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|  | |  | | --- | | **Simulation of Engine Piston**  **Date: Sunday, December 5, 2021 Designer: Lea Youssef Babi**  **Study name: Simulation**  **Analysis type: Static** | | Table of Contents  [Description 1](#_Toc89598270)  [Assumptions 2](#_Toc89598271)  [Model Information 2](#_Toc89598272)  [Study Properties 3](#_Toc89598273)  [Units 3](#_Toc89598274)  [Material Properties 4](#_Toc89598275)  [Loads and Fixtures 4](#_Toc89598276)  [Connector Definitions 5](#_Toc89598277)  [Contact Information 5](#_Toc89598278)  [Mesh information 6](#_Toc89598279)  [Sensor Details 6](#_Toc89598280)  [Resultant Forces 7](#_Toc89598281)  [Beams 7](#_Toc89598282)  [Study Results 8](#_Toc89598283)  [Conclusion 10](#_Toc89598284) | |
| Description No Data |

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| Assumptions |

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| Model Information  |  |  |  |  |  | | --- | --- | --- | --- | --- | | |  | | --- | |  |   ****Model name:** Engine Piston**  ****Current Configuration:** Default** | | | | | ****Solid Bodies**** | | | | | ****Document Name and Reference**** | ****Treated As**** | ****Volumetric Properties**** | ****Document Path/Date Modified**** | | **Chamfer1** | **Solid Body** | ****Mass:0.0017001 kg****  ****Volume:6.07177e-07 m^3****  ****Density:2,800 kg/m^3****  ****Weight:0.0166609 N**** | ****C:\Users\leaba\OneDrive\Desktop\University\5th semester\CAD\Project\Solidworks parts\piston rod.SLDPRT****  **Nov 20 19:32:48 2021** | | **Revolve1** | **Solid Body** | ****Mass:0.00372577 kg****  ****Volume:1.33063e-06 m^3****  ****Density:2,800 kg/m^3****  ****Weight:0.0365125 N**** | ****C:\Users\leaba\OneDrive\Desktop\University\5th semester\CAD\Project\Solidworks parts\piston.SLDPRT****  **Nov 20 00:09:34 2021** | |

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| Study Properties  |  |  | | --- | --- | | Study name | Simulation | | Analysis type | Static | | Mesh type | Solid Mesh | | Thermal Effect: | On | | Thermal option | Include temperature loads | | Zero strain temperature | 298 Kelvin | | Include fluid pressure effects from SOLIDWORKS Flow Simulation | Off | | Solver type | Automatic | | 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:\Users\leaba\OneDrive\Desktop\University\5th semester\CAD\Project\Simulation) | |

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| Units  |  |  | | --- | --- | | Unit system: | SI (MKS) | | Length/Displacement | mm | | Temperature | Kelvin | | Angular velocity | Rad/sec | | Pressure/Stress | N/m^2 | |

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| Material Properties  |  |  |  | | --- | --- | --- | | ****Model Reference**** | ****Properties**** | ****Components**** | |  | |  |  | | --- | --- | | ****Name:**** | **201.0-T43 Insulated Mold Casting (SS)** | | ****Model type:**** | **Linear Elastic Isotropic** | | ****Default failure criterion:**** | **Max von Mises Stress** | | ****Yield strength:**** | **2.25e+08 N/m^2** | | ****Tensile strength:**** | **2.73e+08 N/m^2** | | ****Elastic modulus:**** | **7.1e+10 N/m^2** | | ****Poisson's ratio:**** | **0.33** | | ****Mass density:**** | **2,800 kg/m^3** | | ****Shear modulus:**** | **2.3e+10 N/m^2** | | ****Thermal expansion coefficient:**** | **1.9e-05 /Kelvin** | | **SolidBody 1(Chamfer1)(piston rod-2),**  **SolidBody 1(Revolve1)(piston-1)** | | **Curve Data:N/A** | | | |

