45.948	13.542	29.999	4.728	4.235
2711	501	1	202.50	2.5	0.4	500	2.5	54.711	16.482	31.446	3.566	3.557	52.751	15.942	35.905	5.900	3.285
2712	501	1	203.00	3	0.4	500	3	58.945	17.053	34.779	3.600	3.040	58.029	19.555	41.051	7.047	2.815
2713	501	1	204.00	4	0.4	500	4	63.367	17.274	39.136	3.488	2.269	66.222	26.672	49.614	9.217	2.094
2714	501	1	205.00	5	0.4	500	5	64.285	16.836	41.213	3.278	1.744	73.103	33.778	56.948	11.192	1.879
2715	501	1	206.00	6	0.4	500	6	63.372	16.147	41.919	3.047	1.374	80.412	45.379	63.840	13.059	1.755
2716	501	1	207.00	7	0.4	500	7	61.567	15.381	41.827	2.823	1.108	89.019	52.227	70.714	15.150	1.478
2717	501	1	207.50	7.5	0.4	500	7.5	60.503	15.017	41.599	2.714	1.002	93.539	50.435	74.153	15.930	0.538
2718	501	1	208.00	8	0.4	500	8	59.370	14.649	41.290	2.619	0.909	98.822	53.752	77.058	16.673	0.528
2719	501	1	209.00	9	0.4	500	9	57.115	13.947	40.519	2.445	0.761	109.093	59.746	84.569	18.248	0.507
2720	501	1	210.00	10	0.4	500	10	54.910	13.326	39.644	2.302	0.646	119.716	65.465	93.450	19.688	0.493
2722	751	1	300.25	0.25	0.4	750	0.25	34.997	11.211	30.346	2.358	17.641	23.556	8.887	20.263	1.647	16.273
2723	751	1	300.50	0.5	0.4	750	0.5	42.470	12.825	31.296	3.033	11.929	26.586	11.747	16.505	2.391	11.316
2724	751	1	300.75	0.75	0.4	750	0.75	44.593	13.578	29.058	3.278	9.043	32.885	11.510	19.234	2.858	8.836
2725	751	1	301.00	1	0.4	750	1	48.676	14.583	29.440	3.567	7.581	40.138	13.107	23.308	3.243	7.572
2726	751	1	301.25	1.25	0.4	750	1.25	54.018	15.709	31.619	3.784	6.629	47.533	14.628	27.956	3.623	6.719
2727	751	1	302.00	2	0.4	750	2	71.583	21.066	42.024	4.478	4.994	67.668	18.533	42.497	4.550	5.115
2728	751	1	302.50	2.5	0.4	750	2.5	81.067	22.655	48.756	4.713	4.262	77.819	19.805	50.740	5.747	4.334
2729	751	1	303.00	3	0.4	750	3	88.175	23.608	54.360	4.809	3.664	85.525	21.240	57.973	6.992	3.359
2730	751	1	304.00	4	0.4	750	4	96.308	24.174	61.989	4.746	2.762	95.959	23.719	69.460	9.454	2.410
2731	751	1	305.00	5	0.4	750	5	98.907	23.730	66.835	4.508	2.141	103.491	39.597	78.730	12.187	2.097
2732	751	1	306.00	6	0.4	750	6	98.319	22.868	67.842	4.207	1.701	111.020	48.429	87.344	14.610	1.916
2733	751	1	307.00	7	0.4	750	7	96.139	21.867	67.798	3.894	1.380	119.850	57.121	96.172	17.026	1.799
2734	751	1	307.50	7.5	0.4	750	7.5	94.703	21.332	67.605	3.741	1.252	124.810	61.313	100.671	18.128	1.759
2735	751	1	308.00	8	0.4	750	8	93.175	20.850	67.301	3.601	1.140	130.216	65.486	105.409	19.215	0.559
2736	751	1	309.00	9	0.4	750	9	89.820	19.876	66.226	3.334	0.956	141.788	75.612	116.389	21.249	0.530
2737	751	1	310.00	10	0.4	750	10	86.544	18.957	65.049	3.108	0.813	154.269	83.796	128.283	23.114	0.508
2739	1001	1	400.25	0.25	0.4	1000	0.25	43.360	13.390	39.311	2.807	20.243	28.598	10.796	25.659	1.983	18.654
2740	1001	1	400.50	0.5	0.4	1000	0.5	52.660	15.854	40.558	3.593	13.570	33.442	14.150	21.527	2.835	12.860
2741	1001	1	400.75	0.75	0.4	1000	0.75	55.703	16.815	37.848	3.904	10.207	41.907	14.303	25.416	3.357	9.980
2742	1001	1	401.00	1	0.4	1000	1	61.340	18.147	38.666	4.231	8.545	51.484	16.344	30.925	3.867	8.528
2743	1001	1	401.25	1.25	0.4	1000	1.25	68.703	19.648	41.821	4.559	7.481	61.194	18.286	37.156	4.280	7.565
2744	1001	1	402.00	2	0.4	1000	2	92.391	24.014	56.406	5.470	5.682	87.790	22.601	56.517	5.377	5.835
2745	1001	1	402.50	2.5	0.4	1000	2.5	105.451	28.000	65.861	5.803	4.864	101.380	24.750	67.790	6.217	4.975
2746	1001	1	403.00	3	0.4	1000	3	115.438	29.325	73.852	5.965	4.196	111.719	26.247	77.438	7.421	4.048
2747	1001	1	404.00	4	0.4	1000	4	127.480	30.230	88.192	5.951	3.185	125.387	28.322	92.372	10.396	3.017

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Model								Membrane Stress Factors									
	OD	T	od	t	d/D	D/T	t/T	Branch					Header				
								Axial	In-Plane	Out-of-Plane	Torsional	Pressure	Axial	In-Plane	Out-of-Plane	Torsional	Pressure
2748	1001	1	405.00	5	0.4	1000	5	131.986	29.863	92.980	5.699	2.482	134.192	43.915	103.913	13.102	2.303
2749	1001	1	406.00	6	0.4	1000	6	132.236	28.897	94.695	5.354	1.980	141.915	55.058	114.007	15.762	2.065
2750	1001	1	407.00	7	0.4	1000	7	129.990	27.720	94.869	4.986	1.613	150.720	65.165	124.241	18.321	1.978
2751	1001	1	407.50	7.5	0.4	1000	7.5	128.389	27.113	94.517	4.805	1.466	155.732	70.192	129.557	19.554	1.841
2752	1001	1	408.00	8	0.4	1000	8	126.572	26.478	93.932	4.628	1.337	161.243	75.198	134.927	20.794	1.796
2753	1001	1	409.00	9	0.4	1000	9	122.469	25.270	92.822	4.252	1.125	173.548	84.936	147.635	23.155	0.562
2754	1001	1	410.00	10	0.4	1000	10	118.020	24.109	91.343	3.978	0.958	187.016	94.356	161.592	25.375	0.535
2756	1251	1	500.25	0.25	0.4	1250	0.25	51.393	15.093	48.490	3.230	22.581	32.896	12.342	30.488	2.279	20.791
2757	1251	1	500.50	0.5	0.4	1250	0.5	62.311	18.684	50.015	4.128	15.028	39.578	16.253	26.431	3.252	14.265
2758	1251	1	500.75	0.75	0.4	1250	0.75	65.961	19.820	46.648	4.485	11.233	50.083	16.870	31.564	3.854	10.992
2759	1251	1	501.00	1	0.4	1250	1	72.918	21.452	47.772	4.875	9.393	61.845	19.352	38.551	4.448	9.375
2760	1251	1	501.25	1.25	0.4	1250	1.25	82.084	23.311	51.937	5.322	8.231	73.757	21.718	46.381	4.938	8.388
2761	1251	1	502.00	2	0.4	1250	2	111.546	28.697	70.646	6.392	6.282	106.437	27.638	70.551	6.186	6.463
2762	1251	1	502.50	2.5	0.4	1250	2.5	127.988	32.742	82.894	6.821	5.392	123.360	29.514	84.730	6.725	5.527
2763	1251	1	503.00	3	0.4	1250	3	140.777	34.398	93.114	7.048	4.662	136.395	31.146	96.609	7.902	4.754
2764	1251	1	504.00	4	0.4	1250	4	157.432	35.657	112.515	7.088	3.553	152.998	36.975	115.015	11.033	3.389
2765	1251	1	505.00	5	0.4	1250	5	163.605	35.372	119.052	6.835	2.778	164.335	47.971	128.705	13.886	2.503
2766	1251	1	506.00	6	0.4	1250	6	164.843	33.687	121.949	6.460	2.225	172.692	59.884	140.492	16.714	2.188
2767	1251	1	507.00	7	0.4	1250	7	162.810	32.426	122.237	6.045	1.818	181.464	70.877	151.248	19.465	2.089
2768	1251	1	507.50	7.5	0.4	1250	7.5	160.948	31.767	122.001	5.836	1.654	186.621	76.314	158.063	20.801	2.049
2769	1251	1	508.00	8	0.4	1250	8	158.850	31.073	121.360	5.630	1.511	192.131	81.818	164.741	22.114	2.013
2770	1251	1	509.00	9	0.4	1250	9	154.213	29.724	119.639	5.232	1.274	204.921	92.554	179.414	24.622	1.952
2771	1251	1	510.00	10	0.4	1250	10	148.994	28.427	118.111	4.854	1.088	219.574	103.027	195.577	27.107	0.560
2773	1501	1	600.25	0.25	0.4	1500	0.25	59.291	17.354	58.113	3.639	24.744	36.643	13.759	34.881	2.547	22.739
2774	1501	1	600.50	0.5	0.4	1500	0.5	71.567	21.344	59.798	4.630	16.356	45.171	16.607	31.148	3.636	15.541
2775	1501	1	600.75	0.75	0.4	1500	0.75	75.634	22.626	55.569	5.024	12.204	57.584	19.266	37.539	4.318	11.987
2776	1501	1	601.00	1	0.4	1500	1	83.728	24.544	56.878	5.476	10.161	71.371	22.158	45.998	4.992	10.232
2777	1501	1	601.25	1.25	0.4	1500	1.25	94.473	26.746	61.924	5.990	8.909	85.386	24.933	55.413	5.559	9.099
2778	1501	1	602.00	2	0.4	1500	2	129.305	33.084	84.674	7.256	6.824	123.831	31.174	84.331	6.972	7.027
2779	1501	1	602.50	2.5	0.4	1500	2.5	148.966	37.051	99.571	7.775	5.866	144.016	34.097	101.267	7.554	6.025
2780	1501	1	603.00	3	0.4	1500	3	164.484	39.006	111.963	8.062	5.081	159.734	35.918	115.293	8.364	5.193
2781	1501	1	604.00	4	0.4	1500	4	185.106	40.610	136.918	8.164	3.885	180.846	39.967	137.715	11.630	3.725
2782	1501	1	605.00	5	0.4	1500	5	193.648	40.385	144.965	7.918	3.046	193.585	51.771	153.279	14.573	2.698
2783	1501	1	606.00	6	0.4	1500	6	195.855	39.319	148.661	7.521	2.444	202.730	64.187	166.635	17.537	2.325
2784	1501	1	607.00	7	0.4	1500	7	194.282	37.087	149.628	7.068	2.002	211.967	75.856	180.549	20.448	2.184
2785	1501	1	607.50	7.5	0.4	1500	7.5	192.513	36.375	149.722	6.836	1.824	216.921	81.678	187.865	21.874	2.175
2786	1501	1	608.00	8	0.4	1500	8	190.299	35.628	148.777	6.607	1.667	222.777	87.522	195.345	23.268	2.142
2787	1501	1	609.00	9	0.4	1500	9	185.046	34.093	146.971	6.156	1.409	235.669	99.038	211.332	25.989	2.083

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Model								Membrane Stress Factors									
	OD	T	od	t	d/D	D/T	t/T	Branch					Header				
								Axial	In-Plane	Out-of-Plane	Torsional	Pressure	Axial	In-Plane	Out-of-Plane	Torsional	Pressure
2788	1501	1	610.00	10	0.4	1500	10	179.263	32.699	144.857	5.733	1.205	251.219	110.408	229.327	28.567	2.033
2791	1751	1	700.50	0.5	0.4	1750	0.5	80.637	23.899	69.831	5.105	17.592	50.332	18.479	35.674	3.993	16.717
2792	1751	1	700.75	0.75	0.4	1750	0.75	84.826	25.279	64.564	5.533	13.084	64.558	21.500	43.361	4.751	12.864
2793	1751	1	701.00	1	0.4	1750	1	93.869	27.470	65.832	6.033	10.865	80.257	24.811	53.214	5.463	10.962
2794	1751	1	701.25	1.25	0.4	1750	1.25	106.049	29.966	71.730	6.619	9.532	96.209	27.959	64.242	6.146	9.749
2795	1751	1	702.00	2	0.4	1750	2	145.893	37.210	98.399	8.065	7.318	140.239	35.154	97.759	7.725	7.544
2796	1751	1	702.50	2.5	0.4	1750	2.5	168.616	40.623	115.918	8.674	6.300	163.541	38.461	117.400	8.365	6.479
2797	1751	1	703.00	3	0.4	1750	3	186.856	43.200	130.901	9.019	5.464	181.936	40.509	133.985	9.326	5.595
2798	1751	1	704.00	4	0.4	1750	4	211.268	45.123	160.331	9.185	4.187	206.875	44.810	159.435	12.186	4.033
2799	1751	1	705.00	5	0.4	1750	5	222.345	44.994	170.627	8.952	3.289	221.827	55.329	177.880	15.212	2.883
2800	1751	1	706.00	6	0.4	1750	6	225.860	43.906	175.279	8.538	2.645	232.283	68.076	194.849	18.274	2.461
2801	1751	1	707.00	7	0.4	1750	7	224.779	41.908	176.746	8.054	2.170	242.034	80.258	210.374	21.312	2.296
2802	1751	1	707.50	7.5	0.4	1750	7.5	223.080	41.027	176.593	7.801	1.978	247.331	86.397	218.214	22.808	2.250
2803	1751	1	708.00	8	0.4	1750	8	220.828	40.139	176.302	7.552	1.811	253.041	92.568	226.618	24.283	2.213
2804	1751	1	709.00	9	0.4	1750	9	215.318	38.339	174.057	7.060	1.533	266.354	104.744	243.761	27.140	2.147
2805	1751	1	710.00	10	0.4	1750	10	209.062	36.658	171.856	6.590	1.313	282.131	116.840	262.863	29.889	2.095
2808	2001	1	800.50	0.5	0.4	2000	0.5	89.392	26.249	80.063	5.557	18.762	55.122	20.195	40.048	4.331	17.821
2809	2001	1	800.75	0.75	0.4	2000	0.75	93.621	27.769	73.659	6.010	13.912	71.077	23.598	49.053	5.135	13.679
2810	2001	1	801.00	1	0.4	2000	1	103.448	30.181	74.908	6.569	11.563	88.574	27.274	60.364	5.954	11.645
2811	2001	1	801.25	1.25	0.4	2000	1.25	116.942	33.011	81.345	7.201	10.110	106.412	30.813	72.789	6.695	10.350
2812	2001	1	802.00	2	0.4	2000	2	161.524	41.106	111.837	8.830	7.779	155.674	39.613	110.898	8.452	8.025
2813	2001	1	802.50	2.5	0.4	2000	2.5	187.223	44.962	131.958	9.522	6.704	182.080	42.649	133.186	9.146	6.899
2814	2001	1	803.00	3	0.4	2000	3	207.945	47.514	149.140	9.930	5.819	203.024	44.965	151.973	9.843	5.964
2815	2001	1	804.00	4	0.4	2000	4	236.079	49.787	183.570	10.155	4.467	230.895	47.944	181.270	12.724	4.320
2816	2001	1	805.00	5	0.4	2000	5	249.830	49.758	196.013	9.935	3.515	247.863	58.716	204.321	15.812	3.069
2817	2001	1	806.00	6	0.4	2000	6	254.709	48.589	201.442	9.512	2.831	261.069	71.678	223.156	18.949	2.507
2818	2001	1	807.00	7	0.4	2000	7	254.259	46.887	202.594	9.003	2.326	271.404	84.305	239.052	22.096	2.373
2819	2001	1	807.50	7.5	0.4	2000	7.5	252.655	45.942	203.501	8.736	2.122	274.340	90.675	247.179	23.645	2.321
2820	2001	1	808.00	8	0.4	2000	8	250.479	44.939	202.965	8.468	1.944	282.794	97.084	257.520	25.184	2.278
2821	2001	1	809.00	9	0.4	2000	9	244.683	43.009	201.196	7.937	1.647	296.242	105.943	276.171	27.622	2.206
2822	2001	1	810.00	10	0.4	2000	10	237.879	41.111	198.943	7.427	1.413	312.029	119.267	296.360	30.686	2.150
2825	2251	1	900.50	0.5	0.4	2250	0.5	98.030	28.571	90.498	5.991	19.865	59.607	21.868	44.323	4.650	18.856
2826	2251	1	900.75	0.75	0.4	2250	0.75	102.108	30.178	82.709	6.470	14.692	77.197	25.607	54.484	5.552	14.445
2827	2251	1	901.00	1	0.4	2250	1	112.597	32.806	83.795	7.073	12.198	96.458	29.659	67.256	6.416	12.283
2828	2251	1	901.25	1.25	0.4	2250	1.25	127.323	35.940	91.379	7.761	10.653	116.056	33.546	81.620	7.224	10.920
2829	2251	1	902.00	2	0.4	2250	2	176.383	44.824	125.036	9.552	8.213	170.088	42.571	123.772	9.143	8.475
2830	2251	1	902.50	2.5	0.4	2250	2.5	204.851	49.163	147.351	10.327	7.082	199.151	47.448	148.345	9.906	7.295
2831	2251	1	903.00	3	0.4	2250	3	228.077	51.989	167.480	10.793	6.153	223.141	49.245	169.995	10.340	6.311



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Model								Membrane Stress Factors									
	OD	T	od	t	d/D	D/T	t/T	Branch					Header				
								Axial	In-Plane	Out-of-Plane	Torsional	Pressure	Axial	In-Plane	Out-of-Plane	Torsional	Pressure
2832	2251	1	904.00	4	0.4	2250	4	259.695	54.586	206.389	11.085	4.730	255.863	50.938	204.986	13.233	4.589
2833	2251	1	905.00	5	0.4	2250	5	275.983	54.667	219.778	10.880	3.726	275.596	61.899	230.233	16.364	3.243
2834	2251	1	906.00	6	0.4	2250	6	282.552	53.453	228.715	10.448	3.004	289.158	75.112	253.284	19.594	2.598
2835	2251	1	907.00	7	0.4	2250	7	282.747	51.629	229.861	9.914	2.471	300.511	83.742	270.624	21.797	2.445
2836	2251	1	907.50	7.5	0.4	2250	7.5	281.430	50.644	229.879	9.638	2.256	305.729	90.223	279.200	23.441	2.387
2837	2251	1	908.00	8	0.4	2250	8	279.159	49.609	229.440	9.351	2.068	311.287	96.611	287.897	25.097	2.338
2838	2251	1	909.00	9	0.4	2250	9	273.340	47.522	228.249	8.791	1.755	325.237	109.696	308.063	28.398	2.257
2839	2251	1	910.00	10	0.4	2250	10	266.260	45.479	225.931	8.246	1.508	337.954	123.523	329.027	31.582	2.195
2842	2501	1	1000.50	0.5	0.4	2500	0.5	106.484	30.796	100.775	6.410	20.939	63.786	23.423	48.230	4.956	19.844
2843	2501	1	1000.75	0.75	0.4	2500	0.75	110.343	32.252	91.853	6.906	15.435	82.970	27.477	59.795	5.919	15.172
2844	2501	1	1001.00	1	0.4	2500	1	121.226	35.329	92.664	7.553	12.805	103.924	31.884	74.067	6.855	12.882
2845	2501	1	1001.25	1.25	0.4	2500	1.25	137.145	38.649	100.532	8.263	11.231	125.150	36.134	89.647	7.739	11.464
2846	2501	1	1002.00	2	0.4	2500	2	190.374	48.367	138.087	10.244	8.624	184.333	46.075	136.477	9.810	8.899
2847	2501	1	1002.50	2.5	0.4	2500	2.5	221.442	53.046	163.208	11.098	7.441	216.434	50.582	163.950	10.638	7.669
2848	2501	1	1003.00	3	0.4	2500	3	247.101	56.216	185.081	11.621	6.467	242.346	53.414	187.714	10.728	6.640
2849	2501	1	1004.00	4	0.4	2500	4	282.409	59.168	228.537	11.967	4.978	278.728	53.851	227.242	13.727	4.843
2850	2501	1	1005.00	5	0.4	2500	5	301.448	59.320	243.230	11.786	3.926	301.097	64.960	255.228	15.984	3.412
2851	2501	1	1006.00	6	0.4	2500	6	309.543	58.140	252.512	11.350	3.168	316.185	72.769	279.689	19.158	2.689
2852	2501	1	1007.00	7	0.4	2500	7	310.393	56.228	255.704	10.797	2.609	325.240	86.809	298.155	22.373	2.516
2853	2501	1	1007.50	7.5	0.4	2500	7.5	309.288	55.186	255.899	10.507	2.383	333.721	93.347	309.256	23.993	2.451
2854	2501	1	1008.00	8	0.4	2500	8	307.098	54.116	256.316	10.211	2.185	336.855	99.949	317.481	25.658	2.395
2855	2501	1	1009.00	9	0.4	2500	9	301.292	51.869	255.899	9.615	1.856	354.826	113.289	342.452	29.081	2.293
2856	2501	1	1010.00	10	0.4	2500	10	293.866	49.695	252.748	9.038	1.596	366.852	127.352	361.076	32.376	2.237
2857	9	1	3.70	0.1	0.45	8	0.1	1.018	1.010	0.968	1.001	3.815	0.207	0.136	0.177	0.099	2.426
2858	9	1	3.85	0.25	0.45	8	0.25	1.170	0.952	0.993	0.997	1.559	0.447	0.273	0.390	0.230	2.018
2859	9	1	4.10	0.5	0.45	8	0.5	1.373	0.885	0.969	0.921	1.163	0.972	0.457	0.516	0.422	1.570
2860	9	1	4.35	0.75	0.45	8	0.75	1.469	0.833	0.881	0.821	0.981	1.574	0.594	0.652	0.568	1.308
2861	9	1	4.60	1	0.45	8	1	1.473	0.778	0.785	0.759	0.870	2.172	0.658	0.744	0.664	1.133
2862	9	1	4.85	1.25	0.45	8	1.25	1.484	0.741	0.740	0.720	0.745	2.883	0.627	0.817	0.741	0.949
2863	9	1	5.60	2	0.45	8	2	1.367	0.651	0.651	0.708	0.516	5.219	0.789	1.019	0.911	0.790
2864	9	1	6.10	2.5	0.45	8	2.5	1.252	0.609	0.609	0.732	0.423	6.501	0.909	1.160	1.021	0.932
2865	9	1	6.60	3	0.45	8	3	1.140	0.552	0.552	0.764	0.366	7.777	1.051	1.306	1.137	0.948
2874	17	1	7.30	0.1	0.45	16	0.1	1.190	0.996	1.173	0.930	4.046	0.399	0.266	0.254	0.130	3.537
2875	17	1	7.45	0.25	0.45	16	0.25	1.806	1.114	1.613	1.056	2.555	0.627	0.450	0.523	0.281	2.984
2876	17	1	7.70	0.5	0.45	16	0.5	2.207	1.128	1.664	0.966	2.029	1.169	0.711	0.745	0.533	2.335
2877	17	1	7.95	0.75	0.45	16	0.75	2.306	1.122	1.530	0.911	1.706	1.843	0.968	1.007	0.816	1.931
2878	17	1	8.20	1	0.45	16	1	2.319	1.045	1.388	0.892	1.500	2.457	1.185	1.217	1.039	1.644
2879	17	1	8.45	1.25	0.45	16	1.25	2.327	0.965	1.264	0.873	1.281	3.063	1.356	1.383	1.230	1.361

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Model								Membrane Stress Factors									
	OD	T	od	t	d/D	D/T	t/T	Branch					Header				
								Axial	In-Plane	Out-of-Plane	Torsional	Pressure	Axial	In-Plane	Out-of-Plane	Torsional	Pressure
2880	17	1	9.20	2	0.45	16	2	2.123	0.884	0.933	0.822	0.873	4.590	1.767	1.731	1.542	0.991
2881	17	1	9.70	2.5	0.45	16	2.5	1.981	0.799	0.792	0.825	0.716	5.494	1.496	1.953	1.682	0.871
2882	17	1	10.20	3	0.45	16	3	1.846	0.715	0.712	0.834	0.601	6.657	1.658	2.142	1.788	0.844
2883	17	1	11.20	4	0.45	16	4	1.589	0.653	0.653	0.867	0.448	9.568	1.964	2.500	1.972	0.848
2884	17	1	12.20	5	0.45	16	5	1.383	0.597	0.587	0.895	0.351	12.489	2.267	2.849	2.194	0.980
2885	17	1	13.20	6	0.45	16	6	1.218	0.555	0.555	0.963	0.288	14.929	2.915	3.160	2.444	0.985
2886	17	1	14.20	7	0.45	16	7	1.085	0.526	0.509	1.135	0.246	17.347	3.178	3.468	2.729	0.990
2891	25	1	10.90	0.1	0.45	24	0.1	1.468	1.019	1.440	0.944	4.178	0.592	0.409	0.385	0.153	4.297
2892	25	1	11.05	0.25	0.45	24	0.25	2.498	1.395	2.216	0.991	3.391	0.931	0.688	0.805	0.335	3.643
2893	25	1	11.30	0.5	0.45	24	0.5	3.040	1.464	2.310	0.957	2.692	1.403	0.903	0.910	0.628	2.834
2894	25	1	11.55	0.75	0.45	24	0.75	3.092	1.417	2.117	0.969	2.232	2.133	1.251	1.299	0.945	2.349
2895	25	1	11.80	1	0.45	24	1	3.065	1.478	1.938	1.018	1.937	2.887	1.562	1.581	1.249	2.016
2896	25	1	12.05	1.25	0.45	24	1.25	3.054	1.388	1.793	0.997	1.651	3.646	1.829	1.850	1.534	1.662
2897	25	1	12.80	2	0.45	24	2	2.818	1.253	1.413	0.909	1.117	5.659	2.540	2.459	2.073	1.184
2898	25	1	13.30	2.5	0.45	24	2.5	2.659	1.153	1.239	0.904	0.913	6.814	2.301	2.768	2.287	1.043
2899	25	1	13.80	3	0.45	24	3	2.498	1.087	1.100	0.904	0.765	7.848	2.669	3.031	2.427	0.948
2900	25	1	14.80	4	0.45	24	4	2.201	0.977	0.897	0.910	0.569	9.621	3.071	3.477	2.647	0.867
2901	25	1	15.80	5	0.45	24	5	1.954	0.894	0.757	0.926	0.447	11.106	3.418	3.853	2.832	0.942
2902	25	1	16.80	6	0.45	24	6	1.743	0.827	0.665	0.967	0.365	12.674	4.164	4.342	3.039	0.950
2903	25	1	17.80	7	0.45	24	7	1.563	0.770	0.614	0.999	0.307	13.948	4.448	4.750	3.282	0.972
2904	25	1	18.30	7.5	0.45	24	7.5	1.478	0.747	0.594	1.027	0.284	14.548	4.580	4.957	3.349	0.802
2905	25	1	18.80	8	0.45	24	8	1.407	0.731	0.592	1.058	0.264	15.105	4.712	5.159	3.475	0.802
2906	25	1	19.80	9	0.45	24	9	1.276	0.707	0.556	1.135	0.227	16.013	4.994	5.496	3.831	0.812
2907	25	1	20.80	10	0.45	24	10	1.157	0.845	0.526	1.224	0.205	17.626	5.264	5.842	4.135	0.821
2908	33	1	14.50	0.1	0.45	32	0.1	1.769	1.125	1.702	0.949	4.741	0.682	0.542	0.544	0.173	4.917
2909	33	1	14.65	0.25	0.45	32	0.25	3.190	1.647	2.783	0.965	4.078	1.345	0.921	0.856	0.403	4.180
2910	33	1	14.90	0.5	0.45	32	0.5	3.835	1.768	2.900	0.979	3.200	1.714	1.060	1.054	0.668	3.225
2911	33	1	15.15	0.75	0.45	32	0.75	3.813	1.689	2.644	1.079	2.623	2.375	1.480	1.476	1.023	2.667
2912	33	1	15.40	1	0.45	32	1	3.736	1.742	2.434	1.141	2.259	3.230	1.870	1.876	1.380	2.295
2913	33	1	15.65	1.25	0.45	32	1.25	3.698	1.672	2.276	1.160	1.922	4.115	2.099	2.244	1.731	1.917
2914	33	1	16.40	2	0.45	32	2	3.548	1.565	1.934	1.074	1.319	6.555	2.845	3.138	2.515	1.335
2915	33	1	16.90	2.5	0.45	32	2.5	3.314	1.508	1.711	0.965	1.059	7.925	3.020	3.563	2.781	1.176
2916	33	1	17.40	3	0.45	32	3	3.155	1.435	1.563	0.960	0.886	9.212	3.327	3.947	3.000	1.069
2917	33	1	18.40	4	0.45	32	4	2.844	1.355	1.332	0.958	0.656	11.481	3.917	4.586	3.285	0.855
2918	33	1	19.40	5	0.45	32	5	2.565	1.251	1.162	0.960	0.514	13.424	4.642	5.111	3.508	0.819
2919	33	1	20.40	6	0.45	32	6	2.324	1.155	1.031	0.967	0.419	15.108	4.842	5.553	3.711	0.870
2920	33	1	21.40	7	0.45	32	7	2.114	1.048	0.927	0.994	0.351	16.576	5.169	5.959	3.903	0.947
2921	33	1	21.90	7.5	0.45	32	7.5	2.022	1.015	0.883	1.003	0.325	17.263	5.541	6.156	4.006	0.785

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Model								Membrane Stress Factors									
	OD	T	od	t	d/D	D/T	t/T	Branch					Header				
								Axial	In-Plane	Out-of-Plane	Torsional	Pressure	Axial	In-Plane	Out-of-Plane	Torsional	Pressure
2922	33	1	22.40	8	0.45	32	8	1.921	0.986	0.841	1.017	0.302	17.888	5.697	6.337	4.106	0.786
2923	33	1	23.40	9	0.45	32	9	1.769	0.940	0.778	1.054	0.264	19.662	6.465	6.984	4.352	0.844
2924	33	1	24.40	10	0.45	32	10	1.625	0.895	0.749	1.144	0.234	20.967	6.871	7.459	4.677	0.839
2925	41	1	18.10	0.1	0.45	40	0.1	2.109	1.237	1.953	0.950	5.146	0.878	0.657	0.680	0.215	5.419
2926	41	1	18.25	0.25	0.45	40	0.25	3.866	1.903	3.308	0.954	4.666	1.697	1.129	1.038	0.443	4.612
2927	41	1	18.50	0.5	0.45	40	0.5	4.598	2.026	3.442	1.050	3.613	2.130	1.293	1.193	0.721	3.536
2928	41	1	18.75	0.75	0.45	40	0.75	4.492	1.958	3.123	1.173	2.934	2.587	1.789	1.645	1.082	2.920
2929	41	1	19.00	1	0.45	40	1	4.361	2.005	2.884	1.242	2.513	3.519	2.284	2.122	1.475	2.518
2930	41	1	19.25	1.25	0.45	40	1.25	4.294	1.939	2.719	1.266	2.138	4.487	2.565	2.568	1.868	2.119
2931	41	1	20.00	2	0.45	40	2	4.167	1.870	2.404	1.154	1.466	7.255	3.557	3.715	2.810	1.442
2932	41	1	20.50	2.5	0.45	40	2.5	4.057	1.849	2.245	1.128	1.197	8.931	4.091	4.329	3.241	1.300
2933	41	1	21.00	3	0.45	40	3	3.819	1.821	2.052	1.150	0.984	10.376	4.469	4.805	3.474	1.150
2934	41	1	22.00	4	0.45	40	4	3.521	1.694	1.817	0.998	0.727	13.064	5.213	5.663	3.861	0.869
2935	41	1	23.00	5	0.45	40	5	3.230	1.575	1.627	0.994	0.567	15.440	5.807	6.364	4.130	0.830
2936	41	1	24.00	6	0.45	40	6	2.963	1.463	1.467	0.992	0.461	17.556	6.533	6.974	4.370	0.839
2937	41	1	25.00	7	0.45	40	7	2.726	1.367	1.339	0.995	0.385	19.413	6.986	7.484	4.579	0.843
2938	41	1	25.50	7.5	0.45	40	7.5	2.617	1.323	1.282	1.002	0.356	20.270	7.190	7.725	4.685	0.845
2939	41	1	26.00	8	0.45	40	8	2.514	1.282	1.228	1.022	0.330	21.106	7.151	7.981	4.797	0.860
2940	41	1	27.00	9	0.45	40	9	2.324	1.210	1.131	1.043	0.288	22.634	7.506	8.411	5.010	0.792
2941	41	1	28.00	10	0.45	40	10	2.153	1.193	1.048	1.075	0.256	24.038	8.515	8.850	5.254	0.795
2942	51	1	22.60	0.1	0.45	50	0.1	2.474	1.355	2.264	0.949	5.779	1.134	0.790	0.868	0.240	6.010
2943	51	1	22.75	0.25	0.45	50	0.25	4.693	2.154	3.934	0.952	5.312	2.185	1.371	1.575	0.489	5.116
2944	51	1	23.00	0.5	0.45	50	0.5	5.521	2.292	4.079	1.136	4.044	2.715	1.579	1.921	0.785	3.887
2945	51	1	23.25	0.75	0.45	50	0.75	5.311	2.272	3.680	1.261	3.254	2.852	2.015	1.853	1.165	3.200
2946	51	1	23.50	1	0.45	50	1	5.119	2.320	3.411	1.336	2.776	3.851	2.546	2.390	1.556	2.763
2947	51	1	23.75	1.25	0.45	50	1.25	5.016	2.262	3.238	1.365	2.362	4.902	3.055	2.913	1.988	2.340
2948	51	1	24.50	2	0.45	50	2	4.935	2.246	2.983	1.363	1.623	7.988	4.417	4.331	3.087	1.563
2949	51	1	25.00	2.5	0.45	50	2.5	4.884	2.245	2.867	1.210	1.324	9.925	5.106	5.159	3.637	1.357
2950	51	1	25.50	3	0.45	50	3	4.797	2.225	2.756	1.180	1.106	11.711	5.740	5.857	4.053	1.219
2951	51	1	26.50	4	0.45	50	4	4.422	2.101	2.473	1.123	0.801	14.789	6.402	6.932	4.492	0.913
2952	51	1	27.50	5	0.45	50	5	4.134	1.968	2.274	1.033	0.623	17.630	7.447	7.894	4.832	0.848
2953	51	1	28.50	6	0.45	50	6	3.851	1.849	2.095	1.026	0.505	20.212	8.142	8.710	5.110	0.847
2954	51	1	29.50	7	0.45	50	7	3.584	1.724	1.935	1.020	0.421	22.544	8.741	9.409	5.368	0.851
2955	51	1	30.00	7.5	0.45	50	7.5	3.459	1.663	1.863	1.019	0.388	23.636	9.324	9.742	5.490	0.853
2956	51	1	30.50	8	0.45	50	8	3.340	1.617	1.793	1.025	0.359	24.710	9.515	10.070	5.615	0.869
2957	51	1	31.50	9	0.45	50	9	3.113	1.515	1.668	1.028	0.313	26.654	10.125	10.643	5.450	0.877
2958	51	1	32.50	10	0.45	50	10	2.901	1.435	1.553	1.053	0.276	28.456	10.464	11.166	5.743	0.885
2959	61	1	27.10	0.1	0.45	60	0.1	2.857	1.463	2.562	0.947	6.670	1.394	0.909	1.064	0.261	6.543

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Model								Membrane Stress Factors									
	OD	T	od	t	d/D	D/T	t/T	Branch					Header				
								Axial	In-Plane	Out-of-Plane	Torsional	Pressure	Axial	In-Plane	Out-of-Plane	Torsional	Pressure
2960	61	1	27.25	0.25	0.45	60	0.25	5.487	2.375	4.523	0.976	5.873	2.670	1.573	1.891	0.531	5.563
2961	61	1	27.50	0.5	0.45	60	0.5	6.419	2.629	4.680	1.202	4.421	3.366	1.811	2.247	0.848	4.204
2962	61	1	27.75	0.75	0.45	60	0.75	6.122	2.581	4.205	1.334	3.533	3.155	2.215	2.054	1.228	3.451
2963	61	1	28.00	1	0.45	60	1	5.885	2.628	3.908	1.414	3.005	4.195	2.827	2.651	1.604	2.982
2964	61	1	28.25	1.25	0.45	60	1.25	5.761	2.579	3.737	1.446	2.559	5.299	3.409	3.237	2.009	2.539
2965	61	1	29.00	2	0.45	60	2	5.754	2.616	3.563	1.457	1.763	8.647	5.103	4.906	3.295	1.684
2966	61	1	29.50	2.5	0.45	60	2.5	5.764	2.632	3.498	1.424	1.438	10.765	6.075	5.877	3.939	1.445
2967	61	1	30.00	3	0.45	60	3	5.732	2.622	3.429	1.250	1.200	12.762	6.934	6.779	4.451	1.296
2968	61	1	31.00	4	0.45	60	4	5.396	2.508	3.173	1.181	0.866	16.264	7.934	8.128	5.030	0.985
2969	61	1	32.00	5	0.45	60	5	5.111	2.368	2.973	1.144	0.672	19.549	8.798	9.344	5.445	0.902
2970	61	1	33.00	6	0.45	60	6	4.812	2.221	2.778	1.057	0.543	22.547	9.685	10.395	5.490	0.855
2971	61	1	34.00	7	0.45	60	7	4.532	2.079	2.599	1.049	0.452	25.318	10.532	11.309	5.837	0.857
2972	61	1	34.50	7.5	0.45	60	7.5	4.407	2.019	2.510	1.092	0.416	26.579	10.924	11.727	5.545	0.860
2973	61	1	35.00	8	0.45	60	8	4.259	1.944	2.427	1.042	0.384	27.867	11.399	12.136	5.721	0.876
2974	61	1	36.00	9	0.45	60	9	3.996	1.832	2.273	1.076	0.334	30.215	12.007	12.889	6.053	0.885
2975	61	1	37.00	10	0.45	60	10	3.759	1.739	2.132	1.041	0.294	32.479	12.567	13.577	6.371	0.894
2976	71	1	31.60	0.1	0.45	70	0.1	3.227	1.560	2.849	0.945	7.257	1.644	1.016	1.244	0.280	7.035
2977	71	1	31.75	0.25	0.45	70	0.25	6.246	2.574	5.078	1.018	6.380	3.117	1.779	2.157	0.567	5.970
2978	71	1	32.00	0.5	0.45	70	0.5	7.288	2.917	5.249	1.260	4.748	3.944	2.071	2.576	0.899	4.485
2979	71	1	32.25	0.75	0.45	70	0.75	6.932	2.879	4.707	1.398	3.773	3.502	2.404	2.261	1.280	3.671
2980	71	1	32.50	1	0.45	70	1	6.657	2.927	4.381	1.482	3.203	4.572	3.075	2.901	1.672	3.176
2981	71	1	32.75	1.25	0.45	70	1.25	6.533	2.901	4.218	1.517	2.731	5.709	3.739	3.544	2.071	2.718
2982	71	1	33.50	2	0.45	70	2	6.620	2.980	4.131	1.540	1.889	9.280	5.628	5.472	3.456	1.805
2983	71	1	34.00	2.5	0.45	70	2.5	6.716	3.014	4.139	1.510	1.541	11.560	6.761	6.572	4.179	1.521
2984	71	1	34.50	3	0.45	70	3	6.746	3.010	4.123	1.494	1.285	13.735	7.779	7.631	4.774	1.359
2985	71	1	35.50	4	0.45	70	4	6.599	2.940	3.993	1.248	0.941	17.836	9.500	9.432	5.644	1.024
2986	71	1	36.50	5	0.45	70	5	6.184	2.742	3.719	1.191	0.716	21.223	10.565	10.734	5.546	0.863
2987	71	1	37.50	6	0.45	70	6	5.873	2.589	3.513	1.161	0.577	24.585	11.723	12.018	6.024	0.862
2988	71	1	38.50	7	0.45	70	7	5.570	2.437	3.310	1.137	0.479	27.720	12.718	13.159	6.428	0.864
2989	71	1	39.00	7.5	0.45	70	7.5	5.424	2.356	3.212	1.070	0.441	29.205	13.168	13.686	6.046	0.867
2990	71	1	39.50	8	0.45	70	8	5.273	2.284	3.115	1.067	0.407	30.659	13.217	14.187	6.244	0.883
2991	71	1	40.50	9	0.45	70	9	4.993	2.162	2.936	1.108	0.353	33.416	13.965	15.125	6.612	0.892
2992	71	1	41.50	10	0.45	70	10	4.715	2.040	2.767	1.030	0.310	35.981	14.645	15.973	6.957	0.902
2993	81	1	36.10	0.1	0.45	80	0.1	3.577	1.653	3.129	0.943	7.759	1.890	1.113	1.433	0.299	7.483
2994	81	1	36.25	0.25	0.45	80	0.25	6.969	2.801	5.613	1.051	6.829	3.605	1.970	2.492	0.603	6.346
2995	81	1	36.50	0.5	0.45	80	0.5	8.135	3.198	5.801	1.313	5.043	4.000	2.342	2.637	0.953	4.759
2996	81	1	36.75	0.75	0.45	80	0.75	7.737	3.168	5.192	1.455	3.989	3.894	2.569	2.470	1.319	3.881
2997	81	1	37.00	1	0.45	80	1	7.454	3.217	4.844	1.542	3.381	4.991	3.291	3.146	1.739	3.356

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Model								Membrane Stress Factors									
	OD	T	od	t	d/D	D/T	t/T	Branch					Header				
								Axial	In-Plane	Out-of-Plane	Torsional	Pressure	Axial	In-Plane	Out-of-Plane	Torsional	Pressure
2998	81	1	37.25	1.25	0.45	80	1.25	7.335	3.220	4.684	1.583	2.887	6.172	4.013	3.848	2.149	2.879
2999	81	1	38.00	2	0.45	80	2	7.561	3.331	4.706	1.616	2.005	9.917	6.101	5.953	3.586	1.930
3000	81	1	38.50	2.5	0.45	80	2.5	7.741	3.377	4.786	1.589	1.637	12.333	7.381	7.230	4.376	1.592
3001	81	1	39.00	3	0.45	80	3	7.823	3.399	4.822	1.559	1.364	14.654	8.546	8.400	5.044	1.415
3002	81	1	40.00	4	0.45	80	4	7.742	3.324	4.764	1.303	0.997	19.081	10.356	10.539	5.645	1.088
3003	81	1	41.00	5	0.45	80	5	7.300	3.116	4.488	1.236	0.757	22.737	11.789	12.058	5.955	0.949
3004	81	1	42.00	6	0.45	80	6	7.005	2.949	4.280	1.200	0.608	26.419	13.156	13.579	6.506	0.867
3005	81	1	43.00	7	0.45	80	7	6.671	2.778	4.060	1.174	0.504	29.889	14.340	14.953	6.967	0.870
3006	81	1	43.50	7.5	0.45	80	7.5	6.504	2.700	3.950	1.141	0.463	31.574	15.149	15.597	6.507	0.884
3007	81	1	44.00	8	0.45	80	8	6.331	2.627	3.844	1.152	0.428	33.182	15.664	16.201	6.721	0.888
3008	81	1	45.00	9	0.45	80	9	6.017	2.481	3.635	1.109	0.370	36.273	16.616	17.339	7.125	0.897
3009	81	1	46.00	10	0.45	80	10	5.720	2.336	3.444	1.123	0.325	39.134	17.469	18.365	7.505	0.622
3010	91	1	40.60	0.1	0.45	90	0.1	3.923	1.733	3.404	0.943	8.282	2.166	1.212	1.662	0.318	7.967
3011	91	1	40.75	0.25	0.45	90	0.25	7.668	3.020	6.132	1.089	7.260	4.141	2.165	2.666	0.640	6.734
3012	91	1	41.00	0.5	0.45	90	0.5	8.947	3.420	6.327	1.363	5.313	4.535	2.587	2.919	0.997	4.997
3013	91	1	41.25	0.75	0.45	90	0.75	8.532	3.451	5.660	1.507	4.186	4.341	2.841	2.772	1.355	4.066
3014	91	1	41.50	1	0.45	90	1	8.259	3.514	5.294	1.599	3.543	5.475	3.490	3.425	1.790	3.517
3015	91	1	41.75	1.25	0.45	90	1.25	8.164	3.537	5.146	1.651	3.030	6.690	4.264	4.152	2.216	3.027
3016	91	1	42.50	2	0.45	90	2	8.558	3.702	5.277	1.688	2.113	10.584	6.532	6.450	3.373	2.037
3017	91	1	43.00	2.5	0.45	90	2.5	8.834	3.769	5.438	1.663	1.727	13.098	7.947	7.860	4.542	1.657
3018	91	1	43.50	3	0.45	90	3	8.978	3.784	5.536	1.624	1.440	15.547	9.252	9.174	4.751	1.465
3019	91	1	44.50	4	0.45	90	4	8.945	3.710	5.546	1.558	1.050	20.222	11.326	11.588	5.850	1.132
3020	91	1	45.50	5	0.45	90	5	8.668	3.573	5.395	1.293	0.808	24.625	13.144	13.688	6.669	1.032
3021	91	1	46.50	6	0.45	90	6	8.182	3.302	5.074	1.236	0.637	28.118	14.508	15.100	6.941	0.872
3022	91	1	47.50	7	0.45	90	7	7.822	3.122	4.835	1.207	0.527	31.900	16.164	16.712	7.465	0.885
3023	91	1	48.00	7.5	0.45	90	7.5	7.621	3.035	4.718	1.173	0.483	33.705	16.803	17.451	6.917	0.888
3024	91	1	48.50	8	0.45	90	8	7.436	2.952	4.599	1.185	0.447	35.473	17.401	18.166	7.153	0.892
3025	91	1	49.50	9	0.45	90	9	7.100	2.784	4.371	1.167	0.386	38.862	18.510	19.503	7.597	0.607
3026	91	1	50.50	10	0.45	90	10	6.755	2.646	4.150	1.151	0.339	42.076	19.510	20.724	8.011	0.610
3027	101	1	45.10	0.1	0.45	100	0.1	4.250	1.811	3.662	0.945	8.778	2.400	1.296	1.843	0.331	8.388
3028	101	1	45.25	0.25	0.45	100	0.25	8.329	3.232	6.633	1.123	7.651	4.585	2.335	3.194	0.671	7.067
3029	101	1	45.50	0.5	0.45	100	0.5	9.732	3.681	6.833	1.410	5.563	5.081	2.823	3.207	1.039	5.221
3030	101	1	45.75	0.75	0.45	100	0.75	9.312	3.726	6.113	1.556	4.367	4.830	3.099	3.078	1.388	4.239
3031	101	1	46.00	1	0.45	100	1	9.066	3.808	5.733	1.653	3.694	6.001	3.674	3.794	1.835	3.668
3032	101	1	46.25	1.25	0.45	100	1.25	9.014	3.847	5.591	1.709	3.163	7.258	4.496	4.519	2.276	3.166
3033	101	1	47.00	2	0.45	100	2	9.602	4.060	5.853	1.756	2.215	11.303	6.929	6.949	3.466	2.138
3034	101	1	47.50	2.5	0.45	100	2.5	9.974	4.131	6.092	1.734	1.813	13.899	8.469	8.483	4.280	1.720
3035	101	1	48.00	3	0.45	100	3	10.189	4.165	6.257	1.692	1.512	16.432	9.806	9.926	4.913	1.508

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Model								Membrane Stress Factors									
	OD	T	od	t	d/D	D/T	t/T	Branch					Header				
								Axial	In-Plane	Out-of-Plane	Torsional	Pressure	Axial	In-Plane	Out-of-Plane	Torsional	Pressure
3036	101	1	49.00	4	0.45	100	4	10.209	4.075	6.345	1.615	1.101	21.306	12.236	12.600	6.110	1.173
3037	101	1	50.00	5	0.45	100	5	9.929	3.942	6.225	1.339	0.845	26.001	14.280	14.979	7.023	1.069
3038	101	1	51.00	6	0.45	100	6	9.403	3.641	5.885	1.274	0.664	29.685	15.788	16.558	7.337	0.877
3039	101	1	52.00	7	0.45	100	7	8.995	3.444	5.641	1.222	0.548	33.738	17.650	18.403	7.921	0.888
3040	101	1	52.50	7.5	0.45	100	7.5	8.785	3.363	5.508	1.225	0.503	35.675	18.377	19.259	7.293	0.891
3041	101	1	53.00	8	0.45	100	8	8.576	3.270	5.383	1.213	0.464	37.573	19.061	20.078	7.551	0.895
3042	101	1	54.00	9	0.45	100	9	8.196	3.101	5.130	1.193	0.400	41.248	20.328	21.630	8.034	0.596
3043	101	1	55.00	10	0.45	100	10	7.824	2.933	4.884	1.152	0.351	44.763	21.476	23.066	8.481	0.599
3044	251	1	112.60	0.1	0.45	250	0.1	7.971	2.999	7.114	1.071	13.870	5.357	2.359	4.599	0.515	13.080
3045	251	1	112.75	0.25	0.45	250	0.25	15.907	5.670	13.094	1.564	11.766	10.353	4.516	8.091	1.063	10.815
3046	251	1	113.00	0.5	0.45	250	0.5	19.059	6.912	13.513	1.997	8.188	12.482	5.646	7.819	1.572	7.692
3047	251	1	113.25	0.75	0.45	250	0.75	19.136	7.173	12.180	2.193	6.276	12.370	6.277	7.700	1.897	6.102
3048	251	1	113.50	1	0.45	250	1	19.843	6.796	11.796	2.344	5.271	14.789	6.937	9.225	2.243	5.257
3049	251	1	113.75	1.25	0.45	250	1.25	20.982	7.151	12.036	2.460	4.563	17.213	7.044	10.906	2.789	4.614
3050	251	1	114.50	2	0.45	250	2	25.439	8.139	14.494	2.686	3.326	24.195	11.130	16.268	4.418	3.300
3051	251	1	115.00	2.5	0.45	250	2.5	27.757	9.441	16.170	2.709	2.777	27.948	13.902	19.488	5.464	2.519
3052	251	1	115.50	3	0.45	250	3	29.256	9.633	17.466	2.696	2.344	31.214	16.483	22.112	6.530	2.156
3053	251	1	116.50	4	0.45	250	4	30.417	9.552	19.009	2.545	1.717	37.226	21.960	27.152	8.359	1.785
3054	251	1	117.50	5	0.45	250	5	30.123	9.202	19.552	2.365	1.303	43.487	26.869	31.738	9.987	1.412
3055	251	1	118.50	6	0.45	250	6	29.193	8.772	19.525	2.195	1.022	50.188	31.348	36.384	11.561	1.320
3056	251	1	119.50	7	0.45	250	7	28.032	8.343	19.231	2.047	0.824	57.247	35.452	41.734	12.928	0.530
3057	251	1	120.00	7.5	0.45	250	7.5	27.431	8.137	19.015	1.943	0.747	60.809	37.376	44.437	13.544	0.520
3058	251	1	120.50	8	0.45	250	8	26.839	7.943	18.763	1.910	0.681	64.225	39.228	46.905	14.117	0.513
3059	251	1	121.50	9	0.45	250	9	25.702	7.575	18.250	1.850	0.576	71.246	42.730	52.171	15.168	0.507
3060	251	1	122.50	10	0.45	250	10	24.645	7.263	17.692	1.796	0.495	78.766	44.127	57.539	16.110	0.502
3061	501	1	225.10	0.1	0.45	500	0.1	12.905	4.517	12.345	1.343	19.561	9.231	3.619	8.705	0.756	18.290
3062	501	1	225.25	0.25	0.45	500	0.25	25.981	8.815	22.990	2.188	16.101	17.628	6.992	15.195	1.571	14.934
3063	501	1	225.50	0.5	0.45	500	0.5	31.553	10.144	23.954	2.851	10.987	19.171	9.165	13.283	2.279	10.398
3064	501	1	225.75	0.75	0.45	500	0.75	32.593	10.705	22.050	3.086	8.312	23.256	9.254	15.326	2.712	8.108
3065	501	1	226.00	1	0.45	500	1	34.997	11.128	22.066	3.354	6.943	28.060	10.209	18.379	3.053	6.930
3066	501	1	226.25	1.25	0.45	500	1.25	38.262	12.144	23.314	3.570	6.036	32.963	11.291	21.782	3.384	6.097
3067	501	1	227.00	2	0.45	500	2	49.329	14.365	30.105	4.079	4.491	46.417	14.079	32.450	5.347	4.576
3068	501	1	227.50	2.5	0.45	500	2.5	55.215	16.767	34.520	4.239	3.802	53.173	15.991	38.705	6.690	3.838
3069	501	1	228.00	3	0.45	500	3	59.421	17.333	38.069	4.277	3.249	58.317	19.599	44.096	8.007	2.939
3070	501	1	229.00	4	0.45	500	4	63.738	17.529	42.679	4.138	2.426	65.902	26.690	52.987	10.499	2.191
3071	501	1	230.00	5	0.45	500	5	64.515	17.046	44.810	3.871	1.863	72.480	33.801	60.567	12.758	1.938
3072	501	1	231.00	6	0.45	500	6	63.427	16.294	45.467	3.569	1.468	79.848	40.724	67.754	14.773	1.792
3073	501	1	232.00	7	0.45	500	7	61.446	15.497	45.289	3.279	1.185	88.190	47.364	74.943	17.178	1.562



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Model								Membrane Stress Factors									
	OD	T	od	t	d/D	D/T	t/T	Branch					Header				
								Axial	In-Plane	Out-of-Plane	Torsional	Pressure	Axial	In-Plane	Out-of-Plane	Torsional	Pressure
3074	501	1	232.50	7.5	0.45	500	7.5	60.299	15.127	45.003	3.155	1.073	92.817	50.546	78.620	17.712	0.562
3075	501	1	233.00	8	0.45	500	8	59.113	14.743	44.628	3.033	0.975	97.523	56.177	82.306	18.648	0.547
3076	501	1	234.00	9	0.45	500	9	56.667	14.032	43.710	2.801	0.817	107.792	62.754	90.541	20.386	0.521
3077	501	1	235.00	10	0.45	500	10	54.309	13.361	42.743	2.610	0.688	118.020	69.042	99.688	21.966	0.503
3079	751	1	337.75	0.25	0.45	750	0.25	35.109	10.932	32.792	2.778	19.542	23.158	9.158	21.055	2.005	18.052
3080	751	1	338.00	0.5	0.45	750	0.5	42.844	13.658	34.345	3.600	13.122	26.754	11.965	18.086	2.872	12.440
3081	751	1	338.25	0.75	0.45	750	0.75	44.872	14.456	32.010	3.917	9.847	33.131	12.270	21.157	3.387	9.620
3082	751	1	338.50	1	0.45	750	1	48.902	15.505	32.485	4.231	8.207	40.454	13.919	25.581	3.829	8.186
3083	751	1	338.75	1.25	0.45	750	1.25	54.257	16.663	34.870	4.589	7.147	47.814	15.468	30.565	4.244	7.264
3084	751	1	339.50	2	0.45	750	2	71.775	20.047	46.212	5.372	5.366	67.866	18.616	46.055	5.232	5.517
3085	751	1	340.00	2.5	0.45	750	2.5	81.236	22.745	53.497	5.650	4.569	77.967	20.254	55.036	6.350	4.678
3086	751	1	340.50	3	0.45	750	3	88.265	23.682	59.440	5.759	3.924	85.551	21.413	62.550	7.813	3.637
3087	751	1	341.50	4	0.45	750	4	96.206	24.211	67.436	5.662	2.959	95.709	29.730	74.373	10.647	2.547
3088	751	1	342.50	5	0.45	750	5	98.574	23.363	72.467	5.355	2.293	102.909	39.196	83.840	13.390	2.178
3089	751	1	343.50	6	0.45	750	6	97.860	22.508	73.348	4.979	1.822	110.218	48.931	92.674	16.069	2.001
3090	751	1	344.50	7	0.45	750	7	95.359	21.519	73.134	4.594	1.478	118.748	57.748	101.718	18.677	1.819
3091	751	1	345.00	7.5	0.45	750	7.5	93.806	21.002	72.753	4.402	1.340	123.546	62.098	106.914	19.908	1.772
3092	751	1	345.50	8	0.45	750	8	92.261	20.490	72.359	4.198	1.221	128.535	66.429	112.258	21.093	1.735
3093	751	1	346.50	9	0.45	750	9	88.750	18.346	71.201	3.894	1.024	139.746	74.715	124.361	23.335	0.554
3094	751	1	347.50	10	0.45	750	10	85.102	17.462	69.782	3.575	0.870	151.999	82.791	136.677	25.374	0.530
3096	1001	1	450.25	0.25	0.45	1000	0.25	43.550	13.593	42.772	3.337	22.502	27.759	10.897	26.272	2.387	20.780
3097	1001	1	450.50	0.5	0.45	1000	0.5	53.234	16.861	44.889	4.288	14.956	33.371	14.302	23.639	3.410	14.203
3098	1001	1	450.75	0.75	0.45	1000	0.75	55.988	17.841	41.930	4.669	11.139	41.965	15.163	28.092	4.032	10.895
3099	1001	1	451.00	1	0.45	1000	1	61.414	19.213	42.782	5.063	9.270	51.540	17.285	34.137	4.578	9.310
3100	1001	1	451.25	1.25	0.45	1000	1.25	68.594	20.765	46.186	5.510	8.081	61.217	19.289	40.857	5.084	8.238
3101	1001	1	452.00	2	0.45	1000	2	92.078	25.215	62.016	6.547	6.108	87.522	23.452	61.515	6.262	6.284
3102	1001	1	452.50	2.5	0.45	1000	2.5	104.977	27.865	72.147	6.941	5.220	100.933	25.420	73.413	7.271	5.366
3103	1001	1	453.00	3	0.45	1000	3	114.797	29.148	80.539	7.125	4.498	111.143	26.676	83.358	8.558	4.598
3104	1001	1	454.00	4	0.45	1000	4	127.131	29.999	95.382	7.088	3.410	124.547	34.380	98.646	11.472	3.255
3105	1001	1	455.00	5	0.45	1000	5	130.870	29.603	100.138	6.767	2.656	133.107	44.619	110.215	14.398	2.410
3106	1001	1	456.00	6	0.45	1000	6	130.657	28.085	101.746	6.338	2.119	140.551	54.462	119.984	17.285	2.152
3107	1001	1	457.00	7	0.45	1000	7	128.341	26.942	101.588	5.881	1.726	148.907	64.343	131.201	20.064	2.055
3108	1001	1	457.50	7.5	0.45	1000	7.5	126.392	26.341	101.077	5.655	1.569	153.758	69.196	137.338	21.412	2.015
3109	1001	1	458.00	8	0.45	1000	8	124.486	25.739	100.614	5.435	1.431	159.187	74.048	143.863	22.758	1.978
3110	1001	1	459.00	9	0.45	1000	9	120.087	24.539	99.139	5.014	1.203	171.117	83.588	157.584	25.335	1.916
3111	1001	1	460.00	10	0.45	1000	10	115.509	23.415	97.310	4.630	1.025	184.607	92.779	172.532	27.791	0.560
3113	1251	1	562.75	0.25	0.45	1250	0.25	51.701	16.053	53.039	3.848	25.187	31.619	12.427	30.823	2.734	23.207
3114	1251	1	563.00	0.5	0.45	1250	0.5	63.009	19.817	55.734	4.933	16.601	39.195	15.411	28.781	3.905	15.780

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Model								Membrane Stress Factors									
	OD	T	od	t	d/D	D/T	t/T	Branch					Header				
								Axial	In-Plane	Out-of-Plane	Torsional	Pressure	Axial	In-Plane	Out-of-Plane	Torsional	Pressure
3115	1251	1	563.25	0.75	0.45	1250	0.75	66.173	20.957	51.885	5.353	12.319	49.770	17.799	34.594	4.617	12.095
3116	1251	1	563.50	1	0.45	1250	1	72.696	22.616	52.918	5.819	10.206	61.446	20.362	42.228	5.261	10.267
3117	1251	1	563.75	1.25	0.45	1250	1.25	81.492	24.515	57.301	6.305	8.917	73.214	22.789	50.653	5.874	9.092
3118	1251	1	564.50	2	0.45	1250	2	110.368	29.984	77.328	7.626	6.757	105.431	27.978	76.264	7.246	6.970
3119	1251	1	565.00	2.5	0.45	1250	2.5	126.514	32.491	90.334	8.131	5.788	122.046	30.361	91.060	7.771	5.957
3120	1251	1	565.50	3	0.45	1250	3	139.049	34.060	101.204	8.387	4.999	134.861	31.752	103.403	9.257	5.122
3121	1251	1	566.50	4	0.45	1250	4	155.032	35.186	120.758	8.418	3.805	151.800	38.134	122.036	12.216	3.664
3122	1251	1	567.50	5	0.45	1250	5	161.131	34.771	127.344	8.098	2.973	162.189	47.253	135.677	15.269	2.635
3123	1251	1	568.50	6	0.45	1250	6	162.065	33.748	130.047	7.635	2.380	170.329	59.175	149.045	18.330	2.279
3124	1251	1	569.50	7	0.45	1250	7	159.601	32.113	130.150	7.122	1.944	178.915	69.785	161.766	21.320	2.203
3125	1251	1	570.00	7.5	0.45	1250	7.5	157.725	31.364	129.631	6.865	1.769	183.822	75.084	168.551	22.775	2.163
3126	1251	1	570.50	8	0.45	1250	8	155.582	30.593	129.069	6.611	1.616	189.347	80.366	175.835	24.193	2.128
3127	1251	1	571.50	9	0.45	1250	9	150.606	29.091	127.414	6.122	1.363	201.760	90.776	191.109	26.925	2.067
3128	1251	1	572.50	10	0.45	1250	10	145.235	27.796	125.401	5.665	1.163	216.046	100.975	208.107	29.607	2.014
3130	1501	1	675.25	0.25	0.45	1500	0.25	59.601	18.392	63.523	4.333	27.678	35.471	13.775	34.774	3.048	25.399
3131	1501	1	675.50	0.5	0.45	1500	0.5	72.402	22.588	66.847	5.529	18.106	44.421	17.443	33.814	4.353	17.209
3132	1501	1	675.75	0.75	0.45	1500	0.75	75.718	23.856	62.024	5.991	13.386	56.855	20.233	41.079	5.160	13.151
3133	1501	1	676.00	1	0.45	1500	1	83.113	25.776	62.997	6.530	11.054	70.448	23.217	50.259	5.909	11.145
3134	1501	1	676.25	1.25	0.45	1500	1.25	93.311	28.008	68.215	7.086	9.649	84.214	26.058	60.384	6.603	9.867
3135	1501	1	677.00	2	0.45	1500	2	127.116	34.411	92.451	8.628	7.341	121.875	32.242	91.010	8.191	7.580
3136	1501	1	677.50	2.5	0.45	1500	2.5	146.294	37.383	108.233	9.235	6.298	141.650	35.053	108.633	8.556	6.494
3137	1501	1	678.00	3	0.45	1500	3	161.443	39.283	121.534	9.562	5.448	157.052	36.731	123.347	9.923	5.592
3138	1501	1	679.00	4	0.45	1500	4	180.900	40.738	145.760	9.661	4.158	177.680	41.689	146.151	12.915	4.024
3139	1501	1	680.00	5	0.45	1500	5	189.587	40.360	154.055	9.351	3.257	190.120	51.211	163.643	16.077	2.854
3140	1501	1	681.00	6	0.45	1500	6	191.694	39.143	157.722	8.864	2.613	199.329	63.395	178.476	19.259	2.414
3141	1501	1	682.00	7	0.45	1500	7	189.595	37.542	158.303	8.311	2.140	208.233	74.606	192.589	22.406	2.295
3142	1501	1	682.50	7.5	0.45	1500	7.5	187.755	36.665	157.988	8.029	1.949	213.288	80.252	200.156	23.374	2.248
3143	1501	1	683.00	8	0.45	1500	8	185.445	35.828	157.472	7.748	1.783	218.837	82.659	207.872	24.984	2.208
3144	1501	1	684.00	9	0.45	1500	9	180.043	34.124	155.860	7.200	1.506	231.356	94.485	224.470	28.111	2.141
3145	1501	1	685.00	10	0.45	1500	10	174.044	32.492	153.458	6.683	1.289	246.477	106.079	243.249	31.083	2.085
3148	1751	1	788.00	0.5	0.45	1750	0.5	81.435	25.199	78.001	6.093	19.516	49.183	19.311	38.582	4.770	18.535
3149	1751	1	788.25	0.75	0.45	1750	0.75	84.700	26.559	71.948	6.588	14.376	63.334	22.479	47.259	5.633	14.123
3150	1751	1	788.50	1	0.45	1750	1	92.825	28.720	73.046	7.176	11.828	78.748	25.875	58.134	6.499	11.954
3151	1751	1	788.75	1.25	0.45	1750	1.25	104.259	31.257	79.005	7.813	10.334	94.331	29.108	69.891	7.290	10.583
3152	1751	1	789.50	2	0.45	1750	2	142.651	38.550	107.322	9.554	7.879	137.253	36.289	105.455	9.074	8.145
3153	1751	1	790.00	2.5	0.45	1750	2.5	164.634	41.959	125.697	10.263	6.768	159.967	39.495	125.767	9.173	6.984
3154	1751	1	790.50	3	0.45	1750	3	182.264	44.170	141.464	10.660	5.860	177.818	36.023	142.878	10.574	6.026
3155	1751	1	791.50	4	0.45	1750	4	205.392	45.986	170.111	10.834	4.482	202.179	45.049	170.679	13.567	4.354

STP-PT-074: Local Stress in Nozzles, Shells and Formed Heads from External Heads

Model								Membrane Stress Factors									
	OD	T	od	t	d/D	D/T	t/T	Branch					Header				
								Axial	In-Plane	Out-of-Plane	Torsional	Pressure	Axial	In-Plane	Out-of-Plane	Torsional	Pressure
3156	1751	1	792.50	5	0.45	1750	5	216.518	45.695	180.291	10.536	3.517	216.833	54.799	191.159	15.930	3.066
3157	1751	1	793.50	6	0.45	1750	6	219.617	44.380	184.827	10.027	2.827	227.167	63.720	207.861	19.143	2.522
3158	1751	1	794.50	7	0.45	1750	7	218.308	42.671	186.219	9.447	2.319	236.897	75.039	221.778	22.450	2.381
3159	1751	1	795.00	7.5	0.45	1750	7.5	216.538	41.734	186.345	9.145	2.114	241.913	80.775	231.822	24.163	2.326
3160	1751	1	795.50	8	0.45	1750	8	214.199	40.791	186.014	8.840	1.935	247.508	86.515	239.979	25.852	2.281
3161	1751	1	796.50	9	0.45	1750	9	208.504	38.941	184.295	8.248	1.638	260.006	98.851	257.466	29.197	2.203
3162	1751	1	797.50	10	0.45	1750	10	201.970	37.127	181.540	7.680	1.404	275.233	111.262	277.257	32.370	2.143
3165	2001	1	900.50	0.5	0.45	2000	0.5	90.225	27.679	89.286	6.628	20.837	53.563	21.065	43.183	5.158	19.772
3166	2001	1	900.75	0.75	0.45	2000	0.75	93.310	29.129	82.096	7.151	15.307	69.330	24.593	53.315	6.111	15.038
3167	2001	1	901.00	1	0.45	2000	1	101.931	31.501	82.934	7.790	12.625	86.462	28.383	65.767	7.060	12.710
3168	2001	1	901.25	1.25	0.45	2000	1.25	114.457	34.317	89.470	8.492	10.970	103.774	31.988	79.087	7.935	11.250
3169	2001	1	902.00	2	0.45	2000	2	157.037	42.460	121.550	10.429	8.382	151.580	40.100	119.284	9.927	8.665
3170	2001	1	902.50	2.5	0.45	2000	2.5	181.878	46.298	142.757	11.227	7.205	177.185	43.756	142.488	9.771	7.441
3171	2001	1	903.00	3	0.45	2000	3	201.822	48.793	160.973	11.695	6.243	197.467	39.018	162.609	11.202	6.427
3172	2001	1	904.00	4	0.45	2000	4	228.639	50.927	193.800	11.933	4.782	225.493	48.248	194.803	13.349	4.874
3173	2001	1	905.00	5	0.45	2000	5	242.028	50.763	205.831	11.661	3.758	242.394	54.753	218.314	16.501	3.268
3174	2001	1	906.00	6	0.45	2000	6	246.484	49.446	212.071	11.146	3.025	254.124	66.740	238.013	19.778	2.623
3175	2001	1	907.00	7	0.45	2000	7	245.866	47.613	214.190	10.534	2.485	264.383	78.359	254.525	23.113	2.461
3176	2001	1	907.50	7.5	0.45	2000	7.5	244.156	46.633	213.943	10.216	2.267	269.416	84.357	259.679	24.915	2.398
3177	2001	1	908.00	8	0.45	2000	8	241.874	45.596	214.323	9.893	2.077	275.245	90.311	269.490	26.659	2.345
3178	2001	1	909.00	9	0.45	2000	9	236.045	43.567	212.477	9.258	1.761	288.037	102.853	290.434	30.127	2.260
3179	2001	1	910.00	10	0.45	2000	10	229.101	41.558	209.615	8.644	1.511	303.522	115.817	311.341	33.482	2.195
3182	2251	1	1013.00	0.5	0.45	2250	0.5	98.767	30.087	100.588	7.140	22.118	57.620	22.718	47.575	5.522	20.935
3183	2251	1	1013.25	0.75	0.45	2250	0.75	101.548	31.616	92.122	7.679	16.194	74.920	26.588	59.166	6.556	15.888
3184	2251	1	1013.50	1	0.45	2250	1	110.547	34.126	92.520	8.372	13.334	93.592	30.739	73.057	7.594	13.422
3185	2251	1	1013.75	1.25	0.45	2250	1.25	124.131	37.232	99.873	9.126	11.628	112.652	34.722	88.089	8.538	11.857
3186	2251	1	1014.50	2	0.45	2250	2	170.648	46.139	135.698	11.249	8.854	165.067	44.537	132.984	10.733	9.160
3187	2251	1	1015.00	2.5	0.45	2250	2.5	197.959	50.383	159.406	12.142	7.616	193.312	47.789	158.815	10.367	7.843
3188	2251	1	1015.50	3	0.45	2250	3	220.138	53.201	179.930	12.672	6.603	215.914	41.980	181.970	11.044	6.772
3189	2251	1	1016.50	4	0.45	2250	4	250.631	55.674	216.632	12.988	5.065	247.831	48.301	218.570	13.889	5.169
3190	2251	1	1017.50	5	0.45	2250	5	266.340	55.576	230.175	12.728	3.984	266.746	57.647	244.679	17.057	3.310
3191	2251	1	1018.50	6	0.45	2250	6	272.509	54.232	237.683	12.207	3.211	280.141	67.875	266.419	20.380	2.722
3192	2251	1	1019.50	7	0.45	2250	7	272.508	52.331	242.367	11.572	2.640	291.477	81.486	286.197	23.768	2.539
3193	2251	1	1020.00	7.5	0.45	2250	7.5	270.700	51.288	242.648	11.243	2.410	295.810	87.631	293.782	25.579	2.465
3194	2251	1	1020.50	8	0.45	2250	8	268.537	50.187	242.273	10.906	2.209	301.712	93.736	300.120	27.386	2.408
3195	2251	1	1021.50	9	0.45	2250	9	262.624	47.973	240.544	10.234	1.875	315.331	106.370	323.064	30.982	2.314
3196	2251	1	1022.50	10	0.45	2250	10	255.446	45.857	237.580	9.580	1.611	329.960	119.760	343.556	34.457	2.238
3199	2501	1	1125.50	0.5	0.45	2500	0.5	107.106	32.341	111.924	7.626	23.328	61.424	24.250	51.845	5.870	22.038

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Model								Membrane Stress Factors									
	OD	T	od	t	d/D	D/T	t/T	Branch					Header				
								Axial	In-Plane	Out-of-Plane	Torsional	Pressure	Axial	In-Plane	Out-of-Plane	Torsional	Pressure
3200	2501	1	1125.75	0.75	0.45	2500	0.75	109.382	33.895	101.966	8.187	17.029	80.118	28.456	64.817	6.979	16.705
3201	2501	1	1126.00	1	0.45	2500	1	118.808	36.656	102.125	8.922	14.004	100.156	32.956	80.262	8.097	14.074
3202	2501	1	1126.25	1.25	0.45	2500	1.25	133.234	39.957	110.049	9.772	12.213	120.933	37.265	96.926	9.117	12.470
3203	2501	1	1127.00	2	0.45	2500	2	183.502	49.655	148.930	12.022	9.304	177.865	47.143	145.857	9.387	9.627
3204	2501	1	1127.50	2.5	0.45	2500	2.5	213.149	54.292	175.599	13.006	8.004	208.713	39.925	175.155	10.940	8.274
3205	2501	1	1128.00	3	0.45	2500	3	237.745	57.374	199.001	13.605	6.946	233.834	44.813	201.676	11.602	7.129
3206	2501	1	1129.00	4	0.45	2500	4	271.564	60.164	238.801	13.989	5.332	268.964	51.043	241.533	14.418	5.449
3207	2501	1	1130.00	5	0.45	2500	5	289.550	60.182	254.810	13.752	4.198	290.720	60.416	271.858	17.595	3.517
3208	2501	1	1131.00	6	0.45	2500	6	297.192	58.817	264.152	13.226	3.385	305.208	70.724	295.104	20.952	2.819
3209	2501	1	1132.00	7	0.45	2500	7	297.656	56.816	268.722	12.568	2.787	316.682	84.392	314.557	24.399	2.612
3210	2501	1	1132.50	7.5	0.45	2500	7.5	296.677	55.711	270.069	12.222	2.545	322.504	90.559	324.783	26.175	2.534
3211	2501	1	1133.00	8	0.45	2500	8	294.257	54.562	270.712	11.870	2.334	328.397	96.852	335.844	28.033	2.468
3212	2501	1	1134.00	9	0.45	2500	9	288.367	52.260	267.547	11.171	1.983	336.111	109.610	350.544	31.764	2.363
3213	2501	1	1135.00	10	0.45	2500	10	281.026	49.956	265.178	10.488	1.706	356.843	123.462	374.940	35.391	2.282
3214	9	1	4.10	0.1	0.5	8	0.1	1.019	1.014	0.974	1.023	4.250	0.226	0.134	0.176	0.109	2.630
3215	9	1	4.25	0.25	0.5	8	0.25	1.169	0.956	1.038	1.034	1.739	0.551	0.291	0.388	0.227	2.189
3216	9	1	4.50	0.5	0.5	8	0.5	1.365	0.894	1.022	0.961	1.298	1.168	0.487	0.545	0.408	1.693
3217	9	1	4.75	0.75	0.5	8	0.75	1.450	0.850	0.918	0.844	1.075	1.832	0.629	0.697	0.618	1.376
3218	9	1	5.00	1	0.5	8	1	1.485	0.802	0.822	0.785	0.962	2.596	0.747	0.814	0.735	1.193
3219	9	1	5.25	1.25	0.5	8	1.25	1.508	0.772	0.772	0.746	0.821	3.430	0.825	0.897	0.805	0.990
3220	9	1	6.00	2	0.5	8	2	1.453	0.674	0.674	0.738	0.566	5.783	0.857	1.119	1.008	0.836
3221	9	1	6.50	2.5	0.5	8	2.5	1.316	0.626	0.626	0.742	0.462	7.205	0.996	1.261	1.125	0.976
3222	9	1	7.00	3	0.5	8	3	1.218	0.579	0.579	0.774	0.395	8.625	1.156	1.414	1.246	1.003
3231	17	1	8.10	0.1	0.5	16	0.1	1.180	0.989	1.207	0.941	4.504	0.422	0.284	0.273	0.147	3.826
3232	17	1	8.25	0.25	0.5	16	0.25	1.761	1.114	1.689	1.084	2.784	0.640	0.479	0.542	0.320	3.239
3233	17	1	8.50	0.5	0.5	16	0.5	2.142	1.129	1.758	0.982	2.244	1.176	0.771	0.792	0.601	2.524
3234	17	1	8.75	0.75	0.5	16	0.75	2.217	1.165	1.593	0.936	1.852	1.881	1.080	1.078	0.893	2.058
3235	17	1	9.00	1	0.5	16	1	2.230	1.208	1.451	0.922	1.619	2.509	1.334	1.311	1.140	1.743
3236	17	1	9.25	1.25	0.5	16	1.25	2.236	1.133	1.323	0.917	1.377	3.124	1.540	1.495	1.335	1.435
3237	17	1	10.00	2	0.5	16	2	2.105	0.957	1.010	0.873	0.945	4.755	2.029	1.926	1.730	1.027
3238	17	1	10.50	2.5	0.5	16	2.5	1.977	0.880	0.856	0.874	0.773	6.167	1.704	2.156	1.881	0.896
3239	17	1	11.00	3	0.5	16	3	1.848	0.820	0.738	0.881	0.649	7.689	1.880	2.370	1.994	0.843
3240	17	1	12.00	4	0.5	16	4	1.616	0.690	0.677	0.908	0.483	11.016	2.211	2.782	2.184	0.985
3241	17	1	13.00	5	0.5	16	5	1.420	0.673	0.628	0.942	0.378	13.835	2.855	3.133	2.425	1.021
3242	17	1	14.00	6	0.5	16	6	1.273	0.731	0.582	1.018	0.304	16.531	3.122	3.469	2.689	1.034
3243	17	1	15.00	7	0.5	16	7	1.159	0.714	0.551	1.104	0.257	19.229	3.374	3.802	3.039	1.049
3244	17	1	15.50	7.5	0.5	16	7.5	1.116	0.713	0.520	1.155	0.245	20.581	3.504	3.965	3.182	1.053
3248	25	1	12.10	0.1	0.5	24	0.1	1.449	1.009	1.482	0.958	4.645	0.614	0.429	0.429	0.175	4.646

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Model								Membrane Stress Factors									
	OD	T	od	t	d/D	D/T	t/T	Branch					Header				
								Axial	In-Plane	Out-of-Plane	Torsional	Pressure	Axial	In-Plane	Out-of-Plane	Torsional	Pressure
3249	25	1	12.25	0.25	0.5	24	0.25	2.424	1.379	2.314	1.006	3.716	0.989	0.723	0.728	0.409	3.956
3250	25	1	12.50	0.5	0.5	24	0.5	2.929	1.505	2.433	0.976	2.947	1.406	0.970	0.977	0.712	3.064
3251	25	1	12.75	0.75	0.5	24	0.75	2.941	1.458	2.195	1.036	2.398	2.166	1.398	1.372	1.021	2.499
3252	25	1	13.00	1	0.5	24	1	2.918	1.557	2.020	1.108	2.071	2.931	1.759	1.704	1.373	2.141
3253	25	1	13.25	1.25	0.5	24	1.25	2.907	1.507	1.881	1.127	1.759	3.703	2.074	2.002	1.691	1.766
3254	25	1	14.00	2	0.5	24	2	2.750	1.364	1.527	0.978	1.201	5.769	2.806	2.692	2.333	1.234
3255	25	1	14.50	2.5	0.5	24	2.5	2.602	1.286	1.344	0.973	0.979	6.959	2.534	3.035	2.571	1.082
3256	25	1	15.00	3	0.5	24	3	2.450	1.214	1.195	0.971	0.820	8.027	2.821	3.331	2.727	0.886
3257	25	1	16.00	4	0.5	24	4	2.170	1.099	0.973	0.975	0.608	9.880	3.265	3.818	2.963	0.939
3258	25	1	17.00	5	0.5	24	5	1.946	1.007	0.822	0.993	0.476	11.726	3.858	4.365	3.177	0.952
3259	25	1	18.00	6	0.5	24	6	1.749	0.932	0.711	1.006	0.388	13.245	4.468	4.804	3.382	0.982
3260	25	1	19.00	7	0.5	24	7	1.578	0.971	0.649	1.037	0.326	14.677	4.757	5.262	3.646	0.798
3261	25	1	19.50	7.5	0.5	24	7.5	1.504	0.949	0.629	1.056	0.302	15.278	4.900	5.454	3.780	0.791
3262	25	1	20.00	8	0.5	24	8	1.438	0.943	0.609	1.126	0.280	15.833	5.048	5.631	3.868	0.795
3263	25	1	21.00	9	0.5	24	9	1.317	0.927	0.583	1.129	0.243	17.517	5.322	5.978	4.220	0.819
3264	25	1	22.00	10	0.5	24	10	1.238	0.895	0.550	1.190	0.209	17.822	5.679	6.332	4.579	0.817
3265	33	1	16.10	0.1	0.5	32	0.1	1.742	1.108	1.748	0.965	5.265	0.700	0.555	0.580	0.227	5.285
3266	33	1	16.25	0.25	0.5	32	0.25	3.089	1.613	2.891	0.976	4.454	1.355	0.946	0.938	0.468	4.513
3267	33	1	16.50	0.5	0.5	32	0.5	3.686	1.772	3.044	1.049	3.484	1.641	1.209	1.281	0.789	3.470
3268	33	1	16.75	0.75	0.5	32	0.75	3.612	1.732	2.744	1.174	2.801	2.389	1.656	1.601	1.125	2.826
3269	33	1	17.00	1	0.5	32	1	3.540	1.819	2.539	1.256	2.402	3.255	2.095	2.017	1.522	2.429
3270	33	1	17.25	1.25	0.5	32	1.25	3.505	1.841	2.384	1.282	2.037	4.152	2.495	2.410	1.910	2.032
3271	33	1	18.00	2	0.5	32	2	3.350	1.741	2.041	1.267	1.389	6.592	3.482	3.381	2.776	1.383
3272	33	1	18.50	2.5	0.5	32	2.5	3.210	1.667	1.858	1.048	1.132	8.054	3.268	3.894	3.138	1.173
3273	33	1	19.00	3	0.5	32	3	3.060	1.592	1.702	1.042	0.946	9.372	3.598	4.319	3.380	0.978
3274	33	1	20.00	4	0.5	32	4	2.766	1.511	1.453	1.035	0.699	11.709	4.555	5.021	3.694	0.867
3275	33	1	21.00	5	0.5	32	5	2.502	1.399	1.264	1.063	0.546	13.741	4.847	5.609	3.938	0.842
3276	33	1	22.00	6	0.5	32	6	2.272	1.322	1.116	1.054	0.444	15.493	5.232	6.086	4.144	0.951
3277	33	1	23.00	7	0.5	32	7	2.077	1.246	0.997	1.057	0.373	17.051	5.814	6.514	4.345	0.795
3278	33	1	23.50	7.5	0.5	32	7.5	1.998	1.222	0.947	1.075	0.344	18.270	6.418	6.959	4.480	0.847
3279	33	1	24.00	8	0.5	32	8	1.914	1.190	0.901	1.085	0.319	19.062	6.567	7.209	4.592	0.844
3280	33	1	25.00	9	0.5	32	9	1.897	1.149	0.818	1.121	0.279	20.565	6.943	7.703	4.822	0.836
3281	33	1	26.00	10	0.5	32	10	1.629	1.105	0.746	1.166	0.247	21.976	7.527	8.248	5.069	0.830
3282	41	1	20.10	0.1	0.5	40	0.1	2.087	1.218	2.010	0.966	5.700	0.907	0.670	0.739	0.255	5.864
3283	41	1	20.25	0.25	0.5	40	0.25	3.748	1.863	3.438	0.975	5.090	1.758	1.153	1.174	0.522	5.008
3284	41	1	20.50	0.5	0.5	40	0.5	4.422	2.033	3.614	1.148	3.922	1.912	1.365	1.310	0.829	3.823
3285	41	1	20.75	0.75	0.5	40	0.75	4.233	1.968	3.245	1.280	3.123	2.590	1.864	1.787	1.208	3.102
3286	41	1	21.00	1	0.5	40	1	4.124	2.169	3.013	1.371	2.665	3.537	2.377	2.291	1.620	2.672

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Model								Membrane Stress Factors									
	OD	T	od	t	d/D	D/T	t/T	Branch					Header				
								Axial	In-Plane	Out-of-Plane	Torsional	Pressure	Axial	In-Plane	Out-of-Plane	Torsional	Pressure
3287	41	1	21.25	1.25	0.5	40	1.25	4.060	2.139	2.852	1.404	2.260	4.514	2.856	2.764	2.056	2.250
3288	41	1	22.00	2	0.5	40	2	3.921	2.078	2.544	1.395	1.542	7.287	3.575	3.997	3.104	1.499
3289	41	1	22.50	2.5	0.5	40	2.5	3.807	2.016	2.381	1.354	1.255	8.981	4.330	4.677	3.582	1.280
3290	41	1	23.00	3	0.5	40	3	3.677	1.944	2.236	1.199	1.048	10.527	4.822	5.246	3.921	1.132
3291	41	1	24.00	4	0.5	40	4	3.396	1.868	1.985	1.156	0.773	13.277	5.621	6.179	4.345	0.906
3292	41	1	25.00	5	0.5	40	5	3.119	1.743	1.775	1.126	0.602	15.741	6.492	6.972	4.649	0.851
3293	41	1	26.00	6	0.5	40	6	2.868	1.625	1.600	1.108	0.489	17.911	7.049	7.625	4.897	0.852
3294	41	1	27.00	7	0.5	40	7	2.645	1.518	1.452	1.100	0.408	19.864	7.862	8.194	5.119	0.801
3295	41	1	27.50	7.5	0.5	40	7.5	2.540	1.496	1.385	1.094	0.377	20.758	8.116	8.454	5.231	0.802
3296	41	1	28.00	8	0.5	40	8	2.441	1.459	1.324	1.094	0.349	21.623	8.270	8.696	5.342	0.803
3297	41	1	29.00	9	0.5	40	9	2.260	1.383	1.212	1.101	0.304	23.230	8.685	9.180	5.566	0.806
3298	41	1	30.00	10	0.5	40	10	2.102	1.318	1.113	1.126	0.270	24.695	9.070	9.641	5.850	0.834
3299	51	1	25.10	0.1	0.5	50	0.1	2.427	1.328	2.328	0.965	6.390	1.170	0.797	0.942	0.284	6.508
3300	51	1	25.25	0.25	0.5	50	0.25	4.552	2.095	4.081	0.992	5.776	2.245	1.379	1.702	0.578	5.553
3301	51	1	25.50	0.5	0.5	50	0.5	5.317	2.348	4.279	1.241	4.381	2.833	1.615	2.074	0.908	4.204
3302	51	1	25.75	0.75	0.5	50	0.75	5.018	2.286	3.829	1.357	3.456	2.842	2.082	2.026	1.295	3.398
3303	51	1	26.00	1	0.5	50	1	4.819	2.497	3.566	1.486	2.937	3.849	2.668	2.598	1.680	2.931
3304	51	1	26.25	1.25	0.5	50	1.25	4.741	2.480	3.403	1.525	2.493	4.911	3.232	3.157	2.185	2.485
3305	51	1	27.00	2	0.5	50	2	4.638	2.459	3.163	1.527	1.705	8.024	4.399	4.692	3.406	1.643
3306	51	1	27.50	2.5	0.5	50	2.5	4.571	2.414	3.044	1.485	1.388	9.934	5.144	5.544	4.010	1.391
3307	51	1	28.00	3	0.5	50	3	4.481	2.410	2.931	1.285	1.157	11.728	5.790	6.297	4.465	1.227
3308	51	1	29.00	4	0.5	50	4	4.239	2.304	2.702	1.231	0.851	14.991	6.851	7.563	5.064	0.935
3309	51	1	30.00	5	0.5	50	5	3.968	2.160	2.484	1.196	0.661	17.895	7.982	8.620	5.437	0.882
3310	51	1	31.00	6	0.5	50	6	3.702	2.030	2.282	1.169	0.535	20.538	8.764	9.521	5.753	0.862
3311	51	1	32.00	7	0.5	50	7	3.447	1.900	2.106	1.149	0.445	22.971	9.624	10.309	6.015	0.810
3312	51	1	32.50	7.5	0.5	50	7.5	3.324	1.841	2.021	1.142	0.411	24.103	9.926	10.662	6.145	0.810
3313	51	1	33.00	8	0.5	50	8	3.217	1.776	1.947	1.133	0.380	25.235	10.205	11.007	6.273	0.811
3314	51	1	34.00	9	0.5	50	9	2.996	1.673	1.802	1.128	0.331	27.208	10.726	11.594	6.418	0.814
3315	51	1	35.00	10	0.5	50	10	2.803	1.579	1.672	1.129	0.292	29.125	11.446	12.192	6.413	0.846
3316	61	1	30.10	0.1	0.5	60	0.1	2.807	1.426	2.635	0.964	7.366	1.439	0.910	1.151	0.308	7.099
3317	61	1	30.25	0.25	0.5	60	0.25	5.332	2.328	4.688	1.038	6.381	2.737	1.595	2.033	0.628	6.038
3318	61	1	30.50	0.5	0.5	60	0.5	6.194	2.657	4.907	1.321	4.774	3.416	1.889	2.430	0.983	4.537
3319	61	1	30.75	0.75	0.5	60	0.75	5.804	2.740	4.383	1.436	3.744	3.125	2.237	2.259	1.312	3.668
3320	61	1	31.00	1	0.5	60	1	5.554	2.806	4.094	1.581	3.173	4.178	2.897	2.894	1.719	3.164
3321	61	1	31.25	1.25	0.5	60	1.25	5.426	2.802	3.929	1.625	2.697	5.297	3.466	3.524	2.224	2.696
3322	61	1	32.00	2	0.5	60	2	5.403	2.825	3.779	1.639	1.850	8.660	5.152	5.308	3.628	1.788
3323	61	1	32.50	2.5	0.5	60	2.5	5.398	2.783	3.722	1.600	1.506	10.767	6.140	6.336	4.338	1.485
3324	61	1	33.00	3	0.5	60	3	5.354	2.735	3.651	1.548	1.254	12.765	7.012	7.260	4.897	1.307



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Model								Membrane Stress Factors									
	OD	T	od	t	d/D	D/T	t/T	Branch					Header				
								Axial	In-Plane	Out-of-Plane	Torsional	Pressure	Axial	In-Plane	Out-of-Plane	Torsional	Pressure
3325	61	1	34.00	4	0.5	60	4	5.166	2.713	3.466	1.298	0.919	16.467	8.251	8.853	5.678	0.997
3326	61	1	35.00	5	0.5	60	5	4.905	2.578	3.253	1.254	0.712	19.805	9.369	10.180	6.126	0.922
3327	61	1	36.00	6	0.5	60	6	4.618	2.423	3.033	1.222	0.574	22.864	10.311	11.324	6.134	0.870
3328	61	1	37.00	7	0.5	60	7	4.351	2.269	2.831	1.198	0.478	25.734	11.425	12.353	6.528	0.885
3329	61	1	37.50	7.5	0.5	60	7.5	4.227	2.207	2.733	1.187	0.440	27.084	11.800	12.822	6.708	0.890
3330	61	1	38.00	8	0.5	60	8	4.098	2.129	2.643	1.180	0.407	28.360	12.163	13.254	6.357	0.819
3331	61	1	39.00	9	0.5	60	9	3.861	2.006	2.469	1.164	0.353	30.809	12.816	14.072	6.731	0.822
3332	61	1	40.00	10	0.5	60	10	3.636	1.893	2.312	1.160	0.311	33.120	13.695	14.835	7.096	0.856
3333	71	1	35.10	0.1	0.5	70	0.1	3.172	1.519	2.943	0.962	7.967	1.725	1.019	1.389	0.337	7.684
3334	71	1	35.25	0.25	0.5	70	0.25	6.103	2.565	5.284	1.088	6.938	3.315	1.807	2.476	0.679	6.525
3335	71	1	35.50	0.5	0.5	70	0.5	7.065	2.956	5.515	1.392	5.130	3.525	2.174	2.617	1.053	4.863
3336	71	1	35.75	0.75	0.5	70	0.75	6.595	3.019	4.916	1.508	3.994	3.463	2.398	2.496	1.362	3.901
3337	71	1	36.00	1	0.5	70	1	6.311	3.101	4.603	1.647	3.379	4.541	3.084	3.181	1.790	3.366
3338	71	1	36.25	1.25	0.5	70	1.25	6.171	3.111	4.443	1.711	2.877	5.700	3.751	3.872	2.203	2.881
3339	71	1	37.00	2	0.5	70	2	6.240	3.182	4.395	1.735	1.983	9.270	5.646	5.888	3.801	1.933
3340	71	1	37.50	2.5	0.5	70	2.5	6.316	3.130	4.413	1.701	1.615	11.537	6.784	7.078	4.598	1.584
3341	71	1	38.00	3	0.5	70	3	6.322	3.094	4.395	1.649	1.344	13.701	7.807	8.158	5.249	1.378
3342	71	1	39.00	4	0.5	70	4	6.207	2.971	4.264	1.361	0.982	17.747	9.760	10.049	6.196	1.090
3343	71	1	40.00	5	0.5	70	5	5.942	2.968	4.064	1.307	0.758	21.447	11.221	11.657	6.184	0.942
3344	71	1	41.00	6	0.5	70	6	5.658	2.802	3.834	1.269	0.610	24.902	12.445	13.073	6.720	0.876
3345	71	1	42.00	7	0.5	70	7	5.362	2.642	3.607	1.241	0.506	28.119	13.130	14.339	7.175	0.828
3346	71	1	42.50	7.5	0.5	70	7.5	5.216	2.564	3.496	1.230	0.466	29.643	13.589	14.914	7.379	0.828
3347	71	1	43.00	8	0.5	70	8	5.077	2.492	3.394	1.219	0.430	31.121	14.028	15.459	6.911	0.827
3348	71	1	44.00	9	0.5	70	9	4.811	2.350	3.194	1.203	0.373	33.960	14.830	16.493	7.330	0.829
3349	71	1	45.00	10	0.5	70	10	4.548	2.223	3.002	1.189	0.328	36.623	15.884	17.426	7.725	0.864
3350	81	1	40.10	0.1	0.5	80	0.1	3.532	1.596	3.226	0.964	8.595	1.984	1.112	1.587	0.355	8.212
3351	81	1	40.25	0.25	0.5	80	0.25	6.824	2.790	5.835	1.136	7.433	3.765	1.993	2.760	0.720	6.939
3352	81	1	40.50	0.5	0.5	80	0.5	7.903	3.242	6.088	1.459	5.445	4.067	2.429	2.935	1.111	5.142
3353	81	1	40.75	0.75	0.5	80	0.75	7.387	3.288	5.430	1.608	4.220	3.861	2.628	2.739	1.406	4.112
3354	81	1	41.00	1	0.5	80	1	7.087	3.387	5.096	1.717	3.564	4.962	3.287	3.469	1.849	3.550
3355	81	1	41.25	1.25	0.5	80	1.25	6.956	3.412	4.946	1.790	3.039	6.154	4.006	4.218	2.282	3.050
3356	81	1	42.00	2	0.5	80	2	7.152	3.529	5.012	1.826	2.105	9.894	6.086	6.446	3.444	2.020
3357	81	1	42.50	2.5	0.5	80	2.5	7.307	3.463	5.107	1.794	1.717	12.302	7.479	7.793	4.164	1.653
3358	81	1	43.00	3	0.5	80	3	7.380	3.572	5.155	1.742	1.429	14.601	8.684	9.017	5.544	1.440
3359	81	1	44.00	4	0.5	80	4	7.340	3.486	5.088	1.608	1.041	18.921	10.758	11.182	6.642	1.140
3360	81	1	45.00	5	0.5	80	5	7.068	3.328	4.905	1.357	0.801	22.947	12.465	13.073	6.626	0.985
3361	81	1	46.00	6	0.5	80	6	6.763	3.157	4.669	1.313	0.643	26.716	14.165	14.748	7.249	0.841
3362	81	1	47.00	7	0.5	80	7	6.427	2.997	4.426	1.284	0.532	30.251	15.449	16.251	7.766	0.836

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Model								Membrane Stress Factors									
	OD	T	od	t	d/D	D/T	t/T	Branch					Header				
								Axial	In-Plane	Out-of-Plane	Torsional	Pressure	Axial	In-Plane	Out-of-Plane	Torsional	Pressure
3363	81	1	47.50	7.5	0.5	80	7.5	6.266	2.909	4.307	1.268	0.489	31.947	16.030	16.945	7.995	0.836
3364	81	1	48.00	8	0.5	80	8	6.116	2.835	4.184	1.257	0.452	33.588	16.579	17.610	7.415	0.836
3365	81	1	49.00	9	0.5	80	9	5.804	2.671	3.960	1.238	0.391	36.748	17.594	18.847	7.875	0.838
3366	81	1	50.00	10	0.5	80	10	5.509	2.541	3.745	1.224	0.343	39.766	17.994	20.000	8.309	0.872
3367	91	1	45.10	0.1	0.5	90	0.1	3.865	1.680	3.503	0.964	9.130	2.233	1.196	1.790	0.374	8.693
3368	91	1	45.25	0.25	0.5	90	0.25	7.516	3.007	6.369	1.181	7.893	4.255	2.178	3.115	0.758	7.327
3369	91	1	45.50	0.5	0.5	90	0.5	8.719	3.517	6.644	1.521	5.733	4.630	2.675	3.261	1.165	5.401
3370	91	1	45.75	0.75	0.5	90	0.75	8.176	3.548	5.929	1.669	4.426	4.319	2.916	2.991	1.444	4.308
3371	91	1	46.00	1	0.5	90	1	7.884	3.664	5.581	1.782	3.734	5.445	3.473	3.762	1.902	3.720
3372	91	1	46.25	1.25	0.5	90	1.25	7.777	3.706	5.443	1.861	3.188	6.665	4.240	4.564	2.377	3.205
3373	91	1	47.00	2	0.5	90	2	8.140	3.872	5.631	1.910	2.219	10.564	6.556	7.000	3.659	2.127
3374	91	1	47.50	2.5	0.5	90	2.5	8.386	3.926	5.814	1.882	1.812	13.063	8.003	8.476	4.375	1.728
3375	91	1	48.00	3	0.5	90	3	8.513	3.844	5.923	1.830	1.508	15.462	9.340	9.831	4.963	1.542
3376	91	1	49.00	4	0.5	90	4	8.546	3.846	5.931	1.710	1.097	20.028	11.676	12.267	6.120	1.184
3377	91	1	50.00	5	0.5	90	5	8.264	3.706	5.769	1.407	0.841	24.320	13.620	14.422	7.017	1.026
3378	91	1	51.00	6	0.5	90	6	7.902	3.514	5.528	1.354	0.673	28.365	15.554	16.348	7.722	0.849
3379	91	1	52.00	7	0.5	90	7	7.547	3.346	5.272	1.317	0.556	32.193	17.031	18.097	8.301	0.844
3380	91	1	52.50	7.5	0.5	90	7.5	7.358	3.259	5.138	1.305	0.510	34.033	17.702	18.913	8.559	0.843
3381	91	1	53.00	8	0.5	90	8	7.193	3.168	5.008	1.292	0.471	35.813	18.341	19.686	8.804	0.843
3382	91	1	54.00	9	0.5	90	9	6.841	2.995	4.757	1.272	0.407	39.292	19.516	21.164	8.372	0.845
3383	91	1	55.00	10	0.5	90	10	6.530	2.850	4.515	1.253	0.357	42.594	20.900	22.514	8.843	0.594
3384	101	1	50.10	0.1	0.5	100	0.1	4.177	1.764	3.772	0.966	9.594	2.470	1.283	1.992	0.394	9.133
3385	101	1	50.25	0.25	0.5	100	0.25	8.171	3.213	6.880	1.223	8.316	4.708	2.361	3.442	0.796	7.692
3386	101	1	50.50	0.5	0.5	100	0.5	9.506	3.783	7.178	1.579	6.002	5.193	2.910	3.581	1.215	5.642
3387	101	1	50.75	0.75	0.5	100	0.75	8.957	3.800	6.415	1.726	4.618	4.817	3.172	3.288	1.479	4.490
3388	101	1	51.00	1	0.5	100	1	8.691	3.934	6.056	1.843	3.892	5.980	3.645	4.059	1.971	3.878
3389	101	1	51.25	1.25	0.5	100	1.25	8.622	3.994	5.942	1.930	3.327	7.231	4.461	4.910	2.448	3.348
3390	101	1	52.00	2	0.5	100	2	9.175	4.211	6.257	1.990	2.326	11.268	6.920	7.540	3.776	2.230
3391	101	1	52.50	2.5	0.5	100	2.5	9.523	4.277	6.524	1.966	1.903	13.849	8.483	9.145	4.541	1.800
3392	101	1	53.00	3	0.5	100	3	9.710	4.230	6.699	1.915	1.584	16.332	9.943	10.626	5.201	1.591
3393	101	1	54.00	4	0.5	100	4	9.832	4.215	6.785	1.758	1.150	21.091	12.527	13.315	6.373	1.171
3394	101	1	55.00	5	0.5	100	5	9.519	4.043	6.650	1.457	0.880	25.619	14.948	15.723	7.365	1.075
3395	101	1	56.00	6	0.5	100	6	9.113	3.867	6.413	1.395	0.702	29.907	16.860	17.901	8.150	0.856
3396	101	1	57.00	7	0.5	100	7	8.700	3.662	6.132	1.351	0.579	34.000	18.526	19.894	8.794	0.851
3397	101	1	57.50	7.5	0.5	100	7.5	8.485	3.576	5.992	1.337	0.531	35.974	19.291	20.829	9.081	0.850
3398	101	1	58.00	8	0.5	100	8	8.303	3.483	5.854	1.323	0.489	37.901	20.015	21.725	9.349	0.850
3399	101	1	59.00	9	0.5	100	9	7.927	3.317	5.576	1.301	0.422	41.639	21.675	23.426	8.830	0.580
3400	101	1	60.00	10	0.5	100	10	7.566	3.140	5.310	1.282	0.370	45.218	22.918	24.991	9.337	0.583

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Model								Membrane Stress Factors									
	OD	T	od	t	d/D	D/T	t/T	Branch					Header				
								Axial	In-Plane	Out-of-Plane	Torsional	Pressure	Axial	In-Plane	Out-of-Plane	Torsional	Pressure
3401	251	1	125.10	0.1	0.5	250	0.1	7.852	2.968	7.335	1.150	15.195	5.353	2.365	4.801	0.614	14.367
3402	251	1	125.25	0.25	0.5	250	0.25	15.764	5.749	13.681	1.770	12.790	10.477	4.538	8.609	1.269	11.827
3403	251	1	125.50	0.5	0.5	250	0.5	18.969	7.051	14.303	2.318	8.849	12.874	5.795	8.739	1.865	8.339
3404	251	1	125.75	0.75	0.5	250	0.75	18.934	7.036	12.989	2.455	6.629	12.575	6.178	8.331	2.164	6.476
3405	251	1	126.00	1	0.5	250	1	19.603	7.486	12.639	2.653	5.539	14.957	6.924	9.949	2.505	5.550
3406	251	1	126.25	1.25	0.5	250	1.25	20.712	7.878	12.935	2.791	4.780	17.390	7.540	11.735	3.102	4.860
3407	251	1	127.00	2	0.5	250	2	25.074	8.946	15.585	3.051	3.472	24.405	10.824	17.385	4.790	3.545
3408	251	1	127.50	2.5	0.5	250	2.5	27.326	9.304	17.357	3.092	2.899	28.130	13.524	20.741	5.985	2.560
3409	251	1	128.00	3	0.5	250	3	28.766	9.661	18.714	3.061	2.458	31.272	16.185	23.716	7.125	2.211
3410	251	1	129.00	4	0.5	250	4	30.357	9.536	20.257	2.890	1.800	36.884	21.250	28.932	9.187	1.823
3411	251	1	130.00	5	0.5	250	5	29.827	8.989	20.847	2.647	1.365	42.572	26.128	33.469	11.025	1.655
3412	251	1	131.00	6	0.5	250	6	28.677	8.796	20.660	2.415	1.068	48.631	31.865	37.999	12.513	1.344
3413	251	1	132.00	7	0.5	250	7	27.358	8.150	20.262	2.220	0.860	54.994	36.280	42.610	13.759	0.533
3414	251	1	132.50	7.5	0.5	250	7.5	26.686	7.937	20.010	2.130	0.778	58.187	38.358	45.133	14.328	0.526
3415	251	1	133.00	8	0.5	250	8	26.028	7.749	19.733	2.096	0.709	61.428	40.326	47.659	14.850	0.520
3416	251	1	134.00	9	0.5	250	9	24.786	7.406	19.154	2.037	0.597	67.870	44.078	52.652	15.801	0.513
3417	251	1	135.00	10	0.5	250	10	23.652	7.099	18.575	1.621	0.512	74.284	47.563	57.555	16.650	0.509
3418	501	1	250.10	0.1	0.5	500	0.1	12.687	4.547	12.869	1.485	21.509	8.767	3.611	8.992	0.902	20.097
3419	501	1	250.25	0.25	0.5	500	0.25	25.867	8.877	24.384	2.564	17.621	17.340	7.180	15.674	1.880	16.366
3420	501	1	250.50	0.5	0.5	500	0.5	31.557	10.773	25.785	3.348	11.917	19.211	9.331	14.374	2.702	11.309
3421	501	1	250.75	0.75	0.5	500	0.75	32.252	10.323	23.668	3.420	8.877	23.312	10.255	16.652	3.096	8.689
3422	501	1	251.00	1	0.5	500	1	34.504	11.175	23.769	3.743	7.368	28.015	10.456	19.946	3.550	7.389
3423	501	1	251.25	1.25	0.5	500	1.25	37.601	12.001	25.128	4.017	6.384	32.850	11.495	23.614	3.928	6.501
3424	501	1	252.00	2	0.5	500	2	48.296	15.598	32.342	4.619	4.728	46.398	14.406	35.022	5.864	4.870
3425	501	1	252.50	2.5	0.5	500	2.5	54.020	16.594	36.989	4.795	3.999	53.259	15.678	41.620	7.342	4.096
3426	501	1	253.00	3	0.5	500	3	59.946	17.108	40.694	4.975	3.416	58.488	18.625	47.244	8.790	3.131
3427	501	1	254.00	4	0.5	500	4	63.638	17.170	46.731	4.790	2.551	65.977	24.587	56.381	11.528	2.263
3428	501	1	255.00	5	0.5	500	5	63.909	16.663	48.401	4.441	1.961	72.109	30.633	64.077	13.955	1.959
3429	501	1	256.00	6	0.5	500	6	62.447	15.899	48.646	4.056	1.546	78.717	37.250	71.351	16.343	1.781
3430	501	1	257.00	7	0.5	500	7	60.156	14.980	48.098	3.689	1.246	86.214	43.970	78.662	18.471	1.672
3431	501	1	257.50	7.5	0.5	500	7.5	58.861	14.550	47.638	3.522	1.127	90.351	55.428	82.335	19.443	1.546
3432	501	1	258.00	8	0.5	500	8	57.545	14.143	47.124	3.354	1.024	94.546	58.773	86.124	20.351	0.554
3433	501	1	259.00	9	0.5	500	9	54.888	13.400	45.960	3.061	0.855	103.518	56.053	93.500	22.132	0.529
3434	501	1	260.00	10	0.5	500	10	52.311	12.731	44.718	2.812	0.722	112.986	61.710	102.044	23.629	0.512
3436	751	1	375.25	0.25	0.5	750	0.25	35.000	11.619	35.154	3.277	21.475	22.500	9.217	21.381	2.392	19.895
3437	751	1	375.50	0.5	0.5	750	0.5	42.970	14.468	37.448	4.260	14.310	26.530	11.372	19.630	3.424	13.586
3438	751	1	375.75	0.75	0.5	750	0.75	44.163	13.622	34.262	4.326	10.586	32.947	12.406	23.456	3.901	10.378
3439	751	1	376.00	1	0.5	750	1	47.958	14.902	35.007	4.683	8.752	39.939	14.115	28.197	4.437	8.782

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Model								Membrane Stress Factors									
	OD	T	od	t	d/D	D/T	t/T	Branch					Header				
								Axial	In-Plane	Out-of-Plane	Torsional	Pressure	Axial	In-Plane	Out-of-Plane	Torsional	Pressure
3440	751	1	376.25	1.25	0.5	750	1.25	52.960	16.177	37.596	5.088	7.594	47.125	15.697	33.558	4.950	7.737
3441	751	1	377.00	2	0.5	750	2	69.664	19.616	49.565	6.012	5.668	67.166	19.572	50.326	6.066	5.855
3442	751	1	377.50	2.5	0.5	750	2.5	78.798	22.816	57.197	6.324	4.819	77.416	20.452	60.013	6.956	4.963
3443	751	1	378.00	3	0.5	750	3	88.636	23.683	66.988	6.442	4.137	85.198	22.129	68.143	8.103	4.231
3444	751	1	379.00	4	0.5	750	4	95.628	24.004	74.420	6.461	3.117	95.513	28.474	80.746	10.550	2.660
3445	751	1	380.00	5	0.5	750	5	97.334	23.402	77.800	6.086	2.415	102.545	35.534	90.685	13.099	2.224
3446	751	1	381.00	6	0.5	750	6	96.094	22.392	78.728	5.633	1.917	109.109	43.008	99.829	15.628	2.053
3447	751	1	382.00	7	0.5	750	7	93.303	21.269	78.227	5.156	1.554	116.660	50.540	109.156	18.065	1.947
3448	751	1	382.50	7.5	0.5	750	7.5	91.589	20.703	77.663	4.929	1.409	120.856	54.228	114.059	19.235	1.906
3449	751	1	383.00	8	0.5	750	8	89.774	20.157	76.962	4.707	1.282	125.414	57.897	119.139	20.361	1.871
3450	751	1	384.00	9	0.5	750	9	85.950	19.085	75.274	4.291	1.073	135.463	65.088	129.657	22.504	0.553
3451	751	1	385.00	10	0.5	750	10	82.158	18.084	73.455	3.920	0.910	146.574	71.988	141.294	24.492	0.531
3453	1001	1	500.25	0.25	0.5	1000	0.25	43.441	14.384	45.879	3.927	24.816	26.829	10.912	26.113	2.834	22.923
3454	1001	1	500.50	0.5	0.5	1000	0.5	53.463	17.793	49.176	5.075	16.361	32.824	13.866	25.506	4.052	15.554
3455	1001	1	500.75	0.75	0.5	1000	0.75	54.760	17.025	44.540	5.111	12.031	41.437	15.232	31.121	4.614	11.716
3456	1001	1	501.00	1	0.5	1000	1	59.949	18.207	45.993	5.537	9.927	50.528	17.397	37.598	5.266	9.880
3457	1001	1	501.25	1.25	0.5	1000	1.25	66.670	19.919	49.790	6.048	8.614	59.873	19.427	44.732	5.827	8.773
3458	1001	1	502.00	2	0.5	1000	2	88.841	24.503	66.424	7.278	6.457	85.991	23.299	67.144	7.214	6.675
3459	1001	1	502.50	2.5	0.5	1000	2.5	101.171	28.255	77.018	7.718	5.506	99.544	25.442	80.052	7.801	5.683
3460	1001	1	503.00	3	0.5	1000	3	114.884	29.468	91.258	7.919	4.739	109.924	26.906	90.872	8.931	4.866
3461	1001	1	504.00	4	0.5	1000	4	125.339	30.165	102.175	7.983	3.590	123.592	32.046	107.392	11.350	3.486
3462	1001	1	505.00	5	0.5	1000	5	128.774	29.575	107.524	7.571	2.794	131.992	39.300	119.779	13.952	2.416
3463	1001	1	506.00	6	0.5	1000	6	128.111	28.338	109.243	7.064	2.227	138.820	47.168	130.464	16.610	2.200
3464	1001	1	507.00	7	0.5	1000	7	125.164	26.997	108.953	6.520	1.814	146.220	55.221	141.219	19.237	2.061
3465	1001	1	507.50	7.5	0.5	1000	7.5	123.228	26.307	108.357	6.251	1.647	150.410	59.251	146.850	20.516	2.010
3466	1001	1	508.00	8	0.5	1000	8	121.078	25.616	107.540	5.989	1.502	155.057	63.295	152.713	21.779	1.967
3467	1001	1	509.00	9	0.5	1000	9	116.391	24.295	105.420	5.501	1.262	165.464	71.317	165.125	24.187	1.898
3468	1001	1	510.00	10	0.5	1000	10	111.574	23.055	103.029	5.027	1.073	177.390	79.125	178.396	26.453	1.845
3470	1251	1	625.25	0.25	0.5	1250	0.25	51.483	16.933	56.907	4.525	27.861	30.973	12.379	29.821	3.233	25.621
3471	1251	1	625.50	0.5	0.5	1250	0.5	63.281	20.870	61.167	5.834	18.196	38.239	16.101	30.927	4.623	17.297
3472	1251	1	625.75	0.75	0.5	1250	0.75	64.308	19.916	54.628	5.786	13.308	48.912	17.800	38.450	5.265	13.078
3473	1251	1	626.00	1	0.5	1250	1	70.664	21.232	56.718	6.230	10.957	59.908	20.390	46.633	6.017	10.901
3474	1251	1	626.25	1.25	0.5	1250	1.25	78.904	23.605	61.705	6.926	9.515	71.257	22.860	55.761	6.697	9.697
3475	1251	1	627.00	2	0.5	1250	2	106.097	29.039	82.914	8.444	7.153	103.031	27.686	83.726	7.701	7.404
3476	1251	1	627.50	2.5	0.5	1250	2.5	121.357	33.126	96.460	9.010	6.111	119.716	30.216	99.921	8.644	6.321
3477	1251	1	628.00	3	0.5	1250	3	138.946	34.659	115.335	9.295	5.268	132.692	29.667	113.429	9.665	5.428
3478	1251	1	629.00	4	0.5	1250	4	152.765	35.687	129.740	9.313	4.003	149.905	35.523	133.943	12.139	4.073
3479	1251	1	630.00	5	0.5	1250	5	158.073	35.159	137.149	8.941	3.125	160.157	42.771	148.854	14.726	2.607

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Model								Membrane Stress Factors									
	OD	T	od	t	d/D	D/T	t/T	Branch					Header				
								Axial	In-Plane	Out-of-Plane	Torsional	Pressure	Axial	In-Plane	Out-of-Plane	Torsional	Pressure
3480	1251	1	631.00	6	0.5	1250	6	158.237	33.903	140.144	8.408	2.500	167.638	50.736	161.444	17.432	2.335
3481	1251	1	632.00	7	0.5	1250	7	155.421	32.268	139.951	7.827	2.042	174.998	58.982	172.742	20.146	2.155
3482	1251	1	632.50	7.5	0.5	1250	7.5	153.346	31.480	139.334	7.531	1.857	179.159	63.207	178.978	21.499	2.091
3483	1251	1	633.00	8	0.5	1250	8	150.978	30.700	138.421	7.241	1.696	183.836	67.469	185.535	22.830	2.038
3484	1251	1	634.00	9	0.5	1250	9	145.679	29.152	135.941	6.682	1.429	194.362	76.074	199.300	25.422	1.955
3485	1251	1	635.00	10	0.5	1250	10	140.096	27.698	133.085	6.096	1.219	206.543	84.467	214.434	27.899	1.894
3487	1501	1	750.25	0.25	0.5	1500	0.25	59.054	19.287	67.785	5.069	30.729	34.590	13.676	34.237	3.595	28.066
3488	1501	1	750.50	0.5	0.5	1500	0.5	72.587	23.482	73.170	6.531	19.878	43.067	18.130	36.144	5.137	18.883
3489	1501	1	750.75	0.75	0.5	1500	0.75	73.062	22.620	64.544	6.467	14.470	55.673	20.176	45.678	5.860	14.235
3490	1501	1	751.00	1	0.5	1500	1	80.441	24.018	67.271	7.175	11.894	68.396	23.163	55.570	6.717	11.953
3491	1501	1	751.25	1.25	0.5	1500	1.25	90.022	26.885	73.424	7.741	10.329	81.542	25.718	66.428	7.439	10.513
3492	1501	1	752.00	2	0.5	1500	2	121.771	33.252	99.117	9.533	7.782	118.616	31.790	99.859	8.353	8.050
3493	1501	1	752.50	2.5	0.5	1500	2.5	147.581	37.541	115.518	10.216	6.658	138.294	30.228	119.179	9.473	6.887
3494	1501	1	753.00	3	0.5	1500	3	161.222	39.398	139.263	10.580	5.747	153.794	33.246	135.492	10.488	5.926
3495	1501	1	754.00	4	0.5	1500	4	178.294	40.727	157.136	10.675	4.376	174.720	38.918	159.923	12.623	4.463
3496	1501	1	755.00	5	0.5	1500	5	185.530	40.261	166.604	10.316	3.423	186.982	45.963	177.295	15.432	2.789
3497	1501	1	756.00	6	0.5	1500	6	186.661	38.981	170.592	9.756	2.745	195.509	53.874	191.317	18.138	2.463
3498	1501	1	757.00	7	0.5	1500	7	184.181	37.330	171.028	9.125	2.247	203.289	62.297	204.337	20.921	2.249
3499	1501	1	757.50	7.5	0.5	1500	7.5	182.065	36.460	170.325	8.803	2.046	207.477	66.670	210.904	22.318	2.222
3500	1501	1	758.00	8	0.5	1500	8	179.580	35.559	169.441	8.484	1.871	212.020	71.076	218.025	23.706	2.176
3501	1501	1	759.00	9	0.5	1500	9	173.899	33.693	166.760	7.859	1.580	222.772	79.940	233.073	26.427	2.099
3502	1501	1	760.00	10	0.5	1500	10	167.666	32.043	163.378	7.273	1.351	235.427	88.826	250.162	29.062	1.937
3505	1751	1	875.50	0.5	0.5	1750	0.5	81.551	26.429	85.243	7.187	21.474	47.411	20.006	40.983	5.614	20.349
3506	1751	1	875.75	0.75	0.5	1750	0.75	81.194	25.147	74.308	7.114	15.425	61.837	22.366	52.593	6.421	15.295
3507	1751	1	876.00	1	0.5	1750	1	89.421	26.622	77.572	7.884	12.758	76.236	25.739	64.139	7.345	12.815
3508	1751	1	876.25	1.25	0.5	1750	1.25	100.240	29.978	84.879	8.537	11.080	91.039	28.672	76.967	8.196	11.286
3509	1751	1	877.00	2	0.5	1750	2	136.085	37.218	114.952	10.558	8.359	132.933	35.692	115.786	9.127	8.651
3510	1751	1	877.50	2.5	0.5	1750	2.5	166.319	41.609	134.323	11.349	7.162	155.614	33.629	138.380	10.287	7.415
3511	1751	1	878.00	3	0.5	1750	3	182.077	43.742	162.791	11.790	6.188	173.575	36.695	157.248	11.301	6.389
3512	1751	1	879.00	4	0.5	1750	4	202.355	45.397	184.266	11.969	4.720	198.213	42.177	185.810	13.292	4.827
3513	1751	1	880.00	5	0.5	1750	5	211.467	44.998	195.853	11.622	3.698	212.764	49.195	205.700	16.143	3.601
3514	1751	1	881.00	6	0.5	1750	6	213.640	43.658	200.954	11.046	2.969	222.591	56.921	221.283	18.822	2.592
3515	1751	1	882.00	7	0.5	1750	7	211.545	41.920	201.982	10.374	2.434	230.861	65.354	235.605	21.618	2.362
3516	1751	1	882.50	7.5	0.5	1750	7.5	209.450	40.974	201.451	10.031	2.219	235.257	69.749	243.182	23.040	2.304
3517	1751	1	883.00	8	0.5	1750	8	206.947	40.031	200.394	9.683	2.031	239.891	74.255	250.732	24.456	2.254
3518	1751	1	884.00	9	0.5	1750	9	200.963	38.125	197.497	9.004	1.719	250.659	83.351	267.476	27.271	2.170
3519	1751	1	885.00	10	0.5	1750	10	194.286	36.139	193.761	8.357	1.472	263.593	92.516	286.130	30.007	2.102
3522	2001	1	1000.50	0.5	0.5	2000	0.5	90.083	28.929	97.113	7.803	22.977	51.395	21.739	45.722	6.054	21.720

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Model								Membrane Stress Factors									
	OD	T	od	t	d/D	D/T	t/T	Branch					Header				
								Axial	In-Plane	Out-of-Plane	Torsional	Pressure	Axial	In-Plane	Out-of-Plane	Torsional	Pressure
3523	2001	1	1000.75	0.75	0.5	2000	0.75	88.782	27.544	83.828	7.724	16.414	67.572	24.426	59.415	6.902	16.292
3524	2001	1	1001.00	1	0.5	2000	1	97.820	30.041	87.690	8.484	13.564	83.513	28.161	72.650	7.910	13.632
3525	2001	1	1001.25	1.25	0.5	2000	1.25	109.749	32.892	96.092	9.283	11.780	99.868	31.469	87.271	8.910	12.004
3526	2001	1	1002.00	2	0.5	2000	2	149.435	40.962	130.420	11.523	8.898	146.397	32.975	131.358	9.882	9.212
3527	2001	1	1002.50	2.5	0.5	2000	2.5	183.926	44.701	152.537	12.421	7.630	171.817	36.928	157.016	11.089	7.905
3528	2001	1	1003.00	3	0.5	2000	3	201.659	47.768	186.050	12.934	6.597	192.117	40.053	178.676	12.109	6.818
3529	2001	1	1004.00	4	0.5	2000	4	224.973	49.716	210.935	13.188	5.038	220.475	45.672	211.147	13.961	5.162
3530	2001	1	1005.00	5	0.5	2000	5	235.958	49.418	224.872	12.859	3.952	237.495	52.328	234.573	16.838	3.861
3531	2001	1	1006.00	6	0.5	2000	6	239.206	48.052	231.071	12.269	3.177	248.749	59.877	252.680	19.459	2.719
3532	2001	1	1007.00	7	0.5	2000	7	237.634	46.217	232.971	11.570	2.608	257.907	68.201	269.177	22.253	2.443
3533	2001	1	1007.50	7.5	0.5	2000	7.5	235.730	45.221	232.321	11.210	2.379	262.481	72.606	276.822	23.686	2.379
3534	2001	1	1008.00	8	0.5	2000	8	233.184	44.218	231.380	10.842	2.179	267.262	77.119	285.051	25.127	2.323
3535	2001	1	1009.00	9	0.5	2000	9	227.032	42.180	228.181	10.119	1.847	278.336	86.373	302.705	28.000	2.233
3536	2001	1	1010.00	10	0.5	2000	10	219.866	40.187	224.181	9.419	1.585	291.157	95.583	322.318	30.784	2.159
3539	2251	1	1125.50	0.5	0.5	2250	0.5	98.287	31.348	108.740	8.386	24.416	55.073	23.362	50.241	6.445	23.002
3540	2251	1	1125.75	0.75	0.5	2250	0.75	96.023	29.832	93.252	8.306	17.348	72.907	26.371	66.024	7.400	17.234
3541	2251	1	1126.00	1	0.5	2250	1	105.663	32.533	97.629	9.126	14.326	90.270	30.438	80.947	8.502	14.397
3542	2251	1	1126.25	1.25	0.5	2250	1.25	118.576	35.659	106.997	9.999	12.441	108.105	34.111	97.286	8.118	12.680
3543	2251	1	1127.00	2	0.5	2250	2	162.073	44.530	145.513	12.444	9.409	159.173	35.911	146.575	10.626	9.744
3544	2251	1	1127.50	2.5	0.5	2250	2.5	200.607	48.678	170.437	13.440	8.070	186.149	40.140	175.314	11.882	8.366
3545	2251	1	1128.00	3	0.5	2250	3	220.508	51.531	208.944	14.040	6.988	210.043	43.411	199.614	12.918	7.229
3546	2251	1	1129.00	4	0.5	2250	4	246.532	53.766	237.623	14.360	5.338	241.857	48.981	236.446	15.225	5.479
3547	2251	1	1130.00	5	0.5	2250	5	259.539	53.548	253.237	14.063	4.193	261.549	55.434	264.024	17.549	4.199
3548	2251	1	1131.00	6	0.5	2250	6	263.719	52.172	260.857	13.450	3.373	274.313	62.754	284.594	20.097	2.845
3549	2251	1	1132.00	7	0.5	2250	7	262.539	50.249	263.160	12.720	2.771	284.176	70.844	302.316	22.827	2.518
3550	2251	1	1132.50	7.5	0.5	2250	7.5	260.743	49.207	262.782	12.341	2.530	289.078	75.167	310.759	24.252	2.446
3551	2251	1	1133.00	8	0.5	2250	8	258.383	48.139	261.865	11.965	2.319	294.179	79.651	319.408	25.705	2.386
3552	2251	1	1134.00	9	0.5	2250	9	252.000	45.991	257.536	11.193	1.967	305.293	88.909	336.482	28.604	2.321
3553	2251	1	1135.00	10	0.5	2250	10	244.664	43.890	254.065	10.452	1.690	318.751	98.492	358.453	31.500	2.250
3556	2501	1	1250.50	0.5	0.5	2500	0.5	106.066	33.662	120.114	8.941	25.791	58.499	24.900	54.611	6.852	24.235
3557	2501	1	1250.75	0.75	0.5	2500	0.75	102.825	32.049	102.490	8.865	18.227	77.900	28.238	72.504	7.875	18.131
3558	2501	1	1251.00	1	0.5	2500	1	113.013	34.962	107.287	9.745	15.044	96.581	32.331	89.006	9.064	15.126
3559	2501	1	1251.25	1.25	0.5	2500	1.25	126.897	38.347	117.728	10.683	13.067	115.850	36.669	107.098	8.680	13.316
3560	2501	1	1252.00	2	0.5	2500	2	173.632	47.951	160.304	13.315	9.886	170.995	38.766	161.464	11.345	10.237
3561	2501	1	1252.50	2.5	0.5	2500	2.5	216.374	52.491	187.864	14.409	8.486	201.575	44.147	193.139	12.653	8.799
3562	2501	1	1253.00	3	0.5	2500	3	237.957	55.464	231.351	15.058	7.346	226.577	46.719	219.991	13.698	7.603
3563	2501	1	1254.00	4	0.5	2500	4	267.188	58.081	262.947	15.493	5.626	262.466	52.029	262.805	16.004	5.781
3564	2501	1	1255.00	5	0.5	2500	5	281.676	57.958	281.210	15.186	4.417	284.475	58.540	293.488	18.234	4.498



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Model								Membrane Stress Factors									
	OD	T	od	t	d/D	D/T	t/T	Branch					Header				
								Axial	In-Plane	Out-of-Plane	Torsional	Pressure	Axial	In-Plane	Out-of-Plane	Torsional	Pressure
3565	2501	1	1256.00	6	0.5	2500	6	287.062	56.494	290.274	14.580	3.558	298.967	65.482	316.497	20.693	2.963
3566	2501	1	1257.00	7	0.5	2500	7	286.580	54.439	293.008	13.831	2.926	310.260	73.495	335.895	23.415	2.607
3567	2501	1	1257.50	7.5	0.5	2500	7.5	284.799	53.291	293.010	13.430	2.671	315.444	77.757	345.289	24.828	2.542
3568	2501	1	1258.00	8	0.5	2500	8	282.415	52.110	292.056	13.037	2.449	320.627	82.210	350.467	26.261	2.478
3569	2501	1	1259.00	9	0.5	2500	9	276.149	49.610	288.768	12.235	2.070	332.428	91.503	373.989	29.194	2.374
3570	2501	1	1260.00	10	0.5	2500	10	268.490	47.427	284.435	11.453	1.780	345.218	101.177	394.992	32.125	2.297
3571	9	1	4.50	0.1	0.55	8	0.1	1.018	1.019	0.991	1.047	4.640	0.252	0.138	0.170	0.120	2.842
3572	9	1	4.65	0.25	0.55	8	0.25	1.134	0.957	1.050	1.061	1.910	0.639	0.350	0.342	0.277	2.329
3573	9	1	4.90	0.5	0.55	8	0.5	1.323	0.897	1.046	0.988	1.398	1.360	0.526	0.571	0.506	1.796
3574	9	1	5.15	0.75	0.55	8	0.75	1.457	0.862	0.964	0.871	1.183	2.166	0.700	0.746	0.623	1.458
3575	9	1	5.40	1	0.55	8	1	1.506	0.805	0.869	0.808	1.053	3.054	0.833	0.876	0.783	1.253
3576	9	1	5.65	1.25	0.55	8	1.25	1.533	0.785	0.785	0.768	0.895	3.981	0.913	0.973	0.884	1.033
3577	9	1	6.40	2	0.55	8	2	1.504	0.689	0.685	0.763	0.615	6.344	0.926	1.213	1.106	0.976
3578	9	1	6.90	2.5	0.55	8	2.5	1.456	0.641	0.641	0.779	0.502	7.905	1.088	1.367	1.231	1.024
3579	9	1	7.40	3	0.55	8	3	1.395	0.610	0.610	0.782	0.424	9.467	1.271	1.516	1.370	1.063
3580	9	1	8.40	4	0.55	8	4	1.158	0.530	0.527	0.842	0.342	12.592	1.700	1.812	1.707	1.106
3588	17	1	8.90	0.1	0.55	16	0.1	1.147	0.979	1.211	0.891	4.742	0.462	0.290	0.332	0.161	4.024
3589	17	1	9.05	0.25	0.55	16	0.25	1.688	1.079	1.712	1.102	2.980	0.666	0.489	0.512	0.370	3.424
3590	17	1	9.30	0.5	0.55	16	0.5	2.050	1.106	1.797	0.998	2.419	1.236	0.853	0.843	0.639	2.668
3591	17	1	9.55	0.75	0.55	16	0.75	2.154	1.191	1.662	0.959	2.018	1.922	1.180	1.148	0.918	2.198
3592	17	1	9.80	1	0.55	16	1	2.187	1.264	1.533	0.986	1.757	2.569	1.467	1.406	1.266	1.851
3593	17	1	10.05	1.25	0.55	16	1.25	2.209	1.194	1.404	0.985	1.490	3.206	1.707	1.616	1.482	1.518
3594	17	1	10.80	2	0.55	16	2	2.107	1.034	1.079	0.931	1.016	5.418	2.224	2.092	1.920	1.063
3595	17	1	11.30	2.5	0.55	16	2.5	1.992	0.964	0.916	0.934	0.829	7.046	1.898	2.350	2.082	0.920
3596	17	1	11.80	3	0.55	16	3	1.875	0.908	0.790	0.938	0.694	8.775	2.089	2.590	2.200	0.888
3597	17	1	12.80	4	0.55	16	4	1.777	0.818	0.692	0.965	0.516	12.163	2.439	3.029	2.393	1.021
3598	17	1	13.80	5	0.55	16	5	1.634	0.840	0.644	0.993	0.404	15.136	3.056	3.406	2.665	1.067
3599	17	1	14.80	6	0.55	16	6	1.580	0.808	0.611	1.034	0.324	18.105	3.311	3.757	2.972	1.091
3600	17	1	15.80	7	0.55	16	7	1.488	0.803	0.569	1.130	0.270	21.081	3.562	4.076	3.351	1.117
3601	17	1	16.30	7.5	0.55	16	7.5	1.236	0.807	0.543	1.150	0.252	22.576	3.684	4.225	3.555	1.126
3602	17	1	16.80	8	0.55	16	8	1.198	0.814	0.527	1.201	0.246	24.075	3.822	4.377	3.772	1.132
3605	25	1	13.30	0.1	0.55	24	0.1	1.377	0.982	1.482	0.913	4.988	0.560	0.429	0.404	0.219	4.867
3606	25	1	13.45	0.25	0.55	24	0.25	2.356	1.326	2.338	0.996	3.924	0.979	0.725	0.766	0.461	4.173
3607	25	1	13.70	0.5	0.55	24	0.5	2.771	1.520	2.488	1.024	3.149	1.397	1.086	1.055	0.757	3.230
3608	25	1	13.95	0.75	0.55	24	0.75	2.830	1.478	2.307	1.136	2.592	2.199	1.517	1.454	1.083	2.660
3609	25	1	14.20	1	0.55	24	1	2.826	1.652	2.134	1.223	2.231	2.987	1.909	1.830	1.535	2.279
3610	25	1	14.45	1.25	0.55	24	1.25	2.832	1.610	1.995	1.246	1.889	3.775	2.257	2.155	1.892	1.875
3611	25	1	15.20	2	0.55	24	2	2.702	1.500	1.632	1.060	1.283	5.879	3.063	2.914	2.608	1.281

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Model								Membrane Stress Factors									
	OD	T	od	t	d/D	D/T	t/T	Branch					Header				
								Axial	In-Plane	Out-of-Plane	Torsional	Pressure	Axial	In-Plane	Out-of-Plane	Torsional	Pressure
3612	25	1	15.70	2.5	0.55	24	2.5	2.565	1.361	1.439	1.056	1.044	7.093	3.453	3.293	2.864	1.119
3613	25	1	16.20	3	0.55	24	3	2.430	1.310	1.283	1.053	0.873	8.278	3.137	3.665	3.045	0.916
3614	25	1	17.20	4	0.55	24	4	2.173	1.214	1.044	1.078	0.646	10.311	3.988	4.257	3.299	0.841
3615	25	1	18.20	5	0.55	24	5	1.960	1.190	0.875	1.069	0.505	12.139	4.410	4.796	3.509	0.978
3616	25	1	19.20	6	0.55	24	6	1.918	1.129	0.747	1.070	0.412	13.834	4.741	5.318	3.742	0.797
3617	25	1	20.20	7	0.55	24	7	1.794	1.081	0.668	1.116	0.346	15.314	5.041	5.776	4.020	0.786
3618	25	1	20.70	7.5	0.55	24	7.5	1.738	1.063	0.656	1.139	0.319	16.182	5.267	5.978	4.109	0.826
3619	25	1	21.20	8	0.55	24	8	1.806	1.049	0.633	1.162	0.297	17.017	5.407	6.182	4.284	0.820
3620	25	1	22.20	9	0.55	24	9	1.713	1.006	0.612	1.190	0.255	17.788	5.768	6.575	4.658	0.809
3621	25	1	23.20	10	0.55	24	10	1.667	0.989	0.576	1.245	0.224	18.890	6.160	6.964	5.053	0.818
3622	33	1	17.70	0.1	0.55	32	0.1	1.632	1.069	1.754	0.929	5.459	0.708	0.552	0.573	0.257	5.574
3623	33	1	17.85	0.25	0.55	32	0.25	2.897	1.538	2.917	0.982	4.676	1.357	0.944	1.049	0.535	4.788
3624	33	1	18.10	0.5	0.55	32	0.5	3.456	1.787	3.112	1.124	3.705	1.618	1.260	1.244	0.867	3.674
3625	33	1	18.35	0.75	0.55	32	0.75	3.448	1.921	2.875	1.299	3.013	2.419	1.781	1.708	1.272	3.019
3626	33	1	18.60	1	0.55	32	1	3.398	1.988	2.677	1.402	2.575	3.314	2.260	2.168	1.704	2.587
3627	33	1	18.85	1.25	0.55	32	1.25	3.384	1.957	2.524	1.433	2.179	4.223	2.696	2.595	2.145	2.161
3628	33	1	19.60	2	0.55	32	2	3.254	1.904	2.176	1.410	1.479	6.730	3.828	3.669	3.120	1.436
3629	33	1	20.10	2.5	0.55	32	2.5	3.122	1.830	1.987	1.252	1.202	8.191	3.862	4.219	3.517	1.216
3630	33	1	20.60	3	0.55	32	3	2.980	1.751	1.822	1.225	1.003	9.532	4.252	4.680	3.777	1.142
3631	33	1	21.60	4	0.55	32	4	2.705	1.665	1.550	1.184	0.741	11.917	4.881	5.443	4.116	0.877
3632	33	1	22.60	5	0.55	32	5	2.460	1.555	1.349	1.158	0.578	14.009	5.177	6.081	4.369	0.887
3633	33	1	23.60	6	0.55	32	6	2.261	1.462	1.188	1.140	0.470	16.214	6.244	6.795	4.605	0.845
3634	33	1	24.60	7	0.55	32	7	2.083	1.388	1.056	1.134	0.393	18.076	6.650	7.376	4.834	0.841
3635	33	1	25.10	7.5	0.55	32	7.5	2.004	1.350	0.998	1.140	0.363	18.940	6.885	7.640	4.959	0.837
3636	33	1	25.60	8	0.55	32	8	1.920	1.314	0.939	1.147	0.337	19.817	7.118	7.930	5.067	0.833
3637	33	1	26.60	9	0.55	32	9	1.946	1.259	0.842	1.175	0.294	21.576	7.733	8.546	5.312	0.827
3638	33	1	27.60	10	0.55	32	10	1.848	1.216	0.758	1.207	0.260	23.021	8.170	9.078	5.620	0.816
3639	41	1	22.10	0.1	0.55	40	0.1	1.941	1.152	1.999	0.939	6.098	0.911	0.661	0.744	0.289	6.184
3640	41	1	22.25	0.25	0.55	40	0.25	3.499	1.775	3.463	0.994	5.323	1.744	1.139	1.335	0.607	5.314
3641	41	1	22.50	0.5	0.55	40	0.5	4.128	1.967	3.690	1.238	4.160	2.066	1.402	1.424	0.957	4.047
3642	41	1	22.75	0.75	0.55	40	0.75	4.009	2.024	3.393	1.426	3.350	2.610	1.994	1.924	1.378	3.315
3643	41	1	23.00	1	0.55	40	1	3.923	2.284	3.170	1.540	2.850	3.582	2.550	2.462	1.814	2.847
3644	41	1	23.25	1.25	0.55	40	1.25	3.883	2.264	3.013	1.580	2.413	4.588	3.070	2.978	2.313	2.395
3645	41	1	24.00	2	0.55	40	2	3.769	2.258	2.708	1.564	1.639	7.425	4.011	4.332	3.498	1.558
3646	41	1	24.50	2.5	0.55	40	2.5	3.659	2.199	2.539	1.511	1.331	9.130	4.627	5.057	4.028	1.329
3647	41	1	25.00	3	0.55	40	3	3.533	2.125	2.383	1.320	1.110	10.705	5.146	5.678	4.398	1.168
3648	41	1	26.00	4	0.55	40	4	3.272	1.964	2.113	1.268	0.817	13.534	6.223	6.726	4.852	0.912
3649	41	1	27.00	5	0.55	40	5	3.016	1.912	1.885	1.233	0.636	16.025	6.956	7.545	5.179	0.853

STP-PT-074: Local Stress in Nozzles, Shells and Formed Heads from External Heads

Model								Membrane Stress Factors									
	OD	T	od	t	d/D	D/T	t/T	Branch					Header				
								Axial	In-Plane	Out-of-Plane	Torsional	Pressure	Axial	In-Plane	Out-of-Plane	Torsional	Pressure
3650	41	1	28.00	6	0.55	40	6	2.782	1.783	1.691	1.208	0.516	18.276	7.684	8.264	5.441	0.791
3651	41	1	29.00	7	0.55	40	7	2.580	1.697	1.529	1.191	0.431	20.308	8.285	8.922	5.673	0.814
3652	41	1	29.50	7.5	0.55	40	7.5	2.486	1.649	1.457	1.185	0.397	21.221	8.485	9.187	5.792	0.815
3653	41	1	30.00	8	0.55	40	8	2.392	1.601	1.386	1.180	0.369	22.140	8.725	9.448	5.911	0.816
3654	41	1	31.00	9	0.55	40	9	2.232	1.525	1.262	1.174	0.320	24.622	9.387	10.346	6.199	0.876
3655	41	1	32.00	10	0.55	40	10	2.110	1.450	1.158	1.186	0.283	26.418	9.897	11.006	6.462	0.873
3656	51	1	27.60	0.1	0.55	50	0.1	2.337	1.246	2.312	0.949	6.566	1.171	0.780	0.958	0.345	6.871
3657	51	1	27.75	0.25	0.55	50	0.25	4.246	1.996	4.115	1.023	6.027	2.230	1.370	1.670	0.676	5.891
3658	51	1	28.00	0.5	0.55	50	0.5	4.949	2.334	4.371	1.352	4.638	2.778	1.649	1.647	1.052	4.450
3659	51	1	28.25	0.75	0.55	50	0.75	4.713	2.558	3.996	1.554	3.701	2.828	2.192	2.178	1.415	3.641
3660	51	1	28.50	1	0.55	50	1	4.524	2.624	3.741	1.678	3.136	3.880	2.835	2.796	1.872	3.129
3661	51	1	28.75	1.25	0.55	50	1.25	4.472	2.617	3.582	1.725	2.657	4.979	3.457	3.401	2.453	2.650
3662	51	1	29.50	2	0.55	50	2	4.384	2.651	3.349	1.723	1.811	8.150	4.679	5.058	3.843	1.739
3663	51	1	30.00	2.5	0.55	50	2.5	4.321	2.613	3.225	1.669	1.471	10.113	5.468	5.991	4.520	1.447
3664	51	1	30.50	3	0.55	50	3	4.237	2.555	3.106	1.603	1.225	11.947	6.715	6.805	5.022	1.268
3665	51	1	31.50	4	0.55	50	4	4.020	2.492	2.857	1.356	0.898	15.318	7.538	8.196	5.674	0.971
3666	51	1	32.50	5	0.55	50	5	3.778	2.357	2.619	1.312	0.697	18.335	8.472	9.342	6.074	0.902
3667	51	1	33.50	6	0.55	50	6	3.527	2.212	2.398	1.282	0.564	21.019	9.261	10.324	6.411	0.873
3668	51	1	34.50	7	0.55	50	7	3.303	2.072	2.202	1.255	0.470	23.621	10.227	11.209	6.689	0.823
3669	51	1	35.00	7.5	0.55	50	7.5	3.190	2.023	2.116	1.247	0.432	24.742	10.551	11.587	6.828	0.824
3670	51	1	35.50	8	0.55	50	8	3.100	1.945	2.032	1.236	0.401	25.855	10.850	11.963	6.806	0.825
3671	51	1	36.50	9	0.55	50	9	2.905	1.858	1.874	1.227	0.348	28.005	11.664	12.621	7.146	0.855
3672	51	1	37.50	10	0.55	50	10	2.729	1.760	1.730	1.211	0.307	29.950	12.183	13.275	7.470	0.862
3673	61	1	33.10	0.1	0.55	60	0.1	2.709	1.353	2.619	0.958	7.155	1.454	0.891	1.198	0.383	7.531
3674	61	1	33.25	0.25	0.55	60	0.25	4.986	2.226	4.737	1.085	6.710	2.401	1.589	2.056	0.743	6.439
3675	61	1	33.50	0.5	0.55	60	0.5	5.763	2.633	5.020	1.448	5.048	2.143	1.960	1.875	1.141	4.821
3676	61	1	33.75	0.75	0.55	60	0.75	5.410	2.861	4.567	1.661	4.000	3.042	2.375	2.420	1.484	3.916
3677	61	1	34.00	1	0.55	60	1	5.146	2.943	4.281	1.792	3.380	4.146	3.081	3.097	1.947	3.368
3678	61	1	34.25	1.25	0.55	60	1.25	5.055	2.950	4.122	1.845	2.869	5.320	3.682	3.779	2.494	2.869
3679	61	1	35.00	2	0.55	60	2	5.010	3.020	3.981	1.858	1.964	8.788	5.478	5.716	4.099	1.879
3680	61	1	35.50	2.5	0.55	60	2.5	5.005	3.006	3.923	1.806	1.596	10.971	6.523	6.837	4.897	1.548
3681	61	1	36.00	3	0.55	60	3	4.973	2.954	3.848	1.739	1.328	13.061	7.274	7.854	5.521	1.351
3682	61	1	37.00	4	0.55	60	4	4.819	2.798	3.642	1.431	0.971	16.885	8.726	9.580	6.368	1.022
3683	61	1	38.00	5	0.55	60	5	4.603	2.760	3.407	1.377	0.751	20.364	10.467	11.034	6.854	0.921
3684	61	1	39.00	6	0.55	60	6	4.372	2.616	3.177	1.340	0.606	23.596	11.199	12.308	6.839	0.835
3685	61	1	40.00	7	0.55	60	7	4.133	2.457	2.954	1.314	0.504	26.578	12.088	13.430	7.270	0.832
3686	61	1	40.50	7.5	0.55	60	7.5	4.019	2.390	2.849	1.300	0.463	27.940	12.489	13.959	7.462	0.833
3687	61	1	41.00	8	0.55	60	8	3.904	2.309	2.750	1.289	0.429	29.302	12.872	14.446	7.037	0.834

STP-PT-074: Local Stress in Nozzles, Shells and Formed Heads from External Heads

Model								Membrane Stress Factors									
	OD	T	od	t	d/D	D/T	t/T	Branch					Header				
								Axial	In-Plane	Out-of-Plane	Torsional	Pressure	Axial	In-Plane	Out-of-Plane	Torsional	Pressure
3688	61	1	42.00	9	0.55	60	9	3.682	2.186	2.561	1.273	0.372	31.911	13.879	15.337	7.467	0.864
3689	61	1	43.00	10	0.55	60	10	3.477	2.063	2.383	1.254	0.327	34.289	14.536	16.158	7.878	0.873
3690	71	1	38.60	0.1	0.55	70	0.1	3.083	1.437	2.927	0.967	7.956	1.667	0.986	1.415	0.412	8.110
3691	71	1	38.75	0.25	0.55	70	0.25	5.728	2.451	5.344	1.143	7.280	3.252	1.803	2.408	0.797	6.916
3692	71	1	39.00	0.5	0.55	70	0.5	6.578	3.007	5.650	1.537	5.417	2.454	2.226	2.120	1.215	5.147
3693	71	1	39.25	0.75	0.55	70	0.75	6.116	3.150	5.120	1.755	4.264	3.283	2.536	2.668	1.542	4.163
3694	71	1	39.50	1	0.55	70	1	5.785	3.251	4.807	1.892	3.596	4.423	3.263	3.397	2.028	3.583
3695	71	1	39.75	1.25	0.55	70	1.25	5.634	3.272	4.649	1.951	3.056	5.652	3.974	4.144	2.497	3.065
3696	71	1	40.50	2	0.55	70	2	5.681	3.364	4.617	1.978	2.105	9.389	6.074	6.339	3.820	2.014
3697	71	1	41.00	2.5	0.55	70	2.5	5.744	3.370	4.632	1.929	1.712	11.773	7.318	7.639	5.196	1.642
3698	71	1	41.50	3	0.55	70	3	5.761	3.324	4.612	1.862	1.423	14.045	8.434	8.814	5.924	1.427
3699	71	1	42.50	4	0.55	70	4	5.683	3.315	4.461	1.503	1.037	18.298	10.317	10.874	6.959	1.120
3700	71	1	43.50	5	0.55	70	5	5.494	3.155	4.238	1.438	0.800	22.221	11.845	12.646	6.891	0.970
3701	71	1	44.50	6	0.55	70	6	5.263	3.004	3.995	1.393	0.643	25.878	12.759	14.208	7.494	0.898
3702	71	1	45.50	7	0.55	70	7	5.028	2.831	3.753	1.360	0.533	29.307	14.537	15.607	7.982	0.841
3703	71	1	46.00	7.5	0.55	70	7.5	4.907	2.753	3.641	1.348	0.491	30.953	15.059	16.261	8.212	0.841
3704	71	1	46.50	8	0.55	70	8	4.771	2.672	3.524	1.336	0.454	32.536	15.550	16.874	8.428	0.842
3705	71	1	47.50	9	0.55	70	9	4.543	2.534	3.307	1.313	0.393	35.585	15.996	18.033	8.117	0.873
3706	71	1	48.50	10	0.55	70	10	4.313	2.403	3.106	1.299	0.345	38.419	16.794	19.068	8.562	0.881
3707	81	1	44.10	0.1	0.55	80	0.1	3.466	1.513	3.225	0.971	8.721	1.933	1.072	1.507	0.436	8.661
3708	81	1	44.25	0.25	0.55	80	0.25	6.463	2.664	5.934	1.200	7.739	3.737	1.995	2.906	0.847	7.360
3709	81	1	44.50	0.5	0.55	80	0.5	7.397	3.272	6.265	1.616	5.747	4.509	2.481	3.189	1.284	5.442
3710	81	1	44.75	0.75	0.55	80	0.75	6.841	3.429	5.663	1.839	4.508	3.564	2.786	2.924	1.596	4.395
3711	81	1	45.00	1	0.55	80	1	6.455	3.547	5.324	1.983	3.796	4.727	3.469	3.700	2.096	3.782
3712	81	1	45.25	1.25	0.55	80	1.25	6.282	3.583	5.175	2.047	3.231	6.005	4.255	4.508	2.636	3.246
3713	81	1	46.00	2	0.55	80	2	6.409	3.691	5.257	2.088	2.234	9.966	6.518	6.930	4.000	2.140
3714	81	1	46.50	2.5	0.55	80	2.5	6.558	3.718	5.358	2.043	1.820	12.521	7.906	8.391	4.742	1.731
3715	81	1	47.00	3	0.55	80	3	6.644	3.691	5.398	1.975	1.513	14.974	9.169	9.726	6.259	1.536
3716	81	1	48.00	4	0.55	80	4	6.638	3.547	5.321	1.792	1.100	19.602	11.336	12.102	7.249	1.126
3717	81	1	49.00	5	0.55	80	5	6.465	3.546	5.112	1.494	0.846	23.925	13.361	14.184	7.384	1.026
3718	81	1	50.00	6	0.55	80	6	6.270	3.365	4.862	1.441	0.678	27.985	14.906	16.040	8.075	0.853
3719	81	1	51.00	7	0.55	80	7	5.999	3.190	4.600	1.405	0.561	31.803	16.253	17.703	8.631	0.850
3720	81	1	51.50	7.5	0.55	80	7.5	5.854	3.111	4.475	1.391	0.516	33.658	16.866	18.486	8.890	0.849
3721	81	1	52.00	8	0.55	80	8	5.749	3.026	4.345	1.377	0.476	35.446	17.449	19.230	9.137	0.850
3722	81	1	53.00	9	0.55	80	9	5.480	2.876	4.107	1.356	0.412	38.909	18.821	20.644	8.699	0.587
3723	81	1	54.00	10	0.55	80	10	5.217	2.712	3.873	1.334	0.361	42.188	19.822	21.935	9.186	0.592
3724	91	1	49.60	0.1	0.55	90	0.1	3.846	1.593	3.520	0.978	9.293	2.008	1.167	1.685	0.458	9.182
3725	91	1	49.75	0.25	0.55	90	0.25	7.191	2.901	6.507	1.254	8.220	4.228	2.176	3.219	0.893	7.776

