Simulation of 2105 Housing

Date: Wednesday, May 15, 2019
Designer: Justin Palmer
Study name: Firewall Torque
Analysis type: Static

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Description

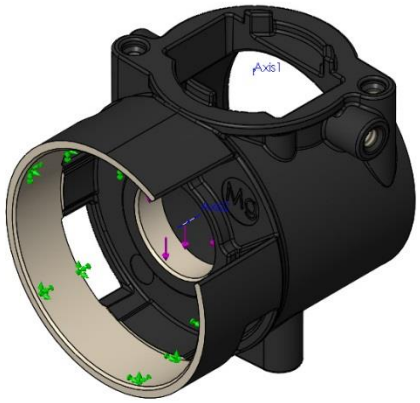
A linear, static FEA of the 2105 housing.

Assumptions

Comments:
The model is assumed to behave statically due to a normal load acting on the bearing bore and torque produced by compressive loads acting against the piston.

The material, AZ91D magnesium, is assumed to obey Hooke's Law.

Model Information



Model name: 671085
Current Configuration: 1-4-20 THREAD

Solid Bodies

Document Name and Reference	Treated As	Volumetric Properties	Document Path/Date Modified
<671085-CAST>-<DATE & CAVITY PINS>	Solid Body	**Mass:0.0398463 lb** **Volume:0.609362 in^3** **Density:0.0653903 lb/in^3** **Weight:0.0398193 lbf**	**C:\SWPDM\GDT\Solidworks\User Files\2110-(POC1)\2110 REFRESH\671085.SLDPRT** May 15 07:03:59 2019

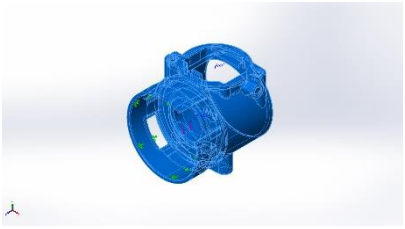
Study Properties

Study name	Firewall Torque
Analysis type	Static
Mesh type	Solid Mesh
Thermal Effect:	On
Thermal option	Include temperature loads
Zero strain temperature	77 Fahrenheit
Include fluid pressure effects from SOLIDWORKS Flow Simulation	Off
Solver type	Direct sparse solver
Inplane Effect:	Off
Soft Spring:	Off
Inertial Relief:	Off
Incompatible bonding options	Automatic
Large displacement	Off
Compute free body forces	On
Friction	Off
Use Adaptive Method:	Off
Result folder	SOLIDWORKS document (C:\SWPDM\GDT\Solidworks\User Files\2110-(POC1)\2110 REFRESH)

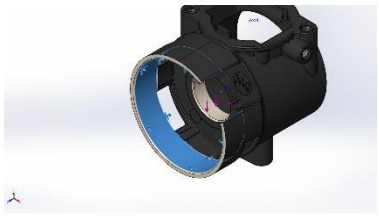
Units

Unit system:	English (IPS)
Length/Displacement	in
Temperature	Fahrenheit
Angular velocity	Hertz
Pressure/Stress	psi

Material Properties

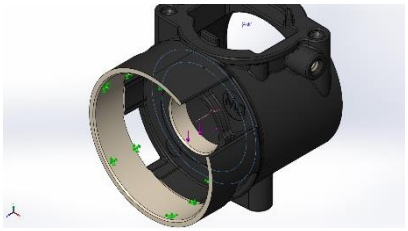
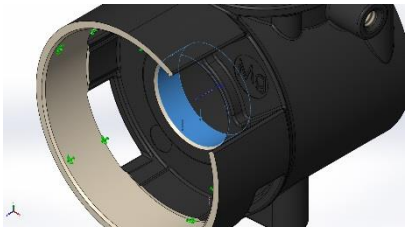
Model Reference	Properties	Components
	**Name:** AZ91D **Model type:** Linear Elastic Isotropic **Default failure criterion:** Unknown **Yield strength:** 23206 psi **Tensile strength:** 33358.7 psi **Elastic modulus:** 6.5267e+06 psi **Poisson's ratio:** 0.35 **Mass density:** 0.0653904 lb/in^3 **Thermal expansion coefficient:** 1.38889e-05 /Fahrenheit	SolidBody 1(<671085-CAST>-<DATE & CAVITY PINS>)(671085)
Curve Data:N/A		

Loads and Fixtures

Fixture name	Fixture Image	Fixture Details
Fixed-1		**Entities:** 1 face(s) **Type:** Fixed Geometry

