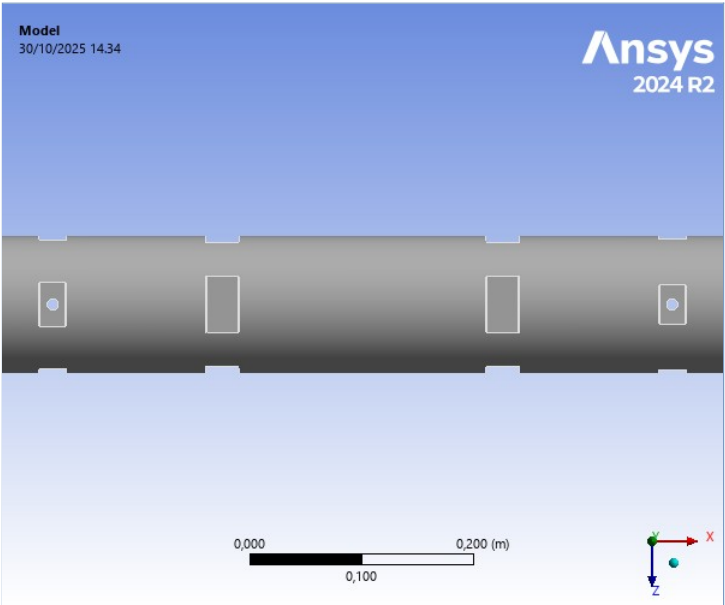




Project

First Saved	Tuesday, October 28, 2025
Last Saved	Thursday, October 30, 2025
Product Version	2024 R2
Save Project Before Solution	No
Save Project After Solution	No



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  - [AlSI 4140 Steel, oil quenched, 100 mm \(4 in.\) round \[845°C \(1550°F\) quench, 540°C \(1000°F\) temper\]](#) 2

Units

TABLE 1

Unit System	Metric (m, kg, N, s, V, A) Degrees rad/s Celsius
Angle	Degrees
Rotational Velocity	rad/s
Temperature	Celsius

Model (A4, B4)

TABLE 2  
Model (A4, B4) > Geometry Imports

Object Name	<i>Geometry Imports</i>
State	Solved

TABLE 3  
Model (A4, B4) > Geometry Imports > Geometry Import (A3, B3)

Object Name	<i>Geometry Import (A3, B3)</i>
State	Solved
<b>Definition</b>	
Source	C:\Users\Rober\Downloads\Barrel_V2.SLDPR
Type	SOLIDWORKS
<b>Basic Geometry Options</b>	
Solid Bodies	Yes
Surface Bodies	Yes
Line Bodies	No
Parameters	Independent
Parameter Key	ANS/DS
Attributes	No
Named Selections	No
Material Properties	No
<b>Advanced Geometry Options</b>	
Use Associativity	Yes
Coordinate Systems	No
Reader Mode Saves Updated File	No
Use Instances	Yes
Smart CAD Update	Yes
Compare Parts On Update	No
Analysis Type	3-D
Mixed Import Resolution	None
Import Facet Quality	Source
Clean Bodies On Import	No
Stitch Surfaces On Import	None
Decompose Disjoint Geometry	Yes
Enclosure and Symmetry Processing	Yes

Geometry

TABLE 4  
Model (A4, B4) > Geometry

Object Name	<i>Geometry</i>
-------------	-----------------

State	Fully Defined
<b>Definition</b>	
Source	C:\Users\Robert\Downloads\Barrel_V2.SLDPRT
Type	SOLIDWORKS
Length Unit	Meters
Element Control	Program Controlled
Display Style	Body Color
<b>Bounding Box</b>	
Length X	0,67295 m
Length Y	0,12112 m
Length Z	0,12112 m
<b>Properties</b>	
Volume	5,3672e-003 m³
Mass	42,133 kg
Scale Factor Value	1,
<b>Statistics</b>	
Bodies	1
Active Bodies	1
Nodes	757248
Elements	428196
Mesh Metric	Element Quality
Min	4,5001e-002
Max	0,99992
Average	0,63751
Standard Deviation	0,14661
<b>Update Options</b>	
Assign Default Material	No
<b>Basic Geometry Options</b>	
Solid Bodies	Yes
Surface Bodies	Yes
Line Bodies	No
Parameters	Independent
Parameter Key	ANS;DS
Attributes	No
Named Selections	No
Material Properties	No
<b>Advanced Geometry Options</b>	
Use Associativity	Yes
Coordinate Systems	No
Reader Mode Saves Updated File	No
Use Instances	Yes
Smart CAD Update	Yes
Compare Parts On Update	No
Analysis Type	3-D
Mixed Import Resolution	None
Import Facet Quality	Source
Clean Bodies On Import	No
Stitch Surfaces On Import	None
Decompose Disjoint Geometry	Yes
Enclosure and Symmetry Processing	Yes

**TABLE 5**  
**Model (A4, B4) > Geometry > Parts**

Object Name	Barrel_V2
State	Meshed
<b>Graphics Properties</b>	
Visible	Yes
Transparency	1
<b>Definition</b>	
Suppressed	No
Stiffness Behavior	Flexible
Coordinate System	Default Coordinate System
Reference Temperature	By Environment
Treatment	None
<b>Material</b>	
Assignment	ANSI 4140 Steel, oil quenched, 100 mm (4 in.) round [845°C (1550°F) quench, 540°C (1000°F) temper] 2
Nonlinear Effects	Yes
Thermal Strain Effects	Yes
<b>Bounding Box</b>	
Length X	0,67295 m
Length Y	0,12112 m
Length Z	0,12112 m
<b>Properties</b>	
Volume	5,3672e-003 m³
Mass	42,133 kg
Centroid X	6,5695e-004 m
Centroid Y	7,3545e-006 m
Centroid Z	-1,5227e-005 m
Moment of Inertia Ip1	9,8425e-002 kg·m²
Moment of Inertia Ip2	1,546 kg·m²
Moment of Inertia Ip3	1,5461 kg·m²
<b>Statistics</b>	
Nodes	757248
Elements	428196
Mesh Metric	Element Quality
Min	4,5001e-002
Max	0,99992
Average	0,63751

Standard Deviation	0,14661
--------------------	---------

TABLE 6

## Model (A4, B4) &gt; Construction Geometry

Object Name	Construction Geometry
State	Fully Defined
Display	
Show Mesh	No

TABLE 7

## Model (A4, B4) &gt; Construction Geometry &gt; Paths

Object Name	Path	Path 2
State	Fully Defined	
Definition		
Path Type	Two Points	
Path Coordinate System	Global Coordinate System	
Number of Sampling Points	47,	
Suppressed	No	
Start		
Coordinate System	Global Coordinate System	
Start X Coordinate	0,2666 m	0,33 m
Start Y Coordinate	3,15e-002 m	5,e-002 m
Start Z Coordinate	0, m	
Location	Defined	
End		
Coordinate System	Global Coordinate System	
End X Coordinate	-0,2655 m	-0,33 m
End Y Coordinate	3,15e-002 m	5,e-002 m
End Z Coordinate	0, m	
Location	Defined	

TABLE 8

## Model (A4, B4) &gt; Construction Geometry &gt; Surface

Object Name	Surface	Surface 2
State	Fully Defined	
Definition		
Coordinate System	Global Coordinate System	Coordinate System
Suppressed	No	

TABLE 9

## Model (A4, B4) &gt; Materials

Object Name	Materials
State	Fully Defined
Statistics	
Materials	1
Material Assignments	0

## Coordinate Systems

TABLE 10

## Model (A4, B4) &gt; Coordinate Systems &gt; Coordinate System

Object Name	Global Coordinate System	Coordinate System
	State	Fully Defined
Definition		
Type	Cartesian	
Coordinate System ID	0,	Program Controlled
Coordinate System		
APDL Name		No
Suppressed		
Origin		
Origin X	0, m	Global Coordinates
Origin Y	0, m	
Origin Z	0, m	
Define By		Defined
Location		
Directional Vectors		
X Axis Data	[ 1, 0, 0, ]	[ 0, 0, -1, ]
Y Axis Data	[ 0, 1, 0, ]	[ 1, 0, 0, ]
Z Axis Data	[ 0, 0, 1, ]	[ 0, -1, 0, ]
Transfer Properties		
Source		No
Read Only		
Principal Axis		
Axis		Y
Define By		Global X Axis
Orientation About Principal Axis		
Axis		Z
Define By		Default
Transformations		
Base Configuration		Absolute
Transformed Configuration		[ 0, 0, 0, ]

## Mesh

TABLE 11

## Model (A4, B4) &gt; Mesh

Object Name	Mesh
State	Solved

<b>Display</b>	
Display Style	Use Geometry Setting
<b>Defaults</b>	
Physics Preference	Mechanical
Element Order	Program Controlled
Element Size	2,5e-003 m
<b>Sizing</b>	
Use Adaptive Sizing	Yes
Resolution	1
Mesh Defeaturing	Yes
Defeature Size	Default
Transition	Fast
Span Angle Center	Coarse
Initial Size Seed	Assembly
Bounding Box Diagonal	0,69441 m
Average Surface Area	2,178e-003 m²
Minimum Edge Length	9,2284e-004 m
<b>Quality</b>	
Check Mesh Quality	Yes, Errors
Error Limits	Aggressive Mechanical
Target Element Quality	1,e-003
Smoothing	Medium
Mesh Metric	Element Quality
Min	4,5001e-002
Max	0,99992
Average	0,63751
Standard Deviation	0,14661
<b>Inflation</b>	
Use Automatic Inflation	None
Inflation Option	Smooth Transition
Transition Ratio	0,272
Maximum Layers	5
Growth Rate	1,2
Inflation Algorithm	Pre
Inflation Element Type	Wedges
View Advanced Options	No
<b>Advanced</b>	
Number of CPUs for Parallel Part Meshing	Program Controlled
Straight Sided Elements	No
Rigid Body Behavior	Dimensionally Reduced
Triangle Surface Mesher	Program Controlled
Topology Checking	Yes
Pinch Tolerance	Please Define
Generate Pinch on Refresh	No
<b>Statistics</b>	
Nodes	757248
Elements	428196
Show Detailed Statistics	No

## Steady-State Thermal (A5)

**TABLE 12**  
**Model (A4, B4) > Analysis**

Object Name	<i>Steady-State Thermal (A5)</i>
State	Solved
<b>Definition</b>	
Physics Type	Thermal
Analysis Type	Steady-State
Solver Target	Mechanical APDL
<b>Options</b>	
Generate Input Only	No

**TABLE 13**  
**Model (A4, B4) > Steady-State Thermal (A5) > Initial Condition**

Object Name	<i>Initial Temperature</i>
State	Fully Defined
<b>Definition</b>	
Initial Temperature	Uniform Temperature
Initial Temperature Value	22, °C

**TABLE 14**  
**Model (A4, B4) > Steady-State Thermal (A5) > Analysis Settings**

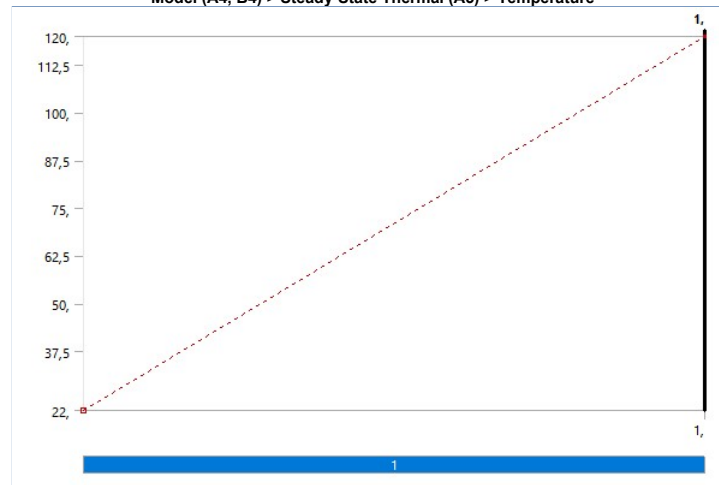
Object Name	<i>Analysis Settings</i>
State	Fully Defined
<b>Step Controls</b>	
Number Of Steps	1,
Current Step Number	1,
Step End Time	1, s
Auto Time Stepping	Program Controlled
<b>Solver Controls</b>	
Solver Type	Program Controlled
Solver Pivot Checking	Program Controlled
<b>Radiosity Controls</b>	
Radiosity Solver	Program Controlled
Flux Convergence	1,e-004
Maximum Iteration	1000,
Solver Tolerance	0,1 W/m²

Over Relaxation	0,1
Hemicube Resolution	10,
<b>Nonlinear Controls</b>	
Heat Convergence	Program Controlled
Temperature Convergence	Program Controlled
Line Search	Program Controlled
<b>Advanced</b>	
Contact Split (DMP)	Program Controlled
<b>Output Controls</b>	
Output Selection	None
Calculate Thermal Flux	Yes
Contact Data	Yes
Nodal Forces	No
Volume and Energy	Yes
Euler Angles	Yes
General Miscellaneous	No
Contact Miscellaneous	No
Store Results At	All Time Points
Result File Compression	Program Controlled
<b>Analysis Data Management</b>	
Solver Files Directory	C:\Users\Rober\Desktop\Ansys\Barrel_files\dp0\SYS\MECH\
Future Analysis	None
Scratch Solver Files Directory	
Save MAPDL db	No
Contact Summary	Program Controlled
Delete Unneeded Files	Yes
Nonlinear Solution	Yes
Solver Units	Active System
Solver Unit System	mks

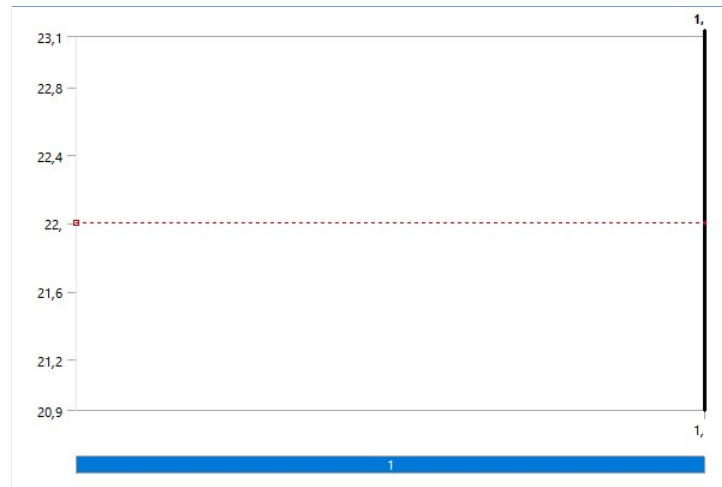
**TABLE 15**  
**Model (A4, B4) > Steady-State Thermal (A5) > Loads**

Object Name	Temperature	Radiation
State	Fully Defined	
Scope		
Scoping Method	Geometry Selection	
Geometry	1 Face	
Definition		
Type	Temperature	Radiation
Magnitude	120, °C (ramped)	
Suppressed	No	
Correlation		To Ambient
Emissivity		1, (step applied)
Ambient Temperature		22, °C (ramped)

**FIGURE 1**  
**Model (A4, B4) > Steady-State Thermal (A5) > Temperature**



**FIGURE 2**  
**Model (A4, B4) > Steady-State Thermal (A5) > Radiation**



Solution (A6)

**TABLE 16**  
Model (A4, B4) > Steady-State Thermal (A5) > Solution

Object Name	<i>Solution (A6)</i>
State	Solved
<b>Adaptive Mesh Refinement</b>	
Max Refinement Loops	1,
Refinement Depth	2,
<b>Information</b>	
Status	Done
MAPDL Elapsed Time	1 m 30 s
MAPDL Memory Used	6,9424 GB
MAPDL Result File Size	207,56 MB
<b>Post Processing</b>	
Beam Section Results	No
On Demand Stress/Strain	No

**TABLE 17**  
Model (A4, B4) > Steady-State Thermal (A5) > Solution (A6) > Solution Information

Object Name	<i>Solution Information</i>
State	Solved
<b>Solution Information</b>	
Solution Output	Solver Output
Update Interval	2,5 s
Display Points	All
<b>FE Connection Visibility</b>	
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 18**  
Model (A4, B4) > Steady-State Thermal (A5) > Solution (A6) > Results

Object Name	Temperature	Total Heat Flux
State	Solved	
Scope		
Scoping Method	Geometry Selection	
Geometry	All Bodies	
Definition		
Type	Temperature	Total Heat Flux
By	Time	
Display Time	Last	
Separate Data by Entity	No	
Calculate Time History	Yes	
Identifier		
Suppressed	No	
Results		
Minimum	114,68 °C	4,0969 W/m²
Maximum	120, °C	15140 W/m²
Average	118,22 °C	1636,3 W/m²
Minimum Occurs On	Barrel_V2	
Maximum Occurs On	Barrel_V2	
Information		
Time	1, s	
Load Step	1	
Substep	1	
Iteration Number	2	
Integration Point Results		
Display Option		Averaged
Average Across Bodies		No

FIGURE 3  
Model (A4, B4) > Steady-State Thermal (A5) > Solution (A6) > Temperature

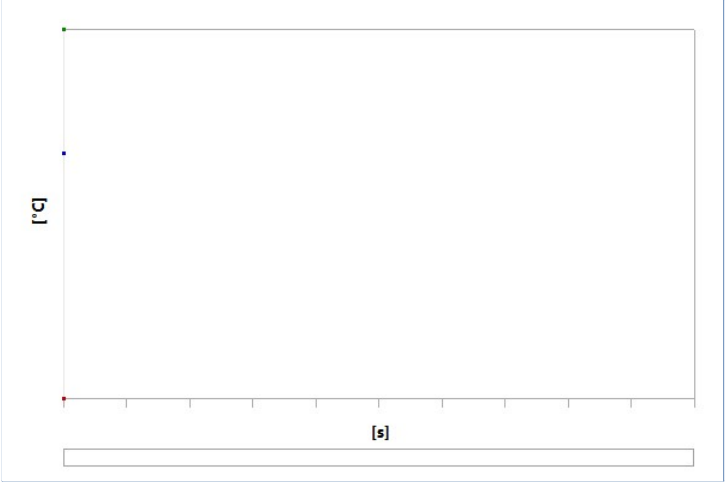


TABLE 19  
Model (A4, B4) > Steady-State Thermal (A5) > Solution (A6) > Temperature