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| **Loads and Fixtures**  | ****Fixture name**** | ****Fixture Image**** | ****Fixture Details**** | | --- | --- | --- | | **Fixed-1** |  | |  |  | | --- | --- | | Entities: | **2 face(s)** | | Type: | **Fixed Geometry** | | | ****Resultant Forces****   |  |  |  |  |  | | --- | --- | --- | --- | --- | | **Components** | **X** | **Y** | **Z** | **Resultant** | | **Reaction force(N)** | **-0.00258747** | **-44.4838** | **-0.000207447** | **44.4838** | | **Reaction Moment(N.m)** | **0** | **0** | **0** | **0** | | | |  | ****Load name**** | ****Load Image**** | ****Load Details**** | | --- | --- | --- | | **Force-1** |  | |  |  | | --- | --- | | Entities: | **1 face(s)** | | Type: | **Apply normal force** | | Value: | **44.48 N** | | |

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| Connector Definitions No Data |

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| Contact Information  | Contact | Contact Image | Contact Properties | | --- | --- | --- | | Global Interaction |  | |  |  | | --- | --- | | Type: | **Bonded** | | Components: | **1 component(s)** | | Options: | **Independent mesh** | | |

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
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| Mesh information  |  |  | | --- | --- | | Mesh type | Solid Mesh | | Mesher Used: | Standard mesh | | Automatic Transition: | Off | | Include Mesh Auto Loops: | Off | | Jacobian points for High quality mesh | 16 Points | | Element Size | 1.24727 mm | | Tolerance | 0.0623633 mm | | Mesh Quality | High | | Remesh failed parts independently | Off |  Mesh information - Details  |  |  | | --- | --- | | Total Nodes | 13323 | | Total Elements | 7892 | | Maximum Aspect Ratio | 9.955 | | % of elements with Aspect Ratio < 3 | 97.3 | | Percentage of elements with Aspect Ratio > 10 | 0 | | Percentage of distorted elements | 0 | | Time to complete mesh(hh;mm;ss): | 00:00:02 | | Computer name: |  | |

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| Sensor Details No Data |

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| Resultant ForcesReaction forces  | Selection set | Units | Sum X | Sum Y | Sum Z | Resultant | | --- | --- | --- | --- | --- | --- | | Entire Model | N | -0.00258747 | -44.4838 | -0.000207447 | 44.4838 |  Reaction Moments  | Selection set | Units | Sum X | Sum Y | Sum Z | Resultant | | --- | --- | --- | --- | --- | --- | | Entire Model | N.m | 0 | 0 | 0 | 0 | |
| Free body forces  | Selection set | Units | Sum X | Sum Y | Sum Z | Resultant | | --- | --- | --- | --- | --- | --- | | Entire Model | N | 0.00472906 | 0.00596881 | 0.000365825 | 0.00762395 |  Free body moments  | Selection set | Units | Sum X | Sum Y | Sum Z | Resultant | | --- | --- | --- | --- | --- | --- | | Entire Model | N.m | 0 | 0 | 0 | 1e-33 | |

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| Beams No Data |

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| Study Results  | Name | Type | Min | Max | | --- | --- | --- | --- | | Stress1 | VON: von Mises Stress | 0.004N/mm^2 (MPa)  Node: 5664 | 7.075N/mm^2 (MPa)  Node: 3489 | | **Engine Piston-Simulation-Stress-Stress1** | | | |  | Name | Type | Min | Max | | --- | --- | --- | --- | | Displacement1 | URES: Resultant Displacement | 0.000micron  Node: 55 | 1.307micron  Node: 4669 | | **Engine Piston-Simulation-Displacement-Displacement1** | | | |  | Name | Type | Min | Max | | --- | --- | --- | --- | | Strain1 | ESTRN: Equivalent Strain | 5.746e-08  Element: 4805 | 7.997e-05  Element: 1834 | | **Engine Piston-Simulation-Strain-Strain1** | | | |  | Name | Type | Min | Max | | --- | --- | --- | --- | | Factor of Safety1 | Automatic | 31.802  Node: 3489 | 61,803.461  Node: 5664 | | **Engine Piston-Simulation-Factor of Safety-Factor of Safety1** | | | | |

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| Conclusion |