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Model								Membrane Stress Factors									
	OD	T	od	t	d/D	D/T	t/T	Branch					Header				
								Axial	In-Plane	Out-of-Plane	Torsional	Pressure	Axial	In-Plane	Out-of-Plane	Torsional	Pressure
3726	91	1	50.00	0.5	0.55	90	0.5	8.218	3.528	6.866	1.690	6.050	3.160	2.742	3.059	1.354	5.727
3727	91	1	50.25	0.75	0.55	90	0.75	7.587	3.699	6.199	1.918	4.728	3.890	3.053	3.185	1.673	4.608
3728	91	1	50.50	1	0.55	90	1	7.161	3.838	5.840	2.067	3.976	5.068	3.658	4.003	2.184	3.963
3729	91	1	50.75	1.25	0.55	90	1.25	6.978	3.892	5.701	2.136	3.389	6.390	4.486	4.872	2.714	3.382
3730	91	1	51.50	2	0.55	90	2	7.218	4.011	5.907	2.192	2.355	10.556	6.921	7.511	4.153	2.258
3731	91	1	52.00	2.5	0.55	90	2.5	7.453	4.056	6.099	2.148	1.921	13.261	8.439	9.120	4.958	1.814
3732	91	1	52.50	3	0.55	90	3	7.602	4.041	6.205	2.080	1.598	15.873	9.840	10.606	6.287	1.594
3733	91	1	53.50	4	0.55	90	4	7.678	4.068	6.211	1.927	1.160	20.849	12.473	13.288	6.809	1.189
3734	91	1	54.50	5	0.55	90	5	7.591	3.904	6.024	1.552	0.889	25.511	14.554	15.654	7.810	1.071
3735	91	1	55.50	6	0.55	90	6	7.319	3.737	5.766	1.489	0.710	29.942	16.319	17.799	8.570	0.861
3736	91	1	56.50	7	0.55	90	7	7.038	3.554	5.493	1.444	0.587	34.147	17.864	19.747	9.224	0.858
3737	91	1	57.00	7.5	0.55	90	7.5	6.902	3.467	5.352	1.427	0.539	36.160	18.573	20.649	9.509	0.858
3738	91	1	57.50	8	0.55	90	8	6.760	3.364	5.219	1.413	0.497	38.171	19.539	21.545	9.787	0.570
3739	91	1	58.50	9	0.55	90	9	6.482	3.188	4.943	1.390	0.429	42.012	20.807	23.202	9.223	0.571
3740	91	1	59.50	10	0.55	90	10	6.208	3.048	4.697	1.370	0.377	45.643	21.969	24.723	9.752	0.572
3741	101	1	55.10	0.1	0.55	100	0.1	4.219	1.669	3.808	0.982	9.796	2.265	1.250	1.891	0.485	9.700
3742	101	1	55.25	0.25	0.55	100	0.25	7.908	3.104	7.069	1.305	8.670	4.773	2.388	3.621	0.942	8.196
3743	101	1	55.50	0.5	0.55	100	0.5	9.041	3.773	7.456	1.759	6.283	4.260	2.981	3.378	1.416	5.985
3744	101	1	55.75	0.75	0.55	100	0.75	8.350	3.961	6.729	1.992	4.931	4.274	3.316	3.516	1.740	4.803
3745	101	1	56.00	1	0.55	100	1	7.901	4.116	6.354	2.146	4.143	5.470	3.826	4.322	2.266	4.131
3746	101	1	56.25	1.25	0.55	100	1.25	7.722	4.190	6.229	2.221	3.536	6.821	4.699	5.241	2.789	3.536
3747	101	1	57.00	2	0.55	100	2	8.103	4.323	6.577	2.292	2.468	11.182	7.289	8.092	4.287	2.370
3748	101	1	57.50	2.5	0.55	100	2.5	8.438	4.390	6.858	2.254	2.018	14.025	8.926	9.843	5.147	1.893
3749	101	1	58.00	3	0.55	100	3	8.664	4.380	7.038	2.186	1.679	16.765	10.450	11.463	5.884	1.648
3750	101	1	59.00	4	0.55	100	4	8.785	4.246	7.117	2.024	1.217	22.019	13.343	14.416	7.049	1.234
3751	101	1	60.00	5	0.55	100	5	8.754	4.269	6.961	1.835	0.930	27.000	15.662	17.066	8.189	1.114
3752	101	1	61.00	6	0.55	100	6	8.484	4.074	6.710	1.533	0.741	31.755	17.646	19.483	9.038	0.869
3753	101	1	62.00	7	0.55	100	7	8.168	3.882	6.422	1.481	0.611	36.307	19.384	21.708	9.757	0.865
3754	101	1	62.50	7.5	0.55	100	7.5	7.987	3.801	6.278	1.462	0.560	38.537	20.484	22.770	10.080	0.558
3755	101	1	63.00	8	0.55	100	8	7.848	3.700	6.117	1.446	0.516	40.700	21.258	23.783	10.382	0.558
3756	101	1	64.00	9	0.55	100	9	7.531	3.524	5.830	1.419	0.446	44.895	22.695	25.695	10.941	0.559
3757	101	1	65.00	10	0.55	100	10	7.215	3.346	5.543	1.400	0.390	48.895	24.013	27.464	10.272	0.559
3758	251	1	137.60	0.1	0.55	250	0.1	8.960	2.867	7.679	1.180	16.069	5.749	2.343	4.965	0.727	15.433
3759	251	1	137.75	0.25	0.55	250	0.25	16.957	5.499	14.511	1.903	13.505	11.321	4.556	9.045	1.479	12.682
3760	251	1	138.00	0.5	0.55	250	0.5	20.199	6.819	15.389	2.548	9.354	12.518	5.770	8.335	2.170	8.886
3761	251	1	138.25	0.75	0.55	250	0.75	19.920	7.273	14.079	2.870	7.096	12.932	6.491	9.189	2.573	6.947
3762	251	1	138.50	1	0.55	250	1	20.330	7.759	13.749	3.114	5.907	15.329	6.686	10.831	2.939	5.923
3763	251	1	138.75	1.25	0.55	250	1.25	21.290	7.643	14.098	3.287	5.086	17.777	7.317	12.735	3.551	5.175

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Model								Membrane Stress Factors									
	OD	T	od	t	d/D	D/T	t/T	Branch					Header				
								Axial	In-Plane	Out-of-Plane	Torsional	Pressure	Axial	In-Plane	Out-of-Plane	Torsional	Pressure
3764	251	1	139.50	2	0.55	250	2	25.622	9.286	17.019	3.598	3.685	25.229	11.192	18.791	5.553	3.773
3765	251	1	140.00	2.5	0.55	250	2.5	27.948	9.670	18.922	3.639	3.087	29.392	14.007	22.372	6.798	3.114
3766	251	1	140.50	3	0.55	250	3	29.465	9.812	20.364	3.590	2.606	32.977	16.781	25.557	8.100	2.327
3767	251	1	141.50	4	0.55	250	4	31.332	9.660	21.968	3.365	1.906	39.490	22.059	31.114	10.440	1.880
3768	251	1	142.50	5	0.55	250	5	30.817	9.247	22.431	3.090	1.444	46.082	27.854	36.182	12.404	1.699
3769	251	1	143.50	6	0.55	250	6	29.665	8.774	22.272	2.755	1.132	53.082	32.756	41.072	14.029	1.401
3770	251	1	144.50	7	0.55	250	7	28.348	8.342	21.823	2.516	0.909	60.290	37.412	46.206	15.497	0.526
3771	251	1	145.00	7.5	0.55	250	7.5	27.673	8.136	21.542	2.412	0.823	63.979	39.530	48.988	16.118	0.516
3772	251	1	145.50	8	0.55	250	8	27.012	7.945	21.240	2.325	0.749	67.727	41.561	51.798	16.689	0.508
3773	251	1	146.50	9	0.55	250	9	25.747	7.569	20.610	1.862	0.630	75.092	45.393	57.248	17.721	0.495
3774	251	1	147.50	10	0.55	250	10	24.612	7.263	19.955	1.759	0.540	82.403	48.974	62.580	18.637	0.487
3775	501	1	275.10	0.1	0.55	500	0.1	14.885	4.352	13.529	1.505	22.891	9.574	3.593	9.161	1.041	21.977
3776	501	1	275.25	0.25	0.55	500	0.25	28.152	8.672	25.813	2.708	18.890	18.947	7.175	16.723	2.163	17.789
3777	501	1	275.50	0.5	0.55	500	0.5	34.280	10.349	27.453	3.666	12.753	21.211	9.346	15.441	3.126	12.160
3778	501	1	275.75	0.75	0.55	500	0.75	35.157	10.889	25.453	4.083	9.516	25.244	9.841	17.807	3.688	9.327
3779	501	1	276.00	1	0.55	500	1	37.355	11.791	25.424	4.416	7.864	30.177	11.090	21.227	4.178	7.891
3780	501	1	276.25	1.25	0.55	500	1.25	40.538	12.672	26.797	4.745	6.792	35.287	12.151	25.080	4.612	6.921
3781	501	1	277.00	2	0.55	500	2	51.788	14.998	34.344	5.470	5.011	49.757	14.999	37.148	5.731	5.174
3782	501	1	277.50	2.5	0.55	500	2.5	57.809	16.956	39.207	5.676	4.235	57.111	15.760	44.138	8.307	4.352
3783	501	1	278.00	3	0.55	500	3	64.256	17.504	43.086	5.711	3.617	62.751	18.588	50.091	10.039	3.665
3784	501	1	279.00	4	0.55	500	4	67.939	17.533	49.462	5.486	2.702	70.872	24.391	59.797	13.176	2.443
3785	501	1	280.00	5	0.55	500	5	68.056	16.899	51.102	5.134	2.078	77.734	30.635	67.991	15.732	2.010
3786	501	1	281.00	6	0.55	500	6	66.336	16.033	51.241	4.671	1.639	85.061	37.102	75.807	18.406	1.918
3787	501	1	282.00	7	0.55	500	7	63.773	15.144	50.571	4.227	1.321	93.264	43.462	83.701	20.769	1.758
3788	501	1	282.50	7.5	0.55	500	7.5	62.369	14.727	50.088	4.026	1.194	97.887	56.454	87.771	21.840	0.572
3789	501	1	283.00	8	0.55	500	8	60.920	14.306	49.514	3.823	1.084	102.596	59.812	91.849	22.845	0.556
3790	501	1	284.00	9	0.55	500	9	58.038	13.535	48.273	3.480	0.905	112.538	66.191	100.188	24.667	0.530
3791	501	1	285.00	10	0.55	500	10	55.279	12.846	46.944	3.178	0.761	122.895	60.883	109.663	26.396	0.508
3793	751	1	412.75	0.25	0.55	750	0.25	38.109	11.251	36.928	3.431	22.667	25.728	9.124	23.348	2.732	21.772
3794	751	1	413.00	0.5	0.55	750	0.5	46.589	13.705	39.540	4.606	15.180	29.287	12.152	21.715	3.929	14.687
3795	751	1	413.25	0.75	0.55	750	0.75	48.302	14.687	37.099	5.055	11.370	35.516	13.124	25.050	4.635	11.159
3796	751	1	413.50	1	0.55	750	1	51.967	15.629	37.585	5.528	9.359	42.825	14.881	29.943	5.256	9.307
3797	751	1	413.75	1.25	0.55	750	1.25	57.060	16.969	40.119	6.001	8.091	50.422	16.504	35.563	5.743	8.246
3798	751	1	414.50	2	0.55	750	2	74.530	20.557	52.528	7.113	6.010	71.785	19.230	53.286	6.859	6.223
3799	751	1	415.00	2.5	0.55	750	2.5	84.124	23.118	60.482	7.476	5.107	82.753	20.870	63.530	7.807	5.276
3800	751	1	415.50	3	0.55	750	3	94.778	23.972	71.026	7.608	4.381	91.095	22.427	72.112	8.977	4.499
3801	751	1	416.50	4	0.55	750	4	101.887	24.295	78.613	7.447	3.300	102.247	28.145	85.499	11.513	2.788
3802	751	1	417.50	5	0.55	750	5	103.447	23.552	81.964	7.004	2.557	110.021	34.979	96.145	14.212	2.285



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Model								Membrane Stress Factors									
	OD	T	od	t	d/D	D/T	t/T	Branch					Header				
								Axial	In-Plane	Out-of-Plane	Torsional	Pressure	Axial	In-Plane	Out-of-Plane	Torsional	Pressure
3803	751	1	418.50	6	0.55	750	6	101.930	22.496	82.753	6.468	2.031	117.378	42.132	106.024	16.910	2.104
3804	751	1	419.50	7	0.55	750	7	98.824	21.324	82.112	5.937	1.647	125.858	49.415	116.242	19.537	1.989
3805	751	1	420.00	7.5	0.55	750	7.5	96.968	20.736	81.491	5.673	1.493	130.690	52.990	121.570	20.797	1.946
3806	751	1	420.50	8	0.55	750	8	94.974	20.201	80.713	5.379	1.358	135.773	56.532	126.832	22.012	1.905
3807	751	1	421.50	9	0.55	750	9	90.892	19.089	78.925	4.890	1.137	147.115	63.486	138.431	24.321	0.555
3808	751	1	422.50	10	0.55	750	10	86.821	18.097	76.986	4.444	0.964	159.344	70.320	151.657	26.478	0.531
3810	1001	1	550.25	0.25	0.55	1000	0.25	47.334	13.169	47.817	4.094	26.578	31.565	10.883	30.281	3.232	25.176
3811	1001	1	550.50	0.5	0.55	1000	0.5	57.951	16.763	51.458	5.461	17.334	36.603	14.528	28.512	4.631	16.847
3812	1001	1	550.75	0.75	0.55	1000	0.75	60.425	17.964	48.687	5.987	12.937	44.922	16.044	33.346	5.467	12.712
3813	1001	1	551.00	1	0.55	1000	1	65.445	19.029	49.763	6.421	10.623	54.510	18.252	40.073	6.219	10.666
3814	1001	1	551.25	1.25	0.55	1000	1.25	72.316	21.055	53.487	7.119	9.190	64.463	20.118	47.707	6.797	9.367
3815	1001	1	552.00	2	0.55	1000	2	95.623	25.568	70.788	8.588	6.853	92.422	24.033	71.421	7.822	7.100
3816	1001	1	552.50	2.5	0.55	1000	2.5	108.633	28.419	81.936	9.103	5.836	106.987	23.953	85.170	8.877	6.041
3817	1001	1	553.00	3	0.55	1000	3	123.516	29.592	97.228	9.334	5.019	118.140	26.333	96.579	9.829	5.171
3818	1001	1	554.00	4	0.55	1000	4	134.195	30.237	108.330	9.252	3.797	132.891	31.759	114.004	12.437	3.859
3819	1001	1	555.00	5	0.55	1000	5	137.483	29.610	113.563	8.797	2.955	142.189	38.618	127.098	15.127	2.496
3820	1001	1	556.00	6	0.55	1000	6	136.503	28.410	115.253	8.197	2.357	150.002	45.974	138.741	17.926	2.253
3821	1001	1	557.00	7	0.55	1000	7	133.193	26.913	114.781	7.563	1.919	158.473	53.690	150.426	20.719	2.099
3822	1001	1	557.50	7.5	0.55	1000	7.5	131.025	26.206	114.060	7.252	1.744	163.347	57.597	156.576	22.088	2.042
3823	1001	1	558.00	8	0.55	1000	8	128.666	25.504	113.091	6.951	1.590	168.470	61.470	162.941	23.444	1.996
3824	1001	1	559.00	9	0.55	1000	9	123.621	24.149	110.790	6.366	1.336	180.325	69.152	176.513	26.038	1.924
3825	1001	1	560.00	10	0.55	1000	10	118.433	22.888	108.222	5.836	1.137	193.620	76.581	191.432	28.459	1.867
3827	1251	1	687.75	0.25	0.55	1250	0.25	55.828	15.389	58.321	4.706	29.729	36.708	12.381	36.458	3.681	28.201
3828	1251	1	688.00	0.5	0.55	1250	0.5	68.542	19.520	63.090	6.224	19.241	43.192	16.102	34.912	5.264	18.766
3829	1251	1	688.25	0.75	0.55	1250	0.75	71.636	20.918	59.985	6.852	14.211	53.498	18.640	41.288	6.179	14.087
3830	1251	1	688.50	1	0.55	1250	1	77.857	22.095	61.676	7.483	11.733	65.229	21.298	49.863	6.986	11.783
3831	1251	1	688.75	1.25	0.55	1250	1.25	86.341	24.641	66.570	8.128	10.155	77.381	23.555	59.470	7.803	10.342
3832	1251	1	689.50	2	0.55	1250	2	115.066	30.155	88.617	9.943	7.594	111.615	24.844	89.096	8.831	7.868
3833	1251	1	690.00	2.5	0.55	1250	2.5	131.314	32.588	102.789	10.595	6.479	129.664	27.790	106.193	9.925	6.712
3834	1251	1	690.50	3	0.55	1250	3	150.376	34.585	122.924	10.921	5.581	143.645	30.244	120.373	10.752	5.761
3835	1251	1	691.50	4	0.55	1250	4	164.599	35.533	137.707	10.928	4.235	162.210	34.963	142.016	13.073	4.321
3836	1251	1	692.50	5	0.55	1250	5	169.765	34.960	145.012	10.474	3.305	173.445	41.928	157.640	15.970	2.700
3837	1251	1	693.50	6	0.55	1250	6	169.540	33.694	147.887	9.833	2.643	181.785	49.281	171.102	18.772	2.393
3838	1251	1	694.50	7	0.55	1250	7	166.232	32.153	147.462	9.132	2.159	190.368	57.108	183.783	21.642	2.253
3839	1251	1	695.00	7.5	0.55	1250	7.5	163.881	31.340	146.700	8.782	1.964	195.142	61.154	190.544	23.079	2.204
3840	1251	1	695.50	8	0.55	1250	8	161.266	30.525	145.633	8.433	1.794	200.483	65.215	197.604	24.493	2.163
3841	1251	1	696.50	9	0.55	1250	9	155.482	28.836	142.941	7.768	1.512	212.464	73.354	212.811	27.273	2.089
3842	1251	1	697.50	10	0.55	1250	10	149.348	27.362	139.737	7.142	1.290	226.621	81.470	230.299	29.927	1.911

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Model								Membrane Stress Factors									
	OD	T	od	t	d/D	D/T	t/T	Branch					Header				
								Axial	In-Plane	Out-of-Plane	Torsional	Pressure	Axial	In-Plane	Out-of-Plane	Torsional	Pressure
3844	1501	1	825.25	0.25	0.55	1500	0.25	63.704	17.486	68.650	5.269	32.604	41.232	13.741	42.209	4.102	30.955
3845	1501	1	825.50	0.5	0.55	1500	0.5	78.314	22.137	74.523	6.964	20.956	49.181	18.127	41.135	5.837	20.512
3846	1501	1	825.75	0.75	0.55	1500	0.75	81.979	23.706	71.090	7.648	15.454	61.308	21.052	49.046	6.865	15.340
3847	1501	1	826.00	1	0.55	1500	1	89.231	25.710	73.181	8.367	12.743	75.024	24.101	59.393	7.804	12.804
3848	1501	1	826.25	1.25	0.55	1500	1.25	99.175	27.989	79.256	9.051	11.030	89.246	26.756	70.997	7.575	11.245
3849	1501	1	827.00	2	0.55	1500	2	132.877	34.411	105.911	11.200	8.267	129.343	28.294	106.437	9.813	8.572
3850	1501	1	827.50	2.5	0.55	1500	2.5	152.179	37.305	123.103	11.988	7.062	150.687	31.519	126.903	10.955	7.326
3851	1501	1	828.00	3	0.55	1500	3	175.376	39.082	148.312	12.402	6.091	167.498	34.080	143.992	11.683	6.300
3852	1501	1	829.00	4	0.55	1500	4	193.042	40.346	166.600	12.499	4.631	190.041	38.875	169.731	13.874	4.741
3853	1501	1	830.00	5	0.55	1500	5	200.175	39.837	176.147	12.058	3.620	203.448	45.213	188.100	16.808	3.523
3854	1501	1	831.00	6	0.55	1500	6	200.861	38.517	179.757	11.386	2.901	212.951	52.404	202.803	19.565	2.534
3855	1501	1	832.00	7	0.55	1500	7	197.738	36.861	179.855	10.632	2.374	221.740	60.153	216.604	22.424	2.352
3856	1501	1	832.50	7.5	0.55	1500	7.5	195.314	35.985	179.825	10.246	2.163	226.703	64.240	225.243	23.894	2.299
3857	1501	1	833.00	8	0.55	1500	8	192.513	35.093	178.071	9.865	1.978	231.887	68.363	232.276	25.361	2.250
3858	1501	1	834.00	9	0.55	1500	9	186.159	33.362	175.041	9.125	1.671	244.131	76.781	249.625	28.242	2.172
3859	1501	1	835.00	10	0.55	1500	10	179.303	30.994	171.354	8.376	1.429	258.613	85.232	268.819	31.042	1.945
3862	1751	1	963.00	0.5	0.55	1750	0.5	87.517	24.596	85.733	7.665	22.986	54.587	19.992	46.989	6.370	22.129
3863	1751	1	963.25	0.75	0.55	1750	0.75	91.550	26.319	81.931	7.548	16.602	68.404	23.287	56.419	7.507	16.491
3864	1751	1	963.50	1	0.55	1750	1	99.682	28.561	84.485	8.168	13.675	83.981	26.422	68.542	8.561	13.736
3865	1751	1	963.75	1.25	0.55	1750	1.25	110.927	31.114	91.555	9.803	11.836	100.067	29.740	81.986	8.329	12.060
3866	1751	1	964.50	2	0.55	1750	2	149.253	38.417	123.031	12.361	8.883	145.740	31.632	123.400	10.760	9.204
3867	1751	1	965.00	2.5	0.55	1750	2.5	171.413	41.734	142.774	13.278	7.598	170.277	35.157	146.737	11.964	7.880
3868	1751	1	965.50	3	0.55	1750	3	198.644	43.811	173.134	13.786	6.559	189.736	37.813	166.699	12.619	6.786
3869	1751	1	966.50	4	0.55	1750	4	219.669	45.343	195.121	13.976	4.995	216.346	42.347	196.688	14.684	5.122
3870	1751	1	967.50	5	0.55	1750	5	228.794	44.495	206.512	13.553	3.911	232.250	48.391	218.150	17.624	3.829
3871	1751	1	968.50	6	0.55	1750	6	230.450	43.365	211.442	12.861	3.139	243.017	55.327	235.606	20.296	2.669
3872	1751	1	969.50	7	0.55	1750	7	227.695	41.467	212.068	12.064	2.573	252.494	63.046	251.644	23.160	2.439
3873	1751	1	970.00	7.5	0.55	1750	7.5	225.229	40.483	211.802	11.653	2.345	257.479	67.126	260.343	24.637	2.378
3874	1751	1	970.50	8	0.55	1750	8	222.345	39.458	210.300	11.243	2.146	262.821	71.266	268.346	26.118	2.354
3875	1751	1	971.50	9	0.55	1750	9	215.564	37.446	206.170	10.439	1.816	275.112	79.849	285.559	29.072	2.271
3876	1751	1	972.50	10	0.55	1750	10	208.142	35.615	202.813	9.671	1.556	289.970	88.527	307.245	31.975	2.207
3879	2001	1	1100.50	0.5	0.55	2000	0.5	96.102	26.979	96.749	8.327	24.001	59.571	21.778	52.756	6.866	23.642
3880	2001	1	1100.75	0.75	0.55	2000	0.75	100.498	28.812	92.684	8.235	17.671	74.967	25.393	63.750	8.051	17.577
3881	2001	1	1101.00	1	0.55	2000	1	109.382	31.266	95.572	8.907	14.544	92.226	28.897	77.583	8.025	14.620
3882	2001	1	1101.25	1.25	0.55	2000	1.25	121.781	34.128	103.880	9.644	12.584	110.132	26.820	93.131	9.050	12.827
3883	2001	1	1102.00	2	0.55	2000	2	164.320	42.169	139.037	13.468	9.459	160.950	34.839	139.468	11.695	9.805
3884	2001	1	1102.50	2.5	0.55	2000	2.5	189.177	45.898	162.024	14.508	8.098	188.584	38.655	166.403	12.962	8.405
3885	2001	1	1103.00	3	0.55	2000	3	220.453	48.282	197.713	15.100	6.996	210.724	41.478	189.299	13.685	7.247

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Model								Membrane Stress Factors									
	OD	T	od	t	d/D	D/T	t/T	Branch					Header				
								Axial	In-Plane	Out-of-Plane	Torsional	Pressure	Axial	In-Plane	Out-of-Plane	Torsional	Pressure
3886	2001	1	1104.00	4	0.55	2000	4	244.737	50.120	222.920	15.372	5.334	241.446	45.845	224.357	16.165	5.480
3887	2001	1	1105.00	5	0.55	2000	5	255.821	49.714	236.467	14.973	4.181	260.039	51.668	249.605	18.454	4.190
3888	2001	1	1106.00	6	0.55	2000	6	258.528	48.178	242.831	14.266	3.359	272.336	58.290	269.577	21.038	2.806
3889	2001	1	1107.00	7	0.55	2000	7	256.199	46.187	244.101	13.433	2.757	282.715	65.798	287.369	23.856	2.546
3890	2001	1	1107.50	7.5	0.55	2000	7.5	253.831	45.108	243.451	13.001	2.514	287.964	69.809	296.142	25.326	2.483
3891	2001	1	1108.00	8	0.55	2000	8	250.856	44.023	242.268	12.566	2.303	293.416	73.972	305.090	26.806	2.426
3892	2001	1	1109.00	9	0.55	2000	9	243.834	41.504	238.705	11.708	1.952	306.026	82.566	324.521	29.814	2.340
3893	2001	1	1110.00	10	0.55	2000	10	235.911	39.447	233.963	10.885	1.674	320.909	91.460	345.719	32.783	2.271
3896	2251	1	1238.00	0.5	0.55	2250	0.5	104.359	29.161	107.585	8.201	25.378	64.146	23.378	58.250	7.335	25.067
3897	2251	1	1238.25	0.75	0.55	2250	0.75	108.915	31.146	103.158	8.898	18.678	81.025	27.340	70.800	8.624	18.600
3898	2251	1	1238.50	1	0.55	2250	1	118.402	33.784	106.267	9.620	15.366	99.866	31.197	86.280	8.642	15.447
3899	2251	1	1238.75	1.25	0.55	2250	1.25	131.870	36.855	115.297	10.429	13.295	119.445	29.141	103.395	9.763	13.554
3900	2251	1	1239.50	2	0.55	2250	2	178.402	45.771	155.082	14.498	9.997	175.278	37.987	155.589	12.588	10.367
3901	2251	1	1240.00	2.5	0.55	2250	2.5	220.207	49.880	181.021	15.653	8.566	205.865	42.102	185.830	13.926	8.894
3902	2251	1	1240.50	3	0.55	2250	3	241.039	52.504	221.913	16.338	7.406	230.557	45.043	211.686	15.019	7.677
3903	2251	1	1241.50	4	0.55	2250	4	268.476	54.656	250.366	16.698	5.653	265.374	49.266	252.290	17.105	5.817
3904	2251	1	1242.50	5	0.55	2250	5	281.487	54.319	266.418	16.324	4.435	286.770	54.842	281.510	19.300	4.520
3905	2251	1	1243.50	6	0.55	2250	6	285.273	52.767	273.569	15.608	3.566	300.957	61.189	303.669	21.779	2.942
3906	2251	1	1244.50	7	0.55	2250	7	283.427	50.670	275.492	14.744	2.929	312.147	68.326	322.958	24.492	2.629
3907	2251	1	1245.00	7.5	0.55	2250	7.5	281.101	49.565	274.149	14.293	2.673	317.567	72.312	331.256	25.938	2.553
3908	2251	1	1245.50	8	0.55	2250	8	278.180	48.386	273.788	13.838	2.449	323.462	76.404	341.973	27.415	2.491
3909	2251	1	1246.50	9	0.55	2250	9	270.919	46.081	270.025	12.933	2.079	336.316	84.948	362.368	30.424	2.392
3910	2251	1	1247.50	10	0.55	2250	10	262.598	43.828	265.157	12.057	1.786	351.702	93.830	385.262	33.442	2.318
3913	2501	1	1375.50	0.5	0.55	2500	0.5	112.135	31.273	118.166	8.806	27.416	68.399	24.909	63.622	7.785	26.426
3914	2501	1	1375.75	0.75	0.55	2500	0.75	116.870	33.326	113.171	9.542	19.623	86.692	29.140	77.493	9.168	19.569
3915	2501	1	1376.00	1	0.55	2500	1	126.950	36.143	116.882	10.312	16.093	106.998	33.358	94.806	9.244	16.239
3916	2501	1	1376.25	1.25	0.55	2500	1.25	141.365	39.495	127.013	11.171	13.963	128.218	31.442	113.914	10.443	14.241
3917	2501	1	1377.00	2	0.55	2500	2	191.533	49.098	170.174	15.489	10.510	188.819	41.473	170.751	13.469	10.900
3918	2501	1	1377.50	2.5	0.55	2500	2.5	237.712	53.594	199.269	16.763	9.011	222.264	46.105	204.469	14.884	9.362
3919	2501	1	1378.00	3	0.55	2500	3	260.649	56.529	245.428	17.506	7.793	249.535	48.535	234.433	15.982	8.084
3920	2501	1	1379.00	4	0.55	2500	4	290.898	58.968	277.456	17.964	5.955	288.142	52.599	280.129	18.021	6.130
3921	2501	1	1380.00	5	0.55	2500	5	305.853	58.719	295.689	17.614	4.675	312.410	57.919	313.046	20.119	4.770
3922	2501	1	1381.00	6	0.55	2500	6	310.808	57.167	305.281	16.891	3.762	328.570	63.983	339.091	22.500	2.926
3923	2501	1	1382.00	7	0.55	2500	7	309.440	54.994	307.242	16.007	3.093	341.171	70.995	359.991	25.170	2.708
3924	2501	1	1382.50	7.5	0.55	2500	7.5	307.311	53.800	305.901	15.539	2.824	347.356	74.840	363.752	26.569	2.629
3925	2501	1	1383.00	8	0.55	2500	8	304.352	52.582	305.048	15.062	2.588	353.163	78.833	379.555	28.034	2.559
3926	2501	1	1384.00	9	0.55	2500	9	297.010	50.131	301.894	14.116	2.198	367.048	87.290	402.709	31.031	2.450
3927	2501	1	1385.00	10	0.55	2500	10	288.406	47.742	295.797	13.196	1.880	383.116	96.174	425.703	34.097	2.368

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Model								Membrane Stress Factors									
	OD	T	od	t	d/D	D/T	t/T	Branch					Header				
								Axial	In-Plane	Out-of-Plane	Torsional	Pressure	Axial	In-Plane	Out-of-Plane	Torsional	Pressure
3928	9	1	4.90	0.1	0.6	8	0.1	1.021	1.018	0.984	1.057	4.761	0.291	0.141	0.170	0.136	2.982
3929	9	1	5.05	0.25	0.6	8	0.25	1.129	0.959	1.080	1.098	2.092	0.752	0.330	0.327	0.312	2.497
3930	9	1	5.30	0.5	0.6	8	0.5	1.326	0.900	1.082	1.010	1.543	1.597	0.576	0.600	0.487	1.917
3931	9	1	5.55	0.75	0.6	8	0.75	1.452	0.861	1.003	0.895	1.289	2.524	0.760	0.789	0.683	1.539
3932	9	1	5.80	1	0.6	8	1	1.532	0.817	0.910	0.827	1.144	3.464	0.922	0.933	0.804	1.311
3933	9	1	6.05	1.25	0.6	8	1.25	1.572	0.790	0.816	0.804	0.969	4.327	1.029	1.038	0.896	1.075
3934	9	1	6.80	2	0.6	8	2	1.602	0.716	0.705	0.792	0.662	6.898	0.997	1.301	1.169	1.015
3935	9	1	7.30	2.5	0.6	8	2.5	1.569	0.660	0.656	0.807	0.540	8.607	1.185	1.463	1.336	1.076
3936	9	1	7.80	3	0.6	8	3	1.518	0.623	0.619	0.791	0.445	10.312	1.392	1.617	1.502	1.128
3937	9	1	8.80	4	0.6	8	4	1.416	0.575	0.555	0.847	0.363	13.730	1.868	1.923	1.883	1.198
3945	17	1	9.70	0.1	0.6	16	0.1	1.174	0.973	1.225	0.897	5.268	0.486	0.300	0.335	0.185	4.303
3946	17	1	9.85	0.25	0.6	16	0.25	1.627	1.061	1.749	1.082	3.175	0.780	0.503	0.563	0.435	3.680
3947	17	1	10.10	0.5	0.6	16	0.5	1.963	1.082	1.856	1.022	2.616	1.265	0.908	0.891	0.725	2.860
3948	17	1	10.35	0.75	0.6	16	0.75	2.096	1.210	1.738	1.020	2.180	2.055	1.279	1.217	1.032	2.340
3949	17	1	10.60	1	0.6	16	1	2.155	1.328	1.604	1.089	1.892	2.807	1.598	1.497	1.279	1.959
3950	17	1	10.85	1.25	0.6	16	1.25	2.199	1.280	1.474	1.100	1.600	3.594	1.866	1.726	1.640	1.602
3951	17	1	11.60	2	0.6	16	2	2.142	1.113	1.145	1.001	1.085	6.138	2.439	2.254	2.112	1.097
3952	17	1	12.10	2.5	0.6	16	2.5	2.043	1.053	0.975	1.002	0.884	7.973	2.106	2.540	2.277	0.943
3953	17	1	12.60	3	0.6	16	3	1.938	1.001	0.841	1.006	0.739	9.917	2.312	2.806	2.396	0.992
3954	17	1	13.60	4	0.6	16	4	1.888	0.910	0.721	1.031	0.548	13.212	2.959	3.251	2.644	1.057
3955	17	1	14.60	5	0.6	16	5	1.756	0.840	0.660	1.040	0.424	16.462	3.246	3.634	2.913	1.117
3956	17	1	15.60	6	0.6	16	6	1.774	0.786	0.622	1.096	0.345	19.714	3.505	3.980	3.275	1.168
3957	17	1	16.60	7	0.6	16	7	1.709	0.892	0.577	1.157	0.294	22.979	3.743	4.314	3.682	1.189
3962	25	1	14.50	0.1	0.6	24	0.1	1.346	0.969	1.507	0.924	5.421	0.562	0.433	0.427	0.254	5.186
3963	25	1	14.65	0.25	0.6	24	0.25	2.250	1.292	2.395	1.034	4.218	0.995	0.731	0.803	0.539	4.462
3964	25	1	14.90	0.5	0.6	24	0.5	2.640	1.523	2.575	1.103	3.384	1.406	1.168	1.130	0.872	3.445
3965	25	1	15.15	0.75	0.6	24	0.75	2.718	1.484	2.409	1.255	2.778	2.251	1.638	1.550	1.226	2.827
3966	25	1	15.40	1	0.6	24	1	2.745	1.747	2.245	1.362	2.385	3.056	2.057	1.962	1.637	2.407
3967	25	1	15.65	1.25	0.6	24	1.25	2.778	1.714	2.098	1.388	2.015	3.855	2.420	2.297	2.122	1.973
3968	25	1	16.40	2	0.6	24	2	2.699	1.599	1.731	1.155	1.363	6.034	3.394	3.154	2.893	1.322
3969	25	1	16.90	2.5	0.6	24	2.5	2.579	1.514	1.532	1.150	1.107	7.298	3.846	3.583	3.162	1.157
3970	25	1	17.40	3	0.6	24	3	2.449	1.429	1.364	1.210	0.924	8.464	3.621	3.954	3.359	0.991
3971	25	1	18.40	4	0.6	24	4	2.210	1.337	1.108	1.177	0.683	10.587	4.205	4.618	3.622	0.831
3972	25	1	19.40	5	0.6	24	5	2.013	1.324	0.925	1.158	0.534	12.514	4.639	5.214	3.834	1.011
3973	25	1	20.40	6	0.6	24	6	2.031	1.257	0.789	1.155	0.435	14.225	5.069	5.730	4.112	0.833
3974	25	1	21.40	7	0.6	24	7	1.917	1.085	0.692	1.158	0.360	15.718	5.481	6.167	4.408	0.823
3975	25	1	21.90	7.5	0.6	24	7.5	1.864	1.053	0.672	1.174	0.333	16.415	5.681	6.374	4.566	0.817
3976	25	1	22.40	8	0.6	24	8	1.974	1.024	0.661	1.193	0.309	17.077	5.881	6.568	4.728	0.811

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Model								Membrane Stress Factors									
	OD	T	od	t	d/D	D/T	t/T	Branch					Header				
								Axial	In-Plane	Out-of-Plane	Torsional	Pressure	Axial	In-Plane	Out-of-Plane	Torsional	Pressure
3977	25	1	23.40	9	0.6	24	9	1.912	0.979	0.623	1.231	0.269	19.648	6.279	6.954	5.126	0.813
3978	25	1	24.40	10	0.6	24	10	1.860	0.814	0.595	1.277	0.239	21.283	6.681	7.328	5.553	0.826
3979	33	1	19.30	0.1	0.6	32	0.1	1.588	1.048	1.779	0.946	5.922	0.718	0.552	0.598	0.298	5.940
3980	33	1	19.45	0.25	0.6	32	0.25	2.872	1.486	2.982	1.016	5.013	1.374	0.940	1.160	0.644	5.117
3981	33	1	19.70	0.5	0.6	32	0.5	3.289	1.708	3.217	1.240	3.966	1.579	1.348	1.392	1.008	3.918
3982	33	1	19.95	0.75	0.6	32	0.75	3.293	1.794	2.996	1.452	3.217	2.468	1.913	1.827	1.453	3.207
3983	33	1	20.20	1	0.6	32	1	3.275	2.090	2.808	1.578	2.743	3.383	2.432	2.323	1.918	2.742
3984	33	1	20.45	1.25	0.6	32	1.25	3.291	2.068	2.662	1.615	2.317	4.315	2.903	2.783	2.415	2.288
3985	33	1	21.20	2	0.6	32	2	3.208	2.072	2.309	1.577	1.565	6.851	4.119	3.936	3.486	1.487
3986	33	1	21.70	2.5	0.6	32	2.5	3.086	1.940	2.109	1.381	1.270	8.327	4.727	4.529	3.905	1.257
3987	33	1	22.20	3	0.6	32	3	2.951	1.914	1.933	1.349	1.059	9.680	4.518	5.025	4.172	1.173
3988	33	1	23.20	4	0.6	32	4	2.695	1.774	1.646	1.298	0.781	12.274	5.343	5.950	4.557	0.874
3989	33	1	24.20	5	0.6	32	5	2.466	1.697	1.424	1.264	0.609	14.541	6.193	6.697	4.818	0.846
3990	33	1	25.20	6	0.6	32	6	2.273	1.610	1.246	1.244	0.495	16.664	6.680	7.396	5.049	0.839
3991	33	1	26.20	7	0.6	32	7	2.112	1.526	1.100	1.232	0.414	18.659	7.209	8.050	5.302	0.829
3992	33	1	26.70	7.5	0.6	32	7.5	2.042	1.488	1.037	1.229	0.382	19.613	7.463	8.364	5.458	0.824
3993	33	1	27.20	8	0.6	32	8	1.976	1.453	0.982	1.226	0.354	20.518	7.713	8.657	5.530	0.819
3994	33	1	28.20	9	0.6	32	9	2.048	1.266	0.894	1.241	0.305	22.132	8.184	9.172	5.816	0.807
3995	33	1	29.20	10	0.6	32	10	1.952	1.204	0.811	1.250	0.270	23.580	8.639	9.625	6.203	0.853
3996	41	1	24.10	0.1	0.6	40	0.1	1.905	1.124	2.052	0.960	6.630	0.919	0.655	0.767	0.363	6.600
3997	41	1	24.25	0.25	0.6	40	0.25	3.333	1.659	3.539	1.033	5.701	1.759	1.125	1.448	0.722	5.679
3998	41	1	24.50	0.5	0.6	40	0.5	3.922	2.050	3.812	1.373	4.444	1.770	1.496	1.629	1.119	4.315
3999	41	1	24.75	0.75	0.6	40	0.75	3.837	2.328	3.534	1.606	3.569	2.656	2.115	2.071	1.582	3.532
4000	41	1	25.00	1	0.6	40	1	3.765	2.392	3.324	1.745	3.029	3.660	2.727	2.646	2.050	3.024
4001	41	1	25.25	1.25	0.6	40	1.25	3.757	2.381	3.172	1.791	2.560	4.688	3.306	3.199	2.607	2.541
4002	41	1	26.00	2	0.6	40	2	3.683	2.447	2.868	1.763	1.733	7.554	4.797	4.646	3.929	1.639
4003	41	1	26.50	2.5	0.6	40	2.5	3.578	2.324	2.690	1.692	1.405	9.273	4.904	5.423	4.499	1.375
4004	41	1	27.00	3	0.6	40	3	3.457	2.230	2.525	1.458	1.170	10.858	5.445	6.082	4.887	1.202
4005	41	1	28.00	4	0.6	40	4	3.203	2.135	2.233	1.397	0.860	13.699	6.583	7.191	5.353	0.934
4006	41	1	29.00	5	0.6	40	5	2.962	2.084	1.980	1.356	0.669	16.225	7.314	8.092	5.710	0.870
4007	41	1	30.00	6	0.6	40	6	2.754	1.952	1.779	1.323	0.543	18.865	8.122	9.058	5.985	0.872
4008	41	1	31.00	7	0.6	40	7	2.565	1.857	1.603	1.298	0.453	21.135	8.730	9.830	6.249	0.870
4009	41	1	31.50	7.5	0.6	40	7.5	2.474	1.805	1.520	1.286	0.418	22.243	9.037	10.215	6.380	0.869
4010	41	1	32.00	8	0.6	40	8	2.399	1.755	1.444	1.285	0.387	23.312	9.335	10.578	6.513	0.867
4011	41	1	33.00	9	0.6	40	9	2.394	1.666	1.310	1.268	0.336	25.439	10.132	11.329	6.786	0.865
4012	41	1	34.00	10	0.6	40	10	2.277	1.594	1.197	1.274	0.297	27.447	10.687	12.036	7.063	0.859
4013	51	1	30.10	0.1	0.6	50	0.1	2.256	1.234	2.352	0.973	7.132	1.202	0.774	1.014	0.412	7.384
4014	51	1	30.25	0.25	0.6	50	0.25	4.051	1.972	4.204	1.097	6.460	1.985	1.376	1.581	0.812	6.332

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Model								Membrane Stress Factors									
	OD	T	od	t	d/D	D/T	t/T	Branch					Header				
								Axial	In-Plane	Out-of-Plane	Torsional	Pressure	Axial	In-Plane	Out-of-Plane	Torsional	Pressure
4015	51	1	30.50	0.5	0.6	50	0.5	4.703	2.520	4.516	1.510	4.947	2.074	1.739	1.785	1.244	4.762
4016	51	1	30.75	0.75	0.6	50	0.75	4.487	2.657	4.162	1.760	3.937	2.854	2.335	2.342	1.611	3.867
4017	51	1	31.00	1	0.6	50	1	4.349	2.739	3.922	1.911	3.328	3.941	3.028	3.001	2.213	3.316
4018	51	1	31.25	1.25	0.6	50	1.25	4.304	2.742	3.771	1.967	2.816	5.069	3.698	3.651	2.779	2.807
4019	51	1	32.00	2	0.6	50	2	4.248	2.865	3.543	1.956	1.914	8.285	5.392	5.426	4.338	1.832
4020	51	1	32.50	2.5	0.6	50	2.5	4.186	2.748	3.417	1.883	1.552	10.279	5.982	6.433	5.076	1.499
4021	51	1	33.00	3	0.6	50	3	4.099	2.762	3.284	1.574	1.290	12.133	6.726	7.310	5.612	1.306
4022	51	1	34.00	4	0.6	50	4	3.884	2.585	3.011	1.496	0.945	15.492	7.937	8.772	6.282	0.991
4023	51	1	35.00	5	0.6	50	5	3.649	2.521	2.751	1.444	0.733	18.483	8.908	9.994	6.721	0.919
4024	51	1	36.00	6	0.6	50	6	3.419	2.392	2.516	1.407	0.592	21.269	10.019	11.051	7.047	0.839
4025	51	1	37.00	7	0.6	50	7	3.205	2.243	2.304	1.375	0.494	23.794	10.761	11.990	7.351	0.838
4026	51	1	37.50	7.5	0.6	50	7.5	3.108	2.178	2.210	1.364	0.455	24.998	11.098	12.388	7.497	0.839
4027	51	1	38.00	8	0.6	50	8	3.012	2.114	2.120	1.352	0.421	26.150	11.418	12.795	7.506	0.841
4028	51	1	39.00	9	0.6	50	9	2.852	2.017	1.953	1.335	0.365	29.078	12.245	13.970	7.864	0.849
4029	51	1	40.00	10	0.6	50	10	2.681	1.920	1.796	1.316	0.322	31.371	12.951	14.796	8.224	0.843
4030	61	1	36.10	0.1	0.6	60	0.1	2.647	1.316	2.668	0.989	7.998	1.422	0.873	1.223	0.448	8.074
4031	61	1	36.25	0.25	0.6	60	0.25	4.770	2.200	4.846	1.173	7.124	2.764	1.576	1.882	0.885	6.898
4032	61	1	36.50	0.5	0.6	60	0.5	5.484	2.816	5.191	1.630	5.381	2.389	2.017	2.039	1.345	5.141
4033	61	1	36.75	0.75	0.6	60	0.75	5.147	2.967	4.759	1.889	4.251	3.051	2.522	2.610	1.706	4.160
4034	61	1	37.00	1	0.6	60	1	4.912	3.067	4.489	2.049	3.584	4.195	3.283	3.332	2.214	3.569
4035	61	1	37.25	1.25	0.6	60	1.25	4.822	3.084	4.340	2.112	3.037	5.397	3.909	4.060	2.813	3.039
4036	61	1	38.00	2	0.6	60	2	4.821	3.246	4.210	2.119	2.075	8.930	5.715	6.139	4.639	1.979
4037	61	1	38.50	2.5	0.6	60	2.5	4.813	3.231	4.150	2.049	1.684	11.141	7.051	7.339	5.517	1.611
4038	61	1	39.00	3	0.6	60	3	4.774	3.060	4.063	1.958	1.399	13.222	8.289	8.403	6.189	1.394
4039	61	1	40.00	4	0.6	60	4	4.620	3.003	3.833	1.580	1.020	17.067	9.687	10.241	7.074	1.088
4040	61	1	41.00	5	0.6	60	5	4.412	2.957	3.575	1.517	0.789	20.578	10.670	11.804	7.613	0.972
4041	61	1	42.00	6	0.6	60	6	4.187	2.809	3.322	1.473	0.636	23.811	11.731	13.158	7.560	0.877
4042	61	1	43.00	7	0.6	60	7	3.964	2.656	3.087	1.442	0.528	26.746	12.657	14.366	8.022	0.849
4043	61	1	43.50	7.5	0.6	60	7.5	3.853	2.558	2.967	1.426	0.486	28.240	13.080	14.922	8.233	0.850
4044	61	1	44.00	8	0.6	60	8	3.738	2.499	2.861	1.411	0.450	29.632	13.797	15.454	8.446	0.874
4045	61	1	45.00	9	0.6	60	9	3.528	2.357	2.660	1.397	0.390	32.190	14.555	16.442	8.846	0.882
4046	61	1	46.00	10	0.6	60	10	3.345	2.236	2.480	1.370	0.343	34.594	15.254	17.301	8.657	0.892
4047	71	1	42.10	0.1	0.6	70	0.1	3.007	1.395	2.982	0.999	8.732	1.687	0.963	1.418	0.484	8.691
4048	71	1	42.25	0.25	0.6	70	0.25	5.496	2.419	5.473	1.252	7.738	3.270	1.810	2.197	0.946	7.414
4049	71	1	42.50	0.5	0.6	70	0.5	6.273	3.100	5.848	1.735	5.766	3.911	2.331	2.314	1.434	5.482
4050	71	1	42.75	0.75	0.6	70	0.75	5.819	3.265	5.339	2.001	4.529	3.267	2.688	2.883	1.785	4.422
4051	71	1	43.00	1	0.6	70	1	5.512	3.382	5.043	2.169	3.810	4.448	3.465	3.656	2.361	3.797
4052	71	1	43.25	1.25	0.6	70	1.25	5.384	3.414	4.898	2.239	3.234	5.716	4.239	4.457	2.904	3.246



STP-PT-074: Local Stress in Nozzles, Shells and Formed Heads from External Heads

Model								Membrane Stress Factors									
	OD	T	od	t	d/D	D/T	t/T	Branch					Header				
								Axial	In-Plane	Out-of-Plane	Torsional	Pressure	Axial	In-Plane	Out-of-Plane	Torsional	Pressure
4053	71	1	44.00	2	0.6	70	2	5.434	3.605	4.882	2.265	2.222	9.507	6.430	6.795	4.872	2.124
4054	71	1	44.50	2.5	0.6	70	2.5	5.493	3.610	4.899	2.212	1.805	11.914	7.730	8.175	5.869	1.707
4055	71	1	45.00	3	0.6	70	3	5.511	3.565	4.863	2.107	1.499	14.211	8.890	9.426	6.659	1.473
4056	71	1	46.00	4	0.6	70	4	5.426	3.501	4.695	1.661	1.090	18.487	10.834	11.615	7.751	1.148
4057	71	1	47.00	5	0.6	70	5	5.252	3.363	4.451	1.581	0.839	22.434	12.657	13.507	8.336	1.006
4058	71	1	48.00	6	0.6	70	6	5.024	3.202	4.181	1.530	0.675	26.087	14.019	15.161	8.274	0.860
4059	71	1	49.00	7	0.6	70	7	4.785	3.030	3.918	1.492	0.560	29.525	15.207	16.655	8.815	0.859
4060	71	1	49.50	7.5	0.6	70	7.5	4.685	2.951	3.796	1.478	0.515	31.186	15.283	17.361	9.062	0.880
4061	71	1	50.00	8	0.6	70	8	4.551	2.864	3.669	1.464	0.476	32.796	15.786	18.029	9.295	0.883
4062	71	1	51.00	9	0.6	70	9	4.339	2.716	3.447	1.444	0.412	35.843	16.708	19.265	8.886	0.892
4063	71	1	52.00	10	0.6	70	10	4.129	2.578	3.234	1.424	0.362	38.614	17.557	20.393	9.387	0.902
4064	81	1	48.10	0.1	0.6	80	0.1	3.388	1.464	3.291	1.004	9.451	1.800	1.065	1.632	0.516	9.343
4065	81	1	48.25	0.25	0.6	80	0.25	6.222	2.673	6.086	1.323	8.298	3.840	2.049	3.062	1.011	7.925
4066	81	1	48.50	0.5	0.6	80	0.5	7.073	3.370	6.491	1.830	6.070	4.094	2.594	2.589	1.525	5.811
4067	81	1	48.75	0.75	0.6	80	0.75	6.515	3.550	5.910	2.102	4.783	3.514	2.947	3.158	1.872	4.668
4068	81	1	49.00	1	0.6	80	1	6.145	3.687	5.590	2.277	4.017	4.713	3.668	3.977	2.451	4.005
4069	81	1	49.25	1.25	0.6	80	1.25	5.988	3.735	5.455	2.353	3.416	6.027	4.498	4.840	3.007	3.411
4070	81	1	50.00	2	0.6	80	2	6.103	3.944	5.560	2.398	2.357	10.059	6.883	7.424	4.544	2.259
4071	81	1	50.50	2.5	0.6	80	2.5	6.232	3.974	5.659	2.334	1.919	12.657	8.332	8.980	6.156	1.806
4072	81	1	51.00	3	0.6	80	3	6.317	3.938	5.696	2.243	1.594	15.135	9.642	10.395	7.050	1.579
4073	81	1	52.00	4	0.6	80	4	6.300	3.780	5.587	1.995	1.156	19.815	12.095	12.928	8.113	1.179
4074	81	1	53.00	5	0.6	80	5	6.140	3.736	5.354	1.643	0.887	24.154	13.971	15.138	8.159	1.056
4075	81	1	54.00	6	0.6	80	6	5.934	3.575	5.087	1.581	0.711	28.207	15.560	17.097	8.906	0.869
4076	81	1	55.00	7	0.6	80	7	5.697	3.386	4.807	1.538	0.588	32.074	17.219	18.897	9.527	0.885
4077	81	1	55.50	7.5	0.6	80	7.5	5.575	3.298	4.673	1.520	0.540	33.899	17.867	19.716	9.807	0.888
4078	81	1	56.00	8	0.6	80	8	5.459	3.211	4.550	1.510	0.499	35.722	18.480	20.529	10.065	0.891
4079	81	1	57.00	9	0.6	80	9	5.217	3.074	4.279	1.482	0.432	39.185	19.629	22.030	10.545	0.586
4080	81	1	58.00	10	0.6	80	10	4.980	2.917	4.037	1.461	0.379	42.480	20.681	23.420	10.041	0.591
4081	91	1	54.10	0.1	0.6	90	0.1	3.754	1.536	3.600	1.009	10.014	2.056	1.145	1.844	0.545	9.898
4082	91	1	54.25	0.25	0.6	90	0.25	6.939	2.879	6.685	1.387	8.805	4.340	2.240	2.835	1.068	8.376
4083	91	1	54.50	0.5	0.6	90	0.5	7.880	3.632	7.126	1.919	6.396	4.676	2.860	3.939	1.601	6.103
4084	91	1	54.75	0.75	0.6	90	0.75	7.235	3.828	6.476	2.196	4.977	3.809	3.209	3.448	1.943	4.890
4085	91	1	55.00	1	0.6	90	1	6.813	3.984	6.137	2.378	4.206	5.020	3.855	4.313	2.529	4.195
4086	91	1	55.25	1.25	0.6	90	1.25	6.638	4.052	6.014	2.462	3.581	6.373	4.732	5.233	3.105	3.586
4087	91	1	56.00	2	0.6	90	2	6.858	4.284	6.259	2.524	2.485	10.618	7.294	8.045	4.721	2.387
4088	91	1	56.50	2.5	0.6	90	2.5	7.075	4.327	6.456	2.463	2.027	13.371	8.984	9.755	5.684	1.894
4089	91	1	57.00	3	0.6	90	3	7.222	4.301	6.556	2.372	1.684	16.019	10.478	11.332	6.447	1.640
4090	91	1	58.00	4	0.6	90	4	7.275	4.133	6.524	2.170	1.220	21.027	13.055	14.164	8.576	1.231

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Model								Membrane Stress Factors									
	OD	T	od	t	d/D	D/T	t/T	Branch					Header				
								Axial	In-Plane	Out-of-Plane	Torsional	Pressure	Axial	In-Plane	Out-of-Plane	Torsional	Pressure
4091	91	1	59.00	5	0.6	90	5	7.137	3.937	6.314	1.708	0.933	25.741	15.186	16.694	8.622	1.105
4092	91	1	60.00	6	0.6	90	6	6.958	3.926	6.050	1.630	0.745	30.168	16.994	18.954	9.473	0.876
4093	91	1	61.00	7	0.6	90	7	6.693	3.742	5.743	1.578	0.614	34.379	18.873	21.029	10.169	0.893
4094	91	1	61.50	7.5	0.6	90	7.5	6.560	3.663	5.584	1.560	0.564	36.420	19.615	22.007	10.482	0.896
4095	91	1	62.00	8	0.6	90	8	6.418	3.547	5.442	1.545	0.520	38.408	20.318	22.937	10.768	0.569
4096	91	1	63.00	9	0.6	90	9	6.156	3.384	5.161	1.517	0.450	42.257	21.639	24.710	11.297	0.568
4097	91	1	64.00	10	0.6	90	10	5.889	3.231	4.897	1.497	0.394	45.958	23.147	26.377	10.631	0.570
4098	101	1	60.10	0.1	0.6	100	0.1	4.125	1.618	3.897	1.016	10.572	2.499	1.218	2.041	0.570	10.436
4099	101	1	60.25	0.25	0.6	100	0.25	7.656	3.079	7.271	1.450	9.298	4.825	2.419	3.146	1.117	8.804
4100	101	1	60.50	0.5	0.6	100	0.5	8.691	3.880	7.744	2.002	6.700	5.278	3.090	4.354	1.673	6.380
4101	101	1	60.75	0.75	0.6	100	0.75	7.977	4.094	7.038	2.292	5.194	4.168	3.463	3.756	2.024	5.097
4102	101	1	61.00	1	0.6	100	1	7.522	4.268	6.683	2.474	4.382	5.383	4.025	4.661	2.598	4.351
4103	101	1	61.25	1.25	0.6	100	1.25	7.344	4.358	6.579	2.565	3.736	6.762	4.946	5.633	3.196	3.749
4104	101	1	62.00	2	0.6	100	2	7.683	4.611	6.970	2.644	2.604	11.206	7.707	8.662	4.916	2.504
4105	101	1	62.50	2.5	0.6	100	2.5	8.008	4.671	7.262	2.589	2.128	14.104	9.473	10.522	5.900	1.980
4106	101	1	63.00	3	0.6	100	3	8.211	4.655	7.433	2.495	1.770	16.881	11.096	12.233	6.732	1.699
4107	101	1	64.00	4	0.6	100	4	8.333	4.627	7.489	2.222	1.281	22.195	13.937	15.361	8.983	1.278
4108	101	1	65.00	5	0.6	100	5	8.205	4.276	7.304	1.774	0.976	27.215	16.308	18.172	9.029	1.149
4109	101	1	66.00	6	0.6	100	6	7.971	4.261	7.023	1.679	0.777	31.988	18.613	20.737	9.983	0.848
4110	101	1	67.00	7	0.6	100	7	7.737	4.081	6.716	1.618	0.639	36.551	20.422	23.096	10.754	0.899
4111	101	1	67.50	7.5	0.6	100	7.5	7.602	3.988	6.540	1.595	0.586	38.765	21.256	24.215	11.092	0.902
4112	101	1	68.00	8	0.6	100	8	7.438	3.899	6.381	1.575	0.540	40.904	22.049	25.283	11.416	0.558
4113	101	1	69.00	9	0.6	100	9	7.141	3.698	6.074	1.550	0.466	45.121	23.531	27.327	11.992	0.557
4114	101	1	70.00	10	0.6	100	10	6.858	3.531	5.780	1.526	0.409	49.194	25.226	29.258	12.553	0.554
4115	251	1	150.10	0.1	0.6	250	0.1	8.862	2.809	7.927	1.279	17.342	5.740	2.326	5.130	0.858	16.723
4116	251	1	150.25	0.25	0.6	250	0.25	16.786	5.607	15.083	2.174	14.521	11.321	4.627	9.386	1.753	13.697
4117	251	1	150.50	0.5	0.6	250	0.5	19.975	6.947	16.193	2.989	10.007	12.666	6.001	9.172	2.558	9.527
4118	251	1	150.75	0.75	0.6	250	0.75	19.604	7.177	14.920	3.332	7.551	12.718	6.737	9.772	3.028	7.400
4119	251	1	151.00	1	0.6	250	1	19.926	7.665	14.651	3.631	6.260	14.953	7.096	11.574	3.426	6.286
4120	251	1	151.25	1.25	0.6	250	1.25	20.812	8.079	15.075	3.839	5.376	17.345	7.713	13.571	4.067	5.483
4121	251	1	152.00	2	0.6	250	2	24.962	9.144	18.193	4.213	3.886	24.740	11.643	19.862	6.342	3.995
4122	251	1	152.50	2.5	0.6	250	2.5	27.185	9.490	20.170	4.247	3.243	28.856	14.535	23.563	7.907	3.300
4123	251	1	153.00	3	0.6	250	3	28.617	10.068	21.622	4.177	2.744	32.459	17.409	26.690	9.191	2.457
4124	251	1	154.00	4	0.6	250	4	30.469	9.875	23.190	3.881	2.006	39.040	23.234	32.402	11.822	1.920
4125	251	1	155.00	5	0.6	250	5	29.819	8.963	23.570	3.530	1.521	45.730	28.753	37.622	13.989	1.718
4126	251	1	156.00	6	0.6	250	6	28.594	8.927	23.306	3.095	1.190	52.764	33.760	42.756	15.741	1.455
4127	251	1	157.00	7	0.6	250	7	27.186	8.011	22.792	2.918	0.955	59.991	38.301	48.520	17.177	0.541
4128	251	1	157.50	7.5	0.6	250	7.5	26.498	8.248	22.467	2.676	0.863	63.666	40.416	51.418	17.819	0.530

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Model								Membrane Stress Factors									
	OD	T	od	t	d/D	D/T	t/T	Branch					Header				
								Axial	In-Plane	Out-of-Plane	Torsional	Pressure	Axial	In-Plane	Out-of-Plane	Torsional	Pressure
4129	251	1	158.00	8	0.6	250	8	25.803	8.052	22.130	2.555	0.786	67.354	42.447	54.292	18.410	0.518
4130	251	1	159.00	9	0.6	250	9	24.545	7.691	21.429	2.000	0.660	74.667	46.294	59.979	19.460	0.504
4131	251	1	160.00	10	0.6	250	10	23.358	7.347	20.734	1.880	0.564	81.970	50.111	65.615	20.541	0.495
4132	501	1	300.10	0.1	0.6	500	0.1	13.647	4.409	13.974	1.672	24.736	9.467	3.581	9.218	1.229	23.870
4133	501	1	300.25	0.25	0.6	500	0.25	28.013	8.793	26.973	3.143	20.391	18.993	7.165	17.065	2.550	19.272
4134	501	1	300.50	0.5	0.6	500	0.5	34.197	10.876	29.076	4.278	13.552	21.110	9.555	16.524	3.684	13.075
4135	501	1	300.75	0.75	0.6	500	0.75	35.012	11.634	27.121	4.782	10.159	25.074	10.380	18.973	4.337	9.970
4136	501	1	301.00	1	0.6	500	1	37.070	12.489	27.149	5.216	8.356	29.888	11.677	22.556	4.899	8.396
4137	501	1	301.25	1.25	0.6	500	1.25	40.130	13.263	28.625	5.591	7.194	34.860	12.744	26.405	5.381	7.335
4138	501	1	302.00	2	0.6	500	2	51.018	15.702	36.535	6.415	5.282	48.919	14.389	38.814	6.441	5.467
4139	501	1	302.50	2.5	0.6	500	2.5	56.818	16.617	41.558	6.640	4.460	56.048	16.105	45.925	9.484	4.598
4140	501	1	303.00	3	0.6	500	3	63.111	17.699	45.485	6.666	3.807	61.456	18.428	51.956	11.297	3.893
4141	501	1	304.00	4	0.6	500	4	66.419	16.947	51.719	6.370	2.843	69.348	24.044	61.666	14.999	2.593
4142	501	1	305.00	5	0.6	500	5	66.227	16.248	53.157	5.871	2.187	75.981	30.202	69.893	17.644	2.083
4143	501	1	306.00	6	0.6	500	6	64.265	15.468	53.081	5.344	1.725	83.165	36.499	77.780	20.600	1.944
4144	501	1	307.00	7	0.6	500	7	61.529	14.442	52.215	4.834	1.390	91.296	53.849	85.808	23.179	1.850
4145	501	1	307.50	7.5	0.6	500	7.5	60.033	14.683	51.607	4.600	1.257	95.705	57.332	89.943	24.332	1.731
4146	501	1	308.00	8	0.6	500	8	58.531	13.628	50.964	4.389	1.142	100.293	60.701	94.159	25.407	0.575
4147	501	1	309.00	9	0.6	500	9	55.530	13.484	49.535	3.989	0.952	109.953	67.102	102.879	27.334	0.548
4148	501	1	310.00	10	0.6	500	10	52.685	12.129	48.055	3.649	0.806	120.166	59.715	113.352	29.126	0.526
4150	751	1	450.25	0.25	0.6	750	0.25	37.860	11.231	38.712	3.998	24.475	25.489	9.205	24.607	3.207	23.632
4151	751	1	450.50	0.5	0.6	750	0.5	46.444	14.344	42.036	5.355	16.319	28.920	11.969	23.052	4.613	15.841
4152	751	1	450.75	0.75	0.6	750	0.75	47.962	15.367	39.611	5.923	12.166	35.007	13.736	26.659	5.400	11.951
4153	751	1	451.00	1	0.6	750	1	51.353	16.573	40.167	6.444	9.964	42.090	15.552	31.809	6.146	10.005
4154	751	1	451.25	1.25	0.6	750	1.25	56.192	17.848	42.816	7.079	8.586	49.473	17.045	37.653	6.133	8.760
4155	751	1	452.00	2	0.6	750	2	72.969	21.360	55.692	8.313	6.346	70.123	18.302	55.867	7.771	6.582
4156	751	1	452.50	2.5	0.6	750	2.5	82.161	22.809	63.881	8.722	5.381	80.652	20.479	66.273	8.765	5.577
4157	751	1	453.00	3	0.6	750	3	92.444	23.952	70.448	8.858	4.612	88.614	22.433	74.926	9.899	4.753
4158	751	1	454.00	4	0.6	750	4	98.922	24.241	81.794	8.631	3.472	99.200	27.757	88.221	12.448	3.496
4159	751	1	455.00	5	0.6	750	5	100.029	23.537	84.801	8.082	2.689	106.698	34.198	98.640	15.224	2.328
4160	751	1	456.00	6	0.6	750	6	98.207	22.429	85.342	7.431	2.136	113.812	40.994	108.284	18.065	2.117
4161	751	1	457.00	7	0.6	750	7	94.878	20.507	84.451	6.774	1.733	122.035	47.985	118.578	20.844	1.986
4162	751	1	457.50	7.5	0.6	750	7.5	92.945	19.886	83.612	6.448	1.571	126.768	51.450	123.846	22.176	1.938
4163	751	1	458.00	8	0.6	750	8	90.880	19.284	82.682	6.146	1.430	131.807	54.902	129.452	23.361	1.898
4164	751	1	459.00	9	0.6	750	9	86.693	18.180	80.618	5.589	1.198	142.591	61.637	142.050	25.812	1.833
4165	751	1	460.00	10	0.6	750	10	82.523	17.155	78.455	5.096	1.016	154.488	68.151	155.553	28.093	0.545
4167	1001	1	600.25	0.25	0.6	1000	0.25	46.868	13.738	50.106	4.770	28.784	30.987	10.926	31.296	3.781	27.341
4168	1001	1	600.50	0.5	0.6	1000	0.5	57.712	17.469	54.845	6.360	18.648	35.864	14.460	30.169	5.414	18.183

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Model								Membrane Stress Factors									
	OD	T	od	t	d/D	D/T	t/T	Branch					Header				
								Axial	In-Plane	Out-of-Plane	Torsional	Pressure	Axial	In-Plane	Out-of-Plane	Torsional	Pressure
4169	1001	1	600.75	0.75	0.6	1000	0.75	59.819	18.695	52.087	7.010	13.735	43.943	16.670	35.410	6.346	13.630
4170	1001	1	601.00	1	0.6	1000	1	64.369	20.189	53.243	6.935	11.322	53.177	18.715	42.505	7.139	11.375
4171	1001	1	601.25	1.25	0.6	1000	1.25	70.813	21.859	57.176	8.390	9.756	62.779	20.887	50.483	7.209	9.954
4172	1001	1	602.00	2	0.6	1000	2	92.983	26.410	74.982	10.003	7.240	89.652	22.302	74.796	9.052	7.518
4173	1001	1	602.50	2.5	0.6	1000	2.5	105.380	28.369	86.352	10.584	6.156	103.587	24.759	88.673	10.083	6.392
4174	1001	1	603.00	3	0.6	1000	3	119.617	29.465	101.366	10.827	5.288	114.259	26.752	100.132	10.868	5.468
4175	1001	1	604.00	4	0.6	1000	4	129.421	29.899	112.276	10.698	3.997	128.149	31.027	117.323	13.255	4.079
4176	1001	1	605.00	5	0.6	1000	5	132.121	29.249	117.258	10.131	3.109	136.982	37.599	129.933	16.190	2.552
4177	1001	1	606.00	6	0.6	1000	6	130.749	28.025	118.503	9.404	2.480	144.410	44.510	141.194	19.069	2.270
4178	1001	1	607.00	7	0.6	1000	7	127.204	26.609	117.510	8.643	2.020	152.635	51.746	152.522	21.726	2.171
4179	1001	1	607.50	7.5	0.6	1000	7.5	124.959	25.882	116.645	8.265	1.835	157.260	55.480	158.702	23.442	2.124
4180	1001	1	608.00	8	0.6	1000	8	122.532	24.698	115.469	7.902	1.674	162.275	59.153	165.004	24.560	2.082
4181	1001	1	609.00	9	0.6	1000	9	117.378	23.362	112.790	7.183	1.408	173.895	66.484	179.400	27.595	1.896
4182	1001	1	610.00	10	0.6	1000	10	112.138	21.953	109.905	6.570	1.198	186.650	73.717	195.062	30.176	1.836
4184	1251	1	750.25	0.25	0.6	1250	0.25	55.103	16.012	60.965	5.475	32.235	35.785	12.411	37.380	4.296	30.654
4185	1251	1	750.50	0.5	0.6	1250	0.5	68.084	20.325	67.204	7.280	20.704	42.096	16.687	36.856	6.129	20.271
4186	1251	1	750.75	0.75	0.6	1250	0.75	70.744	21.707	64.219	7.364	15.224	52.060	19.282	43.764	7.199	15.123
4187	1251	1	751.00	1	0.6	1250	1	76.290	23.465	65.894	7.954	12.522	63.286	21.732	52.765	7.205	12.583
4188	1251	1	751.25	1.25	0.6	1250	1.25	84.169	25.446	70.990	8.563	10.796	74.973	20.341	62.778	8.076	11.013
4189	1251	1	752.00	2	0.6	1250	2	111.326	30.990	93.671	11.529	8.030	107.746	26.100	93.131	10.283	8.338
4190	1251	1	752.50	2.5	0.6	1250	2.5	126.743	33.418	108.187	12.272	6.840	124.941	28.842	110.430	11.371	7.107
4191	1251	1	753.00	3	0.6	1250	3	144.797	34.859	127.793	12.628	5.885	138.216	30.956	124.723	11.998	6.096
4192	1251	1	754.00	4	0.6	1250	4	157.880	35.374	142.156	12.596	4.460	155.807	34.316	145.799	14.181	4.569
4193	1251	1	755.00	5	0.6	1250	5	162.321	34.874	149.027	12.034	3.478	166.330	40.921	160.856	16.673	3.387
4194	1251	1	756.00	6	0.6	1250	6	161.654	33.196	151.152	11.262	2.781	174.490	47.624	173.477	19.969	2.426
4195	1251	1	757.00	7	0.6	1250	7	158.062	31.513	150.442	10.419	2.272	182.739	54.842	185.939	22.896	2.283
4196	1251	1	757.50	7.5	0.6	1250	7.5	155.654	30.657	149.484	9.998	2.067	187.463	58.647	192.981	24.382	2.231
4197	1251	1	758.00	8	0.6	1250	8	152.942	29.818	148.017	9.584	1.889	192.296	62.482	199.716	25.870	2.185
4198	1251	1	759.00	9	0.6	1250	9	147.070	28.242	144.614	8.784	1.593	204.235	70.158	215.563	28.765	2.106
4199	1251	1	760.00	10	0.6	1250	10	140.952	26.565	141.441	8.043	1.360	217.687	77.852	233.602	31.555	2.039
4201	1501	1	900.25	0.25	0.6	1500	0.25	62.653	18.151	71.406	6.128	35.390	40.013	13.735	42.989	4.767	33.674
4202	1501	1	900.50	0.5	0.6	1500	0.5	77.711	22.969	79.267	7.589	22.565	47.693	18.694	43.184	6.782	22.173
4203	1501	1	900.75	0.75	0.6	1500	0.75	80.768	24.506	75.991	8.262	16.565	59.390	21.675	51.736	7.905	16.473
4204	1501	1	901.00	1	0.6	1500	1	87.144	26.498	78.074	8.927	13.610	72.476	24.493	62.586	8.044	13.676
4205	1501	1	901.25	1.25	0.6	1500	1.25	96.347	28.785	84.358	9.614	11.732	86.085	23.165	74.617	9.017	11.961
4206	1501	1	902.00	2	0.6	1500	2	128.059	35.222	111.738	12.929	8.744	124.351	29.747	110.870	11.471	9.076
4207	1501	1	902.50	2.5	0.6	1500	2.5	146.285	38.080	129.139	13.825	7.458	144.678	32.783	131.359	12.627	7.751
4208	1501	1	903.00	3	0.6	1500	3	168.047	39.825	153.359	14.286	6.425	160.535	35.000	148.436	13.133	6.661

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Model								Membrane Stress Factors									
	OD	T	od	t	d/D	D/T	t/T	Branch					Header				
								Axial	In-Plane	Out-of-Plane	Torsional	Pressure	Axial	In-Plane	Out-of-Plane	Torsional	Pressure
4209	1501	1	904.00	4	0.6	1500	4	184.306	40.929	171.206	14.354	4.878	181.830	37.580	173.473	15.127	5.010
4210	1501	1	905.00	5	0.6	1500	5	190.569	39.865	180.161	13.810	3.811	194.519	44.108	191.430	18.071	3.823
4211	1501	1	906.00	6	0.6	1500	6	190.701	38.694	183.255	13.005	3.053	203.533	50.568	206.141	20.804	2.574
4212	1501	1	907.00	7	0.6	1500	7	187.339	36.840	182.946	12.106	2.499	212.176	57.707	220.432	23.713	2.376
4213	1501	1	907.50	7.5	0.6	1500	7.5	184.815	35.872	181.878	11.649	2.277	216.923	61.513	227.841	25.224	2.344
4214	1501	1	908.00	8	0.6	1500	8	181.968	34.892	180.556	11.195	2.082	221.948	65.375	235.564	26.733	2.296
4215	1501	1	909.00	9	0.6	1500	9	175.580	32.740	176.820	10.317	1.760	233.853	73.227	252.382	29.727	2.212
4216	1501	1	910.00	10	0.6	1500	10	168.741	30.946	172.715	9.485	1.506	247.905	81.203	271.552	32.647	2.153
4219	1751	1	1050.50	0.5	0.6	1750	0.5	86.655	25.462	91.013	8.391	24.271	52.763	20.553	49.249	7.376	23.935
4220	1751	1	1050.75	0.75	0.6	1750	0.75	90.053	24.130	87.525	9.119	17.802	66.072	23.657	59.492	7.699	17.731
4221	1751	1	1051.00	1	0.6	1750	1	97.175	25.843	90.025	9.838	14.544	80.891	22.994	72.183	8.835	14.691
4222	1751	1	1051.25	1.25	0.6	1750	1.25	107.472	27.896	97.313	10.618	12.596	96.265	25.866	86.171	9.919	12.845
4223	1751	1	1052.00	2	0.6	1750	2	143.290	39.141	129.009	14.246	9.404	139.643	33.231	128.018	12.633	9.766
4224	1751	1	1052.50	2.5	0.6	1750	2.5	164.206	42.456	149.273	15.265	8.027	162.985	36.613	151.678	13.853	8.350
4225	1751	1	1053.00	3	0.6	1750	3	189.619	44.486	178.012	15.827	6.922	181.407	38.973	171.427	14.275	7.186
4226	1751	1	1054.00	4	0.6	1750	4	208.870	45.880	199.545	16.001	5.264	206.404	40.854	201.631	16.103	5.413
4227	1751	1	1055.00	5	0.6	1750	5	216.936	45.249	210.459	15.476	4.117	221.356	47.325	222.818	19.020	4.189
4228	1751	1	1056.00	6	0.6	1750	6	218.010	43.660	214.744	14.652	3.304	231.713	53.383	239.686	21.590	2.722
4229	1751	1	1057.00	7	0.6	1750	7	214.929	41.673	214.878	13.707	2.708	240.816	60.310	255.151	24.441	2.491
4230	1751	1	1057.50	7.5	0.6	1750	7.5	212.382	40.643	214.388	13.222	2.469	245.648	64.050	263.740	25.929	2.429
4231	1751	1	1058.00	8	0.6	1750	8	209.448	39.583	212.329	12.739	2.260	250.808	67.870	271.083	27.449	2.374
4232	1751	1	1059.00	9	0.6	1750	9	202.680	37.114	208.402	11.790	1.913	263.025	75.777	289.325	30.487	2.286
4233	1751	1	1060.00	10	0.6	1750	10	195.303	35.479	203.814	10.886	1.640	277.181	83.885	309.391	33.494	2.217
4236	2001	1	1200.50	0.5	0.6	2000	0.5	95.056	27.846	102.662	9.175	25.852	57.357	22.316	55.086	7.936	25.585
4237	2001	1	1200.75	0.75	0.6	2000	0.75	98.696	26.550	98.549	9.948	18.952	72.148	25.682	66.708	8.360	18.900
4238	2001	1	1201.00	1	0.6	2000	1	106.349	28.421	101.343	10.729	15.480	88.541	25.233	81.151	9.605	15.632
4239	2001	1	1201.25	1.25	0.6	2000	1.25	117.644	30.699	109.563	11.581	13.406	105.597	28.438	96.981	10.798	13.661
4240	2001	1	1202.00	2	0.6	2000	2	157.308	42.830	145.611	15.459	10.016	153.821	36.611	144.370	13.749	10.397
4241	2001	1	1202.50	2.5	0.6	2000	2.5	180.723	46.550	169.102	16.613	8.558	180.033	40.317	171.562	15.052	8.900
4242	2001	1	1203.00	3	0.6	2000	3	209.625	48.827	202.181	17.277	7.385	200.833	42.799	194.245	15.421	7.668
4243	2001	1	1204.00	4	0.6	2000	4	231.853	50.541	226.994	17.546	5.623	229.706	45.779	229.697	17.928	5.794
4244	2001	1	1205.00	5	0.6	2000	5	241.682	49.988	240.212	17.050	4.403	247.158	50.611	254.421	20.009	4.492
4245	2001	1	1206.00	6	0.6	2000	6	243.781	48.356	245.536	16.209	3.536	259.077	56.310	273.268	22.439	2.781
4246	2001	1	1207.00	7	0.6	2000	7	241.085	46.284	246.260	15.230	2.902	268.971	62.987	290.347	25.192	2.581
4247	2001	1	1207.50	7.5	0.6	2000	7.5	238.600	45.148	245.089	14.724	2.647	274.118	66.557	298.601	26.648	2.510
4248	2001	1	1208.00	8	0.6	2000	8	235.607	44.015	243.585	14.213	2.425	279.494	70.334	307.292	28.149	2.447
4249	2001	1	1209.00	9	0.6	2000	9	228.585	41.756	239.478	13.205	2.056	291.856	78.204	326.340	31.217	2.348
4250	2001	1	1210.00	10	0.6	2000	10	220.741	39.601	235.015	12.237	1.765	306.228	86.407	348.277	34.266	2.273

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Model								Membrane Stress Factors									
	OD	T	od	t	d/D	D/T	t/T	Branch					Header				
								Axial	In-Plane	Out-of-Plane	Torsional	Pressure	Axial	In-Plane	Out-of-Plane	Torsional	Pressure
4253	2251	1	1350.50	0.5	0.6	2250	0.5	102.898	30.018	113.421	9.912	27.329	61.601	23.881	60.501	8.447	27.133
4254	2251	1	1350.75	0.75	0.6	2250	0.75	106.734	28.868	109.338	10.738	20.032	77.805	27.587	73.838	8.996	20.006
4255	2251	1	1351.00	1	0.6	2250	1	114.948	30.909	112.305	11.569	16.357	95.681	27.406	89.877	10.339	16.527
4256	2251	1	1351.25	1.25	0.6	2250	1.25	127.106	33.372	121.567	12.505	14.166	114.270	30.897	107.660	11.636	14.449
4257	2251	1	1352.00	2	0.6	2250	2	170.275	46.280	161.533	16.609	10.592	167.057	39.845	160.236	14.836	10.999
4258	2251	1	1352.50	2.5	0.6	2250	2.5	195.944	50.335	187.924	17.896	9.058	195.949	43.850	190.835	16.238	9.424
4259	2251	1	1353.00	3	0.6	2250	3	228.554	52.945	225.319	18.634	7.820	219.288	46.555	215.193	17.146	8.126
4260	2251	1	1354.00	4	0.6	2250	4	253.429	54.937	254.041	19.005	5.960	251.845	49.334	257.749	19.056	6.140
4261	2251	1	1355.00	5	0.6	2250	5	265.085	54.468	269.214	18.539	4.671	272.003	53.900	285.795	21.011	4.777
4262	2251	1	1356.00	6	0.6	2250	6	268.132	52.799	275.712	17.687	3.755	285.523	59.221	306.954	23.298	2.898
4263	2251	1	1357.00	7	0.6	2250	7	265.830	50.619	276.744	16.679	3.084	296.425	65.432	325.417	25.890	2.669
4264	2251	1	1357.50	7.5	0.6	2250	7.5	263.460	49.450	275.789	16.151	2.815	301.760	68.910	334.217	27.312	2.586
4265	2251	1	1358.00	8	0.6	2250	8	260.459	48.253	274.336	15.619	2.579	307.346	72.542	343.458	28.772	2.515
4266	2251	1	1359.00	9	0.6	2250	9	253.272	45.861	270.035	14.566	2.190	319.840	80.382	363.114	31.813	2.404
4267	2251	1	1360.00	10	0.6	2250	10	245.143	43.526	264.459	13.543	1.882	334.816	88.496	385.172	34.886	2.321
4270	2501	1	1500.50	0.5	0.6	2500	0.5	110.341	29.368	124.241	10.631	28.732	65.591	25.421	65.904	8.941	28.618
4271	2501	1	1500.75	0.75	0.6	2500	0.75	114.351	31.122	119.776	11.505	21.047	83.015	25.648	80.668	9.602	21.060
4272	2501	1	1501.00	1	0.6	2500	1	122.939	33.305	123.338	12.387	17.185	102.313	29.490	98.653	11.047	17.378
4273	2501	1	1501.25	1.25	0.6	2500	1.25	135.896	35.969	133.235	13.387	14.886	122.421	33.292	118.037	12.447	15.180
4274	2501	1	1502.00	2	0.6	2500	2	182.371	49.570	177.245	17.691	11.137	179.546	43.003	175.943	15.890	11.566
4275	2501	1	1502.50	2.5	0.6	2500	2.5	210.223	53.986	206.222	19.100	9.530	211.036	47.831	210.329	17.088	9.920
4276	2501	1	1503.00	3	0.6	2500	3	246.217	56.828	248.935	19.930	8.233	236.638	50.183	240.067	18.303	8.560
4277	2501	1	1504.00	4	0.6	2500	4	273.944	59.116	280.152	20.395	6.280	273.101	52.820	285.114	20.176	6.490
4278	2501	1	1505.00	5	0.6	2500	5	287.238	58.743	297.510	19.955	4.925	295.952	57.146	317.003	22.017	5.046
4279	2501	1	1506.00	6	0.6	2500	6	291.241	57.062	305.191	19.097	3.962	311.327	62.178	340.727	24.167	3.963
4280	2501	1	1507.00	7	0.6	2500	7	289.549	54.800	306.739	18.070	3.256	323.562	68.056	360.814	26.688	2.758
4281	2501	1	1507.50	7.5	0.6	2500	7.5	287.286	53.570	306.000	17.522	2.973	329.380	71.569	370.540	28.046	2.660
4285	9	1	5.30	0.1	0.65	8	0.1	1.020	1.019	0.990	1.080	5.156	0.339	0.223	0.163	0.158	3.172
4286	9	1	5.45	0.25	0.65	8	0.25	1.131	0.958	1.103	1.135	2.299	0.873	0.327	0.283	0.313	2.663
4287	9	1	5.70	0.5	0.65	8	0.5	1.344	0.904	1.081	0.994	1.674	1.818	0.563	0.626	0.517	2.038
4288	9	1	5.95	0.75	0.65	8	0.75	1.490	0.874	1.015	0.918	1.395	2.801	0.841	0.845	0.673	1.639
4289	9	1	6.20	1	0.65	8	1	1.584	0.833	0.948	0.843	1.232	3.734	1.014	1.011	0.829	1.373
4290	9	1	6.45	1.25	0.65	8	1.25	1.653	0.814	0.853	0.821	1.041	4.665	1.118	1.139	0.971	1.116
4291	9	1	7.20	2	0.65	8	2	1.690	0.735	0.730	0.825	0.708	7.454	1.475	1.418	1.279	1.056
4292	9	1	7.70	2.5	0.65	8	2.5	1.674	0.689	0.689	0.831	0.571	9.306	1.419	1.555	1.461	1.131
4293	9	1	8.20	3	0.65	8	3	1.668	0.643	0.638	0.848	0.476	11.158	1.522	1.721	1.586	1.198
4302	17	1	10.50	0.1	0.65	16	0.1	1.170	0.963	1.242	0.904	5.600	0.507	0.266	0.294	0.209	4.557
4303	17	1	10.65	0.25	0.65	16	0.25	1.575	1.038	1.786	1.109	3.425	0.811	0.507	0.585	0.507	3.921



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Model								Membrane Stress Factors									
	OD	T	od	t	d/D	D/T	t/T	Branch					Header				
								Axial	In-Plane	Out-of-Plane	Torsional	Pressure	Axial	In-Plane	Out-of-Plane	Torsional	Pressure
4304	17	1	10.90	0.5	0.65	16	0.5	1.907	1.098	1.902	0.991	2.808	1.508	0.926	0.939	0.812	3.042
4305	17	1	11.15	0.75	0.65	16	0.75	2.056	1.220	1.788	1.080	2.337	2.309	1.381	1.284	1.155	2.481
4306	17	1	11.40	1	0.65	16	1	2.144	1.409	1.656	1.179	2.024	3.154	1.731	1.583	1.428	2.066
4307	17	1	11.65	1.25	0.65	16	1.25	2.199	1.368	1.540	1.198	1.707	4.038	2.028	1.831	1.654	1.661
4308	17	1	12.40	2	0.65	16	2	2.230	1.192	1.196	1.079	1.152	6.890	2.661	2.407	2.309	1.129
4309	17	1	12.90	2.5	0.65	16	2.5	2.191	1.145	1.017	1.080	0.937	8.943	2.511	2.722	2.484	0.964
4310	17	1	13.40	3	0.65	16	3	2.134	1.102	0.876	1.114	0.783	10.729	2.744	2.991	2.603	1.019
4311	17	1	14.40	4	0.65	16	4	2.011	1.015	0.750	1.106	0.580	14.261	3.114	3.457	2.880	1.096
4312	17	1	15.40	5	0.65	16	5	2.060	0.873	0.691	1.116	0.449	17.793	3.415	3.865	3.186	1.170
4313	17	1	16.40	6	0.65	16	6	1.990	1.013	0.641	1.150	0.365	21.333	3.670	4.238	3.591	1.236
4319	25	1	15.70	0.1	0.65	24	0.1	1.319	0.999	1.528	0.940	5.849	0.615	0.432	0.439	0.294	5.491
4320	25	1	15.85	0.25	0.65	24	0.25	2.173	1.252	2.433	1.023	4.450	1.027	0.730	0.963	0.659	4.762
4321	25	1	16.10	0.5	0.65	24	0.5	2.516	1.512	2.639	1.174	3.612	1.436	1.227	1.201	1.023	3.672
4322	25	1	16.35	0.75	0.65	24	0.75	2.621	1.706	2.483	1.397	2.962	2.328	1.754	1.648	1.409	3.003
4323	25	1	16.60	1	0.65	24	1	2.695	1.841	2.326	1.524	2.538	3.162	2.229	2.119	1.783	2.550
4324	25	1	16.85	1.25	0.65	24	1.25	2.748	1.816	2.181	1.550	2.140	3.986	2.653	2.457	2.369	2.086
4325	25	1	17.60	2	0.65	24	2	2.685	1.760	1.811	1.267	1.441	6.186	3.685	3.367	3.211	1.363
4326	25	1	18.10	2.5	0.65	24	2.5	2.575	1.667	1.598	1.348	1.169	7.472	4.172	3.830	3.499	1.186
4327	25	1	18.60	3	0.65	24	3	2.461	1.532	1.421	1.323	0.975	8.656	3.760	4.233	3.703	1.032
4328	25	1	19.60	4	0.65	24	4	2.252	1.463	1.153	1.285	0.720	10.837	4.520	4.954	3.972	0.989
4329	25	1	20.60	5	0.65	24	5	2.079	1.465	0.961	1.262	0.562	12.855	5.026	5.578	4.184	1.044
4330	25	1	21.60	6	0.65	24	6	2.161	1.287	0.830	1.241	0.453	14.592	5.485	6.135	4.505	0.822
4331	25	1	22.60	7	0.65	24	7	2.053	1.320	0.717	1.252	0.379	16.188	5.918	6.618	4.817	0.810
4332	25	1	23.10	7.5	0.65	24	7.5	2.004	1.289	0.696	1.253	0.350	16.936	6.130	6.845	4.983	0.803
4333	25	1	23.60	8	0.65	24	8	1.956	1.264	0.698	1.266	0.325	18.820	6.340	7.062	5.191	0.806
4334	25	1	24.60	9	0.65	24	9	1.867	1.226	0.644	1.297	0.283	20.637	6.759	7.487	5.624	0.824
4336	33	1	20.90	0.1	0.65	32	0.1	1.546	1.026	1.798	0.969	6.391	0.722	0.545	0.621	0.377	6.292
4337	33	1	21.05	0.25	0.65	32	0.25	2.755	1.427	3.033	1.056	5.344	1.380	0.923	1.116	0.765	5.432
4338	33	1	21.30	0.5	0.65	32	0.5	3.120	1.806	3.304	1.380	4.218	1.590	1.445	1.502	1.183	4.156
4339	33	1	21.55	0.75	0.65	32	0.75	3.154	2.123	3.102	1.641	3.414	2.545	2.055	1.957	1.577	3.392
4340	33	1	21.80	1	0.65	32	1	3.177	2.186	2.925	1.791	2.905	3.492	2.617	2.488	2.047	2.901
4341	33	1	22.05	1.25	0.65	32	1.25	3.230	2.173	2.777	1.831	2.450	4.441	3.144	2.980	2.728	2.417
4342	33	1	22.80	2	0.65	32	2	3.167	2.223	2.417	1.765	1.652	7.049	4.520	4.229	3.922	1.539
4343	33	1	23.30	2.5	0.65	32	2.5	3.050	2.125	2.202	1.519	1.339	8.563	5.210	4.874	4.379	1.222
4344	33	1	23.80	3	0.65	32	3	2.923	2.024	2.013	1.482	1.115	9.961	5.003	5.422	4.661	1.201
4345	33	1	24.80	4	0.65	32	4	2.685	1.844	1.707	1.428	0.822	12.514	6.013	6.362	5.035	0.878
4346	33	1	25.80	5	0.65	32	5	2.481	1.847	1.474	1.389	0.640	14.843	6.692	7.178	5.293	0.837
4347	33	1	26.80	6	0.65	32	6	2.311	1.764	1.288	1.363	0.520	17.104	7.207	7.939	5.527	0.826

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Model								Membrane Stress Factors									
	OD	T	od	t	d/D	D/T	t/T	Branch					Header				
								Axial	In-Plane	Out-of-Plane	Torsional	Pressure	Axial	In-Plane	Out-of-Plane	Torsional	Pressure
4348	33	1	27.80	7	0.65	32	7	2.165	1.679	1.138	1.337	0.434	19.128	7.775	8.654	5.809	0.813
4349	33	1	28.30	7.5	0.65	32	7.5	2.111	1.576	1.088	1.321	0.397	20.139	8.042	8.953	5.985	0.807
4350	33	1	28.80	8	0.65	32	8	2.270	1.529	1.027	1.313	0.368	21.025	8.298	9.236	6.151	0.800
4351	33	1	29.80	9	0.65	32	9	2.167	1.453	0.917	1.318	0.321	22.730	8.796	9.850	6.498	0.854
4352	33	1	30.80	10	0.65	32	10	2.084	1.386	0.823	1.358	0.283	24.304	9.277	10.364	6.846	0.845
4353	41	1	26.10	0.1	0.65	40	0.1	1.867	1.096	2.070	0.986	6.903	0.938	0.648	0.857	0.434	7.037
4354	41	1	26.25	0.25	0.65	40	0.25	3.332	1.587	3.597	1.087	6.075	1.553	1.144	1.398	0.868	6.071
4355	41	1	26.50	0.5	0.65	40	0.5	3.714	2.272	3.919	1.541	4.717	1.800	1.566	1.662	1.330	4.594
4356	41	1	26.75	0.75	0.65	40	0.75	3.661	2.411	3.664	1.828	3.781	2.725	2.267	2.229	1.820	3.734
4357	41	1	27.00	1	0.65	40	1	3.632	2.490	3.467	1.993	3.202	3.767	2.927	2.839	2.352	3.190
4358	41	1	27.25	1.25	0.65	40	1.25	3.670	2.489	3.319	2.046	2.703	4.822	3.550	3.430	2.970	2.680
4359	41	1	28.00	2	0.65	40	2	3.608	2.626	3.005	1.993	1.824	7.732	5.136	4.973	4.454	1.721
4360	41	1	28.50	2.5	0.65	40	2.5	3.498	2.540	2.809	1.897	1.477	9.463	5.363	5.790	5.075	1.421
4361	41	1	29.00	3	0.65	40	3	3.373	2.432	2.627	1.607	1.229	11.046	5.984	6.499	5.488	1.234
4362	41	1	30.00	4	0.65	40	4	3.144	2.216	2.311	1.536	0.903	14.043	6.872	7.745	5.959	0.937
4363	41	1	31.00	5	0.65	40	5	2.927	2.250	2.051	1.488	0.703	16.711	8.274	8.769	6.317	0.867
4364	41	1	32.00	6	0.65	40	6	2.735	2.110	1.834	1.453	0.569	19.208	8.684	9.700	6.591	0.861
4365	41	1	33.00	7	0.65	40	7	2.561	2.006	1.646	1.426	0.475	21.565	9.746	10.554	6.839	0.856
4366	41	1	33.50	7.5	0.65	40	7.5	2.488	1.960	1.566	1.415	0.438	22.723	9.940	10.978	6.974	0.857
4367	41	1	34.00	8	0.65	40	8	2.413	1.917	1.486	1.399	0.405	23.841	10.261	11.374	7.112	0.854
4368	41	1	35.00	9	0.65	40	9	2.295	1.770	1.365	1.384	0.350	26.054	10.890	12.186	7.402	0.848
4369	41	1	36.00	10	0.65	40	10	2.368	1.676	1.240	1.357	0.308	28.204	11.476	12.995	7.682	0.840
4370	51	1	32.60	0.1	0.65	50	0.1	2.208	1.202	2.412	1.007	7.696	1.198	0.755	1.074	0.484	7.855
4371	51	1	32.75	0.25	0.65	50	0.25	3.846	1.937	4.277	1.182	6.879	2.258	1.355	1.730	0.968	6.747
4372	51	1	33.00	0.5	0.65	50	0.5	4.453	2.590	4.645	1.711	5.246	2.058	1.777	1.934	1.471	5.049
4373	51	1	33.25	0.75	0.65	50	0.75	4.278	2.745	4.317	2.014	4.164	2.918	2.498	2.519	1.956	4.087
4374	51	1	33.50	1	0.65	50	1	4.172	2.841	4.093	2.196	3.513	4.045	3.244	3.218	2.552	3.498
4375	51	1	33.75	1.25	0.65	50	1.25	4.165	2.853	3.947	2.257	2.970	5.206	3.963	3.911	3.179	2.961
4376	51	1	34.50	2	0.65	50	2	4.138	3.069	3.717	2.248	2.014	8.490	5.419	5.810	4.946	1.909
4377	51	1	35.00	2.5	0.65	50	2.5	4.061	3.000	3.571	2.158	1.631	10.492	6.316	6.868	5.761	1.559
4378	51	1	35.50	3	0.65	50	3	3.964	2.897	3.417	1.741	1.354	12.352	7.082	7.788	6.335	1.343
4379	51	1	36.50	4	0.65	50	4	3.751	2.662	3.115	1.649	0.990	15.725	8.317	9.338	7.019	1.007
4380	51	1	37.50	5	0.65	50	5	3.526	2.714	2.833	1.590	0.767	18.692	9.608	10.636	7.445	0.938
4381	51	1	38.50	6	0.65	50	6	3.333	2.578	2.586	1.541	0.621	21.753	10.863	11.892	7.806	0.843
4382	51	1	39.50	7	0.65	50	7	3.143	2.419	2.369	1.513	0.517	24.594	11.744	13.027	8.081	0.891
4383	51	1	40.00	7.5	0.65	50	7.5	3.052	2.361	2.268	1.497	0.476	25.809	11.977	13.498	8.238	0.841
4384	51	1	40.50	8	0.65	50	8	2.965	2.288	2.172	1.478	0.441	27.105	12.375	14.056	8.396	0.837
4385	51	1	41.50	9	0.65	50	9	2.810	2.182	2.000	1.461	0.383	29.610	13.140	14.948	8.699	0.897

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Model								Membrane Stress Factors									
	OD	T	od	t	d/D	D/T	t/T	Branch					Header				
								Axial	In-Plane	Out-of-Plane	Torsional	Pressure	Axial	In-Plane	Out-of-Plane	Torsional	Pressure
4386	51	1	42.50	10	0.65	50	10	2.663	2.054	1.845	1.445	0.337	32.205	14.115	15.970	9.009	0.902
4387	61	1	39.10	0.1	0.65	60	0.1	2.575	1.278	2.751	1.028	8.603	1.428	0.849	1.287	0.525	8.611
4388	61	1	39.25	0.25	0.65	60	0.25	4.544	2.157	4.936	1.295	7.605	2.771	1.604	2.064	1.049	7.355
4389	61	1	39.50	0.5	0.65	60	0.5	5.197	2.890	5.343	1.853	5.702	2.377	2.238	2.213	1.591	5.450
4390	61	1	39.75	0.75	0.65	60	0.75	4.895	3.061	4.938	2.167	4.492	3.101	2.661	2.810	1.999	4.400
4391	61	1	40.00	1	0.65	60	1	4.709	3.174	4.687	2.361	3.780	4.296	3.480	3.581	2.700	3.766
4392	61	1	40.25	1.25	0.65	60	1.25	4.660	3.199	4.548	2.435	3.201	5.541	4.206	4.362	3.189	3.205
4393	61	1	41.00	2	0.65	60	2	4.666	3.461	4.418	2.447	2.183	9.129	6.280	6.563	5.310	2.078
4394	61	1	41.50	2.5	0.65	60	2.5	4.638	3.412	4.338	2.359	1.769	11.366	7.463	7.832	6.288	1.669
4395	61	1	42.00	3	0.65	60	3	4.583	3.317	4.230	2.250	1.468	13.463	8.489	8.957	7.015	1.436
4396	61	1	43.00	4	0.65	60	4	4.421	3.082	3.964	1.742	1.069	17.329	9.864	10.900	7.943	1.081
4397	61	1	44.00	5	0.65	60	5	4.224	3.142	3.682	1.670	0.825	20.817	11.139	12.533	8.439	0.986
4398	61	1	45.00	6	0.65	60	6	4.009	2.977	3.411	1.617	0.665	24.033	12.225	13.962	8.887	0.895
4399	61	1	46.00	7	0.65	60	7	3.806	2.839	3.162	1.581	0.552	27.043	13.498	15.247	8.787	0.813
4400	61	1	46.50	7.5	0.65	60	7.5	3.704	2.764	3.046	1.570	0.509	28.478	13.946	15.839	9.019	0.811
4401	61	1	47.00	8	0.65	60	8	3.602	2.685	2.932	1.550	0.470	29.848	14.369	16.393	9.235	0.810
4402	61	1	48.00	9	0.65	60	9	3.437	2.539	2.729	1.523	0.408	33.248	15.861	17.872	9.648	0.872
4403	61	1	49.00	10	0.65	60	10	3.264	2.424	2.549	1.507	0.359	35.842	16.443	18.998	10.074	0.883
4404	71	1	45.60	0.1	0.65	70	0.1	2.933	1.348	3.032	1.041	9.501	1.565	0.936	1.522	0.570	9.339
4405	71	1	45.75	0.25	0.65	70	0.25	5.247	2.429	5.584	1.388	8.251	3.337	1.872	2.414	1.132	7.938
4406	71	1	46.00	0.5	0.65	70	0.5	5.954	3.175	6.025	1.978	6.064	2.287	2.509	2.499	1.705	5.823
4407	71	1	46.25	0.75	0.65	70	0.75	5.528	3.361	5.543	2.308	4.784	3.289	2.836	3.103	2.089	4.676
4408	71	1	46.50	1	0.65	70	1	5.261	3.494	5.266	2.505	4.016	4.521	3.680	3.926	2.726	4.003
4409	71	1	46.75	1.25	0.65	70	1.25	5.171	3.691	5.135	2.586	3.406	5.834	4.504	4.781	3.336	3.422
4410	71	1	47.50	2	0.65	70	2	5.222	3.816	5.123	2.618	2.337	9.698	6.810	7.263	5.590	2.234
4411	71	1	48.00	2.5	0.65	70	2.5	5.255	3.788	5.121	2.534	1.897	12.148	8.163	8.730	6.706	1.780
4412	71	1	48.50	3	0.65	70	3	5.255	3.706	5.071	2.423	1.573	14.475	9.527	10.053	7.573	1.550
4413	71	1	49.50	4	0.65	70	4	5.154	3.469	4.855	1.832	1.142	18.766	11.579	12.354	8.728	1.196
4414	71	1	50.50	5	0.65	70	5	4.980	3.543	4.573	1.739	0.878	22.693	13.227	14.333	9.313	1.031
4415	71	1	51.50	6	0.65	70	6	4.780	3.391	4.296	1.678	0.705	26.333	14.613	16.076	9.063	0.874
4416	71	1	52.50	7	0.65	70	7	4.556	3.229	4.014	1.638	0.584	29.775	15.312	17.665	9.645	0.825
4417	71	1	53.00	7.5	0.65	70	7.5	4.451	3.131	3.888	1.620	0.538	31.424	15.848	18.408	9.907	0.822
4418	71	1	53.50	8	0.65	70	8	4.349	3.067	3.762	1.607	0.497	33.007	16.362	19.101	10.156	0.821
4419	71	1	54.50	9	0.65	70	9	4.137	2.906	3.519	1.581	0.431	36.048	17.319	20.408	10.642	0.820
4420	71	1	55.50	10	0.65	70	10	3.943	2.756	3.302	1.560	0.378	38.940	18.522	21.623	11.108	0.861
4421	81	1	52.10	0.1	0.65	80	0.1	3.284	1.420	3.353	1.047	10.096	1.977	1.034	1.730	0.609	9.962
4422	81	1	52.25	0.25	0.65	80	0.25	5.954	2.686	6.216	1.474	8.847	3.834	2.067	2.757	1.201	8.457
4423	81	1	52.50	0.5	0.65	80	0.5	6.724	3.447	6.694	2.092	6.439	4.099	2.762	2.800	1.804	6.165

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Model								Membrane Stress Factors									
	OD	T	od	t	d/D	D/T	t/T	Branch					Header				
								Axial	In-Plane	Out-of-Plane	Torsional	Pressure	Axial	In-Plane	Out-of-Plane	Torsional	Pressure
4424	81	1	52.75	0.75	0.65	80	0.75	6.184	3.651	6.142	2.431	5.014	3.496	3.095	3.400	2.169	4.927
4425	81	1	53.00	1	0.65	80	1	5.844	3.906	5.840	2.636	4.230	4.759	3.888	4.275	2.832	4.219
4426	81	1	53.25	1.25	0.65	80	1.25	5.717	4.001	5.720	2.727	3.593	6.120	4.769	5.193	3.464	3.601
4427	81	1	54.00	2	0.65	80	2	5.833	4.147	5.842	2.769	2.479	10.244	7.361	7.940	5.244	2.376
4428	81	1	54.50	2.5	0.65	80	2.5	5.936	4.140	5.926	2.693	2.016	12.874	8.912	9.579	7.046	1.880
4429	81	1	55.00	3	0.65	80	3	5.992	4.066	5.935	2.581	1.673	15.393	10.306	11.077	8.035	1.620
4430	81	1	56.00	4	0.65	80	4	5.961	3.834	5.786	1.924	1.212	20.088	12.657	13.731	9.405	1.214
4431	81	1	57.00	5	0.65	80	5	5.813	3.897	5.522	1.805	0.928	24.412	14.566	16.043	9.998	1.084
4432	81	1	58.00	6	0.65	80	6	5.611	3.747	5.224	1.733	0.742	28.471	16.447	18.116	9.760	0.844
4433	81	1	59.00	7	0.65	80	7	5.393	3.580	4.927	1.683	0.614	32.303	17.887	20.001	10.415	0.836
4434	81	1	59.50	7.5	0.65	80	7.5	5.277	3.478	4.782	1.665	0.564	34.134	18.548	20.875	10.708	0.833
4435	81	1	60.00	8	0.65	80	8	5.168	3.390	4.642	1.650	0.521	35.918	19.179	21.712	10.989	0.831
4436	81	1	61.00	9	0.65	80	9	4.950	3.244	4.370	1.624	0.451	39.381	20.359	23.310	11.522	0.831
4437	81	1	62.00	10	0.65	80	10	4.725	3.093	4.127	1.600	0.396	42.672	20.778	24.787	12.029	0.871
4438	91	1	58.60	0.1	0.65	90	0.1	3.650	1.483	3.667	1.054	10.738	2.219	1.109	1.942	0.639	10.583
4439	91	1	58.75	0.25	0.65	90	0.25	6.660	2.889	6.837	1.552	9.392	4.310	2.251	3.085	1.266	8.943
4440	91	1	59.00	0.5	0.65	90	0.5	7.507	3.709	7.354	2.198	6.784	4.698	3.007	4.216	1.895	6.483
4441	91	1	59.25	0.75	0.65	90	0.75	6.867	3.977	6.734	2.544	5.260	3.762	3.363	3.722	2.273	5.161
4442	91	1	59.50	1	0.65	90	1	6.469	4.189	6.417	2.756	4.402	5.026	4.069	4.633	2.945	4.403
4443	91	1	59.75	1.25	0.65	90	1.25	6.316	4.301	6.312	2.857	3.743	6.421	5.120	5.606	3.630	3.782
4444	91	1	60.50	2	0.65	90	2	6.513	4.556	6.576	2.912	2.611	10.765	7.775	8.591	5.449	2.511
4445	91	1	61.00	2.5	0.65	90	2.5	6.698	4.472	6.753	2.839	2.128	13.572	9.467	10.400	6.467	1.977
4446	91	1	61.50	3	0.65	90	3	6.818	4.408	6.834	2.727	1.768	16.250	11.006	12.053	8.427	1.686
4447	91	1	62.50	4	0.65	90	4	6.856	4.178	6.757	2.381	1.278	21.303	13.639	15.029	9.588	1.266
4448	91	1	63.50	5	0.65	90	5	6.721	4.270	6.505	1.875	0.976	26.018	16.051	17.679	10.680	1.143
4449	91	1	64.50	6	0.65	90	6	6.513	4.093	6.196	1.786	0.778	30.438	17.921	20.060	10.371	0.855
4450	91	1	65.50	7	0.65	90	7	6.280	3.905	5.878	1.729	0.641	34.653	19.555	22.249	11.110	0.846
4451	91	1	66.00	7.5	0.65	90	7.5	6.192	3.821	5.722	1.706	0.589	36.675	20.309	23.275	11.435	0.843
4452	91	1	66.50	8	0.65	90	8	6.043	3.743	5.575	1.688	0.543	38.648	21.026	24.255	11.747	0.842
4453	91	1	67.50	9	0.65	90	9	5.785	3.562	5.269	1.657	0.469	42.497	22.683	26.144	12.332	0.571
4454	91	1	68.50	10	0.65	90	10	5.578	3.427	4.990	1.638	0.412	46.142	23.949	27.871	12.878	0.573
4455	101	1	65.10	0.1	0.65	100	0.1	4.024	1.561	3.976	1.060	11.391	2.485	1.227	2.168	0.667	11.227
4456	101	1	65.25	0.25	0.65	100	0.25	7.365	3.086	7.451	1.626	9.906	4.815	2.443	3.446	1.333	9.427
4457	101	1	65.50	0.5	0.65	100	0.5	8.305	3.962	8.009	2.297	7.109	5.380	3.249	4.750	1.987	6.793
4458	101	1	65.75	0.75	0.65	100	0.75	7.582	4.235	7.328	2.651	5.491	4.059	3.628	4.038	2.377	5.383
4459	101	1	66.00	1	0.65	100	1	7.134	4.465	6.995	2.870	4.588	5.323	4.400	4.995	3.024	4.593
4460	101	1	66.25	1.25	0.65	100	1.25	6.965	4.595	6.909	2.979	3.905	6.766	5.362	6.038	3.732	3.952
4461	101	1	67.00	2	0.65	100	2	7.277	4.897	7.328	3.061	2.736	11.303	8.126	9.240	5.886	2.736

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Model								Membrane Stress Factors									
	OD	T	od	t	d/D	D/T	t/T	Branch					Header				
								Axial	In-Plane	Out-of-Plane	Torsional	Pressure	Axial	In-Plane	Out-of-Plane	Torsional	Pressure
4462	101	1	67.50	2.5	0.65	100	2.5	7.553	4.788	7.607	2.975	2.235	14.248	9.968	11.194	6.719	2.070
4463	101	1	68.00	3	0.65	100	3	7.734	4.737	7.759	2.861	1.858	17.084	11.642	13.004	8.265	1.751
4464	101	1	69.00	4	0.65	100	4	7.832	4.510	7.761	2.612	1.342	22.469	14.745	16.300	10.054	1.440
4465	101	1	70.00	5	0.65	100	5	7.708	4.600	7.530	1.945	1.021	27.505	17.204	19.244	9.901	1.190
4466	101	1	71.00	6	0.65	100	6	7.484	4.408	7.239	1.837	0.812	32.281	19.287	21.930	10.916	0.864
4467	101	1	72.00	7	0.65	100	7	7.296	4.241	6.868	1.769	0.668	36.822	21.116	24.411	11.738	0.856
4468	101	1	72.50	7.5	0.65	100	7.5	7.157	4.130	6.703	1.744	0.612	39.017	21.960	25.576	12.102	0.853
4469	101	1	73.00	8	0.65	100	8	6.999	4.073	6.541	1.724	0.564	41.175	23.075	26.719	12.445	0.560
4470	101	1	74.00	9	0.65	100	9	6.744	3.866	6.219	1.687	0.486	45.364	24.611	28.869	13.078	0.557
4471	101	1	75.00	10	0.65	100	10	6.457	3.732	5.910	1.664	0.426	49.373	26.030	30.873	13.668	0.557
4472	251	1	162.60	0.1	0.65	250	0.1	8.727	2.789	8.126	1.405	18.705	5.666	2.329	5.178	1.001	18.059
4473	251	1	162.75	0.25	0.65	250	0.25	16.560	5.671	15.631	2.493	15.538	11.212	4.677	9.633	2.073	14.714
4474	251	1	163.00	0.5	0.65	250	0.5	19.628	7.129	16.968	3.472	10.612	12.721	6.174	9.041	3.025	10.171
4475	251	1	163.25	0.75	0.65	250	0.75	19.133	7.523	15.745	3.874	8.005	12.333	6.716	10.317	3.563	7.849
4476	251	1	163.50	1	0.65	250	1	19.320	8.050	15.528	4.238	6.610	14.429	7.498	12.169	4.008	6.639
4477	251	1	163.75	1.25	0.65	250	1.25	20.102	8.494	16.019	4.488	5.662	16.746	8.110	14.219	4.694	5.777
4478	251	1	164.50	2	0.65	250	2	23.985	9.620	19.303	4.926	4.080	23.973	12.130	20.663	7.339	4.192
4479	251	1	165.00	2.5	0.65	250	2.5	26.075	9.957	21.313	4.952	3.404	28.097	15.150	24.429	8.988	3.473
4480	251	1	165.50	3	0.65	250	3	27.382	10.040	22.756	4.844	2.876	31.721	18.099	27.743	10.757	2.576
4481	251	1	166.50	4	0.65	250	4	29.158	9.787	24.222	4.459	2.109	38.481	24.094	33.548	13.380	1.957
4482	251	1	167.50	5	0.65	250	5	28.387	9.292	24.461	4.023	1.597	45.350	29.777	38.790	15.805	1.726
4483	251	1	168.50	6	0.65	250	6	27.098	8.742	24.064	3.598	1.249	52.390	34.833	44.569	17.667	1.496
4484	251	1	169.50	7	0.65	250	7	25.646	8.210	23.446	2.958	1.001	59.638	39.399	50.536	19.140	0.553
4485	251	1	170.00	7.5	0.65	250	7.5	24.940	8.031	23.076	2.931	0.904	63.323	41.519	53.551	19.801	0.541
4486	251	1	170.50	8	0.65	250	8	24.262	8.069	22.695	2.799	0.822	66.935	43.545	56.486	20.399	0.532
4487	251	1	171.50	9	0.65	250	9	22.977	7.698	21.885	2.137	0.689	74.195	47.367	62.357	21.454	0.516
4488	251	1	172.50	10	0.65	250	10	21.819	7.381	21.166	2.006	0.589	81.341	50.934	68.067	22.376	0.505
4489	501	1	325.10	0.1	0.65	500	0.1	13.371	4.432	14.246	1.869	26.641	9.416	3.598	9.466	1.434	25.788
4490	501	1	325.25	0.25	0.65	500	0.25	27.787	8.841	28.055	3.642	21.598	18.917	7.287	17.851	2.994	20.747
4491	501	1	325.50	0.5	0.65	500	0.5	33.997	11.365	30.651	4.986	14.455	20.815	9.550	17.318	4.322	13.990
4492	501	1	325.75	0.75	0.65	500	0.75	34.635	12.164	28.742	5.505	10.793	24.639	10.880	19.887	5.083	10.599
4493	501	1	326.00	1	0.65	500	1	36.491	12.820	28.818	5.981	8.843	29.268	12.213	23.568	5.735	8.888
4494	501	1	326.25	1.25	0.65	500	1.25	39.361	13.791	30.394	6.472	7.590	34.056	13.320	27.678	5.860	7.754
4495	501	1	327.00	2	0.65	500	2	49.726	16.350	38.574	7.456	5.550	47.551	14.634	40.123	7.332	5.755
4496	501	1	327.50	2.5	0.65	500	2.5	55.196	17.248	43.657	7.737	4.681	54.318	16.324	47.250	10.973	4.838
4497	501	1	328.00	3	0.65	500	3	58.951	17.647	47.578	7.747	3.993	59.522	18.193	53.233	12.988	4.096
4498	501	1	329.00	4	0.65	500	4	64.062	17.636	53.349	7.353	2.981	67.109	23.635	62.810	17.176	2.740
4499	501	1	330.00	5	0.65	500	5	63.533	16.628	54.520	6.732	2.292	73.559	29.643	70.957	19.871	2.104

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Model								Membrane Stress Factors									
	OD	T	od	t	d/D	D/T	t/T	Branch					Header				
								Axial	In-Plane	Out-of-Plane	Torsional	Pressure	Axial	In-Plane	Out-of-Plane	Torsional	Pressure
4500	501	1	331.00	6	0.65	500	6	61.342	15.669	54.170	6.080	1.808	80.718	47.677	78.795	23.121	1.957
4501	501	1	332.00	7	0.65	500	7	58.442	14.702	53.074	5.455	1.458	88.707	54.987	86.880	25.906	1.843
4502	501	1	332.50	7.5	0.65	500	7.5	56.892	14.181	52.372	5.169	1.319	93.099	58.451	91.027	27.138	1.803
4503	501	1	333.00	8	0.65	500	8	55.329	13.789	51.682	4.905	1.197	97.634	61.807	95.240	28.275	1.690
4504	501	1	334.00	9	0.65	500	9	52.269	12.963	50.210	4.437	0.999	106.763	68.130	104.913	30.281	0.566
4505	501	1	335.00	10	0.65	500	10	49.364	12.251	48.656	4.022	0.836	116.768	74.105	115.664	32.007	0.545
4507	751	1	487.75	0.25	0.65	750	0.25	37.429	11.689	40.265	4.645	26.257	24.989	9.273	25.207	3.743	25.481
4508	751	1	488.00	0.5	0.65	750	0.5	46.148	14.927	44.467	6.252	17.437	28.303	12.441	24.220	5.382	16.975
4509	751	1	488.25	0.75	0.65	750	0.75	47.376	15.970	42.059	6.518	12.828	34.191	14.276	28.102	6.296	12.727
4510	751	1	488.50	1	0.65	750	1	50.398	16.733	42.581	7.051	10.566	41.001	15.939	33.433	6.558	10.617
4511	751	1	488.75	1.25	0.65	750	1.25	54.910	18.175	45.345	7.535	9.074	48.054	15.477	39.447	7.290	9.259
4512	751	1	489.50	2	0.65	750	2	70.771	22.053	58.537	9.589	6.675	67.736	19.189	57.920	8.985	6.940
4513	751	1	490.00	2.5	0.65	750	2.5	79.427	23.495	66.811	10.121	5.652	77.744	21.135	68.317	9.653	5.872
4514	751	1	490.50	3	0.65	750	3	89.106	24.233	73.351	10.255	4.840	85.231	22.716	76.819	10.768	5.003
4515	751	1	491.50	4	0.65	750	4	94.845	24.175	83.843	9.946	3.640	95.131	27.016	89.746	13.264	3.704
4516	751	1	492.50	5	0.65	750	5	95.472	23.286	86.544	9.259	2.819	102.130	32.897	99.703	16.099	2.356
4517	751	1	493.50	6	0.65	750	6	93.320	22.149	86.600	8.464	2.239	109.082	39.167	109.167	19.051	2.118
4518	751	1	494.50	7	0.65	750	7	89.806	20.698	85.315	7.663	1.817	117.161	45.721	119.217	21.987	2.052
4519	751	1	495.00	7.5	0.65	750	7.5	87.796	20.049	84.373	7.290	1.648	121.695	49.045	124.710	23.399	2.006
4520	751	1	495.50	8	0.65	750	8	85.692	19.492	83.301	6.917	1.500	126.548	52.297	130.748	24.782	1.872
4521	751	1	496.50	9	0.65	750	9	81.410	18.232	80.980	6.251	1.257	137.038	58.695	143.472	27.382	1.801
4522	751	1	497.50	10	0.65	750	10	77.214	17.189	78.549	5.656	1.067	148.424	64.942	157.074	29.789	0.562
4524	1001	1	650.25	0.25	0.65	1000	0.25	46.157	14.219	51.904	5.536	31.014	30.115	10.944	31.685	4.392	29.519
4525	1001	1	650.50	0.5	0.65	1000	0.5	57.220	18.098	57.989	7.068	19.956	34.845	14.933	31.556	6.287	19.520
4526	1001	1	650.75	0.75	0.65	1000	0.75	58.953	17.398	55.308	7.743	14.626	42.598	16.976	37.089	6.732	14.533
4527	1001	1	651.00	1	0.65	1000	1	62.915	18.596	56.399	8.354	12.013	51.420	16.628	44.433	7.571	12.065
4528	1001	1	651.25	1.25	0.65	1000	1.25	68.817	19.960	60.367	8.970	10.322	60.534	18.541	52.570	8.430	10.528
4529	1001	1	652.00	2	0.65	1000	2	89.608	27.063	78.528	11.436	7.623	86.053	23.440	77.168	10.550	7.920
4530	1001	1	652.50	2.5	0.65	1000	2.5	101.257	29.012	90.006	12.216	6.471	99.175	25.678	90.955	11.098	6.728
4531	1001	1	653.00	3	0.65	1000	3	114.463	30.082	99.207	12.479	5.554	109.139	27.319	102.156	12.098	5.754
4532	1001	1	654.00	4	0.65	1000	4	123.228	30.459	114.409	12.279	4.193	122.116	30.298	118.660	14.313	4.290
4533	1001	1	655.00	5	0.65	1000	5	125.321	29.320	118.825	11.575	3.260	130.331	35.822	130.707	16.924	3.173
4534	1001	1	656.00	6	0.65	1000	6	123.591	28.115	119.580	10.698	2.600	137.428	42.893	141.369	19.827	2.304
4535	1001	1	657.00	7	0.65	1000	7	119.819	26.311	118.252	9.781	2.119	145.459	49.751	152.592	23.218	2.182
4536	1001	1	657.50	7.5	0.65	1000	7.5	117.511	25.704	117.191	9.331	1.926	150.017	53.246	159.015	24.731	2.134
4537	1001	1	658.00	8	0.65	1000	8	115.047	24.904	115.785	8.891	1.757	154.975	56.770	165.603	25.818	2.090
4538	1001	1	659.00	9	0.65	1000	9	109.875	23.228	112.716	8.069	1.478	166.108	63.778	180.003	29.092	2.008
4539	1001	1	660.00	10	0.65	1000	10	104.629	21.988	109.551	7.309	1.259	178.596	70.660	196.012	31.808	1.794



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Model								Membrane Stress Factors									
	OD	T	od	t	d/D	D/T	t/T	Branch					Header				
								Axial	In-Plane	Out-of-Plane	Torsional	Pressure	Axial	In-Plane	Out-of-Plane	Torsional	Pressure
4541	1251	1	812.75	0.25	0.65	1250	0.25	54.040	16.531	62.926	6.331	34.752	34.602	12.559	37.646	4.977	33.126
4542	1251	1	813.00	0.5	0.65	1250	0.5	67.433	20.979	71.006	8.153	22.165	40.662	17.137	38.366	7.097	21.778
4543	1251	1	813.25	0.75	0.65	1250	0.75	69.536	20.399	68.138	8.890	16.219	50.205	19.559	45.752	7.567	16.141
4544	1251	1	813.50	1	0.65	1250	1	74.313	21.784	69.704	9.596	13.303	60.872	19.389	55.022	8.641	13.366
4545	1251	1	813.75	1.25	0.65	1250	1.25	81.478	23.422	74.845	10.300	11.427	71.946	21.698	65.258	9.628	11.649
4546	1251	1	814.50	2	0.65	1250	2	106.755	31.575	97.809	12.188	8.462	102.876	27.461	95.838	12.053	8.792
4547	1251	1	815.00	2.5	0.65	1250	2.5	121.163	33.983	112.362	14.100	7.195	119.031	30.009	112.951	12.621	7.486
4548	1251	1	815.50	3	0.65	1250	3	137.748	35.373	124.218	14.487	6.185	131.399	31.769	126.853	13.469	6.419
4549	1251	1	816.50	4	0.65	1250	4	149.489	36.062	144.142	14.400	4.681	147.674	33.569	147.054	15.393	4.808
4550	1251	1	817.50	5	0.65	1250	5	153.169	35.195	150.402	13.712	3.649	157.481	39.713	161.097	17.720	3.699
4551	1251	1	818.50	6	0.65	1250	6	152.040	33.314	152.116	12.781	2.918	165.179	45.765	173.718	21.096	2.442
4552	1251	1	819.50	7	0.65	1250	7	148.291	31.529	150.753	11.779	2.384	173.112	52.484	185.924	24.088	2.306
4553	1251	1	820.00	7.5	0.65	1250	7.5	145.786	30.919	149.465	11.279	2.170	177.726	56.007	192.664	25.633	2.253
4554	1251	1	820.50	8	0.65	1250	8	143.067	29.996	148.086	10.785	1.983	182.705	59.601	200.071	27.156	2.207
4555	1251	1	821.50	9	0.65	1250	9	137.251	28.215	144.548	9.844	1.673	193.963	66.879	215.593	30.190	2.131
4556	1251	1	822.50	10	0.65	1250	10	131.139	26.546	140.430	8.968	1.430	207.102	74.129	232.890	33.104	2.068
4558	1501	1	975.25	0.25	0.65	1500	0.25	61.135	18.640	73.215	6.722	38.181	38.431	14.005	42.881	5.506	36.387
4559	1501	1	975.50	0.5	0.65	1500	0.5	76.767	21.813	83.416	9.162	24.163	45.897	19.119	44.812	7.817	23.838
4560	1501	1	975.75	0.75	0.65	1500	0.75	79.263	23.215	80.389	9.971	17.664	57.086	19.302	53.932	8.437	17.610
4561	1501	1	976.00	1	0.65	1500	1	84.686	24.772	82.340	10.748	14.385	69.513	21.996	65.142	9.642	14.550
4562	1501	1	976.25	1.25	0.65	1500	1.25	92.989	26.648	88.592	11.570	12.435	82.359	24.638	77.364	10.773	12.686
4563	1501	1	977.00	2	0.65	1500	2	122.340	35.706	116.142	13.762	9.221	118.337	31.294	113.774	13.500	9.590
4564	1501	1	977.50	2.5	0.65	1500	2.5	139.329	38.535	133.676	15.824	7.851	137.335	34.169	133.991	14.103	8.171
4565	1501	1	978.00	3	0.65	1500	3	159.138	40.227	155.516	16.321	6.755	152.110	36.060	150.563	14.858	7.018
4566	1501	1	979.00	4	0.65	1500	4	173.732	41.221	172.708	16.350	5.123	171.749	36.871	175.093	16.538	5.274
4567	1501	1	980.00	5	0.65	1500	5	179.067	40.415	180.931	15.683	4.000	183.473	42.923	192.255	19.400	4.070
4568	1501	1	981.00	6	0.65	1500	6	178.703	38.772	183.350	14.721	3.204	191.993	48.549	206.037	21.980	2.572
4569	1501	1	982.00	7	0.65	1500	7	175.061	36.822	182.376	13.659	2.623	200.265	54.996	219.410	24.873	2.403
4570	1501	1	982.50	7.5	0.65	1500	7.5	172.505	35.803	181.087	13.118	2.390	204.831	58.473	226.494	26.393	2.346
4571	1501	1	983.00	8	0.65	1500	8	169.639	34.803	179.890	12.586	2.186	209.816	62.041	234.544	27.940	2.293
4572	1501	1	984.00	9	0.65	1500	9	163.296	32.458	175.384	11.545	1.849	221.410	69.350	250.628	31.022	2.209
4573	1501	1	985.00	10	0.65	1500	10	156.551	30.914	170.995	10.568	1.583	235.063	76.879	269.742	34.060	2.141
4576	1751	1	1138.00	0.5	0.65	1750	0.5	85.450	24.362	95.387	10.129	25.990	50.615	20.944	50.828	8.452	25.743
4577	1751	1	1138.25	0.75	0.65	1750	0.75	88.179	25.876	92.098	11.010	18.992	63.342	21.413	61.618	9.261	18.961
4578	1751	1	1138.50	1	0.65	1750	1	94.252	27.614	94.536	11.844	15.453	77.340	24.479	74.687	10.592	15.632
4579	1751	1	1138.75	1.25	0.65	1750	1.25	103.460	29.712	101.703	12.760	13.360	91.840	27.455	88.844	11.861	13.631
4580	1751	1	1139.50	2	0.65	1750	2	136.559	39.523	133.616	15.244	9.919	132.576	34.957	130.818	14.887	10.298
4581	1751	1	1140.00	2.5	0.65	1750	2.5	155.963	42.751	153.991	17.411	8.454	154.308	38.171	154.283	15.504	8.808

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Model								Membrane Stress Factors									
	OD	T	od	t	d/D	D/T	t/T	Branch					Header				
								Axial	In-Plane	Out-of-Plane	Torsional	Pressure	Axial	In-Plane	Out-of-Plane	Torsional	Pressure
4582	1751	1	1140.50	3	0.65	1750	3	178.914	44.736	179.736	18.016	7.281	171.450	40.237	173.801	16.253	7.574
4583	1751	1	1141.50	4	0.65	1750	4	196.266	46.015	200.192	18.159	5.530	194.532	42.029	203.097	18.603	5.706
4584	1751	1	1142.50	5	0.65	1750	5	203.182	45.268	210.357	17.521	4.323	208.326	46.296	223.024	20.546	4.413
4585	1751	1	1143.50	6	0.65	1750	6	203.636	43.591	213.608	16.540	3.467	217.996	51.417	238.335	22.924	2.702
4586	1751	1	1144.50	7	0.65	1750	7	200.303	41.509	213.208	15.431	2.843	226.861	57.542	253.059	25.684	2.505
4587	1751	1	1145.00	7.5	0.65	1750	7.5	197.668	40.421	211.843	14.861	2.592	231.277	60.770	260.221	27.117	2.428
4588	1751	1	1145.50	8	0.65	1750	8	194.714	39.320	210.159	14.294	2.373	236.257	64.262	267.968	28.635	2.368
4589	1751	1	1146.50	9	0.65	1750	9	187.993	37.152	205.622	13.183	2.010	247.989	71.583	285.194	49.350	2.271
4590	1751	1	1147.50	10	0.65	1750	10	180.777	35.076	200.927	12.120	1.725	261.752	79.104	305.355	53.919	2.198
4593	2001	1	1300.50	0.5	0.65	2000	0.5	93.550	26.797	106.972	11.051	27.685	54.918	22.631	56.544	8.561	27.527
4594	2001	1	1300.75	0.75	0.65	2000	0.75	96.518	28.425	103.466	11.990	20.219	69.040	23.437	68.941	10.046	20.215
4595	2001	1	1301.00	1	0.65	2000	1	103.056	30.324	106.107	12.893	16.449	84.568	26.831	83.705	11.503	16.645
4596	2001	1	1301.25	1.25	0.65	2000	1.25	113.122	32.632	114.262	13.892	14.224	100.585	30.148	99.760	12.893	14.504
4597	2001	1	1302.00	2	0.65	2000	2	149.748	43.088	150.259	16.642	10.569	145.877	38.490	147.073	16.221	10.982
4598	2001	1	1302.50	2.5	0.65	2000	2.5	171.372	46.690	173.389	18.882	9.017	170.223	42.044	173.821	16.898	9.392
4599	2001	1	1303.00	3	0.65	2000	3	197.256	48.935	203.115	19.596	7.772	189.546	44.279	196.893	17.649	8.086
4600	2001	1	1304.00	4	0.65	2000	4	217.160	50.495	226.633	19.848	5.909	215.978	45.674	230.460	19.938	6.104
4601	2001	1	1305.00	5	0.65	2000	5	225.682	49.835	238.882	19.241	4.624	231.989	49.617	253.473	21.702	4.730
4602	2001	1	1306.00	6	0.65	2000	6	226.985	48.099	243.279	18.249	3.712	242.923	54.265	270.684	23.874	3.715
4603	2001	1	1307.00	7	0.65	2000	7	223.924	45.927	242.791	17.100	3.046	252.436	59.971	286.081	26.451	2.596
4604	2001	1	1307.50	7.5	0.65	2000	7.5	221.474	44.771	241.801	16.511	2.779	257.313	63.155	294.112	43.331	2.512
4605	2001	1	1308.00	8	0.65	2000	8	218.480	43.603	240.020	15.915	2.546	262.599	66.517	302.430	46.098	2.442
4606	2001	1	1309.00	9	0.65	2000	9	211.514	41.286	235.581	14.746	2.160	274.420	73.743	320.702	51.383	2.332
4610	2251	1	1463.00	0.5	0.65	2250	0.5	101.063	29.104	117.954	11.922	29.267	58.869	24.189	62.036	9.187	29.209
4611	2251	1	1463.25	0.75	0.65	2250	0.75	104.256	30.847	114.316	12.922	21.370	74.347	25.350	76.062	10.792	21.425
4612	2251	1	1463.50	1	0.65	2250	1	111.195	32.914	117.359	13.889	17.384	91.263	29.091	92.644	12.384	17.619
4613	2251	1	1463.75	1.25	0.65	2250	1.25	122.054	35.420	126.330	14.968	15.040	108.717	32.772	110.477	13.943	15.352
4614	2251	1	1464.50	2	0.65	2250	2	161.737	46.414	166.279	17.990	11.183	158.155	42.005	163.077	17.526	11.637
4615	2251	1	1465.00	2.5	0.65	2250	2.5	185.569	50.396	192.142	20.272	9.546	185.054	45.796	193.439	18.530	9.940
4616	2251	1	1465.50	3	0.65	2250	3	214.212	52.878	225.522	21.076	8.232	206.393	48.217	219.276	19.661	8.578
4617	2251	1	1466.50	4	0.65	2250	4	236.659	54.729	252.055	21.430	6.264	236.340	49.385	257.295	21.304	6.485
4618	2251	1	1467.50	5	0.65	2250	5	246.909	54.146	266.242	20.866	4.906	254.859	52.997	283.372	22.921	5.033
4619	2251	1	1468.50	6	0.65	2250	6	249.005	52.376	272.077	19.857	3.942	267.256	57.370	303.121	24.898	4.004
4627	2501	1	1625.50	0.5	0.65	2500	0.5	108.108	31.309	128.610	12.752	30.771	62.517	25.645	67.364	9.782	30.807
4628	2501	1	1625.75	0.75	0.65	2500	0.75	111.462	33.165	124.804	13.811	22.451	79.289	27.178	82.971	11.506	22.570
4629	2501	1	1626.00	1	0.65	2500	1	118.791	35.355	128.140	14.843	18.269	97.429	31.208	101.217	13.209	18.549
4630	2501	1	1626.25	1.25	0.65	2500	1.25	130.417	38.094	137.995	15.990	15.813	116.369	35.207	120.841	14.856	16.158
4631	2501	1	1627.00	2	0.65	2500	2	173.004	49.555	181.640	19.273	11.763	169.772	45.161	178.610	18.778	12.255

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Model								Membrane Stress Factors									
	OD	T	od	t	d/D	D/T	t/T	Branch					Header				
								Axial	In-Plane	Out-of-Plane	Torsional	Pressure	Axial	In-Plane	Out-of-Plane	Torsional	Pressure
4632	2501	1	1627.50	2.5	0.65	2500	2.5	198.908	53.888	210.836	21.580	10.048	199.158	49.447	213.206	19.841	10.480
4633	2501	1	1628.00	3	0.65	2500	3	230.352	56.599	247.344	22.474	8.668	222.616	52.065	241.380	21.030	9.048
4634	2501	1	1629.00	4	0.65	2500	4	255.249	58.719	277.093	22.934	6.602	256.018	53.017	284.117	22.669	6.850
4642	9	1	5.70	0.1	0.7	8	0.1	1.018	1.020	0.997	1.104	5.853	0.384	0.240	0.155	0.163	3.358
4643	9	1	5.85	0.25	0.7	8	0.25	1.147	0.956	1.082	1.174	2.496	0.977	0.468	0.292	0.339	2.828
4644	9	1	6.10	0.5	0.7	8	0.5	1.381	0.919	1.103	0.866	1.759	1.998	0.605	0.657	0.572	2.160
4645	9	1	6.35	0.75	0.7	8	0.75	1.552	0.888	1.048	0.844	1.499	2.999	0.908	0.873	0.714	1.723
4646	9	1	6.60	1	0.7	8	1	1.665	0.885	0.974	0.869	1.320	4.001	0.946	1.058	0.917	1.431
4647	9	1	6.85	1.25	0.7	8	1.25	1.744	0.806	0.892	0.853	1.111	5.006	0.787	1.189	1.050	1.159
4648	9	1	7.60	2	0.7	8	2	1.833	0.752	0.740	0.862	0.752	8.007	1.572	1.512	1.390	1.100
4649	9	1	8.10	2.5	0.7	8	2.5	1.847	0.704	0.696	0.866	0.606	10.005	1.717	1.689	1.589	1.189
4650	9	1	8.60	3	0.7	8	3	1.836	0.668	0.668	0.882	0.506	12.001	1.658	1.816	1.743	1.271
4659	17	1	11.30	0.1	0.7	16	0.1	1.171	0.968	1.257	0.911	6.150	0.523	0.374	0.294	0.266	4.774
4660	17	1	11.45	0.25	0.7	16	0.25	1.534	1.011	1.818	1.082	3.670	0.833	0.548	0.674	0.586	4.130
4661	17	1	11.70	0.5	0.7	16	0.5	1.871	1.258	1.938	1.023	2.993	1.682	0.988	0.987	0.908	3.206
4662	17	1	11.95	0.75	0.7	16	0.75	2.055	1.223	1.827	1.181	2.489	2.575	1.353	1.348	1.277	2.608
4663	17	1	12.20	1	0.7	16	1	2.189	1.492	1.705	1.295	2.151	3.517	1.861	1.664	1.561	2.189
4664	17	1	12.45	1.25	0.7	16	1.25	2.256	1.383	1.603	1.308	1.811	4.503	2.172	2.039	1.796	1.733
4665	17	1	13.20	2	0.7	16	2	2.343	1.317	1.243	1.167	1.218	7.668	2.878	2.548	2.366	1.158
4666	17	1	13.70	2.5	0.7	16	2.5	2.341	1.251	1.056	1.209	0.989	9.587	3.190	2.871	2.608	1.004
4667	17	1	14.20	3	0.7	16	3	2.350	1.205	0.910	1.194	0.826	11.499	2.864	3.158	2.793	1.047
4668	17	1	15.20	4	0.7	16	4	2.290	1.127	0.766	1.178	0.605	15.313	3.258	3.662	3.114	1.137
4669	17	1	16.20	5	0.7	16	5	2.205	1.101	0.699	1.189	0.472	19.131	3.562	4.103	3.483	1.226
4676	25	1	16.90	0.1	0.7	24	0.1	1.299	0.953	1.542	0.955	6.267	0.622	0.493	0.518	0.378	5.803
4677	25	1	17.05	0.25	0.7	24	0.25	2.105	1.206	2.465	1.062	4.733	1.031	0.715	1.033	0.786	5.040
4678	25	1	17.30	0.5	0.7	24	0.5	2.415	1.425	2.694	1.301	3.831	1.466	1.243	1.278	1.204	3.886
4679	25	1	17.55	0.75	0.7	24	0.75	2.568	1.873	2.550	1.570	3.138	2.428	1.886	1.749	1.595	3.169
4680	25	1	17.80	1	0.7	24	1	2.706	1.931	2.403	1.718	2.684	3.289	2.403	2.277	2.012	2.685
4681	25	1	18.05	1.25	0.7	24	1.25	2.779	1.897	2.260	1.740	2.260	4.134	2.883	2.611	2.640	2.195
4682	25	1	18.80	2	0.7	24	2	2.744	1.842	1.882	1.648	1.517	6.365	3.975	3.571	3.521	1.400
4683	25	1	19.30	2.5	0.7	24	2.5	2.647	1.830	1.659	1.466	1.229	7.664	4.490	4.063	3.816	1.211
4684	25	1	19.80	3	0.7	24	3	2.542	1.725	1.471	1.440	1.025	10.528	4.080	4.500	4.023	1.052
4685	25	1	20.80	4	0.7	24	4	2.351	1.673	1.188	1.395	0.756	11.139	4.878	5.274	4.287	1.016
4686	25	1	21.80	5	0.7	24	5	2.436	1.565	0.998	1.360	0.585	18.454	5.160	5.912	4.557	1.072
4687	25	1	22.80	6	0.7	24	6	2.321	1.471	0.953	1.333	0.475	22.154	5.649	6.539	4.885	1.130
4688	25	1	23.80	7	0.7	24	7	2.213	1.393	0.833	1.337	0.398	25.869	6.112	7.058	5.226	1.186
4689	25	1	24.30	7.5	0.7	24	7.5	2.167	1.359	0.782	1.366	0.367	27.734	6.336	7.302	5.448	1.214
4690	25	1	24.80	8	0.7	24	8	2.112	1.323	0.735	1.358	0.341	29.604	6.560	7.534	5.674	0.820

STP-PT-074: Local Stress in Nozzles, Shells and Formed Heads from External Heads

Model								Membrane Stress Factors									
	OD	T	od	t	d/D	D/T	t/T	Branch					Header				
								Axial	In-Plane	Out-of-Plane	Torsional	Pressure	Axial	In-Plane	Out-of-Plane	Torsional	Pressure
4693	33	1	22.50	0.1	0.7	32	0.1	1.513	1.012	1.820	0.996	6.931	0.731	0.597	0.701	0.448	6.662
4694	33	1	22.65	0.25	0.7	32	0.25	2.648	1.364	3.074	1.099	5.681	1.232	0.941	1.386	0.924	5.772
4695	33	1	22.90	0.5	0.7	32	0.5	2.973	2.053	3.381	1.550	4.470	1.650	1.447	1.539	1.426	4.429
4696	33	1	23.15	0.75	0.7	32	0.75	3.064	2.198	3.197	1.868	3.614	2.654	2.166	2.103	1.697	3.602
4697	33	1	23.40	1	0.7	32	1	3.173	2.277	3.033	2.044	3.070	3.646	2.808	2.656	2.125	3.064
4698	33	1	23.65	1.25	0.7	32	1.25	3.246	2.471	2.886	2.083	2.586	4.628	3.409	3.186	3.084	2.552
4699	33	1	24.40	2	0.7	32	2	3.206	2.438	2.515	1.981	1.736	7.258	4.873	4.499	4.376	1.611
4700	33	1	24.90	2.5	0.7	32	2.5	3.091	2.329	2.281	1.866	1.405	8.795	5.600	5.173	4.837	1.372
4701	33	1	25.40	3	0.7	32	3	2.973	2.210	2.082	1.616	1.169	10.211	5.342	5.771	5.110	1.223
4702	33	1	26.40	4	0.7	32	4	2.749	1.986	1.751	1.557	0.861	12.753	6.159	6.770	5.480	0.880
4703	33	1	27.40	5	0.7	32	5	2.560	1.990	1.504	1.508	0.671	15.243	7.084	7.668	5.732	0.829
4704	33	1	28.40	6	0.7	32	6	2.403	1.885	1.322	1.483	0.540	17.564	7.739	8.571	5.983	0.812
4705	33	1	29.40	7	0.7	32	7	2.269	1.777	1.165	1.440	0.451	19.604	8.328	9.273	6.320	0.852
4706	33	1	29.90	7.5	0.7	32	7.5	2.472	1.723	1.095	1.424	0.416	20.588	8.608	9.614	6.503	0.848
4707	33	1	30.40	8	0.7	32	8	2.410	1.678	1.137	1.417	0.386	21.529	8.886	9.933	6.685	0.844
4708	33	1	31.40	9	0.7	32	9	2.309	1.593	1.012	1.432	0.336	23.317	9.418	10.529	7.047	0.834
4709	33	1	32.40	10	0.7	32	10	2.219	1.523	0.915	1.447	0.296	24.992	9.931	11.087	7.447	0.822
4710	41	1	28.10	0.1	0.7	40	0.1	1.739	1.065	2.089	1.022	7.472	0.925	0.690	0.901	0.508	7.433
4711	41	1	28.25	0.25	0.7	40	0.25	3.191	1.504	3.646	1.159	6.441	1.557	1.118	1.524	1.037	6.430
4712	41	1	28.50	0.5	0.7	40	0.5	3.523	2.323	4.015	1.750	4.981	1.814	1.779	1.794	1.582	4.846
4713	41	1	28.75	0.75	0.7	40	0.75	3.531	2.480	3.782	2.100	3.984	2.835	2.440	2.387	2.111	3.930
4714	41	1	29.00	1	0.7	40	1	3.597	2.574	3.604	2.299	3.370	3.913	3.151	3.039	2.712	3.352
4715	41	1	29.25	1.25	0.7	40	1.25	3.664	2.833	3.460	2.352	2.849	5.023	3.829	3.674	3.390	2.827
4716	41	1	30.00	2	0.7	40	2	3.627	2.878	3.128	2.260	1.918	8.009	5.661	5.325	5.029	1.813
4717	41	1	30.50	2.5	0.7	40	2.5	3.517	2.775	2.910	2.130	1.551	9.781	6.612	6.207	5.680	1.431
4718	41	1	31.00	3	0.7	40	3	3.395	2.649	2.708	2.001	1.289	11.391	6.642	6.941	6.089	1.255
4719	41	1	32.00	4	0.7	40	4	3.160	2.401	2.357	1.683	0.945	14.335	7.711	8.225	6.542	0.940
4720	41	1	33.00	5	0.7	40	5	2.949	2.396	2.082	1.624	0.735	17.031	8.846	9.329	6.876	0.859
4721	41	1	34.00	6	0.7	40	6	2.769	2.283	1.852	1.592	0.595	19.673	9.660	10.318	7.145	0.849
4722	41	1	35.00	7	0.7	40	7	2.617	2.161	1.678	1.558	0.493	22.179	10.272	11.379	7.424	0.844
4723	41	1	35.50	7.5	0.7	40	7.5	2.541	2.104	1.588	1.533	0.455	23.408	10.630	11.691	7.559	0.839
4724	41	1	36.00	8	0.7	40	8	2.706	2.028	1.510	1.519	0.421	24.640	10.977	12.354	7.737	0.835
4725	41	1	37.00	9	0.7	40	9	2.602	1.939	1.355	1.490	0.366	26.787	11.628	13.144	7.973	0.825
4726	41	1	38.00	10	0.7	40	10	2.478	1.840	1.316	1.482	0.323	28.813	12.240	13.882	8.516	0.813
4727	51	1	35.10	0.1	0.7	50	0.1	2.154	1.169	2.425	1.048	8.247	1.155	0.735	1.128	0.568	8.309
4728	51	1	35.25	0.25	0.7	50	0.25	3.893	1.887	4.338	1.307	7.299	2.257	1.553	1.882	1.153	7.153
4729	51	1	35.50	0.5	0.7	50	0.5	4.215	2.640	4.762	1.958	5.533	2.077	2.070	2.091	1.751	5.325
4730	51	1	35.75	0.75	0.7	50	0.75	4.103	2.814	4.465	2.326	4.383	3.027	2.685	2.719	2.283	4.300