Time [s]	Minimum [°C]	Maximum [°C]	Average [°C]
1,	114,68	120,	118,22

FIGURE 4  
Model (A4, B4) > Steady-State Thermal (A5) > Solution (A6) > Temperature > Figure

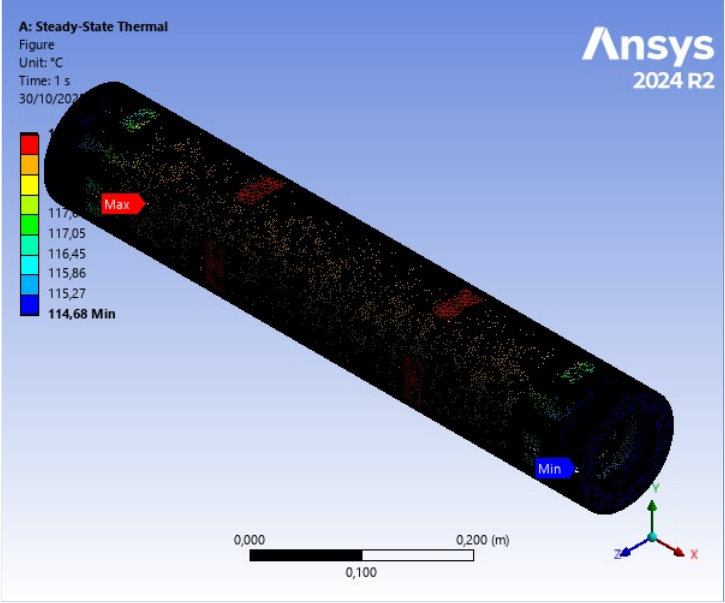
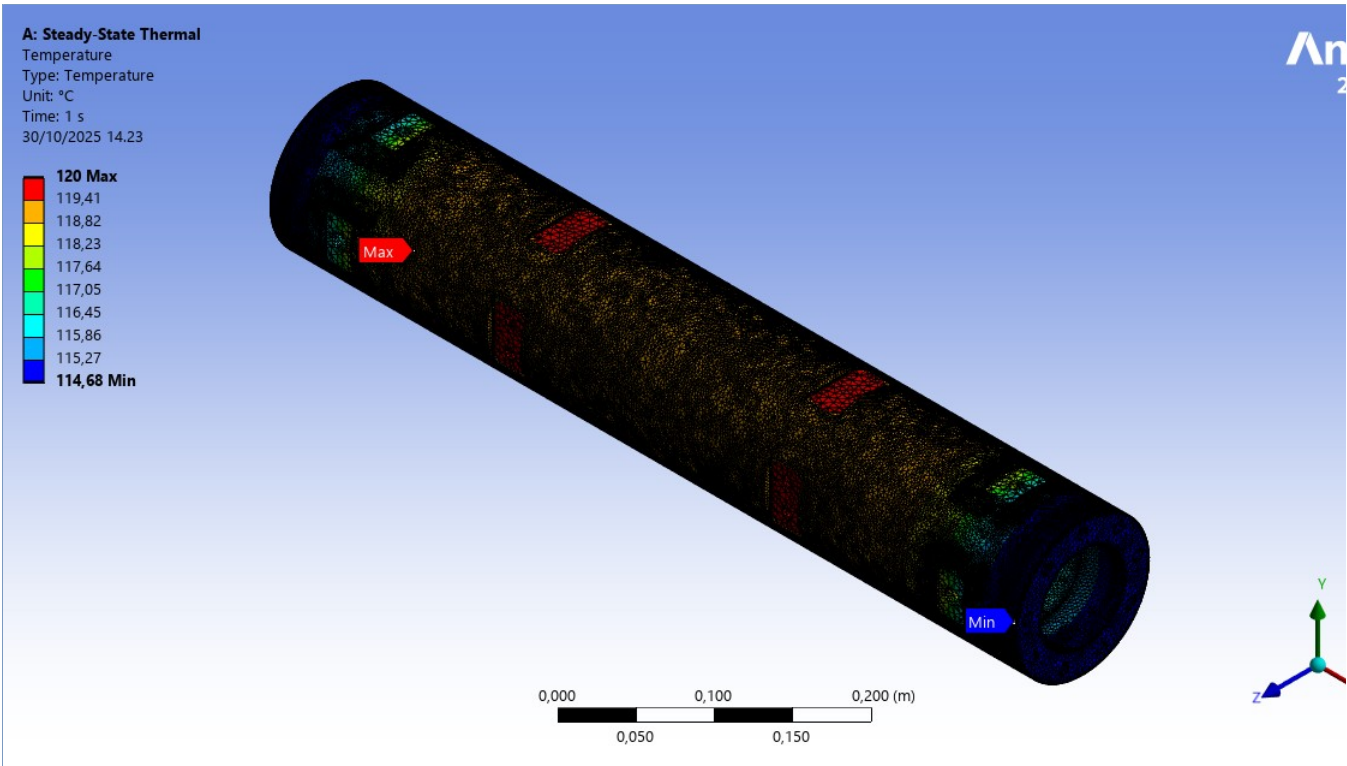
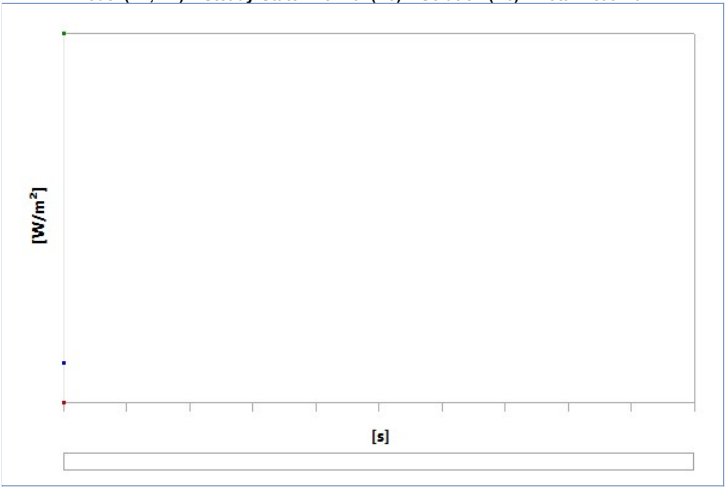


FIGURE 5  
Model (A4, B4) > Steady-State Thermal (A5) > Solution (A6) > Temperature > Image





**FIGURE 6**  
Model (A4, B4) > Steady-State Thermal (A5) > Solution (A6) > Total Heat Flux



**TABLE 20**  
Model (A4, B4) > Steady-State Thermal (A5) > Solution (A6) > Total Heat Flux

Time [s]	Minimum [W/m²]	Maximum [W/m²]	Average [W/m²]
1,	4,0969	15140	1636,3

**FIGURE 7**  
Model (A4, B4) > Steady-State Thermal (A5) > Solution (A6) > Total Heat Flux > Figure

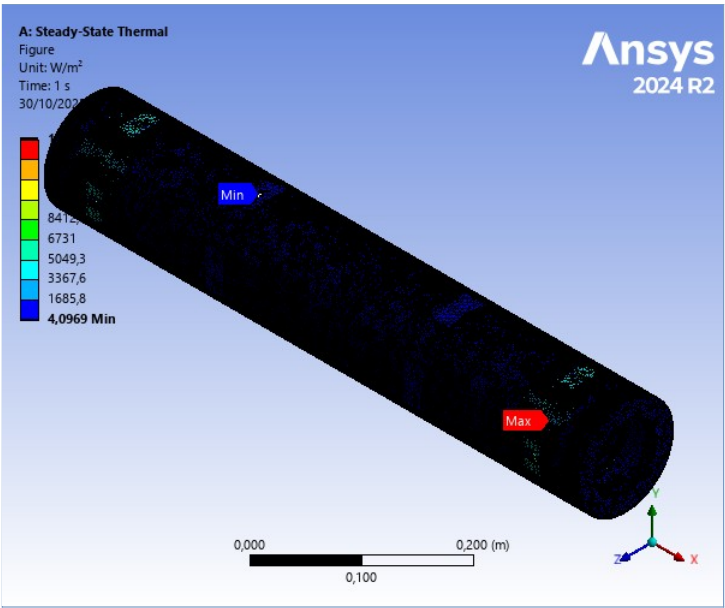
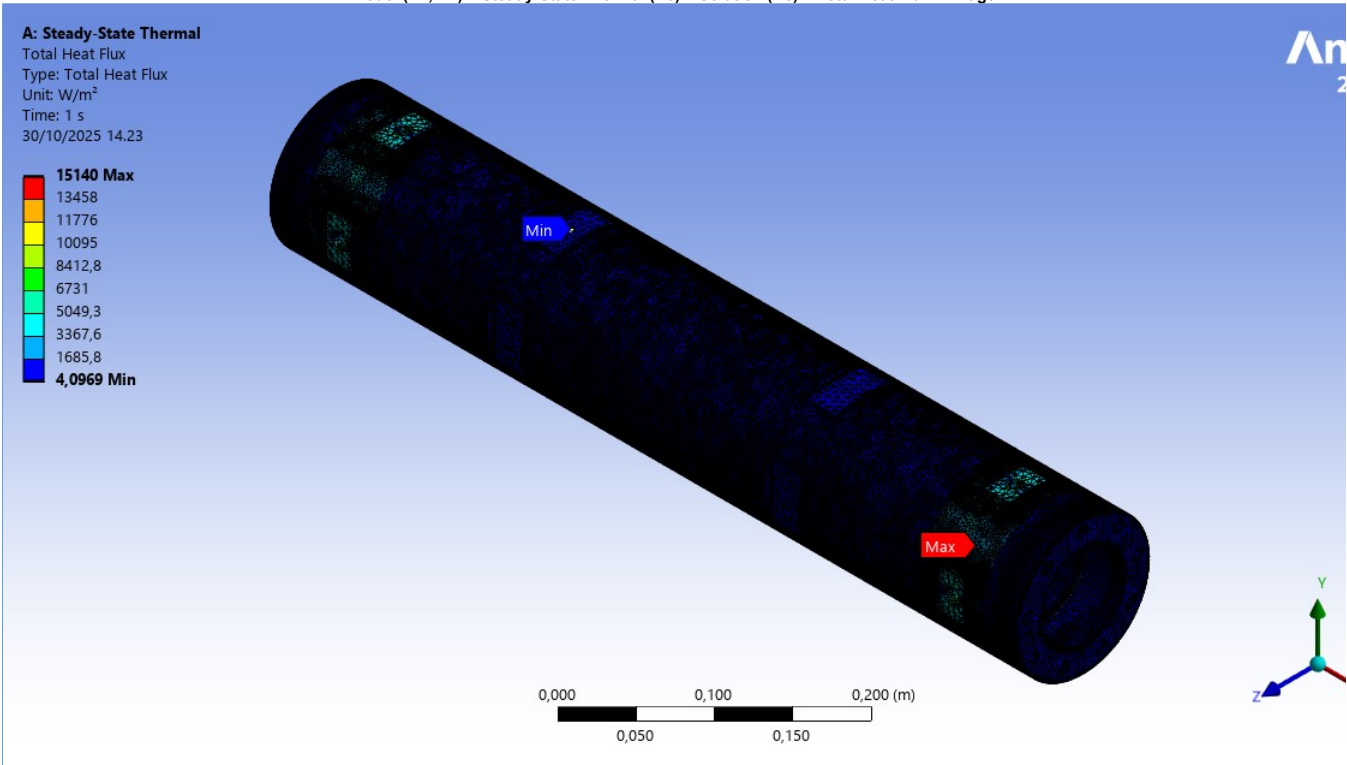


FIGURE 8  
Model (A4, B4) > Steady-State Thermal (A5) > Solution (A6) > Total Heat Flux > Image



Static Structural (B5)

TABLE 21  
Model (A4, B4) > Analysis

Object Name	Static Structural (B5)
State	Solved
Definition	
Physics Type	Structural
Analysis Type	Static Structural
Solver Target	Mechanical APDL
Options	
Environment Temperature	22, °C
Generate Input Only	No

TABLE 22  
Model (A4, B4) > Static Structural (B5) > Analysis Settings

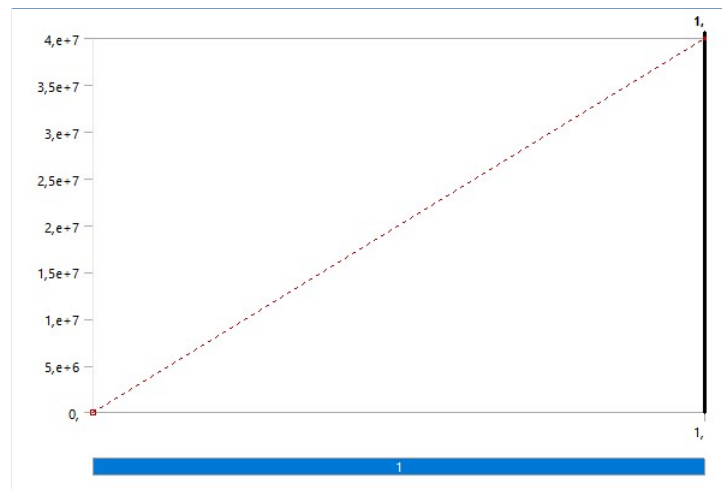
Object Name	Analysis Settings
-------------	-------------------

State	Fully Defined
<b>Step Controls</b>	
Number Of Steps	1,
Current Step Number	1,
Step End Time	1, s
Auto Time Stepping	Program Controlled
<b>Solver Controls</b>	
Solver Type	Program Controlled
Weak Springs	Off
Solver Pivot Checking	Program Controlled
Large Deflection	Off
Inertia Relief	Off
Quasi-Static Solution	Off
<b>Rotordynamics Controls</b>	
Coriolis Effect	Off
<b>Restart Controls</b>	
Generate Restart Points	Program Controlled
Retain Files After Full Solve	No
Combine Restart Files	Program Controlled
<b>Nonlinear Controls</b>	
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	Program Controlled
<b>Advanced</b>	
Inverse Option	No
Contact Split (DMP)	Program Controlled
<b>Output Controls</b>	
Output Selection	None
Stress	Yes
Back Stress	No
Strain	Yes
Contact Data	Yes
Nonlinear Data	No
Nodal Forces	No
Volume and Energy	Yes
Euler Angles	Yes
General Miscellaneous	No
Contact Miscellaneous	No
Store Results At	All Time Points
Result File Compression	Program Controlled
<b>Analysis Data Management</b>	
Solver Files Directory	C:\Users\Robert\Desktop\Ansys\Barrel_files\dp0\SYS-1\MECH\
Future Analysis	None
Scratch Solver Files Directory	
Save MAPDL db	No
Contact Summary	Program Controlled
Delete Unneeded Files	Yes
Nonlinear Solution	No
Solver Units	Active System
Solver Unit System	mks

**TABLE 23**  
**Model (A4, B4) > Static Structural (B5) > Loads**

Object Name	Pressure	Displacement	Displacement 2	Displacement 3	Displacement 4	Displacement 5	Force
State	Fully Defined						
Scope							
Scoping Method	Geometry Selection						
Geometry	35 Faces	8 Faces	2 Faces				1 Face
Definition							
Type	Pressure	Displacement					Force
Define By	Normal To	Components					
Applied By	Surface Effect						Surface Effect
Loaded Area	Deformed						
Magnitude	4.e+007 Pa (ramped)						
Suppressed	No						
Coordinate System	Global Coordinate System						
X Component	0, m (ramped)		Free				20000 N (ramped)
Y Component	Free		0, m (ramped)		Free	Free	0, N (ramped)
Z Component	Free	0, m (ramped)		Free		0, m (ramped)	0, N (ramped)

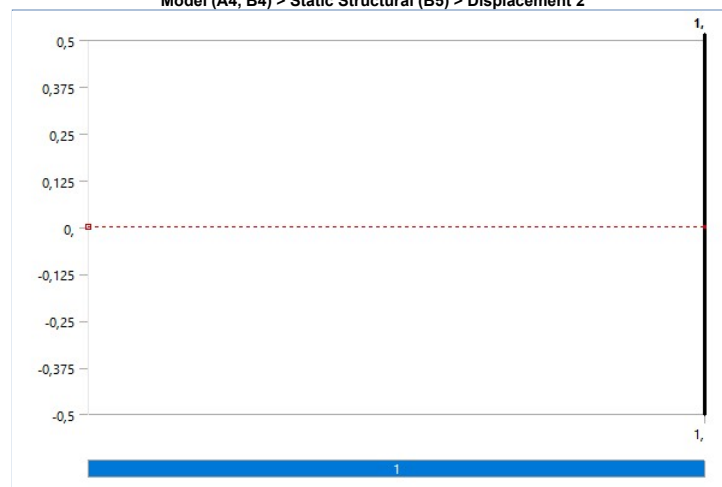
**FIGURE 9**  
**Model (A4, B4) > Static Structural (B5) > Pressure**



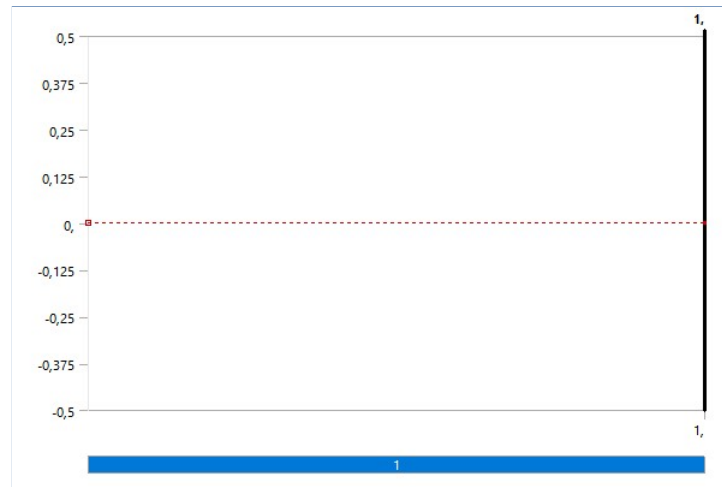
**FIGURE 10**  
**Model (A4, B4) > Static Structural (B5) > Displacement**



