PROJECT SUBMISSION

Pitch Control Mechanism

Program: Senior 1 Mechatronics Engineering

Course Code: MDP 211

Course Name: Machine Element Design

Submitted to:

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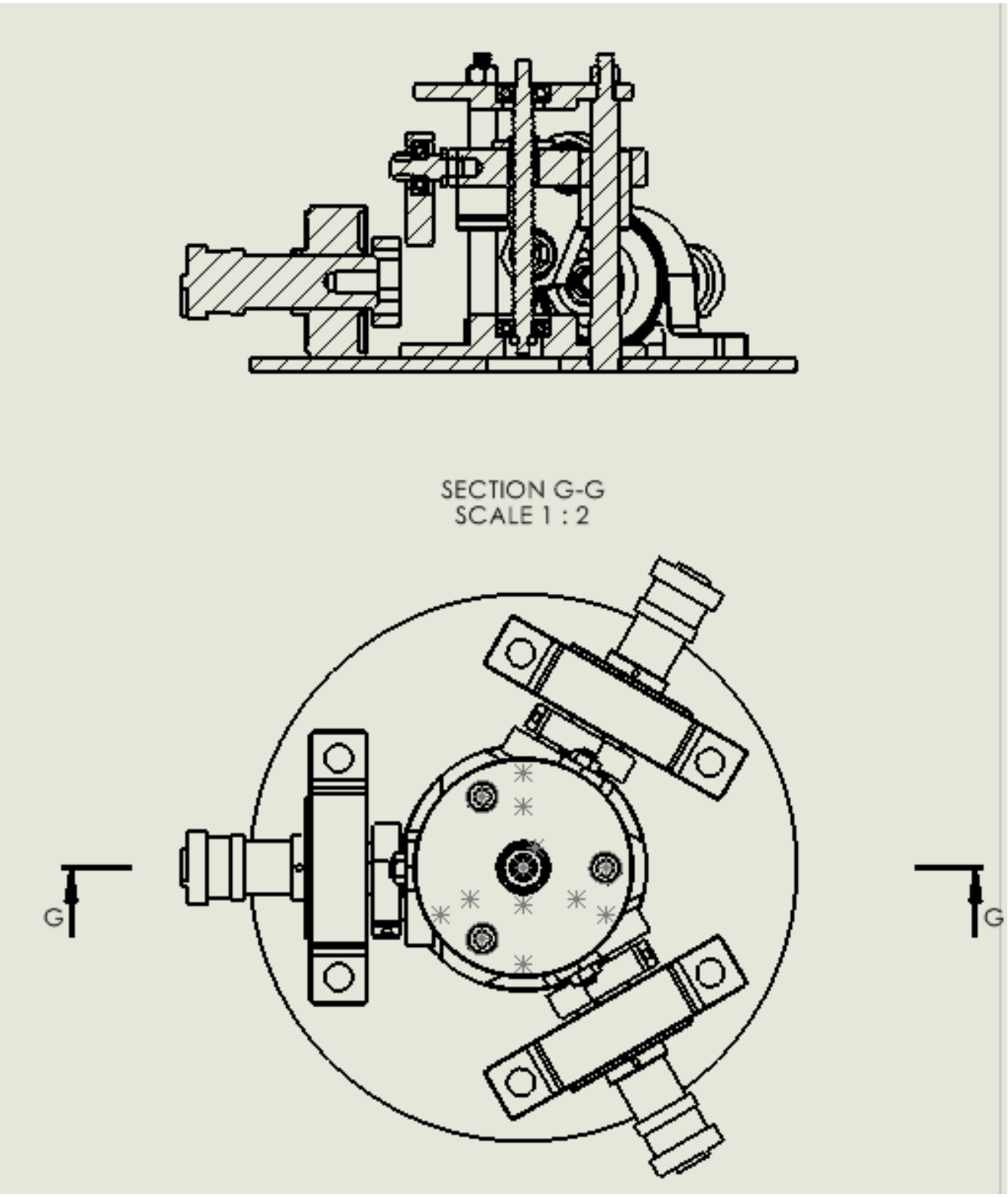
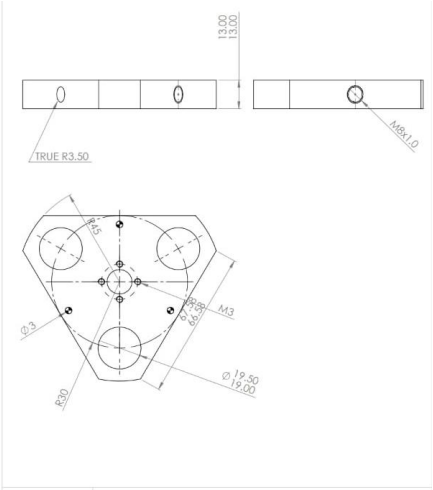
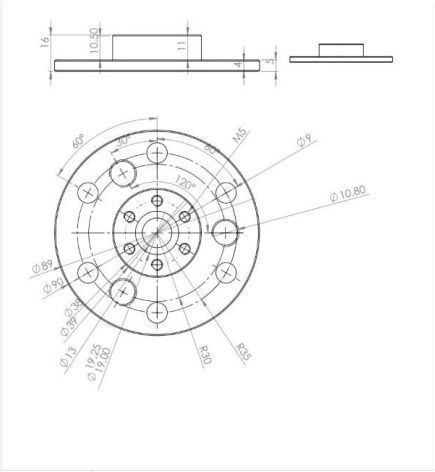
Final construction drawing



