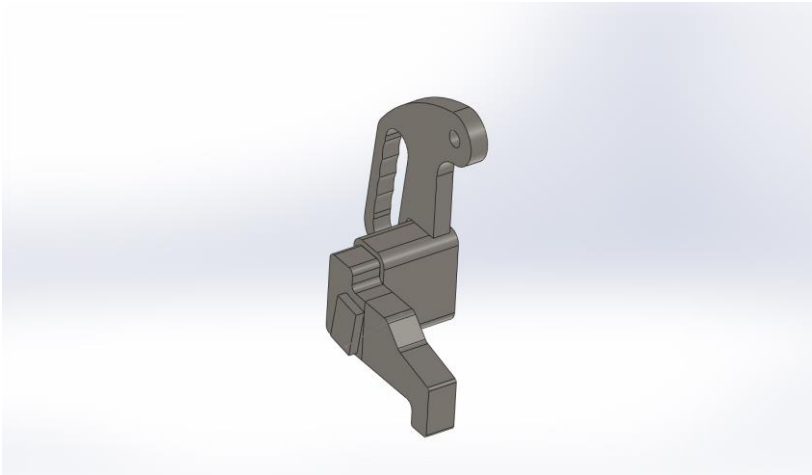


Simulation of HYDRA HOOK

Date: Monday, April 15, 2013
Designer: John Bartoli
Study name: R&D 95-2104B
Analysis type: Static

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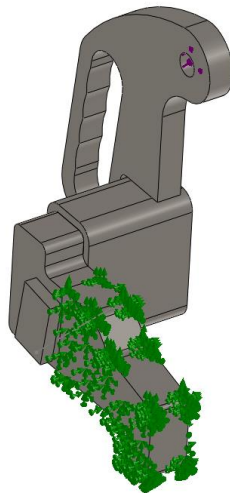
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Description

HYDRA HOOK (95-2104B) is used at Triple C with FORKLIFT BOOM LIFT (95-0101) to raise a maximum weight of 2275-lbs. The approximate lifting force applied to this device is 760 lbs and is produced through a tensile force developed in a 3/8" chain. In overestimating the applied force acting at the 11/16" hole, an 840-lb load shall be defined as acting 45 degrees from the vertical.

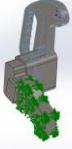
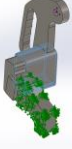
Model Information



Model name: R&D-HYDRA HOOK
Current Configuration: Default

Solid Bodies

Document Name and Reference	Treated As	Volumetric Properties	Document Path/Date Modified
Imported1 	Solid Body	Mass:0.265874 lb Volume:0.9375 in ³ Density:0.283599 lb/in ³ Weight:0.265694 lbf	G:\TripleC-Hydra Hook\FI .375 X 1.25 L 2.sldprt Apr 10 16:21:53 2013

Split Line4 	Solid Body	Mass:6.1138 lb Volume:21.5579 in ³ Density:0.283599 lb/in ³ Weight:6.10965 lbf	G:\TripleC-Hydra Hook\R & D FP-HYDRA HOOK REV A.sldprt Apr 15 08:11:55 2013
Imported1 	Solid Body	Mass:4.84486 lb Volume:17.0835 in ³ Density:0.283599 lb/in ³ Weight:4.84157 lbf	G:\TripleC-Hydra Hook\R & D FP-HYDRA HOOK REV B.sldprt Apr 10 16:21:53 2013
Imported1 	Solid Body	Mass:2.4781 lb Volume:8.73804 in ³ Density:0.283599 lb/in ³ Weight:2.47642 lbf	G:\TripleC-Hydra Hook\RT 4x2x.25 L 3.375_Default_As Machined_.sldprt Apr 10 16:21:53 2013



