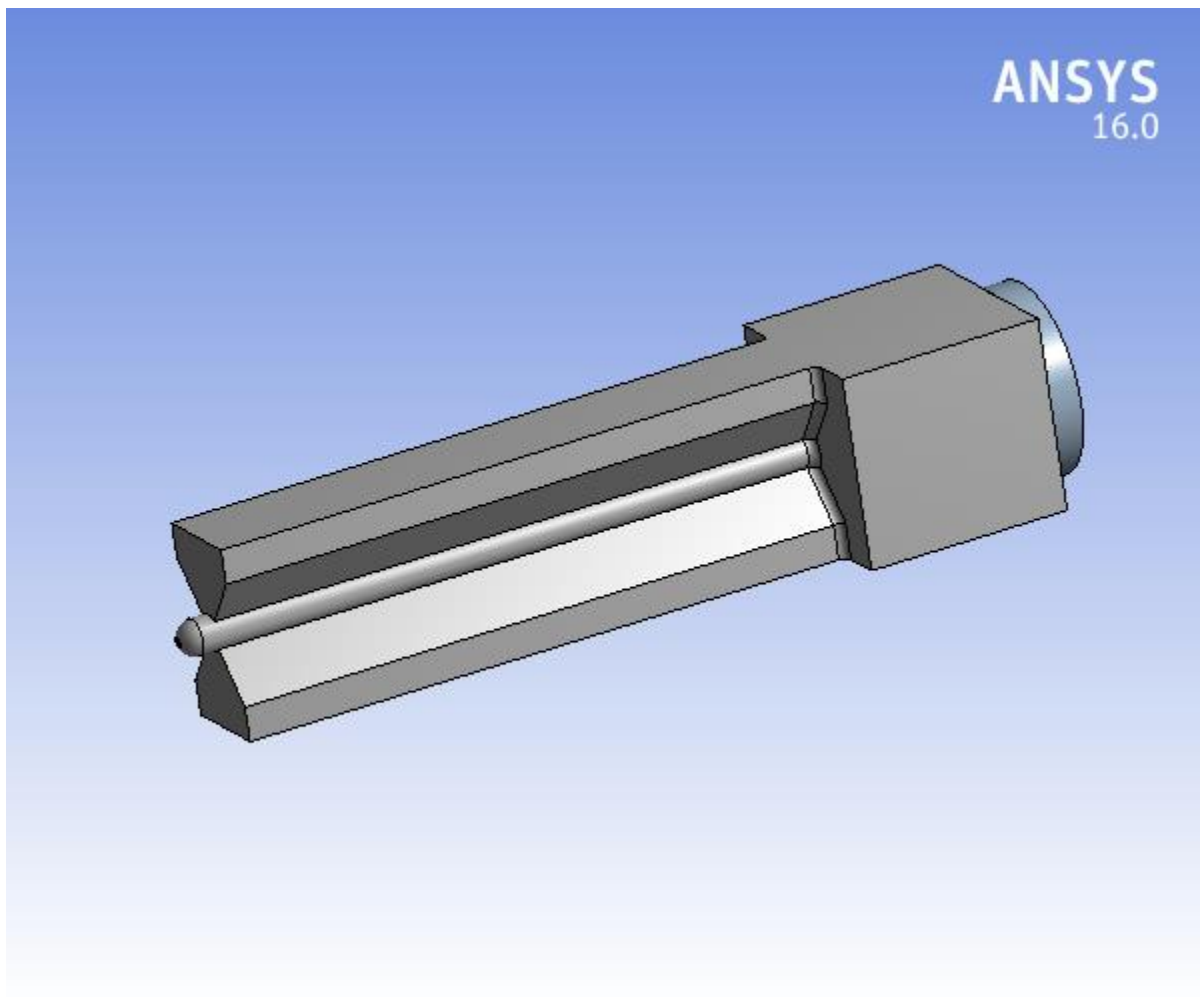




TGT-CALC-16-005

Author	Dave Meekins
Subject	TGT-CALC-16-002
First Saved	Wednesday, July 13, 2016
Last Saved	Monday, July 18, 2016
Product Version	16.0 Release
Save Project Before Solution	No
Save Project After Solution	No



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 - [EL = 0.069*2.72^\(-2.06*\(\(S1+S2+S3\)/\(3*SEQV\)-0.333\)\)](#)
- [Material Data](#)
 - [7075 \(UNS A97075\)](#)

Units

TABLE 1

Unit System	U.S. Customary (in, lbm, lbf, s, V, A) Degrees rad/s Fahrenheit
Angle	Degrees
Rotational Velocity	rad/s
Temperature	Fahrenheit

Comment

Elastic-Plastic model of cell meeting requirements of ASME BPVC VIII D2 Part 5.2.4 and 5.3.3. Note that the applicable Code is ASME B31.3 2014. Section 304.7.2 is used to qualify the pressure design. Design pressure is assumed to be 600 psi. Load conditions assumed in model are 3x design pressure (not 2.4 as given in D2) which is in keeping with the B31.3 Code. Thermal and cyclic analysis has been completed in a screening calculation and is included in TGT-CALC-16-003. The solution solves for the loading condition and meets the requirements of protection against local failure with exception of extremely small sections of the mesh which is a feature of the calculation and are sufficiently small in volume that they may be ignored.

Conclusion: Cell is adequate for operations at 600 psi for temperatures near and below 300K

Model (F4)

Geometry

TABLE 2
Model (F4) > Geometry

Object Name	<i>Geometry</i>
State	Fully Defined
Definition	
Source	D:\Meekins\GoogleDrive\ANSYS\E12-14-012_files\dp0\SYS-1\DM\SYS-1.agdb
Type	DesignModeler
Length Unit	Meters
Element Control	Program Controlled
Display Style	Body Color
Bounding Box	
Length X	13.156 in
Length Y	2.7876 in
Length Z	3. in
Properties	
Volume	52.258 in ³
Mass	5.1344 lbm
Scale Factor Value	1.
Statistics	
Bodies	4
Active Bodies	4
Nodes	86899
Elements	54108
Mesh Metric	None
Basic Geometry Options	
Parameters	Yes
Parameter Key	DS
Attributes	No
Named Selections	No
Material Properties	No
Advanced Geometry Options	
Use Associativity	Yes
Coordinate Systems	No
Reader Mode Saves Updated File	No
Use Instances	Yes
Smart CAD Update	No
Compare Parts On Update	No
Attach File Via Temp File	Yes
Temporary Directory	C:\Users\David\AppData\Local\Temp
Analysis Type	3-D
Decompose Disjoint Geometry	Yes
Enclosure and Symmetry Processing	Yes

TABLE 3
Model (F4) > Geometry > Parts

Object Name	<i>main body:1</i>	<i>entrance:1</i>	<i>exit beam:1</i>	<i>ent beam:1</i>
-------------	--------------------	-------------------	--------------------	-------------------

State	Meshed			
Graphics Properties				
Visible	Yes			
Transparency	1			
Definition				
Suppressed	No			
Stiffness Behavior	Flexible			
Coordinate System	Default Coordinate System			
Reference Temperature	By Environment			
Material				
Assignment	7075 (UNS A97075)			
Nonlinear Effects	Yes			
Thermal Strain Effects	No			
Bounding Box				
Length X	12.656 in	3.329 in	1.3991e-002 in	1.1983e-002 in
Length Y	2.7876 in	2.75 in	8.8961e-002 in	8.8945e-002 in
Length Z	3. in	2.75 in	8.8961e-002 in	8.8913e-002 in
Properties				
Volume	48.983 in³	3.2749 in³	7.4871e-005 in³	6.206e-005 in³
Mass	4.8126 lbm	0.32177 lbm	7.3562e-006 lbm	6.0975e-006 lbm
Centroid X	0.49859 in	5.0611 in	-7.494 in	2.3977 in
Centroid Y	3.4577 in			
Centroid Z	1.3328 in			
Moment of Inertia Ip1	6.0674 lbm·in²	0.25323 lbm·in²	7.6636e-009 lbm·in²	6.0227e-009 lbm·in²
Moment of Inertia Ip2	65.536 lbm·in²	0.32838 lbm·in²	3.9255e-009 lbm·in²	3.0641e-009 lbm·in²
Moment of Inertia Ip3	67.19 lbm·in²	0.32838 lbm·in²	3.9258e-009 lbm·in²	3.0641e-009 lbm·in²
Statistics				
Nodes	50539	28778	3975	3607
Elements	32847	18215	1592	1454
Mesh Metric	None			

Coordinate Systems

TABLE 4
Model (F4) > Coordinate Systems > Coordinate System

Object Name	<i>Global Coordinate System</i>
State	Fully Defined
Definition	
Type	Cartesian
Coordinate System ID	0.
Origin	
Origin X	0. in
Origin Y	0. in
Origin Z	0. in
Directional Vectors	
X Axis Data	[1. 0. 0.]
Y Axis Data	[0. 1. 0.]
Z Axis Data	[0. 0. 1.]

Connections

TABLE 5
Model (F4) > Connections

Object Name	<i>Connections</i>
State	Fully Defined
Auto Detection	
Generate Automatic Connection On Refresh	Yes
Transparency	
Enabled	Yes

TABLE 6
Model (F4) > Connections > Contacts

Object Name	<i>Contacts</i>
State	Fully Defined
Definition	
Connection Type	Contact
Scope	
Scoping Method	Geometry Selection
Geometry	All Bodies
Auto Detection	
Tolerance Type	Slider
Tolerance Slider	0.
Tolerance Value	3.4446e-002 in
Use Range	No
Face/Face	Yes
Face/Edge	No
Edge/Edge	No
Priority	Include All
Group By	Bodies
Search Across	Bodies
Statistics	
Connections	3
Active Connections	3

TABLE 7
Model (F4) > Connections > Contacts > Contact Regions

Object Name	Bonded - main body:1 To entrance:1	Bonded - main body:1 To exit beam:1	Bonded - entrance:1 To ent beam:1
State	Fully Defined		
Scope			
Scoping Method	Geometry Selection		
Contact	1 Face		
Target	1 Face		
Contact Bodies	main body:1		entrance:1
Target Bodies	entrance:1	exit beam:1	ent beam:1
Definition			
Type	Bonded		
Scope Mode	Manual		

Behavior	Program Controlled
Trim Contact	Program Controlled
Suppressed	No
Advanced	
Formulation	Program Controlled
Detection Method	Program Controlled
Penetration Tolerance	Program Controlled
Elastic Slip Tolerance	Program Controlled
Normal Stiffness	Program Controlled
Update Stiffness	Program Controlled
Pinball Region	Program Controlled
Geometric Modification	
Contact Geometry Correction	None
Target Geometry Correction	None

Mesh

TABLE 8
Model (F4) > Mesh

Object Name	<i>Mesh</i>
State	Solved
Display	
Display Style	Body Color
Defaults	
Physics Preference	Mechanical
Relevance	0
Sizing	
Use Advanced Size Function	Off
Relevance Center	Medium
Element Size	Default
Initial Size Seed	Active Assembly
Smoothing	High
Transition	Slow
Span Angle Center	Medium
Minimum Edge Length	0.196350 in
Inflation	
Use Automatic Inflation	Program Controlled
Inflation Option	Smooth Transition
Transition Ratio	0.272
Maximum Layers	5
Growth Rate	1.2
Inflation Algorithm	Pre
View Advanced Options	No
Patch Conforming Options	
Triangle Surface Mesher	Program Controlled
Patch Independent Options	
Topology Checking	No