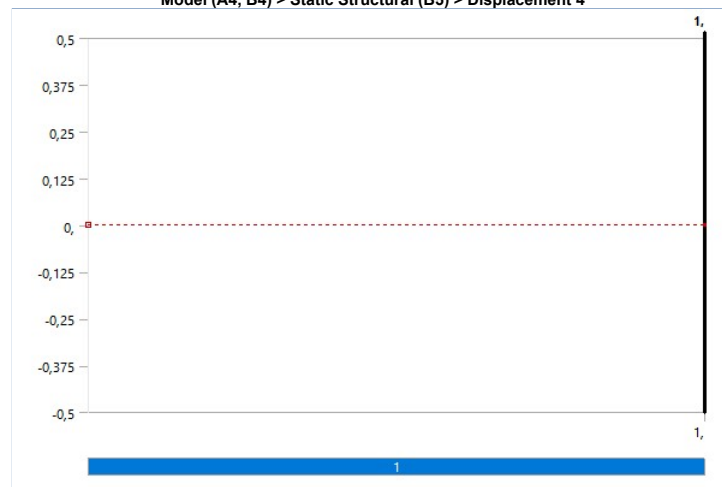
**FIGURE 11**  
**Model (A4, B4) > Static Structural (B5) > Displacement 2**



**FIGURE 12**  
**Model (A4, B4) > Static Structural (B5) > Displacement 3**



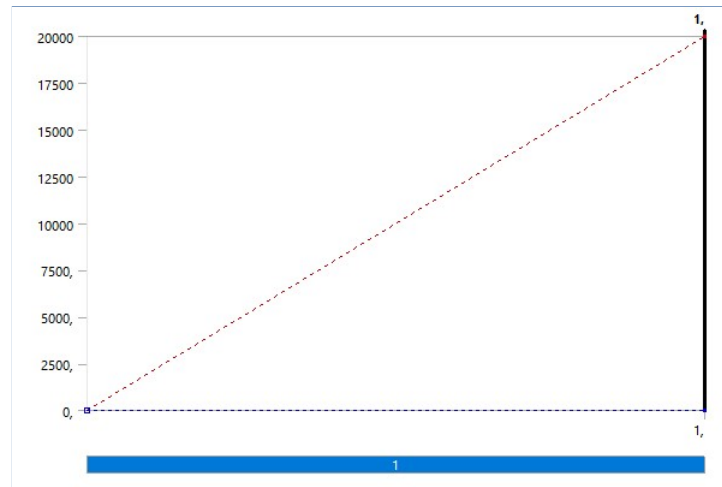
**FIGURE 13**  
**Model (A4, B4) > Static Structural (B5) > Displacement 4**



**FIGURE 14**  
**Model (A4, B4) > Static Structural (B5) > Displacement 5**



**FIGURE 15**  
**Model (A4, B4) > Static Structural (B5) > Force**



**TABLE 24**  
Model (A4, B4) > Static Structural (B5) > Imported Load (A6)

Object Name	Imported Load (A6)
State	Fully Defined
<b>Definition</b>	
Type	Imported Data
Interpolation Type	Mechanical Results Transfer
Suppressed	No
Source	A6::Solution
<b>Data Management</b>	
Delete Mapped Data Files	Yes

**TABLE 25**  
Model (A4, B4) > Static Structural (B5) > Imported Load (A6) > Imported Body Temperature

Object Name	Imported Body Temperature
State	Solved
<b>Scope</b>	
Scoping Method	Geometry Selection
Geometry	1 Body
<b>Definition</b>	
Type	Imported Body Temperature
Tabular Loading	Program Controlled
Suppressed	No
Source Environment	Steady-State Thermal (A5)
Source Time	Worksheet

Model (A4, B4) > Static Structural (B5) > Imported Load (A6) > Imported Body Temperature

	Source Time (s)	Analysis Time (s)	Scale	Offset (Δ°C)
1	End Time	1	1	0
*				

### Solution (B6)

**TABLE 26**  
Model (A4, B4) > Static Structural (B5) > Solution

Object Name	Solution (B6)
State	Solved
<b>Adaptive Mesh Refinement</b>	
Max Refinement Loops	1,
Refinement Depth	2,
<b>Information</b>	
Status	Done
MAPDL Elapsed Time	1 m 34 s
MAPDL Memory Used	5,416 GB
MAPDL Result File Size	326,38 MB
<b>Post Processing</b>	
Beam Section Results	No
On Demand Stress/Strain	No

**TABLE 27**  
Model (A4, B4) > Static Structural (B5) > Solution (B6) > Solution Information

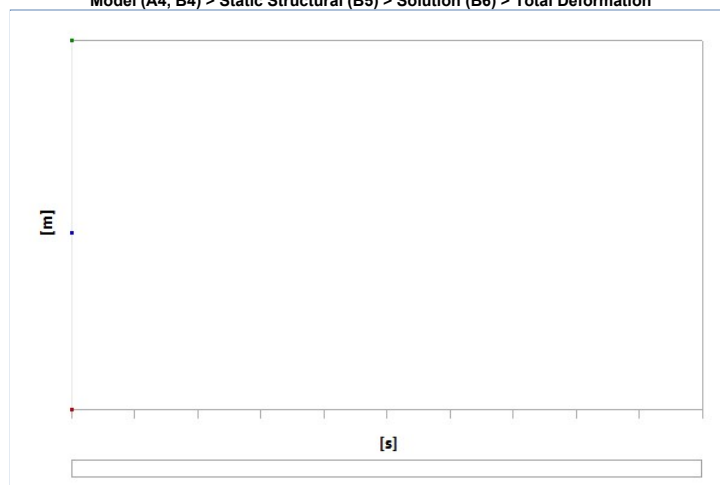
Object Name	Solution Information
State	Solved
<b>Solution Information</b>	
Solution Output	Solver Output
Newton-Raphson Residuals	0
Identify Element Violations	0
Update Interval	2,5 s
Display Points	All
<b>FE Connection Visibility</b>	
Activate Visibility	Yes
Display	All FE Connectors
Draw Connections Attached To	All Nodes
Line Color	Connection Type

Visible on Results	No
Line Thickness	Single
Display Type	Lines

**TABLE 28**  
**Model (A4, B4) > Static Structural (B5) > Solution (B6) > Results**

Object Name	Total Deformation	Equivalent Stress	Directional Deformation	Directional Deformation 2	Directional Deformation 3	Equivalent Stress 2	Directional Deformation 5	Equivalent Stress 3	Equivalent Stress 4	Directional Deformation 7	Directional Deformation 8
State	Solved										
Scope											
Scoping Method	Geometry Selection					Path	Geometry Selection	Path	Surface		
Geometry	All Bodies						35 Faces	All Bodies			
Path						Path		Path 2			
Surface								Surface			
Definition											
Type	Total Deformation	Equivalent (von-Mises) Stress	Directional Deformation			Equivalent (von-Mises) Stress	Directional Deformation	Equivalent (von-Mises) Stress		Directional Deformation	
By						Time					
Display Time						Last					
Separate Data by Entity	No						No				
Calculate Time History	Yes										
Identifier											
Suppressed	No										
Orientation		X Axis	Y Axis	Z Axis		Z Axis		Y Axis	Z Axis		
Coordinate System		Global Coordinate System				Global Coordinate System		Global Coordinate System			
Results											
Minimum	3,3957e-008 m	45817 Pa	-2,5382e-004 m	-8,1916e-005 m	-8,4482e-005 m	3,5853e+006 Pa	-6,5411e-005 m	1,1953e+007 Pa	1,1533e+005 Pa	-8,1916e-005 m	-6,8955e-006 m
Maximum	5,6702e-004 m	3,1235e+009 Pa	5,6388e-004 m	8,185e-005 m	8,1725e-005 m	3,341e+008 Pa	5,8239e-005 m	3,0241e+008 Pa	7,1222e+008 Pa	8,185e-005 m	5,8361e-007 m
Average	2,7126e-004 m	7,3416e+007 Pa	1,5659e-004 m	2,3247e-007 m	-1,4279e-006 m	1,1874e+008 Pa	-9,4077e-007 m	6,8109e+007 Pa	7,6654e+007 Pa	-1,7259e-007 m	-1,0863e-006 m
Minimum Occurs On	Barrel_V2										
Maximum Occurs On	Barrel_V2										
Information											
Time	1, s										
Load Step	1										
Substep	1										
Iteration Number	1										
Integration Point Results											
Display Option	Averaged					Averaged		Averaged			
Average Across Bodies	No					No		No			
Graph Controls											
X-Axis						S		S			

**FIGURE 16**  
**Model (A4, B4) > Static Structural (B5) > Solution (B6) > Total Deformation**



**TABLE 29**  
**Model (A4, B4) > Static Structural (B5) > Solution (B6) > Total Deformation**

Time [s]	Minimum [m]	Maximum [m]	Average [m]
1,	3,3957e-008	5,6702e-004	2,7126e-004

**FIGURE 17**

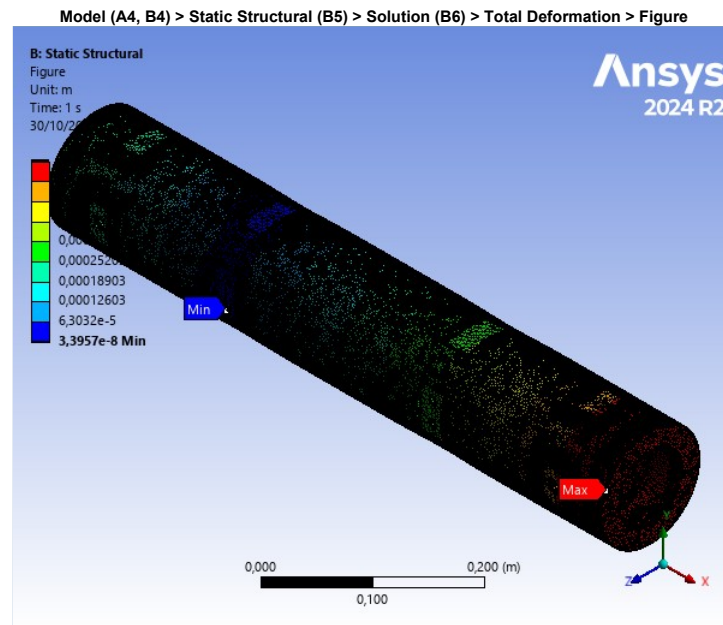


FIGURE 18

Model (A4, B4) &gt; Static Structural (B5) &gt; Solution (B6) &gt; Total Deformation &gt; Image

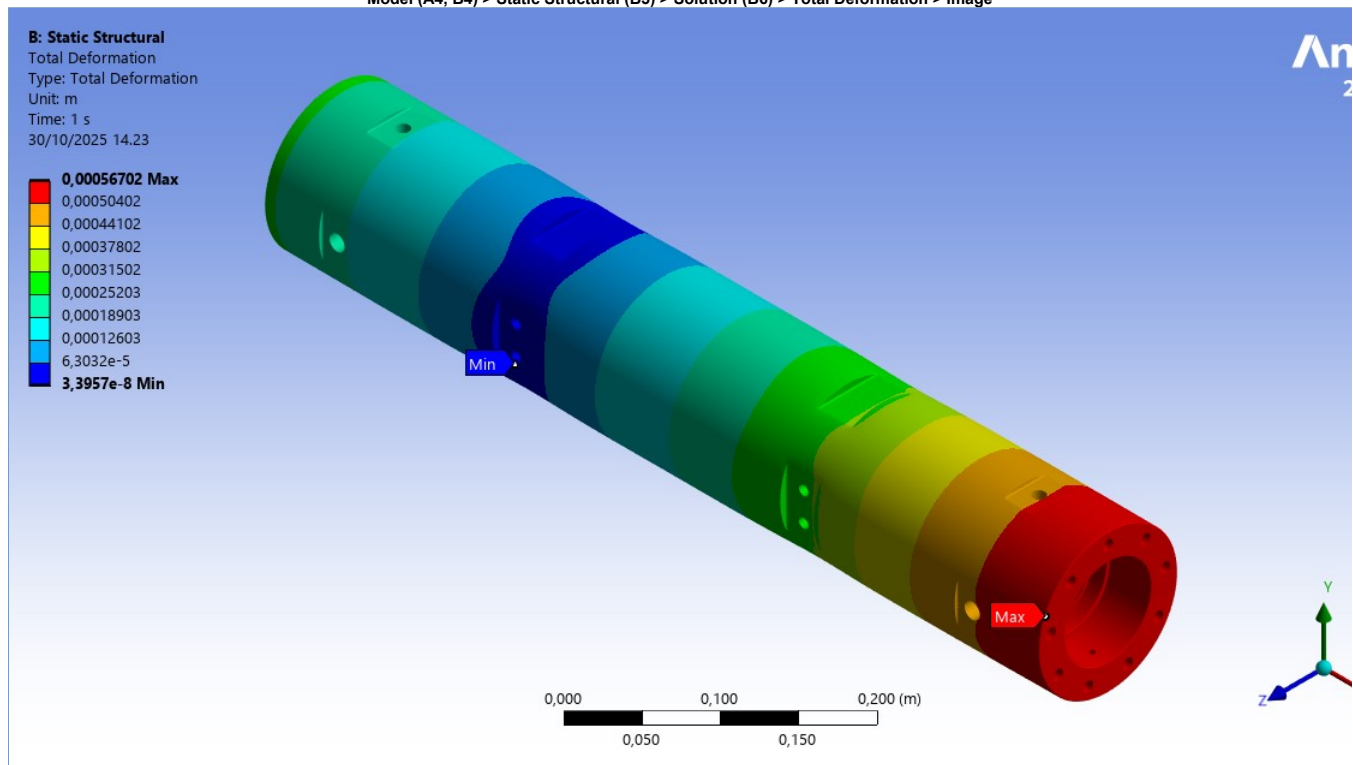


FIGURE 19

Model (A4, B4) &gt; Static Structural (B5) &gt; Solution (B6) &gt; Equivalent Stress



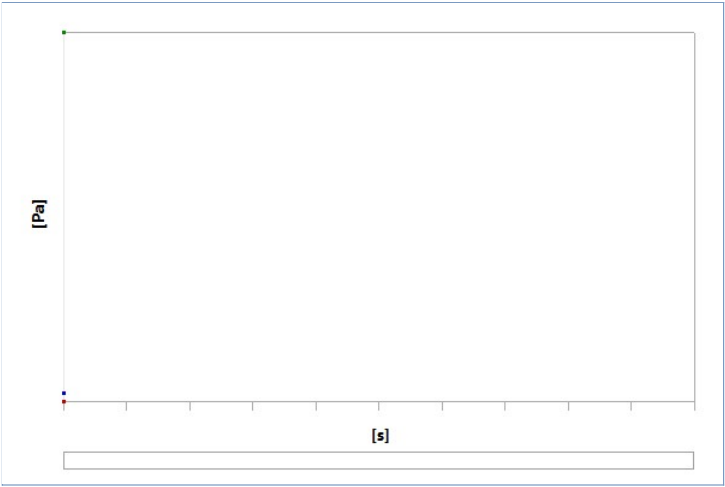


TABLE 30  
Model (A4, B4) > Static Structural (B5) > Solution (B6) > Equivalent Stress

Time [s]	Minimum [Pa]	Maximum [Pa]	Average [Pa]
1,	45817	3,1235e+009	7,3416e+007

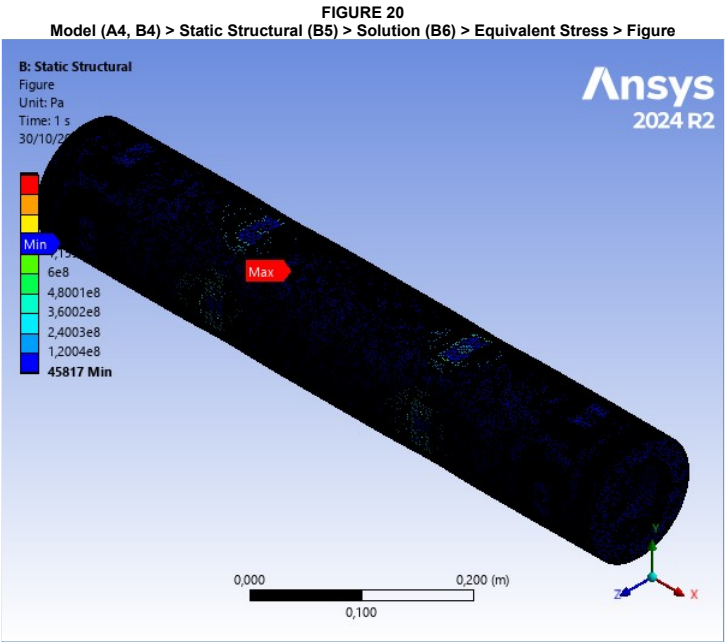
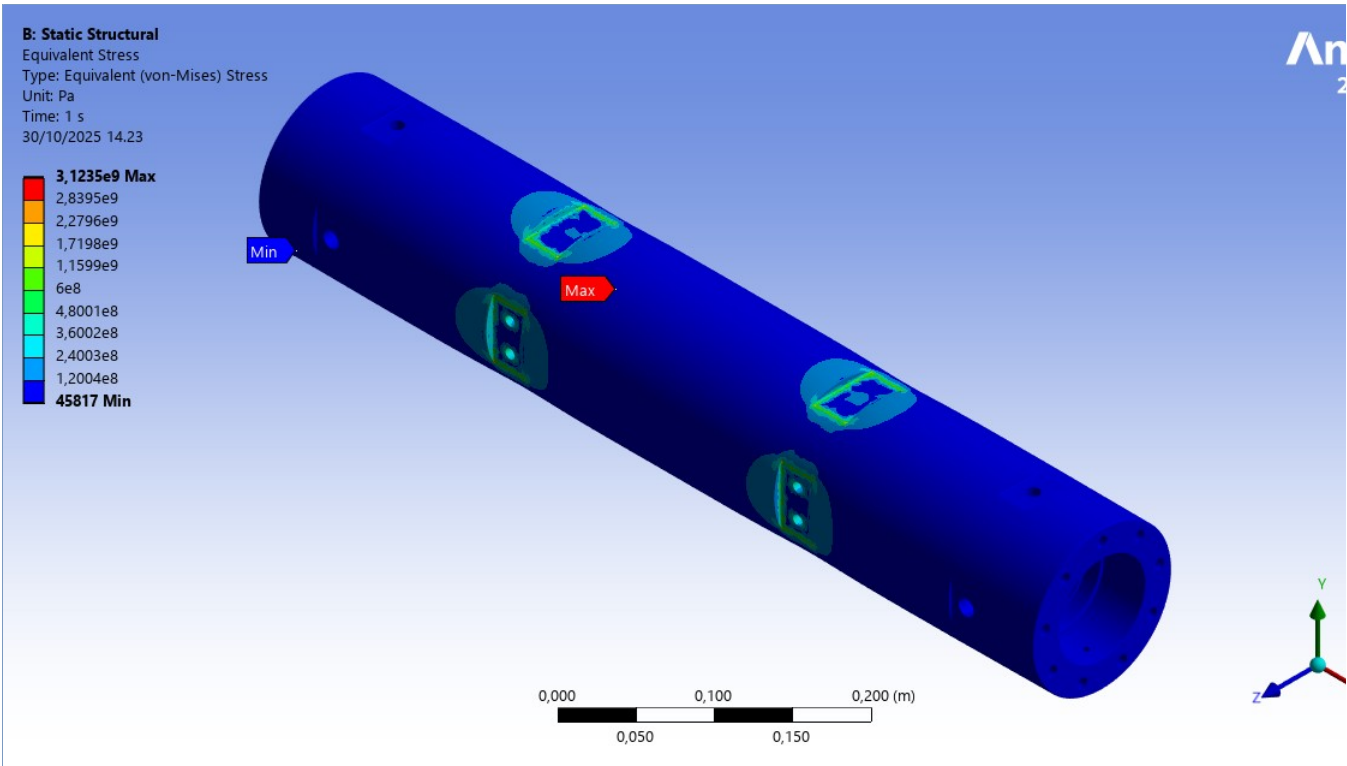
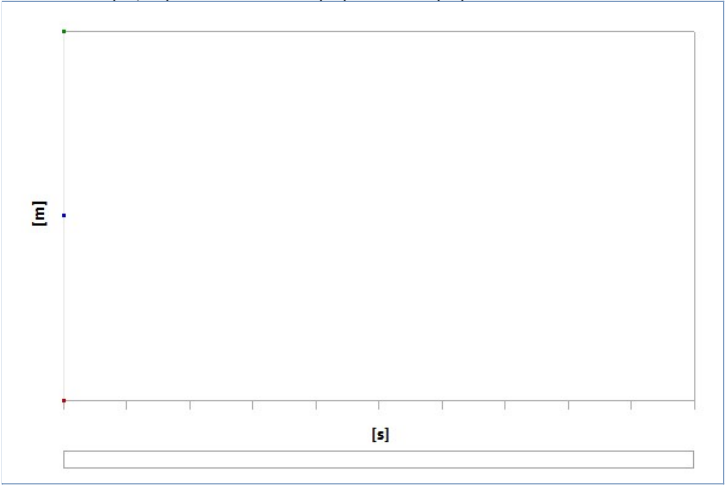


