Reverse Engineering a Toy Nerf Gun

NERF REBELLE

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ME 210 - Fall 2020
Sections: 17295, 17350
Instructor: Barr

BLACK BOX DIAGRAM

Pull on shaft (Linear Potential Energy: Shaft)

Pull on Trigger Releasing Vacuum Spring (Releasing Spring Potential Energy : Trigger)

INPUTS

Transform Displacement to Stored Energy (Shaft to Spring)
Transform Stored Energy to Displacement (Spring to Bullet)

$-(\frac{1}{2})kx^2=(\frac{1}{2})mv^2$

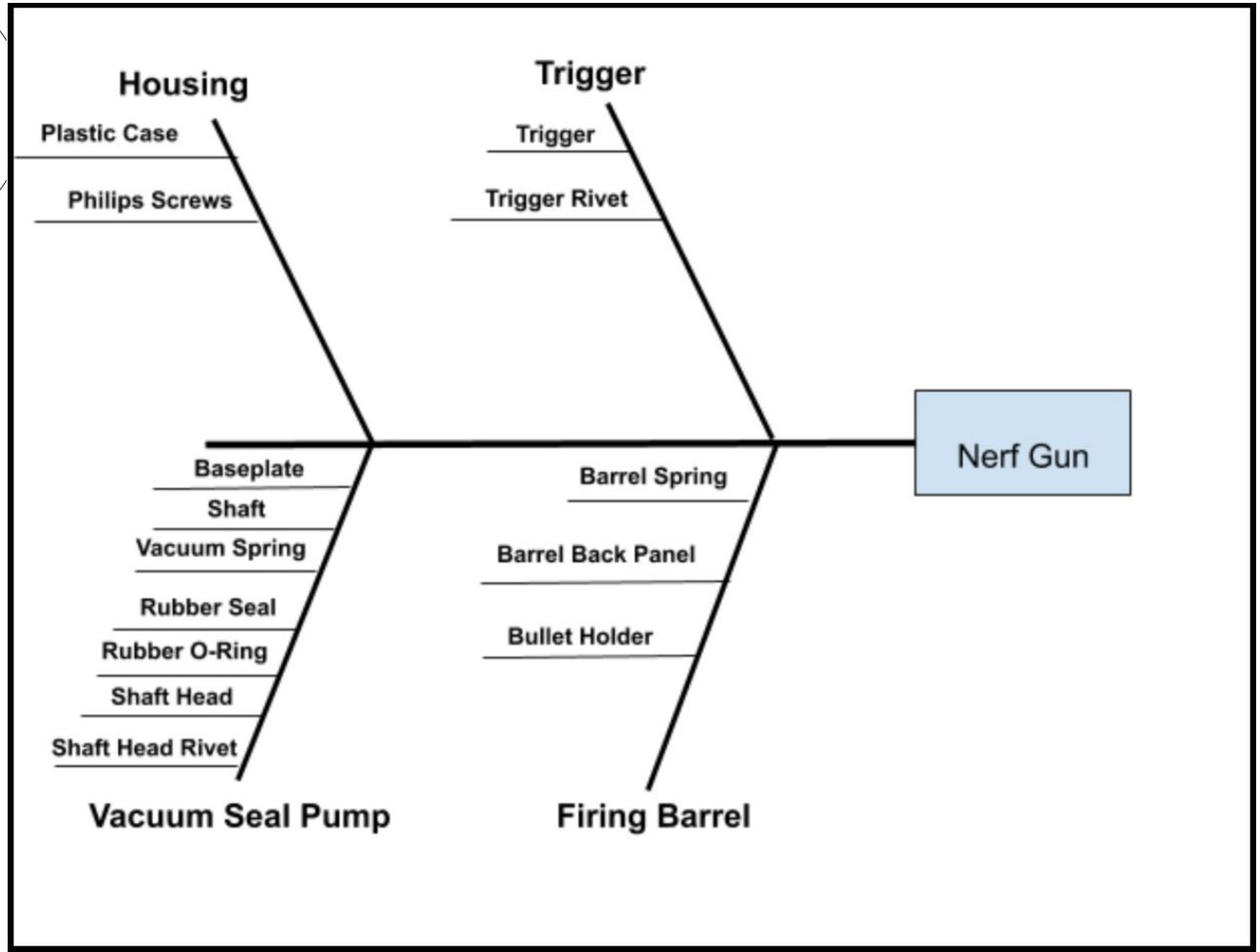
BLACK BOX

Displacement on Vacuum Spring (Spring Potential Energy: Vacuum Spring)

Kinetic Energy of Bullet (Transformed Potential Energy of Spring to Kinetic Energy: Bullet)