Advanced	
Number of CPUs for Parallel Part Meshing	Program Controlled
Shape Checking	Standard Mechanical
Element Midside Nodes	Program Controlled
Straight Sided Elements	No
Number of Retries	0
Extra Retries For Assembly	Yes
Rigid Body Behavior	Dimensionally Reduced
Mesh Morphing	Disabled
Defeaturing	
Pinch Tolerance	Please Define
Generate Pinch on Refresh	No
Automatic Mesh Based Defeaturing	On
Defeaturing Tolerance	Default
Statistics	
Nodes	86899
Elements	54108
Mesh Metric	None

TABLE 9
Model (F4) > Mesh > Mesh Controls

Object Name	Inflation	Inflation 2	Inflation 3	Inflation 4
State	Fully Defined			
Scope				
Scoping Method	Geometry Selection			
Geometry	1 Body			
Definition				
Suppressed	No			
Boundary Scoping Method	Geometry Selection			
Boundary	1 Face			
Inflation Option	Smooth Transition			
Transition Ratio	Default (0.272)			
Maximum Layers	5			
Growth Rate	1.2			
Inflation Algorithm	Pre			

Static Structural (F5)

TABLE 10
Model (F4) > Analysis

Object Name	<i>Static Structural (F5)</i>
State	Solved
Definition	
Physics Type	Structural
Analysis Type	Static Structural
Solver Target	Mechanical APDL
Options	
Environment Temperature	71.6 °F

Generate Input Only	No
---------------------	----

TABLE 11
Model (F4) > Static Structural (F5) > Analysis Settings

Object Name	Analysis Settings
State	Fully Defined
Step Controls	
Number Of Steps	1.
Current Step Number	1.
Step End Time	1. s
Auto Time Stepping	Program Controlled
Solver Controls	
Solver Type	Program Controlled
Weak Springs	Program Controlled
Solver Pivot Checking	Program Controlled
Large Deflection	On
Inertia Relief	Off
Restart Controls	
Generate Restart Points	Program Controlled
Retain Files After Full Solve	No
Nonlinear Controls	
Newton-Raphson Option	Program Controlled
Force Convergence	Program Controlled
Moment Convergence	Program Controlled
Displacement Convergence	Program Controlled
Rotation Convergence	Program Controlled
Line Search	Program Controlled
Stabilization	Constant
--Method	Energy
--Energy Dissipation Ratio	1.e-004
--Activation For First Substep	No
--Stabilization Force Limit	0.2
Output Controls	
Stress	Yes
Strain	Yes
Nodal Forces	No
Contact Miscellaneous	Yes
General Miscellaneous	No
Store Results At	All Time Points
Analysis Data Management	
Solver Files Directory	D:\Meekins\GoogleDrive\ANSYS\E12-14-012_files\dp0\SYS-3\MECH\
Future Analysis	None
Scratch Solver Files Directory	
Save MAPDL db	No
Delete Unneeded Files	Yes
Nonlinear Solution	Yes
Solver Units	Active System
Solver Unit System	Bin

TABLE 12
Model (F4) > Static Structural (F5) > Loads

Object Name	Fixed Support	Pressure	Pressure 2
State	Fully Defined		
Scope			
Scoping Method	Geometry Selection		
Geometry	1 Face	5 Faces	
Definition			
Type	Fixed Support	Pressure	
Suppressed	No		
Define By		Normal To	
Magnitude		1800. psi (ramped)	