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Model								Membrane Stress Factors									
	OD	T	od	t	d/D	D/T	t/T	Branch					Header				
								Axial	In-Plane	Out-of-Plane	Torsional	Pressure	Axial	In-Plane	Out-of-Plane	Torsional	Pressure
4731	51	1	36.00	1	0.7	50	1	4.065	2.925	4.261	2.544	3.692	4.212	3.469	3.468	2.971	3.676
4732	51	1	36.25	1.25	0.7	50	1.25	4.138	3.223	4.126	2.614	3.119	5.414	4.259	4.201	3.664	3.111
4733	51	1	37.00	2	0.7	50	2	4.115	3.353	3.875	2.581	2.111	8.761	6.341	6.206	5.645	1.997
4734	51	1	37.50	2.5	0.7	50	2.5	4.025	3.266	3.699	2.415	1.707	10.771	6.906	7.336	6.506	1.605
4735	51	1	38.00	3	0.7	50	3	3.931	3.147	3.520	2.268	1.419	12.704	8.193	8.323	7.099	1.368
4736	51	1	39.00	4	0.7	50	4	3.710	2.880	3.178	1.816	1.036	16.122	9.394	9.969	7.759	1.016
4737	51	1	40.00	5	0.7	50	5	3.489	2.838	2.868	1.745	0.803	19.193	10.544	11.356	8.156	0.932
4738	51	1	41.00	6	0.7	50	6	3.300	2.689	2.608	1.695	0.649	22.120	11.557	12.629	8.494	0.881
4739	51	1	42.00	7	0.7	50	7	3.119	2.587	2.399	1.659	0.540	24.861	12.749	13.804	8.774	0.882
4740	51	1	42.50	7.5	0.7	50	7.5	3.034	2.520	2.306	1.642	0.497	26.377	13.193	14.334	8.926	0.881
4741	51	1	43.00	8	0.7	50	8	2.945	2.470	2.207	1.625	0.461	27.737	13.626	14.997	9.082	0.881
4742	51	1	44.00	9	0.7	50	9	2.816	2.331	2.015	1.583	0.397	30.429	14.462	16.119	9.426	0.879
4743	51	1	45.00	10	0.7	50	10	2.848	2.208	1.921	1.562	0.350	33.078	15.478	17.231	9.797	0.881
4744	61	1	42.10	0.1	0.7	60	0.1	2.493	1.239	2.768	1.072	9.355	1.313	0.830	1.249	0.626	9.157
4745	61	1	42.25	0.25	0.7	60	0.25	4.310	2.097	5.016	1.443	8.063	2.524	1.775	2.263	1.260	7.829
4746	61	1	42.50	0.5	0.7	60	0.5	4.918	2.940	5.484	2.128	5.973	2.394	2.358	2.389	1.904	5.769
4747	61	1	42.75	0.75	0.7	60	0.75	4.675	3.129	5.111	2.519	4.693	3.197	2.850	3.027	2.393	4.628
4748	61	1	43.00	1	0.7	60	1	4.555	3.503	4.882	2.744	3.969	4.453	3.781	3.848	3.154	3.954
4749	61	1	43.25	1.25	0.7	60	1.25	4.596	3.581	4.755	2.828	3.335	5.744	4.495	4.679	3.856	3.365
4750	61	1	44.00	2	0.7	60	2	4.594	3.776	4.606	2.830	2.271	9.419	6.981	7.013	6.105	2.178
4751	61	1	44.50	2.5	0.7	60	2.5	4.549	3.711	4.497	2.660	1.852	11.682	8.220	8.346	7.158	1.730
4752	61	1	45.00	3	0.7	60	3	4.479	3.594	4.358	2.506	1.526	13.799	8.678	9.530	7.914	1.480
4753	61	1	46.00	4	0.7	60	4	4.309	3.318	4.049	1.924	1.115	17.621	10.276	11.527	8.812	1.094
4754	61	1	47.00	5	0.7	60	5	4.108	3.221	3.726	1.835	0.862	21.271	12.649	13.326	9.277	0.997
4755	61	1	48.00	6	0.7	60	6	3.909	3.151	3.437	1.780	0.694	24.607	13.606	14.911	9.715	0.868
4756	61	1	49.00	7	0.7	60	7	3.702	2.988	3.172	1.734	0.577	27.768	14.727	16.361	10.021	0.861
4757	61	1	49.50	7.5	0.7	60	7.5	3.616	2.909	3.075	1.718	0.531	29.290	14.703	16.983	10.199	0.858
4758	61	1	50.00	8	0.7	60	8	3.524	2.840	2.962	1.694	0.491	30.647	15.210	17.629	10.372	0.855
4759	61	1	51.00	9	0.7	60	9	3.362	2.704	2.761	1.663	0.426	33.513	16.502	18.876	10.484	0.863
4760	61	1	52.00	10	0.7	60	10	3.205	2.572	2.548	1.634	0.372	36.653	17.443	20.198	10.957	0.859
4761	71	1	49.10	0.1	0.7	70	0.1	2.842	1.302	3.111	1.089	10.147	1.687	0.920	1.444	0.668	9.926
4762	71	1	49.25	0.25	0.7	70	0.25	4.985	2.497	5.678	1.536	8.745	3.283	1.975	2.625	1.349	8.427
4763	71	1	49.50	0.5	0.7	70	0.5	5.636	3.224	6.188	2.278	6.407	2.758	2.626	2.694	2.030	6.162
4764	71	1	49.75	0.75	0.7	70	0.75	5.261	3.621	5.742	2.682	5.002	3.362	3.058	3.341	2.442	4.917
4765	71	1	50.00	1	0.7	70	1	5.057	3.824	5.488	2.917	4.190	4.668	3.929	4.222	3.298	4.202
4766	71	1	50.25	1.25	0.7	70	1.25	5.013	3.918	5.368	3.011	3.549	6.032	4.807	5.131	4.065	3.580
4767	71	1	51.00	2	0.7	70	2	5.091	4.159	5.342	3.045	2.431	10.006	7.336	7.771	6.456	2.341
4768	71	1	51.50	2.5	0.7	70	2.5	5.102	4.115	5.309	2.881	1.986	12.488	8.779	9.304	7.680	1.847

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Model								Membrane Stress Factors									
	OD	T	od	t	d/D	D/T	t/T	Branch					Header				
								Axial	In-Plane	Out-of-Plane	Torsional	Pressure	Axial	In-Plane	Out-of-Plane	Torsional	Pressure
4769	71	1	52.00	3	0.7	70	3	5.070	4.009	5.218	2.758	1.646	14.816	10.449	10.680	8.591	1.587
4770	71	1	53.00	4	0.7	70	4	4.939	3.728	4.950	2.023	1.192	19.100	12.534	13.099	9.735	1.322
4771	71	1	54.00	5	0.7	70	5	4.770	3.626	4.633	1.914	0.915	22.982	13.753	15.134	10.264	1.050
4772	71	1	55.00	6	0.7	70	6	4.572	3.518	4.323	1.847	0.735	26.605	14.634	16.957	10.806	0.958
4773	71	1	56.00	7	0.7	70	7	4.383	3.374	4.038	1.793	0.610	30.363	16.564	18.800	10.465	0.886
4774	71	1	56.50	7.5	0.7	70	7.5	4.281	3.250	3.899	1.774	0.560	32.006	17.156	19.589	10.741	0.885
4775	71	1	57.00	8	0.7	70	8	4.178	3.244	3.769	1.755	0.518	33.664	17.737	20.372	11.003	0.885
4776	71	1	58.00	9	0.7	70	9	3.991	3.082	3.544	1.730	0.449	36.878	19.118	21.867	11.516	0.627
4777	71	1	59.00	10	0.7	70	10	3.807	2.943	3.319	1.701	0.395	40.236	19.690	23.420	12.012	0.635
4778	81	1	56.10	0.1	0.7	80	0.1	3.188	1.363	3.453	1.098	10.836	1.920	0.996	1.807	0.706	10.625
4779	81	1	56.25	0.25	0.7	80	0.25	5.675	2.707	6.331	1.643	9.390	3.746	2.177	2.981	1.427	8.987
4780	81	1	56.50	0.5	0.7	80	0.5	6.372	3.496	6.882	2.413	6.803	4.074	2.883	3.029	2.146	6.525
4781	81	1	56.75	0.75	0.7	80	0.75	5.872	3.909	6.365	2.828	5.282	3.549	3.371	3.667	2.564	5.188
4782	81	1	57.00	1	0.7	80	1	5.587	4.129	6.088	3.072	4.416	4.882	4.147	4.596	3.399	4.419
4783	81	1	57.25	1.25	0.7	80	1.25	5.504	4.239	5.984	3.178	3.747	6.304	5.107	5.575	4.229	3.785
4784	81	1	58.00	2	0.7	80	2	5.630	4.506	6.091	3.238	2.581	10.528	7.820	8.473	6.522	2.494
4785	81	1	58.50	2.5	0.7	80	2.5	5.700	4.491	6.141	3.115	2.100	13.209	9.428	10.203	8.105	1.957
4786	81	1	59.00	3	0.7	80	3	5.742	4.395	6.124	2.918	1.742	15.753	10.851	11.772	9.159	1.662
4787	81	1	60.00	4	0.7	80	4	5.674	4.104	5.901	2.593	1.265	20.442	13.221	14.520	10.546	1.374
4788	81	1	61.00	5	0.7	80	5	5.523	3.817	5.592	1.989	0.967	24.768	15.391	16.946	11.155	1.114
4789	81	1	62.00	6	0.7	80	6	5.327	3.841	5.267	1.904	0.773	28.767	17.037	19.086	10.644	0.859
4790	81	1	63.00	7	0.7	80	7	5.101	3.686	4.944	1.852	0.639	32.545	18.477	21.042	11.334	0.852
4791	81	1	63.50	7.5	0.7	80	7.5	5.000	3.605	4.796	1.829	0.587	34.350	19.143	21.952	11.643	0.850
4792	81	1	64.00	8	0.7	80	8	4.901	3.487	4.659	1.810	0.543	36.122	20.071	22.836	11.946	0.877
4793	81	1	65.00	9	0.7	80	9	4.691	3.406	4.376	1.774	0.469	40.163	21.194	24.779	12.455	0.606
4794	81	1	66.00	10	0.7	80	10	4.495	3.262	4.132	1.750	0.413	43.658	22.353	26.538	12.988	0.612
4795	91	1	63.10	0.1	0.7	90	0.1	3.546	1.418	3.734	1.107	11.534	2.177	1.178	2.043	0.745	11.338
4796	91	1	63.25	0.25	0.7	90	0.25	6.362	2.908	6.975	1.738	9.970	4.239	2.372	3.366	1.511	9.531
4797	91	1	63.50	0.5	0.7	90	0.5	7.126	3.861	7.572	2.539	7.170	4.771	3.136	4.543	2.261	6.872
4798	91	1	63.75	0.75	0.7	90	0.75	6.512	4.186	6.986	2.962	5.540	3.762	3.625	4.002	2.687	5.439
4799	91	1	64.00	1	0.7	90	1	6.148	4.425	6.691	3.215	4.624	5.105	4.335	4.975	3.496	4.631
4800	91	1	64.25	1.25	0.7	90	1.25	6.029	4.552	6.600	3.334	3.927	6.573	5.458	6.016	4.361	3.976
4801	91	1	65.00	2	0.7	90	2	6.234	4.851	6.858	3.413	2.720	11.033	8.252	9.167	6.601	2.733
4802	91	1	65.50	2.5	0.7	90	2.5	6.377	4.848	7.004	3.297	2.217	13.889	10.003	11.061	8.459	2.061
4803	91	1	66.00	3	0.7	90	3	6.458	4.760	7.046	3.137	1.849	16.606	11.577	12.796	9.643	1.733
4804	91	1	67.00	4	0.7	90	4	6.485	4.478	6.905	2.765	1.335	21.709	14.462	15.919	10.726	1.417
4805	91	1	68.00	5	0.7	90	5	6.346	4.167	6.601	2.061	1.017	26.375	16.667	18.649	11.823	1.165
4806	91	1	69.00	6	0.7	90	6	6.138	4.174	6.251	1.959	0.810	30.747	18.528	21.123	11.309	0.870



STP-PT-074: Local Stress in Nozzles, Shells and Formed Heads from External Heads

Model								Membrane Stress Factors									
	OD	T	od	t	d/D	D/T	t/T	Branch					Header				
								Axial	In-Plane	Out-of-Plane	Torsional	Pressure	Axial	In-Plane	Out-of-Plane	Torsional	Pressure
4807	91	1	70.00	7	0.7	90	7	5.911	4.047	5.908	1.891	0.668	34.900	20.452	23.383	12.089	0.884
4808	91	1	70.50	7.5	0.7	90	7.5	5.809	3.915	5.751	1.867	0.613	36.913	21.220	24.459	12.433	0.885
4809	91	1	71.00	8	0.7	90	8	5.686	3.868	5.586	1.846	0.565	38.888	21.956	25.503	12.760	0.886
4810	91	1	72.00	9	0.7	90	9	5.453	3.693	5.278	1.814	0.489	42.638	23.340	27.425	13.372	0.581
4811	91	1	73.00	10	0.7	90	10	5.228	3.532	4.997	1.787	0.429	46.255	24.624	29.241	13.941	0.582
4812	101	1	70.10	0.1	0.7	100	0.1	3.888	1.487	4.056	1.110	12.092	2.391	1.264	2.263	0.787	11.939
4813	101	1	70.25	0.25	0.7	100	0.25	7.054	3.102	7.611	1.841	10.517	4.662	2.554	3.727	1.582	10.026
4814	101	1	70.50	0.5	0.7	100	0.5	7.899	4.112	8.258	2.656	7.513	5.354	3.407	4.438	2.362	7.191
4815	101	1	70.75	0.75	0.7	100	0.75	7.182	4.452	7.606	3.089	5.782	4.024	3.874	4.355	2.803	5.675
4816	101	1	71.00	1	0.7	100	1	6.755	4.711	7.297	3.350	4.818	5.364	4.828	5.369	3.544	4.830
4817	101	1	71.25	1.25	0.7	100	1.25	6.607	4.856	7.226	3.480	4.097	6.865	5.950	6.468	4.474	4.154
4818	101	1	72.00	2	0.7	100	2	6.902	5.170	7.650	3.575	2.850	11.523	9.162	9.841	6.837	2.878
4819	101	1	72.50	2.5	0.7	100	2.5	7.145	5.188	7.899	3.466	2.329	14.561	10.489	11.912	8.158	2.159
4820	101	1	73.00	3	0.7	100	3	7.277	5.112	8.001	3.307	1.936	17.430	12.104	13.797	10.061	1.800
4821	101	1	74.00	4	0.7	100	4	7.357	4.816	7.933	2.927	1.398	22.863	15.399	17.234	11.274	1.460
4822	101	1	75.00	5	0.7	100	5	7.312	4.504	7.642	2.138	1.065	27.870	17.847	20.275	12.523	1.212
4823	101	1	76.00	6	0.7	100	6	7.058	4.483	7.282	2.015	0.845	32.593	19.917	23.073	11.904	0.960
4824	101	1	77.00	7	0.7	100	7	6.810	4.362	6.904	1.935	0.695	37.109	22.051	25.659	12.772	0.831
4825	101	1	77.50	7.5	0.7	100	7.5	6.658	4.228	6.741	1.905	0.636	39.281	22.905	26.856	13.145	0.893
4826	101	1	78.00	8	0.7	100	8	6.527	4.180	6.565	1.879	0.587	41.414	23.723	28.038	13.506	0.895
4827	101	1	79.00	9	0.7	100	9	6.281	3.985	6.231	1.847	0.506	45.548	25.267	30.274	14.168	0.567
4828	101	1	80.00	10	0.7	100	10	6.039	3.868	5.912	1.816	0.444	49.486	26.706	32.350	14.785	0.568
4829	251	1	175.10	0.1	0.7	250	0.1	8.532	2.746	8.297	1.536	19.709	5.646	2.340	5.342	1.171	19.328
4830	251	1	175.25	0.25	0.7	250	0.25	16.267	5.750	16.154	2.872	16.561	11.270	4.754	10.044	2.441	15.718
4831	251	1	175.50	0.5	0.7	250	0.5	19.189	7.230	17.738	3.946	11.251	12.437	6.293	10.548	3.576	10.810
4832	251	1	175.75	0.75	0.7	250	0.75	18.517	7.845	16.574	4.517	8.454	11.803	7.094	10.824	4.205	8.294
4833	251	1	176.00	1	0.7	250	1	18.539	8.411	16.399	4.955	6.956	13.765	7.877	12.712	4.706	6.985
4834	251	1	176.25	1.25	0.7	250	1.25	19.193	8.885	16.958	5.258	5.944	15.965	8.535	14.799	5.497	6.067
4835	251	1	177.00	2	0.7	250	2	22.719	10.073	20.344	5.772	4.270	23.021	13.385	21.334	8.599	4.393
4836	251	1	177.50	2.5	0.7	250	2.5	24.614	10.394	22.324	5.771	3.561	27.161	16.731	25.131	10.510	3.642
4837	251	1	178.00	3	0.7	250	3	25.802	10.443	23.732	5.617	3.008	30.828	19.950	28.453	12.529	2.724
4838	251	1	179.00	4	0.7	250	4	26.425	10.118	25.010	5.113	2.202	37.856	25.151	34.329	15.673	1.984
4839	251	1	180.00	5	0.7	250	5	26.568	9.518	25.079	4.550	1.670	44.896	30.848	40.116	17.834	1.730
4840	251	1	181.00	6	0.7	250	6	25.213	8.269	24.539	4.054	1.306	52.099	35.901	46.212	19.741	1.510
4841	251	1	182.00	7	0.7	250	7	23.758	7.775	23.759	3.617	1.045	59.361	40.564	52.337	21.320	0.567
4842	251	1	182.50	7.5	0.7	250	7.5	23.053	7.527	23.342	3.184	0.944	62.939	42.658	55.324	21.972	0.555
4843	251	1	183.00	8	0.7	250	8	22.371	7.923	22.906	2.829	0.857	66.536	44.655	58.329	22.556	0.545
4844	251	1	184.00	9	0.7	250	9	21.101	7.635	22.053	2.778	0.718	73.664	48.420	64.256	23.571	0.530

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Model								Membrane Stress Factors									
	OD	T	od	t	d/D	D/T	t/T	Branch					Header				
								Axial	In-Plane	Out-of-Plane	Torsional	Pressure	Axial	In-Plane	Out-of-Plane	Torsional	Pressure
4845	251	1	185.00	10	0.7	250	10	19.974	7.313	21.195	2.584	0.613	80.702	51.919	70.057	24.430	0.519
4846	501	1	350.10	0.1	0.7	500	0.1	13.018	4.430	14.392	2.107	28.643	9.320	3.611	9.673	1.657	27.751
4847	501	1	350.25	0.25	0.7	500	0.25	27.471	9.185	29.013	4.223	23.053	18.612	7.319	18.212	3.497	22.237
4848	501	1	350.50	0.5	0.7	500	0.5	33.694	11.792	32.218	5.665	15.366	22.781	9.929	18.005	5.058	14.911
4849	501	1	350.75	0.75	0.7	500	0.75	34.084	12.161	30.349	6.298	11.333	23.958	11.218	20.674	5.594	11.233
4850	501	1	351.00	1	0.7	500	1	35.662	12.186	30.468	6.809	9.332	28.340	11.416	24.409	6.354	9.381
4851	501	1	351.25	1.25	0.7	500	1.25	38.278	13.073	32.111	7.152	7.985	32.875	12.575	28.550	6.985	8.157
4852	501	1	352.00	2	0.7	500	2	47.942	16.756	40.445	8.136	5.816	45.661	15.290	41.030	8.426	6.040
4853	501	1	352.50	2.5	0.7	500	2.5	53.005	17.781	45.505	8.931	4.899	52.083	16.701	48.063	12.728	5.075
4854	501	1	353.00	3	0.7	500	3	56.407	18.141	49.324	8.969	4.176	56.949	17.924	53.883	15.118	4.296
4855	501	1	354.00	4	0.7	500	4	60.916	17.772	53.640	8.442	3.116	64.213	23.020	63.182	19.895	3.133
4856	501	1	355.00	5	0.7	500	5	60.031	16.971	55.093	7.661	2.397	70.680	41.025	71.097	23.817	2.140
4857	501	1	356.00	6	0.7	500	6	57.616	15.876	54.613	6.856	1.892	77.815	48.976	78.808	26.063	1.969
4858	501	1	357.00	7	0.7	500	7	54.588	14.826	53.451	6.103	1.526	85.677	56.304	86.715	29.049	1.818
4859	501	1	357.50	7.5	0.7	500	7.5	53.003	14.295	52.739	5.764	1.380	89.930	59.764	91.042	30.354	1.775
4860	501	1	358.00	8	0.7	500	8	51.410	13.817	51.929	5.436	1.254	94.279	63.065	95.818	31.531	1.738
4861	501	1	359.00	9	0.7	500	9	48.310	12.965	50.278	4.873	1.046	103.512	69.305	106.104	33.576	1.602
4862	501	1	360.00	10	0.7	500	10	45.419	12.166	48.523	4.400	0.874	112.595	75.097	116.199	35.273	0.559
4864	751	1	525.25	0.25	0.7	750	0.25	36.838	12.061	41.505	5.232	28.692	24.298	9.428	25.400	4.350	27.344
4865	751	1	525.50	0.5	0.7	750	0.5	45.734	14.411	46.733	7.190	18.561	27.500	12.816	25.175	6.256	18.121
4866	751	1	525.75	0.75	0.7	750	0.75	46.652	15.398	44.379	7.917	13.596	33.122	14.532	29.284	6.938	13.513
4867	751	1	526.00	1	0.7	750	1	49.224	16.407	44.860	8.548	11.164	39.576	14.682	34.770	7.769	11.221
4868	751	1	526.25	1.25	0.7	750	1.25	53.318	17.152	47.634	9.125	9.559	46.250	16.262	40.863	8.569	9.758
4869	751	1	527.00	2	0.7	750	2	68.053	20.652	60.913	10.497	7.002	64.743	20.172	59.292	10.472	7.291
4870	751	1	527.50	2.5	0.7	750	2.5	76.069	23.993	69.107	11.692	5.921	74.004	21.861	69.462	10.901	6.166
4871	751	1	528.00	3	0.7	750	3	81.798	24.698	75.513	11.819	5.067	80.928	23.041	77.567	11.901	5.246
4872	751	1	529.00	4	0.7	750	4	89.777	24.684	84.520	11.387	3.807	90.137	26.259	89.788	14.224	3.883
4873	751	1	530.00	5	0.7	750	5	89.883	23.680	86.696	10.537	2.949	96.736	31.681	99.296	17.024	2.374
4874	751	1	531.00	6	0.7	750	6	87.435	22.305	86.362	9.560	2.343	103.513	37.592	108.334	20.073	2.157
4875	751	1	532.00	7	0.7	750	7	83.745	20.845	85.033	8.598	1.902	111.429	43.833	118.606	34.247	2.045
4876	751	1	532.50	7.5	0.7	750	7.5	81.676	20.023	84.074	8.141	1.726	115.623	47.037	124.004	36.120	1.998
4877	751	1	533.00	8	0.7	750	8	79.552	19.464	82.869	7.694	1.572	120.441	50.184	129.954	37.849	1.955
4878	751	1	534.00	9	0.7	750	9	75.248	18.180	80.414	6.893	1.318	130.542	56.243	142.654	40.929	1.753
4879	751	1	535.00	10	0.7	750	10	71.066	17.024	77.884	6.194	1.120	141.040	62.187	155.663	43.543	1.650
4881	1001	1	700.25	0.25	0.7	1000	0.25	45.163	14.595	53.210	6.256	33.248	29.047	11.220	31.626	5.086	31.720
4882	1001	1	700.50	0.5	0.7	1000	0.5	56.625	17.646	60.837	8.585	21.253	33.615	15.276	32.560	7.224	20.858
4883	1001	1	700.75	0.75	0.7	1000	0.75	57.904	18.787	58.238	9.412	15.525	41.037	15.741	38.465	8.047	15.451
4884	1001	1	701.00	1	0.7	1000	1	61.226	20.052	59.213	10.132	12.613	49.366	17.825	45.987	9.131	12.773

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Model								Membrane Stress Factors									
	OD	T	od	t	d/D	D/T	t/T	Branch					Header				
								Axial	In-Plane	Out-of-Plane	Torsional	Pressure	Axial	In-Plane	Out-of-Plane	Torsional	Pressure
4885	1001	1	701.25	1.25	0.7	1000	1.25	66.539	21.463	63.151	10.847	10.889	57.973	19.826	54.194	10.111	11.108
4886	1001	1	702.00	2	0.7	1000	2	85.705	25.486	81.296	12.655	8.006	81.775	24.692	78.631	12.404	8.333
4887	1001	1	702.50	2.5	0.7	1000	2.5	96.475	29.406	92.636	14.025	6.786	93.930	26.708	92.068	12.665	7.070
4888	1001	1	703.00	3	0.7	1000	3	104.435	30.440	101.644	14.300	5.819	102.995	27.979	102.827	13.535	6.045
4889	1001	1	704.00	4	0.7	1000	4	115.895	30.714	114.513	14.006	4.389	114.846	29.404	118.264	15.415	4.504
4890	1001	1	705.00	5	0.7	1000	5	117.335	29.699	118.285	13.139	3.412	122.501	34.253	129.312	17.837	3.448
4891	1001	1	706.00	6	0.7	1000	6	115.240	28.150	118.609	12.074	2.722	129.158	39.875	139.333	20.699	2.299
4892	1001	1	707.00	7	0.7	1000	7	111.274	26.459	117.027	10.974	2.219	136.818	47.433	150.385	37.495	2.184
4893	1001	1	707.50	7.5	0.7	1000	7.5	108.939	25.589	116.064	10.439	2.017	141.383	50.722	156.804	39.739	2.135
4894	1001	1	708.00	8	0.7	1000	8	106.468	24.764	114.702	9.912	1.841	145.991	54.048	163.289	41.847	2.093
4895	1001	1	709.00	9	0.7	1000	9	101.277	22.960	111.450	8.923	1.550	156.479	60.558	177.012	45.709	2.018
4896	1001	1	710.00	10	0.7	1000	10	96.135	21.662	108.116	8.031	1.322	167.982	67.042	192.111	49.050	1.956
4898	1251	1	875.25	0.25	0.7	1250	0.25	52.584	16.858	63.921	7.193	37.301	33.095	12.787	37.027	5.724	35.585
4899	1251	1	875.50	0.5	0.7	1250	0.5	66.524	20.633	74.160	9.878	23.620	39.053	17.435	39.465	7.823	23.292
4900	1251	1	875.75	0.75	0.7	1250	0.75	68.171	21.951	71.496	10.790	17.224	48.135	18.259	47.206	9.154	17.175
4901	1251	1	876.00	1	0.7	1250	1	72.151	23.404	72.968	11.603	13.979	58.207	20.748	56.710	10.407	14.157
4902	1251	1	876.25	1.25	0.7	1250	1.25	78.508	25.084	78.019	12.450	12.067	68.583	23.116	67.027	11.559	12.309
4903	1251	1	877.00	2	0.7	1250	2	101.708	29.957	100.812	14.632	8.891	97.367	28.942	97.290	14.228	9.243
4904	1251	1	877.50	2.5	0.7	1250	2.5	114.930	34.218	115.173	15.444	7.550	112.189	31.294	113.905	14.444	7.872
4905	1251	1	878.00	3	0.7	1250	3	125.056	35.563	126.740	16.512	6.483	123.540	31.739	127.176	15.230	6.745
4906	1251	1	879.00	4	0.7	1250	4	139.865	36.142	143.321	16.350	4.902	138.232	32.664	145.929	16.733	5.048
4907	1251	1	880.00	5	0.7	1250	5	142.671	35.175	148.820	15.506	3.820	147.117	38.433	159.298	19.538	3.881
4908	1251	1	881.00	6	0.7	1250	6	141.172	33.519	150.037	14.389	3.055	154.320	43.764	170.634	34.596	2.445
4909	1251	1	882.00	7	0.7	1250	7	137.169	31.626	149.025	13.197	2.497	161.893	49.721	182.274	40.048	2.287
4910	1251	1	882.50	7.5	0.7	1250	7.5	134.658	30.658	147.543	12.603	2.273	166.303	52.975	188.695	42.590	2.229
4911	1251	1	883.00	8	0.7	1250	8	131.942	29.703	145.872	12.015	2.078	171.039	56.301	195.314	45.014	2.180
4912	1251	1	884.00	9	0.7	1250	9	126.179	27.847	142.456	10.899	1.755	182.088	63.067	210.723	49.474	2.101
4913	1251	1	885.00	10	0.7	1250	10	120.242	26.129	137.990	9.864	1.501	194.118	69.863	226.735	53.429	2.037
4915	1501	1	1050.25	0.25	0.7	1500	0.25	59.225	18.926	73.874	8.054	41.001	36.577	14.211	41.275	6.312	39.117
4916	1501	1	1050.50	0.5	0.7	1500	0.5	75.631	23.458	86.855	11.090	25.755	43.943	19.211	45.893	8.706	25.513
4917	1501	1	1050.75	0.75	0.7	1500	0.75	77.611	24.923	84.122	12.082	18.759	54.588	20.614	55.416	10.185	18.736
4918	1501	1	1051.00	1	0.7	1500	1	82.113	26.530	85.963	12.994	15.221	66.263	23.463	66.814	11.612	15.416
4919	1501	1	1051.25	1.25	0.7	1500	1.25	89.406	28.464	92.007	13.941	13.137	78.315	26.234	79.105	12.923	13.404
4920	1501	1	1052.00	2	0.7	1500	2	116.236	34.130	119.294	16.488	9.696	111.659	32.974	115.041	15.978	10.090
4921	1501	1	1052.50	2.5	0.7	1500	2.5	131.889	38.598	136.491	17.473	8.243	129.160	35.687	134.679	16.196	8.596
4922	1501	1	1053.00	3	0.7	1500	3	143.922	40.232	150.575	18.515	7.086	142.509	36.075	150.483	16.952	7.378
4923	1501	1	1054.00	4	0.7	1500	4	161.843	41.106	170.690	18.482	5.367	160.196	36.005	173.575	18.138	5.539
4924	1501	1	1055.00	5	0.7	1500	5	166.101	40.183	177.978	17.665	4.188	170.598	41.760	188.985	20.830	4.271

STP-PT-074: Local Stress in Nozzles, Shells and Formed Heads from External Heads

Model								Membrane Stress Factors									
	OD	T	od	t	d/D	D/T	t/T	Branch					Header				
								Axial	In-Plane	Out-of-Plane	Torsional	Pressure	Axial	In-Plane	Out-of-Plane	Torsional	Pressure
4925	1501	1	1056.00	6	0.7	1500	6	165.244	38.468	180.567	16.523	3.355	178.516	46.412	201.455	36.237	3.362
4926	1501	1	1057.00	7	0.7	1500	7	161.437	36.431	179.657	15.271	2.748	186.274	52.127	213.609	42.107	2.389
4927	1501	1	1057.50	7.5	0.7	1500	7.5	158.873	35.378	178.321	14.637	2.504	190.769	55.227	220.357	44.891	2.319
4928	1501	1	1058.00	8	0.7	1500	8	155.986	34.332	176.674	14.007	2.291	195.502	58.370	227.415	47.587	2.261
4929	1501	1	1059.00	9	0.7	1500	9	149.765	32.263	172.465	12.786	1.939	206.509	65.114	243.036	52.573	2.171
4930	1501	1	1060.00	10	0.7	1500	10	143.239	30.305	167.650	11.646	1.663	219.147	72.023	260.529	57.073	2.102
4933	1751	1	1225.50	0.5	0.7	1750	0.5	83.954	26.089	98.697	12.230	27.708	48.361	19.704	51.824	9.527	27.561
4934	1751	1	1225.75	0.75	0.7	1750	0.75	86.264	27.706	96.000	13.303	20.172	60.505	22.815	63.086	11.164	20.197
4935	1751	1	1226.00	1	0.7	1750	1	91.251	29.480	98.242	14.295	16.359	73.648	26.019	76.326	12.745	16.580
4936	1751	1	1226.25	1.25	0.7	1750	1.25	99.410	31.633	105.293	15.346	14.126	87.219	29.152	90.535	14.216	14.402
4937	1751	1	1227.00	2	0.7	1750	2	129.670	38.063	136.709	18.220	10.437	125.036	36.818	131.850	17.644	10.858
4938	1751	1	1227.50	2.5	0.7	1750	2.5	147.369	42.615	156.642	19.382	8.882	144.823	39.889	154.530	17.916	9.263
4939	1751	1	1228.00	3	0.7	1750	3	161.326	44.514	173.177	20.349	7.641	160.303	40.239	173.475	18.670	7.960
4940	1751	1	1229.00	4	0.7	1750	4	182.186	45.672	196.670	20.443	5.796	180.898	41.801	200.291	20.668	5.990
4941	1751	1	1230.00	5	0.7	1750	5	187.945	44.819	206.186	19.669	4.528	193.168	45.044	218.054	29.718	4.630
4942	1751	1	1231.00	6	0.7	1750	6	187.702	43.047	210.036	18.498	3.631	201.718	49.276	231.717	37.660	3.641
4943	1751	1	1232.00	7	0.7	1750	7	184.137	40.902	209.569	17.197	2.977	209.951	79.248	244.746	44.829	2.484
4944	1751	1	1232.50	7.5	0.7	1750	7.5	181.534	39.784	208.425	16.533	2.715	214.393	84.981	251.784	47.824	2.403
4945	1751	1	1233.00	8	0.7	1750	8	178.607	38.652	206.516	15.872	2.486	219.424	92.632	259.183	50.708	2.336
4946	1751	1	1234.00	9	0.7	1750	9	172.104	36.425	202.054	14.579	2.108	230.709	103.896	275.658	56.153	2.233
4950	2001	1	1400.50	0.5	0.7	2000	0.5	91.596	28.605	109.949	13.300	29.516	52.421	21.457	57.488	10.317	29.495
4951	2001	1	1400.75	0.75	0.7	2000	0.75	94.262	30.328	107.268	14.448	21.480	65.932	24.885	70.435	12.084	21.568
4952	2001	1	1401.00	1	0.7	2000	1	99.714	32.263	109.968	15.514	17.419	80.511	28.454	85.509	13.816	17.684
4953	2001	1	1401.25	1.25	0.7	2000	1.25	108.595	34.621	117.783	16.671	15.052	95.475	31.933	101.461	15.483	15.372
4954	2001	1	1402.00	2	0.7	2000	2	141.976	41.762	153.081	19.859	11.129	137.372	40.486	147.904	19.252	11.592
4955	2001	1	1402.50	2.5	0.7	2000	2.5	161.896	46.386	176.064	21.193	9.479	159.706	43.966	174.315	20.019	9.900
4956	2001	1	1403.00	3	0.7	2000	3	183.613	48.525	194.640	22.065	8.161	177.121	44.114	195.492	21.028	8.516
4957	2001	1	1404.00	4	0.7	2000	4	201.032	49.930	221.444	22.253	6.195	200.515	45.673	226.377	22.323	6.417
4958	2001	1	1405.00	5	0.7	2000	5	208.322	49.174	233.576	21.528	4.845	214.778	59.507	246.800	32.143	4.968
4959	2001	1	1406.00	6	0.7	2000	6	208.846	47.357	238.724	20.351	3.888	224.407	73.515	261.977	38.910	3.942
4967	2251	1	1575.50	0.5	0.7	2250	0.5	98.755	30.900	120.621	14.301	31.210	56.155	23.051	62.875	11.037	31.303
4968	2251	1	1575.75	0.75	0.7	2250	0.75	101.740	32.803	118.009	15.535	22.706	70.980	26.827	77.379	12.951	22.867
4969	2251	1	1576.00	1	0.7	2250	1	107.541	34.881	121.073	16.672	18.409	86.859	30.733	94.228	14.837	18.738
4970	2251	1	1576.25	1.25	0.7	2250	1.25	117.139	37.440	129.656	17.920	15.835	103.217	34.565	111.913	16.617	16.281
4971	2251	1	1577.00	2	0.7	2250	2	153.247	45.241	168.687	21.410	11.780	148.803	43.975	163.412	20.797	12.271
4972	2251	1	1577.50	2.5	0.7	2250	2.5	175.040	49.830	193.936	22.894	10.040	173.313	47.825	192.695	21.606	10.500
4973	2251	1	1578.00	3	0.7	2250	3	198.899	52.221	215.035	23.704	8.648	192.705	47.778	216.746	22.674	9.039
4984	2501	1	1750.50	0.5	0.7	2500	0.5	105.393	33.135	130.779	15.254	32.799	59.595	24.602	68.073	11.714	33.008

STP-PT-074: Local Stress in Nozzles, Shells and Formed Heads from External Heads

Model								Membrane Stress Factors									
	OD	T	od	t	d/D	D/T	t/T	Branch					Header				
								Axial	In-Plane	Out-of-Plane	Torsional	Pressure	Axial	In-Plane	Out-of-Plane	Torsional	Pressure
4985	2501	1	1750.75	0.75	0.7	2500	0.75	108.662	35.195	128.251	16.563	23.857	75.656	28.720	84.161	13.799	24.106
4986	2501	1	1751.00	1	0.7	2500	1	114.809	37.371	131.498	17.766	19.342	92.781	32.956	102.494	15.816	19.733
4987	2501	1	1751.25	1.25	0.7	2500	1.25	125.072	40.138	140.904	19.099	16.649	110.392	37.113	121.844	17.750	17.147
4988	2501	1	1752.00	2	0.7	2500	2	164.023	48.596	183.662	22.891	12.401	159.817	47.383	178.614	21.355	12.954

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STP-PT-074: Local Stress in Nozzles, Shells and Formed Heads from External Heads

Model								Secondary (inside) Stress Factors									
	OD	T	od	t	d/D	D/T	t/T	Branch					Header				
								Axial	In-Plane	Out-of-Plane	Torsional	Pressure	Axial	In-Plane	Out-of-Plane	Torsional	Pressure
1	9	1	0.50	0.1	0.05	8	0.1	1.131	1.071	1.071	1.313	0.794	0.207	0.058	0.058	0.057	1.538
2	9	1	0.65	0.25	0.05	8	0.25	1.125	0.804	0.780	1.770	0.715	0.431	0.102	0.095	0.083	1.293
18	17	1	0.90	0.1	0.05	16	0.1	1.092	0.833	0.834	0.757	1.328	0.426	0.093	0.092	0.075	1.469
19	17	1	1.05	0.25	0.05	16	0.25	1.087	0.570	0.572	0.551	0.850	0.870	0.176	0.172	0.116	1.233
20	17	1	1.30	0.5	0.05	16	0.5	1.146	0.347	0.324	0.557	0.892	1.426	0.290	0.277	0.154	1.091
21	17	1	1.55	0.75	0.05	16	0.75	1.130	0.451	0.430	1.019	1.023	1.828	0.404	0.387	0.186	1.011
35	25	1	1.30	0.1	0.05	24	0.1	1.155	0.926	0.927	0.745	0.883	0.610	0.141	0.150	0.076	1.673
36	25	1	1.45	0.25	0.05	24	0.25	1.167	0.732	0.734	0.638	0.609	1.238	0.259	0.268	0.137	1.430
37	25	1	1.70	0.5	0.05	24	0.5	1.355	0.473	0.476	0.598	0.587	2.045	0.404	0.395	0.189	1.248
38	25	1	1.95	0.75	0.05	24	0.75	1.664	0.465	0.465	0.598	0.603	2.721	0.541	0.524	0.227	1.148
39	25	1	2.20	1	0.05	24	1	1.873	0.524	0.530	0.614	0.628	3.247	0.675	0.679	0.260	1.076
52	33	1	1.70	0.1	0.05	32	0.1	1.233	0.983	0.978	0.773	0.818	0.770	0.192	0.202	0.077	1.813
53	33	1	1.85	0.25	0.05	32	0.25	1.671	0.786	0.785	0.687	0.744	1.535	0.373	0.382	0.150	1.591
54	33	1	2.10	0.5	0.05	32	0.5	2.548	0.591	0.592	0.637	0.755	2.535	0.548	0.575	0.222	1.372
55	33	1	2.35	0.75	0.05	32	0.75	2.980	0.675	0.667	0.615	0.743	3.414	0.712	0.715	0.268	1.252
56	33	1	2.60	1	0.05	32	1	3.193	0.704	0.713	0.615	0.735	4.125	0.869	0.887	0.304	1.163
57	33	1	2.85	1.25	0.05	32	1.25	3.356	0.713	0.746	0.631	0.669	4.829	1.082	1.148	0.339	1.028
69	41	1	2.10	0.1	0.05	40	0.1	1.316	1.030	1.026	0.793	0.870	0.913	0.244	0.261	0.078	1.932
70	41	1	2.25	0.25	0.05	40	0.25	2.625	0.857	0.857	0.719	0.857	1.768	0.464	0.496	0.161	1.723
71	41	1	2.50	0.5	0.05	40	0.5	3.837	0.787	0.844	0.666	0.903	2.993	0.688	0.735	0.249	1.474
72	41	1	2.75	0.75	0.05	40	0.75	4.340	0.881	0.920	0.635	0.896	3.939	0.891	0.902	0.305	1.337
73	41	1	3.00	1	0.05	40	1	4.536	0.898	0.943	0.626	0.880	4.862	1.094	1.119	0.347	1.239
74	41	1	3.25	1.25	0.05	40	1.25	4.792	0.901	0.951	0.624	0.792	6.262	1.334	1.438	0.384	1.092
86	51	1	2.60	0.1	0.05	50	0.1	1.935	1.075	1.074	0.810	1.017	1.065	0.309	0.341	0.080	2.044
87	51	1	2.75	0.25	0.05	50	0.25	3.895	0.934	1.018	0.745	0.984	2.024	0.583	0.641	0.172	1.858
88	51	1	3.00	0.5	0.05	50	0.5	5.488	1.182	1.289	0.694	1.039	3.428	0.866	0.940	0.277	1.599
89	51	1	3.25	0.75	0.05	50	0.75	6.025	1.203	1.320	0.660	1.051	4.579	1.125	1.144	0.346	1.428
90	51	1	3.50	1	0.05	50	1	6.139	1.164	1.287	0.641	1.039	5.771	1.384	1.453	0.396	1.315
91	51	1	3.75	1.25	0.05	50	1.25	6.413	1.123	1.246	0.636	0.944	8.115	1.684	1.844	0.438	1.160
92	51	1	4.50	2	0.05	50	2	6.312	1.007	1.152	0.666	0.718	15.170	2.544	3.004	0.539	1.012
103	61	1	3.10	0.1	0.05	60	0.1	2.611	1.113	1.117	0.822	1.209	1.196	0.373	0.421	0.082	2.137
104	61	1	3.25	0.25	0.05	60	0.25	5.213	1.357	1.481	0.763	1.117	2.247	0.699	0.787	0.179	1.964
105	61	1	3.50	0.5	0.05	60	0.5	7.167	1.628	1.784	0.715	1.140	3.841	1.031	1.166	0.299	1.703
106	61	1	3.75	0.75	0.05	60	0.75	7.702	1.594	1.762	0.680	1.166	5.189	1.366	1.422	0.381	1.505
107	61	1	4.00	1	0.05	60	1	7.703	1.489	1.659	0.662	1.160	7.124	1.689	1.809	0.441	1.379
108	61	1	4.25	1.25	0.05	60	1.25	7.937	1.391	1.562	0.654	1.067	10.028	2.056	2.291	0.489	1.212
109	61	1	5.00	2	0.05	60	2	7.839	1.166	1.343	0.686	0.828	18.631	3.081	3.661	0.599	1.007



STP-PT-074: Local Stress in Nozzles, Shells and Formed Heads from External Heads

Model								Secondary (inside) Stress Factors									
	OD	T	od	t	d/D	D/T	t/T	Branch					Header				
								Axial	In-Plane	Out-of-Plane	Torsional	Pressure	Axial	In-Plane	Out-of-Plane	Torsional	Pressure
110	61	1	5.50	2.5	0.05	60	2.5	7.573	1.105	1.295	0.853	0.710	23.846	3.686	4.552	0.662	1.122
120	71	1	3.60	0.1	0.05	70	0.1	3.291	1.148	1.154	0.830	1.427	1.305	0.432	0.503	0.083	2.203
121	71	1	3.75	0.25	0.05	70	0.25	6.567	1.815	1.986	0.776	1.260	2.455	0.834	0.943	0.186	2.049
122	71	1	4.00	0.5	0.05	70	0.5	8.871	2.110	2.327	0.731	1.224	4.106	1.199	1.351	0.318	1.787
123	71	1	4.25	0.75	0.05	70	0.75	9.375	2.005	2.232	0.696	1.254	6.001	1.600	1.717	0.412	1.570
124	71	1	4.50	1	0.05	70	1	9.251	1.832	2.054	0.673	1.254	8.537	2.004	2.193	0.481	1.433
125	71	1	4.75	1.25	0.05	70	1.25	9.412	1.680	1.901	0.656	1.164	12.002	2.460	2.778	0.537	1.257
126	71	1	5.50	2	0.05	70	2	9.174	1.329	1.543	0.700	0.918	22.096	3.658	4.377	0.660	1.023
127	71	1	6.00	2.5	0.05	70	2.5	8.933	1.218	1.437	0.855	0.794	28.269	4.332	5.380	0.726	1.095
128	71	1	6.50	3	0.05	70	3	8.695	1.169	1.402	1.028	0.695	33.973	4.962	6.402	0.793	1.215
137	81	1	4.10	0.1	0.05	80	0.1	3.962	1.178	1.279	0.837	1.653	1.402	0.499	0.586	0.084	2.260
138	81	1	4.25	0.25	0.05	80	0.25	7.939	2.295	2.517	0.786	1.413	2.571	0.998	1.066	0.192	2.114
139	81	1	4.50	0.5	0.05	80	0.5	10.601	2.614	2.900	0.743	1.300	4.506	1.361	1.558	0.335	1.859
140	81	1	4.75	0.75	0.05	80	0.75	11.044	2.429	2.724	0.710	1.324	6.947	1.837	2.023	0.439	1.631
141	81	1	5.00	1	0.05	80	1	10.779	2.184	2.468	0.694	1.327	9.969	2.326	2.595	0.517	1.477
142	81	1	5.25	1.25	0.05	80	1.25	10.846	1.975	2.254	0.681	1.242	13.972	2.873	3.286	0.582	1.295
143	81	1	6.00	2	0.05	80	2	10.419	1.501	1.761	0.711	0.992	25.576	4.264	5.150	0.719	1.040
144	81	1	6.50	2.5	0.05	80	2.5	10.122	1.337	1.593	0.845	0.861	32.643	5.020	6.275	0.789	1.088
145	81	1	7.00	3	0.05	80	3	9.884	1.250	1.511	1.013	0.758	39.237	5.706	7.399	0.855	1.201
154	91	1	4.60	0.1	0.05	90	0.1	4.626	1.429	1.570	0.843	1.879	1.479	0.576	0.662	0.085	2.312
155	91	1	4.75	0.25	0.05	90	0.25	9.342	2.798	3.079	0.794	1.574	2.776	1.151	1.236	0.196	2.169
156	91	1	5.00	0.5	0.05	90	0.5	12.342	3.135	3.499	0.754	1.372	4.906	1.553	1.748	0.349	1.921
157	91	1	5.25	0.75	0.05	90	0.75	12.712	2.866	3.235	0.722	1.383	7.854	2.078	2.315	0.461	1.686
158	91	1	5.50	1	0.05	90	1	12.298	2.541	2.897	0.707	1.386	11.415	2.653	3.011	0.549	1.516
159	91	1	5.75	1.25	0.05	90	1.25	12.259	2.276	2.619	0.686	1.305	15.960	3.293	3.814	0.622	1.328
160	91	1	6.50	2	0.05	90	2	11.591	1.682	1.992	0.720	1.054	28.966	4.888	5.953	0.776	1.060
161	91	1	7.00	2.5	0.05	90	2.5	11.214	1.464	1.763	0.836	0.918	37.015	5.733	7.228	0.850	1.083
162	91	1	7.50	3	0.05	90	3	10.932	1.339	1.633	0.983	0.810	44.470	6.486	8.462	0.917	1.183
163	91	1	8.50	4	0.05	90	4	10.615	1.245	1.557	1.327	0.652	58.032	7.838	11.009	1.057	1.353
171	101	1	5.10	0.1	0.05	100	0.1	5.275	1.707	1.871	0.847	2.099	1.545	0.659	0.740	0.086	2.355
172	101	1	5.25	0.25	0.05	100	0.25	10.773	3.318	3.664	0.801	1.738	2.919	1.291	1.410	0.200	2.212
173	101	1	5.50	0.5	0.05	100	0.5	14.099	3.667	4.118	0.762	1.443	5.322	1.750	1.954	0.361	1.974
174	101	1	5.75	0.75	0.05	100	0.75	14.379	3.311	3.771	0.732	1.434	8.778	2.316	2.628	0.484	1.732
175	101	1	6.00	1	0.05	100	1	13.805	2.906	3.338	0.716	1.435	12.865	2.991	3.439	0.579	1.551
176	101	1	6.25	1.25	0.05	100	1.25	13.642	2.580	2.997	0.703	1.358	17.961	3.726	4.368	0.659	1.357
177	101	1	7.00	2	0.05	100	2	12.721	1.870	2.236	0.733	1.107	32.415	5.536	6.809	0.829	1.082
178	101	1	7.50	2.5	0.05	100	2.5	12.256	1.601	1.946	0.830	0.966	41.349	6.478	8.231	0.910	1.077
179	101	1	8.00	3	0.05	100	3	11.909	1.437	1.770	0.956	0.852	49.681	7.295	9.590	0.979	1.163

STP-PT-074: Local Stress in Nozzles, Shells and Formed Heads from External Heads

Model								Secondary (inside) Stress Factors									
	OD	T	od	t	d/D	D/T	t/T	Branch					Header				
								Axial	In-Plane	Out-of-Plane	Torsional	Pressure	Axial	In-Plane	Out-of-Plane	Torsional	Pressure
180	101	1	9.00	4	0.05	100	4	11.497	1.291	1.622	1.275	0.689	64.835	8.736	12.327	1.121	1.355
188	251	1	12.60	0.1	0.05	250	0.1	14.570	6.117	6.939	0.871	4.747	2.401	1.852	2.216	0.093	2.650
189	251	1	12.75	0.25	0.05	250	0.25	33.639	11.747	13.990	0.846	4.021	5.274	3.529	3.978	0.239	2.516
190	251	1	13.00	0.5	0.05	250	0.5	41.491	11.999	14.749	0.865	2.555	12.323	4.262	5.034	0.485	2.421
191	251	1	13.25	0.75	0.05	250	0.75	39.273	10.053	12.687	0.871	2.021	23.066	5.925	7.738	0.656	2.219
192	251	1	13.50	1	0.05	250	1	35.515	8.318	10.691	0.870	1.845	34.711	8.123	10.750	0.834	1.977
193	251	1	13.75	1.25	0.05	250	1.25	32.871	7.081	9.231	0.871	1.719	47.525	10.304	13.902	0.990	1.690
194	251	1	14.50	2	0.05	250	2	27.276	4.809	6.391	0.883	1.447	82.732	15.630	22.133	1.368	1.253
195	251	1	15.00	2.5	0.05	250	2.5	25.312	3.974	5.285	0.899	1.292	104.273	18.412	26.819	1.560	1.170
196	251	1	15.50	3	0.05	250	3	24.113	3.415	4.514	0.921	1.155	124.561	20.711	30.989	1.725	1.167
197	251	1	16.50	4	0.05	250	4	22.759	2.745	3.545	0.978	0.934	162.744	24.243	38.329	1.982	1.244
198	251	1	17.50	5	0.05	250	5	21.979	2.446	2.997	1.057	0.774	198.489	26.867	44.900	2.189	1.403
199	251	1	18.50	6	0.05	250	6	21.337	2.306	2.665	1.162	0.658	232.493	28.957	51.152	2.371	1.563
200	251	1	19.50	7	0.05	250	7	20.784	2.227	2.461	1.293	0.574	264.353	30.895	57.265	2.553	1.679
201	251	1	20.00	7.5	0.05	250	7.5	20.426	2.221	2.349	1.366	0.540	279.949	31.898	60.291	2.646	1.726
202	251	1	20.50	8	0.05	250	8	20.338	2.230	2.343	1.451	0.511	294.342	32.842	63.305	2.732	1.764
203	251	1	21.50	9	0.05	250	9	20.111	2.232	2.280	1.641	0.464	323.193	34.677	69.448	2.910	1.821
204	251	1	22.50	10	0.05	250	10	20.027	2.262	2.283	1.877	0.428	350.439	36.445	75.873	3.088	1.858
205	501	1	25.10	0.1	0.05	500	0.1	30.930	12.973	16.458	0.873	7.807	4.054	3.383	4.243	0.101	2.958
206	501	1	25.25	0.25	0.05	500	0.25	72.645	25.074	33.820	0.897	6.777	9.086	5.939	7.119	0.283	2.850
207	501	1	25.50	0.5	0.05	500	0.5	87.150	24.718	34.456	0.959	4.059	23.542	6.938	10.006	0.556	2.892
208	501	1	25.75	0.75	0.05	500	0.75	79.014	19.960	28.584	0.980	2.827	46.339	11.671	16.905	0.805	2.775
209	501	1	26.00	1	0.05	500	1	69.216	16.209	23.710	0.981	2.338	69.205	16.129	23.916	0.984	2.555
210	501	1	26.25	1.25	0.05	500	1.25	61.941	13.639	20.218	0.980	2.076	93.211	20.257	31.198	1.193	2.254
211	501	1	27.00	2	0.05	500	2	48.252	9.466	13.736	0.980	1.672	159.176	30.507	50.905	1.746	1.481
212	501	1	27.50	2.5	0.05	500	2.5	43.866	8.127	11.280	0.986	1.487	199.230	36.076	62.487	2.080	1.268
213	501	1	28.00	3	0.05	500	3	41.436	7.280	9.590	0.996	1.333	237.308	40.842	73.090	2.388	1.209
214	501	1	29.00	4	0.05	500	4	39.221	6.289	7.476	1.017	1.091	309.612	49.263	92.087	2.904	1.210
215	501	1	30.00	5	0.05	500	5	38.285	5.719	6.258	1.039	0.911	379.762	56.229	109.177	3.324	1.269
216	501	1	31.00	6	0.05	500	6	37.448	5.346	5.490	1.063	0.774	446.401	61.963	124.367	3.674	1.381
217	501	1	32.00	7	0.05	500	7	36.754	5.070	4.974	1.091	0.667	511.019	66.740	138.160	4.001	1.519
218	501	1	32.50	7.5	0.05	500	7.5	36.405	4.962	4.778	1.109	0.622	542.567	68.892	144.836	4.154	1.596
219	501	1	33.00	8	0.05	500	8	35.993	4.859	4.604	1.126	0.583	573.607	70.766	151.300	4.299	1.668
220	501	1	34.00	9	0.05	500	9	35.224	4.713	4.364	1.164	0.516	634.150	74.312	163.733	4.570	1.793
221	501	1	35.00	10	0.05	500	10	34.457	4.628	4.161	1.194	0.462	693.420	78.210	175.686	4.829	1.905
223	751	1	37.75	0.25	0.05	750	0.25	110.672	36.749	55.058	0.934	8.834	12.788	7.785	9.347	0.315	3.167
224	751	1	38.00	0.5	0.05	750	0.5	130.781	35.510	54.732	1.037	5.200	34.762	9.703	15.097	0.600	3.273
225	751	1	38.25	0.75	0.05	750	0.75	116.542	28.277	44.839	1.052	3.460	67.901	16.822	26.030	0.847	3.204

STP-PT-074: Local Stress in Nozzles, Shells and Formed Heads from External Heads

Model								Secondary (inside) Stress Factors									
	OD	T	od	t	d/D	D/T	t/T	Branch					Header				
								Axial	In-Plane	Out-of-Plane	Torsional	Pressure	Axial	In-Plane	Out-of-Plane	Torsional	Pressure
226	751	1	38.50	1	0.05	750	1	100.423	22.911	36.864	1.037	2.738	101.150	23.124	37.250	1.085	3.001
227	751	1	38.75	1.25	0.05	750	1.25	88.679	19.277	31.253	1.029	2.371	135.229	28.836	48.666	1.285	2.701
228	751	1	39.50	2	0.05	750	2	67.660	13.838	21.132	1.021	1.854	228.563	43.223	80.069	1.959	1.833
229	751	1	40.00	2.5	0.05	750	2.5	61.195	12.308	17.395	1.025	1.636	285.566	51.874	99.106	2.368	1.436
230	751	1	40.50	3	0.05	750	3	57.718	11.420	14.846	1.033	1.460	339.799	59.389	116.809	2.755	1.270
231	751	1	41.50	4	0.05	750	4	54.732	10.424	11.663	1.052	1.191	443.082	72.371	148.906	3.453	1.206
232	751	1	42.50	5	0.05	750	5	53.645	9.784	9.867	1.073	0.996	541.987	83.273	177.862	4.054	1.233
233	751	1	43.50	6	0.05	750	6	52.968	9.302	8.763	1.088	0.849	638.006	92.314	204.347	4.583	1.293
234	751	1	44.50	7	0.05	750	7	52.240	8.869	8.054	1.105	0.735	734.065	101.057	229.684	5.086	1.373
235	751	1	45.00	7.5	0.05	750	7.5	51.849	8.697	7.775	1.109	0.686	780.293	105.221	240.986	5.311	1.425
236	751	1	45.50	8	0.05	750	8	51.462	8.503	7.539	1.120	0.643	826.041	109.158	251.864	5.523	1.475
237	751	1	46.50	9	0.05	750	9	50.616	8.198	7.176	1.128	0.569	916.104	116.472	273.675	5.921	1.606
238	751	1	47.50	10	0.05	750	10	49.562	7.941	6.911	1.151	0.508	1004.189	123.145	294.312	6.282	1.738
240	1001	1	50.25	0.25	0.05	1000	0.25	147.539	46.726	76.522	0.986	10.508	16.507	9.066	10.983	0.342	3.464
241	1001	1	50.50	0.5	0.05	1000	0.5	172.713	44.707	75.211	1.128	6.120	45.584	12.505	20.183	0.634	3.599
242	1001	1	50.75	0.75	0.05	1000	0.75	152.174	35.380	61.017	1.139	3.978	88.725	21.382	35.232	0.875	3.558
243	1001	1	51.00	1	0.05	1000	1	129.944	28.643	49.877	1.110	3.074	131.548	29.210	50.529	1.129	3.363
244	1001	1	51.25	1.25	0.05	1000	1.25	113.820	24.211	42.138	1.086	2.623	174.757	36.306	65.969	1.384	3.064
245	1001	1	52.00	2	0.05	1000	2	86.243	17.978	28.558	1.051	2.017	293.476	55.155	108.901	2.172	2.146
246	1001	1	52.50	2.5	0.05	1000	2.5	77.842	16.396	23.532	1.051	1.772	366.431	66.161	135.199	2.630	1.666
247	1001	1	53.00	3	0.05	1000	3	73.472	15.582	20.195	1.059	1.575	435.973	75.812	159.995	3.076	1.394
248	1001	1	54.00	4	0.05	1000	4	69.813	14.716	16.119	1.078	1.277	568.513	92.806	205.877	3.901	1.233
249	1001	1	55.00	5	0.05	1000	5	68.544	14.104	13.828	1.096	1.065	695.477	107.012	247.753	4.640	1.217
250	1001	1	56.00	6	0.05	1000	6	67.890	13.544	12.444	1.111	0.908	819.054	120.520	286.438	5.299	1.254
251	1001	1	57.00	7	0.05	1000	7	67.206	13.018	11.540	1.124	0.787	939.971	133.148	322.503	5.902	1.311
252	1001	1	57.50	7.5	0.05	1000	7.5	66.877	12.747	11.206	1.130	0.736	999.712	138.968	339.768	6.186	1.341
253	1001	1	58.00	8	0.05	1000	8	66.391	12.514	10.924	1.134	0.691	1058.935	144.565	356.558	6.453	1.373
254	1001	1	59.00	9	0.05	1000	9	65.398	12.039	10.498	1.145	0.613	1180.035	156.261	390.319	7.012	1.452
255	1001	1	60.00	10	0.05	1000	10	64.309	11.622	10.095	1.154	0.548	1295.404	165.808	418.687	7.493	1.541
257	1251	1	62.75	0.25	0.05	1250	0.25	183.606	55.547	98.333	1.043	11.935	20.493	9.966	12.538	0.364	3.739
258	1251	1	63.00	0.5	0.05	1250	0.5	213.458	52.910	95.557	1.229	6.894	55.934	15.127	25.120	0.661	3.884
259	1251	1	63.25	0.75	0.05	1250	0.75	186.171	41.659	77.001	1.227	4.415	108.851	25.471	44.487	0.920	3.858
260	1251	1	63.50	1	0.05	1250	1	158.202	33.865	62.805	1.181	3.363	160.510	34.681	63.680	1.189	3.669
261	1251	1	63.75	1.25	0.05	1250	1.25	137.984	28.773	52.982	1.147	2.843	212.233	43.047	83.019	1.493	3.368
262	1251	1	64.50	2	0.05	1250	2	103.844	21.917	35.826	1.089	2.165	355.340	66.154	137.378	2.337	2.418
263	1251	1	65.00	2.5	0.05	1250	2.5	93.980	20.426	29.695	1.080	1.897	443.510	79.315	170.883	2.861	1.895
264	1251	1	65.50	3	0.05	1250	3	88.856	19.728	25.666	1.082	1.682	527.760	91.011	202.867	3.359	1.544
265	1251	1	66.50	4	0.05	1250	4	84.682	19.066	20.859	1.101	1.357	688.389	111.079	262.887	4.288	1.286

STP-PT-074: Local Stress in Nozzles, Shells and Formed Heads from External Heads

Model								Secondary (inside) Stress Factors									
	OD	T	od	t	d/D	D/T	t/T	Branch					Header				
								Axial	In-Plane	Out-of-Plane	Torsional	Pressure	Axial	In-Plane	Out-of-Plane	Torsional	Pressure
266	1251	1	67.50	5	0.05	1250	5	83.278	18.527	18.183	1.118	1.127	842.251	129.832	317.773	5.131	1.225
267	1251	1	68.50	6	0.05	1250	6	82.510	17.928	16.582	1.134	0.959	992.261	147.245	369.603	5.907	1.234
268	1251	1	69.50	7	0.05	1250	7	81.761	17.284	15.470	1.147	0.831	1139.332	163.225	416.863	6.619	1.274
269	1251	1	70.00	7.5	0.05	1250	7.5	81.333	16.987	15.060	1.152	0.777	1212.037	170.510	439.547	6.948	1.299
270	1251	1	70.50	8	0.05	1250	8	80.896	16.693	14.678	1.156	0.730	1284.206	177.666	460.456	7.276	1.326
271	1251	1	71.50	9	0.05	1250	9	79.830	16.046	14.177	1.166	0.648	1427.335	191.294	505.075	7.883	1.382
272	1251	1	72.50	10	0.05	1250	10	78.695	15.473	13.798	1.173	0.581	1568.847	203.901	547.742	8.462	1.436
274	1501	1	75.25	0.25	0.05	1500	0.25	219.202	63.504	120.267	1.109	13.180	24.024	10.941	14.522	0.385	3.993
275	1501	1	75.50	0.5	0.05	1500	0.5	253.108	60.361	116.146	1.346	7.566	66.109	17.592	30.161	0.688	4.139
276	1501	1	75.75	0.75	0.05	1500	0.75	219.116	47.547	92.681	1.327	4.795	127.956	29.229	53.361	0.945	4.122
277	1501	1	76.00	1	0.05	1500	1	185.478	38.712	75.600	1.254	3.616	188.340	39.591	76.655	1.257	3.933
278	1501	1	76.25	1.25	0.05	1500	1.25	161.155	33.123	63.742	1.204	3.039	248.159	49.706	99.959	1.587	3.631
279	1501	1	77.00	2	0.05	1500	2	121.092	25.702	43.130	1.137	2.300	414.666	76.390	165.409	2.514	2.653
280	1501	1	77.50	2.5	0.05	1500	2.5	109.819	24.317	35.897	1.127	2.013	517.734	91.456	206.022	3.074	2.100
281	1501	1	78.00	3	0.05	1500	3	103.980	23.767	31.175	1.124	1.782	616.198	104.742	244.817	3.612	1.690
282	1501	1	79.00	4	0.05	1500	4	99.478	23.384	25.732	1.129	1.433	804.285	128.806	318.261	4.633	1.361
283	1501	1	80.00	5	0.05	1500	5	97.944	22.974	22.802	1.142	1.186	984.760	151.486	386.610	5.576	1.254
284	1501	1	81.00	6	0.05	1500	6	97.036	22.448	20.982	1.156	1.006	1160.535	172.334	450.133	6.447	1.231
285	1501	1	82.00	7	0.05	1500	7	96.173	21.785	19.752	1.169	0.871	1333.452	191.576	509.838	7.268	1.249
286	1501	1	82.50	7.5	0.05	1500	7.5	95.705	21.289	19.311	1.175	0.815	1418.445	200.118	539.279	7.627	1.268
287	1501	1	83.00	8	0.05	1500	8	95.142	21.005	18.886	1.179	0.765	1503.309	209.098	567.080	8.016	1.288
288	1501	1	84.00	9	0.05	1500	9	94.022	20.288	18.245	1.185	0.680	1671.733	225.511	621.663	8.715	1.336
289	1501	1	85.00	10	0.05	1500	10	92.694	19.508	17.755	1.192	0.610	1837.822	240.754	674.854	9.377	1.385
291	1751	1	87.75	0.25	0.05	1750	0.25	254.201	70.537	141.814	1.184	14.276	27.930	11.578	16.895	0.400	4.207
292	1751	1	88.00	0.5	0.05	1750	0.5	291.612	66.774	135.723	1.466	8.147	76.115	19.662	35.090	0.712	4.350
293	1751	1	88.25	0.75	0.05	1750	0.75	251.376	52.959	108.724	1.434	5.122	146.363	32.490	62.381	0.980	4.337
294	1751	1	88.50	1	0.05	1750	1	212.072	43.323	88.264	1.342	3.837	214.692	44.201	89.241	1.323	4.149
295	1751	1	88.75	1.25	0.05	1750	1.25	183.744	37.197	74.124	1.269	3.213	282.291	55.706	116.006	1.665	3.845
296	1751	1	89.50	2	0.05	1750	2	138.178	29.312	50.357	1.187	2.425	470.726	85.366	192.132	2.659	2.847
297	1751	1	90.00	2.5	0.05	1750	2.5	125.372	28.044	42.087	1.173	2.121	587.236	102.167	239.720	3.273	2.273
298	1751	1	90.50	3	0.05	1750	3	118.949	27.768	36.814	1.170	1.877	699.454	117.046	285.871	3.845	1.824
299	1751	1	91.50	4	0.05	1750	4	114.185	27.648	30.787	1.174	1.506	913.274	143.980	371.838	4.935	1.455
300	1751	1	92.50	5	0.05	1750	5	112.757	27.280	27.726	1.179	1.243	1118.629	169.754	453.125	5.990	1.304
301	1751	1	93.50	6	0.05	1750	6	111.654	26.869	25.715	1.188	1.052	1318.910	192.539	527.984	6.894	1.249
302	1751	1	94.50	7	0.05	1750	7	110.563	26.159	24.473	1.200	0.908	1515.329	213.949	601.746	7.788	1.245
303	1751	1	95.00	7.5	0.05	1750	7.5	109.953	25.787	23.966	1.207	0.849	1612.707	224.284	637.376	8.200	1.255
304	1751	1	95.50	8	0.05	1750	8	109.308	25.352	23.683	1.212	0.797	1709.616	234.030	672.373	8.619	1.269
305	1751	1	96.50	9	0.05	1750	9	108.012	24.518	23.021	1.220	0.708	1909.403	256.777	740.373	9.455	1.301

STP-PT-074: Local Stress in Nozzles, Shells and Formed Heads from External Heads

Model	Secondary (inside) Stress Factors																
	OD	T	od	t	d/D	D/T	t/T	Branch					Header				
								Axial	In-Plane	Out-of-Plane	Torsional	Pressure	Axial	In-Plane	Out-of-Plane	Torsional	Pressure
306	1751	1	97.50	10	0.05	1750	10	106.533	23.665	22.722	1.227	0.636	2099.520	274.882	812.799	10.205	1.344
309	2001	1	100.50	0.5	0.05	2000	0.5	329.706	73.185	155.437	1.579	8.658	85.869	21.819	39.888	0.730	4.564
310	2001	1	100.75	0.75	0.05	2000	0.75	282.833	58.138	124.267	1.534	5.412	164.755	35.706	71.287	1.020	4.550
311	2001	1	101.00	1	0.05	2000	1	237.933	47.835	100.528	1.426	4.034	241.364	49.064	101.800	1.398	4.358
312	2001	1	101.25	1.25	0.05	2000	1.25	205.713	41.201	83.774	1.340	3.371	316.638	61.722	131.350	1.763	4.051
313	2001	1	102.00	2	0.05	2000	2	154.507	32.836	57.445	1.235	2.541	526.732	94.470	219.205	2.822	3.030
314	2001	1	102.50	2.5	0.05	2000	2.5	140.646	31.704	48.291	1.219	2.223	657.353	112.834	273.896	3.453	2.435
315	2001	1	103.00	3	0.05	2000	3	133.937	31.562	42.466	1.216	1.967	782.757	129.053	326.161	4.083	1.960
316	2001	1	104.00	4	0.05	2000	4	128.967	31.828	36.059	1.218	1.576	1022.983	159.969	426.252	5.235	1.557
317	2001	1	105.00	5	0.05	2000	5	127.423	31.783	32.768	1.221	1.298	1253.731	188.429	519.672	6.339	1.369
318	2001	1	106.00	6	0.05	2000	6	126.293	31.256	30.849	1.226	1.095	1478.918	214.113	609.572	7.357	1.280
319	2001	1	107.00	7	0.05	2000	7	124.962	30.508	29.508	1.234	0.943	1699.709	237.816	695.532	8.324	1.252
320	2001	1	107.50	7.5	0.05	2000	7.5	124.266	30.075	29.010	1.241	0.881	1808.469	249.603	733.239	8.790	1.250
321	2001	1	108.00	8	0.05	2000	8	123.560	29.578	28.858	1.244	0.827	1917.450	260.446	776.168	9.234	1.258
322	2001	1	109.00	9	0.05	2000	9	121.960	28.687	28.162	1.251	0.734	2132.945	281.499	851.849	10.087	1.309
323	2001	1	110.00	10	0.05	2000	10	120.213	27.683	27.656	1.257	0.659	2346.951	301.481	931.183	10.895	1.358
326	2251	1	113.00	0.5	0.05	2250	0.5	366.899	79.121	175.271	1.687	9.120	95.989	23.822	45.037	0.754	4.760
327	2251	1	113.25	0.75	0.05	2250	0.75	313.701	63.778	140.580	1.628	5.674	182.770	38.991	80.626	1.064	4.740
328	2251	1	113.50	1	0.05	2250	1	263.180	52.417	113.029	1.513	4.212	267.264	53.855	114.528	1.487	4.553
329	2251	1	113.75	1.25	0.05	2250	1.25	227.038	44.687	94.686	1.428	3.514	350.111	67.579	148.665	1.868	4.233
330	2251	1	114.50	2	0.05	2250	2	170.717	36.278	66.240	1.283	2.648	581.591	103.252	252.485	2.965	3.196
331	2251	1	115.00	2.5	0.05	2250	2.5	155.701	35.419	54.437	1.264	2.318	727.319	123.209	308.221	3.670	2.582
332	2251	1	115.50	3	0.05	2250	3	148.795	35.409	48.276	1.262	2.052	865.816	140.900	367.634	4.341	2.104
333	2251	1	116.50	4	0.05	2250	4	144.073	35.942	41.559	1.263	1.643	1129.554	175.817	479.181	5.559	1.662
334	2251	1	117.50	5	0.05	2250	5	141.980	36.166	37.908	1.267	1.350	1387.360	205.207	586.181	6.659	1.463
335	2251	1	118.50	6	0.05	2250	6	141.195	35.632	36.162	1.271	1.137	1635.815	235.738	688.342	7.852	1.309
336	2251	1	119.50	7	0.05	2250	7	139.808	34.957	35.077	1.271	0.977	1882.509	263.417	788.425	8.965	1.257
337	2251	1	120.00	7.5	0.05	2250	7.5	138.846	34.447	34.528	1.274	0.912	2000.149	275.009	829.349	9.409	1.246
338	2251	1	120.50	8	0.05	2250	8	137.888	33.759	34.365	1.275	0.855	2121.385	285.914	881.646	9.835	1.295
339	2251	1	121.50	9	0.05	2250	9	135.964	32.962	33.407	1.285	0.758	2361.651	310.594	969.308	10.787	1.373
340	2251	1	122.50	10	0.05	2250	10	133.841	31.824	32.452	1.291	0.680	2595.602	332.184	1047.897	11.637	1.433
343	2501	1	125.50	0.5	0.05	2500	0.5	403.866	84.781	195.106	1.805	9.527	105.503	25.661	49.927	0.786	4.939
344	2501	1	125.75	0.75	0.05	2500	0.75	343.820	68.257	157.733	1.729	5.905	200.448	42.039	90.436	1.118	4.917
345	2501	1	126.00	1	0.05	2500	1	288.086	56.554	125.362	1.585	4.379	292.787	57.954	127.132	1.528	4.718
346	2501	1	126.25	1.25	0.05	2500	1.25	248.278	48.917	107.209	1.466	3.651	382.518	72.404	168.075	1.977	4.400
347	2501	1	127.00	2	0.05	2500	2	186.772	39.633	71.706	1.342	2.747	635.328	111.459	272.745	3.115	3.346
348	2501	1	127.50	2.5	0.05	2500	2.5	170.503	38.705	60.617	1.310	2.407	793.734	132.757	341.306	3.826	2.715
349	2501	1	128.00	3	0.05	2500	3	163.182	39.056	54.144	1.307	2.130	944.657	152.825	408.609	4.541	2.227

STP-PT-074: Local Stress in Nozzles, Shells and Formed Heads from External Heads

Model								Secondary (inside) Stress Factors									
	OD	T	od	t	d/D	D/T	t/T	Branch					Header				
								Axial	In-Plane	Out-of-Plane	Torsional	Pressure	Axial	In-Plane	Out-of-Plane	Torsional	Pressure
350	2501	1	129.00	4	0.05	2500	4	158.508	39.982	46.970	1.308	1.706	1236.140	190.046	533.270	5.856	1.790
351	2501	1	130.00	5	0.05	2500	5	156.800	40.273	43.435	1.312	1.400	1518.213	225.675	654.730	7.084	1.530
352	2501	1	131.00	6	0.05	2500	6	155.942	40.001	41.632	1.311	1.177	1792.035	254.534	768.122	8.235	1.373
353	2501	1	132.00	7	0.05	2500	7	154.312	39.217	40.154	1.316	1.010	2057.544	285.207	873.961	9.417	1.315
354	2501	1	132.50	7.5	0.05	2500	7.5	153.512	38.580	40.076	1.311	0.942	2189.440	295.853	932.576	9.862	1.298
355	2501	1	133.00	8	0.05	2500	8	152.301	38.178	39.621	1.312	0.882	2321.448	311.303	978.789	10.436	1.350
356	2501	1	134.00	9	0.05	2500	9	150.036	37.077	38.800	1.318	0.782	2583.343	337.788	1081.002	11.508	1.438
357	2501	1	135.00	10	0.05	2500	10	147.594	35.942	38.445	1.323	0.701	2845.985	358.789	1183.815	12.331	1.503
358	9	1	0.90	0.1	0.1	8	0.1	1.086	0.834	0.826	0.764	1.575	0.334	0.095	0.094	0.076	1.487
359	9	1	1.05	0.25	0.1	8	0.25	1.076	0.570	0.571	0.550	0.980	0.694	0.182	0.172	0.117	1.321
360	9	1	1.30	0.5	0.1	8	0.5	1.144	0.355	0.320	0.551	1.012	1.084	0.296	0.274	0.161	1.150
361	9	1	1.55	0.75	0.1	8	0.75	1.147	0.466	0.424	1.031	1.170	1.362	0.400	0.379	0.194	1.067
375	17	1	1.70	0.1	0.1	16	0.1	1.192	0.985	0.976	0.777	1.463	0.579	0.184	0.203	0.079	1.847
376	17	1	1.85	0.25	0.1	16	0.25	1.222	0.832	0.832	0.687	0.848	1.207	0.343	0.392	0.153	1.609
377	17	1	2.10	0.5	0.1	16	0.5	1.841	0.606	0.606	0.636	0.798	2.046	0.517	0.601	0.227	1.447
378	17	1	2.35	0.75	0.1	16	0.75	2.158	0.636	0.663	0.614	0.769	2.635	0.665	0.687	0.277	1.317
379	17	1	2.60	1	0.1	16	1	2.296	0.658	0.712	0.616	0.756	3.112	0.805	0.851	0.317	1.226
380	17	1	2.85	1.25	0.1	16	1.25	2.424	0.650	0.726	0.622	0.688	3.362	0.986	1.102	0.355	1.085
392	25	1	2.50	0.1	0.1	24	0.1	1.330	1.066	1.064	0.813	1.474	0.762	0.268	0.311	0.083	2.093
393	25	1	2.65	0.25	0.1	24	0.25	2.654	0.912	0.915	0.740	1.033	1.549	0.512	0.634	0.173	1.878
394	25	1	2.90	0.5	0.1	24	0.5	3.842	1.001	1.178	0.689	1.046	2.656	0.769	0.980	0.278	1.644
395	25	1	3.15	0.75	0.1	24	0.75	4.268	1.031	1.219	0.654	1.039	3.490	0.985	1.091	0.350	1.493
396	25	1	3.40	1	0.1	24	1	4.363	1.016	1.193	0.637	1.020	4.194	1.194	1.322	0.404	1.376
397	25	1	3.65	1.25	0.1	24	1.25	4.599	0.985	1.160	0.633	0.919	5.621	1.444	1.688	0.449	1.207
398	25	1	4.40	2	0.1	24	2	4.513	0.870	1.086	0.677	0.696	10.433	2.113	2.753	0.558	1.075
409	33	1	3.30	0.1	0.1	32	0.1	2.068	1.122	1.132	0.835	1.371	0.892	0.348	0.429	0.086	2.272
410	33	1	3.45	0.25	0.1	32	0.25	4.254	1.387	1.639	0.769	1.230	1.771	0.675	0.823	0.187	2.072
411	33	1	3.70	0.5	0.1	32	0.5	5.933	1.647	1.963	0.721	1.217	3.025	0.988	1.277	0.314	1.788
412	33	1	3.95	0.75	0.1	32	0.75	6.382	1.579	1.904	0.686	1.228	4.085	1.305	1.499	0.408	1.623
413	33	1	4.20	1	0.1	32	1	6.360	1.451	1.772	0.663	1.217	5.717	1.606	1.869	0.479	1.491
414	33	1	4.45	1.25	0.1	32	1.25	6.557	1.336	1.653	0.661	1.116	8.048	1.953	2.372	0.537	1.303
415	33	1	5.20	2	0.1	32	2	6.460	1.084	1.381	0.709	0.859	14.896	2.821	3.770	0.665	1.058
416	33	1	5.70	2.5	0.1	32	2.5	6.254	1.003	1.311	0.879	0.734	19.000	3.277	4.658	0.735	1.221
417	33	1	6.20	3	0.1	32	3	6.020	0.949	1.296	1.044	0.646	22.754	3.680	5.569	0.811	1.329
426	41	1	4.10	0.1	0.1	40	0.1	2.878	1.168	1.248	0.849	1.558	0.984	0.452	0.544	0.090	2.413
427	41	1	4.25	0.25	0.1	40	0.25	5.915	2.055	2.449	0.786	1.464	1.938	0.887	1.030	0.196	2.209
428	41	1	4.50	0.5	0.1	40	0.5	8.080	2.340	2.830	0.743	1.356	3.426	1.215	1.554	0.343	1.921
429	41	1	4.75	0.75	0.1	40	0.75	8.515	2.165	2.658	0.710	1.360	5.242	1.613	1.897	0.456	1.719



STP-PT-074: Local Stress in Nozzles, Shells and Formed Heads from External Heads

Model								Secondary (inside) Stress Factors									
	OD	T	od	t	d/D	D/T	t/T	Branch					Header				
								Axial	In-Plane	Out-of-Plane	Torsional	Pressure	Axial	In-Plane	Out-of-Plane	Torsional	Pressure
430	41	1	5.00	1	0.1	40	1	8.342	1.934	2.401	0.689	1.355	7.534	2.025	2.464	0.543	1.573
431	41	1	5.25	1.25	0.1	40	1.25	8.446	1.742	2.192	0.670	1.258	10.605	2.487	3.136	0.616	1.375
432	41	1	6.00	2	0.1	40	2	8.139	1.303	1.713	0.734	0.990	19.440	3.590	4.926	0.769	1.084
433	41	1	6.50	2.5	0.1	40	2.5	7.866	1.153	1.547	0.872	0.852	24.792	4.132	6.002	0.845	1.200
434	41	1	7.00	3	0.1	40	3	7.640	1.079	1.465	1.038	0.744	29.706	4.586	7.063	0.918	1.352
443	51	1	5.10	0.1	0.1	50	0.1	3.849	1.497	1.810	0.861	1.879	1.059	0.586	0.686	0.094	2.553
444	51	1	5.25	0.25	0.1	50	0.25	8.064	2.927	3.538	0.805	1.797	2.171	1.151	1.330	0.205	2.331
445	51	1	5.50	0.5	0.1	50	0.5	10.822	3.235	3.996	0.762	1.526	3.958	1.560	1.873	0.372	2.047
446	51	1	5.75	0.75	0.1	50	0.75	11.191	2.913	3.668	0.732	1.488	6.736	1.982	2.481	0.505	1.804
447	51	1	6.00	1	0.1	50	1	10.803	2.545	3.241	0.713	1.477	9.887	2.552	3.272	0.611	1.650
448	51	1	6.25	1.25	0.1	50	1.25	10.743	2.253	2.911	0.699	1.385	13.856	3.171	4.173	0.701	1.445
449	51	1	7.00	2	0.1	50	2	10.068	1.611	2.179	0.768	1.112	25.099	4.592	6.517	0.891	1.117
450	51	1	7.50	2.5	0.1	50	2.5	9.660	1.388	1.900	0.865	0.962	32.009	5.265	7.878	0.978	1.179
451	51	1	8.00	3	0.1	50	3	9.312	1.251	1.725	0.990	0.843	38.392	5.804	9.169	1.053	1.346
452	51	1	9.00	4	0.1	50	4	8.887	1.134	1.578	1.310	0.673	49.824	6.647	11.735	1.209	1.561
460	61	1	6.10	0.1	0.1	60	0.1	4.756	1.977	2.391	0.869	2.241	1.107	0.722	0.857	0.097	2.669
461	61	1	6.25	0.25	0.1	60	0.25	10.269	3.820	4.691	0.818	2.154	2.424	1.410	1.632	0.213	2.422
462	61	1	6.50	0.5	0.1	60	0.5	13.604	4.142	5.222	0.778	1.704	4.613	1.898	2.188	0.397	2.145
463	61	1	6.75	0.75	0.1	60	0.75	13.856	3.660	4.719	0.755	1.599	8.238	2.353	3.080	0.546	1.880
464	61	1	7.00	1	0.1	60	1	13.217	3.152	4.116	0.739	1.570	12.241	3.085	4.120	0.667	1.712
465	61	1	7.25	1.25	0.1	60	1.25	12.967	2.760	3.662	0.734	1.478	17.109	3.860	5.276	0.774	1.495
466	61	1	8.00	2	0.1	60	2	11.876	1.928	2.679	0.800	1.203	30.745	5.622	8.243	1.002	1.152
467	61	1	8.50	2.5	0.1	60	2.5	11.304	1.636	2.292	0.872	1.046	39.048	6.429	9.915	1.105	1.176
468	61	1	9.00	3	0.1	60	3	10.849	1.455	2.035	0.963	0.918	46.910	7.072	11.481	1.187	1.334
469	61	1	10.00	4	0.1	60	4	10.189	1.264	1.759	1.204	0.733	61.067	8.019	14.465	1.346	1.590
470	61	1	11.00	5	0.1	60	5	9.877	1.206	1.669	1.526	0.610	73.607	8.953	17.490	1.506	1.704
477	71	1	7.10	0.1	0.1	70	0.1	5.603	2.456	2.982	0.875	2.606	1.188	0.856	1.034	0.101	2.765
478	71	1	7.25	0.25	0.1	70	0.25	12.505	4.709	5.880	0.827	2.519	2.619	1.660	1.935	0.219	2.493
479	71	1	7.50	0.5	0.1	70	0.5	16.423	5.049	6.496	0.793	1.891	5.249	2.225	2.496	0.418	2.227
480	71	1	7.75	0.75	0.1	70	0.75	16.503	4.398	5.804	0.773	1.703	9.748	2.718	3.701	0.581	1.961
481	71	1	8.00	1	0.1	70	1	15.591	3.750	5.025	0.771	1.648	14.540	3.610	4.997	0.717	1.761
482	71	1	8.25	1.25	0.1	70	1.25	15.120	3.257	4.435	0.779	1.550	20.321	4.544	6.426	0.837	1.541
483	71	1	9.00	2	0.1	70	2	13.574	2.246	3.198	0.832	1.274	36.306	6.651	10.072	1.100	1.181
484	71	1	9.50	2.5	0.1	70	2.5	12.856	1.891	2.710	0.886	1.112	46.011	7.616	12.101	1.221	1.180
485	71	1	10.00	3	0.1	70	3	12.294	1.668	2.376	0.953	0.977	55.128	8.349	13.948	1.317	1.309
486	71	1	11.00	4	0.1	70	4	11.449	1.425	1.981	1.135	0.778	72.028	9.434	17.426	1.482	1.600
487	71	1	12.00	5	0.1	70	5	10.931	1.324	1.803	1.384	0.648	87.124	10.504	20.831	1.645	1.769
488	71	1	13.00	6	0.1	70	6	10.710	1.304	1.754	1.707	0.558	100.658	11.448	24.312	1.809	1.836

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Model								Secondary (inside) Stress Factors									
	OD	T	od	t	d/D	D/T	t/T	Branch					Header				
								Axial	In-Plane	Out-of-Plane	Torsional	Pressure	Axial	In-Plane	Out-of-Plane	Torsional	Pressure
494	81	1	8.10	0.1	0.1	80	0.1	6.412	2.928	3.578	0.879	2.966	1.303	0.984	1.205	0.103	2.845
495	81	1	8.25	0.25	0.1	80	0.25	14.770	5.594	7.104	0.833	2.883	2.841	1.906	2.241	0.224	2.555
496	81	1	8.50	0.5	0.1	80	0.5	19.237	5.941	7.794	0.805	2.082	5.972	2.524	2.864	0.436	2.299
497	81	1	8.75	0.75	0.1	80	0.75	19.127	5.121	6.908	0.803	1.805	11.226	3.084	4.323	0.613	2.037
498	81	1	9.00	1	0.1	80	1	17.924	4.333	5.947	0.808	1.718	16.847	4.138	5.901	0.761	1.815
499	81	1	9.25	1.25	0.1	80	1.25	17.217	3.743	5.229	0.818	1.610	23.438	5.212	7.609	0.893	1.579
500	81	1	10.00	2	0.1	80	2	15.194	2.560	3.732	0.862	1.330	41.748	7.667	11.977	1.189	1.205
501	81	1	10.50	2.5	0.1	80	2.5	14.316	2.145	3.141	0.903	1.165	52.826	8.790	14.396	1.328	1.193
502	81	1	11.00	3	0.1	80	3	13.672	1.887	2.734	0.954	1.026	63.252	9.649	16.574	1.438	1.283
503	81	1	12.00	4	0.1	80	4	12.716	1.598	2.238	1.091	0.816	82.671	10.901	20.585	1.614	1.605
504	81	1	13.00	5	0.1	80	5	12.030	1.465	1.981	1.285	0.676	100.173	12.108	24.387	1.784	1.797
505	81	1	14.00	6	0.1	80	6	11.640	1.418	1.870	1.536	0.582	116.076	13.136	28.208	1.949	1.910
506	81	1	15.00	7	0.1	80	7	11.556	1.406	1.847	1.860	0.512	130.709	14.195	32.160	2.128	1.951
507	81	1	15.50	7.5	0.1	80	7.5	11.581	1.405	1.864	2.039	0.487	137.402	14.778	34.157	2.221	1.962
511	91	1	9.10	0.1	0.1	90	0.1	7.310	3.394	4.187	0.882	3.317	1.411	1.108	1.374	0.106	2.918
512	91	1	9.25	0.25	0.1	90	0.25	17.047	6.470	8.362	0.838	3.241	3.071	2.139	2.505	0.230	2.607
513	91	1	9.50	0.5	0.1	90	0.5	22.063	6.820	9.122	0.824	2.275	6.665	2.812	3.217	0.454	2.365
514	91	1	9.75	0.75	0.1	90	0.75	21.729	5.831	8.032	0.833	1.907	12.716	3.450	4.961	0.639	2.109
515	91	1	10.00	1	0.1	90	1	20.213	4.902	6.882	0.840	1.783	19.153	4.662	6.828	0.798	1.865
516	91	1	10.25	1.25	0.1	90	1.25	19.256	4.215	6.031	0.850	1.662	26.557	5.877	8.827	0.941	1.620
517	91	1	11.00	2	0.1	90	2	16.739	2.872	4.274	0.888	1.375	47.098	8.668	13.948	1.269	1.226
518	91	1	11.50	2.5	0.1	90	2.5	15.708	2.400	3.582	0.920	1.209	59.490	9.954	16.778	1.426	1.205
519	91	1	12.00	3	0.1	90	3	14.979	2.112	3.102	0.961	1.066	71.181	10.937	19.312	1.550	1.273
520	91	1	13.00	4	0.1	90	4	13.917	1.775	2.506	1.066	0.849	92.886	12.455	23.871	1.747	1.597
521	91	1	14.00	5	0.1	90	5	13.149	1.616	2.185	1.216	0.701	112.909	13.765	28.163	1.921	1.817
522	91	1	15.00	6	0.1	90	6	12.575	1.551	2.005	1.415	0.599	131.162	14.876	32.354	2.095	1.951
523	91	1	16.00	7	0.1	90	7	12.304	1.525	1.944	1.671	0.528	147.859	16.060	36.594	2.282	2.031
524	91	1	16.50	7.5	0.1	90	7.5	12.243	1.519	1.938	1.822	0.499	155.782	16.681	38.770	2.375	2.041
525	91	1	17.00	8	0.1	90	8	12.192	1.530	1.935	1.984	0.474	163.439	17.296	40.985	2.473	2.055
528	101	1	10.10	0.1	0.1	100	0.1	8.228	3.845	4.793	0.884	3.659	1.512	1.225	1.550	0.108	2.988
529	101	1	10.25	0.25	0.1	100	0.25	19.341	7.340	9.650	0.842	3.590	3.374	2.334	2.785	0.236	2.658
530	101	1	10.50	0.5	0.1	100	0.5	24.879	7.682	10.463	0.845	2.466	7.347	3.097	3.567	0.467	2.428
531	101	1	10.75	0.75	0.1	100	0.75	24.312	6.526	9.170	0.860	2.008	14.201	3.819	5.608	0.663	2.180
532	101	1	11.00	1	0.1	100	1	22.462	5.458	7.828	0.868	1.846	21.418	5.183	7.766	0.831	1.924
533	101	1	11.25	1.25	0.1	100	1.25	21.249	4.676	6.840	0.878	1.710	29.631	6.537	10.065	0.983	1.665
534	101	1	12.00	2	0.1	100	2	18.239	3.179	4.825	0.911	1.413	52.356	9.645	15.973	1.341	1.247
535	101	1	12.50	2.5	0.1	100	2.5	17.051	2.656	4.030	0.938	1.246	66.028	11.096	19.228	1.517	1.215
536	101	1	13.00	3	0.1	100	3	16.240	2.334	3.479	0.970	1.101	78.953	12.202	22.143	1.655	1.266

STP-PT-074: Local Stress in Nozzles, Shells and Formed Heads from External Heads

Model								Secondary (inside) Stress Factors									
	OD	T	od	t	d/D	D/T	t/T	Branch					Header				
								Axial	In-Plane	Out-of-Plane	Torsional	Pressure	Axial	In-Plane	Out-of-Plane	Torsional	Pressure
537	101	1	14.00	4	0.1	100	4	15.093	1.960	2.788	1.053	0.878	103.032	14.019	27.330	1.872	1.585
538	101	1	15.00	5	0.1	100	5	14.217	1.778	2.395	1.172	0.723	125.422	15.468	32.132	2.058	1.824
539	101	1	16.00	6	0.1	100	6	13.539	1.697	2.167	1.330	0.615	145.881	16.655	36.723	2.248	1.979
540	101	1	17.00	7	0.1	100	7	13.121	1.657	2.059	1.533	0.539	164.832	17.971	41.312	2.440	2.080
541	101	1	17.50	7.5	0.1	100	7.5	13.000	1.658	2.035	1.661	0.509	173.744	18.652	43.623	2.537	2.114
542	101	1	18.00	8	0.1	100	8	12.843	1.638	2.009	1.790	0.484	182.453	19.308	45.988	2.635	2.138
543	101	1	19.00	9	0.1	100	9	12.907	1.667	2.052	2.094	0.440	198.744	20.575	50.770	2.837	2.152
545	251	1	25.10	0.1	0.1	250	0.1	22.029	9.484	14.372	0.884	7.892	3.089	2.374	3.482	0.121	3.696
546	251	1	25.25	0.25	0.1	250	0.25	53.252	18.396	30.239	0.908	7.758	7.017	4.573	5.704	0.317	3.296
547	251	1	25.50	0.5	0.1	250	0.5	66.143	18.595	31.582	1.016	4.887	17.679	5.836	8.925	0.622	3.201
548	251	1	25.75	0.75	0.1	250	0.75	61.190	15.202	26.708	1.060	3.346	35.490	8.963	15.528	0.872	3.066
549	251	1	26.00	1	0.1	250	1	54.005	12.438	22.355	1.065	2.658	53.583	12.234	22.370	1.107	2.828
550	251	1	26.25	1.25	0.1	250	1.25	48.616	10.510	19.224	1.070	2.281	72.609	15.172	29.427	1.324	2.496
551	251	1	27.00	2	0.1	250	2	38.006	7.458	13.252	1.074	1.750	124.555	22.994	48.287	1.948	1.606
552	251	1	27.50	2.5	0.1	250	2.5	34.429	6.514	10.971	1.083	1.535	155.940	27.062	59.253	2.335	1.344
553	251	1	28.00	3	0.1	250	3	32.373	5.924	9.416	1.094	1.364	185.685	30.593	69.248	2.678	1.287
554	251	1	29.00	4	0.1	250	4	30.237	5.224	7.483	1.116	1.103	241.885	36.318	87.018	3.260	1.407
555	251	1	30.00	5	0.1	250	5	28.998	4.806	6.367	1.134	0.914	296.249	41.849	102.936	3.727	1.705
556	251	1	31.00	6	0.1	250	6	28.048	4.554	5.665	1.150	0.771	347.755	46.256	116.965	4.157	1.962
557	251	1	32.00	7	0.1	250	7	27.137	4.352	5.173	1.167	0.662	397.680	50.052	129.908	4.561	2.181
558	251	1	32.50	7.5	0.1	250	7.5	26.817	4.260	4.965	1.184	0.616	421.979	51.736	136.029	4.730	2.278
559	251	1	33.00	8	0.1	250	8	26.357	4.208	4.807	1.197	0.576	445.756	53.386	141.941	4.895	2.367
560	251	1	34.00	9	0.1	250	9	25.435	4.069	4.557	1.219	0.508	492.173	56.287	153.320	5.232	2.535
561	251	1	35.00	10	0.1	250	10	24.615	3.979	4.354	1.270	0.454	536.557	58.874	163.984	5.530	2.672
562	501	1	50.10	0.1	0.1	500	0.1	43.735	15.641	30.549	0.878	12.742	5.295	3.280	5.050	0.143	4.595
563	501	1	50.25	0.25	0.1	500	0.25	107.057	31.162	65.604	1.061	12.303	13.719	6.410	9.334	0.398	4.171
564	501	1	50.50	0.5	0.1	500	0.5	130.900	31.264	67.461	1.321	7.605	34.563	9.358	17.826	0.743	4.146
565	501	1	50.75	0.75	0.1	500	0.75	117.398	25.526	55.899	1.356	4.921	68.298	15.599	32.212	1.032	4.105
566	501	1	51.00	1	0.1	500	1	101.418	21.312	46.298	1.315	3.659	102.023	21.318	46.611	1.325	3.900
567	501	1	51.25	1.25	0.1	500	1.25	89.305	18.415	39.447	1.278	3.000	136.229	26.970	61.259	1.648	3.564
568	501	1	52.00	2	0.1	500	2	67.638	14.043	27.159	1.209	2.161	230.361	40.698	101.767	2.593	2.481
569	501	1	52.50	2.5	0.1	500	2.5	60.734	12.920	22.669	1.198	1.862	288.026	48.425	126.433	3.161	1.892
570	501	1	53.00	3	0.1	500	3	56.809	12.338	19.688	1.200	1.634	342.819	55.681	149.513	3.686	1.532
571	501	1	54.00	4	0.1	500	4	52.968	11.659	16.121	1.215	1.303	447.107	68.310	192.048	4.649	1.344
572	501	1	55.00	5	0.1	500	5	51.148	11.121	14.157	1.230	1.075	546.960	79.187	230.739	5.516	1.532
573	501	1	56.00	6	0.1	500	6	49.914	10.725	12.955	1.242	0.909	643.595	88.761	266.180	6.284	1.776
574	501	1	57.00	7	0.1	500	7	48.824	10.322	12.136	1.248	0.783	738.494	97.307	299.324	6.981	2.021
575	501	1	57.50	7.5	0.1	500	7.5	48.225	10.171	11.815	1.255	0.731	785.197	101.281	315.018	7.310	2.129

STP-PT-074: Local Stress in Nozzles, Shells and Formed Heads from External Heads

Model								Secondary (inside) Stress Factors									
	OD	T	od	t	d/D	D/T	t/T	Branch					Header				
								Axial	In-Plane	Out-of-Plane	Torsional	Pressure	Axial	In-Plane	Out-of-Plane	Torsional	Pressure
576	501	1	58.00	8	0.1	500	8	47.644	9.982	11.532	1.261	0.684	831.459	105.074	330.278	7.626	2.233
577	501	1	59.00	9	0.1	500	9	46.483	9.603	11.057	1.262	0.605	922.497	112.038	359.397	8.255	2.429
578	501	1	60.00	10	0.1	500	10	45.272	9.219	10.660	1.266	0.539	1012.449	118.342	386.993	8.797	2.612
580	751	1	75.25	0.25	0.1	750	0.25	158.041	40.334	100.709	1.270	15.597	19.455	7.629	13.088	0.460	4.883
581	751	1	75.50	0.5	0.1	750	0.5	191.123	41.358	102.942	1.681	9.577	49.783	12.682	26.477	0.828	4.861
582	751	1	75.75	0.75	0.1	750	0.75	169.038	34.492	84.469	1.673	6.076	98.088	20.913	48.377	1.157	4.860
583	751	1	76.00	1	0.1	750	1	144.487	28.836	69.552	1.571	4.414	145.711	29.130	70.134	1.550	4.670
584	751	1	76.25	1.25	0.1	750	1.25	126.285	25.056	59.065	1.497	3.558	192.972	36.593	91.779	1.968	4.329
585	751	1	77.00	2	0.1	750	2	94.981	19.822	40.713	1.376	2.504	324.364	54.887	152.800	3.141	3.154
586	751	1	77.50	2.5	0.1	750	2.5	85.561	18.774	34.320	1.350	2.142	405.089	66.033	190.447	3.845	2.474
587	751	1	78.00	3	0.1	750	3	80.359	18.326	30.216	1.339	1.869	482.323	75.898	226.315	4.498	1.955
588	751	1	79.00	4	0.1	750	4	75.420	17.964	25.501	1.335	1.473	629.839	93.176	293.394	5.713	1.452
589	751	1	80.00	5	0.1	750	5	73.017	17.593	23.012	1.345	1.204	770.964	108.022	355.613	6.819	1.404
590	751	1	81.00	6	0.1	750	6	71.276	17.040	21.463	1.355	1.012	908.546	121.390	413.855	7.829	1.628
591	751	1	82.00	7	0.1	750	7	69.711	16.475	20.376	1.363	0.870	1043.335	133.643	468.931	8.787	1.842
592	751	1	82.50	7.5	0.1	750	7.5	68.950	16.242	19.933	1.371	0.812	1116.877	142.330	497.895	9.329	1.941
593	751	1	83.00	8	0.1	750	8	68.199	16.102	19.541	1.379	0.760	1183.303	147.952	523.734	9.789	2.043
594	751	1	84.00	9	0.1	750	9	66.706	15.645	18.855	1.388	0.672	1314.875	160.278	573.477	10.611	2.253
595	751	1	85.00	10	0.1	750	10	65.201	15.108	18.267	1.394	0.601	1445.020	172.244	621.175	11.404	2.439
597	1001	1	100.25	0.25	0.1	1000	0.25	207.178	47.927	134.942	1.502	18.250	24.828	8.742	17.210	0.509	5.525
598	1001	1	100.50	0.5	0.1	1000	0.5	248.200	50.498	137.098	2.025	11.161	64.953	15.574	35.173	0.915	5.478
599	1001	1	100.75	0.75	0.1	1000	0.75	217.759	42.153	112.336	1.984	7.006	126.572	26.078	64.348	1.276	5.499
600	1001	1	101.00	1	0.1	1000	1	184.996	35.334	92.219	1.829	5.030	187.068	36.031	93.132	1.779	5.313
601	1001	1	101.25	1.25	0.1	1000	1.25	160.909	30.794	78.051	1.714	4.019	246.773	45.097	121.680	2.278	4.962
602	1001	1	102.00	2	0.1	1000	2	120.948	24.997	53.949	1.543	2.798	413.480	68.022	202.553	3.664	3.712
603	1001	1	102.50	2.5	0.1	1000	2.5	109.383	24.061	45.851	1.508	2.389	516.432	81.908	253.239	4.473	2.961
604	1001	1	103.00	3	0.1	1000	3	103.324	23.847	40.831	1.492	2.080	614.889	93.954	301.500	5.236	2.361
605	1001	1	104.00	4	0.1	1000	4	97.785	23.836	35.329	1.480	1.630	803.585	115.089	392.909	6.658	1.657
606	1001	1	105.00	5	0.1	1000	5	95.040	23.643	32.532	1.475	1.323	984.851	133.471	478.635	7.973	1.428
607	1001	1	106.00	6	0.1	1000	6	92.891	23.142	30.799	1.472	1.105	1161.436	149.832	559.850	9.207	1.474
608	1001	1	107.00	7	0.1	1000	7	90.730	22.542	29.491	1.481	0.945	1334.758	167.660	637.246	10.360	1.694
609	1001	1	107.50	7.5	0.1	1000	7.5	89.719	22.150	28.932	1.485	0.880	1420.289	176.282	674.058	10.893	1.793
610	1001	1	108.00	8	0.1	1000	8	88.683	21.806	28.415	1.487	0.823	1505.425	184.917	710.814	11.447	1.890
611	1001	1	109.00	9	0.1	1000	9	86.633	21.227	27.474	1.497	0.727	1674.303	201.418	781.140	12.486	2.079
612	1001	1	110.00	10	0.1	1000	10	84.656	20.715	26.696	1.502	0.650	1841.076	217.293	850.030	13.460	2.259
614	1251	1	125.25	0.25	0.1	1250	0.25	255.040	54.905	168.749	1.734	20.498	29.776	9.827	20.580	0.555	6.087
615	1251	1	125.50	0.5	0.1	1250	0.5	303.467	58.683	171.012	2.350	12.507	79.389	18.230	43.646	0.989	6.009
616	1251	1	125.75	0.75	0.1	1250	0.75	264.408	49.246	139.774	2.271	7.799	153.803	30.716	80.030	1.424	6.039

STP-PT-074: Local Stress in Nozzles, Shells and Formed Heads from External Heads

Model								Secondary (inside) Stress Factors									
	OD	T	od	t	d/D	D/T	t/T	Branch					Header				
								Axial	In-Plane	Out-of-Plane	Torsional	Pressure	Axial	In-Plane	Out-of-Plane	Torsional	Pressure
617	1251	1	126.00	1	0.1	1250	1	223.746	41.551	114.456	2.074	5.558	226.475	42.247	115.682	2.007	5.855
618	1251	1	126.25	1.25	0.1	1250	1.25	194.136	36.261	96.772	1.925	4.418	297.975	52.709	150.939	2.582	5.493
619	1251	1	127.00	2	0.1	1250	2	145.913	29.720	67.189	1.708	3.058	497.647	79.905	251.583	4.140	4.186
620	1251	1	127.50	2.5	0.1	1250	2.5	132.683	29.002	57.252	1.665	2.609	621.835	96.260	313.329	5.070	3.382
621	1251	1	128.00	3	0.1	1250	3	125.818	28.972	51.490	1.645	2.270	741.459	109.981	374.985	5.918	2.724
622	1251	1	129.00	4	0.1	1250	4	120.109	29.306	45.419	1.635	1.775	969.169	134.402	489.912	7.521	1.910
623	1251	1	130.00	5	0.1	1250	5	117.268	29.319	42.504	1.621	1.435	1188.279	155.593	598.725	9.022	1.556
624	1251	1	131.00	6	0.1	1250	6	114.830	28.860	40.691	1.613	1.193	1402.015	177.681	702.464	10.415	1.420
625	1251	1	132.00	7	0.1	1250	7	112.187	28.283	39.212	1.615	1.014	1620.179	201.649	805.299	11.865	1.517
626	1251	1	132.50	7.5	0.1	1250	7.5	110.814	27.726	38.538	1.615	0.943	1724.885	212.598	853.757	12.537	1.609
627	1251	1	133.00	8	0.1	1250	8	109.543	27.478	37.977	1.615	0.880	1828.570	222.864	901.600	13.144	1.703
628	1251	1	134.00	9	0.1	1250	9	106.887	26.537	36.818	1.614	0.776	2034.311	243.623	993.494	14.372	1.882
629	1251	1	135.00	10	0.1	1250	10	104.273	26.023	35.741	1.616	0.692	2238.681	263.247	1082.730	15.578	2.059
631	1501	1	150.25	0.25	0.1	1500	0.25	301.754	61.853	201.812	1.955	22.473	34.776	10.658	24.286	0.593	6.582
632	1501	1	150.50	0.5	0.1	1500	0.5	356.689	66.160	204.232	2.650	13.695	93.628	20.937	52.167	1.046	6.473
633	1501	1	150.75	0.75	0.1	1500	0.75	309.043	56.315	166.414	2.541	8.501	180.334	34.998	95.548	1.570	6.513
634	1501	1	151.00	1	0.1	1500	1	260.958	47.604	136.360	2.303	6.027	264.321	47.977	137.847	2.218	6.329
635	1501	1	151.25	1.25	0.1	1500	1.25	225.922	41.588	115.103	2.125	4.773	347.131	59.600	179.609	2.865	5.960
636	1501	1	152.00	2	0.1	1500	2	170.097	34.112	80.004	1.871	3.290	578.470	90.894	298.594	4.593	4.600
637	1501	1	152.50	2.5	0.1	1500	2.5	155.216	33.517	68.837	1.827	2.808	723.177	108.950	374.059	5.616	3.750
638	1501	1	153.00	3	0.1	1500	3	147.920	33.748	62.280	1.812	2.443	861.796	124.503	446.986	6.547	3.046
639	1501	1	154.00	4	0.1	1500	4	142.049	34.716	55.575	1.804	1.909	1133.298	154.927	587.212	8.413	2.174
640	1501	1	155.00	5	0.1	1500	5	139.483	34.748	52.684	1.786	1.539	1389.998	178.957	719.099	10.072	1.711
641	1501	1	156.00	6	0.1	1500	6	136.994	34.428	50.828	1.770	1.275	1640.659	205.688	844.672	11.655	1.506
642	1501	1	157.00	7	0.1	1500	7	133.955	33.814	49.307	1.758	1.081	1887.034	231.184	966.377	13.148	1.420
643	1501	1	157.50	7.5	0.1	1500	7.5	132.487	33.366	48.687	1.751	1.003	2009.035	243.509	1027.135	13.875	1.458
644	1501	1	158.00	8	0.1	1500	8	130.873	32.971	47.940	1.748	0.935	2130.743	255.889	1084.241	14.585	1.544
645	1501	1	159.00	9	0.1	1500	9	127.577	32.014	46.678	1.739	0.821	2371.476	279.318	1199.217	15.949	1.718
646	1501	1	160.00	10	0.1	1500	10	124.308	30.964	45.543	1.732	0.731	2610.079	302.147	1310.725	17.285	1.889
649	1751	1	175.50	0.5	0.1	1750	0.5	408.858	73.218	236.976	2.932	14.763	107.582	23.743	60.527	1.101	6.963
650	1751	1	175.75	0.75	0.1	1750	0.75	352.585	62.330	192.627	2.783	9.132	206.332	39.077	110.822	1.727	7.002
651	1751	1	176.00	1	0.1	1750	1	296.814	52.652	157.434	2.519	6.449	302.249	53.353	159.907	2.463	6.810
652	1751	1	176.25	1.25	0.1	1750	1.25	256.428	46.077	132.794	2.315	5.090	396.267	66.287	208.267	3.175	6.431
653	1751	1	177.00	2	0.1	1750	2	193.599	38.682	92.944	2.038	3.499	659.256	102.856	346.997	5.079	5.004
654	1751	1	177.50	2.5	0.1	1750	2.5	176.974	38.233	79.998	2.001	2.987	824.163	122.824	433.991	6.196	4.109
655	1751	1	178.00	3	0.1	1750	3	169.296	38.619	72.676	1.993	2.601	983.180	140.553	518.781	7.247	3.363
656	1751	1	179.00	4	0.1	1750	4	164.003	39.653	65.882	1.978	2.033	1286.921	171.026	680.525	9.170	2.405
657	1751	1	180.00	5	0.1	1750	5	161.803	39.915	63.063	1.958	1.638	1578.697	199.770	834.039	10.964	1.872

STP-PT-074: Local Stress in Nozzles, Shells and Formed Heads from External Heads

Model								Secondary (inside) Stress Factors									
	OD	T	od	t	d/D	D/T	t/T	Branch					Header				
								Axial	In-Plane	Out-of-Plane	Torsional	Pressure	Axial	In-Plane	Out-of-Plane	Torsional	Pressure
658	1751	1	181.00	6	0.1	1750	6	159.432	39.646	61.379	1.932	1.354	1864.488	229.884	982.386	12.674	1.611
659	1751	1	182.00	7	0.1	1750	7	156.201	38.898	59.826	1.909	1.144	2144.199	258.394	1125.113	14.318	1.467
660	1751	1	182.50	7.5	0.1	1750	7.5	154.415	38.484	59.075	1.898	1.060	2283.103	272.181	1195.684	15.115	1.420
661	1751	1	183.00	8	0.1	1750	8	152.614	38.063	58.349	1.886	0.986	2421.440	285.875	1264.810	15.885	1.408
662	1751	1	184.00	9	0.1	1750	9	148.729	37.019	57.067	1.871	0.864	2696.124	312.496	1399.900	17.429	1.540
663	1751	1	185.00	10	0.1	1750	10	144.958	35.976	55.886	1.857	0.767	2967.980	338.058	1530.398	18.862	1.701
666	2001	1	200.50	0.5	0.1	2000	0.5	459.495	80.260	270.006	3.202	15.742	121.087	26.134	68.989	1.150	7.347
667	2001	1	200.75	0.75	0.1	2000	0.75	394.654	68.338	218.913	3.023	9.713	231.229	42.691	126.093	1.863	7.393
668	2001	1	201.00	1	0.1	2000	1	331.620	57.720	178.475	2.733	6.837	337.789	58.134	181.207	2.671	7.204
669	2001	1	201.25	1.25	0.1	2000	1.25	286.394	50.563	150.620	2.504	5.384	441.995	72.561	235.933	3.433	6.820
670	2001	1	202.00	2	0.1	2000	2	216.299	42.592	105.234	2.205	3.692	735.332	112.121	392.238	5.495	5.350
671	2001	1	202.50	2.5	0.1	2000	2.5	198.587	42.316	91.718	2.174	3.153	918.674	133.932	493.923	6.695	4.418
672	2001	1	203.00	3	0.1	2000	3	190.766	42.999	83.452	2.169	2.747	1094.868	153.276	586.994	7.822	3.637
673	2001	1	204.00	4	0.1	2000	4	185.750	44.213	76.025	2.155	2.148	1435.649	185.585	770.096	9.889	2.620
674	2001	1	205.00	5	0.1	2000	5	184.324	44.722	73.781	2.133	1.730	1760.993	219.314	948.055	11.825	2.032
675	2001	1	206.00	6	0.1	2000	6	181.865	44.529	71.974	2.096	1.428	2079.811	252.333	1116.031	13.657	1.732
676	2001	1	207.00	7	0.1	2000	7	178.691	43.799	70.617	2.064	1.204	2393.486	283.432	1282.036	15.412	1.540
677	2001	1	207.50	7.5	0.1	2000	7.5	176.898	43.412	69.810	2.051	1.114	2548.592	298.658	1360.690	16.265	1.480
678	2001	1	208.00	8	0.1	2000	8	174.718	42.916	69.025	2.034	1.036	2702.746	313.876	1439.105	17.125	1.439
679	2001	1	209.00	9	0.1	2000	9	170.379	41.645	67.579	2.010	0.906	3009.884	342.942	1594.981	18.747	1.394
680	2001	1	210.00	10	0.1	2000	10	165.993	40.440	66.265	1.986	0.802	3314.123	371.325	1748.285	20.325	1.513
683	2251	1	225.50	0.5	0.1	2250	0.5	509.071	86.975	300.947	3.457	16.645	134.162	28.418	76.868	1.218	7.710
684	2251	1	225.75	0.75	0.1	2250	0.75	435.725	74.451	244.214	3.265	10.256	255.482	46.352	140.701	2.014	7.749
685	2251	1	226.00	1	0.1	2250	1	365.644	62.793	199.197	2.941	7.202	372.804	62.774	202.499	2.877	7.571
686	2251	1	226.25	1.25	0.1	2250	1.25	315.401	54.895	168.017	2.686	5.659	487.075	79.007	263.375	3.683	7.183
687	2251	1	227.00	2	0.1	2250	2	238.742	46.554	118.041	2.376	3.870	809.212	121.834	438.792	5.909	5.673
688	2251	1	227.50	2.5	0.1	2250	2.5	219.604	46.466	102.474	2.345	3.306	1009.667	144.229	548.310	7.153	4.711
689	2251	1	228.00	3	0.1	2250	3	211.330	47.282	93.702	2.344	2.883	1209.906	164.745	657.739	8.314	3.890
690	2251	1	229.00	4	0.1	2250	4	207.625	48.742	86.937	2.332	2.257	1579.095	201.258	862.129	10.540	2.833
691	2251	1	230.00	5	0.1	2250	5	206.720	49.436	83.941	2.311	1.816	1938.214	238.505	1052.622	12.682	2.196
692	2251	1	231.00	6	0.1	2250	6	204.200	48.972	82.793	2.264	1.497	2291.513	273.465	1250.660	14.577	1.852
693	2251	1	232.00	7	0.1	2250	7	201.498	48.365	81.624	2.229	1.262	2634.567	306.762	1433.656	16.439	1.622
694	2251	1	232.50	7.5	0.1	2250	7.5	199.335	47.864	80.850	2.209	1.166	2808.513	323.710	1527.697	17.337	1.551
695	2251	1	233.00	8	0.1	2250	8	197.031	47.554	79.644	2.188	1.084	2975.128	339.089	1609.891	18.206	1.504
696	2251	1	234.00	9	0.1	2250	9	191.997	46.468	78.456	2.157	0.944	3324.671	376.603	1796.160	20.294	1.422
697	2251	1	235.00	10	0.1	2250	10	187.081	45.124	76.990	2.131	0.835	3661.911	406.921	1968.633	21.971	1.391
700	2501	1	250.50	0.5	0.1	2500	0.5	557.498	93.586	333.035	3.716	17.497	147.343	30.550	85.232	1.240	8.031
701	2501	1	250.75	0.75	0.1	2500	0.75	476.030	79.892	269.332	3.491	10.757	279.097	49.777	155.202	2.141	8.096



STP-PT-074: Local Stress in Nozzles, Shells and Formed Heads from External Heads

Model								Secondary (inside) Stress Factors									
	OD	T	od	t	d/D	D/T	t/T	Branch					Header				
								Axial	In-Plane	Out-of-Plane	Torsional	Pressure	Axial	In-Plane	Out-of-Plane	Torsional	Pressure
702	2501	1	251.00	1	0.1	2500	1	398.549	67.296	219.724	3.142	7.539	406.628	66.938	223.496	3.079	7.912
703	2501	1	251.25	1.25	0.1	2500	1.25	343.891	59.414	185.225	2.856	5.908	530.207	84.572	289.644	3.956	7.525
704	2501	1	252.00	2	0.1	2500	2	260.761	50.160	130.100	2.519	4.036	879.565	130.735	481.299	6.243	5.971
705	2501	1	252.50	2.5	0.1	2500	2.5	240.599	50.144	113.604	2.505	3.448	1101.339	153.915	604.689	7.621	4.982
706	2501	1	253.00	3	0.1	2500	3	231.894	51.195	104.265	2.518	3.010	1313.227	176.210	723.644	8.873	4.131
707	2501	1	254.00	4	0.1	2500	4	228.467	53.000	98.662	2.517	2.359	1721.911	215.925	969.586	11.264	3.009
708	2501	1	255.00	5	0.1	2500	5	228.757	53.871	95.189	2.486	1.899	2113.161	255.653	1170.452	13.384	2.364
709	2501	1	256.00	6	0.1	2500	6	227.017	54.037	93.864	2.453	1.564	2504.321	296.994	1384.516	15.652	1.989
710	2501	1	257.00	7	0.1	2500	7	223.427	53.276	92.412	2.401	1.317	2878.918	332.219	1591.069	17.597	1.741
711	2501	1	257.50	7.5	0.1	2500	7.5	221.781	52.570	91.788	2.372	1.217	3059.918	349.280	1686.847	18.584	1.626
712	2501	1	258.00	8	0.1	2500	8	219.610	51.977	91.094	2.355	1.129	3253.563	368.587	1791.168	19.599	1.562
713	2501	1	259.00	9	0.1	2500	9	214.344	50.909	89.450	2.305	0.983	3619.379	402.058	1978.120	21.427	1.440
714	2501	1	260.00	10	0.1	2500	10	208.887	49.450	87.917	2.268	0.868	3990.212	435.184	2182.607	23.218	1.414
715	9	1	1.30	0.1	0.15	8	0.1	1.113	0.947	0.948	0.758	1.860	0.379	0.138	0.153	0.078	1.702
716	9	1	1.45	0.25	0.15	8	0.25	1.119	0.698	0.696	0.635	0.831	0.826	0.250	0.284	0.143	1.540
717	9	1	1.70	0.5	0.15	8	0.5	1.092	0.472	0.473	0.597	0.702	1.308	0.380	0.393	0.200	1.344
718	9	1	1.95	0.75	0.15	8	0.75	1.091	0.429	0.458	0.593	0.684	1.647	0.494	0.489	0.244	1.244
719	9	1	2.20	1	0.15	8	1	1.149	0.467	0.503	0.611	0.693	1.906	0.600	0.622	0.284	1.160
732	17	1	2.50	0.1	0.15	16	0.1	1.282	1.064	1.060	0.822	2.238	0.603	0.245	0.305	0.086	2.159
733	17	1	2.65	0.25	0.15	16	0.25	2.067	0.908	0.912	0.740	1.124	1.267	0.473	0.622	0.178	1.919
734	17	1	2.90	0.5	0.15	16	0.5	3.036	0.909	1.141	0.688	1.084	2.216	0.714	0.957	0.286	1.699
735	17	1	3.15	0.75	0.15	16	0.75	3.385	0.960	1.179	0.654	1.060	2.877	0.912	1.074	0.364	1.541
736	17	1	3.40	1	0.15	16	1	3.456	0.941	1.153	0.638	1.034	3.411	1.092	1.249	0.421	1.420
737	17	1	3.65	1.25	0.15	16	1.25	3.660	0.910	1.122	0.632	0.925	4.292	1.308	1.597	0.470	1.251
738	17	1	4.40	2	0.15	16	2	3.604	0.796	1.053	0.697	0.700	7.877	1.867	2.607	0.588	1.101
749	25	1	3.70	0.1	0.15	24	0.1	1.913	1.138	1.164	0.854	2.299	0.728	0.369	0.463	0.095	2.482
750	25	1	3.85	0.25	0.15	24	0.25	4.031	1.544	1.962	0.780	1.400	1.531	0.721	0.913	0.199	2.231
751	25	1	4.10	0.5	0.15	24	0.5	5.630	1.793	2.301	0.733	1.339	2.636	1.009	1.414	0.340	1.912
752	25	1	4.35	0.75	0.15	24	0.75	6.025	1.680	2.192	0.699	1.333	3.715	1.311	1.607	0.451	1.741
753	25	1	4.60	1	0.15	24	1	5.956	1.513	2.005	0.675	1.317	5.227	1.622	2.039	0.537	1.588
754	25	1	4.85	1.25	0.15	24	1.25	6.104	1.373	1.848	0.660	1.207	7.359	1.970	2.604	0.609	1.382
755	25	1	5.60	2	0.15	24	2	5.940	1.089	1.488	0.739	0.927	13.539	2.781	4.127	0.760	1.091
756	25	1	6.10	2.5	0.15	24	2.5	5.734	0.995	1.373	0.896	0.790	17.211	3.159	5.052	0.836	1.269
757	25	1	6.60	3	0.15	24	3	5.539	0.938	1.327	1.078	0.684	20.512	3.464	5.973	0.914	1.411
766	33	1	4.90	0.1	0.15	32	0.1	2.861	1.229	1.622	0.873	2.137	0.793	0.508	0.615	0.104	2.724
767	33	1	5.05	0.25	0.15	32	0.25	6.109	2.450	3.178	0.811	1.763	1.730	0.997	1.197	0.214	2.430
768	33	1	5.30	0.5	0.15	32	0.5	8.341	2.725	3.608	0.759	1.560	3.155	1.379	1.781	0.379	2.095
769	33	1	5.55	0.75	0.15	32	0.75	8.717	2.461	3.326	0.731	1.516	5.182	1.679	2.219	0.518	1.859

STP-PT-074: Local Stress in Nozzles, Shells and Formed Heads from External Heads

Model	Secondary (inside) Stress Factors																
	OD	T	od	t	d/D	D/T	t/T	Branch					Header				
								Axial	In-Plane	Out-of-Plane	Torsional	Pressure	Axial	In-Plane	Out-of-Plane	Torsional	Pressure
770	33	1	5.80	1	0.15	32	1	8.462	2.154	2.951	0.714	1.497	7.569	2.148	2.934	0.630	1.704
771	33	1	6.05	1.25	0.15	32	1.25	8.472	1.909	2.663	0.708	1.390	10.633	2.652	3.757	0.727	1.479
772	33	1	6.80	2	0.15	32	2	7.974	1.394	2.015	0.788	1.096	19.359	3.760	5.901	0.924	1.141
773	33	1	7.30	2.5	0.15	32	2.5	7.616	1.214	1.767	0.895	0.942	24.673	4.251	7.147	1.011	1.251
774	33	1	7.80	3	0.15	32	3	7.301	1.114	1.613	1.029	0.821	29.515	4.609	8.321	1.088	1.443
775	33	1	8.80	4	0.15	32	4	6.926	1.040	1.493	1.362	0.648	38.014	5.330	10.651	1.253	1.658
783	41	1	6.10	0.1	0.15	40	0.1	3.746	1.722	2.266	0.884	2.119	0.902	0.647	0.799	0.112	2.914
784	41	1	6.25	0.25	0.15	40	0.25	8.271	3.357	4.466	0.829	2.185	1.946	1.265	1.507	0.225	2.568
785	41	1	6.50	0.5	0.15	40	0.5	11.142	3.658	4.999	0.785	1.794	3.726	1.747	2.115	0.410	2.228
786	41	1	6.75	0.75	0.15	40	0.75	11.437	3.230	4.526	0.763	1.668	6.711	2.037	2.895	0.572	1.961
787	41	1	7.00	1	0.15	40	1	10.952	2.778	3.953	0.748	1.625	9.977	2.670	3.895	0.706	1.790
788	41	1	7.25	1.25	0.15	40	1.25	10.784	2.430	3.526	0.760	1.517	13.993	3.333	5.014	0.824	1.553
789	41	1	8.00	2	0.15	40	2	9.871	1.725	2.596	0.839	1.217	25.270	4.759	7.871	1.071	1.185
790	41	1	8.50	2.5	0.15	40	2.5	9.344	1.480	2.226	0.911	1.051	32.095	5.366	9.474	1.179	1.233
791	41	1	9.00	3	0.15	40	3	8.902	1.322	1.978	1.002	0.918	38.536	5.810	10.973	1.265	1.445
792	41	1	10.00	4	0.15	40	4	8.259	1.177	1.709	1.241	0.727	49.943	6.685	13.780	1.429	1.731
793	41	1	11.00	5	0.15	40	5	7.927	1.148	1.616	1.564	0.603	59.968	7.406	16.616	1.597	1.870
800	51	1	7.60	0.1	0.15	50	0.1	4.745	2.322	3.083	0.893	2.543	1.062	0.807	1.026	0.121	3.115
801	51	1	7.75	0.25	0.15	50	0.25	11.050	4.466	6.139	0.840	2.748	2.206	1.572	1.899	0.236	2.700
802	51	1	8.00	0.5	0.15	50	0.5	14.715	4.793	6.806	0.807	2.107	4.634	2.160	2.513	0.443	2.361
803	51	1	8.25	0.75	0.15	50	0.75	14.844	4.157	6.081	0.797	1.847	8.632	2.526	3.769	0.627	2.069
804	51	1	8.50	1	0.15	50	1	14.025	3.528	5.259	0.814	1.755	12.955	3.309	5.152	0.785	1.868
805	51	1	8.75	1.25	0.15	50	1.25	13.582	3.053	4.647	0.833	1.633	18.186	4.165	6.680	0.924	1.626
806	51	1	9.50	2	0.15	50	2	12.092	2.130	3.362	0.897	1.324	32.593	5.985	10.528	1.232	1.227
807	51	1	10.00	2.5	0.15	50	2.5	11.356	1.819	2.847	0.945	1.152	41.323	6.758	12.657	1.368	1.235
808	51	1	10.50	3	0.15	50	3	10.765	1.612	2.490	1.001	1.008	49.500	7.407	14.577	1.474	1.427
809	51	1	11.50	4	0.15	50	4	9.850	1.384	2.057	1.153	0.797	64.559	8.477	18.123	1.648	1.775
810	51	1	12.50	5	0.15	50	5	9.234	1.292	1.841	1.370	0.659	77.870	9.357	21.480	1.824	1.978
811	51	1	13.50	6	0.15	50	6	8.918	1.286	1.763	1.658	0.564	89.837	10.342	24.868	2.000	2.085
812	51	1	14.50	7	0.15	50	7	8.917	1.299	1.779	2.014	0.501	100.437	11.260	28.322	2.194	2.119
817	61	1	9.10	0.1	0.15	60	0.1	5.821	2.893	3.903	0.898	2.999	1.204	0.956	1.242	0.128	3.272
818	61	1	9.25	0.25	0.15	60	0.25	13.888	5.542	7.873	0.846	3.316	2.580	1.863	2.245	0.246	2.808
819	61	1	9.50	0.5	0.15	60	0.5	18.324	5.885	8.665	0.826	2.432	5.538	2.542	2.955	0.472	2.478
820	61	1	9.75	0.75	0.15	60	0.75	18.227	5.042	7.675	0.851	2.024	10.549	2.972	4.663	0.674	2.190
821	61	1	10.00	1	0.15	60	1	17.031	4.240	6.595	0.870	1.871	15.937	3.946	6.460	0.850	1.953
822	61	1	10.25	1.25	0.15	60	1.25	16.290	3.644	5.799	0.891	1.725	22.230	4.957	8.396	1.010	1.688
823	61	1	11.00	2	0.15	60	2	14.164	2.523	4.148	0.945	1.402	39.739	7.169	13.334	1.369	1.260
824	61	1	11.50	2.5	0.15	60	2.5	13.221	2.153	3.492	0.980	1.226	50.284	8.185	16.047	1.536	1.254

STP-PT-074: Local Stress in Nozzles, Shells and Formed Heads from External Heads

Model								Secondary (inside) Stress Factors									
	OD	T	od	t	d/D	D/T	t/T	Branch					Header				
								Axial	In-Plane	Out-of-Plane	Torsional	Pressure	Axial	In-Plane	Out-of-Plane	Torsional	Pressure
825	61	1	12.00	3	0.15	60	3	12.508	1.905	3.034	1.017	1.076	60.211	9.055	18.472	1.664	1.403
826	61	1	13.00	4	0.15	60	4	11.424	1.624	2.458	1.118	0.851	78.507	10.333	22.796	1.864	1.789
827	61	1	14.00	5	0.15	60	5	10.571	1.495	2.133	1.262	0.699	95.259	11.438	26.837	2.048	2.039
828	61	1	15.00	6	0.15	60	6	9.997	1.431	1.961	1.459	0.596	110.374	12.561	30.738	2.229	2.194
829	61	1	16.00	7	0.15	60	7	9.718	1.432	1.901	1.714	0.523	124.137	13.589	34.664	2.437	2.278
830	61	1	16.50	7.5	0.15	60	7.5	9.591	1.449	1.889	1.863	0.493	130.736	14.067	36.694	2.546	2.304
831	61	1	17.00	8	0.15	60	8	9.650	1.457	1.902	2.028	0.468	136.921	14.542	38.724	2.659	2.314
834	71	1	10.60	0.1	0.15	70	0.1	6.953	3.435	4.728	0.901	3.464	1.331	1.092	1.446	0.134	3.413
835	71	1	10.75	0.25	0.15	70	0.25	16.746	6.575	9.648	0.849	3.872	2.975	2.123	2.568	0.253	2.905
836	71	1	11.00	0.5	0.15	70	0.5	21.930	6.931	10.561	0.862	2.755	6.421	2.880	3.441	0.497	2.585
837	71	1	11.25	0.75	0.15	70	0.75	21.565	5.884	9.287	0.894	2.200	12.442	3.375	5.570	0.713	2.306
838	71	1	11.50	1	0.15	70	1	19.967	4.918	7.949	0.915	1.979	18.890	4.573	7.800	0.903	2.037
839	71	1	11.75	1.25	0.15	70	1.25	18.902	4.205	6.965	0.936	1.806	26.240	5.737	10.169	1.078	1.762
840	71	1	12.50	2	0.15	70	2	16.133	2.914	4.950	0.985	1.464	46.677	8.343	16.250	1.486	1.297
841	71	1	13.00	2.5	0.15	70	2.5	14.964	2.487	4.151	1.012	1.282	58.967	9.655	19.593	1.683	1.267
842	71	1	13.50	3	0.15	70	3	14.142	2.205	3.594	1.039	1.130	70.540	10.690	22.564	1.835	1.377
843	71	1	14.50	4	0.15	70	4	12.923	1.874	2.882	1.108	0.896	92.073	12.229	27.811	2.066	1.787
844	71	1	15.50	5	0.15	70	5	11.943	1.715	2.462	1.207	0.734	112.016	13.619	32.595	2.268	2.071
845	71	1	16.50	6	0.15	70	6	11.165	1.643	2.208	1.342	0.621	130.147	14.876	37.073	2.473	2.262
846	71	1	17.50	7	0.15	70	7	10.700	1.600	2.087	1.521	0.541	146.986	16.024	41.517	2.690	2.386
847	71	1	18.00	7.5	0.15	70	7.5	10.505	1.581	2.055	1.632	0.510	154.896	16.566	43.746	2.804	2.428
848	71	1	18.50	8	0.15	70	8	10.357	1.579	2.032	1.752	0.483	162.543	17.072	45.995	2.917	2.459
849	71	1	19.50	9	0.15	70	9	10.255	1.598	2.027	2.031	0.439	176.673	17.957	50.453	3.147	2.489
850	71	1	20.50	10	0.15	70	10	10.447	1.623	2.069	2.360	0.404	190.148	18.881	55.127	3.389	2.490
851	81	1	12.10	0.1	0.15	80	0.1	8.089	3.950	5.561	0.903	3.929	1.445	1.220	1.625	0.138	3.537
852	81	1	12.25	0.25	0.15	80	0.25	19.607	7.563	11.454	0.853	4.409	3.354	2.353	2.864	0.259	2.995
853	81	1	12.50	0.5	0.15	80	0.5	25.513	7.929	12.475	0.892	3.072	7.261	3.186	3.918	0.523	2.686
854	81	1	12.75	0.75	0.15	80	0.75	24.853	6.688	10.913	0.931	2.373	14.325	3.818	6.485	0.751	2.419
855	81	1	13.00	1	0.15	80	1	22.837	5.562	9.314	0.952	2.084	21.780	5.188	9.157	0.951	2.140
856	81	1	13.25	1.25	0.15	80	1.25	21.430	4.740	8.139	0.973	1.881	30.165	6.493	11.974	1.138	1.839
857	81	1	14.00	2	0.15	80	2	17.995	3.296	5.756	1.017	1.514	53.399	9.560	19.239	1.588	1.327
858	81	1	14.50	2.5	0.15	80	2.5	16.629	2.820	4.816	1.040	1.331	67.359	11.091	23.245	1.814	1.287
859	81	1	15.00	3	0.15	80	3	15.693	2.503	4.162	1.062	1.173	80.531	12.307	26.810	1.992	1.354
860	81	1	16.00	4	0.15	80	4	14.356	2.133	3.323	1.111	0.932	105.116	14.090	33.046	2.256	1.777
861	81	1	17.00	5	0.15	80	5	13.325	1.935	2.822	1.179	0.763	127.799	15.784	38.557	2.490	2.084
862	81	1	18.00	6	0.15	80	6	12.447	1.844	2.504	1.278	0.643	148.826	17.202	43.686	2.712	2.302
863	81	1	19.00	7	0.15	80	7	11.770	1.802	2.309	1.411	0.557	168.438	18.456	48.668	2.947	2.455
864	81	1	19.50	7.5	0.15	80	7.5	11.487	1.774	2.244	1.487	0.523	177.848	19.043	51.159	3.060	2.513

STP-PT-074: Local Stress in Nozzles, Shells and Formed Heads from External Heads

Model								Secondary (inside) Stress Factors									
	OD	T	od	t	d/D	D/T	t/T	Branch					Header				
								Axial	In-Plane	Out-of-Plane	Torsional	Pressure	Axial	In-Plane	Out-of-Plane	Torsional	Pressure
865	81	1	20.00	8	0.15	80	8	11.339	1.765	2.222	1.575	0.494	186.815	19.606	53.615	3.176	2.559
866	81	1	21.00	9	0.15	80	9	10.983	1.748	2.160	1.777	0.447	204.047	20.655	58.617	3.413	2.623
867	81	1	22.00	10	0.15	80	10	10.818	1.769	2.163	2.023	0.410	220.088	21.636	63.666	3.660	2.654
868	91	1	13.60	0.1	0.15	90	0.1	9.209	4.442	6.392	0.903	4.388	1.550	1.320	1.815	0.142	3.651
869	91	1	13.75	0.25	0.15	90	0.25	22.426	8.509	13.262	0.857	4.925	3.716	2.567	3.130	0.266	3.081
870	91	1	14.00	0.5	0.15	90	0.5	29.049	8.887	14.404	0.918	3.379	8.167	3.461	4.406	0.547	2.785
871	91	1	14.25	0.75	0.15	90	0.75	28.091	7.456	12.553	0.963	2.543	16.181	4.260	7.410	0.786	2.529
872	91	1	14.50	1	0.15	90	1	25.647	6.182	10.689	0.984	2.186	24.620	5.795	10.529	0.998	2.250
873	91	1	14.75	1.25	0.15	90	1.25	23.885	5.253	9.316	1.004	1.952	33.991	7.233	13.796	1.189	1.920
874	91	1	15.50	2	0.15	90	2	19.813	3.682	6.569	1.044	1.554	59.736	10.764	22.211	1.687	1.359
875	91	1	16.00	2.5	0.15	90	2.5	18.233	3.156	5.488	1.065	1.369	75.499	12.489	26.979	1.930	1.298
876	91	1	16.50	3	0.15	90	3	17.168	2.810	4.735	1.083	1.209	90.194	13.874	31.161	2.133	1.337
877	91	1	17.50	4	0.15	90	4	15.736	2.398	3.774	1.120	0.964	117.715	16.070	38.459	2.436	1.763
878	91	1	18.50	5	0.15	90	5	14.654	2.177	3.197	1.169	0.789	143.254	18.046	44.850	2.695	2.087
879	91	1	19.50	6	0.15	90	6	13.750	2.063	2.830	1.243	0.663	167.172	19.676	50.736	2.946	2.326
880	91	1	20.50	7	0.15	90	7	13.002	1.997	2.579	1.339	0.571	189.600	21.050	56.334	3.202	2.503
881	91	1	21.00	7.5	0.15	90	7.5	12.713	1.994	2.477	1.398	0.535	200.382	21.692	59.108	3.328	2.573
882	91	1	21.50	8	0.15	90	8	12.395	1.959	2.440	1.465	0.504	210.658	22.321	61.801	3.442	2.631
883	91	1	22.50	9	0.15	90	9	11.858	1.942	2.343	1.618	0.453	230.584	23.452	67.282	3.686	2.723
884	91	1	23.50	10	0.15	90	10	11.514	1.932	2.309	1.813	0.414	249.277	24.506	72.763	3.937	2.780
885	101	1	15.10	0.1	0.15	100	0.1	10.327	4.897	7.219	0.905	4.838	1.694	1.418	1.969	0.144	3.749
886	101	1	15.25	0.25	0.15	100	0.25	25.227	9.403	15.086	0.859	5.419	4.039	2.742	3.390	0.279	3.166
887	101	1	15.50	0.5	0.15	100	0.5	32.549	9.793	16.333	0.942	3.676	9.040	3.706	4.927	0.567	2.880
888	101	1	15.75	0.75	0.15	100	0.75	31.271	8.188	14.190	0.990	2.708	17.997	4.692	8.327	0.816	2.637
889	101	1	16.00	1	0.15	100	1	28.392	6.771	12.059	1.011	2.285	27.415	6.381	11.900	1.038	2.357
890	101	1	16.25	1.25	0.15	100	1.25	26.292	5.746	10.498	1.031	2.020	37.750	7.962	15.627	1.238	2.012
891	101	1	17.00	2	0.15	100	2	21.540	4.055	7.377	1.066	1.596	66.084	11.912	25.266	1.765	1.397
892	101	1	17.50	2.5	0.15	100	2.5	19.769	3.491	6.157	1.086	1.403	83.432	13.860	30.761	2.034	1.310
893	101	1	18.00	3	0.15	100	3	18.595	3.115	5.309	1.102	1.243	99.598	15.407	35.586	2.260	1.333
894	101	1	19.00	4	0.15	100	4	17.067	2.672	4.230	1.131	0.991	129.972	18.055	44.020	2.607	1.749
895	101	1	20.00	5	0.15	100	5	15.944	2.427	3.583	1.167	0.812	158.338	20.313	51.363	2.891	2.084
896	101	1	21.00	6	0.15	100	6	14.990	2.295	3.162	1.221	0.682	185.045	22.168	58.062	3.174	2.339
897	101	1	22.00	7	0.15	100	7	14.204	2.220	2.864	1.294	0.586	210.218	23.705	64.352	3.452	2.535
898	101	1	22.50	7.5	0.15	100	7.5	13.867	2.191	2.741	1.339	0.547	222.285	24.415	67.410	3.586	2.616
899	101	1	23.00	8	0.15	100	8	13.557	2.170	2.651	1.390	0.514	233.991	25.067	70.427	3.714	2.685
900	101	1	24.00	9	0.15	100	9	12.956	2.120	2.543	1.507	0.460	256.470	26.330	76.390	3.963	2.797
901	101	1	25.00	10	0.15	100	10	12.456	2.097	2.467	1.666	0.418	277.751	27.454	82.349	4.213	2.877
902	251	1	37.60	0.1	0.15	250	0.1	26.227	9.870	19.671	0.891	10.441	3.549	2.280	3.585	0.162	4.913

STP-PT-074: Local Stress in Nozzles, Shells and Formed Heads from External Heads

Model								Secondary (inside) Stress Factors									
	OD	T	od	t	d/D	D/T	t/T	Branch					Header				
								Axial	In-Plane	Out-of-Plane	Torsional	Pressure	Axial	In-Plane	Out-of-Plane	Torsional	Pressure
903	251	1	37.75	0.25	0.15	250	0.25	65.116	19.546	42.979	1.001	11.020	9.118	4.558	6.677	0.399	4.258
904	251	1	38.00	0.5	0.15	250	0.5	82.169	20.154	45.813	1.267	7.091	21.893	6.287	12.303	0.768	4.052
905	251	1	38.25	0.75	0.15	250	0.75	75.467	16.848	38.763	1.334	4.686	43.594	10.187	22.249	1.083	3.935
906	251	1	38.50	1	0.15	250	1	66.106	14.182	32.496	1.319	3.514	65.976	14.029	32.542	1.378	3.695
907	251	1	38.75	1.25	0.15	250	1.25	58.900	12.297	27.950	1.299	2.876	88.933	17.743	43.000	1.658	3.327
908	251	1	39.50	2	0.15	250	2	45.064	9.327	19.433	1.259	2.048	152.003	26.631	71.540	2.548	2.212
909	251	1	40.00	2.5	0.15	250	2.5	40.355	8.459	16.239	1.256	1.758	190.275	31.853	88.514	3.083	1.674
910	251	1	40.50	3	0.15	250	3	37.563	7.919	14.100	1.263	1.541	226.544	36.437	104.186	3.580	1.440
911	251	1	41.50	4	0.15	250	4	34.590	7.406	11.502	1.282	1.228	295.131	44.167	132.500	4.451	1.635
912	251	1	42.50	5	0.15	250	5	32.984	7.083	10.042	1.295	1.013	360.758	50.682	157.913	5.214	1.972
913	251	1	43.50	6	0.15	250	6	31.738	6.763	9.107	1.303	0.855	424.038	56.307	180.937	5.906	2.275
914	251	1	44.50	7	0.15	250	7	30.618	6.419	8.442	1.308	0.734	485.269	61.143	201.949	6.504	2.548
915	251	1	45.00	7.5	0.15	250	7.5	30.128	6.270	8.169	1.306	0.683	515.494	63.369	211.968	6.801	2.675
916	251	1	45.50	8	0.15	250	8	29.682	6.106	7.927	1.310	0.639	544.962	65.438	221.456	7.075	2.794
917	251	1	46.50	9	0.15	250	9	28.628	5.825	7.509	1.306	0.562	603.335	69.789	239.820	7.585	3.017
918	251	1	47.50	10	0.15	250	10	27.743	5.504	7.162	1.322	0.501	659.996	73.915	256.994	8.081	3.219
919	501	1	75.10	0.1	0.15	500	0.1	50.533	14.645	39.496	0.902	16.823	6.811	3.031	6.293	0.188	6.348
920	501	1	75.25	0.25	0.15	500	0.25	126.864	30.019	88.418	1.379	16.936	16.853	6.176	12.435	0.516	5.643
921	501	1	75.50	0.5	0.15	500	0.5	157.622	32.897	93.815	1.926	10.730	41.306	10.383	24.129	0.947	5.413
922	501	1	75.75	0.75	0.15	500	0.75	141.541	28.038	78.542	1.943	6.847	81.998	17.283	44.895	1.334	5.371
923	501	1	76.00	1	0.15	500	1	121.735	23.707	65.179	1.845	4.919	122.764	23.946	65.721	1.794	5.154
924	501	1	76.25	1.25	0.15	500	1.25	106.844	20.741	55.679	1.752	3.896	163.304	29.917	86.433	2.306	4.770
925	501	1	77.00	2	0.15	500	2	80.397	16.574	38.751	1.591	2.638	275.739	45.874	144.518	3.692	3.443
926	501	1	77.50	2.5	0.15	500	2.5	72.125	15.722	32.828	1.552	2.227	344.782	54.763	180.316	4.489	2.674
927	501	1	78.00	3	0.15	500	3	67.386	15.354	29.030	1.536	1.927	410.625	62.554	214.129	5.242	2.103
928	501	1	79.00	4	0.15	500	4	62.508	14.959	24.692	1.526	1.502	536.168	75.782	277.419	6.599	1.591
929	501	1	80.00	5	0.15	500	5	59.856	14.545	22.359	1.534	1.220	656.420	87.299	335.942	7.853	1.868
930	501	1	81.00	6	0.15	500	6	57.902	14.317	20.880	1.551	1.022	778.023	100.907	392.896	9.069	2.160
931	501	1	82.00	7	0.15	500	7	56.177	14.025	19.805	1.565	0.876	893.121	112.642	444.739	10.151	2.424
932	501	1	82.50	7.5	0.15	500	7.5	55.367	13.836	19.355	1.572	0.816	949.823	118.254	469.565	10.642	2.550
933	501	1	83.00	8	0.15	500	8	54.580	13.604	18.957	1.574	0.764	1006.181	123.846	493.889	11.155	2.673
934	501	1	84.00	9	0.15	500	9	53.050	13.202	18.238	1.581	0.675	1117.549	133.803	540.640	12.080	2.909
935	501	1	85.00	10	0.15	500	10	51.548	12.692	17.601	1.579	0.602	1227.454	143.615	585.177	12.961	3.133
937	751	1	112.75	0.25	0.15	750	0.25	184.506	38.906	132.159	1.810	21.213	23.425	7.468	17.666	0.613	6.833
938	751	1	113.00	0.5	0.15	750	0.5	226.906	43.195	140.135	2.539	13.362	59.856	14.157	35.965	1.090	6.522
939	751	1	113.25	0.75	0.15	750	0.75	201.187	37.373	116.730	2.517	8.418	117.700	23.440	67.181	1.602	6.493
940	751	1	113.50	1	0.15	750	1	171.687	31.871	96.516	2.338	5.956	174.704	32.100	98.004	2.281	6.277
941	751	1	113.75	1.25	0.15	750	1.25	149.736	27.955	82.117	2.181	4.664	230.917	40.550	128.485	2.949	5.869

STP-PT-074: Local Stress in Nozzles, Shells and Formed Heads from External Heads

Model								Secondary (inside) Stress Factors									
	OD	T	od	t	d/D	D/T	t/T	Branch					Header				
								Axial	In-Plane	Out-of-Plane	Torsional	Pressure	Axial	In-Plane	Out-of-Plane	Torsional	Pressure
942	751	1	114.50	2	0.15	750	2	112.700	22.706	57.317	1.925	3.110	387.836	62.530	214.946	4.725	4.389
943	751	1	115.00	2.5	0.15	750	2.5	101.931	21.998	49.056	1.865	2.617	484.878	74.450	268.918	5.753	3.493
944	751	1	115.50	3	0.15	750	3	96.113	21.846	43.985	1.837	2.255	577.746	84.710	320.535	6.707	2.800
945	751	1	116.50	4	0.15	750	4	90.549	21.807	38.537	1.819	1.743	755.150	102.367	418.259	8.449	1.973
946	751	1	117.50	5	0.15	750	5	87.428	21.501	35.731	1.812	1.400	925.195	120.681	509.928	10.049	1.786
947	751	1	118.50	6	0.15	750	6	84.865	20.955	33.912	1.806	1.161	1090.930	138.106	596.928	11.540	2.042
948	751	1	119.50	7	0.15	750	7	82.401	20.587	32.473	1.804	0.987	1253.608	154.556	680.278	12.954	2.288
949	751	1	120.00	7.5	0.15	750	7.5	81.217	20.350	31.866	1.799	0.918	1333.955	162.606	720.511	13.634	2.406
950	751	1	120.50	8	0.15	750	8	80.019	20.147	31.266	1.799	0.857	1413.892	170.262	760.134	14.297	2.522
951	751	1	121.50	9	0.15	750	9	77.731	19.713	30.191	1.797	0.755	1572.108	185.342	836.700	15.578	2.749
952	751	1	122.50	10	0.15	750	10	75.565	19.233	29.190	1.795	0.674	1728.546	199.680	911.077	16.785	2.966
954	1001	1	150.25	0.25	0.15	1000	0.25	239.251	46.639	174.751	2.217	24.684	30.198	8.372	22.907	0.681	7.767
955	1001	1	150.50	0.5	0.15	1000	0.5	291.890	52.807	185.158	3.110	15.506	77.156	17.501	47.386	1.194	7.378
956	1001	1	150.75	0.75	0.15	1000	0.75	256.688	45.796	153.765	3.044	9.703	150.412	28.520	88.536	1.893	7.362
957	1001	1	151.00	1	0.15	1000	1	218.136	39.048	127.031	2.795	6.810	222.162	39.113	129.015	2.712	7.149
958	1001	1	151.25	1.25	0.15	1000	1.25	189.689	34.293	108.168	2.581	5.301	292.387	49.711	169.194	3.512	6.723
959	1001	1	152.00	2	0.15	1000	2	143.071	28.052	75.454	2.247	3.507	489.478	75.954	281.890	5.620	5.140
960	1001	1	152.50	2.5	0.15	1000	2.5	130.284	27.534	65.053	2.178	2.948	611.681	90.196	353.042	6.829	4.161
961	1001	1	153.00	3	0.15	1000	3	123.784	27.588	58.870	2.162	2.540	729.527	102.352	421.773	7.941	3.398
962	1001	1	154.00	4	0.15	1000	4	118.172	27.832	52.651	2.143	1.957	953.736	125.583	552.046	9.982	2.411
963	1001	1	155.00	5	0.15	1000	5	115.193	27.697	49.695	2.116	1.564	1169.274	148.642	675.552	11.874	1.864
964	1001	1	156.00	6	0.15	1000	6	112.246	27.206	47.661	2.094	1.288	1384.229	171.445	796.361	13.765	1.916
965	1001	1	157.00	7	0.15	1000	7	109.192	26.544	45.923	2.068	1.089	1591.346	191.916	909.831	15.454	2.166
966	1001	1	157.50	7.5	0.15	1000	7.5	107.660	26.312	45.183	2.059	1.008	1693.892	202.330	966.110	16.281	2.279
967	1001	1	158.00	8	0.15	1000	8	106.114	25.968	44.440	2.047	0.939	1795.720	211.936	1020.818	17.078	2.388
968	1001	1	159.00	9	0.15	1000	9	103.013	25.558	42.942	2.032	0.824	1998.313	231.161	1127.688	18.667	2.604
969	1001	1	160.00	10	0.15	1000	10	100.023	24.975	41.562	2.016	0.733	2198.458	249.743	1231.529	20.168	2.813
971	1251	1	187.75	0.25	0.15	1250	0.25	292.288	53.300	216.445	2.603	27.670	35.928	9.897	27.311	0.738	8.644
972	1251	1	188.00	0.5	0.15	1250	0.5	354.178	61.404	229.619	3.647	17.357	93.956	20.598	58.786	1.293	8.175
973	1251	1	188.25	0.75	0.15	1250	0.75	309.375	53.239	189.712	3.528	10.813	181.906	33.048	109.475	2.189	8.163
974	1251	1	188.50	1	0.15	1250	1	262.105	45.323	156.367	3.213	7.551	267.730	45.967	159.142	3.149	7.944
975	1251	1	188.75	1.25	0.15	1250	1.25	227.288	40.008	132.749	2.946	5.851	351.673	58.097	208.311	4.075	7.500
976	1251	1	189.50	2	0.15	1250	2	172.083	33.173	93.203	2.551	3.850	586.204	88.429	347.112	6.482	5.816
977	1251	1	190.00	2.5	0.15	1250	2.5	157.467	32.712	80.744	2.500	3.237	733.578	104.872	435.631	7.865	4.768
978	1251	1	190.50	3	0.15	1250	3	150.515	32.964	73.615	2.492	2.790	875.391	118.639	521.404	9.132	3.963
979	1251	1	191.50	4	0.15	1250	4	145.347	33.467	66.869	2.470	2.150	1143.976	147.607	683.097	11.450	2.831
980	1251	1	192.50	5	0.15	1250	5	142.763	33.413	63.910	2.435	1.715	1403.198	174.475	838.118	13.587	2.153
981	1251	1	193.50	6	0.15	1250	6	139.951	32.892	61.888	2.390	1.407	1655.932	199.944	986.683	15.626	1.822