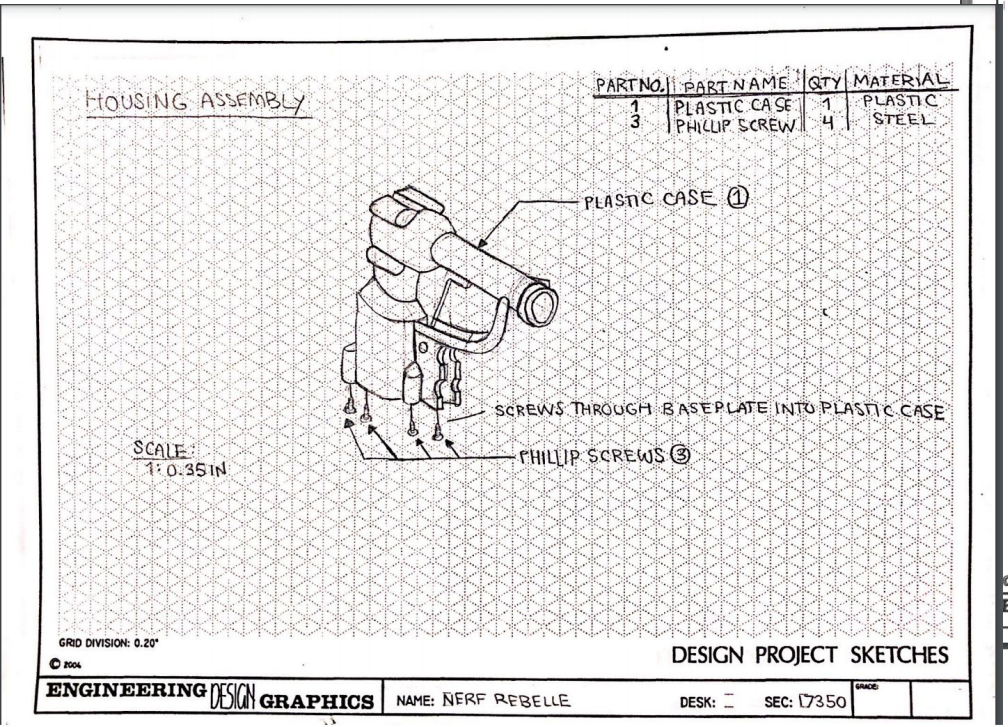
OUTPUTS

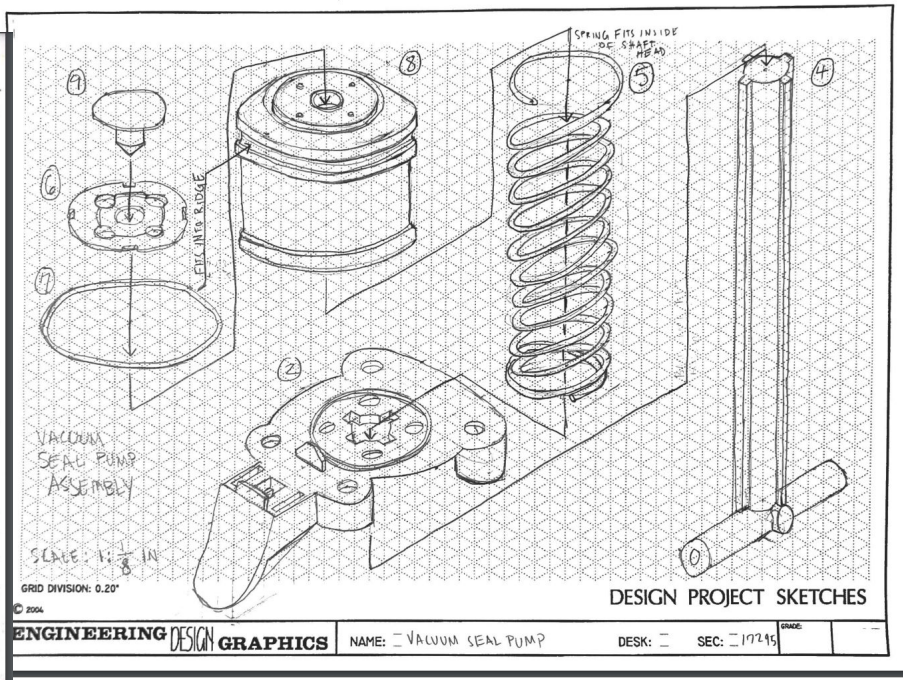
Fishbone Diagram



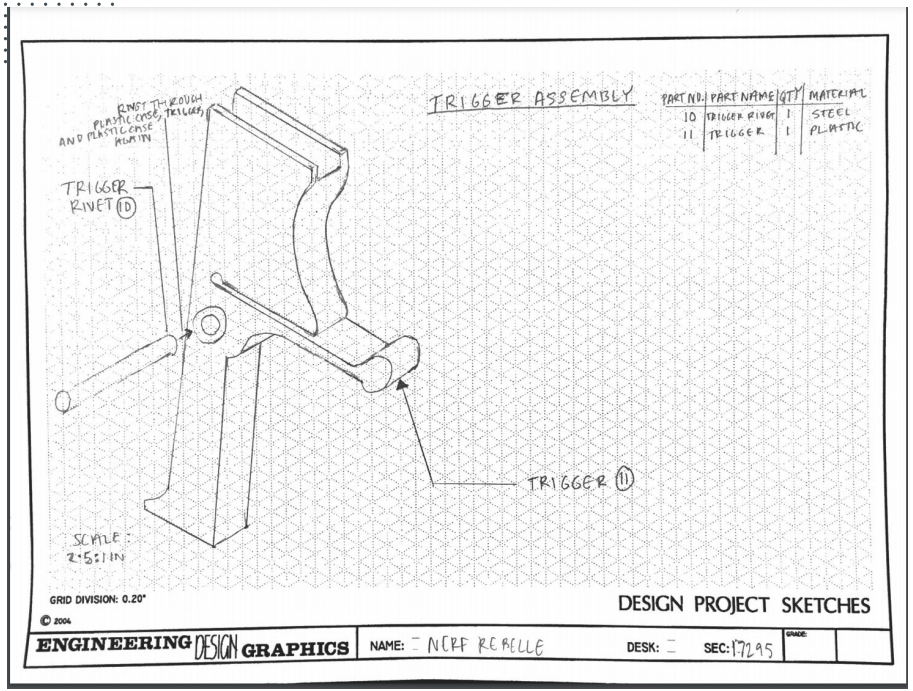
Parts List			
Nerf Gun			
Part No.	**Part Name**	**No. Required**	**Material**
1	Plastic Case	1	Plastic
2	Baseplate	1	Plastic
3	Philips Screw	4	Steel
4	Shaft	1	Plastic
5	Vacuum Spring	1	Steel
6	Rubber Seal	1	Rubber
7	Rubber O-Ring	1	Rubber
8	Shaft Head	1	Plastic
9	Shaft Head Rivet	1	Steel
10	Trigger Rivet	1	Steel
11	Trigger	1	Plastic
12	Barrel Back Panel	1	Plastic
13	Barrel Spring	1	Steel
14	Bullet Holder	1	Plastic