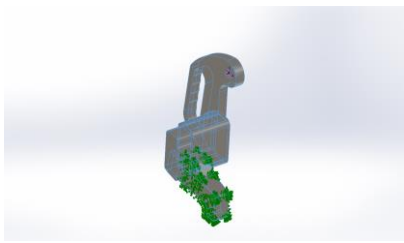
Study Properties

Study name	R&D 95-2104B
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	FFEPlus
Inplane Effect:	Off
Soft Spring:	Off
Inertial Relief:	Off
Incompatible bonding options	Automatic
Large displacement	On
Compute free body forces	On
Friction	Off
Use Adaptive Method:	Off
Result folder	SolidWorks document (G:\TripleC-Hydra Hook)

Units

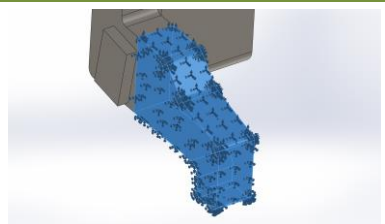
Unit system:	English (IPS)
Length/Displacement	in
Temperature	Fahrenheit
Angular velocity	Hertz
Pressure/Stress	psi

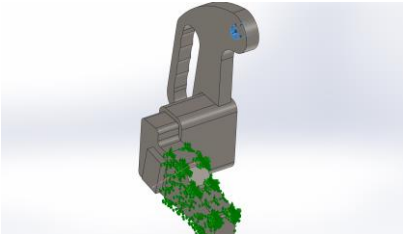
Material Properties

Model Reference	Properties	Components
	Name: ASTM A36 Steel Model type: Linear Elastic Isotropic Default failure criterion: Max von Mises Stress Yield strength: 36259.4 psi Tensile strength: 58015.1 psi Elastic modulus: 2.90075e+007 psi Poisson's ratio: 0.26 Mass density: 0.283599 lb/in³ Shear modulus: 1.15015e+007 psi	SolidBody 1(Imported1)(FI .375 X 1.25 L 2-1), SolidBody 1(Split Line4)(R & D FP-HYDRA HOOK REV A-1), SolidBody 1(Imported1)(R & D FP-HYDRA HOOK REV B-1), SolidBody 1(Imported1)(RT 4x2x.25 L 3.375_Default_As Machined_-1)
Curve Data:N/A		

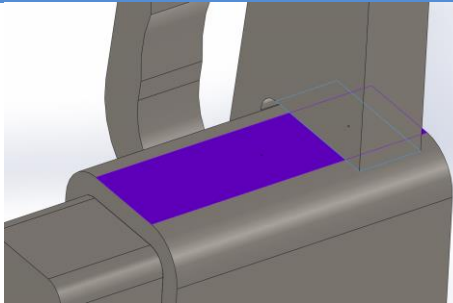
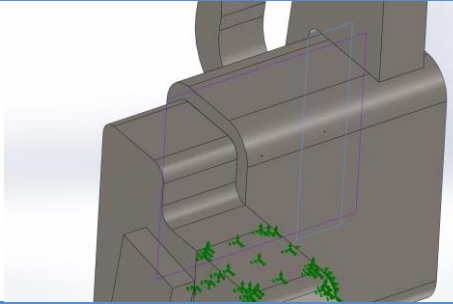
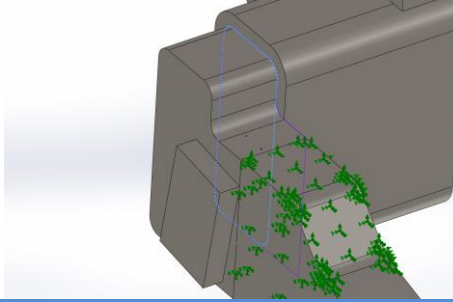
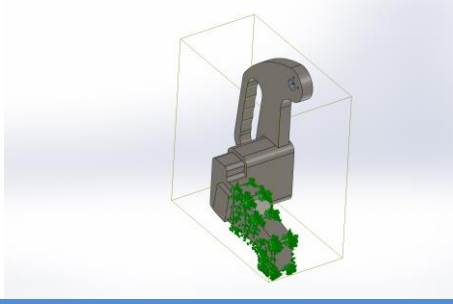