STP-PT-074: Local Stress in Nozzles, Shells and Formed Heads from External Heads

Model								Secondary (inside) Stress Factors									
	OD	T	od	t	d/D	D/T	t/T	Branch					Header				
								Axial	In-Plane	Out-of-Plane	Torsional	Pressure	Axial	In-Plane	Out-of-Plane	Torsional	Pressure
982	1251	1	194.50	7	0.15	1250	7	136.609	32.117	60.095	2.350	1.184	1904.282	224.039	1131.158	17.565	2.042
983	1251	1	195.00	7.5	0.15	1250	7.5	134.730	31.676	59.151	2.328	1.094	2027.495	235.880	1201.874	18.516	2.149
984	1251	1	195.50	8	0.15	1250	8	132.892	31.350	58.240	2.311	1.016	2149.012	247.229	1270.387	19.438	2.254
985	1251	1	196.50	9	0.15	1250	9	129.116	30.688	56.571	2.277	0.887	2392.291	270.231	1407.382	21.225	2.459
986	1251	1	197.50	10	0.15	1250	10	125.332	30.089	55.122	2.248	0.787	2632.862	291.615	1539.236	22.947	2.661
988	1501	1	225.25	0.25	0.15	1500	0.25	343.645	59.574	257.013	2.981	30.443	41.411	11.183	31.660	0.794	9.373
989	1501	1	225.50	0.5	0.15	1500	0.5	413.566	69.336	272.078	4.156	19.012	109.938	23.300	69.684	1.412	8.835
990	1501	1	225.75	0.75	0.15	1500	0.75	359.576	60.048	224.826	3.986	11.816	211.490	37.222	129.699	2.454	8.836
991	1501	1	226.00	1	0.15	1500	1	303.789	51.215	185.001	3.606	8.219	310.410	51.792	188.261	3.532	8.616
992	1501	1	226.25	1.25	0.15	1500	1.25	263.237	45.245	157.153	3.295	6.348	406.817	65.448	246.291	4.558	8.166
993	1501	1	227.00	2	0.15	1500	2	199.957	38.049	110.406	2.844	4.160	677.071	99.417	409.288	7.237	6.406
994	1501	1	227.50	2.5	0.15	1500	2.5	183.985	37.362	96.339	2.807	3.497	847.069	117.528	514.886	8.764	5.301
995	1501	1	228.00	3	0.15	1500	3	176.689	37.819	88.282	2.809	3.015	1010.202	133.655	615.958	10.153	4.439
996	1501	1	229.00	4	0.15	1500	4	172.036	38.621	81.090	2.795	2.325	1321.438	166.732	809.026	12.693	3.202
997	1501	1	230.00	5	0.15	1500	5	170.124	38.656	78.228	2.757	1.853	1621.066	197.044	993.781	15.046	2.418
998	1501	1	231.00	6	0.15	1500	6	167.529	38.097	76.321	2.696	1.517	1913.293	225.174	1171.897	17.279	2.028
999	1501	1	232.00	7	0.15	1500	7	164.118	37.221	74.480	2.636	1.271	2200.738	252.451	1344.836	19.469	1.935
1000	1501	1	232.50	7.5	0.15	1500	7.5	162.131	36.944	73.512	2.614	1.173	2342.499	265.746	1430.005	20.491	2.038
1001	1501	1	233.00	8	0.15	1500	8	160.091	36.469	72.484	2.584	1.087	2484.101	278.745	1512.667	21.503	2.142
1002	1501	1	234.00	9	0.15	1500	9	155.582	35.762	70.606	2.535	0.947	2772.455	306.195	1681.413	23.668	2.336
1003	1501	1	235.00	10	0.15	1500	10	151.074	35.104	69.108	2.494	0.836	3052.442	331.665	1842.647	25.654	2.529
1006	1751	1	263.00	0.5	0.15	1750	0.5	470.751	76.682	314.294	4.633	20.531	125.386	25.726	80.560	1.577	9.431
1007	1751	1	263.25	0.75	0.15	1750	0.75	407.668	66.513	260.853	4.413	12.734	240.013	41.260	150.602	2.703	9.442
1008	1751	1	263.50	1	0.15	1750	1	343.840	56.731	213.020	3.974	8.835	351.233	57.328	216.610	3.890	9.234
1009	1751	1	263.75	1.25	0.15	1750	1.25	297.605	50.214	180.229	3.622	6.804	459.537	72.145	282.194	5.024	8.770
1010	1751	1	264.50	2	0.15	1750	2	226.591	42.661	127.513	3.130	4.441	763.839	108.848	471.637	7.941	6.940
1011	1751	1	265.00	2.5	0.15	1750	2.5	209.395	42.058	111.653	3.108	3.734	955.666	128.642	593.135	9.606	5.785
1012	1751	1	265.50	3	0.15	1750	3	201.936	42.597	102.322	3.118	3.221	1141.766	148.892	707.759	11.182	4.909
1013	1751	1	266.50	4	0.15	1750	4	198.247	43.592	95.273	3.115	2.485	1494.078	185.499	933.773	13.951	3.566
1014	1751	1	267.50	5	0.15	1750	5	197.112	43.737	92.571	3.069	1.980	1833.030	218.762	1147.969	16.519	2.700
1015	1751	1	268.50	6	0.15	1750	6	195.043	43.157	90.904	3.009	1.620	2163.460	250.330	1354.998	18.969	2.246
1016	1751	1	269.50	7	0.15	1750	7	191.592	42.461	89.080	2.934	1.356	2488.852	280.226	1556.985	21.283	1.945
1017	1751	1	270.00	7.5	0.15	1750	7.5	189.537	42.025	88.128	2.895	1.251	2649.479	294.862	1656.763	22.433	1.941
1018	1751	1	270.50	8	0.15	1750	8	187.138	41.573	86.950	2.858	1.158	2810.072	309.126	1755.104	23.576	2.039
1019	1751	1	271.50	9	0.15	1750	9	182.273	40.593	84.636	2.792	1.005	3127.625	337.742	1946.371	25.787	2.218
1020	1751	1	272.50	10	0.15	1750	10	177.123	39.834	82.930	2.742	0.885	3444.696	365.693	2136.936	27.940	2.405
1023	2001	1	300.50	0.5	0.15	2000	0.5	526.191	83.620	355.300	5.079	21.931	140.642	28.186	91.230	1.742	10.050
1024	2001	1	300.75	0.75	0.15	2000	0.75	454.190	72.295	292.537	4.815	13.590	267.877	45.309	169.070	2.961	10.063

STP-PT-074: Local Stress in Nozzles, Shells and Formed Heads from External Heads

Model								Secondary (inside) Stress Factors									
	OD	T	od	t	d/D	D/T	t/T	Branch					Header				
								Axial	In-Plane	Out-of-Plane	Torsional	Pressure	Axial	In-Plane	Out-of-Plane	Torsional	Pressure
1025	2001	1	301.00	1	0.15	2000	1	382.423	61.631	240.593	4.319	9.400	391.341	62.772	244.989	4.264	9.847
1026	2001	1	301.25	1.25	0.15	2000	1.25	330.805	54.671	204.205	3.927	7.224	511.203	78.926	320.029	5.493	9.371
1027	2001	1	302.00	2	0.15	2000	2	252.415	47.044	144.073	3.403	4.700	849.328	118.716	532.656	8.661	7.466
1028	2001	1	302.50	2.5	0.15	2000	2.5	234.036	46.640	126.026	3.394	3.951	1061.563	140.401	666.481	10.460	6.253
1029	2001	1	303.00	3	0.15	2000	3	226.789	47.183	116.948	3.419	3.411	1264.880	162.314	799.618	12.090	5.312
1030	2001	1	304.00	4	0.15	2000	4	224.024	48.239	109.323	3.421	2.635	1656.110	201.942	1053.281	15.035	3.887
1031	2001	1	305.00	5	0.15	2000	5	223.872	48.502	107.012	3.380	2.100	2032.226	237.912	1295.857	17.777	2.953
1032	2001	1	306.00	6	0.15	2000	6	222.290	48.178	105.509	3.308	1.717	2398.791	271.913	1531.565	20.398	2.452
1033	2001	1	307.00	7	0.15	2000	7	219.039	47.401	103.985	3.221	1.436	2758.580	304.025	1763.518	22.869	2.094
1034	2001	1	307.50	7.5	0.15	2000	7.5	216.870	46.856	102.895	3.181	1.323	2937.209	320.276	1875.801	24.128	1.970
1035	2001	1	308.00	8	0.15	2000	8	214.579	46.521	101.703	3.145	1.223	3114.996	336.284	1983.873	25.371	1.924
1036	2001	1	309.00	9	0.15	2000	9	209.311	45.413	99.256	3.064	1.059	3467.716	366.759	2203.150	27.694	2.113
1037	2001	1	310.00	10	0.15	2000	10	203.665	44.362	97.371	2.997	0.931	3817.441	396.548	2423.292	29.982	2.295
1040	2251	1	338.00	0.5	0.15	2250	0.5	579.857	89.920	396.024	5.525	23.257	155.312	30.245	101.828	1.870	10.575
1041	2251	1	338.25	0.75	0.15	2250	0.75	499.130	77.687	326.016	5.194	14.394	294.543	49.087	188.443	3.208	10.590
1042	2251	1	338.50	1	0.15	2250	1	419.692	66.560	267.088	4.647	9.939	429.567	67.501	271.973	4.595	10.389
1043	2251	1	338.75	1.25	0.15	2250	1.25	362.684	59.007	226.325	4.226	7.621	560.861	84.673	354.804	5.909	9.901
1044	2251	1	339.50	2	0.15	2250	2	277.466	51.384	160.525	3.679	4.942	930.903	125.968	592.252	9.311	7.950
1045	2251	1	340.00	2.5	0.15	2250	2.5	257.995	51.077	140.956	3.676	4.156	1161.831	151.824	742.605	11.222	6.683
1046	2251	1	340.50	3	0.15	2250	3	250.943	51.790	130.755	3.706	3.589	1385.722	175.558	887.128	12.958	5.717
1047	2251	1	341.50	4	0.15	2250	4	249.629	53.106	123.491	3.724	2.774	1811.596	217.435	1169.941	16.083	4.181
1048	2251	1	342.50	5	0.15	2250	5	250.267	53.345	121.296	3.675	2.212	2222.188	255.726	1440.321	18.985	3.213
1049	2251	1	343.50	6	0.15	2250	6	249.237	53.051	120.067	3.598	1.809	2625.806	291.166	1704.890	21.669	2.653
1050	2251	1	344.50	7	0.15	2250	7	246.145	52.157	119.351	3.510	1.511	3021.401	327.052	1960.464	24.407	2.245
1051	2251	1	345.00	7.5	0.15	2250	7.5	244.199	51.634	118.312	3.462	1.391	3216.686	344.198	2089.302	25.779	2.110
1052	2251	1	345.50	8	0.15	2250	8	241.460	51.037	117.421	3.418	1.286	3408.179	359.288	2210.705	26.918	1.981
1053	2251	1	346.50	9	0.15	2250	9	236.350	50.035	114.800	3.330	1.112	3808.235	396.658	2467.341	29.751	2.011
1054	2251	1	347.50	10	0.15	2250	10	230.200	48.819	112.024	3.246	0.975	4185.359	428.218	2702.187	32.156	2.175
1057	2501	1	375.50	0.5	0.15	2500	0.5	631.865	96.055	433.572	5.923	24.522	169.209	32.268	111.372	1.995	11.057
1058	2501	1	375.75	0.75	0.15	2500	0.75	542.259	82.966	356.740	5.562	15.156	320.366	52.404	206.413	3.441	11.099
1059	2501	1	376.00	1	0.15	2500	1	456.017	71.094	296.197	4.961	10.447	466.668	71.715	301.580	4.909	10.885
1060	2501	1	376.25	1.25	0.15	2500	1.25	393.690	63.227	248.521	4.500	7.995	608.021	89.802	389.239	6.335	10.413
1061	2501	1	377.00	2	0.15	2500	2	301.890	55.299	176.681	3.922	5.170	1006.206	134.917	648.895	9.903	8.389
1062	2501	1	377.50	2.5	0.15	2500	2.5	281.490	55.296	155.354	3.943	4.345	1259.579	162.297	815.368	11.929	7.077
1063	2501	1	378.00	3	0.15	2500	3	274.415	56.270	144.714	3.987	3.752	1503.893	188.233	977.779	13.865	6.059
1064	2501	1	379.00	4	0.15	2500	4	274.154	57.982	136.985	4.027	2.902	1970.551	235.216	1289.264	17.255	4.513
1065	2501	1	380.00	5	0.15	2500	5	276.315	58.360	135.454	3.985	2.315	2414.397	274.116	1587.267	20.200	3.442
1066	2501	1	381.00	6	0.15	2500	6	275.903	57.895	134.940	3.892	1.894	2850.489	312.840	1867.651	23.136	2.815

STP-PT-074: Local Stress in Nozzles, Shells and Formed Heads from External Heads

Model								Secondary (inside) Stress Factors									
	OD	T	od	t	d/D	D/T	t/T	Branch					Header				
								Axial	In-Plane	Out-of-Plane	Torsional	Pressure	Axial	In-Plane	Out-of-Plane	Torsional	Pressure
1067	2501	1	382.00	7	0.15	2500	7	272.985	57.008	135.227	3.797	1.582	3278.699	351.643	2160.435	26.148	2.412
1068	2501	1	382.50	7.5	0.15	2500	7.5	270.918	56.477	134.563	3.748	1.457	3490.313	367.726	2299.659	27.317	2.258
1069	2501	1	383.00	8	0.15	2500	8	268.400	55.773	133.568	3.688	1.348	3698.228	385.481	2437.264	28.733	2.096
1070	2501	1	384.00	9	0.15	2500	9	262.783	54.462	131.393	3.591	1.166	4117.339	421.272	2716.524	31.459	1.900
1071	2501	1	385.00	10	0.15	2500	10	256.918	53.021	128.102	3.489	1.020	4529.856	454.882	2974.587	33.897	2.076
1072	9	1	1.70	0.1	0.2	8	0.1	1.140	0.989	0.989	0.790	2.523	0.385	0.173	0.207	0.084	1.899
1073	9	1	1.85	0.25	0.2	8	0.25	1.166	0.830	0.830	0.685	1.057	0.858	0.319	0.413	0.162	1.697
1074	9	1	2.10	0.5	0.2	8	0.5	1.142	0.610	0.610	0.631	0.888	1.402	0.472	0.566	0.240	1.506
1075	9	1	2.35	0.75	0.2	8	0.75	1.303	0.567	0.625	0.612	0.828	1.775	0.589	0.604	0.298	1.380
1076	9	1	2.60	1	0.2	8	1	1.368	0.578	0.674	0.609	0.802	2.064	0.697	0.758	0.345	1.282
1077	9	1	2.85	1.25	0.2	8	1.25	1.465	0.572	0.685	0.624	0.732	2.193	0.846	0.978	0.389	1.113
1089	17	1	3.30	0.1	0.2	16	0.1	1.352	1.112	1.128	0.856	2.700	0.562	0.302	0.393	0.099	2.503
1090	17	1	3.45	0.25	0.2	16	0.25	2.716	1.127	1.505	0.770	1.380	1.227	0.586	0.816	0.205	2.215
1091	17	1	3.70	0.5	0.2	16	0.5	3.887	1.350	1.807	0.721	1.311	2.171	0.843	1.243	0.336	1.898
1092	17	1	3.95	0.75	0.2	16	0.75	4.225	1.287	1.756	0.686	1.288	2.869	1.084	1.364	0.442	1.724
1093	17	1	4.20	1	0.2	16	1	4.213	1.171	1.633	0.662	1.260	3.605	1.312	1.652	0.523	1.574
1094	17	1	4.45	1.25	0.2	16	1.25	4.375	1.116	1.527	0.654	1.138	5.023	1.577	2.117	0.591	1.377
1095	17	1	5.20	2	0.2	16	2	4.300	0.933	1.279	0.752	0.855	9.207	2.191	3.391	0.736	1.080
1096	17	1	5.70	2.5	0.2	16	2.5	4.130	0.860	1.213	0.930	0.722	11.627	2.466	4.174	0.814	1.277
1097	17	1	6.20	3	0.2	16	3	3.960	0.789	1.202	1.104	0.644	13.713	2.723	4.954	0.899	1.397
1106	25	1	4.90	0.1	0.2	24	0.1	2.313	1.178	1.531	0.886	2.965	0.655	0.467	0.577	0.117	2.919
1107	25	1	5.05	0.25	0.2	24	0.25	5.017	2.189	3.010	0.824	1.796	1.472	0.921	1.192	0.232	2.553
1108	25	1	5.30	0.5	0.2	24	0.5	6.931	2.451	3.432	0.762	1.622	2.665	1.297	1.730	0.393	2.164
1109	25	1	5.55	0.75	0.2	24	0.75	7.288	2.215	3.172	0.736	1.567	4.268	1.531	2.074	0.541	1.921
1110	25	1	5.80	1	0.2	24	1	7.088	1.935	2.820	0.723	1.538	6.200	1.921	2.756	0.662	1.754
1111	25	1	6.05	1.25	0.2	24	1.25	7.120	1.714	2.551	0.724	1.418	8.724	2.361	3.551	0.767	1.517
1112	25	1	6.80	2	0.2	24	2	6.696	1.278	1.942	0.817	1.104	15.903	3.286	5.604	0.975	1.167
1113	25	1	7.30	2.5	0.2	24	2.5	6.363	1.130	1.704	0.922	0.943	20.268	3.670	6.797	1.066	1.284
1114	25	1	7.80	3	0.2	24	3	6.066	1.067	1.554	1.054	0.819	24.165	4.025	7.903	1.144	1.486
1115	25	1	8.80	4	0.2	24	4	5.699	0.999	1.436	1.394	0.649	30.905	4.647	10.081	1.314	1.706
1123	33	1	6.50	0.1	0.2	32	0.1	3.284	1.645	2.328	0.902	3.019	0.820	0.622	0.788	0.134	3.236
1124	33	1	6.65	0.25	0.2	32	0.25	7.466	3.237	4.634	0.850	2.337	1.715	1.234	1.476	0.249	2.765
1125	33	1	6.90	0.5	0.2	32	0.5	10.144	3.533	5.200	0.798	1.953	3.340	1.733	2.096	0.435	2.355
1126	33	1	7.15	0.75	0.2	32	0.75	10.427	3.107	4.702	0.778	1.785	6.007	2.053	2.925	0.616	2.064
1127	33	1	7.40	1	0.2	32	1	9.977	2.659	4.105	0.780	1.720	8.935	2.498	3.969	0.770	1.863
1128	33	1	7.65	1.25	0.2	32	1.25	9.810	2.317	3.665	0.808	1.593	12.619	3.126	5.162	0.905	1.615
1129	33	1	8.40	2	0.2	32	2	8.902	1.676	2.703	0.898	1.268	22.846	4.392	8.153	1.186	1.234
1130	33	1	8.90	2.5	0.2	32	2.5	8.366	1.444	2.312	0.962	1.092	29.023	4.969	9.820	1.305	1.272

STP-PT-074: Local Stress in Nozzles, Shells and Formed Heads from External Heads

Model									Secondary (inside) Stress Factors								
	OD	T	od	t	d/D	D/T	t/T	Branch					Header				
								Axial	In-Plane	Out-of-Plane	Torsional	Pressure	Axial	In-Plane	Out-of-Plane	Torsional	Pressure
1131	33	1	9.40	3	0.2	32	3	7.902	1.295	2.044	1.040	0.949	34.725	5.459	11.329	1.398	1.506
1132	33	1	10.40	4	0.2	32	4	7.182	1.194	1.737	1.249	0.748	44.966	6.184	14.166	1.565	1.831
1133	33	1	11.40	5	0.2	32	5	6.790	1.165	1.613	1.543	0.616	53.716	7.012	16.918	1.743	1.991
1134	33	1	12.40	6	0.2	32	6	6.739	1.149	1.621	1.918	0.545	61.187	7.770	19.714	1.921	2.044
1140	41	1	8.10	0.1	0.2	40	0.1	4.200	2.184	3.128	0.912	3.110	0.964	0.764	0.991	0.147	3.481
1141	41	1	8.25	0.25	0.2	40	0.25	10.014	4.237	6.322	0.859	2.936	1.992	1.525	1.820	0.260	2.923
1142	41	1	8.50	0.5	0.2	40	0.5	13.459	4.559	7.034	0.820	2.313	4.171	2.117	2.496	0.469	2.504
1143	41	1	8.75	0.75	0.2	40	0.75	13.605	3.946	6.292	0.824	1.993	7.790	2.511	3.811	0.675	2.185
1144	41	1	9.00	1	0.2	40	1	12.851	3.337	5.446	0.856	1.866	11.750	3.072	5.267	0.856	1.962
1145	41	1	9.25	1.25	0.2	40	1.25	12.433	2.878	4.823	0.888	1.718	16.495	3.847	6.858	1.020	1.692
1146	41	1	10.00	2	0.2	40	2	10.966	2.058	3.505	0.967	1.380	29.803	5.494	10.922	1.367	1.279
1147	41	1	10.50	2.5	0.2	40	2.5	10.211	1.772	2.969	1.011	1.196	37.803	6.297	13.147	1.518	1.285
1148	41	1	11.00	3	0.2	40	3	9.619	1.578	2.596	1.060	1.045	45.277	6.926	15.140	1.634	1.518
1149	41	1	12.00	4	0.2	40	4	8.635	1.368	2.120	1.185	0.820	59.002	7.906	18.765	1.813	1.894
1150	41	1	13.00	5	0.2	40	5	7.971	1.316	1.873	1.369	0.674	70.990	8.888	22.107	1.999	2.127
1151	41	1	14.00	6	0.2	40	6	7.559	1.308	1.765	1.620	0.575	81.704	9.765	25.427	2.181	2.253
1152	41	1	15.00	7	0.2	40	7	7.423	1.321	1.749	1.949	0.507	90.955	10.495	28.717	2.395	2.302
1153	41	1	15.50	7.5	0.2	40	7.5	7.459	1.323	1.767	2.133	0.483	95.282	10.872	30.419	2.514	2.305
1157	51	1	10.10	0.1	0.2	50	0.1	5.426	2.804	4.121	0.919	3.089	1.121	0.919	1.229	0.160	3.734
1158	51	1	10.25	0.25	0.2	50	0.25	13.277	5.407	8.487	0.861	3.699	2.482	1.831	2.201	0.274	3.087
1159	51	1	10.50	0.5	0.2	50	0.5	17.673	5.760	9.387	0.849	2.777	5.247	2.548	3.033	0.511	2.667
1160	51	1	10.75	0.75	0.2	50	0.75	17.578	4.920	8.322	0.895	2.251	10.033	3.021	4.943	0.740	2.349
1161	51	1	11.00	1	0.2	50	1	16.387	4.122	7.159	0.929	2.030	15.266	3.777	6.945	0.941	2.082
1162	51	1	11.25	1.25	0.2	50	1.25	15.611	3.530	6.305	0.962	1.845	21.344	4.728	9.091	1.132	1.793
1163	51	1	12.00	2	0.2	50	2	13.384	2.525	4.533	1.034	1.478	38.338	6.919	14.581	1.556	1.323
1164	51	1	12.50	2.5	0.2	50	2.5	12.368	2.172	3.819	1.068	1.289	48.547	7.973	17.587	1.751	1.311
1165	51	1	13.00	3	0.2	50	3	11.599	1.938	3.318	1.097	1.131	58.137	8.769	20.258	1.898	1.502
1166	51	1	14.00	4	0.2	50	4	10.423	1.658	2.670	1.168	0.891	75.799	10.119	24.951	2.116	1.944
1167	51	1	15.00	5	0.2	50	5	9.481	1.531	2.281	1.274	0.727	91.836	11.319	29.188	2.323	2.218
1168	51	1	16.00	6	0.2	50	6	8.816	1.472	2.066	1.423	0.615	106.378	12.333	33.209	2.516	2.411
1169	51	1	17.00	7	0.2	50	7	8.372	1.469	1.948	1.622	0.537	119.649	13.239	37.185	2.745	2.530
1170	51	1	17.50	7.5	0.2	50	7.5	8.217	1.479	1.921	1.741	0.505	125.806	13.654	39.170	2.870	2.567
1171	51	1	18.00	8	0.2	50	8	8.103	1.487	1.902	1.874	0.478	131.708	14.056	41.176	2.993	2.592
1172	51	1	19.00	9	0.2	50	9	8.040	1.515	1.915	2.183	0.436	142.759	14.823	45.250	3.249	2.607
1174	61	1	12.10	0.1	0.2	60	0.1	6.710	3.371	5.116	0.928	3.634	1.255	1.054	1.432	0.169	3.940
1175	61	1	12.25	0.25	0.2	60	0.25	16.561	6.490	10.682	0.858	4.445	2.943	2.099	2.549	0.285	3.231
1176	61	1	12.50	0.5	0.2	60	0.5	21.889	6.875	11.775	0.896	3.233	6.303	2.911	3.627	0.553	2.819
1177	61	1	12.75	0.75	0.2	60	0.75	21.502	5.826	10.375	0.952	2.506	12.261	3.470	6.093	0.800	2.512

STP-PT-074: Local Stress in Nozzles, Shells and Formed Heads from External Heads

Model								Secondary (inside) Stress Factors									
	OD	T	od	t	d/D	D/T	t/T	Branch					Header				
								Axial	In-Plane	Out-of-Plane	Torsional	Pressure	Axial	In-Plane	Out-of-Plane	Torsional	Pressure
1178	61	1	13.00	1	0.2	60	1	19.839	4.850	8.892	0.987	2.185	18.730	4.464	8.661	1.020	2.212
1179	61	1	13.25	1.25	0.2	60	1.25	18.675	4.132	7.804	1.019	1.955	26.080	5.619	11.378	1.221	1.900
1180	61	1	14.00	2	0.2	60	2	15.662	2.981	5.573	1.085	1.551	46.584	8.315	18.381	1.710	1.365
1181	61	1	14.50	2.5	0.2	60	2.5	14.391	2.564	4.686	1.113	1.357	58.900	9.584	22.231	1.950	1.329
1182	61	1	15.00	3	0.2	60	3	13.452	2.310	4.059	1.135	1.194	70.489	10.579	25.648	2.133	1.482
1183	61	1	16.00	4	0.2	60	4	12.108	1.997	3.251	1.176	0.945	92.112	12.426	31.629	2.394	1.951
1184	61	1	17.00	5	0.2	60	5	11.069	1.808	2.760	1.239	0.771	111.962	13.913	36.895	2.631	2.288
1185	61	1	18.00	6	0.2	60	6	10.174	1.723	2.437	1.331	0.648	130.264	15.099	41.751	2.853	2.527
1186	61	1	19.00	7	0.2	60	7	9.532	1.663	2.225	1.455	0.559	147.255	16.125	46.447	3.105	2.673
1187	61	1	19.50	7.5	0.2	60	7.5	9.286	1.642	2.186	1.535	0.525	155.097	16.610	48.710	3.235	2.734
1188	61	1	20.00	8	0.2	60	8	9.049	1.640	2.126	1.618	0.496	162.840	17.052	51.030	3.363	2.785
1189	61	1	21.00	9	0.2	60	9	8.736	1.641	2.077	1.821	0.447	177.244	17.885	55.620	3.629	2.852
1190	61	1	22.00	10	0.2	60	10	8.601	1.663	2.046	2.070	0.410	190.740	18.727	60.303	3.896	2.882
1191	71	1	14.10	0.1	0.2	70	0.1	7.990	3.893	6.107	0.934	4.182	1.387	1.170	1.617	0.176	4.120
1192	71	1	14.25	0.25	0.2	70	0.25	19.824	7.502	12.900	0.862	5.159	3.413	2.316	2.889	0.293	3.368
1193	71	1	14.50	0.5	0.2	70	0.5	26.054	7.915	14.178	0.935	3.672	7.350	3.225	4.225	0.591	2.963
1194	71	1	14.75	0.75	0.2	70	0.75	25.359	6.671	12.443	0.999	2.753	14.458	3.851	7.255	0.850	2.672
1195	71	1	15.00	1	0.2	70	1	23.203	5.532	10.635	1.033	2.334	22.125	5.137	10.396	1.086	2.369
1196	71	1	15.25	1.25	0.2	70	1.25	21.640	4.707	9.310	1.065	2.058	30.692	6.508	13.698	1.302	2.014
1197	71	1	16.00	2	0.2	70	2	17.841	3.431	6.619	1.124	1.612	54.321	9.661	22.182	1.853	1.415
1198	71	1	16.50	2.5	0.2	70	2.5	16.283	2.971	5.552	1.150	1.410	68.838	11.158	27.006	2.119	1.346
1199	71	1	17.00	3	0.2	70	3	15.203	2.709	4.807	1.168	1.244	82.389	12.429	31.240	2.337	1.463
1200	71	1	18.00	4	0.2	70	4	13.691	2.355	3.844	1.196	0.988	107.712	14.747	38.613	2.653	1.944
1201	71	1	19.00	5	0.2	70	5	12.574	2.123	3.258	1.234	0.807	131.172	16.535	45.014	2.923	2.308
1202	71	1	20.00	6	0.2	70	6	11.608	1.970	2.860	1.289	0.676	152.511	17.824	50.652	3.181	2.576
1203	71	1	21.00	7	0.2	70	7	10.891	1.910	2.574	1.371	0.581	172.850	18.977	56.114	3.469	2.780
1204	71	1	21.50	7.5	0.2	70	7.5	10.585	1.906	2.500	1.426	0.542	182.363	19.498	58.727	3.600	2.835
1205	71	1	22.00	8	0.2	70	8	10.256	1.863	2.423	1.482	0.510	191.784	20.008	61.363	3.735	2.906
1206	71	1	23.00	9	0.2	70	9	9.751	1.834	2.308	1.629	0.458	209.589	20.925	66.570	4.009	3.014
1207	71	1	24.00	10	0.2	70	10	9.405	1.831	2.239	1.795	0.417	226.249	22.022	71.761	4.286	3.085
1208	81	1	16.10	0.1	0.2	80	0.1	9.256	4.370	7.092	0.937	4.748	1.537	1.270	1.793	0.181	4.281
1209	81	1	16.25	0.25	0.2	80	0.25	23.050	8.442	15.125	0.865	5.837	3.788	2.534	3.171	0.302	3.496
1210	81	1	16.50	0.5	0.2	80	0.5	30.163	8.885	16.601	0.970	4.091	8.334	3.516	4.802	0.624	3.102
1211	81	1	16.75	0.75	0.2	80	0.75	29.122	7.459	14.507	1.039	2.992	16.605	4.279	8.414	0.898	2.826
1212	81	1	17.00	1	0.2	80	1	26.467	6.171	12.375	1.072	2.478	25.431	5.795	12.135	1.145	2.524
1213	81	1	17.25	1.25	0.2	80	1.25	24.497	5.300	10.812	1.101	2.157	35.162	7.363	16.031	1.373	2.152
1214	81	1	18.00	2	0.2	80	2	19.913	3.868	7.661	1.155	1.664	61.974	10.942	26.115	1.963	1.465
1215	81	1	18.50	2.5	0.2	80	2.5	18.118	3.389	6.422	1.179	1.455	78.159	12.659	31.766	2.277	1.364

STP-PT-074: Local Stress in Nozzles, Shells and Formed Heads from External Heads

Model								Secondary (inside) Stress Factors									
	OD	T	od	t	d/D	D/T	t/T	Branch					Header				
								Axial	In-Plane	Out-of-Plane	Torsional	Pressure	Axial	In-Plane	Out-of-Plane	Torsional	Pressure
1216	81	1	19.00	3	0.2	80	3	16.891	3.101	5.558	1.196	1.285	93.471	14.217	36.822	2.529	1.443
1217	81	1	20.00	4	0.2	80	4	15.235	2.719	4.446	1.217	1.024	122.214	16.917	45.641	2.903	1.928
1218	81	1	21.00	5	0.2	80	5	14.033	2.459	3.768	1.239	0.837	148.994	19.011	53.260	3.213	2.308
1219	81	1	22.00	6	0.2	80	6	13.045	2.271	3.308	1.274	0.701	174.168	20.686	60.123	3.510	2.604
1220	81	1	23.00	7	0.2	80	7	12.257	2.144	2.993	1.329	0.601	197.769	22.059	66.462	3.819	2.833
1221	81	1	23.50	7.5	0.2	80	7.5	11.858	2.122	2.867	1.364	0.561	209.026	22.654	69.512	3.968	2.927
1222	81	1	24.00	8	0.2	80	8	11.602	2.113	2.744	1.407	0.525	220.036	23.180	72.512	4.118	3.011
1223	81	1	25.00	9	0.2	80	9	10.986	2.060	2.602	1.511	0.468	240.999	24.272	78.395	4.401	3.149
1224	81	1	26.00	10	0.2	80	10	10.443	2.036	2.490	1.638	0.423	260.867	25.533	84.185	4.687	3.232
1225	91	1	18.10	0.1	0.2	90	0.1	10.515	4.813	8.084	0.938	5.309	1.716	1.370	1.948	0.185	4.430
1226	91	1	18.25	0.25	0.2	90	0.25	26.219	9.321	17.352	0.868	6.482	4.161	2.711	3.482	0.315	3.622
1227	91	1	18.50	0.5	0.2	90	0.5	34.195	9.799	19.024	1.002	4.490	9.299	3.761	5.391	0.652	3.236
1228	91	1	18.75	0.75	0.2	90	0.75	32.798	8.200	16.572	1.074	3.220	18.711	4.749	9.574	0.939	2.975
1229	91	1	19.00	1	0.2	90	1	29.650	6.774	14.115	1.106	2.617	28.673	6.437	13.884	1.199	2.676
1230	91	1	19.25	1.25	0.2	90	1.25	27.273	5.879	12.312	1.133	2.251	39.526	8.196	18.370	1.433	2.300
1231	91	1	20.00	2	0.2	90	2	21.936	4.300	8.706	1.181	1.713	69.393	12.193	30.080	2.054	1.518
1232	91	1	20.50	2.5	0.2	90	2.5	19.889	3.808	7.292	1.204	1.495	87.422	14.171	36.687	2.401	1.389
1233	91	1	21.00	3	0.2	90	3	18.513	3.500	6.312	1.220	1.320	104.448	16.070	42.604	2.687	1.430
1234	91	1	22.00	4	0.2	90	4	16.740	3.084	5.061	1.238	1.055	136.511	19.170	52.959	3.132	1.913
1235	91	1	23.00	5	0.2	90	5	15.466	2.811	4.297	1.251	0.864	166.559	21.594	61.912	3.482	2.303
1236	91	1	24.00	6	0.2	90	6	14.491	2.594	3.784	1.273	0.724	194.917	23.550	69.915	3.826	2.615
1237	91	1	25.00	7	0.2	90	7	13.642	2.425	3.422	1.307	0.619	221.675	25.142	77.253	4.165	2.865
1238	91	1	25.50	7.5	0.2	90	7.5	13.244	2.369	3.271	1.331	0.577	234.550	25.826	80.754	4.326	2.971
1239	91	1	26.00	8	0.2	90	8	12.890	2.339	3.146	1.359	0.540	247.078	26.451	84.160	4.484	3.066
1240	91	1	27.00	9	0.2	90	9	12.259	2.304	2.918	1.444	0.478	271.142	27.753	90.783	4.801	3.226
1241	91	1	28.00	10	0.2	90	10	11.611	2.238	2.798	1.533	0.431	293.946	29.146	97.237	5.090	3.353
1242	101	1	20.10	0.1	0.2	100	0.1	11.742	5.224	9.054	0.938	5.867	1.879	1.428	2.103	0.188	4.566
1243	101	1	20.25	0.25	0.2	100	0.25	29.353	10.154	19.606	0.881	7.093	4.562	2.866	3.777	0.329	3.747
1244	101	1	20.50	0.5	0.2	100	0.5	38.138	10.657	21.439	1.030	4.869	10.332	3.993	5.985	0.682	3.369
1245	101	1	20.75	0.75	0.2	100	0.75	36.396	8.902	18.640	1.106	3.440	20.818	5.211	10.755	0.980	3.121
1246	101	1	21.00	1	0.2	100	1	32.747	7.390	15.850	1.136	2.751	31.869	7.095	15.645	1.251	2.825
1247	101	1	21.25	1.25	0.2	100	1.25	29.980	6.435	13.808	1.161	2.342	43.797	9.009	20.723	1.496	2.444
1248	101	1	22.00	2	0.2	100	2	23.881	4.735	9.744	1.202	1.759	76.593	13.403	34.055	2.146	1.577
1249	101	1	22.50	2.5	0.2	100	2.5	21.588	4.211	8.160	1.224	1.531	96.385	15.751	41.634	2.514	1.411
1250	101	1	23.00	3	0.2	100	3	20.091	3.893	7.066	1.240	1.352	115.088	17.884	48.447	2.830	1.420
1251	101	1	24.00	4	0.2	100	4	18.194	3.471	5.679	1.256	1.081	150.326	21.377	60.389	3.345	1.898
1252	101	1	25.00	5	0.2	100	5	16.899	3.169	4.843	1.265	0.887	183.500	24.137	70.741	3.741	2.294
1253	101	1	26.00	6	0.2	100	6	15.881	2.938	4.274	1.279	0.744	214.914	26.367	79.957	4.129	2.617



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Model								Secondary (inside) Stress Factors									
	OD	T	od	t	d/D	D/T	t/T	Branch					Header				
								Axial	In-Plane	Out-of-Plane	Torsional	Pressure	Axial	In-Plane	Out-of-Plane	Torsional	Pressure
1254	101	1	27.00	7	0.2	100	7	15.022	2.743	3.860	1.299	0.636	244.797	28.206	88.387	4.506	2.883
1255	101	1	27.50	7.5	0.2	100	7.5	14.608	2.663	3.696	1.317	0.592	259.143	28.997	92.369	4.679	2.997
1256	101	1	28.00	8	0.2	100	8	14.205	2.610	3.557	1.341	0.553	273.180	29.732	96.233	4.849	3.101
1257	101	1	29.00	9	0.2	100	9	13.471	2.528	3.304	1.410	0.489	300.265	31.289	103.708	5.187	3.282
1258	101	1	30.00	10	0.2	100	10	12.876	2.489	3.111	1.477	0.438	325.976	32.893	110.896	5.509	3.428
1259	251	1	50.10	0.1	0.2	250	0.1	28.910	9.383	23.349	0.893	12.979	4.080	2.092	4.019	0.203	6.045
1260	251	1	50.25	0.25	0.2	250	0.25	72.602	18.916	52.734	1.157	13.880	10.368	4.376	8.377	0.481	5.240
1261	251	1	50.50	0.5	0.2	250	0.5	92.598	20.770	57.474	1.615	9.089	24.764	6.566	15.302	0.910	4.879
1262	251	1	50.75	0.75	0.2	250	0.75	85.244	17.957	49.144	1.704	5.939	49.135	10.906	28.067	1.293	4.753
1263	251	1	51.00	1	0.2	250	1	74.434	15.257	41.276	1.664	4.334	74.327	15.168	41.302	1.656	4.501
1264	251	1	51.25	1.25	0.2	250	1.25	66.056	13.363	35.551	1.615	3.450	99.914	19.006	54.667	2.059	4.099
1265	251	1	52.00	2	0.2	250	2	50.076	10.419	24.894	1.525	2.336	170.682	29.159	91.713	3.255	2.806
1266	251	1	52.50	2.5	0.2	250	2.5	44.654	9.668	20.980	1.508	1.972	213.722	34.647	113.997	3.950	2.122
1267	251	1	53.00	3	0.2	250	3	41.361	9.266	18.389	1.508	1.709	254.567	39.442	134.769	4.586	1.704
1268	251	1	54.00	4	0.2	250	4	37.780	8.918	15.319	1.522	1.342	331.808	47.554	172.715	5.719	1.849
1269	251	1	55.00	5	0.2	250	5	35.773	8.734	13.612	1.541	1.099	405.556	54.815	207.121	6.733	2.217
1270	251	1	56.00	6	0.2	250	6	34.293	8.398	12.514	1.559	0.925	480.096	63.028	240.212	7.722	2.569
1271	251	1	57.00	7	0.2	250	7	33.001	8.076	11.707	1.571	0.794	549.950	69.764	269.647	8.543	2.878
1272	251	1	57.50	7.5	0.2	250	7.5	32.369	7.889	11.365	1.572	0.741	584.237	72.877	283.623	8.956	3.024
1273	251	1	58.00	8	0.2	250	8	31.763	7.694	11.059	1.569	0.692	618.219	75.927	297.179	9.345	3.164
1274	251	1	59.00	9	0.2	250	9	30.610	7.352	10.510	1.566	0.610	684.765	81.591	322.897	10.060	3.427
1275	251	1	60.00	10	0.2	250	10	29.513	6.955	10.028	1.546	0.542	749.910	86.529	347.215	10.752	3.672
1276	501	1	100.10	0.1	0.2	500	0.1	54.393	13.566	45.288	0.985	21.156	8.019	2.831	7.504	0.242	8.148
1277	501	1	100.25	0.25	0.2	500	0.25	138.592	29.428	105.407	1.820	21.059	18.689	6.036	14.898	0.649	7.213
1278	501	1	100.50	0.5	0.2	500	0.5	174.561	33.693	115.476	2.629	13.506	46.113	11.248	29.665	1.155	6.709
1279	501	1	100.75	0.75	0.2	500	0.75	156.951	29.667	97.598	2.662	8.591	91.957	18.499	56.328	1.695	6.613
1280	501	1	101.00	1	0.2	500	1	135.102	25.465	81.415	2.499	6.077	137.155	25.451	82.511	2.419	6.365
1281	501	1	101.25	1.25	0.2	500	1.25	118.307	22.428	69.604	2.344	4.727	182.273	32.438	108.776	3.137	5.921
1282	501	1	102.00	2	0.2	500	2	89.130	18.030	48.849	2.075	3.083	307.705	49.622	182.717	5.017	4.345
1283	501	1	102.50	2.5	0.2	500	2.5	80.189	17.107	41.750	2.007	2.571	385.000	58.690	228.620	6.096	3.424
1284	501	1	103.00	3	0.2	500	3	75.138	16.862	37.312	1.971	2.203	458.684	66.523	272.258	7.063	2.761
1285	501	1	104.00	4	0.2	500	4	69.920	16.571	32.396	1.952	1.690	599.287	81.672	354.416	8.826	1.933
1286	501	1	105.00	5	0.2	500	5	66.913	16.436	29.784	1.948	1.356	733.766	96.389	431.067	10.441	2.192
1287	501	1	106.00	6	0.2	500	6	64.516	16.238	28.046	1.947	1.126	864.625	109.905	503.573	11.939	2.494
1288	501	1	107.00	7	0.2	500	7	62.347	15.995	26.704	1.950	0.961	996.788	123.768	574.894	13.460	2.705
1289	501	1	107.50	7.5	0.2	500	7.5	61.324	15.739	26.139	1.946	0.894	1060.236	130.126	608.189	14.178	2.841
1290	501	1	108.00	8	0.2	500	8	60.310	15.566	25.592	1.946	0.836	1123.200	136.223	640.896	14.832	2.975
1291	501	1	109.00	9	0.2	500	9	58.404	15.111	24.606	1.942	0.738	1248.240	147.833	704.570	16.089	3.234

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Model	Secondary (inside) Stress Factors																
	OD	T	od	t	d/D	D/T	t/T	Branch					Header				
								Axial	In-Plane	Out-of-Plane	Torsional	Pressure	Axial	In-Plane	Out-of-Plane	Torsional	Pressure
1292	501	1	110.00	10	0.2	500	10	56.573	14.658	23.717	1.937	0.659	1371.261	158.969	765.515	17.327	3.482
1294	751	1	150.25	0.25	0.2	750	0.25	198.882	37.800	155.735	2.471	26.254	26.345	7.459	21.274	0.740	8.730
1295	751	1	150.50	0.5	0.2	750	0.5	248.299	44.746	170.970	3.546	16.747	65.867	15.246	43.686	1.336	8.072
1296	751	1	150.75	0.75	0.2	750	0.75	220.723	39.333	143.864	3.500	10.545	129.899	24.453	83.106	2.187	7.983
1297	751	1	151.00	1	0.2	750	1	188.624	33.718	119.487	3.226	7.373	192.640	34.243	121.607	3.144	7.737
1298	751	1	151.25	1.25	0.2	750	1.25	164.486	29.758	101.880	2.984	5.683	254.270	43.325	159.741	4.080	7.261
1299	751	1	152.00	2	0.2	750	2	124.434	24.515	71.720	2.595	3.661	426.720	65.554	268.108	6.500	5.501
1300	751	1	152.50	2.5	0.2	750	2.5	113.190	23.617	61.886	2.503	3.046	533.545	77.116	336.025	7.865	4.450
1301	751	1	153.00	3	0.2	750	3	107.327	23.393	56.005	2.472	2.605	635.982	88.335	401.384	9.104	3.682
1302	751	1	154.00	4	0.2	750	4	101.960	23.308	49.934	2.446	1.990	831.162	110.081	525.381	11.351	2.593
1303	751	1	155.00	5	0.2	750	5	98.873	23.134	46.880	2.411	1.583	1018.114	129.798	642.647	13.422	2.050
1304	751	1	156.00	6	0.2	750	6	96.053	22.854	44.785	2.379	1.300	1200.253	148.250	754.808	15.343	2.322
1305	751	1	157.00	7	0.2	750	7	93.159	22.431	43.029	2.344	1.097	1379.181	165.887	863.075	17.198	2.584
1306	751	1	157.50	7.5	0.2	750	7.5	91.723	22.240	42.203	2.332	1.016	1467.636	174.220	915.381	18.071	2.773
1307	751	1	158.00	8	0.2	750	8	90.233	21.895	41.379	2.318	0.946	1555.667	182.823	967.203	18.941	2.897
1308	751	1	159.00	9	0.2	750	9	87.356	21.446	39.845	2.293	0.830	1730.181	199.157	1068.537	20.630	3.139
1309	751	1	160.00	10	0.2	750	10	84.660	20.920	38.463	2.276	0.739	1908.609	216.543	1169.959	22.398	3.322
1311	1001	1	200.25	0.25	0.2	1000	0.25	255.432	45.637	204.054	3.094	30.648	33.213	9.112	27.070	0.835	9.937
1312	1001	1	200.50	0.5	0.2	1000	0.5	316.169	54.202	224.131	4.373	19.439	84.323	18.483	57.395	1.530	9.154
1313	1001	1	200.75	0.75	0.2	1000	0.75	279.049	47.531	188.101	4.252	12.181	164.452	29.754	108.606	2.631	9.078
1314	1001	1	201.00	1	0.2	1000	1	237.565	40.796	155.966	3.879	8.462	242.525	41.463	158.528	3.793	8.830
1315	1001	1	201.25	1.25	0.2	1000	1.25	206.642	36.105	132.757	3.562	6.486	319.480	52.237	208.213	4.905	8.337
1316	1001	1	202.00	2	0.2	1000	2	157.238	30.294	93.819	3.075	4.142	534.954	78.862	349.474	7.796	6.471
1317	1001	1	202.50	2.5	0.2	1000	2.5	144.165	29.583	81.492	2.975	3.445	668.732	93.350	438.457	9.412	5.309
1318	1001	1	203.00	3	0.2	1000	3	137.937	29.501	74.402	2.965	2.948	796.725	108.042	524.116	10.876	4.466
1319	1001	1	204.00	4	0.2	1000	4	133.068	29.601	67.580	2.941	2.249	1041.650	134.320	688.036	13.524	3.176
1320	1001	1	205.00	5	0.2	1000	5	130.435	29.421	64.361	2.889	1.782	1276.310	158.093	843.882	15.954	2.449
1321	1001	1	206.00	6	0.2	1000	6	127.611	28.968	62.117	2.831	1.457	1505.235	180.629	994.169	18.246	2.246
1322	1001	1	207.00	7	0.2	1000	7	124.323	28.486	60.076	2.773	1.222	1729.746	202.069	1139.827	20.436	2.489
1323	1001	1	207.50	7.5	0.2	1000	7.5	122.559	28.077	59.055	2.740	1.128	1840.862	212.421	1210.977	21.481	2.608
1324	1001	1	208.00	8	0.2	1000	8	120.721	27.783	57.999	2.714	1.046	1951.520	222.891	1280.947	22.526	2.725
1325	1001	1	209.00	9	0.2	1000	9	117.126	27.138	56.058	2.669	0.913	2171.115	243.001	1419.487	24.557	2.952
1326	1001	1	210.00	10	0.2	1000	10	113.420	26.490	54.139	2.628	0.809	2389.121	262.518	1553.540	26.523	3.209
1328	1251	1	250.25	0.25	0.2	1250	0.25	309.174	52.580	251.124	3.656	34.550	40.370	10.844	33.246	0.916	11.059
1329	1251	1	250.50	0.5	0.2	1250	0.5	380.293	62.581	275.779	5.136	21.777	101.996	21.412	70.815	1.787	10.155
1330	1251	1	250.75	0.75	0.2	1250	0.75	333.727	54.800	230.668	4.935	13.602	197.211	34.685	133.339	3.064	10.079
1331	1251	1	251.00	1	0.2	1250	1	283.301	47.014	191.431	4.465	9.407	290.165	48.106	195.006	4.402	9.831
1332	1251	1	251.25	1.25	0.2	1250	1.25	246.105	41.755	162.400	4.080	7.184	380.689	60.300	254.835	5.681	9.315

STP-PT-074: Local Stress in Nozzles, Shells and Formed Heads from External Heads

Model								Secondary (inside) Stress Factors									
	OD	T	od	t	d/D	D/T	t/T	Branch					Header				
								Axial	In-Plane	Out-of-Plane	Torsional	Pressure	Axial	In-Plane	Out-of-Plane	Torsional	Pressure
1333	1251	1	252.00	2	0.2	1250	2	188.103	35.620	115.212	3.530	4.565	634.089	90.194	426.852	8.933	7.317
1334	1251	1	252.50	2.5	0.2	1250	2.5	173.653	35.020	100.632	3.430	3.796	792.902	108.314	536.259	10.749	6.061
1335	1251	1	253.00	3	0.2	1250	3	167.261	35.178	92.467	3.434	3.249	945.271	125.214	641.943	12.389	5.134
1336	1251	1	254.00	4	0.2	1250	4	163.193	35.398	85.028	3.409	2.481	1234.588	155.057	842.707	15.345	3.693
1337	1251	1	255.00	5	0.2	1250	5	161.349	35.304	81.965	3.354	1.964	1512.796	182.241	1035.876	18.085	2.848
1338	1251	1	256.00	6	0.2	1250	6	158.880	34.756	79.809	3.277	1.601	1784.009	207.777	1222.481	20.657	2.371
1339	1251	1	257.00	7	0.2	1250	7	155.290	33.901	77.457	3.193	1.336	2055.171	233.738	1405.865	23.252	2.424
1340	1251	1	257.50	7.5	0.2	1250	7.5	153.433	33.505	76.382	3.153	1.232	2186.962	245.787	1494.453	24.463	2.534
1341	1251	1	258.00	8	0.2	1250	8	151.405	33.188	75.234	3.118	1.140	2319.284	257.732	1583.398	25.656	2.646
1342	1251	1	259.00	9	0.2	1250	9	147.076	32.283	72.777	3.044	0.990	2579.399	281.059	1756.249	27.965	2.862
1343	1251	1	260.00	10	0.2	1250	10	142.687	31.385	70.626	2.982	0.873	2838.089	303.762	1926.588	30.246	3.071
1345	1501	1	300.25	0.25	0.2	1500	0.25	360.603	58.954	297.369	4.181	38.097	45.795	12.386	37.905	0.975	12.072
1346	1501	1	300.50	0.5	0.2	1500	0.5	440.952	70.228	326.537	5.821	23.867	118.788	23.992	83.935	2.045	11.052
1347	1501	1	300.75	0.75	0.2	1500	0.75	385.391	61.381	272.474	5.563	14.886	228.373	39.241	157.775	3.467	10.979
1348	1501	1	301.00	1	0.2	1500	1	326.514	52.700	225.408	5.005	10.265	334.804	53.982	229.830	4.980	10.731
1349	1501	1	301.25	1.25	0.2	1500	1.25	283.491	46.939	191.532	4.566	7.813	438.006	67.654	300.170	6.396	10.206
1350	1501	1	302.00	2	0.2	1500	2	217.547	40.613	136.055	3.954	4.941	728.707	101.647	502.571	10.014	8.081
1351	1501	1	302.50	2.5	0.2	1500	2.5	201.875	40.232	119.271	3.863	4.107	910.545	122.450	631.021	12.039	6.754
1352	1501	1	303.00	3	0.2	1500	3	195.490	40.597	110.139	3.883	3.518	1085.034	141.236	755.406	13.852	5.751
1353	1501	1	304.00	4	0.2	1500	4	192.599	41.149	102.429	3.878	2.688	1418.542	174.485	994.173	17.097	4.169
1354	1501	1	305.00	5	0.2	1500	5	191.648	41.074	99.441	3.820	2.129	1737.943	204.762	1222.421	20.103	3.238
1355	1501	1	306.00	6	0.2	1500	6	189.599	40.469	97.505	3.727	1.737	2049.232	233.212	1443.695	22.912	2.687
1356	1501	1	307.00	7	0.2	1500	7	186.335	39.612	96.167	3.626	1.450	2355.044	260.536	1661.050	25.652	2.359
1357	1501	1	307.50	7.5	0.2	1500	7.5	184.214	39.067	94.848	3.580	1.337	2507.061	274.013	1766.910	26.977	2.469
1358	1501	1	308.00	8	0.2	1500	8	181.961	38.616	93.706	3.527	1.235	2656.662	287.196	1870.795	28.319	2.572
1359	1501	1	309.00	9	0.2	1500	9	177.157	37.552	90.996	3.441	1.067	2956.295	313.121	2077.882	30.864	2.782
1360	1501	1	310.00	10	0.2	1500	10	172.410	36.640	88.764	3.359	0.937	3252.313	338.947	2281.991	33.367	2.981
1362	1751	1	350.25	0.25	0.2	1750	0.25	409.561	64.714	341.785	4.678	41.368	51.561	13.694	43.116	1.078	12.946
1363	1751	1	350.50	0.5	0.2	1750	0.5	498.734	77.084	375.045	6.478	25.856	134.652	26.354	96.690	2.257	11.831
1364	1751	1	350.75	0.75	0.2	1750	0.75	434.328	67.467	312.821	6.143	16.076	257.306	43.153	180.998	3.834	11.764
1365	1751	1	351.00	1	0.2	1750	1	367.372	57.972	260.139	5.510	11.059	376.646	59.355	265.007	5.486	11.530
1366	1751	1	351.25	1.25	0.2	1750	1.25	318.673	51.722	219.443	5.012	8.398	492.017	74.068	343.820	7.041	10.987
1367	1751	1	352.00	2	0.2	1750	2	245.465	45.242	156.164	4.352	5.289	817.485	112.243	575.510	10.986	8.781
1368	1751	1	352.50	2.5	0.2	1750	2.5	228.950	45.051	137.465	4.268	4.395	1020.194	134.792	721.831	13.161	7.371
1369	1751	1	353.00	3	0.2	1750	3	222.855	45.681	127.473	4.312	3.765	1215.502	155.382	864.354	15.116	6.296
1370	1751	1	354.00	4	0.2	1750	4	221.201	46.553	119.171	4.329	2.880	1588.581	191.735	1135.005	18.648	4.599
1371	1751	1	355.00	5	0.2	1750	5	221.436	46.448	116.905	4.255	2.288	1946.840	224.535	1399.379	21.795	3.578
1372	1751	1	356.00	6	0.2	1750	6	219.819	45.712	116.436	4.153	1.867	2294.890	255.108	1650.312	24.861	2.965

STP-PT-074: Local Stress in Nozzles, Shells and Formed Heads from External Heads

Model								Secondary (inside) Stress Factors									
	OD	T	od	t	d/D	D/T	t/T	Branch					Header				
								Axial	In-Plane	Out-of-Plane	Torsional	Pressure	Axial	In-Plane	Out-of-Plane	Torsional	Pressure
1373	1751	1	357.00	7	0.2	1750	7	217.061	44.768	115.621	4.038	1.559	2643.167	286.361	1910.473	27.991	2.545
1374	1751	1	357.50	7.5	0.2	1750	7.5	215.203	44.318	114.494	3.987	1.435	2813.107	300.769	2032.697	29.414	2.409
1375	1751	1	358.00	8	0.2	1750	8	213.035	43.727	113.228	3.928	1.328	2981.406	315.263	2152.179	30.859	2.508
1376	1751	1	359.00	9	0.2	1750	9	208.160	42.428	110.554	3.814	1.146	3316.416	343.889	2393.563	33.651	2.710
1377	1751	1	360.00	10	0.2	1750	10	202.553	41.291	107.196	3.716	1.006	3649.335	371.748	2630.008	36.362	2.902
1380	2001	1	400.50	0.5	0.2	2000	0.5	554.018	83.485	422.860	7.092	27.735	150.039	28.866	108.996	2.456	12.607
1381	2001	1	400.75	0.75	0.2	2000	0.75	481.115	72.993	352.301	6.693	17.186	285.669	47.013	204.084	4.205	12.546
1382	2001	1	401.00	1	0.2	2000	1	406.463	62.774	290.725	5.982	11.797	416.908	64.412	296.286	5.994	12.308
1383	2001	1	401.25	1.25	0.2	2000	1.25	352.465	56.123	246.955	5.438	8.940	544.466	80.254	386.983	7.671	11.756
1384	2001	1	402.00	2	0.2	2000	2	272.510	49.578	176.518	4.740	5.610	901.925	122.374	647.754	11.934	9.443
1385	2001	1	402.50	2.5	0.2	2000	2.5	255.102	49.717	155.186	4.662	4.659	1126.212	147.018	810.895	14.287	7.961
1386	2001	1	403.00	3	0.2	2000	3	249.410	50.506	144.518	4.717	3.992	1342.556	169.264	971.962	16.388	6.821
1387	2001	1	404.00	4	0.2	2000	4	249.276	51.643	136.455	4.751	3.063	1754.025	208.334	1279.832	20.138	5.012
1388	2001	1	405.00	5	0.2	2000	5	250.625	51.656	135.866	4.688	2.435	2148.843	243.411	1576.307	23.552	3.907
1389	2001	1	406.00	6	0.2	2000	6	251.047	50.869	136.139	4.565	1.989	2534.117	276.544	1864.903	26.851	3.249
1390	2001	1	407.00	7	0.2	2000	7	249.121	49.877	135.216	4.448	1.659	2910.842	308.597	2145.658	29.962	2.760
1391	2001	1	407.50	7.5	0.2	2000	7.5	247.386	49.251	134.422	4.383	1.527	3097.284	324.085	2285.979	31.550	2.568
1392	2001	1	408.00	8	0.2	2000	8	245.223	48.485	133.018	4.315	1.410	3282.926	339.464	2419.809	33.019	2.453
1393	2001	1	409.00	9	0.2	2000	9	239.853	47.285	130.413	4.191	1.217	3650.936	370.051	2702.771	35.973	2.647
1394	2001	1	410.00	10	0.2	2000	10	234.229	45.952	126.804	4.069	1.067	4017.530	399.897	2961.194	38.957	2.837
1397	2251	1	450.50	0.5	0.2	2250	0.5	607.076	89.613	469.379	7.661	29.485	164.672	31.130	121.139	2.612	13.284
1398	2251	1	450.75	0.75	0.2	2250	0.75	525.735	78.376	390.413	7.209	18.226	311.712	50.335	225.740	4.532	13.232
1399	2251	1	451.00	1	0.2	2250	1	443.731	67.429	324.583	6.427	12.497	454.493	68.889	330.341	6.453	13.006
1400	2251	1	451.25	1.25	0.2	2250	1.25	384.510	60.597	273.585	5.837	9.454	593.283	85.394	428.668	8.240	12.444
1401	2251	1	452.00	2	0.2	2250	2	298.477	53.869	194.641	5.112	5.913	982.980	131.657	713.114	12.769	10.073
1402	2251	1	452.50	2.5	0.2	2250	2.5	280.441	54.174	171.773	5.034	4.909	1227.664	158.425	894.483	15.288	8.490
1403	2251	1	453.00	3	0.2	2250	3	275.182	55.136	161.386	5.104	4.211	1461.172	181.451	1075.769	17.505	7.293
1404	2251	1	454.00	4	0.2	2250	4	276.523	56.512	153.037	5.153	3.236	1913.381	223.212	1417.514	21.431	5.413
1405	2251	1	455.00	5	0.2	2250	5	280.383	56.776	154.900	5.104	2.575	2342.198	260.740	1748.522	25.116	4.229
1406	2251	1	456.00	6	0.2	2250	6	282.801	55.987	156.145	4.979	2.102	2758.376	295.633	2065.812	28.529	3.513
1407	2251	1	457.00	7	0.2	2250	7	281.623	54.529	155.889	4.829	1.754	3170.250	328.420	2384.324	31.828	2.976
1408	2251	1	457.50	7.5	0.2	2250	7.5	280.266	54.063	155.058	4.760	1.615	3369.150	345.900	2530.362	33.484	2.773
1409	2251	1	458.00	8	0.2	2250	8	278.209	53.253	154.006	4.687	1.492	3567.243	361.218	2682.477	35.062	2.569
1410	2251	1	459.00	9	0.2	2250	9	272.740	51.877	150.709	4.550	1.288	3975.210	396.539	2987.934	38.480	2.604
1411	2251	1	460.00	10	0.2	2250	10	266.488	50.402	147.241	4.414	1.127	4382.990	428.094	3297.656	41.531	2.802
1414	2501	1	500.50	0.5	0.2	2500	0.5	657.879	95.128	514.690	8.210	31.159	178.851	33.542	132.915	2.833	13.978
1415	2501	1	500.75	0.75	0.2	2500	0.75	568.807	83.275	427.582	7.700	19.217	338.498	53.620	247.861	4.863	13.924
1416	2501	1	501.00	1	0.2	2500	1	479.648	71.728	352.388	6.853	13.158	492.093	73.078	358.953	6.919	13.716

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Model								Secondary (inside) Stress Factors									
	OD	T	od	t	d/D	D/T	t/T	Branch					Header				
								Axial	In-Plane	Out-of-Plane	Torsional	Pressure	Axial	In-Plane	Out-of-Plane	Torsional	Pressure
1417	2501	1	501.25	1.25	0.2	2500	1.25	415.826	64.528	299.403	6.220	9.939	641.235	91.127	468.891	8.814	13.150
1418	2501	1	502.00	2	0.2	2500	2	323.425	57.806	213.485	5.465	6.196	1060.771	141.083	781.124	13.639	10.660
1419	2501	1	502.50	2.5	0.2	2500	2.5	305.122	58.336	189.212	5.393	5.146	1323.871	168.491	979.493	16.238	9.022
1420	2501	1	503.00	3	0.2	2500	3	300.326	59.618	177.687	5.479	4.417	1576.815	194.170	1177.153	18.654	7.749
1421	2501	1	504.00	4	0.2	2500	4	303.496	61.366	169.757	5.552	3.397	2062.640	238.096	1552.445	22.813	5.743
1422	2501	1	505.00	5	0.2	2500	5	310.091	61.576	173.750	5.498	2.704	2528.920	276.897	1915.872	26.578	4.509
1423	2501	1	506.00	6	0.2	2500	6	313.996	60.709	176.020	5.365	2.209	2980.174	313.326	2269.145	30.153	3.717
1424	2501	1	507.00	7	0.2	2500	7	313.670	59.353	175.966	5.207	1.844	3413.993	349.271	2604.618	33.798	3.151
1425	2501	1	507.50	7.5	0.2	2500	7.5	312.291	58.772	175.497	5.135	1.697	3636.587	367.148	2779.028	35.339	2.932
1426	2501	1	508.00	8	0.2	2500	8	310.339	57.980	173.998	5.056	1.567	3851.755	384.219	2937.082	37.111	2.754
1427	2501	1	509.00	9	0.2	2500	9	304.812	56.242	171.624	4.901	1.353	4282.188	417.986	3275.969	40.461	2.556
1428	2501	1	510.00	10	0.2	2500	10	298.394	54.809	167.244	4.760	1.183	4712.303	452.651	3597.649	43.818	2.745
1429	9	1	2.10	0.1	0.25	8	0.1	1.166	1.031	1.010	0.819	3.488	0.377	0.193	0.257	0.091	2.121
1430	9	1	2.25	0.25	0.25	8	0.25	1.209	0.873	0.874	0.716	1.257	0.846	0.370	0.527	0.182	1.857
1431	9	1	2.50	0.5	0.25	8	0.5	1.402	0.656	0.738	0.665	1.062	1.417	0.541	0.712	0.279	1.647
1432	9	1	2.75	0.75	0.25	8	0.75	1.619	0.691	0.808	0.633	0.986	1.821	0.671	0.716	0.352	1.500
1433	9	1	3.00	1	0.25	8	1	1.674	0.672	0.826	0.623	0.946	2.143	0.789	0.892	0.409	1.386
1434	9	1	3.25	1.25	0.25	8	1.25	1.808	0.674	0.837	0.625	0.843	2.340	0.944	1.144	0.458	1.202
1446	17	1	4.10	0.1	0.25	16	0.1	1.458	1.142	1.190	0.885	3.309	0.508	0.357	0.465	0.120	2.889
1447	17	1	4.25	0.25	0.25	16	0.25	3.168	1.492	2.102	0.815	1.640	1.151	0.705	0.975	0.238	2.510
1448	17	1	4.50	0.5	0.25	16	0.5	4.490	1.728	2.451	0.743	1.522	2.067	1.017	1.451	0.385	2.095
1449	17	1	4.75	0.75	0.25	16	0.75	4.819	1.596	2.317	0.710	1.484	2.869	1.213	1.560	0.517	1.880
1450	17	1	5.00	1	0.25	16	1	4.744	1.412	2.100	0.709	1.450	3.996	1.477	2.039	0.624	1.703
1451	17	1	5.25	1.25	0.25	16	1.25	4.850	1.284	1.931	0.711	1.316	5.586	1.788	2.635	0.716	1.474
1452	17	1	6.00	2	0.25	16	2	4.653	1.046	1.527	0.791	0.996	10.210	2.444	4.209	0.895	1.129
1453	17	1	6.50	2.5	0.25	16	2.5	4.426	0.968	1.377	0.940	0.844	12.897	2.736	5.118	0.980	1.287
1454	17	1	7.00	3	0.25	16	3	4.224	0.916	1.300	1.110	0.727	15.236	3.026	5.984	1.064	1.450
1463	25	1	6.10	0.1	0.25	24	0.1	2.532	1.322	1.981	0.915	3.750	0.684	0.533	0.679	0.150	3.410
1464	25	1	6.25	0.25	0.25	24	0.25	5.731	2.666	3.961	0.866	2.200	1.414	1.065	1.378	0.273	2.874
1465	25	1	6.50	0.5	0.25	24	0.5	7.894	2.948	4.483	0.796	1.929	2.707	1.531	1.927	0.445	2.399
1466	25	1	6.75	0.75	0.25	24	0.75	8.209	2.613	4.090	0.774	1.793	4.673	1.835	2.526	0.626	2.093
1467	25	1	7.00	1	0.25	24	1	7.904	2.243	3.594	0.788	1.732	6.915	2.122	3.438	0.782	1.891
1468	25	1	7.25	1.25	0.25	24	1.25	7.833	1.960	3.229	0.809	1.594	9.762	2.633	4.476	0.923	1.627
1469	25	1	8.00	2	0.25	24	2	7.156	1.464	2.412	0.918	1.249	17.766	3.633	7.113	1.198	1.247
1470	25	1	8.50	2.5	0.25	24	2.5	6.712	1.274	2.076	0.993	1.069	22.564	4.140	8.578	1.311	1.289
1471	25	1	9.00	3	0.25	24	3	6.312	1.208	1.845	1.079	0.926	27.007	4.530	9.934	1.396	1.539
1472	25	1	10.00	4	0.25	24	4	5.710	1.132	1.587	1.313	0.726	34.574	5.243	12.397	1.571	1.843
1473	25	1	11.00	5	0.25	24	5	5.439	1.106	1.510	1.642	0.603	40.852	5.945	14.813	1.750	1.968

STP-PT-074: Local Stress in Nozzles, Shells and Formed Heads from External Heads

Model								Secondary (inside) Stress Factors									
	OD	T	od	t	d/D	D/T	t/T	Branch					Header				
								Axial	In-Plane	Out-of-Plane	Torsional	Pressure	Axial	In-Plane	Out-of-Plane	Torsional	Pressure
1480	33	1	8.10	0.1	0.25	32	0.1	3.517	1.914	2.896	0.932	3.779	0.846	0.690	0.906	0.174	3.784
1481	33	1	8.25	0.25	0.25	32	0.25	8.463	3.759	5.920	0.881	2.906	1.726	1.389	1.691	0.294	3.110
1482	33	1	8.50	0.5	0.25	32	0.5	11.498	4.079	6.638	0.826	2.389	3.598	1.978	2.362	0.489	2.607
1483	33	1	8.75	0.75	0.25	32	0.75	11.698	3.541	5.969	0.828	2.070	6.603	2.382	3.562	0.709	2.256
1484	33	1	9.00	1	0.25	32	1	11.084	2.991	5.183	0.877	1.932	9.969	2.753	4.950	0.904	2.016
1485	33	1	9.25	1.25	0.25	32	1.25	10.756	2.578	4.611	0.921	1.769	14.052	3.414	6.482	1.085	1.730
1486	33	1	10.00	2	0.25	32	2	9.480	1.902	3.379	1.021	1.406	25.557	4.895	10.393	1.452	1.311
1487	33	1	10.50	2.5	0.25	32	2.5	8.803	1.648	2.873	1.070	1.214	32.446	5.606	12.530	1.607	1.309
1488	33	1	11.00	3	0.25	32	3	8.238	1.478	2.513	1.116	1.056	38.838	6.142	14.432	1.721	1.561
1489	33	1	12.00	4	0.25	32	4	7.318	1.352	2.053	1.238	0.827	50.337	7.127	17.832	1.904	1.966
1490	33	1	13.00	5	0.25	32	5	6.656	1.307	1.804	1.418	0.678	60.308	7.976	20.965	2.095	2.200
1491	33	1	14.00	6	0.25	32	6	6.274	1.294	1.690	1.671	0.577	69.019	8.734	24.045	2.288	2.326
1492	33	1	15.00	7	0.25	32	7	6.126	1.312	1.677	2.001	0.510	76.464	9.412	27.099	2.505	2.350
1493	33	1	15.50	7.5	0.25	32	7.5	6.105	1.321	1.688	2.193	0.487	79.828	9.739	28.654	2.635	2.351
1497	41	1	10.10	0.1	0.25	40	0.1	4.545	2.449	3.801	0.947	3.766	0.983	0.823	1.121	0.191	4.083
1498	41	1	10.25	0.25	0.25	40	0.25	11.296	4.759	7.930	0.881	3.660	2.164	1.668	2.041	0.306	3.298
1499	41	1	10.50	0.5	0.25	40	0.5	15.212	5.115	8.855	0.844	2.872	4.547	2.366	2.880	0.531	2.784
1500	41	1	10.75	0.75	0.25	40	0.75	15.237	4.385	7.900	0.906	2.345	8.586	2.846	4.635	0.779	2.427
1501	41	1	11.00	1	0.25	40	1	14.254	3.672	6.823	0.957	2.110	13.100	3.338	6.549	0.999	2.146
1502	41	1	11.25	1.25	0.25	40	1.25	13.626	3.144	6.036	1.003	1.904	18.408	4.200	8.611	1.207	1.834
1503	41	1	12.00	2	0.25	40	2	11.671	2.323	4.378	1.099	1.510	33.325	6.153	13.904	1.663	1.358
1504	41	1	12.50	2.5	0.25	40	2.5	10.744	2.016	3.704	1.138	1.312	42.262	7.055	16.792	1.864	1.339
1505	41	1	13.00	3	0.25	40	3	10.006	1.831	3.222	1.168	1.147	50.659	7.754	19.368	2.010	1.559
1506	41	1	14.00	4	0.25	40	4	8.874	1.591	2.593	1.232	0.901	66.021	9.141	23.875	2.222	2.028
1507	41	1	15.00	5	0.25	40	5	7.993	1.493	2.216	1.330	0.734	79.696	10.202	27.865	2.432	2.335
1508	41	1	16.00	6	0.25	40	6	7.345	1.461	1.996	1.476	0.621	91.928	11.071	31.624	2.633	2.532
1509	41	1	17.00	7	0.25	40	7	6.899	1.456	1.876	1.671	0.541	102.945	11.840	35.324	2.872	2.648
1510	41	1	17.50	7.5	0.25	40	7.5	6.756	1.460	1.840	1.787	0.509	107.943	12.190	37.143	3.006	2.681
1511	41	1	18.00	8	0.25	40	8	6.640	1.458	1.815	1.918	0.481	112.755	12.533	39.006	3.140	2.702
1512	41	1	19.00	9	0.25	40	9	6.512	1.498	1.817	2.241	0.439	121.495	13.288	42.715	3.418	2.709
1514	51	1	12.60	0.1	0.25	50	0.1	5.922	3.040	4.919	0.963	3.903	1.125	0.963	1.347	0.206	4.377
1515	51	1	12.75	0.25	0.25	50	0.25	14.891	5.890	10.473	0.878	4.598	2.710	1.945	2.428	0.320	3.503
1516	51	1	13.00	0.5	0.25	50	0.5	19.901	6.292	11.669	0.907	3.468	5.721	2.772	3.560	0.590	2.987
1517	51	1	13.25	0.75	0.25	50	0.75	19.643	5.346	10.340	0.982	2.684	11.074	3.350	5.998	0.861	2.642
1518	51	1	13.50	1	0.25	50	1	18.159	4.449	8.898	1.034	2.317	17.003	4.091	8.595	1.104	2.318
1519	51	1	13.75	1.25	0.25	50	1.25	17.103	3.850	7.837	1.080	2.054	23.780	5.204	11.353	1.330	1.979
1520	51	1	14.50	2	0.25	50	2	14.260	2.836	5.639	1.170	1.604	42.647	7.675	18.414	1.883	1.414
1521	51	1	15.00	2.5	0.25	50	2.5	12.999	2.513	4.755	1.204	1.398	54.058	8.802	22.332	2.142	1.368



STP-PT-074: Local Stress in Nozzles, Shells and Formed Heads from External Heads

Model								Secondary (inside) Stress Factors									
	OD	T	od	t	d/D	D/T	t/T	Branch					Header				
								Axial	In-Plane	Out-of-Plane	Torsional	Pressure	Axial	In-Plane	Out-of-Plane	Torsional	Pressure
1522	51	1	15.50	3	0.25	50	3	12.074	2.298	4.130	1.225	1.228	64.797	9.837	25.813	2.337	1.541
1523	51	1	16.50	4	0.25	50	4	10.691	2.004	3.305	1.257	0.969	84.691	11.615	31.854	2.607	2.053
1524	51	1	17.50	5	0.25	50	5	9.656	1.805	2.797	1.302	0.789	102.822	12.980	37.099	2.849	2.421
1525	51	1	18.50	6	0.25	50	6	8.810	1.687	2.463	1.377	0.662	119.373	14.058	41.875	3.077	2.683
1526	51	1	19.50	7	0.25	50	7	8.130	1.633	2.224	1.486	0.571	134.592	14.927	46.414	3.339	2.868
1527	51	1	20.00	7.5	0.25	50	7.5	7.833	1.625	2.155	1.550	0.536	141.725	15.345	48.635	3.482	2.937
1528	51	1	20.50	8	0.25	50	8	7.618	1.620	2.098	1.629	0.506	148.514	15.792	50.828	3.624	2.991
1529	51	1	21.50	9	0.25	50	9	7.239	1.618	2.010	1.806	0.455	161.277	16.783	55.212	3.913	3.066
1530	51	1	22.50	10	0.25	50	10	7.008	1.644	1.966	2.028	0.416	172.938	17.733	59.603	4.208	3.098
1531	61	1	15.10	0.1	0.25	60	0.1	7.321	3.567	6.041	0.972	4.256	1.294	1.079	1.564	0.215	4.612
1532	61	1	15.25	0.25	0.25	60	0.25	18.469	6.913	13.026	0.875	5.496	3.217	2.184	2.806	0.334	3.691
1533	61	1	15.50	0.5	0.25	60	0.5	24.558	7.361	14.506	0.961	4.037	6.867	3.114	4.205	0.642	3.181
1534	61	1	15.75	0.75	0.25	60	0.75	23.982	6.220	12.795	1.045	3.010	13.545	3.766	7.377	0.935	2.853
1535	61	1	16.00	1	0.25	60	1	21.960	5.160	10.979	1.095	2.514	20.853	4.845	10.675	1.197	2.527
1536	61	1	16.25	1.25	0.25	60	1.25	20.463	4.525	9.643	1.138	2.189	29.051	6.171	14.152	1.435	2.138
1537	61	1	17.00	2	0.25	60	2	16.712	3.354	6.903	1.221	1.682	51.788	9.117	23.111	2.051	1.476
1538	61	1	17.50	2.5	0.25	60	2.5	15.145	3.012	5.814	1.253	1.466	65.538	10.578	28.116	2.363	1.393
1539	61	1	18.00	3	0.25	60	3	14.015	2.769	5.046	1.272	1.291	78.501	11.933	32.577	2.606	1.545
1540	61	1	19.00	4	0.25	60	4	12.427	2.429	4.042	1.291	1.021	102.733	14.159	40.329	2.950	2.055
1541	61	1	20.00	5	0.25	60	5	11.248	2.194	3.414	1.310	0.832	125.094	15.867	47.002	3.238	2.460
1542	61	1	21.00	6	0.25	60	6	10.273	2.017	2.985	1.347	0.697	145.874	17.216	52.993	3.496	2.768
1543	61	1	22.00	7	0.25	60	7	9.519	1.903	2.678	1.409	0.598	165.177	18.293	58.545	3.809	3.001
1544	61	1	22.50	7.5	0.25	60	7.5	9.264	1.878	2.546	1.448	0.558	174.289	18.825	61.206	3.970	3.095
1545	61	1	23.00	8	0.25	60	8	8.975	1.852	2.462	1.505	0.524	183.061	19.413	63.816	4.119	3.175
1546	61	1	24.00	9	0.25	60	9	8.399	1.818	2.330	1.618	0.469	199.813	20.533	68.977	4.424	3.303
1547	61	1	25.00	10	0.25	60	10	7.959	1.787	2.221	1.757	0.425	215.358	21.599	74.057	4.732	3.390
1548	71	1	17.60	0.1	0.25	70	0.1	8.721	4.034	7.147	0.974	4.924	1.482	1.152	1.708	0.219	4.792
1549	71	1	17.75	0.25	0.25	70	0.25	22.021	7.847	15.593	0.877	6.346	3.689	2.349	3.293	0.344	3.852
1550	71	1	18.00	0.5	0.25	70	0.5	29.138	8.341	17.345	1.008	4.573	8.051	3.378	4.883	0.676	3.350
1551	71	1	18.25	0.75	0.25	70	0.75	28.215	7.025	15.246	1.099	3.320	15.894	4.114	8.723	0.982	3.042
1552	71	1	18.50	1	0.25	70	1	25.640	5.903	13.050	1.146	2.702	24.480	5.556	12.701	1.265	2.718
1553	71	1	18.75	1.25	0.25	70	1.25	23.698	5.169	11.440	1.186	2.316	33.979	7.073	16.879	1.524	2.322
1554	71	1	19.50	2	0.25	70	2	19.061	3.879	8.164	1.260	1.748	60.545	10.487	27.868	2.187	1.543
1555	71	1	20.00	2.5	0.25	70	2.5	17.181	3.498	6.869	1.289	1.520	76.509	12.361	34.004	2.549	1.430
1556	71	1	20.50	3	0.25	70	3	15.871	3.237	5.964	1.309	1.339	91.586	14.000	39.495	2.838	1.534
1557	71	1	21.50	4	0.25	70	4	14.095	2.865	4.790	1.323	1.066	119.841	16.656	49.056	3.258	2.068
1558	71	1	22.50	5	0.25	70	5	12.803	2.604	4.055	1.329	0.868	146.184	18.723	57.290	3.605	2.472
1559	71	1	23.50	6	0.25	70	6	11.824	2.397	3.551	1.343	0.727	170.851	20.361	64.608	3.923	2.809

STP-PT-074: Local Stress in Nozzles, Shells and Formed Heads from External Heads

Model								Secondary (inside) Stress Factors									
	OD	T	od	t	d/D	D/T	t/T	Branch					Header				
								Axial	In-Plane	Out-of-Plane	Torsional	Pressure	Axial	In-Plane	Out-of-Plane	Torsional	Pressure
1560	71	1	24.50	7	0.25	70	7	10.999	2.240	3.185	1.383	0.622	194.038	21.684	71.321	4.278	3.077
1561	71	1	25.00	7.5	0.25	70	7.5	10.637	2.167	3.049	1.415	0.580	205.084	22.392	74.501	4.446	3.189
1562	71	1	25.50	8	0.25	70	8	10.325	2.116	2.916	1.439	0.542	215.833	23.120	77.616	4.610	3.290
1563	71	1	26.50	9	0.25	70	9	9.744	2.057	2.694	1.517	0.481	236.297	24.457	83.637	4.942	3.456
1564	71	1	27.50	10	0.25	70	10	9.174	2.010	2.558	1.608	0.434	255.608	25.635	89.509	5.263	3.584
1565	81	1	20.10	0.1	0.25	80	0.1	10.101	4.464	8.256	0.972	5.595	1.661	1.231	1.882	0.223	4.982
1566	81	1	20.25	0.25	0.25	80	0.25	25.485	8.703	18.151	0.882	7.145	4.198	2.505	3.661	0.354	4.027
1567	81	1	20.50	0.5	0.25	80	0.5	33.619	9.249	20.197	1.049	5.077	9.091	3.615	5.571	0.712	3.530
1568	81	1	20.75	0.75	0.25	80	0.75	32.324	7.769	17.694	1.146	3.614	18.265	4.555	10.108	1.036	3.237
1569	81	1	21.00	1	0.25	80	1	29.204	6.613	15.119	1.190	2.883	28.132	6.271	14.793	1.332	2.916
1570	81	1	21.25	1.25	0.25	80	1.25	26.804	5.785	13.223	1.225	2.438	38.885	7.971	19.678	1.600	2.512
1571	81	1	22.00	2	0.25	80	2	21.313	4.386	9.412	1.290	1.808	68.607	11.772	32.485	2.331	1.617
1572	81	1	22.50	2.5	0.25	80	2.5	19.149	3.969	7.918	1.319	1.567	86.560	13.958	39.731	2.736	1.451
1573	81	1	23.00	3	0.25	80	3	17.677	3.687	6.881	1.339	1.381	103.539	15.826	46.263	3.071	1.516
1574	81	1	24.00	4	0.25	80	4	15.737	3.298	5.548	1.352	1.101	135.467	18.876	57.681	3.576	2.046
1575	81	1	25.00	5	0.25	80	5	14.371	2.995	4.721	1.352	0.898	165.406	21.269	67.535	3.982	2.463
1576	81	1	26.00	6	0.25	80	6	13.380	2.763	4.150	1.355	0.752	193.610	23.198	76.263	4.323	2.818
1577	81	1	27.00	7	0.25	80	7	12.506	2.570	3.730	1.370	0.643	220.351	24.964	84.228	4.709	3.110
1578	81	1	27.50	7.5	0.25	80	7.5	12.123	2.499	3.566	1.402	0.599	233.080	25.831	87.930	4.897	3.234
1579	81	1	28.00	8	0.25	80	8	11.725	2.423	3.411	1.417	0.560	245.597	26.653	91.580	5.079	3.348
1580	81	1	29.00	9	0.25	80	9	11.056	2.302	3.176	1.477	0.495	269.468	28.154	98.546	5.437	3.543
1581	81	1	30.00	10	0.25	80	10	10.503	2.262	2.972	1.537	0.443	293.577	29.828	105.742	5.809	3.714
1582	91	1	22.60	0.1	0.25	90	0.1	11.440	4.858	9.357	0.970	6.245	1.839	1.302	2.029	0.226	5.158
1583	91	1	22.75	0.25	0.25	90	0.25	28.886	9.502	20.724	0.897	7.901	4.648	2.670	3.993	0.362	4.196
1584	91	1	23.00	0.5	0.25	90	0.5	37.986	10.092	23.047	1.097	5.552	10.054	3.861	6.254	0.750	3.702
1585	91	1	23.25	0.75	0.25	90	0.75	36.318	8.555	20.137	1.202	3.893	20.586	5.050	11.498	1.086	3.424
1586	91	1	23.50	1	0.25	90	1	32.660	7.299	17.183	1.241	3.054	31.690	6.970	16.889	1.390	3.107
1587	91	1	23.75	1.25	0.25	90	1.25	29.814	6.381	15.003	1.264	2.555	43.646	8.832	22.479	1.668	2.696
1588	91	1	24.50	2	0.25	90	2	23.488	4.876	10.657	1.316	1.865	76.636	13.182	37.237	2.431	1.700
1589	91	1	25.00	2.5	0.25	90	2.5	21.043	4.429	8.963	1.345	1.612	96.583	15.652	45.667	2.878	1.480
1590	91	1	25.50	3	0.25	90	3	19.416	4.139	7.796	1.364	1.418	115.447	17.750	53.268	3.249	1.508
1591	91	1	26.50	4	0.25	90	4	17.357	3.732	6.318	1.379	1.132	150.952	21.213	66.647	3.851	2.032
1592	91	1	27.50	5	0.25	90	5	15.917	3.429	5.403	1.377	0.929	184.394	23.972	78.233	4.323	2.471
1593	91	1	28.50	6	0.25	90	6	14.808	3.163	4.767	1.372	0.775	216.096	26.200	88.510	4.709	2.823
1594	91	1	29.50	7	0.25	90	7	13.994	2.954	4.295	1.401	0.663	246.288	28.423	97.833	5.146	3.132
1595	91	1	30.00	7.5	0.25	90	7.5	13.595	2.857	4.117	1.416	0.617	260.705	29.449	102.194	5.348	3.265
1596	91	1	30.50	8	0.25	90	8	13.171	2.782	3.944	1.431	0.576	274.905	30.400	106.409	5.550	3.389
1597	91	1	31.50	9	0.25	90	9	12.468	2.635	3.639	1.459	0.508	302.192	32.131	114.489	5.934	3.607

STP-PT-074: Local Stress in Nozzles, Shells and Formed Heads from External Heads

Model								Secondary (inside) Stress Factors									
	OD	T	od	t	d/D	D/T	t/T	Branch					Header				
								Axial	In-Plane	Out-of-Plane	Torsional	Pressure	Axial	In-Plane	Out-of-Plane	Torsional	Pressure
1598	91	1	32.50	10	0.25	90	10	11.802	2.499	3.412	1.513	0.455	329.782	33.979	122.720	6.334	3.801
1599	101	1	25.10	0.1	0.25	100	0.1	12.773	5.217	10.447	0.963	6.971	2.018	1.374	2.177	0.226	5.311
1600	101	1	25.25	0.25	0.25	100	0.25	32.185	10.239	23.259	0.915	8.615	5.044	2.794	4.272	0.376	4.358
1601	101	1	25.50	0.5	0.25	100	0.5	42.251	10.878	25.885	1.150	6.001	11.112	4.083	6.945	0.782	3.866
1602	101	1	25.75	0.75	0.25	100	0.75	40.212	9.319	22.576	1.261	4.157	22.861	5.525	12.891	1.130	3.602
1603	101	1	26.00	1	0.25	100	1	36.011	7.952	19.233	1.296	3.219	35.137	7.645	18.968	1.449	3.288
1604	101	1	26.25	1.25	0.25	100	1.25	32.737	6.950	16.772	1.314	2.669	48.250	9.668	25.262	1.742	2.874
1605	101	1	27.00	2	0.25	100	2	25.602	5.354	11.896	1.352	1.921	84.401	14.552	41.985	2.524	1.791
1606	101	1	27.50	2.5	0.25	100	2.5	22.904	4.878	10.010	1.379	1.653	106.247	17.280	51.595	2.994	1.511
1607	101	1	28.00	3	0.25	100	3	21.126	4.575	8.715	1.400	1.452	126.900	19.612	60.299	3.425	1.505
1608	101	1	29.00	4	0.25	100	4	18.888	4.167	7.078	1.416	1.159	165.860	23.471	75.686	4.113	2.017
1609	101	1	30.00	5	0.25	100	5	17.409	3.852	6.088	1.423	0.953	202.606	26.581	89.067	4.644	2.457
1610	101	1	31.00	6	0.25	100	6	16.405	3.584	5.393	1.412	0.799	237.581	29.256	100.945	5.078	2.830
1611	101	1	32.00	7	0.25	100	7	15.509	3.348	4.878	1.416	0.684	271.039	31.876	111.741	5.566	3.147
1612	101	1	32.50	7.5	0.25	100	7.5	15.050	3.230	4.676	1.444	0.632	287.172	33.011	116.785	5.792	3.282
1613	101	1	33.00	8	0.25	100	8	14.647	3.145	4.479	1.451	0.590	303.020	34.115	121.643	6.011	3.415
1614	101	1	34.00	9	0.25	100	9	13.854	2.947	4.162	1.458	0.520	333.468	36.110	130.879	6.429	3.648
1615	101	1	35.00	10	0.25	100	10	13.163	2.801	3.896	1.490	0.466	364.429	38.206	140.278	6.863	3.863
1616	251	1	62.60	0.1	0.25	250	0.1	30.465	8.846	25.979	0.905	15.633	4.707	2.039	4.637	0.244	7.207
1617	251	1	62.75	0.25	0.25	250	0.25	77.333	18.451	60.393	1.393	16.573	11.429	4.281	9.660	0.573	6.264
1618	251	1	63.00	0.5	0.25	250	0.5	99.715	21.987	67.553	2.043	10.918	26.649	6.874	17.801	1.063	5.716
1619	251	1	63.25	0.75	0.25	250	0.75	91.806	18.699	58.126	2.153	7.102	53.090	11.490	33.252	1.495	5.550
1620	251	1	63.50	1	0.25	250	1	80.221	16.170	49.045	2.086	5.107	80.736	15.963	49.380	2.016	5.324
1621	251	1	63.75	1.25	0.25	250	1.25	71.003	14.289	42.272	2.002	4.001	108.545	20.383	65.580	2.595	4.874
1622	251	1	64.50	2	0.25	250	2	53.668	11.320	29.769	1.845	2.619	185.334	31.264	110.549	4.120	3.389
1623	251	1	65.00	2.5	0.25	250	2.5	47.826	10.582	25.238	1.814	2.185	232.186	36.996	137.875	4.983	2.579
1624	251	1	65.50	3	0.25	250	3	44.281	10.202	22.287	1.807	1.876	276.504	41.866	163.396	5.756	2.077
1625	251	1	66.50	4	0.25	250	4	40.347	9.924	18.844	1.810	1.457	360.620	51.187	210.570	7.169	2.002
1626	251	1	67.50	5	0.25	250	5	38.056	9.635	16.916	1.818	1.184	440.872	60.178	253.737	8.434	2.388
1627	251	1	68.50	6	0.25	250	6	36.374	9.435	15.665	1.840	0.995	518.672	68.205	293.826	9.582	2.747
1628	251	1	69.50	7	0.25	250	7	34.891	9.115	14.717	1.855	0.854	594.415	75.737	331.230	10.633	3.078
1629	251	1	70.00	7.5	0.25	250	7.5	34.201	8.798	14.314	1.846	0.797	634.282	79.977	350.388	11.218	3.248
1630	251	1	70.50	8	0.25	250	8	33.572	8.783	13.959	1.857	0.746	671.067	83.459	367.664	11.705	3.399
1631	251	1	71.50	9	0.25	250	9	32.248	8.377	13.276	1.851	0.658	743.815	90.166	400.963	12.647	3.688
1632	251	1	72.50	10	0.25	250	10	31.033	7.894	12.673	1.829	0.587	814.905	96.161	432.396	13.534	3.960
1633	501	1	125.10	0.1	0.25	500	0.1	55.999	13.049	49.461	1.124	25.370	8.779	2.798	8.510	0.304	9.936
1634	501	1	125.25	0.25	0.25	500	0.25	144.762	28.818	118.580	2.365	24.938	20.224	5.941	17.161	0.761	8.738
1635	501	1	125.50	0.5	0.25	500	0.5	184.658	34.556	133.677	3.445	16.105	49.028	11.907	34.238	1.362	7.937

STP-PT-074: Local Stress in Nozzles, Shells and Formed Heads from External Heads

Model								Secondary (inside) Stress Factors									
	OD	T	od	t	d/D	D/T	t/T	Branch					Header				
								Axial	In-Plane	Out-of-Plane	Torsional	Pressure	Axial	In-Plane	Out-of-Plane	Torsional	Pressure
1636	501	1	125.75	0.75	0.25	500	0.75	166.527	30.697	114.031	3.459	10.232	98.005	19.123	65.956	2.179	7.774
1637	501	1	126.00	1	0.25	500	1	143.449	26.437	95.462	3.229	7.173	146.279	26.871	97.067	3.133	7.492
1638	501	1	126.25	1.25	0.25	500	1.25	125.552	23.397	81.740	3.008	5.511	194.213	33.956	128.213	4.059	6.997
1639	501	1	127.00	2	0.25	500	2	94.918	19.135	57.725	2.640	3.495	327.571	51.091	215.993	6.459	5.209
1640	501	1	127.50	2.5	0.25	500	2.5	85.756	18.296	49.604	2.546	2.887	409.892	60.228	270.643	7.780	4.160
1641	501	1	128.00	3	0.25	500	3	80.708	17.989	44.636	2.497	2.458	488.269	69.685	322.767	8.976	3.423
1642	501	1	129.00	4	0.25	500	4	75.580	17.711	39.234	2.449	1.869	637.666	86.566	421.377	11.131	2.381
1643	501	1	130.00	5	0.25	500	5	72.533	17.500	36.371	2.430	1.486	780.575	101.776	514.023	13.095	2.360
1644	501	1	131.00	6	0.25	500	6	69.935	17.165	34.388	2.405	1.226	919.687	116.028	602.285	14.942	2.673
1645	501	1	132.00	7	0.25	500	7	67.483	16.761	32.776	2.387	1.038	1059.340	130.537	688.756	16.812	2.980
1646	501	1	132.50	7.5	0.25	500	7.5	66.329	16.621	32.058	2.379	0.964	1126.740	137.287	729.799	17.650	3.122
1647	501	1	133.00	8	0.25	500	8	65.173	16.454	31.386	2.371	0.900	1193.979	143.548	770.283	18.459	3.262
1648	501	1	134.00	9	0.25	500	9	62.954	16.068	30.131	2.357	0.793	1326.642	156.146	848.895	20.044	3.533
1649	501	1	135.00	10	0.25	500	10	60.879	15.367	28.998	2.336	0.708	1458.066	168.273	925.233	21.557	3.796
1651	751	1	187.75	0.25	0.25	750	0.25	205.052	37.642	173.607	3.270	31.127	28.571	8.050	24.553	0.890	10.578
1652	751	1	188.00	0.5	0.25	750	0.5	259.325	45.311	196.151	4.663	19.944	69.401	15.688	50.129	1.686	9.552
1653	751	1	188.25	0.75	0.25	750	0.75	231.473	40.099	166.543	4.567	12.562	136.925	25.472	96.468	2.856	9.391
1654	751	1	188.50	1	0.25	750	1	198.215	34.532	138.967	4.188	8.721	202.867	35.374	141.525	4.108	9.103
1655	751	1	188.75	1.25	0.25	750	1.25	172.960	30.655	118.693	3.856	6.647	267.663	44.424	186.316	5.302	8.576
1656	751	1	189.50	2	0.25	750	2	131.754	25.717	84.090	3.348	4.169	448.563	66.467	313.372	8.368	6.589
1657	751	1	190.00	2.5	0.25	750	2.5	120.610	24.978	72.972	3.235	3.438	560.582	80.103	393.009	10.047	5.391
1658	751	1	190.50	3	0.25	750	3	115.038	24.830	66.477	3.171	2.925	667.973	92.475	470.200	11.563	4.507
1659	751	1	191.50	4	0.25	750	4	110.243	24.719	59.891	3.128	2.216	872.189	114.484	616.335	14.279	3.175
1660	751	1	192.50	5	0.25	750	5	107.458	24.378	56.595	3.075	1.751	1067.834	134.428	755.387	16.752	2.497
1661	751	1	193.50	6	0.25	750	6	104.681	23.923	54.264	3.012	1.429	1257.787	153.194	888.655	19.097	2.570
1662	751	1	194.50	7	0.25	750	7	101.695	23.364	52.177	2.951	1.199	1444.568	171.146	1017.990	21.321	2.836
1663	751	1	195.00	7.5	0.25	750	7.5	100.099	23.146	51.162	2.929	1.108	1541.459	180.938	1083.976	22.561	2.925
1664	751	1	195.50	8	0.25	750	8	98.477	22.814	50.188	2.901	1.029	1633.301	189.672	1146.321	23.605	3.051
1665	751	1	196.50	9	0.25	750	9	95.313	22.146	48.274	2.847	0.900	1815.837	206.746	1268.755	25.670	3.352
1666	751	1	197.50	10	0.25	750	10	92.295	21.640	46.465	2.809	0.798	1996.093	223.341	1387.933	27.672	3.591
1668	1001	1	250.25	0.25	0.25	1000	0.25	260.299	45.165	226.179	4.056	36.426	35.696	9.914	31.247	1.006	12.126
1669	1001	1	250.50	0.5	0.25	1000	0.5	326.917	54.408	255.606	5.721	23.119	88.149	18.828	65.578	2.043	10.902
1670	1001	1	250.75	0.75	0.25	1000	0.75	290.041	48.049	216.570	5.533	14.516	171.864	30.865	125.295	3.475	10.739
1671	1001	1	251.00	1	0.25	1000	1	247.496	41.400	180.263	5.025	10.022	253.832	42.458	183.722	4.985	10.457
1672	1001	1	251.25	1.25	0.25	1000	1.25	215.622	36.860	153.757	4.601	7.601	333.613	53.104	241.306	6.408	9.900
1673	1001	1	252.00	2	0.25	1000	2	165.483	31.569	109.308	3.993	4.731	557.240	80.778	405.599	10.015	7.740
1674	1001	1	252.50	2.5	0.25	1000	2.5	152.884	31.058	95.585	3.875	3.899	695.422	97.226	509.285	12.004	6.418
1675	1001	1	253.00	3	0.25	1000	3	147.249	31.067	87.752	3.804	3.318	828.075	111.863	609.185	13.773	5.409

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Model								Secondary (inside) Stress Factors									
	OD	T	od	t	d/D	D/T	t/T	Branch					Header				
								Axial	In-Plane	Out-of-Plane	Torsional	Pressure	Axial	In-Plane	Out-of-Plane	Torsional	Pressure
1676	1001	1	254.00	4	0.25	1000	4	143.334	31.152	80.336	3.779	2.515	1081.444	137.963	800.060	16.931	3.854
1677	1001	1	255.00	5	0.25	1000	5	141.285	30.800	76.974	3.704	1.985	1323.677	161.604	982.527	19.820	3.064
1678	1001	1	256.00	6	0.25	1000	6	138.708	30.250	74.516	3.623	1.618	1559.323	183.847	1158.742	22.540	2.547
1679	1001	1	257.00	7	0.25	1000	7	135.449	29.486	72.146	3.526	1.348	1790.246	205.364	1329.969	25.164	2.737
1680	1001	1	257.50	7.5	0.25	1000	7.5	133.661	29.042	70.977	3.480	1.242	1904.620	215.794	1414.255	26.457	2.855
1681	1001	1	258.00	8	0.25	1000	8	131.720	28.646	69.869	3.442	1.150	2018.547	225.957	1497.318	27.686	2.974
1682	1001	1	259.00	9	0.25	1000	9	127.968	27.870	67.459	3.367	0.997	2243.889	246.498	1660.681	30.117	3.202
1683	1001	1	260.00	10	0.25	1000	10	123.990	27.081	65.025	3.295	0.879	2474.108	267.982	1825.392	32.692	3.436
1685	1251	1	312.75	0.25	0.25	1250	0.25	311.834	51.751	276.710	4.775	41.087	42.089	11.525	37.317	1.165	13.489
1686	1251	1	313.00	0.5	0.25	1250	0.5	389.709	62.406	312.828	6.687	25.955	105.973	21.943	80.763	2.383	12.099
1687	1251	1	313.25	0.75	0.25	1250	0.75	344.038	55.074	264.504	6.406	16.247	204.361	35.553	153.168	4.049	11.933
1688	1251	1	313.50	1	0.25	1250	1	292.880	47.508	219.758	5.775	11.174	300.770	48.693	224.071	5.771	11.659
1689	1251	1	313.75	1.25	0.25	1250	1.25	254.973	42.416	187.265	5.272	8.446	394.692	60.574	294.073	7.405	11.071
1690	1251	1	314.50	2	0.25	1250	2	196.864	36.909	133.519	4.584	5.223	656.864	93.836	493.556	11.517	8.752
1691	1251	1	315.00	2.5	0.25	1250	2.5	183.195	36.562	117.225	4.465	4.303	819.775	112.476	619.557	13.743	7.317
1692	1251	1	315.50	3	0.25	1250	3	177.748	36.754	108.319	4.409	3.665	975.557	129.113	741.000	15.731	6.203
1693	1251	1	316.50	4	0.25	1250	4	175.081	37.065	100.421	4.392	2.789	1273.378	158.641	974.087	19.291	4.460
1694	1251	1	317.50	5	0.25	1250	5	173.953	36.809	97.392	4.315	2.206	1557.976	185.403	1199.471	22.517	3.577
1695	1251	1	318.50	6	0.25	1250	6	171.897	36.060	96.167	4.209	1.798	1835.572	210.497	1415.657	25.567	2.967
1696	1251	1	319.50	7	0.25	1250	7	168.743	35.106	94.544	4.086	1.497	2106.449	234.772	1630.251	28.513	2.671
1697	1251	1	320.00	7.5	0.25	1250	7.5	167.117	34.656	93.241	4.026	1.379	2240.790	246.772	1730.099	29.964	2.781
1698	1251	1	320.50	8	0.25	1250	8	165.035	34.151	91.939	3.975	1.276	2374.134	258.642	1833.637	31.365	2.892
1699	1251	1	321.50	9	0.25	1250	9	160.665	33.059	89.064	3.867	1.101	2639.663	281.533	2036.470	34.090	3.108
1700	1251	1	322.50	10	0.25	1250	10	156.093	32.128	86.111	3.771	0.964	2902.083	304.594	2235.478	36.809	3.314
1702	1501	1	375.25	0.25	0.25	1500	0.25	360.069	57.594	325.214	5.437	45.324	47.437	12.917	42.321	1.299	14.678
1703	1501	1	375.50	0.5	0.25	1500	0.5	448.084	69.540	367.561	7.565	28.579	121.932	24.658	94.766	2.657	13.135
1704	1501	1	375.75	0.75	0.25	1500	0.75	394.041	61.373	310.348	7.199	17.815	234.416	39.743	179.751	4.552	12.976
1705	1501	1	376.00	1	0.25	1500	1	335.020	52.957	257.505	6.466	12.227	343.722	54.186	262.330	6.489	12.707
1706	1501	1	376.25	1.25	0.25	1500	1.25	291.509	47.428	219.345	5.888	9.216	449.908	67.690	343.670	8.280	12.109
1707	1501	1	377.00	2	0.25	1500	2	226.503	41.731	156.891	5.144	5.672	746.989	104.858	575.863	12.787	9.670
1708	1501	1	377.50	2.5	0.25	1500	2.5	212.009	41.677	137.824	5.028	4.677	931.798	125.571	720.423	15.251	8.114
1709	1501	1	378.00	3	0.25	1500	3	206.899	42.132	128.409	4.989	3.988	1109.877	143.968	865.847	17.433	6.905
1710	1501	1	379.00	4	0.25	1500	4	205.760	42.743	120.245	4.976	3.038	1448.311	176.483	1139.836	21.296	5.000
1711	1501	1	380.00	5	0.25	1500	5	206.072	42.510	119.509	4.891	2.405	1776.264	206.393	1407.248	24.919	4.030
1712	1501	1	381.00	6	0.25	1500	6	206.382	41.661	119.241	4.762	1.958	2090.694	234.055	1661.648	28.261	3.345
1713	1501	1	382.00	7	0.25	1500	7	204.041	40.625	117.652	4.622	1.631	2399.471	260.636	1911.045	31.478	2.852
1714	1501	1	382.50	7.5	0.25	1500	7.5	202.215	40.065	116.395	4.553	1.500	2552.208	273.785	2032.617	33.018	2.733
1715	1501	1	383.00	8	0.25	1500	8	200.021	39.385	114.726	4.483	1.384	2704.378	286.784	2150.399	34.582	2.841

STP-PT-074: Local Stress in Nozzles, Shells and Formed Heads from External Heads

Model								Secondary (inside) Stress Factors									
	OD	T	od	t	d/D	D/T	t/T	Branch					Header				
								Axial	In-Plane	Out-of-Plane	Torsional	Pressure	Axial	In-Plane	Out-of-Plane	Torsional	Pressure
1716	1501	1	384.00	9	0.25	1500	9	195.563	38.287	112.099	4.354	1.197	3005.538	312.159	2394.571	37.629	3.045
1717	1501	1	385.00	10	0.25	1500	10	190.366	37.119	108.630	4.233	1.047	3305.164	337.429	2631.713	40.571	3.244
1720	1751	1	438.00	0.5	0.25	1750	0.5	503.303	76.090	420.787	8.371	30.991	137.689	27.309	108.745	2.949	14.136
1721	1751	1	438.25	0.75	0.25	1750	0.75	441.409	67.135	354.341	7.929	19.257	262.733	43.658	205.234	5.051	13.974
1722	1751	1	438.50	1	0.25	1750	1	374.701	58.203	294.113	7.097	13.192	384.911	59.242	299.911	7.171	13.706
1723	1751	1	438.75	1.25	0.25	1750	1.25	325.960	52.110	250.493	6.460	9.920	503.281	74.945	392.733	9.122	13.091
1724	1751	1	439.50	2	0.25	1750	2	254.524	46.320	179.410	5.675	6.093	833.706	115.779	656.486	14.062	10.518
1725	1751	1	440.00	2.5	0.25	1750	2.5	239.572	46.431	158.781	5.578	5.022	1038.910	138.160	823.542	16.690	8.852
1726	1751	1	440.50	3	0.25	1750	3	235.033	47.164	148.093	5.552	4.284	1237.683	158.363	987.123	19.070	7.559
1727	1751	1	441.50	4	0.25	1750	4	235.519	48.017	140.201	5.518	3.266	1614.771	193.282	1303.934	23.198	5.509
1728	1751	1	442.50	5	0.25	1750	5	239.182	47.806	141.756	5.437	2.586	1975.252	224.732	1600.924	26.979	4.439
1729	1751	1	443.50	6	0.25	1750	6	240.733	46.911	142.499	5.294	2.106	2325.258	254.199	1895.424	30.519	3.679
1730	1751	1	444.50	7	0.25	1750	7	239.163	45.763	140.747	5.141	1.754	2667.654	282.979	2168.874	33.993	3.133
1731	1751	1	445.00	7.5	0.25	1750	7.5	237.479	45.095	140.286	5.052	1.613	2836.748	296.557	2318.392	35.663	2.910
1732	1751	1	445.50	8	0.25	1750	8	235.471	44.506	138.953	4.983	1.489	3005.972	310.221	2458.502	37.292	2.805
1733	1751	1	446.50	9	0.25	1750	9	230.603	43.181	135.811	4.831	1.285	3340.330	338.076	2733.885	40.727	3.002
1734	1751	1	447.50	10	0.25	1750	10	224.965	41.824	132.003	4.687	1.124	3671.974	364.845	3006.335	44.099	3.191
1737	2001	1	500.50	0.5	0.25	2000	0.5	555.448	82.096	472.447	9.138	33.258	152.527	29.702	122.425	3.227	15.079
1738	2001	1	500.75	0.75	0.25	2000	0.75	485.936	72.872	397.703	8.612	20.601	290.000	47.193	230.726	5.523	14.913
1739	2001	1	501.00	1	0.25	2000	1	412.285	63.324	330.017	7.688	14.089	423.391	64.372	336.288	7.801	14.641
1740	2001	1	501.25	1.25	0.25	2000	1.25	358.624	56.527	280.226	6.998	10.582	552.951	81.689	438.780	9.941	14.013
1741	2001	1	502.00	2	0.25	2000	2	281.234	50.572	201.251	6.169	6.483	915.440	125.751	734.432	15.213	11.327
1742	2001	1	502.50	2.5	0.25	2000	2.5	266.048	50.975	178.627	6.089	5.343	1141.038	150.098	921.868	18.082	9.537
1743	2001	1	503.00	3	0.25	2000	3	262.167	51.905	167.376	6.079	4.559	1358.257	171.419	1105.006	20.603	8.155
1744	2001	1	504.00	4	0.25	2000	4	264.629	52.993	160.479	6.042	3.478	1772.510	208.909	1455.426	24.978	5.980
1745	2001	1	505.00	5	0.25	2000	5	271.519	52.884	163.359	5.962	2.755	2168.648	242.544	1787.815	28.983	4.815
1746	2001	1	506.00	6	0.25	2000	6	274.740	52.057	166.413	5.810	2.244	2550.415	273.738	2128.061	32.752	3.994
1747	2001	1	507.00	7	0.25	2000	7	273.871	50.748	165.333	5.638	1.870	2925.681	303.788	2440.441	36.384	3.391
1748	2001	1	507.50	7.5	0.25	2000	7.5	272.600	50.013	164.618	5.546	1.719	3111.077	318.691	2598.217	38.204	3.155
1749	2001	1	508.00	8	0.25	2000	8	270.773	49.346	163.622	5.462	1.587	3295.567	333.525	2757.102	40.217	2.948
1750	2001	1	509.00	9	0.25	2000	9	265.673	47.844	160.632	5.292	1.369	3661.500	362.664	3075.991	44.120	2.975
1751	2001	1	510.00	10	0.25	2000	10	259.915	46.301	156.232	5.134	1.197	4024.981	391.713	3372.350	47.795	3.160
1754	2251	1	563.00	0.5	0.25	2250	0.5	604.503	87.717	521.127	9.852	35.396	166.335	31.723	135.114	3.474	15.908
1755	2251	1	563.25	0.75	0.25	2250	0.75	527.841	78.411	438.386	9.262	21.885	315.239	50.507	254.379	5.958	15.763
1756	2251	1	563.50	1	0.25	2250	1	447.459	68.086	362.251	8.247	14.944	459.148	69.173	368.859	8.385	15.478
1757	2251	1	563.75	1.25	0.25	2250	1.25	389.219	60.720	308.983	7.501	11.209	599.277	87.813	483.575	10.643	14.848
1758	2251	1	564.50	2	0.25	2250	2	306.821	54.672	222.882	6.648	6.847	994.394	134.766	812.308	16.245	12.086
1759	2251	1	565.00	2.5	0.25	2250	2.5	291.531	55.340	198.403	6.576	5.643	1237.955	160.954	1017.124	19.293	10.203



STP-PT-074: Local Stress in Nozzles, Shells and Formed Heads from External Heads

Model								Secondary (inside) Stress Factors									
	OD	T	od	t	d/D	D/T	t/T	Branch					Header				
								Axial	In-Plane	Out-of-Plane	Torsional	Pressure	Axial	In-Plane	Out-of-Plane	Torsional	Pressure
1760	2251	1	565.50	3	0.25	2250	3	288.399	56.437	186.036	6.594	4.815	1471.004	183.228	1215.907	21.961	8.715
1761	2251	1	566.50	4	0.25	2250	4	293.014	57.749	181.039	6.568	3.675	1918.846	223.110	1603.753	26.615	6.403
1762	2251	1	567.50	5	0.25	2250	5	303.228	57.758	185.453	6.460	2.912	2346.459	257.876	1968.575	30.842	5.160
1763	2251	1	568.50	6	0.25	2250	6	308.127	56.820	189.241	6.301	2.373	2766.203	290.174	2340.007	34.711	4.280
1764	2251	1	569.50	7	0.25	2250	7	308.542	55.441	191.353	6.111	1.977	3164.684	322.880	2712.201	38.842	3.615
1765	2251	1	570.00	7.5	0.25	2250	7.5	307.533	54.660	186.411	6.014	1.817	3365.448	337.783	2821.085	40.793	3.367
1766	2251	1	570.50	8	0.25	2250	8	305.472	53.859	187.623	5.915	1.679	3562.315	353.351	3031.766	43.121	3.136
1767	2251	1	571.50	9	0.25	2250	9	300.617	52.216	186.104	5.725	1.448	3967.967	386.649	3411.848	47.032	2.972
1768	2251	1	572.50	10	0.25	2250	10	294.309	50.608	180.740	5.552	1.266	4363.723	415.336	3730.156	51.004	3.154
1771	2501	1	625.50	0.5	0.25	2500	0.5	651.614	93.317	569.508	10.530	37.421	180.147	34.019	148.329	3.736	16.736
1772	2501	1	625.75	0.75	0.25	2500	0.75	567.906	83.782	479.097	9.869	23.106	340.106	53.591	278.488	6.384	16.591
1773	2501	1	626.00	1	0.25	2500	1	481.236	72.733	396.886	8.781	15.749	494.481	74.345	404.494	8.971	16.336
1774	2501	1	626.25	1.25	0.25	2500	1.25	418.718	65.091	336.937	7.980	11.795	644.462	94.274	527.355	11.394	15.678
1775	2501	1	627.00	2	0.25	2500	2	331.258	58.477	242.995	7.107	7.192	1065.668	144.116	882.690	17.355	12.804
1776	2501	1	627.50	2.5	0.25	2500	2.5	316.035	59.292	217.263	7.056	5.926	1327.820	171.035	1108.789	20.472	10.850
1777	2501	1	628.00	3	0.25	2500	3	313.799	60.613	204.629	7.086	5.058	1579.141	194.908	1326.148	23.265	9.253
1778	2501	1	629.00	4	0.25	2500	4	320.737	62.361	201.134	7.093	3.863	2060.155	236.633	1749.003	28.217	6.831
1779	2501	1	630.00	5	0.25	2500	5	334.003	62.463	208.111	6.978	3.062	2517.767	273.428	2154.702	32.513	5.473
1780	2501	1	631.00	6	0.25	2500	6	340.428	61.423	212.656	6.826	2.495	2963.656	307.033	2553.066	36.662	4.549
1781	2501	1	632.00	7	0.25	2500	7	342.249	59.965	214.103	6.611	2.079	3397.248	340.093	2937.868	41.182	3.835
1782	2501	1	632.50	7.5	0.25	2500	7.5	341.338	59.185	213.540	6.507	1.911	3611.225	356.077	3125.717	43.496	3.562
1783	2501	1	633.00	8	0.25	2500	8	339.949	58.224	213.432	6.397	1.765	3823.340	372.516	3326.155	45.818	3.330
1784	2501	1	634.00	9	0.25	2500	9	335.268	56.525	210.825	6.185	1.522	4247.213	405.270	3703.132	49.967	2.958
1785	2501	1	635.00	10	0.25	2500	10	329.477	54.769	204.263	5.994	1.331	4663.602	437.533	4023.140	54.598	3.129
1786	9	1	2.50	0.1	0.3	8	0.1	1.185	1.062	1.044	0.845	3.787	0.372	0.204	0.298	0.102	2.373
1787	9	1	2.65	0.25	0.3	8	0.25	1.245	0.908	0.911	0.739	1.551	0.805	0.400	0.627	0.205	2.031
1788	9	1	2.90	0.5	0.3	8	0.5	1.600	0.773	0.970	0.686	1.221	1.383	0.593	0.817	0.319	1.782
1789	9	1	3.15	0.75	0.3	8	0.75	1.821	0.808	1.013	0.652	1.133	1.810	0.738	0.848	0.405	1.607
1790	9	1	3.40	1	0.3	8	1	1.853	0.778	0.994	0.639	1.081	2.162	0.861	1.012	0.474	1.474
1791	9	1	3.65	1.25	0.3	8	1.25	1.984	0.749	0.976	0.634	0.959	2.518	1.030	1.304	0.531	1.277
1792	9	1	4.40	2	0.3	8	2	1.960	0.646	0.942	0.785	0.721	3.709	1.407	2.158	0.675	1.023
1803	17	1	4.90	0.1	0.3	16	0.1	1.583	1.159	1.324	0.914	4.242	0.506	0.398	0.527	0.150	3.305
1804	17	1	5.05	0.25	0.3	16	0.25	3.469	1.781	2.637	0.862	1.903	1.067	0.799	1.090	0.281	2.804
1805	17	1	5.30	0.5	0.3	16	0.5	4.903	2.033	3.041	0.770	1.735	1.982	1.172	1.588	0.437	2.308
1806	17	1	5.55	0.75	0.3	16	0.75	5.223	1.843	2.836	0.741	1.666	3.004	1.416	1.805	0.592	2.015
1807	17	1	5.80	1	0.3	16	1	5.105	1.603	2.538	0.770	1.620	4.265	1.599	2.398	0.725	1.820
1808	17	1	6.05	1.25	0.3	16	1.25	5.155	1.439	2.315	0.783	1.473	5.979	1.950	3.128	0.842	1.567
1809	17	1	6.80	2	0.3	16	2	4.836	1.151	1.785	0.872	1.120	10.895	2.630	5.003	1.063	1.202

STP-PT-074: Local Stress in Nozzles, Shells and Formed Heads from External Heads

Model								Secondary (inside) Stress Factors									
	OD	T	od	t	d/D	D/T	t/T	Branch					Header				
								Axial	In-Plane	Out-of-Plane	Torsional	Pressure	Axial	In-Plane	Out-of-Plane	Torsional	Pressure
1810	17	1	7.30	2.5	0.3	16	2.5	4.550	1.076	1.568	0.981	0.949	13.815	2.987	6.074	1.155	1.274
1811	17	1	7.80	3	0.3	16	3	4.293	1.026	1.428	1.112	0.820	16.334	3.283	7.037	1.240	1.481
1812	17	1	8.80	4	0.3	16	4	3.990	0.918	1.316	1.403	0.628	20.062	3.784	8.689	1.461	1.679
1820	25	1	7.30	0.1	0.3	24	0.1	2.628	1.490	2.333	0.946	4.725	0.692	0.576	0.766	0.192	3.909
1821	25	1	7.45	0.25	0.3	24	0.25	6.223	2.994	4.781	0.901	2.602	1.419	1.169	1.504	0.324	3.194
1822	25	1	7.70	0.5	0.3	24	0.5	8.583	3.299	5.415	0.822	2.260	2.817	1.704	2.066	0.503	2.625
1823	25	1	7.95	0.75	0.3	24	0.75	8.860	2.891	4.921	0.817	2.024	4.938	2.072	2.922	0.710	2.254
1824	25	1	8.20	1	0.3	24	1	8.475	2.452	4.306	0.863	1.915	7.384	2.408	4.047	0.906	2.012
1825	25	1	8.45	1.25	0.3	24	1.25	8.309	2.133	3.862	0.913	1.752	10.498	2.816	5.344	1.080	1.727
1826	25	1	9.20	2	0.3	24	2	7.428	1.622	2.872	1.036	1.374	19.153	3.964	8.576	1.428	1.316
1827	25	1	9.70	2.5	0.3	24	2.5	6.903	1.428	2.458	1.094	1.177	24.328	4.529	10.351	1.565	1.306
1828	25	1	10.20	3	0.3	24	3	6.436	1.357	2.159	1.153	1.020	29.092	4.953	11.941	1.663	1.555
1829	25	1	11.20	4	0.3	24	4	5.671	1.272	1.783	1.303	0.796	37.392	5.819	14.773	1.843	1.933
1830	25	1	12.20	5	0.3	24	5	5.210	1.231	1.601	1.529	0.653	44.243	6.534	17.382	2.036	2.128
1831	25	1	13.20	6	0.3	24	6	5.094	1.234	1.570	1.792	0.545	48.905	7.008	19.494	2.250	2.183
1832	25	1	14.20	7	0.3	24	7	5.094	1.245	1.640	2.148	0.482	53.284	7.684	21.946	2.468	2.180
1837	33	1	9.70	0.1	0.3	32	0.1	3.688	2.073	3.327	0.974	4.727	0.843	0.724	1.001	0.220	4.333
1838	33	1	9.85	0.25	0.3	32	0.25	9.155	4.072	7.007	0.906	3.457	1.840	1.489	1.844	0.346	3.462
1839	33	1	10.10	0.5	0.3	32	0.5	12.485	4.421	7.906	0.846	2.846	3.785	2.158	2.678	0.547	2.860
1840	33	1	10.35	0.75	0.3	32	0.75	12.624	3.811	7.107	0.899	2.369	7.018	2.615	4.126	0.802	2.463
1841	33	1	10.60	1	0.3	32	1	11.879	3.190	6.168	0.970	2.146	10.698	3.054	5.843	1.039	2.171
1842	33	1	10.85	1.25	0.3	32	1.25	11.421	2.786	5.487	1.030	1.937	15.121	3.649	7.719	1.261	1.852
1843	33	1	11.60	2	0.3	32	2	9.848	2.086	4.025	1.154	1.525	27.516	5.329	12.497	1.732	1.386
1844	33	1	12.10	2.5	0.3	32	2.5	9.045	1.849	3.419	1.198	1.318	34.979	6.075	15.127	1.924	1.361
1845	33	1	12.60	3	0.3	32	3	8.391	1.702	2.980	1.229	1.149	41.925	6.743	17.458	2.061	1.587
1846	33	1	13.60	4	0.3	32	4	7.345	1.528	2.393	1.295	0.898	54.477	7.918	21.515	2.257	2.063
1847	33	1	14.60	5	0.3	32	5	6.552	1.458	2.041	1.398	0.732	65.392	8.824	25.075	2.467	2.342
1848	33	1	15.60	6	0.3	32	6	5.978	1.422	1.838	1.551	0.619	74.887	9.557	28.408	2.674	2.525
1849	33	1	16.60	7	0.3	32	7	5.873	1.455	1.804	1.745	0.525	81.544	10.258	31.022	2.908	2.592
1850	33	1	17.10	7.5	0.3	32	7.5	5.811	1.464	1.800	1.874	0.494	85.113	10.640	32.584	3.016	2.614
1851	33	1	17.60	8	0.3	32	8	5.804	1.470	1.811	2.014	0.467	88.418	11.067	34.140	3.160	2.623
1852	33	1	18.60	9	0.3	32	9	5.848	1.519	1.873	2.342	0.429	94.359	11.698	37.287	3.452	2.604
1854	41	1	12.10	0.1	0.3	40	0.1	4.787	2.580	4.309	0.997	4.330	0.966	0.839	1.208	0.238	4.657
1855	41	1	12.25	0.25	0.3	40	0.25	12.185	5.028	9.277	0.907	4.350	2.297	1.743	2.223	0.360	3.683
1856	41	1	12.50	0.5	0.3	40	0.5	16.490	5.419	10.449	0.894	3.438	4.801	2.523	3.329	0.604	3.070
1857	41	1	12.75	0.75	0.3	40	0.75	16.435	4.627	9.334	0.983	2.710	9.155	3.063	5.368	0.889	2.681
1858	41	1	13.00	1	0.3	40	1	15.282	3.853	8.072	1.054	2.357	14.099	3.599	7.718	1.149	2.337
1859	41	1	13.25	1.25	0.3	40	1.25	14.478	3.400	7.147	1.116	2.089	19.848	4.523	10.238	1.392	1.992

STP-PT-074: Local Stress in Nozzles, Shells and Formed Heads from External Heads

Model								Secondary (inside) Stress Factors									
	OD	T	od	t	d/D	D/T	t/T	Branch					Header				
								Axial	In-Plane	Out-of-Plane	Torsional	Pressure	Axial	In-Plane	Out-of-Plane	Torsional	Pressure
1860	41	1	14.00	2	0.3	40	2	12.135	2.562	5.197	1.236	1.626	35.927	6.634	16.688	1.970	1.435
1861	41	1	14.50	2.5	0.3	40	2.5	11.038	2.320	4.401	1.277	1.412	45.641	7.637	20.264	2.223	1.391
1862	41	1	15.00	3	0.3	40	3	10.193	2.139	3.828	1.299	1.236	54.743	8.574	23.432	2.408	1.592
1863	41	1	16.00	4	0.3	40	4	8.919	1.872	3.061	1.329	0.971	71.459	10.118	28.910	2.657	2.123
1864	41	1	17.00	5	0.3	40	5	7.953	1.685	2.578	1.373	0.790	86.466	11.299	33.644	2.888	2.493
1865	41	1	18.00	6	0.3	40	6	7.187	1.610	2.261	1.448	0.664	99.858	12.214	37.907	3.117	2.746
1866	41	1	19.00	7	0.3	40	7	6.576	1.583	2.049	1.562	0.573	111.949	13.077	41.950	3.374	2.891
1867	41	1	19.50	7.5	0.3	40	7.5	6.366	1.571	1.981	1.632	0.538	117.494	13.530	43.919	3.525	2.954
1868	41	1	20.00	8	0.3	40	8	6.159	1.567	1.921	1.720	0.508	122.776	13.979	45.883	3.675	3.002
1869	41	1	21.00	9	0.3	40	9	6.333	1.625	1.992	1.897	0.448	129.686	14.710	48.703	3.938	3.016
1870	41	1	22.00	10	0.3	40	10	6.232	1.641	2.003	2.132	0.409	138.455	15.615	52.615	4.246	3.033
1871	51	1	15.10	0.1	0.3	50	0.1	6.282	3.127	5.534	1.010	4.902	1.152	0.956	1.419	0.249	4.935
1872	51	1	15.25	0.25	0.3	50	0.25	16.020	6.088	12.131	0.901	5.442	2.857	1.974	2.732	0.378	3.916
1873	51	1	15.50	0.5	0.3	50	0.5	21.533	6.539	13.660	0.965	4.148	6.108	2.883	4.008	0.665	3.304
1874	51	1	15.75	0.75	0.3	50	0.75	21.181	5.548	12.137	1.069	3.121	11.783	3.518	6.909	0.979	2.934
1875	51	1	16.00	1	0.3	50	1	19.467	4.698	10.460	1.138	2.606	18.230	4.351	10.055	1.268	2.584
1876	51	1	16.25	1.25	0.3	50	1.25	18.198	4.136	9.226	1.196	2.259	25.536	5.546	13.386	1.537	2.177
1877	51	1	17.00	2	0.3	50	2	14.869	3.172	6.666	1.309	1.722	45.938	8.161	21.990	2.224	1.504
1878	51	1	17.50	2.5	0.3	50	2.5	13.404	2.883	5.635	1.347	1.496	58.276	9.500	26.796	2.552	1.425
1879	51	1	18.00	3	0.3	50	3	12.330	2.670	4.906	1.367	1.314	70.263	10.842	31.233	2.774	1.589
1880	51	1	19.00	4	0.3	50	4	10.773	2.356	3.927	1.380	1.039	91.951	12.863	38.682	3.109	2.155
1881	51	1	20.00	5	0.3	50	5	9.616	2.120	3.300	1.391	0.846	111.790	14.407	45.052	3.385	2.581
1882	51	1	21.00	6	0.3	50	6	8.687	1.948	2.866	1.417	0.708	130.057	15.616	50.735	3.651	2.900
1883	51	1	22.00	7	0.3	50	7	7.956	1.828	2.568	1.469	0.608	146.800	16.817	55.946	3.966	3.138
1884	51	1	22.50	7.5	0.3	50	7.5	7.657	1.784	2.435	1.505	0.567	154.673	17.377	58.450	4.128	3.232
1885	51	1	23.00	8	0.3	50	8	7.441	1.774	2.327	1.548	0.532	162.137	17.955	60.865	4.294	3.311
1886	51	1	24.00	9	0.3	50	9	6.883	1.735	2.186	1.675	0.477	176.421	18.946	65.695	4.621	3.436
1887	51	1	25.00	10	0.3	50	10	6.503	1.721	2.083	1.799	0.432	189.448	19.901	70.389	4.953	3.488
1888	61	1	18.10	0.1	0.3	60	0.1	7.768	3.607	6.746	1.013	4.941	1.362	1.043	1.608	0.256	5.202
1889	61	1	18.25	0.25	0.3	60	0.25	19.811	7.032	14.983	0.892	6.477	3.432	2.174	3.145	0.393	4.152
1890	61	1	18.50	0.5	0.3	60	0.5	26.515	7.541	16.892	1.027	4.811	7.251	3.180	4.708	0.722	3.541
1891	61	1	18.75	0.75	0.3	60	0.75	25.825	6.413	14.946	1.145	3.508	14.442	3.917	8.497	1.061	3.189
1892	61	1	19.00	1	0.3	60	1	23.536	5.496	12.847	1.206	2.841	22.370	5.144	12.457	1.364	2.840
1893	61	1	19.25	1.25	0.3	60	1.25	21.795	4.834	11.306	1.259	2.419	31.181	6.537	16.617	1.653	2.419
1894	61	1	20.00	2	0.3	60	2	17.472	3.754	8.130	1.362	1.801	55.719	9.622	27.459	2.412	1.585
1895	61	1	20.50	2.5	0.3	60	2.5	15.648	3.425	6.865	1.398	1.561	70.589	11.403	33.569	2.804	1.451
1896	61	1	21.00	3	0.3	60	3	14.347	3.193	5.976	1.419	1.373	84.604	12.910	39.038	3.109	1.576
1897	61	1	22.00	4	0.3	60	4	12.553	2.838	4.808	1.427	1.090	110.835	15.366	48.560	3.546	2.153

STP-PT-074: Local Stress in Nozzles, Shells and Formed Heads from External Heads

Model								Secondary (inside) Stress Factors									
	OD	T	od	t	d/D	D/T	t/T	Branch					Header				
								Axial	In-Plane	Out-of-Plane	Torsional	Pressure	Axial	In-Plane	Out-of-Plane	Torsional	Pressure
1898	61	1	23.00	5	0.3	60	5	11.252	2.558	4.058	1.421	0.890	135.143	17.265	56.718	3.887	2.609
1899	61	1	24.00	6	0.3	60	6	10.222	2.355	3.535	1.428	0.745	157.757	18.949	63.914	4.197	2.968
1900	61	1	25.00	7	0.3	60	7	9.450	2.193	3.157	1.472	0.637	178.868	20.492	70.490	4.534	3.252
1901	61	1	25.50	7.5	0.3	60	7.5	9.118	2.133	2.997	1.492	0.594	188.967	21.166	73.581	4.717	3.372
1902	61	1	26.00	8	0.3	60	8	8.804	2.070	2.865	1.510	0.555	199.601	21.990	76.942	4.911	3.489
1903	61	1	27.00	9	0.3	60	9	8.236	1.961	2.642	1.557	0.492	218.101	23.228	82.761	5.269	3.665
1904	61	1	28.00	10	0.3	60	10	7.710	1.892	2.490	1.646	0.444	235.380	24.327	88.393	5.619	3.799
1905	71	1	21.10	0.1	0.3	70	0.1	9.245	4.032	7.951	1.008	5.727	1.578	1.128	1.784	0.258	5.433
1906	71	1	21.25	0.25	0.3	70	0.25	23.541	7.885	17.837	0.898	7.454	3.941	2.341	3.511	0.406	4.379
1907	71	1	21.50	0.5	0.3	70	0.5	31.381	8.450	20.121	1.096	5.429	8.348	3.458	5.481	0.775	3.764
1908	71	1	21.75	0.75	0.3	70	0.75	30.330	7.290	17.745	1.226	3.871	17.032	4.274	10.081	1.131	3.431
1909	71	1	22.00	1	0.3	70	1	27.466	6.250	15.227	1.284	3.064	26.388	5.909	14.861	1.458	3.085
1910	71	1	22.25	1.25	0.3	70	1.25	25.234	5.485	13.364	1.317	2.569	36.624	7.489	19.850	1.754	2.655
1911	71	1	23.00	2	0.3	70	2	19.948	4.308	9.576	1.405	1.874	65.049	11.192	32.951	2.559	1.682
1912	71	1	23.50	2.5	0.3	70	2.5	17.808	3.942	8.091	1.445	1.617	82.282	13.264	40.405	3.013	1.499
1913	71	1	24.00	3	0.3	70	3	16.309	3.693	7.054	1.468	1.422	98.544	15.027	47.097	3.378	1.569
1914	71	1	25.00	4	0.3	70	4	14.279	3.326	5.699	1.487	1.132	129.105	17.917	58.829	3.904	2.146
1915	71	1	26.00	5	0.3	70	5	12.893	3.034	4.851	1.470	0.926	157.678	20.200	68.941	4.342	2.619
1916	71	1	27.00	6	0.3	70	6	11.832	2.775	4.247	1.460	0.775	184.507	22.415	77.853	4.709	3.004
1917	71	1	28.00	7	0.3	70	7	10.985	2.571	3.791	1.485	0.663	209.763	24.294	85.927	5.089	3.319
1918	71	1	28.50	7.5	0.3	70	7.5	10.633	2.490	3.603	1.470	0.617	221.854	25.126	89.690	5.298	3.455
1919	71	1	29.00	8	0.3	70	8	10.275	2.417	3.445	1.504	0.577	234.736	26.106	93.797	5.521	3.590
1920	71	1	30.00	9	0.3	70	9	9.588	2.299	3.166	1.544	0.511	257.454	27.576	100.824	5.912	3.806
1921	71	1	31.00	10	0.3	70	10	9.041	2.192	2.989	1.585	0.456	278.679	28.876	107.441	6.293	3.980
1922	81	1	24.10	0.1	0.3	80	0.1	10.686	4.410	9.127	0.999	6.542	1.736	1.165	1.906	0.257	5.575
1923	81	1	24.25	0.25	0.3	80	0.25	27.157	8.656	20.633	0.913	8.366	4.508	2.429	3.932	0.416	4.540
1924	81	1	24.50	0.5	0.3	80	0.5	36.100	9.303	23.313	1.168	6.005	9.507	3.622	6.268	0.800	3.940
1925	81	1	24.75	0.75	0.3	80	0.75	34.668	8.114	20.511	1.308	4.212	19.407	4.735	11.583	1.172	3.628
1926	81	1	25.00	1	0.3	80	1	31.231	6.962	17.569	1.361	3.275	30.026	6.562	17.121	1.516	3.291
1927	81	1	25.25	1.25	0.3	80	1.25	28.516	6.101	15.387	1.386	2.711	41.526	8.305	22.891	1.837	2.858
1928	81	1	26.00	2	0.3	80	2	22.358	4.835	11.021	1.458	1.942	73.942	12.701	38.432	2.686	1.790
1929	81	1	26.50	2.5	0.3	80	2.5	19.886	4.438	9.305	1.498	1.668	93.390	15.046	47.238	3.188	1.539
1930	81	1	27.00	3	0.3	80	3	18.193	4.181	8.117	1.522	1.464	111.773	17.055	55.194	3.608	1.566
1931	81	1	28.00	4	0.3	80	4	15.982	3.805	6.597	1.547	1.167	146.380	20.369	69.217	4.264	2.135
1932	81	1	29.00	5	0.3	80	5	14.471	3.473	5.642	1.537	0.957	178.872	23.198	81.336	4.779	2.614
1933	81	1	30.00	6	0.3	80	6	13.456	3.233	4.970	1.518	0.803	209.604	25.816	92.096	5.203	3.014
1934	81	1	31.00	7	0.3	80	7	12.618	3.020	4.454	1.539	0.687	238.785	28.057	101.787	5.633	3.351
1935	81	1	31.50	7.5	0.3	80	7.5	12.230	2.868	4.253	1.557	0.638	252.818	29.041	106.312	5.863	3.499

STP-PT-074: Local Stress in Nozzles, Shells and Formed Heads from External Heads

Model								Secondary (inside) Stress Factors									
	OD	T	od	t	d/D	D/T	t/T	Branch					Header				
								Axial	In-Plane	Out-of-Plane	Torsional	Pressure	Axial	In-Plane	Out-of-Plane	Torsional	Pressure
1936	81	1	32.00	8	0.3	80	8	11.766	2.786	4.066	1.542	0.595	267.819	30.250	111.183	6.123	3.647
1937	81	1	33.00	9	0.3	80	9	11.064	2.594	3.745	1.543	0.525	294.179	31.940	119.474	6.547	3.888
1938	81	1	34.00	10	0.3	80	10	10.386	2.491	3.507	1.580	0.468	319.360	33.488	127.342	6.962	4.093
1939	91	1	27.10	0.1	0.3	90	0.1	12.108	4.761	10.308	0.986	7.381	1.925	1.218	2.055	0.256	5.755
1940	91	1	27.25	0.25	0.3	90	0.25	30.683	9.374	23.439	0.939	9.237	4.916	2.529	4.260	0.428	4.736
1941	91	1	27.50	0.5	0.3	90	0.5	40.687	10.136	26.520	1.242	6.545	10.662	3.845	7.093	0.841	4.140
1942	91	1	27.75	0.75	0.3	90	0.75	38.883	8.915	23.284	1.390	4.533	21.852	5.226	13.160	1.222	3.842
1943	91	1	28.00	1	0.3	90	1	34.873	7.637	19.914	1.436	3.475	33.774	7.275	19.507	1.574	3.509
1944	91	1	28.25	1.25	0.3	90	1.25	31.701	6.734	17.417	1.455	2.848	46.507	9.178	26.064	1.908	3.072
1945	91	1	29.00	2	0.3	90	2	24.632	5.334	12.429	1.509	2.007	81.831	13.911	43.581	2.843	1.915
1946	91	1	29.50	2.5	0.3	90	2.5	21.861	4.917	10.492	1.546	1.717	103.200	16.478	53.672	3.393	1.563
1947	91	1	30.00	3	0.3	90	3	20.015	4.640	9.171	1.570	1.504	123.429	18.676	62.846	3.866	1.552
1948	91	1	31.00	4	0.3	90	4	17.659	4.264	7.492	1.594	1.198	161.545	22.309	79.072	4.614	2.110
1949	91	1	32.00	5	0.3	90	5	16.132	3.931	6.480	1.597	0.984	198.945	26.102	93.881	5.182	2.603
1950	91	1	33.00	6	0.3	90	6	15.007	3.635	5.732	1.573	0.826	233.357	29.148	106.543	5.668	3.011
1951	91	1	34.00	7	0.3	90	7	14.125	3.360	5.178	1.549	0.706	266.201	31.760	117.969	6.156	3.361
1952	91	1	34.50	7.5	0.3	90	7.5	13.686	3.267	4.942	1.560	0.657	282.043	32.928	123.300	6.413	3.518
1953	91	1	35.00	8	0.3	90	8	13.269	3.138	4.738	1.565	0.613	298.978	34.311	129.028	6.701	3.676
1954	91	1	36.00	9	0.3	90	9	12.511	2.944	4.374	1.568	0.541	328.999	36.319	138.763	7.171	3.937
1955	91	1	37.00	10	0.3	90	10	11.778	2.843	4.075	1.595	0.482	357.720	38.097	147.882	7.619	4.163
1956	101	1	30.10	0.1	0.3	100	0.1	13.461	5.079	11.470	0.976	8.187	2.106	1.283	2.237	0.260	5.959
1957	101	1	30.25	0.25	0.3	100	0.25	34.118	10.028	26.201	0.970	10.069	5.530	2.651	4.896	0.439	4.940
1958	101	1	30.50	0.5	0.3	100	0.5	45.152	11.002	29.699	1.319	7.061	11.859	4.050	7.916	0.877	4.340
1959	101	1	30.75	0.75	0.3	100	0.75	42.956	9.675	26.037	1.473	4.843	24.229	5.707	14.729	1.271	4.052
1960	101	1	31.00	1	0.3	100	1	38.384	8.288	22.233	1.511	3.666	37.377	7.962	21.858	1.641	3.717
1961	101	1	31.25	1.25	0.3	100	1.25	34.755	7.352	19.416	1.521	2.979	51.333	10.016	29.221	1.975	3.276
1962	101	1	32.00	2	0.3	100	2	26.850	5.831	13.834	1.560	2.070	89.925	15.283	48.966	2.932	2.062
1963	101	1	32.50	2.5	0.3	100	2.5	23.827	5.370	11.691	1.591	1.763	113.304	18.102	60.430	3.532	1.621
1964	101	1	33.00	3	0.3	100	3	21.797	5.112	10.222	1.616	1.540	135.401	20.504	70.868	4.053	1.576
1965	101	1	34.00	4	0.3	100	4	19.340	4.724	8.413	1.639	1.231	178.382	24.958	90.075	4.891	2.118
1966	101	1	35.00	5	0.3	100	5	17.638	4.401	7.272	1.653	1.008	218.111	28.924	106.483	5.568	2.591
1967	101	1	36.00	6	0.3	100	6	16.467	4.088	6.489	1.635	0.848	255.976	32.379	121.106	6.113	3.003
1968	101	1	37.00	7	0.3	100	7	15.682	3.804	5.878	1.605	0.725	292.267	35.362	134.367	6.656	3.362
1969	101	1	37.50	7.5	0.3	100	7.5	15.227	3.672	5.628	1.598	0.675	309.840	36.719	140.552	6.941	3.523
1970	101	1	38.00	8	0.3	100	8	14.815	3.626	5.394	1.598	0.630	328.586	38.318	147.154	7.259	3.687
1971	101	1	39.00	9	0.3	100	9	14.004	3.395	4.993	1.625	0.555	362.041	40.629	158.435	7.783	3.963
1972	101	1	40.00	10	0.3	100	10	13.099	3.114	4.665	1.639	0.493	394.295	42.701	169.026	8.275	4.206
1973	251	1	75.10	0.1	0.3	250	0.1	31.082	8.436	27.940	0.948	18.106	5.045	1.909	5.115	0.300	8.473

STP-PT-074: Local Stress in Nozzles, Shells and Formed Heads from External Heads

Model								Secondary (inside) Stress Factors									
	OD	T	od	t	d/D	D/T	t/T	Branch					Header				
								Axial	In-Plane	Out-of-Plane	Torsional	Pressure	Axial	In-Plane	Out-of-Plane	Torsional	Pressure
1974	251	1	75.25	0.25	0.3	250	0.25	80.004	18.135	66.448	1.715	19.172	12.466	4.085	10.975	0.658	7.348
1975	251	1	75.50	0.5	0.3	250	0.5	104.259	21.533	76.156	2.550	12.638	27.778	7.291	19.799	1.219	6.585
1976	251	1	75.75	0.75	0.3	250	0.75	96.198	19.355	66.057	2.664	8.190	55.856	11.956	37.841	1.734	6.356
1977	251	1	76.00	1	0.3	250	1	83.933	16.785	55.808	2.568	5.838	84.616	16.642	56.261	2.457	6.048
1978	251	1	76.25	1.25	0.3	250	1.25	74.232	14.867	48.177	2.449	4.525	113.610	21.184	74.798	3.161	5.560
1979	251	1	77.00	2	0.3	250	2	56.071	11.874	34.063	2.223	2.889	194.080	32.089	126.663	5.004	3.925
1980	251	1	77.50	2.5	0.3	250	2.5	50.037	11.166	29.024	2.174	2.387	243.073	37.652	158.225	6.016	3.020
1981	251	1	78.00	3	0.3	250	3	46.375	10.865	25.768	2.158	2.036	290.891	43.759	188.729	6.997	2.459
1982	251	1	79.00	4	0.3	250	4	42.280	10.528	21.987	2.149	1.565	379.534	54.230	244.158	8.651	2.110
1983	251	1	80.00	5	0.3	250	5	39.871	10.317	19.890	2.145	1.265	464.005	63.654	295.268	10.147	2.508
1984	251	1	81.00	6	0.3	250	6	38.019	9.997	18.493	2.156	1.060	545.786	72.307	342.905	11.499	2.876
1985	251	1	82.00	7	0.3	250	7	36.478	9.606	17.446	2.155	0.910	625.310	80.404	387.587	12.787	3.219
1986	251	1	82.50	7.5	0.3	250	7.5	35.669	9.512	16.965	2.161	0.849	664.692	84.160	409.242	13.392	3.385
1987	251	1	83.00	8	0.3	250	8	34.953	9.260	16.532	2.151	0.795	703.306	87.946	429.963	13.986	3.542
1988	251	1	84.00	9	0.3	250	9	33.583	8.907	15.751	2.146	0.704	779.576	95.021	470.078	15.125	3.847
1989	251	1	85.00	10	0.3	250	10	32.284	8.548	15.040	2.139	0.629	857.278	102.281	509.863	16.317	4.148
1990	501	1	150.10	0.1	0.3	500	0.1	55.909	12.604	52.475	1.297	29.305	9.309	2.946	9.386	0.384	11.722
1991	501	1	150.25	0.25	0.3	500	0.25	146.703	28.744	128.808	2.983	28.593	21.484	6.314	19.194	0.868	10.233
1992	501	1	150.50	0.5	0.3	500	0.5	189.523	34.872	148.766	4.357	18.559	50.757	12.219	38.184	1.601	9.111
1993	501	1	150.75	0.75	0.3	500	0.75	171.684	31.130	128.056	4.327	11.781	101.136	19.759	73.928	2.741	8.872
1994	501	1	151.00	1	0.3	500	1	147.999	26.911	107.507	4.017	8.210	151.218	27.519	109.411	3.928	8.555
1995	501	1	151.25	1.25	0.3	500	1.25	129.658	23.890	92.213	3.729	6.253	200.737	34.539	144.769	5.070	8.007
1996	501	1	152.00	2	0.3	500	2	98.442	19.786	65.406	3.268	3.882	338.358	52.176	244.418	7.967	6.043
1997	501	1	152.50	2.5	0.3	500	2.5	89.352	19.028	56.485	3.156	3.183	423.185	62.819	306.615	9.544	4.884
1998	501	1	153.00	3	0.3	500	3	84.452	18.752	51.064	3.096	2.696	504.077	72.390	366.106	10.944	4.029
1999	501	1	154.00	4	0.3	500	4	79.577	18.456	45.258	3.014	2.035	657.767	89.435	478.689	13.444	2.812
2000	501	1	155.00	5	0.3	500	5	76.697	18.164	42.188	2.952	1.609	804.662	104.883	584.965	15.736	2.470
2001	501	1	156.00	6	0.3	500	6	74.091	17.804	40.004	2.912	1.319	947.438	119.416	686.727	17.859	2.782
2002	501	1	157.00	7	0.3	500	7	71.542	17.304	38.173	2.867	1.114	1087.521	133.229	784.616	19.881	3.079
2003	501	1	157.50	7.5	0.3	500	7.5	70.285	17.104	37.302	2.851	1.033	1159.740	140.973	834.240	21.024	3.233
2004	501	1	158.00	8	0.3	500	8	69.022	16.855	36.512	2.831	0.962	1228.912	147.541	881.448	21.973	3.375
2005	501	1	159.00	9	0.3	500	9	66.630	16.431	35.014	2.805	0.847	1365.075	160.553	973.229	23.827	3.646
2006	501	1	160.00	10	0.3	500	10	64.364	15.821	33.617	2.770	0.756	1499.695	173.266	1062.331	25.634	3.911
2008	751	1	225.25	0.25	0.3	750	0.25	204.696	37.204	186.678	4.098	35.846	29.732	8.457	27.254	1.077	12.399
2009	751	1	225.50	0.5	0.3	750	0.5	262.638	45.250	216.247	5.838	22.956	70.985	15.813	55.523	2.099	10.977
2010	751	1	225.75	0.75	0.3	750	0.75	235.768	40.226	185.331	5.706	14.500	139.813	25.903	107.239	3.603	10.732
2011	751	1	226.00	1	0.3	750	1	202.364	34.753	155.130	5.204	10.016	207.395	35.630	158.066	5.154	10.415
2012	751	1	226.25	1.25	0.3	750	1.25	176.890	30.964	132.790	4.785	7.571	273.803	44.486	208.533	6.615	9.825