Resultant Forces

Components	X	Y	Z	Resultant
Reaction force(lbf)	0.337363	17.9998	-2.74219e-06	18.0029
Reaction Moment(lbf.in)	0	0	0	0

Load name	Load Image	Load Details
Torque-1		**Entities:** 1 face(s) **Reference:** Axis2 **Type:** Apply torque **Value:** 23 lbf.in
Force-1		**Entities:** 1 face(s) **Reference:** Edge< 1 > **Type:** Apply force **Values:** ---, ---, 18 lbf

Comments:
The model is loaded with a normal acting force relative to a plane within the bearing bore. This normal force is equivalent to a 30 PSIG pressure load inside a 0.875 inch cylinder.

From the calculation of a top-dead-center load of 30 PSIG acting against the piston, a torque was applied against the housing "firewall" relative to an axis in the center of the bearing bore.

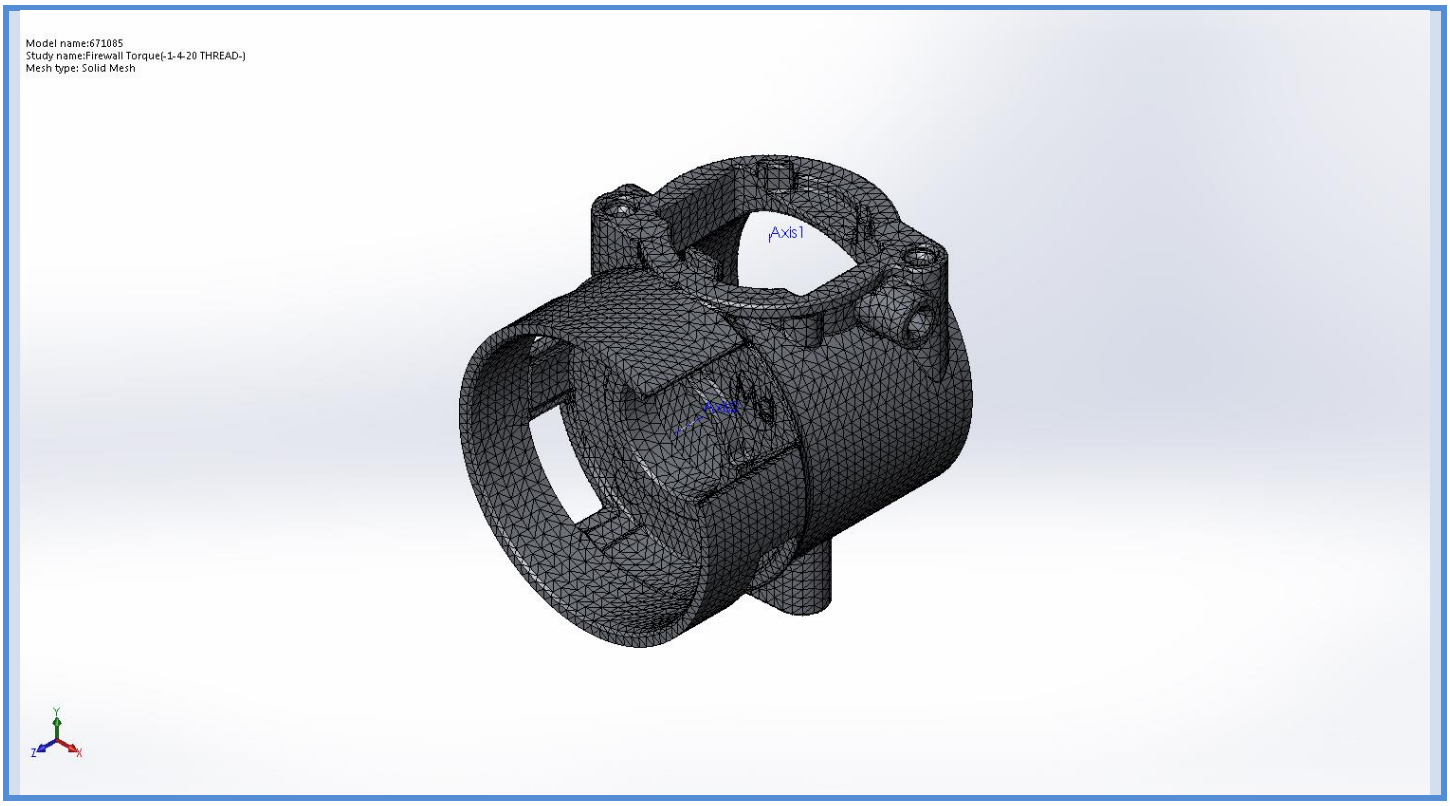
The model is constrained from rotations or translations on the inner diameter where the housing is assembled onto the stator lam stack.