Loads and Fixtures

Fixture name	Fixture Image	Fixture Details			
Fixed-1		Entities: 15 face(s) Type: Fixed Geometry			
Resultant Forces					
Components		X	Y	Z	Resultant
Reaction force(lbf)		-593.949	0.0981447	593.975	839.989
Reaction Moment(lbf-in)		0	0	0	0

Load name	Load Image	Load Details			
Force-1		Entities: 1 face(s) Type: Apply force Values: ---, ---, -840 lbf			

Contact Information

Contact	Contact Image	Contact Properties
Contact Set-1		Type: Bonded contact pair Entites: 2 face(s)
Contact Set-2		Type: Bonded contact pair Entites: 2 face(s)
Contact Set-3		Type: Bonded contact pair Entites: 8 edge(s), 1 face(s)
Global Contact		Type: Bonded Components: 1 component(s) Options: Compatible mesh



Mesh Information

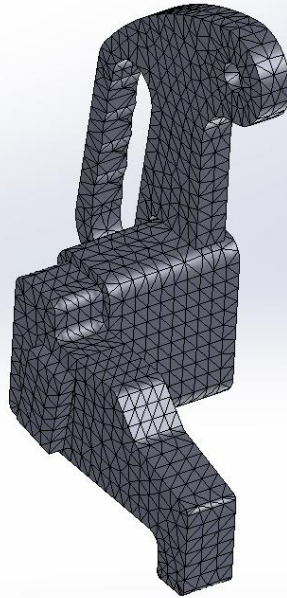
Mesh type	Solid Mesh
Mesher Used:	Curvature based mesh
Jacobian points	4 Points
Maximum element size	0 mm
Minimum element size	0 mm
Mesh Quality	High
Remesh failed parts with incompatible mesh	Off

Mesh Information - Details

Total Nodes	15493
Total Elements	8817
Maximum Aspect Ratio	10.987
% of elements with Aspect Ratio < 3	98.1
% of elements with Aspect Ratio > 10	0.0227
% of distorted elements(Jacobian)	0
Time to complete mesh(hh:mm:ss):	00:00:05
Computer name:	JBARTOLI1



Model name: R&D-HYDRA HOOK
Study name: R&D 95-2104B
Mesh type: Solid mesh



Resultant Forces

Reaction Forces

Selection set	Units	Sum X	Sum Y	Sum Z	Resultant
Entire Model	lbf	-593.949	0.0981447	593.975	839.989

Reaction Moments

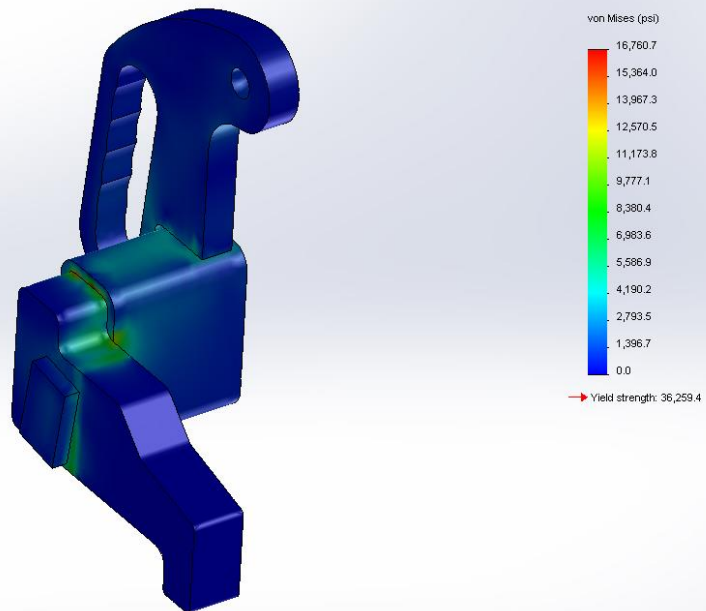
Selection set	Units	Sum X	Sum Y	Sum Z	Resultant
Entire Model	lbf-in	0	0	0	0



