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|  | |  | | --- | | **Simulation of 100\_Y-AXIS-ASSEMBLY**  **Date: Thursday, 16 March, 2023 Designer: Solidworks**  **Study name: Y-AXIS**  **Analysis type: Static** | | Table of Contents  [Description 1](#_Toc129865458)  [Assumptions 2](#_Toc129865459)  [Model Information 3](#_Toc129865460)  [Study Properties 9](#_Toc129865461)  [Units 10](#_Toc129865462)  [Material Properties 11](#_Toc129865463)  [Loads and Fixtures 13](#_Toc129865464)  [Connector Definitions 13](#_Toc129865465)  [Interaction Information 14](#_Toc129865466)  [Mesh information 14](#_Toc129865467)  [Sensor Details 14](#_Toc129865468)  [Resultant Forces 15](#_Toc129865469)  [Beams 15](#_Toc129865470)  [Study Results 16](#_Toc129865471)  [Conclusion 19](#_Toc129865472)  [Appendix 19](#_Toc129865473) | |
| Description No Data |

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| Assumptions |

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| Model Information  |  |  |  |  |  | | --- | --- | --- | --- | --- | | |  | | --- | |  |   ****Model name:** 100\_Y-AXIS-ASSEMBLY**  ****Current Configuration:** Default** | | | | | ****Solid Bodies**** | | | | | ****Document Name and Reference**** | ****Treated As**** | ****Volumetric Properties**** | ****Document Path/Date Modified**** | | **Cut-Extrude6** | **Solid Body** | ****Mass:8.74379 kg****  ****Volume:0.001121 m^3****  ****Density:7,800 kg/m^3****  ****Weight:85.6891 N**** | ****C:\Users\tatwi\Documents\GitHub\24-Increasing-Changeover-Capabilities-at-Isola\117\_Y-AXIS\_HOOK.SLDPRT****  **Mar 16 12:23:02 2023** | | **Cut-Extrude6** | **Solid Body** | ****Mass:8.74379 kg****  ****Volume:0.001121 m^3****  ****Density:7,800 kg/m^3****  ****Weight:85.6891 N**** | ****C:\Users\tatwi\Documents\GitHub\24-Increasing-Changeover-Capabilities-at-Isola\117\_Y-AXIS\_HOOK.SLDPRT****  **Mar 16 12:23:02 2023** | | **Revolve1** | **Solid Body** | ****Mass:0.00509185 kg****  ****Volume:6.47818e-07 m^3****  ****Density:7,860 kg/m^3****  ****Weight:0.0499002 N**** | ****C:\Users\tatwi\Documents\GitHub\24-Increasing-Changeover-Capabilities-at-Isola\118\_Y-AXIS\_BEARING.SLDPRT****  **Mar 16 12:23:02 2023** | | **Revolve1** | **Solid Body** | ****Mass:0.00509185 kg****  ****Volume:6.47818e-07 m^3****  ****Density:7,860 kg/m^3****  ****Weight:0.0499002 N**** | ****C:\Users\tatwi\Documents\GitHub\24-Increasing-Changeover-Capabilities-at-Isola\118\_Y-AXIS\_BEARING.SLDPRT****  **Mar 16 12:23:02 2023** | | **Boss-Extrude1** | **Solid Body** | ****Mass:0.00888945 kg****  ****Volume:1.13097e-06 m^3****  ****Density:7,860 kg/m^3****  ****Weight:0.0871166 