FIGURE 1
Model (F4) > Static Structural (F5) > Pressure

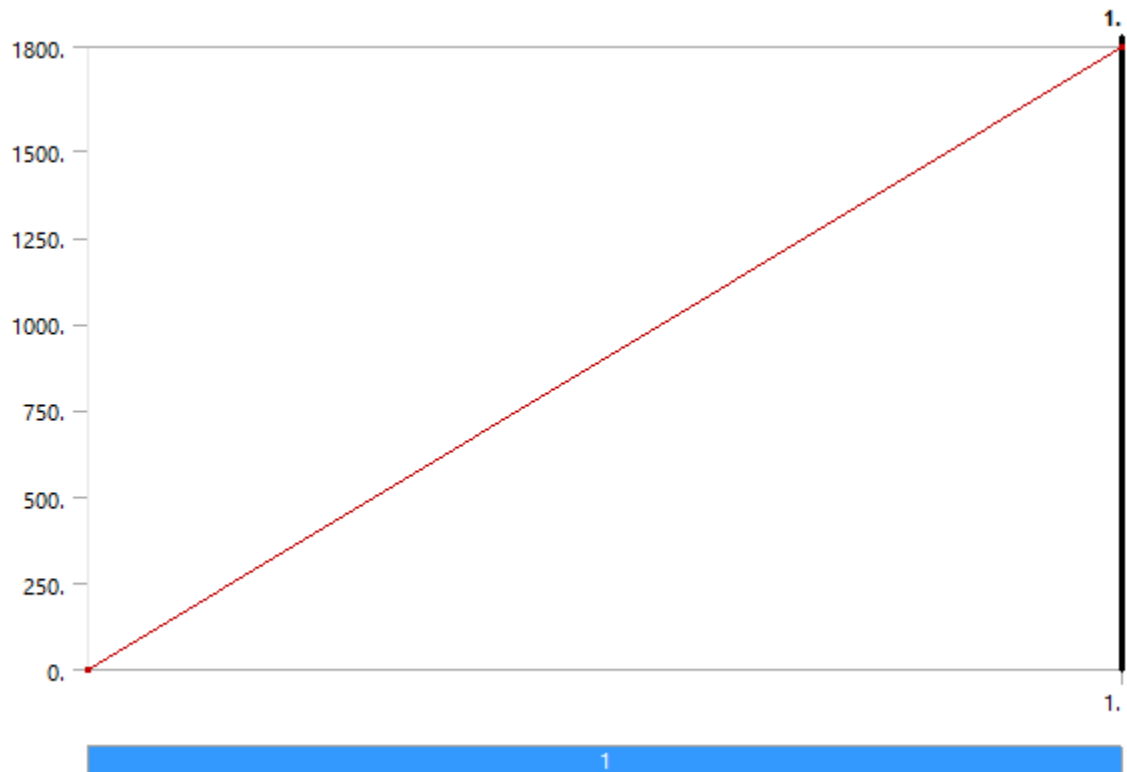


FIGURE 2
Model (F4) > Static Structural (F5) > Pressure > Figure

F: Elastic Plastic

Figure

Time: 1. s

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■ Pressure: 1800. psi

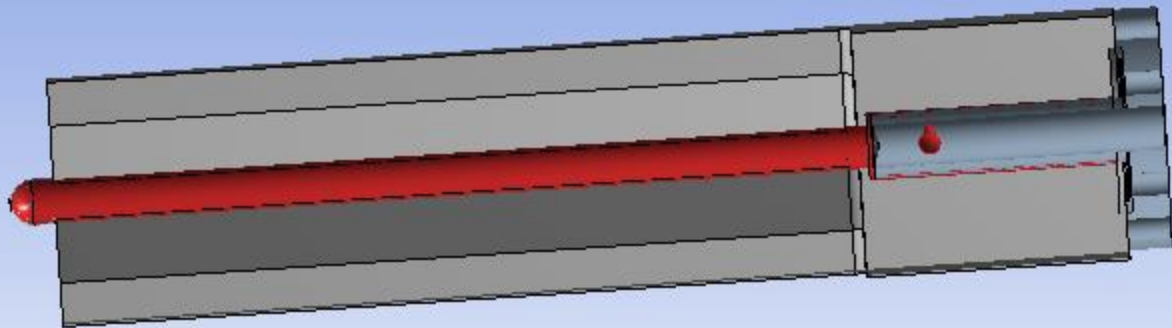


FIGURE 3

Model (F4) > Static Structural (F5) > Pressure 2

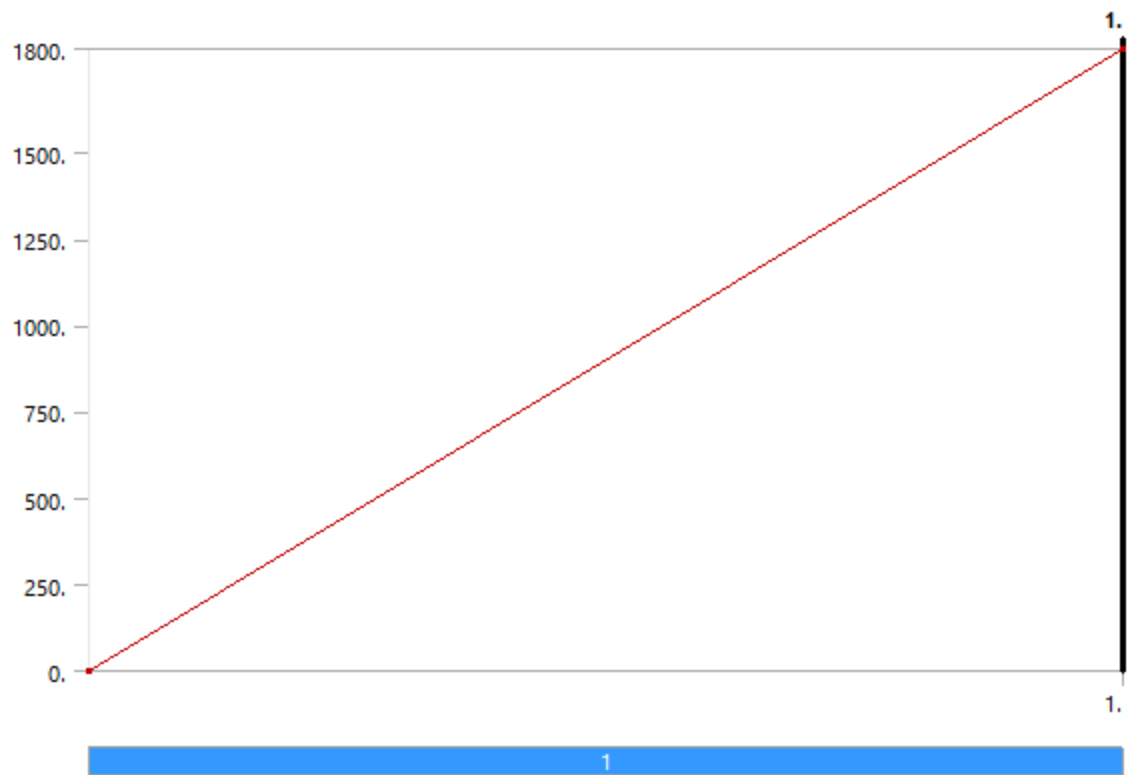


FIGURE 4
Model (F4) > Static Structural (F5) > Pressure 2 > Figure

F: Elastic Plastic

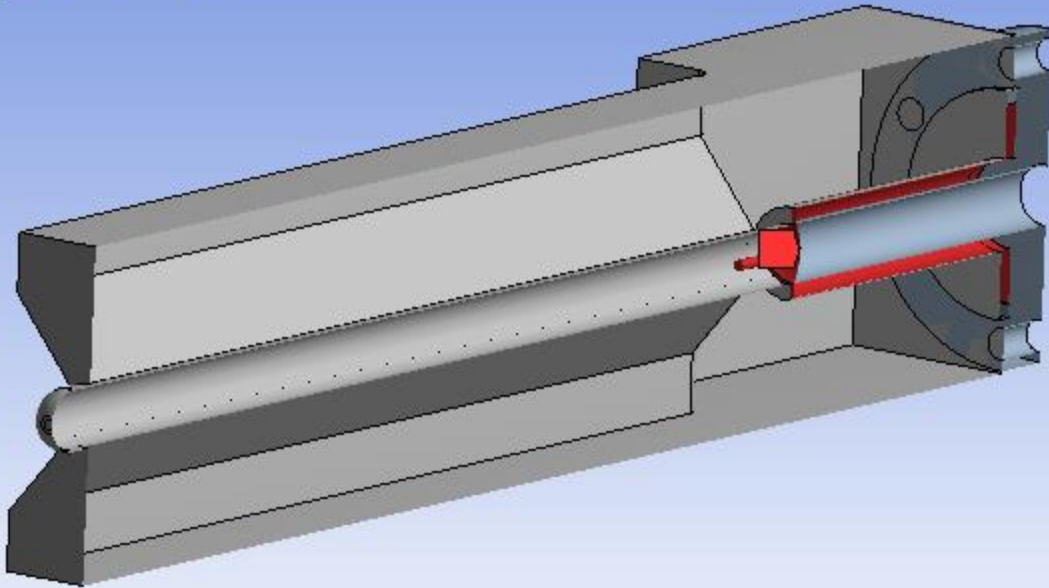
Figure

Time: 1. s

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■ Pressure 2: 1800. psi



Solution (F6)

TABLE 13

Model (F4) > Static Structural (F5) > Solution

Object Name	<i>Solution (F6)</i>
State	Solved
Adaptive Mesh Refinement	
Max Refinement Loops	1.
Refinement Depth	2.
Information	
Status	Done
Post Processing	
Calculate Beam Section Results	No

TABLE 14

Model (F4) > Static Structural (F5) > Solution (F6) > Solution Information

Object Name	<i>Solution Information</i>
State	Solved
Solution Information	

Solution Output	Solver Output
Newton-Raphson Residuals	0
Update Interval	2.5 s
Display Points	All
FE Connection Visibility	
Activate Visibility	Yes
Display	All FE Connectors
Draw Connections Attached To	All Nodes
Line Color	Connection Type
Visible on Results	No
Line Thickness	Single
Display Type	Lines

TABLE 15
Model (F4) > Static Structural (F5) > Solution (F6) > Results

Object Name	Equivalent Stress	Maximum Principal Elastic Strain	Maximum Shear Stress	Maximum Principal Stress
State	Solved			
Scope				
Scoping Method	Geometry Selection			
Geometry	All Bodies			
Definition				
Type	Equivalent (von-Mises) Stress	Maximum Principal Elastic Strain	Maximum Shear Stress	Maximum Principal Stress
By	Time			
Display Time	Last			
Calculate Time History	Yes			
Identifier				
Suppressed	No			
Integration Point Results				
Display Option	Averaged			
Average Across Bodies	No			
Results				
Minimum	2.9084 psi	-6.2702e-006 in/in	1.6697 psi	-6807.5 psi
Maximum	37413 psi	2.8822e-003 in/in	19714 psi	45976 psi
Minimum Occurs On	main body:1			entrance:1
Maximum Occurs On	ent beam:1	entrance:1	ent beam:1	entrance:1
Minimum Value Over Time				
Minimum	0.76166 psi	-6.2702e-006 in/in	0.43973 psi	-6807.5 psi
Maximum	2.9084 psi	-1.7065e-006 in/in	1.6697 psi	-2306.3 psi
Maximum Value Over Time				
Minimum	13943 psi	1.2742e-003 in/in	7686.9 psi	13856 psi
Maximum	37413 psi	2.8822e-003 in/in	19714 psi	45976 psi
Information				
Time	1. s			

Load Step	1
Substep	4
Iteration Number	12

FIGURE 5
Model (F4) > Static Structural (F5) > Solution (F6) > Equivalent Stress

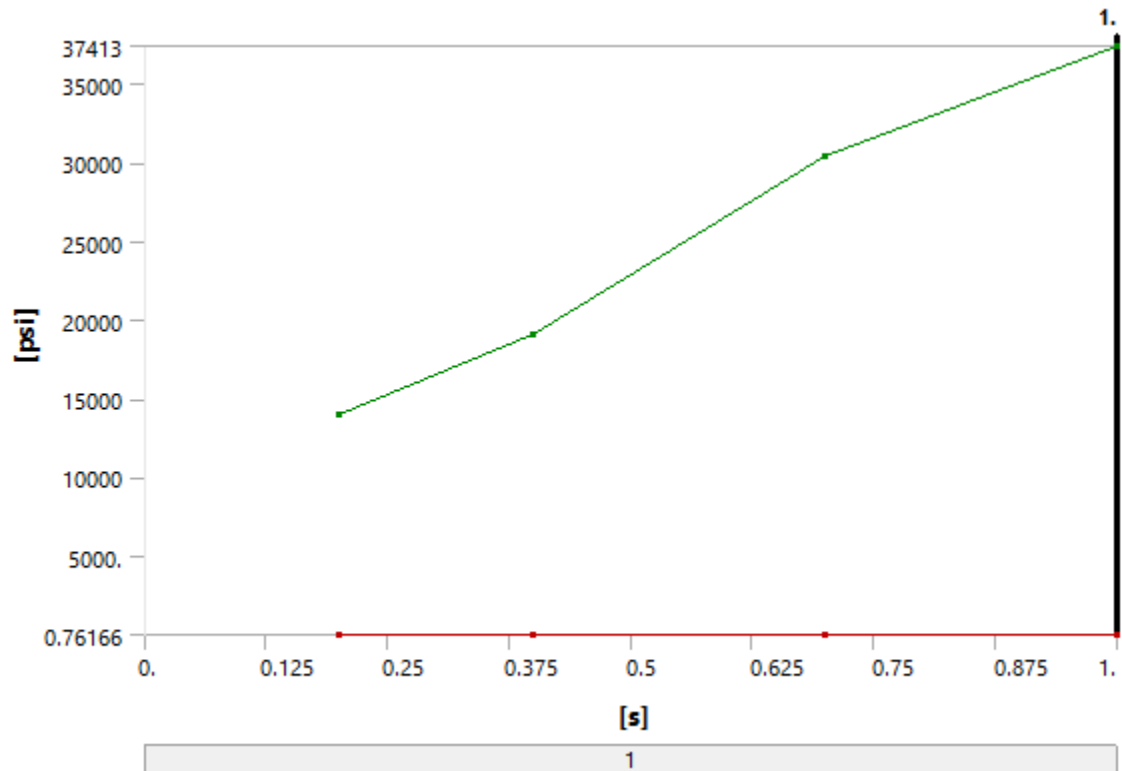


TABLE 16
Model (F4) > Static Structural (F5) > Solution (F6) > Equivalent Stress

Time [s]	Minimum [psi]	Maximum [psi]
0.2	0.76166	13943
0.4	1.5283	19077
0.7	2.6605	30435
1.	2.9084	37413

FIGURE 6
Model (F4) > Static Structural (F5) > Solution (F6) > Equivalent Stress > Figure

F: Elastic Plastic

Figure

Type: Equivalent (von-Mises) Stress

Unit: psi

Time: 1

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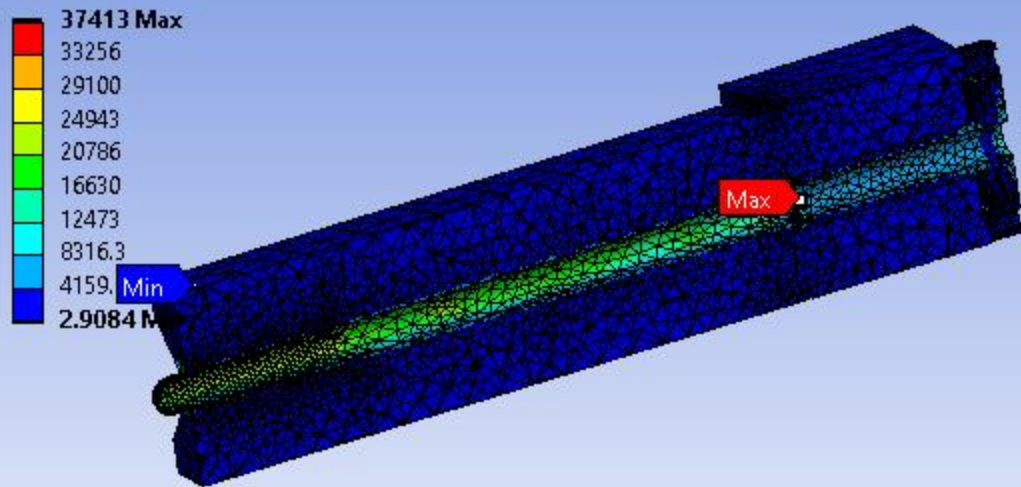


FIGURE 7

Model (F4) > Static Structural (F5) > Solution (F6) > Maximum Principal Elastic Strain

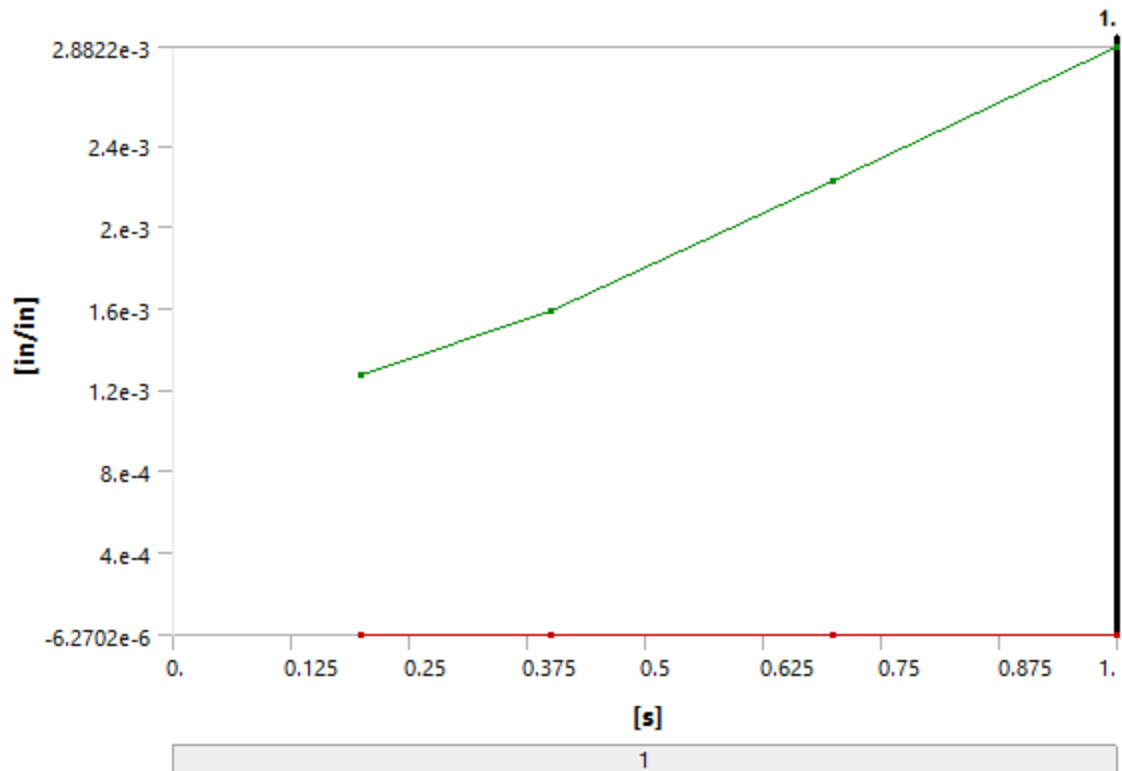


TABLE 17
Model (F4) > Static Structural (F5) > Solution (F6) > Maximum Principal Elastic Strain