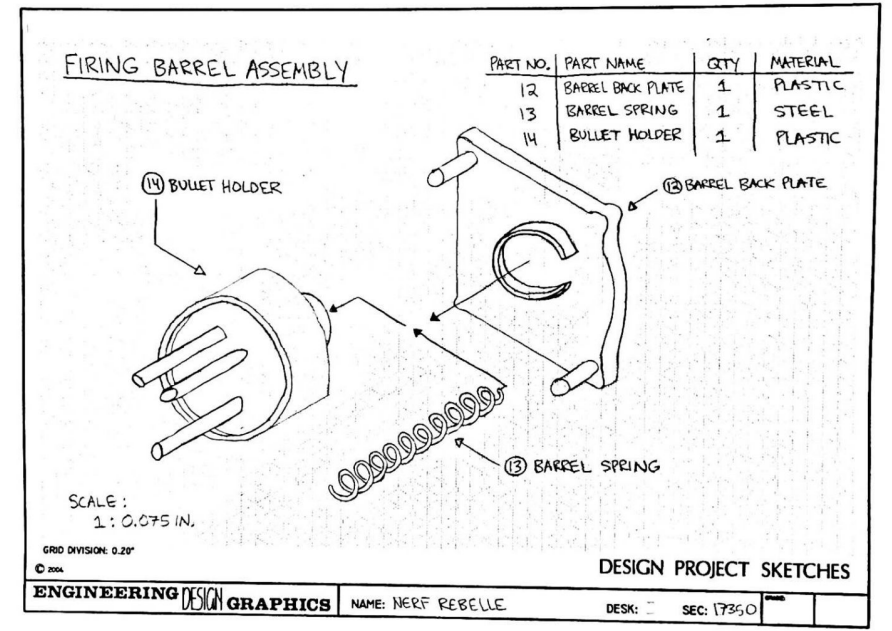
Exploded Sub-Assembly Sketches





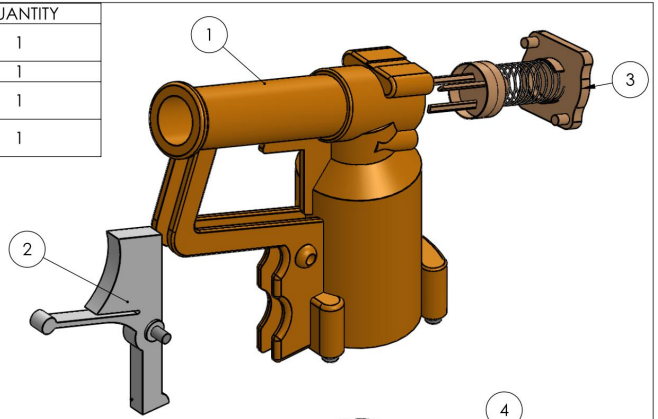
Exploded Sub-Assembly Sketches

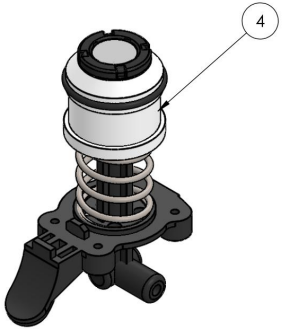




Exploded Assembly

ITEM NUMBER	PART NAME	QUANTITY
1	HOUSING ASSEMBLY	1
2	TRIGGER ASSEMBLY	1
3	FIRING BARREL ASSEMBLY	1
4	VACUUM PUMP ASSEMBLY	1



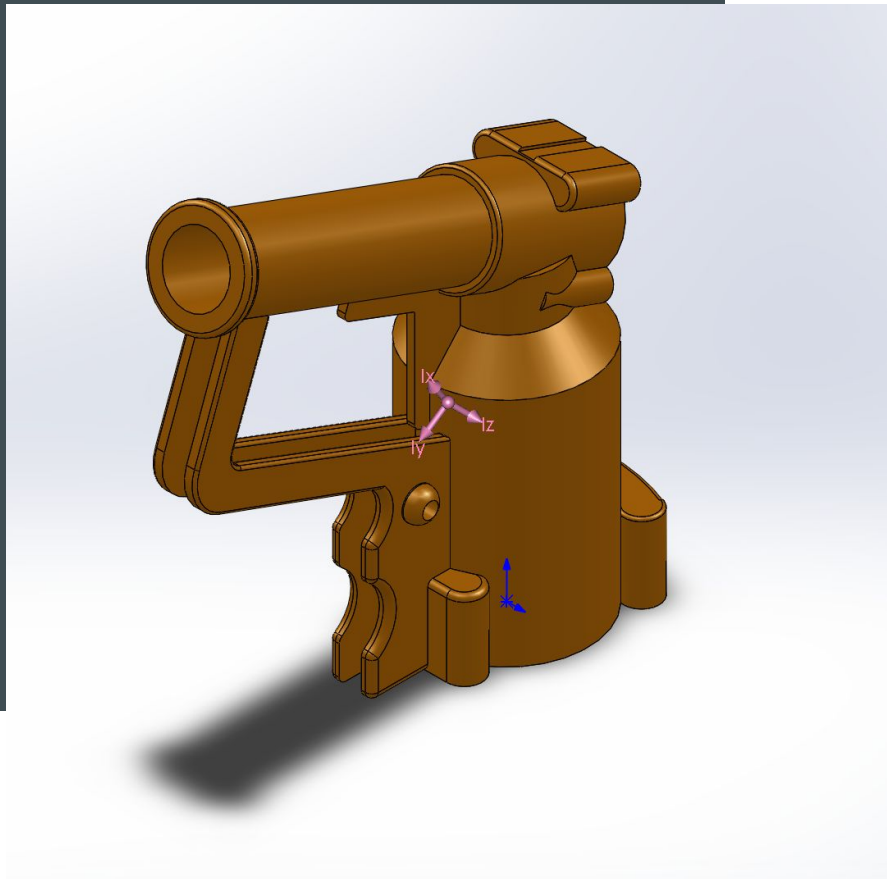


NERF GUN ASSEMBLY

SCALE 1:1

NAME: NERF REBELLE	SEC: 17295	GRADE	DC 4
DESIGN WORKBOOK USING SOLIDWORKS			

Mass Properties Analysis



Mass properties of PLASTIC_CASE_fixed_barrel (1)
Configuration: Default
Coordinate system: -- default --

Density = 0.04 pounds per cubic inch

Mass = 0.05 pounds

Volume = 1.34 cubic inches

Surface area = 37.68 square inches

Center of mass: (inches)
X = 0.00
Y = 1.55
Z = 0.45

Principal axes of inertia and principal moments of inertia: (pounds * square inches)
Taken at the center of mass.