N**** | ****C:\Users\tatwi\Documents\GitHub\24-Increasing-Changeover-Capabilities-at-Isola\119\_Y-AXIS-DOWEL.SLDPRT****  **Mar 16 12:23:02 2023** | | **Boss-Extrude1** | **Solid Body** | ****Mass:0.00888945 kg****  ****Volume:1.13097e-06 m^3****  ****Density:7,860 kg/m^3****  ****Weight:0.0871166 N**** | ****C:\Users\tatwi\Documents\GitHub\24-Increasing-Changeover-Capabilities-at-Isola\119\_Y-AXIS-DOWEL.SLDPRT****  **Mar 16 12:23:02 2023** | | **Mirror4** | **Solid Body** | ****Mass:28.91 kg****  ****Volume:0.00367811 m^3****  ****Density:7,860 kg/m^3****  ****Weight:283.318 N**** | ****C:\Users\tatwi\Documents\GitHub\24-Increasing-Changeover-Capabilities-at-Isola\121\_Y-AXIS\_BASE.SLDPRT****  **Mar 16 12:23:02 2023** | | **CBORE for M4 Hex Head Machine Screw2** | **Solid Body** | ****Mass:0.246985 kg****  ****Volume:3.1423e-05 m^3****  ****Density:7,860 kg/m^3****  ****Weight:2.42045 N**** | ****C:\Users\tatwi\Documents\GitHub\24-Increasing-Changeover-Capabilities-at-Isola\122-Y-AXIS\_L\_BRACKET.SLDPRT****  **Mar 16 12:23:02 2023** | | **CBORE for M4 Hex Head Machine Screw2** | **Solid Body** | ****Mass:0.246985 kg****  ****Volume:3.1423e-05 m^3****  ****Density:7,860 kg/m^3****  ****Weight:2.42045 N**** | ****C:\Users\tatwi\Documents\GitHub\24-Increasing-Changeover-Capabilities-at-Isola\122-Y-AXIS\_L\_BRACKET.SLDPRT****  **Mar 16 12:23:02 2023** | | **CBORE for M4 Hex Head Machine Screw2** | **Solid Body** | ****Mass:0.246985 kg****  ****Volume:3.1423e-05 m^3****  ****Density:7,860 kg/m^3****  ****Weight:2.42045 N**** | ****C:\Users\tatwi\Documents\GitHub\24-Increasing-Changeover-Capabilities-at-Isola\122-Y-AXIS\_L\_BRACKET.SLDPRT****  **Mar 16 12:23:02 2023** | | **CBORE for M4 Hex Head Machine Screw2** | **Solid Body** | ****Mass:0.246985 kg****  ****Volume:3.1423e-05 m^3****  ****Density:7,860 kg/m^3****  ****Weight:2.42045 N**** | ****C:\Users\tatwi\Documents\GitHub\24-Increasing-Changeover-Capabilities-at-Isola\122-Y-AXIS\_L\_BRACKET.SLDPRT****  **Mar 16 12:23:02 2023** | | **CBORE for M4 Hex Head Machine Screw2** | **Solid Body** | ****Mass:0.246985 kg****  ****Volume:3.1423e-05 m^3****  ****Density:7,860 kg/m^3****  ****Weight:2.42045 N**** | ****C:\Users\tatwi\Documents\GitHub\24-Increasing-Changeover-Capabilities-at-Isola\122-Y-AXIS\_L\_BRACKET.SLDPRT****  **Mar 16 12:23:02 2023** | | **CBORE for M4 Hex Head Machine Screw2** | **Solid Body** | ****Mass:0.246985 kg****  ****Volume:3.1423e-05 m^3****  ****Density:7,860 kg/m^3****  ****Weight:2.42045 N**** | ****C:\Users\tatwi\Documents\GitHub\24-Increasing-Changeover-Capabilities-at-Isola\122-Y-AXIS\_L\_BRACKET.SLDPRT****  **Mar 16 12:23:02 2023** | | **Fillet1** | **Solid Body** | ****Mass:40.8897 kg****  ****Volume:0.00520225 m^3****  ****Density:7,860 kg/m^3****  ****Weight:400.719 N**** | ****C:\Users\tatwi\Documents\GitHub\24-Increasing-Changeover-Capabilities-at-Isola\123\_Y-AXIS-UNDER\_BASE.SLDPRT****  **Mar 16 12:23:02 2023** | | **SSEBWM16\_b** | **Solid Body** | ****Mass:0.265956 kg****  ****Volume:3.38366e-05 m^3****  ****Density:7,860 kg/m^3****  ****Weight:2.60637 N**** | ****C:\Users\tatwi\Documents\GitHub\24-Increasing-Changeover-Capabilities-at-Isola\131\_Y\_AXIS\_LINEAR-RAIL\_BASE.SLDPRT****  **Mar 16 12:23:02 2023** | | **SSEBWM16\_b** | **Solid Body** | ****Mass:0.265956 kg****  ****Volume:3.38366e-05 m^3****  ****Density:7,860 kg/m^3****  ****Weight:2.60637 N**** | ****C:\Users\tatwi\Documents\GitHub\24-Increasing-Changeover-Capabilities-at-Isola\131\_Y\_AXIS\_LINEAR-RAIL\_BASE.SLDPRT****  **Mar 16 12:23:02 2023** | | **SSEBWM16\_b** | **Solid Body** | ****Mass:0.265956 kg****  ****Volume:3.38366e-05 m^3****  ****Density:7,860 kg/m^3****  ****Weight:2.60637 N**** | ****C:\Users\tatwi\Documents\GitHub\24-Increasing-Changeover-Capabilities-at-Isola\131\_Y\_AXIS\_LINEAR-RAIL\_BASE.SLDPRT****  **Mar 16 12:23:02 2023** | | **SSEBWM16\_b** | **Solid Body** | ****Mass:0.265956 kg****  ****Volume:3.38366e-05 m^3****  ****Density:7,860 kg/m^3****  ****Weight:2.60637 N**** | ****C:\Users\tatwi\Documents\GitHub\24-Increasing-Changeover-Capabilities-at-Isola\131\_Y\_AXIS\_LINEAR-RAIL\_BASE.SLDPRT****  **Mar 16 12:23:02 2023** | | **SSE2BWML16G-669\_r** | **Solid Body** | ****Mass:1.96349 kg****  ****Volume:0.000249808 m^3****  ****Density:7,860 kg/m^3****  ****Weight:19.2422 N**** | ****C:\Users\tatwi\Documents\GitHub\24-Increasing-Changeover-Capabilities-at-Isola\132\_Y-AXIS\_LINEAR-RAIL\_RAIL.SLDPRT****  **Mar 16 12:23:02 2023** | | **SSE2BWML16G-669\_r** | **Solid Body** | ****Mass:1.96349 kg****  ****Volume:0.000249808 m^3****  ****Density:7,860 kg/m^3****  ****Weight:19.2422 N**** | ****C:\Users\tatwi\Documents\GitHub\24-Increasing-Changeover-Capabilities-at-Isola\132\_Y-AXIS\_LINEAR-RAIL\_RAIL.SLDPRT****  **Mar 16 12:23:02 2023** | | **Cut-Extrude1** | **Solid Body** | ****Mass:0.23179 kg****  ****Volume:2.94898e-05 m^3****  ****Density:7,860 kg/m^3****  ****Weight:2.27154 N**** | ****C:\Users\tatwi\Documents\GitHub\24-Increasing-Changeover-Capabilities-at-Isola\141\_Y-AXIS\_PINION.SLDPRT****  **Mar 16 12:23:02 2023** | | **Fillet1** | **Solid Body** | ****Mass:0.468845 kg****  ****Volume:5.96494e-05 m^3****  ****Density:7,860 kg/m^3****  ****Weight:4.59468 N**** | ****C:\Users\tatwi\Documents\GitHub\24-Increasing-Changeover-Capabilities-at-Isola\142-Y-AXIS-RACK\_RGEAS1\_5\_300\_A.SLDPRT****  **Mar 16 12:23:02 