FIGURE 21  
Model (A4, B4) > Static Structural (B5) > Solution (B6) > Equivalent Stress > Image



**FIGURE 22**  
Model (A4, B4) > Static Structural (B5) > Solution (B6) > Directional Deformation



**TABLE 31**  
Model (A4, B4) > Static Structural (B5) > Solution (B6) > Directional Deformation

Time [s]	Minimum [m]	Maximum [m]	Average [m]
1,	-2,5382e-004	5,6388e-004	1,5659e-004

**FIGURE 23**  
Model (A4, B4) > Static Structural (B5) > Solution (B6) > Directional Deformation > Figure

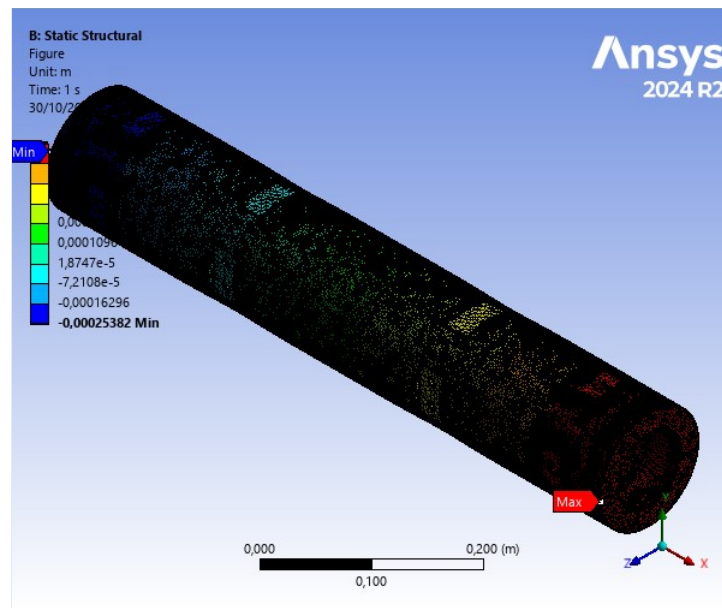


FIGURE 24  
Model (A4, B4) > Static Structural (B5) > Solution (B6) > Directional Deformation > Image

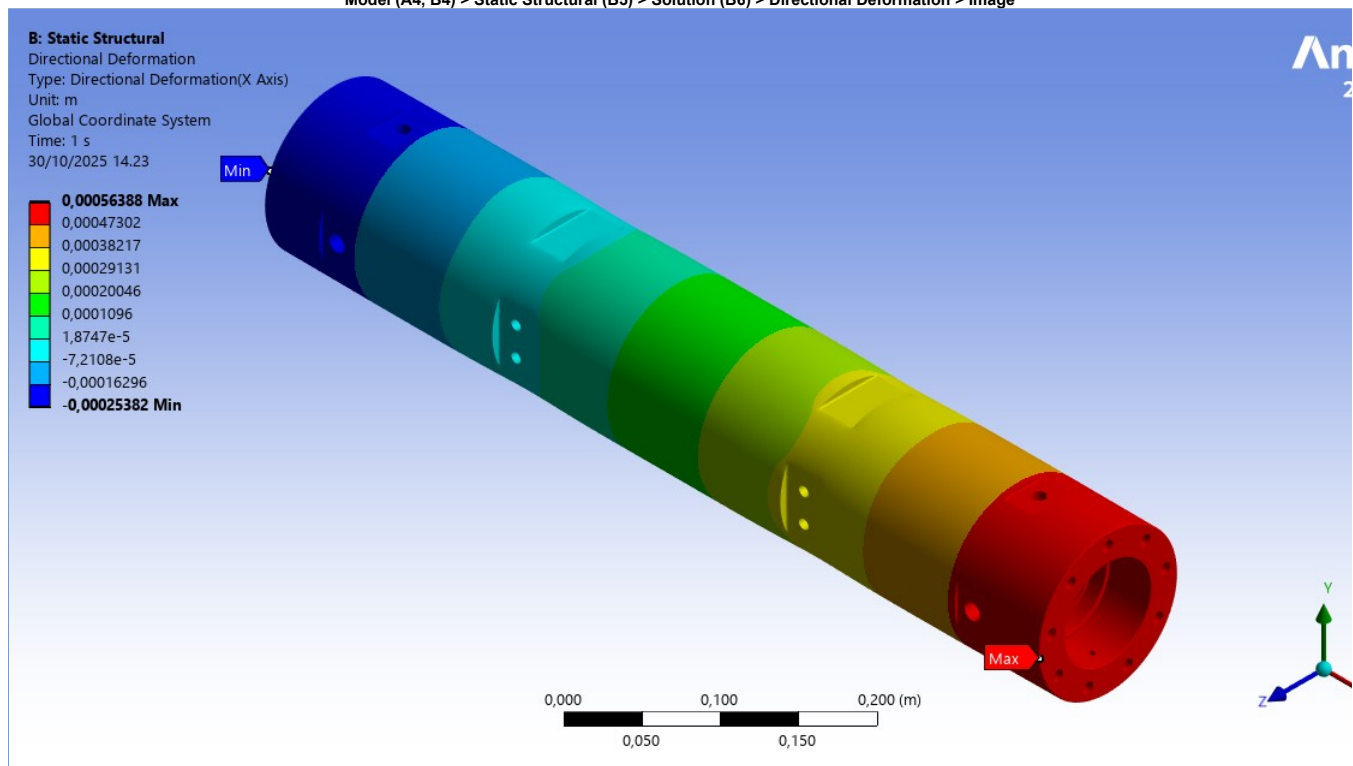


FIGURE 25  
Model (A4, B4) > Static Structural (B5) > Solution (B6) > Directional Deformation 2

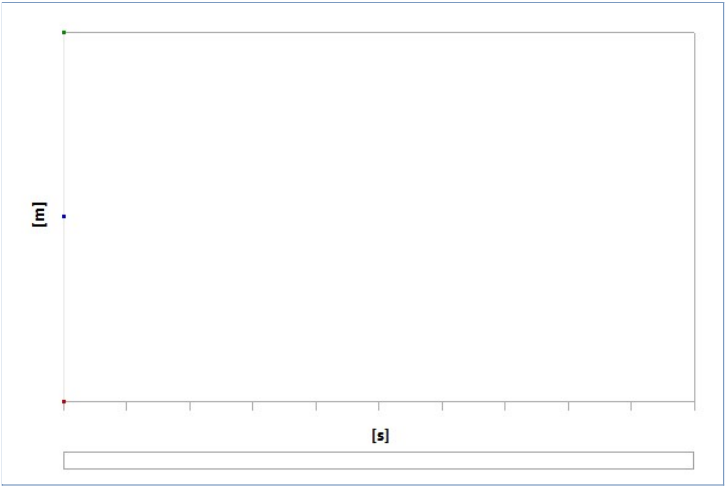


TABLE 32

Model (A4, B4) > Static Structural (B5) > Solution (B6) > Directional Deformation 2

Time [s]	Minimum [m]	Maximum [m]	Average [m]
1,	-8,1916e-005	8,185e-005	2,3247e-007

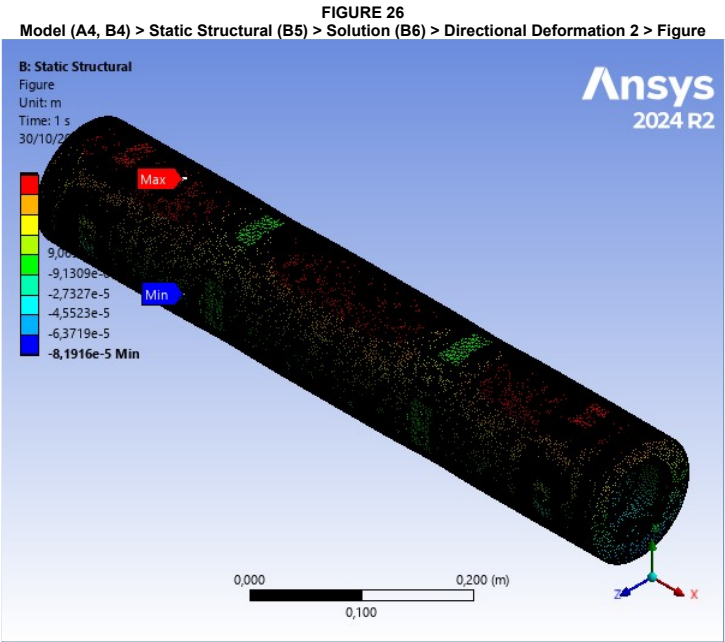
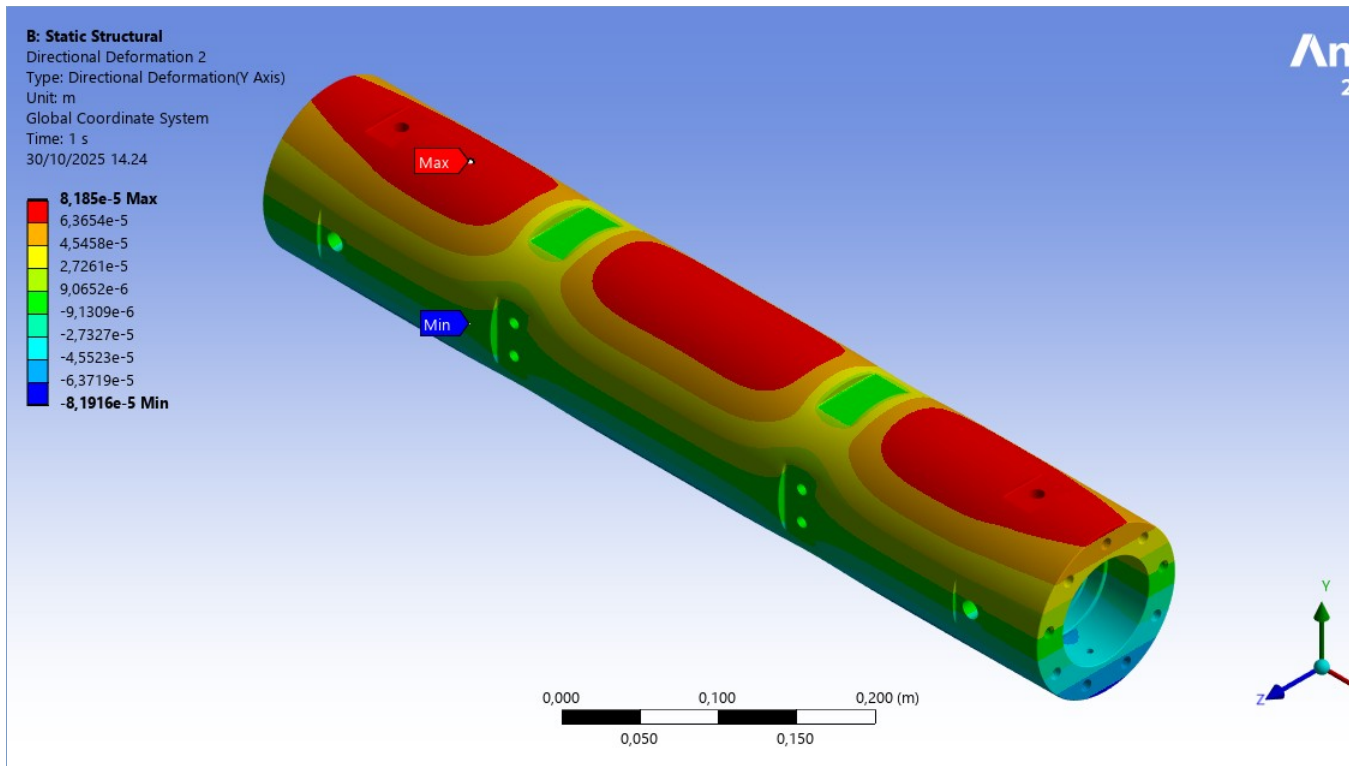
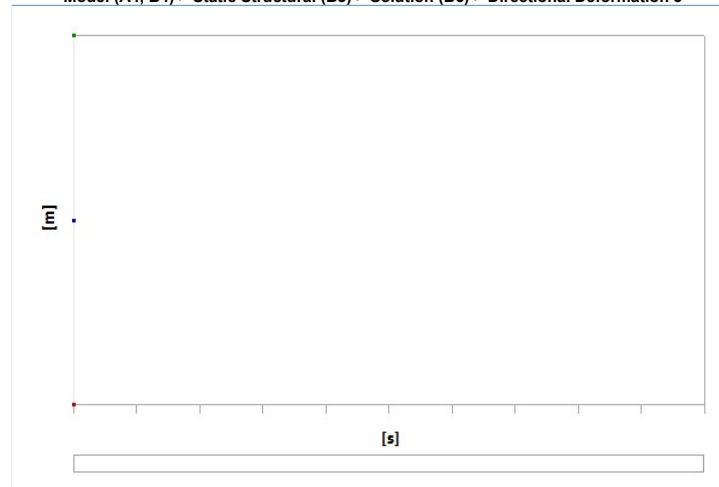


FIGURE 27

Model (A4, B4) > Static Structural (B5) > Solution (B6) > Directional Deformation 2 > Image



**FIGURE 28**  
 Model (A4, B4) > Static Structural (B5) > Solution (B6) > Directional Deformation 3



**TABLE 33**  
 Model (A4, B4) > Static Structural (B5) > Solution (B6) > Directional Deformation 3

Time [s]	Minimum [m]	Maximum [m]	Average [m]
1,	-8,4482e-005	8,1725e-005	-1,4279e-006

**FIGURE 29**  
 Model (A4, B4) > Static Structural (B5) > Solution (B6) > Directional Deformation 3 > Figure

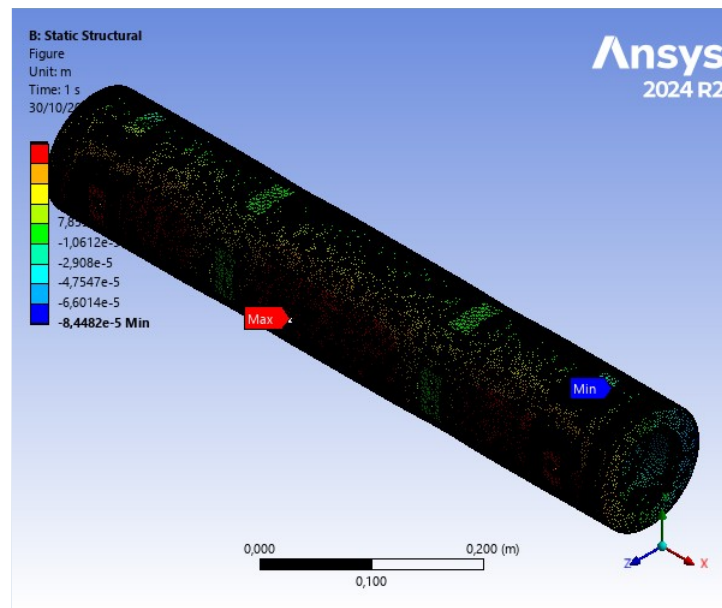


FIGURE 30  
Model (A4, B4) > Static Structural (B5) > Solution (B6) > Directional Deformation 3 > Image