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Model								Secondary (inside) Stress Factors									
	OD	T	od	t	d/D	D/T	t/T	Branch					Header				
								Axial	In-Plane	Out-of-Plane	Torsional	Pressure	Axial	In-Plane	Out-of-Plane	Torsional	Pressure
2013	751	1	227.00	2	0.3	750	2	135.780	26.352	94.638	4.168	4.645	458.060	68.763	351.237	10.286	7.625
2014	751	1	227.50	2.5	0.3	750	2.5	124.942	25.766	82.440	4.043	3.802	571.919	82.416	440.724	12.259	6.277
2015	751	1	228.00	3	0.3	750	3	119.845	25.624	75.456	3.984	3.220	680.953	94.733	527.132	14.030	5.247
2016	751	1	229.00	4	0.3	750	4	115.685	25.490	68.524	3.876	2.429	887.979	116.455	691.952	17.147	3.749
2017	751	1	230.00	5	0.3	750	5	113.314	25.011	65.074	3.763	1.914	1086.124	136.117	848.584	19.985	2.999
2018	751	1	231.00	6	0.3	750	6	110.592	24.464	62.447	3.670	1.558	1281.345	155.396	1001.697	22.794	2.698
2019	751	1	232.00	7	0.3	750	7	107.642	23.829	60.123	3.586	1.298	1469.897	173.535	1148.160	25.397	2.959
2020	751	1	232.50	7.5	0.3	750	7.5	106.028	23.590	58.996	3.555	1.196	1563.605	182.285	1220.246	26.612	3.088
2021	751	1	233.00	8	0.3	750	8	104.374	23.102	57.806	3.503	1.107	1656.433	190.911	1291.614	27.865	3.213
2022	751	1	234.00	9	0.3	750	9	101.167	22.505	55.669	3.439	0.964	1841.130	208.032	1431.977	30.233	3.457
2023	751	1	235.00	10	0.3	750	10	97.934	21.740	53.495	3.371	0.855	2022.103	224.805	1567.539	32.543	3.689
2025	1001	1	300.25	0.25	0.3	1000	0.25	256.721	44.293	241.475	5.067	41.956	36.429	10.231	34.073	1.285	14.227
2026	1001	1	300.50	0.5	0.3	1000	0.5	327.528	53.933	279.821	7.128	26.673	89.260	19.329	72.067	2.562	12.551
2027	1001	1	300.75	0.75	0.3	1000	0.75	292.416	47.878	239.139	6.891	16.792	174.046	31.065	138.518	4.384	12.306
2028	1001	1	301.00	1	0.3	1000	1	250.268	41.679	199.825	6.228	11.544	256.904	42.427	203.664	6.234	11.987
2029	1001	1	301.25	1.25	0.3	1000	1.25	218.596	37.185	170.836	5.701	8.688	337.757	53.547	267.908	7.969	11.370
2030	1001	1	302.00	2	0.3	1000	2	169.291	32.149	122.147	4.974	5.290	562.560	82.967	450.303	12.280	8.963
2031	1001	1	302.50	2.5	0.3	1000	2.5	157.541	31.725	107.255	4.854	4.332	702.242	99.155	565.641	14.601	7.436
2032	1001	1	303.00	3	0.3	1000	3	152.588	31.852	98.889	4.792	3.675	835.527	113.600	676.517	16.635	6.263
2033	1001	1	304.00	4	0.3	1000	4	149.742	31.873	91.318	4.697	2.780	1089.134	138.919	889.598	20.241	4.552
2034	1001	1	305.00	5	0.3	1000	5	148.126	31.463	88.120	4.559	2.191	1331.361	161.804	1092.938	23.502	3.655
2035	1001	1	306.00	6	0.3	1000	6	146.078	30.698	86.697	4.414	1.781	1570.171	184.156	1292.325	26.758	3.041
2036	1001	1	307.00	7	0.3	1000	7	143.521	29.929	84.726	4.290	1.483	1800.818	205.239	1484.136	29.730	2.875
2037	1001	1	307.50	7.5	0.3	1000	7.5	141.801	29.452	83.486	4.237	1.365	1914.805	215.637	1578.551	31.191	2.991
2038	1001	1	308.00	8	0.3	1000	8	139.845	28.949	82.017	4.171	1.259	2028.326	225.675	1671.977	32.624	3.105
2039	1001	1	309.00	9	0.3	1000	9	136.215	28.121	79.564	4.065	1.090	2252.384	245.956	1855.531	35.587	3.325
2040	1001	1	310.00	10	0.3	1000	10	132.172	27.228	76.771	3.967	0.957	2475.402	265.694	2037.223	38.418	3.540
2042	1251	1	375.25	0.25	0.3	1250	0.25	304.249	50.352	293.239	5.926	47.368	42.099	11.731	39.836	1.498	15.846
2043	1251	1	375.50	0.5	0.3	1250	0.5	386.745	61.443	339.959	8.288	30.047	106.079	22.333	87.841	2.981	13.949
2044	1251	1	375.75	0.75	0.3	1250	0.75	343.787	55.160	289.962	7.940	18.814	205.121	35.515	168.117	5.087	13.692
2045	1251	1	376.00	1	0.3	1250	1	293.806	48.128	242.122	7.132	12.895	301.605	48.719	246.596	7.197	13.372
2046	1251	1	376.25	1.25	0.3	1250	1.25	256.437	43.010	206.761	6.516	9.676	395.811	61.971	323.945	9.175	12.740
2047	1251	1	377.00	2	0.3	1250	2	200.255	37.269	148.390	5.714	5.873	657.332	95.398	543.662	14.034	10.134
2048	1251	1	377.50	2.5	0.3	1250	2.5	187.769	37.147	130.910	5.604	4.809	820.093	113.784	683.117	16.647	8.455
2049	1251	1	378.00	3	0.3	1250	3	183.356	37.497	121.594	5.546	4.081	975.604	130.026	817.427	18.927	7.158
2050	1251	1	379.00	4	0.3	1250	4	182.014	37.810	113.663	5.466	3.089	1271.266	158.392	1076.528	22.923	5.245
2051	1251	1	380.00	5	0.3	1250	5	182.779	37.387	113.119	5.313	2.436	1552.830	183.864	1322.409	26.558	4.229
2052	1251	1	381.00	6	0.3	1250	6	182.634	36.528	112.517	5.145	1.979	1826.060	207.828	1561.693	29.978	3.502

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	OD	T	od	t	d/D	D/T	t/T	Branch					Header				
								Axial	In-Plane	Out-of-Plane	Torsional	Pressure	Axial	In-Plane	Out-of-Plane	Torsional	Pressure
2053	1251	1	382.00	7	0.3	1250	7	180.503	35.473	110.852	4.972	1.647	2098.968	232.115	1799.864	33.744	2.987
2054	1251	1	382.50	7.5	0.3	1250	7.5	178.970	34.954	109.716	4.902	1.514	2232.757	243.679	1915.723	35.517	2.935
2055	1251	1	383.00	8	0.3	1250	8	176.906	34.335	108.203	4.813	1.398	2363.389	255.101	2029.145	37.350	3.042
2056	1251	1	384.00	9	0.3	1250	9	172.765	33.266	105.310	4.701	1.207	2625.604	277.317	2256.684	40.712	3.250
2057	1251	1	385.00	10	0.3	1250	10	168.112	32.250	101.858	4.547	1.058	2883.457	299.711	2477.396	44.098	3.446
2059	1501	1	450.25	0.25	0.3	1500	0.25	348.379	55.921	342.726	6.748	52.341	47.336	13.083	45.433	1.651	17.318
2060	1501	1	450.50	0.5	0.3	1500	0.5	441.268	68.253	397.299	9.341	33.104	121.886	25.078	103.026	3.385	15.214
2061	1501	1	450.75	0.75	0.3	1500	0.75	391.128	61.940	338.487	8.885	20.641	233.825	39.519	196.447	5.725	14.942
2062	1501	1	451.00	1	0.3	1500	1	333.766	54.011	282.884	7.947	14.119	343.204	54.989	288.461	8.092	14.629
2063	1501	1	451.25	1.25	0.3	1500	1.25	291.424	48.288	241.008	7.259	10.571	449.228	69.751	377.428	10.280	13.973
2064	1501	1	452.00	2	0.3	1500	2	229.078	42.020	173.474	6.397	6.397	744.162	106.811	632.081	15.646	11.204
2065	1501	1	452.50	2.5	0.3	1500	2.5	216.335	42.126	153.849	6.307	5.236	928.245	127.010	794.351	18.497	9.384
2066	1501	1	453.00	3	0.3	1500	3	212.594	42.667	143.682	6.270	4.444	1104.257	144.643	950.929	20.996	7.955
2067	1501	1	454.00	4	0.3	1500	4	213.076	43.254	136.248	6.196	3.367	1438.990	175.792	1251.282	25.339	5.872
2068	1501	1	455.00	5	0.3	1500	5	217.479	42.883	138.191	6.054	2.658	1757.190	203.319	1536.467	29.233	4.730
2069	1501	1	456.00	6	0.3	1500	6	218.969	41.937	139.148	5.862	2.159	2065.532	229.299	1820.382	33.198	3.918
2070	1501	1	457.00	7	0.3	1500	7	217.367	40.789	138.345	5.679	1.796	2367.495	254.241	2100.064	37.456	3.329
2071	1501	1	457.50	7.5	0.3	1500	7.5	215.915	40.109	136.864	5.574	1.650	2517.105	266.697	2228.878	39.400	3.095
2072	1501	1	458.00	8	0.3	1500	8	213.829	39.507	135.063	5.476	1.524	2663.921	279.067	2356.517	41.437	3.004
2073	1501	1	459.00	9	0.3	1500	9	209.166	38.158	131.881	5.295	1.315	2958.232	303.223	2626.274	45.328	3.202
2074	1501	1	460.00	10	0.3	1500	10	204.327	37.004	128.225	5.146	1.150	3257.374	328.454	2894.279	49.085	3.401
2077	1751	1	525.50	0.5	0.3	1750	0.5	491.813	75.286	451.996	10.288	35.908	136.590	27.616	117.774	3.764	16.375
2078	1751	1	525.75	0.75	0.3	1750	0.75	434.929	68.212	384.748	9.743	22.327	260.489	43.273	223.544	6.342	16.095
2079	1751	1	526.00	1	0.3	1750	1	370.896	59.404	320.749	8.717	15.253	381.672	60.740	327.210	8.927	15.798
2080	1751	1	526.25	1.25	0.3	1750	1.25	323.834	53.245	273.706	7.942	11.395	498.994	76.862	428.589	11.285	15.112
2081	1751	1	527.00	2	0.3	1750	2	256.208	46.409	197.532	7.061	6.877	825.731	117.440	717.317	17.144	12.207
2082	1751	1	527.50	2.5	0.3	1750	2.5	243.375	46.739	175.962	6.969	5.626	1028.789	139.091	900.606	20.210	10.260
2083	1751	1	528.00	3	0.3	1750	3	240.406	47.583	165.069	6.966	4.777	1224.322	158.235	1078.839	22.880	8.685
2084	1751	1	529.00	4	0.3	1750	4	243.196	48.368	159.579	6.911	3.622	1593.974	191.497	1417.719	27.501	6.429
2085	1751	1	530.00	5	0.3	1750	5	251.077	48.055	164.205	6.764	2.858	1946.539	220.785	1752.207	31.650	5.179
2086	1751	1	531.00	6	0.3	1750	6	254.135	47.159	165.665	6.572	2.323	2287.852	248.227	2067.116	36.247	4.285
2087	1751	1	532.00	7	0.3	1750	7	253.599	45.792	165.296	6.366	1.933	2621.249	274.831	2378.046	40.923	3.637
2088	1751	1	532.50	7.5	0.3	1750	7.5	252.456	45.083	164.516	6.264	1.776	2785.814	288.150	2531.320	43.296	3.382
2089	1751	1	533.00	8	0.3	1750	8	250.533	44.340	163.118	6.151	1.639	2949.596	301.236	2684.364	45.388	3.161
2090	1751	1	534.00	9	0.3	1750	9	246.042	42.921	159.857	5.933	1.414	3272.483	327.856	2984.623	49.594	3.175
2091	1751	1	535.00	10	0.3	1750	10	240.717	41.566	155.972	5.739	1.236	3593.733	357.363	3281.812	53.710	3.354
2094	2001	1	600.50	0.5	0.3	2000	0.5	538.589	81.839	504.000	11.197	38.561	149.983	29.763	131.513	4.097	17.415
2095	2001	1	600.75	0.75	0.3	2000	0.75	475.233	73.989	428.688	10.555	23.926	285.255	47.177	249.356	6.902	17.135

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Model								Secondary (inside) Stress Factors									
	OD	T	od	t	d/D	D/T	t/T	Branch					Header				
								Axial	In-Plane	Out-of-Plane	Torsional	Pressure	Axial	In-Plane	Out-of-Plane	Torsional	Pressure
2096	2001	1	601.00	1	0.3	2000	1	405.104	64.434	357.133	9.417	16.306	416.532	65.975	364.059	9.671	16.832
2097	2001	1	601.25	1.25	0.3	2000	1.25	353.852	57.828	305.139	8.578	12.167	544.069	83.430	477.124	12.209	16.138
2098	2001	1	602.00	2	0.3	2000	2	281.678	50.496	220.737	7.666	7.321	899.785	126.835	797.590	18.474	13.109
2099	2001	1	602.50	2.5	0.3	2000	2.5	269.092	51.062	197.499	7.599	5.992	1122.667	150.372	1002.581	21.790	11.088
2100	2001	1	603.00	3	0.3	2000	3	267.202	51.987	186.136	7.620	5.087	1335.049	170.621	1200.298	24.618	9.367
2101	2001	1	604.00	4	0.3	2000	4	273.036	53.136	183.020	7.595	3.859	1739.685	205.904	1582.302	29.445	6.949
2102	2001	1	605.00	5	0.3	2000	5	283.420	53.042	189.198	7.472	3.046	2123.216	236.677	1951.303	34.002	5.599
2103	2001	1	606.00	6	0.3	2000	6	288.326	51.949	192.388	7.281	2.476	2494.821	265.760	2305.041	39.226	4.634
2104	2001	1	607.00	7	0.3	2000	7	288.950	50.482	192.840	7.057	2.060	2858.403	293.423	2650.223	44.263	3.921
2105	2001	1	607.50	7.5	0.3	2000	7.5	287.893	49.735	191.618	6.932	1.893	3037.031	307.121	2814.098	46.629	3.641
2106	2001	1	608.00	8	0.3	2000	8	286.523	48.960	191.334	6.808	1.747	3214.147	323.194	2990.601	49.049	3.397
2107	2001	1	609.00	9	0.3	2000	9	282.430	47.349	188.381	6.590	1.507	3565.656	355.479	3326.935	53.688	3.172
2108	2001	1	610.00	10	0.3	2000	10	276.698	45.824	183.978	6.365	1.317	3915.802	387.115	3660.711	58.094	3.342
2111	2251	1	675.50	0.5	0.3	2250	0.5	582.925	87.994	554.131	12.035	41.056	163.063	31.823	144.976	4.436	18.435
2112	2251	1	675.75	0.75	0.3	2250	0.75	513.663	79.555	471.300	11.321	25.439	308.597	50.824	274.306	7.432	18.146
2113	2251	1	676.00	1	0.3	2250	1	437.533	69.164	392.588	10.080	17.297	450.793	71.116	400.828	10.399	17.845
2114	2251	1	676.25	1.25	0.3	2250	1.25	382.349	62.031	334.336	9.193	12.897	588.348	89.591	523.344	13.081	17.145
2115	2251	1	677.00	2	0.3	2250	2	305.755	54.390	242.783	8.243	7.740	971.317	135.785	874.739	19.705	13.994
2116	2251	1	677.50	2.5	0.3	2250	2.5	293.588	55.173	218.158	8.203	6.331	1209.868	160.636	1098.602	23.182	11.865
2117	2251	1	678.00	3	0.3	2250	3	292.813	56.306	206.580	8.244	5.376	1438.642	181.844	1316.438	26.111	10.010
2118	2251	1	679.00	4	0.3	2250	4	301.524	57.614	205.430	8.258	4.079	1875.338	218.764	1735.125	31.316	7.404
2119	2251	1	680.00	5	0.3	2250	5	314.498	57.406	213.468	8.154	3.222	2283.412	251.223	2132.854	36.234	5.960
2120	2251	1	681.00	6	0.3	2250	6	321.402	56.362	217.516	7.960	2.619	2686.282	280.372	2515.162	41.857	4.928
2121	2251	1	682.00	7	0.3	2250	7	323.269	54.921	220.911	7.714	2.179	3076.727	312.264	2916.008	47.355	4.168
2122	2251	1	682.50	7.5	0.3	2250	7.5	322.331	54.046	220.603	7.591	2.003	3267.691	329.298	3107.241	49.975	3.868
2123	2251	1	683.00	8	0.3	2250	8	321.635	53.184	219.305	7.458	1.848	3466.803	347.733	3288.023	52.713	3.615
2124	2251	1	684.00	9	0.3	2250	9	317.308	51.448	216.411	7.208	1.593	3844.820	384.476	3659.937	57.646	3.183
2125	2251	1	685.00	10	0.3	2250	10	312.217	49.863	214.189	6.960	1.392	4224.011	418.142	4058.933	62.334	3.350
2128	2501	1	750.50	0.5	0.3	2500	0.5	624.616	93.779	603.006	12.833	43.427	175.664	33.972	158.495	4.756	19.402
2129	2501	1	750.75	0.75	0.3	2500	0.75	549.863	84.602	512.130	12.033	26.873	330.978	54.543	298.547	7.954	19.111
2130	2501	1	751.00	1	0.3	2500	1	468.253	73.650	426.974	10.703	18.232	482.820	75.929	436.309	11.074	18.819
2131	2501	1	751.25	1.25	0.3	2500	1.25	409.192	66.004	363.393	9.766	13.582	628.249	95.505	567.878	13.931	18.083
2132	2501	1	752.00	2	0.3	2500	2	328.943	58.204	264.927	8.785	8.135	1038.896	144.190	950.543	20.930	14.823
2133	2501	1	752.50	2.5	0.3	2500	2.5	317.062	59.023	238.378	8.774	6.652	1291.839	169.979	1191.864	24.524	12.597
2134	2501	1	753.00	3	0.3	2500	3	317.361	60.440	226.114	8.845	5.651	1537.886	192.811	1428.050	27.697	10.624
2135	2501	1	754.00	4	0.3	2500	4	329.182	62.030	228.123	8.922	4.289	2005.468	231.547	1883.918	32.970	7.856
2136	2501	1	755.00	5	0.3	2500	5	344.827	61.906	237.834	8.820	3.388	2445.332	263.721	2321.131	38.613	6.318
2137	2501	1	756.00	6	0.3	2500	6	353.272	60.773	244.231	8.623	2.755	2867.373	294.866	2742.551	44.518	5.223

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Model								Secondary (inside) Stress Factors									
	OD	T	od	t	d/D	D/T	t/T	Branch					Header				
								Axial	In-Plane	Out-of-Plane	Torsional	Pressure	Axial	In-Plane	Out-of-Plane	Torsional	Pressure
2138	2501	1	757.00	7	0.3	2500	7	356.507	59.196	247.342	8.380	2.292	3286.940	332.126	3158.422	50.279	4.416
2139	2501	1	757.50	7.5	0.3	2500	7.5	356.723	58.258	249.050	8.231	2.106	3488.217	351.585	3379.754	53.243	4.092
2140	2501	1	758.00	8	0.3	2500	8	355.688	57.411	248.374	8.099	1.944	3696.116	369.610	3585.536	55.677	3.810
2141	2501	1	759.00	9	0.3	2500	9	352.394	55.543	243.006	7.811	1.675	4100.673	406.442	3935.252	61.238	3.378
2142	2501	1	760.00	10	0.3	2500	10	347.068	53.751	241.074	7.558	1.464	4504.114	444.286	4372.520	66.024	3.368
2143	9	1	2.90	0.1	0.35	8	0.1	1.197	1.085	1.074	0.869	4.809	0.367	0.221	0.330	0.118	2.651
2144	9	1	3.05	0.25	0.35	8	0.25	1.274	0.950	0.964	0.764	1.657	0.756	0.436	0.708	0.234	2.258
2145	9	1	3.30	0.5	0.35	8	0.5	1.714	0.879	1.185	0.705	1.372	1.326	0.644	0.915	0.361	1.912
2146	9	1	3.55	0.75	0.35	8	0.75	1.937	0.906	1.201	0.671	1.276	1.862	0.795	0.995	0.459	1.707
2147	9	1	3.80	1	0.35	8	1	1.955	0.866	1.148	0.671	1.219	2.389	0.928	1.119	0.541	1.556
2148	9	1	4.05	1.25	0.35	8	1.25	2.072	0.834	1.105	0.678	1.070	2.829	1.095	1.445	0.606	1.343
2149	9	1	4.80	2	0.35	8	2	1.999	0.702	0.985	0.857	0.773	4.002	1.467	2.359	0.758	1.030
2150	9	1	5.30	2.5	0.35	8	2.5	1.852	0.672	0.974	1.032	0.688	4.701	1.739	2.927	0.861	1.134
2160	17	1	5.70	0.1	0.35	16	0.1	1.650	1.167	1.525	0.943	5.255	0.508	0.427	0.578	0.188	3.742
2161	17	1	5.85	0.25	0.35	16	0.25	3.644	2.000	3.088	0.905	2.164	1.082	0.870	1.185	0.333	3.099
2162	17	1	6.10	0.5	0.35	16	0.5	5.160	2.272	3.558	0.802	1.954	1.960	1.296	1.672	0.495	2.511
2163	17	1	6.35	0.75	0.35	16	0.75	5.474	2.035	3.299	0.797	1.844	3.098	1.585	2.034	0.667	2.148
2164	17	1	6.60	1	0.35	16	1	5.327	1.748	2.937	0.846	1.779	4.425	1.801	2.721	0.828	1.926
2165	17	1	6.85	1.25	0.35	16	1.25	5.337	1.568	2.672	0.872	1.617	6.224	2.076	3.581	0.973	1.649
2166	17	1	7.60	2	0.35	16	2	4.921	1.253	2.043	0.973	1.233	11.363	2.802	5.772	1.237	1.262
2167	17	1	8.10	2.5	0.35	16	2.5	4.590	1.186	1.772	1.057	1.045	14.380	3.199	6.978	1.339	1.247
2168	17	1	8.60	3	0.35	16	3	4.308	1.087	1.576	1.141	0.884	16.848	3.498	7.931	1.463	1.479
2169	17	1	9.60	4	0.35	16	4	3.897	1.051	1.377	1.388	0.684	21.035	4.061	9.824	1.654	1.740
2170	17	1	10.60	5	0.35	16	5	3.673	1.054	1.358	1.720	0.572	24.643	4.816	11.911	1.848	1.822
2177	25	1	8.50	0.1	0.35	24	0.1	2.675	1.600	2.593	0.988	5.318	0.684	0.597	0.832	0.239	4.417
2178	25	1	8.65	0.25	0.35	24	0.25	6.526	3.209	5.459	0.934	2.988	1.434	1.237	1.592	0.383	3.519
2179	25	1	8.90	0.5	0.35	24	0.5	9.039	3.534	6.221	0.845	2.603	2.872	1.836	2.257	0.572	2.851
2180	25	1	9.15	0.75	0.35	24	0.75	9.289	3.076	5.653	0.883	2.262	5.104	2.253	3.269	0.798	2.419
2181	25	1	9.40	1	0.35	24	1	8.848	2.585	4.949	0.951	2.096	7.696	2.633	4.602	1.031	2.136
2182	25	1	9.65	1.25	0.35	24	1.25	8.616	2.291	4.440	1.016	1.900	10.927	2.944	6.099	1.247	1.815
2183	25	1	10.40	2	0.35	24	2	7.576	1.756	3.312	1.162	1.485	20.081	4.241	9.930	1.673	1.379
2184	25	1	10.90	2.5	0.35	24	2.5	6.970	1.593	2.827	1.214	1.274	25.555	4.818	12.031	1.835	1.343
2185	25	1	11.40	3	0.35	24	3	6.457	1.515	2.474	1.253	1.105	30.576	5.373	13.882	1.948	1.560
2186	25	1	12.40	4	0.35	24	4	5.636	1.404	2.010	1.345	0.861	39.347	6.302	17.077	2.136	1.995
2187	25	1	13.40	5	0.35	24	5	5.116	1.350	1.764	1.484	0.686	45.874	6.928	19.545	2.385	2.221
2188	25	1	14.40	6	0.35	24	6	4.803	1.359	1.641	1.693	0.579	51.678	7.628	22.126	2.566	2.339
2189	25	1	15.40	7	0.35	24	7	4.673	1.395	1.616	1.978	0.510	56.338	8.282	24.625	2.788	2.374
2190	25	1	15.90	7.5	0.35	24	7.5	4.691	1.404	1.655	2.145	0.486	58.277	8.613	25.856	2.912	2.368

STP-PT-074: Local Stress in Nozzles, Shells and Formed Heads from External Heads

Model								Secondary (inside) Stress Factors									
	OD	T	od	t	d/D	D/T	t/T	Branch					Header				
								Axial	In-Plane	Out-of-Plane	Torsional	Pressure	Axial	In-Plane	Out-of-Plane	Torsional	Pressure
2191	25	1	16.40	8	0.35	24	8	4.734	1.447	1.715	2.343	0.467	61.596	8.807	27.795	3.085	2.353
2194	33	1	11.30	0.1	0.35	32	0.1	3.764	2.162	3.646	1.033	5.676	0.822	0.730	1.061	0.271	4.887
2195	33	1	11.45	0.25	0.35	32	0.25	9.591	4.243	7.910	0.943	3.977	1.907	1.526	2.031	0.408	3.824
2196	33	1	11.70	0.5	0.35	32	0.5	13.152	4.614	9.004	0.892	3.305	3.870	2.263	3.023	0.622	3.122
2197	33	1	11.95	0.75	0.35	32	0.75	13.257	3.962	8.111	0.981	2.676	7.288	2.775	4.623	0.904	2.688
2198	33	1	12.20	1	0.35	32	1	12.425	3.342	7.056	1.064	2.361	11.224	3.262	6.658	1.174	2.334
2199	33	1	12.45	1.25	0.35	32	1.25	11.863	2.967	6.284	1.141	2.100	15.899	3.868	8.870	1.438	1.982
2200	33	1	13.20	2	0.35	32	2	10.065	2.286	4.633	1.290	1.632	29.055	5.653	14.524	2.015	1.444
2201	33	1	13.70	2.5	0.35	32	2.5	9.145	2.103	3.936	1.334	1.412	37.007	6.520	17.665	2.253	1.397
2202	33	1	14.20	3	0.35	32	3	8.428	1.949	3.432	1.355	1.230	44.392	7.316	20.427	2.415	1.580
2203	33	1	15.20	4	0.35	32	4	7.312	1.720	2.747	1.385	0.963	57.724	8.629	25.170	2.637	2.113
2204	33	1	16.20	5	0.35	32	5	6.473	1.609	2.318	1.438	0.783	69.355	9.635	29.220	2.864	2.466
2205	33	1	17.20	6	0.35	32	6	5.963	1.563	2.091	1.528	0.643	78.113	10.431	32.249	3.111	2.667
2206	33	1	18.20	7	0.35	32	7	5.598	1.558	1.947	1.662	0.557	86.671	11.236	35.603	3.323	2.801
2207	33	1	18.70	7.5	0.35	32	7.5	5.436	1.563	1.903	1.759	0.523	90.517	11.602	37.240	3.452	2.842
2208	33	1	19.20	8	0.35	32	8	5.353	1.570	1.871	1.854	0.493	94.106	11.959	38.872	3.596	2.869
2209	33	1	20.20	9	0.35	32	9	5.272	1.596	1.845	2.063	0.445	100.708	12.715	42.178	3.924	2.888
2210	33	1	21.20	10	0.35	32	10	5.257	1.616	1.935	2.365	0.409	106.062	13.443	45.354	4.257	2.860
2211	41	1	14.10	0.1	0.35	40	0.1	4.909	2.632	4.695	1.059	5.564	0.958	0.829	1.252	0.290	5.224
2212	41	1	14.25	0.25	0.35	40	0.25	12.749	5.135	10.384	0.938	4.993	2.362	1.746	2.421	0.426	4.070
2213	41	1	14.50	0.5	0.35	40	0.5	17.372	5.559	11.835	0.960	3.995	4.966	2.588	3.664	0.671	3.356
2214	41	1	14.75	0.75	0.35	40	0.75	17.275	4.740	10.601	1.075	3.079	9.491	3.194	5.985	1.002	2.935
2215	41	1	15.00	1	0.35	40	1	15.997	4.071	9.185	1.157	2.607	14.719	3.779	8.727	1.306	2.561
2216	41	1	15.25	1.25	0.35	40	1.25	15.071	3.604	8.149	1.233	2.271	20.774	4.749	11.665	1.599	2.151
2217	41	1	16.00	2	0.35	40	2	12.443	2.835	5.961	1.379	1.733	37.771	6.961	19.234	2.301	1.507
2218	41	1	16.50	2.5	0.35	40	2.5	11.205	2.609	5.058	1.421	1.502	48.042	8.100	23.457	2.615	1.438
2219	41	1	17.00	3	0.35	40	3	10.266	2.436	4.407	1.438	1.316	57.679	9.128	27.208	2.839	1.604
2220	41	1	18.00	4	0.35	40	4	8.876	2.155	3.523	1.444	1.034	75.409	10.831	33.675	3.139	2.151
2221	41	1	19.00	5	0.35	40	5	7.835	1.949	2.948	1.462	0.841	91.300	12.131	39.150	3.387	2.579
2222	41	1	20.00	6	0.35	40	6	7.032	1.805	2.559	1.492	0.705	106.200	13.439	44.244	3.624	2.895
2223	41	1	21.00	7	0.35	40	7	6.556	1.740	2.366	1.543	0.593	116.892	14.352	47.746	3.873	3.075
2224	41	1	21.50	7.5	0.35	40	7.5	6.351	1.728	2.293	1.596	0.555	122.665	14.792	49.814	4.020	3.154
2225	41	1	22.00	8	0.35	40	8	6.155	1.721	2.218	1.655	0.520	128.104	15.233	51.832	4.195	3.218
2226	41	1	23.00	9	0.35	40	9	5.855	1.711	2.104	1.764	0.468	138.578	16.115	55.963	4.524	3.314
2227	41	1	24.00	10	0.35	40	10	5.696	1.723	2.052	1.941	0.428	147.610	16.845	59.905	4.862	3.360
2228	51	1	17.60	0.1	0.35	50	0.1	6.422	3.139	5.991	1.074	5.234	1.173	0.933	1.469	0.303	5.580
2229	51	1	17.75	0.25	0.35	50	0.25	16.724	6.118	13.501	0.924	6.220	2.965	1.988	2.910	0.449	4.371
2230	51	1	18.00	0.5	0.35	50	0.5	22.659	6.607	15.404	1.044	4.806	6.183	2.933	4.492	0.752	3.650

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Model								Secondary (inside) Stress Factors									
	OD	T	od	t	d/D	D/T	t/T	Branch					Header				
								Axial	In-Plane	Out-of-Plane	Torsional	Pressure	Axial	In-Plane	Out-of-Plane	Torsional	Pressure
2231	51	1	18.25	0.75	0.35	50	0.75	22.263	5.723	13.734	1.185	3.556	12.322	3.628	7.753	1.112	3.248
2232	51	1	18.50	1	0.35	50	1	20.402	4.926	11.864	1.268	2.897	19.184	4.574	11.416	1.436	2.872
2233	51	1	18.75	1.25	0.35	50	1.25	18.974	4.350	10.482	1.321	2.467	26.912	5.807	15.288	1.749	2.430
2234	51	1	19.50	2	0.35	50	2	15.278	3.480	7.614	1.456	1.832	48.556	8.549	25.369	2.566	1.597
2235	51	1	20.00	2.5	0.35	50	2.5	13.653	3.208	6.460	1.500	1.585	61.681	10.128	31.054	2.968	1.470
2236	51	1	20.50	3	0.35	50	3	12.449	3.015	5.633	1.535	1.392	74.047	11.468	36.133	3.270	1.611
2237	51	1	21.50	4	0.35	50	4	10.741	2.693	4.523	1.536	1.103	97.029	13.651	44.946	3.684	2.219
2238	51	1	22.50	5	0.35	50	5	9.509	2.447	3.802	1.529	0.899	118.095	15.504	52.443	3.983	2.689
2239	51	1	23.50	6	0.35	50	6	8.535	2.264	3.290	1.532	0.749	137.526	17.106	59.035	4.296	3.010
2240	51	1	24.50	7	0.35	50	7	7.782	2.106	2.910	1.553	0.644	156.223	18.627	65.345	4.604	3.350
2241	51	1	25.00	7.5	0.35	50	7.5	7.465	2.040	2.767	1.567	0.600	164.609	19.241	68.138	4.801	3.464
2242	51	1	25.50	8	0.35	50	8	7.176	1.982	2.628	1.576	0.561	172.767	19.807	70.873	4.988	3.538
2243	51	1	26.50	9	0.35	50	9	6.872	1.957	2.575	1.626	0.488	184.170	20.429	74.505	5.289	3.653
2244	51	1	27.50	10	0.35	50	10	6.525	1.865	2.458	1.720	0.441	198.227	21.452	79.585	5.664	3.778
2245	61	1	21.10	0.1	0.35	60	0.1	7.956	3.571	7.264	1.067	5.617	1.391	0.991	1.625	0.304	5.802
2246	61	1	21.25	0.25	0.35	60	0.25	20.632	6.980	16.565	0.918	7.374	3.633	2.092	3.332	0.464	4.607
2247	61	1	21.50	0.5	0.35	60	0.5	27.848	7.545	18.950	1.132	5.554	7.466	3.157	5.166	0.801	3.890
2248	61	1	21.75	0.75	0.35	60	0.75	27.107	6.640	16.837	1.292	3.998	14.971	3.994	9.440	1.189	3.512
2249	61	1	22.00	1	0.35	60	1	24.650	5.721	14.511	1.371	3.168	23.326	5.305	13.985	1.548	3.143
2250	61	1	22.25	1.25	0.35	60	1.25	22.717	5.038	12.789	1.412	2.649	32.580	6.732	18.764	1.883	2.693
2251	61	1	23.00	2	0.35	60	2	17.996	4.082	9.256	1.535	1.918	58.872	10.220	31.545	2.767	1.712
2252	61	1	23.50	2.5	0.35	60	2.5	16.007	3.770	7.857	1.587	1.653	74.665	12.102	38.736	3.245	1.533
2253	61	1	24.00	3	0.35	60	3	14.558	3.562	6.862	1.614	1.451	89.588	13.703	45.196	3.623	1.614
2254	61	1	25.00	4	0.35	60	4	12.553	3.227	5.542	1.639	1.154	117.471	16.342	56.503	4.161	2.228
2255	61	1	26.00	5	0.35	60	5	11.173	2.942	4.697	1.606	0.943	143.399	18.798	66.194	4.553	2.726
2256	61	1	27.00	6	0.35	60	6	10.158	2.720	4.089	1.595	0.789	167.536	20.856	74.703	4.922	3.127
2257	61	1	28.00	7	0.35	60	7	9.336	2.533	3.635	1.586	0.675	191.108	22.753	82.770	5.291	3.465
2258	61	1	28.50	7.5	0.35	60	7.5	8.973	2.441	3.445	1.585	0.629	201.930	23.535	86.368	5.511	3.605
2259	61	1	29.00	8	0.35	60	8	8.615	2.367	3.271	1.610	0.587	212.365	24.240	89.815	5.725	3.731
2260	61	1	30.00	9	0.35	60	9	7.998	2.248	3.016	1.623	0.520	232.201	25.559	96.379	6.140	3.947
2261	61	1	31.00	10	0.35	60	10	7.571	2.198	2.957	1.601	0.459	246.230	26.198	100.677	6.457	4.068
2262	71	1	24.60	0.1	0.35	70	0.1	9.452	3.955	8.534	1.058	6.422	1.585	1.066	1.788	0.310	6.058
2263	71	1	24.75	0.25	0.35	70	0.25	24.469	7.755	19.634	0.926	8.460	4.126	2.246	3.721	0.479	4.865
2264	71	1	25.00	0.5	0.35	70	0.5	32.911	8.473	22.508	1.225	6.246	8.541	3.420	6.022	0.858	4.146
2265	71	1	25.25	0.75	0.35	70	0.75	31.802	7.515	19.938	1.399	4.410	17.668	4.357	11.199	1.259	3.786
2266	71	1	25.50	1	0.35	70	1	28.743	6.469	17.149	1.470	3.423	27.510	6.080	16.656	1.637	3.421
2267	71	1	25.75	1.25	0.35	70	1.25	26.304	5.747	15.072	1.503	2.821	38.215	7.682	22.338	1.991	2.963
2268	71	1	26.50	2	0.35	70	2	20.564	4.644	10.863	1.609	2.000	68.121	11.610	37.433	2.986	1.831



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Model	Secondary (inside) Stress Factors																
	OD	T	od	t	d/D	D/T	t/T	Branch					Header				
								Axial	In-Plane	Out-of-Plane	Torsional	Pressure	Axial	In-Plane	Out-of-Plane	Torsional	Pressure
2269	71	1	27.00	2.5	0.35	70	2.5	18.201	4.303	9.210	1.658	1.714	86.266	13.739	46.081	3.539	1.570
2270	71	1	27.50	3	0.35	70	3	16.534	4.079	8.054	1.686	1.502	103.412	15.551	53.892	3.989	1.601
2271	71	1	28.50	4	0.35	70	4	14.332	3.740	6.567	1.717	1.196	136.703	19.044	68.176	4.572	2.225
2272	71	1	29.50	5	0.35	70	5	12.802	3.434	5.606	1.701	0.980	167.068	22.009	80.173	5.099	2.733
2273	71	1	30.50	6	0.35	70	6	11.796	3.150	4.912	1.647	0.822	195.657	24.495	90.750	5.533	3.157
2274	71	1	31.50	7	0.35	70	7	10.927	2.973	4.393	1.611	0.702	223.790	26.850	100.741	5.953	3.524
2275	71	1	32.00	7.5	0.35	70	7.5	10.513	2.854	4.175	1.631	0.654	236.805	27.800	105.213	6.206	3.681
2276	71	1	32.50	8	0.35	70	8	10.178	2.763	3.994	1.610	0.611	249.464	28.668	109.461	6.443	3.825
2277	71	1	33.50	9	0.35	70	9	9.457	2.570	3.684	1.655	0.539	273.724	30.287	117.533	6.904	4.077
2278	71	1	34.50	10	0.35	70	10	8.870	2.448	3.449	1.681	0.482	297.564	31.933	125.519	7.372	4.300
2279	81	1	28.10	0.1	0.35	80	0.1	10.898	4.296	9.775	1.046	7.305	1.774	1.120	1.951	0.316	6.298
2280	81	1	28.25	0.25	0.35	80	0.25	28.169	8.452	22.649	0.957	9.481	4.533	2.357	4.193	0.494	5.108
2281	81	1	28.50	0.5	0.35	80	0.5	37.807	9.413	26.031	1.322	6.888	9.847	3.643	6.934	0.906	4.387
2282	81	1	28.75	0.75	0.35	80	0.75	36.326	8.338	23.018	1.506	4.793	20.284	4.894	12.951	1.329	4.042
2283	81	1	29.00	1	0.35	80	1	32.678	7.172	19.765	1.568	3.665	31.527	6.822	19.304	1.716	3.682
2284	81	1	29.25	1.25	0.35	80	1.25	29.747	6.432	17.340	1.591	2.985	43.620	8.581	25.892	2.082	3.218
2285	81	1	30.00	2	0.35	80	2	23.041	5.168	12.456	1.674	2.078	77.310	13.109	43.505	3.123	1.998
2286	81	1	30.50	2.5	0.35	80	2.5	20.341	4.800	10.559	1.720	1.771	97.760	15.499	53.675	3.737	1.619
2287	81	1	31.00	3	0.35	80	3	18.500	4.574	9.262	1.749	1.548	118.015	17.843	63.379	4.176	1.615
2288	81	1	32.00	4	0.35	80	4	16.090	4.228	7.595	1.780	1.232	154.712	21.657	79.880	4.974	2.215
2289	81	1	33.00	5	0.35	80	5	14.444	3.895	6.532	1.776	1.012	189.206	25.100	94.243	5.603	2.726
2290	81	1	34.00	6	0.35	80	6	13.408	3.611	5.772	1.741	0.850	221.937	28.034	106.994	6.112	3.161
2291	81	1	35.00	7	0.35	80	7	12.311	3.391	5.199	1.695	0.727	254.254	30.814	119.033	6.595	3.546
2292	81	1	35.50	7.5	0.35	80	7.5	12.109	3.274	4.943	1.673	0.676	269.351	31.958	124.422	6.876	3.714
2293	81	1	36.00	8	0.35	80	8	11.721	3.114	4.734	1.723	0.633	284.043	33.006	129.569	7.141	3.869
2294	81	1	37.00	9	0.35	80	9	10.962	2.931	4.393	1.679	0.557	312.361	34.962	139.283	7.658	4.148
2295	81	1	38.00	10	0.35	80	10	10.040	2.749	4.005	1.646	0.497	340.360	36.905	148.818	8.181	4.398
2296	91	1	31.60	0.1	0.35	90	0.1	12.310	4.606	11.003	1.030	8.182	1.995	1.174	2.194	0.319	6.520
2297	91	1	31.75	0.25	0.35	90	0.25	31.780	9.098	25.657	0.995	10.438	5.120	2.488	4.668	0.508	5.342
2298	91	1	32.00	0.5	0.35	90	0.5	42.549	10.305	29.537	1.423	7.489	11.130	3.860	7.853	0.952	4.615
2299	91	1	32.25	0.75	0.35	90	0.75	40.689	9.120	26.077	1.613	5.154	22.816	5.430	14.693	1.389	4.282
2300	91	1	32.50	1	0.35	90	1	36.446	7.908	22.353	1.666	3.892	35.393	7.537	21.932	1.791	3.928
2301	91	1	32.75	1.25	0.35	90	1.25	33.034	7.085	19.578	1.678	3.142	48.793	9.444	29.415	2.166	3.459
2302	91	1	33.50	2	0.35	90	2	25.412	5.680	14.027	1.740	2.151	86.052	14.544	49.533	3.246	2.174
2303	91	1	34.00	2.5	0.35	90	2.5	22.438	5.278	11.903	1.779	1.825	108.659	17.178	61.221	3.902	1.692
2304	91	1	34.50	3	0.35	90	3	20.411	5.038	10.453	1.807	1.591	131.031	19.759	72.398	4.412	1.643
2305	91	1	35.50	4	0.35	90	4	17.783	4.713	8.603	1.833	1.264	171.684	24.158	91.551	5.352	2.203
2306	91	1	36.50	5	0.35	90	5	16.103	4.375	7.472	1.841	1.040	210.037	28.068	108.361	6.079	2.712

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Model								Secondary (inside) Stress Factors									
	OD	T	od	t	d/D	D/T	t/T	Branch					Header				
								Axial	In-Plane	Out-of-Plane	Torsional	Pressure	Axial	In-Plane	Out-of-Plane	Torsional	Pressure
2307	91	1	37.50	6	0.35	90	6	14.880	4.045	6.647	1.811	0.875	246.536	31.442	123.346	6.666	3.152
2308	91	1	38.50	7	0.35	90	7	14.079	3.763	6.016	1.770	0.749	282.801	34.664	137.542	7.200	3.547
2309	91	1	39.00	7.5	0.35	90	7.5	13.514	3.665	5.746	1.742	0.698	299.818	36.017	143.889	7.514	3.722
2310	91	1	39.50	8	0.35	90	8	13.219	3.538	5.498	1.738	0.651	316.423	37.269	150.009	7.812	3.884
2311	91	1	40.50	9	0.35	90	9	12.416	3.319	5.096	1.678	0.574	348.501	39.538	161.445	8.383	4.180
2312	91	1	41.50	10	0.35	90	10	11.710	3.097	4.779	1.702	0.512	380.462	41.844	172.665	8.969	4.452
2313	101	1	35.10	0.1	0.35	100	0.1	13.701	4.889	12.217	1.009	9.074	2.253	1.228	2.445	0.319	6.718
2314	101	1	35.25	0.25	0.35	100	0.25	35.257	9.728	28.610	1.039	11.341	5.712	2.605	5.255	0.522	5.567
2315	101	1	35.50	0.5	0.35	100	0.5	47.131	11.145	33.016	1.525	8.055	12.387	4.049	8.770	0.993	4.831
2316	101	1	35.75	0.75	0.35	100	0.75	44.897	9.869	29.114	1.720	5.494	25.275	5.948	16.428	1.443	4.509
2317	101	1	36.00	1	0.35	100	1	40.079	8.623	24.922	1.763	4.108	39.123	8.217	24.543	1.864	4.160
2318	101	1	36.25	1.25	0.35	100	1.25	36.198	7.712	21.794	1.764	3.291	53.762	10.360	32.906	2.253	3.686
2319	101	1	37.00	2	0.35	100	2	27.724	6.163	15.593	1.801	2.224	94.372	15.913	55.489	3.352	2.347
2320	101	1	37.50	2.5	0.35	100	2.5	24.481	5.742	13.243	1.835	1.878	119.938	19.088	69.196	4.033	1.815
2321	101	1	38.00	3	0.35	100	3	22.277	5.502	11.633	1.860	1.631	143.408	21.582	81.357	4.666	1.674
2322	101	1	39.00	4	0.35	100	4	19.539	5.166	9.640	1.882	1.293	187.818	26.562	103.213	5.714	2.194
2323	101	1	40.00	5	0.35	100	5	17.753	4.827	8.412	1.894	1.065	229.741	30.929	122.472	6.531	2.696
2324	101	1	41.00	6	0.35	100	6	16.585	4.498	7.537	1.873	0.897	269.869	34.726	139.784	7.190	3.137
2325	101	1	42.00	7	0.35	100	7	15.654	4.194	6.860	1.847	0.769	309.793	38.421	156.187	7.781	3.538
2326	101	1	42.50	7.5	0.35	100	7.5	15.186	4.062	6.566	1.825	0.716	328.542	39.960	163.555	8.128	3.716
2327	101	1	43.00	8	0.35	100	8	14.811	3.921	6.301	1.800	0.670	346.912	41.398	170.620	8.456	3.884
2328	101	1	44.00	9	0.35	100	9	13.967	3.680	5.851	1.756	0.590	382.592	44.026	183.937	9.081	4.191
2329	101	1	45.00	10	0.35	100	10	13.212	3.457	5.489	1.730	0.525	418.297	46.685	196.970	9.731	4.478
2330	251	1	87.60	0.1	0.35	250	0.1	30.938	8.111	29.217	0.993	20.073	5.282	1.849	5.426	0.377	9.755
2331	251	1	87.75	0.25	0.35	250	0.25	80.811	17.922	71.163	2.031	21.407	12.776	4.021	11.735	0.745	8.421
2332	251	1	88.00	0.5	0.35	250	0.5	106.501	21.841	83.314	3.092	14.222	28.435	7.602	21.635	1.361	7.413
2333	251	1	88.25	0.75	0.35	250	0.75	98.648	19.712	72.815	3.222	9.221	57.556	12.253	41.866	2.096	7.116
2334	251	1	88.50	1	0.35	250	1	86.146	17.134	61.712	3.094	6.534	87.206	17.197	62.421	2.969	6.775
2335	251	1	88.75	1.25	0.35	250	1.25	76.139	15.195	53.321	2.942	5.024	117.132	21.762	83.192	3.824	6.246
2336	251	1	89.50	2	0.35	250	2	57.548	12.256	37.839	2.659	3.145	200.020	32.599	141.227	5.992	4.471
2337	251	1	90.00	2.5	0.35	250	2.5	51.462	11.563	32.366	2.589	2.579	250.558	39.288	176.732	7.166	3.486
2338	251	1	90.50	3	0.35	250	3	47.795	11.244	28.861	2.565	2.188	298.365	45.319	210.130	8.205	2.821
2339	251	1	91.50	4	0.35	250	4	43.744	10.861	24.835	2.546	1.669	389.075	56.052	272.497	10.064	2.165
2340	251	1	92.50	5	0.35	250	5	41.219	10.593	22.554	2.523	1.342	477.371	66.152	331.459	11.863	2.580
2341	251	1	93.50	6	0.35	250	6	39.412	10.231	21.084	2.487	1.121	561.406	75.182	385.899	13.437	2.952
2342	251	1	94.50	7	0.35	250	7	37.614	9.756	19.852	2.460	0.962	643.167	83.687	437.153	14.921	3.301
2343	251	1	95.00	7.5	0.35	250	7.5	36.800	9.614	19.323	2.462	0.898	683.491	87.778	461.890	15.635	3.468
2344	251	1	95.50	8	0.35	250	8	36.040	9.410	18.835	2.454	0.841	723.530	91.657	486.115	16.308	3.631

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Model								Secondary (inside) Stress Factors									
	OD	T	od	t	d/D	D/T	t/T	Branch					Header				
								Axial	In-Plane	Out-of-Plane	Torsional	Pressure	Axial	In-Plane	Out-of-Plane	Torsional	Pressure
2345	251	1	96.50	9	0.35	250	9	34.603	8.938	17.954	2.433	0.747	802.191	99.256	532.693	17.619	3.944
2346	251	1	97.50	10	0.35	250	10	33.229	8.462	17.139	2.401	0.669	879.248	106.370	577.038	18.881	4.242
2347	501	1	175.10	0.1	0.35	500	0.1	54.508	12.141	54.148	1.466	32.739	9.681	3.028	10.149	0.482	13.509
2348	501	1	175.25	0.25	0.35	500	0.25	145.357	28.406	136.132	3.609	32.047	22.002	6.626	20.719	1.029	11.708
2349	501	1	175.50	0.5	0.35	500	0.5	190.268	34.764	160.833	5.267	20.852	51.287	12.258	41.282	1.985	10.244
2350	501	1	175.75	0.75	0.35	500	0.75	173.197	31.157	139.552	5.243	13.272	102.286	20.029	80.588	3.337	9.919
2351	501	1	176.00	1	0.35	500	1	149.510	26.992	117.422	4.843	9.214	153.324	27.624	119.901	4.768	9.569
2352	501	1	176.25	1.25	0.35	500	1.25	131.249	23.996	100.989	4.496	6.971	203.231	34.518	158.549	6.134	8.981
2353	501	1	177.00	2	0.35	500	2	100.152	20.111	71.978	3.956	4.251	342.407	53.777	268.313	9.528	6.844
2354	501	1	177.50	2.5	0.35	500	2.5	91.260	19.422	62.399	3.836	3.462	428.033	64.376	336.904	11.335	5.553
2355	501	1	178.00	3	0.35	500	3	86.642	19.142	56.667	3.759	2.921	509.557	73.904	402.293	12.921	4.586
2356	501	1	179.00	4	0.35	500	4	82.092	18.801	50.533	3.657	2.191	664.291	90.871	526.567	15.728	3.281
2357	501	1	180.00	5	0.35	500	5	79.366	18.322	47.290	3.563	1.725	811.850	106.205	644.098	18.281	2.609
2358	501	1	181.00	6	0.35	500	6	76.877	17.862	44.944	3.449	1.408	955.407	120.702	757.032	20.653	2.841
2359	501	1	182.00	7	0.35	500	7	74.289	17.241	42.940	3.375	1.184	1095.745	134.582	865.825	22.937	3.131
2360	501	1	182.50	7.5	0.35	500	7.5	73.013	16.945	42.019	3.331	1.097	1164.955	141.280	918.887	24.153	3.273
2361	501	1	183.00	8	0.35	500	8	71.712	16.699	41.080	3.292	1.021	1237.313	148.870	973.762	25.285	3.422
2362	501	1	184.00	9	0.35	500	9	69.208	16.230	39.336	3.244	0.897	1373.788	162.109	1076.275	27.400	3.690
2363	501	1	185.00	10	0.35	500	10	66.843	15.582	37.749	3.178	0.800	1508.513	174.859	1176.084	29.412	3.951
2365	751	1	262.75	0.25	0.35	750	0.25	199.820	36.393	195.561	4.901	40.200	29.428	8.690	28.447	1.319	14.195
2366	751	1	263.00	0.5	0.35	750	0.5	260.169	44.664	231.355	7.035	25.847	71.005	16.237	59.596	2.613	12.363
2367	751	1	263.25	0.75	0.35	750	0.75	234.999	40.276	199.985	6.863	16.361	139.710	25.954	115.828	4.407	12.016
2368	751	1	263.50	1	0.35	750	1	202.334	35.344	168.067	6.243	11.271	207.791	35.520	171.365	6.246	11.679
2369	751	1	263.75	1.25	0.35	750	1.25	177.186	31.593	144.109	5.752	8.470	273.964	45.354	226.097	7.973	11.042
2370	751	1	264.50	2	0.35	750	2	137.056	26.533	103.251	5.049	5.110	457.927	70.128	381.197	12.250	8.638
2371	751	1	265.00	2.5	0.35	750	2.5	126.852	26.028	90.389	4.918	4.163	571.565	83.545	478.658	14.486	7.108
2372	751	1	265.50	3	0.35	750	3	122.205	25.969	83.030	4.848	3.518	680.132	95.577	572.449	16.470	5.937
2373	751	1	266.50	4	0.35	750	4	118.626	25.719	75.866	4.737	2.648	887.984	117.225	753.255	20.042	4.353
2374	751	1	267.50	5	0.35	750	5	116.568	25.238	72.348	4.637	2.080	1084.305	136.362	923.991	23.195	3.480
2375	751	1	268.50	6	0.35	750	6	114.133	24.438	70.451	4.450	1.689	1274.663	154.519	1088.669	26.312	2.879
2376	751	1	269.50	7	0.35	750	7	111.673	23.690	68.644	4.362	1.412	1461.428	171.847	1249.171	29.542	3.016
2377	751	1	270.00	7.5	0.35	750	7.5	110.156	23.169	67.503	4.280	1.295	1553.205	180.507	1327.594	31.126	3.137
2378	751	1	270.50	8	0.35	750	8	108.648	23.019	66.389	4.232	1.199	1644.779	189.136	1405.479	32.577	3.257
2379	751	1	271.50	9	0.35	750	9	105.106	22.311	63.612	4.069	1.042	1826.431	205.956	1558.687	35.400	3.491
2380	751	1	272.50	10	0.35	750	10	101.665	21.290	61.007	3.960	0.913	2006.283	222.406	1709.094	38.027	3.720
2382	1001	1	350.25	0.25	0.35	1000	0.25	247.329	43.056	250.091	6.048	47.220	35.507	10.301	35.014	1.595	16.310
2383	1001	1	350.50	0.5	0.35	1000	0.5	320.845	53.104	296.548	8.545	30.132	88.385	19.537	76.688	3.167	14.162
2384	1001	1	350.75	0.75	0.35	1000	0.75	288.459	48.602	255.842	8.240	18.970	172.262	30.809	148.321	5.330	13.802

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Model								Secondary (inside) Stress Factors									
	OD	T	od	t	d/D	D/T	t/T	Branch					Header				
								Axial	In-Plane	Out-of-Plane	Torsional	Pressure	Axial	In-Plane	Out-of-Plane	Torsional	Pressure
2385	1001	1	351.00	1	0.35	1000	1	247.847	42.528	214.665	7.439	13.017	254.676	43.087	218.724	7.531	13.456
2386	1001	1	351.25	1.25	0.35	1000	1.25	217.004	38.064	183.886	6.818	9.742	334.518	54.792	287.879	9.557	12.787
2387	1001	1	352.00	2	0.35	1000	2	169.865	32.160	132.666	6.018	5.847	558.487	84.218	486.080	14.597	10.154
2388	1001	1	352.50	2.5	0.35	1000	2.5	159.026	31.877	116.929	5.891	4.760	696.783	99.997	610.241	17.221	8.409
2389	1001	1	353.00	3	0.35	1000	3	154.836	32.062	108.394	5.837	4.023	828.330	113.994	729.855	19.499	7.047
2390	1001	1	354.00	4	0.35	1000	4	152.764	32.125	100.685	5.710	3.031	1078.190	138.365	959.628	23.477	5.226
2391	1001	1	355.00	5	0.35	1000	5	153.101	31.592	99.705	5.560	2.385	1315.606	160.173	1178.413	27.200	4.200
2392	1001	1	356.00	6	0.35	1000	6	152.493	30.795	98.781	5.389	1.935	1545.180	180.807	1389.798	31.290	3.471
2393	1001	1	357.00	7	0.35	1000	7	150.070	29.772	96.769	5.210	1.610	1770.382	200.778	1596.502	35.159	2.981
2394	1001	1	357.50	7.5	0.35	1000	7.5	148.405	29.257	95.420	5.123	1.480	1882.325	210.716	1699.390	37.035	3.093
2395	1001	1	358.00	8	0.35	1000	8	146.625	28.898	94.077	5.022	1.367	1991.869	220.449	1799.116	38.824	3.199
2396	1001	1	359.00	9	0.35	1000	9	142.935	27.901	91.237	4.893	1.182	2210.609	239.864	1998.232	42.334	3.408
2397	1001	1	360.00	10	0.35	1000	10	138.684	26.820	87.864	4.707	1.037	2426.584	258.981	2193.282	45.542	3.609
2399	1251	1	437.75	0.25	0.35	1250	0.25	290.350	48.702	301.905	7.066	53.355	40.888	11.784	40.893	1.797	18.231
2400	1251	1	438.00	0.5	0.35	1250	0.5	375.506	61.338	358.088	9.861	33.921	104.341	22.467	93.174	3.684	15.788
2401	1251	1	438.25	0.75	0.35	1250	0.75	336.479	56.027	308.646	9.446	21.255	201.737	35.600	179.367	6.180	15.403
2402	1251	1	438.50	1	0.35	1250	1	288.725	48.896	258.433	8.495	14.553	297.205	49.945	263.700	8.688	15.063
2403	1251	1	438.75	1.25	0.35	1250	1.25	252.861	43.835	221.316	7.771	10.862	389.631	63.337	346.453	11.006	14.362
2404	1251	1	439.50	2	0.35	1250	2	199.610	37.494	160.085	6.896	6.498	648.013	96.169	582.558	16.597	11.496
2405	1251	1	440.00	2.5	0.35	1250	2.5	188.493	37.142	142.312	6.785	5.286	806.544	114.070	732.208	19.544	9.595
2406	1251	1	440.50	3	0.35	1250	3	185.026	37.526	132.636	6.753	4.468	958.859	129.560	875.334	22.068	8.030
2407	1251	1	441.50	4	0.35	1250	4	184.846	37.759	125.822	6.663	3.368	1247.668	156.353	1150.637	26.427	5.991
2408	1251	1	442.50	5	0.35	1250	5	188.801	37.182	127.719	6.502	2.650	1521.911	180.262	1415.649	31.029	4.803
2409	1251	1	443.50	6	0.35	1250	6	189.547	36.375	127.692	6.295	2.149	1787.327	202.831	1669.840	35.690	3.967
2410	1251	1	444.50	7	0.35	1250	7	188.292	35.189	126.659	6.097	1.787	2046.806	224.636	1919.575	40.186	3.368
2411	1251	1	445.00	7.5	0.35	1250	7.5	186.371	34.647	125.068	5.962	1.641	2174.463	235.787	2042.359	42.266	3.131
2412	1251	1	445.50	8	0.35	1250	8	184.744	34.083	123.905	5.872	1.516	2300.864	248.057	2163.758	44.334	3.127
2413	1251	1	446.50	9	0.35	1250	9	180.595	32.973	120.505	5.690	1.308	2553.494	272.891	2405.688	48.360	3.320
2414	1251	1	447.50	10	0.35	1250	10	175.887	31.835	116.861	5.502	1.145	2801.638	297.008	2642.373	52.100	3.504
2416	1501	1	525.25	0.25	0.35	1500	0.25	329.149	53.762	349.550	8.021	59.051	45.434	13.256	46.023	2.004	19.920
2417	1501	1	525.50	0.5	0.35	1500	0.5	424.902	68.816	415.447	11.067	37.398	118.846	25.095	108.605	4.174	17.214
2418	1501	1	525.75	0.75	0.35	1500	0.75	379.724	62.670	357.266	10.563	23.371	228.543	40.157	208.262	6.951	16.823
2419	1501	1	526.00	1	0.35	1500	1	325.626	54.644	299.327	9.460	15.950	335.291	56.176	305.613	9.730	16.469
2420	1501	1	526.25	1.25	0.35	1500	1.25	285.317	49.054	256.188	8.632	11.880	439.069	70.986	401.001	12.287	15.746
2421	1501	1	527.00	2	0.35	1500	2	227.020	42.414	186.256	7.707	7.081	727.539	107.121	672.452	18.419	12.713
2422	1501	1	527.50	2.5	0.35	1500	2.5	215.952	41.907	166.271	7.620	5.759	907.296	126.672	845.281	21.630	10.672
2423	1501	1	528.00	3	0.35	1500	3	213.480	42.479	156.516	7.621	4.869	1078.009	143.525	1012.709	24.325	8.917
2424	1501	1	529.00	4	0.35	1500	4	216.072	42.982	151.695	7.582	3.672	1402.306	172.311	1330.398	29.034	6.658

STP-PT-074: Local Stress in Nozzles, Shells and Formed Heads from External Heads

Model								Secondary (inside) Stress Factors									
	OD	T	od	t	d/D	D/T	t/T	Branch					Header				
								Axial	In-Plane	Out-of-Plane	Torsional	Pressure	Axial	In-Plane	Out-of-Plane	Torsional	Pressure
2425	1501	1	530.00	5	0.35	1500	5	223.017	42.612	155.504	7.434	2.889	1710.084	197.892	1636.128	34.497	5.333
2426	1501	1	531.00	6	0.35	1500	6	225.522	41.550	157.382	7.217	2.344	2007.042	221.970	1935.930	39.707	4.398
2427	1501	1	532.00	7	0.35	1500	7	224.838	40.291	156.510	6.967	1.948	2296.697	249.190	2220.580	44.667	3.722
2428	1501	1	532.50	7.5	0.35	1500	7.5	223.508	39.520	155.456	6.843	1.790	2440.813	263.499	2363.445	47.009	3.459
2429	1501	1	533.00	8	0.35	1500	8	222.073	38.955	154.516	6.720	1.652	2582.241	277.162	2505.361	49.330	3.227
2430	1501	1	534.00	9	0.35	1500	9	217.806	37.640	151.060	6.465	1.424	2864.444	304.707	2786.273	53.748	3.280
2431	1501	1	535.00	10	0.35	1500	10	212.887	36.331	147.096	6.254	1.245	3143.127	331.642	3062.507	58.017	3.452
2434	1751	1	613.00	0.5	0.35	1750	0.5	469.577	75.581	469.203	12.189	40.627	132.415	27.388	123.501	4.623	18.492
2435	1751	1	613.25	0.75	0.35	1750	0.75	418.972	68.755	403.059	11.543	25.335	252.511	44.314	235.123	7.646	18.074
2436	1751	1	613.50	1	0.35	1750	1	359.105	59.892	337.813	10.335	17.233	370.004	61.707	344.886	10.678	17.731
2437	1751	1	613.75	1.25	0.35	1750	1.25	314.787	53.811	288.789	9.417	12.817	483.783	77.725	451.422	13.412	17.002
2438	1751	1	614.50	2	0.35	1750	2	252.496	46.957	211.111	8.464	7.617	801.915	117.173	758.383	20.110	13.842
2439	1751	1	615.00	2.5	0.35	1750	2.5	241.788	46.469	189.555	8.407	6.193	1000.419	138.114	953.664	23.499	11.666
2440	1751	1	615.50	3	0.35	1750	3	240.266	47.043	178.994	8.449	5.237	1187.564	156.122	1139.526	26.431	9.739
2441	1751	1	616.50	4	0.35	1750	4	245.900	47.884	177.106	8.459	3.950	1545.123	186.720	1503.719	31.722	7.261
2442	1751	1	617.50	5	0.35	1750	5	255.526	47.445	182.652	8.328	3.110	1883.309	213.450	1843.323	37.735	5.823
2443	1751	1	618.50	6	0.35	1750	6	259.797	46.319	185.974	8.087	2.523	2210.104	242.416	2179.787	43.436	4.796
2444	1751	1	619.50	7	0.35	1750	7	260.252	44.969	186.544	7.827	2.096	2528.185	274.000	2505.954	48.840	4.047
2445	1751	1	620.00	7.5	0.35	1750	7.5	259.413	44.179	186.263	7.702	1.926	2685.608	288.804	2672.032	51.406	3.750
2446	1751	1	620.50	8	0.35	1750	8	258.221	43.528	185.209	7.555	1.777	2841.120	304.517	2827.649	53.999	3.490
2447	1751	1	621.50	9	0.35	1750	9	254.355	41.947	182.190	7.275	1.532	3150.254	334.057	3145.035	58.896	3.271
2448	1751	1	622.50	10	0.35	1750	10	249.301	40.607	178.844	6.989	1.339	3455.626	363.690	3472.670	63.592	3.434
2451	2001	1	700.50	0.5	0.35	2000	0.5	511.133	81.952	519.661	13.224	43.642	144.784	29.561	137.270	5.049	19.747
2452	2001	1	700.75	0.75	0.35	2000	0.75	455.528	74.483	446.926	12.466	27.154	275.263	48.329	261.511	8.308	19.295
2453	2001	1	701.00	1	0.35	2000	1	390.196	64.888	374.197	11.153	18.428	402.731	67.002	382.666	11.561	18.957
2454	2001	1	701.25	1.25	0.35	2000	1.25	342.275	58.273	320.601	10.158	13.691	526.208	84.216	501.457	14.514	18.216
2455	2001	1	702.00	2	0.35	2000	2	276.079	51.222	234.720	9.173	8.114	871.000	126.250	839.802	21.623	14.878
2456	2001	1	702.50	2.5	0.35	2000	2.5	265.869	50.898	211.679	9.167	6.596	1083.827	148.450	1053.465	25.266	12.580
2457	2001	1	703.00	3	0.35	2000	3	265.674	51.475	200.910	9.247	5.578	1285.767	167.404	1258.314	28.316	10.552
2458	2001	1	704.00	4	0.35	2000	4	274.317	52.412	201.245	9.299	4.210	1675.859	199.749	1658.810	34.308	7.823
2459	2001	1	705.00	5	0.35	2000	5	286.474	52.200	209.698	9.170	3.315	2044.503	228.432	2043.607	40.768	6.261
2460	2001	1	706.00	6	0.35	2000	6	292.692	51.383	214.593	8.936	2.689	2396.944	262.789	2412.725	46.889	5.147
2461	2001	1	707.00	7	0.35	2000	7	294.357	50.101	216.339	8.657	2.234	2742.804	296.248	2776.491	52.667	4.336
2462	2001	1	707.50	7.5	0.35	2000	7.5	293.970	49.290	216.290	8.501	2.052	2913.037	313.003	2955.681	55.518	4.011
2463	2001	1	708.00	8	0.35	2000	8	292.805	48.616	213.753	8.342	1.893	3082.147	329.660	3108.232	58.245	3.768
2464	2001	1	709.00	9	0.35	2000	9	289.367	46.992	212.999	8.042	1.632	3415.650	361.543	3483.857	63.638	3.433
2465	2001	1	710.00	10	0.35	2000	10	284.532	45.541	209.653	7.770	1.425	3746.116	393.412	3844.568	68.699	3.432
2468	2251	1	788.00	0.5	0.35	2250	0.5	549.958	87.900	569.072	14.186	46.488	156.456	31.495	150.828	5.433	20.939

STP-PT-074: Local Stress in Nozzles, Shells and Formed Heads from External Heads

Model								Secondary (inside) Stress Factors									
	OD	T	od	t	d/D	D/T	t/T	Branch					Header				
								Axial	In-Plane	Out-of-Plane	Torsional	Pressure	Axial	In-Plane	Out-of-Plane	Torsional	Pressure
2469	2251	1	788.25	0.75	0.35	2250	0.75	489.159	79.702	488.646	13.332	28.854	296.888	51.976	286.699	8.933	20.464
2470	2251	1	788.50	1	0.35	2250	1	419.047	69.512	408.918	11.901	19.545	433.516	71.967	419.200	12.399	20.126
2471	2251	1	788.75	1.25	0.35	2250	1.25	367.885	62.404	350.155	10.873	14.518	565.342	90.039	547.789	15.528	19.363
2472	2251	1	789.50	2	0.35	2250	2	298.506	55.195	257.635	9.864	8.584	935.222	134.775	916.333	23.029	15.873
2473	2251	1	790.00	2.5	0.35	2250	2.5	288.860	55.196	233.162	9.892	6.975	1166.159	158.355	1151.712	26.853	13.453
2474	2251	1	790.50	3	0.35	2250	3	290.068	56.031	222.815	10.009	5.899	1382.455	177.798	1376.610	30.048	11.320
2475	2251	1	791.50	4	0.35	2250	4	301.284	57.278	225.641	10.090	4.453	1795.534	211.059	1810.222	36.759	8.329
2476	2251	1	792.50	5	0.35	2250	5	315.822	57.302	236.963	9.979	3.507	2189.447	244.077	2237.750	43.435	6.658
2477	2251	1	793.50	6	0.35	2250	6	323.972	56.396	242.693	9.730	2.845	2571.151	281.154	2635.333	50.000	5.473
2478	2251	1	794.50	7	0.35	2250	7	326.894	54.993	245.779	9.437	2.364	2935.756	316.502	3025.896	56.198	4.582
2479	2251	1	795.00	7.5	0.35	2250	7.5	327.130	54.275	246.081	9.276	2.172	3116.708	334.742	3221.341	59.404	4.311
2480	2251	1	795.50	8	0.35	2250	8	326.660	53.398	245.898	9.134	2.003	3307.548	354.219	3423.311	62.507	4.098
2481	2251	1	796.50	9	0.35	2250	9	323.368	51.797	242.095	8.810	1.725	3660.550	387.517	3781.939	68.196	3.752
2482	2251	1	797.50	10	0.35	2250	10	318.652	50.141	240.941	8.507	1.507	4019.196	422.031	4208.758	73.685	3.453
2485	2501	1	875.50	0.5	0.35	2500	0.5	585.914	93.547	616.135	15.090	49.229	167.988	33.931	164.414	5.825	22.076
2486	2501	1	875.75	0.75	0.35	2500	0.75	520.735	84.698	527.664	14.156	30.504	316.695	55.506	310.316	9.524	21.566
2487	2501	1	876.00	1	0.35	2500	1	446.066	73.941	441.719	12.620	20.651	463.375	76.506	453.744	13.149	21.227
2488	2501	1	876.25	1.25	0.35	2500	1.25	391.768	66.449	378.677	11.538	15.295	602.107	95.748	592.836	16.491	20.457
2489	2501	1	877.00	2	0.35	2500	2	319.795	59.062	279.635	10.516	9.028	995.508	142.969	991.297	24.399	16.812
2490	2501	1	877.50	2.5	0.35	2500	2.5	310.765	59.316	254.366	10.593	7.332	1240.236	167.274	1244.442	28.372	14.301
2491	2501	1	878.00	3	0.35	2500	3	313.153	60.455	242.233	10.737	6.203	1472.412	188.064	1479.729	31.695	12.066
2492	2501	1	879.00	4	0.35	2500	4	327.047	61.930	249.188	10.863	4.684	1911.756	222.752	1959.217	39.026	8.803
2493	2501	1	880.00	5	0.35	2500	5	344.303	62.065	261.130	10.765	3.688	2330.098	260.634	2400.037	46.211	7.035
2494	2501	1	881.00	6	0.35	2500	6	354.280	61.198	271.378	10.517	2.992	2734.505	299.356	2856.851	53.094	5.769
2495	2501	1	882.00	7	0.35	2500	7	358.248	59.728	274.599	10.213	2.486	3134.278	338.424	3281.616	60.034	4.897
2496	2501	1	882.50	7.5	0.35	2500	7.5	358.862	58.907	275.479	10.037	2.283	3315.426	356.325	3480.188	63.187	4.634
2497	2501	1	883.00	8	0.35	2500	8	358.777	58.131	275.609	9.867	2.106	3510.226	374.858	3694.650	66.193	4.422
2498	2501	1	884.00	9	0.35	2500	9	356.118	56.344	272.490	9.526	1.815	3898.183	411.206	4092.870	72.187	4.050
2499	2501	1	885.00	10	0.35	2500	10	351.921	54.600	270.831	9.203	1.585	4267.584	446.389	4517.999	78.230	3.725
2500	9	1	3.30	0.1	0.4	8	0.1	1.204	1.101	1.100	0.893	5.491	0.363	0.238	0.359	0.139	2.948
2501	9	1	3.45	0.25	0.4	8	0.25	1.296	0.972	1.106	0.810	2.035	0.784	0.478	0.769	0.270	2.492
2502	9	1	3.70	0.5	0.4	8	0.5	1.755	0.993	1.371	0.721	1.517	1.445	0.721	1.017	0.410	2.046
2503	9	1	3.95	0.75	0.4	8	0.75	1.986	0.991	1.367	0.687	1.415	2.047	0.860	1.126	0.519	1.809
2504	9	1	4.20	1	0.4	8	1	2.001	0.939	1.287	0.723	1.350	2.643	0.991	1.242	0.610	1.649
2505	9	1	4.45	1.25	0.4	8	1.25	2.104	0.907	1.232	0.734	1.184	3.100	1.164	1.600	0.693	1.432
2506	9	1	5.20	2	0.4	8	2	2.035	0.756	1.047	0.874	0.849	4.399	1.538	2.595	0.853	1.082
2507	9	1	5.70	2.5	0.4	8	2.5	1.918	0.726	1.002	1.037	0.738	5.149	1.810	3.176	0.956	1.097
2508	9	1	6.20	3	0.4	8	3	1.777	0.700	1.002	1.206	0.703	5.907	2.032	3.693	1.067	1.202



STP-PT-074: Local Stress in Nozzles, Shells and Formed Heads from External Heads

Model								Secondary (inside) Stress Factors									
	OD	T	od	t	d/D	D/T	t/T	Branch					Header				
								Axial	In-Plane	Out-of-Plane	Torsional	Pressure	Axial	In-Plane	Out-of-Plane	Torsional	Pressure
2517	17	1	6.50	0.1	0.4	16	0.1	1.675	1.170	1.669	0.975	5.828	0.531	0.444	0.617	0.232	4.180
2518	17	1	6.65	0.25	0.4	16	0.25	3.720	2.163	3.448	0.946	2.423	1.210	0.920	1.245	0.395	3.390
2519	17	1	6.90	0.5	0.4	16	0.5	5.278	2.454	3.990	0.831	2.179	2.126	1.392	1.715	0.563	2.709
2520	17	1	7.15	0.75	0.4	16	0.75	5.592	2.181	3.698	0.868	2.020	3.145	1.716	2.253	0.747	2.278
2521	17	1	7.40	1	0.4	16	1	5.433	1.854	3.286	0.944	1.931	4.470	1.997	2.978	0.936	2.018
2522	17	1	7.65	1.25	0.4	16	1.25	5.415	1.676	2.994	0.982	1.752	6.330	2.175	3.980	1.107	1.725
2523	17	1	8.40	2	0.4	16	2	4.924	1.369	2.287	1.082	1.338	11.634	2.942	6.496	1.417	1.313
2524	17	1	8.90	2.5	0.4	16	2.5	4.539	1.253	1.963	1.140	1.114	14.589	3.337	7.745	1.544	1.270
2525	17	1	9.40	3	0.4	16	3	4.242	1.214	1.740	1.207	0.958	17.294	3.708	8.919	1.657	1.466
2526	17	1	10.40	4	0.4	16	4	3.810	1.172	1.486	1.396	0.740	22.126	4.582	11.217	1.837	1.765
2527	17	1	11.40	5	0.4	16	5	3.516	1.176	1.368	1.675	0.613	25.584	5.163	13.212	2.057	1.895
2528	17	1	12.40	6	0.4	16	6	3.332	1.210	1.368	2.040	0.542	27.876	5.530	15.032	2.318	1.907
2534	25	1	9.70	0.1	0.4	24	0.1	2.681	1.672	2.773	1.048	6.410	0.711	0.605	0.874	0.290	4.905
2535	25	1	9.85	0.25	0.4	24	0.25	6.655	3.339	5.997	0.981	3.366	1.588	1.273	1.688	0.451	3.843
2536	25	1	10.10	0.5	0.4	24	0.5	9.287	3.680	6.903	0.897	2.949	2.856	1.911	2.514	0.656	3.079
2537	25	1	10.35	0.75	0.4	24	0.75	9.531	3.190	6.290	0.961	2.504	5.199	2.372	3.577	0.890	2.604
2538	25	1	10.60	1	0.4	24	1	9.054	2.706	5.517	1.065	2.275	7.873	2.794	5.096	1.157	2.265
2539	25	1	10.85	1.25	0.4	24	1.25	8.772	2.418	4.959	1.136	2.044	11.226	3.075	6.816	1.413	1.915
2540	25	1	11.60	2	0.4	24	2	7.608	1.916	3.717	1.296	1.588	20.744	4.464	11.222	1.923	1.428
2541	25	1	12.10	2.5	0.4	24	2.5	6.955	1.780	3.177	1.350	1.364	26.441	5.126	13.648	2.114	1.371
2542	25	1	12.60	3	0.4	24	3	6.414	1.649	2.776	1.372	1.162	31.270	5.680	15.538	2.239	1.547
2543	25	1	13.60	4	0.4	24	4	5.531	1.529	2.234	1.427	0.902	40.239	6.652	19.063	2.488	2.020
2544	25	1	14.60	5	0.4	24	5	4.940	1.481	1.917	1.510	0.732	47.627	7.504	22.043	2.687	2.300
2545	25	1	15.60	6	0.4	24	6	4.586	1.470	1.750	1.664	0.616	53.623	8.240	24.731	2.877	2.453
2546	25	1	16.60	7	0.4	24	7	4.461	1.492	1.701	1.884	0.533	59.955	8.812	27.985	3.143	2.526
2547	25	1	17.10	7.5	0.4	24	7.5	4.371	1.509	1.665	2.001	0.505	62.399	9.161	29.416	3.287	2.539
2548	25	1	17.60	8	0.4	24	8	4.343	1.535	1.674	2.160	0.482	64.494	9.503	30.791	3.454	2.535
2549	25	1	18.60	9	0.4	24	9	4.284	1.596	1.717	2.489	0.457	67.943	10.159	33.487	3.801	2.491
2551	33	1	12.90	0.1	0.4	32	0.1	3.770	2.198	3.871	1.097	6.514	0.894	0.725	1.092	0.322	5.369
2552	33	1	13.05	0.25	0.4	32	0.25	9.798	4.310	8.623	0.985	4.471	1.978	1.538	2.156	0.478	4.174
2553	33	1	13.30	0.5	0.4	32	0.5	13.542	4.700	9.934	0.958	3.757	3.932	2.308	3.274	0.711	3.375
2554	33	1	13.55	0.75	0.4	32	0.75	13.638	4.051	8.978	1.086	2.982	7.378	2.868	5.011	1.009	2.903
2555	33	1	13.80	1	0.4	32	1	12.750	3.497	7.829	1.190	2.573	11.459	3.393	7.326	1.326	2.507
2556	33	1	14.05	1.25	0.4	32	1.25	12.125	3.107	6.992	1.268	2.258	16.281	4.028	9.825	1.640	2.102
2557	33	1	14.80	2	0.4	32	2	10.149	2.518	5.182	1.441	1.730	29.934	5.884	16.289	2.330	1.499
2558	33	1	15.30	2.5	0.4	32	2.5	9.161	2.350	4.417	1.502	1.496	38.182	6.804	19.896	2.612	1.432
2559	33	1	15.80	3	0.4	32	3	8.377	2.204	3.850	1.522	1.307	45.829	7.657	23.068	2.804	1.571
2560	33	1	16.80	4	0.4	32	4	7.260	1.934	3.105	1.533	1.005	58.914	9.058	28.095	3.075	2.139

STP-PT-074: Local Stress in Nozzles, Shells and Formed Heads from External Heads

Model								Secondary (inside) Stress Factors									
	OD	T	od	t	d/D	D/T	t/T	Branch					Header				
								Axial	In-Plane	Out-of-Plane	Torsional	Pressure	Axial	In-Plane	Out-of-Plane	Torsional	Pressure
2561	33	1	17.80	5	0.4	32	5	6.392	1.788	2.613	1.550	0.814	70.739	10.229	32.521	3.323	2.523
2562	33	1	18.80	6	0.4	32	6	5.750	1.709	2.298	1.575	0.682	81.373	11.292	36.542	3.530	2.787
2563	33	1	19.80	7	0.4	32	7	5.280	1.681	2.085	1.656	0.587	90.319	12.128	40.113	3.772	2.955
2564	33	1	20.30	7.5	0.4	32	7.5	5.132	1.670	2.018	1.708	0.549	94.331	12.513	41.828	3.908	3.012
2565	33	1	20.80	8	0.4	32	8	5.005	1.667	1.948	1.776	0.518	98.322	12.943	43.624	4.083	3.058
2566	33	1	21.80	9	0.4	32	9	4.816	1.663	1.876	1.935	0.465	104.938	13.622	46.916	4.421	3.102
2567	33	1	22.80	10	0.4	32	10	4.752	1.687	1.841	2.138	0.426	110.516	14.256	50.139	4.775	3.101
2568	41	1	16.10	0.1	0.4	40	0.1	4.938	2.642	4.964	1.122	5.742	1.063	0.812	1.282	0.338	5.748
2569	41	1	16.25	0.25	0.4	40	0.25	13.034	5.143	11.291	0.971	5.597	2.407	1.738	2.614	0.508	4.478
2570	41	1	16.50	0.5	0.4	40	0.5	17.898	5.586	13.023	1.039	4.534	4.952	2.623	4.030	0.754	3.662
2571	41	1	16.75	0.75	0.4	40	0.75	17.794	4.900	11.710	1.197	3.444	9.706	3.269	6.549	1.128	3.205
2572	41	1	17.00	1	0.4	40	1	16.450	4.233	10.177	1.305	2.855	15.169	3.899	9.665	1.470	2.802
2573	41	1	17.25	1.25	0.4	40	1.25	15.432	3.748	9.042	1.374	2.450	21.448	4.935	12.989	1.802	2.346
2574	41	1	18.00	2	0.4	40	2	12.590	3.086	6.653	1.549	1.834	39.175	7.211	21.640	2.636	1.578
2575	41	1	18.50	2.5	0.4	40	2.5	11.259	2.881	5.666	1.617	1.583	49.930	8.495	26.497	3.005	1.466
2576	41	1	19.00	3	0.4	40	3	10.239	2.724	4.943	1.651	1.388	60.021	9.627	30.844	3.277	1.582
2577	41	1	20.00	4	0.4	40	4	8.751	2.458	3.952	1.660	1.095	78.533	11.560	38.312	3.624	2.206
2578	41	1	21.00	5	0.4	40	5	7.793	2.202	3.360	1.626	0.874	93.762	13.034	43.901	3.905	2.651
2579	41	1	22.00	6	0.4	40	6	7.004	2.060	2.931	1.616	0.730	108.827	14.431	49.407	4.145	2.991
2580	41	1	23.00	7	0.4	40	7	6.356	1.964	2.612	1.631	0.625	121.982	15.493	54.197	4.422	3.235
2581	41	1	23.50	7.5	0.4	40	7.5	6.105	1.900	2.500	1.647	0.584	128.069	15.975	56.463	4.581	3.331
2582	41	1	24.00	8	0.4	40	8	5.870	1.870	2.398	1.663	0.547	133.836	16.417	58.665	4.774	3.412
2583	41	1	25.00	9	0.4	40	9	5.485	1.813	2.244	1.735	0.487	144.745	17.352	63.023	5.141	3.537
2584	41	1	26.00	10	0.4	40	10	5.248	1.789	2.119	1.830	0.443	154.223	18.105	67.136	5.509	3.612
2585	51	1	20.10	0.1	0.4	50	0.1	6.491	3.105	6.302	1.122	6.095	1.288	0.886	1.467	0.346	6.052
2586	51	1	20.25	0.25	0.4	50	0.25	17.077	6.046	14.576	0.950	6.962	3.090	1.908	2.977	0.530	4.776
2587	51	1	20.50	0.5	0.4	50	0.5	23.328	6.581	16.874	1.146	5.435	6.262	2.890	4.649	0.824	3.961
2588	51	1	20.75	0.75	0.4	50	0.75	22.927	5.875	15.112	1.332	3.979	12.508	3.682	8.403	1.237	3.530
2589	51	1	21.00	1	0.4	50	1	20.984	5.081	13.089	1.436	3.183	19.600	4.663	12.499	1.623	3.132
2590	51	1	21.25	1.25	0.4	50	1.25	19.454	4.499	11.588	1.493	2.669	27.572	5.922	16.833	1.993	2.662
2591	51	1	22.00	2	0.4	50	2	15.508	3.731	8.469	1.663	1.939	49.967	8.781	28.200	2.974	1.692
2592	51	1	22.50	2.5	0.4	50	2.5	13.757	3.488	7.210	1.722	1.664	63.593	10.393	34.655	3.452	1.521
2593	51	1	23.00	3	0.4	50	3	12.453	3.328	6.303	1.772	1.460	76.410	11.775	40.461	3.819	1.574
2594	51	1	24.00	4	0.4	50	4	10.642	3.040	5.089	1.787	1.159	101.126	14.557	50.981	4.256	2.226
2595	51	1	25.00	5	0.4	50	5	9.328	2.790	4.268	1.754	0.947	123.181	16.735	59.652	4.584	2.743
2596	51	1	26.00	6	0.4	50	6	8.528	2.572	3.789	1.704	0.777	141.771	18.324	66.321	4.858	3.128
2597	51	1	27.00	7	0.4	50	7	7.770	2.401	3.383	1.676	0.664	160.093	19.723	72.892	5.224	3.440
2598	51	1	27.50	7.5	0.4	50	7.5	7.439	2.356	3.215	1.663	0.618	168.724	20.347	75.962	5.426	3.572

STP-PT-074: Local Stress in Nozzles, Shells and Formed Heads from External Heads

Model								Secondary (inside) Stress Factors									
	OD	T	od	t	d/D	D/T	t/T	Branch					Header				
								Axial	In-Plane	Out-of-Plane	Torsional	Pressure	Axial	In-Plane	Out-of-Plane	Torsional	Pressure
2599	51	1	28.00	8	0.4	50	8	7.118	2.289	3.059	1.671	0.578	176.971	20.930	78.892	5.633	3.687
2600	51	1	29.00	9	0.4	50	9	6.616	2.173	2.826	1.677	0.513	193.016	22.134	84.697	6.045	3.888
2601	51	1	30.00	10	0.4	50	10	6.195	2.085	2.640	1.722	0.461	207.317	23.075	90.008	6.463	4.036
2602	61	1	24.10	0.1	0.4	60	0.1	8.033	3.501	7.629	1.109	6.286	1.501	0.956	1.643	0.356	6.351
2603	61	1	24.25	0.25	0.4	60	0.25	21.090	6.835	17.860	0.949	8.264	3.605	2.072	3.412	0.549	5.083
2604	61	1	24.50	0.5	0.4	60	0.5	28.671	7.599	20.733	1.260	6.261	7.448	3.181	5.609	0.899	4.268
2605	61	1	24.75	0.75	0.4	60	0.75	27.934	6.784	18.510	1.465	4.472	15.358	4.047	10.325	1.332	3.856
2606	61	1	25.00	1	0.4	60	1	25.384	5.865	15.998	1.562	3.489	24.058	5.474	15.427	1.741	3.463
2607	61	1	25.25	1.25	0.4	60	1.25	23.328	5.271	14.118	1.607	2.876	33.657	6.917	20.780	2.128	2.982
2608	61	1	26.00	2	0.4	60	2	18.281	4.332	10.257	1.761	2.032	60.585	10.442	34.964	3.209	1.838
2609	61	1	26.50	2.5	0.4	60	2.5	16.116	4.061	8.723	1.825	1.741	76.941	12.340	43.079	3.776	1.587
2610	61	1	27.00	3	0.4	60	3	14.577	3.881	7.656	1.857	1.525	93.179	14.212	50.820	4.168	1.629
2611	61	1	28.00	4	0.4	60	4	12.448	3.597	6.223	1.895	1.213	122.401	17.436	63.854	4.802	2.276
2612	61	1	29.00	5	0.4	60	5	11.000	3.327	5.292	1.881	0.994	149.528	20.146	75.058	5.262	2.806
2613	61	1	30.00	6	0.4	60	6	9.975	3.093	4.612	1.823	0.833	175.764	22.606	85.343	5.658	3.254
2614	61	1	31.00	7	0.4	60	7	9.276	2.895	4.205	1.753	0.699	195.834	23.879	92.309	6.000	3.574
2615	61	1	31.50	7.5	0.4	60	7.5	8.842	2.802	3.994	1.714	0.651	206.841	24.662	96.288	6.247	3.725
2616	61	1	32.00	8	0.4	60	8	8.502	2.729	3.826	1.701	0.608	217.501	25.397	100.086	6.483	3.863
2617	61	1	33.00	9	0.4	60	9	7.826	2.605	3.506	1.709	0.537	238.491	26.921	107.527	6.952	4.112
2618	61	1	34.00	10	0.4	60	10	7.375	2.475	3.300	1.676	0.478	257.389	28.155	114.225	7.392	4.308
2619	71	1	28.10	0.1	0.4	70	0.1	9.562	3.850	8.947	1.085	7.235	1.712	1.023	1.848	0.360	6.620
2620	71	1	28.25	0.25	0.4	70	0.25	24.970	7.537	21.077	0.974	9.471	4.112	2.198	3.992	0.566	5.376
2621	71	1	28.50	0.5	0.4	70	0.5	33.858	8.574	24.567	1.381	7.021	8.744	3.419	6.556	0.961	4.554
2622	71	1	28.75	0.75	0.4	70	0.75	32.760	7.643	21.881	1.601	4.927	18.129	4.496	12.242	1.421	4.158
2623	71	1	29.00	1	0.4	70	1	29.597	6.642	18.872	1.686	3.773	28.349	6.250	18.332	1.843	3.772
2624	71	1	29.25	1.25	0.4	70	1.25	27.021	5.997	16.614	1.719	3.069	39.477	7.851	24.697	2.247	3.282
2625	71	1	30.00	2	0.4	70	2	20.937	4.887	12.023	1.847	2.123	70.598	12.012	41.665	3.398	2.025
2626	71	1	30.50	2.5	0.4	70	2.5	18.415	4.588	10.236	1.910	1.806	90.251	14.422	51.865	3.976	1.663
2627	71	1	31.00	3	0.4	70	3	16.629	4.408	8.992	1.944	1.579	108.307	16.362	60.839	4.501	1.635
2628	71	1	32.00	4	0.4	70	4	14.270	4.119	7.381	1.983	1.255	142.243	20.183	76.747	5.271	2.273
2629	71	1	33.00	5	0.4	70	5	12.633	3.843	6.318	1.967	1.032	174.021	23.408	90.583	5.888	2.812
2630	71	1	34.00	6	0.4	70	6	11.422	3.580	5.568	1.943	0.867	205.017	26.384	103.331	6.368	3.279
2631	71	1	35.00	7	0.4	70	7	10.708	3.322	4.965	1.870	0.741	233.479	28.746	114.341	6.816	3.666
2632	71	1	35.50	7.5	0.4	70	7.5	10.316	3.198	4.748	1.863	0.691	247.164	29.824	119.463	7.085	3.839
2633	71	1	36.00	8	0.4	70	8	9.951	3.183	4.643	1.785	0.634	255.234	29.765	121.801	7.298	3.943
2634	71	1	37.00	9	0.4	70	9	9.235	3.013	4.267	1.748	0.556	280.772	31.717	131.038	7.836	4.231
2635	71	1	38.00	10	0.4	70	10	8.608	2.851	3.947	1.761	0.499	304.239	33.323	139.360	8.330	4.467
2636	81	1	32.10	0.1	0.4	80	0.1	11.020	4.160	10.226	1.064	8.240	1.917	1.079	2.131	0.365	6.889

STP-PT-074: Local Stress in Nozzles, Shells and Formed Heads from External Heads

Model								Secondary (inside) Stress Factors									
	OD	T	od	t	d/D	D/T	t/T	Branch					Header				
								Axial	In-Plane	Out-of-Plane	Torsional	Pressure	Axial	In-Plane	Out-of-Plane	Torsional	Pressure
2637	81	1	32.25	0.25	0.4	80	0.25	28.767	8.207	24.287	1.025	10.619	4.737	2.339	4.500	0.582	5.650
2638	81	1	32.50	0.5	0.4	80	0.5	38.860	9.496	28.358	1.509	7.726	10.114	3.650	7.544	1.018	4.822
2639	81	1	32.75	0.75	0.4	80	0.75	37.399	8.456	25.219	1.736	5.350	20.816	5.055	14.149	1.498	4.440
2640	81	1	33.00	1	0.4	80	1	33.630	7.429	21.714	1.809	4.040	32.484	6.987	21.224	1.939	4.059
2641	81	1	33.25	1.25	0.4	80	1.25	30.525	6.680	19.063	1.829	3.252	44.995	8.837	28.547	2.348	3.564
2642	81	1	34.00	2	0.4	80	2	23.486	5.426	13.770	1.929	2.207	80.665	13.731	48.654	3.479	2.243
2643	81	1	34.50	2.5	0.4	80	2.5	20.669	5.086	11.744	1.982	1.869	102.143	16.181	60.215	4.182	1.742
2644	81	1	35.00	3	0.4	80	3	18.667	4.898	10.332	2.019	1.628	122.460	18.456	70.755	4.775	1.678
2645	81	1	36.00	4	0.4	80	4	16.038	4.601	8.515	2.052	1.293	160.771	22.806	89.584	5.727	2.264
2646	81	1	37.00	5	0.4	80	5	14.279	4.321	7.354	2.052	1.064	196.817	26.522	106.093	6.477	2.802
2647	81	1	38.00	6	0.4	80	6	13.216	4.047	6.524	2.020	0.896	232.213	30.010	121.395	7.039	3.279
2648	81	1	39.00	7	0.4	80	7	12.339	3.764	5.872	1.967	0.768	264.970	32.797	134.739	7.560	3.682
2649	81	1	39.50	7.5	0.4	80	7.5	11.919	3.647	5.638	1.969	0.715	280.718	34.067	140.927	7.833	3.862
2650	81	1	40.00	8	0.4	80	8	11.511	3.493	5.413	1.925	0.668	296.064	35.264	146.820	8.156	4.032
2651	81	1	41.00	9	0.4	80	9	10.786	3.475	5.116	1.797	0.578	320.007	36.499	155.025	8.692	4.285
2652	81	1	42.00	10	0.4	80	10	10.025	3.313	4.731	1.788	0.516	347.578	38.412	165.044	9.237	4.547
2653	91	1	36.10	0.1	0.4	90	0.1	12.416	4.441	11.489	1.045	9.201	2.161	1.137	2.358	0.370	7.155
2654	91	1	36.25	0.25	0.4	90	0.25	32.379	8.832	27.417	1.082	11.664	5.418	2.450	5.095	0.599	5.918
2655	91	1	36.50	0.5	0.4	90	0.5	43.687	10.361	32.119	1.639	8.385	11.443	3.859	8.545	1.068	5.074
2656	91	1	36.75	0.75	0.4	90	0.75	41.838	9.320	28.517	1.872	5.747	23.385	5.597	16.020	1.563	4.704
2657	91	1	37.00	1	0.4	90	1	37.467	8.179	24.510	1.930	4.291	36.417	7.692	24.063	2.028	4.328
2658	91	1	37.25	1.25	0.4	90	1.25	33.942	7.340	21.527	1.939	3.424	50.691	9.961	32.624	2.479	3.862
2659	91	1	38.00	2	0.4	90	2	25.968	5.928	15.507	2.003	2.293	89.625	15.166	55.223	3.658	2.446
2660	91	1	38.50	2.5	0.4	90	2.5	22.789	5.544	13.198	2.057	1.929	113.360	17.848	68.477	4.368	1.874
2661	91	1	39.00	3	0.4	90	3	20.560	5.361	11.602	2.089	1.674	135.788	20.471	80.595	5.050	1.715
2662	91	1	40.00	4	0.4	90	4	17.796	5.074	9.645	2.109	1.326	178.147	25.307	102.354	6.171	2.253
2663	91	1	41.00	5	0.4	90	5	16.001	4.779	8.426	2.129	1.093	219.195	29.765	122.144	6.988	2.798
2664	91	1	42.00	6	0.4	90	6	14.851	4.496	7.512	2.107	0.922	257.536	33.462	139.474	7.677	3.264
2665	91	1	43.00	7	0.4	90	7	13.943	4.230	6.806	2.080	0.791	294.201	36.721	155.175	8.278	3.673
2666	91	1	43.50	7.5	0.4	90	7.5	13.504	4.090	6.510	2.051	0.737	311.941	38.190	162.477	8.562	3.861
2667	91	1	44.00	8	0.4	90	8	12.866	3.946	6.225	2.013	0.688	329.275	39.573	169.476	8.905	4.036
2668	91	1	45.00	9	0.4	90	9	12.299	3.762	5.848	1.999	0.607	364.155	42.378	183.277	9.633	4.371
2669	91	1	46.00	10	0.4	90	10	11.530	3.678	5.561	1.835	0.532	387.804	43.402	191.175	10.116	4.585
2670	101	1	40.10	0.1	0.4	100	0.1	13.780	4.702	12.735	1.024	10.161	2.480	1.180	2.661	0.373	7.403
2671	101	1	40.25	0.25	0.4	100	0.25	35.920	9.483	30.536	1.154	12.705	5.994	2.567	5.634	0.613	6.167
2672	101	1	40.50	0.5	0.4	100	0.5	48.385	11.182	35.891	1.770	9.003	12.700	4.104	9.463	1.127	5.371
2673	101	1	40.75	0.75	0.4	100	0.75	46.154	10.140	31.825	2.007	6.119	26.088	6.192	18.022	1.640	5.002
2674	101	1	41.00	1	0.4	100	1	41.220	8.896	27.327	2.052	4.530	40.533	8.498	27.089	2.120	4.624

STP-PT-074: Local Stress in Nozzles, Shells and Formed Heads from External Heads

Model								Secondary (inside) Stress Factors									
	OD	T	od	t	d/D	D/T	t/T	Branch					Header				
								Axial	In-Plane	Out-of-Plane	Torsional	Pressure	Axial	In-Plane	Out-of-Plane	Torsional	Pressure
2675	101	1	41.25	1.25	0.4	100	1.25	37.156	7.960	23.921	2.046	3.592	55.759	10.889	36.412	2.567	4.113
2676	101	1	42.00	2	0.4	100	2	28.287	6.420	17.182	2.083	2.373	98.170	16.532	61.737	3.804	2.644
2677	101	1	42.50	2.5	0.4	100	2.5	24.820	6.015	14.618	2.117	1.989	123.945	19.435	76.625	4.607	2.012
2678	101	1	43.00	3	0.4	100	3	22.489	5.815	12.900	2.155	1.721	148.382	22.398	90.335	5.355	1.748
2679	101	1	44.00	4	0.4	100	4	19.617	5.555	10.795	2.177	1.358	194.506	27.711	115.025	6.585	2.242
2680	101	1	45.00	5	0.4	100	5	17.731	5.270	9.492	2.192	1.118	239.333	32.659	137.629	7.504	2.779
2681	101	1	46.00	6	0.4	100	6	16.446	4.944	8.523	2.177	0.945	281.316	36.807	157.537	8.288	3.242
2682	101	1	47.00	7	0.4	100	7	15.532	4.774	7.754	2.178	0.813	321.631	40.473	175.664	8.956	3.655
2683	101	1	47.50	7.5	0.4	100	7.5	14.780	4.475	7.437	2.115	0.757	341.154	42.155	184.101	9.259	3.844
2684	101	1	48.00	8	0.4	100	8	14.670	4.375	7.140	2.115	0.708	360.310	43.709	192.221	9.624	4.023
2685	101	1	49.00	9	0.4	100	9	13.814	4.187	6.674	2.087	0.625	398.959	46.956	208.271	10.426	4.368
2686	101	1	50.00	10	0.4	100	10	12.874	4.008	6.172	2.061	0.556	434.918	49.589	222.546	11.114	4.669
2687	251	1	100.10	0.1	0.4	250	0.1	30.449	7.856	29.948	1.097	22.684	5.608	1.908	5.947	0.438	10.908
2688	251	1	100.25	0.25	0.4	250	0.25	80.409	17.822	74.570	2.460	23.787	13.500	4.004	13.047	0.845	9.398
2689	251	1	100.50	0.5	0.4	250	0.5	107.213	21.891	89.177	3.715	15.792	28.818	7.694	23.086	1.560	8.162
2690	251	1	100.75	0.75	0.4	250	0.75	99.570	19.832	78.441	3.845	10.226	58.030	12.482	44.990	2.494	7.797
2691	251	1	101.00	1	0.4	250	1	87.105	17.276	66.706	3.667	7.209	88.440	17.472	67.639	3.551	7.469
2692	251	1	101.25	1.25	0.4	250	1.25	77.015	15.353	57.729	3.476	5.507	118.806	21.956	90.292	4.548	6.905
2693	251	1	102.00	2	0.4	250	2	58.294	12.482	41.121	3.143	3.391	202.859	33.742	153.667	7.034	4.996
2694	251	1	102.50	2.5	0.4	250	2.5	52.189	11.835	35.273	3.056	2.763	254.041	40.489	192.457	8.350	3.931
2695	251	1	103.00	3	0.4	250	3	48.608	11.505	31.570	3.027	2.334	302.620	46.594	229.165	9.507	3.177
2696	251	1	104.00	4	0.4	250	4	44.525	11.142	27.316	2.993	1.768	394.477	57.402	297.689	11.554	2.267
2697	251	1	105.00	5	0.4	250	5	42.111	10.883	24.967	2.956	1.415	482.000	67.183	361.472	13.549	2.604
2698	251	1	106.00	6	0.4	250	6	40.184	10.509	23.363	2.915	1.178	566.626	76.336	421.466	15.403	2.974
2699	251	1	107.00	7	0.4	250	7	38.456	10.085	22.088	2.856	1.010	649.224	84.997	478.447	17.082	3.322
2700	251	1	107.50	7.5	0.4	250	7.5	37.646	9.994	21.522	2.841	0.943	691.872	89.702	507.314	17.824	3.501
2701	251	1	108.00	8	0.4	250	8	36.738	9.781	20.950	2.829	0.884	732.213	93.827	534.203	18.589	3.665
2702	251	1	109.00	9	0.4	250	9	35.235	9.316	19.972	2.802	0.786	811.556	101.739	586.063	19.996	3.979
2703	251	1	110.00	10	0.4	250	10	33.869	9.012	19.099	2.795	0.707	889.898	109.147	636.067	21.413	4.282
2704	501	1	200.10	0.1	0.4	500	0.1	52.423	11.927	54.823	1.724	36.746	9.831	3.141	10.672	0.582	15.288
2705	501	1	200.25	0.25	0.4	500	0.25	141.640	27.938	140.966	4.311	35.567	21.977	6.737	21.670	1.252	13.169
2706	501	1	200.50	0.5	0.4	500	0.5	187.900	34.372	169.915	6.293	23.153	50.901	12.475	43.589	2.414	11.361
2707	501	1	200.75	0.75	0.4	500	0.75	172.024	31.248	148.578	6.232	14.748	101.950	20.058	85.951	4.032	10.948
2708	501	1	201.00	1	0.4	500	1	149.028	27.544	125.590	5.720	10.203	152.833	27.589	128.048	5.702	10.567
2709	501	1	201.25	1.25	0.4	500	1.25	130.898	24.647	108.123	5.307	7.677	202.647	35.361	169.688	7.272	9.933
2710	501	1	202.00	2	0.4	500	2	100.358	20.323	77.397	4.688	4.605	341.278	54.679	287.606	11.125	7.622
2711	501	1	202.50	2.5	0.4	500	2.5	91.838	19.612	67.342	4.559	3.731	426.480	65.168	360.970	13.133	6.202
2712	501	1	203.00	3	0.4	500	3	87.424	19.380	61.364	4.486	3.143	507.581	74.514	431.423	14.870	5.123

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Model								Secondary (inside) Stress Factors									
	OD	T	od	t	d/D	D/T	t/T	Branch					Header				
								Axial	In-Plane	Out-of-Plane	Torsional	Pressure	Axial	In-Plane	Out-of-Plane	Torsional	Pressure
2713	501	1	204.00	4	0.4	500	4	83.263	19.055	55.090	4.359	2.357	660.822	90.961	564.752	17.922	3.728
2714	501	1	205.00	5	0.4	500	5	80.732	18.556	51.764	4.221	1.849	806.875	105.905	691.207	20.942	2.964
2715	501	1	206.00	6	0.4	500	6	78.296	18.018	49.348	4.104	1.502	948.408	119.987	812.538	24.101	3.016
2716	501	1	207.00	7	0.4	500	7	75.838	17.367	47.222	3.970	1.258	1087.055	133.650	930.030	26.838	3.299
2717	501	1	207.50	7.5	0.4	500	7.5	74.569	17.149	46.202	3.915	1.160	1155.236	140.372	987.321	28.150	3.429
2718	501	1	208.00	8	0.4	500	8	73.250	16.837	45.248	3.872	1.077	1226.227	147.638	1046.891	29.451	3.415
2719	501	1	209.00	9	0.4	500	9	70.744	16.254	43.412	3.778	0.945	1360.467	160.779	1157.883	31.774	3.672
2720	501	1	210.00	10	0.4	500	10	68.305	15.659	41.692	3.676	0.843	1494.153	173.409	1266.954	33.990	3.927
2722	751	1	300.25	0.25	0.4	750	0.25	191.773	35.419	199.734	5.825	44.741	28.657	8.665	29.003	1.594	16.004
2723	751	1	300.50	0.5	0.4	750	0.5	253.615	44.435	241.577	8.312	28.711	69.818	16.329	62.453	3.168	13.742
2724	751	1	300.75	0.75	0.4	750	0.75	230.659	40.947	210.628	8.109	18.217	137.445	25.738	122.037	5.280	13.293
2725	751	1	301.00	1	0.4	750	1	199.216	35.897	177.656	7.352	12.518	204.692	36.401	181.110	7.425	12.916
2726	751	1	301.25	1.25	0.4	750	1.25	174.927	32.207	152.855	6.750	9.358	270.019	46.264	239.344	9.407	12.244
2727	751	1	302.00	2	0.4	750	2	136.256	27.072	110.115	5.982	5.568	451.409	70.621	403.846	14.214	9.624
2728	751	1	302.50	2.5	0.4	750	2.5	126.760	26.112	96.935	5.854	4.512	564.561	84.014	508.499	16.772	7.922
2729	751	1	303.00	3	0.4	750	3	122.614	26.026	89.529	5.786	3.802	671.094	95.622	607.958	18.930	6.566
2730	751	1	304.00	4	0.4	750	4	119.523	25.815	82.263	5.656	2.852	872.573	115.833	797.434	22.662	4.883
2731	751	1	305.00	5	0.4	750	5	118.252	25.215	79.795	5.493	2.236	1064.208	134.006	978.097	26.916	3.894
2732	751	1	306.00	6	0.4	750	6	116.868	24.540	78.251	5.268	1.818	1249.840	151.223	1152.478	30.894	3.216
2733	751	1	307.00	7	0.4	750	7	114.474	23.599	76.191	5.094	1.514	1431.256	167.954	1322.391	34.589	3.103
2734	751	1	307.50	7.5	0.4	750	7.5	113.166	23.152	75.177	5.082	1.388	1520.518	176.245	1405.573	36.330	3.219
2735	751	1	308.00	8	0.4	750	8	111.571	22.843	73.956	4.956	1.285	1609.126	184.399	1487.803	38.048	3.331
2736	751	1	309.00	9	0.4	750	9	108.300	22.089	71.202	4.876	1.114	1785.407	201.898	1650.735	41.265	3.552
2737	751	1	310.00	10	0.4	750	10	104.979	21.503	68.892	4.713	0.978	1959.545	219.985	1810.616	44.239	3.764
2739	1001	1	400.25	0.25	0.4	1000	0.25	234.654	41.528	253.165	7.139	52.522	34.384	10.416	35.609	1.906	18.441
2740	1001	1	400.50	0.5	0.4	1000	0.5	309.641	53.516	306.925	10.039	33.521	86.354	19.555	80.016	3.858	15.791
2741	1001	1	400.75	0.75	0.4	1000	0.75	280.541	49.125	267.168	9.689	21.121	168.237	31.376	155.382	6.390	15.306
2742	1001	1	401.00	1	0.4	1000	1	242.013	42.953	225.117	8.740	14.467	249.172	43.985	229.728	8.933	14.921
2743	1001	1	401.25	1.25	0.4	1000	1.25	212.515	38.558	193.391	7.992	10.777	327.658	55.665	302.781	11.276	14.211
2744	1001	1	402.00	2	0.4	1000	2	167.675	32.955	140.340	7.116	6.379	545.482	84.110	509.672	16.854	11.329
2745	1001	1	402.50	2.5	0.4	1000	2.5	157.836	32.055	124.523	6.997	5.163	680.278	99.434	640.130	19.744	9.408
2746	1001	1	403.00	3	0.4	1000	3	154.284	31.904	116.100	6.945	4.350	808.221	112.632	766.080	22.182	7.780
2747	1001	1	404.00	4	0.4	1000	4	153.027	31.876	109.031	6.838	3.263	1049.912	135.338	1005.601	26.926	5.809
2748	1001	1	405.00	5	0.4	1000	5	155.339	31.343	109.943	6.661	2.560	1279.419	155.705	1234.951	31.968	4.638
2749	1001	1	406.00	6	0.4	1000	6	155.442	30.468	109.487	6.463	2.074	1501.309	175.449	1454.776	36.696	3.818
2750	1001	1	407.00	7	0.4	1000	7	153.521	29.463	107.854	6.221	1.725	1717.622	198.143	1671.586	41.105	3.235
2751	1001	1	407.50	7.5	0.4	1000	7.5	151.865	28.874	106.507	6.087	1.584	1824.328	209.314	1777.866	43.200	3.105
2752	1001	1	408.00	8	0.4	1000	8	150.341	28.375	105.330	5.981	1.462	1930.282	220.566	1882.475	45.229	3.205



STP-PT-074: Local Stress in Nozzles, Shells and Formed Heads from External Heads

Model	Secondary (inside) Stress Factors																
	OD	T	od	t	d/D	D/T	t/T	Branch					Header				
								Axial	In-Plane	Out-of-Plane	Torsional	Pressure	Axial	In-Plane	Out-of-Plane	Torsional	Pressure
2753	1001	1	409.00	9	0.4	1000	9	146.604	27.374	102.217	5.804	1.264	2139.654	242.045	2089.285	49.142	3.398
2754	1001	1	410.00	10	0.4	1000	10	142.424	26.395	98.462	5.589	1.106	2353.650	263.597	2302.095	52.935	3.596
2756	1251	1	500.25	0.25	0.4	1250	0.25	272.043	47.410	301.834	8.281	59.431	38.882	12.044	40.913	2.208	20.594
2757	1251	1	500.50	0.5	0.4	1250	0.5	358.524	61.564	366.654	11.560	37.797	100.849	22.310	96.250	4.468	17.555
2758	1251	1	500.75	0.75	0.4	1250	0.75	323.968	56.345	318.850	11.069	23.682	195.288	36.329	186.114	7.350	17.048
2759	1251	1	501.00	1	0.4	1250	1	279.268	49.244	268.566	9.949	16.184	288.222	50.672	274.474	10.241	16.660
2760	1251	1	501.25	1.25	0.4	1250	1.25	245.407	44.164	230.744	9.087	12.031	377.522	63.824	360.678	12.890	15.933
2761	1251	1	502.00	2	0.4	1250	2	195.700	38.217	168.505	8.129	7.091	626.986	95.801	606.251	19.150	12.832
2762	1251	1	502.50	2.5	0.4	1250	2.5	185.995	37.534	150.841	8.039	5.737	781.524	112.656	761.930	22.318	10.728
2763	1251	1	503.00	3	0.4	1250	3	183.384	37.543	141.667	8.052	4.833	928.757	127.235	911.146	24.972	8.886
2764	1251	1	504.00	4	0.4	1250	4	184.855	37.733	136.901	7.986	3.627	1205.429	151.883	1196.245	30.720	6.609
2765	1251	1	505.00	5	0.4	1250	5	190.195	37.217	139.993	7.822	2.847	1468.691	174.768	1468.849	36.475	5.270
2766	1251	1	506.00	6	0.4	1250	6	191.787	36.315	141.070	7.575	2.305	1722.725	201.198	1734.694	41.825	4.325
2767	1251	1	507.00	7	0.4	1250	7	190.690	35.123	139.967	7.319	1.913	1974.996	227.661	1996.525	46.973	3.659
2768	1251	1	507.50	7.5	0.4	1250	7.5	189.398	34.518	139.080	7.166	1.758	2096.961	240.497	2124.730	49.422	3.390
2769	1251	1	508.00	8	0.4	1250	8	187.871	33.950	137.656	7.050	1.622	2218.418	253.016	2249.709	51.842	3.167
2770	1251	1	509.00	9	0.4	1250	9	184.057	32.746	134.525	6.774	1.399	2457.949	277.448	2497.643	56.330	3.338
2771	1251	1	510.00	10	0.4	1250	10	179.402	31.670	130.549	6.531	1.223	2695.624	302.121	2747.068	60.556	3.507
2773	1501	1	600.25	0.25	0.4	1500	0.25	305.559	53.276	347.341	9.348	65.830	42.811	13.490	45.783	2.486	22.591
2774	1501	1	600.50	0.5	0.4	1500	0.5	402.206	68.825	422.021	12.921	41.688	114.298	24.756	111.750	5.028	19.175
2775	1501	1	600.75	0.75	0.4	1500	0.75	362.722	62.848	366.701	12.300	26.043	219.613	40.885	214.886	8.241	18.623
2776	1501	1	601.00	1	0.4	1500	1	312.594	54.934	308.831	11.039	17.737	323.120	56.626	316.205	11.419	18.251
2777	1501	1	601.25	1.25	0.4	1500	1.25	274.898	49.244	265.381	10.085	13.169	422.856	71.078	414.950	14.319	17.503
2778	1501	1	602.00	2	0.4	1500	2	221.149	42.958	195.077	9.105	7.738	701.028	106.224	696.444	21.171	14.191
2779	1501	1	602.50	2.5	0.4	1500	2.5	211.917	42.586	175.840	9.045	6.256	872.419	124.627	874.045	24.599	11.933
2780	1501	1	603.00	3	0.4	1500	3	210.401	43.033	166.106	9.117	5.269	1036.956	140.263	1043.658	27.502	9.939
2781	1501	1	604.00	4	0.4	1500	4	214.811	43.357	164.506	9.088	3.956	1346.732	166.556	1376.970	34.214	7.321
2782	1501	1	605.00	5	0.4	1500	5	222.777	43.011	169.489	8.924	3.105	1640.713	195.168	1687.351	40.509	5.832
2783	1501	1	606.00	6	0.4	1500	6	226.222	42.030	172.162	8.654	2.515	1927.333	224.905	1995.537	46.554	4.785
2784	1501	1	607.00	7	0.4	1500	7	226.024	40.885	172.110	8.355	2.088	2203.599	253.988	2293.167	52.217	4.022
2785	1501	1	607.50	7.5	0.4	1500	7.5	225.077	40.260	171.815	8.222	1.917	2339.732	267.567	2445.110	54.944	3.749
2786	1501	1	608.00	8	0.4	1500	8	223.785	39.621	170.453	8.053	1.769	2474.038	281.824	2584.913	57.581	3.564
2787	1501	1	609.00	9	0.4	1500	9	219.977	37.964	167.243	7.731	1.524	2742.142	309.383	2874.549	62.758	3.328
2788	1501	1	610.00	10	0.4	1500	10	215.508	36.790	163.430	7.462	1.332	3004.745	336.295	3157.507	67.562	3.479
2791	1751	1	700.50	0.5	0.4	1750	0.5	441.751	75.468	473.279	14.159	45.274	126.537	27.478	126.323	5.544	20.697
2792	1751	1	700.75	0.75	0.4	1750	0.75	397.840	68.769	411.258	13.422	28.219	242.069	45.022	242.046	9.053	20.106
2793	1751	1	701.00	1	0.4	1750	1	342.726	60.156	345.852	12.014	19.162	355.210	62.226	354.990	12.489	19.727
2794	1751	1	701.25	1.25	0.4	1750	1.25	301.641	53.954	297.640	11.000	14.213	464.560	77.907	466.073	15.665	18.960

STP-PT-074: Local Stress in Nozzles, Shells and Formed Heads from External Heads

Model								Secondary (inside) Stress Factors									
	OD	T	od	t	d/D	D/T	t/T	Branch					Header				
								Axial	In-Plane	Out-of-Plane	Torsional	Pressure	Axial	In-Plane	Out-of-Plane	Torsional	Pressure
2795	1751	1	702.00	2	0.4	1750	2	244.605	47.494	220.066	9.971	8.324	768.786	115.791	780.629	23.000	15.454
2796	1751	1	702.50	2.5	0.4	1750	2.5	235.825	47.354	199.483	9.986	6.730	958.298	135.372	980.859	26.664	13.051
2797	1751	1	703.00	3	0.4	1750	3	235.646	47.916	190.037	10.069	5.670	1136.611	151.778	1171.398	30.055	10.923
2798	1751	1	704.00	4	0.4	1750	4	242.642	48.705	190.383	10.108	4.258	1476.121	181.073	1539.921	37.412	7.957
2799	1751	1	705.00	5	0.4	1750	5	253.253	48.528	198.397	9.969	3.341	1800.495	214.611	1897.061	44.377	6.344
2800	1751	1	706.00	6	0.4	1750	6	258.421	47.523	202.577	9.678	2.706	2111.832	246.540	2237.327	50.940	5.185
2801	1751	1	707.00	7	0.4	1750	7	259.546	46.240	203.911	9.367	2.246	2413.527	277.942	2570.396	57.092	4.415
2802	1751	1	707.50	7.5	0.4	1750	7.5	259.015	45.623	203.650	9.185	2.062	2561.788	293.331	2734.575	60.114	4.188
2803	1751	1	708.00	8	0.4	1750	8	257.995	44.749	203.162	9.019	1.903	2709.385	308.799	2901.768	62.995	3.981
2804	1751	1	709.00	9	0.4	1750	9	254.663	43.392	200.233	8.691	1.638	2999.070	338.267	3219.206	68.467	3.630
2805	1751	1	710.00	10	0.4	1750	10	250.412	41.961	196.409	8.383	1.430	3287.244	367.560	3536.698	73.797	3.469
2808	2001	1	800.50	0.5	0.4	2000	0.5	477.892	81.551	521.536	15.331	48.672	137.870	30.029	140.116	6.050	22.117
2809	2001	1	800.75	0.75	0.4	2000	0.75	429.799	74.201	453.284	14.456	30.268	262.737	48.874	268.052	9.797	21.495
2810	2001	1	801.00	1	0.4	2000	1	370.249	64.934	381.360	12.950	20.506	384.750	67.306	392.440	13.516	21.114
2811	2001	1	801.25	1.25	0.4	2000	1.25	326.076	58.452	327.586	11.847	15.181	502.533	84.091	513.460	16.855	20.309
2812	2001	1	802.00	2	0.4	2000	2	266.338	51.724	243.699	10.813	8.875	830.079	124.570	859.314	24.783	16.632
2813	2001	1	802.50	2.5	0.4	2000	2.5	258.281	51.895	222.156	10.867	7.172	1033.812	145.127	1077.905	28.640	14.091
2814	2001	1	803.00	3	0.4	2000	3	259.387	52.800	212.866	11.033	6.042	1226.808	162.288	1287.489	32.475	11.836
2815	2001	1	804.00	4	0.4	2000	4	268.816	53.782	215.846	11.080	4.540	1594.012	196.055	1695.306	40.395	8.540
2816	2001	1	805.00	5	0.4	2000	5	281.941	53.599	226.627	10.937	3.563	1940.977	231.779	2085.779	47.794	6.783
2817	2001	1	806.00	6	0.4	2000	6	288.884	52.770	232.256	10.656	2.885	2280.607	266.437	2462.334	54.904	5.547
2818	2001	1	807.00	7	0.4	2000	7	291.248	51.431	233.887	10.317	2.394	2607.002	300.072	2818.313	61.557	4.839
2819	2001	1	807.50	7.5	0.4	2000	7.5	291.220	50.719	235.255	10.140	2.198	2765.051	316.467	3011.193	64.784	4.595
2820	2001	1	808.00	8	0.4	2000	8	290.474	49.825	234.725	9.958	2.027	2925.333	332.843	3191.139	67.926	4.374
2821	2001	1	809.00	9	0.4	2000	9	287.654	48.355	232.725	9.601	1.745	3238.877	365.246	3546.348	74.016	3.994
2822	2001	1	810.00	10	0.4	2000	10	283.641	46.754	229.465	9.255	1.524	3549.505	397.977	3899.980	79.960	3.683
2825	2251	1	900.50	0.5	0.4	2250	0.5	511.030	87.368	567.509	16.404	51.863	148.530	32.442	153.510	6.519	23.452
2826	2251	1	900.75	0.75	0.4	2250	0.75	459.200	79.573	491.886	15.449	32.357	281.983	52.531	292.183	10.518	22.821
2827	2251	1	901.00	1	0.4	2250	1	395.511	69.665	413.965	13.826	21.869	412.512	72.231	427.450	14.474	22.419
2828	2251	1	901.25	1.25	0.4	2250	1.25	348.661	62.607	357.905	12.626	16.096	537.809	89.887	561.613	17.975	21.600
2829	2251	1	902.00	2	0.4	2250	2	286.547	55.850	266.183	11.602	9.392	888.250	132.757	934.437	26.372	17.759
2830	2251	1	902.50	2.5	0.4	2250	2.5	279.336	56.240	243.480	11.702	7.587	1105.135	154.558	1169.490	30.433	15.070
2831	2251	1	903.00	3	0.4	2250	3	281.829	57.202	235.383	11.862	6.392	1312.407	172.045	1401.682	34.880	12.702
2832	2251	1	904.00	4	0.4	2250	4	293.716	58.550	240.771	12.007	4.802	1704.322	211.134	1841.723	43.457	9.111
2833	2251	1	905.00	5	0.4	2250	5	308.906	58.560	252.572	11.867	3.771	2080.143	247.938	2259.077	51.009	7.202
2834	2251	1	906.00	6	0.4	2250	6	317.561	57.655	262.780	11.582	3.052	2436.217	284.770	2688.882	58.470	5.864
2835	2251	1	907.00	7	0.4	2250	7	321.227	56.247	265.319	11.238	2.534	2782.693	320.831	3072.036	65.896	5.236
2836	2251	1	907.50	7.5	0.4	2250	7.5	321.767	55.485	265.937	11.040	2.325	2958.941	339.514	3275.429	69.558	4.960

STP-PT-074: Local Stress in Nozzles, Shells and Formed Heads from External Heads

Model								Secondary (inside) Stress Factors									
	OD	T	od	t	d/D	D/T	t/T	Branch					Header				
								Axial	In-Plane	Out-of-Plane	Torsional	Pressure	Axial	In-Plane	Out-of-Plane	Torsional	Pressure
2837	2251	1	908.00	8	0.4	2250	8	321.394	54.638	266.052	10.840	2.144	3129.268	357.819	3471.326	72.898	4.742
2838	2251	1	909.00	9	0.4	2250	9	319.044	53.058	264.412	10.448	1.845	3462.337	393.272	3857.497	79.621	4.343
2839	2251	1	910.00	10	0.4	2250	10	315.308	51.369	261.317	10.091	1.611	3790.505	428.159	4237.263	85.869	4.003
2842	2501	1	1000.50	0.5	0.4	2500	0.5	541.726	92.756	608.448	17.420	54.926	158.557	34.675	165.963	6.952	24.754
2843	2501	1	1000.75	0.75	0.4	2500	0.75	486.282	84.312	528.379	16.349	34.155	300.188	55.936	315.573	11.169	24.053
2844	2501	1	1001.00	1	0.4	2500	1	418.626	73.808	445.231	14.623	22.988	438.753	76.663	460.986	15.328	23.665
2845	2501	1	1001.25	1.25	0.4	2500	1.25	369.446	66.518	383.727	13.387	16.983	570.752	95.416	603.743	19.080	22.829
2846	2501	1	1002.00	2	0.4	2500	2	305.448	59.778	288.000	12.355	9.882	942.637	140.519	1007.513	27.824	18.812
2847	2501	1	1002.50	2.5	0.4	2500	2.5	298.998	60.366	265.077	12.502	7.979	1172.138	163.252	1262.645	32.066	16.008
2848	2501	1	1003.00	3	0.4	2500	3	302.844	61.567	256.708	12.696	6.722	1393.964	182.134	1510.183	36.876	13.518
2849	2501	1	1004.00	4	0.4	2500	4	316.826	63.308	264.676	12.916	5.053	1808.580	223.761	1982.180	45.882	9.636
2850	2501	1	1005.00	5	0.4	2500	5	334.316	63.276	277.955	12.784	3.966	2204.826	264.263	2426.752	54.335	7.608
2851	2501	1	1006.00	6	0.4	2500	6	344.733	62.352	289.161	12.473	3.212	2579.882	303.242	2871.140	62.320	6.284
2852	2501	1	1007.00	7	0.4	2500	7	349.714	60.873	294.816	12.064	2.665	2954.111	341.817	3307.239	70.113	5.584
2853	2501	1	1007.50	7.5	0.4	2500	7.5	350.653	60.043	295.905	11.888	2.446	3132.005	361.188	3516.797	73.901	5.316
2854	2501	1	1008.00	8	0.4	2500	8	350.543	59.218	296.535	11.688	2.255	3307.074	380.464	3722.907	77.639	5.067
2855	2501	1	1009.00	9	0.4	2500	9	349.065	57.455	296.462	11.284	1.941	3665.825	418.326	4151.701	85.139	4.630
2856	2501	1	1010.00	10	0.4	2500	10	345.528	55.703	293.152	10.891	1.693	4015.429	456.073	4553.582	92.022	4.285
2857	9	1	3.70	0.1	0.45	8	0.1	1.204	1.113	1.123	0.917	6.158	0.363	0.250	0.395	0.166	3.256
2858	9	1	3.85	0.25	0.45	8	0.25	1.311	0.994	1.241	0.857	2.329	0.848	0.512	0.818	0.315	2.731
2859	9	1	4.10	0.5	0.45	8	0.5	1.760	1.113	1.523	0.755	1.659	1.557	0.784	1.076	0.467	2.208
2860	9	1	4.35	0.75	0.45	8	0.75	1.981	1.068	1.506	0.742	1.549	2.224	0.946	1.236	0.583	1.923
2861	9	1	4.60	1	0.45	8	1	1.968	0.970	1.390	0.802	1.452	2.836	1.151	1.413	0.685	1.767
2862	9	1	4.85	1.25	0.45	8	1.25	2.056	0.922	1.322	0.802	1.276	3.352	1.221	1.703	0.767	1.518
2863	9	1	5.60	2	0.45	8	2	2.035	0.829	1.111	0.915	0.923	4.731	1.600	2.803	0.950	1.128
2864	9	1	6.10	2.5	0.45	8	2.5	1.940	0.807	1.034	1.057	0.773	5.612	1.893	3.403	1.057	1.072
2865	9	1	6.60	3	0.45	8	3	1.837	0.793	1.007	1.222	0.733	6.669	2.102	3.940	1.171	1.177
2874	17	1	7.30	0.1	0.45	16	0.1	1.669	1.167	1.771	1.016	6.658	0.574	0.451	0.640	0.281	4.600
2875	17	1	7.45	0.25	0.45	16	0.25	3.705	2.284	3.716	0.991	2.706	1.301	0.951	1.301	0.467	3.676
2876	17	1	7.70	0.5	0.45	16	0.5	5.272	2.590	4.333	0.892	2.407	2.300	1.461	1.832	0.648	2.903
2877	17	1	7.95	0.75	0.45	16	0.75	5.595	2.290	4.028	0.954	2.197	3.213	1.819	2.440	0.834	2.420
2878	17	1	8.20	1	0.45	16	1	5.438	1.954	3.587	1.059	2.078	4.495	2.124	3.216	1.049	2.116
2879	17	1	8.45	1.25	0.45	16	1.25	5.404	1.774	3.274	1.122	1.880	6.301	2.310	4.303	1.249	1.796
2880	17	1	9.20	2	0.45	16	2	4.856	1.483	2.505	1.231	1.411	11.564	3.031	7.039	1.589	1.345
2881	17	1	9.70	2.5	0.45	16	2.5	4.488	1.409	2.178	1.287	1.196	14.926	3.573	8.693	1.731	1.273
2882	17	1	10.20	3	0.45	16	3	4.156	1.356	1.925	1.332	1.028	17.793	4.081	10.051	1.848	1.419
2883	17	1	11.20	4	0.45	16	4	3.697	1.294	1.594	1.442	0.793	22.527	4.844	12.391	2.046	1.773
2884	17	1	12.20	5	0.45	16	5	3.387	1.278	1.408	1.645	0.649	26.002	5.401	14.433	2.270	1.935

STP-PT-074: Local Stress in Nozzles, Shells and Formed Heads from External Heads

Model								Secondary (inside) Stress Factors									
	OD	T	od	t	d/D	D/T	t/T	Branch					Header				
								Axial	In-Plane	Out-of-Plane	Torsional	Pressure	Axial	In-Plane	Out-of-Plane	Torsional	Pressure
2885	17	1	13.20	6	0.45	16	6	3.160	1.289	1.308	1.939	0.563	28.344	5.828	16.224	2.536	1.976
2886	17	1	14.20	7	0.45	16	7	3.011	1.336	1.308	2.322	0.535	29.794	6.348	17.908	2.832	1.943
2891	25	1	10.90	0.1	0.45	24	0.1	2.642	1.713	2.886	1.115	7.073	0.780	0.596	0.899	0.342	5.332
2892	25	1	11.05	0.25	0.45	24	0.25	6.640	3.408	6.408	1.038	3.764	1.762	1.278	1.773	0.528	4.155
2893	25	1	11.30	0.5	0.45	24	0.5	9.350	3.759	7.454	0.960	3.291	2.964	1.956	2.686	0.756	3.298
2894	25	1	11.55	0.75	0.45	24	0.75	9.602	3.261	6.819	1.070	2.746	5.205	2.449	3.830	0.995	2.782
2895	25	1	11.80	1	0.45	24	1	9.113	2.825	6.000	1.199	2.453	7.852	2.898	5.466	1.298	2.390
2896	25	1	12.05	1.25	0.45	24	1.25	8.799	2.530	5.407	1.296	2.183	11.242	3.223	7.373	1.599	2.007
2897	25	1	12.80	2	0.45	24	2	7.567	2.121	4.078	1.455	1.654	20.735	4.565	12.174	2.184	1.471
2898	25	1	13.30	2.5	0.45	24	2.5	6.896	1.974	3.507	1.531	1.421	26.474	5.249	14.858	2.390	1.391
2899	25	1	13.80	3	0.45	24	3	6.331	1.852	3.073	1.562	1.234	31.728	5.907	17.200	2.541	1.513
2900	25	1	14.80	4	0.45	24	4	5.434	1.714	2.468	1.586	0.958	40.868	7.056	21.105	2.804	2.024
2901	25	1	15.80	5	0.45	24	5	4.764	1.638	2.087	1.617	0.776	48.599	8.031	24.410	3.013	2.344
2902	25	1	16.80	6	0.45	24	6	4.433	1.589	1.881	1.695	0.651	56.195	8.779	27.973	3.217	2.535
2903	25	1	17.80	7	0.45	24	7	4.191	1.580	1.742	1.826	0.561	61.876	9.531	30.939	3.493	2.639
2904	25	1	18.30	7.5	0.45	24	7.5	4.110	1.583	1.697	1.920	0.526	64.249	9.879	32.358	3.653	2.663
2905	25	1	18.80	8	0.45	24	8	4.029	1.592	1.661	2.018	0.501	66.377	10.227	33.730	3.830	2.672
2906	25	1	19.80	9	0.45	24	9	3.884	1.623	1.607	2.272	0.464	69.594	10.898	36.241	4.191	2.644
2907	25	1	20.80	10	0.45	24	10	3.829	1.690	1.653	2.595	0.437	71.973	11.471	38.700	4.583	2.578
2908	33	1	14.50	0.1	0.45	32	0.1	3.720	2.217	4.011	1.165	6.902	0.971	0.700	1.101	0.370	5.832
2909	33	1	14.65	0.25	0.45	32	0.25	9.812	4.319	9.186	1.031	4.970	2.168	1.523	2.293	0.571	4.537
2910	33	1	14.90	0.5	0.45	32	0.5	13.678	4.714	10.709	1.037	4.195	3.852	2.331	3.535	0.823	3.646
2911	33	1	15.15	0.75	0.45	32	0.75	13.791	4.175	9.720	1.210	3.287	7.403	2.927	5.366	1.119	3.137
2912	33	1	15.40	1	0.45	32	1	12.883	3.614	8.502	1.343	2.786	11.563	3.486	7.929	1.480	2.710
2913	33	1	15.65	1.25	0.45	32	1.25	12.218	3.218	7.613	1.431	2.415	16.490	4.164	10.702	1.842	2.257
2914	33	1	16.40	2	0.45	32	2	10.140	2.721	5.687	1.652	1.825	30.511	6.077	17.940	2.649	1.555
2915	33	1	16.90	2.5	0.45	32	2.5	9.130	2.521	4.871	1.663	1.547	38.533	6.966	21.732	2.963	1.422
2916	33	1	17.40	3	0.45	32	3	8.341	2.403	4.278	1.719	1.353	46.306	7.972	25.271	3.169	1.555
2917	33	1	18.40	4	0.45	32	4	7.133	2.168	3.436	1.741	1.061	60.319	9.613	31.275	3.472	2.153
2918	33	1	19.40	5	0.45	32	5	6.238	2.018	2.874	1.731	0.860	72.492	10.906	36.229	3.739	2.570
2919	33	1	20.40	6	0.45	32	6	5.574	1.877	2.499	1.733	0.719	83.451	12.060	40.662	3.964	2.866
2920	33	1	21.40	7	0.45	32	7	5.069	1.818	2.240	1.748	0.617	92.632	12.946	44.489	4.234	3.061
2921	33	1	21.90	7.5	0.45	32	7.5	4.860	1.791	2.145	1.782	0.577	96.974	13.439	46.395	4.376	3.135
2922	33	1	22.40	8	0.45	32	8	4.700	1.776	2.059	1.805	0.543	100.777	13.803	48.142	4.565	3.189
2923	33	1	23.40	9	0.45	32	9	4.578	1.765	1.969	1.899	0.484	110.410	14.649	52.881	4.977	3.280
2924	33	1	24.40	10	0.45	32	10	4.452	1.773	1.924	2.050	0.439	117.083	15.429	56.598	5.372	3.312
2925	41	1	18.10	0.1	0.45	40	0.1	4.903	2.625	5.115	1.172	7.151	1.173	0.771	1.268	0.383	6.131
2926	41	1	18.25	0.25	0.45	40	0.25	13.058	5.084	11.952	1.007	6.211	2.534	1.682	2.643	0.598	4.826

STP-PT-074: Local Stress in Nozzles, Shells and Formed Heads from External Heads

Model								Secondary (inside) Stress Factors									
	OD	T	od	t	d/D	D/T	t/T	Branch					Header				
								Axial	In-Plane	Out-of-Plane	Torsional	Pressure	Axial	In-Plane	Out-of-Plane	Torsional	Pressure
2927	41	1	18.50	0.5	0.45	40	0.5	18.083	5.555	13.985	1.135	5.049	4.941	2.584	4.116	0.872	3.930
2928	41	1	18.75	0.75	0.45	40	0.75	18.013	5.003	12.640	1.340	3.795	9.654	3.313	6.941	1.249	3.443
2929	41	1	19.00	1	0.45	40	1	16.649	4.341	11.017	1.476	3.096	15.197	3.998	10.351	1.651	3.017
2930	41	1	19.25	1.25	0.45	40	1.25	15.583	3.850	9.815	1.555	2.622	21.564	5.002	13.994	2.055	2.533
2931	41	1	20.00	2	0.45	40	2	12.606	3.292	7.270	1.763	1.928	39.628	7.301	23.566	3.033	1.660
2932	41	1	20.50	2.5	0.45	40	2.5	11.222	3.133	6.223	1.860	1.663	50.620	8.624	28.995	3.469	1.522
2933	41	1	21.00	3	0.45	40	3	10.215	2.928	5.473	1.824	1.430	60.647	9.968	33.668	3.708	1.577
2934	41	1	22.00	4	0.45	40	4	8.723	2.682	4.431	1.857	1.131	79.398	12.105	41.952	4.068	2.220
2935	41	1	23.00	5	0.45	40	5	7.630	2.503	3.719	1.851	0.921	96.210	13.804	48.890	4.410	2.702
2936	41	1	24.00	6	0.45	40	6	6.792	2.323	3.210	1.824	0.770	111.811	15.337	55.096	4.669	3.074
2937	41	1	25.00	7	0.45	40	7	6.150	2.187	2.847	1.798	0.658	125.374	16.493	60.390	4.987	3.345
2938	41	1	25.50	7.5	0.45	40	7.5	5.890	2.117	2.708	1.803	0.614	131.622	17.001	62.847	5.157	3.453
2939	41	1	26.00	8	0.45	40	8	5.655	2.048	2.588	1.793	0.576	137.876	17.612	65.354	5.360	3.552
2940	41	1	27.00	9	0.45	40	9	5.237	1.975	2.382	1.837	0.511	148.732	18.482	69.848	5.772	3.696
2941	41	1	28.00	10	0.45	40	10	4.892	1.913	2.215	1.902	0.462	158.415	19.353	74.131	6.180	3.793
2942	51	1	22.60	0.1	0.45	50	0.1	6.453	3.056	6.505	1.161	7.167	1.406	0.851	1.460	0.400	6.510
2943	51	1	22.75	0.25	0.45	50	0.25	17.165	5.919	15.426	0.982	7.726	3.044	1.875	3.128	0.624	5.198
2944	51	1	23.00	0.5	0.45	50	0.5	23.605	6.637	18.115	1.268	6.031	6.176	2.904	4.990	0.926	4.293
2945	51	1	23.25	0.75	0.45	50	0.75	23.244	5.965	16.305	1.503	4.381	12.598	3.748	9.006	1.377	3.828
2946	51	1	23.50	1	0.45	50	1	21.277	5.177	14.165	1.632	3.458	19.868	4.776	13.517	1.819	3.408
2947	51	1	23.75	1.25	0.45	50	1.25	19.692	4.666	12.569	1.700	2.862	28.013	6.047	18.276	2.234	2.907
2948	51	1	24.50	2	0.45	50	2	15.575	3.931	9.236	1.894	2.037	51.067	9.040	30.902	3.377	1.796
2949	51	1	25.00	2.5	0.45	50	2.5	13.734	3.740	7.891	1.970	1.747	65.680	10.871	38.451	3.884	1.570
2950	51	1	25.50	3	0.45	50	3	12.377	3.629	6.931	2.039	1.530	79.043	12.460	45.024	4.304	1.588
2951	51	1	26.50	4	0.45	50	4	10.586	3.305	5.670	1.974	1.194	102.260	15.074	55.613	4.770	2.256
2952	51	1	27.50	5	0.45	50	5	9.290	3.042	4.810	1.958	0.977	125.136	17.479	65.480	5.128	2.794
2953	51	1	28.50	6	0.45	50	6	8.294	2.935	4.178	1.942	0.819	145.726	19.319	73.843	5.488	3.216
2954	51	1	29.50	7	0.45	50	7	7.501	2.702	3.703	1.917	0.698	164.712	20.855	81.256	5.907	3.555
2955	51	1	30.00	7.5	0.45	50	7.5	7.176	2.649	3.516	1.903	0.651	173.582	21.559	84.663	6.115	3.698
2956	51	1	30.50	8	0.45	50	8	6.824	2.544	3.321	1.872	0.609	182.654	22.350	88.180	6.356	3.834
2957	51	1	31.50	9	0.45	50	9	6.350	2.381	3.055	1.878	0.539	198.692	23.604	94.295	6.821	4.051
2958	51	1	32.50	10	0.45	50	10	5.882	2.289	2.809	1.883	0.482	213.435	24.729	100.045	7.284	4.222
2959	61	1	27.10	0.1	0.45	60	0.1	7.994	3.421	7.866	1.137	7.213	1.634	0.930	1.706	0.409	6.848
2960	61	1	27.25	0.25	0.45	60	0.25	21.199	6.641	18.849	0.989	9.154	3.535	2.030	3.652	0.646	5.544
2961	61	1	27.50	0.5	0.45	60	0.5	29.030	7.653	22.227	1.413	6.937	7.535	3.186	6.045	1.001	4.636
2962	61	1	27.75	0.75	0.45	60	0.75	28.334	6.862	19.952	1.668	4.927	15.493	4.126	11.074	1.493	4.189
2963	61	1	28.00	1	0.45	60	1	25.754	5.999	17.291	1.786	3.798	24.407	5.587	16.670	1.952	3.774
2964	61	1	28.25	1.25	0.45	60	1.25	23.644	5.435	15.296	1.839	3.093	34.231	7.030	22.540	2.397	3.262

STP-PT-074: Local Stress in Nozzles, Shells and Formed Heads from External Heads

Model								Secondary (inside) Stress Factors									
	OD	T	od	t	d/D	D/T	t/T	Branch					Header				
								Axial	In-Plane	Out-of-Plane	Torsional	Pressure	Axial	In-Plane	Out-of-Plane	Torsional	Pressure
2965	61	1	29.00	2	0.45	60	2	18.407	4.518	11.173	2.010	2.144	62.439	10.883	38.522	3.579	2.005
2966	61	1	29.50	2.5	0.45	60	2.5	16.172	4.293	9.558	2.088	1.826	79.475	12.820	47.643	4.239	1.664
2967	61	1	30.00	3	0.45	60	3	14.497	4.186	8.384	2.136	1.595	95.540	14.765	55.909	4.759	1.629
2968	61	1	31.00	4	0.45	60	4	12.409	3.904	6.922	2.101	1.241	123.699	17.871	69.345	5.365	2.264
2969	61	1	32.00	5	0.45	60	5	10.981	3.735	5.956	2.090	1.023	151.739	20.814	82.069	5.801	2.847
2970	61	1	33.00	6	0.45	60	6	9.951	3.499	5.256	2.061	0.861	177.464	23.109	92.983	6.300	3.298
2971	61	1	34.00	7	0.45	60	7	8.990	3.245	4.681	2.013	0.732	201.555	25.167	102.682	6.775	3.661
2972	61	1	34.50	7.5	0.45	60	7.5	8.578	3.180	4.446	1.981	0.685	212.987	26.110	107.164	7.034	3.827
2973	61	1	35.00	8	0.45	60	8	8.206	3.049	4.209	1.969	0.639	224.704	27.132	111.754	7.320	3.989
2974	61	1	36.00	9	0.45	60	9	7.582	2.885	3.868	1.933	0.565	245.678	28.732	119.726	7.846	4.257
2975	61	1	37.00	10	0.45	60	10	6.992	2.691	3.530	1.953	0.505	265.258	30.136	127.151	8.347	4.481
2976	71	1	31.60	0.1	0.45	70	0.1	9.502	3.737	9.203	1.107	8.056	1.856	0.987	1.983	0.414	7.157
2977	71	1	31.75	0.25	0.45	70	0.25	25.130	7.327	22.208	1.049	10.515	4.324	2.160	4.305	0.663	5.864
2978	71	1	32.00	0.5	0.45	70	0.5	34.289	8.605	26.293	1.570	7.766	8.885	3.449	7.050	1.074	4.949
2979	71	1	32.25	0.75	0.45	70	0.75	33.238	7.752	23.552	1.834	5.423	18.303	4.604	13.122	1.592	4.518
2980	71	1	32.50	1	0.45	70	1	30.029	6.826	20.367	1.937	4.111	28.774	6.352	19.792	2.073	4.109
2981	71	1	32.75	1.25	0.45	70	1.25	27.414	6.164	17.984	1.973	3.309	40.490	8.222	26.964	2.548	3.622
2982	71	1	33.50	2	0.45	70	2	21.130	5.069	13.088	2.114	2.242	72.714	12.453	45.773	3.774	2.243
2983	71	1	34.00	2.5	0.45	70	2.5	18.472	4.808	11.170	2.181	1.896	92.395	14.674	56.720	4.524	1.741
2984	71	1	34.50	3	0.45	70	3	16.624	4.683	9.867	2.227	1.651	111.012	16.969	66.705	5.136	1.686
2985	71	1	35.50	4	0.45	70	4	14.050	4.486	8.105	2.287	1.312	146.013	20.996	84.498	6.023	2.293
2986	71	1	36.50	5	0.45	70	5	12.693	4.213	7.088	2.191	1.061	176.442	23.948	98.628	6.458	2.854
2987	71	1	37.50	6	0.45	70	6	11.547	4.034	6.325	2.190	0.893	206.814	26.835	112.170	7.075	3.321
2988	71	1	38.50	7	0.45	70	7	10.611	3.806	5.728	2.126	0.766	235.542	29.374	124.317	7.623	3.722
2989	71	1	39.00	7.5	0.45	70	7.5	10.009	3.692	5.361	2.103	0.713	249.289	30.534	129.920	7.920	3.900
2990	71	1	39.50	8	0.45	70	8	9.713	3.544	5.179	2.088	0.668	263.390	31.787	135.650	8.255	4.076
2991	71	1	40.50	9	0.45	70	9	8.961	3.311	4.729	2.045	0.590	289.044	33.758	145.718	8.847	4.374
2992	71	1	41.50	10	0.45	70	10	8.313	3.155	4.359	1.979	0.524	313.322	35.513	154.995	9.408	4.634
2993	81	1	36.10	0.1	0.45	80	0.1	10.927	4.032	10.526	1.089	9.104	2.070	1.053	2.272	0.424	7.485
2994	81	1	36.25	0.25	0.45	80	0.25	28.878	7.978	25.506	1.119	11.722	5.052	2.281	4.945	0.685	6.181
2995	81	1	36.50	0.5	0.45	80	0.5	39.393	9.487	30.357	1.729	8.532	10.236	3.715	8.035	1.148	5.298
2996	81	1	36.75	0.75	0.45	80	0.75	37.979	8.658	27.147	1.999	5.884	21.204	5.241	15.282	1.694	4.871
2997	81	1	37.00	1	0.45	80	1	34.146	7.616	23.425	2.087	4.404	33.224	7.212	23.055	2.202	4.462
2998	81	1	37.25	1.25	0.45	80	1.25	30.980	6.848	20.612	2.106	3.509	46.129	9.230	31.114	2.678	3.930
2999	81	1	38.00	2	0.45	80	2	23.696	5.597	14.946	2.211	2.337	82.375	13.933	52.923	3.940	2.477
3000	81	1	38.50	2.5	0.45	80	2.5	20.705	5.308	12.765	2.280	1.965	104.479	16.487	65.673	4.757	1.893
3001	81	1	39.00	3	0.45	80	3	18.612	5.139	11.273	2.319	1.704	125.411	19.053	77.353	5.452	1.733
3002	81	1	40.00	4	0.45	80	4	15.900	4.992	9.390	2.364	1.351	165.750	23.833	98.816	6.485	2.299