Mesh information

Mesh type	Solid Mesh
Mesher Used:	Standard mesh
Automatic Transition:	Off
Include Mesh Auto Loops:	Off
Jacobian points	4 Points
Element Size	0.05 in
Tolerance	0.0025 in
Mesh Quality Plot	High

Mesh information - Details

Total Nodes	99495
Total Elements	59623
Maximum Aspect Ratio	43.938
% of elements with Aspect Ratio < 3	90.6
% of elements with Aspect Ratio > 10	0.327
% of distorted elements(Jacobian)	0
Time to complete mesh(hh;mm;ss):	00:00:16
Computer name:	SHEWS-14022



Resultant Forces

Reaction forces

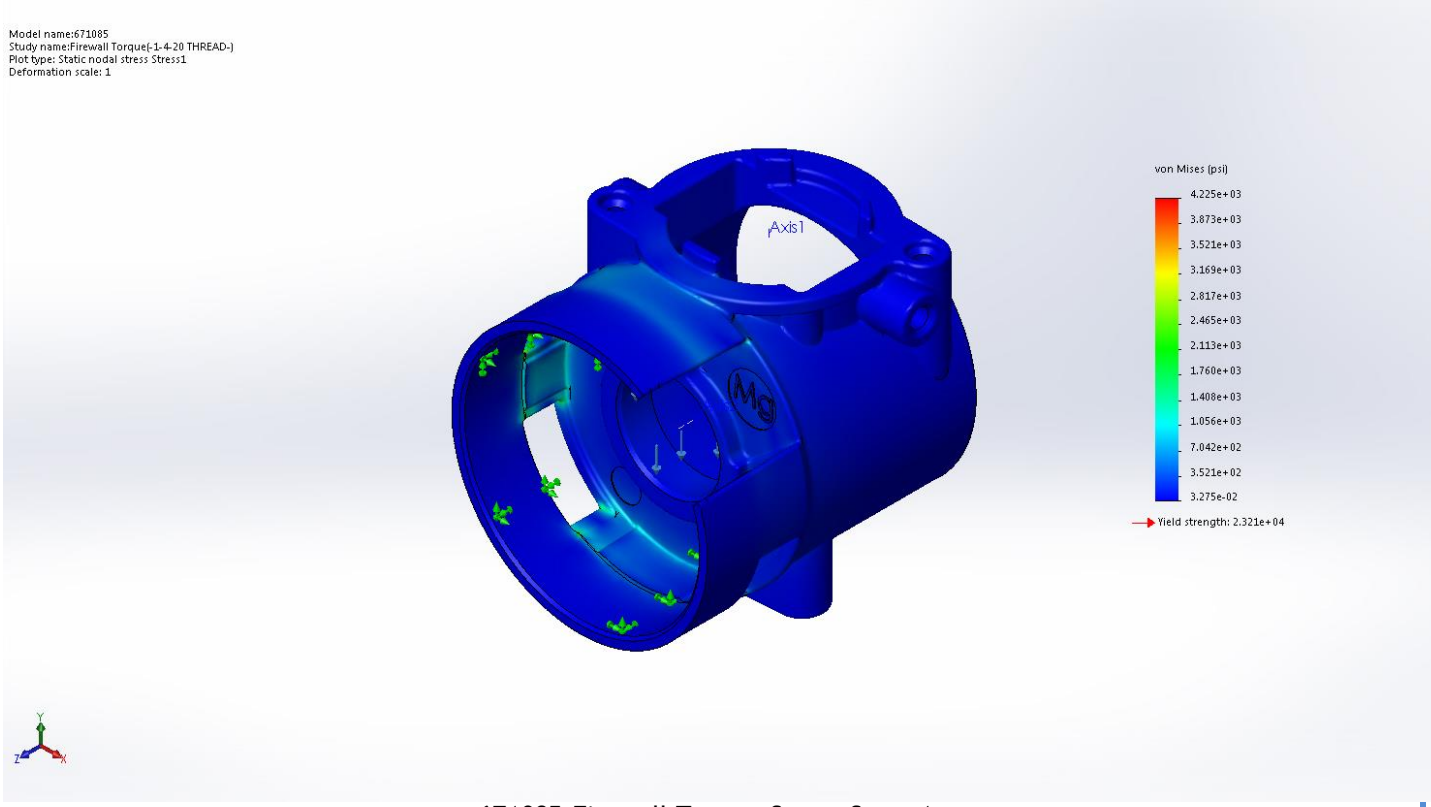
Selection set	Units	Sum X	Sum Y	Sum Z	Resultant
Entire Model	lbf	0.337363	17.9998	-2.74219e-06	18.0029