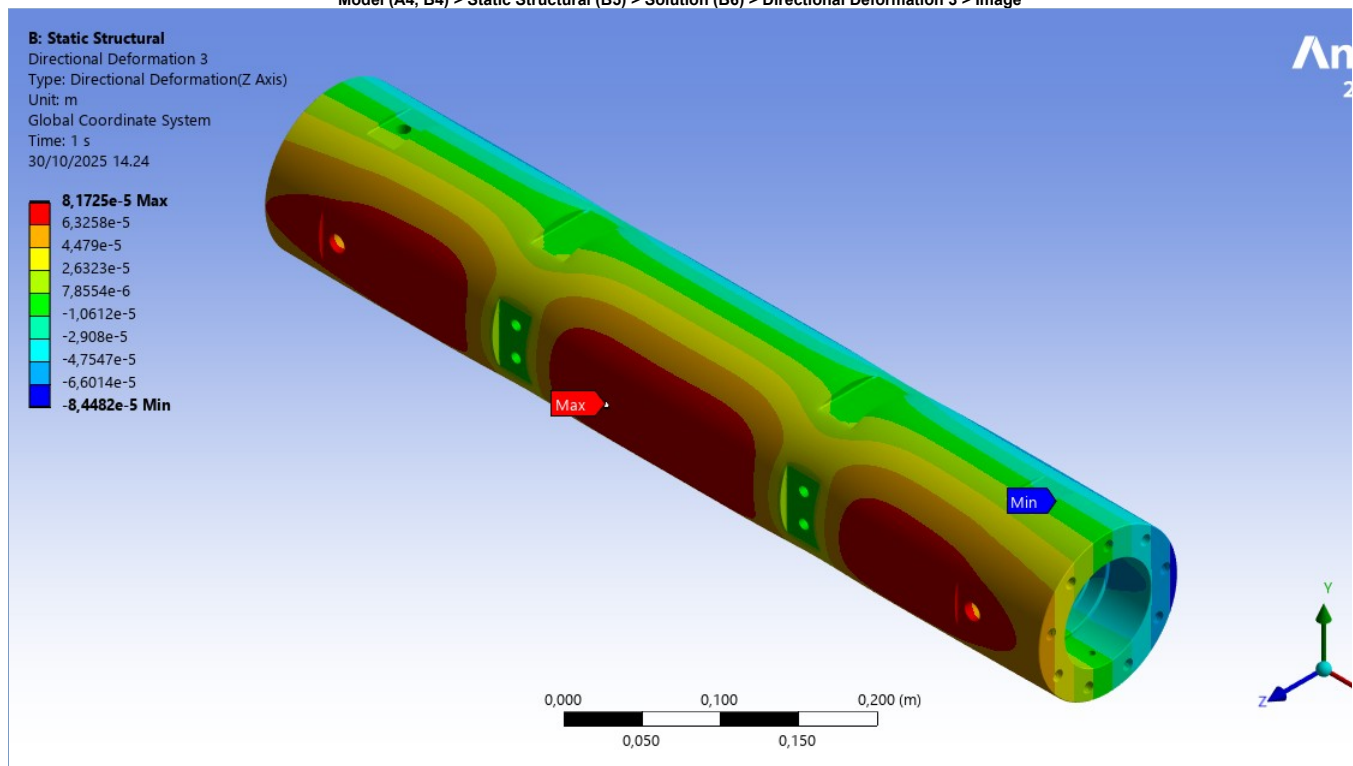
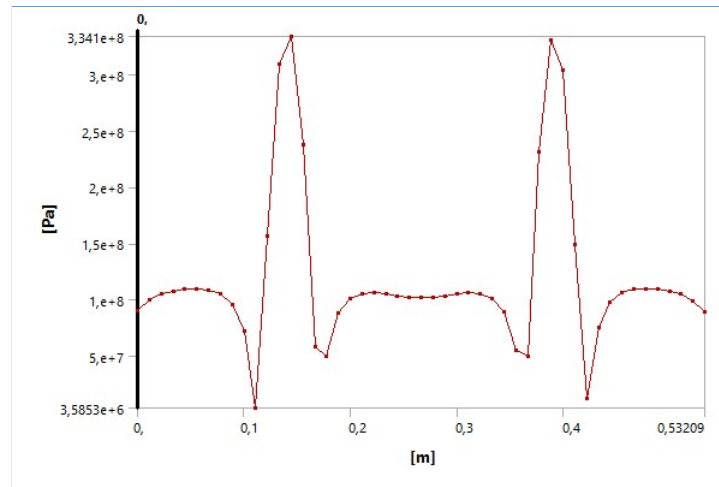


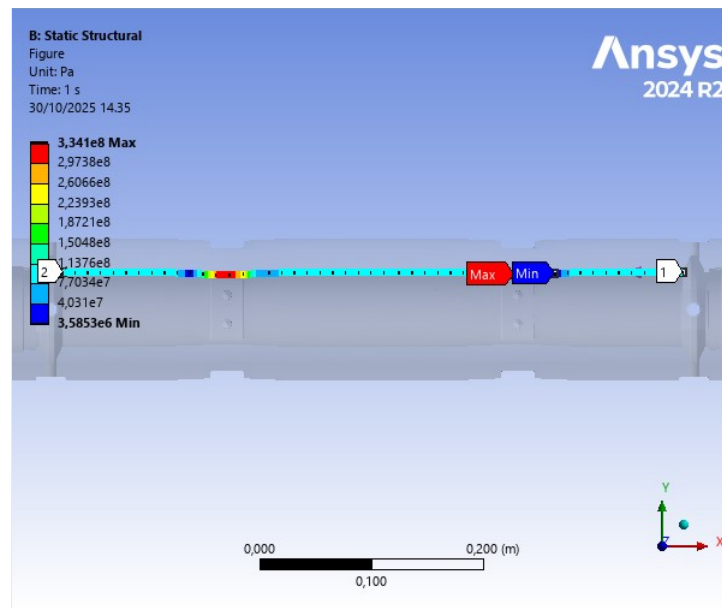
FIGURE 31  
Model (A4, B4) > Static Structural (B5) > Solution (B6) > Equivalent Stress 2



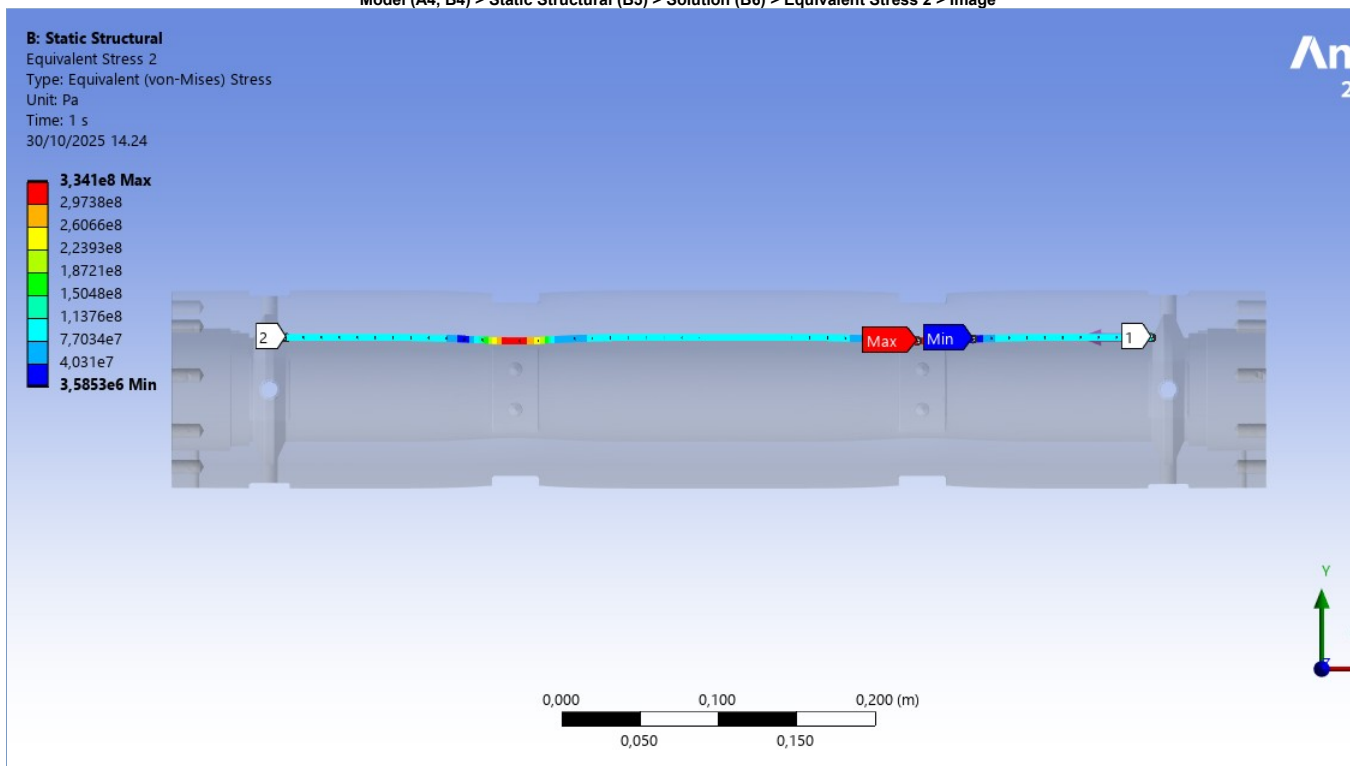
**TABLE 34**  
**Model (A4, B4) > Static Structural (B5) > Solution (B6) > Equivalent Stress 2**

Length [m]	Value [Pa]
0,	9,0263e+007
1,1085e-002	9,9659e+007
2,2171e-002	1,0478e+008
3,3256e-002	1,0765e+008
4,4341e-002	1,0912e+008
5,5427e-002	1,0963e+008
6,6512e-002	1,085e+008
7,7597e-002	1,0541e+008
8,8682e-002	9,6045e+007
9,9768e-002	7,2039e+007
0,11085	3,5853e+006
0,12194	1,5666e+008
0,13302	3,0973e+008
0,14411	3,341e+008
0,15519	2,3796e+008
0,16628	5,7875e+007
0,17736	5,0103e+007
0,18845	8,7714e+007
0,19954	1,0101e+008
0,21062	1,0547e+008
0,22171	1,061e+008
0,23279	1,0476e+008
0,24388	1,0346e+008
0,25496	1,0208e+008
0,26605	1,0147e+008
0,27713	1,0217e+008
0,28822	1,0324e+008
0,2993	1,0494e+008
0,31039	1,0586e+008
0,32147	1,0526e+008
0,33256	1,0115e+008
0,34364	8,9339e+007
0,35473	5,5433e+007
0,36582	4,9306e+007
0,3769	2,3102e+008
0,38799	3,3064e+008
0,39907	3,0387e+008
0,41016	1,4948e+008
0,42124	1,2303e+007
0,43233	7,5695e+007
0,44341	9,7851e+007
0,4545	1,0609e+008
0,46558	1,0938e+008
0,47667	1,0951e+008
0,48775	1,0924e+008
0,49884	1,0768e+008
0,50992	1,0475e+008
0,52101	9,9258e+007
0,53209	8,9558e+007

**FIGURE 32**  
**Model (A4, B4) > Static Structural (B5) > Solution (B6) > Equivalent Stress 2 > Figure**



**FIGURE 33**  
Model (A4, B4) > Static Structural (B5) > Solution (B6) > Equivalent Stress 2 > Image



**FIGURE 34**  
Model (A4, B4) > Static Structural (B5) > Solution (B6) > Directional Deformation 5



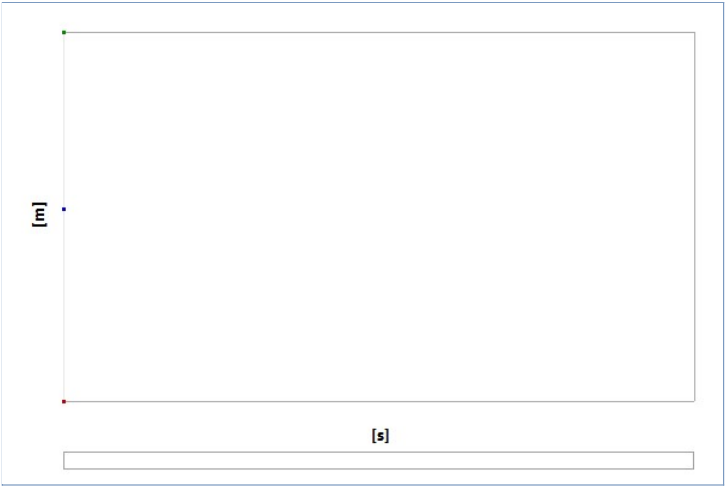


TABLE 35

Model (A4, B4) > Static Structural (B5) > Solution (B6) > Directional Deformation 5

Time [s]	Minimum [m]	Maximum [m]	Average [m]
1,	-6,5411e-005	5,8239e-005	-9,4077e-007

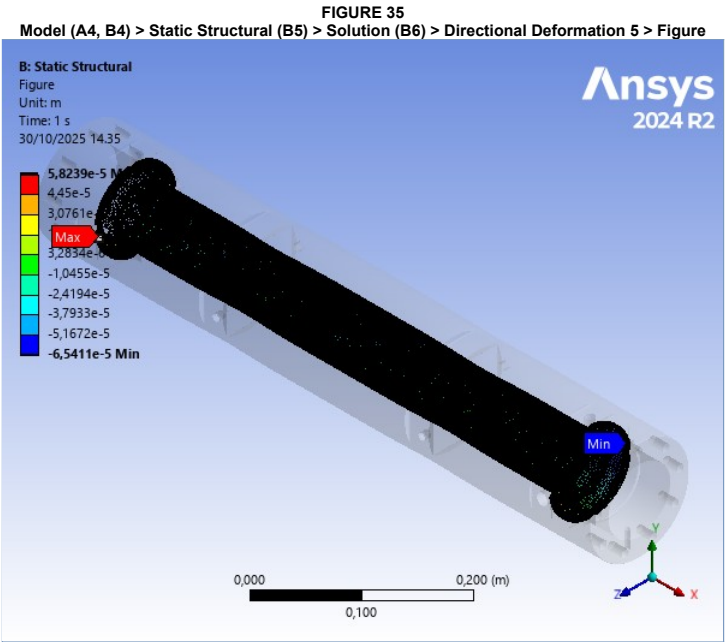
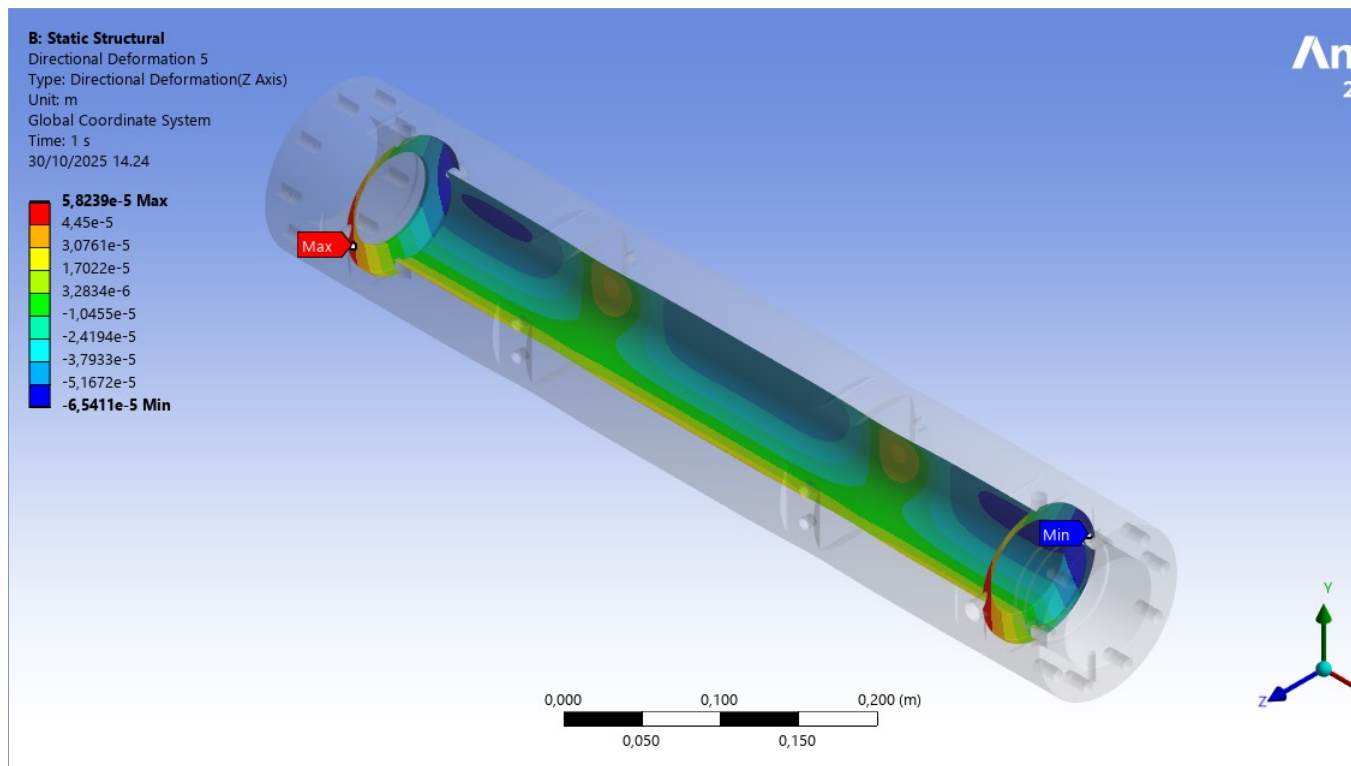
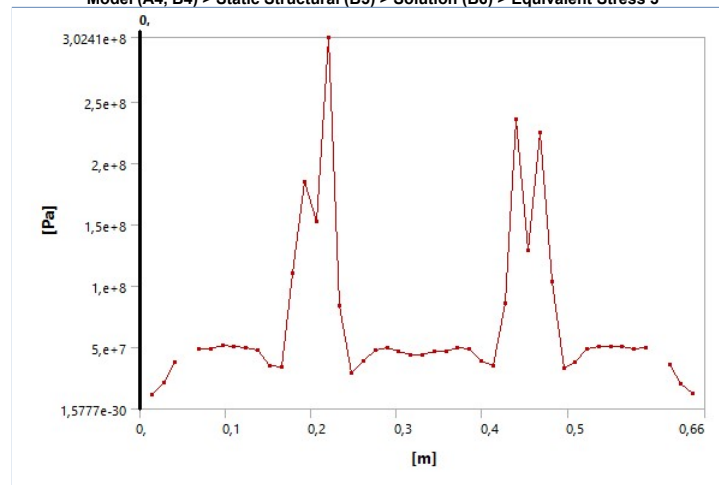


FIGURE 36

Model (A4, B4) > Static Structural (B5) > Solution (B6) > Directional Deformation 5 > Image