STP-PT-074: Local Stress in Nozzles, Shells and Formed Heads from External Heads

Model	Secondary (inside) Stress Factors																
	OD	T	od	t	d/D	D/T	t/T	Branch					Header				
								Axial	In-Plane	Out-of-Plane	Torsional	Pressure	Axial	In-Plane	Out-of-Plane	Torsional	Pressure
3003	81	1	41.00	5	0.45	80	5	14.448	4.819	8.227	2.307	1.092	199.301	27.028	115.107	7.108	2.839
3004	81	1	42.00	6	0.45	80	6	13.282	4.553	7.448	2.302	0.922	233.938	30.440	131.317	7.817	3.312
3005	81	1	43.00	7	0.45	80	7	12.219	4.397	6.754	2.252	0.794	266.907	33.438	145.945	8.444	3.730
3006	81	1	43.50	7.5	0.45	80	7.5	11.756	4.224	6.477	2.238	0.739	283.624	34.986	153.187	8.801	3.926
3007	81	1	44.00	8	0.45	80	8	11.304	4.072	6.191	2.214	0.692	299.189	36.290	159.701	9.144	4.103
3008	81	1	45.00	9	0.45	80	9	10.494	3.827	5.699	2.120	0.610	329.126	38.652	171.938	9.800	4.424
3009	81	1	46.00	10	0.45	80	10	9.793	3.556	5.271	2.097	0.546	357.701	40.777	183.181	10.426	4.709
3010	91	1	40.60	0.1	0.45	90	0.1	12.366	4.281	11.848	1.055	10.243	2.230	1.125	2.393	0.429	7.844
3011	91	1	40.75	0.25	0.45	90	0.25	32.586	8.672	28.813	1.214	12.948	5.517	2.454	5.442	0.705	6.543
3012	91	1	41.00	0.5	0.45	90	0.5	44.267	10.352	34.331	1.894	9.253	11.585	3.897	9.094	1.200	5.578
3013	91	1	41.25	0.75	0.45	90	0.75	42.470	9.515	30.657	2.165	6.314	23.816	5.774	17.286	1.766	5.159
3014	91	1	41.50	1	0.45	90	1	38.049	8.359	26.422	2.235	4.678	37.235	7.980	26.107	2.294	4.755
3015	91	1	41.75	1.25	0.45	90	1.25	34.403	7.497	23.218	2.238	3.701	51.524	10.190	35.230	2.787	4.219
3016	91	1	42.50	2	0.45	90	2	26.167	6.087	16.784	2.309	2.429	91.439	15.334	59.942	4.123	2.704
3017	91	1	43.00	2.5	0.45	90	2.5	22.848	5.744	14.323	2.357	2.030	115.774	18.221	74.476	4.961	2.052
3018	91	1	43.50	3	0.45	90	3	20.619	5.585	12.691	2.409	1.756	138.868	21.065	87.858	5.736	1.774
3019	91	1	44.50	4	0.45	90	4	17.676	5.460	10.614	2.435	1.386	183.407	26.337	112.550	6.995	2.288
3020	91	1	45.50	5	0.45	90	5	15.815	5.285	9.335	2.477	1.142	224.786	30.768	134.093	7.987	2.840
3021	91	1	46.50	6	0.45	90	6	14.882	5.069	8.483	2.374	0.948	259.046	33.906	150.347	8.530	3.291
3022	91	1	47.50	7	0.45	90	7	13.695	4.861	7.717	2.369	0.817	296.821	37.555	168.009	9.231	3.720
3023	91	1	48.00	7.5	0.45	90	7.5	13.373	4.716	7.488	2.329	0.762	314.718	39.152	176.083	9.617	3.912
3024	91	1	48.50	8	0.45	90	8	12.826	4.526	7.166	2.353	0.712	332.217	40.643	183.774	9.994	4.093
3025	91	1	49.50	9	0.45	90	9	12.069	4.287	6.685	2.286	0.629	366.158	43.408	198.252	10.721	4.434
3026	91	1	50.50	10	0.45	90	10	11.280	4.083	6.194	2.234	0.564	398.582	45.882	211.635	11.413	4.734
3027	101	1	45.10	0.1	0.45	100	0.1	13.725	4.528	13.101	1.024	11.430	2.524	1.175	2.687	0.426	8.125
3028	101	1	45.25	0.25	0.45	100	0.25	36.098	9.326	32.042	1.311	14.054	6.224	2.582	5.956	0.723	6.834
3029	101	1	45.50	0.5	0.45	100	0.5	48.947	11.250	38.253	2.061	9.932	12.884	4.105	10.131	1.255	5.842
3030	101	1	45.75	0.75	0.45	100	0.75	46.782	10.324	34.131	2.329	6.720	26.349	6.278	19.281	1.831	5.430
3031	101	1	46.00	1	0.45	100	1	41.774	9.067	29.375	2.380	4.938	41.069	8.717	29.115	2.378	5.029
3032	101	1	46.25	1.25	0.45	100	1.25	37.617	8.117	25.750	2.367	3.884	56.606	11.106	39.245	2.891	4.490
3033	101	1	47.00	2	0.45	100	2	28.526	6.571	18.577	2.404	2.517	100.020	16.665	66.862	4.319	2.925
3034	101	1	47.50	2.5	0.45	100	2.5	24.972	6.200	15.880	2.449	2.095	126.467	19.904	83.182	5.235	2.212
3035	101	1	48.00	3	0.45	100	3	22.521	6.032	14.048	2.488	1.805	152.322	23.226	98.722	6.056	1.808
3036	101	1	49.00	4	0.45	100	4	19.464	5.893	11.825	2.508	1.419	199.937	28.737	126.127	7.479	2.276
3037	101	1	50.00	5	0.45	100	5	17.486	5.720	10.455	2.541	1.168	245.025	33.590	150.629	8.591	2.816
3038	101	1	51.00	6	0.45	100	6	16.631	5.541	9.593	2.485	0.970	282.496	37.236	169.285	9.205	3.265
3039	101	1	52.00	7	0.45	100	7	15.563	5.253	8.876	2.421	0.838	323.917	41.360	189.603	9.996	3.693
3040	101	1	52.50	7.5	0.45	100	7.5	15.017	5.138	8.530	2.435	0.782	343.641	43.148	198.908	10.402	3.887

STP-PT-074: Local Stress in Nozzles, Shells and Formed Heads from External Heads

Model									Secondary (inside) Stress Factors								
	OD	T	od	t	d/D	D/T	t/T	Branch					Header				
								Axial	In-Plane	Out-of-Plane	Torsional	Pressure	Axial	In-Plane	Out-of-Plane	Torsional	Pressure
3041	101	1	53.00	8	0.45	100	8	14.512	5.024	8.213	2.453	0.732	362.959	44.851	207.827	10.817	4.072
3042	101	1	54.00	9	0.45	100	9	13.593	4.762	7.623	2.378	0.646	400.476	48.004	224.629	11.609	4.414
3043	101	1	55.00	10	0.45	100	10	12.719	4.474	7.097	2.325	0.579	436.609	50.860	240.223	12.361	4.726
3044	251	1	112.60	0.1	0.45	250	0.1	29.546	7.584	30.357	1.211	25.000	5.710	1.944	6.228	0.520	12.155
3045	251	1	112.75	0.25	0.45	250	0.25	79.002	17.614	76.947	2.929	26.072	13.042	4.200	12.861	1.009	10.438
3046	251	1	113.00	0.5	0.45	250	0.5	106.540	21.782	93.726	4.395	17.327	28.566	7.712	24.036	1.865	8.949
3047	251	1	113.25	0.75	0.45	250	0.75	99.380	19.788	83.046	4.532	11.212	58.058	12.616	47.688	2.966	8.510
3048	251	1	113.50	1	0.45	250	1	87.022	17.367	70.781	4.285	7.872	88.309	17.430	71.697	4.152	8.109
3049	251	1	113.75	1.25	0.45	250	1.25	76.974	15.580	61.347	4.046	5.980	118.630	22.043	95.848	5.288	7.520
3050	251	1	114.50	2	0.45	250	2	58.368	12.622	43.875	3.658	3.629	202.657	34.324	163.495	8.042	5.503
3051	251	1	115.00	2.5	0.45	250	2.5	52.355	12.005	37.741	3.572	2.941	253.756	40.984	204.899	9.457	4.339
3052	251	1	115.50	3	0.45	250	3	48.815	11.748	33.894	3.546	2.475	303.205	47.314	244.871	10.797	3.507
3053	251	1	116.50	4	0.45	250	4	44.900	11.445	29.545	3.490	1.865	395.002	58.030	318.425	13.249	2.526
3054	251	1	117.50	5	0.45	250	5	42.514	11.169	27.147	3.439	1.486	482.576	67.793	387.170	15.717	2.609
3055	251	1	118.50	6	0.45	250	6	40.577	10.993	25.494	3.386	1.234	567.071	76.952	451.925	17.793	2.973
3056	251	1	119.50	7	0.45	250	7	38.823	10.645	24.155	3.324	1.056	649.521	85.667	513.613	19.631	3.318
3057	251	1	120.00	7.5	0.45	250	7.5	37.910	10.514	23.529	3.313	0.985	690.171	89.917	543.435	20.517	3.484
3058	251	1	120.50	8	0.45	250	8	37.087	10.370	22.948	3.313	0.924	730.468	94.020	572.675	21.305	3.647
3059	251	1	121.50	9	0.45	250	9	35.466	10.111	21.893	3.306	0.822	809.782	102.094	629.149	22.824	3.960
3060	251	1	122.50	10	0.45	250	10	34.136	9.798	20.942	3.293	0.741	889.435	110.390	684.775	24.263	4.270
3061	501	1	225.10	0.1	0.45	500	0.1	49.667	11.649	54.608	1.974	40.591	9.631	3.181	10.861	0.699	17.100
3062	501	1	225.25	0.25	0.45	500	0.25	136.058	27.114	143.202	5.031	38.999	21.521	6.761	22.071	1.504	14.638
3063	501	1	225.50	0.5	0.45	500	0.5	183.237	34.209	176.060	7.360	25.431	50.017	12.638	45.340	2.917	12.474
3064	501	1	225.75	0.75	0.45	500	0.75	168.773	31.784	155.186	7.281	16.218	100.286	19.975	89.846	4.778	11.970
3065	501	1	226.00	1	0.45	500	1	146.660	27.933	131.685	6.676	11.193	150.370	28.288	134.128	6.688	11.549
3066	501	1	226.25	1.25	0.45	500	1.25	129.033	25.050	113.564	6.164	8.383	199.588	36.015	177.988	8.482	10.893
3067	501	1	227.00	2	0.45	500	2	99.434	20.796	81.767	5.458	4.961	336.265	55.030	302.215	12.754	8.407
3068	501	1	227.50	2.5	0.45	500	2.5	91.221	19.893	71.400	5.325	4.005	419.905	65.245	379.459	14.931	6.814
3069	501	1	228.00	3	0.45	500	3	87.054	19.465	65.340	5.245	3.364	499.345	74.280	453.320	16.789	5.597
3070	501	1	229.00	4	0.45	500	4	83.242	19.187	59.035	5.103	2.515	649.666	90.071	593.601	20.531	4.124
3071	501	1	230.00	5	0.45	500	5	80.971	18.717	55.762	4.942	1.970	792.423	104.316	726.425	24.342	3.269
3072	501	1	231.00	6	0.45	500	6	78.635	18.134	53.298	4.776	1.601	930.382	117.914	853.897	27.832	2.969
3073	501	1	232.00	7	0.45	500	7	76.156	17.530	51.175	4.664	1.335	1065.325	131.149	977.473	30.983	3.237
3074	501	1	232.50	7.5	0.45	500	7.5	74.894	17.345	50.083	4.582	1.232	1132.166	137.609	1038.197	32.510	3.367
3075	501	1	233.00	8	0.45	500	8	73.844	17.130	49.281	4.494	1.141	1198.269	144.317	1098.074	33.830	3.494
3076	501	1	234.00	9	0.45	500	9	71.157	16.563	47.283	4.432	0.994	1332.352	158.168	1218.237	36.510	3.753
3077	501	1	235.00	10	0.45	500	10	68.830	16.007	45.562	4.284	0.881	1462.235	171.730	1333.375	38.940	3.993
3079	751	1	337.75	0.25	0.45	750	0.25	181.517	34.136	199.980	6.765	49.099	27.599	8.796	29.078	1.925	17.790

STP-PT-074: Local Stress in Nozzles, Shells and Formed Heads from External Heads

Model								Secondary (inside) Stress Factors									
	OD	T	od	t	d/D	D/T	t/T	Branch					Header				
								Axial	In-Plane	Out-of-Plane	Torsional	Pressure	Axial	In-Plane	Out-of-Plane	Torsional	Pressure
3080	751	1	338.00	0.5	0.45	750	0.5	244.251	44.714	247.286	9.657	31.510	67.938	16.339	64.419	3.810	15.136
3081	751	1	338.25	0.75	0.45	750	0.75	223.869	41.318	217.565	9.415	20.017	134.230	26.442	126.626	6.239	14.578
3082	751	1	338.50	1	0.45	750	1	194.110	36.242	184.309	8.550	13.738	199.707	37.094	188.109	8.702	14.159
3083	751	1	338.75	1.25	0.45	750	1.25	170.831	32.429	158.882	7.848	10.230	263.780	46.879	248.765	10.958	13.449
3084	751	1	339.50	2	0.45	750	2	133.881	27.524	115.371	6.959	6.010	441.218	70.636	420.350	16.284	10.624
3085	751	1	340.00	2.5	0.45	750	2.5	125.019	26.693	102.153	6.831	4.845	549.935	83.310	527.818	18.968	8.753
3086	751	1	340.50	3	0.45	750	3	121.215	26.384	94.753	6.767	4.068	653.716	94.178	630.919	21.205	7.156
3087	751	1	341.50	4	0.45	750	4	118.565	26.070	87.749	6.661	3.040	849.167	113.109	827.188	26.425	5.333
3088	751	1	342.50	5	0.45	750	5	118.581	25.394	86.476	6.458	2.381	1034.516	129.992	1013.921	31.290	4.234
3089	751	1	343.50	6	0.45	750	6	117.639	24.751	85.351	6.249	1.928	1213.244	149.557	1194.143	35.716	3.476
3090	751	1	344.50	7	0.45	750	7	115.421	23.869	83.443	6.018	1.600	1387.504	168.709	1369.033	39.909	3.067
3091	751	1	345.00	7.5	0.45	750	7.5	114.040	23.290	82.118	5.910	1.475	1473.421	178.162	1454.987	41.869	3.174
3092	751	1	345.50	8	0.45	750	8	112.628	22.919	81.219	5.801	1.360	1559.458	187.837	1541.007	43.672	3.281
3093	751	1	346.50	9	0.45	750	9	109.465	22.198	78.484	5.619	1.179	1728.600	205.824	1709.365	47.234	3.484
3094	751	1	347.50	10	0.45	750	10	106.074	21.287	75.944	5.438	1.034	1895.244	223.444	1874.428	50.556	3.680
3096	1001	1	450.25	0.25	0.45	1000	0.25	219.420	41.197	250.415	8.274	57.769	32.577	10.676	35.100	2.301	20.559
3097	1001	1	450.50	0.5	0.45	1000	0.5	294.638	53.537	310.240	11.560	36.832	83.199	19.326	81.731	4.587	17.339
3098	1001	1	450.75	0.75	0.45	1000	0.75	269.238	49.322	272.667	11.182	23.217	162.416	31.940	159.380	7.485	16.737
3099	1001	1	451.00	1	0.45	1000	1	233.297	43.257	230.912	10.110	15.885	240.632	44.471	236.014	10.379	16.333
3100	1001	1	451.25	1.25	0.45	1000	1.25	205.495	38.722	198.971	9.255	11.791	316.957	55.905	311.345	12.999	15.607
3101	1001	1	452.00	2	0.45	1000	2	163.440	33.302	145.881	8.297	6.890	527.622	83.411	524.413	19.139	12.490
3102	1001	1	452.50	2.5	0.45	1000	2.5	154.593	32.735	130.470	8.206	5.549	657.271	97.841	658.236	22.211	10.402
3103	1001	1	453.00	3	0.45	1000	3	151.659	32.681	122.386	8.203	4.657	780.554	110.162	786.632	25.183	8.572
3104	1001	1	454.00	4	0.45	1000	4	151.215	32.752	116.620	8.101	3.481	1013.559	131.006	1032.423	31.408	6.302
3105	1001	1	455.00	5	0.45	1000	5	154.696	32.180	118.622	7.905	2.725	1233.475	154.933	1265.902	37.091	4.995
3106	1001	1	456.00	6	0.45	1000	6	154.945	31.229	118.499	7.643	2.203	1448.695	178.973	1495.232	42.515	4.094
3107	1001	1	457.00	7	0.45	1000	7	153.486	30.217	117.242	7.357	1.829	1655.670	201.915	1715.717	47.468	3.444
3108	1001	1	457.50	7.5	0.45	1000	7.5	151.963	29.455	115.917	7.193	1.679	1757.875	213.094	1824.970	49.839	3.189
3109	1001	1	458.00	8	0.45	1000	8	150.526	29.276	114.586	7.083	1.549	1859.075	224.176	1931.815	52.091	3.190
3110	1001	1	459.00	9	0.45	1000	9	146.842	27.899	111.301	6.831	1.337	2059.182	245.825	2144.687	56.519	3.365
3111	1001	1	460.00	10	0.45	1000	10	142.997	27.133	107.860	6.578	1.171	2257.610	266.885	2355.519	60.627	3.535
3113	1251	1	562.75	0.25	0.45	1250	0.25	252.190	47.358	295.847	9.590	65.563	36.428	12.246	39.804	2.667	23.064
3114	1251	1	563.00	0.5	0.45	1250	0.5	338.529	61.418	367.802	13.285	41.618	96.801	22.564	97.985	5.309	19.370
3115	1251	1	563.25	0.75	0.45	1250	0.75	308.546	56.294	322.769	12.696	26.025	187.331	36.868	189.833	8.589	18.694
3116	1251	1	563.50	1	0.45	1250	1	267.268	49.382	273.356	11.447	17.769	276.893	50.999	280.485	11.852	18.292
3117	1251	1	563.75	1.25	0.45	1250	1.25	235.716	44.431	235.787	10.516	13.183	363.233	63.814	368.964	14.823	17.531
3118	1251	1	564.50	2	0.45	1250	2	189.626	38.641	174.132	9.498	7.667	604.154	94.614	620.144	21.689	14.168
3119	1251	1	565.00	2.5	0.45	1250	2.5	181.098	38.285	157.170	9.467	6.170	751.555	110.423	777.847	25.047	11.881

STP-PT-074: Local Stress in Nozzles, Shells and Formed Heads from External Heads

Model								Secondary (inside) Stress Factors									
	OD	T	od	t	d/D	D/T	t/T	Branch					Header				
								Axial	In-Plane	Out-of-Plane	Torsional	Pressure	Axial	In-Plane	Out-of-Plane	Torsional	Pressure
3120	1251	1	565.50	3	0.45	1250	3	179.244	38.603	148.845	9.495	5.179	892.424	123.903	929.797	28.880	9.866
3121	1251	1	566.50	4	0.45	1250	4	181.469	38.804	145.281	9.456	3.871	1158.801	150.475	1220.279	35.869	7.151
3122	1251	1	567.50	5	0.45	1250	5	187.500	38.424	149.742	9.261	3.030	1409.169	178.010	1496.499	42.422	5.665
3123	1251	1	568.50	6	0.45	1250	6	189.665	37.495	151.637	8.969	2.450	1652.277	204.781	1766.548	48.433	4.613
3124	1251	1	569.50	7	0.45	1250	7	188.924	36.372	151.013	8.626	2.032	1887.436	230.514	2026.162	54.163	3.933
3125	1251	1	570.00	7.5	0.45	1250	7.5	187.865	35.699	150.039	8.471	1.865	2002.534	243.043	2153.969	56.869	3.727
3126	1251	1	570.50	8	0.45	1250	8	186.385	35.158	148.776	8.310	1.720	2116.992	255.438	2281.314	59.462	3.535
3127	1251	1	571.50	9	0.45	1250	9	183.069	33.891	145.783	7.985	1.482	2344.617	280.158	2532.994	64.546	3.335
3128	1251	1	572.50	10	0.45	1250	10	178.839	32.744	142.096	7.687	1.296	2568.660	304.308	2783.984	69.207	3.483
3130	1501	1	675.25	0.25	0.45	1500	0.25	280.892	52.966	336.921	10.768	72.691	40.284	13.664	43.688	2.990	25.300
3131	1501	1	675.50	0.5	0.45	1500	0.5	376.749	68.384	419.782	14.792	45.898	108.808	25.471	113.074	5.951	21.194
3132	1501	1	675.75	0.75	0.45	1500	0.75	342.987	62.664	368.569	14.080	28.709	209.727	41.321	218.212	9.580	20.476
3133	1501	1	676.00	1	0.45	1500	1	297.013	54.943	311.785	12.685	19.490	308.548	56.865	320.892	13.196	20.067
3134	1501	1	676.25	1.25	0.45	1500	1.25	262.141	49.399	269.089	11.620	14.422	404.829	70.951	421.860	16.436	19.268
3135	1501	1	677.00	2	0.45	1500	2	212.954	43.607	200.482	10.623	8.366	670.733	104.548	707.352	23.913	15.682
3136	1501	1	677.50	2.5	0.45	1500	2.5	205.053	43.425	182.350	10.611	6.728	835.084	121.387	887.127	27.934	13.213
3137	1501	1	678.00	3	0.45	1500	3	204.404	43.924	174.096	10.679	5.648	990.941	135.546	1059.501	32.205	11.037
3138	1501	1	679.00	4	0.45	1500	4	209.199	44.627	173.071	10.745	4.222	1287.313	168.210	1391.695	39.931	7.884
3139	1501	1	680.00	5	0.45	1500	5	217.719	44.267	179.864	10.546	3.305	1565.725	198.302	1706.337	47.083	6.218
3140	1501	1	681.00	6	0.45	1500	6	221.553	43.357	183.489	10.234	2.672	1834.255	227.585	2011.942	53.813	5.054
3141	1501	1	682.00	7	0.45	1500	7	222.015	42.118	184.191	9.853	2.215	2094.589	255.955	2310.298	60.127	4.470
3142	1501	1	682.50	7.5	0.45	1500	7.5	221.355	41.406	183.763	9.673	2.033	2222.983	270.189	2456.219	63.230	4.236
3143	1501	1	683.00	8	0.45	1500	8	220.200	40.705	182.753	9.480	1.874	2349.361	284.018	2599.760	66.315	4.028
3144	1501	1	684.00	9	0.45	1500	9	216.915	39.189	180.020	9.098	1.613	2600.228	311.862	2888.982	72.091	3.661
3145	1501	1	685.00	10	0.45	1500	10	212.819	38.037	176.313	8.784	1.409	2848.141	339.884	3173.314	77.649	3.452
3148	1751	1	788.00	0.5	0.45	1750	0.5	411.044	74.845	467.022	16.203	49.894	120.197	28.153	127.324	6.553	22.899
3149	1751	1	788.25	0.75	0.45	1750	0.75	373.579	68.315	409.656	15.329	31.077	230.050	45.356	244.164	10.499	22.126
3150	1751	1	788.50	1	0.45	1750	1	323.620	59.967	347.457	13.773	21.053	338.066	62.166	359.433	14.379	21.711
3151	1751	1	788.75	1.25	0.45	1750	1.25	285.886	54.053	299.955	12.648	15.572	442.137	77.413	471.272	17.891	20.882
3152	1751	1	789.50	2	0.45	1750	2	234.219	48.153	225.363	11.627	9.007	731.691	113.459	789.199	25.924	17.078
3153	1751	1	790.00	2.5	0.45	1750	2.5	227.025	48.205	206.231	11.671	7.242	911.703	131.461	989.084	30.570	14.449
3154	1751	1	790.50	3	0.45	1750	3	227.601	48.870	198.293	11.794	6.078	1080.709	148.399	1180.429	35.228	12.118
3155	1751	1	791.50	4	0.45	1750	4	234.607	49.750	199.653	11.866	4.545	1402.891	184.024	1548.472	43.553	8.556
3156	1751	1	792.50	5	0.45	1750	5	245.488	49.649	208.952	11.726	3.558	1707.760	216.820	1901.405	51.365	6.739
3157	1751	1	793.50	6	0.45	1750	6	251.057	48.679	214.347	11.378	2.876	2000.409	248.982	2241.185	58.953	5.575
3158	1751	1	794.50	7	0.45	1750	7	252.711	47.174	216.510	10.975	2.384	2282.729	280.494	2571.078	66.131	4.960
3159	1751	1	795.00	7.5	0.45	1750	7.5	252.483	46.494	216.380	10.764	2.188	2424.200	296.431	2734.977	69.611	4.704
3160	1751	1	795.50	8	0.45	1750	8	251.731	45.770	216.036	10.547	2.017	2561.401	311.917	2896.842	73.017	4.477

STP-PT-074: Local Stress in Nozzles, Shells and Formed Heads from External Heads

Model	Secondary (inside) Stress Factors																
	OD	T	od	t	d/D	D/T	t/T	Branch					Header				
								Axial	In-Plane	Out-of-Plane	Torsional	Pressure	Axial	In-Plane	Out-of-Plane	Torsional	Pressure
3161	1751	1	796.50	9	0.45	1750	9	249.124	44.345	213.888	10.169	1.734	2840.953	343.675	3226.768	79.583	4.082
3162	1751	1	797.50	10	0.45	1750	10	244.970	42.945	210.149	9.785	1.513	3111.664	373.968	3544.253	85.782	3.755
3165	2001	1	900.50	0.5	0.45	2000	0.5	441.977	80.790	510.879	17.482	53.647	130.588	30.648	140.792	7.101	24.496
3166	2001	1	900.75	0.75	0.45	2000	0.75	401.293	73.723	448.242	16.510	33.362	248.997	49.146	269.161	11.344	23.668
3167	2001	1	901.00	1	0.45	2000	1	347.515	64.702	380.093	14.799	22.559	364.738	67.125	395.128	15.494	23.252
3168	2001	1	901.25	1.25	0.45	2000	1.25	307.271	58.385	328.155	13.591	16.643	476.774	83.402	517.042	19.243	22.387
3169	2001	1	902.00	2	0.45	2000	2	253.569	52.353	248.111	12.554	9.606	788.358	121.754	864.519	27.795	18.381
3170	2001	1	902.50	2.5	0.45	2000	2.5	247.364	52.704	228.843	12.667	7.720	979.322	140.686	1082.671	33.042	15.598
3171	2001	1	903.00	3	0.45	2000	3	249.305	53.585	221.667	12.833	6.481	1163.353	160.714	1293.508	38.041	13.127
3172	2001	1	904.00	4	0.45	2000	4	258.311	54.913	225.344	13.005	4.847	1510.741	198.990	1697.109	47.119	9.284
3173	2001	1	905.00	5	0.45	2000	5	271.477	54.516	237.088	12.765	3.794	1839.467	235.310	2083.254	55.753	7.207
3174	2001	1	906.00	6	0.45	2000	6	278.576	53.560	244.957	12.432	3.066	2152.684	270.288	2461.614	63.956	6.065
3175	2001	1	907.00	7	0.45	2000	7	281.415	52.273	247.537	12.047	2.541	2459.362	304.246	2817.470	71.792	5.400
3176	2001	1	907.50	7.5	0.45	2000	7.5	281.576	51.478	247.336	11.842	2.330	2611.779	322.249	2992.118	75.674	5.129
3177	2001	1	908.00	8	0.45	2000	8	281.070	50.879	248.033	11.659	2.148	2761.275	339.271	3180.080	79.464	4.885
3178	2001	1	909.00	9	0.45	2000	9	278.999	49.166	246.376	11.190	1.847	3056.333	372.773	3531.910	86.590	4.461
3179	2001	1	910.00	10	0.45	2000	10	275.351	47.568	243.241	10.781	1.611	3347.100	405.776	3882.001	93.391	4.117
3182	2251	1	1013.00	0.5	0.45	2250	0.5	470.124	86.399	551.466	18.681	57.259	140.536	33.028	154.137	7.614	25.986
3183	2251	1	1013.25	0.75	0.45	2250	0.75	426.414	78.727	483.845	17.581	35.588	266.074	52.691	292.426	12.117	25.119
3184	2251	1	1013.50	1	0.45	2250	1	369.309	69.040	409.900	15.757	23.997	388.938	71.681	428.084	16.528	24.711
3185	2251	1	1013.75	1.25	0.45	2250	1.25	326.856	62.510	354.664	14.469	17.669	508.349	88.972	560.392	20.470	23.805
3186	2251	1	1014.50	2	0.45	2250	2	271.487	56.380	270.075	13.442	10.171	838.991	129.413	935.627	29.546	19.609
3187	2251	1	1015.00	2.5	0.45	2250	2.5	266.205	56.996	250.495	13.602	8.171	1044.264	149.348	1171.327	35.370	16.704
3188	2251	1	1015.50	3	0.45	2250	3	269.382	58.042	243.941	13.809	6.857	1238.935	172.090	1399.545	40.661	14.089
3189	2251	1	1016.50	4	0.45	2250	4	280.868	59.389	249.862	13.975	5.130	1609.689	213.713	1833.647	50.619	10.029
3190	2251	1	1017.50	5	0.45	2250	5	295.607	59.321	263.553	13.808	4.015	1960.815	253.609	2248.965	59.976	7.646
3191	2251	1	1018.50	6	0.45	2250	6	304.388	58.363	273.051	13.463	3.245	2294.672	290.907	2653.443	68.814	6.515
3192	2251	1	1019.50	7	0.45	2250	7	308.424	56.952	278.347	13.051	2.689	2620.396	327.410	3053.643	77.293	5.826
3193	2251	1	1020.00	7.5	0.45	2250	7.5	308.796	56.193	278.965	12.843	2.467	2783.570	345.677	3251.691	81.430	5.527
3194	2251	1	1020.50	8	0.45	2250	8	309.097	55.367	279.266	12.607	2.273	2940.830	363.321	3437.257	85.221	5.280
3195	2251	1	1021.50	9	0.45	2250	9	307.392	53.696	278.299	12.163	1.954	3256.896	398.844	3821.999	93.239	4.821
3196	2251	1	1022.50	10	0.45	2250	10	303.794	52.140	275.374	11.756	1.704	3572.081	435.869	4205.207	100.559	4.438
3199	2501	1	1125.50	0.5	0.45	2500	0.5	495.926	91.583	589.420	19.805	60.633	149.412	35.227	166.073	8.110	27.411
3200	2501	1	1125.75	0.75	0.45	2500	0.75	449.298	83.380	516.950	18.603	37.551	282.513	55.870	315.076	12.851	26.505
3201	2501	1	1126.00	1	0.45	2500	1	389.337	73.268	438.100	16.668	25.321	412.221	75.948	460.111	17.484	26.079
3202	2501	1	1126.25	1.25	0.45	2500	1.25	344.731	66.176	379.665	15.299	18.703	537.634	94.147	601.729	21.638	25.160
3203	2501	1	1127.00	2	0.45	2500	2	288.249	60.227	289.921	14.283	10.707	887.154	136.493	999.678	31.333	20.774
3204	2501	1	1127.50	2.5	0.45	2500	2.5	283.793	61.027	271.128	14.489	8.596	1104.585	158.481	1255.677	37.482	17.720

STP-PT-074: Local Stress in Nozzles, Shells and Formed Heads from External Heads

Model								Secondary (inside) Stress Factors									
	OD	T	od	t	d/D	D/T	t/T	Branch					Header				
								Axial	In-Plane	Out-of-Plane	Torsional	Pressure	Axial	In-Plane	Out-of-Plane	Torsional	Pressure
3205	2501	1	1128.00	3	0.45	2500	3	288.605	62.377	266.197	14.766	7.217	1311.621	182.829	1503.632	43.491	14.988
3206	2501	1	1129.00	4	0.45	2500	4	302.464	63.883	273.571	14.956	5.399	1701.549	227.892	1961.411	53.972	10.735
3207	2501	1	1130.00	5	0.45	2500	5	318.587	63.875	290.206	14.802	4.226	2069.934	269.780	2409.863	63.918	8.077
3208	2501	1	1131.00	6	0.45	2500	6	328.826	62.896	300.981	14.457	3.413	2427.387	310.346	2843.061	73.443	6.959
3209	2501	1	1132.00	7	0.45	2500	7	333.664	61.460	306.458	14.015	2.828	2772.679	349.213	3259.705	82.504	6.211
3210	2501	1	1132.50	7.5	0.45	2500	7.5	335.001	60.562	308.558	13.798	2.594	2938.275	367.618	3467.533	86.772	5.885
3211	2501	1	1133.00	8	0.45	2500	8	335.033	59.724	310.161	13.550	2.390	3109.467	386.831	3686.061	91.104	5.610
3212	2501	1	1134.00	9	0.45	2500	9	334.059	58.046	308.015	13.092	2.055	3441.820	425.846	4076.962	99.434	5.147
3213	2501	1	1135.00	10	0.45	2500	10	331.199	56.315	306.953	12.629	1.791	3769.022	463.285	4491.324	107.209	4.738
3214	9	1	4.10	0.1	0.5	8	0.1	1.200	1.122	1.142	0.942	6.959	0.390	0.259	0.426	0.199	3.565
3215	9	1	4.25	0.25	0.5	8	0.25	1.318	1.018	1.349	0.905	2.533	0.915	0.537	0.851	0.371	2.969
3216	9	1	4.50	0.5	0.5	8	0.5	1.733	1.224	1.646	0.805	1.802	1.658	0.797	1.195	0.530	2.375
3217	9	1	4.75	0.75	0.5	8	0.75	1.918	1.148	1.589	0.827	1.654	2.355	1.082	1.307	0.645	2.049
3218	9	1	5.00	1	0.5	8	1	1.954	1.043	1.485	0.878	1.570	3.027	1.231	1.492	0.764	1.838
3219	9	1	5.25	1.25	0.5	8	1.25	2.049	0.990	1.414	0.875	1.378	3.578	1.289	1.796	0.855	1.574
3220	9	1	6.00	2	0.5	8	2	2.020	0.908	1.178	0.971	0.994	5.081	1.678	2.976	1.051	1.174
3221	9	1	6.50	2.5	0.5	8	2.5	1.944	0.884	1.080	1.094	0.830	6.173	1.931	3.595	1.163	1.070
3222	9	1	7.00	3	0.5	8	3	1.872	0.876	1.023	1.240	0.752	7.414	2.161	4.134	1.277	1.137
3231	17	1	8.10	0.1	0.5	16	0.1	1.640	1.161	1.829	1.078	7.402	0.616	0.448	0.660	0.333	4.993
3232	17	1	8.25	0.25	0.5	16	0.25	3.637	2.373	3.897	1.060	2.971	1.409	0.960	1.344	0.550	3.959
3233	17	1	8.50	0.5	0.5	16	0.5	5.157	2.688	4.590	0.968	2.635	2.437	1.497	1.928	0.754	3.101
3234	17	1	8.75	0.75	0.5	16	0.75	5.463	2.354	4.237	1.041	2.340	3.354	2.102	2.554	0.935	2.565
3235	17	1	9.00	1	0.5	16	1	5.322	2.026	3.790	1.160	2.186	4.365	2.472	3.373	1.155	2.221
3236	17	1	9.25	1.25	0.5	16	1.25	5.287	1.885	3.481	1.218	1.969	6.172	2.711	4.552	1.366	1.857
3237	17	1	10.00	2	0.5	16	2	4.778	1.660	2.732	1.413	1.502	11.667	3.173	7.731	1.767	1.353
3238	17	1	10.50	2.5	0.5	16	2.5	4.406	1.592	2.372	1.464	1.274	14.915	3.782	9.461	1.927	1.291
3239	17	1	11.00	3	0.5	16	3	4.062	1.525	2.090	1.491	1.095	17.824	4.319	10.969	2.050	1.367
3240	17	1	12.00	4	0.5	16	4	3.552	1.429	1.691	1.556	0.844	22.637	5.125	13.531	2.256	1.759
3241	17	1	13.00	5	0.5	16	5	3.233	1.377	1.447	1.675	0.682	26.099	5.590	15.595	2.473	1.951
3242	17	1	14.00	6	0.5	16	6	3.032	1.416	1.314	1.866	0.595	28.467	6.181	17.421	2.745	2.018
3243	17	1	15.00	7	0.5	16	7	2.905	1.418	1.284	2.052	0.536	29.921	6.683	19.090	3.061	2.007
3244	17	1	15.50	7.5	0.5	16	7.5	2.856	1.461	1.263	2.201	0.515	30.343	6.946	19.860	3.267	1.981
3248	25	1	12.10	0.1	0.5	24	0.1	2.559	1.745	2.945	1.190	7.419	0.830	0.580	0.900	0.394	5.753
3249	25	1	12.25	0.25	0.5	24	0.25	6.490	3.438	6.693	1.102	4.168	1.890	1.270	1.861	0.623	4.479
3250	25	1	12.50	0.5	0.5	24	0.5	9.236	3.790	7.880	1.036	3.625	3.200	1.972	2.862	0.882	3.533
3251	25	1	12.75	0.75	0.5	24	0.75	9.454	3.329	7.180	1.180	2.952	5.049	2.897	3.936	1.105	2.943
3252	25	1	13.00	1	0.5	24	1	8.982	2.928	6.343	1.347	2.590	7.737	3.444	5.768	1.443	2.527
3253	25	1	13.25	1.25	0.5	24	1.25	8.676	2.686	5.748	1.455	2.282	11.082	3.846	7.811	1.788	2.095



STP-PT-074: Local Stress in Nozzles, Shells and Formed Heads from External Heads

Model								Secondary (inside) Stress Factors									
	OD	T	od	t	d/D	D/T	t/T	Branch					Header				
								Axial	In-Plane	Out-of-Plane	Torsional	Pressure	Axial	In-Plane	Out-of-Plane	Torsional	Pressure
3254	25	1	14.00	2	0.5	24	2	7.464	2.336	4.414	1.666	1.742	20.735	4.855	13.150	2.456	1.514
3255	25	1	14.50	2.5	0.5	24	2.5	6.790	2.210	3.819	1.755	1.498	26.549	5.408	16.130	2.689	1.409
3256	25	1	15.00	3	0.5	24	3	6.222	2.097	3.356	1.791	1.302	31.862	6.185	18.730	2.844	1.470
3257	25	1	16.00	4	0.5	24	4	5.313	1.921	2.687	1.794	1.013	41.115	7.438	23.052	3.124	2.009
3258	25	1	17.00	5	0.5	24	5	4.680	1.800	2.274	1.786	0.819	50.195	8.532	27.309	3.318	2.360
3259	25	1	18.00	6	0.5	24	6	4.218	1.725	2.000	1.804	0.685	56.998	9.431	30.616	3.564	2.579
3260	25	1	19.00	7	0.5	24	7	3.950	1.709	1.788	1.873	0.589	62.849	10.265	33.755	3.859	2.712
3261	25	1	19.50	7.5	0.5	24	7.5	3.820	1.717	1.681	1.920	0.551	65.143	10.674	35.129	4.006	2.744
3262	25	1	20.00	8	0.5	24	8	3.754	1.742	1.644	1.993	0.518	67.115	11.020	36.426	4.198	2.759
3263	25	1	21.00	9	0.5	24	9	3.702	1.781	1.580	2.182	0.471	70.329	11.659	38.929	4.599	2.752
3264	25	1	22.00	10	0.5	24	10	3.643	1.748	1.667	2.325	0.425	72.615	12.252	41.302	5.017	2.705
3265	33	1	16.10	0.1	0.5	32	0.1	3.605	2.217	4.064	1.231	7.388	1.052	0.672	1.097	0.423	6.197
3266	33	1	16.25	0.25	0.5	32	0.25	9.631	4.283	9.547	1.080	5.458	2.328	1.479	2.301	0.672	4.848
3267	33	1	16.50	0.5	0.5	32	0.5	13.555	4.684	11.287	1.134	4.618	3.831	2.313	3.589	0.957	3.883
3268	33	1	16.75	0.75	0.5	32	0.75	13.642	4.272	10.241	1.336	3.547	7.228	3.473	5.575	1.240	3.297
3269	33	1	17.00	1	0.5	32	1	12.754	3.747	8.989	1.508	2.955	11.315	4.156	8.279	1.683	2.865
3270	33	1	17.25	1.25	0.5	32	1.25	12.086	3.426	8.073	1.627	2.530	16.158	4.703	11.225	2.104	2.389
3271	33	1	18.00	2	0.5	32	2	10.031	2.917	6.114	1.837	1.880	30.054	6.151	18.992	3.005	1.612
3272	33	1	18.50	2.5	0.5	32	2.5	9.013	2.811	5.285	1.897	1.621	38.784	7.200	23.553	3.344	1.460
3273	33	1	19.00	3	0.5	32	3	8.210	2.694	4.657	1.969	1.419	46.698	8.272	27.494	3.575	1.517
3274	33	1	20.00	4	0.5	32	4	6.992	2.453	3.754	1.994	1.115	60.913	10.056	34.163	3.891	2.137
3275	33	1	21.00	5	0.5	32	5	6.089	2.277	3.130	1.970	0.905	73.645	11.574	39.833	4.163	2.591
3276	33	1	22.00	6	0.5	32	6	5.414	2.119	2.697	1.924	0.756	84.407	12.716	44.508	4.413	2.905
3277	33	1	23.00	7	0.5	32	7	4.913	2.018	2.403	1.914	0.648	93.890	13.767	48.696	4.710	3.126
3278	33	1	23.50	7.5	0.5	32	7.5	4.741	2.002	2.300	1.923	0.604	100.502	14.360	51.828	4.881	3.225
3279	33	1	24.00	8	0.5	32	8	4.539	1.968	2.184	1.957	0.567	104.858	14.808	53.922	5.095	3.298
3280	33	1	25.00	9	0.5	32	9	4.285	1.939	2.033	2.022	0.505	112.554	15.653	57.824	5.513	3.397
3281	33	1	26.00	10	0.5	32	10	4.094	1.920	1.909	2.114	0.455	119.347	16.571	61.632	5.935	3.453
3282	41	1	20.10	0.1	0.5	40	0.1	4.779	2.604	5.194	1.230	8.190	1.257	0.748	1.249	0.446	6.567
3283	41	1	20.25	0.25	0.5	40	0.25	12.881	4.990	12.434	1.041	6.831	2.748	1.660	2.727	0.706	5.202
3284	41	1	20.50	0.5	0.5	40	0.5	17.989	5.596	14.764	1.251	5.550	4.840	2.636	4.338	1.017	4.228
3285	41	1	20.75	0.75	0.5	40	0.75	17.875	5.138	13.328	1.489	4.102	9.535	3.935	7.282	1.374	3.650
3286	41	1	21.00	1	0.5	40	1	16.525	4.504	11.650	1.659	3.295	15.061	4.736	10.924	1.850	3.214
3287	41	1	21.25	1.25	0.5	40	1.25	15.456	4.119	10.407	1.772	2.756	21.410	5.417	14.820	2.323	2.717
3288	41	1	22.00	2	0.5	40	2	12.491	3.441	7.793	1.991	1.985	39.478	7.352	25.113	3.413	1.717
3289	41	1	22.50	2.5	0.5	40	2.5	11.117	3.342	6.729	2.047	1.705	50.881	8.934	31.227	3.862	1.575
3290	41	1	23.00	3	0.5	40	3	10.075	3.222	5.946	2.106	1.495	61.291	10.275	36.550	4.191	1.549
3291	41	1	24.00	4	0.5	40	4	8.561	3.040	4.839	2.154	1.184	80.379	12.564	45.763	4.587	2.210

STP-PT-074: Local Stress in Nozzles, Shells and Formed Heads from External Heads

Model								Secondary (inside) Stress Factors									
	OD	T	od	t	d/D	D/T	t/T	Branch					Header				
								Axial	In-Plane	Out-of-Plane	Torsional	Pressure	Axial	In-Plane	Out-of-Plane	Torsional	Pressure
3292	41	1	25.00	5	0.5	40	5	7.461	2.791	4.065	2.131	0.966	97.941	14.558	53.717	4.917	2.727
3293	41	1	26.00	6	0.5	40	6	6.615	2.609	3.497	2.089	0.808	113.346	16.071	60.355	5.222	3.114
3294	41	1	27.00	7	0.5	40	7	5.963	2.439	3.078	2.036	0.691	127.464	17.468	66.321	5.567	3.413
3295	41	1	27.50	7.5	0.5	40	7.5	5.692	2.350	2.910	2.030	0.644	133.810	18.073	68.999	5.743	3.532
3296	41	1	28.00	8	0.5	40	8	5.449	2.303	2.766	2.019	0.603	139.798	18.632	71.540	5.953	3.634
3297	41	1	29.00	9	0.5	40	9	5.020	2.206	2.515	2.043	0.534	150.756	19.649	76.314	6.417	3.797
3298	41	1	30.00	10	0.5	40	10	4.682	2.131	2.323	2.072	0.481	160.715	20.642	80.883	6.869	3.915
3299	51	1	25.10	0.1	0.5	50	0.1	6.275	3.004	6.596	1.208	8.202	1.505	0.828	1.482	0.463	6.969
3300	51	1	25.25	0.25	0.5	50	0.25	16.952	5.755	16.016	1.026	8.457	3.254	1.838	3.239	0.737	5.609
3301	51	1	25.50	0.5	0.5	50	0.5	23.534	6.657	19.112	1.416	6.616	6.116	2.966	5.307	1.078	4.624
3302	51	1	25.75	0.75	0.5	50	0.75	23.114	6.127	17.184	1.686	4.737	12.454	4.404	9.448	1.551	4.059
3303	51	1	26.00	1	0.5	50	1	21.160	5.424	14.965	1.840	3.688	19.712	5.316	14.251	2.017	3.626
3304	51	1	26.25	1.25	0.5	50	1.25	19.557	4.933	13.301	1.938	3.018	27.838	6.129	19.318	2.519	3.114
3305	51	1	27.00	2	0.5	50	2	15.443	4.040	9.861	2.137	2.102	51.279	9.196	33.060	3.755	1.909
3306	51	1	27.50	2.5	0.5	50	2.5	13.593	3.927	8.478	2.209	1.791	65.461	11.011	40.906	4.364	1.681
3307	51	1	28.00	3	0.5	50	3	12.309	3.825	7.548	2.250	1.566	78.826	12.664	48.008	4.814	1.627
3308	51	1	29.00	4	0.5	50	4	10.420	3.686	6.196	2.297	1.246	103.662	15.514	60.491	5.388	2.256
3309	51	1	30.00	5	0.5	50	5	9.098	3.483	5.266	2.313	1.023	126.992	18.082	71.464	5.763	2.816
3310	51	1	31.00	6	0.5	50	6	8.090	3.265	4.582	2.244	0.859	147.988	20.203	80.774	6.150	3.260
3311	51	1	32.00	7	0.5	50	7	7.316	3.040	4.057	2.173	0.735	167.805	22.121	89.246	6.595	3.627
3312	51	1	32.50	7.5	0.5	50	7.5	6.960	2.933	3.823	2.193	0.685	176.863	22.929	93.013	6.809	3.779
3313	51	1	33.00	8	0.5	50	8	6.661	2.837	3.631	2.163	0.638	185.555	23.661	96.619	7.078	3.917
3314	51	1	34.00	9	0.5	50	9	6.141	2.615	3.308	2.168	0.568	201.858	25.019	103.297	7.592	4.153
3315	51	1	35.00	10	0.5	50	10	5.617	2.501	2.980	2.116	0.507	217.214	26.348	109.674	8.117	4.348
3316	61	1	30.10	0.1	0.5	60	0.1	7.810	3.331	7.972	1.163	7.777	1.746	0.898	1.774	0.467	7.312
3317	61	1	30.25	0.25	0.5	60	0.25	20.967	6.456	19.535	1.061	10.021	3.742	1.989	3.940	0.760	5.986
3318	61	1	30.50	0.5	0.5	60	0.5	28.978	7.648	23.423	1.598	7.591	7.558	3.252	6.410	1.133	4.987
3319	61	1	30.75	0.75	0.5	60	0.75	28.210	7.039	21.007	1.886	5.319	15.455	4.811	11.704	1.721	4.478
3320	61	1	31.00	1	0.5	60	1	25.634	6.291	18.243	2.021	4.055	24.419	5.816	17.691	2.243	4.043
3321	61	1	31.25	1.25	0.5	60	1.25	23.501	5.700	16.159	2.095	3.268	34.271	7.164	23.950	2.712	3.513
3322	61	1	32.00	2	0.5	60	2	18.248	4.618	11.881	2.275	2.209	62.188	10.824	40.759	4.028	2.172
3323	61	1	32.50	2.5	0.5	60	2.5	15.998	4.456	10.224	2.337	1.869	79.228	12.986	50.512	4.743	1.760
3324	61	1	33.00	3	0.5	60	3	14.382	4.383	9.070	2.376	1.628	95.334	14.907	59.407	5.305	1.699
3325	61	1	34.00	4	0.5	60	4	12.206	4.240	7.539	2.428	1.294	126.070	18.475	75.531	6.023	2.283
3326	61	1	35.00	5	0.5	60	5	10.731	4.119	6.504	2.465	1.066	154.182	21.538	89.305	6.527	2.853
3327	61	1	36.00	6	0.5	60	6	9.674	3.833	5.788	2.452	0.899	180.389	24.177	101.420	7.057	3.328
3328	61	1	37.00	7	0.5	60	7	8.700	3.645	5.141	2.355	0.772	205.504	26.579	112.539	7.582	3.735
3329	61	1	37.50	7.5	0.5	60	7.5	8.360	3.541	4.908	2.335	0.716	217.160	27.601	117.513	7.839	3.911

STP-PT-074: Local Stress in Nozzles, Shells and Formed Heads from External Heads

Model								Secondary (inside) Stress Factors									
	OD	T	od	t	d/D	D/T	t/T	Branch					Header				
								Axial	In-Plane	Out-of-Plane	Torsional	Pressure	Axial	In-Plane	Out-of-Plane	Torsional	Pressure
3330	61	1	38.00	8	0.5	60	8	8.074	3.323	4.711	2.297	0.670	228.431	28.554	122.270	8.146	4.073
3331	61	1	39.00	9	0.5	60	9	7.301	3.180	4.211	2.234	0.590	249.866	30.320	131.101	8.737	4.359
3332	61	1	40.00	10	0.5	60	10	6.786	2.955	3.879	2.220	0.529	270.340	31.968	139.499	9.321	4.607
3333	71	1	35.10	0.1	0.5	70	0.1	9.297	3.631	9.376	1.137	8.821	1.927	0.969	1.978	0.484	7.773
3334	71	1	35.25	0.25	0.5	70	0.25	24.956	7.139	23.080	1.151	11.516	4.285	2.163	4.354	0.788	6.417
3335	71	1	35.50	0.5	0.5	70	0.5	34.326	8.562	27.748	1.793	8.495	8.851	3.508	7.379	1.202	5.389
3336	71	1	35.75	0.75	0.5	70	0.75	33.109	7.889	24.776	2.086	5.850	18.256	5.136	13.854	1.833	4.829
3337	71	1	36.00	1	0.5	70	1	29.917	7.107	21.471	2.200	4.391	28.774	6.427	20.964	2.383	4.401
3338	71	1	36.25	1.25	0.5	70	1.25	27.246	6.423	18.955	2.253	3.498	40.183	8.175	28.359	2.885	3.863
3339	71	1	37.00	2	0.5	70	2	20.903	5.182	13.854	2.387	2.319	72.360	12.402	48.307	4.226	2.429
3340	71	1	37.50	2.5	0.5	70	2.5	18.252	4.935	11.899	2.453	1.949	92.038	14.848	59.972	5.045	1.862
3341	71	1	38.00	3	0.5	70	3	16.374	4.861	10.557	2.501	1.690	110.645	17.017	70.635	5.704	1.767
3342	71	1	39.00	4	0.5	70	4	13.932	4.729	8.840	2.554	1.340	146.310	21.220	90.135	6.593	2.300
3343	71	1	40.00	5	0.5	70	5	12.358	4.659	7.731	2.606	1.105	179.213	24.833	106.999	7.240	2.870
3344	71	1	41.00	6	0.5	70	6	11.292	4.415	6.974	2.568	0.931	210.309	27.969	121.958	7.938	3.350
3345	71	1	42.00	7	0.5	70	7	10.270	4.185	6.271	2.535	0.802	240.204	30.882	135.823	8.547	3.784
3346	71	1	42.50	7.5	0.5	70	7.5	9.894	4.046	6.014	2.507	0.747	254.272	32.126	142.092	8.830	3.972
3347	71	1	43.00	8	0.5	70	8	9.504	3.937	5.754	2.429	0.697	268.074	33.306	148.042	9.162	4.148
3348	71	1	44.00	9	0.5	70	9	8.661	3.650	5.173	2.426	0.613	294.349	35.458	159.213	9.830	4.469
3349	71	1	45.00	10	0.5	70	10	8.090	3.430	4.813	2.362	0.552	319.691	37.497	169.752	10.491	4.755
3350	81	1	40.10	0.1	0.5	80	0.1	10.762	3.869	10.695	1.087	10.126	2.159	1.036	2.267	0.480	8.100
3351	81	1	40.25	0.25	0.5	80	0.25	28.706	7.837	26.456	1.257	12.883	5.119	2.300	5.122	0.808	6.767
3352	81	1	40.50	0.5	0.5	80	0.5	39.395	9.509	31.943	1.989	9.322	10.267	3.748	8.523	1.276	5.711
3353	81	1	40.75	0.75	0.5	80	0.75	37.792	8.739	28.484	2.284	6.343	20.959	5.405	15.977	1.929	5.157
3354	81	1	41.00	1	0.5	80	1	33.985	7.899	24.634	2.378	4.704	32.934	7.194	24.184	2.498	4.732
3355	81	1	41.25	1.25	0.5	80	1.25	30.802	7.109	21.699	2.406	3.715	45.782	9.128	32.684	3.029	4.190
3356	81	1	42.00	2	0.5	80	2	23.445	5.689	15.790	2.507	2.423	81.937	13.895	55.730	4.433	2.678
3357	81	1	42.50	2.5	0.5	80	2.5	20.452	5.426	13.561	2.572	2.022	104.468	16.813	69.548	5.278	2.043
3358	81	1	43.00	3	0.5	80	3	18.369	5.300	12.057	2.599	1.747	125.463	19.242	82.022	5.967	1.806
3359	81	1	44.00	4	0.5	80	4	15.711	5.220	10.161	2.690	1.379	165.083	23.864	104.522	7.084	2.294
3360	81	1	45.00	5	0.5	80	5	14.055	5.066	8.949	2.711	1.137	202.312	27.963	124.444	7.967	2.858
3361	81	1	46.00	6	0.5	80	6	12.914	4.958	8.121	2.724	0.964	238.366	31.761	142.745	8.778	3.357
3362	81	1	47.00	7	0.5	80	7	11.851	4.724	7.396	2.733	0.830	272.117	34.981	158.996	9.478	3.789
3363	81	1	47.50	7.5	0.5	80	7.5	11.424	4.563	7.110	2.656	0.774	288.365	36.451	166.545	9.798	3.985
3364	81	1	48.00	8	0.5	80	8	10.972	4.412	6.802	2.601	0.724	304.233	37.844	173.781	10.133	4.169
3365	81	1	49.00	9	0.5	80	9	10.162	4.146	6.245	2.598	0.642	334.853	40.408	187.338	10.879	4.509
3366	81	1	50.00	10	0.5	80	10	9.353	3.952	5.719	2.519	0.573	364.737	42.876	200.212	11.621	4.818
3367	91	1	45.10	0.1	0.5	90	0.1	12.121	4.122	11.993	1.059	11.307	2.383	1.085	2.570	0.485	8.463

STP-PT-074: Local Stress in Nozzles, Shells and Formed Heads from External Heads

Model								Secondary (inside) Stress Factors									
	OD	T	od	t	d/D	D/T	t/T	Branch					Header				
								Axial	In-Plane	Out-of-Plane	Torsional	Pressure	Axial	In-Plane	Out-of-Plane	Torsional	Pressure
3368	91	1	45.25	0.25	0.5	90	0.25	32.320	8.497	29.787	1.382	14.183	5.845	2.444	5.786	0.827	7.101
3369	91	1	45.50	0.5	0.5	90	0.5	44.248	10.428	36.075	2.192	10.095	11.601	3.960	9.612	1.342	6.015
3370	91	1	45.75	0.75	0.5	90	0.75	42.261	9.599	32.131	2.477	6.805	23.548	5.652	18.062	2.011	5.463
3371	91	1	46.00	1	0.5	90	1	37.865	8.636	27.751	2.552	5.000	36.894	7.923	27.347	2.600	5.042
3372	91	1	46.25	1.25	0.5	90	1.25	34.174	7.776	24.390	2.557	3.920	51.082	10.025	36.926	3.153	4.495
3373	91	1	47.00	2	0.5	90	2	25.894	6.224	17.705	2.610	2.522	91.291	15.508	63.258	4.709	2.931
3374	91	1	47.50	2.5	0.5	90	2.5	22.567	5.863	15.182	2.668	2.093	115.676	18.508	78.684	5.566	2.220
3375	91	1	48.00	3	0.5	90	3	20.280	5.775	13.498	2.709	1.801	138.809	21.210	92.920	6.283	1.842
3376	91	1	49.00	4	0.5	90	4	17.506	5.716	11.457	2.725	1.416	182.463	26.391	118.680	7.568	2.284
3377	91	1	50.00	5	0.5	90	5	15.941	5.676	10.238	2.763	1.167	223.658	30.964	141.663	8.662	2.838
3378	91	1	51.00	6	0.5	90	6	14.651	5.478	9.351	2.789	0.990	263.756	35.243	162.942	9.577	3.335
3379	91	1	52.00	7	0.5	90	7	13.614	5.233	8.623	2.771	0.854	301.474	38.918	181.954	10.362	3.769
3380	91	1	52.50	7.5	0.5	90	7.5	13.001	5.071	8.208	2.792	0.797	319.715	40.618	190.827	10.732	3.969
3381	91	1	53.00	8	0.5	90	8	12.555	4.989	7.895	2.738	0.747	337.647	42.218	199.394	11.085	4.159
3382	91	1	54.00	9	0.5	90	9	11.710	4.637	7.319	2.710	0.661	372.265	45.175	215.424	11.888	4.510
3383	91	1	55.00	10	0.5	90	10	10.957	4.371	6.809	2.637	0.592	406.237	48.079	230.678	12.711	4.836
3384	101	1	50.10	0.1	0.5	100	0.1	13.379	4.374	13.264	1.044	12.419	2.670	1.127	2.880	0.497	8.840
3385	101	1	50.25	0.25	0.5	100	0.25	35.751	9.132	33.037	1.509	15.379	6.510	2.565	6.447	0.850	7.423
3386	101	1	50.50	0.5	0.5	100	0.5	48.915	11.308	40.142	2.407	10.838	12.906	4.157	10.694	1.405	6.300
3387	101	1	50.75	0.75	0.5	100	0.75	46.536	10.409	35.727	2.667	7.240	26.044	6.157	20.122	2.080	5.752
3388	101	1	51.00	1	0.5	100	1	41.560	9.349	30.814	2.717	5.280	40.684	8.614	30.466	2.693	5.334
3389	101	1	51.25	1.25	0.5	100	1.25	37.398	8.409	27.043	2.710	4.117	56.389	11.000	41.287	3.296	4.811
3390	101	1	52.00	2	0.5	100	2	28.244	6.728	19.579	2.709	2.618	99.751	16.883	70.409	4.910	3.163
3391	101	1	52.50	2.5	0.5	100	2.5	24.632	6.304	16.785	2.766	2.163	126.202	20.114	87.665	5.829	2.402
3392	101	1	53.00	3	0.5	100	3	22.205	6.207	14.954	2.809	1.855	151.275	23.179	103.621	6.612	1.953
3393	101	1	54.00	4	0.5	100	4	19.305	6.111	12.719	2.820	1.451	198.625	28.811	132.601	8.110	2.265
3394	101	1	55.00	5	0.5	100	5	17.657	6.059	11.421	2.853	1.194	244.223	34.048	159.133	9.344	2.821
3395	101	1	56.00	6	0.5	100	6	16.372	5.906	10.522	2.888	1.013	287.261	38.583	182.904	10.356	3.303
3396	101	1	57.00	7	0.5	100	7	15.292	5.701	9.772	2.880	0.875	328.626	42.677	204.704	11.224	3.736
3397	101	1	57.50	7.5	0.5	100	7.5	14.633	5.570	9.321	2.879	0.819	348.710	44.601	214.939	11.629	3.937
3398	101	1	58.00	8	0.5	100	8	14.181	5.431	9.010	2.872	0.768	368.392	46.395	224.756	12.006	4.128
3399	101	1	59.00	9	0.5	100	9	13.343	5.083	8.411	2.854	0.681	407.581	49.999	243.850	12.904	4.494
3400	101	1	60.00	10	0.5	100	10	12.410	4.868	7.792	2.832	0.608	444.526	53.093	261.117	13.757	4.821
3401	251	1	125.10	0.1	0.5	250	0.1	28.317	7.434	30.267	1.352	27.307	5.811	1.993	6.464	0.614	13.410
3402	251	1	125.25	0.25	0.5	250	0.25	76.760	17.310	78.208	3.427	28.301	13.034	4.288	13.262	1.215	11.464
3403	251	1	125.50	0.5	0.5	250	0.5	104.811	21.487	97.006	5.153	18.848	28.182	7.822	24.783	2.203	9.724
3404	251	1	125.75	0.75	0.5	250	0.75	97.735	20.126	86.001	5.183	12.222	57.024	12.527	49.480	3.449	9.103
3405	251	1	126.00	1	0.5	250	1	85.707	17.822	73.492	4.922	8.528	86.764	17.504	74.431	4.795	8.697

STP-PT-074: Local Stress in Nozzles, Shells and Formed Heads from External Heads

Model								Secondary (inside) Stress Factors									
	OD	T	od	t	d/D	D/T	t/T	Branch					Header				
								Axial	In-Plane	Out-of-Plane	Torsional	Pressure	Axial	In-Plane	Out-of-Plane	Torsional	Pressure
3406	251	1	126.25	1.25	0.5	250	1.25	75.849	15.949	63.789	4.639	6.426	116.565	22.093	99.475	6.077	8.095
3407	251	1	127.00	2	0.5	250	2	57.473	13.069	45.728	4.188	3.828	199.076	34.386	169.638	9.200	5.932
3408	251	1	127.50	2.5	0.5	250	2.5	51.541	12.356	39.445	4.096	3.085	249.168	41.144	212.567	10.845	4.627
3409	251	1	128.00	3	0.5	250	3	48.048	12.125	35.523	4.048	2.585	296.450	47.294	253.054	12.263	3.828
3410	251	1	129.00	4	0.5	250	4	44.806	11.802	31.209	4.014	1.936	385.679	58.266	328.889	15.055	2.747
3411	251	1	130.00	5	0.5	250	5	42.750	11.531	28.869	3.974	1.536	471.349	68.521	400.457	17.611	2.572
3412	251	1	131.00	6	0.5	250	6	40.922	11.013	27.270	3.914	1.271	553.457	77.976	467.627	19.902	2.930
3413	251	1	132.00	7	0.5	250	7	39.248	10.979	25.944	3.850	1.085	633.741	86.977	531.937	21.860	3.266
3414	251	1	132.50	7.5	0.5	250	7.5	38.460	10.806	25.343	3.800	1.013	673.172	91.299	563.001	22.799	3.428
3415	251	1	133.00	8	0.5	250	8	37.622	10.527	24.738	3.793	0.950	712.145	95.529	593.323	23.669	3.584
3416	251	1	134.00	9	0.5	250	9	36.159	10.227	23.657	3.809	0.846	789.150	103.828	652.348	25.307	3.889
3417	251	1	135.00	10	0.5	250	10	34.579	9.914	22.589	3.821	0.763	864.901	111.748	709.162	26.819	4.183
3418	501	1	250.10	0.1	0.5	500	0.1	46.397	11.275	53.388	2.237	44.346	9.429	3.231	10.890	0.840	18.888
3419	501	1	250.25	0.25	0.5	500	0.25	129.251	26.189	143.056	5.837	42.391	20.646	6.916	21.850	1.795	16.091
3420	501	1	250.50	0.5	0.5	500	0.5	176.612	34.450	179.261	8.494	27.631	48.462	12.600	46.272	3.459	13.561
3421	501	1	250.75	0.75	0.5	500	0.75	164.981	31.458	160.480	8.313	17.851	97.885	20.316	93.273	5.503	12.851
3422	501	1	251.00	1	0.5	500	1	143.637	27.990	136.508	7.682	12.287	146.883	28.210	139.158	7.705	12.464
3423	501	1	251.25	1.25	0.5	500	1.25	126.425	25.141	117.889	7.114	9.150	195.247	36.033	184.768	9.773	11.821
3424	501	1	252.00	2	0.5	500	2	97.283	21.069	85.158	6.252	5.289	329.425	55.354	313.645	14.717	9.189
3425	501	1	252.50	2.5	0.5	500	2.5	89.143	20.439	74.567	6.059	4.231	411.405	65.790	393.698	17.261	7.460
3426	501	1	253.00	3	0.5	500	3	86.041	20.174	68.334	5.951	3.536	489.063	75.093	470.050	19.443	6.052
3427	501	1	254.00	4	0.5	500	4	84.147	19.755	64.010	5.836	2.627	635.478	91.454	614.720	24.038	4.397
3428	501	1	255.00	5	0.5	500	5	82.591	19.195	61.733	5.699	2.050	774.473	106.268	751.963	28.174	3.470
3429	501	1	256.00	6	0.5	500	6	80.382	18.596	59.448	5.499	1.664	908.171	120.861	883.360	31.907	2.930
3430	501	1	257.00	7	0.5	500	7	77.870	18.000	57.147	5.392	1.387	1039.543	135.959	1011.680	35.253	3.193
3431	501	1	257.50	7.5	0.5	500	7.5	76.605	17.860	56.042	5.282	1.279	1103.359	143.454	1073.567	36.922	3.315
3432	501	1	258.00	8	0.5	500	8	75.216	17.429	54.887	5.254	1.185	1167.835	150.377	1135.907	38.339	3.439
3433	501	1	259.00	9	0.5	500	9	72.487	16.903	52.649	5.108	1.034	1295.812	164.721	1258.749	41.217	3.681
3434	501	1	260.00	10	0.5	500	10	70.016	16.280	50.563	4.979	0.920	1421.282	178.111	1378.286	43.819	3.912
3436	751	1	375.25	0.25	0.5	750	0.25	170.243	34.262	196.992	7.807	53.521	26.164	9.029	28.347	2.307	19.659
3437	751	1	375.50	0.5	0.5	750	0.5	232.598	44.692	248.323	11.042	34.256	65.317	16.318	65.244	4.500	16.460
3438	751	1	375.75	0.75	0.5	750	0.75	219.281	40.938	225.876	10.751	22.151	131.270	26.269	132.075	7.149	15.737
3439	751	1	376.00	1	0.5	750	1	190.435	36.368	191.784	9.821	15.169	195.782	36.986	196.280	9.968	15.351
3440	751	1	376.25	1.25	0.5	750	1.25	167.617	32.715	165.498	9.065	11.244	258.730	46.952	259.334	12.616	14.680
3441	751	1	377.00	2	0.5	750	2	130.896	27.634	120.658	8.009	6.435	434.167	71.393	438.538	18.896	11.700
3442	751	1	377.50	2.5	0.5	750	2.5	121.766	27.092	106.943	7.816	5.120	541.941	84.431	550.664	22.070	9.678
3443	751	1	378.00	3	0.5	750	3	120.298	27.023	100.284	7.699	4.267	644.216	95.857	658.141	25.334	7.915
3444	751	1	379.00	4	0.5	750	4	121.406	26.763	98.071	7.519	3.170	836.947	115.848	862.264	31.283	5.593

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Model								Secondary (inside) Stress Factors									
	OD	T	od	t	d/D	D/T	t/T	Branch					Header				
								Axial	In-Plane	Out-of-Plane	Torsional	Pressure	Axial	In-Plane	Out-of-Plane	Torsional	Pressure
3445	751	1	380.00	5	0.5	750	5	121.260	26.119	96.793	7.307	2.470	1019.275	137.362	1056.392	36.639	4.416
3446	751	1	381.00	6	0.5	750	6	119.734	25.303	95.014	7.026	1.996	1194.681	157.708	1243.323	41.561	3.743
3447	751	1	382.00	7	0.5	750	7	117.161	24.407	92.608	6.754	1.653	1366.075	177.655	1425.776	46.113	3.261
3448	751	1	382.50	7.5	0.5	750	7.5	115.503	23.989	91.086	6.666	1.521	1450.154	187.044	1515.159	48.276	3.198
3449	751	1	383.00	8	0.5	750	8	113.777	23.624	89.566	6.591	1.407	1533.629	196.455	1604.114	50.282	3.301
3450	751	1	384.00	9	0.5	750	9	110.331	22.801	86.588	6.364	1.215	1700.063	215.002	1780.179	54.189	3.500
3451	751	1	385.00	10	0.5	750	10	106.694	22.065	83.293	6.193	1.070	1864.909	233.272	1954.528	57.744	3.695
3453	1001	1	500.25	0.25	0.5	1000	0.25	203.197	41.019	243.099	9.448	63.069	30.284	10.761	33.481	2.755	22.738
3454	1001	1	500.50	0.5	0.5	1000	0.5	277.712	53.227	307.668	13.155	40.000	79.487	19.862	82.221	5.395	18.928
3455	1001	1	500.75	0.75	0.5	1000	0.75	264.836	48.921	284.968	12.789	25.801	159.426	31.706	167.272	8.533	18.156
3456	1001	1	501.00	1	0.5	1000	1	229.823	43.386	241.811	11.647	17.630	236.889	44.355	247.895	11.894	17.801
3457	1001	1	501.25	1.25	0.5	1000	1.25	202.408	39.117	208.733	10.713	13.022	312.625	56.141	327.304	14.986	17.115
3458	1001	1	502.00	2	0.5	1000	2	159.877	33.553	153.442	9.531	7.405	522.876	84.673	552.286	22.331	13.840
3459	1001	1	502.50	2.5	0.5	1000	2.5	150.279	32.742	137.229	9.364	5.883	652.614	99.789	693.307	26.520	11.572
3460	1001	1	503.00	3	0.5	1000	3	150.856	32.955	131.102	9.303	4.892	775.529	112.752	828.511	30.395	9.577
3461	1001	1	504.00	4	0.5	1000	4	155.114	32.973	131.247	9.060	3.629	1007.733	139.326	1086.845	37.477	6.566
3462	1001	1	505.00	5	0.5	1000	5	157.385	32.386	132.210	8.774	2.829	1226.577	164.766	1332.561	43.941	5.269
3463	1001	1	506.00	6	0.5	1000	6	156.984	31.457	131.435	8.460	2.281	1438.000	188.894	1569.360	49.855	4.490
3464	1001	1	507.00	7	0.5	1000	7	154.954	30.376	129.644	8.147	1.890	1643.472	212.392	1800.782	55.388	3.923
3465	1001	1	507.50	7.5	0.5	1000	7.5	153.262	29.798	128.024	7.972	1.733	1744.311	223.891	1914.432	58.041	3.693
3466	1001	1	508.00	8	0.5	1000	8	151.441	29.258	126.357	7.823	1.598	1844.280	235.140	2027.193	60.513	3.491
3467	1001	1	509.00	9	0.5	1000	9	147.387	28.309	122.651	7.553	1.378	2042.621	257.244	2250.869	65.330	3.470
3468	1001	1	510.00	10	0.5	1000	10	143.269	27.374	119.070	7.307	1.207	2238.739	278.922	2472.169	69.711	3.636
3470	1251	1	625.25	0.25	0.5	1250	0.25	231.424	47.006	284.361	10.883	71.644	34.665	12.302	37.754	3.175	25.511
3471	1251	1	625.50	0.5	0.5	1250	0.5	316.265	60.886	360.991	15.060	45.186	91.977	23.065	98.056	6.208	21.174
3472	1251	1	625.75	0.75	0.5	1250	0.75	304.713	55.974	339.437	14.583	29.029	184.556	36.571	200.379	9.778	20.340
3473	1251	1	626.00	1	0.5	1250	1	264.262	49.527	287.961	13.207	19.798	273.270	50.883	296.032	13.572	19.984
3474	1251	1	626.25	1.25	0.5	1250	1.25	232.909	44.740	248.733	12.152	14.598	359.823	64.135	390.008	17.056	19.250
3475	1251	1	627.00	2	0.5	1250	2	185.565	38.890	184.068	10.895	8.265	601.199	96.181	657.070	25.499	15.716
3476	1251	1	627.50	2.5	0.5	1250	2.5	175.836	38.200	166.019	10.762	6.558	749.779	112.931	824.854	30.488	13.231
3477	1251	1	628.00	3	0.5	1250	3	178.391	38.213	160.746	10.745	5.454	891.058	129.581	985.573	34.894	11.037
3478	1251	1	629.00	4	0.5	1250	4	186.150	38.486	163.993	10.577	4.035	1158.103	160.048	1292.792	42.963	7.653
3479	1251	1	630.00	5	0.5	1250	5	190.980	37.970	167.507	10.224	3.144	1410.420	188.721	1586.553	50.322	5.982
3480	1251	1	631.00	6	0.5	1250	6	191.908	37.017	168.401	9.818	2.534	1653.038	216.091	1871.989	57.100	5.090
3481	1251	1	632.00	7	0.5	1250	7	190.757	35.801	167.266	9.474	2.096	1891.106	242.884	2147.336	63.617	4.452
3482	1251	1	632.50	7.5	0.5	1250	7.5	189.272	35.208	165.979	9.235	1.923	2006.820	255.905	2283.107	66.671	4.190
3483	1251	1	633.00	8	0.5	1250	8	187.434	34.520	164.315	9.040	1.770	2121.659	268.813	2418.126	69.611	3.956
3484	1251	1	634.00	9	0.5	1250	9	183.240	33.391	160.386	8.696	1.524	2349.123	294.179	2685.386	75.171	3.576



STP-PT-074: Local Stress in Nozzles, Shells and Formed Heads from External Heads

Model								Secondary (inside) Stress Factors									
	OD	T	od	t	d/D	D/T	t/T	Branch					Header				
								Axial	In-Plane	Out-of-Plane	Torsional	Pressure	Axial	In-Plane	Out-of-Plane	Torsional	Pressure
3485	1251	1	635.00	10	0.5	1250	10	178.808	32.323	156.371	8.389	1.331	2572.447	319.177	2948.930	80.479	3.586
3487	1501	1	750.25	0.25	0.5	1500	0.25	255.803	52.312	321.090	12.097	79.595	38.595	13.589	42.814	3.563	28.022
3488	1501	1	750.50	0.5	0.5	1500	0.5	349.597	67.546	408.507	16.732	50.299	103.192	25.931	112.660	6.927	23.198
3489	1501	1	750.75	0.75	0.5	1500	0.75	340.355	62.238	389.875	16.161	31.941	207.191	40.887	231.243	10.870	22.303
3490	1501	1	751.00	1	0.5	1500	1	295.137	54.991	330.818	14.604	21.759	306.244	56.726	341.090	15.061	21.950
3491	1501	1	751.25	1.25	0.5	1500	1.25	260.152	49.771	285.941	13.427	16.023	402.569	71.360	449.061	18.915	21.210
3492	1501	1	752.00	2	0.5	1500	2	208.711	43.681	213.046	12.122	9.046	672.452	106.497	755.860	28.584	17.439
3493	1501	1	752.50	2.5	0.5	1500	2.5	198.992	43.220	193.338	12.038	7.173	838.578	126.304	948.219	34.125	14.754
3494	1501	1	753.00	3	0.5	1500	3	203.596	43.314	189.575	12.053	5.964	997.061	145.271	1134.068	39.040	12.372
3495	1501	1	754.00	4	0.5	1500	4	214.667	43.499	195.898	11.936	4.404	1296.324	178.839	1487.445	47.961	8.693
3496	1501	1	755.00	5	0.5	1500	5	221.919	43.084	201.897	11.596	3.429	1578.523	210.363	1823.960	56.128	6.612
3497	1501	1	756.00	6	0.5	1500	6	224.923	42.047	205.011	11.156	2.763	1850.782	240.647	2151.126	63.695	5.623
3498	1501	1	757.00	7	0.5	1500	7	224.503	40.679	204.845	10.694	2.284	2114.756	269.959	2467.789	70.949	4.895
3499	1501	1	757.50	7.5	0.5	1500	7.5	223.551	40.033	204.048	10.499	2.094	2245.129	284.374	2623.290	74.350	4.601
3500	1501	1	758.00	8	0.5	1500	8	221.990	39.360	202.767	10.249	1.929	2374.097	298.522	2780.947	77.680	4.347
3501	1501	1	759.00	9	0.5	1500	9	217.920	38.012	199.112	9.814	1.657	2628.308	326.512	3089.243	83.977	3.920
3502	1501	1	760.00	10	0.5	1500	10	213.374	36.763	194.937	9.453	1.445	2877.010	354.210	3391.295	90.011	3.595
3505	1751	1	875.50	0.5	0.5	1750	0.5	379.374	73.925	451.942	18.259	54.707	113.570	28.598	126.646	7.591	25.096
3506	1751	1	875.75	0.75	0.5	1750	0.75	372.844	67.970	437.145	17.629	34.645	228.049	44.930	260.562	11.916	24.153
3507	1751	1	876.00	1	0.5	1750	1	323.114	59.937	370.734	15.876	23.569	336.450	62.118	383.515	16.445	23.789
3508	1751	1	876.25	1.25	0.5	1750	1.25	284.895	54.342	320.624	14.587	17.338	442.021	77.855	504.584	20.578	23.001
3509	1751	1	877.00	2	0.5	1750	2	229.643	48.153	240.240	13.264	9.764	737.218	115.691	847.837	31.371	19.000
3510	1751	1	877.50	2.5	0.5	1750	2.5	220.536	47.872	219.566	13.224	7.740	919.932	138.818	1064.551	37.458	16.142
3511	1751	1	878.00	3	0.5	1750	3	226.806	48.108	217.124	13.260	6.435	1093.427	159.513	1271.666	42.840	13.592
3512	1751	1	879.00	4	0.5	1750	4	241.382	48.327	227.203	13.191	4.752	1422.379	196.073	1668.741	52.540	9.641
3513	1751	1	880.00	5	0.5	1750	5	251.416	47.716	236.369	12.895	3.694	1732.592	230.061	2045.966	61.408	7.165
3514	1751	1	881.00	6	0.5	1750	6	256.242	46.698	241.467	12.453	2.975	2031.862	262.791	2412.445	69.724	6.080
3515	1751	1	882.00	7	0.5	1750	7	256.876	45.264	242.690	11.941	2.457	2320.992	294.694	2767.706	77.574	5.285
3516	1751	1	882.50	7.5	0.5	1750	7.5	256.273	44.542	242.434	11.709	2.252	2465.060	310.124	2945.784	81.357	4.963
3517	1751	1	883.00	8	0.5	1750	8	254.906	43.842	241.152	11.412	2.075	2605.471	325.694	3117.588	85.023	4.684
3518	1751	1	884.00	9	0.5	1750	9	251.456	42.431	238.339	10.969	1.782	2884.602	356.175	3464.521	92.071	4.221
3519	1751	1	885.00	10	0.5	1750	10	246.739	41.038	233.981	10.525	1.551	3159.979	386.078	3807.077	98.773	3.846
3522	2001	1	1000.50	0.5	0.5	2000	0.5	405.673	79.527	491.094	19.658	58.437	123.092	31.004	139.701	8.204	26.852
3523	2001	1	1000.75	0.75	0.5	2000	0.75	402.339	73.200	481.003	18.957	37.152	247.270	48.627	288.198	12.857	25.854
3524	2001	1	1001.00	1	0.5	2000	1	348.644	64.505	408.117	17.039	25.259	364.353	67.008	423.845	17.698	25.486
3525	2001	1	1001.25	1.25	0.5	2000	1.25	307.607	58.502	353.258	15.650	18.569	478.415	83.842	556.933	22.112	24.667
3526	2001	1	1002.00	2	0.5	2000	2	249.023	52.316	266.118	14.313	10.436	797.575	125.566	935.043	34.004	20.458
3527	2001	1	1002.50	2.5	0.5	2000	2.5	240.533	52.194	244.420	14.325	8.270	995.040	150.567	1173.038	40.594	17.432

STP-PT-074: Local Stress in Nozzles, Shells and Formed Heads from External Heads

Model									Secondary (inside) Stress Factors								
	OD	T	od	t	d/D	D/T	t/T	Branch					Header				
								Axial	In-Plane	Out-of-Plane	Torsional	Pressure	Axial	In-Plane	Out-of-Plane	Torsional	Pressure
3528	2001	1	1003.00	3	0.5	2000	3	248.416	52.686	243.936	14.418	6.873	1182.963	172.826	1402.221	46.346	14.723
3529	2001	1	1004.00	4	0.5	2000	4	266.307	53.059	257.580	14.400	5.075	1538.782	211.960	1838.514	56.768	10.516
3530	2001	1	1005.00	5	0.5	2000	5	278.657	52.418	269.658	14.089	3.941	1876.259	248.178	2257.754	66.240	7.670
3531	2001	1	1006.00	6	0.5	2000	6	285.359	51.175	276.843	13.630	3.172	2199.219	283.169	2658.041	75.191	6.495
3532	2001	1	1007.00	7	0.5	2000	7	287.796	49.504	280.661	13.106	2.620	2513.551	317.298	3054.984	83.692	5.629
3533	2001	1	1007.50	7.5	0.5	2000	7.5	287.594	48.752	280.456	12.840	2.401	2667.587	333.949	3244.607	87.788	5.285
3534	2001	1	1008.00	8	0.5	2000	8	286.619	47.965	279.870	12.573	2.210	2820.675	350.333	3437.478	91.785	4.981
3535	2001	1	1009.00	9	0.5	2000	9	283.581	46.414	277.346	12.043	1.896	3123.036	383.135	3817.459	99.468	4.478
3536	2001	1	1010.00	10	0.5	2000	10	279.174	45.011	273.729	11.596	1.651	3423.510	415.566	4202.490	106.920	4.119
3539	2251	1	1125.50	0.5	0.5	2250	0.5	429.413	84.927	526.830	20.969	62.658	132.046	33.322	152.216	8.780	28.489
3540	2251	1	1125.75	0.75	0.5	2250	0.75	429.573	78.041	522.214	20.187	39.505	265.222	52.074	314.489	13.744	27.453
3541	2251	1	1126.00	1	0.5	2250	1	372.156	68.789	443.478	18.134	26.845	390.504	71.620	462.287	18.888	27.085
3542	2251	1	1126.25	1.25	0.5	2250	1.25	328.476	62.399	383.964	16.643	19.722	512.071	89.442	606.440	23.592	26.247
3543	2251	1	1127.00	2	0.5	2250	2	267.094	56.165	290.709	15.305	11.075	853.277	134.845	1016.855	36.526	21.847
3544	2251	1	1127.50	2.5	0.5	2250	2.5	259.260	56.325	268.273	15.372	8.769	1064.365	161.416	1276.393	43.505	18.657
3545	2251	1	1128.00	3	0.5	2250	3	269.135	56.958	270.173	15.524	7.293	1267.596	185.075	1526.622	49.685	15.812
3546	2251	1	1129.00	4	0.5	2250	4	289.982	57.661	287.829	15.564	5.383	1647.753	226.901	2003.489	60.759	11.343
3547	2251	1	1130.00	5	0.5	2250	5	305.009	57.079	302.371	15.283	4.177	2009.204	265.255	2453.487	70.870	8.279
3548	2251	1	1131.00	6	0.5	2250	6	313.326	55.845	311.895	14.821	3.359	2355.042	302.161	2890.210	80.338	6.874
3549	2251	1	1132.00	7	0.5	2250	7	317.150	54.075	317.408	14.238	2.773	2696.182	338.186	3325.285	89.434	5.949
3550	2251	1	1132.50	7.5	0.5	2250	7.5	317.228	53.221	317.748	13.973	2.541	2860.554	355.997	3533.262	93.946	5.584
3551	2251	1	1133.00	8	0.5	2250	8	317.217	52.259	318.190	13.679	2.339	3025.267	373.833	3741.644	98.238	5.268
3552	2251	1	1134.00	9	0.5	2250	9	314.670	50.511	315.242	13.126	2.005	3347.886	408.207	4138.185	106.544	4.819
3553	2251	1	1135.00	10	0.5	2250	10	310.492	48.730	312.673	12.603	1.745	3667.913	442.397	4565.033	114.300	4.460
3556	2501	1	1250.50	0.5	0.5	2500	0.5	451.280	90.023	560.653	22.183	66.742	140.289	35.423	164.088	9.313	30.074
3557	2501	1	1250.75	0.75	0.5	2500	0.75	454.848	82.632	561.664	21.328	41.739	282.026	55.410	339.935	14.577	28.983
3558	2501	1	1251.00	1	0.5	2500	1	393.849	72.835	476.771	19.155	28.347	414.779	75.915	498.972	19.977	28.616
3559	2501	1	1251.25	1.25	0.5	2500	1.25	347.764	66.047	413.132	17.573	20.817	543.913	94.712	654.408	25.144	27.731
3560	2501	1	1252.00	2	0.5	2500	2	283.622	59.812	314.302	16.232	11.669	906.272	143.660	1097.048	38.828	23.160
3561	2501	1	1252.50	2.5	0.5	2500	2.5	276.796	60.179	291.300	16.347	9.239	1129.890	171.694	1374.455	46.228	19.808
3562	2501	1	1253.00	3	0.5	2500	3	288.172	61.061	295.452	16.545	7.678	1345.258	197.083	1643.995	52.798	16.794
3563	2501	1	1254.00	4	0.5	2500	4	312.360	62.115	316.044	16.700	5.677	1753.224	241.134	2156.762	64.577	12.130
3564	2501	1	1255.00	5	0.5	2500	5	329.531	61.649	334.237	16.426	4.400	2134.066	281.328	2641.503	75.076	8.888
3565	2501	1	1256.00	6	0.5	2500	6	340.065	60.360	346.677	15.945	3.537	2505.840	320.636	3118.641	85.169	7.236
3566	2501	1	1257.00	7	0.5	2500	7	345.041	58.584	353.162	15.369	2.919	2864.932	358.281	3577.931	94.846	6.232
3567	2501	1	1257.50	7.5	0.5	2500	7.5	345.857	57.689	354.917	15.058	2.673	3041.605	376.314	3806.411	99.320	5.888
3568	2501	1	1258.00	8	0.5	2500	8	346.696	56.718	356.456	14.751	2.460	3214.784	394.636	4031.313	103.883	5.606
3569	2501	1	1259.00	9	0.5	2500	9	344.440	54.829	354.987	14.182	2.109	3559.259	431.325	4475.712	112.874	5.141

STP-PT-074: Local Stress in Nozzles, Shells and Formed Heads from External Heads

Model								Secondary (inside) Stress Factors									
	OD	T	od	t	d/D	D/T	t/T	Branch					Header				
								Axial	In-Plane	Out-of-Plane	Torsional	Pressure	Axial	In-Plane	Out-of-Plane	Torsional	Pressure
3570	2501	1	1260.00	10	0.5	2500	10	340.803	52.899	352.664	13.615	1.835	3899.691	467.832	4925.350	121.401	4.743
3571	9	1	4.50	0.1	0.55	8	0.1	1.188	1.130	1.154	0.971	7.986	0.404	0.259	0.411	0.237	3.924
3572	9	1	4.65	0.25	0.55	8	0.25	1.314	1.106	1.366	0.962	2.950	0.957	0.606	0.824	0.437	3.182
3573	9	1	4.90	0.5	0.55	8	0.5	1.666	1.309	1.684	0.866	1.897	1.761	0.917	1.187	0.617	2.514
3574	9	1	5.15	0.75	0.55	8	0.75	1.897	1.229	1.664	0.907	1.776	2.488	1.132	1.391	0.721	2.140
3575	9	1	5.40	1	0.55	8	1	1.956	1.113	1.553	0.970	1.683	3.194	1.287	1.628	0.847	1.904
3576	9	1	5.65	1.25	0.55	8	1.25	2.047	1.061	1.487	0.970	1.477	3.776	1.363	1.858	0.945	1.626
3577	9	1	6.40	2	0.55	8	2	2.055	1.006	1.244	1.060	1.062	5.406	1.718	3.108	1.154	1.214
3578	9	1	6.90	2.5	0.55	8	2.5	2.015	0.977	1.132	1.143	0.886	6.758	1.990	3.748	1.271	1.115
3579	9	1	7.40	3	0.55	8	3	1.959	0.958	1.063	1.265	0.768	8.117	2.214	4.282	1.399	1.101
3580	9	1	8.40	4	0.55	8	4	1.860	0.941	1.075	1.507	0.706	10.852	2.513	5.146	1.786	1.244
3588	17	1	8.90	0.1	0.55	16	0.1	1.603	1.148	1.805	1.129	7.627	0.625	0.498	0.744	0.387	5.311
3589	17	1	9.05	0.25	0.55	16	0.25	3.501	2.398	3.913	1.124	3.257	1.445	1.108	1.408	0.632	4.154
3590	17	1	9.30	0.5	0.55	16	0.5	4.913	2.733	4.697	1.053	2.832	2.573	1.744	2.141	0.874	3.241
3591	17	1	9.55	0.75	0.55	16	0.75	5.281	2.408	4.419	1.162	2.510	3.546	2.139	2.760	1.062	2.706
3592	17	1	9.80	1	0.55	16	1	5.181	2.120	3.976	1.317	2.325	4.564	2.528	3.524	1.286	2.325
3593	17	1	10.05	1.25	0.55	16	1.25	5.160	2.011	3.679	1.398	2.086	6.058	2.793	4.808	1.515	1.937
3594	17	1	10.80	2	0.55	16	2	4.671	1.872	2.927	1.624	1.590	11.429	3.394	8.215	1.960	1.395
3595	17	1	11.30	2.5	0.55	16	2.5	4.314	1.799	2.554	1.674	1.350	14.675	3.885	10.113	2.131	1.315
3596	17	1	11.80	3	0.55	16	3	3.979	1.715	2.251	1.686	1.160	17.538	4.440	11.765	2.258	1.318
3597	17	1	12.80	4	0.55	16	4	3.516	1.582	1.801	1.702	0.893	22.334	5.251	14.495	2.466	1.720
3598	17	1	13.80	5	0.55	16	5	3.201	1.528	1.512	1.772	0.721	25.752	5.872	16.648	2.694	1.938
3599	17	1	14.80	6	0.55	16	6	3.007	1.502	1.383	1.818	0.598	28.037	6.421	18.463	2.980	2.027
3600	17	1	15.80	7	0.55	16	7	2.935	1.586	1.303	2.021	0.542	29.344	6.915	20.018	3.354	2.033
3601	17	1	16.30	7.5	0.55	16	7.5	2.934	1.635	1.315	2.150	0.522	29.676	7.115	20.709	3.597	2.014
3602	17	1	16.80	8	0.55	16	8	2.946	1.696	1.347	2.295	0.511	29.860	7.299	21.379	3.850	1.987
3605	25	1	13.30	0.1	0.55	24	0.1	2.457	1.741	2.878	1.293	8.193	0.856	0.643	0.928	0.473	6.170
3606	25	1	13.45	0.25	0.55	24	0.25	6.143	3.408	6.743	1.178	4.503	1.946	1.459	1.997	0.737	4.692
3607	25	1	13.70	0.5	0.55	24	0.5	8.902	3.764	8.094	1.132	3.918	3.219	2.319	3.080	1.014	3.679
3608	25	1	13.95	0.75	0.55	24	0.75	9.224	3.436	7.491	1.339	3.188	4.913	2.958	4.076	1.258	3.113
3609	25	1	14.20	1	0.55	24	1	8.783	3.035	6.640	1.544	2.762	7.534	3.559	5.993	1.588	2.678
3610	25	1	14.45	1.25	0.55	24	1.25	8.488	2.839	6.045	1.672	2.413	10.827	4.001	8.177	1.981	2.205
3611	25	1	15.20	2	0.55	24	2	7.302	2.557	4.712	1.901	1.828	20.459	5.094	13.962	2.736	1.561
3612	25	1	15.70	2.5	0.55	24	2.5	6.639	2.478	4.102	2.014	1.573	26.279	5.664	17.219	2.991	1.429
3613	25	1	16.20	3	0.55	24	3	6.117	2.367	3.639	2.055	1.369	32.188	6.477	20.403	3.135	1.394
3614	25	1	17.20	4	0.55	24	4	5.230	2.147	2.921	2.048	1.066	41.956	7.882	25.396	3.424	1.963
3615	25	1	18.20	5	0.55	24	5	4.549	2.033	2.418	2.008	0.862	50.328	9.080	29.612	3.642	2.350
3616	25	1	19.20	6	0.55	24	6	4.023	1.952	2.034	1.983	0.720	57.340	10.059	33.248	3.881	2.600

STP-PT-074: Local Stress in Nozzles, Shells and Formed Heads from External Heads

Model								Secondary (inside) Stress Factors									
	OD	T	od	t	d/D	D/T	t/T	Branch					Header				
								Axial	In-Plane	Out-of-Plane	Torsional	Pressure	Axial	In-Plane	Out-of-Plane	Torsional	Pressure
3617	25	1	20.20	7	0.55	24	7	3.740	1.923	1.744	2.036	0.618	62.924	10.827	36.390	4.180	2.746
3618	25	1	20.70	7.5	0.55	24	7.5	3.634	1.914	1.646	2.086	0.578	65.170	11.179	37.781	4.370	2.787
3619	25	1	21.20	8	0.55	24	8	3.657	1.920	1.568	2.119	0.543	67.171	11.510	39.127	4.573	2.813
3620	25	1	22.20	9	0.55	24	9	3.534	1.856	1.525	2.157	0.479	70.355	12.119	41.650	4.987	2.825
3621	25	1	23.20	10	0.55	24	10	3.390	1.900	1.443	2.300	0.435	72.612	12.721	44.012	5.419	2.796
3622	33	1	17.70	0.1	0.55	32	0.1	3.418	2.197	3.966	1.374	8.725	1.063	0.755	1.179	0.526	6.761
3623	33	1	17.85	0.25	0.55	32	0.25	9.164	4.197	9.652	1.162	5.847	2.389	1.730	2.558	0.793	5.165
3624	33	1	18.10	0.5	0.55	32	0.5	13.162	4.706	11.632	1.242	4.986	3.891	2.766	3.982	1.110	4.091
3625	33	1	18.35	0.75	0.55	32	0.75	13.380	4.369	10.685	1.513	3.835	7.071	3.541	5.771	1.401	3.525
3626	33	1	18.60	1	0.55	32	1	12.545	3.895	9.420	1.727	3.158	11.077	4.267	8.627	1.854	3.061
3627	33	1	18.85	1.25	0.55	32	1.25	11.894	3.593	8.495	1.866	2.679	15.904	4.862	11.783	2.337	2.551
3628	33	1	19.60	2	0.55	32	2	9.856	3.194	6.510	2.112	1.966	30.089	6.442	20.320	3.344	1.672
3629	33	1	20.10	2.5	0.55	32	2.5	8.845	3.112	5.661	2.190	1.693	38.646	7.354	25.148	3.741	1.488
3630	33	1	20.60	3	0.55	32	3	8.050	3.010	5.017	2.250	1.482	46.614	8.486	29.463	3.992	1.460
3631	33	1	21.60	4	0.55	32	4	6.832	2.737	4.054	2.293	1.168	60.936	10.408	36.802	4.317	2.097
3632	33	1	22.60	5	0.55	32	5	5.942	2.558	3.376	2.247	0.949	73.683	12.051	42.987	4.597	2.573
3633	33	1	23.60	6	0.55	32	6	5.316	2.421	2.904	2.192	0.793	86.519	13.605	49.165	4.837	2.920
3634	33	1	24.60	7	0.55	32	7	4.805	2.307	2.548	2.184	0.679	96.862	14.795	54.106	5.210	3.175
3635	33	1	25.10	7.5	0.55	32	7.5	4.597	2.268	2.405	2.177	0.634	101.464	15.320	56.361	5.385	3.272
3636	33	1	25.60	8	0.55	32	8	4.343	2.236	2.244	2.179	0.593	105.846	15.870	58.575	5.600	3.355
3637	33	1	26.60	9	0.55	32	9	3.979	2.169	1.958	2.206	0.527	113.848	16.764	62.885	6.056	3.490
3638	33	1	27.60	10	0.55	32	10	3.801	2.133	1.768	2.258	0.476	120.062	17.552	66.513	6.510	3.551
3639	41	1	22.10	0.1	0.55	40	0.1	4.402	2.562	5.083	1.405	9.006	1.264	0.843	1.408	0.556	7.224
3640	41	1	22.25	0.25	0.55	40	0.25	12.306	4.846	12.594	1.127	7.194	2.814	1.949	3.059	0.835	5.583
3641	41	1	22.50	0.5	0.55	40	0.5	17.562	5.617	15.242	1.382	5.975	4.689	3.118	4.767	1.182	4.467
3642	41	1	22.75	0.75	0.55	40	0.75	17.637	5.211	13.940	1.691	4.434	9.337	4.006	7.539	1.509	3.910
3643	41	1	23.00	1	0.55	40	1	16.353	4.695	12.234	1.900	3.527	14.862	4.851	11.426	2.041	3.444
3644	41	1	23.25	1.25	0.55	40	1.25	15.309	4.297	10.966	2.033	2.923	21.221	5.560	15.585	2.587	2.915
3645	41	1	24.00	2	0.55	40	2	12.350	3.722	8.297	2.295	2.074	39.798	7.579	26.905	3.803	1.807
3646	41	1	24.50	2.5	0.55	40	2.5	10.962	3.649	7.202	2.364	1.777	51.055	9.091	33.366	4.339	1.611
3647	41	1	25.00	3	0.55	40	3	9.917	3.585	6.397	2.432	1.556	61.617	10.498	39.200	4.702	1.551
3648	41	1	26.00	4	0.55	40	4	8.386	3.343	5.221	2.479	1.235	81.357	13.081	49.561	5.104	2.187
3649	41	1	27.00	5	0.55	40	5	7.319	3.117	4.416	2.472	1.011	98.769	15.176	58.134	5.460	2.719
3650	41	1	28.00	6	0.55	40	6	6.400	2.893	3.736	2.402	0.847	114.294	16.922	65.426	5.786	3.124
3651	41	1	29.00	7	0.55	40	7	5.770	2.731	3.269	2.344	0.725	128.530	18.455	71.984	6.165	3.442
3652	41	1	29.50	7.5	0.55	40	7.5	5.543	2.662	3.116	2.333	0.675	134.871	19.125	74.866	6.384	3.567
3653	41	1	30.00	8	0.55	40	8	5.312	2.576	2.945	2.334	0.634	140.924	19.740	77.645	6.612	3.679
3654	41	1	31.00	9	0.55	40	9	4.905	2.482	2.648	2.321	0.557	156.287	21.209	84.998	7.171	3.913

STP-PT-074: Local Stress in Nozzles, Shells and Formed Heads from External Heads

Model								Secondary (inside) Stress Factors									
	OD	T	od	t	d/D	D/T	t/T	Branch					Header				
								Axial	In-Plane	Out-of-Plane	Torsional	Pressure	Axial	In-Plane	Out-of-Plane	Torsional	Pressure
3655	41	1	32.00	10	0.55	40	10	4.640	2.404	2.460	2.309	0.500	167.116	22.324	90.253	7.682	4.058
3656	51	1	27.60	0.1	0.55	50	0.1	5.808	2.932	6.486	1.389	8.700	1.511	0.933	1.674	0.578	7.688
3657	51	1	27.75	0.25	0.55	50	0.25	16.315	5.556	16.277	1.087	8.845	3.327	2.160	3.603	0.880	6.059
3658	51	1	28.00	0.5	0.55	50	0.5	23.156	6.665	19.794	1.583	7.100	5.964	3.463	5.655	1.257	4.898
3659	51	1	28.25	0.75	0.55	50	0.75	23.013	6.171	18.040	1.922	5.114	12.439	4.508	9.939	1.744	4.389
3660	51	1	28.50	1	0.55	50	1	21.139	5.630	15.777	2.113	3.951	19.815	5.463	15.103	2.291	3.923
3661	51	1	28.75	1.25	0.55	50	1.25	19.567	5.120	14.069	2.223	3.208	28.126	6.307	20.576	2.780	3.374
3662	51	1	29.50	2	0.55	50	2	15.397	4.341	10.503	2.472	2.198	51.901	9.296	35.293	4.228	2.053
3663	51	1	30.00	2.5	0.55	50	2.5	13.525	4.238	9.093	2.555	1.866	66.463	11.185	43.847	4.919	1.726
3664	51	1	30.50	3	0.55	50	3	12.122	4.199	8.058	2.588	1.628	80.193	12.878	51.637	5.415	1.660
3665	51	1	31.50	4	0.55	50	4	10.200	4.027	6.648	2.712	1.295	106.212	16.183	65.700	6.010	2.255
3666	51	1	32.50	5	0.55	50	5	8.895	3.889	5.675	2.679	1.064	129.644	18.895	77.590	6.436	2.831
3667	51	1	33.50	6	0.55	50	6	7.888	3.602	4.936	2.642	0.894	151.158	21.207	87.971	6.851	3.297
3668	51	1	34.50	7	0.55	50	7	7.097	3.365	4.347	2.572	0.766	171.383	23.274	97.406	7.352	3.684
3669	51	1	35.00	7.5	0.55	50	7.5	6.736	3.220	4.083	2.534	0.714	180.663	24.168	101.593	7.612	3.846
3670	51	1	35.50	8	0.55	50	8	6.431	3.136	3.846	2.510	0.667	189.455	24.988	105.535	7.886	3.991
3671	51	1	36.50	9	0.55	50	9	5.892	2.925	3.457	2.469	0.593	206.436	26.575	113.139	8.491	4.249
3672	51	1	37.50	10	0.55	50	10	5.419	2.758	3.123	2.409	0.525	221.567	27.953	119.890	9.074	4.451
3673	61	1	33.10	0.1	0.55	60	0.1	7.266	3.242	7.871	1.361	8.808	1.705	1.030	1.998	0.606	8.186
3674	61	1	33.25	0.25	0.55	60	0.25	20.356	6.214	19.914	1.110	10.397	3.734	2.387	4.269	0.927	6.549
3675	61	1	33.50	0.5	0.55	60	0.5	28.789	7.642	24.340	1.799	8.116	7.190	3.811	6.735	1.339	5.341
3676	61	1	33.75	0.75	0.55	60	0.75	28.384	7.142	22.136	2.160	5.732	15.464	4.881	12.267	1.901	4.799
3677	61	1	34.00	1	0.55	60	1	25.889	6.501	19.304	2.328	4.341	24.621	5.924	18.680	2.488	4.339
3678	61	1	34.25	1.25	0.55	60	1.25	23.752	5.894	17.138	2.417	3.473	34.766	7.267	25.423	3.022	3.781
3679	61	1	35.00	2	0.55	60	2	18.365	4.898	12.672	2.623	2.316	63.732	10.965	43.653	4.543	2.346
3680	61	1	35.50	2.5	0.55	60	2.5	15.987	4.818	10.920	2.707	1.949	81.520	13.140	54.331	5.356	1.811
3681	61	1	36.00	3	0.55	60	3	14.291	4.749	9.721	2.759	1.692	98.821	15.314	64.409	5.930	1.741
3682	61	1	37.00	4	0.55	60	4	12.009	4.596	8.116	2.853	1.343	130.462	19.137	81.968	6.772	2.298
3683	61	1	38.00	5	0.55	60	5	10.445	4.481	6.979	2.887	1.106	159.760	22.412	97.321	7.323	2.899
3684	61	1	39.00	6	0.55	60	6	9.237	4.224	6.190	2.876	0.932	187.622	25.386	111.243	7.918	3.410
3685	61	1	40.00	7	0.55	60	7	8.343	3.977	5.541	2.818	0.800	213.185	27.862	123.419	8.523	3.834
3686	61	1	40.50	7.5	0.55	60	7.5	7.938	3.895	5.142	2.776	0.746	225.361	28.987	129.030	8.808	4.023
3687	61	1	41.00	8	0.55	60	8	7.548	3.744	4.923	2.710	0.698	237.018	30.037	134.356	9.111	4.195
3688	61	1	42.00	9	0.55	60	9	6.972	3.472	4.392	2.674	0.617	259.759	32.076	144.594	9.821	4.508
3689	61	1	43.00	10	0.55	60	10	6.311	3.239	3.995	2.624	0.549	280.381	33.808	153.675	10.482	4.767
3690	71	1	38.60	0.1	0.55	70	0.1	8.727	3.517	9.260	1.333	9.317	1.943	1.100	2.237	0.624	8.629
3691	71	1	38.75	0.25	0.55	70	0.25	24.431	6.926	23.547	1.200	11.909	4.426	2.551	4.709	0.958	6.963
3692	71	1	39.00	0.5	0.55	70	0.5	34.397	8.583	28.873	2.024	9.054	8.498	4.059	7.523	1.407	5.716

STP-PT-074: Local Stress in Nozzles, Shells and Formed Heads from External Heads

Model								Secondary (inside) Stress Factors									
	OD	T	od	t	d/D	D/T	t/T	Branch					Header				
								Axial	In-Plane	Out-of-Plane	Torsional	Pressure	Axial	In-Plane	Out-of-Plane	Torsional	Pressure
3693	71	1	39.25	0.75	0.55	70	0.75	33.690	8.079	26.203	2.399	6.298	18.469	5.196	14.583	2.032	5.175
3694	71	1	39.50	1	0.55	70	1	30.554	7.330	22.802	2.543	4.703	29.356	6.530	22.232	2.650	4.721
3695	71	1	39.75	1.25	0.55	70	1.25	27.862	6.625	20.184	2.599	3.721	41.260	8.262	30.221	3.219	4.157
3696	71	1	40.50	2	0.55	70	2	21.265	5.424	14.824	2.773	2.432	75.580	12.698	52.210	4.752	2.644
3697	71	1	41.00	2.5	0.55	70	2.5	18.407	5.305	12.742	2.844	2.031	96.530	15.174	65.036	5.646	2.008
3698	71	1	41.50	3	0.55	70	3	16.418	5.239	11.365	2.904	1.756	116.432	17.553	76.868	6.385	1.807
3699	71	1	42.50	4	0.55	70	4	13.712	5.172	9.501	2.971	1.384	153.857	21.920	98.160	7.416	2.324
3700	71	1	43.50	5	0.55	70	5	12.002	5.029	8.305	3.028	1.141	188.808	25.734	117.015	8.134	2.936
3701	71	1	44.50	6	0.55	70	6	10.684	4.794	7.415	3.051	0.965	222.409	29.248	134.318	8.937	3.471
3702	71	1	45.50	7	0.55	70	7	9.746	4.553	6.708	3.016	0.830	253.549	32.209	149.603	9.646	3.925
3703	71	1	46.00	7.5	0.55	70	7.5	9.268	4.416	6.369	2.986	0.774	268.434	33.585	156.695	9.979	4.130
3704	71	1	46.50	8	0.55	70	8	8.814	4.255	6.029	2.943	0.724	282.935	34.859	163.491	10.299	4.322
3705	71	1	47.50	9	0.55	70	9	8.063	4.023	5.497	2.914	0.638	311.276	37.362	176.566	11.091	4.676
3706	71	1	48.50	10	0.55	70	10	7.422	3.776	5.005	2.825	0.571	337.421	39.471	188.211	11.832	4.979
3707	81	1	44.10	0.1	0.55	80	0.1	10.207	3.755	10.618	1.279	10.281	2.180	1.158	2.447	0.628	9.023
3708	81	1	44.25	0.25	0.55	80	0.25	28.445	7.625	27.112	1.306	13.310	5.202	2.684	5.217	0.989	7.355
3709	81	1	44.50	0.5	0.55	80	0.5	39.931	9.458	33.358	2.252	9.919	9.865	4.266	8.447	1.474	6.062
3710	81	1	44.75	0.75	0.55	80	0.75	38.895	8.966	30.229	2.634	6.829	21.430	5.472	16.882	2.140	5.529
3711	81	1	45.00	1	0.55	80	1	35.110	8.108	26.254	2.752	5.045	33.988	7.283	25.744	2.783	5.078
3712	81	1	45.25	1.25	0.55	80	1.25	31.861	7.312	23.189	2.781	3.960	47.818	9.322	35.133	3.425	4.535
3713	81	1	46.00	2	0.55	80	2	24.085	5.935	16.936	2.893	2.544	86.681	14.198	60.394	5.057	2.920
3714	81	1	46.50	2.5	0.55	80	2.5	20.789	5.768	14.550	2.987	2.111	110.609	16.969	75.340	5.925	2.207
3715	81	1	47.00	3	0.55	80	3	18.467	5.704	12.943	3.039	1.816	133.348	19.693	89.152	6.749	1.855
3716	81	1	48.00	4	0.55	80	4	15.445	5.612	10.904	3.050	1.427	176.231	24.569	114.176	7.985	2.369
3717	81	1	49.00	5	0.55	80	5	13.506	5.529	9.581	3.159	1.175	217.222	29.038	136.946	8.975	2.988
3718	81	1	50.00	6	0.55	80	6	12.238	5.357	8.700	3.179	0.995	255.562	32.895	157.213	9.905	3.520
3719	81	1	51.00	7	0.55	80	7	11.163	5.091	7.909	3.155	0.858	292.059	36.337	175.704	10.716	3.990
3720	81	1	51.50	7.5	0.55	80	7.5	10.553	4.980	7.449	3.140	0.797	309.707	37.926	184.333	11.102	4.192
3721	81	1	52.00	8	0.55	80	8	10.245	4.805	7.230	3.120	0.746	326.818	39.432	192.589	11.455	4.396
3722	81	1	53.00	9	0.55	80	9	9.385	4.546	6.592	3.076	0.663	360.491	42.378	208.577	12.280	4.786
3723	81	1	54.00	10	0.55	80	10	8.647	4.290	6.040	2.998	0.589	392.058	44.909	222.991	13.112	5.115
3724	91	1	49.60	0.1	0.55	90	0.1	11.669	3.978	11.951	1.228	11.275	2.414	1.212	2.646	0.632	9.402
3725	91	1	49.75	0.25	0.55	90	0.25	32.398	8.288	30.615	1.429	14.658	5.954	2.795	5.858	1.017	7.724
3726	91	1	50.00	0.5	0.55	90	0.5	45.365	10.288	37.789	2.479	10.723	11.226	4.470	9.502	1.553	6.430
3727	91	1	50.25	0.75	0.55	90	0.75	43.992	9.817	34.209	2.865	7.319	24.466	5.821	19.253	2.246	5.893
3728	91	1	50.50	1	0.55	90	1	39.557	8.866	29.670	2.960	5.362	38.702	8.089	29.358	2.931	5.443
3729	91	1	50.75	1.25	0.55	90	1.25	35.739	7.967	26.143	2.961	4.183	53.962	10.279	39.805	3.575	4.865
3730	91	1	51.50	2	0.55	90	2	26.822	6.433	19.020	3.030	2.652	97.353	15.617	68.450	5.313	3.183



STP-PT-074: Local Stress in Nozzles, Shells and Formed Heads from External Heads

Model								Secondary (inside) Stress Factors									
	OD	T	od	t	d/D	D/T	t/T	Branch					Header				
								Axial	In-Plane	Out-of-Plane	Torsional	Pressure	Axial	In-Plane	Out-of-Plane	Torsional	Pressure
3731	91	1	52.00	2.5	0.55	90	2.5	23.111	6.201	16.325	3.092	2.189	124.049	18.753	85.441	6.267	2.414
3732	91	1	52.50	3	0.55	90	3	20.504	6.156	14.524	3.144	1.875	149.456	21.726	101.204	7.078	1.957
3733	91	1	53.50	4	0.55	90	4	17.183	6.071	12.303	3.172	1.466	198.148	27.257	130.313	8.520	2.392
3734	91	1	54.50	5	0.55	90	5	15.117	6.059	10.858	3.208	1.204	243.708	32.054	156.236	9.784	2.999
3735	91	1	55.50	6	0.55	90	6	13.639	5.868	9.841	3.276	1.019	287.132	36.370	179.850	10.832	3.537
3736	91	1	56.50	7	0.55	90	7	12.574	5.623	9.088	3.283	0.880	328.641	40.252	201.497	11.741	4.016
3737	91	1	57.00	7.5	0.55	90	7.5	12.147	5.463	8.757	3.271	0.822	348.732	42.063	211.691	12.161	4.238
3738	91	1	57.50	8	0.55	90	8	11.599	5.310	8.373	3.265	0.771	369.213	43.977	221.943	12.580	4.457
3739	91	1	58.50	9	0.55	90	9	10.705	5.143	7.688	3.202	0.682	407.373	47.183	240.469	13.417	4.849
3740	91	1	59.50	10	0.55	90	10	9.963	4.793	7.122	3.199	0.609	443.925	50.103	257.702	14.329	5.204
3741	101	1	55.10	0.1	0.55	100	0.1	13.071	4.218	13.271	1.201	12.400	2.609	1.277	2.917	0.649	9.853
3742	101	1	55.25	0.25	0.55	100	0.25	36.271	8.923	34.085	1.560	15.921	6.466	2.951	6.214	1.053	8.128
3743	101	1	55.50	0.5	0.55	100	0.5	50.662	11.157	42.157	2.705	11.494	12.598	4.647	10.621	1.621	6.740
3744	101	1	55.75	0.75	0.55	100	0.75	48.936	10.631	38.126	3.092	7.780	27.320	6.324	21.507	2.335	6.203
3745	101	1	56.00	1	0.55	100	1	43.854	9.568	33.015	3.161	5.663	43.098	8.796	32.772	3.042	5.757
3746	101	1	56.25	1.25	0.55	100	1.25	39.476	8.598	29.034	3.142	4.395	59.893	11.193	44.395	3.711	5.176
3747	101	1	57.00	2	0.55	100	2	29.493	6.919	21.076	3.155	2.756	107.553	16.970	76.340	5.543	3.434
3748	101	1	57.50	2.5	0.55	100	2.5	25.389	6.679	18.080	3.229	2.265	136.905	20.481	95.369	6.572	2.612
3749	101	1	58.00	3	0.55	100	3	22.534	6.521	16.093	3.271	1.933	164.821	23.706	113.038	7.451	2.113
3750	101	1	59.00	4	0.55	100	4	18.939	6.513	13.699	3.287	1.503	218.454	29.698	145.837	9.157	2.401
3751	101	1	60.00	5	0.55	100	5	16.802	6.460	12.205	3.300	1.233	268.777	34.927	175.195	10.559	3.000
3752	101	1	61.00	6	0.55	100	6	15.325	6.321	11.178	3.357	1.044	316.959	39.672	202.113	11.724	3.537
3753	101	1	62.00	7	0.55	100	7	14.173	6.087	10.353	3.394	0.902	363.252	43.992	226.960	12.726	4.022
3754	101	1	62.50	7.5	0.55	100	7.5	13.509	5.940	9.898	3.385	0.843	386.608	46.225	239.229	13.202	4.256
3755	101	1	63.00	8	0.55	100	8	13.182	5.889	9.616	3.388	0.791	408.686	48.142	250.543	13.655	4.472
3756	101	1	64.00	9	0.55	100	9	12.199	5.483	8.868	3.358	0.700	451.630	51.783	272.003	14.507	4.876
3757	101	1	65.00	10	0.55	100	10	11.438	5.140	8.287	3.287	0.627	492.974	55.100	292.048	15.486	5.247
3758	251	1	137.60	0.1	0.55	250	0.1	30.060	7.132	30.675	1.353	27.942	5.669	2.020	5.654	0.762	14.812
3759	251	1	137.75	0.25	0.55	250	0.25	82.845	16.701	80.888	3.616	29.891	13.245	4.275	12.449	1.475	12.417
3760	251	1	138.00	0.5	0.55	250	0.5	114.380	21.566	101.826	5.681	20.221	30.361	7.761	26.076	2.590	10.318
3761	251	1	138.25	0.75	0.55	250	0.75	107.664	20.149	91.370	5.964	13.138	62.530	12.699	52.569	4.028	9.732
3762	251	1	138.50	1	0.55	250	1	94.635	17.875	78.383	5.704	9.177	95.935	17.711	79.538	5.596	9.334
3763	251	1	138.75	1.25	0.55	250	1.25	83.689	16.094	68.152	5.400	6.902	129.440	22.707	106.521	7.057	8.709
3764	251	1	139.50	2	0.55	250	2	62.784	13.212	49.067	4.913	4.069	223.035	35.044	182.322	10.558	6.437
3765	251	1	140.00	2.5	0.55	250	2.5	55.676	12.621	42.408	4.811	3.265	280.110	41.794	228.647	12.344	5.032
3766	251	1	140.50	3	0.55	250	3	51.372	12.352	38.279	4.759	2.731	334.346	47.934	272.539	14.136	4.149
3767	251	1	141.50	4	0.55	250	4	47.191	12.070	33.741	4.668	2.035	436.987	58.833	354.779	17.390	2.988
3768	251	1	142.50	5	0.55	250	5	44.513	11.811	31.263	4.587	1.610	534.900	68.796	431.758	20.242	2.780

STP-PT-074: Local Stress in Nozzles, Shells and Formed Heads from External Heads

Model								Secondary (inside) Stress Factors									
	OD	T	od	t	d/D	D/T	t/T	Branch					Header				
								Axial	In-Plane	Out-of-Plane	Torsional	Pressure	Axial	In-Plane	Out-of-Plane	Torsional	Pressure
3769	251	1	143.50	6	0.55	250	6	42.361	11.528	29.567	4.481	1.328	629.953	78.205	504.869	22.711	3.186
3770	251	1	144.50	7	0.55	250	7	40.391	11.260	28.159	4.407	1.133	723.957	87.498	575.800	25.025	3.577
3771	251	1	145.00	7.5	0.55	250	7.5	39.424	11.066	27.474	4.353	1.056	770.187	91.910	610.135	26.098	3.765
3772	251	1	145.50	8	0.55	250	8	38.592	10.896	26.889	4.315	0.990	815.516	96.162	643.331	27.018	3.945
3773	251	1	146.50	9	0.55	250	9	36.933	10.516	25.741	4.333	0.882	905.590	104.581	708.437	28.894	4.301
3774	251	1	147.50	10	0.55	250	10	35.231	10.276	24.537	4.350	0.796	994.251	112.591	771.134	30.561	4.644
3775	501	1	275.10	0.1	0.55	500	0.1	49.721	10.801	55.361	2.320	45.232	9.838	3.301	10.556	1.006	20.951
3776	501	1	275.25	0.25	0.55	500	0.25	139.545	26.163	149.928	6.371	45.118	22.064	6.979	22.216	2.121	17.502
3777	501	1	275.50	0.5	0.55	500	0.5	192.108	33.860	190.210	9.485	29.951	52.912	12.779	49.673	3.984	14.443
3778	501	1	275.75	0.75	0.55	500	0.75	178.814	31.958	169.970	9.488	19.204	106.120	20.491	98.801	6.386	13.783
3779	501	1	276.00	1	0.55	500	1	155.947	28.501	144.936	8.816	13.228	160.044	28.848	148.285	8.893	13.374
3780	501	1	276.25	1.25	0.55	500	1.25	137.422	25.672	125.494	8.200	9.834	212.847	36.688	197.070	11.225	12.709
3781	501	1	277.00	2	0.55	500	2	105.456	21.441	90.676	7.297	5.638	360.340	55.715	335.627	16.764	9.941
3782	501	1	277.50	2.5	0.55	500	2.5	96.290	20.553	79.275	7.099	4.482	450.639	66.058	421.838	19.798	8.103
3783	501	1	278.00	3	0.55	500	3	92.489	20.332	72.595	6.979	3.737	536.006	75.001	503.987	22.736	6.521
3784	501	1	279.00	4	0.55	500	4	90.420	19.905	67.957	6.747	2.771	697.814	91.351	660.330	27.993	4.689
3785	501	1	280.00	5	0.55	500	5	88.403	19.271	65.367	6.524	2.161	850.825	108.479	808.140	32.628	3.693
3786	501	1	281.00	6	0.55	500	6	85.910	18.864	62.966	6.312	1.752	999.395	124.711	951.020	36.858	3.088
3787	501	1	282.00	7	0.55	500	7	83.062	18.113	60.489	6.123	1.460	1144.262	140.090	1089.500	40.670	3.354
3788	501	1	282.50	7.5	0.55	500	7.5	81.544	17.767	59.189	6.031	1.347	1216.323	147.614	1158.131	42.385	3.492
3789	501	1	283.00	8	0.55	500	8	80.026	17.344	58.010	5.980	1.248	1286.980	155.106	1225.065	44.128	3.623
3790	501	1	284.00	9	0.55	500	9	77.045	16.876	55.648	5.759	1.087	1427.808	169.224	1357.763	47.241	3.885
3791	501	1	285.00	10	0.55	500	10	74.108	16.496	53.360	5.613	0.964	1569.044	183.527	1489.589	50.284	4.146
3793	751	1	412.75	0.25	0.55	750	0.25	187.255	33.185	211.439	8.585	56.688	28.699	9.043	29.848	2.689	21.548
3794	751	1	413.00	0.5	0.55	750	0.5	257.364	44.096	269.146	12.412	37.336	72.315	16.679	71.394	5.134	17.674
3795	751	1	413.25	0.75	0.55	750	0.75	238.226	41.280	239.841	12.247	23.867	142.853	26.833	140.532	8.260	16.891
3796	751	1	413.50	1	0.55	750	1	207.355	36.718	204.347	11.235	16.357	213.634	37.519	209.519	11.469	16.495
3797	751	1	413.75	1.25	0.55	750	1.25	182.570	33.140	176.687	10.397	12.098	282.982	47.410	277.646	14.406	15.789
3798	751	1	414.50	2	0.55	750	2	141.934	28.304	128.802	9.299	6.861	476.264	71.305	471.175	21.669	12.644
3799	751	1	415.00	2.5	0.55	750	2.5	131.478	27.476	113.928	9.141	5.439	595.279	83.968	592.479	25.837	10.496
3800	751	1	415.50	3	0.55	750	3	129.080	27.050	106.128	9.031	4.517	708.064	96.418	708.259	29.601	8.615
3801	751	1	416.50	4	0.55	750	4	129.914	26.800	103.773	8.791	3.345	920.927	119.119	928.952	36.385	5.919
3802	751	1	417.50	5	0.55	750	5	129.622	26.148	102.463	8.440	2.608	1122.363	141.022	1138.752	42.515	4.750
3803	751	1	418.50	6	0.55	750	6	127.693	25.282	100.440	8.084	2.104	1317.871	161.723	1342.637	48.068	4.047
3804	751	1	419.50	7	0.55	750	7	124.828	24.348	97.978	7.800	1.746	1507.657	181.751	1540.319	53.189	3.538
3805	751	1	420.00	7.5	0.55	750	7.5	123.048	23.873	96.401	7.585	1.605	1601.553	191.275	1638.143	55.563	3.501
3806	751	1	420.50	8	0.55	750	8	120.942	23.540	94.573	7.455	1.482	1695.507	201.395	1735.768	57.950	3.475
3807	751	1	421.50	9	0.55	750	9	116.990	22.775	91.200	7.236	1.281	1881.151	220.000	1928.441	62.278	3.696

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Model								Secondary (inside) Stress Factors									
	OD	T	od	t	d/D	D/T	t/T	Branch					Header				
								Axial	In-Plane	Out-of-Plane	Torsional	Pressure	Axial	In-Plane	Out-of-Plane	Torsional	Pressure
3808	751	1	422.50	10	0.55	750	10	113.185	21.933	88.118	6.983	1.127	2063.171	238.428	2116.757	66.315	3.903
3810	1001	1	550.25	0.25	0.55	1000	0.25	228.045	39.564	266.476	10.444	66.592	35.452	10.768	37.465	3.200	25.020
3811	1001	1	550.50	0.5	0.55	1000	0.5	313.072	52.781	339.985	14.888	43.615	89.329	19.890	91.406	6.135	20.429
3812	1001	1	550.75	0.75	0.55	1000	0.75	288.926	49.192	302.480	14.517	27.800	174.701	32.289	178.464	9.827	19.536
3813	1001	1	551.00	1	0.55	1000	1	251.305	43.599	257.584	13.234	19.008	260.021	44.858	264.983	13.612	19.149
3814	1001	1	551.25	1.25	0.55	1000	1.25	221.327	39.430	222.733	12.223	14.020	343.560	56.392	350.457	17.060	18.413
3815	1001	1	552.00	2	0.55	1000	2	174.069	34.189	163.747	11.013	7.903	576.723	84.213	593.283	26.019	14.940
3816	1001	1	552.50	2.5	0.55	1000	2.5	162.950	33.535	146.378	10.898	6.252	719.722	100.977	745.385	31.021	12.519
3817	1001	1	553.00	3	0.55	1000	3	162.445	33.315	138.914	10.840	5.186	856.133	115.895	891.210	35.457	10.387
3818	1001	1	554.00	4	0.55	1000	4	166.735	32.911	139.232	10.610	3.830	1113.220	142.710	1169.167	43.501	7.109
3819	1001	1	555.00	5	0.55	1000	5	169.050	32.181	140.301	10.280	2.982	1356.791	168.581	1434.043	50.770	5.625
3820	1001	1	556.00	6	0.55	1000	6	168.447	31.189	139.715	9.838	2.404	1591.427	192.899	1691.192	57.488	4.790
3821	1001	1	557.00	7	0.55	1000	7	165.844	30.077	137.444	9.406	1.992	1820.661	216.560	1942.196	63.752	4.183
3822	1001	1	557.50	7.5	0.55	1000	7.5	164.027	29.509	135.929	9.227	1.827	1933.537	228.267	2066.176	66.715	3.936
3823	1001	1	558.00	8	0.55	1000	8	161.904	28.977	133.959	8.977	1.686	2045.198	239.380	2187.962	69.558	3.726
3824	1001	1	559.00	9	0.55	1000	9	157.676	28.001	130.439	8.646	1.453	2267.330	261.812	2431.573	74.862	3.663
3825	1001	1	560.00	10	0.55	1000	10	152.664	27.058	125.932	8.264	1.272	2487.497	284.033	2673.197	79.949	3.849
3827	1251	1	687.75	0.25	0.55	1250	0.25	263.139	45.252	315.800	12.084	75.462	41.434	12.371	44.941	3.668	28.121
3828	1251	1	688.00	0.5	0.55	1250	0.5	361.383	60.241	403.791	17.090	49.195	104.473	22.881	109.895	7.035	22.884
3829	1251	1	688.25	0.75	0.55	1250	0.75	332.777	55.957	359.003	16.522	31.298	202.701	37.036	213.173	11.236	21.898
3830	1251	1	688.50	1	0.55	1250	1	289.365	49.500	305.965	14.953	21.335	301.065	51.250	316.354	15.459	21.485
3831	1251	1	688.75	1.25	0.55	1250	1.25	255.098	44.880	264.623	13.807	15.715	396.616	64.228	417.023	19.371	20.725
3832	1251	1	689.50	2	0.55	1250	2	202.491	39.388	196.053	12.534	8.824	664.182	96.813	704.628	29.919	16.971
3833	1251	1	690.00	2.5	0.55	1250	2.5	191.330	38.899	176.712	12.446	6.975	829.051	116.059	885.042	35.612	14.313
3834	1251	1	690.50	3	0.55	1250	3	192.917	38.894	170.060	12.448	5.783	985.846	133.183	1057.553	40.679	11.958
3835	1251	1	691.50	4	0.55	1250	4	201.067	38.711	173.885	12.282	4.261	1281.658	163.467	1388.655	49.857	8.331
3836	1251	1	692.50	5	0.55	1250	5	205.954	37.869	177.527	11.913	3.316	1561.634	192.447	1704.041	58.131	6.353
3837	1251	1	693.50	6	0.55	1250	6	206.979	36.707	178.872	11.435	2.671	1831.128	220.062	2012.259	65.813	5.395
3838	1251	1	694.50	7	0.55	1250	7	205.243	35.355	177.310	10.938	2.210	2094.261	246.698	2307.945	73.033	4.702
3839	1251	1	695.00	7.5	0.55	1250	7.5	203.844	34.752	176.266	10.752	2.027	2223.139	259.845	2454.619	76.424	4.421
3840	1251	1	695.50	8	0.55	1250	8	201.762	34.258	174.376	10.489	1.867	2351.723	272.901	2600.975	79.753	4.180
3841	1251	1	696.50	9	0.55	1250	9	197.122	32.762	170.337	10.027	1.607	2603.974	298.289	2888.795	86.107	3.777
3842	1251	1	697.50	10	0.55	1250	10	191.867	31.667	165.612	9.627	1.404	2856.693	323.358	3177.609	91.988	3.771
3844	1501	1	825.25	0.25	0.55	1500	0.25	293.613	50.282	361.111	13.429	83.379	46.647	13.811	51.821	4.109	30.938
3845	1501	1	825.50	0.5	0.55	1500	0.5	403.845	66.879	463.161	18.990	54.181	118.178	25.689	127.559	7.845	25.095
3846	1501	1	825.75	0.75	0.55	1500	0.75	371.384	62.041	411.437	18.259	34.431	227.852	41.318	245.958	12.460	24.008
3847	1501	1	826.00	1	0.55	1500	1	322.803	54.784	350.197	16.506	23.456	337.290	56.952	363.449	17.132	23.604
3848	1501	1	826.25	1.25	0.55	1500	1.25	284.749	49.688	303.194	15.202	17.247	444.089	71.188	479.279	21.626	22.807

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Model								Secondary (inside) Stress Factors									
	OD	T	od	t	d/D	D/T	t/T	Branch					Header				
								Axial	In-Plane	Out-of-Plane	Torsional	Pressure	Axial	In-Plane	Out-of-Plane	Torsional	Pressure
3849	1501	1	827.00	2	0.55	1500	2	228.040	44.139	226.377	13.922	9.663	741.901	108.460	808.105	33.451	18.800
3850	1501	1	827.50	2.5	0.55	1500	2.5	216.909	43.801	205.404	13.882	7.632	925.866	129.737	1014.575	39.778	15.927
3851	1501	1	828.00	3	0.55	1500	3	220.791	44.003	200.144	13.952	6.328	1101.384	148.659	1213.378	45.382	13.369
3852	1501	1	829.00	4	0.55	1500	4	232.928	43.992	207.608	13.838	4.657	1431.796	182.059	1592.264	55.527	9.427
3853	1501	1	830.00	5	0.55	1500	5	240.714	43.242	214.446	13.467	3.619	1744.215	213.862	1955.001	64.649	6.982
3854	1501	1	831.00	6	0.55	1500	6	243.490	41.955	217.252	12.964	2.913	2044.781	244.180	2303.291	73.216	5.913
3855	1501	1	832.00	7	0.55	1500	7	242.965	40.628	217.264	12.421	2.408	2339.445	273.934	2646.433	81.319	5.145
3856	1501	1	832.50	7.5	0.55	1500	7.5	241.893	39.836	217.453	12.164	2.207	2483.190	288.294	2825.893	85.240	4.833
3857	1501	1	833.00	8	0.55	1500	8	240.177	39.150	215.349	11.917	2.034	2626.740	302.393	2984.480	88.924	4.559
3858	1501	1	834.00	9	0.55	1500	9	235.487	37.654	211.283	11.384	1.748	2907.629	330.522	3315.359	96.121	4.110
3859	1501	1	835.00	10	0.55	1500	10	230.137	36.382	206.499	10.912	1.525	3188.739	358.174	3646.765	102.764	3.765
3862	1751	1	963.00	0.5	0.55	1750	0.5	441.938	72.991	517.704	20.755	58.700	130.672	28.318	144.091	8.603	27.176
3863	1751	1	963.25	0.75	0.55	1750	0.75	406.099	67.537	460.188	19.858	37.331	250.732	45.299	276.767	13.611	25.988
3864	1751	1	963.50	1	0.55	1750	1	353.021	59.651	392.073	17.950	25.406	370.545	62.178	408.626	18.654	25.575
3865	1751	1	963.75	1.25	0.55	1750	1.25	311.652	54.102	339.436	16.479	18.666	487.313	77.507	537.815	23.793	24.748
3866	1751	1	964.50	2	0.55	1750	2	251.168	48.503	255.589	15.175	10.431	813.602	119.260	908.355	36.695	20.490
3867	1751	1	965.00	2.5	0.55	1750	2.5	240.263	48.435	232.555	15.221	8.237	1015.099	142.622	1136.623	43.638	17.424
3868	1751	1	965.50	3	0.55	1750	3	246.574	48.802	229.231	15.316	6.829	1207.117	163.061	1359.604	49.752	14.688
3869	1751	1	966.50	4	0.55	1750	4	262.359	49.063	240.442	15.304	5.026	1569.906	199.185	1785.813	60.762	10.442
3870	1751	1	967.50	5	0.55	1750	5	273.001	48.412	249.940	14.951	3.900	1912.027	233.460	2188.258	70.691	7.539
3871	1751	1	968.50	6	0.55	1750	6	277.994	47.127	255.480	14.431	3.137	2242.682	266.212	2582.153	79.972	6.362
3872	1751	1	969.50	7	0.55	1750	7	278.773	45.574	257.117	13.840	2.591	2563.133	297.896	2964.596	88.832	5.508
3873	1751	1	970.00	7.5	0.55	1750	7.5	277.994	44.766	257.325	13.555	2.375	2720.949	313.531	3160.154	93.047	5.174
3874	1751	1	970.50	8	0.55	1750	8	276.612	43.957	255.954	13.266	2.187	2876.309	328.908	3341.109	97.174	4.930
3875	1751	1	971.50	9	0.55	1750	9	272.590	42.386	251.797	12.714	1.877	3183.412	359.483	3697.501	105.101	4.510
3876	1751	1	972.50	10	0.55	1750	10	266.956	40.986	247.559	12.199	1.636	3489.792	389.205	4081.300	112.522	4.160
3879	2001	1	1100.50	0.5	0.55	2000	0.5	476.406	78.589	569.127	22.318	63.057	142.217	30.776	160.031	9.290	29.090
3880	2001	1	1100.75	0.75	0.55	2000	0.75	437.512	72.645	506.197	21.538	40.037	272.107	48.956	306.685	14.663	27.823
3881	2001	1	1101.00	1	0.55	2000	1	380.207	64.136	430.923	19.440	27.224	401.424	67.019	451.703	20.227	27.400
3882	2001	1	1101.25	1.25	0.55	2000	1.25	335.852	58.185	374.257	17.706	19.980	527.177	83.499	595.133	25.769	26.525
3883	2001	1	1102.00	2	0.55	2000	2	272.229	52.525	281.799	16.344	11.153	879.008	129.368	997.711	39.772	22.059
3884	2001	1	1102.50	2.5	0.55	2000	2.5	261.633	52.652	258.493	16.452	8.803	1097.633	154.293	1252.772	47.221	18.812
3885	2001	1	1103.00	3	0.55	2000	3	270.324	53.255	257.303	16.629	7.299	1304.783	176.360	1498.894	53.798	15.905
3886	2001	1	1104.00	4	0.55	2000	4	289.937	53.870	272.189	16.687	5.372	1696.986	214.986	1965.152	65.586	11.378
3887	2001	1	1105.00	5	0.55	2000	5	303.577	53.356	285.003	16.348	4.163	2067.801	251.670	2408.752	76.180	8.261
3888	2001	1	1106.00	6	0.55	2000	6	310.706	51.872	293.368	15.789	3.348	2424.223	286.132	2843.553	86.155	6.769
3889	2001	1	1107.00	7	0.55	2000	7	312.458	50.310	296.232	15.225	2.763	2769.557	320.059	3264.564	95.652	5.901
3890	2001	1	1107.50	7.5	0.55	2000	7.5	312.290	49.492	296.585	14.921	2.531	2940.456	336.699	3472.487	100.257	5.605

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Model								Secondary (inside) Stress Factors									
	OD	T	od	t	d/D	D/T	t/T	Branch					Header				
								Axial	In-Plane	Out-of-Plane	Torsional	Pressure	Axial	In-Plane	Out-of-Plane	Torsional	Pressure
3891	2001	1	1108.00	8	0.55	2000	8	311.632	48.506	296.626	14.562	2.330	3108.509	353.078	3678.020	104.734	5.343
3892	2001	1	1109.00	9	0.55	2000	9	308.069	46.858	293.911	13.978	1.999	3441.100	385.699	4085.899	113.316	4.896
3893	2001	1	1110.00	10	0.55	2000	10	302.959	45.254	289.251	13.395	1.741	3772.321	417.579	4490.430	121.427	4.522
3896	2251	1	1238.00	0.5	0.55	2250	0.5	508.135	83.597	616.519	23.822	67.089	153.119	32.965	175.223	9.945	30.891
3897	2251	1	1238.25	0.75	0.55	2250	0.75	466.399	77.242	548.837	23.101	42.581	291.917	52.310	334.720	15.650	29.550
3898	2251	1	1238.50	1	0.55	2250	1	405.314	68.229	467.074	20.830	28.933	429.802	71.428	491.670	21.761	29.125
3899	2251	1	1238.75	1.25	0.55	2250	1.25	358.146	61.928	404.795	19.016	21.235	564.201	89.665	645.768	27.745	28.222
3900	2251	1	1239.50	2	0.55	2250	2	291.598	56.310	307.387	17.414	11.829	940.639	138.768	1086.815	42.553	23.531
3901	2251	1	1240.00	2.5	0.55	2250	2.5	281.859	56.683	283.630	17.613	9.334	1174.097	165.495	1363.621	50.546	20.110
3902	2251	1	1240.50	3	0.55	2250	3	292.643	57.474	284.716	17.883	7.741	1395.756	188.954	1631.142	57.637	17.057
3903	2251	1	1241.50	4	0.55	2250	4	315.636	58.426	302.848	18.029	5.698	1816.827	229.754	2137.141	70.109	12.255
3904	2251	1	1242.50	5	0.55	2250	5	331.885	57.995	319.176	17.738	4.411	2211.880	268.333	2619.962	81.366	8.965
3905	2251	1	1243.50	6	0.55	2250	6	341.128	56.683	329.490	17.181	3.545	2593.609	304.847	3087.404	91.988	7.130
3906	2251	1	1244.50	7	0.55	2250	7	344.612	54.934	334.661	16.555	2.925	2966.138	340.601	3549.077	102.105	6.316
3907	2251	1	1245.00	7.5	0.55	2250	7.5	345.108	54.027	334.924	16.221	2.679	3147.541	358.061	3762.476	106.946	6.002
3908	2251	1	1245.50	8	0.55	2250	8	344.732	53.137	336.170	15.878	2.465	3328.812	375.618	3997.517	111.769	5.728
3909	2251	1	1246.50	9	0.55	2250	9	341.752	51.209	334.287	15.242	2.114	3684.775	409.902	4441.101	120.943	5.243
3910	2251	1	1247.50	10	0.55	2250	10	337.212	49.401	330.688	14.623	1.840	4038.498	443.612	4884.936	129.807	4.854
3913	2501	1	1375.50	0.5	0.55	2500	0.5	537.580	88.320	661.547	25.405	71.020	163.373	35.115	189.815	10.554	32.624
3914	2501	1	1375.75	0.75	0.55	2500	0.75	493.032	81.518	587.558	24.588	44.979	310.734	55.431	361.012	16.579	31.184
3915	2501	1	1376.00	1	0.55	2500	1	428.516	72.115	501.336	22.178	30.553	456.930	75.573	530.717	23.230	30.751
3916	2501	1	1376.25	1.25	0.55	2500	1.25	378.851	65.478	435.450	20.190	22.397	599.615	95.712	697.728	29.534	29.825
3917	2501	1	1377.00	2	0.55	2500	2	309.674	59.737	330.806	18.458	12.470	998.692	147.545	1166.770	45.258	24.926
3918	2501	1	1377.50	2.5	0.55	2500	2.5	301.022	60.375	307.105	18.745	9.840	1246.825	175.569	1467.759	53.771	21.343
3919	2501	1	1378.00	3	0.55	2500	3	313.784	61.556	311.054	19.059	8.158	1482.775	200.530	1756.534	61.140	18.120
3920	2501	1	1379.00	4	0.55	2500	4	339.911	62.770	333.110	19.286	6.008	1930.876	243.631	2303.984	74.328	13.104
3921	2501	1	1380.00	5	0.55	2500	5	358.647	62.422	352.286	19.006	4.651	2352.410	283.986	2825.595	86.248	9.635
3922	2501	1	1381.00	6	0.55	2500	6	370.010	61.104	366.629	18.485	3.733	2760.354	322.227	3343.734	97.302	7.516
3923	2501	1	1382.00	7	0.55	2500	7	375.129	59.353	373.190	17.817	3.079	3150.066	359.333	3827.159	107.972	6.718
3924	2501	1	1382.50	7.5	0.55	2500	7.5	376.341	58.396	374.133	17.458	2.819	3343.825	378.024	4059.445	113.189	6.373
3925	2501	1	1383.00	8	0.55	2500	8	375.974	57.371	374.825	17.126	2.594	3538.109	395.760	4305.572	118.294	6.066
3926	2501	1	1384.00	9	0.55	2500	9	374.430	55.420	375.657	16.420	2.224	3915.852	431.874	4792.977	128.039	5.563
3927	2501	1	1385.00	10	0.55	2500	10	370.680	53.532	371.970	15.757	1.934	4287.634	468.059	5250.346	137.330	5.154
3928	9	1	4.90	0.1	0.6	8	0.1	1.175	1.128	1.156	1.011	7.996	0.419	0.284	0.434	0.280	4.132
3929	9	1	5.05	0.25	0.6	8	0.25	1.307	1.184	1.411	1.012	3.277	0.998	0.602	0.863	0.517	3.423
3930	9	1	5.30	0.5	0.6	8	0.5	1.638	1.404	1.733	0.923	2.035	1.843	0.939	1.258	0.716	2.680
3931	9	1	5.55	0.75	0.6	8	0.75	1.884	1.311	1.710	1.008	1.894	2.604	1.156	1.512	0.815	2.224
3932	9	1	5.80	1	0.6	8	1	1.996	1.199	1.607	1.082	1.792	3.330	1.351	1.765	0.939	1.965

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Model								Secondary (inside) Stress Factors									
	OD	T	od	t	d/D	D/T	t/T	Branch					Header				
								Axial	In-Plane	Out-of-Plane	Torsional	Pressure	Axial	In-Plane	Out-of-Plane	Torsional	Pressure
3933	9	1	6.05	1.25	0.6	8	1.25	2.105	1.151	1.544	1.074	1.572	3.937	1.465	1.958	1.044	1.679
3934	9	1	6.80	2	0.6	8	2	2.151	1.083	1.303	1.167	1.127	5.890	1.735	3.195	1.271	1.251
3935	9	1	7.30	2.5	0.6	8	2.5	2.126	1.066	1.182	1.227	0.938	7.372	2.035	3.865	1.399	1.160
3936	9	1	7.80	3	0.6	8	3	2.091	1.034	1.105	1.257	0.797	8.862	2.235	4.404	1.540	1.130
3937	9	1	8.80	4	0.6	8	4	2.067	1.072	1.087	1.527	0.708	11.851	2.538	5.246	1.956	1.210
3945	17	1	9.70	0.1	0.6	16	0.1	1.555	1.171	1.748	1.207	9.129	0.652	0.470	0.690	0.442	5.762
3946	17	1	9.85	0.25	0.6	16	0.25	3.338	2.433	3.889	1.213	3.537	1.520	1.052	1.488	0.747	4.484
3947	17	1	10.10	0.5	0.6	16	0.5	4.627	2.776	4.745	1.164	3.039	2.650	1.692	2.302	1.029	3.476
3948	17	1	10.35	0.75	0.6	16	0.75	5.046	2.490	4.506	1.319	2.678	3.717	2.173	2.917	1.220	2.863
3949	17	1	10.60	1	0.6	16	1	4.974	2.249	4.089	1.509	2.461	4.771	2.589	3.590	1.438	2.432
3950	17	1	10.85	1.25	0.6	16	1.25	4.951	2.149	3.814	1.596	2.200	5.809	2.884	4.945	1.677	2.012
3951	17	1	11.60	2	0.6	16	2	4.540	2.021	3.090	1.858	1.674	11.045	3.539	8.602	2.144	1.429
3952	17	1	12.10	2.5	0.6	16	2.5	4.214	1.961	2.712	1.910	1.422	14.240	3.971	10.667	2.314	1.330
3953	17	1	12.60	3	0.6	16	3	3.906	1.897	2.399	1.913	1.223	17.104	4.547	12.459	2.443	1.303
3954	17	1	13.60	4	0.6	16	4	3.497	1.779	1.929	1.906	0.940	21.684	5.434	15.283	2.675	1.657
3955	17	1	14.60	5	0.6	16	5	3.282	1.730	1.661	1.846	0.752	24.957	6.114	17.456	2.959	1.896
3956	17	1	15.60	6	0.6	16	6	3.226	1.710	1.508	1.939	0.627	27.128	6.671	19.225	3.267	2.005
3957	17	1	16.60	7	0.6	16	7	3.213	1.739	1.478	2.093	0.558	28.420	7.101	20.766	3.688	2.032
3962	25	1	14.50	0.1	0.6	24	0.1	2.307	1.766	2.813	1.400	8.859	0.885	0.623	0.930	0.551	6.575
3963	25	1	14.65	0.25	0.6	24	0.25	5.797	3.396	6.739	1.275	4.894	2.035	1.445	2.046	0.876	5.019
3964	25	1	14.90	0.5	0.6	24	0.5	8.452	3.769	8.213	1.261	4.228	3.402	2.337	3.192	1.203	3.914
3965	25	1	15.15	0.75	0.6	24	0.75	8.831	3.522	7.654	1.540	3.417	4.803	3.010	4.204	1.453	3.302
3966	25	1	15.40	1	0.6	24	1	8.456	3.190	6.837	1.790	2.929	7.242	3.616	6.091	1.763	2.818
3967	25	1	15.65	1.25	0.6	24	1.25	8.190	2.986	6.264	1.935	2.541	10.319	4.088	8.330	2.194	2.314
3968	25	1	16.40	2	0.6	24	2	7.114	2.827	4.977	2.164	1.912	20.253	5.222	14.801	2.988	1.592
3969	25	1	16.90	2.5	0.6	24	2.5	6.481	2.756	4.369	2.301	1.645	26.223	5.806	18.426	3.258	1.426
3970	25	1	17.40	3	0.6	24	3	5.942	2.630	3.873	2.361	1.433	31.710	6.684	21.645	3.429	1.374
3971	25	1	18.40	4	0.6	24	4	5.078	2.434	3.112	2.354	1.118	41.561	8.281	27.162	3.707	1.902
3972	25	1	19.40	5	0.6	24	5	4.448	2.299	2.579	2.285	0.904	49.828	9.522	31.668	3.949	2.312
3973	25	1	20.40	6	0.6	24	6	4.042	2.208	2.215	2.276	0.754	56.541	10.500	35.370	4.250	2.576
3974	25	1	21.40	7	0.6	24	7	3.896	2.136	2.009	2.187	0.645	61.767	11.300	38.452	4.590	2.732
3975	25	1	21.90	7.5	0.6	24	7.5	3.815	2.121	1.918	2.184	0.602	63.934	11.657	39.850	4.776	2.781
3976	25	1	22.40	8	0.6	24	8	3.765	2.105	1.844	2.222	0.564	65.782	12.019	41.141	4.994	2.814
3977	25	1	23.40	9	0.6	24	9	3.763	2.104	1.716	2.276	0.501	68.782	12.625	43.605	5.445	2.841
3978	25	1	24.40	10	0.6	24	10	3.740	2.098	1.639	2.384	0.453	70.803	13.152	45.840	5.920	2.825
3979	33	1	19.30	0.1	0.6	32	0.1	3.217	2.199	3.884	1.479	9.737	1.100	0.725	1.173	0.606	7.176
3980	33	1	19.45	0.25	0.6	32	0.25	8.650	4.122	9.677	1.249	6.297	2.503	1.709	2.591	0.949	5.531
3981	33	1	19.70	0.5	0.6	32	0.5	12.610	4.734	11.847	1.390	5.369	4.048	2.776	4.086	1.320	4.361