Time [s]	Minimum [in/in]	Maximum [in/in]
0.2	-1.7065e-006	1.2742e-003
0.4	-3.3903e-006	1.5874e-003
0.7	-5.9363e-006	2.2256e-003
1.	-6.2702e-006	2.8822e-003

FIGURE 8
Model (F4) > Static Structural (F5) > Solution (F6) > Maximum Principal Elastic Strain > Figure

F: Elastic Plastic

Figure

Type: Maximum Principal Elastic Strain

Unit: in/in

Time: 1

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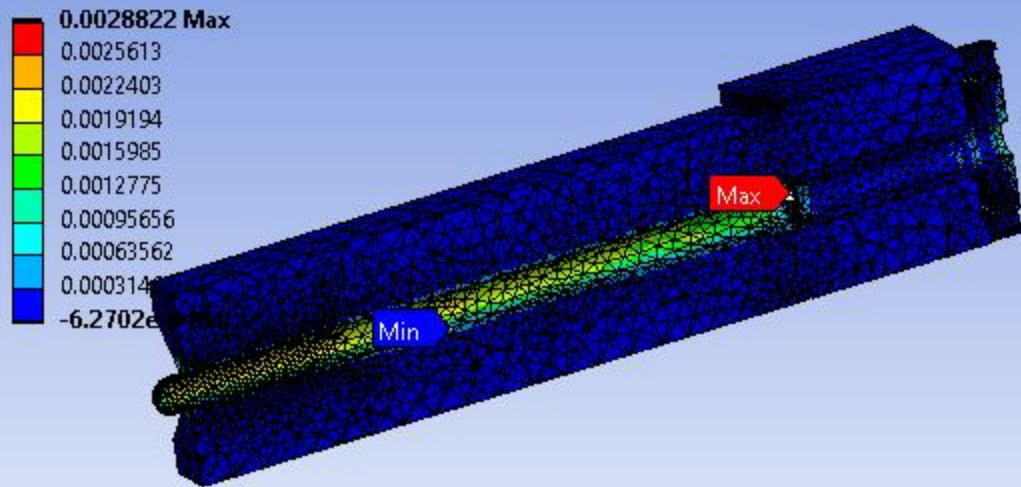


FIGURE 9

Model (F4) > Static Structural (F5) > Solution (F6) > Maximum Shear Stress

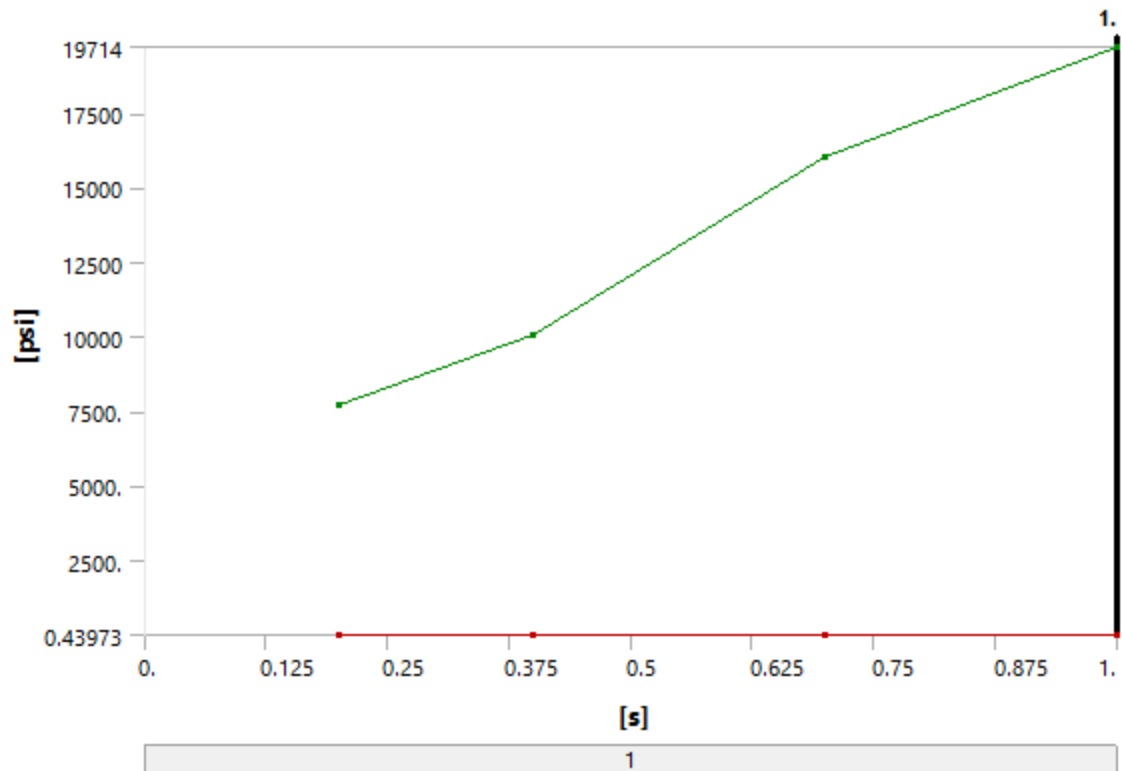


TABLE 18
Model (F4) > Static Structural (F5) > Solution (F6) > Maximum Shear Stress

Time [s]	Minimum [psi]	Maximum [psi]
0.2	0.43973	7686.9
0.4	0.88231	10085
0.7	1.536	16042
1.	1.6697	19714

FIGURE 10
Model (F4) > Static Structural (F5) > Solution (F6) > Maximum Shear Stress > Figure

F: Elastic Plastic

Figure

Type: Maximum Shear Stress

Unit: psi

Time: 1

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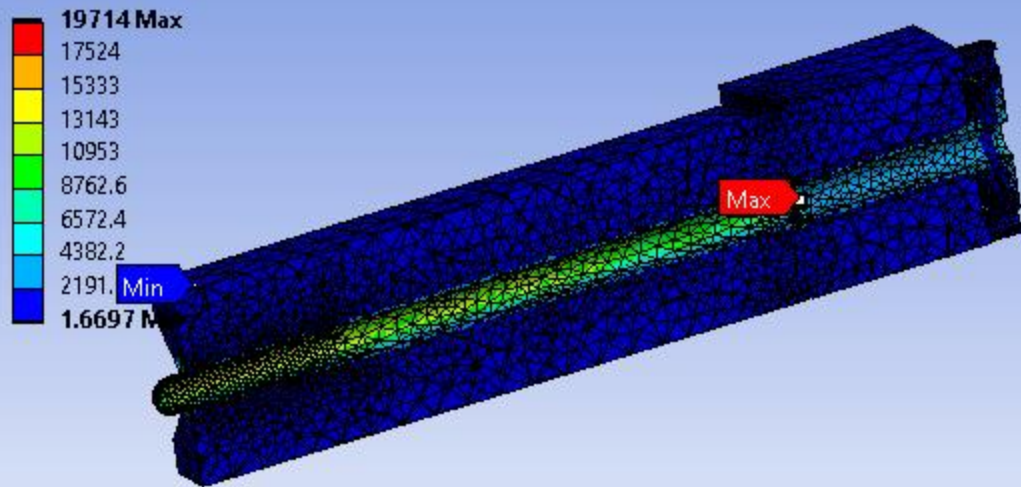


FIGURE 11

Model (F4) > Static Structural (F5) > Solution (F6) > Maximum Principal Stress

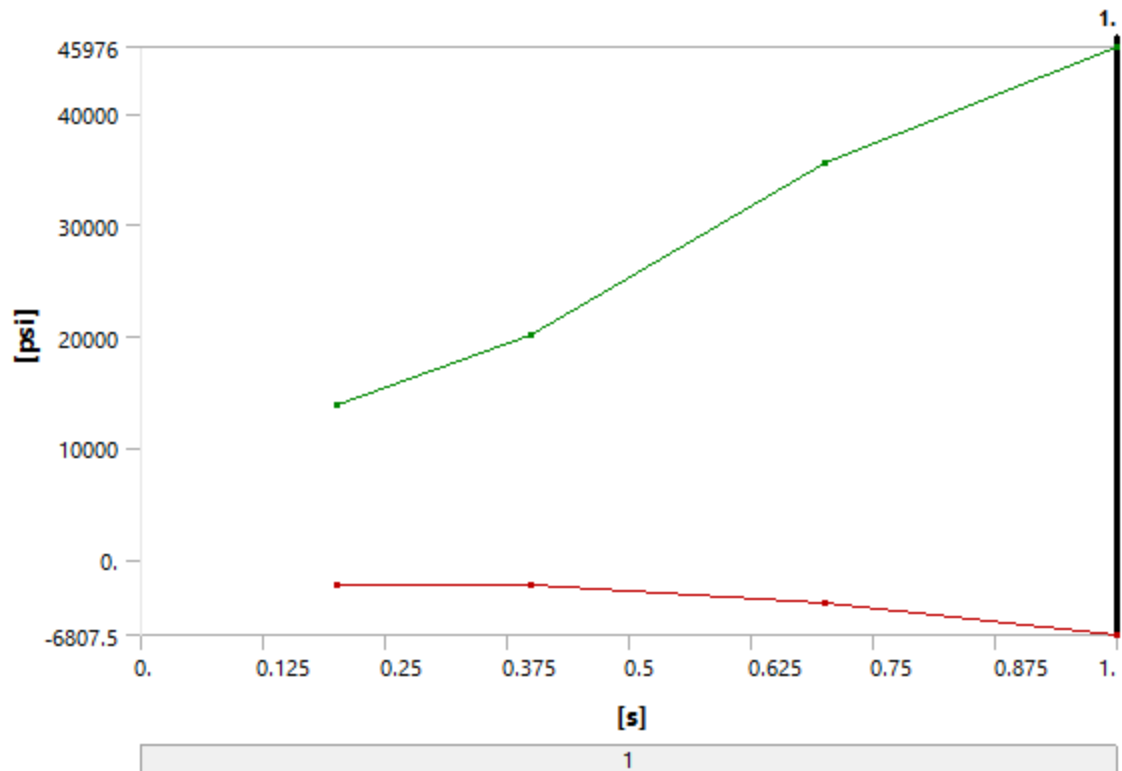


TABLE 19
Model (F4) > Static Structural (F5) > Solution (F6) > Maximum Principal Stress