**FIGURE 37**  
 Model (A4, B4) > Static Structural (B5) > Solution (B6) > Equivalent Stress 3

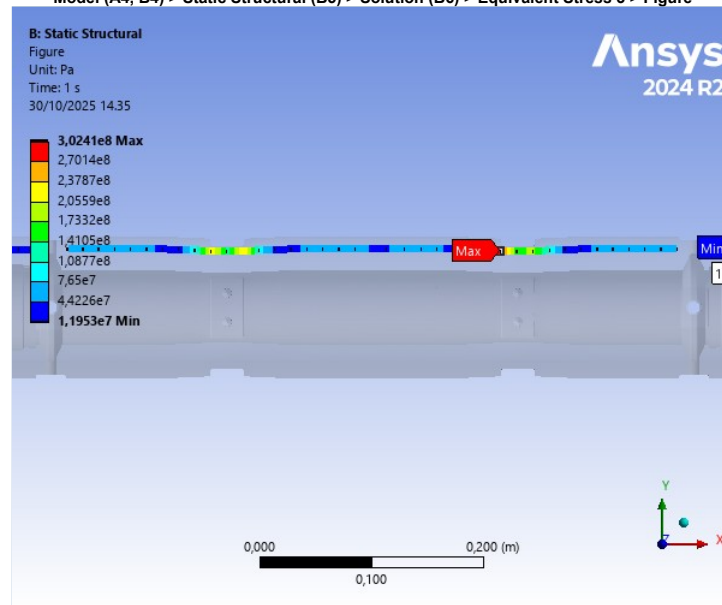


**TABLE 36**  
 Model (A4, B4) > Static Structural (B5) > Solution (B6) > Equivalent Stress 3

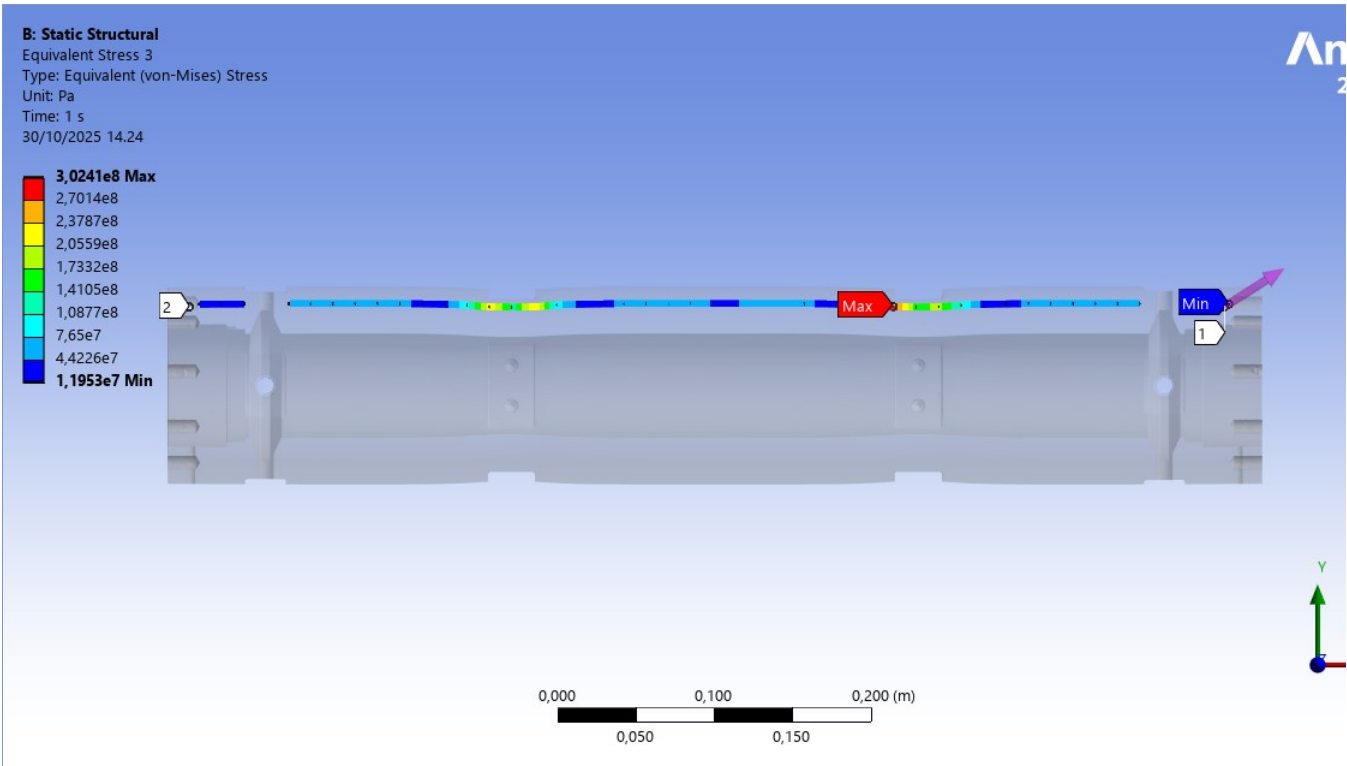
Length [m]	Value [Pa]
0,	
1,375e-002	1,1953e+007
2,75e-002	2,1104e+007
4,125e-002	3,8133e+007
5,5e-002	
6,875e-002	4,9375e+007
8,25e-002	4,8946e+007
9,625e-002	5,156e+007
0,11	5,1167e+007
0,12375	5,0087e+007
0,1375	4,8117e+007
0,15125	3,5636e+007
0,165	3,4161e+007
0,17875	1,1037e+008
0,1925	1,8545e+008
0,20625	1,5316e+008
0,22	3,0241e+008
0,23375	8,3939e+007
0,2475	2,9145e+007
0,26125	3,9333e+007
0,275	4,8445e+007

0,28875	4,9492e+007
0,3025	4,6753e+007
0,31625	4,4059e+007
0,33	4,3664e+007
0,34375	4,6611e+007
0,3575	4,7047e+007
0,37125	4,9748e+007
0,385	4,911e+007
0,39875	3,9422e+007
0,4125	3,482e+007
0,42625	8,614e+007
0,44	2,361e+008
0,45375	1,2934e+008
0,4675	2,2491e+008
0,48125	1,0344e+008
0,495	3,3164e+007
0,50875	3,8354e+007
0,5225	4,8819e+007
0,53625	5,0813e+007
0,55	5,1066e+007
0,56375	5,0909e+007
0,5775	4,9416e+007
0,59125	5,0025e+007
0,605	
0,61875	3,6429e+007
0,6325	2,0115e+007
0,64625	1,2654e+007
0,66	

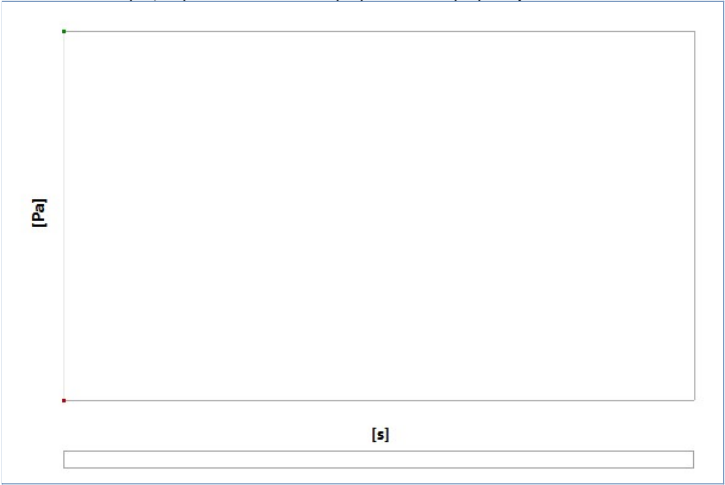
**FIGURE 38**  
Model (A4, B4) > Static Structural (B5) > Solution (B6) > Equivalent Stress 3 > Figure



**FIGURE 39**  
Model (A4, B4) > Static Structural (B5) > Solution (B6) > Equivalent Stress 3 > Image



**FIGURE 40**  
Model (A4, B4) > Static Structural (B5) > Solution (B6) > Equivalent Stress 4



**TABLE 37**  
Model (A4, B4) > Static Structural (B5) > Solution (B6) > Equivalent Stress 4

Time [s]	Minimum [Pa]	Maximum [Pa]
1,	1,1533e+005	7,1222e+008

**FIGURE 41**  
Model (A4, B4) > Static Structural (B5) > Solution (B6) > Equivalent Stress 4 > Figure

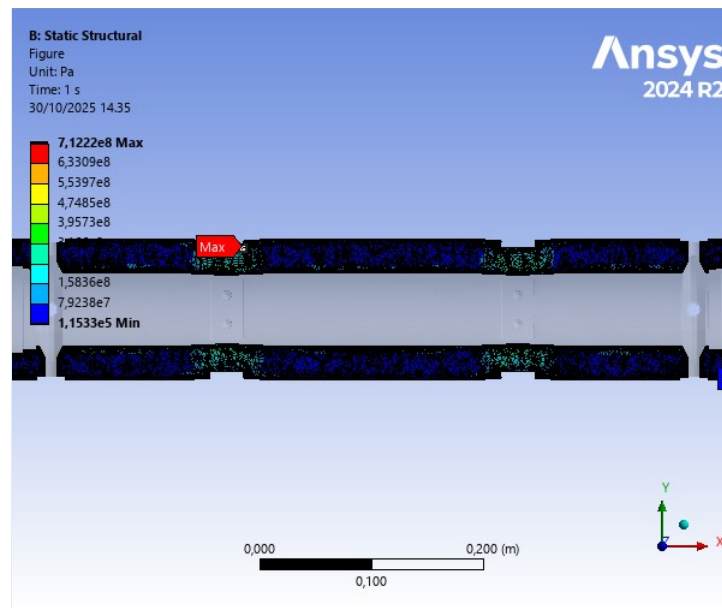


FIGURE 42  
Model (A4, B4) > Static Structural (B5) > Solution (B6) > Equivalent Stress 4 > Image

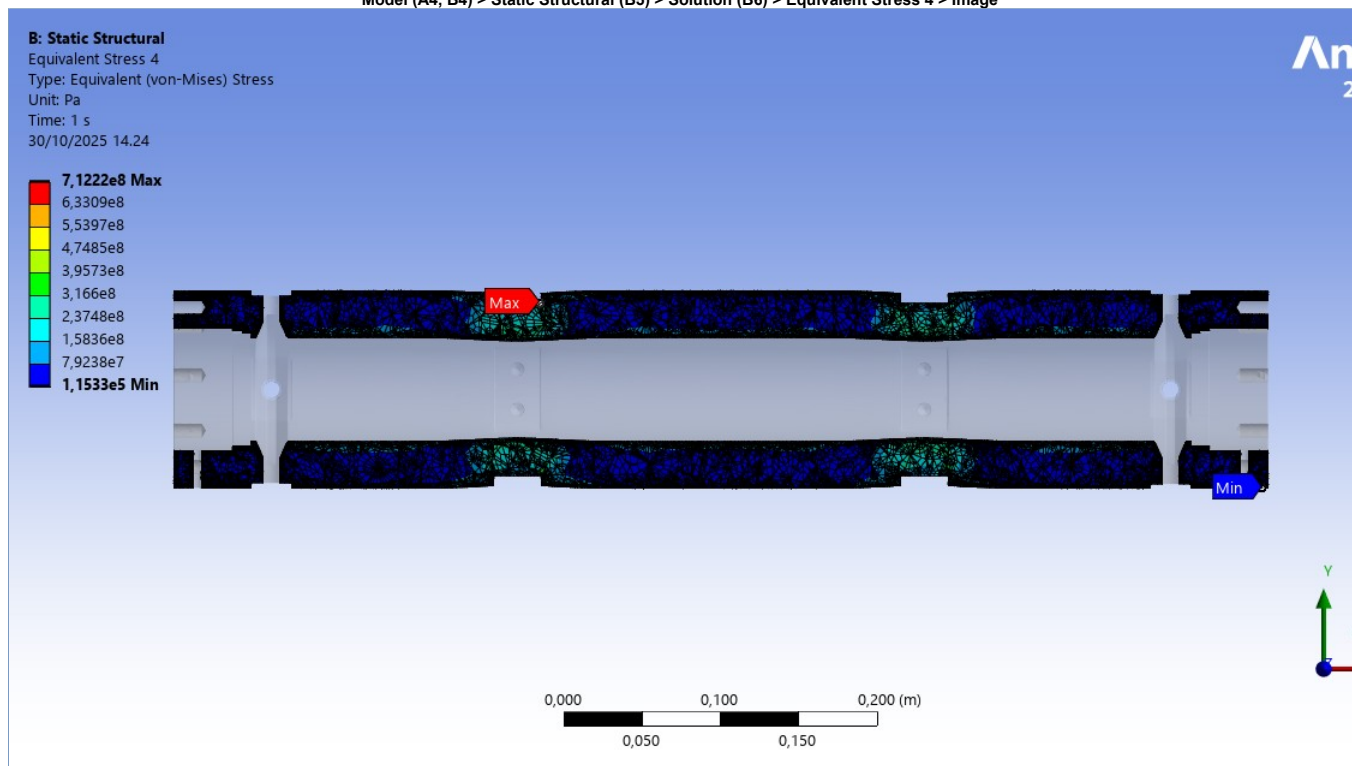


FIGURE 43  
Model (A4, B4) > Static Structural (B5) > Solution (B6) > Directional Deformation 7

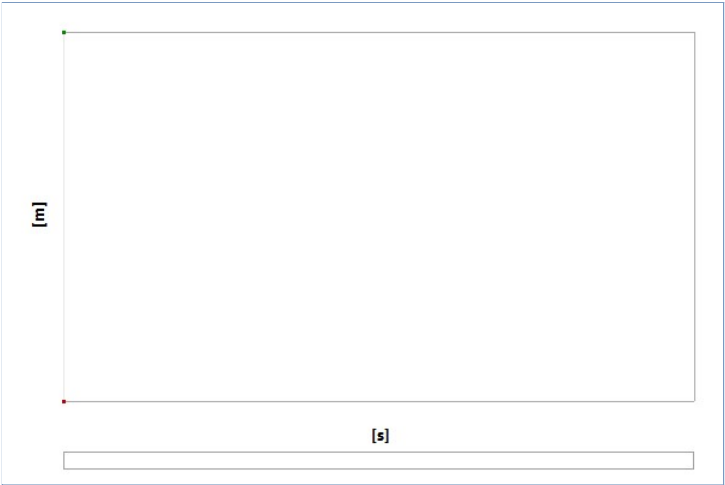


TABLE 38

Model (A4, B4) > Static Structural (B5) > Solution (B6) > Directional Deformation 7

Time [s]	Minimum [m]	Maximum [m]
1,	-8,1916e-005	8,185e-005

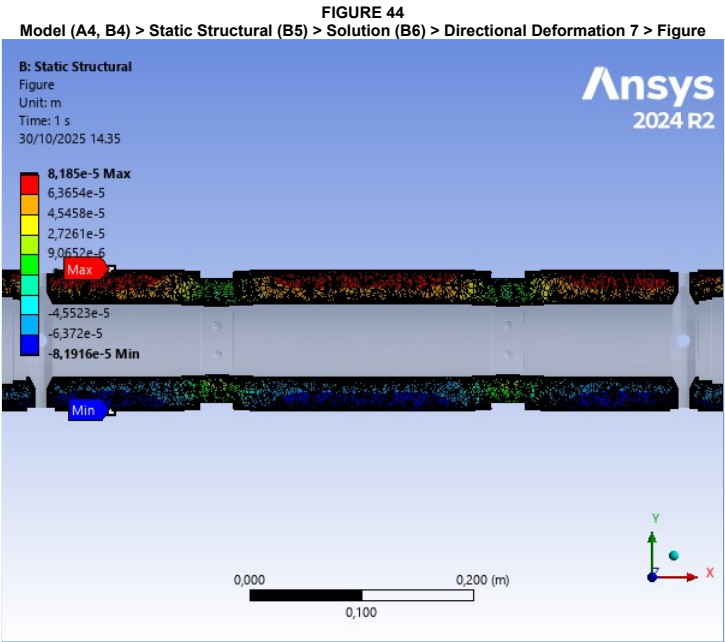
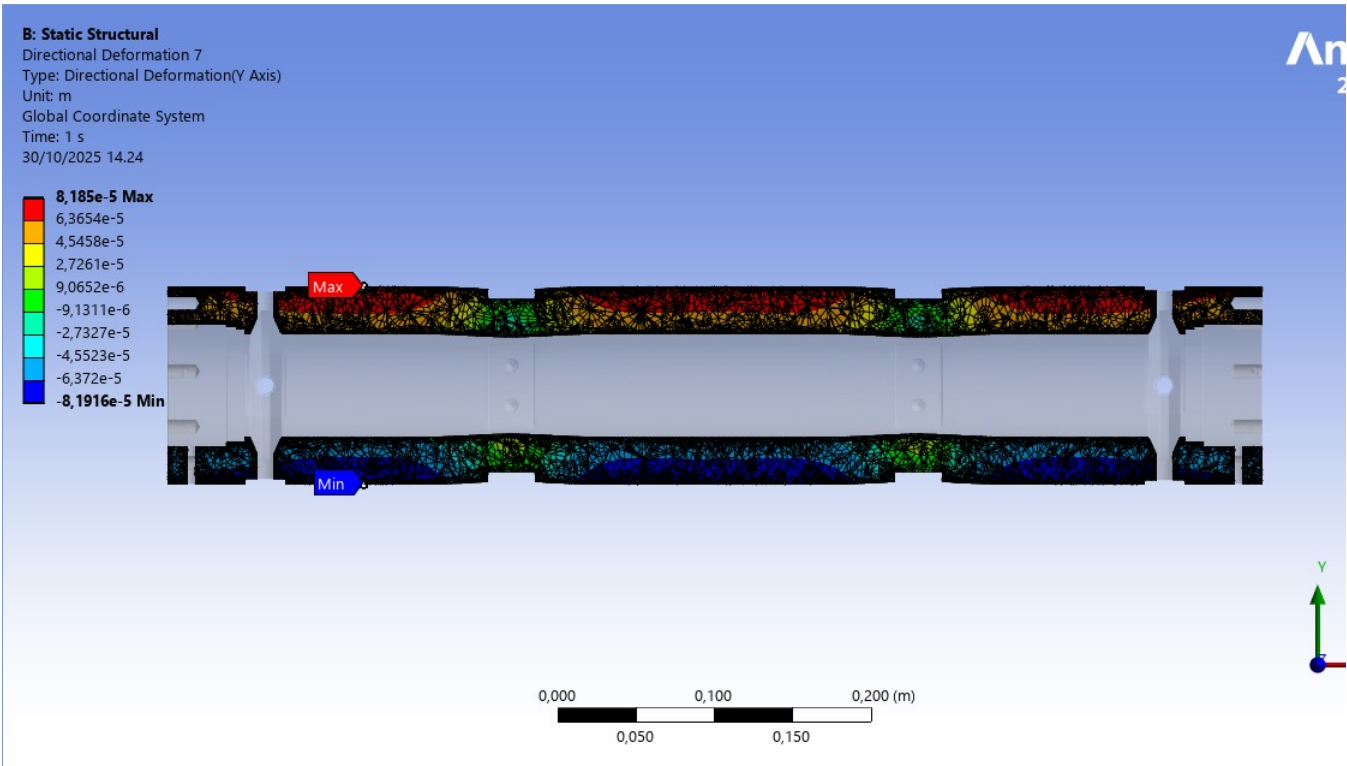
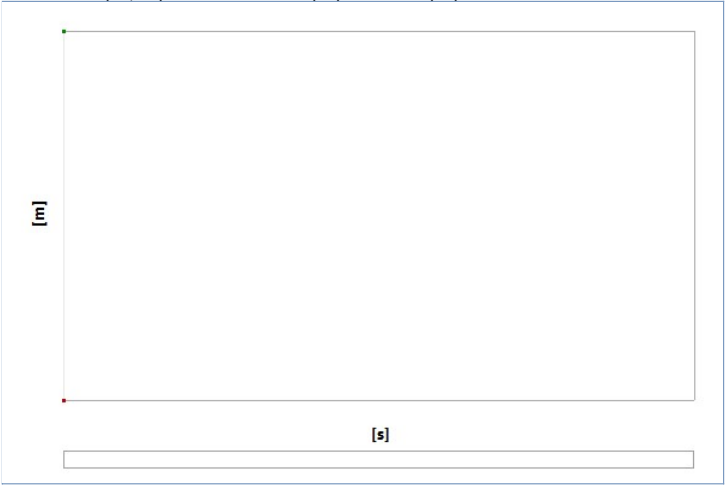