Ix = (0.00,	Px = 0.03	
Iy = (0.00,	Py = 0.08	
Iz = (1.00,	Pz = 0.09	

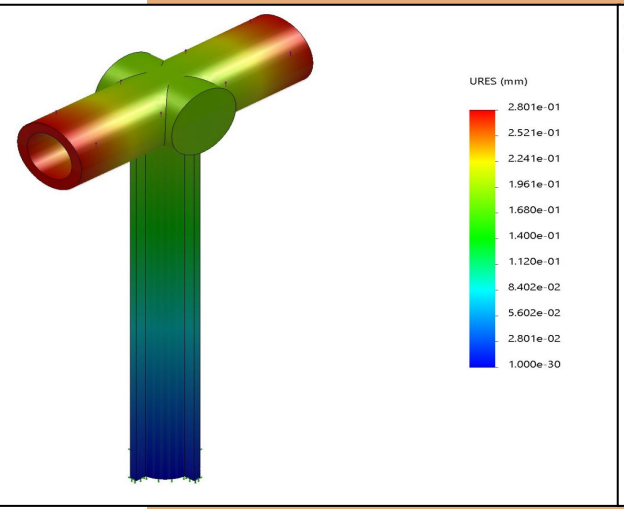
Moments of inertia: (pounds * square inches)
Taken at the center of mass and aligned with the output coordinate system.

Lxx = 0.09	Lxy = 0.00	Lxz = 0.00
Lyx = 0.00	Lyy = 0.04	Lyz = 0.02
Lzx = 0.00	Lzy = 0.02	Lzz = 0.06

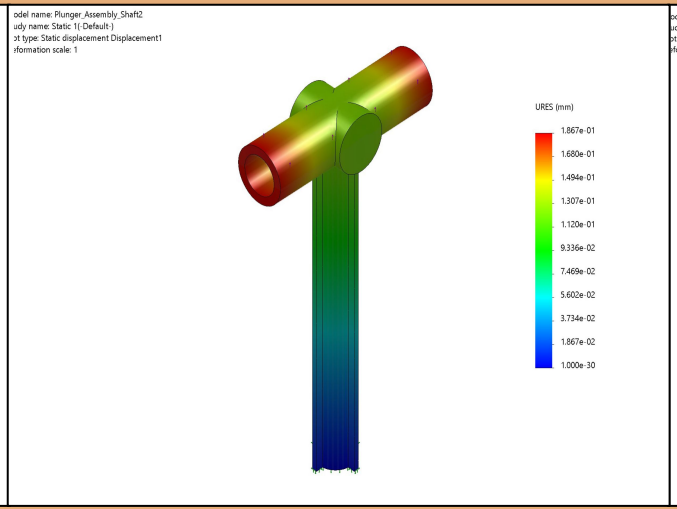
Moments of inertia: (pounds * square inches)
Taken at the output coordinate system.

Ixx = 0.22	Ixy = 0.00	Ixz = 0.00
Iyx = 0.00	Iyy = 0.05	Iyz = 0.06
Izx = 0.00	Izy = 0.06	Izz = 0.18