Time [s]	Minimum [psi]	Maximum [psi]
0.2	-2306.3	13856
0.4	-2375.7	20037
0.7	-4004.3	35550
1.	-6807.5	45976

FIGURE 12
Model (F4) > Static Structural (F5) > Solution (F6) > Maximum Principal Stress > Figure

F: Elastic Plastic

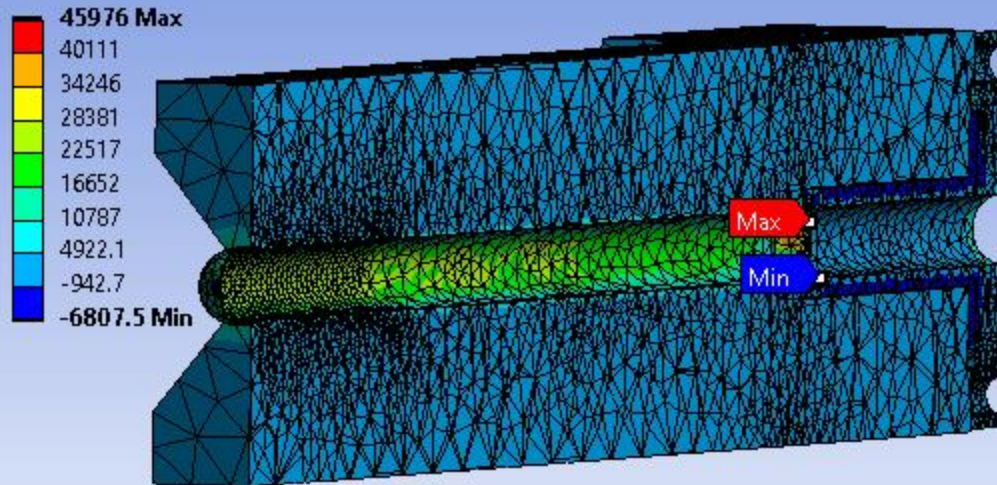
Figure

Type: Maximum Principal Stress

Unit: psi

Time: 1

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ANSYS
16.0**TABLE 20**

Model (F4) > Static Structural (F5) > Solution (F6) > $EL = 0.069 \cdot 2.72^{(-2.06 \cdot ((S1+S2+S3)/(3 \cdot SEQV) - 0.333))}$

Object Name	$EL = 0.069 \cdot 2.72^{(-2.06 \cdot ((S1+S2+S3)/(3 \cdot SEQV) - 0.333))}$		EL-EPPLEQV_RST
State	Solved		
Scope			
Scoping Method	Geometry Selection		
Geometry	All Bodies		
Definition			
Type	User Defined Result		
Expression	$= 0.069 \cdot 2.72^{(-2.06 \cdot ((S1+S2+S3)/(3 \cdot SEQV) - 0.333))}$	= EL-EPPLEQV_RST	
Input Unit System	U.S. Customary (in, lbm, lbf, °F, s, V, A)		
Output Unit			
By	Time		
Display Time	Last		
Coordinate System	Global Coordinate System		
Calculate Time History	Yes		
Identifier	EL		
Suppressed	No		

Integration Point Results		
Display Option	Averaged	
Average Across Bodies	No	
Results		
Minimum	5.3248e-006	-3.3827e-002
Maximum	160.42	
Minimum Occurs On	main body:1	ent beam:1
Maximum Occurs On	main body:1	
Minimum Value Over Time		
Minimum	0.	
Maximum	0.	
Maximum Value Over Time		
Minimum	0.	
Maximum	0.	
Information		
Time	1. s	
Load Step	1	
Substep	4	
Iteration Number	12	

FIGURE 13
Model (F4) > Static Structural (F5) > Solution (F6) > EL = $0.069 \cdot 2.72^{(-2.06 \cdot ((S1+S2+S3)/(3 \cdot SEQV) - 0.333))}$

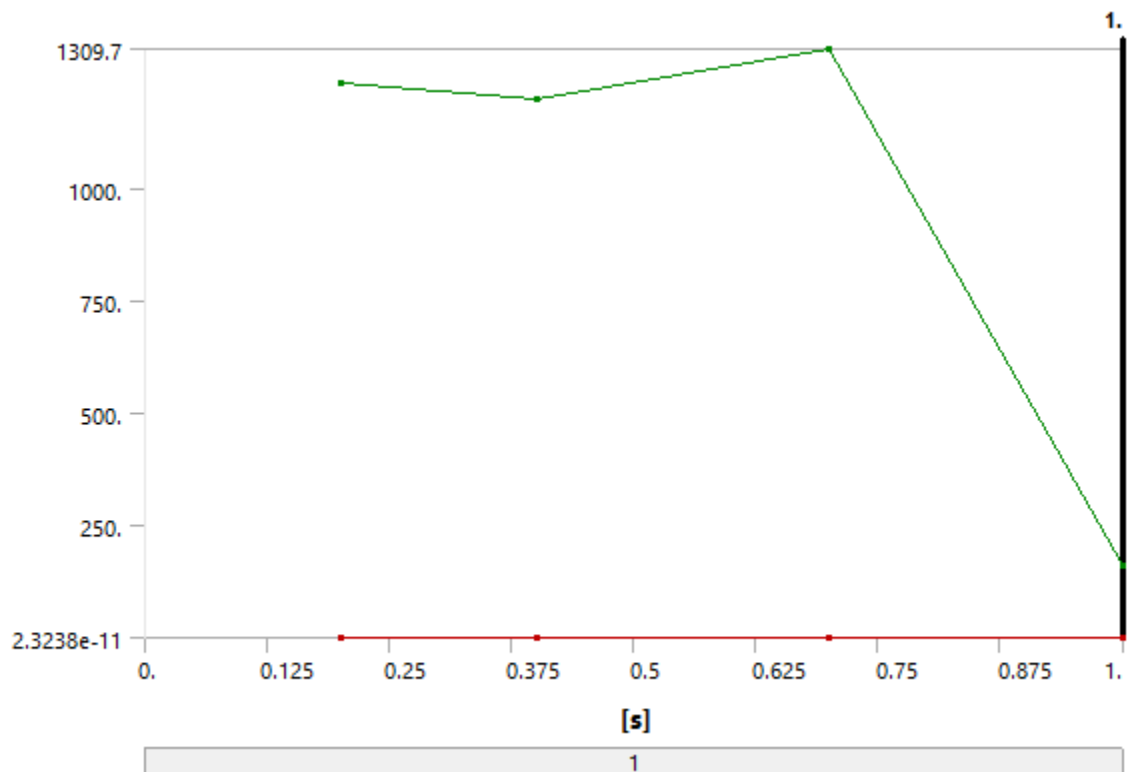


TABLE 21

Model (F4) > Static Structural (F5) > Solution (F6) > EL = $0.069 \cdot 2.72^{(-2.06 \cdot ((S1+S2+S3)/(3 \cdot SEQV) - 0.333))}$

Time [s]	Minimum	Maximum
0.2	2.3238e-011	1234.6
0.4	2.7495e-011	1196.7
0.7	4.1846e-011	1309.7
1.	5.3248e-006	160.42

FIGURE 14

Model (F4) > Static Structural (F5) > Solution (F6) > EL = $0.069 \cdot 2.72^{(-2.06 \cdot ((S1+S2+S3)/(3 \cdot SEQV) - 0.333))}$ > Figure