Study Results

Name	Type	Min	Max
Stress1	VON: von Mises Stress	0 psi Node: 553	16760.7 psi Node: 11881

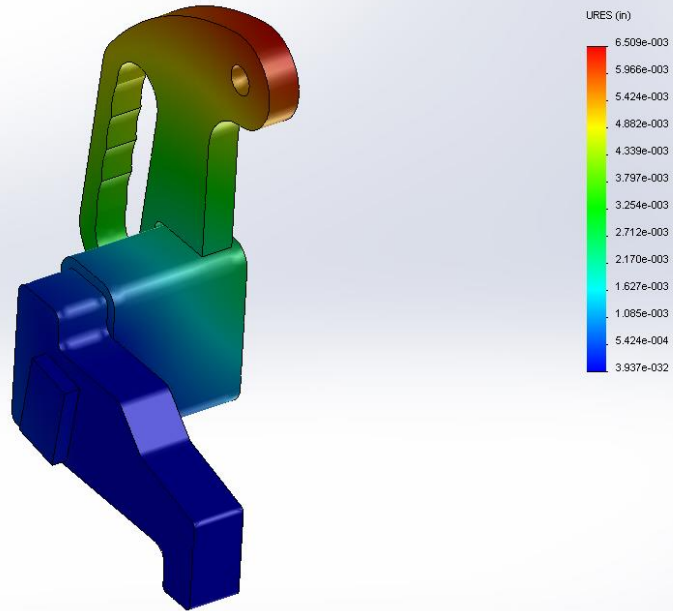
Model name: R&D-HYDRA HOOK
Study name: R&D 95-2104B
Plot type: Static nodal stress Stress1



HYDRA HOOK (95-2104B)

Name	Type	Min	Max
Displacement1	URES: Resultant Displacement	0 in Node: 1	0.0065089 in Node: 9482

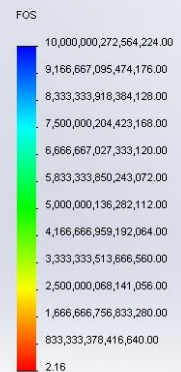
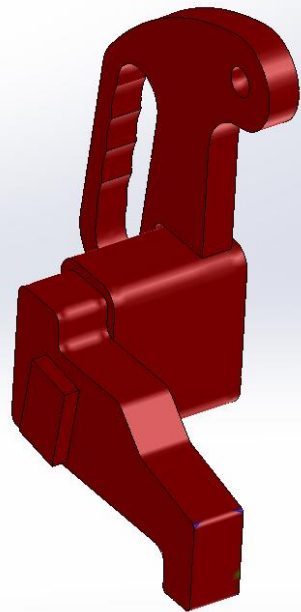
Model name: R&D-HYDRA HOOK
Study name: R&D 95-2104B
Plot type: Static displacement Displacement1



HYDRA HOOK (95-2104B)

Name	Type	Min	Max
Factor of Safety1	Max von Mises Stress	2.16336 Node: 11881	1e+016 Node: 553

Model name: R&D-HYDRA HOOK
Study name: R&D 95-2104B
Plot type: Factor of Safety Factor of Safety1
Criterion: Max von Mises Stress
Factor of safety distribution: Min FOS = 2.2



HYDRA HOOK (95-2104B)

Conclusion

After performing the finite element analysis on HYDRA HOOK the maximum stress, maximum displacement and minimum factor of safety are 16760.7 psi, 0.0065089 inches and 2.16336, respectively. The safety factor of 2.16 proves that the structure is both safe and reliable for a design load of 840 lbs. For the 3/8" lifting chain, Grade 80 (or higher) alloy chain is recommended.