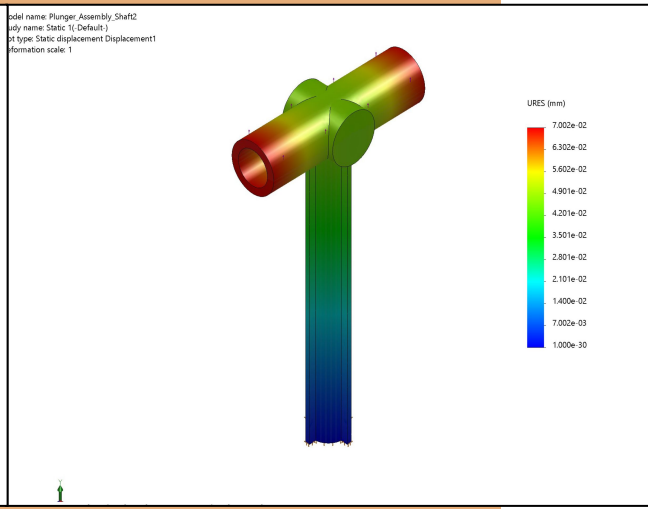
FINITE ELEMENT ANALYSIS: DISPLACEMENT DISTRIBUTIONS



300 N

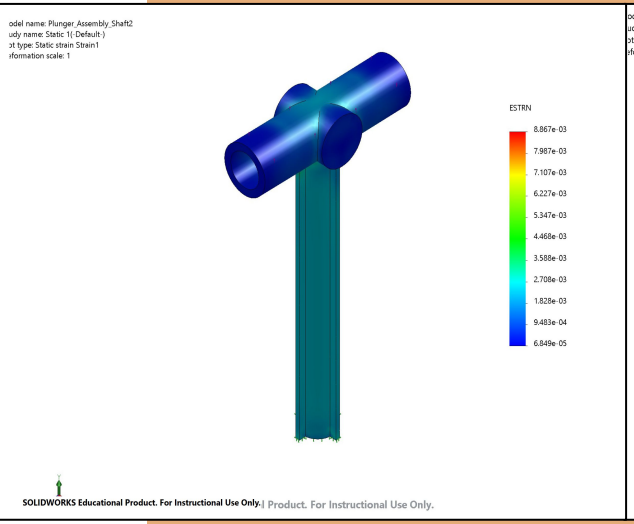


200 N

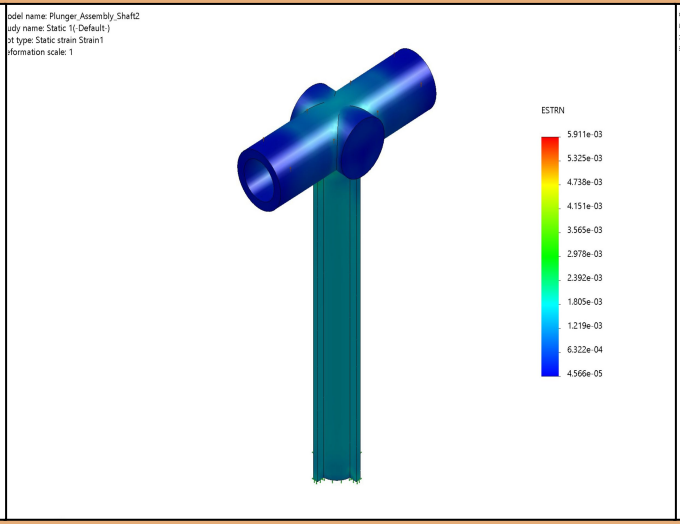


75 N

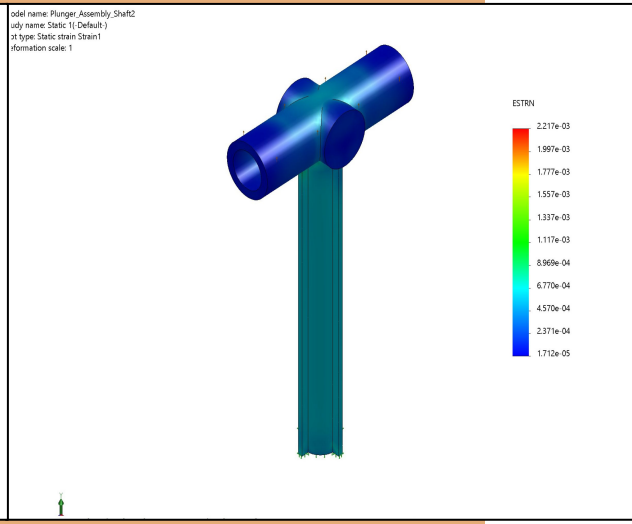
FINITE ELEMENT ANALYSIS: STRAIN DISTRIBUTIONS