2023** | | **Fillet1** | **Solid Body** | ****Mass:0.468845 kg****  ****Volume:5.96494e-05 m^3****  ****Density:7,860 kg/m^3****  ****Weight:4.59468 N**** | ****C:\Users\tatwi\Documents\GitHub\24-Increasing-Changeover-Capabilities-at-Isola\142-Y-AXIS-RACK\_RGEAS1\_5\_300\_A.SLDPRT****  **Mar 16 12:23:02 2023** | | **Cut-Extrude5** | **Solid Body** | ****Mass:0.494604 kg****  ****Volume:6.29267e-05 m^3****  ****Density:7,860 kg/m^3****  ****Weight:4.84712 N**** | ****C:\Users\tatwi\Documents\GitHub\24-Increasing-Changeover-Capabilities-at-Isola\143\_Y-AXIS-MOTORMOUNT.SLDPRT****  **Mar 16 12:23:02 2023** | | **M4x0.7 Tapped Hole1** | **Solid Body** | ****Mass:4.713 kg****  ****Volume:0.000599618 m^3****  ****Density:7,860 kg/m^3****  ****Weight:46.1874 N**** | ****C:\Users\tatwi\Documents\GitHub\24-Increasing-Changeover-Capabilities-at-Isola\145\_Y-AXIS\_RACK-ATTACHMENT.SLDPRT****  **Mar 16 12:23:02 2023** | | **M4x0.7 Tapped Hole1** | **Solid Body** | ****Mass:4.713 kg****  ****Volume:0.000599618 m^3****  ****Density:7,860 kg/m^3****  ****Weight:46.1874 N**** | ****C:\Users\tatwi\Documents\GitHub\24-Increasing-Changeover-Capabilities-at-Isola\145\_Y-AXIS\_RACK-ATTACHMENT.SLDPRT****  **Mar 16 12:23:02 2023** | | **Boss-Extrude1** | **Solid Body** | ****Mass:0.00031752 kg****  ****Volume:4.0397e-08 m^3****  ****Density:7,860 kg/m^3****  ****Weight:0.0031117 N**** | ****C:\Users\tatwi\Documents\GitHub\24-Increasing-Changeover-Capabilities-at-Isola\151\_Y-AXIS\_FORMATE.SLDPRT****  **Mar 16 12:46:42 2023** | | **Revolve1** | **Solid Body** | ****Mass:0.00834988 kg****  ****Volume:1.0705e-06 m^3****  ****Density:7,800 kg/m^3****  ****Weight:0.0818288 N**** | ****C:\Users\tatwi\Documents\GitHub\24-Increasing-Changeover-Capabilities-at-Isola\1\_1110\_STOPPER.SLDPRT****  **Mar 16 12:23:02 2023** | | **Revolve1** | **Solid Body** | ****Mass:0.00834988 kg****  ****Volume:1.0705e-06 m^3****  ****Density:7,800 kg/m^3****  ****Weight:0.0818288 N**** | ****C:\Users\tatwi\Documents\GitHub\24-Increasing-Changeover-Capabilities-at-Isola\1\_1110\_STOPPER.SLDPRT****  **Mar 16 12:23:02 2023** | | **Revolve1** | **Solid Body** | ****Mass:0.00834988 kg****  ****Volume:1.0705e-06 m^3****  ****Density:7,800 kg/m^3****  ****Weight:0.0818288 N**** | ****C:\Users\tatwi\Documents\GitHub\24-Increasing-Changeover-Capabilities-at-Isola\1\_1110\_STOPPER.SLDPRT****  **Mar 16 12:23:02 2023** | | **Revolve1** | **Solid Body** | ****Mass:0.00834988 kg****  ****Volume:1.0705e-06 m^3****  ****Density:7,800 kg/m^3****  ****Weight:0.0818288 N**** | ****C:\Users\tatwi\Documents\GitHub\24-Increasing-Changeover-Capabilities-at-Isola\1\_1110\_STOPPER.SLDPRT****  **Mar 16 12:23:02 2023** | |