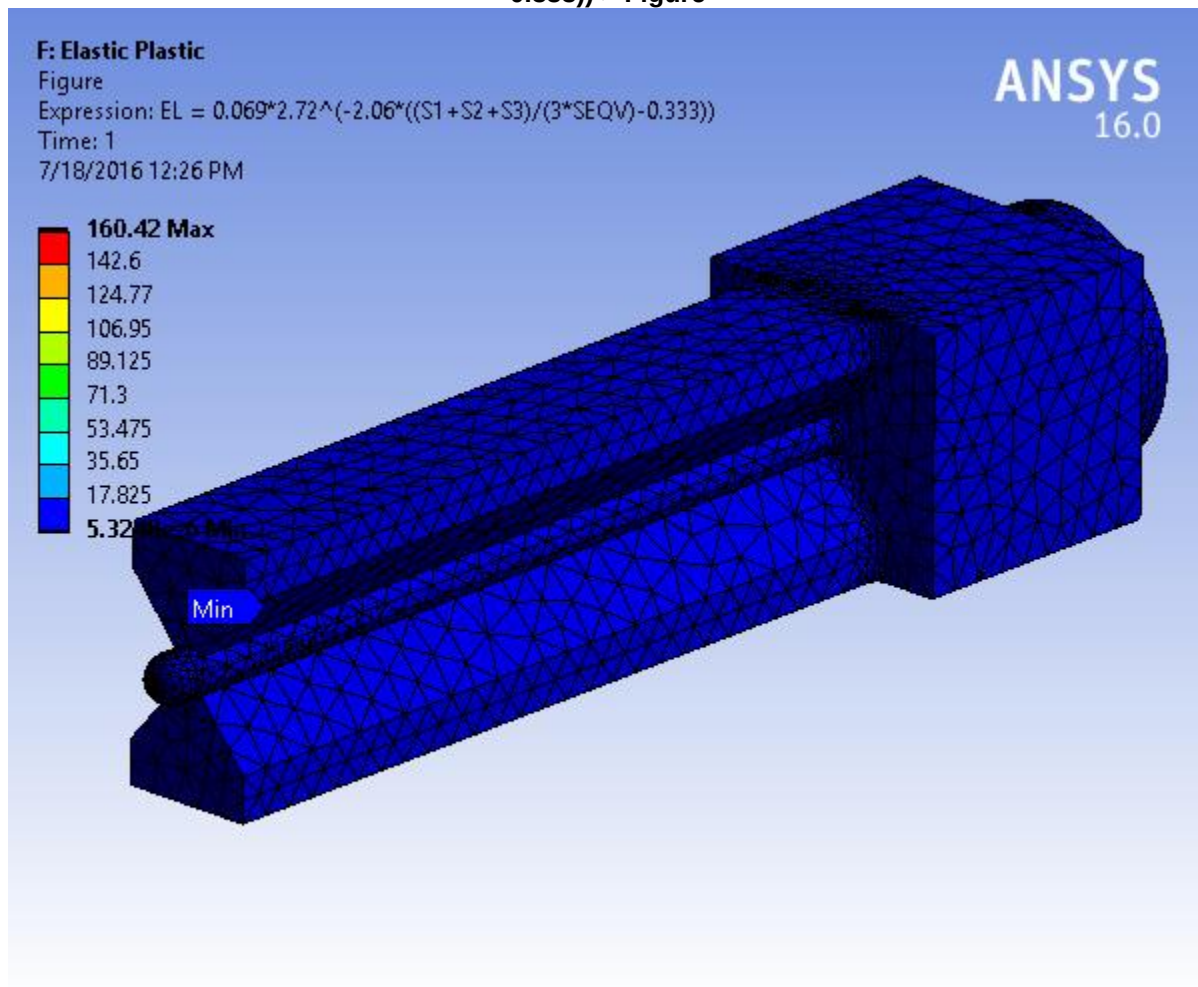


FIGURE 15

Model (F4) > Static Structural (F5) > Solution (F6) > EL-EPPLEQV_RST

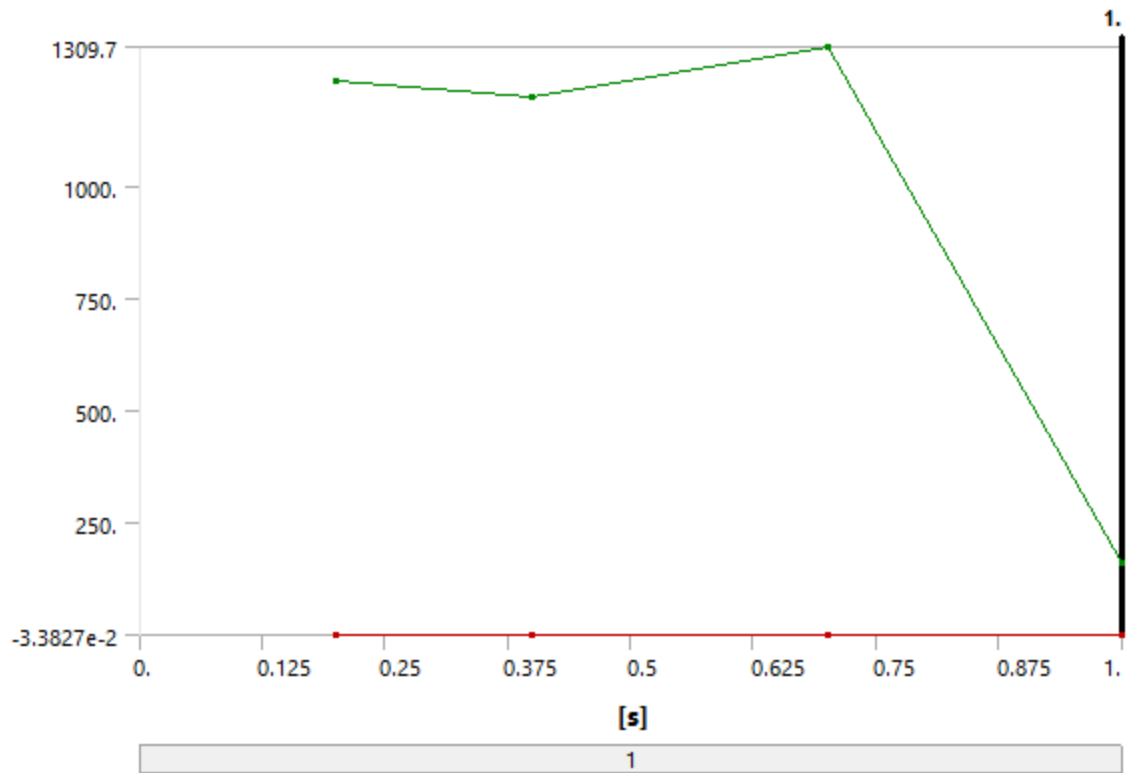


TABLE 22
Model (F4) > Static Structural (F5) > Solution (F6) > EL-EPPLEQV_RST

Time [s]	Minimum	Maximum
0.2	2.3238e-011	1234.6
0.4	2.7495e-011	1196.7
0.7	4.1846e-011	1309.7
1.	-3.3827e-002	160.42

FIGURE 16
Model (F4) > Static Structural (F5) > Solution (F6) > EL-EPPLEQV_RST > Figure

F: Elastic Plastic

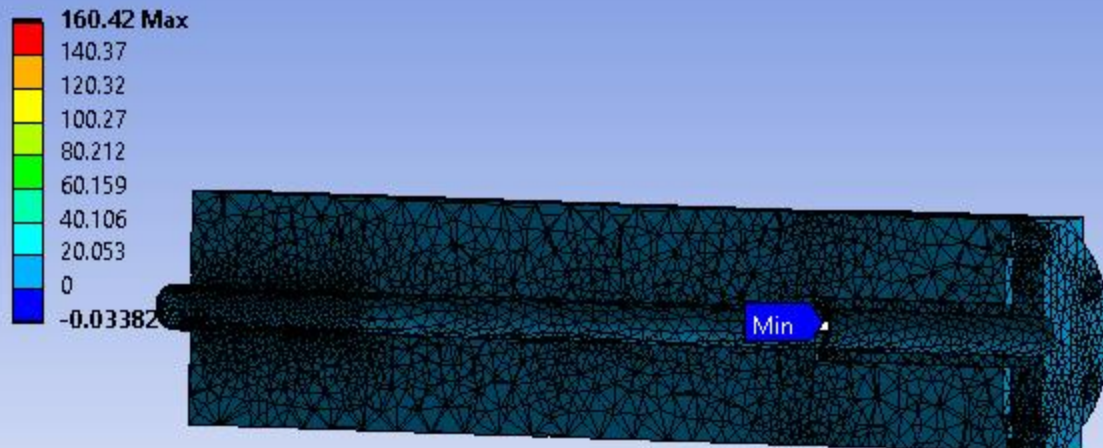
Figure

Expression: EL-EPPLEQV_RST

Time: 1

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Material Data

7075 (UNS A97075)

TABLE 23
7075 (UNS A97075) > Density

Density lbm in ⁻³	Temperature F
9.9505e-002	-459.67
9.9504e-002	-446.94
9.9503e-002	-434.22
9.9503e-002	-421.49
9.9505e-002	-408.76
9.9503e-002	-396.03
9.9498e-002	-383.31
9.949e-002	-370.58
9.9479e-002	-357.85
9.9465e-002	-345.12
9.9449e-002	-332.4

9.9431e-002	-319.67
9.941e-002	-306.94
9.9388e-002	-294.22
9.9363e-002	-281.49
9.9336e-002	-268.76
9.9308e-002	-256.03
9.9278e-002	-243.31
9.9247e-002	-230.58
9.9214e-002	-217.85
9.918e-002	-205.12
9.9145e-002	-192.4
9.9109e-002	-179.67
9.9071e-002	-166.94
9.9033e-002	-154.22
9.8994e-002	-141.49
9.8953e-002	-128.76
9.8912e-002	-116.03
9.8871e-002	-103.31
9.8829e-002	-90.579
9.8786e-002	-77.852
9.8742e-002	-65.125
9.8698e-002	-52.397
9.8654e-002	-39.67
9.8609e-002	-26.943
9.8564e-002	-14.215
9.8519e-002	-1.4882
9.8473e-002	11.239
9.8427e-002	23.966
9.838e-002	36.694
9.8334e-002	49.421
9.8287e-002	62.148
9.824e-002	74.875
9.8192e-002	87.603
9.8145e-002	100.33
9.8097e-002	113.06
9.805e-002	125.78
9.8002e-002	138.51
9.7954e-002	151.24
9.7905e-002	163.97
9.7857e-002	176.69
9.7808e-002	189.42
9.776e-002	202.15
9.7711e-002	214.88
9.7662e-002	227.6
9.7612e-002	240.33
9.7563e-002	253.06
9.7513e-002	265.78
9.7464e-002	278.51

9.7414e-002	291.24
9.7363e-002	303.97
9.7313e-002	316.69
9.7262e-002	329.42
9.7211e-002	342.15
9.716e-002	354.88
9.7109e-002	367.6
9.7057e-002	380.33
9.7005e-002	393.06
9.6953e-002	405.78
9.69e-002	418.51
9.6847e-002	431.24
9.6794e-002	443.97
9.674e-002	456.69
9.6687e-002	469.42
9.6632e-002	482.15
9.6578e-002	494.88
9.6523e-002	507.6
9.6467e-002	520.33
9.6412e-002	533.06
9.6356e-002	545.78
9.6299e-002	558.51
9.6243e-002	571.24
9.6186e-002	583.97
9.6128e-002	596.69
9.6071e-002	609.42
9.6013e-002	622.15
9.5954e-002	634.88
9.5896e-002	647.6
9.5837e-002	660.33
9.5778e-002	673.06
9.5719e-002	685.78
9.5659e-002	698.51
9.56e-002	711.24
9.554e-002	723.97
9.548e-002	736.69
9.542e-002	749.42
9.5361e-002	762.15
9.5301e-002	774.88
9.5241e-002	787.6
9.5182e-002	800.33

TABLE 24
7075 (UNS A97075) > Tensile Yield Strength

Tensile Yield Strength psi	Temperature F
18130	-321.07
17998	-310.78
17864	-300.49
17730	-290.2

17594	-279.91
17458	-269.62
17320	-259.32
17181	-249.03
17041	-238.74
16900	-228.45
16758	-218.16
16614	-207.87
16470	-197.58
16324	-187.29
16178	-177
16030	-166.71
15881	-156.42
15731	-146.12
15579	-135.83
15427	-125.54
15274	-115.25
15119	-104.96
14963	-94.67
14806	-84.379
14649	-74.088
14489	-63.797
14329	-53.506
14168	-43.215
14005	-32.925
13842	-22.634
13779	-12.343
13779	-2.0518
13779	8.2391
13779	18.53
13779	28.821
13779	39.112
13779	49.403
13779	59.694
13779	69.985
13779	80.275
13779	90.566
13779	100.86
13779	111.15
13779	121.44
13779	131.73
13779	142.02
13779	152.31
13779	162.6
13779	172.89
13779	183.18
13779	193.48
13775	203.77

13764	214.06
13742	224.35
13708	234.64
13660	244.93
13598	255.22
13520	265.51
13426	275.8
13316	286.09
13188	296.38
13043	306.68
12880	316.97
12699	327.26
12501	337.55
12287	347.84
12055	358.13
11808	368.42
11546	378.71
11270	389
10982	399.29
10681	409.58
10376	419.88
10132	430.17
9883.6	440.46
9630.9	450.75
9374.7	461.04
9115.9	471.33
8855.2	481.62
8593.5	491.91
8331.4	502.2
8069.9	512.49
7809.6	522.78
7551.4	533.08
7296	543.37
7044.3	553.66
6796.9	563.95
6554.8	574.24
6318.6	584.53
6089.2	594.82
5867.3	605.11
5653.8	615.4
5449.4	625.69
5254.9	635.98
5071	646.28
4898.6	656.57
4738.5	666.86
4591.4	677.15
4458.1	687.44
4339.5	697.73

TABLE 25
7075 (UNS A97075) > Tensile Ultimate Strength

Tensile Ultimate Strength psi	Temperature F
47918	-321.07
46755	-310.78
45660	-300.49
44631	-290.2
43666	-279.91
42762	-269.62
41916	-259.32
41127	-249.03
40393	-238.74
39710	-228.45
39077	-218.16
38491	-207.87
37950	-197.58
37452	-187.29
36995	-177
36575	-166.71
36192	-156.42
35841	-146.12
35522	-135.83
35232	-125.54
34968	-115.25
34729	-104.96
34511	-94.67
34313	-84.379
34133	-74.088
33967	-63.797
33814	-53.506
33672	-43.215
33537	-32.925
33409	-22.634
33283	-12.343
33159	-2.0518
33034	8.2391
32906	18.53
32771	28.821
32629	39.112
32476	49.403
32311	59.694
32130	69.985
31932	80.275
31715	90.566
31476	100.86
31212	111.15
30922	121.44
30603	131.73
30253	142.02