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Model								Secondary (inside) Stress Factors									
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								Axial	In-Plane	Out-of-Plane	Torsional	Pressure	Axial	In-Plane	Out-of-Plane	Torsional	Pressure
3982	33	1	19.95	0.75	0.6	32	0.75	12.910	4.429	10.956	1.733	4.112	6.853	3.591	5.905	1.610	3.751
3983	33	1	20.20	1	0.6	32	1	12.152	4.055	9.709	1.996	3.355	10.692	4.341	8.832	2.038	3.256
3984	33	1	20.45	1.25	0.6	32	1.25	11.543	3.746	8.801	2.158	2.824	15.383	4.966	12.139	2.588	2.713
3985	33	1	21.20	2	0.6	32	2	9.587	3.468	6.845	2.446	2.049	29.435	6.662	21.230	3.709	1.740
3986	33	1	21.70	2.5	0.6	32	2.5	8.600	3.433	6.001	2.520	1.762	37.960	7.531	26.424	4.130	1.507
3987	33	1	22.20	3	0.6	32	3	7.809	3.334	5.336	2.593	1.544	45.883	8.680	31.078	4.392	1.443
3988	33	1	23.20	4	0.6	32	4	6.664	3.056	4.353	2.650	1.220	61.533	10.995	39.846	4.676	2.028
3989	33	1	24.20	5	0.6	32	5	5.797	2.912	3.624	2.603	0.994	74.651	12.789	46.791	4.977	2.531
3990	33	1	25.20	6	0.6	32	6	5.127	2.759	3.068	2.565	0.831	86.313	14.270	52.810	5.269	2.902
3991	33	1	26.20	7	0.6	32	7	4.611	2.620	2.646	2.522	0.711	96.600	15.465	58.131	5.654	3.176
3992	33	1	26.70	7.5	0.6	32	7.5	4.416	2.561	2.488	2.503	0.663	101.233	15.997	60.565	5.855	3.284
3993	33	1	27.20	8	0.6	32	8	4.315	2.492	2.407	2.483	0.620	105.501	16.519	62.838	6.099	3.373
3994	33	1	28.20	9	0.6	32	9	4.150	2.386	2.239	2.389	0.551	112.754	17.407	66.872	6.593	3.498
3995	33	1	29.20	10	0.6	32	10	3.988	2.350	2.098	2.393	0.496	118.709	18.174	70.481	7.082	3.572
3996	41	1	24.10	0.1	0.6	40	0.1	4.149	2.539	4.987	1.493	9.604	1.310	0.810	1.401	0.640	7.642
3997	41	1	24.25	0.25	0.6	40	0.25	11.683	4.715	12.653	1.199	7.732	2.951	1.920	3.067	1.005	5.980
3998	41	1	24.50	0.5	0.6	40	0.5	16.919	5.607	15.565	1.555	6.421	4.654	3.120	4.850	1.404	4.767
3999	41	1	24.75	0.75	0.6	40	0.75	17.099	5.266	14.331	1.932	4.751	9.062	4.092	7.757	1.739	4.199
4000	41	1	25.00	1	0.6	40	1	15.918	4.862	12.638	2.186	3.750	14.514	4.974	11.845	2.244	3.699
4001	41	1	25.25	1.25	0.6	40	1.25	14.927	4.450	11.376	2.342	3.086	20.830	5.727	16.247	2.853	3.132
4002	41	1	26.00	2	0.6	40	2	12.054	4.017	8.712	2.656	2.162	39.104	7.785	28.126	4.243	1.897
4003	41	1	26.50	2.5	0.6	40	2.5	10.690	3.997	7.620	2.726	1.846	50.323	9.163	35.049	4.819	1.636
4004	41	1	27.00	3	0.6	40	3	9.649	3.933	6.802	2.818	1.616	60.866	10.708	41.333	5.202	1.562
4005	41	1	28.00	4	0.6	40	4	8.115	3.674	5.577	2.899	1.285	80.553	13.487	52.533	5.610	2.115
4006	41	1	29.00	5	0.6	40	5	6.998	3.496	4.662	2.891	1.053	97.829	15.731	61.790	5.983	2.664
4007	41	1	30.00	6	0.6	40	6	6.246	3.304	4.007	2.819	0.883	115.849	17.884	71.134	6.293	3.103
4008	41	1	31.00	7	0.6	40	7	5.625	3.137	3.489	2.751	0.755	130.646	19.548	78.548	6.757	3.445
4009	41	1	31.50	7.5	0.6	40	7.5	5.363	3.036	3.278	2.726	0.708	137.525	20.292	81.974	6.984	3.589
4010	41	1	32.00	8	0.6	40	8	5.047	2.967	3.032	2.681	0.661	144.101	20.962	85.251	7.222	3.717
4011	41	1	33.00	9	0.6	40	9	4.633	2.826	2.680	2.596	0.582	156.381	22.175	91.494	7.789	3.944
4012	41	1	34.00	10	0.6	40	10	4.334	2.730	2.405	2.642	0.524	167.387	23.263	97.199	8.347	4.110
4013	51	1	30.10	0.1	0.6	50	0.1	5.477	2.884	6.355	1.463	9.274	1.527	0.914	1.735	0.680	8.198
4014	51	1	30.25	0.25	0.6	50	0.25	15.593	5.374	16.375	1.159	9.501	3.389	2.180	3.739	1.064	6.540
4015	51	1	30.50	0.5	0.6	50	0.5	22.417	6.628	20.259	1.790	7.615	5.717	3.524	5.970	1.506	5.277
4016	51	1	30.75	0.75	0.6	50	0.75	22.406	6.325	18.594	2.201	5.476	12.014	4.561	10.163	1.909	4.679
4017	51	1	31.00	1	0.6	50	1	20.652	5.796	16.330	2.436	4.204	19.274	5.550	15.573	2.520	4.186
4018	51	1	31.25	1.25	0.6	50	1.25	19.142	5.273	14.607	2.564	3.391	27.490	6.436	21.322	3.107	3.606
4019	51	1	32.00	2	0.6	50	2	15.082	4.628	11.024	2.869	2.293	51.169	9.297	36.916	4.747	2.194

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Model								Secondary (inside) Stress Factors									
	OD	T	od	t	d/D	D/T	t/T	Branch					Header				
								Axial	In-Plane	Out-of-Plane	Torsional	Pressure	Axial	In-Plane	Out-of-Plane	Torsional	Pressure
4020	51	1	32.50	2.5	0.6	50	2.5	13.239	4.597	9.612	2.962	1.939	66.052	11.329	46.276	5.452	1.768
4021	51	1	33.00	3	0.6	50	3	11.857	4.570	8.585	3.021	1.690	79.845	13.226	54.672	5.982	1.684
4022	51	1	34.00	4	0.6	50	4	9.945	4.372	7.142	3.180	1.344	105.454	16.600	69.580	6.648	2.187
4023	51	1	35.00	5	0.6	50	5	8.623	4.178	6.101	3.203	1.108	128.819	19.470	82.426	7.106	2.778
4024	51	1	36.00	6	0.6	50	6	7.608	3.991	5.266	3.138	0.933	150.680	22.017	93.940	7.532	3.264
4025	51	1	37.00	7	0.6	50	7	6.806	3.699	4.606	3.039	0.800	170.291	24.120	103.844	8.088	3.652
4026	51	1	37.50	7.5	0.6	50	7.5	6.472	3.616	4.303	3.030	0.745	179.498	25.067	108.386	8.362	3.821
4027	51	1	38.00	8	0.6	50	8	6.163	3.504	4.087	2.992	0.700	188.270	25.951	112.674	8.623	3.972
4028	51	1	39.00	9	0.6	50	9	5.743	3.360	3.714	2.953	0.617	209.648	27.996	123.295	9.296	4.295
4029	51	1	40.00	10	0.6	50	10	5.280	3.226	3.279	2.881	0.554	225.942	29.486	131.223	9.948	4.529
4030	61	1	36.10	0.1	0.6	60	0.1	6.903	3.169	7.736	1.408	9.713	1.780	0.992	1.984	0.695	8.674
4031	61	1	36.25	0.25	0.6	60	0.25	19.540	6.059	20.080	1.218	11.153	3.864	2.358	4.221	1.108	7.023
4032	61	1	36.50	0.5	0.6	60	0.5	27.965	7.588	24.958	2.046	8.696	6.981	3.812	6.889	1.588	5.705
4033	61	1	36.75	0.75	0.6	60	0.75	27.717	7.311	22.853	2.477	6.133	14.994	4.934	12.584	2.091	5.114
4034	61	1	37.00	1	0.6	60	1	25.360	6.669	20.011	2.679	4.621	24.027	6.017	19.301	2.749	4.628
4035	61	1	37.25	1.25	0.6	60	1.25	23.301	6.041	17.821	2.787	3.675	34.084	7.305	26.388	3.344	4.041
4036	61	1	38.00	2	0.6	60	2	18.044	5.179	13.307	3.032	2.419	63.314	11.088	45.919	5.067	2.525
4037	61	1	38.50	2.5	0.6	60	2.5	15.707	5.113	11.558	3.129	2.027	81.192	13.357	57.335	5.960	1.929
4038	61	1	39.00	3	0.6	60	3	14.011	5.087	10.335	3.191	1.756	98.124	15.569	67.844	6.635	1.764
4039	61	1	40.00	4	0.6	60	4	11.710	4.946	8.677	3.343	1.392	129.756	19.535	86.698	7.506	2.236
4040	61	1	41.00	5	0.6	60	5	10.148	4.850	7.484	3.442	1.149	159.572	23.103	103.597	8.079	2.859
4041	61	1	42.00	6	0.6	60	6	8.982	4.666	6.551	3.407	0.971	186.880	26.102	118.322	8.716	3.372
4042	61	1	43.00	7	0.6	60	7	8.103	4.357	5.817	3.361	0.834	212.323	28.721	131.484	9.382	3.806
4043	61	1	43.50	7.5	0.6	60	7.5	7.638	4.305	5.467	3.330	0.779	224.359	29.914	137.570	9.697	3.997
4044	61	1	44.00	8	0.6	60	8	7.373	4.086	5.196	3.274	0.727	236.529	31.144	143.677	9.988	4.182
4045	61	1	45.00	9	0.6	60	9	6.715	3.842	4.635	3.218	0.644	258.607	33.201	154.437	10.706	4.496
4046	61	1	46.00	10	0.6	60	10	6.236	3.669	4.215	3.158	0.575	279.094	35.069	164.266	11.438	4.764
4047	71	1	42.10	0.1	0.6	70	0.1	8.286	3.431	9.115	1.389	10.034	2.026	1.055	2.206	0.722	9.179
4048	71	1	42.25	0.25	0.6	70	0.25	23.531	6.768	23.749	1.337	12.810	4.443	2.516	4.708	1.138	7.462
4049	71	1	42.50	0.5	0.6	70	0.5	33.493	8.533	29.628	2.313	9.690	8.260	4.056	7.762	1.666	6.099
4050	71	1	42.75	0.75	0.6	70	0.75	32.970	8.241	27.076	2.756	6.736	17.955	5.235	14.989	2.238	5.513
4051	71	1	43.00	1	0.6	70	1	30.006	7.485	23.664	2.928	5.008	28.888	6.652	23.136	2.961	5.062
4052	71	1	43.25	1.25	0.6	70	1.25	27.396	6.761	21.004	2.998	3.942	40.765	8.435	31.569	3.631	4.466
4053	71	1	44.00	2	0.6	70	2	20.923	5.704	15.547	3.208	2.543	74.853	12.653	54.642	5.342	2.837
4054	71	1	44.50	2.5	0.6	70	2.5	18.102	5.594	13.452	3.275	2.113	95.862	15.293	68.293	6.367	2.138
4055	71	1	45.00	3	0.6	70	3	16.080	5.549	12.022	3.322	1.821	115.786	17.783	80.890	7.168	1.825
4056	71	1	46.00	4	0.6	70	4	13.404	5.458	10.144	3.463	1.436	153.251	22.277	103.695	8.256	2.269
4057	71	1	47.00	5	0.6	70	5	11.670	5.452	8.890	3.558	1.184	188.861	26.404	124.393	9.013	2.904

STP-PT-074: Local Stress in Nozzles, Shells and Formed Heads from External Heads

Model								Secondary (inside) Stress Factors									
	OD	T	od	t	d/D	D/T	t/T	Branch					Header				
								Axial	In-Plane	Out-of-Plane	Torsional	Pressure	Axial	In-Plane	Out-of-Plane	Torsional	Pressure
4058	71	1	48.00	6	0.6	70	6	10.398	5.286	7.889	3.586	1.004	221.839	29.920	142.676	9.840	3.438
4059	71	1	49.00	7	0.6	70	7	9.357	4.979	7.049	3.580	0.864	252.917	33.043	159.213	10.630	3.901
4060	71	1	49.50	7.5	0.6	70	7.5	8.904	4.917	6.716	3.573	0.809	268.378	34.605	167.263	10.986	4.117
4061	71	1	50.00	8	0.6	70	8	8.523	4.737	6.435	3.579	0.755	282.799	35.967	174.615	11.342	4.312
4062	71	1	51.00	9	0.6	70	9	7.867	4.495	5.775	3.532	0.669	310.411	38.474	188.357	12.055	4.666
4063	71	1	52.00	10	0.6	70	10	7.194	4.200	5.278	3.389	0.597	336.461	40.724	201.038	12.894	4.976
4064	81	1	48.10	0.1	0.6	80	0.1	9.741	3.638	10.460	1.310	11.005	2.252	1.126	2.477	0.726	9.658
4065	81	1	48.25	0.25	0.6	80	0.25	27.479	7.430	27.372	1.476	14.337	4.961	2.679	5.308	1.180	7.938
4066	81	1	48.50	0.5	0.6	80	0.5	38.966	9.481	34.254	2.581	10.612	9.558	4.298	8.848	1.759	6.515
4067	81	1	48.75	0.75	0.6	80	0.75	38.145	9.115	31.262	3.029	7.295	21.005	5.515	17.476	2.376	5.924
4068	81	1	49.00	1	0.6	80	1	34.533	8.260	27.259	3.172	5.370	33.509	7.445	26.811	3.128	5.443
4069	81	1	49.25	1.25	0.6	80	1.25	31.369	7.440	24.135	3.211	4.196	47.089	9.430	36.536	3.826	4.842
4070	81	1	50.00	2	0.6	80	2	23.720	6.242	17.756	3.331	2.660	85.975	14.133	63.206	5.651	3.136
4071	81	1	50.50	2.5	0.6	80	2.5	20.454	6.075	15.333	3.443	2.197	109.955	17.154	79.042	6.685	2.366
4072	81	1	51.00	3	0.6	80	3	18.158	6.022	13.730	3.490	1.885	132.746	19.904	93.718	7.596	1.916
4073	81	1	52.00	4	0.6	80	4	15.087	6.025	11.616	3.530	1.476	176.322	25.034	120.823	8.920	2.301
4074	81	1	53.00	5	0.6	80	5	13.173	5.920	10.270	3.666	1.216	216.875	29.506	144.889	9.907	2.928
4075	81	1	54.00	6	0.6	80	6	11.744	5.880	9.181	3.749	1.031	255.289	33.515	166.733	10.927	3.475
4076	81	1	55.00	7	0.6	80	7	10.666	5.576	8.321	3.723	0.889	292.419	37.279	187.082	11.814	3.963
4077	81	1	55.50	7.5	0.6	80	7.5	10.166	5.508	7.932	3.726	0.831	309.975	38.937	196.420	12.235	4.183
4078	81	1	56.00	8	0.6	80	8	9.698	5.337	7.549	3.715	0.780	327.134	40.517	205.383	12.624	4.391
4079	81	1	57.00	9	0.6	80	9	9.005	5.096	6.964	3.710	0.689	360.135	43.451	222.270	13.396	4.773
4080	81	1	58.00	10	0.6	80	10	8.412	4.728	6.475	3.651	0.616	391.484	46.130	237.848	14.262	5.115
4081	91	1	54.10	0.1	0.6	90	0.1	11.114	3.862	11.801	1.279	12.050	2.468	1.184	2.674	0.742	10.119
4082	91	1	54.25	0.25	0.6	90	0.25	31.319	8.071	30.931	1.618	15.714	5.500	2.796	5.781	1.219	8.352
4083	91	1	54.50	0.5	0.6	90	0.5	44.333	10.383	38.824	2.851	11.500	10.968	4.481	9.794	1.837	6.865
4084	91	1	54.75	0.75	0.6	90	0.75	43.186	9.959	35.377	3.298	7.819	23.891	5.876	19.841	2.494	6.273
4085	91	1	55.00	1	0.6	90	1	38.940	8.996	30.801	3.409	5.709	37.999	8.202	30.418	3.275	5.796
4086	91	1	55.25	1.25	0.6	90	1.25	35.219	8.088	27.203	3.415	4.434	53.202	10.375	41.399	4.011	5.193
4087	91	1	56.00	2	0.6	90	2	26.448	6.709	19.938	3.496	2.779	96.618	15.657	71.614	5.955	3.417
4088	91	1	56.50	2.5	0.6	90	2.5	22.765	6.511	17.207	3.541	2.283	123.805	19.072	89.899	7.063	2.597
4089	91	1	57.00	3	0.6	90	3	20.197	6.389	15.413	3.620	1.950	149.375	22.102	106.674	7.961	2.101
4090	91	1	58.00	4	0.6	90	4	16.877	6.440	13.182	3.643	1.520	197.777	27.570	137.345	9.582	2.331
4091	91	1	59.00	5	0.6	90	5	14.801	6.391	11.752	3.769	1.247	243.464	32.480	165.074	10.802	2.950
4092	91	1	60.00	6	0.6	90	6	13.174	6.338	10.498	3.853	1.055	287.052	36.937	190.408	11.964	3.490
4093	91	1	61.00	7	0.6	90	7	11.998	6.159	9.568	3.876	0.915	329.313	41.153	214.227	12.958	3.994
4094	91	1	61.50	7.5	0.6	90	7.5	11.615	6.033	9.221	3.921	0.855	349.499	43.051	225.260	13.415	4.220
4095	91	1	62.00	8	0.6	90	8	11.183	5.854	8.875	3.913	0.801	369.303	44.849	235.812	13.872	4.434

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Model								Secondary (inside) Stress Factors									
	OD	T	od	t	d/D	D/T	t/T	Branch					Header				
								Axial	In-Plane	Out-of-Plane	Torsional	Pressure	Axial	In-Plane	Out-of-Plane	Torsional	Pressure
4096	91	1	63.00	9	0.6	90	9	10.195	5.482	8.093	3.838	0.710	407.442	48.218	255.843	14.725	4.835
4097	91	1	64.00	10	0.6	90	10	9.437	5.225	7.435	3.845	0.636	444.519	51.451	274.862	15.609	5.204
4098	101	1	60.10	0.1	0.6	100	0.1	12.479	4.074	13.097	1.237	13.297	2.677	1.231	2.849	0.751	10.553
4099	101	1	60.25	0.25	0.6	100	0.25	35.144	8.698	34.425	1.797	17.137	6.035	2.913	6.238	1.244	8.734
4100	101	1	60.50	0.5	0.6	100	0.5	49.570	11.235	43.290	3.118	12.339	12.335	4.650	10.914	1.914	7.195
4101	101	1	60.75	0.75	0.6	100	0.75	48.088	10.751	39.417	3.561	8.330	26.706	6.390	22.161	2.611	6.601
4102	101	1	61.00	1	0.6	100	1	43.208	9.689	34.263	3.644	6.030	42.377	8.922	33.964	3.403	6.128
4103	101	1	61.25	1.25	0.6	100	1.25	38.940	8.706	30.209	3.621	4.661	59.115	11.275	46.169	4.157	5.522
4104	101	1	62.00	2	0.6	100	2	29.094	7.216	22.076	3.626	2.891	107.186	17.264	80.081	6.256	3.696
4105	101	1	62.50	2.5	0.6	100	2.5	25.027	6.901	19.047	3.727	2.364	136.738	20.831	100.261	7.413	2.813
4106	101	1	63.00	3	0.6	100	3	22.171	6.905	17.033	3.712	2.013	164.801	24.071	118.991	8.395	2.274
4107	101	1	64.00	4	0.6	100	4	18.578	6.789	14.629	3.757	1.560	218.103	29.968	153.445	10.175	2.342
4108	101	1	65.00	5	0.6	100	5	16.268	6.817	13.050	3.847	1.277	268.632	35.304	184.781	11.675	2.953
4109	101	1	66.00	6	0.6	100	6	14.670	6.793	11.912	3.960	1.082	317.684	40.361	214.096	12.961	3.507
4110	101	1	67.00	7	0.6	100	7	13.435	6.576	10.912	4.020	0.936	364.258	44.848	240.882	14.069	4.001
4111	101	1	67.50	7.5	0.6	100	7.5	13.105	6.408	10.554	4.007	0.876	386.753	46.929	253.464	14.572	4.230
4112	101	1	68.00	8	0.6	100	8	12.564	6.296	10.114	4.013	0.822	408.965	48.952	265.723	15.060	4.450
4113	101	1	69.00	9	0.6	100	9	11.620	5.995	9.314	4.050	0.730	451.938	52.723	288.857	16.005	4.862
4114	101	1	70.00	10	0.6	100	10	10.949	5.699	8.718	4.023	0.655	494.117	56.369	311.007	16.892	5.248
4115	251	1	150.10	0.1	0.6	250	0.1	28.601	6.831	30.169	1.492	30.012	5.694	2.086	5.787	0.902	16.107
4116	251	1	150.25	0.25	0.6	250	0.25	80.058	16.464	80.892	4.184	32.067	13.055	4.387	12.496	1.756	13.455
4117	251	1	150.50	0.5	0.6	250	0.5	111.879	21.284	103.567	6.565	21.726	29.698	7.972	26.529	3.065	11.079
4118	251	1	150.75	0.75	0.6	250	0.75	105.856	20.242	93.618	6.826	14.102	61.477	12.800	53.946	4.697	10.404
4119	251	1	151.00	1	0.6	250	1	93.258	18.204	80.588	6.541	9.837	94.565	18.079	81.840	6.434	9.952
4120	251	1	151.25	1.25	0.6	250	1.25	82.541	16.441	70.229	6.198	7.377	127.900	23.066	109.863	8.041	9.302
4121	251	1	152.00	2	0.6	250	2	61.903	13.555	50.846	5.686	4.297	220.973	35.095	188.291	11.777	6.917
4122	251	1	152.50	2.5	0.6	250	2.5	54.850	12.800	44.155	5.539	3.436	277.923	41.706	236.244	14.025	5.442
4123	251	1	153.00	3	0.6	250	3	50.533	12.448	40.012	5.518	2.869	332.279	47.804	282.034	16.106	4.419
4124	251	1	154.00	4	0.6	250	4	46.246	12.203	35.518	5.422	2.137	434.598	58.396	367.245	19.674	3.178
4125	251	1	155.00	5	0.6	250	5	43.717	11.997	33.077	5.273	1.686	532.141	68.416	447.074	22.764	2.752
4126	251	1	156.00	6	0.6	250	6	41.533	11.790	31.336	5.112	1.386	626.807	78.491	523.137	25.445	3.153
4127	251	1	157.00	7	0.6	250	7	39.460	11.470	29.986	5.060	1.178	719.600	88.162	596.197	27.817	3.535
4128	251	1	157.50	7.5	0.6	250	7.5	38.528	11.348	29.303	4.997	1.098	765.230	92.737	631.553	28.899	3.719
4129	251	1	158.00	8	0.6	250	8	37.569	11.193	28.615	4.934	1.027	810.974	97.313	666.349	29.985	3.971
4130	251	1	159.00	9	0.6	250	9	35.929	10.876	27.285	4.947	0.915	900.571	105.884	734.197	31.951	4.323
4131	251	1	160.00	10	0.6	250	10	34.371	10.596	26.224	4.988	0.829	989.869	114.542	800.914	33.794	4.599
4132	501	1	300.10	0.1	0.6	500	0.1	46.337	10.508	53.613	2.549	48.123	9.582	3.328	10.556	1.200	22.866
4133	501	1	300.25	0.25	0.6	500	0.25	132.515	25.544	147.843	7.311	48.472	21.190	7.013	21.849	2.513	19.005

STP-PT-074: Local Stress in Nozzles, Shells and Formed Heads from External Heads

Model								Secondary (inside) Stress Factors									
	OD	T	od	t	d/D	D/T	t/T	Branch					Header				
								Axial	In-Plane	Out-of-Plane	Torsional	Pressure	Axial	In-Plane	Out-of-Plane	Torsional	Pressure
4134	501	1	300.50	0.5	0.6	500	0.5	184.996	34.035	191.157	10.782	32.135	51.249	12.875	50.181	4.655	15.519
4135	501	1	300.75	0.75	0.6	500	0.75	173.392	32.120	172.100	10.831	20.655	103.222	20.823	100.382	7.368	14.729
4136	501	1	301.00	1	0.6	500	1	151.729	28.598	147.375	10.034	14.205	155.901	29.086	150.927	10.142	14.287
4137	501	1	301.25	1.25	0.6	500	1.25	133.930	25.829	127.879	9.337	10.530	208.023	36.851	201.254	12.729	13.617
4138	501	1	302.00	2	0.6	500	2	103.146	21.863	93.058	8.394	5.975	352.456	55.317	343.052	19.255	10.695
4139	501	1	302.50	2.5	0.6	500	2.5	94.377	21.029	81.794	8.204	4.727	440.683	65.728	431.015	22.821	8.751
4140	501	1	303.00	3	0.6	500	3	90.310	20.629	75.186	8.084	3.927	524.571	75.329	515.335	26.068	7.063
4141	501	1	304.00	4	0.6	500	4	88.422	19.928	70.293	7.826	2.905	682.000	93.312	674.267	31.892	4.893
4142	501	1	305.00	5	0.6	500	5	86.607	19.341	67.967	7.566	2.264	831.556	110.524	825.325	37.002	3.875
4143	501	1	306.00	6	0.6	500	6	84.217	18.626	65.642	7.233	1.832	975.952	126.687	970.727	41.569	3.284
4144	501	1	307.00	7	0.6	500	7	81.472	18.276	63.314	6.965	1.527	1116.848	142.087	1111.904	45.669	3.259
4145	501	1	307.50	7.5	0.6	500	7.5	79.928	17.718	61.925	6.857	1.407	1186.721	149.596	1181.653	47.548	3.390
4146	501	1	308.00	8	0.6	500	8	78.419	17.522	60.660	6.809	1.304	1255.997	156.826	1250.595	49.418	3.517
4147	501	1	309.00	9	0.6	500	9	75.467	16.992	58.234	6.553	1.137	1392.695	171.259	1385.791	52.656	3.764
4148	501	1	310.00	10	0.6	500	10	72.562	16.317	55.935	6.394	1.008	1529.920	185.287	1520.694	55.783	4.013
4150	751	1	450.25	0.25	0.6	750	0.25	175.667	32.831	206.434	9.735	60.915	28.454	9.116	30.400	3.175	23.433
4151	751	1	450.50	0.5	0.6	750	0.5	245.282	43.970	267.955	14.075	40.172	69.627	16.723	71.836	5.974	19.035
4152	751	1	450.75	0.75	0.6	750	0.75	228.765	41.241	240.818	13.868	25.677	138.078	27.118	142.092	9.453	18.098
4153	751	1	451.00	1	0.6	750	1	199.903	36.619	206.226	12.689	17.575	207.028	37.621	212.552	12.970	17.657
4154	751	1	451.25	1.25	0.6	750	1.25	176.327	33.047	178.689	11.744	12.971	274.392	47.192	281.666	16.273	16.931
4155	751	1	452.00	2	0.6	750	2	137.640	28.571	131.263	10.621	7.285	462.221	71.685	478.120	25.105	13.607
4156	751	1	452.50	2.5	0.6	750	2.5	127.752	27.942	116.806	10.494	5.747	577.369	85.764	600.633	29.736	11.314
4157	751	1	453.00	3	0.6	750	3	124.941	27.685	108.839	10.408	4.756	686.674	98.163	717.959	33.938	9.316
4158	751	1	454.00	4	0.6	750	4	126.020	27.086	106.809	10.133	3.509	892.711	121.017	941.050	41.446	6.249
4159	751	1	455.00	5	0.6	750	5	125.910	26.337	105.850	9.754	2.730	1088.183	142.555	1153.020	48.072	4.975
4160	751	1	456.00	6	0.6	750	6	124.071	25.457	104.068	9.312	2.202	1277.021	163.334	1359.609	54.250	4.229
4161	751	1	457.00	7	0.6	750	7	121.119	24.417	101.517	8.876	1.826	1460.663	183.213	1561.092	59.791	3.678
4162	751	1	457.50	7.5	0.6	750	7.5	119.488	23.827	100.077	8.734	1.677	1551.881	192.775	1659.263	62.350	3.456
4163	751	1	458.00	8	0.6	750	8	117.665	23.407	98.381	8.509	1.549	1640.776	202.453	1756.155	64.879	3.494
4164	751	1	459.00	9	0.6	750	9	113.646	22.790	94.783	8.257	1.340	1818.778	220.898	1949.874	69.482	3.697
4165	751	1	460.00	10	0.6	750	10	109.745	22.455	91.370	7.872	1.178	1994.587	239.120	2140.877	73.647	3.892
4167	1001	1	600.25	0.25	0.6	1000	0.25	211.917	39.026	257.750	11.690	71.376	34.695	10.924	38.226	3.762	27.216
4168	1001	1	600.50	0.5	0.6	1000	0.5	296.339	52.210	335.654	16.765	46.909	85.672	20.177	91.633	7.091	22.001
4169	1001	1	600.75	0.75	0.6	1000	0.75	275.635	48.786	301.270	16.355	29.906	167.916	32.391	179.254	11.182	20.942
4170	1001	1	601.00	1	0.6	1000	1	240.776	43.230	258.078	14.922	20.426	250.597	44.637	267.055	15.338	20.512
4171	1001	1	601.25	1.25	0.6	1000	1.25	212.397	39.086	223.783	13.729	15.023	331.582	55.920	353.727	19.551	19.722
4172	1001	1	602.00	2	0.6	1000	2	167.767	34.241	166.044	12.512	8.396	556.446	86.125	597.639	30.112	16.066
4173	1001	1	602.50	2.5	0.6	1000	2.5	157.326	33.834	149.378	12.429	6.613	694.918	102.843	750.643	35.661	13.486

STP-PT-074: Local Stress in Nozzles, Shells and Formed Heads from External Heads

Model								Secondary (inside) Stress Factors									
	OD	T	od	t	d/D	D/T	t/T	Branch					Header				
								Axial	In-Plane	Out-of-Plane	Torsional	Pressure	Axial	In-Plane	Out-of-Plane	Torsional	Pressure
4174	1001	1	603.00	3	0.6	1000	3	156.197	33.686	141.409	12.384	5.468	826.428	117.575	897.166	40.613	11.215
4175	1001	1	604.00	4	0.6	1000	4	160.740	33.464	142.873	12.220	4.022	1074.013	144.172	1175.660	49.468	7.726
4176	1001	1	605.00	5	0.6	1000	5	162.861	32.690	144.362	11.783	3.127	1309.195	169.796	1443.152	57.520	5.839
4177	1001	1	606.00	6	0.6	1000	6	162.383	31.600	144.074	11.291	2.519	1535.569	193.816	1701.043	64.836	4.938
4178	1001	1	607.00	7	0.6	1000	7	159.954	30.370	141.926	10.815	2.085	1756.365	217.077	1951.108	71.612	4.279
4179	1001	1	607.50	7.5	0.6	1000	7.5	158.027	29.822	140.222	10.546	1.913	1864.219	228.480	2075.580	74.769	4.019
4180	1001	1	608.00	8	0.6	1000	8	156.193	29.347	138.595	10.300	1.764	1971.987	239.682	2197.496	77.824	3.791
4181	1001	1	609.00	9	0.6	1000	9	151.901	28.229	134.809	9.873	1.520	2184.268	261.628	2440.117	83.621	3.582
4182	1001	1	610.00	10	0.6	1000	10	147.197	27.288	130.534	9.454	1.331	2392.339	283.430	2678.510	88.878	3.745
4184	1251	1	750.25	0.25	0.6	1250	0.25	242.608	44.369	302.769	13.394	80.846	40.236	12.468	45.463	4.301	30.609
4185	1251	1	750.50	0.5	0.6	1250	0.5	339.765	59.273	395.582	19.075	52.844	99.837	23.237	109.785	8.080	24.653
4186	1251	1	750.75	0.75	0.6	1250	0.75	315.658	55.299	355.050	18.747	33.636	194.148	37.005	213.226	12.720	23.478
4187	1251	1	751.00	1	0.6	1250	1	275.649	48.948	304.097	17.090	22.947	288.791	50.784	316.629	17.629	23.033
4188	1251	1	751.25	1.25	0.6	1250	1.25	243.524	44.304	264.040	15.651	16.860	381.154	63.825	418.248	22.517	22.221
4189	1251	1	752.00	2	0.6	1250	2	194.218	39.334	197.830	14.171	9.382	638.574	98.939	705.859	34.528	18.238
4190	1251	1	752.50	2.5	0.6	1250	2.5	183.658	39.097	179.588	14.164	7.384	797.446	117.914	886.642	40.876	15.404
4191	1251	1	753.00	3	0.6	1250	3	184.619	39.251	172.820	14.223	6.106	947.931	134.637	1059.455	46.528	12.890
4192	1251	1	754.00	4	0.6	1250	4	192.771	39.184	177.755	14.066	4.480	1232.084	164.396	1387.705	56.578	9.025
4193	1251	1	755.00	5	0.6	1250	5	197.539	38.382	181.987	13.678	3.479	1500.946	192.699	1701.302	65.576	6.551
4194	1251	1	756.00	6	0.6	1250	6	198.755	37.270	183.581	13.155	2.800	1759.005	219.827	2003.546	73.983	5.518
4195	1251	1	757.00	7	0.6	1250	7	196.903	35.932	182.264	12.550	2.314	2012.379	246.186	2301.604	81.825	4.775
4196	1251	1	757.50	7.5	0.6	1250	7.5	195.354	35.303	180.986	12.247	2.123	2136.315	259.169	2447.992	85.511	4.474
4197	1251	1	758.00	8	0.6	1250	8	193.490	34.622	179.231	11.974	1.956	2258.522	271.728	2589.623	89.129	4.216
4198	1251	1	759.00	9	0.6	1250	9	188.881	33.380	174.758	11.447	1.682	2501.533	296.635	2872.182	95.883	3.797
4199	1251	1	760.00	10	0.6	1250	10	183.851	32.408	170.600	11.047	1.469	2738.617	321.094	3161.050	102.184	3.746
4201	1501	1	900.25	0.25	0.6	1500	0.25	269.025	49.153	343.212	14.874	89.546	45.022	13.875	51.915	4.788	33.713
4202	1501	1	900.50	0.5	0.6	1500	0.5	377.739	65.644	450.299	21.298	58.237	112.456	25.998	126.680	8.981	27.076
4203	1501	1	900.75	0.75	0.6	1500	0.75	350.624	61.007	404.307	20.943	37.055	217.554	41.177	244.909	14.090	25.776
4204	1501	1	901.00	1	0.6	1500	1	305.889	54.020	345.866	19.068	25.230	322.697	56.188	362.533	19.764	25.330
4205	1501	1	901.25	1.25	0.6	1500	1.25	270.511	48.971	300.711	17.411	18.505	425.524	71.529	478.640	25.170	24.469
4206	1501	1	902.00	2	0.6	1500	2	217.498	43.873	227.192	15.679	10.275	711.301	110.584	806.240	38.548	20.206
4207	1501	1	902.50	2.5	0.6	1500	2.5	207.282	43.858	207.755	15.754	8.082	887.714	131.557	1010.597	45.591	17.143
4208	1501	1	903.00	3	0.6	1500	3	210.254	44.212	202.364	15.870	6.682	1055.875	149.998	1208.416	51.873	14.413
4209	1501	1	904.00	4	0.6	1500	4	222.121	44.389	211.166	15.777	4.899	1372.240	182.750	1582.342	62.995	10.202
4210	1501	1	905.00	5	0.6	1500	5	229.592	43.659	218.450	15.383	3.800	1671.951	213.554	1940.307	72.853	7.301
4211	1501	1	906.00	6	0.6	1500	6	232.363	42.472	221.799	14.874	3.055	1958.438	243.079	2283.650	82.155	6.005
4212	1501	1	907.00	7	0.6	1500	7	231.923	41.013	222.228	14.191	2.523	2239.439	271.780	2622.515	90.871	5.202
4213	1501	1	907.50	7.5	0.6	1500	7.5	230.581	40.444	221.164	13.942	2.312	2376.013	285.877	2787.101	95.072	4.932



STP-PT-074: Local Stress in Nozzles, Shells and Formed Heads from External Heads

Model									Secondary (inside) Stress Factors								
	OD	T	od	t	d/D	D/T	t/T	Branch					Header				
								Axial	In-Plane	Out-of-Plane	Torsional	Pressure	Axial	In-Plane	Out-of-Plane	Torsional	Pressure
4214	1501	1	908.00	8	0.6	1500	8	228.990	39.631	219.992	13.626	2.130	2512.057	299.841	2952.934	99.131	4.686
4215	1501	1	909.00	9	0.6	1500	9	224.863	38.305	216.275	12.983	1.830	2782.039	326.925	3277.386	106.785	4.268
4216	1501	1	910.00	10	0.6	1500	10	219.374	36.900	211.112	12.462	1.596	3045.942	353.767	3599.664	113.962	3.920
4219	1751	1	1050.50	0.5	0.6	1750	0.5	411.012	71.260	500.129	23.421	63.171	123.941	28.528	142.630	9.804	29.291
4220	1751	1	1050.75	0.75	0.6	1750	0.75	381.346	66.429	449.611	22.948	40.171	238.865	44.950	274.981	15.406	27.874
4221	1751	1	1051.00	1	0.6	1750	1	333.045	59.190	385.139	20.830	27.315	353.554	61.757	406.150	21.713	27.405
4222	1751	1	1051.25	1.25	0.6	1750	1.25	294.728	53.367	335.085	19.044	20.028	465.207	78.715	534.982	27.619	26.518
4223	1751	1	1052.00	2	0.6	1750	2	238.521	48.008	254.616	17.093	11.103	777.097	121.144	899.335	42.239	22.007
4224	1751	1	1052.50	2.5	0.6	1750	2.5	228.601	48.273	234.105	17.222	8.728	969.765	144.170	1126.167	49.908	18.725
4225	1751	1	1053.00	3	0.6	1750	3	233.782	48.886	230.400	17.417	7.216	1152.666	164.053	1344.727	56.716	15.801
4226	1751	1	1054.00	4	0.6	1750	4	249.109	49.423	243.349	17.428	5.291	1500.518	199.482	1766.269	68.770	11.277
4227	1751	1	1055.00	5	0.6	1750	5	259.325	48.728	253.722	17.044	4.096	1826.890	232.760	2162.546	79.513	8.158
4228	1751	1	1056.00	6	0.6	1750	6	263.995	47.476	259.430	16.464	3.292	2140.982	264.157	2547.243	89.559	6.442
4229	1751	1	1057.00	7	0.6	1750	7	264.773	45.972	261.433	15.809	2.717	2446.380	294.851	2923.563	99.116	5.690
4230	1751	1	1057.50	7.5	0.6	1750	7.5	264.067	45.118	261.893	15.459	2.489	2597.264	310.141	3117.649	103.698	5.398
4231	1751	1	1058.00	8	0.6	1750	8	262.973	44.346	260.540	15.087	2.292	2743.768	325.259	3289.353	108.189	5.139
4232	1751	1	1059.00	9	0.6	1750	9	258.781	42.753	256.874	14.478	1.967	3038.859	354.570	3654.942	116.679	4.690
4233	1751	1	1060.00	10	0.6	1750	10	253.827	41.271	252.483	13.839	1.714	3328.329	383.313	4015.890	124.542	4.313
4236	2001	1	1200.50	0.5	0.6	2000	0.5	441.030	76.419	547.280	25.386	67.722	134.656	30.932	158.221	10.571	31.393
4237	2001	1	1200.75	0.75	0.6	2000	0.75	409.170	71.897	490.706	24.836	43.069	258.404	48.409	302.640	16.770	29.870
4238	2001	1	1201.00	1	0.6	2000	1	357.221	64.024	420.452	22.513	29.273	381.750	67.174	446.309	23.601	29.390
4239	2001	1	1201.25	1.25	0.6	2000	1.25	316.438	57.789	366.129	20.571	21.448	502.063	85.453	587.369	29.966	28.462
4240	2001	1	1202.00	2	0.6	2000	2	257.470	51.919	280.040	18.374	11.872	837.240	131.340	986.078	45.744	23.696
4241	2001	1	1202.50	2.5	0.6	2000	2.5	248.056	52.465	259.652	18.596	9.330	1044.966	155.964	1237.459	53.956	20.218
4242	2001	1	1203.00	3	0.6	2000	3	255.441	53.274	257.636	18.869	7.713	1243.127	177.127	1476.565	61.288	17.112
4243	2001	1	1204.00	4	0.6	2000	4	274.214	54.106	274.299	18.973	5.657	1616.034	214.663	1933.910	74.098	12.272
4244	2001	1	1205.00	5	0.6	2000	5	286.858	53.509	287.832	18.623	4.375	1968.800	249.939	2371.147	85.626	8.952
4245	2001	1	1206.00	6	0.6	2000	6	293.947	52.266	296.382	18.004	3.514	2306.574	283.372	2790.159	96.339	6.896
4246	2001	1	1207.00	7	0.6	2000	7	295.735	50.644	299.786	17.339	2.899	2636.027	315.913	3203.751	106.594	6.127
4247	2001	1	1207.50	7.5	0.6	2000	7.5	295.725	49.794	300.189	16.951	2.655	2798.627	331.713	3404.565	111.460	5.811
4248	2001	1	1208.00	8	0.6	2000	8	295.032	48.991	300.100	16.608	2.443	2959.100	347.577	3605.890	116.243	5.528
4249	2001	1	1209.00	9	0.6	2000	9	291.500	47.399	297.406	15.941	2.096	3274.976	379.010	4004.032	125.578	5.050
4250	2001	1	1210.00	10	0.6	2000	10	286.624	45.632	293.886	15.262	1.824	3584.224	410.083	4407.590	134.297	4.656
4253	2251	1	1350.50	0.5	0.6	2250	0.5	468.459	81.017	588.731	27.244	72.066	144.723	33.047	172.489	11.283	33.345
4254	2251	1	1350.75	0.75	0.6	2250	0.75	434.328	76.921	529.284	26.576	45.802	276.777	51.595	329.550	18.060	31.727
4255	2251	1	1351.00	1	0.6	2250	1	379.248	68.530	452.930	24.050	31.104	408.285	72.208	484.374	25.334	31.221
4256	2251	1	1351.25	1.25	0.6	2250	1.25	335.838	61.861	394.899	22.000	22.781	535.817	91.681	636.914	32.160	30.272
4257	2251	1	1352.00	2	0.6	2250	2	274.863	55.626	303.792	19.606	12.594	893.394	140.518	1067.474	48.965	25.274

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Model								Secondary (inside) Stress Factors									
	OD	T	od	t	d/D	D/T	t/T	Branch					Header				
								Axial	In-Plane	Out-of-Plane	Torsional	Pressure	Axial	In-Plane	Out-of-Plane	Torsional	Pressure
4258	2251	1	1352.50	2.5	0.6	2250	2.5	265.870	56.306	283.355	19.900	9.898	1114.673	166.560	1340.126	57.774	21.614
4259	2251	1	1353.00	3	0.6	2250	3	275.688	57.445	283.207	20.221	8.183	1325.177	189.338	1595.060	65.529	18.330
4260	2251	1	1354.00	4	0.6	2250	4	297.330	58.503	304.149	20.441	6.002	1724.627	228.950	2096.109	79.127	13.201
4261	2251	1	1355.00	5	0.6	2250	5	312.703	58.002	320.831	20.098	4.636	2102.071	265.788	2568.478	91.224	9.699
4262	2251	1	1356.00	6	0.6	2250	6	321.336	56.856	331.408	19.534	3.723	2463.131	301.156	3022.043	102.641	7.358
4263	2251	1	1357.00	7	0.6	2250	7	324.992	55.097	337.025	18.763	3.070	2817.490	335.172	3471.330	113.545	6.530
4264	2251	1	1357.50	7.5	0.6	2250	7.5	325.154	54.128	337.759	18.412	2.811	2989.319	352.267	3687.428	118.849	6.198
4265	2251	1	1358.00	8	0.6	2250	8	324.995	53.210	338.437	18.007	2.586	3161.562	368.745	3906.825	123.899	5.892
4266	2251	1	1359.00	9	0.6	2250	9	322.331	51.384	336.896	17.244	2.218	3499.849	401.750	4339.120	133.858	5.386
4267	2251	1	1360.00	10	0.6	2250	10	318.192	49.735	333.364	16.551	1.929	3831.565	434.410	4762.111	143.296	4.969
4270	2501	1	1500.50	0.5	0.6	2500	0.5	493.152	85.958	628.438	28.940	76.096	154.185	35.105	186.662	11.949	35.203
4271	2501	1	1500.75	0.75	0.6	2500	0.75	457.378	81.664	564.704	28.205	48.367	293.829	54.944	354.643	19.264	33.488
4272	2501	1	1501.00	1	0.6	2500	1	399.446	72.789	484.986	25.507	32.827	432.595	77.008	521.837	26.998	32.965
4273	2501	1	1501.25	1.25	0.6	2500	1.25	354.006	65.802	422.427	23.327	24.040	568.088	97.782	685.011	34.244	31.984
4274	2501	1	1502.00	2	0.6	2500	2	290.815	58.988	326.593	20.730	13.280	946.682	149.545	1147.305	52.054	26.742
4275	2501	1	1502.50	2.5	0.6	2500	2.5	282.396	60.006	305.913	21.109	10.435	1180.396	176.855	1437.614	61.270	22.928
4276	2501	1	1503.00	3	0.6	2500	3	294.504	61.429	309.237	21.572	8.628	1405.666	200.866	1719.228	69.549	19.474
4277	2501	1	1504.00	4	0.6	2500	4	319.286	62.656	332.854	21.808	6.331	1827.262	242.237	2247.773	83.860	14.088
4278	2501	1	1505.00	5	0.6	2500	5	337.007	62.397	352.735	21.517	4.890	2227.051	280.939	2754.586	96.469	10.393
4279	2501	1	1506.00	6	0.6	2500	6	347.370	61.132	365.628	20.930	3.922	2609.496	317.700	3240.605	108.353	7.800
4280	2501	1	1507.00	7	0.6	2500	7	352.561	59.342	372.998	20.167	3.233	2983.753	352.837	3717.374	119.854	6.901
4281	2501	1	1507.50	7.5	0.6	2500	7.5	353.495	58.425	374.879	19.772	2.959	3162.175	370.589	3946.037	125.345	6.544
4285	9	1	5.30	0.1	0.65	8	0.1	1.164	1.131	1.159	1.040	8.321	0.429	0.292	0.441	0.330	4.442
4286	9	1	5.45	0.25	0.65	8	0.25	1.299	1.258	1.431	1.065	3.519	1.030	0.604	0.927	0.605	3.663
4287	9	1	5.70	0.5	0.65	8	0.5	1.613	1.498	1.774	1.026	2.172	1.911	0.947	1.407	0.827	2.847
4288	9	1	5.95	0.75	0.65	8	0.75	1.899	1.390	1.731	1.130	2.008	2.701	1.208	1.641	0.925	2.333
4289	9	1	6.20	1	0.65	8	1	2.082	1.299	1.632	1.206	1.898	3.446	1.416	1.880	1.049	2.041
4290	9	1	6.45	1.25	0.65	8	1.25	2.213	1.262	1.586	1.223	1.664	4.137	1.514	2.080	1.157	1.730
4291	9	1	7.20	2	0.65	8	2	2.313	1.257	1.363	1.295	1.189	6.379	1.811	3.235	1.406	1.289
4292	9	1	7.70	2.5	0.65	8	2.5	2.301	1.209	1.245	1.283	0.983	7.992	2.064	3.933	1.541	1.204
4293	9	1	8.20	3	0.65	8	3	2.271	1.189	1.166	1.335	0.837	9.606	2.266	4.477	1.703	1.184
4302	17	1	10.50	0.1	0.65	16	0.1	1.510	1.205	1.687	1.300	9.471	0.663	0.455	0.689	0.507	6.133
4303	17	1	10.65	0.25	0.65	16	0.25	3.132	2.470	3.794	1.325	3.847	1.561	1.035	1.517	0.887	4.771
4304	17	1	10.90	0.5	0.65	16	0.5	4.315	2.811	4.707	1.302	3.248	2.755	1.688	2.389	1.217	3.680
4305	17	1	11.15	0.75	0.65	16	0.75	4.769	2.578	4.511	1.537	2.843	3.859	2.185	3.043	1.415	3.020
4306	17	1	11.40	1	0.65	16	1	4.776	2.391	4.132	1.751	2.593	4.939	2.626	3.674	1.624	2.541
4307	17	1	11.65	1.25	0.65	16	1.25	4.792	2.301	3.888	1.846	2.311	5.906	2.951	4.986	1.863	2.097
4308	17	1	12.40	2	0.65	16	2	4.394	2.360	3.237	2.119	1.755	10.516	3.672	8.861	2.363	1.463

STP-PT-074: Local Stress in Nozzles, Shells and Formed Heads from External Heads

Model								Secondary (inside) Stress Factors									
	OD	T	od	t	d/D	D/T	t/T	Branch					Header				
								Axial	In-Plane	Out-of-Plane	Torsional	Pressure	Axial	In-Plane	Out-of-Plane	Torsional	Pressure
4309	17	1	12.90	2.5	0.65	16	2.5	4.118	2.291	2.877	2.172	1.492	13.622	4.054	11.065	2.553	1.345
4310	17	1	13.40	3	0.65	16	3	3.882	2.195	2.568	2.174	1.283	16.369	4.650	12.939	2.685	1.306
4311	17	1	14.40	4	0.65	16	4	3.547	2.022	2.100	2.152	0.985	20.785	5.595	15.913	2.944	1.577
4312	17	1	15.40	5	0.65	16	5	3.465	1.918	1.815	2.076	0.790	23.943	6.304	18.155	3.231	1.837
4313	17	1	16.40	6	0.65	16	6	3.413	1.895	1.688	2.118	0.658	26.040	6.834	19.959	3.576	1.967
4319	25	1	15.70	0.1	0.65	24	0.1	2.162	1.795	2.702	1.511	10.289	0.901	0.602	0.913	0.634	6.934
4320	25	1	15.85	0.25	0.65	24	0.25	5.380	3.367	6.613	1.387	5.297	2.086	1.404	2.105	1.045	5.369
4321	25	1	16.10	0.5	0.65	24	0.5	7.887	3.802	8.198	1.424	4.517	3.622	2.312	3.355	1.453	4.164
4322	25	1	16.35	0.75	0.65	24	0.75	8.344	3.584	7.714	1.795	3.640	4.931	3.012	4.321	1.711	3.500
4323	25	1	16.60	1	0.65	24	1	8.051	3.336	6.945	2.093	3.095	7.047	3.653	6.222	1.982	2.981
4324	25	1	16.85	1.25	0.65	24	1.25	7.848	3.137	6.409	2.255	2.668	10.045	4.156	8.603	2.398	2.443
4325	25	1	17.60	2	0.65	24	2	6.879	3.217	5.197	2.454	1.993	19.536	5.384	15.293	3.301	1.641
4326	25	1	18.10	2.5	0.65	24	2.5	6.322	3.165	4.616	2.625	1.716	25.410	6.003	19.176	3.591	1.448
4327	25	1	18.60	3	0.65	24	3	5.849	3.037	4.133	2.692	1.496	30.857	6.860	22.654	3.801	1.362
4328	25	1	19.60	4	0.65	24	4	5.081	2.757	3.378	2.681	1.169	40.530	8.537	28.578	4.087	1.813
4329	25	1	20.60	5	0.65	24	5	4.520	2.593	2.854	2.665	0.945	48.547	9.845	33.306	4.318	2.241
4330	25	1	21.60	6	0.65	24	6	4.249	2.451	2.535	2.522	0.791	54.906	10.856	37.078	4.644	2.516
4331	25	1	22.60	7	0.65	24	7	4.073	2.359	2.250	2.474	0.677	59.987	11.695	40.284	4.986	2.691
4332	25	1	23.10	7.5	0.65	24	7.5	4.006	2.292	2.133	2.459	0.631	62.075	12.054	41.710	5.188	2.749
4333	25	1	23.60	8	0.65	24	8	3.958	2.275	2.042	2.457	0.590	63.897	12.390	43.058	5.426	2.790
4334	25	1	24.60	9	0.65	24	9	3.864	2.273	1.948	2.484	0.525	66.714	12.981	45.485	5.904	2.831
4336	33	1	20.90	0.1	0.65	32	0.1	2.979	2.208	3.746	1.591	10.548	1.121	0.696	1.162	0.703	7.550
4337	33	1	21.05	0.25	0.65	32	0.25	8.044	4.042	9.520	1.349	6.758	2.583	1.673	2.573	1.145	5.878
4338	33	1	21.30	0.5	0.65	32	0.5	11.851	4.724	11.857	1.585	5.732	4.246	2.776	4.128	1.587	4.628
4339	33	1	21.55	0.75	0.65	32	0.75	12.252	4.502	11.059	2.009	4.377	6.572	3.625	5.957	1.880	3.975
4340	33	1	21.80	1	0.65	32	1	11.593	4.196	9.858	2.325	3.545	10.249	4.462	8.989	2.258	3.473
4341	33	1	22.05	1.25	0.65	32	1.25	11.052	3.885	8.989	2.525	2.965	14.801	5.132	12.428	2.856	2.891
4342	33	1	22.80	2	0.65	32	2	9.326	3.911	7.144	2.826	2.134	28.901	6.800	22.171	4.099	1.797
4343	33	1	23.30	2.5	0.65	32	2.5	8.430	3.912	6.331	2.882	1.833	37.525	7.715	27.817	4.563	1.535
4344	33	1	23.80	3	0.65	32	3	7.723	3.818	5.688	3.000	1.606	45.619	8.952	32.947	4.838	1.453
4345	33	1	24.80	4	0.65	32	4	6.666	3.484	4.712	3.089	1.272	60.459	11.306	41.958	5.169	1.935
4346	33	1	25.80	5	0.65	32	5	5.857	3.275	3.965	3.024	1.038	73.428	13.188	49.439	5.472	2.459
4347	33	1	26.80	6	0.65	32	6	5.258	3.125	3.410	2.965	0.868	84.857	14.734	55.880	5.757	2.855
4348	33	1	27.80	7	0.65	32	7	4.804	2.957	3.031	2.884	0.743	94.910	16.036	61.499	6.192	3.144
4349	33	1	28.30	7.5	0.65	32	7.5	4.684	2.840	2.946	2.767	0.698	99.198	16.567	63.904	6.405	3.251
4350	33	1	28.80	8	0.65	32	8	4.527	2.743	2.762	2.739	0.650	103.171	17.088	66.170	6.611	3.344
4351	33	1	29.80	9	0.65	32	9	4.361	2.659	2.488	2.697	0.579	110.150	17.999	70.325	7.140	3.483
4352	33	1	30.80	10	0.65	32	10	4.270	2.554	2.279	2.678	0.517	115.890	18.799	74.038	7.670	3.571

STP-PT-074: Local Stress in Nozzles, Shells and Formed Heads from External Heads

Model								Secondary (inside) Stress Factors									
	OD	T	od	t	d/D	D/T	t/T	Branch					Header				
								Axial	In-Plane	Out-of-Plane	Torsional	Pressure	Axial	In-Plane	Out-of-Plane	Torsional	Pressure
4353	41	1	26.10	0.1	0.65	40	0.1	3.829	2.528	4.810	1.596	9.721	1.305	0.791	1.439	0.761	8.096
4354	41	1	26.25	0.25	0.65	40	0.25	10.911	4.586	12.485	1.293	8.271	2.941	1.916	3.145	1.220	6.408
4355	41	1	26.50	0.5	0.65	40	0.5	16.025	5.578	15.642	1.770	6.844	4.949	3.164	5.070	1.703	5.104
4356	41	1	26.75	0.75	0.65	40	0.75	16.332	5.402	14.519	2.229	5.054	8.661	4.134	7.783	2.041	4.453
4357	41	1	27.00	1	0.65	40	1	15.280	4.994	12.873	2.539	3.965	13.816	5.052	11.976	2.496	3.924
4358	41	1	27.25	1.25	0.65	40	1.25	14.363	4.575	11.639	2.732	3.244	19.952	5.842	16.526	3.187	3.326
4359	41	1	28.00	2	0.65	40	2	11.680	4.476	9.051	3.096	2.248	37.906	8.011	28.972	4.770	1.989
4360	41	1	28.50	2.5	0.65	40	2.5	10.406	4.516	7.991	3.165	1.915	49.014	9.218	36.317	5.409	1.651
4361	41	1	29.00	3	0.65	40	3	9.460	4.461	7.217	3.260	1.678	59.752	10.899	43.231	5.794	1.579
4362	41	1	30.00	4	0.65	40	4	8.116	4.163	6.009	3.443	1.337	80.299	13.916	55.813	6.186	2.010
4363	41	1	31.00	5	0.65	40	5	7.094	3.891	5.075	3.427	1.098	98.240	16.393	66.288	6.519	2.602
4364	41	1	32.00	6	0.65	40	6	6.334	3.730	4.387	3.392	0.922	114.390	18.438	75.322	6.853	3.054
4365	41	1	33.00	7	0.65	40	7	5.669	3.561	3.807	3.275	0.789	129.009	20.163	83.280	7.358	3.411
4366	41	1	33.50	7.5	0.65	40	7.5	5.428	3.433	3.581	3.245	0.736	135.911	20.956	87.025	7.605	3.564
4367	41	1	34.00	8	0.65	40	8	5.200	3.346	3.389	3.191	0.688	142.368	21.687	90.500	7.861	3.698
4368	41	1	35.00	9	0.65	40	9	4.972	3.194	3.222	3.020	0.616	154.440	22.923	97.077	8.440	3.926
4369	41	1	36.00	10	0.65	40	10	4.709	3.026	2.919	2.903	0.550	164.823	24.054	102.811	9.050	4.096
4370	51	1	32.60	0.1	0.65	50	0.1	5.103	2.845	6.152	1.543	10.339	1.570	0.875	1.693	0.789	8.642
4371	51	1	32.75	0.25	0.65	50	0.25	14.640	5.187	16.223	1.261	10.130	3.484	2.139	3.694	1.279	6.966
4372	51	1	33.00	0.5	0.65	50	0.5	21.372	6.588	20.436	2.040	8.107	5.736	3.523	6.072	1.804	5.605
4373	51	1	33.25	0.75	0.65	50	0.75	21.518	6.445	18.900	2.530	5.822	11.418	4.604	10.220	2.207	4.960
4374	51	1	33.50	1	0.65	50	1	19.924	5.911	16.678	2.814	4.447	18.464	5.624	15.807	2.778	4.440
4375	51	1	33.75	1.25	0.65	50	1.25	18.501	5.362	14.974	2.982	3.570	26.488	6.561	21.763	3.491	3.830
4376	51	1	34.50	2	0.65	50	2	14.649	5.073	11.445	3.357	2.387	50.094	9.389	38.288	5.330	2.339
4377	51	1	35.00	2.5	0.65	50	2.5	12.894	5.135	10.065	3.456	2.012	64.575	11.382	47.976	6.165	1.822
4378	51	1	35.50	3	0.65	50	3	11.601	5.122	9.060	3.511	1.751	78.233	13.331	56.875	6.743	1.694
4379	51	1	36.50	4	0.65	50	4	9.818	4.887	7.619	3.746	1.394	103.610	16.824	72.766	7.406	2.080
4380	51	1	37.50	5	0.65	50	5	8.603	4.739	6.567	3.841	1.150	127.135	19.928	86.817	7.810	2.693
4381	51	1	38.50	6	0.65	50	6	7.655	4.589	5.664	3.807	0.970	150.916	22.741	100.365	8.178	3.211
4382	51	1	39.50	7	0.65	50	7	6.940	4.307	5.040	3.765	0.833	171.238	25.029	111.571	8.792	3.627
4383	51	1	40.00	7.5	0.65	50	7.5	6.625	4.124	4.735	3.735	0.776	181.081	26.124	116.908	9.082	3.812
4384	51	1	40.50	8	0.65	50	8	6.312	3.989	4.452	3.647	0.728	190.342	27.073	121.800	9.378	3.978
4385	51	1	41.50	9	0.65	50	9	5.836	3.779	4.023	3.579	0.645	207.855	28.790	131.052	9.996	4.271
4386	51	1	42.50	10	0.65	50	10	5.457	3.592	3.691	3.457	0.579	224.209	30.394	139.686	10.732	4.520
4387	61	1	39.10	0.1	0.65	60	0.1	6.435	3.105	7.491	1.467	10.784	1.831	0.946	1.922	0.802	9.165
4388	61	1	39.25	0.25	0.65	60	0.25	18.492	5.886	19.944	1.361	11.969	4.015	2.319	4.195	1.317	7.474
4389	61	1	39.50	0.5	0.65	60	0.5	26.775	7.621	25.230	2.336	9.254	6.738	3.816	7.035	1.896	6.060
4390	61	1	39.75	0.75	0.65	60	0.75	26.727	7.431	23.287	2.845	6.516	14.414	4.982	12.798	2.369	5.453

STP-PT-074: Local Stress in Nozzles, Shells and Formed Heads from External Heads

Model								Secondary (inside) Stress Factors									
	OD	T	od	t	d/D	D/T	t/T	Branch					Header				
								Axial	In-Plane	Out-of-Plane	Torsional	Pressure	Axial	In-Plane	Out-of-Plane	Torsional	Pressure
4391	61	1	40.00	1	0.65	60	1	24.556	6.777	20.483	3.093	4.891	23.267	6.106	19.780	3.068	4.935
4392	61	1	40.25	1.25	0.65	60	1.25	22.616	6.128	18.307	3.224	3.871	33.173	7.459	27.167	3.769	4.316
4393	61	1	41.00	2	0.65	60	2	17.550	5.590	13.802	3.567	2.522	61.862	11.026	47.438	5.767	2.690
4394	61	1	41.50	2.5	0.65	60	2.5	15.300	5.656	12.066	3.684	2.104	79.589	13.397	59.462	6.773	2.037
4395	61	1	42.00	3	0.65	60	3	13.688	5.662	10.875	3.711	1.821	96.392	15.637	70.573	7.515	1.777
4396	61	1	43.00	4	0.65	60	4	11.514	5.523	9.216	3.920	1.442	128.246	19.816	90.934	8.374	2.138
4397	61	1	44.00	5	0.65	60	5	10.041	5.317	7.989	4.076	1.191	157.332	23.407	108.658	8.935	2.765
4398	61	1	45.00	6	0.65	60	6	8.952	5.199	7.048	4.054	1.009	184.343	26.536	124.415	9.492	3.287
4399	61	1	46.00	7	0.65	60	7	8.084	5.008	6.240	4.089	0.869	209.910	29.405	138.848	10.177	3.734
4400	61	1	46.50	7.5	0.65	60	7.5	7.734	4.880	5.939	4.055	0.810	221.786	30.666	145.350	10.523	3.928
4401	61	1	47.00	8	0.65	60	8	7.357	4.708	5.568	3.989	0.759	233.225	31.847	151.549	10.854	4.107
4402	61	1	48.00	9	0.65	60	9	6.843	4.431	5.068	3.852	0.671	260.435	34.314	166.115	11.537	4.498
4403	61	1	49.00	10	0.65	60	10	6.259	4.232	4.561	3.850	0.600	282.276	36.347	177.534	12.346	4.798
4404	71	1	45.60	0.1	0.65	70	0.1	7.794	3.329	8.825	1.406	10.677	2.062	1.024	2.187	0.823	9.737
4405	71	1	45.75	0.25	0.65	70	0.25	22.337	6.559	23.640	1.505	13.695	4.581	2.501	4.856	1.367	8.008
4406	71	1	46.00	0.5	0.65	70	0.5	32.196	8.590	30.010	2.647	10.322	7.927	4.084	8.136	2.001	6.521
4407	71	1	46.25	0.75	0.65	70	0.75	31.887	8.330	27.634	3.163	7.154	17.317	5.297	15.278	2.532	5.878
4408	71	1	46.50	1	0.65	70	1	29.120	7.576	24.249	3.376	5.300	27.902	6.753	23.622	3.294	5.366
4409	71	1	46.75	1.25	0.65	70	1.25	26.641	6.828	21.590	3.468	4.154	39.587	8.502	32.384	4.049	4.743
4410	71	1	47.50	2	0.65	70	2	20.379	6.074	16.114	3.747	2.651	73.309	12.609	56.484	6.108	3.027
4411	71	1	48.00	2.5	0.65	70	2.5	17.655	6.121	14.041	3.876	2.195	94.146	15.332	70.808	7.252	2.272
4412	71	1	48.50	3	0.65	70	3	15.722	6.151	12.642	3.912	1.888	114.368	17.957	84.417	8.079	1.855
4413	71	1	49.50	4	0.65	70	4	13.193	6.047	10.809	4.044	1.485	151.726	22.558	108.665	9.227	2.176
4414	71	1	50.50	5	0.65	70	5	11.509	5.897	9.471	4.201	1.226	186.564	26.659	130.325	9.971	2.812
4415	71	1	51.50	6	0.65	70	6	10.338	5.806	8.509	4.284	1.040	219.252	30.301	149.841	10.696	3.355
4416	71	1	52.50	7	0.65	70	7	9.312	5.666	7.555	4.310	0.898	250.585	33.689	167.925	11.542	3.831
4417	71	1	53.00	7.5	0.65	70	7.5	8.943	5.461	7.248	4.276	0.839	265.280	35.196	176.174	11.941	4.041
4418	71	1	53.50	8	0.65	70	8	8.537	5.413	6.831	4.264	0.785	279.533	36.614	184.043	12.320	4.238
4419	71	1	54.50	9	0.65	70	9	7.795	5.113	6.161	4.242	0.696	306.724	39.227	198.753	13.074	4.595
4420	71	1	55.50	10	0.65	70	10	7.198	4.744	5.656	4.107	0.624	332.824	41.723	212.645	13.901	4.915
4421	81	1	52.10	0.1	0.65	80	0.1	9.095	3.567	10.168	1.391	11.755	2.284	1.079	2.392	0.856	10.282
4422	81	1	52.25	0.25	0.65	80	0.25	26.162	7.207	27.280	1.679	15.338	5.060	2.632	5.361	1.404	8.471
4423	81	1	52.50	0.5	0.65	80	0.5	37.538	9.506	34.718	2.958	11.324	9.229	4.300	8.978	2.092	6.917
4424	81	1	52.75	0.75	0.65	80	0.75	36.962	9.183	31.924	3.478	7.761	20.189	5.566	17.733	2.704	6.272
4425	81	1	53.00	1	0.65	80	1	33.583	8.331	27.952	3.653	5.683	32.450	7.537	27.404	3.486	5.766
4426	81	1	53.25	1.25	0.65	80	1.25	30.561	7.514	24.818	3.712	4.423	45.832	9.479	37.509	4.284	5.140
4427	81	1	54.00	2	0.65	80	2	23.154	6.526	18.428	3.908	2.778	84.669	14.288	65.604	6.384	3.357
4428	81	1	54.50	2.5	0.65	80	2.5	19.984	6.551	16.024	4.036	2.286	108.587	17.322	82.280	7.580	2.530

STP-PT-074: Local Stress in Nozzles, Shells and Formed Heads from External Heads

Model								Secondary (inside) Stress Factors									
	OD	T	od	t	d/D	D/T	t/T	Branch					Header				
								Axial	In-Plane	Out-of-Plane	Torsional	Pressure	Axial	In-Plane	Out-of-Plane	Torsional	Pressure
4429	81	1	55.00	3	0.65	80	3	17.726	6.575	14.406	4.082	1.954	131.320	20.091	97.767	8.580	2.039
4430	81	1	56.00	4	0.65	80	4	14.825	6.512	12.362	4.134	1.528	174.246	25.150	126.097	9.963	2.204
4431	81	1	57.00	5	0.65	80	5	13.034	6.400	11.018	4.303	1.258	214.551	29.708	151.636	10.971	2.841
4432	81	1	58.00	6	0.65	80	6	11.677	6.380	9.906	4.465	1.069	253.312	33.976	175.315	11.880	3.402
4433	81	1	59.00	7	0.65	80	7	10.534	6.195	8.901	4.484	0.924	289.536	37.710	196.624	12.856	3.888
4434	81	1	59.50	7.5	0.65	80	7.5	10.107	6.113	8.516	4.452	0.864	306.943	39.436	206.617	13.293	4.111
4435	81	1	60.00	8	0.65	80	8	9.575	5.889	8.085	4.451	0.812	323.908	41.085	216.196	13.734	4.320
4436	81	1	61.00	9	0.65	80	9	8.945	5.653	7.528	4.466	0.720	356.522	44.133	234.243	14.581	4.704
4437	81	1	62.00	10	0.65	80	10	8.216	5.374	6.851	4.394	0.642	388.121	47.073	251.355	15.379	5.055
4438	91	1	58.60	0.1	0.65	90	0.1	10.434	3.757	11.472	1.330	12.819	2.501	1.132	2.595	0.863	10.771
4439	91	1	58.75	0.25	0.65	90	0.25	29.896	7.835	30.834	1.858	16.837	5.512	2.754	5.834	1.444	8.915
4440	91	1	59.00	0.5	0.65	90	0.5	42.785	10.377	39.351	3.267	12.267	10.615	4.483	10.009	2.182	7.288
4441	91	1	59.25	0.75	0.65	90	0.75	41.921	9.991	36.137	3.787	8.336	23.014	5.978	20.152	2.876	6.641
4442	91	1	59.50	1	0.65	90	1	37.939	9.034	31.607	3.926	6.056	37.024	8.356	31.247	3.663	6.166
4443	91	1	59.75	1.25	0.65	90	1.25	34.369	8.197	27.995	3.942	4.677	52.079	10.512	42.703	4.505	5.533
4444	91	1	60.50	2	0.65	90	2	25.837	7.020	20.667	4.062	2.903	95.325	15.849	74.318	6.726	3.659
4445	91	1	61.00	2.5	0.65	90	2.5	22.236	6.949	17.943	4.180	2.373	122.067	19.108	93.221	7.901	2.768
4446	91	1	61.50	3	0.65	90	3	19.696	6.983	16.125	4.238	2.022	147.497	22.116	110.802	9.031	2.225
4447	91	1	62.50	4	0.65	90	4	16.446	6.950	13.878	4.218	1.570	195.682	27.604	143.125	10.702	2.223
4448	91	1	63.50	5	0.65	90	5	14.418	6.843	12.410	4.416	1.288	241.773	32.745	172.912	11.855	2.864
4449	91	1	64.50	6	0.65	90	6	12.975	6.861	11.247	4.556	1.093	285.178	37.306	199.905	13.034	3.422
4450	91	1	65.50	7	0.65	90	7	11.746	6.636	10.177	4.637	0.947	326.550	41.471	224.769	14.123	3.919
4451	91	1	66.00	7.5	0.65	90	7.5	11.365	6.584	9.812	4.623	0.886	346.561	43.410	236.508	14.622	4.148
4452	91	1	66.50	8	0.65	90	8	10.909	6.489	9.440	4.650	0.832	366.106	45.278	247.792	15.094	4.365
4453	91	1	67.50	9	0.65	90	9	9.940	6.146	8.548	4.637	0.739	404.620	48.912	269.647	16.033	4.777
4454	91	1	68.50	10	0.65	90	10	9.298	5.926	7.909	4.589	0.661	440.765	52.104	289.550	16.915	5.143
4455	101	1	65.10	0.1	0.65	100	0.1	11.785	3.914	12.753	1.255	14.398	2.780	1.199	2.865	0.865	11.285
4456	101	1	65.25	0.25	0.65	100	0.25	33.566	8.457	34.361	2.046	18.259	5.966	2.884	6.427	1.492	9.384
4457	101	1	65.50	0.5	0.65	100	0.5	47.927	11.207	43.931	3.575	13.161	11.921	4.656	11.062	2.288	7.681
4458	101	1	65.75	0.75	0.65	100	0.75	46.761	10.764	40.304	4.088	8.880	25.895	6.559	22.645	3.076	7.024
4459	101	1	66.00	1	0.65	100	1	42.152	9.711	35.175	4.192	6.408	41.350	9.069	34.910	3.856	6.520
4460	101	1	66.25	1.25	0.65	100	1.25	38.050	8.844	31.097	4.174	4.929	57.933	11.504	47.623	4.682	5.884
4461	101	1	67.00	2	0.65	100	2	28.433	7.497	22.872	4.208	3.024	105.482	17.355	82.817	7.026	3.942
4462	101	1	67.50	2.5	0.65	100	2.5	24.423	7.341	19.808	4.326	2.463	134.868	20.851	103.887	8.296	2.993
4463	101	1	68.00	3	0.65	100	3	21.618	7.362	17.810	4.373	2.091	162.841	24.056	123.530	9.422	2.409
4464	101	1	69.00	4	0.65	100	4	18.162	7.343	15.484	4.339	1.614	216.515	30.094	160.182	11.338	2.248
4465	101	1	70.00	5	0.65	100	5	15.920	7.214	13.878	4.477	1.320	266.954	35.479	193.317	12.752	2.869
4466	101	1	71.00	6	0.65	100	6	14.275	7.190	12.693	4.638	1.117	315.322	40.457	223.923	14.140	3.428



STP-PT-074: Local Stress in Nozzles, Shells and Formed Heads from External Heads

Model								Secondary (inside) Stress Factors									
	OD	T	od	t	d/D	D/T	t/T	Branch					Header				
								Axial	In-Plane	Out-of-Plane	Torsional	Pressure	Axial	In-Plane	Out-of-Plane	Torsional	Pressure
4467	101	1	72.00	7	0.65	100	7	13.331	7.161	11.655	4.711	0.968	361.579	45.022	252.310	15.326	3.929
4468	101	1	72.50	7.5	0.65	100	7.5	12.803	7.140	11.184	4.765	0.906	384.009	47.159	265.744	15.885	4.162
4469	101	1	73.00	8	0.65	100	8	12.249	6.911	10.746	4.784	0.854	406.615	49.405	279.262	16.435	4.384
4470	101	1	74.00	9	0.65	100	9	11.447	6.640	10.004	4.757	0.758	449.535	53.297	303.975	17.415	4.809
4471	101	1	75.00	10	0.65	100	10	10.646	6.465	9.278	4.736	0.681	490.579	56.879	327.066	18.399	5.191
4472	251	1	162.60	0.1	0.65	250	0.1	26.990	6.639	29.191	1.682	32.416	5.589	2.123	5.724	1.048	17.413
4473	251	1	162.75	0.25	0.65	250	0.25	76.732	16.063	79.985	4.778	34.207	12.796	4.469	12.473	2.086	14.493
4474	251	1	163.00	0.5	0.65	250	0.5	108.592	21.300	104.181	7.496	23.216	28.783	8.124	26.694	3.624	11.832
4475	251	1	163.25	0.75	0.65	250	0.75	103.335	20.466	94.880	7.796	15.081	60.001	13.120	54.805	5.457	11.074
4476	251	1	163.50	1	0.65	250	1	91.271	18.433	81.988	7.467	10.498	92.656	18.417	83.405	7.401	10.592
4477	251	1	163.75	1.25	0.65	250	1.25	80.864	16.680	71.617	7.096	7.851	125.735	23.321	112.239	9.150	9.913
4478	251	1	164.50	2	0.65	250	2	60.609	13.881	52.223	6.519	4.530	218.217	34.948	192.879	13.535	7.420
4479	251	1	165.00	2.5	0.65	250	2.5	53.632	13.209	45.594	6.388	3.602	274.683	41.367	242.048	15.969	5.847
4480	251	1	165.50	3	0.65	250	3	49.342	12.886	41.595	6.312	2.998	328.335	47.003	288.579	18.179	4.660
4481	251	1	166.50	4	0.65	250	4	44.648	12.563	37.300	6.197	2.229	429.724	58.808	375.649	22.009	3.312
4482	251	1	167.50	5	0.65	250	5	42.134	12.296	34.929	6.071	1.757	527.250	69.769	458.073	25.361	2.742
4483	251	1	168.50	6	0.65	250	6	40.115	11.976	33.182	5.879	1.443	621.392	79.994	536.209	28.245	3.141
4484	251	1	169.50	7	0.65	250	7	37.974	11.967	31.772	5.770	1.223	713.482	89.554	611.229	30.747	3.519
4485	251	1	170.00	7.5	0.65	250	7.5	37.123	11.649	31.011	5.709	1.140	759.011	94.220	647.811	31.894	3.703
4486	251	1	170.50	8	0.65	250	8	36.501	11.635	30.160	5.671	1.068	803.962	98.723	683.570	32.972	3.880
4487	251	1	171.50	9	0.65	250	9	34.837	11.268	29.065	5.615	0.951	893.198	107.503	753.659	34.990	4.232
4488	251	1	172.50	10	0.65	250	10	33.159	11.212	27.786	5.694	0.860	980.957	115.931	821.332	36.869	4.571
4489	501	1	325.10	0.1	0.65	500	0.1	42.762	10.183	50.929	2.821	51.170	9.096	3.329	10.106	1.408	24.781
4490	501	1	325.25	0.25	0.65	500	0.25	124.881	25.117	144.019	8.223	51.645	20.687	7.163	21.742	2.969	20.506
4491	501	1	325.50	0.5	0.65	500	0.5	177.018	33.833	189.653	12.129	34.306	49.304	13.046	50.144	5.415	16.589
4492	501	1	325.75	0.75	0.65	500	0.75	167.052	31.947	172.184	12.170	22.054	99.817	21.056	100.923	8.423	15.665
4493	501	1	326.00	1	0.65	500	1	146.703	28.555	148.073	11.313	15.169	151.263	29.219	152.210	11.525	15.206
4494	501	1	326.25	1.25	0.65	500	1.25	129.675	25.877	128.817	10.554	11.216	201.982	36.630	203.107	14.563	14.479
4495	501	1	327.00	2	0.65	500	2	100.192	22.178	94.531	9.623	6.308	343.144	56.361	346.826	22.246	11.442
4496	501	1	327.50	2.5	0.65	500	2.5	91.808	21.509	83.614	9.462	4.969	429.126	67.239	435.675	26.195	9.388
4497	501	1	328.00	3	0.65	500	3	87.294	21.127	77.204	9.334	4.114	510.790	76.740	520.677	29.804	7.603
4498	501	1	329.00	4	0.65	500	4	85.522	20.502	71.823	9.018	3.035	663.447	94.805	680.271	36.094	5.034
4499	501	1	330.00	5	0.65	500	5	83.685	19.755	69.625	8.681	2.366	809.113	111.667	832.740	41.581	4.037
4500	501	1	331.00	6	0.65	500	6	81.329	19.058	67.394	8.350	1.912	949.260	127.760	979.026	46.400	3.401
4501	501	1	332.00	7	0.65	500	7	78.587	18.753	65.053	7.884	1.593	1086.481	142.961	1121.886	50.781	3.129
4502	501	1	332.50	7.5	0.65	500	7.5	77.165	18.223	63.815	7.832	1.468	1154.308	150.433	1192.371	52.821	3.251
4503	501	1	333.00	8	0.65	500	8	75.840	17.939	62.642	7.763	1.361	1221.282	157.785	1261.651	54.721	3.371
4504	501	1	334.00	9	0.65	500	9	72.858	17.252	60.226	7.465	1.186	1353.265	172.076	1397.323	58.205	3.601

STP-PT-074: Local Stress in Nozzles, Shells and Formed Heads from External Heads

Model								Secondary (inside) Stress Factors									
	OD	T	od	t	d/D	D/T	t/T	Branch					Header				
								Axial	In-Plane	Out-of-Plane	Torsional	Pressure	Axial	In-Plane	Out-of-Plane	Torsional	Pressure
4505	501	1	335.00	10	0.65	500	10	70.008	17.244	57.899	7.250	1.051	1484.726	185.703	1531.803	61.286	3.831
4507	751	1	487.75	0.25	0.65	750	0.25	163.420	32.361	198.870	10.891	65.001	27.794	9.255	30.730	3.725	25.309
4508	751	1	488.00	0.5	0.65	750	0.5	232.164	43.354	263.413	15.728	42.895	66.622	17.045	71.581	6.884	20.361
4509	751	1	488.25	0.75	0.65	750	0.75	218.251	40.637	238.977	15.729	27.433	132.488	27.183	141.990	10.711	19.267
4510	751	1	488.50	1	0.65	750	1	191.366	36.139	205.302	14.558	18.791	199.028	37.332	212.513	14.935	18.821
4511	751	1	488.75	1.25	0.65	750	1.25	169.225	32.835	178.616	13.418	13.833	264.352	47.362	282.316	19.044	18.045
4512	751	1	489.50	2	0.65	750	2	132.595	28.754	132.458	12.086	7.702	446.312	73.354	479.961	28.983	14.547
4513	751	1	490.00	2.5	0.65	750	2.5	123.289	28.231	118.673	11.974	6.048	557.234	87.319	602.422	34.125	12.122
4514	751	1	490.50	3	0.65	750	3	119.642	28.098	111.139	11.919	4.991	662.759	99.368	719.653	38.747	10.006
4515	751	1	491.50	4	0.65	750	4	120.654	27.609	108.184	11.635	3.671	861.226	121.978	942.390	46.845	6.756
4516	751	1	492.50	5	0.65	750	5	120.422	26.741	107.481	11.149	2.854	1049.880	143.524	1155.169	54.148	5.111
4517	751	1	493.50	6	0.65	750	6	118.679	25.890	105.759	10.695	2.300	1230.951	163.758	1359.081	60.606	4.297
4518	751	1	494.50	7	0.65	750	7	115.815	24.831	103.222	10.204	1.906	1407.700	183.164	1559.112	66.559	3.711
4519	751	1	495.00	7.5	0.65	750	7.5	114.070	24.396	101.682	9.960	1.752	1493.739	192.745	1656.290	69.315	3.480
4520	751	1	495.50	8	0.65	750	8	112.298	24.020	100.164	9.707	1.618	1581.224	201.898	1755.274	71.926	3.319
4521	751	1	496.50	9	0.65	750	9	108.569	23.209	96.744	9.330	1.398	1750.706	220.202	1947.338	76.749	3.501
4522	751	1	497.50	10	0.65	750	10	104.726	22.586	93.364	8.959	1.229	1919.225	237.945	2137.418	81.105	3.679
4524	1001	1	650.25	0.25	0.65	1000	0.25	195.233	38.199	245.292	13.024	76.150	33.654	10.978	38.333	4.393	29.419
4525	1001	1	650.50	0.5	0.65	1000	0.5	278.246	51.090	326.908	18.958	50.112	81.467	20.416	90.720	8.118	23.558
4526	1001	1	650.75	0.75	0.65	1000	0.75	261.335	48.029	296.370	18.890	31.984	160.597	32.283	178.246	12.707	22.341
4527	1001	1	651.00	1	0.65	1000	1	229.081	42.970	254.952	17.312	21.824	240.339	44.548	266.097	17.896	21.864
4528	1001	1	651.25	1.25	0.65	1000	1.25	202.694	38.773	222.019	15.921	16.036	318.075	56.915	352.222	22.783	21.055
4529	1001	1	652.00	2	0.65	1000	2	160.560	34.286	166.504	14.155	8.885	534.802	87.851	595.947	34.712	17.189
4530	1001	1	652.50	2.5	0.65	1000	2.5	150.798	33.989	150.934	14.134	6.967	667.982	104.324	748.142	40.840	14.449
4531	1001	1	653.00	3	0.65	1000	3	148.484	34.035	143.106	14.132	5.746	794.387	118.614	893.465	46.380	12.040
4532	1001	1	654.00	4	0.65	1000	4	152.724	33.810	143.871	13.908	4.213	1031.878	144.854	1168.866	55.980	8.335
4533	1001	1	655.00	5	0.65	1000	5	154.688	32.970	145.578	13.421	3.270	1256.657	169.576	1431.196	64.515	5.926
4534	1001	1	656.00	6	0.65	1000	6	153.949	31.918	145.131	12.876	2.631	1473.388	193.136	1685.141	72.340	4.954
4535	1001	1	657.00	7	0.65	1000	7	151.481	30.721	143.085	12.302	2.177	1683.818	215.771	1932.445	79.582	4.257
4536	1001	1	657.50	7.5	0.65	1000	7.5	149.752	30.232	141.679	11.964	1.999	1787.381	226.866	2056.260	82.964	4.003
4537	1001	1	658.00	8	0.65	1000	8	147.869	29.712	139.854	11.720	1.843	1889.962	237.752	2175.749	86.199	3.763
4538	1001	1	659.00	9	0.65	1000	9	143.513	28.667	135.721	11.263	1.588	2092.524	259.191	2413.416	92.343	3.517
4539	1001	1	660.00	10	0.65	1000	10	139.030	27.813	131.700	10.780	1.391	2292.553	279.938	2651.893	97.807	3.666
4541	1251	1	812.75	0.25	0.65	1250	0.25	221.840	43.193	285.772	14.753	86.156	38.499	12.585	44.746	5.003	33.133
4542	1251	1	813.00	0.5	0.65	1250	0.5	317.299	57.815	382.202	21.898	56.497	94.737	23.422	108.354	9.230	26.444
4543	1251	1	813.25	0.75	0.65	1250	0.75	297.656	55.042	346.967	21.634	35.977	185.302	36.696	211.491	14.619	25.048
4544	1251	1	813.50	1	0.65	1250	1	261.036	49.227	298.534	19.781	24.535	275.885	51.382	313.788	20.595	24.562
4545	1251	1	813.75	1.25	0.65	1250	1.25	231.140	44.475	260.241	18.137	17.982	364.527	65.545	414.669	26.152	23.698

STP-PT-074: Local Stress in Nozzles, Shells and Formed Heads from External Heads

Model								Secondary (inside) Stress Factors									
	OD	T	od	t	d/D	D/T	t/T	Branch					Header				
								Axial	In-Plane	Out-of-Plane	Torsional	Pressure	Axial	In-Plane	Out-of-Plane	Torsional	Pressure
4546	1251	1	814.50	2	0.65	1250	2	184.802	38.994	197.121	16.003	9.934	611.306	100.670	699.434	39.768	19.504
4547	1251	1	815.00	2.5	0.65	1250	2.5	175.084	39.051	180.521	16.009	7.785	763.387	119.247	877.491	46.753	16.494
4548	1251	1	815.50	3	0.65	1250	3	174.411	39.316	172.838	16.109	6.419	907.253	135.260	1046.967	52.987	13.816
4549	1251	1	816.50	4	0.65	1250	4	182.024	39.383	178.056	16.011	4.696	1178.984	164.677	1370.113	63.887	9.717
4550	1251	1	817.50	5	0.65	1250	5	186.472	38.647	182.635	15.508	3.642	1435.212	192.163	1676.403	73.567	6.896
4551	1251	1	818.50	6	0.65	1250	6	187.166	37.470	184.127	14.906	2.928	1682.278	218.382	1975.482	82.449	5.503
4552	1251	1	819.50	7	0.65	1250	7	185.400	36.138	182.729	14.264	2.420	1922.886	243.629	2263.126	90.796	4.775
4553	1251	1	820.00	7.5	0.65	1250	7.5	183.829	35.484	181.417	13.933	2.219	2040.253	256.177	2404.868	94.774	4.512
4554	1251	1	820.50	8	0.65	1250	8	181.929	34.978	179.895	13.637	2.044	2158.888	268.309	2550.880	98.557	4.281
4555	1251	1	821.50	9	0.65	1250	9	177.707	33.822	176.106	13.018	1.758	2389.609	292.277	2831.227	105.714	3.878
4556	1251	1	822.50	10	0.65	1250	10	172.661	32.529	171.153	12.468	1.536	2616.069	315.635	3105.045	112.336	3.665
4558	1501	1	975.25	0.25	0.65	1500	0.25	244.110	47.536	320.829	16.329	95.216	43.039	14.098	51.057	5.550	36.463
4559	1501	1	975.50	0.5	0.65	1500	0.5	350.674	64.180	431.513	24.473	62.243	106.596	26.049	124.739	10.201	29.016
4560	1501	1	975.75	0.75	0.65	1500	0.75	328.820	61.417	391.707	24.080	39.629	206.955	40.852	241.456	16.377	27.484
4561	1501	1	976.00	1	0.65	1500	1	288.131	54.840	336.896	21.968	26.971	307.419	57.564	357.485	23.025	26.981
4562	1501	1	976.25	1.25	0.65	1500	1.25	255.566	49.594	294.173	20.162	19.761	405.270	73.221	471.202	29.216	26.089
4563	1501	1	977.00	2	0.65	1500	2	206.038	43.394	224.968	17.819	10.888	678.077	111.988	792.956	44.249	21.582
4564	1501	1	977.50	2.5	0.65	1500	2.5	196.748	43.586	207.925	17.747	8.528	847.030	132.609	994.735	52.058	18.342
4565	1501	1	978.00	3	0.65	1500	3	197.768	44.118	200.744	17.938	7.030	1007.206	150.223	1187.414	58.928	15.435
4566	1501	1	979.00	4	0.65	1500	4	208.755	44.473	210.477	17.930	5.136	1308.972	182.165	1553.406	70.882	10.959
4567	1501	1	980.00	5	0.65	1500	5	215.630	43.937	217.961	17.471	3.980	1594.114	212.138	1901.292	81.553	7.880
4568	1501	1	981.00	6	0.65	1500	6	218.000	42.658	221.252	16.846	3.198	1868.746	240.389	2237.276	91.445	6.002
4569	1501	1	982.00	7	0.65	1500	7	217.296	41.281	221.438	16.128	2.640	2135.879	267.627	2565.710	100.738	5.310
4570	1501	1	982.50	7.5	0.65	1500	7.5	216.072	40.556	220.577	15.752	2.420	2265.196	281.345	2725.270	105.122	5.022
4571	1501	1	983.00	8	0.65	1500	8	214.360	39.808	219.671	15.428	2.229	2394.792	294.893	2892.328	109.402	4.768
4572	1501	1	984.00	9	0.65	1500	9	210.048	38.324	215.232	14.775	1.915	2651.214	321.057	3203.531	117.609	4.327
4573	1501	1	985.00	10	0.65	1500	10	205.277	37.252	211.078	14.113	1.670	2902.985	346.841	3520.766	125.137	3.970
4576	1751	1	1138.00	0.5	0.65	1750	0.5	379.811	70.248	475.975	26.826	67.512	117.403	28.510	140.132	11.114	31.426
4577	1751	1	1138.25	0.75	0.65	1750	0.75	355.940	67.179	432.092	26.363	42.949	226.618	45.065	269.546	18.054	29.769
4578	1751	1	1138.50	1	0.65	1750	1	312.180	59.949	372.267	23.970	29.205	336.021	63.397	398.501	25.275	29.237
4579	1751	1	1138.75	1.25	0.65	1750	1.25	276.905	54.239	325.091	21.991	21.385	442.125	80.404	524.146	32.059	28.307
4580	1751	1	1139.50	2	0.65	1750	2	225.002	47.309	250.789	19.523	11.764	738.629	122.648	880.432	48.449	23.510
4581	1751	1	1140.00	2.5	0.65	1750	2.5	216.158	47.778	233.343	19.346	9.213	921.877	144.832	1102.797	56.899	20.023
4582	1751	1	1140.50	3	0.65	1750	3	219.087	48.633	227.766	19.622	7.596	1096.551	163.849	1316.694	64.330	16.907
4583	1751	1	1141.50	4	0.65	1750	4	233.218	49.324	241.167	19.724	5.550	1425.143	198.176	1721.543	77.199	12.084
4584	1751	1	1142.50	5	0.65	1750	5	242.580	48.808	251.774	19.317	4.294	1735.148	229.792	2105.886	88.648	8.780
4585	1751	1	1143.50	6	0.65	1750	6	246.855	47.606	257.259	18.640	3.448	2033.958	260.383	2475.304	99.410	6.519
4586	1751	1	1144.50	7	0.65	1750	7	247.183	46.120	258.978	17.894	2.846	2324.287	289.473	2840.287	109.471	5.760

STP-PT-074: Local Stress in Nozzles, Shells and Formed Heads from External Heads

Model								Secondary (inside) Stress Factors									
	OD	T	od	t	d/D	D/T	t/T	Branch					Header				
								Axial	In-Plane	Out-of-Plane	Torsional	Pressure	Axial	In-Plane	Out-of-Plane	Torsional	Pressure
4587	1751	1	1145.00	7.5	0.65	1750	7.5	246.363	45.275	258.645	17.477	2.607	2468.828	304.037	3021.868	114.452	5.450
4588	1751	1	1145.50	8	0.65	1750	8	244.897	44.465	257.594	17.127	2.400	2610.239	318.250	3199.959	119.105	5.176
4589	1751	1	1146.50	9	0.65	1750	9	241.004	43.029	254.100	16.391	2.060	2887.844	346.730	3548.531	128.101	4.704
4590	1751	1	1147.50	10	0.65	1750	10	236.162	41.572	250.062	15.708	1.795	3162.701	374.344	3904.551	136.486	4.322
4593	2001	1	1300.50	0.5	0.65	2000	0.5	405.677	75.826	516.753	28.990	72.344	127.338	30.750	154.714	12.019	33.683
4594	2001	1	1300.75	0.75	0.65	2000	0.75	380.222	72.460	469.384	28.424	46.064	244.797	49.047	296.221	19.609	31.889
4595	2001	1	1301.00	1	0.65	2000	1	333.493	64.666	404.169	25.802	31.289	362.219	68.729	436.591	27.416	31.339
4596	2001	1	1301.25	1.25	0.65	2000	1.25	296.071	58.570	353.605	23.677	22.895	476.079	87.165	574.030	34.707	30.364
4597	2001	1	1302.00	2	0.65	2000	2	242.327	51.411	274.820	21.140	12.580	794.786	132.437	962.589	52.274	25.300
4598	2001	1	1302.50	2.5	0.65	2000	2.5	233.825	51.727	257.044	20.915	9.852	991.843	156.310	1205.066	61.417	21.601
4599	2001	1	1303.00	3	0.65	2000	3	238.548	52.798	253.429	21.190	8.123	1179.660	176.546	1440.078	69.382	18.289
4600	2001	1	1304.00	4	0.65	2000	4	255.779	53.798	270.523	21.385	5.937	1533.209	212.945	1881.110	83.142	13.134
4601	2001	1	1305.00	5	0.65	2000	5	267.365	53.386	284.091	21.017	4.588	1867.223	246.360	2302.301	95.205	9.613
4602	2001	1	1306.00	6	0.65	2000	6	273.267	52.123	291.805	20.343	3.682	2187.764	278.096	2705.614	106.643	7.149
4603	2001	1	1307.00	7	0.65	2000	7	274.851	50.577	294.665	19.559	3.037	2499.846	309.192	3097.716	117.502	6.176
4604	2001	1	1307.50	7.5	0.65	2000	7.5	274.528	49.736	295.168	19.160	2.782	2653.249	324.355	3295.223	122.793	5.841
4605	2001	1	1308.00	8	0.65	2000	8	273.621	48.936	294.757	18.755	2.560	2806.403	339.656	3490.351	127.903	5.548
4606	2001	1	1309.00	9	0.65	2000	9	270.563	47.253	292.935	17.914	2.196	3103.732	369.241	3874.720	137.522	5.045
4610	2251	1	1463.00	0.5	0.65	2250	0.5	428.408	80.961	553.060	30.965	76.946	136.461	32.809	168.312	12.928	35.751
4611	2251	1	1463.25	0.75	0.65	2250	0.75	401.636	77.287	502.794	30.325	48.973	261.434	52.773	320.975	21.059	33.849
4612	2251	1	1463.50	1	0.65	2250	1	352.833	69.137	434.276	27.528	33.251	385.940	73.771	472.388	29.372	33.295
4613	2251	1	1463.75	1.25	0.65	2250	1.25	313.249	62.645	379.779	25.250	24.322	506.839	93.347	620.142	37.131	32.262
4614	2251	1	1464.50	2	0.65	2250	2	257.546	55.138	296.890	22.607	13.354	844.862	141.495	1038.359	55.852	26.957
4615	2251	1	1465.00	2.5	0.65	2250	2.5	249.913	55.441	279.540	22.473	10.455	1054.914	166.775	1300.185	65.564	23.048
4616	2251	1	1465.50	3	0.65	2250	3	256.417	56.694	277.745	22.642	8.620	1252.846	188.151	1550.535	73.997	19.549
4617	2251	1	1466.50	4	0.65	2250	4	276.485	58.003	298.223	22.931	6.300	1629.410	226.510	2024.889	88.484	14.101
4618	2251	1	1467.50	5	0.65	2250	5	290.673	57.669	314.949	22.597	4.866	1984.915	261.543	2477.120	101.287	10.379
4619	2251	1	1468.50	6	0.65	2250	6	298.247	56.444	325.420	21.945	3.905	2327.376	294.389	2916.966	113.184	7.772
4627	2501	1	1625.50	0.5	0.65	2500	0.5	449.118	85.802	587.245	32.797	81.264	144.988	34.751	181.415	13.805	37.714
4628	2501	1	1625.75	0.75	0.65	2500	0.75	421.242	81.843	534.302	32.089	51.687	277.130	56.331	344.947	22.445	35.691
4629	2501	1	1626.00	1	0.65	2500	1	369.556	73.126	460.736	29.115	35.107	408.133	78.571	506.066	31.260	35.113
4630	2501	1	1626.25	1.25	0.65	2500	1.25	328.805	66.339	403.956	26.691	25.659	535.840	99.285	664.213	39.430	34.042
4631	2501	1	1627.00	2	0.65	2500	2	271.775	58.792	317.725	24.034	14.079	892.472	150.140	1110.245	59.251	28.506
4632	2501	1	1627.50	2.5	0.65	2500	2.5	264.741	58.896	301.552	23.960	11.025	1113.705	176.747	1393.598	69.490	24.421
4633	2501	1	1628.00	3	0.65	2500	3	273.324	60.363	301.254	24.096	9.092	1323.373	199.124	1658.049	78.355	20.759
4634	2501	1	1629.00	4	0.65	2500	4	296.100	61.996	325.362	24.451	6.649	1720.817	239.111	2164.843	93.506	15.038
4642	9	1	5.70	0.1	0.7	8	0.1	1.169	1.131	1.156	1.070	9.691	0.434	0.328	0.450	0.383	4.747
4643	9	1	5.85	0.25	0.7	8	0.25	1.288	1.321	1.431	1.121	3.668	1.054	0.650	0.996	0.715	3.904

STP-PT-074: Local Stress in Nozzles, Shells and Formed Heads from External Heads

Model								Secondary (inside) Stress Factors									
	OD	T	od	t	d/D	D/T	t/T	Branch					Header				
								Axial	In-Plane	Out-of-Plane	Torsional	Pressure	Axial	In-Plane	Out-of-Plane	Torsional	Pressure
4644	9	1	6.10	0.5	0.7	8	0.5	1.583	1.592	1.810	1.153	2.313	1.968	0.977	1.553	0.951	3.018
4645	9	1	6.35	0.75	0.7	8	0.75	1.968	1.473	1.758	1.273	2.118	2.805	1.233	1.781	1.045	2.447
4646	9	1	6.60	1	0.7	8	1	2.226	1.421	1.640	1.337	1.999	3.597	1.436	1.989	1.173	2.109
4647	9	1	6.85	1.25	0.7	8	1.25	2.394	1.456	1.603	1.390	1.753	4.276	1.607	2.195	1.283	1.784
4648	9	1	7.60	2	0.7	8	2	2.555	1.426	1.415	1.439	1.249	6.871	1.909	3.178	1.551	1.321
4649	9	1	8.10	2.5	0.7	8	2.5	2.548	1.367	1.308	1.408	1.031	8.608	2.134	3.925	1.699	1.247
4650	9	1	8.60	3	0.7	8	3	2.556	1.340	1.234	1.438	0.876	10.355	2.358	4.533	1.866	1.237
4659	17	1	11.30	0.1	0.7	16	0.1	1.468	1.246	1.605	1.407	10.703	0.681	0.517	0.672	0.594	6.457
4660	17	1	11.45	0.25	0.7	16	0.25	2.934	2.507	3.646	1.456	4.278	1.622	1.047	1.499	1.049	5.019
4661	17	1	11.70	0.5	0.7	16	0.5	4.037	2.842	4.606	1.492	3.447	2.883	1.732	2.401	1.438	3.856
4662	17	1	11.95	0.75	0.7	16	0.75	4.489	2.664	4.453	1.835	3.003	4.005	2.237	3.078	1.654	3.157
4663	17	1	12.20	1	0.7	16	1	4.561	2.540	4.095	2.071	2.722	5.079	2.661	3.837	1.861	2.636
4664	17	1	12.45	1.25	0.7	16	1.25	4.624	2.592	3.904	2.138	2.418	6.013	3.004	4.910	2.082	2.171
4665	17	1	13.20	2	0.7	16	2	4.307	2.688	3.337	2.409	1.834	9.857	3.788	8.964	2.599	1.498
4666	17	1	13.70	2.5	0.7	16	2.5	4.113	2.592	2.991	2.466	1.561	12.823	4.185	11.281	2.781	1.361
4667	17	1	14.20	3	0.7	16	3	3.920	2.465	2.685	2.476	1.343	15.453	4.754	13.258	2.927	1.310
4668	17	1	15.20	4	0.7	16	4	3.694	2.278	2.242	2.389	1.030	19.641	5.733	16.371	3.205	1.475
4669	17	1	16.20	5	0.7	16	5	3.584	2.133	1.994	2.336	0.827	22.630	6.442	18.695	3.485	1.757
4676	25	1	16.90	0.1	0.7	24	0.1	2.056	1.807	2.546	1.632	10.165	0.908	0.646	0.927	0.731	7.342
4677	25	1	17.05	0.25	0.7	24	0.25	4.893	3.343	6.344	1.518	5.675	2.148	1.380	2.079	1.268	5.687
4678	25	1	17.30	0.5	0.7	24	0.5	7.158	3.819	7.999	1.667	4.796	3.721	2.292	3.379	1.762	4.404
4679	25	1	17.55	0.75	0.7	24	0.75	7.757	3.661	7.600	2.135	3.854	5.029	3.007	4.384	2.031	3.694
4680	25	1	17.80	1	0.7	24	1	7.599	3.488	6.905	2.494	3.255	6.762	3.671	6.166	2.291	3.142
4681	25	1	18.05	1.25	0.7	24	1.25	7.426	3.377	6.429	2.676	2.791	9.456	4.195	8.614	2.652	2.585
4682	25	1	18.80	2	0.7	24	2	6.615	3.636	5.344	2.866	2.072	18.528	5.493	15.540	3.603	1.690
4683	25	1	19.30	2.5	0.7	24	2.5	6.146	3.591	4.789	2.996	1.784	24.254	6.152	19.659	3.928	1.475
4684	25	1	19.80	3	0.7	24	3	5.737	3.429	4.310	3.084	1.558	29.579	6.981	23.360	4.144	1.371
4685	25	1	20.80	4	0.7	24	4	5.075	3.087	3.548	3.092	1.220	39.072	8.738	29.657	4.418	1.706
4686	25	1	21.80	5	0.7	24	5	4.650	3.007	3.064	2.958	0.991	46.665	10.079	34.541	4.653	2.147
4687	25	1	22.80	6	0.7	24	6	4.421	2.855	2.655	2.863	0.828	52.783	11.137	38.534	4.992	2.445
4688	25	1	23.80	7	0.7	24	7	4.259	2.724	2.428	2.791	0.708	57.568	11.983	41.831	5.347	2.635
4689	25	1	24.30	7.5	0.7	24	7.5	4.245	2.662	2.342	2.743	0.660	59.537	12.335	43.289	5.598	2.700
4690	25	1	24.80	8	0.7	24	8	4.112	2.598	2.266	2.725	0.619	61.214	12.666	44.625	5.848	2.748
4693	33	1	22.50	0.1	0.7	32	0.1	2.707	2.203	3.566	1.695	11.360	1.111	0.733	1.156	0.820	7.938
4694	33	1	22.65	0.25	0.7	32	0.25	7.354	3.954	9.220	1.470	7.233	2.612	1.635	2.539	1.397	6.249
4695	33	1	22.90	0.5	0.7	32	0.5	10.955	4.708	11.691	1.835	6.083	4.364	2.723	4.315	1.960	4.944
4696	33	1	23.15	0.75	0.7	32	0.75	11.467	4.621	10.996	2.356	4.646	6.312	3.601	5.901	2.267	4.235
4697	33	1	23.40	1	0.7	32	1	10.961	4.333	9.876	2.747	3.742	9.789	4.442	9.069	2.592	3.673

STP-PT-074: Local Stress in Nozzles, Shells and Formed Heads from External Heads

Model								Secondary (inside) Stress Factors									
	OD	T	od	t	d/D	D/T	t/T	Branch					Header				
								Axial	In-Plane	Out-of-Plane	Torsional	Pressure	Axial	In-Plane	Out-of-Plane	Torsional	Pressure
4698	33	1	23.65	1.25	0.7	32	1.25	10.526	4.060	9.068	2.998	3.112	14.158	5.150	12.620	3.145	3.061
4699	33	1	24.40	2	0.7	32	2	8.973	4.398	7.334	3.341	2.214	27.667	6.954	22.585	4.517	1.860
4700	33	1	24.90	2.5	0.7	32	2.5	8.174	4.396	6.569	3.360	1.900	36.130	7.890	28.553	4.989	1.566
4701	33	1	25.40	3	0.7	32	3	7.532	4.324	5.920	3.365	1.666	44.144	9.078	34.077	5.242	1.458
4702	33	1	26.40	4	0.7	32	4	6.558	3.933	4.881	3.469	1.323	58.616	11.504	43.606	5.627	1.822
4703	33	1	27.40	5	0.7	32	5	5.846	3.636	4.118	3.396	1.081	71.466	13.519	51.648	5.903	2.368
4704	33	1	28.40	6	0.7	32	6	5.389	3.639	3.683	3.346	0.915	82.706	15.142	58.487	6.216	2.771
4705	33	1	29.40	7	0.7	32	7	4.915	3.447	3.218	3.188	0.783	92.061	16.465	64.149	6.644	3.065
4706	33	1	29.90	7.5	0.7	32	7.5	4.833	3.308	3.056	3.128	0.732	96.226	17.017	66.646	6.863	3.181
4707	33	1	30.40	8	0.7	32	8	4.752	3.232	2.925	3.080	0.685	100.059	17.533	69.046	7.084	3.280
4708	33	1	31.40	9	0.7	32	9	4.597	3.075	2.703	2.950	0.608	106.707	18.469	73.342	7.661	3.430
4709	33	1	32.40	10	0.7	32	10	4.424	2.993	2.500	3.016	0.542	112.142	19.279	77.100	8.231	3.528
4710	41	1	28.10	0.1	0.7	40	0.1	3.489	2.526	4.563	1.709	10.447	1.321	0.804	1.381	0.885	8.475
4711	41	1	28.25	0.25	0.7	40	0.25	10.030	4.456	12.084	1.412	8.779	3.026	1.873	3.059	1.475	6.777
4712	41	1	28.50	0.5	0.7	40	0.5	14.858	5.538	15.425	2.041	7.246	5.036	3.166	5.128	2.066	5.396
4713	41	1	28.75	0.75	0.7	40	0.75	15.300	5.497	14.440	2.600	5.341	8.190	4.173	7.722	2.444	4.700
4714	41	1	29.00	1	0.7	40	1	14.418	5.111	12.883	2.991	4.170	12.907	5.123	11.881	2.819	4.143
4715	41	1	29.25	1.25	0.7	40	1.25	13.729	4.751	11.768	3.232	3.407	19.146	5.868	16.799	3.520	3.522
4716	41	1	30.00	2	0.7	40	2	11.302	5.008	9.313	3.683	2.336	37.063	8.140	29.988	5.231	2.074
4717	41	1	30.50	2.5	0.7	40	2.5	10.139	5.092	8.285	3.744	1.988	48.226	9.393	37.866	5.893	1.683
4718	41	1	31.00	3	0.7	40	3	9.245	5.019	7.471	3.703	1.737	58.794	11.079	45.136	6.300	1.571
4719	41	1	32.00	4	0.7	40	4	7.943	4.668	6.223	3.849	1.386	78.262	14.098	58.017	6.714	1.895
4720	41	1	33.00	5	0.7	40	5	7.015	4.467	5.276	3.846	1.142	95.975	16.669	69.221	7.072	2.498
4721	41	1	34.00	6	0.7	40	6	6.329	4.357	4.550	3.895	0.960	111.867	18.817	78.842	7.409	2.965
4722	41	1	35.00	7	0.7	40	7	5.897	4.126	4.164	3.786	0.834	126.401	20.645	87.450	7.930	3.337
4723	41	1	35.50	7.5	0.7	40	7.5	5.643	4.047	3.911	3.706	0.778	133.168	21.459	91.429	8.193	3.497
4724	41	1	36.00	8	0.7	40	8	5.443	3.842	3.704	3.549	0.730	139.585	22.198	95.190	8.453	3.639
4725	41	1	37.00	9	0.7	40	9	5.322	3.691	3.291	3.483	0.646	150.768	23.523	101.698	9.031	3.867
4726	41	1	38.00	10	0.7	40	10	4.921	3.494	3.113	3.365	0.579	160.628	24.656	107.576	9.693	4.044
4727	51	1	35.10	0.1	0.7	50	0.1	4.653	2.822	5.856	1.654	11.044	1.588	0.889	1.607	0.925	9.088
4728	51	1	35.25	0.25	0.7	50	0.25	13.545	5.000	15.782	1.397	10.767	3.590	2.099	3.634	1.538	7.374
4729	51	1	35.50	0.5	0.7	50	0.5	19.992	6.613	20.251	2.341	8.583	5.844	3.526	6.159	2.180	5.924
4730	51	1	35.75	0.75	0.7	50	0.75	20.306	6.532	18.885	2.930	6.149	10.713	4.649	10.089	2.642	5.234
4731	51	1	36.00	1	0.7	50	1	18.924	6.010	16.768	3.292	4.679	17.488	5.740	15.864	3.143	4.712
4732	51	1	36.25	1.25	0.7	50	1.25	17.656	5.548	15.133	3.512	3.738	25.271	6.736	21.985	3.932	4.069
4733	51	1	37.00	2	0.7	50	2	14.079	5.629	11.682	3.989	2.479	48.105	9.488	38.904	6.008	2.477
4734	51	1	37.50	2.5	0.7	50	2.5	12.442	5.723	10.350	4.123	2.083	62.317	11.316	49.049	6.899	1.906
4735	51	1	38.00	3	0.7	50	3	11.300	5.726	9.370	4.107	1.810	76.967	13.466	59.167	7.406	1.681



STP-PT-074: Local Stress in Nozzles, Shells and Formed Heads from External Heads

Model								Secondary (inside) Stress Factors									
	OD	T	od	t	d/D	D/T	t/T	Branch					Header				
								Axial	In-Plane	Out-of-Plane	Torsional	Pressure	Axial	In-Plane	Out-of-Plane	Torsional	Pressure
4736	51	1	39.00	4	0.7	50	4	9.608	5.467	7.875	4.281	1.443	102.811	17.184	76.526	8.007	1.961
4737	51	1	40.00	5	0.7	50	5	8.433	5.314	6.749	4.411	1.193	126.349	20.363	91.635	8.435	2.598
4738	51	1	41.00	6	0.7	50	6	7.549	4.810	5.910	4.398	1.009	148.052	23.098	104.999	8.862	3.116
4739	51	1	42.00	7	0.7	50	7	6.864	4.864	5.214	4.411	0.867	168.291	25.529	117.087	9.459	3.547
4740	51	1	42.50	7.5	0.7	50	7.5	6.588	4.750	4.912	4.308	0.809	177.831	26.575	122.674	9.787	3.736
4741	51	1	43.00	8	0.7	50	8	6.293	4.780	4.649	4.257	0.757	186.990	27.578	127.981	10.121	3.908
4742	51	1	44.00	9	0.7	50	9	6.006	4.475	4.336	3.985	0.681	204.271	29.410	137.897	10.762	4.212
4743	51	1	45.00	10	0.7	50	10	5.616	4.120	3.980	3.797	0.611	220.622	31.033	147.251	11.493	4.476
4744	61	1	42.10	0.1	0.7	60	0.1	5.857	3.055	7.149	1.569	10.769	1.825	0.956	1.872	0.951	9.718
4745	61	1	42.25	0.25	0.7	60	0.25	17.142	5.671	19.499	1.528	12.702	4.147	2.294	4.313	1.595	7.975
4746	61	1	42.50	0.5	0.7	60	0.5	25.216	7.620	25.111	2.679	9.808	6.536	3.851	7.284	2.300	6.446
4747	61	1	42.75	0.75	0.7	60	0.75	25.358	7.463	23.360	3.281	6.884	13.521	5.038	12.695	2.835	5.752
4748	61	1	43.00	1	0.7	60	1	23.425	6.839	20.653	3.599	5.148	22.023	6.209	19.810	3.459	5.207
4749	61	1	43.25	1.25	0.7	60	1.25	21.645	6.311	18.531	3.780	4.063	31.621	7.507	27.375	4.272	4.559
4750	61	1	44.00	2	0.7	60	2	16.917	6.172	14.127	4.260	2.625	59.665	10.897	48.315	6.558	2.853
4751	61	1	44.50	2.5	0.7	60	2.5	14.787	6.281	12.431	4.393	2.181	77.097	13.301	60.863	7.645	2.139
4752	61	1	45.00	3	0.7	60	3	13.223	6.328	11.185	4.418	1.884	93.979	15.666	72.781	8.357	1.782
4753	61	1	46.00	4	0.7	60	4	11.093	6.171	9.396	4.532	1.490	125.020	19.823	93.985	9.246	1.981
4754	61	1	47.00	5	0.7	60	5	9.808	5.804	8.283	4.681	1.233	156.126	23.744	114.174	9.688	2.660
4755	61	1	48.00	6	0.7	60	6	8.758	5.787	7.398	4.825	1.045	183.806	27.106	131.569	10.186	3.211
4756	61	1	49.00	7	0.7	60	7	7.938	5.565	6.661	4.735	0.903	209.570	30.001	147.210	10.946	3.678
4757	61	1	49.50	7.5	0.7	60	7.5	7.611	5.527	6.130	4.707	0.844	221.825	31.329	154.482	11.343	3.886
4758	61	1	50.00	8	0.7	60	8	7.315	5.275	5.983	4.599	0.791	233.741	32.579	161.469	11.721	4.080
4759	61	1	51.00	9	0.7	60	9	6.752	4.912	5.367	4.444	0.700	256.587	34.914	174.649	12.460	4.432
4760	61	1	52.00	10	0.7	60	10	6.429	4.768	4.897	4.234	0.636	277.978	36.961	186.831	13.187	4.739
4761	71	1	49.10	0.1	0.7	70	0.1	7.145	3.249	8.438	1.479	11.331	2.062	1.028	2.077	0.961	10.290
4762	71	1	49.25	0.25	0.7	70	0.25	20.802	6.317	23.161	1.697	14.513	4.649	2.455	4.828	1.644	8.507
4763	71	1	49.50	0.5	0.7	70	0.5	30.439	8.554	29.925	3.034	10.956	7.573	4.097	8.177	2.401	6.895
4764	71	1	49.75	0.75	0.7	70	0.75	30.370	8.339	27.783	3.638	7.580	16.308	5.382	15.202	3.014	6.199
4765	71	1	50.00	1	0.7	70	1	27.871	7.609	24.498	3.915	5.593	26.519	6.816	23.719	3.728	5.659
4766	71	1	50.25	1.25	0.7	70	1.25	25.580	7.038	21.891	4.045	4.370	37.862	8.523	32.696	4.604	5.009
4767	71	1	51.00	2	0.7	70	2	19.693	6.690	16.516	4.490	2.760	71.167	12.645	57.802	6.914	3.221
4768	71	1	51.50	2.5	0.7	70	2.5	17.086	6.770	14.474	4.616	2.276	91.831	15.319	72.836	8.187	2.414
4769	71	1	52.00	3	0.7	70	3	15.219	6.796	13.092	4.648	1.953	111.413	17.842	86.774	9.115	1.947
4770	71	1	53.00	4	0.7	70	4	12.745	6.695	11.174	4.607	1.535	148.259	22.482	112.265	10.251	2.017
4771	71	1	54.00	5	0.7	70	5	11.065	6.404	9.806	4.854	1.267	182.553	26.664	135.095	10.951	2.666
4772	71	1	55.00	6	0.7	70	6	9.881	6.481	8.903	4.982	1.078	215.237	30.528	156.130	11.557	3.224
4773	71	1	56.00	7	0.7	70	7	9.085	6.181	8.120	5.046	0.931	249.609	34.151	177.202	12.420	3.757

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Model								Secondary (inside) Stress Factors									
	OD	T	od	t	d/D	D/T	t/T	Branch					Header				
								Axial	In-Plane	Out-of-Plane	Torsional	Pressure	Axial	In-Plane	Out-of-Plane	Torsional	Pressure
4774	71	1	56.50	7.5	0.7	70	7.5	8.672	6.008	7.675	4.987	0.871	264.664	35.692	186.312	12.861	3.980
4775	71	1	57.00	8	0.7	70	8	8.290	5.955	7.287	5.051	0.817	279.170	37.176	194.938	13.262	4.188
4776	71	1	58.00	9	0.7	70	9	7.637	5.772	6.693	4.921	0.725	307.556	39.971	211.583	14.087	4.574
4777	71	1	59.00	10	0.7	70	10	7.078	5.479	6.117	4.827	0.648	334.260	42.466	226.895	14.904	4.916
4778	81	1	56.10	0.1	0.7	80	0.1	8.405	3.442	9.711	1.424	12.435	2.284	1.095	2.312	0.981	10.863
4779	81	1	56.25	0.25	0.7	80	0.25	24.490	6.935	26.767	1.914	16.317	5.126	2.597	5.321	1.678	9.001
4780	81	1	56.50	0.5	0.7	80	0.5	35.610	9.437	34.676	3.392	12.026	8.839	4.310	8.969	2.502	7.313
4781	81	1	56.75	0.75	0.7	80	0.75	35.326	9.157	32.165	3.995	8.232	19.188	5.728	17.795	3.208	6.644
4782	81	1	57.00	1	0.7	80	1	32.246	8.355	28.305	4.224	6.015	31.088	7.696	27.715	3.972	6.106
4783	81	1	57.25	1.25	0.7	80	1.25	29.430	7.744	25.215	4.312	4.660	44.167	9.650	38.116	4.918	5.448
4784	81	1	58.00	2	0.7	80	2	22.383	7.150	18.857	4.688	2.906	82.124	14.266	66.972	7.298	3.559
4785	81	1	58.50	2.5	0.7	80	2.5	19.324	7.227	16.491	4.835	2.378	105.688	17.192	84.286	8.669	2.676
4786	81	1	59.00	3	0.7	80	3	17.127	7.289	14.834	4.863	2.034	128.164	19.926	100.476	9.738	2.144
4787	81	1	60.00	4	0.7	80	4	14.239	7.192	12.681	4.775	1.579	170.532	24.983	130.144	11.135	2.045
4788	81	1	61.00	5	0.7	80	5	12.429	6.966	11.234	4.987	1.300	210.886	29.725	157.455	12.031	2.703
4789	81	1	62.00	6	0.7	80	6	11.233	6.838	10.341	5.099	1.105	248.564	33.915	182.063	12.799	3.264
4790	81	1	63.00	7	0.7	80	7	10.244	6.739	9.407	5.193	0.959	284.200	37.738	204.588	13.847	3.754
4791	81	1	63.50	7.5	0.7	80	7.5	9.876	6.661	9.097	5.148	0.897	301.276	39.494	215.140	14.329	3.977
4792	81	1	64.00	8	0.7	80	8	9.540	6.148	8.737	5.161	0.842	318.483	41.329	225.691	14.804	4.193
4793	81	1	65.00	9	0.7	80	9	8.831	6.409	8.035	5.187	0.747	356.632	44.715	248.150	15.720	4.661
4794	81	1	66.00	10	0.7	80	10	8.174	6.103	7.386	5.076	0.669	388.416	47.593	266.610	16.580	5.027
4795	91	1	63.10	0.1	0.7	90	0.1	9.682	3.601	10.978	1.352	13.832	2.571	1.150	2.588	0.998	11.454
4796	91	1	63.25	0.25	0.7	90	0.25	28.084	7.561	30.328	2.121	17.899	5.641	2.727	5.927	1.734	9.524
4797	91	1	63.50	0.5	0.7	90	0.5	40.723	10.272	39.377	3.750	13.035	10.087	4.544	9.984	2.623	7.746
4798	91	1	63.75	0.75	0.7	90	0.75	40.176	9.935	36.462	4.346	8.846	21.928	6.176	20.253	3.407	7.036
4799	91	1	64.00	1	0.7	90	1	36.498	9.125	32.015	4.528	6.410	35.420	8.503	31.507	4.174	6.502
4800	91	1	64.25	1.25	0.7	90	1.25	33.153	8.427	28.451	4.582	4.942	50.123	10.695	43.270	5.153	5.843
4801	91	1	65.00	2	0.7	90	2	24.995	7.602	21.157	4.872	3.040	92.641	15.826	75.904	7.682	3.879
4802	91	1	65.50	2.5	0.7	90	2.5	21.493	7.637	18.428	5.016	2.471	119.025	18.956	95.498	9.059	2.931
4803	91	1	66.00	3	0.7	90	3	19.016	7.694	16.626	5.074	2.096	144.180	21.908	113.818	10.291	2.340
4804	91	1	67.00	4	0.7	90	4	15.797	7.726	14.262	5.004	1.623	192.349	27.481	148.021	11.842	2.076
4805	91	1	68.00	5	0.7	90	5	13.798	7.452	12.718	5.051	1.332	237.417	32.684	178.906	13.083	2.720
4806	91	1	69.00	6	0.7	90	6	12.667	7.410	11.845	5.269	1.132	280.269	37.318	207.332	14.051	3.285
4807	91	1	70.00	7	0.7	90	7	11.713	7.321	10.979	5.370	0.982	321.672	41.573	234.010	15.231	3.792
4808	91	1	70.50	7.5	0.7	90	7.5	11.188	7.186	10.498	5.373	0.919	341.396	43.473	246.425	15.773	4.023
4809	91	1	71.00	8	0.7	90	8	10.798	7.254	10.111	5.351	0.863	360.641	45.356	258.356	16.294	4.241
4810	91	1	72.00	9	0.7	90	9	9.824	6.994	9.123	5.295	0.769	397.852	48.913	281.009	17.281	4.645
4811	91	1	73.00	10	0.7	90	10	9.336	6.385	8.674	5.228	0.689	433.216	52.183	301.994	18.223	5.011

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Model								Secondary (inside) Stress Factors									
	OD	T	od	t	d/D	D/T	t/T	Branch					Header				
								Axial	In-Plane	Out-of-Plane	Torsional	Pressure	Axial	In-Plane	Out-of-Plane	Torsional	Pressure
4812	101	1	70.10	0.1	0.7	100	0.1	10.861	3.835	12.238	1.338	15.120	2.789	1.229	2.811	1.036	12.005
4813	101	1	70.25	0.25	0.7	100	0.25	31.603	8.183	33.792	2.339	19.421	6.101	2.832	6.383	1.779	9.982
4814	101	1	70.50	0.5	0.7	100	0.5	45.717	11.078	43.969	4.106	13.994	11.324	4.751	11.060	2.724	8.122
4815	101	1	70.75	0.75	0.7	100	0.75	44.888	10.749	40.660	4.691	9.429	24.634	6.713	22.686	3.607	7.406
4816	101	1	71.00	1	0.7	100	1	40.626	9.857	35.651	4.831	6.788	39.653	9.280	35.234	4.434	6.876
4817	101	1	71.25	1.25	0.7	100	1.25	36.771	9.066	31.628	4.841	5.212	55.893	11.690	48.306	5.378	6.215
4818	101	1	72.00	2	0.7	100	2	27.545	8.032	23.428	5.052	3.171	102.685	17.308	84.562	8.062	4.184
4819	101	1	72.50	2.5	0.7	100	2.5	23.676	8.046	20.460	5.193	2.572	132.197	20.768	106.777	9.519	3.176
4820	101	1	73.00	3	0.7	100	3	20.922	8.095	18.421	5.243	2.182	159.881	23.917	127.162	10.654	2.548
4821	101	1	74.00	4	0.7	100	4	17.347	8.102	15.840	5.170	1.678	212.632	29.886	165.052	12.668	2.094
4822	101	1	75.00	5	0.7	100	5	15.336	7.919	14.247	5.146	1.362	262.541	35.571	199.732	14.101	2.728
4823	101	1	76.00	6	0.7	100	6	14.090	7.683	13.308	5.373	1.155	310.261	40.659	231.879	15.241	3.292
4824	101	1	77.00	7	0.7	100	7	13.000	7.762	12.277	5.490	1.003	356.625	45.354	262.242	16.551	3.804
4825	101	1	77.50	7.5	0.7	100	7.5	12.446	7.723	11.782	5.497	0.940	378.861	47.483	276.493	17.148	4.039
4826	101	1	78.00	8	0.7	100	8	12.133	7.756	11.527	5.508	0.885	400.567	49.563	290.194	17.706	4.263
4827	101	1	79.00	9	0.7	100	9	11.173	7.357	10.577	5.499	0.788	442.651	53.429	316.244	18.808	4.679
4828	101	1	80.00	10	0.7	100	10	10.492	7.195	9.908	5.487	0.708	483.012	57.080	340.641	19.823	5.061
4829	251	1	175.10	0.1	0.7	250	0.1	25.088	6.276	27.896	1.871	34.345	5.469	2.166	5.672	1.247	18.686
4830	251	1	175.25	0.25	0.7	250	0.25	72.891	15.731	78.222	5.443	36.326	12.419	4.602	12.295	2.471	15.494
4831	251	1	175.50	0.5	0.7	250	0.5	104.490	21.357	103.608	8.539	24.706	27.767	8.324	26.822	4.263	12.553
4832	251	1	175.75	0.75	0.7	250	0.75	100.102	20.540	95.224	8.871	16.043	57.961	13.394	55.023	6.340	11.731
4833	251	1	176.00	1	0.7	250	1	88.684	18.518	82.625	8.508	11.155	89.967	18.623	84.034	8.490	11.218
4834	251	1	176.25	1.25	0.7	250	1.25	78.716	16.782	72.432	8.091	8.317	122.545	23.434	113.385	10.564	10.511
4835	251	1	177.00	2	0.7	250	2	58.931	14.168	53.245	7.558	4.754	214.015	35.509	195.524	15.461	7.909
4836	251	1	177.50	2.5	0.7	250	2.5	52.014	13.633	46.756	7.452	3.766	270.041	42.010	245.590	18.045	6.258
4837	251	1	178.00	3	0.7	250	3	47.627	13.330	42.796	7.385	3.129	323.030	47.817	292.677	20.369	4.892
4838	251	1	179.00	4	0.7	250	4	42.807	13.006	38.763	7.209	2.318	423.677	59.676	381.195	24.405	3.416
4839	251	1	180.00	5	0.7	250	5	40.529	12.834	36.334	7.057	1.825	519.603	70.514	464.220	27.889	2.646
4840	251	1	181.00	6	0.7	250	6	38.449	12.641	34.603	6.858	1.497	612.913	80.697	543.629	30.918	3.020
4841	251	1	182.00	7	0.7	250	7	36.612	12.522	33.036	6.689	1.270	705.080	90.405	620.826	33.598	3.403
4842	251	1	182.50	7.5	0.7	250	7.5	35.743	12.342	32.330	6.600	1.183	749.999	95.037	657.870	34.784	3.584
4843	251	1	183.00	8	0.7	250	8	34.899	12.225	31.562	6.594	1.109	794.804	99.532	694.535	35.891	3.764
4844	251	1	184.00	9	0.7	250	9	33.192	12.061	30.169	6.562	0.988	883.291	108.175	766.040	37.940	4.114
4845	251	1	185.00	10	0.7	250	10	31.712	11.890	28.998	6.456	0.893	970.420	116.476	835.242	39.837	4.454
4846	501	1	350.10	0.1	0.7	500	0.1	39.028	9.846	47.602	3.189	54.631	8.758	3.405	9.868	1.627	26.703
4847	501	1	350.25	0.25	0.7	500	0.25	116.798	24.830	138.417	9.225	54.761	20.416	7.281	22.065	3.481	22.017
4848	501	1	350.50	0.5	0.7	500	0.5	168.183	33.287	185.811	13.841	36.480	47.294	13.342	49.576	6.287	17.664
4849	501	1	350.75	0.75	0.7	500	0.75	160.028	31.532	170.336	14.107	23.473	95.938	21.138	100.356	9.640	16.617

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Model								Secondary (inside) Stress Factors									
	OD	T	od	t	d/D	D/T	t/T	Branch					Header				
								Axial	In-Plane	Out-of-Plane	Torsional	Pressure	Axial	In-Plane	Out-of-Plane	Torsional	Pressure
4850	501	1	351.00	1	0.7	500	1	141.101	28.467	147.229	13.226	16.144	145.715	29.212	151.580	13.525	16.134
4851	501	1	351.25	1.25	0.7	500	1.25	125.053	25.946	128.587	12.319	11.904	194.992	37.480	202.567	17.109	15.365
4852	501	1	352.00	2	0.7	500	2	96.798	22.290	95.218	10.989	6.640	332.607	57.773	346.922	25.673	12.194
4853	501	1	352.50	2.5	0.7	500	2.5	88.667	21.753	84.714	10.843	5.208	416.328	68.365	435.834	29.994	10.030
4854	501	1	353.00	3	0.7	500	3	84.430	21.440	78.840	10.705	4.301	495.330	77.494	520.205	33.867	8.149
4855	501	1	354.00	4	0.7	500	4	81.395	20.894	73.024	10.376	3.167	643.691	95.645	679.415	40.500	5.295
4856	501	1	355.00	5	0.7	500	5	79.417	20.289	70.050	9.905	2.465	784.940	112.121	831.035	46.190	4.095
4857	501	1	356.00	6	0.7	500	6	77.274	19.644	68.081	9.517	1.993	920.672	127.821	976.354	51.331	3.431
4858	501	1	357.00	7	0.7	500	7	74.531	18.944	65.762	9.193	1.660	1053.457	142.873	1118.055	55.856	2.994
4859	501	1	357.50	7.5	0.7	500	7.5	73.284	19.001	64.757	9.050	1.530	1118.509	150.194	1187.936	57.956	3.108
4860	501	1	358.00	8	0.7	500	8	71.864	18.539	63.543	8.863	1.419	1182.934	157.264	1255.872	59.959	3.221
4861	501	1	359.00	9	0.7	500	9	69.052	18.028	61.317	8.643	1.235	1312.503	170.958	1393.190	63.463	3.448
4862	501	1	360.00	10	0.7	500	10	66.194	17.618	58.977	8.325	1.096	1438.387	184.495	1525.516	66.739	3.662
4864	751	1	525.25	0.25	0.7	750	0.25	150.654	31.565	188.709	12.103	68.836	26.848	9.334	30.454	4.353	27.198
4865	751	1	525.50	0.5	0.7	750	0.5	218.057	42.377	255.349	18.242	45.596	63.181	17.234	70.292	7.903	21.694
4866	751	1	525.75	0.75	0.7	750	0.75	206.877	40.887	233.969	18.300	29.211	126.498	26.983	140.278	12.474	20.448
4867	751	1	526.00	1	0.7	750	1	182.256	36.780	202.235	16.977	19.986	190.658	38.220	210.623	17.551	19.955
4868	751	1	526.25	1.25	0.7	750	1.25	161.527	33.422	176.548	15.698	14.681	253.710	48.696	280.183	22.198	19.146
4869	751	1	527.00	2	0.7	750	2	127.019	28.677	132.318	13.914	8.116	428.214	74.718	475.565	33.372	15.481
4870	751	1	527.50	2.5	0.7	750	2.5	118.171	28.276	119.303	13.616	6.349	535.051	88.095	596.859	39.016	12.932
4871	751	1	528.00	3	0.7	750	3	114.263	28.210	112.685	13.565	5.224	636.927	99.863	713.393	44.131	10.705
4872	751	1	529.00	4	0.7	750	4	113.773	27.851	107.479	13.240	3.833	827.780	122.445	933.206	52.741	7.273
4873	751	1	530.00	5	0.7	750	5	113.364	27.067	106.861	12.702	2.977	1007.977	143.003	1141.576	60.317	5.117
4874	751	1	531.00	6	0.7	750	6	111.492	26.241	105.218	12.154	2.399	1180.673	162.814	1341.480	67.110	4.253
4875	751	1	532.00	7	0.7	750	7	108.629	25.408	102.629	11.649	1.988	1349.899	181.509	1537.876	73.262	3.642
4876	751	1	532.50	7.5	0.7	750	7.5	106.931	24.591	101.142	11.429	1.827	1433.497	190.650	1635.191	76.115	3.401
4877	751	1	533.00	8	0.7	750	8	105.226	24.613	99.617	11.157	1.687	1515.702	199.617	1728.821	78.863	3.192
4878	751	1	534.00	9	0.7	750	9	101.552	23.740	96.341	10.597	1.459	1678.270	217.222	1919.774	83.863	3.328
4879	751	1	535.00	10	0.7	750	10	97.907	23.253	93.105	10.264	1.283	1838.813	234.207	2106.537	88.393	3.491
4881	1001	1	700.25	0.25	0.7	1000	0.25	178.170	37.006	230.342	14.539	80.835	32.106	11.219	37.403	5.113	31.674
4882	1001	1	700.50	0.5	0.7	1000	0.5	259.478	50.787	313.942	21.924	53.270	77.311	20.518	89.152	9.269	25.147
4883	1001	1	700.75	0.75	0.7	1000	0.75	245.898	48.885	287.729	21.892	34.076	152.815	32.563	175.447	14.999	23.724
4884	1001	1	701.00	1	0.7	1000	1	216.593	43.864	249.018	20.084	23.228	229.127	45.854	262.210	20.923	23.195
4885	1001	1	701.25	1.25	0.7	1000	1.25	192.089	39.800	217.637	18.536	17.032	303.502	58.394	347.092	26.502	22.338
4886	1001	1	702.00	2	0.7	1000	2	152.732	34.404	165.184	16.463	9.370	510.653	89.051	586.853	39.869	18.280
4887	1001	1	702.50	2.5	0.7	1000	2.5	143.683	33.785	150.957	16.100	7.319	637.840	104.859	736.024	46.618	15.380
4888	1001	1	703.00	3	0.7	1000	3	140.153	33.913	144.207	16.010	6.021	758.317	118.393	878.226	52.576	12.838
4889	1001	1	704.00	4	0.7	1000	4	142.918	33.811	141.945	15.798	4.405	985.467	144.409	1147.789	62.807	8.928

STP-PT-074: Local Stress in Nozzles, Shells and Formed Heads from External Heads

Model								Secondary (inside) Stress Factors									
	OD	T	od	t	d/D	D/T	t/T	Branch					Header				
								Axial	In-Plane	Out-of-Plane	Torsional	Pressure	Axial	In-Plane	Out-of-Plane	Torsional	Pressure
4890	1001	1	705.00	5	0.7	1000	5	144.428	33.090	143.584	15.257	3.416	1199.490	168.093	1402.927	71.758	6.249
4891	1001	1	706.00	6	0.7	1000	6	143.469	32.090	143.067	14.635	2.748	1405.497	190.613	1649.544	79.946	4.871
4892	1001	1	707.00	7	0.7	1000	7	140.779	30.982	140.745	13.926	2.274	1607.075	212.355	1890.492	87.461	4.185
4893	1001	1	707.50	7.5	0.7	1000	7.5	139.146	30.501	139.435	13.594	2.086	1705.098	223.015	2009.759	91.079	3.942
4894	1001	1	708.00	8	0.7	1000	8	137.175	29.884	137.613	13.334	1.925	1802.074	233.613	2126.932	94.439	3.726
4895	1001	1	709.00	9	0.7	1000	9	133.067	28.596	133.790	12.685	1.659	1997.891	254.126	2363.853	100.810	3.377
4896	1001	1	710.00	10	0.7	1000	10	128.698	28.131	129.772	12.226	1.453	2189.068	273.897	2596.538	106.530	3.513
4898	1251	1	875.25	0.25	0.7	1250	0.25	200.791	41.604	264.960	16.815	91.749	36.650	12.864	43.481	5.772	35.620
4899	1251	1	875.50	0.5	0.7	1250	0.5	293.929	58.025	363.858	25.123	60.018	89.664	23.359	106.100	10.619	28.199
4900	1251	1	875.75	0.75	0.7	1250	0.75	278.396	55.762	333.552	24.936	38.340	175.708	37.567	206.760	17.219	26.602
4901	1251	1	876.00	1	0.7	1250	1	245.399	50.026	289.032	22.826	26.095	262.293	52.755	307.511	24.024	26.047
4902	1251	1	876.25	1.25	0.7	1250	1.25	217.920	45.393	253.192	21.032	19.113	346.947	66.841	406.622	30.311	25.151
4903	1251	1	877.00	2	0.7	1250	2	174.998	39.504	194.407	18.756	10.480	581.837	101.555	684.426	45.492	20.726
4904	1251	1	877.50	2.5	0.7	1250	2.5	165.961	38.836	179.595	18.475	8.183	726.353	119.341	857.676	53.241	17.546
4905	1251	1	878.00	3	0.7	1250	3	163.202	38.993	173.339	18.327	6.729	863.185	134.610	1022.294	59.979	14.712
4906	1251	1	879.00	4	0.7	1250	4	169.353	39.267	174.532	18.114	4.913	1122.142	163.268	1335.777	71.389	10.382
4907	1251	1	880.00	5	0.7	1250	5	172.883	38.627	178.760	17.600	3.807	1365.892	189.592	1632.455	81.564	7.404
4908	1251	1	881.00	6	0.7	1250	6	173.287	37.509	179.907	16.843	3.061	1600.721	214.301	1918.738	90.891	5.404
4909	1251	1	882.00	7	0.7	1250	7	171.263	36.254	178.590	16.113	2.529	1830.782	238.582	2201.036	99.692	4.739
4910	1251	1	882.50	7.5	0.7	1250	7.5	169.563	35.630	177.087	15.706	2.319	1943.222	250.376	2339.101	103.828	4.470
4911	1251	1	883.00	8	0.7	1250	8	167.646	35.030	175.238	15.382	2.137	2054.544	262.127	2474.417	107.768	4.230
4912	1251	1	884.00	9	0.7	1250	9	163.490	33.898	171.585	14.655	1.839	2274.614	284.976	2748.312	115.180	3.819
4913	1251	1	885.00	10	0.7	1250	10	158.635	32.631	166.747	14.103	1.607	2490.197	307.351	3011.842	122.045	3.527
4915	1501	1	1050.25	0.25	0.7	1500	0.25	219.423	45.552	294.757	18.684	101.510	40.347	14.363	48.822	6.383	39.244
4916	1501	1	1050.50	0.5	0.7	1500	0.5	323.116	64.508	407.784	27.953	66.108	100.753	25.912	121.823	11.905	30.977
4917	1501	1	1050.75	0.75	0.7	1500	0.75	306.079	61.949	374.071	27.645	42.201	196.055	42.162	235.515	19.252	29.213
4918	1501	1	1051.00	1	0.7	1500	1	269.827	55.516	324.179	25.286	28.702	291.800	59.039	349.040	26.837	28.649
4919	1501	1	1051.25	1.25	0.7	1500	1.25	239.798	50.396	284.212	23.269	20.990	384.731	74.720	459.787	33.849	27.697
4920	1501	1	1052.00	2	0.7	1500	2	194.335	44.203	220.801	20.865	11.489	643.865	112.835	772.620	50.577	22.943
4921	1501	1	1052.50	2.5	0.7	1500	2.5	185.817	43.721	205.814	20.627	8.967	804.023	132.480	967.271	59.196	19.494
4922	1501	1	1053.00	3	0.7	1500	3	183.801	43.781	200.306	20.557	7.374	955.738	148.979	1153.355	66.511	16.413
4923	1501	1	1054.00	4	0.7	1500	4	193.157	44.213	204.937	20.233	5.377	1242.063	180.216	1505.662	79.100	11.674
4924	1501	1	1055.00	5	0.7	1500	5	198.914	43.599	211.993	19.695	4.164	1512.177	208.095	1839.925	90.043	8.430
4925	1501	1	1056.00	6	0.7	1500	6	200.661	42.513	214.818	18.993	3.346	1771.919	235.130	2160.901	100.473	6.167
4926	1501	1	1057.00	7	0.7	1500	7	199.632	41.110	214.685	18.151	2.763	2024.804	261.095	2475.513	110.118	5.219
4927	1501	1	1057.50	7.5	0.7	1500	7.5	198.272	40.416	213.637	17.703	2.532	2148.153	273.911	2629.248	114.758	4.919
4928	1501	1	1058.00	8	0.7	1500	8	196.463	39.663	212.160	17.327	2.332	2273.440	286.922	2787.032	119.275	4.661
4929	1501	1	1059.00	9	0.7	1500	9	192.272	38.328	208.276	16.579	2.006	2516.939	311.569	3092.003	127.687	4.220

STP-PT-074: Local Stress in Nozzles, Shells and Formed Heads from External Heads

Model								Secondary (inside) Stress Factors									
	OD	T	od	t	d/D	D/T	t/T	Branch					Header				
								Axial	In-Plane	Out-of-Plane	Torsional	Pressure	Axial	In-Plane	Out-of-Plane	Torsional	Pressure
4930	1501	1	1060.00	10	0.7	1500	10	187.331	37.158	203.449	15.895	1.751	2755.098	335.793	3391.120	135.587	3.855
4933	1751	1	1225.50	0.5	0.7	1750	0.5	348.207	70.358	446.312	30.560	71.541	110.860	28.449	136.410	13.119	33.552
4934	1751	1	1225.75	0.75	0.7	1750	0.75	330.080	67.464	410.194	30.120	45.669	214.538	46.429	262.228	21.154	31.632
4935	1751	1	1226.00	1	0.7	1750	1	291.003	60.479	355.671	27.505	31.070	318.191	64.744	387.249	29.418	31.039
4936	1751	1	1226.25	1.25	0.7	1750	1.25	258.969	54.946	312.450	25.301	22.718	419.079	81.807	509.739	37.056	30.039
4937	1751	1	1227.00	2	0.7	1750	2	211.570	48.566	244.804	22.789	12.419	700.038	123.229	854.125	55.207	24.977
4938	1751	1	1227.50	2.5	0.7	1750	2.5	203.508	48.220	229.962	22.630	9.691	873.246	144.202	1067.983	64.535	21.278
4939	1751	1	1228.00	3	0.7	1750	3	202.507	48.503	225.456	22.633	7.970	1038.343	162.290	1273.591	72.506	17.973
4940	1751	1	1229.00	4	0.7	1750	4	214.975	48.718	233.515	22.404	5.807	1349.676	195.458	1661.978	85.945	12.855
4941	1751	1	1230.00	5	0.7	1750	5	222.942	48.270	243.278	21.768	4.496	1642.990	225.333	2028.972	97.900	9.364
4942	1751	1	1231.00	6	0.7	1750	6	226.080	47.073	248.125	20.908	3.610	1925.916	253.251	2384.583	108.802	6.924
4943	1751	1	1232.00	7	0.7	1750	7	225.940	45.587	249.196	20.069	2.979	2200.580	281.192	2731.032	119.418	5.637
4944	1751	1	1232.50	7.5	0.7	1750	7.5	224.844	44.860	248.726	19.611	2.730	2334.940	294.558	2903.146	124.402	5.312
4945	1751	1	1233.00	8	0.7	1750	8	223.526	44.118	247.652	19.171	2.514	2469.007	307.897	3071.526	129.251	5.030
4946	1751	1	1234.00	9	0.7	1750	9	219.614	42.676	244.219	18.320	2.160	2731.884	334.524	3406.768	138.657	4.553
4950	2001	1	1400.50	0.5	0.7	2000	0.5	369.624	75.601	480.561	32.810	76.781	120.084	30.994	150.149	14.234	35.907
4951	2001	1	1400.75	0.75	0.7	2000	0.75	350.702	72.473	442.160	32.344	49.006	231.239	50.360	286.913	22.904	33.842
4952	2001	1	1401.00	1	0.7	2000	1	309.379	65.015	383.989	29.501	33.301	342.141	70.062	422.897	31.785	33.225
4953	2001	1	1401.25	1.25	0.7	2000	1.25	275.517	59.114	337.292	27.166	24.330	449.630	88.393	554.802	40.016	32.187
4954	2001	1	1402.00	2	0.7	2000	2	226.720	52.609	266.365	24.585	13.285	749.893	132.691	927.625	59.487	26.828
4955	2001	1	1402.50	2.5	0.7	2000	2.5	219.605	52.494	252.603	24.513	10.371	935.422	155.191	1161.749	69.496	22.909
4956	2001	1	1403.00	3	0.7	2000	3	219.969	52.928	248.741	24.600	8.530	1111.766	174.284	1382.006	77.940	19.394
4957	2001	1	1404.00	4	0.7	2000	4	234.954	53.296	260.441	24.423	6.214	1444.147	209.330	1802.752	92.161	13.927
4958	2001	1	1405.00	5	0.7	2000	5	245.044	52.608	273.020	23.829	4.808	1759.702	240.411	2203.385	104.759	10.212
4959	2001	1	1406.00	6	0.7	2000	6	249.772	51.398	280.063	22.913	3.859	2061.812	269.923	2588.589	116.365	7.611
4967	2251	1	1575.50	0.5	0.7	2250	0.5	388.674	80.327	511.337	34.904	81.643	128.609	33.314	162.953	15.274	38.115
4968	2251	1	1575.75	0.75	0.7	2250	0.75	369.043	77.065	471.048	34.383	52.078	246.538	54.009	309.827	24.540	35.907
4969	2251	1	1576.00	1	0.7	2250	1	325.753	69.098	409.694	31.354	35.369	363.890	74.931	455.799	33.993	35.273
4970	2251	1	1576.25	1.25	0.7	2250	1.25	290.378	62.953	360.183	28.879	25.836	477.689	94.375	597.081	42.731	34.202
4971	2251	1	1577.00	2	0.7	2250	2	240.358	56.341	286.506	26.264	14.102	795.189	141.379	996.453	63.428	28.562
4972	2251	1	1577.50	2.5	0.7	2250	2.5	233.937	56.381	272.878	26.256	11.006	991.662	165.140	1245.306	74.034	24.442
4973	2251	1	1578.00	3	0.7	2250	3	235.724	57.064	270.636	26.424	9.055	1178.618	185.561	1482.816	82.985	20.731
4984	2501	1	1750.50	0.5	0.7	2500	0.5	405.363	84.825	539.064	36.918	86.184	136.620	35.615	175.262	16.289	40.193
4985	2501	1	1750.75	0.75	0.7	2500	0.75	385.239	81.434	497.385	36.256	54.992	260.797	57.580	331.682	26.113	37.870
4986	2501	1	1751.00	1	0.7	2500	1	340.145	72.943	432.377	33.069	37.323	384.361	79.728	486.671	36.126	37.214
4987	2501	1	1751.25	1.25	0.7	2500	1.25	303.746	66.564	380.919	30.452	27.263	503.858	100.265	636.627	45.342	36.095
4988	2501	1	1752.00	2	0.7	2500	2	252.956	59.954	305.184	27.858	14.877	837.794	149.930	1061.438	67.248	30.195



STP-PT-074: Local Stress in Nozzles, Shells and Formed Heads from External Heads

Model								Secondary (outside) Stress Factors										
	OD	T	od	t	d/D	D/T	t/T	Branch					Header					
								Axial	In-Plane	Out-of-Plane	Torsional	Pressure	Axial	In-Plane	Out-of-Plane	Torsional	Pressure	
1	9	1	0.50	0.1	0.05	8	0.1	1.280	1.255	1.253	0.876	0.462	0.269	0.056	0.053	0.053	0.053	1.091
2	9	1	0.65	0.25	0.05	8	0.25	1.565	1.141	1.133	0.878	0.461	0.508	0.098	0.094	0.084	0.084	0.879
18	17	1	0.90	0.1	0.05	16	0.1	1.405	1.234	1.216	0.884	0.978	0.428	0.116	0.117	0.072	0.072	0.871
19	17	1	1.05	0.25	0.05	16	0.25	1.553	1.193	1.176	0.953	0.489	0.953	0.208	0.213	0.114	0.114	0.821
20	17	1	1.30	0.5	0.05	16	0.5	1.663	1.114	1.101	0.976	0.537	1.674	0.315	0.322	0.148	0.148	0.796
21	17	1	1.55	0.75	0.05	16	0.75	1.636	1.061	1.045	0.938	0.535	2.233	0.424	0.432	0.181	0.181	0.783
35	25	1	1.30	0.1	0.05	24	0.1	1.705	1.317	1.311	0.918	0.667	0.633	0.140	0.141	0.074	0.074	0.893
36	25	1	1.45	0.25	0.05	24	0.25	2.136	1.314	1.311	0.972	0.385	1.365	0.278	0.280	0.136	0.136	0.840
37	25	1	1.70	0.5	0.05	24	0.5	2.477	1.254	1.260	0.975	0.399	2.408	0.443	0.454	0.186	0.186	0.826
38	25	1	1.95	0.75	0.05	24	0.75	2.574	1.183	1.193	0.950	0.370	3.318	0.588	0.611	0.224	0.224	0.813
39	25	1	2.20	1	0.05	24	1	2.545	1.126	1.138	0.917	0.338	4.063	0.724	0.768	0.257	0.257	0.801
52	33	1	1.70	0.1	0.05	32	0.1	2.117	1.449	1.459	0.916	0.652	0.837	0.172	0.174	0.076	0.076	1.023
53	33	1	1.85	0.25	0.05	32	0.25	2.947	1.513	1.529	0.959	0.463	1.743	0.357	0.358	0.149	0.149	0.909
54	33	1	2.10	0.5	0.05	32	0.5	3.572	1.469	1.494	0.955	0.428	3.038	0.591	0.596	0.218	0.218	0.862
55	33	1	2.35	0.75	0.05	32	0.75	3.751	1.380	1.409	0.918	0.416	4.218	0.784	0.818	0.263	0.263	0.832
56	33	1	2.60	1	0.05	32	1	3.736	1.297	1.328	0.891	0.385	5.291	0.957	1.022	0.300	0.300	0.818
57	33	1	2.85	1.25	0.05	32	1.25	3.732	1.227	1.259	0.892	0.304	6.955	1.164	1.290	0.332	0.332	0.817
69	41	1	2.10	0.1	0.05	40	0.1	2.575	1.604	1.630	0.912	0.716	1.040	0.215	0.215	0.078	0.078	1.142
70	41	1	2.25	0.25	0.05	40	0.25	3.864	1.755	1.797	0.950	0.566	2.081	0.444	0.442	0.160	0.160	0.984
71	41	1	2.50	0.5	0.05	40	0.5	4.796	1.727	1.780	0.943	0.498	3.696	0.750	0.757	0.244	0.244	0.899
72	41	1	2.75	0.75	0.05	40	0.75	5.024	1.614	1.669	0.909	0.489	5.123	1.001	1.051	0.300	0.300	0.865
73	41	1	3.00	1	0.05	40	1	4.975	1.495	1.550	0.893	0.467	6.747	1.219	1.305	0.342	0.342	0.839
74	41	1	3.25	1.25	0.05	40	1.25	5.002	1.394	1.450	0.895	0.380	8.956	1.466	1.637	0.377	0.377	0.829
86	51	1	2.60	0.1	0.05	50	0.1	3.174	1.810	1.859	0.909	0.864	1.286	0.280	0.281	0.080	0.080	1.275
87	51	1	2.75	0.25	0.05	50	0.25	5.090	2.099	2.181	0.943	0.675	2.496	0.562	0.557	0.170	0.170	1.085
88	51	1	3.00	0.5	0.05	50	0.5	6.414	2.092	2.193	0.938	0.569	4.373	0.954	0.960	0.270	0.270	0.946
89	51	1	3.25	0.75	0.05	50	0.75	6.679	1.939	2.039	0.912	0.562	6.422	1.290	1.362	0.340	0.340	0.900
90	51	1	3.50	1	0.05	50	1	6.547	1.774	1.871	0.896	0.550	8.618	1.579	1.708	0.390	0.390	0.867
91	51	1	3.75	1.25	0.05	50	1.25	6.573	1.626	1.721	0.896	0.467	11.484	1.890	2.122	0.432	0.432	0.840
92	51	1	4.50	2	0.05	50	2	5.867	1.336	1.426	0.865	0.269	19.512	2.764	3.297	0.537	0.537	0.838
103	61	1	3.10	0.1	0.05	60	0.1	3.784	2.027	2.105	0.906	1.039	1.521	0.353	0.344	0.081	0.081	1.386
104	61	1	3.25	0.25	0.05	60	0.25	6.368	2.475	2.612	0.938	0.757	2.890	0.687	0.685	0.177	0.177	1.181
105	61	1	3.50	0.5	0.05	60	0.5	8.077	2.488	2.653	0.937	0.617	5.034	1.160	1.177	0.291	0.291	0.993
106	61	1	3.75	0.75	0.05	60	0.75	8.360	2.292	2.455	0.914	0.612	7.694	1.592	1.693	0.372	0.372	0.931
107	61	1	4.00	1	0.05	60	1	8.122	2.072	2.225	0.897	0.610	10.483	1.959	2.142	0.433	0.433	0.896
108	61	1	4.25	1.25	0.05	60	1.25	8.107	1.877	2.025	0.897	0.536	14.018	2.343	2.657	0.482	0.482	0.857
109	61	1	5.00	2	0.05	60	2	7.290	1.481	1.613	0.877	0.331	23.908	3.371	4.042	0.597	0.597	0.845
110	61	1	5.50	2.5	0.05	60	2.5	6.608	1.344	1.470	0.844	0.247	29.762	4.006	4.964	0.666	0.666	0.847