300 N

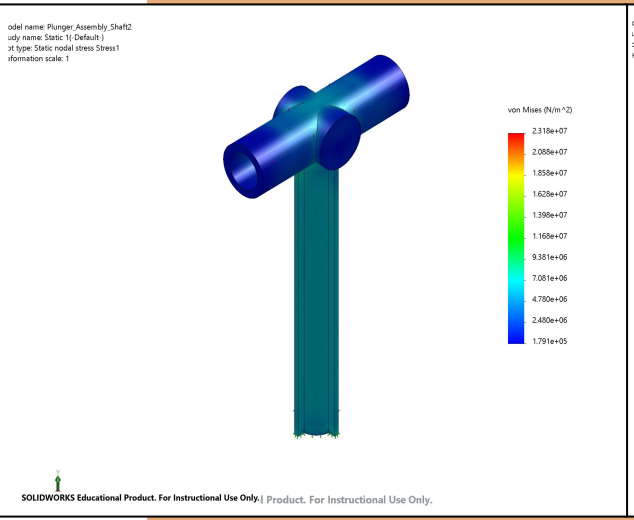


200 N

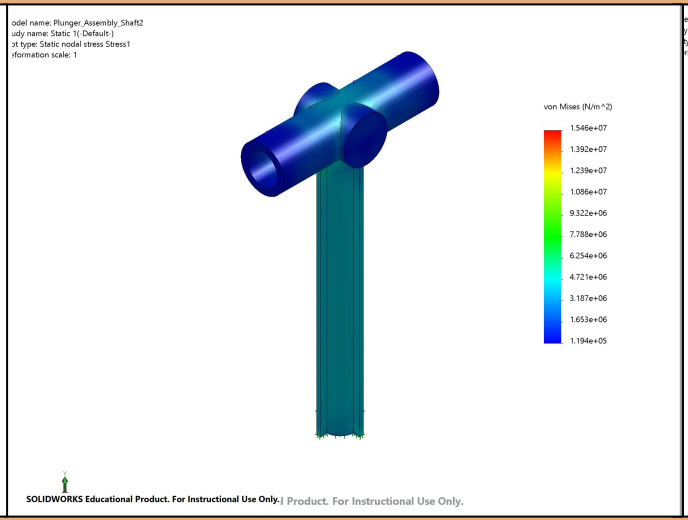


75 N

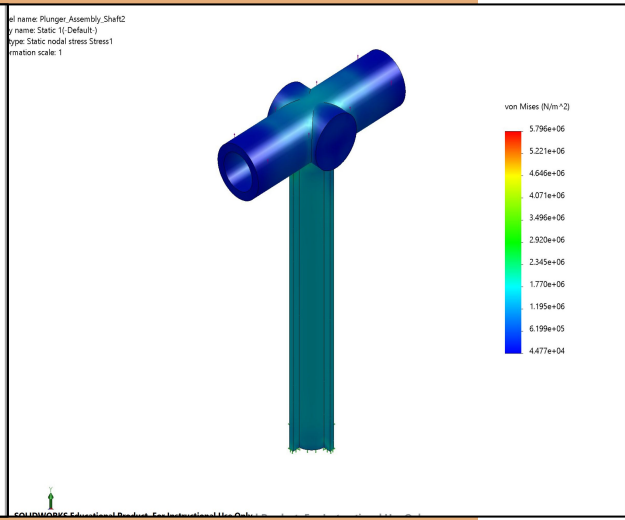
FINITE ELEMENT ANALYSIS: STRESS DISTRIBUTIONS



300 N

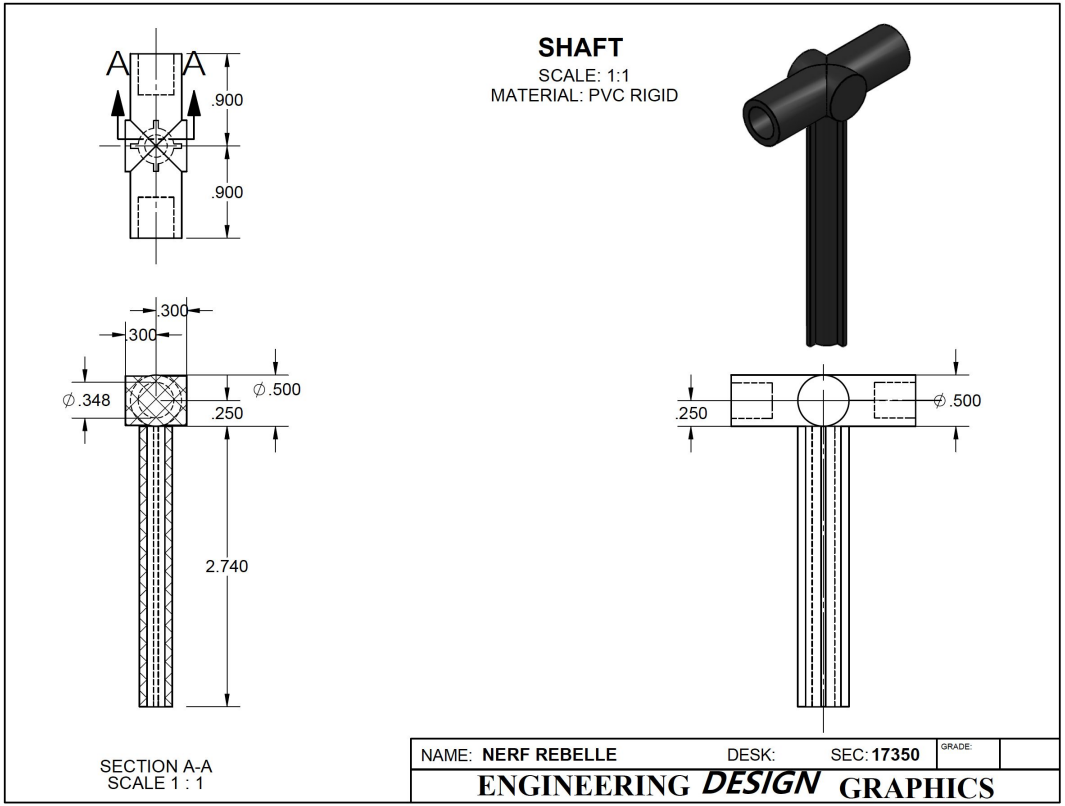


200 N