29869	152.31
29450	162.6
28993	172.89
28495	183.18
27954	193.48
27369	203.77
26686	214.06
26003	224.35
25293	234.64
24560	244.93
23808	255.22
23041	265.51
22263	275.8
21477	286.09
20690	296.38
19904	306.68
19126	316.97
18361	327.26
17613	337.55
16889	347.84
16193	358.13
15532	368.42
14913	378.71
14340	389
13822	399.29
13490	409.58
13189	419.88
12885	430.17
12578	440.46
12270	450.75
11960	461.04
11650	471.33
11340	481.62
11030	491.91
10721	502.2
10415	512.49
10111	522.78
9809.9	533.08
9512.8	543.37
9220.1	553.66
8932.5	563.95
8650.6	574.24
8375	584.53
8106.3	594.82
7845.2	605.11
7592.3	615.4
7348.3	625.69
7113.7	635.98

6889.3	646.28
6675.5	656.57
6473.2	666.86
6282.8	677.15
6105.1	687.44
5940.6	697.73

TABLE 26
7075 (UNS A97075) > Isotropic Secant Coefficient of Thermal Expansion

Coefficient of Thermal Expansion F^{-1}	Temperature F
7.9029e-006	-459.67
8.1015e-006	-446.94
8.3002e-006	-434.22
8.505e-006	-421.49
8.7421e-006	-408.76
8.9684e-006	-396.03
9.1842e-006	-383.31
9.3898e-006	-370.58
9.5857e-006	-357.85
9.7722e-006	-345.12
9.9496e-006	-332.4
1.0118e-005	-319.67
1.0278e-005	-306.94
1.0431e-005	-294.22
1.0575e-005	-281.49
1.0712e-005	-268.76
1.0841e-005	-256.03
1.0964e-005	-243.31
1.108e-005	-230.58
1.119e-005	-217.85
1.1294e-005	-205.12
1.1392e-005	-192.4
1.1485e-005	-179.67
1.1572e-005	-166.94
1.1655e-005	-154.22
1.1732e-005	-141.49
1.1806e-005	-128.76
1.1875e-005	-116.03
1.194e-005	-103.31
1.2001e-005	-90.579
1.2059e-005	-77.852
1.2114e-005	-65.125
1.2165e-005	-52.397
1.2214e-005	-39.67
1.226e-005	-26.943
1.2303e-005	-14.215
1.2345e-005	-1.4882
1.2384e-005	11.239
1.2421e-005	23.966

1.2456e-005	36.694
1.249e-005	49.421
1.2522e-005	62.148
1.2553e-005	74.875
1.2583e-005	87.603
1.2612e-005	100.33
1.2641e-005	113.06
1.2668e-005	125.78
1.2695e-005	138.51
1.2722e-005	151.24
1.2748e-005	163.97
1.2774e-005	176.69
1.28e-005	189.42
1.2826e-005	202.15
1.2852e-005	214.88
1.2878e-005	227.6
1.2904e-005	240.33
1.2931e-005	253.06
1.2958e-005	265.78
1.2986e-005	278.51
1.3014e-005	291.24
1.3043e-005	303.97
1.3072e-005	316.69
1.3102e-005	329.42
1.3133e-005	342.15
1.3165e-005	354.88
1.3197e-005	367.6
1.323e-005	380.33
1.3264e-005	393.06
1.3299e-005	405.78
1.3335e-005	418.51
1.3372e-005	431.24
1.3409e-005	443.97
1.3447e-005	456.69
1.3486e-005	469.42
1.3526e-005	482.15
1.3567e-005	494.88
1.3608e-005	507.6
1.365e-005	520.33
1.3692e-005	533.06
1.3735e-005	545.78
1.3779e-005	558.51
1.3823e-005	571.24
1.3868e-005	583.97
1.3912e-005	596.69
1.3958e-005	609.42
1.4003e-005	622.15
1.4048e-005	634.88

1.4093e-005	647.6
1.4138e-005	660.33
1.4183e-005	673.06
1.4227e-005	685.78
1.4271e-005	698.51
1.4315e-005	711.24
1.4357e-005	723.97
1.4399e-005	736.69
1.444e-005	749.42
1.4479e-005	762.15
1.4517e-005	774.88
1.4554e-005	787.6
1.4589e-005	800.33
Reference Temperature F	
67.73	

TABLE 27
7075 (UNS A97075) > Specific Heat

Specific Heat BTU lbm ⁻¹ F ⁻¹	Temperature F
0.13665	-250.87
0.14014	-240.25
0.14351	-229.63
0.14676	-219.02
0.14989	-208.4
0.15291	-197.78
0.15582	-187.16
0.15862	-176.54
0.16132	-165.92
0.16392	-155.31
0.16642	-144.69
0.16883	-134.07
0.17115	-123.45
0.17338	-112.83
0.17553	-102.22
0.1776	-91.597
0.1796	-80.979
0.18152	-70.361
0.18337	-59.743
0.18515	-49.125
0.18687	-38.506
0.18852	-27.888
0.19012	-17.27
0.19165	-6.6518
0.19314	3.9664
0.19457	14.585
0.19596	25.203
0.1973	35.821
0.1986	46.439
0.19985	57.057

0.20107	67.675
0.20225	78.294
0.2034	88.912
0.20451	99.53
0.2056	110.15
0.20666	120.77
0.20769	131.38
0.2087	142
0.20969	152.62
0.21066	163.24
0.21162	173.86
0.21256	184.48
0.21348	195.09
0.2144	205.71
0.2153	216.33
0.2162	226.95
0.21709	237.57
0.21798	248.18
0.21886	258.8
0.21974	269.42
0.22062	280.04
0.2215	290.66
0.22239	301.28
0.22327	311.89
0.22416	322.51
0.22506	333.13
0.22597	343.75
0.22688	354.37
0.2278	364.98
0.22874	375.6
0.22968	386.22
0.23064	396.84
0.23161	407.46
0.23259	418.08
0.23359	428.69
0.2346	439.31
0.23563	449.93
0.23668	460.55
0.23774	471.17
0.23882	481.78
0.23992	492.4
0.24104	503.02
0.24218	513.64
0.24333	524.26
0.24451	534.88
0.2457	545.49
0.24692	556.11
0.24815	566.73

0.2494	577.35
0.25068	587.97
0.25197	598.58
0.25329	609.2
0.25462	619.82
0.25597	630.44
0.25735	641.06
0.25874	651.68
0.26015	662.29
0.26158	672.91
0.26302	683.53
0.26449	694.15
0.26597	704.77
0.26746	715.38
0.26898	726
0.2705	736.62
0.27205	747.24
0.2736	757.86
0.27517	768.48
0.27675	779.09
0.27834	789.71
0.27994	800.33

TABLE 28
7075 (UNS A97075) > Isotropic Thermal Conductivity

Thermal Conductivity BTU s ⁻¹ in ⁻¹ F ⁻¹	Temperature F
1.0373e-003	-250.87
1.0695e-003	-240.25
1.1005e-003	-229.63
1.1303e-003	-219.02
1.1591e-003	-208.4
1.1868e-003	-197.78
1.2135e-003	-187.16
1.2392e-003	-176.54
1.2639e-003	-165.92
1.2878e-003	-155.31
1.3108e-003	-144.69
1.3329e-003	-134.07
1.3543e-003	-123.45
1.3749e-003	-112.83
1.3949e-003	-102.22
1.4141e-003	-91.597
1.4328e-003	-80.979
1.4509e-003	-70.361
1.4684e-003	-59.743
1.4854e-003	-49.125
1.502e-003	-38.506
1.5181e-003	-27.888
1.5339e-003	-17.27

1.5493e-003	-6.6518
1.5645e-003	3.9664
1.5793e-003	14.585
1.594e-003	25.203
1.6084e-003	35.821
1.6228e-003	46.439
1.637e-003	57.057
1.6512e-003	67.675
1.6653e-003	78.294
1.6795e-003	88.912
1.6938e-003	99.53
1.7081e-003	110.15
1.7226e-003	120.77
1.7373e-003	131.38
1.7521e-003	142
1.7673e-003	152.62
1.7828e-003	163.24
1.7986e-003	173.86
1.8147e-003	184.48
1.8314e-003	195.09
1.8484e-003	205.71
1.866e-003	216.33
1.8841e-003	226.95
1.9028e-003	237.57
1.9222e-003	248.18
1.9422e-003	258.8
1.9629e-003	269.42
1.9843e-003	280.04
2.0065e-003	290.66
2.0296e-003	301.28
2.0535e-003	311.89
2.0784e-003	322.51
2.1041e-003	333.13
2.1309e-003	343.75
2.1587e-003	354.37
2.1876e-003	364.98
2.2175e-003	375.6
2.2486e-003	386.22
2.2809e-003	396.84
2.2937e-003	407.46
2.3017e-003	418.08
2.3091e-003	428.69
2.316e-003	439.31
2.3224e-003	449.93
2.3283e-003	460.55
2.3337e-003	471.17
2.3385e-003	481.78
2.3428e-003	492.4

2.3466e-003	503.02
2.3499e-003	513.64
2.3526e-003	524.26
2.3548e-003	534.88
2.3565e-003	545.49
2.3577e-003	556.11
2.3583e-003	566.73
2.3585e-003	577.35
2.3581e-003	587.97
2.3572e-003	598.58
2.3557e-003	609.2
2.3538e-003	619.82
2.3513e-003	630.44
2.3483e-003	641.06
2.3448e-003	651.68
2.3407e-003	662.29
2.3362e-003	672.91
2.3311e-003	683.53
2.3255e-003	694.15
2.3194e-003	704.77
2.3127e-003	715.38
2.3055e-003	726
2.2978e-003	736.62
2.2896e-003	747.24
2.2809e-003	757.86
2.2716e-003	768.48
2.2618e-003	779.09
2.2515e-003	789.71
2.2407e-003	800.33

TABLE 29
7075 (UNS A97075) > Isotropic Resistivity

Resistivity ohm cmil in ⁻¹	Temperature F
1.3838	-452.47
1.3854	-443.34
1.3871	-434.22
1.3887	-425.09
1.3926	-415.96
1.3984	-406.84
1.406	-397.71
1.4152	-388.59
1.426	-379.46
1.4383	-370.33
1.4521	-361.21
1.4674	-352.08
1.484	-342.95
1.502	-333.83
1.5212	-324.7
1.5416	-315.58

1.5632	-306.45
1.5858	-297.32
1.6095	-288.2
1.6342	-279.07
1.6597	-269.94
1.6862	-260.82
1.7134	-251.69
1.7415	-242.56
1.7702	-233.44
1.7995	-224.31
1.8294	-215.19
1.8599	-206.06
1.8908	-196.93
1.9221	-187.81
1.9538	-178.68
1.9858	-169.55
2.018	-160.43
2.0505	-151.3
2.083	-142.18
2.1156	-133.05
2.1483	-123.92
2.1809	-114.8
2.2134	-105.67
2.2457	-96.544
2.2779	-87.417
2.3097	-78.291
2.3413	-69.165
2.3725	-60.038
2.4032	-50.912
2.4335	-41.786
2.4632	-32.659
2.4923	-23.533
2.5207	-14.407
2.5484	-5.2805
2.5754	3.8458
2.6015	12.972
2.6267	22.098
2.651	31.225
2.6743	40.351
2.6965	49.477
2.7176	58.604
2.7376	67.73