STP-PT-074: Local Stress in Nozzles, Shells and Formed Heads from External Heads

Model								Secondary (outside) Stress Factors									
	OD	T	od	t	d/D	D/T	t/T	Branch					Header				
								Axial	In-Plane	Out-of-Plane	Torsional	Pressure	Axial	In-Plane	Out-of-Plane	Torsional	Pressure
120	71	1	3.60	0.1	0.05	70	0.1	4.397	2.256	2.359	0.905	1.286	1.746	0.430	0.414	0.082	1.496
121	71	1	3.75	0.25	0.05	70	0.25	7.680	2.881	3.078	0.933	0.841	3.301	0.820	0.808	0.183	1.270
122	71	1	4.00	0.5	0.05	70	0.5	9.761	2.914	3.160	0.935	0.661	5.655	1.371	1.396	0.309	1.053
123	71	1	4.25	0.75	0.05	70	0.75	10.043	2.660	2.901	0.915	0.644	8.962	1.902	2.044	0.399	0.968
124	71	1	4.50	1	0.05	70	1	9.687	2.386	2.606	0.899	0.652	12.351	2.359	2.608	0.471	0.923
125	71	1	4.75	1.25	0.05	70	1.25	9.606	2.145	2.356	0.898	0.588	16.561	2.832	3.240	0.528	0.883
126	71	1	5.50	2	0.05	70	2	8.617	1.636	1.818	0.869	0.385	28.279	4.026	4.856	0.656	0.851
127	71	1	6.00	2.5	0.05	70	2.5	7.860	1.453	1.623	0.847	0.291	35.266	4.730	5.888	0.727	0.852
128	71	1	6.50	3	0.05	70	3	7.153	1.340	1.504	0.872	0.232	41.691	5.424	6.964	0.796	0.856
137	81	1	4.10	0.1	0.05	80	0.1	5.009	2.489	2.621	0.903	1.534	1.969	0.510	0.497	0.083	1.601
138	81	1	4.25	0.25	0.05	80	0.25	9.011	3.304	3.568	0.930	0.986	3.594	0.950	0.935	0.188	1.355
139	81	1	4.50	0.5	0.05	80	0.5	11.461	3.358	3.694	0.934	0.701	6.328	1.585	1.621	0.323	1.125
140	81	1	4.75	0.75	0.05	80	0.75	11.714	3.040	3.369	0.916	0.663	10.181	2.216	2.396	0.422	1.009
141	81	1	5.00	1	0.05	80	1	11.227	2.706	3.009	0.900	0.680	14.190	2.771	3.095	0.502	0.947
142	81	1	5.25	1.25	0.05	80	1.25	11.063	2.417	2.704	0.899	0.627	19.048	3.336	3.847	0.569	0.906
143	81	1	6.00	2	0.05	80	2	9.863	1.800	2.043	0.861	0.430	32.620	4.721	5.736	0.713	0.856
144	81	1	6.50	2.5	0.05	80	2.5	9.025	1.570	1.793	0.865	0.330	40.699	5.505	6.889	0.787	0.858
145	81	1	7.00	3	0.05	80	3	8.253	1.425	1.634	0.842	0.262	48.182	6.257	8.070	0.857	0.860
154	91	1	4.60	0.1	0.05	90	0.1	5.620	2.725	2.887	0.902	1.770	2.167	0.592	0.566	0.083	1.687
155	91	1	4.75	0.25	0.05	90	0.25	10.364	3.744	4.085	0.927	1.165	3.942	1.086	1.057	0.192	1.434
156	91	1	5.00	0.5	0.05	90	0.5	13.165	3.817	4.256	0.932	0.748	6.999	1.797	1.861	0.336	1.194
157	91	1	5.25	0.75	0.05	90	0.75	13.372	3.430	3.859	0.916	0.686	11.418	2.536	2.771	0.444	1.047
158	91	1	5.50	1	0.05	90	1	12.746	3.029	3.427	0.902	0.699	16.000	3.188	3.598	0.531	0.981
159	91	1	5.75	1.25	0.05	90	1.25	12.481	2.693	3.066	0.901	0.657	21.500	3.848	4.477	0.605	0.929
160	91	1	6.50	2	0.05	90	2	11.032	1.970	2.280	0.859	0.469	36.821	5.438	6.652	0.765	0.862
161	91	1	7.00	2.5	0.05	90	2.5	10.104	1.692	1.975	0.875	0.365	46.101	6.313	7.959	0.847	0.862
162	91	1	7.50	3	0.05	90	3	9.270	1.515	1.776	0.871	0.291	54.618	7.139	9.251	0.918	0.864
163	91	1	8.50	4	0.05	90	4	7.889	1.317	1.556	0.887	0.209	70.044	8.711	11.988	1.058	0.871
171	101	1	5.10	0.1	0.05	100	0.1	6.232	2.969	3.162	0.901	1.993	2.360	0.675	0.648	0.084	1.770
172	101	1	5.25	0.25	0.05	100	0.25	11.735	4.202	4.622	0.924	1.342	4.257	1.223	1.196	0.195	1.510
173	101	1	5.50	0.5	0.05	100	0.5	14.874	4.286	4.837	0.930	0.822	7.671	2.007	2.089	0.347	1.259
174	101	1	5.75	0.75	0.05	100	0.75	15.015	3.825	4.374	0.916	0.720	12.599	2.854	3.147	0.461	1.106
175	101	1	6.00	1	0.05	100	1	14.244	3.358	3.860	0.903	0.711	17.779	3.616	4.115	0.556	1.018
176	101	1	6.25	1.25	0.05	100	1.25	13.862	2.970	3.442	0.902	0.678	23.924	4.372	5.135	0.638	0.950
177	101	1	7.00	2	0.05	100	2	12.148	2.144	2.531	0.866	0.502	41.036	6.181	7.628	0.815	0.866
178	101	1	7.50	2.5	0.05	100	2.5	11.117	1.822	2.169	0.859	0.396	51.408	7.161	9.086	0.903	0.866
179	101	1	8.00	3	0.05	100	3	10.210	1.610	1.929	0.872	0.317	60.989	8.054	10.505	0.979	0.869
180	101	1	9.00	4	0.05	100	4	8.717	1.370	1.653	0.857	0.224	78.320	9.732	13.445	1.120	0.875

STP-PT-074: Local Stress in Nozzles, Shells and Formed Heads from External Heads

Model								Secondary (outside) Stress Factors									
	OD	T	od	t	d/D	D/T	t/T	Branch					Header				
								Axial	In-Plane	Out-of-Plane	Torsional	Pressure	Axial	In-Plane	Out-of-Plane	Torsional	Pressure
188	251	1	12.60	0.1	0.05	250	0.1	15.438	6.822	7.818	0.891	4.484	4.763	1.908	1.922	0.087	2.773
189	251	1	12.75	0.25	0.05	250	0.25	33.250	11.673	14.227	0.898	3.471	8.899	3.177	3.228	0.225	2.352
190	251	1	13.00	0.5	0.05	250	0.5	40.843	11.720	14.930	0.902	1.979	17.035	4.976	5.631	0.427	1.933
191	251	1	13.25	0.75	0.05	250	0.75	38.798	9.822	13.000	0.909	1.429	29.231	7.470	9.174	0.595	1.740
192	251	1	13.50	1	0.05	250	1	35.048	8.145	11.095	0.915	1.213	42.410	9.834	12.607	0.743	1.592
193	251	1	13.75	1.25	0.05	250	1.25	32.284	6.939	9.663	0.920	1.048	57.006	12.134	16.056	0.885	1.413
194	251	1	14.50	2	0.05	250	2	25.610	4.671	6.784	0.932	0.734	98.446	17.821	24.816	1.288	1.081
195	251	1	15.00	2.5	0.05	250	2.5	22.701	3.814	5.627	0.931	0.627	124.334	20.899	29.811	1.506	0.993
196	251	1	15.50	3	0.05	250	3	20.563	3.254	4.807	0.922	0.546	148.826	23.533	34.301	1.677	0.921
197	251	1	16.50	4	0.05	250	4	17.644	2.590	3.749	0.895	0.410	194.589	27.828	42.310	1.943	0.921
198	251	1	17.50	5	0.05	250	5	15.752	2.200	3.118	0.869	0.321	236.961	31.303	49.595	2.155	0.928
199	251	1	18.50	6	0.05	250	6	14.341	1.943	2.706	0.856	0.256	276.914	34.297	56.606	2.337	0.935
200	251	1	19.50	7	0.05	250	7	13.221	1.756	2.424	0.834	0.208	314.239	36.870	63.537	2.486	0.942
201	251	1	20.00	7.5	0.05	250	7.5	12.581	1.686	2.285	0.868	0.189	332.401	38.117	66.976	2.558	0.946
202	251	1	20.50	8	0.05	250	8	12.310	1.630	2.223	0.880	0.171	349.250	39.372	70.421	2.639	0.949
203	251	1	21.50	9	0.05	250	9	11.601	1.564	2.076	0.852	0.144	382.871	41.934	77.454	2.780	0.953
204	251	1	22.50	10	0.05	250	10	11.110	1.529	1.989	0.853	0.126	414.673	44.527	84.852	2.938	0.958
205	501	1	25.10	0.1	0.05	500	0.1	30.673	12.888	16.670	0.883	7.202	8.264	3.659	3.910	0.097	3.803
206	501	1	25.25	0.25	0.05	500	0.25	69.594	23.708	32.933	0.889	5.879	15.869	5.900	6.533	0.259	3.161
207	501	1	25.50	0.5	0.05	500	0.5	83.756	23.225	33.849	0.922	3.302	30.571	8.946	11.405	0.468	2.531
208	501	1	25.75	0.75	0.05	500	0.75	76.137	18.651	28.455	0.930	2.193	54.203	13.706	19.386	0.668	2.306
209	501	1	26.00	1	0.05	500	1	66.418	14.977	23.837	0.921	1.777	78.570	18.324	27.063	0.863	2.149
210	501	1	26.25	1.25	0.05	500	1.25	59.027	12.453	20.480	0.919	1.545	104.679	22.728	34.839	1.082	1.961
211	501	1	27.00	2	0.05	500	2	43.863	8.379	14.062	0.931	1.107	179.346	34.259	55.785	1.675	1.480
212	501	1	27.50	2.5	0.05	500	2.5	38.098	7.091	11.585	0.940	0.891	226.760	40.910	68.293	2.021	1.294
213	501	1	28.00	3	0.05	500	3	34.153	6.288	9.869	0.945	0.720	272.704	46.817	79.924	2.334	1.165
214	501	1	29.00	4	0.05	500	4	29.039	5.357	7.701	0.946	0.552	360.866	57.167	101.196	2.861	1.020
215	501	1	30.00	5	0.05	500	5	25.781	4.813	6.416	0.941	0.450	445.792	66.218	120.631	3.298	0.979
216	501	1	31.00	6	0.05	500	6	23.471	4.468	5.573	0.929	0.369	525.958	74.014	138.124	3.650	0.986
217	501	1	32.00	7	0.05	500	7	21.761	4.178	4.973	0.914	0.304	603.046	80.740	154.120	3.951	0.993
218	501	1	32.50	7.5	0.05	500	7.5	21.008	4.065	4.732	0.904	0.277	640.521	83.822	161.886	4.084	0.996
219	501	1	33.00	8	0.05	500	8	20.300	3.939	4.511	0.894	0.253	677.309	86.587	169.417	4.215	0.999
220	501	1	34.00	9	0.05	500	9	19.289	3.744	4.184	0.879	0.213	748.771	91.974	183.905	4.455	1.005
221	501	1	35.00	10	0.05	500	10	18.299	3.551	3.894	0.861	0.185	818.426	96.576	197.836	4.675	1.009
223	751	1	37.75	0.25	0.05	750	0.25	105.281	34.358	53.181	0.922	7.680	21.346	8.118	9.478	0.287	3.699
224	751	1	38.00	0.5	0.05	750	0.5	124.954	33.037	53.435	0.999	4.284	42.923	12.199	17.140	0.506	2.929
225	751	1	38.25	0.75	0.05	750	0.75	111.301	26.017	44.229	1.002	2.739	76.246	18.647	29.251	0.721	2.684
226	751	1	38.50	1	0.05	750	1	95.231	20.727	36.631	0.987	2.158	110.859	25.003	41.223	0.968	2.520

STP-PT-074: Local Stress in Nozzles, Shells and Formed Heads from External Heads

Model								Secondary (outside) Stress Factors									
	OD	T	od	t	d/D	D/T	t/T	Branch					Header				
								Axial	In-Plane	Out-of-Plane	Torsional	Pressure	Axial	In-Plane	Out-of-Plane	Torsional	Pressure
227	751	1	38.75	1.25	0.05	750	1.25	83.238	17.192	31.203	0.972	1.872	146.938	31.029	53.226	1.230	2.329
228	751	1	39.50	2	0.05	750	2	60.262	11.918	21.145	0.938	1.391	250.195	47.325	86.310	1.963	1.804
229	751	1	40.00	2.5	0.05	750	2.5	52.156	10.410	17.385	0.940	1.147	316.322	57.312	106.767	2.398	1.541
230	751	1	40.50	3	0.05	750	3	46.954	9.538	14.834	0.947	0.945	380.934	66.554	126.137	2.806	1.392
231	751	1	41.50	4	0.05	750	4	40.509	8.729	11.694	0.960	0.654	506.532	83.279	162.104	3.525	1.185
232	751	1	42.50	5	0.05	750	5	36.307	8.235	9.916	0.967	0.518	627.694	97.958	195.330	4.141	1.071
233	751	1	43.50	6	0.05	750	6	33.260	7.854	8.782	0.966	0.440	744.587	110.807	226.145	4.659	1.025
234	751	1	44.50	7	0.05	750	7	30.820	7.496	7.990	0.957	0.376	860.316	122.588	255.792	5.131	1.032
235	751	1	45.00	7.5	0.05	750	7.5	29.833	7.303	7.655	0.954	0.349	915.662	127.988	269.075	5.335	1.035
236	751	1	45.50	8	0.05	750	8	28.967	7.136	7.364	0.949	0.323	970.269	132.788	281.911	5.530	1.038
237	751	1	46.50	9	0.05	750	9	27.339	6.814	6.887	0.937	0.277	1077.540	141.863	307.661	5.893	1.043
238	751	1	47.50	10	0.05	750	10	26.097	6.475	6.499	0.924	0.238	1181.833	149.895	331.990	6.221	1.047
240	1001	1	50.25	0.25	0.05	1000	0.25	140.141	43.522	73.782	0.968	9.162	26.478	9.967	12.699	0.302	4.116
241	1001	1	50.50	0.5	0.05	1000	0.5	164.767	41.414	73.285	1.093	5.078	54.350	14.889	22.755	0.524	3.237
242	1001	1	50.75	0.75	0.05	1000	0.75	144.778	32.304	59.934	1.087	3.175	96.937	22.720	38.977	0.781	2.975
243	1001	1	51.00	1	0.05	1000	1	122.478	25.734	49.244	1.054	2.457	140.914	30.456	55.055	1.060	2.809
244	1001	1	51.25	1.25	0.05	1000	1.25	105.904	21.384	41.694	1.030	2.125	186.056	37.922	71.138	1.358	2.615
245	1001	1	52.00	2	0.05	1000	2	75.804	15.202	28.077	0.982	1.614	315.133	58.903	116.030	2.192	2.059
246	1001	1	52.50	2.5	0.05	1000	2.5	65.673	13.648	23.004	0.973	1.353	398.385	71.873	144.103	2.703	1.760
247	1001	1	53.00	3	0.05	1000	3	59.542	13.002	19.674	0.961	1.132	480.168	84.011	171.106	3.180	1.582
248	1001	1	54.00	4	0.05	1000	4	52.395	12.579	15.762	0.962	0.798	640.065	105.989	222.284	4.055	1.326
249	1001	1	55.00	5	0.05	1000	5	47.783	12.308	13.666	0.971	0.580	795.585	125.660	270.246	4.822	1.199
250	1001	1	56.00	6	0.05	1000	6	44.168	11.979	12.371	0.980	0.483	946.886	143.095	315.317	5.496	1.097
251	1001	1	57.00	7	0.05	1000	7	41.158	11.590	11.462	0.983	0.422	1094.114	158.968	357.801	6.089	1.070
252	1001	1	57.50	7.5	0.05	1000	7.5	39.817	11.350	11.087	0.981	0.395	1166.352	166.281	378.206	6.361	1.073
253	1001	1	58.00	8	0.05	1000	8	38.621	11.031	10.753	0.979	0.370	1237.995	173.333	398.210	6.616	1.075
254	1001	1	59.00	9	0.05	1000	9	36.507	10.690	10.186	0.973	0.324	1382.420	188.368	438.040	7.115	1.082
255	1001	1	60.00	10	0.05	1000	10	34.728	10.137	9.640	0.961	0.285	1520.134	201.243	472.005	7.557	1.087
257	1251	1	62.75	0.25	0.05	1250	0.25	174.491	51.668	94.818	1.021	10.433	31.389	11.581	15.729	0.321	4.460
258	1251	1	63.00	0.5	0.05	1250	0.5	203.588	48.890	93.036	1.192	5.747	64.950	17.273	28.118	0.551	3.494
259	1251	1	63.25	0.75	0.05	1250	0.75	176.842	38.005	75.472	1.175	3.542	116.803	26.237	48.607	0.838	3.220
260	1251	1	63.50	1	0.05	1250	1	148.573	30.439	61.740	1.118	2.707	169.210	35.328	68.600	1.144	3.046
261	1251	1	63.75	1.25	0.05	1250	1.25	127.636	25.447	52.080	1.086	2.336	222.610	44.080	88.580	1.466	2.848
262	1251	1	64.50	2	0.05	1250	2	90.497	18.350	34.769	1.019	1.800	376.310	69.404	145.089	2.388	2.266
263	1251	1	65.00	2.5	0.05	1250	2.5	78.785	17.062	28.511	1.013	1.528	475.570	84.878	180.666	2.966	1.945
264	1251	1	65.50	3	0.05	1250	3	72.007	16.738	24.476	1.006	1.293	573.340	99.289	215.280	3.510	1.740
265	1251	1	66.50	4	0.05	1250	4	64.609	16.702	19.951	0.988	0.928	765.487	126.029	281.924	4.509	1.461
266	1251	1	67.50	5	0.05	1250	5	59.930	16.710	17.677	0.974	0.677	953.231	149.944	344.564	5.409	1.312

STP-PT-074: Local Stress in Nozzles, Shells and Formed Heads from External Heads

Model								Secondary (outside) Stress Factors									
	OD	T	od	t	d/D	D/T	t/T	Branch					Header				
								Axial	In-Plane	Out-of-Plane	Torsional	Pressure	Axial	In-Plane	Out-of-Plane	Torsional	Pressure
267	1251	1	68.50	6	0.05	1250	6	56.050	16.448	16.370	0.983	0.520	1137.034	171.709	404.775	6.212	1.202
268	1251	1	69.50	7	0.05	1250	7	52.537	15.986	15.400	0.993	0.451	1316.955	193.055	460.543	6.919	1.112
269	1251	1	70.00	7.5	0.05	1250	7.5	50.960	15.783	15.003	0.996	0.426	1405.314	203.019	487.426	7.264	1.115
270	1251	1	70.50	8	0.05	1250	8	49.444	15.511	14.584	0.997	0.402	1492.845	212.609	512.386	7.586	1.120
271	1251	1	71.50	9	0.05	1250	9	46.752	14.958	13.981	0.996	0.358	1665.704	231.247	565.509	8.173	1.126
272	1251	1	72.50	10	0.05	1250	10	44.532	14.361	13.453	0.991	0.318	1834.931	247.961	616.190	8.724	1.132
274	1501	1	75.25	0.25	0.05	1500	0.25	208.496	59.040	116.056	1.081	11.548	35.681	13.043	18.302	0.340	4.757
275	1501	1	75.50	0.5	0.05	1500	0.5	241.470	55.710	113.051	1.295	6.329	75.171	19.417	33.508	0.576	3.714
276	1501	1	75.75	0.75	0.05	1500	0.75	207.945	43.429	90.700	1.268	3.859	135.388	29.426	57.748	0.883	3.426
277	1501	1	76.00	1	0.05	1500	1	173.796	34.879	74.097	1.188	2.923	196.168	39.676	81.831	1.221	3.249
278	1501	1	76.25	1.25	0.05	1500	1.25	148.517	29.180	62.368	1.137	2.519	257.521	50.290	105.801	1.570	3.046
279	1501	1	77.00	2	0.05	1500	2	104.891	21.449	41.420	1.057	1.961	434.482	79.047	173.515	2.578	2.444
280	1501	1	77.50	2.5	0.05	1500	2.5	91.702	20.476	33.968	1.050	1.681	549.149	96.558	216.404	3.207	2.103
281	1501	1	78.00	3	0.05	1500	3	84.377	20.453	29.215	1.046	1.435	662.220	113.065	258.217	3.807	1.882
282	1501	1	79.00	4	0.05	1500	4	77.081	20.965	24.166	1.030	1.046	885.025	143.929	339.340	4.913	1.582
283	1501	1	80.00	5	0.05	1500	5	72.634	21.198	21.865	1.015	0.770	1104.131	172.406	417.039	5.936	1.426
284	1501	1	81.00	6	0.05	1500	6	68.624	21.041	20.568	0.993	0.579	1319.100	200.233	490.690	6.852	1.307
285	1501	1	82.00	7	0.05	1500	7	64.828	20.650	19.663	0.994	0.475	1530.611	226.201	560.873	7.678	1.205
286	1501	1	82.50	7.5	0.05	1500	7.5	63.027	20.308	19.324	1.000	0.448	1634.541	237.963	595.762	8.087	1.164
287	1501	1	83.00	8	0.05	1500	8	61.315	20.015	18.955	1.003	0.426	1737.806	250.033	628.830	8.452	1.168
288	1501	1	84.00	9	0.05	1500	9	58.077	19.424	18.269	1.009	0.384	1941.484	272.600	693.769	9.159	1.174
289	1501	1	85.00	10	0.05	1500	10	55.272	18.680	17.653	1.009	0.346	2142.144	293.352	757.611	9.797	1.181
291	1751	1	87.75	0.25	0.05	1750	0.25	242.132	65.583	136.993	1.146	12.532	40.295	14.303	21.258	0.351	5.010
292	1751	1	88.00	0.5	0.05	1750	0.5	278.387	61.853	132.131	1.400	6.833	85.317	21.188	38.704	0.608	3.899
293	1751	1	88.25	0.75	0.05	1750	0.75	238.433	48.588	106.263	1.361	4.131	153.246	32.221	66.950	0.924	3.598
294	1751	1	88.50	1	0.05	1750	1	198.401	38.976	86.301	1.263	3.111	221.657	44.155	94.552	1.291	3.415
295	1751	1	88.75	1.25	0.05	1750	1.25	168.825	32.561	72.246	1.188	2.679	290.473	55.598	121.939	1.672	3.207
296	1751	1	89.50	2	0.05	1750	2	119.062	24.469	47.935	1.096	2.105	489.182	87.343	200.401	2.726	2.585
297	1751	1	90.00	2.5	0.05	1750	2.5	104.398	23.844	39.366	1.085	1.817	617.852	106.822	250.527	3.387	2.235
298	1751	1	90.50	3	0.05	1750	3	96.585	24.195	33.993	1.083	1.562	745.387	125.376	299.996	4.046	2.009
299	1751	1	91.50	4	0.05	1750	4	89.655	25.259	28.474	1.072	1.153	996.789	159.157	394.680	5.250	1.687
300	1751	1	92.50	5	0.05	1750	5	85.627	25.755	26.225	1.057	0.858	1244.637	192.530	486.763	6.353	1.532
301	1751	1	93.50	6	0.05	1750	6	81.778	25.627	25.034	1.038	0.648	1488.863	223.532	573.355	7.385	1.405
302	1751	1	94.50	7	0.05	1750	7	77.818	25.262	24.328	1.016	0.503	1729.156	252.987	659.779	8.317	1.295
303	1751	1	95.00	7.5	0.05	1750	7.5	75.847	24.993	24.018	1.006	0.468	1847.958	267.246	701.791	8.763	1.246
304	1751	1	95.50	8	0.05	1750	8	73.951	24.649	23.708	1.005	0.444	1966.167	280.643	743.285	9.180	1.222
305	1751	1	96.50	9	0.05	1750	9	70.289	23.998	23.024	1.016	0.404	2207.162	310.523	823.801	10.054	1.227
306	1751	1	97.50	10	0.05	1750	10	66.933	23.190	22.602	1.020	0.367	2437.012	335.413	909.809	10.794	1.231

STP-PT-074: Local Stress in Nozzles, Shells and Formed Heads from External Heads

Model								Secondary (outside) Stress Factors									
	OD	T	od	t	d/D	D/T	t/T	Branch					Header				
								Axial	In-Plane	Out-of-Plane	Torsional	Pressure	Axial	In-Plane	Out-of-Plane	Torsional	Pressure
309	2001	1	100.50	0.5	0.05	2000	0.5	314.943	67.722	151.319	1.500	7.277	94.885	22.956	43.727	0.636	4.075
310	2001	1	100.75	0.75	0.05	2000	0.75	268.270	53.380	121.391	1.448	4.373	170.929	35.175	75.986	0.969	3.761
311	2001	1	101.00	1	0.05	2000	1	222.387	42.804	98.108	1.336	3.279	247.276	48.305	107.180	1.368	3.572
312	2001	1	101.25	1.25	0.05	2000	1.25	188.659	35.905	81.417	1.246	2.824	323.485	60.826	137.288	1.774	3.360
313	2001	1	102.00	2	0.05	2000	2	132.751	27.432	54.318	1.133	2.235	543.522	95.582	227.555	2.909	2.717
314	2001	1	102.50	2.5	0.05	2000	2.5	116.789	27.117	44.700	1.116	1.941	686.282	116.850	284.869	3.628	2.357
315	2001	1	103.00	3	0.05	2000	3	108.937	27.799	38.765	1.119	1.679	827.805	136.960	340.719	4.309	2.127
316	2001	1	104.00	4	0.05	2000	4	102.412	29.539	32.934	1.111	1.252	1108.159	175.283	450.572	5.596	1.812
317	2001	1	105.00	5	0.05	2000	5	98.884	30.300	30.732	1.095	0.940	1384.809	212.509	555.975	6.790	1.644
318	2001	1	106.00	6	0.05	2000	6	95.270	30.352	29.817	1.078	0.713	1658.069	247.463	659.374	7.912	1.509
319	2001	1	107.00	7	0.05	2000	7	91.295	29.865	29.268	1.058	0.551	1927.933	280.317	759.939	8.951	1.393
320	2001	1	107.50	7.5	0.05	2000	7.5	89.272	29.552	28.914	1.048	0.491	2060.900	296.751	804.763	9.433	1.340
321	2001	1	108.00	8	0.05	2000	8	87.206	29.166	28.703	1.036	0.460	2193.105	311.650	855.130	9.906	1.296
322	2001	1	109.00	9	0.05	2000	9	83.161	28.487	27.983	1.015	0.420	2455.517	341.513	945.523	10.802	1.286
323	2001	1	110.00	10	0.05	2000	10	79.361	27.568	27.464	1.024	0.385	2714.184	369.459	1039.886	11.635	1.287
326	2251	1	113.00	0.5	0.05	2250	0.5	350.922	73.340	170.749	1.598	7.678	104.695	24.633	49.037	0.649	4.234
327	2251	1	113.25	0.75	0.05	2250	0.75	297.595	58.367	137.246	1.530	4.590	188.218	38.118	85.466	1.016	3.903
328	2251	1	113.50	1	0.05	2250	1	245.888	46.747	110.173	1.409	3.431	272.039	52.540	119.973	1.443	3.716
329	2251	1	113.75	1.25	0.05	2250	1.25	207.995	39.798	91.827	1.319	2.954	355.538	65.952	154.619	1.876	3.496
330	2251	1	114.50	2	0.05	2250	2	146.130	30.221	62.215	1.171	2.353	596.738	103.583	261.146	3.069	2.836
331	2251	1	115.00	2.5	0.05	2250	2.5	129.027	30.341	49.974	1.146	2.053	753.952	126.214	319.074	3.833	2.478
332	2251	1	115.50	3	0.05	2250	3	121.087	31.466	43.613	1.152	1.784	909.300	147.975	382.414	4.539	2.225
333	2251	1	116.50	4	0.05	2250	4	115.189	33.743	37.493	1.147	1.343	1215.547	190.793	504.600	5.927	1.939
334	2251	1	117.50	5	0.05	2250	5	112.233	34.878	35.281	1.133	1.017	1522.310	231.412	624.763	7.255	1.759
335	2251	1	118.50	6	0.05	2250	6	109.197	35.026	34.732	1.117	0.777	1823.592	271.249	742.385	8.416	1.624
336	2251	1	119.50	7	0.05	2250	7	105.265	34.641	34.419	1.099	0.601	2122.564	308.544	858.307	9.514	1.527
337	2251	1	120.00	7.5	0.05	2250	7.5	103.212	34.298	34.083	1.086	0.532	2268.371	325.754	907.965	10.065	1.481
338	2251	1	120.50	8	0.05	2250	8	101.072	33.929	34.072	1.077	0.479	2414.127	342.262	968.409	10.608	1.439
339	2251	1	121.50	9	0.05	2250	9	96.606	33.117	33.382	1.055	0.433	2706.574	375.110	1072.956	11.527	1.356
340	2251	1	122.50	10	0.05	2250	10	92.550	32.157	32.522	1.034	0.400	2993.096	406.411	1168.550	12.480	1.348
343	2501	1	125.50	0.5	0.05	2500	0.5	386.580	78.673	190.113	1.703	8.034	113.934	26.097	54.085	0.671	4.378
344	2501	1	125.75	0.75	0.05	2500	0.75	326.418	62.223	153.957	1.618	4.783	204.969	40.913	95.316	1.062	4.039
345	2501	1	126.00	1	0.05	2500	1	269.036	50.244	122.019	1.469	3.570	296.183	55.878	132.476	1.512	3.840
346	2501	1	126.25	1.25	0.05	2500	1.25	227.228	42.228	103.729	1.350	3.077	386.360	70.162	174.060	1.946	3.616
347	2501	1	127.00	2	0.05	2500	2	159.661	33.242	67.078	1.205	2.462	648.245	110.480	280.957	3.232	2.946
348	2501	1	127.50	2.5	0.05	2500	2.5	141.213	33.455	55.265	1.181	2.158	818.684	134.974	352.153	4.006	2.587
349	2501	1	128.00	3	0.05	2500	3	133.078	34.932	48.534	1.182	1.883	987.100	158.862	423.906	4.775	2.335
350	2501	1	129.00	4	0.05	2500	4	128.068	37.816	42.172	1.181	1.429	1323.343	205.732	560.033	6.199	2.051



STP-PT-074: Local Stress in Nozzles, Shells and Formed Heads from External Heads

Model								Secondary (outside) Stress Factors									
	OD	T	od	t	d/D	D/T	t/T	Branch					Header				
								Axial	In-Plane	Out-of-Plane	Torsional	Pressure	Axial	In-Plane	Out-of-Plane	Torsional	Pressure
351	2501	1	130.00	5	0.05	2500	5	125.686	39.286	40.160	1.168	1.089	1656.457	251.251	695.559	7.559	1.885
352	2501	1	131.00	6	0.05	2500	6	123.178	39.675	39.836	1.153	0.837	1987.195	291.646	825.967	8.904	1.782
353	2501	1	132.00	7	0.05	2500	7	119.424	39.312	39.509	1.135	0.649	2308.373	332.208	948.768	10.072	1.690
354	2501	1	132.50	7.5	0.05	2500	7.5	117.229	39.049	39.636	1.122	0.575	2469.552	350.800	1017.262	10.660	1.641
355	2501	1	133.00	8	0.05	2500	8	115.054	38.525	39.223	1.113	0.512	2629.501	370.994	1072.265	11.251	1.580
356	2501	1	134.00	9	0.05	2500	9	110.600	37.584	38.887	1.091	0.445	2949.191	407.265	1193.882	12.226	1.498
357	2501	1	135.00	10	0.05	2500	10	106.144	36.543	38.329	1.070	0.413	3265.672	438.717	1315.467	13.294	1.419
358	9	1	0.90	0.1	0.1	8	0.1	1.365	1.251	1.211	0.897	1.156	0.344	0.115	0.116	0.069	0.771
359	9	1	1.05	0.25	0.1	8	0.25	1.455	1.206	1.170	0.962	0.550	0.765	0.207	0.215	0.110	0.741
360	9	1	1.30	0.5	0.1	8	0.5	1.545	1.124	1.096	0.976	0.603	1.272	0.317	0.326	0.153	0.717
361	9	1	1.55	0.75	0.1	8	0.75	1.494	1.075	1.041	0.933	0.616	1.630	0.416	0.437	0.189	0.721
375	17	1	1.70	0.1	0.1	16	0.1	1.913	1.439	1.455	0.938	0.879	0.661	0.171	0.173	0.075	0.998
376	17	1	1.85	0.25	0.1	16	0.25	2.540	1.494	1.522	0.978	0.527	1.409	0.360	0.357	0.147	0.876
377	17	1	2.10	0.5	0.1	16	0.5	3.028	1.441	1.489	0.968	0.450	2.449	0.589	0.614	0.225	0.825
378	17	1	2.35	0.75	0.1	16	0.75	3.159	1.349	1.406	0.929	0.428	3.248	0.766	0.831	0.273	0.793
379	17	1	2.60	1	0.1	16	1	3.132	1.263	1.325	0.896	0.394	3.973	0.924	1.031	0.313	0.796
380	17	1	2.85	1.25	0.1	16	1.25	3.131	1.196	1.257	0.896	0.311	5.174	1.097	1.293	0.348	0.798
392	25	1	2.50	0.1	0.1	24	0.1	2.637	1.725	1.809	0.933	0.941	0.978	0.265	0.263	0.079	1.257
393	25	1	2.65	0.25	0.1	24	0.25	4.023	1.957	2.092	0.969	0.738	1.951	0.538	0.527	0.166	1.051
394	25	1	2.90	0.5	0.1	24	0.5	5.033	1.932	2.100	0.957	0.591	3.362	0.895	0.938	0.274	0.921
395	25	1	3.15	0.75	0.1	24	0.75	5.255	1.787	1.958	0.928	0.571	4.744	1.183	1.315	0.346	0.870
396	25	1	3.40	1	0.1	24	1	5.162	1.633	1.797	0.908	0.553	6.292	1.427	1.636	0.399	0.831
397	25	1	3.65	1.25	0.1	24	1.25	5.201	1.502	1.658	0.909	0.467	8.350	1.677	2.024	0.445	0.831
398	25	1	4.40	2	0.1	24	2	4.647	1.249	1.386	0.863	0.256	13.878	2.371	3.113	0.559	0.843
409	33	1	3.30	0.1	0.1	32	0.1	3.386	2.035	2.198	0.929	1.184	1.272	0.378	0.378	0.081	1.469
410	33	1	3.45	0.25	0.1	32	0.25	5.623	2.493	2.779	0.963	0.891	2.431	0.731	0.726	0.179	1.228
411	33	1	3.70	0.5	0.1	32	0.5	7.165	2.493	2.849	0.959	0.674	4.118	1.202	1.276	0.306	1.018
412	33	1	3.95	0.75	0.1	32	0.75	7.443	2.275	2.621	0.936	0.655	6.355	1.616	1.843	0.402	0.938
413	33	1	4.20	1	0.1	32	1	7.242	2.046	2.367	0.918	0.654	8.671	1.971	2.332	0.473	0.888
414	33	1	4.45	1.25	0.1	32	1.25	7.242	1.849	2.147	0.919	0.581	11.573	2.323	2.875	0.530	0.851
415	33	1	5.20	2	0.1	32	2	6.557	1.443	1.688	0.872	0.362	19.535	3.207	4.301	0.663	0.860
416	33	1	5.70	2.5	0.1	32	2.5	5.979	1.301	1.526	0.870	0.264	24.129	3.720	5.225	0.738	0.867
417	33	1	6.20	3	0.1	32	3	5.411	1.212	1.425	0.933	0.205	28.277	4.210	6.192	0.813	0.877
426	41	1	4.10	0.1	0.1	40	0.1	4.134	2.359	2.608	0.926	1.506	1.544	0.499	0.494	0.083	1.658
427	41	1	4.25	0.25	0.1	40	0.25	7.278	3.069	3.543	0.958	1.079	2.864	0.927	0.933	0.187	1.392
428	41	1	4.50	0.5	0.1	40	0.5	9.340	3.089	3.681	0.958	0.726	4.846	1.505	1.618	0.329	1.134
429	41	1	4.75	0.75	0.1	40	0.75	9.644	2.785	3.360	0.941	0.695	7.948	2.054	2.405	0.443	1.011
430	41	1	5.00	1	0.1	40	1	9.302	2.472	2.996	0.927	0.710	11.032	2.534	3.082	0.532	0.943

STP-PT-074: Local Stress in Nozzles, Shells and Formed Heads from External Heads

Model								Secondary (outside) Stress Factors									
	OD	T	od	t	d/D	D/T	t/T	Branch					Header				
								Axial	In-Plane	Out-of-Plane	Torsional	Pressure	Axial	In-Plane	Out-of-Plane	Torsional	Pressure
431	41	1	5.25	1.25	0.1	40	1.25	9.225	2.211	2.695	0.927	0.655	14.823	3.003	3.818	0.605	0.884
432	41	1	6.00	2	0.1	40	2	8.311	1.654	2.041	0.883	0.445	25.210	4.127	5.652	0.763	0.870
433	41	1	6.50	2.5	0.1	40	2.5	7.619	1.447	1.793	0.869	0.334	31.288	4.727	6.766	0.843	0.880
434	41	1	7.00	3	0.1	40	3	6.987	1.316	1.634	0.858	0.259	36.802	5.278	7.889	0.919	0.888
443	51	1	5.10	0.1	0.1	50	0.1	5.061	2.767	3.134	0.924	1.973	1.845	0.651	0.645	0.084	1.864
444	51	1	5.25	0.25	0.1	50	0.25	9.395	3.819	4.567	0.953	1.488	3.365	1.171	1.197	0.195	1.584
445	51	1	5.50	0.5	0.1	50	0.5	12.073	3.857	4.801	0.956	0.870	5.849	1.874	2.054	0.348	1.300
446	51	1	5.75	0.75	0.1	50	0.75	12.353	3.429	4.355	0.942	0.728	9.884	2.595	3.135	0.480	1.125
447	51	1	6.00	1	0.1	50	1	11.818	3.002	3.843	0.933	0.744	13.956	3.239	4.085	0.590	1.027
448	51	1	6.25	1.25	0.1	50	1.25	11.591	2.659	3.431	0.934	0.710	18.808	3.869	5.082	0.682	0.942
449	51	1	7.00	2	0.1	50	2	10.297	1.926	2.536	0.894	0.521	32.150	5.327	7.508	0.876	0.881
450	51	1	7.50	2.5	0.1	50	2.5	9.456	1.643	2.180	0.856	0.406	40.116	6.076	8.920	0.971	0.888
451	51	1	8.00	3	0.1	50	3	8.697	1.458	1.938	0.836	0.318	47.377	6.721	10.281	1.051	0.900
452	51	1	9.00	4	0.1	50	4	7.486	1.249	1.666	0.892	0.216	60.290	7.865	13.057	1.204	0.915
460	61	1	6.10	0.1	0.1	60	0.1	5.981	3.178	3.676	0.922	2.410	2.119	0.802	0.803	0.085	2.061
461	61	1	6.25	0.25	0.1	60	0.25	11.539	4.587	5.652	0.947	1.882	3.865	1.412	1.470	0.201	1.760
462	61	1	6.50	0.5	0.1	60	0.5	14.803	4.636	5.983	0.951	1.099	6.897	2.230	2.489	0.366	1.449
463	61	1	6.75	0.75	0.1	60	0.75	15.008	4.068	5.394	0.941	0.821	11.763	3.128	3.876	0.508	1.265
464	61	1	7.00	1	0.1	60	1	14.245	3.522	4.728	0.937	0.760	16.785	3.942	5.120	0.635	1.125
465	61	1	7.25	1.25	0.1	60	1.25	13.839	3.097	4.205	0.939	0.741	22.676	4.734	6.408	0.744	1.012
466	61	1	8.00	2	0.1	60	2	12.102	2.198	3.069	0.915	0.577	38.946	6.562	9.516	0.978	0.888
467	61	1	8.50	2.5	0.1	60	2.5	11.080	1.845	2.606	0.885	0.461	48.636	7.465	11.259	1.086	0.896
468	61	1	9.00	3	0.1	60	3	10.207	1.610	2.285	0.864	0.371	57.680	8.240	12.913	1.179	0.905
469	61	1	10.00	4	0.1	60	4	8.793	1.335	1.894	0.842	0.256	73.818	9.531	16.140	1.336	0.925
470	61	1	11.00	5	0.1	60	5	7.780	1.192	1.692	0.853	0.188	88.034	10.645	19.478	1.487	0.943
477	71	1	7.10	0.1	0.1	70	0.1	6.893	3.588	4.228	0.920	2.817	2.364	0.950	0.966	0.086	2.237
478	71	1	7.25	0.25	0.1	70	0.25	13.690	5.355	6.772	0.941	2.257	4.324	1.644	1.730	0.207	1.923
479	71	1	7.50	0.5	0.1	70	0.5	17.530	5.420	7.210	0.947	1.321	7.908	2.574	2.925	0.383	1.586
480	71	1	7.75	0.75	0.1	70	0.75	17.606	4.702	6.466	0.938	0.960	13.598	3.643	4.631	0.529	1.392
481	71	1	8.00	1	0.1	70	1	16.586	4.031	5.644	0.943	0.815	19.491	4.624	6.173	0.668	1.242
482	71	1	8.25	1.25	0.1	70	1.25	15.975	3.520	5.000	0.948	0.760	26.407	5.584	7.772	0.794	1.087
483	71	1	9.00	2	0.1	70	2	13.751	2.464	3.622	0.935	0.618	45.514	7.800	11.631	1.068	0.893
484	71	1	9.50	2.5	0.1	70	2.5	12.548	2.059	3.058	0.910	0.505	56.947	8.887	13.762	1.195	0.902
485	71	1	10.00	3	0.1	70	3	11.548	1.796	2.659	0.888	0.413	67.550	9.782	15.724	1.296	0.911
486	71	1	11.00	4	0.1	70	4	9.951	1.473	2.155	0.864	0.294	86.957	11.267	19.487	1.468	0.932
487	71	1	12.00	5	0.1	70	5	8.811	1.287	1.875	0.876	0.215	104.166	12.505	23.245	1.619	0.946
488	71	1	13.00	6	0.1	70	6	7.976	1.172	1.721	0.877	0.167	119.621	13.831	27.145	1.775	0.962
494	81	1	8.10	0.1	0.1	80	0.1	7.796	3.991	4.784	0.918	3.200	2.593	1.094	1.125	0.087	2.406

STP-PT-074: Local Stress in Nozzles, Shells and Formed Heads from External Heads

Model								Secondary (outside) Stress Factors									
	OD	T	od	t	d/D	D/T	t/T	Branch					Header				
								Axial	In-Plane	Out-of-Plane	Torsional	Pressure	Axial	In-Plane	Out-of-Plane	Torsional	Pressure
495	81	1	8.25	0.25	0.1	80	0.25	15.849	6.123	7.927	0.936	2.614	4.819	1.872	1.978	0.211	2.075
496	81	1	8.50	0.5	0.1	80	0.5	20.232	6.194	8.462	0.941	1.533	8.901	2.901	3.359	0.397	1.709
497	81	1	8.75	0.75	0.1	80	0.75	20.151	5.322	7.555	0.935	1.097	15.363	4.142	5.380	0.546	1.509
498	81	1	9.00	1	0.1	80	1	18.860	4.525	6.573	0.946	0.900	22.145	5.291	7.244	0.695	1.352
499	81	1	9.25	1.25	0.1	80	1.25	18.021	3.929	5.812	0.954	0.792	29.970	6.401	9.153	0.832	1.164
500	81	1	10.00	2	0.1	80	2	15.287	2.725	4.187	0.949	0.651	51.842	9.016	13.818	1.148	0.921
501	81	1	10.50	2.5	0.1	80	2.5	13.886	2.297	3.523	0.929	0.542	64.975	10.304	16.381	1.294	0.907
502	81	1	11.00	3	0.1	80	3	12.766	2.000	3.050	0.908	0.446	77.206	11.359	18.709	1.408	0.916
503	81	1	12.00	4	0.1	80	4	11.035	1.625	2.444	0.871	0.325	99.669	13.055	23.060	1.597	0.934
504	81	1	13.00	5	0.1	80	5	9.759	1.404	2.088	0.864	0.242	119.738	14.482	27.263	1.754	0.953
505	81	1	14.00	6	0.1	80	6	8.817	1.261	1.878	0.854	0.185	137.982	15.916	31.549	1.907	0.964
506	81	1	15.00	7	0.1	80	7	8.131	1.169	1.745	0.862	0.150	154.678	17.245	36.007	2.063	0.978
507	81	1	15.50	7.5	0.1	80	7.5	7.897	1.156	1.709	0.851	0.141	162.368	17.876	38.277	2.142	0.979
511	91	1	9.10	0.1	0.1	90	0.1	8.699	4.391	5.352	0.916	3.562	2.811	1.234	1.291	0.088	2.570
512	91	1	9.25	0.25	0.1	90	0.25	18.003	6.884	9.113	0.931	2.952	5.239	2.091	2.240	0.216	2.217
513	91	1	9.50	0.5	0.1	90	0.5	22.925	6.958	9.743	0.936	1.735	9.842	3.218	3.795	0.409	1.822
514	91	1	9.75	0.75	0.1	90	0.75	22.654	5.933	8.662	0.935	1.226	17.105	4.622	6.140	0.564	1.614
515	91	1	10.00	1	0.1	90	1	21.069	5.004	7.510	0.947	1.000	24.746	5.936	8.328	0.719	1.453
516	91	1	10.25	1.25	0.1	90	1.25	19.993	4.322	6.630	0.956	0.834	33.469	7.202	10.559	0.867	1.259
517	91	1	11.00	2	0.1	90	2	16.731	3.011	4.759	0.960	0.676	57.971	10.211	16.064	1.219	0.964
518	91	1	11.50	2.5	0.1	90	2.5	15.133	2.533	3.995	0.945	0.573	72.742	11.703	19.088	1.384	0.909
519	91	1	12.00	3	0.1	90	3	13.878	2.203	3.450	0.926	0.478	86.555	12.926	21.815	1.514	0.920
520	91	1	13.00	4	0.1	90	4	11.997	1.781	2.743	0.890	0.350	111.856	14.837	26.784	1.715	0.939
521	91	1	14.00	5	0.1	90	5	10.634	1.530	2.323	0.857	0.266	134.927	16.513	31.536	1.890	0.955
522	91	1	15.00	6	0.1	90	6	9.605	1.363	2.051	0.841	0.205	155.902	18.074	36.239	2.044	0.971
523	91	1	16.00	7	0.1	90	7	8.878	1.261	1.891	0.853	0.163	175.114	19.499	41.041	2.196	0.979
524	91	1	16.50	7.5	0.1	90	7.5	8.573	1.242	1.832	0.851	0.145	184.195	20.175	43.513	2.274	0.990
525	91	1	17.00	8	0.1	90	8	8.225	1.221	1.774	0.882	0.136	192.997	20.826	46.038	2.358	0.991
528	101	1	10.10	0.1	0.1	100	0.1	9.587	4.778	5.919	0.914	3.907	3.005	1.369	1.444	0.089	2.716
529	101	1	10.25	0.25	0.1	100	0.25	20.163	7.646	10.329	0.926	3.276	5.734	2.308	2.500	0.221	2.349
530	101	1	10.50	0.5	0.1	100	0.5	25.593	7.712	11.033	0.931	1.927	10.760	3.518	4.225	0.421	1.924
531	101	1	10.75	0.75	0.1	100	0.75	25.122	6.532	9.781	0.937	1.346	18.812	5.089	6.902	0.582	1.712
532	101	1	11.00	1	0.1	100	1	23.230	5.473	8.457	0.946	1.093	27.275	6.562	9.414	0.738	1.546
533	101	1	11.25	1.25	0.1	100	1.25	21.903	4.705	7.452	0.957	0.907	36.872	7.981	11.974	0.898	1.348
534	101	1	12.00	2	0.1	100	2	18.113	3.289	5.336	0.968	0.696	63.926	11.372	18.356	1.281	1.013
535	101	1	12.50	2.5	0.1	100	2.5	16.306	2.767	4.471	0.957	0.598	80.287	13.076	21.859	1.466	0.912
536	101	1	13.00	3	0.1	100	3	14.921	2.403	3.856	0.939	0.505	95.631	14.473	25.015	1.612	0.923
537	101	1	14.00	4	0.1	100	4	12.894	1.943	3.051	0.906	0.371	123.872	16.680	30.697	1.834	0.943

STP-PT-074: Local Stress in Nozzles, Shells and Formed Heads from External Heads

Model								Secondary (outside) Stress Factors									
	OD	T	od	t	d/D	D/T	t/T	Branch					Header				
								Axial	In-Plane	Out-of-Plane	Torsional	Pressure	Axial	In-Plane	Out-of-Plane	Torsional	Pressure
538	101	1	15.00	5	0.1	100	5	11.420	1.664	2.562	0.873	0.284	149.795	18.614	36.026	2.019	0.959
539	101	1	16.00	6	0.1	100	6	10.320	1.483	2.242	0.846	0.222	173.386	20.302	41.187	2.176	0.976
540	101	1	17.00	7	0.1	100	7	9.500	1.380	2.042	0.880	0.177	195.265	21.819	46.393	2.332	0.986
541	101	1	17.50	7.5	0.1	100	7.5	9.208	1.335	1.971	0.853	0.159	205.515	22.542	49.025	2.411	0.989
542	101	1	18.00	8	0.1	100	8	8.849	1.316	1.896	0.888	0.145	215.548	23.255	51.723	2.489	0.991
543	101	1	19.00	9	0.1	100	9	8.405	1.273	1.817	0.893	0.124	234.305	24.683	57.191	2.654	1.003
545	251	1	25.10	0.1	0.1	250	0.1	22.501	9.667	14.899	0.896	7.844	6.183	2.962	3.752	0.094	4.363
546	251	1	25.25	0.25	0.1	250	0.25	51.822	17.445	29.846	0.903	6.957	12.038	4.852	6.336	0.278	3.697
547	251	1	25.50	0.5	0.1	250	0.5	64.516	17.380	31.409	0.983	4.100	23.366	7.074	10.535	0.504	2.923
548	251	1	25.75	0.75	0.1	250	0.75	59.964	14.081	26.904	1.006	2.645	41.697	10.511	18.027	0.716	2.655
549	251	1	26.00	1	0.1	250	1	52.916	11.492	22.766	0.995	2.016	61.187	13.886	25.479	0.955	2.476
550	251	1	26.25	1.25	0.1	250	1.25	47.477	9.840	19.731	0.983	1.676	81.989	17.117	33.054	1.214	2.262
551	251	1	27.00	2	0.1	250	2	35.856	7.004	13.789	0.974	1.139	141.174	25.973	53.412	1.917	1.682
552	251	1	27.50	2.5	0.1	250	2.5	31.262	6.162	11.476	0.987	0.903	178.380	31.000	65.503	2.318	1.390
553	251	1	28.00	3	0.1	250	3	28.071	5.625	9.881	0.995	0.723	214.278	35.550	76.723	2.675	1.228
554	251	1	29.00	4	0.1	250	4	23.868	4.960	7.853	1.001	0.553	282.490	43.175	97.020	3.264	0.993
555	251	1	30.00	5	0.1	250	5	21.157	4.526	6.628	0.997	0.445	347.842	49.593	115.399	3.750	0.974
556	251	1	31.00	6	0.1	250	6	19.294	4.180	5.813	0.980	0.361	409.292	55.228	131.733	4.138	0.992
557	251	1	32.00	7	0.1	250	7	17.831	3.900	5.207	0.963	0.294	468.316	60.246	146.825	4.473	1.009
558	251	1	32.50	7.5	0.1	250	7.5	17.192	3.771	4.950	0.953	0.267	496.944	62.442	153.971	4.636	1.017
559	251	1	33.00	8	0.1	250	8	16.694	3.626	4.747	0.944	0.242	524.900	64.590	160.877	4.781	1.025
560	251	1	34.00	9	0.1	250	9	15.827	3.411	4.397	0.925	0.209	579.316	68.447	174.148	5.057	1.040
561	251	1	35.00	10	0.1	250	10	15.093	3.195	4.109	0.906	0.183	631.492	71.953	186.670	5.319	1.053
562	501	1	50.10	0.1	0.1	500	0.1	42.639	15.123	30.168	0.886	12.127	10.830	4.619	7.350	0.124	5.990
563	501	1	50.25	0.25	0.1	500	0.25	102.431	28.949	63.644	1.039	10.936	20.511	7.649	11.956	0.346	4.954
564	501	1	50.50	0.5	0.1	500	0.5	125.849	28.858	66.054	1.277	6.455	40.996	10.920	20.306	0.609	3.842
565	501	1	50.75	0.75	0.1	500	0.75	112.950	23.685	55.220	1.287	3.998	74.863	16.350	35.699	0.910	3.537
566	501	1	51.00	1	0.1	500	1	97.004	19.359	45.957	1.238	2.918	109.618	22.231	50.805	1.262	3.355
567	501	1	51.25	1.25	0.1	500	1.25	84.629	16.436	39.230	1.200	2.394	145.559	28.062	66.095	1.634	3.134
568	501	1	52.00	2	0.1	500	2	61.319	12.276	26.859	1.104	1.706	248.297	43.615	108.867	2.686	2.455
569	501	1	52.50	2.5	0.1	500	2.5	53.216	11.251	22.312	1.068	1.410	314.125	52.706	135.589	3.311	2.064
570	501	1	53.00	3	0.1	500	3	48.060	10.871	19.327	1.051	1.168	378.402	61.705	161.138	3.891	1.773
571	501	1	54.00	4	0.1	500	4	41.844	10.692	15.842	1.013	0.811	503.605	78.041	209.439	4.923	1.438
572	501	1	55.00	5	0.1	500	5	37.837	10.475	13.926	1.031	0.581	624.815	92.524	254.403	5.819	1.207
573	501	1	56.00	6	0.1	500	6	34.813	10.125	12.683	1.042	0.475	742.136	105.403	296.223	6.590	1.046
574	501	1	57.00	7	0.1	500	7	32.384	9.724	11.761	1.043	0.410	856.560	116.994	335.574	7.276	1.019
575	501	1	57.50	7.5	0.1	500	7.5	31.391	9.475	11.371	1.039	0.381	912.620	122.272	354.273	7.591	1.050
576	501	1	58.00	8	0.1	500	8	30.462	9.223	11.022	1.034	0.355	967.900	127.360	372.444	7.891	1.097

STP-PT-074: Local Stress in Nozzles, Shells and Formed Heads from External Heads

Model								Secondary (outside) Stress Factors									
	OD	T	od	t	d/D	D/T	t/T	Branch					Header				
								Axial	In-Plane	Out-of-Plane	Torsional	Pressure	Axial	In-Plane	Out-of-Plane	Torsional	Pressure
577	501	1	59.00	9	0.1	500	9	28.868	8.718	10.395	1.024	0.308	1076.524	136.844	407.225	8.425	1.198
578	501	1	60.00	10	0.1	500	10	27.519	8.292	9.854	1.013	0.267	1182.939	145.389	440.062	8.939	1.306
580	751	1	75.25	0.25	0.1	750	0.25	150.990	37.364	97.511	1.223	13.859	27.546	9.651	16.829	0.400	5.812
581	751	1	75.50	0.5	0.1	750	0.5	183.311	38.504	100.473	1.593	8.173	56.911	13.765	29.752	0.692	4.471
582	751	1	75.75	0.75	0.1	750	0.75	161.695	31.608	82.881	1.571	4.975	103.984	21.255	52.296	1.065	4.140
583	751	1	76.00	1	0.1	750	1	136.910	25.962	68.332	1.471	3.559	152.217	29.063	74.736	1.519	3.953
584	751	1	76.25	1.25	0.1	750	1.25	118.097	22.337	57.907	1.399	2.897	200.892	36.572	97.036	1.978	3.722
585	751	1	77.00	2	0.1	750	2	84.344	16.805	39.171	1.252	2.103	341.056	56.756	160.624	3.272	2.976
586	751	1	77.50	2.5	0.1	750	2.5	73.584	16.133	32.588	1.199	1.776	431.096	69.771	200.892	4.056	2.544
587	751	1	78.00	3	0.1	750	3	67.334	16.378	28.467	1.178	1.501	519.727	81.885	240.094	4.799	2.195
588	751	1	79.00	4	0.1	750	4	60.529	16.880	24.059	1.149	1.078	693.593	104.310	315.292	6.148	1.785
589	751	1	80.00	5	0.1	750	5	56.322	16.965	21.972	1.112	0.784	863.542	124.578	387.047	7.349	1.505
590	751	1	81.00	6	0.1	750	6	52.860	16.706	20.701	1.084	0.585	1030.130	143.030	455.337	8.437	1.308
591	751	1	82.00	7	0.1	750	7	49.825	16.310	19.745	1.060	0.471	1193.478	160.169	520.689	9.425	1.162
592	751	1	82.50	7.5	0.1	750	7.5	48.425	16.035	19.299	1.065	0.435	1280.812	171.201	554.617	9.985	1.103
593	751	1	83.00	8	0.1	750	8	47.134	15.709	18.886	1.070	0.411	1360.948	179.013	585.527	10.410	1.134
594	751	1	84.00	9	0.1	750	9	44.775	15.047	18.104	1.074	0.365	1518.948	193.857	645.033	11.228	1.243
595	751	1	85.00	10	0.1	750	10	42.778	14.315	17.369	1.071	0.326	1674.371	207.723	702.133	11.981	1.345
597	1001	1	100.25	0.25	0.1	1000	0.25	198.187	44.383	130.735	1.424	16.235	34.341	11.269	21.610	0.447	6.510
598	1001	1	100.50	0.5	0.1	1000	0.5	238.130	46.684	133.735	1.895	9.563	71.902	16.432	38.808	0.764	4.987
599	1001	1	100.75	0.75	0.1	1000	0.75	207.882	38.621	109.911	1.840	5.761	131.365	25.525	68.424	1.221	4.634
600	1001	1	101.00	1	0.1	1000	1	174.554	32.055	90.135	1.692	4.074	191.924	34.847	97.816	1.749	4.442
601	1001	1	101.25	1.25	0.1	1000	1.25	149.464	27.443	75.939	1.585	3.299	252.685	43.789	126.957	2.297	4.203
602	1001	1	102.00	2	0.1	1000	2	106.176	20.867	51.070	1.392	2.419	427.879	68.800	210.506	3.798	3.396
603	1001	1	102.50	2.5	0.1	1000	2.5	93.133	20.822	42.583	1.330	2.068	540.620	84.631	264.117	4.721	2.926
604	1001	1	103.00	3	0.1	1000	3	86.228	21.533	37.505	1.286	1.770	651.772	99.358	316.353	5.592	2.530
605	1001	1	104.00	4	0.1	1000	4	79.609	22.740	32.540	1.265	1.302	870.977	126.778	417.858	7.205	2.069
606	1001	1	105.00	5	0.1	1000	5	75.783	23.162	30.550	1.231	0.967	1086.596	151.789	515.751	8.687	1.743
607	1001	1	106.00	6	0.1	1000	6	72.422	22.990	29.518	1.195	0.728	1298.778	175.053	610.196	10.034	1.515
608	1001	1	107.00	7	0.1	1000	7	69.145	22.544	28.707	1.166	0.560	1508.068	196.692	701.437	11.276	1.349
609	1001	1	107.50	7.5	0.1	1000	7.5	67.553	22.246	28.279	1.150	0.496	1611.161	207.010	745.140	11.870	1.281
610	1001	1	108.00	8	0.1	1000	8	66.022	21.944	27.902	1.136	0.453	1713.629	216.980	788.785	12.432	1.222
611	1001	1	109.00	9	0.1	1000	9	63.092	21.192	27.070	1.107	0.400	1916.989	236.393	872.875	13.484	1.210
612	1001	1	110.00	10	0.1	1000	10	60.446	20.444	26.255	1.092	0.362	2116.974	255.228	955.298	14.447	1.305
614	1251	1	125.25	0.25	0.1	1250	0.25	244.544	50.801	163.768	1.629	18.265	40.118	12.745	25.664	0.494	7.095
615	1251	1	125.50	0.5	0.1	1250	0.5	291.377	53.928	166.787	2.180	10.749	85.902	18.927	47.492	0.837	5.426
616	1251	1	125.75	0.75	0.1	1250	0.75	252.257	45.369	136.547	2.085	6.433	157.361	29.287	84.117	1.364	5.055
617	1251	1	126.00	1	0.1	1250	1	210.612	37.559	111.511	1.904	4.513	229.553	39.901	120.255	1.969	4.858

STP-PT-074: Local Stress in Nozzles, Shells and Formed Heads from External Heads

Model								Secondary (outside) Stress Factors									
	OD	T	od	t	d/D	D/T	t/T	Branch					Header				
								Axial	In-Plane	Out-of-Plane	Torsional	Pressure	Axial	In-Plane	Out-of-Plane	Torsional	Pressure
618	1251	1	126.25	1.25	0.1	1250	1.25	179.539	32.058	93.661	1.763	3.641	301.679	50.100	156.036	2.590	4.604
619	1251	1	127.00	2	0.1	1250	2	127.029	24.697	62.857	1.525	2.685	509.210	79.480	259.309	4.278	3.755
620	1251	1	127.50	2.5	0.1	1250	2.5	112.213	25.128	52.374	1.464	2.314	643.404	97.588	324.113	5.302	3.251
621	1251	1	128.00	3	0.1	1250	3	104.724	26.262	46.480	1.414	2.000	776.471	114.519	390.176	6.292	2.829
622	1251	1	129.00	4	0.1	1250	4	98.737	28.145	41.160	1.371	1.494	1038.107	145.776	516.901	8.133	2.308
623	1251	1	130.00	5	0.1	1250	5	95.713	28.962	39.473	1.339	1.127	1296.377	174.818	640.268	9.838	1.941
624	1251	1	131.00	6	0.1	1250	6	92.773	29.004	38.808	1.300	0.861	1551.252	202.858	760.040	11.426	1.685
625	1251	1	132.00	7	0.1	1250	7	89.547	28.599	38.247	1.264	0.666	1810.967	232.790	879.667	13.051	1.498
626	1251	1	132.50	7.5	0.1	1250	7.5	87.871	28.192	37.951	1.248	0.589	1936.740	246.283	936.802	13.744	1.421
627	1251	1	133.00	8	0.1	1250	8	86.148	27.839	37.614	1.232	0.524	2061.557	259.485	993.514	14.453	1.357
628	1251	1	134.00	9	0.1	1250	9	82.854	26.936	36.835	1.202	0.432	2308.727	284.342	1102.858	15.726	1.255
629	1251	1	135.00	10	0.1	1250	10	79.732	26.141	36.013	1.175	0.388	2553.286	308.045	1209.204	16.900	1.220
631	1501	1	150.25	0.25	0.1	1500	0.25	290.005	56.907	196.206	1.824	20.050	45.858	14.036	29.729	0.536	7.608
632	1501	1	150.50	0.5	0.1	1500	0.5	342.872	60.918	199.261	2.447	11.799	99.637	21.186	56.134	0.922	5.808
633	1501	1	150.75	0.75	0.1	1500	0.75	294.884	51.642	162.444	2.327	7.029	182.517	32.685	99.510	1.518	5.420
634	1501	1	151.00	1	0.1	1500	1	245.328	42.749	132.544	2.107	4.901	265.559	44.516	142.218	2.189	5.222
635	1501	1	151.25	1.25	0.1	1500	1.25	208.440	36.432	111.010	1.927	3.940	348.474	55.704	184.376	2.859	4.962
636	1501	1	152.00	2	0.1	1500	2	147.280	28.249	74.216	1.655	2.916	586.888	88.901	305.799	4.704	4.073
637	1501	1	152.50	2.5	0.1	1500	2.5	130.699	29.106	62.286	1.591	2.528	741.929	108.836	384.612	5.846	3.540
638	1501	1	153.00	3	0.1	1500	3	122.954	30.683	55.559	1.544	2.197	894.756	127.588	462.371	6.936	3.088
639	1501	1	154.00	4	0.1	1500	4	117.747	33.086	49.810	1.465	1.664	1202.041	165.829	615.422	9.072	2.537
640	1501	1	155.00	5	0.1	1500	5	115.800	34.285	48.581	1.437	1.270	1501.804	199.154	763.816	11.013	2.130
641	1501	1	156.00	6	0.1	1500	6	113.438	34.544	48.345	1.396	0.982	1798.744	232.855	907.981	12.814	1.843
642	1501	1	157.00	7	0.1	1500	7	110.522	34.171	48.211	1.356	0.766	2092.826	265.305	1049.708	14.531	1.632
643	1501	1	157.50	7.5	0.1	1500	7.5	108.843	33.850	48.115	1.341	0.680	2238.460	280.863	1120.744	15.343	1.557
644	1501	1	158.00	8	0.1	1500	8	107.118	33.489	47.815	1.323	0.605	2384.177	296.008	1188.068	16.114	1.489
645	1501	1	159.00	9	0.1	1500	9	103.610	32.597	47.267	1.294	0.484	2672.120	325.624	1323.930	17.636	1.378
646	1501	1	160.00	10	0.1	1500	10	100.153	31.534	46.535	1.262	0.411	2957.944	353.339	1456.572	19.015	1.281
649	1751	1	175.50	0.5	0.1	1750	0.5	393.270	67.628	231.253	2.701	12.743	112.830	23.128	64.500	1.004	6.180
650	1751	1	175.75	0.75	0.1	1750	0.75	336.233	56.970	187.787	2.550	7.561	207.096	35.690	114.626	1.666	5.793
651	1751	1	176.00	1	0.1	1750	1	278.591	47.062	152.659	2.290	5.248	301.371	48.669	163.957	2.410	5.587
652	1751	1	176.25	1.25	0.1	1750	1.25	235.879	40.095	127.578	2.078	4.206	395.042	62.529	212.593	3.139	5.323
653	1751	1	177.00	2	0.1	1750	2	166.856	32.000	85.542	1.782	3.120	664.061	99.730	353.530	5.152	4.371
654	1751	1	177.50	2.5	0.1	1750	2.5	148.535	32.855	71.694	1.709	2.718	839.209	121.796	443.864	6.396	3.800
655	1751	1	178.00	3	0.1	1750	3	140.625	34.780	64.177	1.673	2.375	1012.629	142.576	533.567	7.595	3.349
656	1751	1	179.00	4	0.1	1750	4	136.662	37.603	58.560	1.593	1.814	1354.930	181.304	709.499	9.856	2.733
657	1751	1	180.00	5	0.1	1750	5	135.898	39.143	57.833	1.532	1.398	1693.608	220.515	881.490	11.979	2.289
658	1751	1	181.00	6	0.1	1750	6	134.367	39.556	58.173	1.496	1.089	2029.703	258.461	1050.600	13.997	1.974



STP-PT-074: Local Stress in Nozzles, Shells and Formed Heads from External Heads

Model								Secondary (outside) Stress Factors									
	OD	T	od	t	d/D	D/T	t/T	Branch					Header				
								Axial	In-Plane	Out-of-Plane	Torsional	Pressure	Axial	In-Plane	Out-of-Plane	Torsional	Pressure
659	1751	1	182.00	7	0.1	1750	7	131.743	39.344	58.433	1.451	0.859	2362.351	294.520	1216.155	15.876	1.779
660	1751	1	182.50	7.5	0.1	1750	7.5	130.227	39.029	58.506	1.426	0.765	2528.052	312.067	1298.683	16.774	1.697
661	1751	1	183.00	8	0.1	1750	8	128.503	38.686	58.396	1.411	0.683	2692.666	329.536	1379.443	17.653	1.623
662	1751	1	184.00	9	0.1	1750	9	124.841	37.771	57.994	1.378	0.548	3020.504	362.568	1538.552	19.332	1.490
663	1751	1	185.00	10	0.1	1750	10	121.042	36.772	57.203	1.342	0.448	3345.288	394.488	1693.321	20.916	1.387
666	2001	1	200.50	0.5	0.1	2000	0.5	442.372	74.024	263.598	2.941	13.612	125.680	25.003	72.952	1.077	6.494
667	2001	1	200.75	0.75	0.1	2000	0.75	376.421	62.218	213.333	2.776	8.056	230.617	38.486	129.673	1.801	6.096
668	2001	1	201.00	1	0.1	2000	1	311.055	51.281	172.808	2.470	5.567	334.928	52.918	184.859	2.593	5.894
669	2001	1	201.25	1.25	0.1	2000	1.25	263.007	43.694	144.311	2.232	4.450	438.255	67.798	239.740	3.385	5.626
670	2001	1	202.00	2	0.1	2000	2	185.741	35.398	96.289	1.899	3.305	736.872	107.592	398.081	5.535	4.636
671	2001	1	202.50	2.5	0.1	2000	2.5	166.136	36.307	81.568	1.837	2.890	930.245	131.313	503.107	6.890	4.037
672	2001	1	203.00	3	0.1	2000	3	158.300	38.607	73.061	1.805	2.533	1121.469	153.686	601.437	8.158	3.567
673	2001	1	204.00	4	0.1	2000	4	155.425	41.922	67.173	1.734	1.950	1502.480	197.609	799.485	10.581	2.907
674	2001	1	205.00	5	0.1	2000	5	155.984	43.616	67.261	1.646	1.515	1877.731	240.587	997.601	12.876	2.432
675	2001	1	206.00	6	0.1	2000	6	155.315	44.220	68.087	1.585	1.189	2251.329	282.006	1188.685	15.051	2.124
676	2001	1	207.00	7	0.1	2000	7	153.283	44.089	68.891	1.543	0.944	2622.303	321.807	1379.947	17.112	1.916
677	2001	1	207.50	7.5	0.1	2000	7.5	151.755	43.844	68.939	1.520	0.844	2806.366	340.898	1471.564	18.091	1.826
678	2001	1	208.00	8	0.1	2000	8	149.978	43.491	68.980	1.496	0.756	2990.092	359.868	1563.258	19.065	1.746
679	2001	1	209.00	9	0.1	2000	9	146.380	42.675	68.849	1.454	0.611	3354.710	396.571	1745.756	20.907	1.607
680	2001	1	210.00	10	0.1	2000	10	142.614	41.579	68.455	1.422	0.497	3717.895	432.154	1926.939	22.666	1.486
683	2251	1	225.50	0.5	0.1	2250	0.5	490.649	80.135	294.046	3.176	14.418	138.089	26.814	80.767	1.157	6.783
684	2251	1	225.75	0.75	0.1	2250	0.75	415.917	67.509	238.002	2.986	8.521	253.389	41.337	143.962	1.924	6.373
685	2251	1	226.00	1	0.1	2250	1	342.765	55.514	192.642	2.647	5.869	367.866	57.283	205.580	2.789	6.179
686	2251	1	226.25	1.25	0.1	2250	1.25	289.134	47.142	160.635	2.383	4.676	481.021	73.602	266.651	3.606	5.908
687	2251	1	227.00	2	0.1	2250	2	204.573	38.864	107.539	2.023	3.473	807.059	116.181	443.594	5.905	4.881
688	2251	1	227.50	2.5	0.1	2250	2.5	183.344	39.984	90.612	1.981	3.047	1018.115	141.049	556.864	7.349	4.262
689	2251	1	228.00	3	0.1	2250	3	175.320	42.225	81.609	1.966	2.678	1232.784	165.209	671.305	8.739	3.767
690	2251	1	229.00	4	0.1	2250	4	174.143	46.055	76.322	1.888	2.074	1644.117	212.410	891.712	11.228	3.075
691	2251	1	230.00	5	0.1	2250	5	176.063	47.879	76.265	1.791	1.622	2055.743	259.848	1103.266	13.711	2.561
692	2251	1	231.00	6	0.1	2250	6	176.169	48.576	78.133	1.684	1.281	2468.034	303.540	1327.072	16.039	2.272
693	2251	1	232.00	7	0.1	2250	7	174.930	48.551	79.434	1.629	1.023	2872.975	347.459	1537.701	18.293	2.043
694	2251	1	232.50	7.5	0.1	2250	7.5	173.455	48.321	79.872	1.605	0.918	3077.989	368.618	1645.987	19.384	1.954
695	2251	1	233.00	8	0.1	2250	8	171.879	47.938	79.764	1.581	0.823	3275.879	388.308	1741.918	20.348	1.867
696	2251	1	234.00	9	0.1	2250	9	168.312	47.124	80.161	1.530	0.669	3689.367	432.469	1959.123	22.565	1.725
697	2251	1	235.00	10	0.1	2250	10	164.185	46.192	79.736	1.492	0.548	4087.750	471.867	2160.799	24.496	1.598
700	2501	1	250.50	0.5	0.1	2500	0.5	537.920	85.982	325.674	3.416	15.177	150.572	28.657	89.068	1.224	7.051
701	2501	1	250.75	0.75	0.1	2500	0.75	454.372	72.397	262.384	3.184	8.949	275.564	43.862	158.167	2.049	6.645
702	2501	1	251.00	1	0.1	2500	1	373.532	59.342	212.324	2.818	6.143	399.660	60.843	226.190	2.958	6.445

STP-PT-074: Local Stress in Nozzles, Shells and Formed Heads from External Heads

Model								Secondary (outside) Stress Factors									
	OD	T	od	t	d/D	D/T	t/T	Branch					Header				
								Axial	In-Plane	Out-of-Plane	Torsional	Pressure	Axial	In-Plane	Out-of-Plane	Torsional	Pressure
703	2501	1	251.25	1.25	0.1	2500	1.25	314.852	50.837	176.696	2.514	4.882	521.577	177.681	292.232	3.842	6.177
704	2501	1	252.00	2	0.1	2500	2	222.632	41.968	117.944	2.155	3.628	873.474	123.206	484.971	6.254	5.118
705	2501	1	252.50	2.5	0.1	2500	2.5	200.504	43.465	99.923	2.119	3.188	1105.724	149.152	612.147	7.743	4.473
706	2501	1	253.00	3	0.1	2500	3	192.023	45.761	90.168	2.118	2.811	1332.301	176.076	736.312	9.218	3.962
707	2501	1	254.00	4	0.1	2500	4	192.392	49.931	86.467	2.058	2.190	1784.811	228.515	999.636	11.942	3.216
708	2501	1	255.00	5	0.1	2500	5	196.011	52.012	86.263	1.934	1.719	2231.320	277.913	1222.931	14.508	2.697
709	2501	1	256.00	6	0.1	2500	6	197.161	52.619	88.275	1.822	1.365	2684.803	327.101	1464.229	17.088	2.421
710	2501	1	257.00	7	0.1	2500	7	196.389	52.653	90.133	1.718	1.096	3124.147	373.952	1700.014	19.522	2.180
711	2501	1	257.50	7.5	0.1	2500	7.5	195.107	52.459	90.581	1.697	0.985	3338.358	395.918	1811.208	20.628	2.083
712	2501	1	258.00	8	0.1	2500	8	193.603	52.183	90.960	1.675	0.888	3563.193	418.008	1929.656	21.736	1.988
713	2501	1	259.00	9	0.1	2500	9	190.205	51.349	91.055	1.617	0.725	4001.293	461.617	2150.905	23.907	1.841
714	2501	1	260.00	10	0.1	2500	10	185.985	50.353	91.324	1.560	0.597	4436.866	503.440	2387.654	26.014	1.688
715	9	1	1.30	0.1	0.15	8	0.1	1.520	1.321	1.299	0.960	1.180	0.417	0.138	0.139	0.071	0.816
716	9	1	1.45	0.25	0.15	8	0.25	1.759	1.310	1.296	0.999	0.499	0.934	0.280	0.285	0.135	0.767
717	9	1	1.70	0.5	0.15	8	0.5	1.962	1.239	1.250	0.994	0.436	1.541	0.435	0.465	0.196	0.738
718	9	1	1.95	0.75	0.15	8	0.75	2.003	1.162	1.188	0.966	0.401	1.981	0.554	0.617	0.239	0.733
719	9	1	2.20	1	0.15	8	1	1.948	1.103	1.138	0.931	0.370	2.315	0.666	0.767	0.278	0.749
732	17	1	2.50	0.1	0.15	16	0.1	2.390	1.685	1.800	0.955	1.353	0.816	0.261	0.263	0.078	1.265
733	17	1	2.65	0.25	0.15	16	0.25	3.526	1.894	2.075	0.993	0.823	1.668	0.532	0.521	0.169	1.049
734	17	1	2.90	0.5	0.15	16	0.5	4.381	1.856	2.086	0.972	0.626	2.819	0.869	0.935	0.283	0.919
735	17	1	3.15	0.75	0.15	16	0.75	4.574	1.711	1.944	0.944	0.585	3.864	1.132	1.304	0.361	0.855
736	17	1	3.40	1	0.15	16	1	4.497	1.561	1.784	0.920	0.563	5.076	1.349	1.615	0.418	0.831
737	17	1	3.65	1.25	0.15	16	1.25	4.536	1.439	1.647	0.919	0.474	6.697	1.565	1.988	0.466	0.835
738	17	1	4.40	2	0.15	16	2	4.067	1.204	1.380	0.870	0.257	10.946	2.165	3.021	0.589	0.849
749	25	1	3.70	0.1	0.15	24	0.1	3.311	2.101	2.380	0.951	1.426	1.174	0.424	0.435	0.082	1.599
750	25	1	3.85	0.25	0.15	24	0.25	5.535	2.618	3.119	0.988	1.071	2.258	0.803	0.811	0.185	1.331
751	25	1	4.10	0.5	0.15	24	0.5	7.085	2.606	3.223	0.979	0.753	3.718	1.288	1.432	0.330	1.077
752	25	1	4.35	0.75	0.15	24	0.75	7.378	2.358	2.956	0.959	0.706	5.878	1.720	2.097	0.443	0.975
753	25	1	4.60	1	0.15	24	1	7.175	2.104	2.654	0.944	0.705	8.050	2.088	2.655	0.530	0.914
754	25	1	4.85	1.25	0.15	24	1.25	7.168	1.897	2.397	0.944	0.637	10.775	2.440	3.273	0.600	0.872
755	25	1	5.60	2	0.15	24	2	6.512	1.458	1.850	0.897	0.414	18.111	3.292	4.828	0.754	0.890
756	25	1	6.10	2.5	0.15	24	2.5	5.970	1.300	1.648	0.851	0.303	22.280	3.744	5.785	0.837	0.902
757	25	1	6.60	3	0.15	24	3	5.462	1.204	1.522	0.891	0.231	25.971	4.156	6.758	0.916	0.910
766	33	1	4.90	0.1	0.15	32	0.1	4.222	2.524	2.987	0.948	1.826	1.486	0.591	0.617	0.085	1.887
767	33	1	5.05	0.25	0.15	32	0.25	7.629	3.382	4.289	0.982	1.490	2.804	1.071	1.121	0.194	1.595
768	33	1	5.30	0.5	0.15	32	0.5	9.858	3.387	4.510	0.979	0.872	4.627	1.681	1.930	0.359	1.290
769	33	1	5.55	0.75	0.15	32	0.75	10.183	3.012	4.104	0.965	0.745	7.838	2.285	2.928	0.498	1.108
770	33	1	5.80	1	0.15	32	1	9.818	2.643	3.634	0.960	0.764	11.034	2.823	3.799	0.611	1.017

STP-PT-074: Local Stress in Nozzles, Shells and Formed Heads from External Heads

Model								Secondary (outside) Stress Factors									
	OD	T	od	t	d/D	D/T	t/T	Branch					Header				
								Axial	In-Plane	Out-of-Plane	Torsional	Pressure	Axial	In-Plane	Out-of-Plane	Torsional	Pressure
771	33	1	6.05	1.25	0.15	32	1.25	9.699	2.353	3.256	0.962	0.722	14.866	3.335	4.714	0.707	0.931
772	33	1	6.80	2	0.15	32	2	8.711	1.728	2.428	0.920	0.521	25.307	4.507	6.934	0.906	0.910
773	33	1	7.30	2.5	0.15	32	2.5	8.015	1.489	2.097	0.876	0.400	31.435	5.090	8.223	1.003	0.923
774	33	1	7.80	3	0.15	32	3	7.368	1.335	1.873	0.868	0.310	36.938	5.573	9.460	1.085	0.936
775	33	1	8.80	4	0.15	32	4	6.362	1.162	1.621	0.881	0.206	46.506	6.418	11.970	1.243	0.952
783	41	1	6.10	0.1	0.15	40	0.1	5.125	2.940	3.600	0.945	2.332	1.754	0.751	0.803	0.088	2.140
784	41	1	6.25	0.25	0.15	40	0.25	9.771	4.149	5.526	0.974	2.000	3.264	1.325	1.426	0.200	1.839
785	41	1	6.50	0.5	0.15	40	0.5	12.661	4.169	5.879	0.974	1.186	5.673	2.049	2.430	0.379	1.498
786	41	1	6.75	0.75	0.15	40	0.75	12.957	3.651	5.318	0.963	0.844	9.774	2.826	3.784	0.535	1.292
787	41	1	7.00	1	0.15	40	1	12.388	3.160	4.674	0.967	0.791	13.963	3.533	4.994	0.672	1.138
788	41	1	7.25	1.25	0.15	40	1.25	12.108	2.786	4.168	0.971	0.766	18.900	4.211	6.247	0.791	1.023
789	41	1	8.00	2	0.15	40	2	10.701	1.997	3.067	0.940	0.593	32.444	5.748	9.259	1.042	0.920
790	41	1	8.50	2.5	0.15	40	2.5	9.832	1.710	2.613	0.916	0.472	40.414	6.473	10.931	1.155	0.935
791	41	1	9.00	3	0.15	40	3	9.059	1.512	2.294	0.893	0.378	47.809	7.078	12.512	1.252	0.949
792	41	1	10.00	4	0.15	40	4	7.840	1.268	1.904	0.885	0.262	60.778	8.046	15.535	1.413	0.972
793	41	1	11.00	5	0.15	40	5	6.927	1.133	1.691	0.860	0.187	72.087	9.036	18.648	1.570	0.982
800	51	1	7.60	0.1	0.15	50	0.1	6.248	3.445	4.378	0.942	2.938	2.058	0.944	1.032	0.091	2.429
801	51	1	7.75	0.25	0.15	50	0.25	12.478	5.091	7.131	0.965	2.603	3.829	1.625	1.804	0.208	2.116
802	51	1	8.00	0.5	0.15	50	0.5	16.170	5.130	7.652	0.966	1.563	6.955	2.480	3.044	0.395	1.727
803	51	1	8.25	0.75	0.15	50	0.75	16.358	4.424	6.885	0.962	1.091	12.122	3.464	4.859	0.568	1.507
804	51	1	8.50	1	0.15	50	1	15.486	3.774	6.020	0.976	0.868	17.479	4.373	6.513	0.723	1.336
805	51	1	8.75	1.25	0.15	50	1.25	14.958	3.293	5.349	0.984	0.798	23.778	5.257	8.234	0.871	1.148
806	51	1	9.50	2	0.15	50	2	12.944	2.385	3.905	0.975	0.655	41.078	7.259	12.363	1.186	0.927
807	51	1	10.00	2.5	0.15	50	2.5	11.831	2.029	3.303	0.955	0.538	51.377	8.208	14.616	1.329	0.943
808	51	1	10.50	3	0.15	50	3	10.903	1.781	2.873	0.934	0.438	60.893	8.975	16.661	1.440	0.959
809	51	1	11.50	4	0.15	50	4	9.436	1.465	2.318	0.891	0.317	78.184	10.261	20.494	1.627	0.984
810	51	1	12.50	5	0.15	50	5	8.377	1.277	1.997	0.885	0.234	93.359	11.408	24.190	1.785	1.001
811	51	1	13.50	6	0.15	50	6	7.624	1.157	1.814	0.838	0.177	106.942	12.410	27.958	1.946	1.012
812	51	1	14.50	7	0.15	50	7	7.053	1.120	1.705	0.854	0.142	119.005	13.332	31.840	2.109	1.019
817	61	1	9.10	0.1	0.15	60	0.1	7.360	3.927	5.157	0.938	3.501	2.308	1.122	1.260	0.095	2.698
818	61	1	9.25	0.25	0.15	60	0.25	15.198	6.011	8.789	0.955	3.165	4.440	1.906	2.204	0.216	2.365
819	61	1	9.50	0.5	0.15	60	0.5	19.660	6.061	9.471	0.956	1.913	8.190	2.875	3.655	0.412	1.926
820	61	1	9.75	0.75	0.15	60	0.75	19.675	5.165	8.481	0.963	1.318	14.400	4.059	5.937	0.592	1.694
821	61	1	10.00	1	0.15	60	1	18.458	4.357	7.385	0.979	1.041	20.900	5.166	8.057	0.762	1.514
822	61	1	10.25	1.25	0.15	60	1.25	17.648	3.801	6.549	0.991	0.845	28.384	6.225	10.235	0.925	1.301
823	61	1	11.00	2	0.15	60	2	14.975	2.759	4.758	0.998	0.696	49.326	8.705	15.599	1.306	0.967
824	61	1	11.50	2.5	0.15	60	2.5	13.606	2.343	4.015	0.982	0.588	61.859	9.911	18.515	1.479	0.947
825	61	1	12.00	3	0.15	60	3	12.515	2.051	3.480	0.966	0.488	73.516	10.898	21.128	1.615	0.964

STP-PT-074: Local Stress in Nozzles, Shells and Formed Heads from External Heads

Model								Secondary (outside) Stress Factors									
	OD	T	od	t	d/D	D/T	t/T	Branch					Header				
								Axial	In-Plane	Out-of-Plane	Torsional	Pressure	Axial	In-Plane	Out-of-Plane	Torsional	Pressure
826	61	1	13.00	4	0.15	60	4	10.843	1.672	2.777	0.924	0.356	94.736	12.578	25.839	1.822	0.992
827	61	1	14.00	5	0.15	60	5	9.589	1.451	2.346	0.887	0.270	113.935	13.892	30.296	1.999	1.011
828	61	1	15.00	6	0.15	60	6	8.710	1.315	2.075	0.885	0.209	131.230	15.021	34.656	2.159	1.026
829	61	1	16.00	7	0.15	60	7	8.083	1.238	1.915	0.892	0.166	146.949	16.157	39.076	2.321	1.039
830	61	1	16.50	7.5	0.15	60	7.5	7.751	1.216	1.844	0.858	0.149	154.437	16.759	41.360	2.408	1.043
831	61	1	17.00	8	0.15	60	8	7.517	1.202	1.798	0.864	0.134	161.494	17.369	43.659	2.496	1.046
834	71	1	10.60	0.1	0.15	70	0.1	8.460	4.384	5.940	0.934	4.031	2.548	1.289	1.489	0.099	2.947
835	71	1	10.75	0.25	0.15	70	0.25	17.908	6.902	10.482	0.946	3.690	4.991	2.171	2.565	0.224	2.591
836	71	1	11.00	0.5	0.15	70	0.5	23.116	6.960	11.320	0.947	2.238	9.395	3.243	4.261	0.431	2.101
837	71	1	11.25	0.75	0.15	70	0.75	22.908	5.873	10.088	0.965	1.525	16.597	4.614	7.005	0.609	1.858
838	71	1	11.50	1	0.15	70	1	21.319	4.926	8.759	0.978	1.196	24.212	5.909	9.610	0.793	1.672
839	71	1	11.75	1.25	0.15	70	1.25	20.203	4.312	7.752	0.993	0.971	32.853	7.143	12.266	0.973	1.452
840	71	1	12.50	2	0.15	70	2	16.855	3.117	5.616	1.011	0.726	57.202	10.093	18.923	1.407	1.052
841	71	1	13.00	2.5	0.15	70	2.5	15.219	2.650	4.733	1.003	0.625	71.866	11.579	22.558	1.612	0.950
842	71	1	13.50	3	0.15	70	3	13.951	2.343	4.097	0.990	0.528	85.563	12.879	25.800	1.773	0.966
843	71	1	14.50	4	0.15	70	4	12.084	1.946	3.253	0.954	0.385	110.712	14.910	31.559	2.011	0.995
844	71	1	15.50	5	0.15	70	5	10.705	1.688	2.725	0.914	0.297	133.714	16.462	36.863	2.208	1.016
845	71	1	16.50	6	0.15	70	6	9.667	1.512	2.374	0.882	0.234	154.550	17.750	41.883	2.376	1.035
846	71	1	17.50	7	0.15	70	7	8.973	1.394	2.155	0.884	0.188	173.864	19.149	46.899	2.547	1.051
847	71	1	18.00	7.5	0.15	70	7.5	8.642	1.350	2.079	0.860	0.169	182.978	19.822	49.429	2.640	1.057
848	71	1	18.50	8	0.15	70	8	8.345	1.323	2.003	0.873	0.154	191.764	20.467	51.988	2.728	1.063
849	71	1	19.50	9	0.15	70	9	7.926	1.276	1.894	0.874	0.129	207.925	21.618	57.070	2.891	1.070
850	71	1	20.50	10	0.15	70	10	7.520	1.256	1.811	0.833	0.109	223.305	22.816	62.395	3.081	1.074
851	81	1	12.10	0.1	0.15	80	0.1	9.550	4.821	6.728	0.931	4.531	2.791	1.447	1.708	0.102	3.179
852	81	1	12.25	0.25	0.15	80	0.25	20.602	7.759	12.202	0.937	4.184	5.554	2.422	2.893	0.231	2.796
853	81	1	12.50	0.5	0.15	80	0.5	26.524	7.822	13.180	0.947	2.541	10.565	3.586	4.861	0.446	2.257
854	81	1	12.75	0.75	0.15	80	0.75	26.067	6.553	11.700	0.966	1.715	18.734	5.134	8.072	0.623	2.004
855	81	1	13.00	1	0.15	80	1	24.084	5.484	10.134	0.979	1.336	27.400	6.605	11.155	0.817	1.814
856	81	1	13.25	1.25	0.15	80	1.25	22.646	4.802	8.952	0.990	1.086	37.151	8.004	14.302	1.009	1.589
857	81	1	14.00	2	0.15	80	2	18.612	3.464	6.468	1.018	0.747	64.715	11.414	22.286	1.492	1.130
858	81	1	14.50	2.5	0.15	80	2.5	16.710	2.982	5.447	1.017	0.654	81.420	13.265	26.686	1.727	0.969
859	81	1	15.00	3	0.15	80	3	15.273	2.662	4.715	1.005	0.560	97.094	14.804	30.611	1.913	0.968
860	81	1	16.00	4	0.15	80	4	13.200	2.228	3.740	0.977	0.407	125.997	17.230	37.519	2.191	0.997
861	81	1	17.00	5	0.15	80	5	11.739	1.940	3.124	0.940	0.318	152.338	19.050	43.671	2.398	1.020
862	81	1	18.00	6	0.15	80	6	10.620	1.731	2.707	0.905	0.253	176.607	20.547	49.440	2.577	1.041
863	81	1	19.00	7	0.15	80	7	9.779	1.578	2.422	0.879	0.206	199.222	22.122	55.087	2.761	1.059
864	81	1	19.50	7.5	0.15	80	7.5	9.415	1.529	2.312	0.867	0.187	210.077	22.867	57.924	2.851	1.067
865	81	1	20.00	8	0.15	80	8	9.189	1.470	2.239	0.883	0.170	220.350	23.592	60.715	2.946	1.074

STP-PT-074: Local Stress in Nozzles, Shells and Formed Heads from External Heads

Model								Secondary (outside) Stress Factors									
	OD	T	od	t	d/D	D/T	t/T	Branch					Header				
								Axial	In-Plane	Out-of-Plane	Torsional	Pressure	Axial	In-Plane	Out-of-Plane	Torsional	Pressure
866	81	1	21.00	9	0.15	80	9	8.652	1.397	2.091	0.859	0.143	240.161	24.941	66.427	3.143	1.085
867	81	1	22.00	10	0.15	80	10	8.215	1.349	1.986	0.857	0.121	258.614	26.224	72.212	3.350	1.092
868	91	1	13.60	0.1	0.15	90	0.1	10.616	5.241	7.519	0.927	5.006	3.094	1.596	1.948	0.103	3.398
869	91	1	13.75	0.25	0.15	90	0.25	23.250	8.581	13.928	0.930	4.649	6.106	2.656	3.251	0.239	2.985
870	91	1	14.00	0.5	0.15	90	0.5	29.876	8.655	15.054	0.946	2.826	11.684	3.909	5.450	0.460	2.398
871	91	1	14.25	0.75	0.15	90	0.75	29.154	7.207	13.319	0.965	1.892	20.804	5.623	9.134	0.633	2.136
872	91	1	14.50	1	0.15	90	1	26.766	6.042	11.510	0.980	1.464	30.481	7.266	12.696	0.837	1.943
873	91	1	14.75	1.25	0.15	90	1.25	24.995	5.276	10.147	0.991	1.191	41.287	8.820	16.331	1.041	1.715
874	91	1	15.50	2	0.15	90	2	20.283	3.809	7.315	1.021	0.769	71.735	12.760	25.601	1.552	1.201
875	91	1	16.00	2.5	0.15	90	2.5	18.122	3.320	6.157	1.025	0.675	90.583	14.905	30.869	1.829	1.033
876	91	1	16.50	3	0.15	90	3	16.507	2.976	5.328	1.018	0.585	108.137	16.689	35.513	2.040	0.969
877	91	1	17.50	4	0.15	90	4	14.233	2.510	4.228	0.996	0.433	140.675	19.511	43.659	2.357	0.998
878	91	1	18.50	5	0.15	90	5	12.658	2.196	3.533	0.962	0.335	170.506	21.637	50.839	2.589	1.022
879	91	1	19.50	6	0.15	90	6	11.489	1.959	3.063	0.927	0.269	198.230	23.556	57.489	2.798	1.045
880	91	1	20.50	7	0.15	90	7	10.546	1.777	2.724	0.897	0.220	224.137	25.325	63.850	3.002	1.066
881	91	1	21.00	7.5	0.15	90	7.5	10.112	1.708	2.581	0.884	0.200	236.567	26.121	67.006	3.106	1.074
882	91	1	21.50	8	0.15	90	8	9.919	1.647	2.493	0.873	0.184	248.436	26.925	70.090	3.208	1.082
883	91	1	22.50	9	0.15	90	9	9.268	1.544	2.307	0.883	0.155	271.438	28.399	76.369	3.419	1.096
884	91	1	23.50	10	0.15	90	10	8.834	1.468	2.183	0.881	0.132	292.963	29.776	82.650	3.632	1.106
885	101	1	15.10	0.1	0.15	100	0.1	11.672	5.627	8.300	0.924	5.457	3.382	1.733	2.164	0.104	3.602
886	101	1	15.25	0.25	0.15	100	0.25	25.863	9.362	15.659	0.925	5.090	6.678	2.878	3.654	0.246	3.160
887	101	1	15.50	0.5	0.15	100	0.5	33.185	9.445	16.923	0.944	3.096	12.771	4.210	6.029	0.473	2.526
888	101	1	15.75	0.75	0.15	100	0.75	32.181	7.841	14.932	0.963	2.057	22.801	6.082	10.178	0.644	2.257
889	101	1	16.00	1	0.15	100	1	29.379	6.575	12.876	0.980	1.581	33.482	7.881	14.225	0.856	2.061
890	101	1	16.25	1.25	0.15	100	1.25	27.270	5.728	11.336	0.992	1.287	45.300	9.591	18.351	1.071	1.831
891	101	1	17.00	2	0.15	100	2	21.878	4.174	8.150	1.020	0.805	78.660	14.048	28.974	1.618	1.275
892	101	1	17.50	2.5	0.15	100	2.5	19.466	3.647	6.857	1.030	0.691	99.411	16.472	35.072	1.920	1.095
893	101	1	18.00	3	0.15	100	3	17.681	3.281	5.934	1.028	0.606	118.802	18.509	40.465	2.156	0.959
894	101	1	19.00	4	0.15	100	4	15.204	2.789	4.714	1.010	0.456	154.881	21.755	49.943	2.510	0.998
895	101	1	20.00	5	0.15	100	5	13.526	2.452	3.944	0.981	0.350	188.134	24.245	58.239	2.791	1.024
896	101	1	21.00	6	0.15	100	6	12.290	2.201	3.419	0.947	0.283	219.215	26.579	65.843	3.035	1.049
897	101	1	22.00	7	0.15	100	7	11.283	1.998	3.030	0.917	0.233	248.368	28.568	73.011	3.264	1.070
898	101	1	22.50	7.5	0.15	100	7.5	10.839	1.910	2.867	0.903	0.212	262.323	29.468	76.506	3.373	1.080
899	101	1	23.00	8	0.15	100	8	10.472	1.833	2.735	0.890	0.195	275.860	30.314	79.960	3.476	1.089
900	101	1	24.00	9	0.15	100	9	9.948	1.717	2.539	0.870	0.165	301.845	31.936	86.800	3.696	1.128
901	101	1	25.00	10	0.15	100	10	9.385	1.617	2.372	0.882	0.144	326.456	33.418	93.659	3.918	1.184
902	251	1	37.60	0.1	0.15	250	0.1	26.404	9.938	20.008	0.900	10.616	7.149	3.199	5.208	0.106	5.809
903	251	1	37.75	0.25	0.15	250	0.25	63.138	18.345	42.202	0.985	9.981	13.927	5.334	8.751	0.334	4.918

STP-PT-074: Local Stress in Nozzles, Shells and Formed Heads from External Heads

Model								Secondary (outside) Stress Factors									
	OD	T	od	t	d/D	D/T	t/T	Branch					Header				
								Axial	In-Plane	Out-of-Plane	Torsional	Pressure	Axial	In-Plane	Out-of-Plane	Torsional	Pressure
904	251	1	38.00	0.5	0.15	250	0.5	80.118	18.728	45.412	1.221	6.076	27.027	7.506	14.400	0.610	3.791
905	251	1	38.25	0.75	0.15	250	0.75	73.976	15.763	38.883	1.262	3.827	49.327	11.108	25.265	0.901	3.454
906	251	1	38.50	1	0.15	250	1	64.790	13.103	32.874	1.241	2.781	72.890	15.085	36.217	1.247	3.253
907	251	1	38.75	1.25	0.15	250	1.25	57.555	11.421	28.438	1.213	2.240	97.546	19.001	47.309	1.622	3.007
908	251	1	39.50	2	0.15	250	2	42.754	8.660	19.905	1.120	1.510	167.891	29.194	77.981	2.644	2.287
909	251	1	40.00	2.5	0.15	250	2.5	37.165	7.831	16.673	1.068	1.215	212.377	35.503	96.710	3.237	1.894
910	251	1	40.50	3	0.15	250	3	33.387	7.337	14.488	1.039	0.985	255.538	41.245	114.389	3.765	1.617
911	251	1	41.50	4	0.15	250	4	28.520	6.770	11.786	1.065	0.663	338.298	51.344	146.987	4.690	1.278
912	251	1	42.50	5	0.15	250	5	25.395	6.366	10.185	1.073	0.515	417.618	60.006	176.730	5.452	1.166
913	251	1	43.50	6	0.15	250	6	23.190	6.009	9.110	1.067	0.430	493.502	67.462	203.838	6.077	1.292
914	251	1	44.50	7	0.15	250	7	21.489	5.651	8.300	1.061	0.361	566.560	73.930	228.729	6.641	1.431
915	251	1	45.00	7.5	0.15	250	7.5	20.773	5.460	7.960	1.056	0.330	602.346	76.908	240.557	6.886	1.505
916	251	1	45.50	8	0.15	250	8	20.206	5.287	7.675	1.051	0.303	637.240	79.665	251.791	7.115	1.578
917	251	1	46.50	9	0.15	250	9	19.080	4.949	7.140	1.028	0.255	706.071	84.626	273.493	7.583	1.729
918	251	1	47.50	10	0.15	250	10	18.248	4.680	6.719	1.011	0.218	772.572	89.065	293.714	7.998	1.879
919	501	1	75.10	0.1	0.15	500	0.1	49.168	14.190	38.862	0.902	16.251	12.278	4.584	9.505	0.177	8.007
920	501	1	75.25	0.25	0.15	500	0.25	121.702	27.993	85.852	1.318	15.185	23.366	7.808	15.776	0.462	6.599
921	501	1	75.50	0.5	0.15	500	0.5	152.016	30.489	91.904	1.810	9.236	47.324	11.301	27.353	0.783	5.002
922	501	1	75.75	0.75	0.15	500	0.75	136.456	25.826	77.425	1.823	5.664	87.106	17.297	48.604	1.231	4.602
923	501	1	76.00	1	0.15	500	1	116.525	21.780	64.372	1.725	3.988	128.563	23.600	70.090	1.775	4.394
924	501	1	76.25	1.25	0.15	500	1.25	101.240	18.808	54.928	1.631	3.173	170.527	29.602	91.504	2.327	4.130
925	501	1	77.00	2	0.15	500	2	72.901	14.404	37.642	1.434	2.214	290.773	47.229	152.309	3.864	3.268
926	501	1	77.50	2.5	0.15	500	2.5	63.520	13.499	31.547	1.357	1.850	367.927	57.607	190.864	4.783	2.777
927	501	1	78.00	3	0.15	500	3	57.880	13.667	27.726	1.296	1.553	443.496	67.243	228.102	5.626	2.397
928	501	1	79.00	4	0.15	500	4	51.454	14.073	23.580	1.245	1.103	591.223	84.718	299.588	7.166	1.928
929	501	1	80.00	5	0.15	500	5	47.448	14.098	21.488	1.194	0.797	735.209	100.340	367.383	8.518	1.609
930	501	1	81.00	6	0.15	500	6	44.295	13.802	20.147	1.152	0.591	880.647	116.728	434.015	9.850	1.548
931	501	1	82.00	7	0.15	500	7	41.655	13.405	19.090	1.116	0.470	1018.992	130.315	495.512	10.954	1.682
932	501	1	82.50	7.5	0.15	500	7.5	40.486	13.142	18.621	1.121	0.432	1086.975	136.989	525.037	11.471	1.751
933	501	1	83.00	8	0.15	500	8	39.400	12.876	18.185	1.124	0.403	1154.346	143.357	554.007	11.929	1.823
934	501	1	84.00	9	0.15	500	9	37.474	12.184	17.364	1.125	0.355	1287.252	155.453	609.850	12.859	1.971
935	501	1	85.00	10	0.15	500	10	35.844	11.689	16.617	1.120	0.315	1417.789	166.840	663.009	13.696	2.123
937	751	1	112.75	0.25	0.15	750	0.25	177.018	36.031	128.299	1.690	18.995	31.170	9.718	21.707	0.570	7.812
938	751	1	113.00	0.5	0.15	750	0.5	218.418	39.857	136.930	2.352	11.540	65.493	14.451	39.569	0.969	5.900
939	751	1	113.25	0.75	0.15	750	0.75	192.931	34.382	114.425	2.339	6.996	121.222	22.083	71.003	1.554	5.466
940	751	1	113.50	1	0.15	750	1	162.881	28.768	94.487	2.155	4.856	178.238	30.491	102.396	2.255	5.252
941	751	1	113.75	1.25	0.15	750	1.25	140.036	24.734	80.006	1.993	3.835	235.373	39.082	133.493	2.950	4.972
942	751	1	114.50	2	0.15	750	2	99.927	19.237	54.299	1.708	2.709	399.639	62.137	222.741	4.893	3.989



STP-PT-074: Local Stress in Nozzles, Shells and Formed Heads from External Heads

Model								Secondary (outside) Stress Factors									
	OD	T	od	t	d/D	D/T	t/T	Branch					Header				
								Axial	In-Plane	Out-of-Plane	Torsional	Pressure	Axial	In-Plane	Out-of-Plane	Torsional	Pressure
943	751	1	115.00	2.5	0.15	750	2.5	87.886	18.759	45.659	1.615	2.302	505.440	75.766	279.867	6.066	3.424
944	751	1	115.50	3	0.15	750	3	81.319	19.481	40.517	1.547	1.967	609.545	88.386	335.736	7.159	2.997
945	751	1	116.50	4	0.15	750	4	74.980	20.530	35.628	1.453	1.443	814.353	112.477	444.380	9.171	2.415
946	751	1	117.50	5	0.15	750	5	71.300	20.922	33.677	1.405	1.072	1015.047	135.838	549.019	11.012	2.014
947	751	1	118.50	6	0.15	750	6	68.122	20.772	32.594	1.348	0.808	1212.752	157.805	650.160	12.718	1.737
948	751	1	119.50	7	0.15	750	7	65.112	20.283	31.727	1.307	0.620	1407.271	178.250	748.062	14.271	1.733
949	751	1	120.00	7.5	0.15	750	7.5	63.671	20.008	31.304	1.286	0.547	1503.558	187.898	795.717	14.988	1.798
950	751	1	120.50	8	0.15	750	8	62.265	19.697	30.861	1.267	0.485	1598.982	197.543	842.596	15.681	1.864
951	751	1	121.50	9	0.15	750	9	59.632	19.029	29.979	1.232	0.411	1788.187	215.825	933.757	17.004	2.003
952	751	1	122.50	10	0.15	750	10	57.286	18.342	29.092	1.199	0.365	1974.595	233.091	1022.391	18.239	2.146
954	1001	1	150.25	0.25	0.15	1000	0.25	230.079	42.791	169.977	2.047	22.110	38.390	11.337	27.329	0.670	8.771
955	1001	1	150.50	0.5	0.15	1000	0.5	281.036	48.667	180.849	2.875	13.429	82.077	17.110	51.130	1.120	6.605
956	1001	1	150.75	0.75	0.15	1000	0.75	245.647	41.728	150.356	2.810	8.088	152.211	26.004	92.232	1.832	6.140
957	1001	1	151.00	1	0.15	1000	1	205.962	34.813	123.742	2.546	5.564	223.232	36.390	133.102	2.664	5.926
958	1001	1	151.25	1.25	0.15	1000	1.25	176.067	29.849	104.608	2.324	4.371	293.879	46.631	173.791	3.470	5.632
959	1001	1	152.00	2	0.15	1000	2	125.230	23.650	70.402	1.960	3.101	497.475	73.694	289.102	5.748	4.576
960	1001	1	152.50	2.5	0.15	1000	2.5	111.006	23.581	59.334	1.866	2.660	628.835	89.588	363.717	7.094	3.945
961	1001	1	153.00	3	0.15	1000	3	103.996	24.537	53.099	1.795	2.295	758.858	105.800	437.208	8.383	3.486
962	1001	1	154.00	4	0.15	1000	4	98.510	26.139	47.837	1.682	1.719	1014.193	136.450	580.428	10.780	2.814
963	1001	1	155.00	5	0.15	1000	5	95.754	26.805	46.312	1.594	1.302	1265.711	165.197	719.872	12.998	2.344
964	1001	1	156.00	6	0.15	1000	6	93.020	26.865	45.730	1.535	0.999	1518.768	193.693	858.385	15.192	2.019
965	1001	1	157.00	7	0.15	1000	7	90.061	26.460	45.236	1.474	0.776	1765.164	219.912	990.633	17.144	1.783
966	1001	1	157.50	7.5	0.15	1000	7.5	88.485	26.171	44.962	1.452	0.687	1887.169	232.324	1056.538	18.063	1.794
967	1001	1	158.00	8	0.15	1000	8	86.925	25.832	44.657	1.430	0.610	2008.352	244.772	1120.782	18.952	1.856
968	1001	1	159.00	9	0.15	1000	9	83.850	25.025	43.862	1.389	0.489	2249.517	268.356	1246.973	20.638	1.986
969	1001	1	160.00	10	0.15	1000	10	80.962	24.197	42.998	1.352	0.409	2488.173	290.932	1370.357	22.226	2.121
971	1251	1	187.75	0.25	0.15	1250	0.25	281.575	48.943	210.845	2.392	24.805	44.315	13.032	31.868	0.764	9.600
972	1251	1	188.00	0.5	0.15	1250	0.5	341.109	56.471	224.289	3.353	15.064	97.928	19.438	62.513	1.281	7.234
973	1251	1	188.25	0.75	0.15	1250	0.75	295.669	48.148	185.197	3.231	9.031	181.767	29.891	112.861	2.099	6.757
974	1251	1	188.50	1	0.15	1250	1	246.750	40.035	151.835	2.895	6.175	266.134	42.210	162.751	3.046	6.541
975	1251	1	188.75	1.25	0.15	1250	1.25	209.893	34.404	127.692	2.616	4.828	349.899	53.889	212.256	3.989	6.239
976	1251	1	189.50	2	0.15	1250	2	149.284	27.712	85.994	2.199	3.429	589.938	84.668	353.391	6.539	5.117
977	1251	1	190.00	2.5	0.15	1250	2.5	133.178	28.131	72.704	2.103	2.960	746.289	104.149	445.370	8.074	4.426
978	1251	1	190.50	3	0.15	1250	3	126.021	29.228	65.453	2.045	2.571	900.945	123.308	536.301	9.550	3.923
979	1251	1	191.50	4	0.15	1250	4	121.841	31.132	60.037	1.935	1.952	1203.591	158.671	712.591	12.287	3.167
980	1251	1	192.50	5	0.15	1250	5	120.347	31.973	59.128	1.805	1.498	1503.646	192.005	886.256	14.854	2.633
981	1251	1	193.50	6	0.15	1250	6	118.328	32.079	59.165	1.712	1.165	1800.321	223.943	1055.797	17.259	2.254
982	1251	1	194.50	7	0.15	1250	7	115.607	31.806	59.216	1.645	0.916	2094.129	254.601	1222.819	19.534	2.011

STP-PT-074: Local Stress in Nozzles, Shells and Formed Heads from External Heads

Model								Secondary (outside) Stress Factors									
	OD	T	od	t	d/D	D/T	t/T	Branch					Header				
								Axial	In-Plane	Out-of-Plane	Torsional	Pressure	Axial	In-Plane	Out-of-Plane	Torsional	Pressure
983	1251	1	195.00	7.5	0.15	1250	7.5	114.095	31.556	59.155	1.608	0.816	2239.891	269.363	1304.948	20.599	1.914
984	1251	1	195.50	8	0.15	1250	8	112.474	31.236	58.987	1.582	0.729	2384.388	283.823	1385.216	21.654	1.828
985	1251	1	196.50	9	0.15	1250	9	109.144	30.459	58.523	1.535	0.585	2673.314	311.923	1546.042	23.652	1.928
986	1251	1	197.50	10	0.15	1250	10	105.719	29.590	57.660	1.492	0.476	2959.188	338.996	1701.741	25.551	2.057
988	1501	1	225.25	0.25	0.15	1500	0.25	331.907	55.100	250.912	2.732	27.215	49.949	14.479	36.261	0.845	10.324
989	1501	1	225.50	0.5	0.15	1500	0.5	398.712	63.548	265.943	3.809	16.532	112.963	21.532	73.299	1.417	7.770
990	1501	1	225.75	0.75	0.15	1500	0.75	343.467	53.946	219.290	3.632	9.889	209.539	33.370	132.709	2.348	7.282
991	1501	1	226.00	1	0.15	1500	1	285.448	44.839	179.240	3.224	6.726	306.292	46.953	191.317	3.395	7.066
992	1501	1	226.25	1.25	0.15	1500	1.25	242.235	38.485	150.621	2.894	5.236	401.809	59.957	249.467	4.427	6.757
993	1501	1	227.00	2	0.15	1500	2	172.395	31.594	101.059	2.436	3.716	676.534	94.711	414.515	7.229	5.573
994	1501	1	227.50	2.5	0.15	1500	2.5	154.791	32.534	85.882	2.349	3.221	855.591	116.877	523.674	8.907	4.835
995	1501	1	228.00	3	0.15	1500	3	147.567	33.860	77.662	2.298	2.811	1032.053	138.135	630.246	10.535	4.293
996	1501	1	229.00	4	0.15	1500	4	144.877	35.865	72.218	2.194	2.154	1379.995	177.607	839.391	13.555	3.469
997	1501	1	230.00	5	0.15	1500	5	144.914	36.694	72.068	2.061	1.669	1724.476	214.926	1045.038	16.394	2.878
998	1501	1	231.00	6	0.15	1500	6	143.829	36.826	72.875	1.915	1.310	2065.615	250.901	1247.037	19.086	2.485
999	1501	1	232.00	7	0.15	1500	7	141.501	36.485	73.448	1.811	1.042	2403.652	285.228	1445.489	21.625	2.231
1000	1501	1	232.50	7.5	0.15	1500	7.5	139.985	36.295	73.597	1.787	0.934	2571.654	302.023	1544.320	22.845	2.125
1001	1501	1	233.00	8	0.15	1500	8	138.424	35.971	73.627	1.740	0.836	2739.007	318.406	1640.317	24.032	2.029
1002	1501	1	234.00	9	0.15	1500	9	134.772	35.271	73.317	1.668	0.678	3078.966	352.661	1836.649	26.493	1.883
1003	1501	1	235.00	10	0.15	1500	10	131.183	34.438	72.804	1.623	0.553	3409.887	383.885	2025.359	28.654	1.996
1006	1751	1	263.00	0.5	0.15	1750	0.5	454.222	70.147	307.384	4.246	17.885	127.477	23.413	84.039	1.527	8.258
1007	1751	1	263.25	0.75	0.15	1750	0.75	389.345	59.376	254.342	4.002	10.674	236.110	36.535	153.152	2.569	7.759
1008	1751	1	263.50	1	0.15	1750	1	322.560	49.258	206.047	3.526	7.235	344.572	51.415	219.033	3.704	7.551
1009	1751	1	263.75	1.25	0.15	1750	1.25	273.072	42.327	172.267	3.150	5.610	451.481	65.426	284.591	4.825	7.236
1010	1751	1	264.50	2	0.15	1750	2	194.279	35.230	115.917	2.644	3.973	758.946	104.482	475.639	7.870	5.997
1011	1751	1	265.00	2.5	0.15	1750	2.5	175.415	36.657	98.722	2.598	3.453	959.698	128.903	600.797	9.702	5.205
1012	1751	1	265.50	3	0.15	1750	3	168.444	38.430	89.349	2.580	3.025	1159.043	152.563	720.866	11.517	4.658
1013	1751	1	266.50	4	0.15	1750	4	167.657	40.662	84.355	2.500	2.335	1549.975	196.118	964.074	14.806	3.756
1014	1751	1	267.50	5	0.15	1750	5	169.388	41.439	85.083	2.334	1.823	1937.182	237.142	1201.061	17.894	3.112
1015	1751	1	268.50	6	0.15	1750	6	169.487	41.263	86.755	2.173	1.443	2321.259	276.535	1434.713	20.852	2.729
1016	1751	1	269.50	7	0.15	1750	7	167.664	40.887	87.953	2.006	1.154	2702.904	314.745	1665.594	23.648	2.455
1017	1751	1	270.00	7.5	0.15	1750	7.5	166.289	40.597	88.399	1.935	1.037	2892.060	333.415	1780.432	24.997	2.337
1018	1751	1	270.50	8	0.15	1750	8	164.688	40.243	88.671	1.872	0.934	3081.376	351.734	1894.106	26.338	2.234
1019	1751	1	271.50	9	0.15	1750	9	161.005	39.436	88.650	1.815	0.762	3456.809	387.328	2116.665	28.889	2.053
1020	1751	1	272.50	10	0.15	1750	10	157.246	38.620	88.502	1.755	0.627	3831.273	422.544	2339.014	31.311	1.926
1023	2001	1	300.50	0.5	0.15	2000	0.5	507.990	76.470	347.762	4.655	19.135	141.655	25.267	94.510	1.652	8.736
1024	2001	1	300.75	0.75	0.15	2000	0.75	433.396	64.376	285.085	4.359	11.408	262.035	39.920	171.143	2.779	8.237
1025	2001	1	301.00	1	0.15	2000	1	358.177	53.201	232.401	3.815	7.700	381.985	56.085	246.698	4.023	8.033

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Model								Secondary (outside) Stress Factors									
	OD	T	od	t	d/D	D/T	t/T	Branch					Header				
								Axial	In-Plane	Out-of-Plane	Torsional	Pressure	Axial	In-Plane	Out-of-Plane	Torsional	Pressure
1026	2001	1	301.25	1.25	0.15	2000	1.25	302.728	45.897	194.694	3.395	5.953	499.625	71.356	321.426	5.224	7.710
1027	2001	1	302.00	2	0.15	2000	2	215.553	38.939	130.299	2.856	4.207	839.791	114.025	535.286	8.521	6.426
1028	2001	1	302.50	2.5	0.15	2000	2.5	195.547	40.625	110.721	2.843	3.664	1060.687	140.391	672.569	10.473	5.590
1029	2001	1	303.00	3	0.15	2000	3	188.979	42.662	101.398	2.860	3.219	1277.854	165.076	811.679	12.341	4.969
1030	2001	1	304.00	4	0.15	2000	4	190.221	45.378	96.503	2.795	2.499	1709.430	212.012	1083.487	15.854	4.005
1031	2001	1	305.00	5	0.15	2000	5	193.854	46.170	98.136	2.630	1.962	2136.964	256.459	1350.838	19.181	3.310
1032	2001	1	306.00	6	0.15	2000	6	194.932	45.985	100.629	2.422	1.561	2561.488	298.715	1615.646	22.346	2.929
1033	2001	1	307.00	7	0.15	2000	7	193.873	45.125	102.763	2.260	1.258	2982.646	340.195	1879.759	25.390	2.628
1034	2001	1	307.50	7.5	0.15	2000	7.5	192.597	44.666	103.375	2.163	1.133	3192.638	359.930	2008.768	26.825	2.508
1035	2001	1	308.00	8	0.15	2000	8	191.186	44.307	103.738	2.086	1.025	3401.513	379.673	2133.715	28.265	2.398
1036	2001	1	309.00	9	0.15	2000	9	187.420	43.348	104.099	1.974	0.842	3818.473	418.372	2387.839	31.020	2.206
1037	2001	1	310.00	10	0.15	2000	10	183.314	42.426	104.258	1.891	0.697	4231.746	456.075	2644.052	33.669	2.047
1040	2251	1	338.00	0.5	0.15	2250	0.5	560.330	81.976	387.927	5.061	20.325	155.311	26.865	104.898	1.770	9.160
1041	2251	1	338.25	0.75	0.15	2250	0.75	476.319	69.013	317.733	4.696	12.099	286.907	42.818	190.052	2.989	8.655
1042	2251	1	338.50	1	0.15	2250	1	392.636	57.083	257.764	4.097	8.146	417.790	60.037	273.008	4.305	8.463
1043	2251	1	338.75	1.25	0.15	2250	1.25	331.187	49.364	215.386	3.635	6.276	546.114	76.022	355.243	5.603	8.130
1044	2251	1	339.50	2	0.15	2250	2	236.092	42.613	144.436	3.080	4.424	916.741	123.156	593.478	9.149	6.805
1045	2251	1	340.00	2.5	0.15	2250	2.5	214.733	44.192	123.030	3.100	3.859	1156.228	150.925	747.281	11.184	5.925
1046	2251	1	340.50	3	0.15	2250	3	209.137	46.627	112.850	3.124	3.395	1394.330	177.567	897.982	13.168	5.266
1047	2251	1	341.50	4	0.15	2250	4	212.526	49.818	108.595	3.087	2.648	1861.791	226.667	1199.823	16.818	4.237
1048	2251	1	342.50	5	0.15	2250	5	217.997	50.859	111.208	2.934	2.089	2327.513	273.931	1497.142	20.416	3.514
1049	2251	1	343.50	6	0.15	2250	6	220.475	50.526	114.676	2.714	1.670	2792.918	319.245	1792.875	23.762	3.103
1050	2251	1	344.50	7	0.15	2250	7	220.093	49.621	117.279	2.520	1.351	3254.472	363.322	2083.307	26.954	2.789
1051	2251	1	345.00	7.5	0.15	2250	7.5	218.833	49.017	118.098	2.417	1.221	3480.851	384.810	2228.327	28.573	2.673
1052	2251	1	345.50	8	0.15	2250	8	217.464	48.451	118.897	2.319	1.107	3710.250	405.697	2371.004	30.075	2.541
1053	2251	1	346.50	9	0.15	2250	9	213.903	47.155	119.798	2.141	0.914	4175.091	450.909	2663.873	33.401	2.356
1054	2251	1	347.50	10	0.15	2250	10	209.711	46.099	120.073	2.028	0.761	4622.396	490.010	2938.054	36.093	2.194
1057	2501	1	375.50	0.5	0.15	2500	0.5	610.931	87.525	424.995	5.423	21.440	168.074	28.433	114.151	1.871	9.551
1058	2501	1	375.75	0.75	0.15	2500	0.75	517.493	73.575	347.696	5.021	12.758	310.781	45.415	207.450	3.185	9.058
1059	2501	1	376.00	1	0.15	2500	1	426.051	60.770	285.679	4.360	8.568	452.381	63.324	301.929	4.586	8.857
1060	2501	1	376.25	1.25	0.15	2500	1.25	358.856	52.808	236.176	3.864	6.579	590.182	81.350	388.718	5.962	8.537
1061	2501	1	377.00	2	0.15	2500	2	256.008	46.064	158.388	3.297	4.625	987.653	130.631	648.894	9.632	7.147
1062	2501	1	377.50	2.5	0.15	2500	2.5	233.994	47.686	135.096	3.342	4.038	1248.806	160.527	818.295	11.838	6.236
1063	2501	1	378.00	3	0.15	2500	3	228.766	50.532	124.484	3.383	3.558	1506.847	188.989	986.567	13.957	5.566
1064	2501	1	379.00	4	0.15	2500	4	234.582	54.124	120.482	3.367	2.786	2016.068	243.939	1317.804	18.006	4.467
1065	2501	1	380.00	5	0.15	2500	5	242.215	55.368	124.378	3.216	2.206	2518.370	291.684	1644.469	21.602	3.725
1066	2501	1	381.00	6	0.15	2500	6	246.177	55.134	128.264	3.006	1.770	3019.068	340.224	1957.464	25.165	3.285
1067	2501	1	382.00	7	0.15	2500	7	246.469	54.058	132.255	2.761	1.439	3517.026	387.584	2288.119	28.672	2.945

STP-PT-074: Local Stress in Nozzles, Shells and Formed Heads from External Heads

Model								Secondary (outside) Stress Factors									
	OD	T	od	t	d/D	D/T	t/T	Branch					Header				
								Axial	In-Plane	Out-of-Plane	Torsional	Pressure	Axial	In-Plane	Out-of-Plane	Torsional	Pressure
1068	2501	1	382.50	7.5	0.15	2500	7.5	245.556	53.288	133.409	2.673	1.304	3767.037	409.429	2447.927	30.247	2.811
1069	2501	1	383.00	8	0.15	2500	8	244.296	52.579	134.429	2.568	1.184	4011.498	432.446	2605.591	31.871	2.689
1070	2501	1	384.00	9	0.15	2500	9	240.601	51.030	135.958	2.372	0.983	4502.120	476.409	2925.422	35.085	2.484
1071	2501	1	385.00	10	0.15	2500	10	236.343	49.566	136.203	2.199	0.822	4990.058	519.290	3225.943	38.108	2.301
1072	9	1	1.70	0.1	0.2	8	0.1	1.702	1.418	1.439	0.981	1.623	0.469	0.168	0.169	0.073	0.972
1073	9	1	1.85	0.25	0.2	8	0.25	2.107	1.459	1.497	1.017	0.670	1.029	0.356	0.355	0.153	0.863
1074	9	1	2.10	0.5	0.2	8	0.5	2.444	1.392	1.469	0.990	0.482	1.683	0.563	0.608	0.238	0.784
1075	9	1	2.35	0.75	0.2	8	0.75	2.528	1.294	1.391	0.948	0.431	2.155	0.710	0.814	0.294	0.757
1076	9	1	2.60	1	0.2	8	1	2.491	1.208	1.313	0.907	0.391	2.559	0.837	0.997	0.341	0.770
1077	9	1	2.85	1.25	0.2	8	1.25	2.494	1.149	1.250	0.903	0.309	3.259	0.987	1.233	0.382	0.782
1089	17	1	3.30	0.1	0.2	16	0.1	2.731	1.893	2.157	0.976	1.846	0.906	0.355	0.368	0.081	1.518
1090	17	1	3.45	0.25	0.2	16	0.25	4.291	2.261	2.708	1.015	1.105	1.805	0.688	0.697	0.186	1.242
1091	17	1	3.70	0.5	0.2	16	0.5	5.445	2.230	2.782	0.995	0.778	2.981	1.098	1.242	0.330	1.027
1092	17	1	3.95	0.75	0.2	16	0.75	5.700	2.027	2.567	0.972	0.700	4.367	1.440	1.786	0.438	0.941
1093	17	1	4.20	1	0.2	16	1	5.579	1.820	2.321	0.954	0.683	5.883	1.722	2.236	0.520	0.873
1094	17	1	4.45	1.25	0.2	16	1.25	5.604	1.655	2.110	0.952	0.603	7.819	1.993	2.743	0.585	0.867
1095	17	1	5.20	2	0.2	16	2	5.107	1.315	1.668	0.905	0.371	12.930	2.669	4.037	0.733	0.890
1096	17	1	5.70	2.5	0.2	16	2.5	4.670	1.198	1.510	0.861	0.264	15.710	3.037	4.843	0.816	0.898
1097	17	1	6.20	3	0.2	16	3	4.257	1.124	1.415	0.954	0.203	18.056	3.377	5.662	0.899	0.901
1106	25	1	4.90	0.1	0.2	24	0.1	3.757	2.386	2.930	0.972	1.906	1.269	0.558	0.610	0.088	1.919
1107	25	1	5.05	0.25	0.2	24	0.25	6.659	3.142	4.192	1.009	1.539	2.440	1.013	1.114	0.201	1.629
1108	25	1	5.30	0.5	0.2	24	0.5	8.630	3.132	4.423	1.000	0.914	3.957	1.572	1.881	0.375	1.302
1109	25	1	5.55	0.75	0.2	24	0.75	8.973	2.785	4.037	0.985	0.788	6.625	2.115	2.847	0.523	1.121
1110	25	1	5.80	1	0.2	24	1	8.697	2.445	3.585	0.986	0.789	9.311	2.598	3.688	0.644	1.019
1111	25	1	6.05	1.25	0.2	24	1.25	8.625	2.184	3.220	0.988	0.740	12.554	3.050	4.574	0.746	0.930
1112	25	1	6.80	2	0.2	24	2	7.799	1.620	2.416	0.948	0.533	21.279	4.075	6.699	0.954	0.929
1113	25	1	7.30	2.5	0.2	24	2.5	7.184	1.406	2.090	0.908	0.407	26.349	4.572	7.926	1.054	0.948
1114	25	1	7.80	3	0.2	24	3	6.616	1.270	1.867	0.879	0.315	30.807	4.973	9.083	1.139	0.960
1115	25	1	8.80	4	0.2	24	4	5.703	1.117	1.612	0.895	0.207	38.408	5.689	11.406	1.301	0.976
1123	33	1	6.50	0.1	0.2	32	0.1	4.773	2.860	3.706	0.968	2.407	1.564	0.747	0.851	0.098	2.269
1124	33	1	6.65	0.25	0.2	32	0.25	9.112	4.013	5.780	0.999	2.240	2.964	1.310	1.521	0.208	1.981
1125	33	1	6.90	0.5	0.2	32	0.5	11.890	4.022	6.197	0.993	1.368	5.101	1.998	2.510	0.401	1.603
1126	33	1	7.15	0.75	0.2	32	0.75	12.228	3.507	5.620	0.988	0.947	8.853	2.733	3.938	0.574	1.374
1127	33	1	7.40	1	0.2	32	1	11.733	3.024	4.950	0.999	0.833	12.676	3.401	5.212	0.725	1.199
1128	33	1	7.65	1.25	0.2	32	1.25	11.492	2.667	4.428	1.005	0.809	17.253	4.050	6.557	0.864	1.062
1129	33	1	8.40	2	0.2	32	2	10.189	1.984	3.276	0.984	0.637	29.656	5.489	9.735	1.147	0.942
1130	33	1	8.90	2.5	0.2	32	2.5	9.376	1.706	2.791	0.962	0.510	36.920	6.155	11.473	1.271	0.964
1131	33	1	9.40	3	0.2	32	3	8.651	1.512	2.444	0.936	0.403	43.522	6.695	13.061	1.369	0.988

STP-PT-074: Local Stress in Nozzles, Shells and Formed Heads from External Heads

Model								Secondary (outside) Stress Factors									
	OD	T	od	t	d/D	D/T	t/T	Branch					Header				
								Axial	In-Plane	Out-of-Plane	Torsional	Pressure	Axial	In-Plane	Out-of-Plane	Torsional	Pressure
1132	33	1	10.40	4	0.2	32	4	7.471	1.271	2.009	0.890	0.283	55.216	7.636	16.098	1.544	1.014
1133	33	1	11.40	5	0.2	32	5	6.652	1.127	1.771	0.859	0.205	65.125	8.465	19.097	1.705	1.029
1134	33	1	12.40	6	0.2	32	6	6.052	1.059	1.644	0.902	0.155	73.532	9.186	22.174	1.875	1.033
1140	41	1	8.10	0.1	0.2	40	0.1	5.787	3.306	4.481	0.964	3.005	1.826	0.922	1.080	0.108	2.592
1141	41	1	8.25	0.25	0.2	40	0.25	11.614	4.851	7.422	0.987	2.899	3.481	1.586	1.887	0.212	2.297
1142	41	1	8.50	0.5	0.2	40	0.5	15.183	4.875	8.026	0.982	1.797	6.274	2.379	3.131	0.418	1.862
1143	41	1	8.75	0.75	0.2	40	0.75	15.443	4.189	7.249	0.991	1.233	11.041	3.296	5.034	0.608	1.616
1144	41	1	9.00	1	0.2	40	1	14.679	3.575	6.357	1.010	0.958	15.997	4.149	6.782	0.782	1.426
1145	41	1	9.25	1.25	0.2	40	1.25	14.215	3.178	5.671	1.022	0.839	21.778	4.961	8.587	0.944	1.206
1146	41	1	10.00	2	0.2	40	2	12.350	2.352	4.175	1.019	0.701	37.834	6.847	12.989	1.306	0.947
1147	41	1	10.50	2.5	0.2	40	2.5	11.304	2.013	3.540	1.005	0.582	47.315	7.732	15.356	1.465	0.969
1148	41	1	11.00	3	0.2	40	3	10.429	1.775	3.081	0.984	0.474	56.043	8.502	17.477	1.585	0.990
1149	41	1	12.00	4	0.2	40	4	9.027	1.465	2.472	0.934	0.337	71.838	9.708	21.377	1.783	1.032
1150	41	1	13.00	5	0.2	40	5	8.025	1.283	2.114	0.894	0.252	85.540	10.655	25.039	1.947	1.057
1151	41	1	14.00	6	0.2	40	6	7.280	1.177	1.901	0.888	0.193	97.732	11.530	28.718	2.113	1.074
1152	41	1	15.00	7	0.2	40	7	6.750	1.132	1.771	0.885	0.153	108.217	12.417	32.384	2.276	1.084
1153	41	1	15.50	7.5	0.2	40	7.5	6.528	1.124	1.726	0.892	0.138	113.096	12.880	34.287	2.364	1.085
1157	51	1	10.10	0.1	0.2	50	0.1	7.047	3.822	5.441	0.958	3.719	2.117	1.120	1.372	0.117	2.961
1158	51	1	10.25	0.25	0.2	50	0.25	14.763	5.843	9.517	0.972	3.663	4.174	1.898	2.355	0.219	2.647
1159	51	1	10.50	0.5	0.2	50	0.5	19.295	5.888	10.352	0.969	2.286	7.703	2.808	3.892	0.430	2.138
1160	51	1	10.75	0.75	0.2	50	0.75	19.384	4.997	9.305	0.991	1.553	13.701	3.936	6.395	0.637	1.873
1161	51	1	11.00	1	0.2	50	1	18.229	4.277	8.129	1.012	1.198	20.026	5.000	8.756	0.832	1.672
1162	51	1	11.25	1.25	0.2	50	1.25	17.438	3.787	7.236	1.030	0.954	27.280	6.013	11.182	1.019	1.438
1163	51	1	12.00	2	0.2	50	2	14.806	2.790	5.308	1.048	0.748	47.636	8.456	17.221	1.467	1.026
1164	51	1	12.50	2.5	0.2	50	2.5	13.450	2.428	4.495	1.039	0.640	59.800	9.740	20.484	1.670	0.971
1165	51	1	13.00	3	0.2	50	3	12.372	2.166	3.904	1.026	0.537	71.100	10.770	23.381	1.827	0.993
1166	51	1	14.00	4	0.2	50	4	10.739	1.802	3.110	0.983	0.383	91.629	12.356	28.491	2.056	1.034
1167	51	1	15.00	5	0.2	50	5	9.515	1.563	2.607	0.938	0.294	110.084	13.520	33.160	2.240	1.076
1168	51	1	16.00	6	0.2	50	6	8.630	1.398	2.291	0.902	0.231	126.723	14.694	37.631	2.409	1.101
1169	51	1	17.00	7	0.2	50	7	7.978	1.298	2.078	0.877	0.185	141.881	15.791	42.086	2.586	1.119
1170	51	1	17.50	7.5	0.2	50	7.5	7.713	1.265	2.004	0.887	0.168	148.896	16.301	44.321	2.682	1.125
1171	51	1	18.00	8	0.2	50	8	7.460	1.235	1.933	0.860	0.151	155.621	16.805	46.582	2.776	1.130
1172	51	1	19.00	9	0.2	50	9	7.048	1.202	1.836	0.863	0.127	168.162	17.775	51.175	2.970	1.134
1174	61	1	12.10	0.1	0.2	60	0.1	8.295	4.296	6.395	0.952	4.396	2.400	1.298	1.652	0.123	3.297
1175	61	1	12.25	0.25	0.2	60	0.25	17.889	6.770	11.629	0.959	4.366	4.820	2.180	2.808	0.230	2.956
1176	61	1	12.50	0.5	0.2	60	0.5	23.360	6.837	12.698	0.970	2.731	9.094	3.193	4.648	0.448	2.373
1177	61	1	12.75	0.75	0.2	60	0.75	23.219	5.765	11.366	0.994	1.837	16.268	4.515	7.743	0.657	2.092
1178	61	1	13.00	1	0.2	60	1	21.630	4.944	9.899	1.012	1.407	23.896	5.771	10.721	0.866	1.884

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Model								Secondary (outside) Stress Factors									
	OD	T	od	t	d/D	D/T	t/T	Branch					Header				
								Axial	In-Plane	Out-of-Plane	Torsional	Pressure	Axial	In-Plane	Out-of-Plane	Torsional	Pressure
1179	61	1	13.25	1.25	0.2	60	1.25	20.481	4.357	8.793	1.027	1.124	32.529	6.987	13.781	1.075	1.642
1180	61	1	14.00	2	0.2	60	2	17.050	3.264	6.432	1.062	0.773	56.921	10.057	21.541	1.597	1.142
1181	61	1	14.50	2.5	0.2	60	2.5	15.382	2.857	5.445	1.060	0.676	71.627	11.660	25.782	1.842	0.972
1182	61	1	15.00	3	0.2	60	3	14.091	2.565	4.728	1.052	0.580	85.373	12.968	29.545	2.035	0.994
1183	61	1	16.00	4	0.2	60	4	12.213	2.153	3.766	1.021	0.418	110.685	14.974	36.144	2.319	1.036
1184	61	1	17.00	5	0.2	60	5	10.861	1.871	3.151	0.977	0.324	133.676	16.614	41.991	2.530	1.072
1185	61	1	18.00	6	0.2	60	6	9.817	1.665	2.729	0.938	0.258	154.711	18.068	47.423	2.719	1.103
1186	61	1	19.00	7	0.2	60	7	8.997	1.515	2.430	0.906	0.210	174.192	19.355	52.702	2.910	1.138
1187	61	1	19.50	7.5	0.2	60	7.5	8.758	1.461	2.339	0.893	0.191	183.201	19.938	55.267	3.011	1.148
1188	61	1	20.00	8	0.2	60	8	8.473	1.414	2.236	0.883	0.174	192.072	20.494	57.892	3.108	1.156
1189	61	1	21.00	9	0.2	60	9	7.980	1.336	2.098	0.886	0.147	208.555	21.565	63.105	3.308	1.189
1190	61	1	22.00	10	0.2	60	10	7.563	1.288	1.975	0.861	0.125	223.949	22.570	68.427	3.519	1.197
1191	71	1	14.10	0.1	0.2	70	0.1	9.521	4.734	7.342	0.949	5.037	2.741	1.461	1.922	0.127	3.608
1192	71	1	14.25	0.25	0.2	70	0.25	20.975	7.643	13.758	0.947	5.019	5.450	2.443	3.254	0.241	3.232
1193	71	1	14.50	0.5	0.2	70	0.5	27.348	7.730	15.048	0.968	3.140	10.424	3.544	5.386	0.470	2.578
1194	71	1	14.75	0.75	0.2	70	0.75	26.946	6.513	13.425	0.993	2.093	18.739	5.042	9.077	0.672	2.283
1195	71	1	15.00	1	0.2	70	1	24.895	5.574	11.660	1.013	1.591	27.612	6.477	12.674	0.894	2.070
1196	71	1	15.25	1.25	0.2	70	1.25	23.367	4.894	10.337	1.027	1.274	37.547	7.887	16.371	1.119	1.822
1197	71	1	16.00	2	0.2	70	2	19.136	3.713	7.537	1.065	0.796	65.519	11.569	25.804	1.684	1.250
1198	71	1	16.50	2.5	0.2	70	2.5	17.152	3.266	6.380	1.074	0.700	82.819	13.478	31.165	1.988	1.059
1199	71	1	17.00	3	0.2	70	3	15.649	2.946	5.542	1.067	0.609	98.944	15.065	35.882	2.219	0.993
1200	71	1	18.00	4	0.2	70	4	13.520	2.501	4.420	1.048	0.453	128.766	17.606	44.108	2.557	1.036
1201	71	1	19.00	5	0.2	70	5	12.043	2.186	3.702	1.010	0.345	156.055	19.787	51.274	2.809	1.074
1202	71	1	20.00	6	0.2	70	6	10.926	1.953	3.199	0.971	0.278	180.789	21.402	57.638	3.007	1.115
1203	71	1	21.00	7	0.2	70	7	10.016	1.762	2.828	0.936	0.229	204.209	22.862	63.812	3.212	1.247
1204	71	1	21.50	7.5	0.2	70	7.5	9.669	1.682	2.709	0.922	0.208	215.228	23.531	66.789	3.316	1.275
1205	71	1	22.00	8	0.2	70	8	9.366	1.626	2.586	0.908	0.192	226.040	24.167	69.786	3.437	1.325
1206	71	1	23.00	9	0.2	70	9	8.811	1.522	2.390	0.887	0.163	246.513	25.340	75.718	3.670	1.403
1207	71	1	24.00	10	0.2	70	10	8.371	1.435	2.242	0.872	0.139	265.591	26.422	81.644	3.900	1.452
1208	81	1	16.10	0.1	0.2	80	0.1	10.719	5.137	8.277	0.946	5.647	3.080	1.610	2.187	0.130	3.899
1209	81	1	16.25	0.25	0.2	80	0.25	23.996	8.457	15.877	0.941	5.626	6.078	2.686	3.675	0.252	3.483
1210	81	1	16.50	0.5	0.2	80	0.5	31.264	8.570	17.411	0.965	3.520	11.710	3.867	6.120	0.487	2.761
1211	81	1	16.75	0.75	0.2	80	0.75	30.557	7.233	15.469	0.991	2.328	21.106	5.525	10.388	0.684	2.453
1212	81	1	17.00	1	0.2	80	1	28.037	6.170	13.407	1.011	1.757	31.167	7.135	14.602	0.917	2.237
1213	81	1	17.25	1.25	0.2	80	1.25	26.118	5.404	11.862	1.028	1.407	42.333	8.726	18.936	1.156	1.986
1214	81	1	18.00	2	0.2	80	2	21.085	4.139	8.624	1.062	0.861	73.875	12.976	30.150	1.777	1.370
1215	81	1	18.50	2.5	0.2	80	2.5	18.801	3.654	7.294	1.079	0.720	93.221	15.197	36.479	2.098	1.146
1216	81	1	19.00	3	0.2	80	3	17.099	3.313	6.341	1.081	0.632	111.512	17.046	42.165	2.361	0.993



STP-PT-074: Local Stress in Nozzles, Shells and Formed Heads from External Heads

Model								Secondary (outside) Stress Factors									
	OD	T	od	t	d/D	D/T	t/T	Branch					Header				
								Axial	In-Plane	Out-of-Plane	Torsional	Pressure	Axial	In-Plane	Out-of-Plane	Torsional	Pressure
1217	81	1	20.00	4	0.2	80	4	14.720	2.838	5.066	1.065	0.479	145.535	20.203	52.100	2.757	1.037
1218	81	1	21.00	5	0.2	80	5	13.100	2.499	4.250	1.037	0.363	176.869	22.794	60.711	3.065	1.076
1219	81	1	22.00	6	0.2	80	6	11.886	2.241	3.680	1.000	0.295	206.083	24.877	68.484	3.336	1.206
1220	81	1	23.00	7	0.2	80	7	10.971	2.028	3.272	0.964	0.243	233.367	26.616	75.688	3.579	1.355
1221	81	1	23.50	7.5	0.2	80	7.5	10.575	1.937	3.103	0.948	0.223	246.379	27.377	79.158	3.698	1.421
1222	81	1	24.00	8	0.2	80	8	10.173	1.852	2.946	0.934	0.204	259.066	28.076	82.589	3.816	1.482
1223	81	1	25.00	9	0.2	80	9	9.585	1.723	2.722	0.909	0.175	283.256	29.420	89.309	4.065	1.587
1224	81	1	26.00	10	0.2	80	10	9.097	1.618	2.533	0.889	0.152	306.092	30.609	95.949	4.312	1.646
1225	91	1	18.10	0.1	0.2	90	0.1	11.900	5.514	9.217	0.943	6.226	3.397	1.747	2.459	0.131	4.172
1226	91	1	18.25	0.25	0.2	90	0.25	26.961	9.222	18.001	0.937	6.197	6.716	2.912	4.141	0.263	3.711
1227	91	1	18.50	0.5	0.2	90	0.5	35.088	9.364	19.765	0.975	3.875	12.939	4.169	6.836	0.502	2.926
1228	91	1	18.75	0.75	0.2	90	0.75	34.067	7.928	17.507	1.023	2.545	23.390	5.971	11.688	0.712	2.607
1229	91	1	19.00	1	0.2	90	1	31.066	6.747	15.139	1.022	1.908	34.606	7.775	16.520	0.959	2.390
1230	91	1	19.25	1.25	0.2	90	1.25	28.752	5.904	13.369	1.026	1.528	46.944	9.572	21.483	1.209	2.136
1231	91	1	20.00	2	0.2	90	2	22.938	4.549	9.693	1.057	0.946	81.865	14.320	34.480	1.872	1.495
1232	91	1	20.50	2.5	0.2	90	2.5	20.361	4.027	8.196	1.078	0.743	103.400	16.823	41.909	2.234	1.233
1233	91	1	21.00	3	0.2	90	3	18.460	3.666	7.125	1.087	0.652	123.789	19.032	48.601	2.536	1.060
1234	91	1	22.00	4	0.2	90	4	15.849	3.166	5.707	1.075	0.503	161.911	22.864	60.360	3.008	1.036
1235	91	1	23.00	5	0.2	90	5	14.091	2.812	4.801	1.057	0.386	197.213	25.892	70.550	3.373	1.104
1236	91	1	24.00	6	0.2	90	6	12.817	2.530	4.173	1.025	0.307	230.245	28.345	79.668	3.677	1.276
1237	91	1	25.00	7	0.2	90	7	11.838	2.302	3.714	0.991	0.256	261.328	30.365	88.053	3.945	1.438
1238	91	1	25.50	7.5	0.2	90	7.5	11.404	2.209	3.521	0.973	0.235	276.233	31.259	92.059	4.078	1.513
1239	91	1	26.00	8	0.2	90	8	11.020	2.109	3.355	0.959	0.216	290.685	32.090	95.958	4.209	1.583
1240	91	1	27.00	9	0.2	90	9	10.347	1.940	3.062	0.932	0.185	318.465	33.540	103.556	4.458	1.706
1241	91	1	28.00	10	0.2	90	10	9.851	1.817	2.859	0.909	0.160	344.842	34.898	110.987	4.725	1.809
1242	101	1	20.10	0.1	0.2	100	0.1	13.044	5.863	10.134	0.939	6.782	3.722	1.876	2.700	0.131	4.429
1243	101	1	20.25	0.25	0.2	100	0.25	29.892	9.951	20.153	0.935	6.736	7.250	3.125	4.477	0.273	3.923
1244	101	1	20.50	0.5	0.2	100	0.5	38.822	10.112	22.110	1.002	4.209	14.142	4.447	7.553	0.514	3.078
1245	101	1	20.75	0.75	0.2	100	0.75	37.490	8.593	19.541	1.056	2.748	25.627	6.401	12.995	0.741	2.751
1246	101	1	21.00	1	0.2	100	1	34.010	7.292	16.863	1.054	2.048	37.947	8.376	18.433	1.005	2.531
1247	101	1	21.25	1.25	0.2	100	1.25	31.300	6.407	14.862	1.042	1.639	51.401	10.381	24.017	1.277	2.274
1248	101	1	22.00	2	0.2	100	2	24.715	4.940	10.746	1.060	1.026	89.542	15.593	38.789	1.996	1.612
1249	101	1	22.50	2.5	0.2	100	2.5	21.847	4.394	9.080	1.073	0.787	113.149	18.459	47.318	2.394	1.317
1250	101	1	23.00	3	0.2	100	3	19.767	4.007	7.899	1.089	0.668	135.582	21.066	55.053	2.731	1.133
1251	101	1	24.00	4	0.2	100	4	16.924	3.489	6.340	1.087	0.523	177.631	25.454	68.695	3.263	1.035
1252	101	1	25.00	5	0.2	100	5	15.047	3.120	5.353	1.070	0.407	216.752	28.934	80.549	3.672	1.158
1253	101	1	26.00	6	0.2	100	6	13.688	2.824	4.665	1.044	0.319	253.500	31.761	91.121	4.012	1.333
1254	101	1	27.00	7	0.2	100	7	12.637	2.575	4.154	1.012	0.265	288.256	34.097	100.796	4.310	1.504