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| Study Properties  |  |  | | --- | --- | | Study name | Y-AXIS | | 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\tatwi\Documents\GitHub\24-Increasing-Changeover-Capabilities-at-Isola) | |

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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:**** | **Stainless Steel (ferritic)** | | ****Model type:**** | **Linear Elastic Isotropic** | | ****Default failure criterion:**** | **Unknown** | | ****Yield strength:**** | **1.72339e+08 N/m^2** | | ****Tensile strength:**** | **5.13613e+08 N/m^2** | | ****Elastic modulus:**** | **2e+11 N/m^2** | | ****Poisson's ratio:**** | **0.28** | | ****Mass density:**** | **7,800 kg/m^3** | | ****Shear modulus:**** | **7.7e+10 N/m^2** | | ****Thermal expansion coefficient:**** | **1.1e-05 /Kelvin** | | **SolidBody 1(Cut-Extrude6)(117\_Y-AXIS\_HOOK-2),**  **SolidBody 1(Cut-Extrude6)(117\_Y-AXIS\_HOOK-5),**  **SolidBody 1(Revolve1)(1\_1110\_STOPPER-1),**  **SolidBody 1(Revolve1)(1\_1110\_STOPPER-2),**  **SolidBody 1(Revolve1)(1\_1110\_STOPPER-3),**  **SolidBody 1(Revolve1)(1\_1110\_STOPPER-4)** | | | | **Curve Data:N/A** | | | | | |  | |  |  | | --- | --- | | ****Name:**** | **201 Annealed Stainless Steel (SS)** | | ****Model type:**** | **Linear Elastic Isotropic** | | ****Default failure criterion:**** | **Unknown** | | ****Yield strength:**** | **2.92e+08 N/m^2** | | ****Tensile strength:**** | **6.85e+08 N/m^2** | | ****Elastic modulus:**** | **2.07e+11 N/m^2** | | ****Poisson's ratio:**** | **0.27** | | ****Mass density:**** | **7,860 kg/m^3** | | ****Thermal expansion coefficient:**** | **1.7e-05 /Kelvin** | | **SolidBody 1(Revolve1)(118\_Y-AXIS\_BEARING-1),**  **SolidBody 1(Revolve1)(118\_Y-AXIS\_BEARING-2),**  **SolidBody 1(Boss-Extrude1)(119\_Y-AXIS-DOWEL-1),**  **SolidBody 1(Boss-Extrude1)(119\_Y-AXIS-DOWEL-2),**  **SolidBody 1(Mirror4)(121\_Y-AXIS\_BASE-1),**  **SolidBody 1(CBORE for M4 Hex Head Machine Screw2)(122-Y-AXIS\_L\_BRACKET-1),**  **SolidBody 1(CBORE for M4 Hex Head Machine Screw2)(122-Y-AXIS\_L\_BRACKET-4),**  **SolidBody 1(CBORE for M4 Hex Head Machine Screw2)(122-Y-AXIS\_L\_BRACKET-5),**  **SolidBody 1(CBORE for M4 Hex Head Machine Screw2)(122-Y-AXIS\_L\_BRACKET-6),**  **SolidBody 1(CBORE for M4 Hex Head Machine Screw2)(122-Y-AXIS\_L\_BRACKET-7),**  **SolidBody 1(CBORE for M4 Hex Head Machine Screw2)(122-Y-AXIS\_L\_BRACKET-8),**  **SolidBody 1(Fillet1)(123\_Y-AXIS-UNDER\_BASE-1),**  **SolidBody 1(SSEBWM16\_b)(131\_Y\_AXIS\_LINEAR-RAIL\_BASE-1),**  **SolidBody 1(SSEBWM16\_b)(131\_Y\_AXIS\_LINEAR-RAIL\_BASE-2),**  **SolidBody 1(SSEBWM16\_b)(131\_Y\_AXIS\_LINEAR-RAIL\_BASE-3),**  **SolidBody 1(SSEBWM16\_b)(131\_Y\_AXIS\_LINEAR-RAIL\_BASE-4),**  **SolidBody 1(SSE2BWML16G-669\_r)(132\_Y-AXIS\_LINEAR-RAIL\_RAIL-2),**  **SolidBody 1(SSE2BWML16G-669\_r)(132\_Y-AXIS\_LINEAR-RAIL\_RAIL-3),**  **SolidBody 1(Cut-Extrude1)(141\_Y-AXIS\_PINION-1),**  **SolidBody 1(Fillet1)(142-Y-AXIS-RACK\_RGEAS1\_5\_300\_A-1),**  **SolidBody 1(Fillet1)(142-Y-AXIS-RACK\_RGEAS1\_5\_300\_A-2),**  **SolidBody 1(Cut-Extrude5)(143\_Y-AXIS-MOTORMOUNT-1),**  **SolidBody 1(M4x0.7 Tapped Hole1)(145\_Y-AXIS\_RACK-ATTACHMENT-1),**  **SolidBody 1(M4x0.7 Tapped Hole1)(145\_Y-AXIS\_RACK-ATTACHMENT-2),**  **SolidBody 1(Boss-Extrude1)(151\_Y-AXIS\_FORMATE-1)** | | | | **Curve Data:N/A** | | | | | |