TABLE 30
7075 (UNS A97075) > Isotropic Elasticity

Temperature F	Young's Modulus psi	Poisson's Ratio	Bulk Modulus psi	Shear Modulus psi
-459.67	1.1431e+007	0.32387	1.0817e+007	4.3172e+006
-445.62	1.1432e+007	0.32391	1.082e+007	4.3174e+006
-431.56	1.1429e+007	0.32398	1.0822e+007	4.3162e+006

-417.51	1.1423e+007	0.32407	1.0822e+007	4.3138e+006
-403.45	1.1415e+007	0.32418	1.0821e+007	4.3102e+006
-389.4	1.1404e+007	0.32431	1.0818e+007	4.3056e+006
-375.34	1.139e+007	0.32446	1.0814e+007	4.2999e+006
-361.29	1.1374e+007	0.32463	1.0809e+007	4.2932e+006
-347.23	1.1355e+007	0.32481	1.0803e+007	4.2857e+006
-333.18	1.1335e+007	0.32501	1.0796e+007	4.2773e+006
-319.12	1.1312e+007	0.32521	1.0787e+007	4.2682e+006
-305.07	1.1288e+007	0.32543	1.0777e+007	4.2583e+006
-291.02	1.1262e+007	0.32566	1.0766e+007	4.2478e+006
-276.96	1.1234e+007	0.32589	1.0754e+007	4.2366e+006
-262.91	1.1205e+007	0.32613	1.0741e+007	4.2249e+006
-248.85	1.1175e+007	0.32637	1.0727e+007	4.2126e+006
-234.8	1.1143e+007	0.32662	1.0712e+007	4.1999e+006
-220.74	1.1111e+007	0.32687	1.0696e+007	4.1867e+006
-206.69	1.1077e+007	0.32713	1.0679e+007	4.1732e+006
-192.63	1.1042e+007	0.32738	1.0661e+007	4.1593e+006
-178.58	1.1006e+007	0.32763	1.0642e+007	4.1451e+006
-164.52	1.097e+007	0.32788	1.0623e+007	4.1306e+006
-150.47	1.0933e+007	0.32813	1.0602e+007	4.1159e+006
-136.42	1.0895e+007	0.32838	1.0581e+007	4.101e+006
-122.36	1.0857e+007	0.32862	1.0558e+007	4.0859e+006
-108.31	1.0819e+007	0.32885	1.0535e+007	4.0707e+006
-94.252	1.078e+007	0.32908	1.0512e+007	4.0553e+006
-80.197	1.074e+007	0.32931	1.0487e+007	4.0399e+006
-66.143	1.0701e+007	0.32953	1.0462e+007	4.0243e+006
-52.088	1.0661e+007	0.32974	1.0436e+007	4.0088e+006
-38.034	1.0621e+007	0.32995	1.041e+007	3.9931e+006
-23.979	1.0581e+007	0.33014	1.0383e+007	3.9775e+006
-9.9245	1.0541e+007	0.33033	1.0355e+007	3.9618e+006
4.13	1.0501e+007	0.33052	1.0326e+007	3.9462e+006
18.185	1.0461e+007	0.33069	1.0298e+007	3.9306e+006
32.239	1.0421e+007	0.33086	1.0268e+007	3.915e+006
46.294	1.038e+007	0.33102	1.0238e+007	3.8994e+006
60.348	1.034e+007	0.33117	1.0208e+007	3.8839e+006
74.403	1.03e+007	0.33131	1.0177e+007	3.8684e+006
88.457	1.026e+007	0.33145	1.0145e+007	3.8529e+006
102.51	1.022e+007	0.33158	1.0114e+007	3.8375e+006
116.57	1.018e+007	0.33171	1.0081e+007	3.8221e+006
130.62	1.014e+007	0.33183	1.0049e+007	3.8067e+006
144.68	1.01e+007	0.33194	1.0016e+007	3.7914e+006
158.73	1.006e+007	0.33205	9.9828e+006	3.776e+006
172.78	1.002e+007	0.33216	9.9493e+006	3.7607e+006
186.84	9.9795e+006	0.33226	9.9156e+006	3.7453e+006
200.89	9.9393e+006	0.33236	9.8817e+006	3.7299e+006
214.95	9.8989e+006	0.33246	9.8475e+006	3.7145e+006
229	9.8584e+006	0.33257	9.8132e+006	3.699e+006
243.06	9.8176e+006	0.33267	9.7787e+006	3.6835e+006

257.11	9.7766e+006	0.33278	9.7441e+006	3.6678e+006
271.17	9.7353e+006	0.33289	9.7094e+006	3.6519e+006
285.22	9.6935e+006	0.33301	9.6746e+006	3.636e+006
299.28	9.6513e+006	0.33313	9.6397e+006	3.6198e+006
313.33	9.6086e+006	0.33327	9.6048e+006	3.6034e+006
327.38	9.5652e+006	0.33342	9.5699e+006	3.5867e+006
341.44	9.5212e+006	0.33358	9.535e+006	3.5698e+006
355.49	9.4764e+006	0.33375	9.5002e+006	3.5525e+006
369.55	9.4308e+006	0.33394	9.4654e+006	3.5349e+006
383.6	9.3842e+006	0.33416	9.4307e+006	3.5169e+006
397.66	9.3365e+006	0.33439	9.3961e+006	3.4984e+006
411.71	9.2877e+006	0.33465	9.3616e+006	3.4795e+006
425.77	9.2377e+006	0.33493	9.3272e+006	3.46e+006
439.82	9.1863e+006	0.33525	9.293e+006	3.4399e+006
453.88	9.1334e+006	0.33559	9.259e+006	3.4192e+006
467.93	9.0788e+006	0.33598	9.2252e+006	3.3978e+006
481.98	9.0226e+006	0.3364	9.1916e+006	3.3757e+006
496.04	8.9645e+006	0.33686	9.1582e+006	3.3528e+006
510.09	8.9044e+006	0.33736	9.125e+006	3.3291e+006
524.15	8.8421e+006	0.33792	9.0921e+006	3.3044e+006
538.2	8.7776e+006	0.33852	9.0595e+006	3.2788e+006
552.26	8.7106e+006	0.33918	9.0272e+006	3.2522e+006
566.31	8.6411e+006	0.33989	8.9952e+006	3.2245e+006
580.37	8.5688e+006	0.34067	8.9635e+006	3.1957e+006
594.42	8.4935e+006	0.34152	8.9321e+006	3.1657e+006
608.48	8.4153e+006	0.34243	8.9011e+006	3.1343e+006
622.53	8.3337e+006	0.34342	8.8704e+006	3.1017e+006
636.58	8.2487e+006	0.34448	8.8401e+006	3.0676e+006
650.64	8.1602e+006	0.34563	8.8102e+006	3.0321e+006
664.69	8.0678e+006	0.34687	8.7807e+006	2.995e+006
678.75	7.9714e+006	0.34819	8.7516e+006	2.9563e+006
692.8	7.8709e+006	0.34961	8.7229e+006	2.916e+006
706.86	7.7659e+006	0.35114	8.6947e+006	2.8739e+006
720.91	7.6564e+006	0.35277	8.667e+006	2.8299e+006
734.97	7.5421e+006	0.35451	8.6397e+006	2.7841e+006
749.02	7.4228e+006	0.35636	8.6129e+006	2.7363e+006
763.08	7.2982e+006	0.35834	8.5867e+006	2.6864e+006
777.13	7.1682e+006	0.36045	8.561e+006	2.6345e+006
791.18	7.0325e+006	0.36269	8.5359e+006	2.5804e+006
805.24	6.8908e+006	0.36507	8.5113e+006	2.524e+006
819.29	6.7431e+006	0.36759	8.4875e+006	2.4653e+006
833.35	6.5889e+006	0.37026	8.4642e+006	2.4042e+006
847.4	6.4281e+006	0.37309	8.4418e+006	2.3407e+006
861.46	6.2603e+006	0.37608	8.4201e+006	2.2747e+006
875.51	6.0855e+006	0.37925	8.3992e+006	2.2061e+006
889.57	5.9032e+006	0.38258	8.3793e+006	2.1348e+006
903.62	5.7132e+006	0.38611	8.3604e+006	2.0609e+006
917.68	5.5153e+006	0.38982	8.3427e+006	1.9842e+006

931.73	5.3092e+006	0.39373	8.3262e+006	1.9047e+006
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TABLE 31
7075 (UNS A97075) > Multilinear Isotropic Hardening

Stress psi	Plastic Strain in in ⁻¹	Temperature F
16249	0	67.73
19107	4.7368e-003	67.73
21701	9.4737e-003	67.73
24046	1.4211e-002	67.73
26154	1.8947e-002	67.73
28039	2.3684e-002	67.73
29714	2.8421e-002	67.73
31193	3.3158e-002	67.73
32488	3.7895e-002	67.73
33612	4.2632e-002	67.73
34580	4.7368e-002	67.73
35405	5.2105e-002	67.73
36099	5.6842e-002	67.73
36676	6.1579e-002	67.73
37150	6.6316e-002	67.73
37533	7.1053e-002	67.73
37840	7.5789e-002	67.73
38082	8.0526e-002	67.73
38274	8.5263e-002	67.73
38429	9.e-002	67.73

TABLE 32
7075 (UNS A97075) > Alternating Stress R-Ratio

Alternating Stress psi	Cycles	R-Ratio
50442	4000	-1
49352	4677.6	-1
48261	5469.9	-1
47166	6396.4	-1
46067	7479.9	-1
44962	8746.9	-1
43853	10229	-1
42739	11961	-1
41620	13987	-1
40499	16356	-1
39375	19127	-1
38251	22367	-1
37129	26156	-1
36010	30586	-1
34896	35767	-1
33790	41826	-1
32695	48910	-1
31612	57195	-1
30546	66883	-1
29498	78213	-1

28471	91461	-1
27468	1.0695e+005	-1
26492	1.2507e+005	-1
25546	1.4626e+005	-1
24632	1.7103e+005	-1
23753	2.e+005	-1
22911	2.3388e+005	-1
22108	2.7349e+005	-1
21346	3.1982e+005	-1
20627	3.7399e+005	-1
19953	4.3734e+005	-1
19325	5.1143e+005	-1
18744	5.9806e+005	-1
18210	6.9936e+005	-1
17724	8.1782e+005	-1
17285	9.5635e+005	-1
16894	1.1183e+006	-1
16548	1.3078e+006	-1
16247	1.5293e+006	-1
15989	1.7884e+006	-1
15771	2.0913e+006	-1
15590	2.4455e+006	-1
15442	2.8598e+006	-1
15324	3.3442e+006	-1
15230	3.9106e+006	-1
15155	4.5731e+006	-1
15092	5.3477e+006	-1
15035	6.2535e+006	-1
14976	7.3128e+006	-1
14816	1.e+007	-1