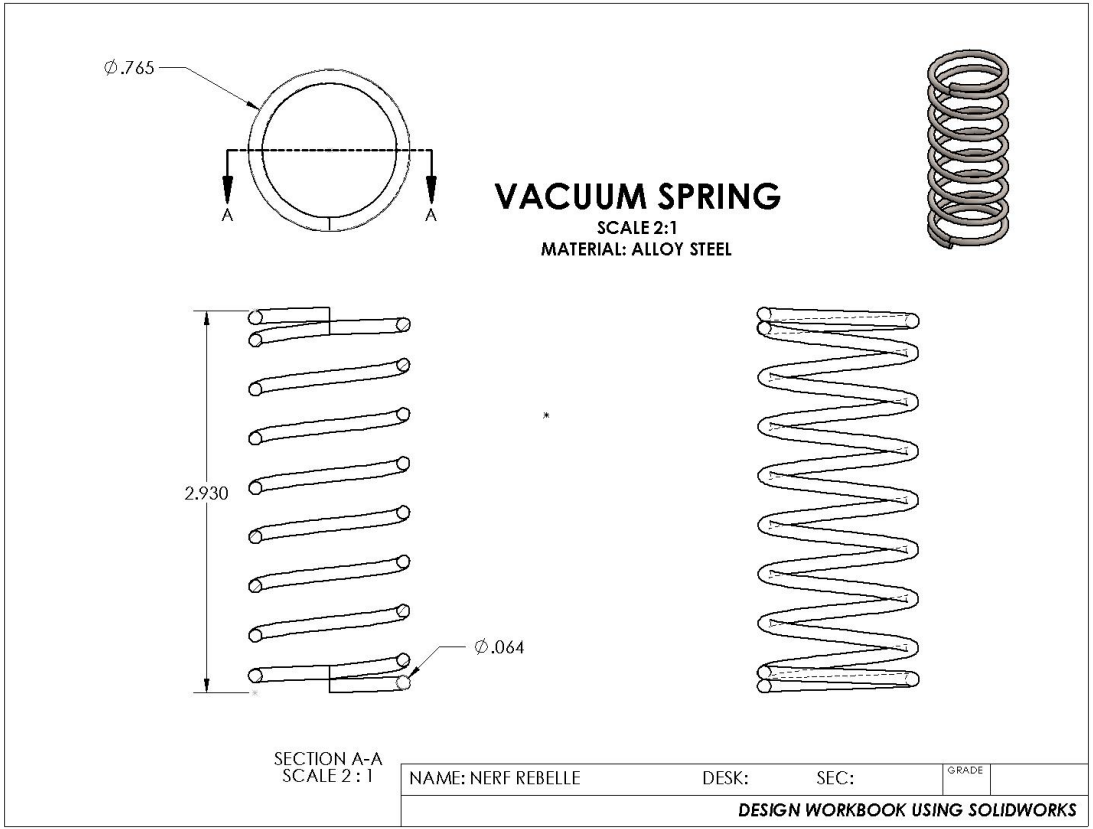


75 N

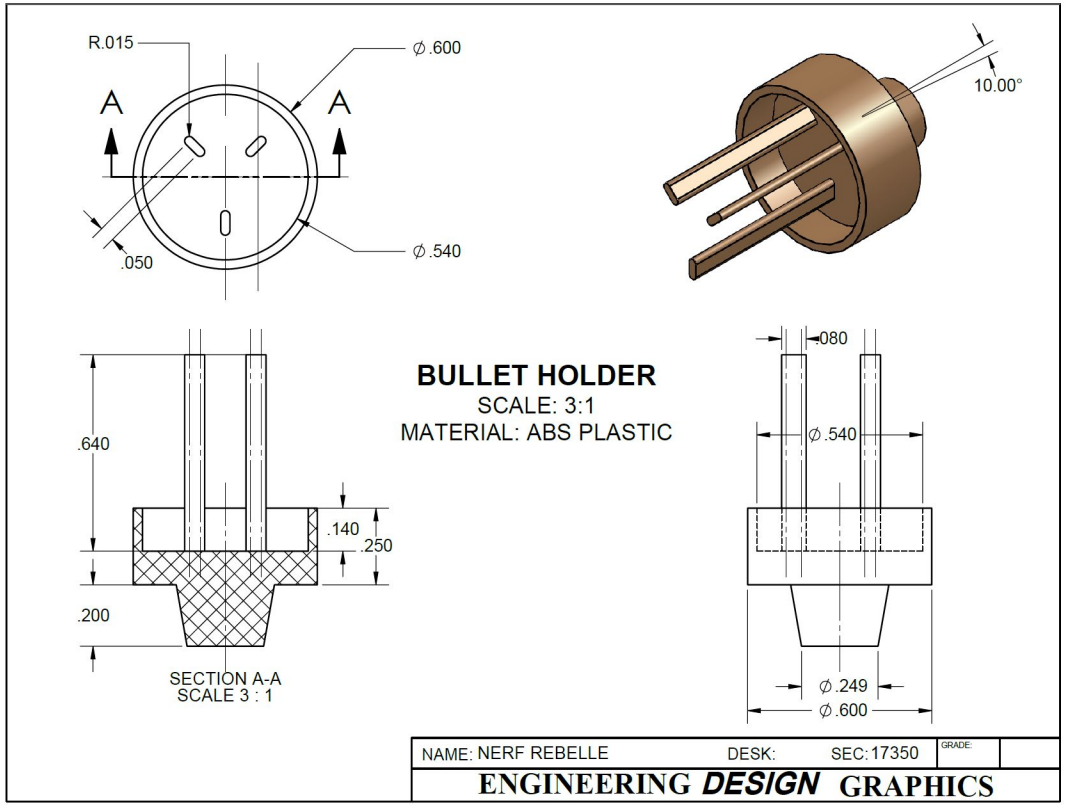
Individual Part Orthographic Drawing



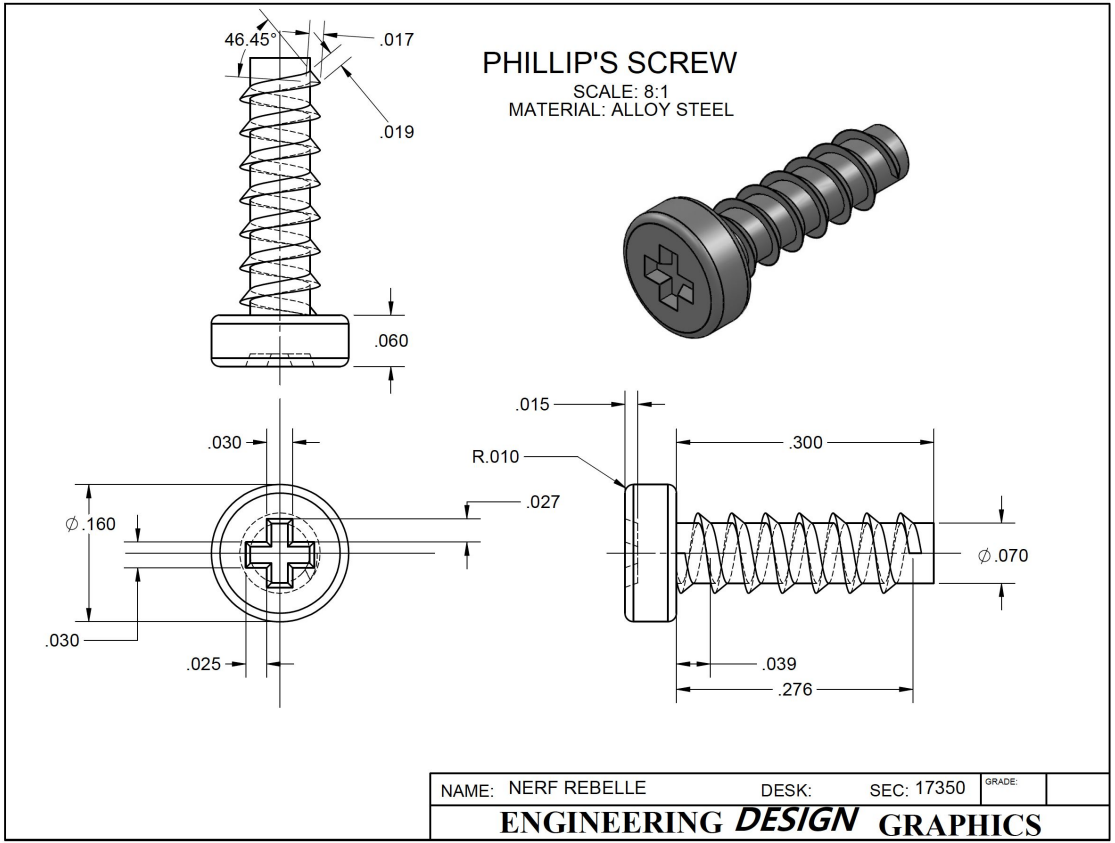
Individual Part Orthographic Drawing



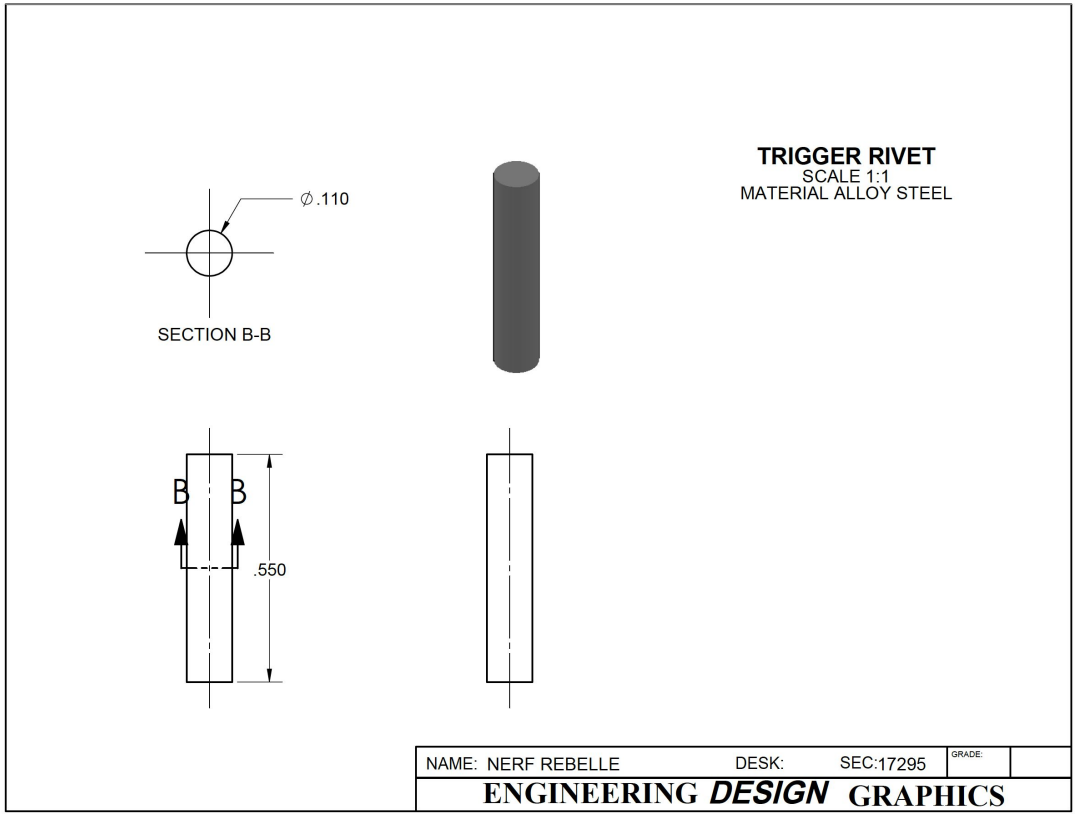
Individual Part Orthographic Drawing