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| **Loads and Fixtures**  | ****Fixture name**** | ****Fixture Image**** | ****Fixture Details**** | | --- | --- | --- | | **Fixed-1** |  | |  |  | | --- | --- | | Entities: | **4 edge(s)** | | Type: | **Fixed Geometry** | | | ****Resultant Forces****   |  |  |  |  |  | | --- | --- | --- | --- | --- | | **Components** | **X** | **Y** | **Z** | **Resultant** | | **Reaction force(N)** | **-0.135597** | **8,443.18** | **0.205688** | **8,443.18** | | **Reaction Moment(N.m)** | **0** | **0** | **0** | **0** | | | |  | ****Load name**** | ****Load Image**** | ****Load Details**** | | --- | --- | --- | | **Force-1** |  | |  |  | | --- | --- | | Entities: | **2 face(s)** | | Type: | **Apply normal force** | | Value: | **1,000 lbf** | | |

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| Connector Definitions No Data |

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

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| Mesh information  |  |  | | --- | --- | | Mesh type | Solid Mesh | | Mesher Used: | Blended curvature-based mesh | | Jacobian points for High quality mesh | 16 Points | | Maximum element size | 52.6729 mm | | Minimum element size | 2.63365 mm | | Mesh Quality | High | |

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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 | -0.135597 | 8,443.18 | 0.205688 | 8,443.18 |  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 | -158.663 | 36.4831 | -51.4591 | 170.742 |  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 | 6.131e-01N/m^2  Node: 1083992 | 3.635e+08N/m^2  Node: 1131217 | | **100\_Y-AXIS-ASSEMBLY-Y-AXIS-Stress-Stress1** | | | |  | Name | Type | Min | Max | | --- | --- | --- | --- | | Displacement1 | URES: Resultant Displacement | 0.000e+00mm  Node: 28170 | 8.840e-01mm  Node: 38 | | **100\_Y-AXIS-ASSEMBLY-Y-AXIS-Displacement-Displacement1** | | | |  | Name | Type | Min | Max | | --- | --- | --- | --- | | Strain1 | ESTRN: Equivalent Strain | 3.013e-12  Element: 713465 | 1.372e-03  Element: 749018 | | **100\_Y-AXIS-ASSEMBLY-Y-AXIS-Strain-Strain1** | | | |  | Name | Type | Min | Max | | --- | --- | --- | --- | | Factor of Safety1 | Automatic | 8.033e-01  Node: 1131217 | 4.763e+08  Node: 1083992 | | **100\_Y-AXIS-ASSEMBLY-Y-AXIS-Factor of Safety-Factor of Safety1** | | | | |

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| Conclusion |

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| Appendix |