Reaction Moments

Selection set	Units	Sum X	Sum Y	Sum Z	Resultant
Entire Model	lbf.in	0	0	0	0

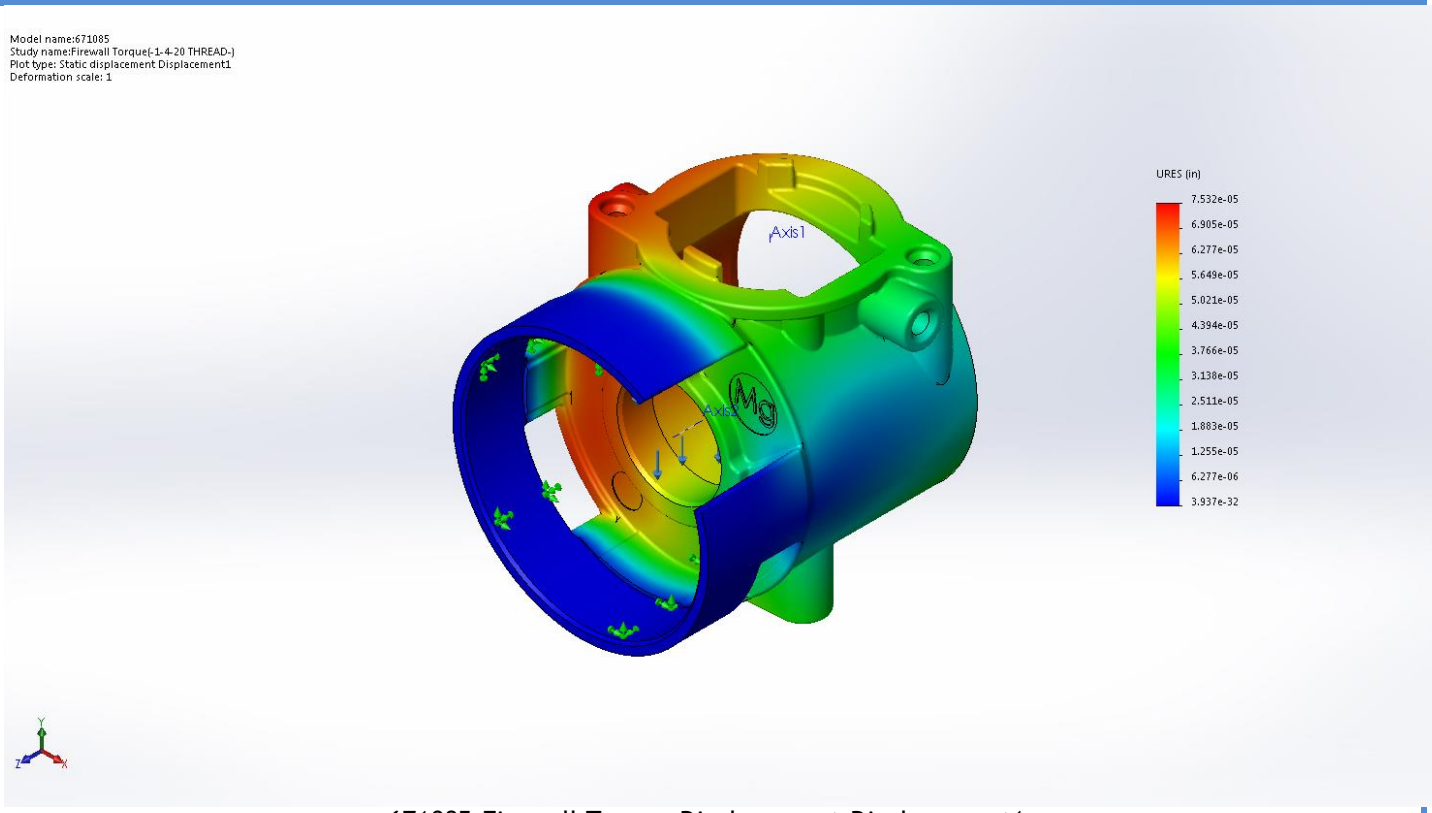
Study Results

Name	Type	Min	Max
Stress1	VON: von Mises Stress	3.275e-02 psi Node: 39322	4.225e+03 psi Node: 95167