FIGURE 45

Model (A4, B4) > Static Structural (B5) > Solution (B6) > Directional Deformation 7 > Image



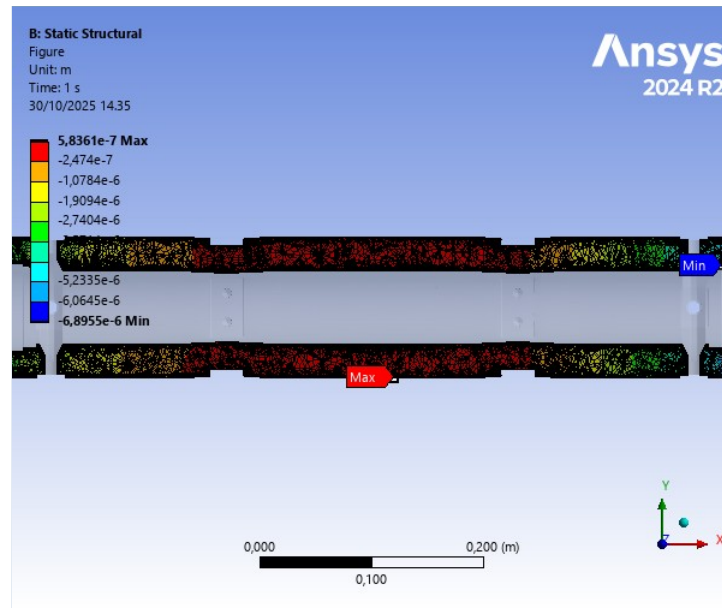
**FIGURE 46**  
Model (A4, B4) > Static Structural (B5) > Solution (B6) > Directional Deformation 8



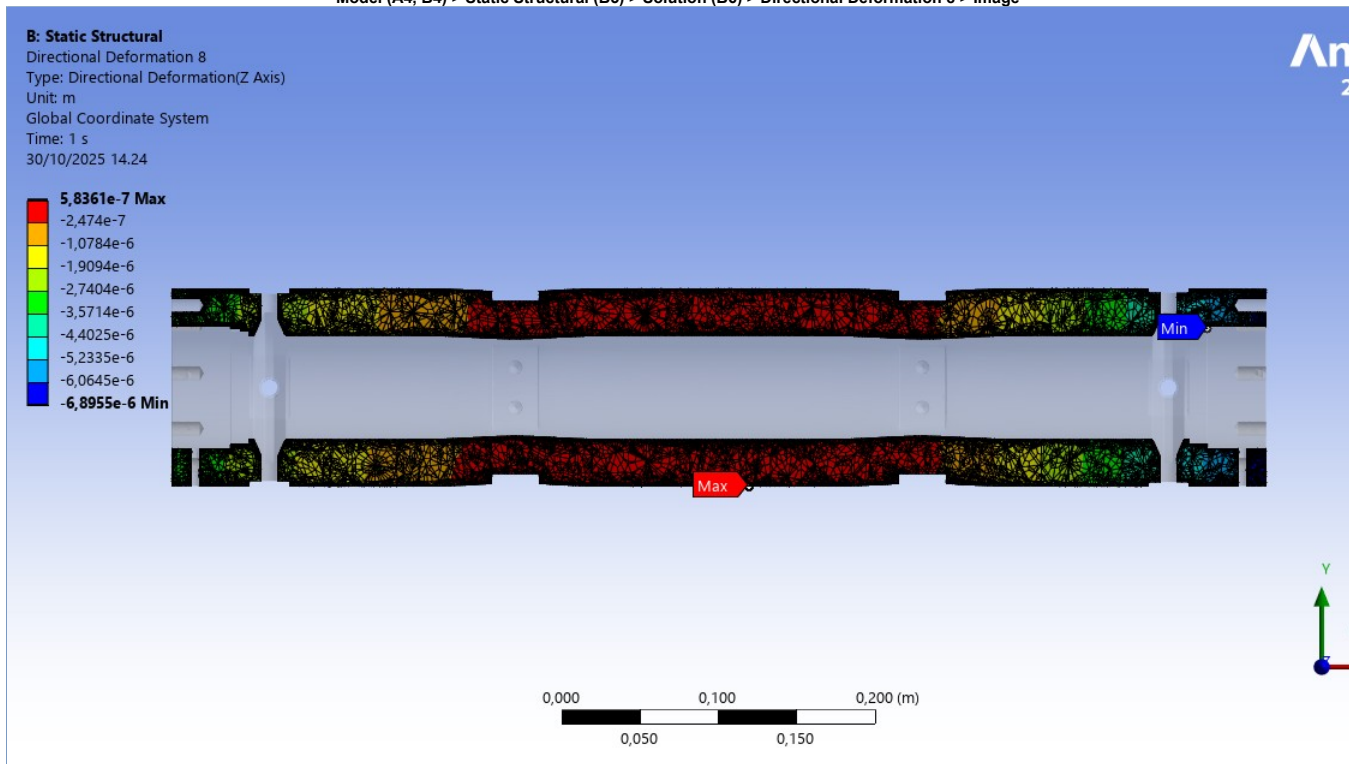
**TABLE 39**  
Model (A4, B4) > Static Structural (B5) > Solution (B6) > Directional Deformation 8

Time [s]	Minimum [m]	Maximum [m]
1,	-6,8955e-006	5,8361e-007

**FIGURE 47**  
Model (A4, B4) > Static Structural (B5) > Solution (B6) > Directional Deformation 8 > Figure



**FIGURE 48**  
Model (A4, B4) > Static Structural (B5) > Solution (B6) > Directional Deformation 8 > Image



**TABLE 40**  
Model (A4, B4) > Static Structural (B5) > Solution (B6) > Results

Object Name	Directional Deformation 9		Directional Deformation 10	Equivalent Stress 5	Directional Deformation 4
State	Solved				
Scope					
Scoping Method	Surface				Geometry Selection
Surface	Surface 2				
Geometry	All Bodies				35 Faces
Definition					
Type	Directional Deformation			Equivalent (von-Mises) Stress	Directional Deformation
Orientation	Y Axis	Z Axis			Y Axis
By				Time	
Display Time				Last	
Coordinate System	Global Coordinate System				Global Coordinate System
Calculate Time History				Yes	
Suppressed				No	
Separate Data by Entity					No
Identifier					



Results				
Minimum	-2,757e-007 m	-8,4482e-005 m	1,2583e+005 Pa	-6,158e-005 m
Maximum	2,5082e-007 m	8,1725e-005 m	8,2681e+008 Pa	6,1477e-005 m
Average	8,9342e-009 m	-1,3721e-006 m	7,5373e+007 Pa	5,7851e-007 m
Minimum Occurs On	Barrel_V2			
Maximum Occurs On	Barrel_V2			
Information				
Time	1, s			
Load Step	1			
Substep	1			
Iteration Number	1			
Integration Point Results				
Display Option			Averaged	
Average Across Bodies			No	

FIGURE 49  
Model (A4, B4) > Static Structural (B5) > Solution (B6) > Directional Deformation 9

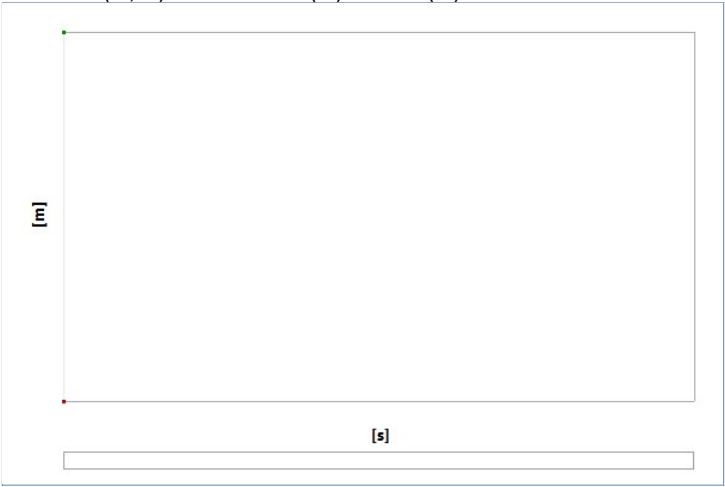


TABLE 41  
Model (A4, B4) > Static Structural (B5) > Solution (B6) > Directional Deformation 9

Time [s]	Minimum [m]	Maximum [m]
1,	-2,757e-007	2,5082e-007

FIGURE 50  
Model (A4, B4) > Static Structural (B5) > Solution (B6) > Directional Deformation 9 > Figure

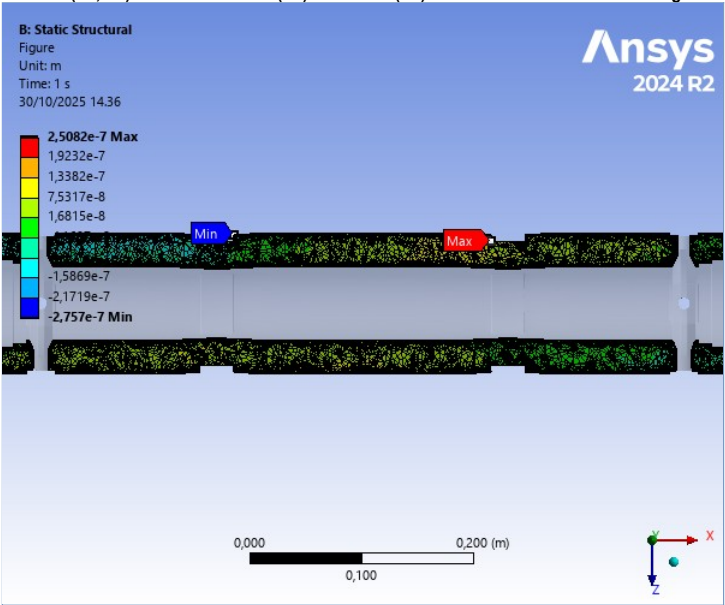
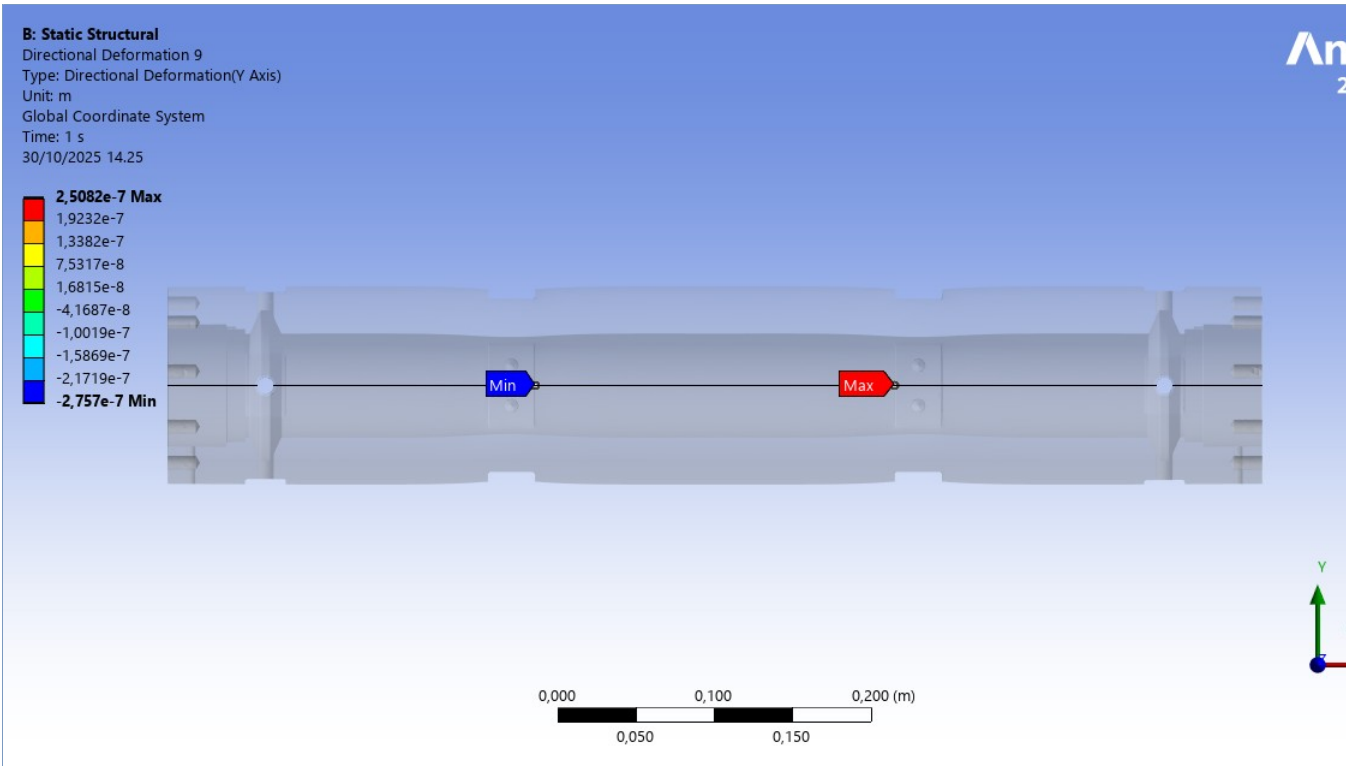
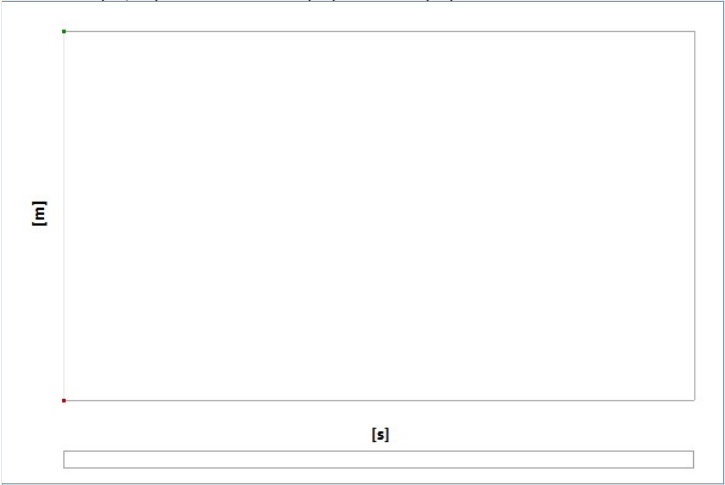


FIGURE 51  
Model (A4, B4) > Static Structural (B5) > Solution (B6) > Directional Deformation 9 > Image



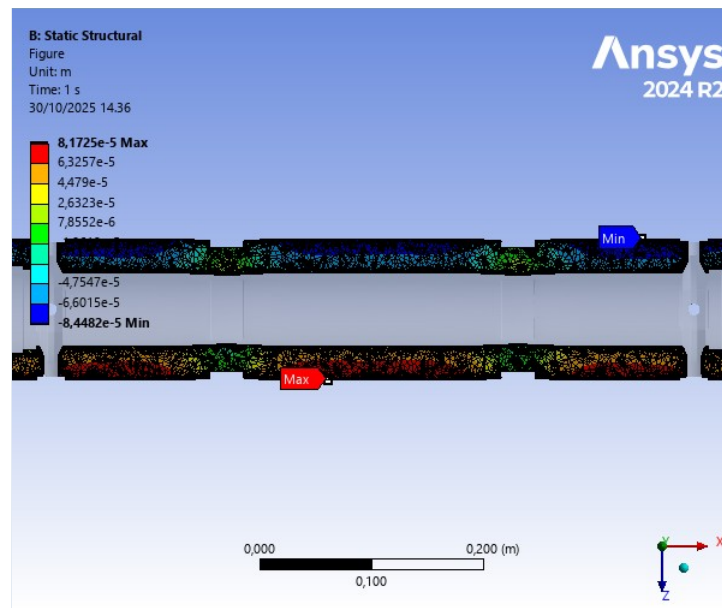
**FIGURE 52**  
Model (A4, B4) > Static Structural (B5) > Solution (B6) > Directional Deformation 10