Individual Part Orthographic Drawing

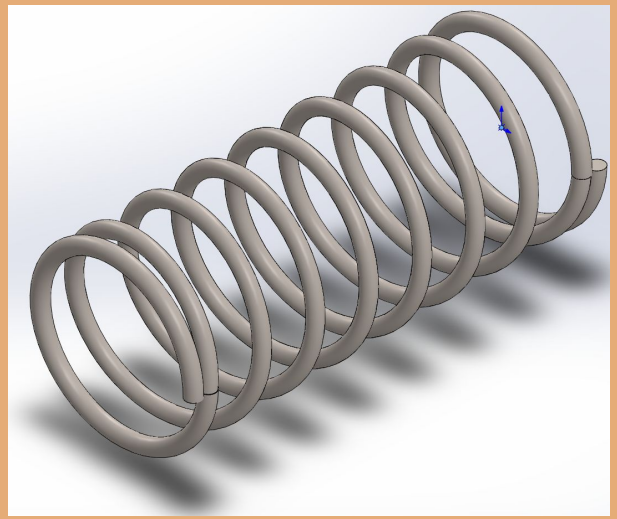


Individual Part Orthographic Drawing



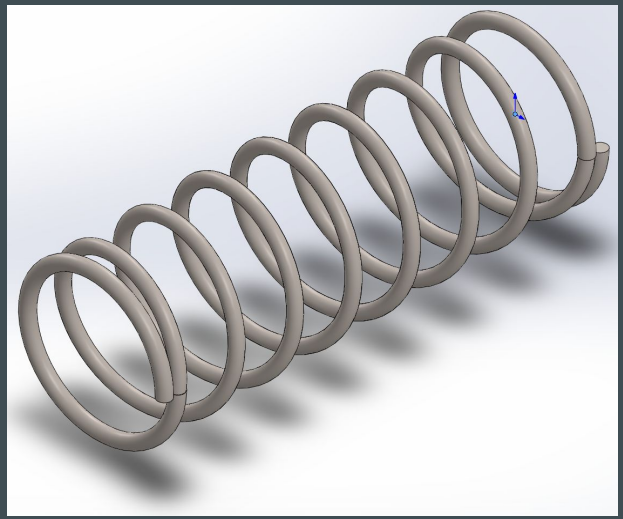
Redesign

Original length: 2.93 in



Before

Redesign length: 3.3 in



After

Closing Thoughts

NERF REBELLE