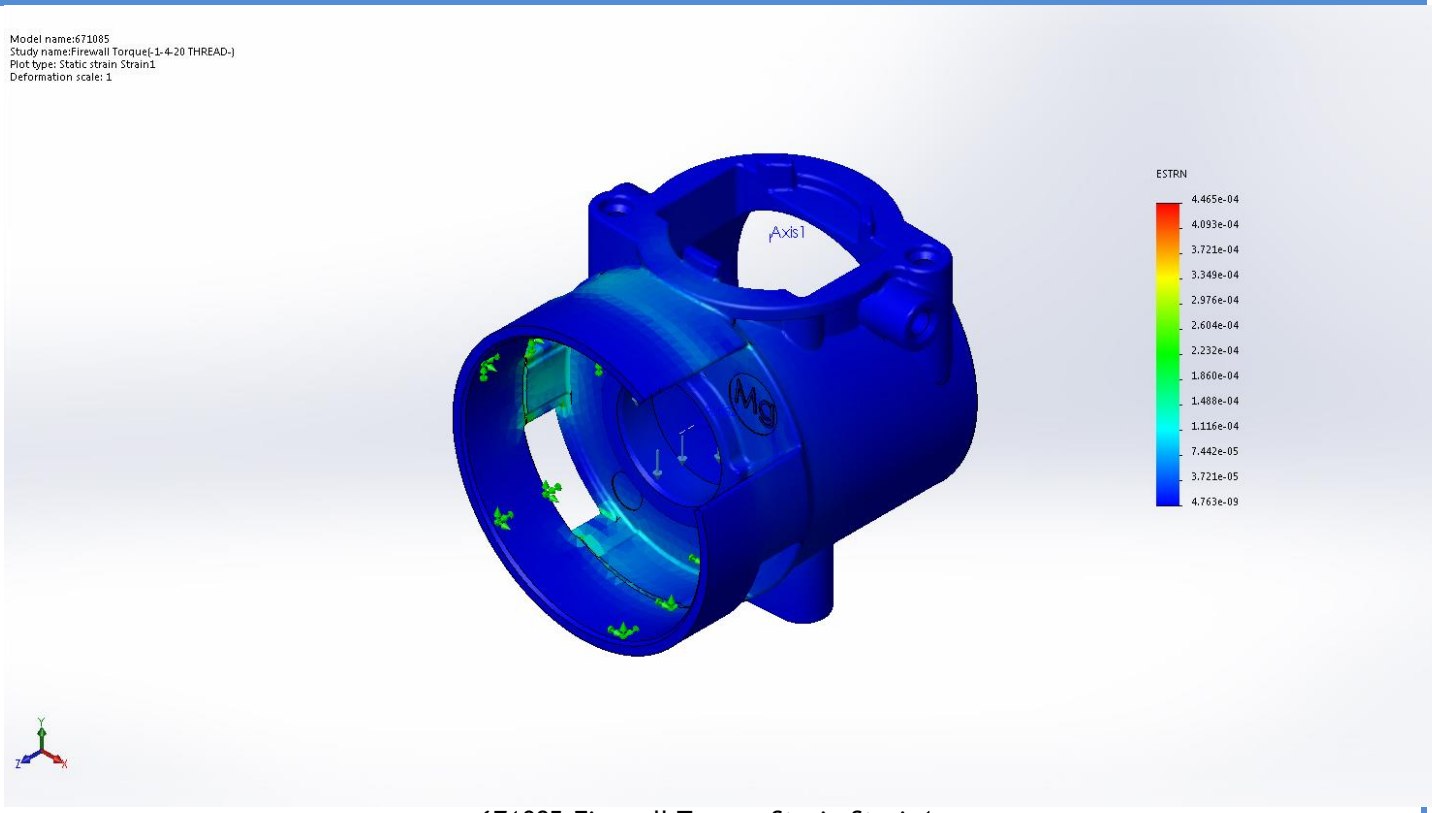
671085-Firewall Torque-Stress-Stress1

Name	Type	Min	Max
Displacement1	URES: Resultant Displacement	0.000e+00 in Node: 389	7.532e-05 in Node: 1675



671085-Firewall Torque-Displacement-Displacement1

Name	Type	Min	Max
Strain1	ESTRN: Equivalent Strain	4.763e-09 Element: 59516	4.465e-04 Element: 37452



671085-Firewall Torque-Strain-Strain1

Conclusion

Comments:

The part is acceptable as-is and requires no further modifications.