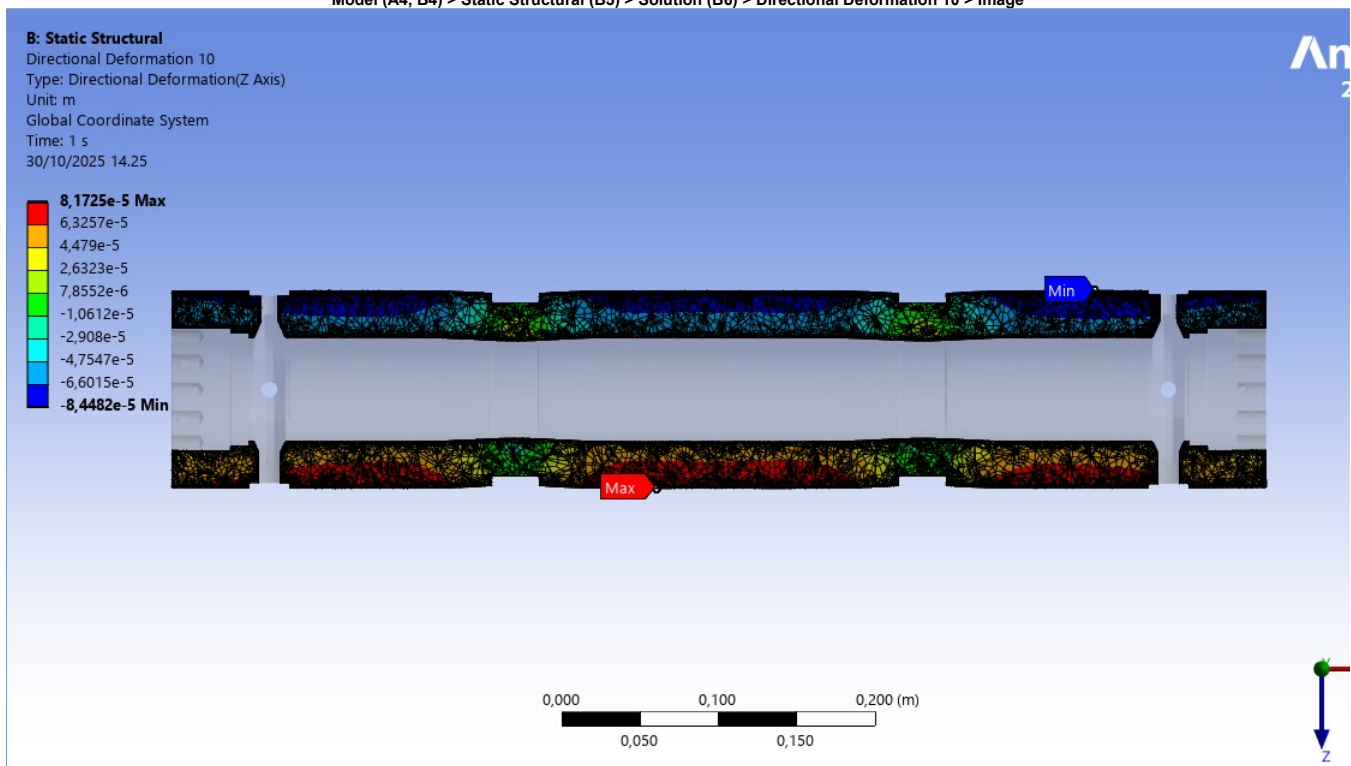
**TABLE 42**  
Model (A4, B4) > Static Structural (B5) > Solution (B6) > Directional Deformation 10

Time [s]	Minimum [m]	Maximum [m]
1,	-8,4482e-005	8,1725e-005

**FIGURE 53**  
Model (A4, B4) > Static Structural (B5) > Solution (B6) > Directional Deformation 10 > Figure



**FIGURE 54**  
Model (A4, B4) > Static Structural (B5) > Solution (B6) > Directional Deformation 10 > Image



**FIGURE 55**  
Model (A4, B4) > Static Structural (B5) > Solution (B6) > Equivalent Stress 5

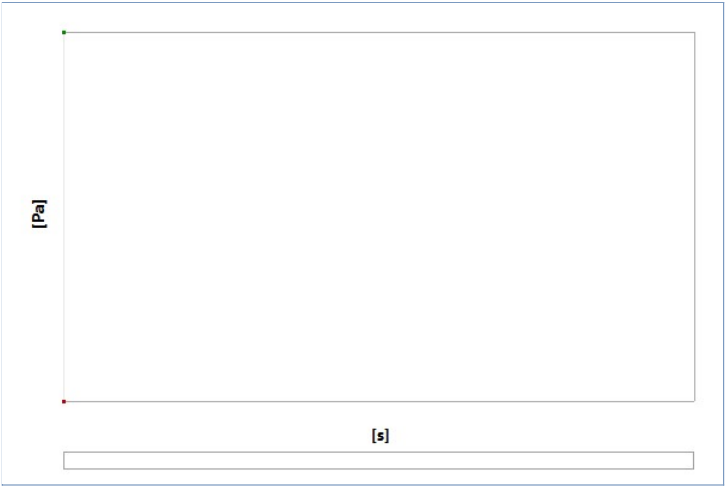


TABLE 43  
Model (A4, B4) > Static Structural (B5) > Solution (B6) > Equivalent Stress 5

Time [s]	Minimum [Pa]	Maximum [Pa]
1,	1,2583e+005	8,2681e+008

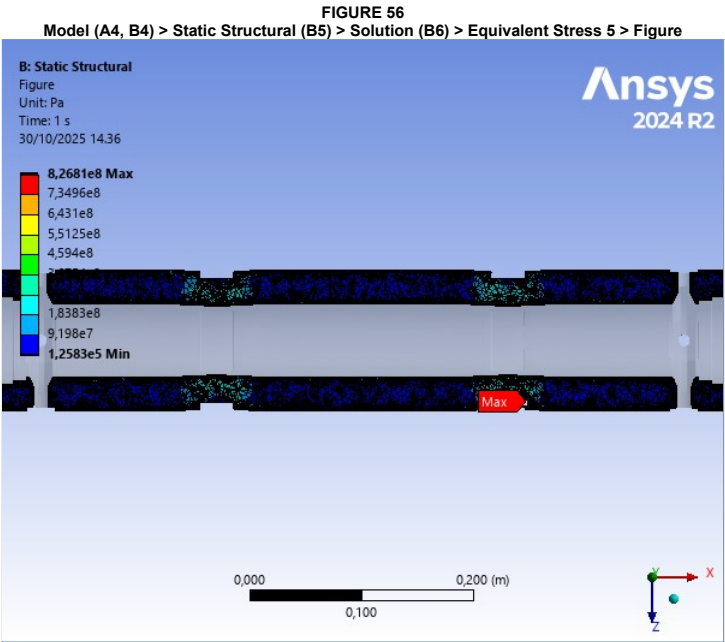
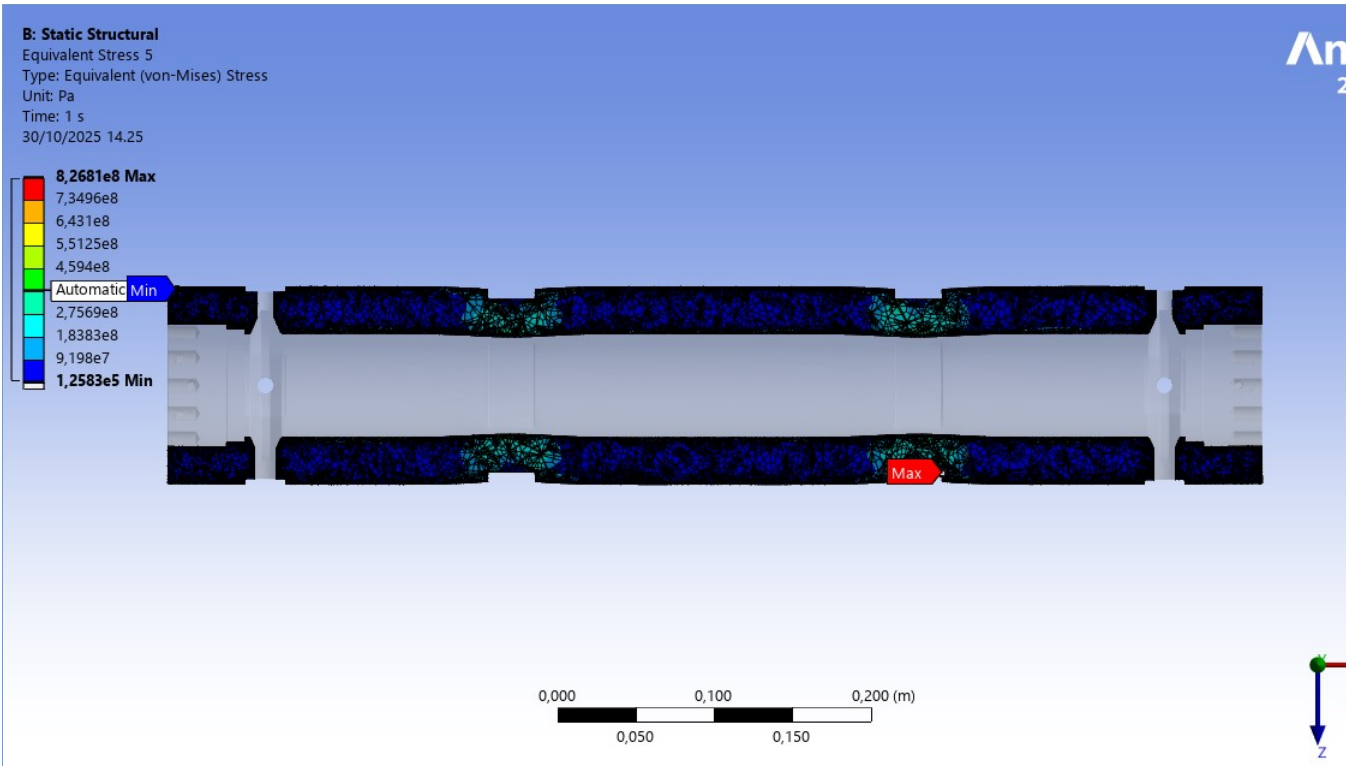
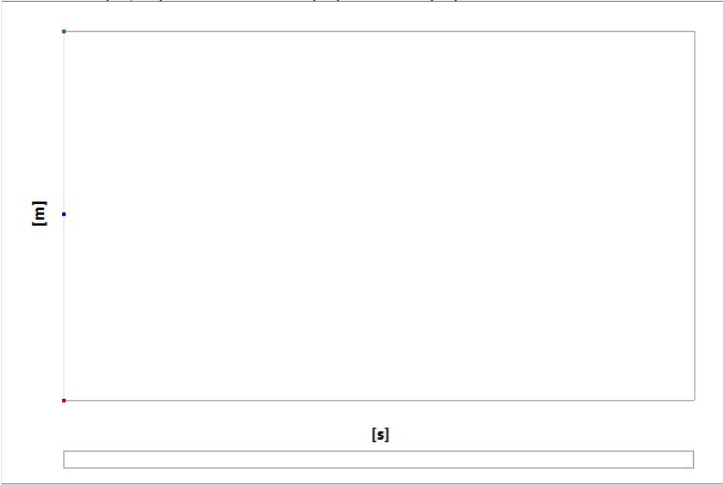


FIGURE 57  
Model (A4, B4) > Static Structural (B5) > Solution (B6) > Equivalent Stress 5 > Image



**FIGURE 58**  
Model (A4, B4) > Static Structural (B5) > Solution (B6) > Directional Deformation 4



**TABLE 44**  
Model (A4, B4) > Static Structural (B5) > Solution (B6) > Directional Deformation 4

Time [s]	Minimum [m]	Maximum [m]	Average [m]
1,	-6,158e-005	6,1477e-005	5,7851e-007

**FIGURE 59**  
Model (A4, B4) > Static Structural (B5) > Solution (B6) > Directional Deformation 4 > Figure

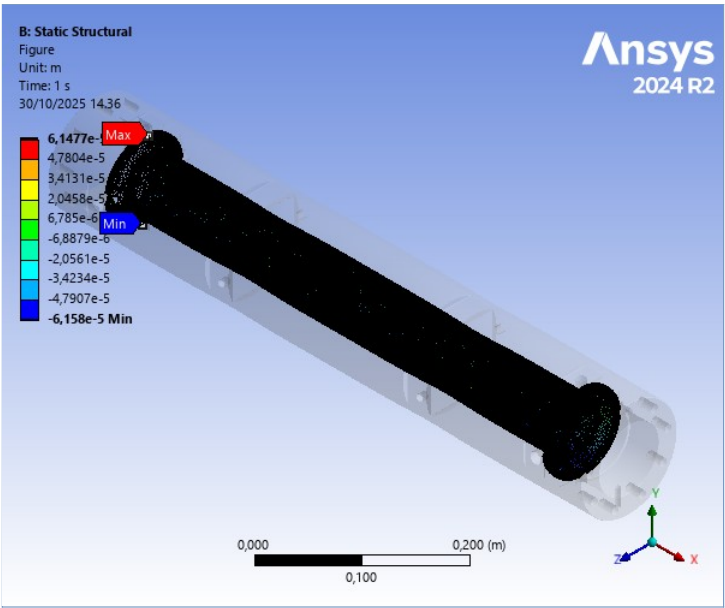
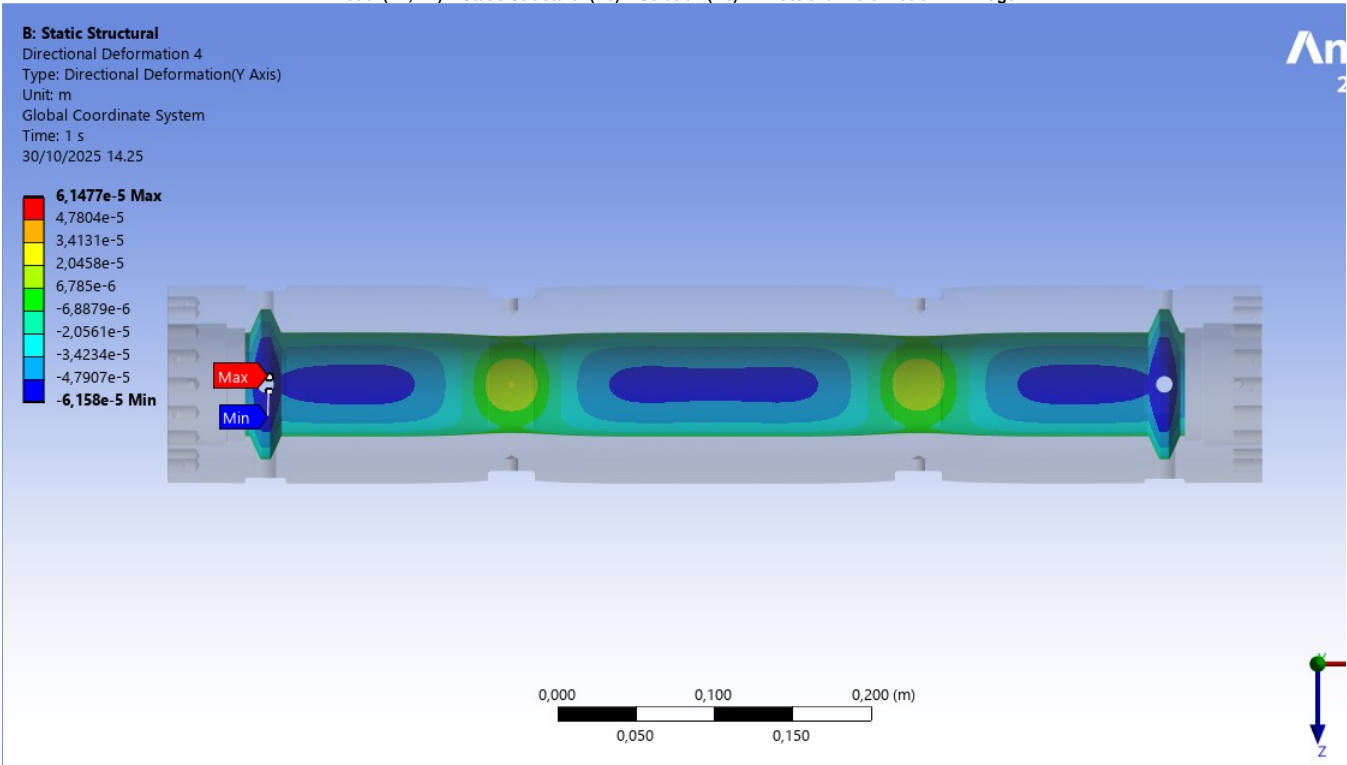


FIGURE 60  
Model (A4, B4) > Static Structural (B5) > Solution (B6) > Directional Deformation 4 > Image



Material Data

AISI 4140 Steel, oil quenched, 100 mm (4 in.) round [845°C (1550°F) quench, 540°C (1000°F) temper] 2

TABLE 45  
AISI 4140 Steel, oil quenched, 100 mm (4 in.) round [845°C (1550°F) quench, 540°C (1000°F) temper] 2 > Constants

Density	7850, kg m <sup>-3</sup>
Coefficient of Thermal Expansion	1,2e-005 C <sup>-1</sup>

TABLE 46  
AISI 4140 Steel, oil quenched, 100 mm (4 in.) round [845°C (1550°F) quench, 540°C (1000°F) temper] 2 > Color

Red	Green	Blue
181,	155,	130,

TABLE 47  
AISI 4140 Steel, oil quenched, 100 mm (4 in.) round [845°C (1550°F) quench, 540°C (1000°F) temper] 2 > Isotropic Elasticity

Young's Modulus Pa	Poisson's Ratio	Bulk Modulus Pa	Shear Modulus Pa	Temperature C

2,05e+011	0,29	1,627e+011	7,9457e+010	
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TABLE 48

AISI 4140 Steel, oil quenched, 100 mm (4 in.) round [845°C (1550°F) quench, 540°C (1000°F) temper] 2 > Tensile Yield Strength

Tensile Yield Strength Pa
6,85e+008

TABLE 49

AISI 4140 Steel, oil quenched, 100 mm (4 in.) round [845°C (1550°F) quench, 540°C (1000°F) temper] 2 > Tensile Ultimate Strength

Tensile Ultimate Strength Pa
8,83e+008

TABLE 50

AISI 4140 Steel, oil quenched, 100 mm (4 in.) round [845°C (1550°F) quench, 540°C (1000°F) temper] 2 > Isotropic Thermal Conductivity

Thermal Conductivity W m <sup>-1</sup> C <sup>-1</sup>	Temperature C
42,6	100,
42,2	200,
37,7	400,
33,	600,