Working drawings of all parts



Part 4:	slider		
Drawn:		Date:	6/2
Revised:		Scale:	1/1



Part 4:	Base Flange		
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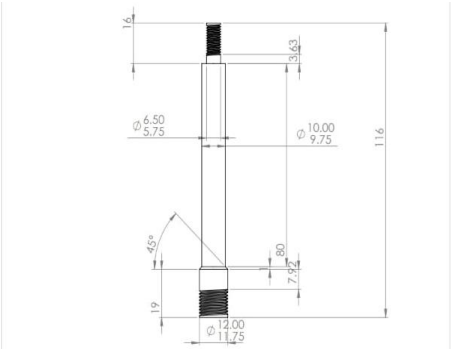
Revised:		Scale:	1/1



Part 4:	post		
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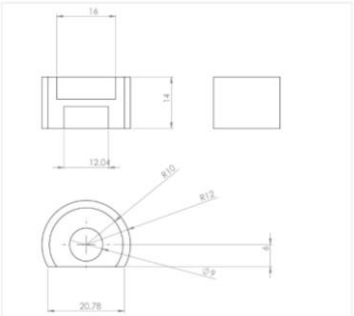
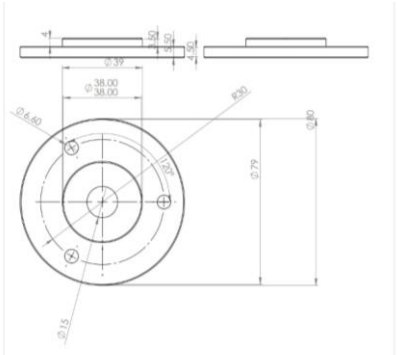
Revised:		Scale:	1/1



Part 4:	cover bearing		
Drawn:		Date:	6/2
Revised:		Scale:	1/1



Part 4:	roof		
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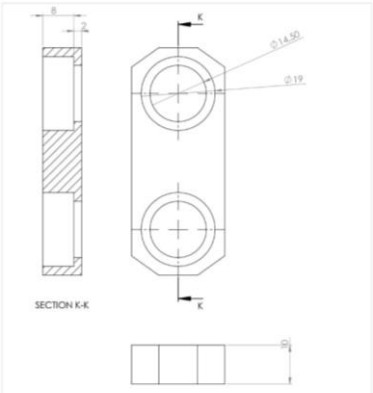
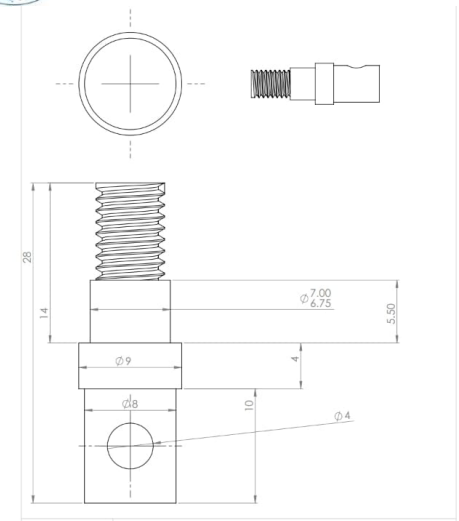
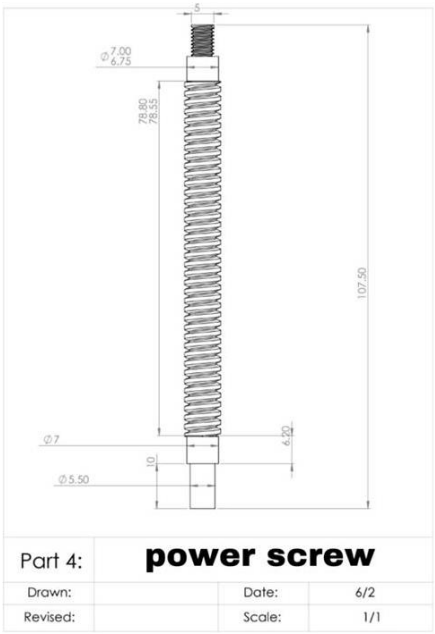
Revised:		Scale:	1/1



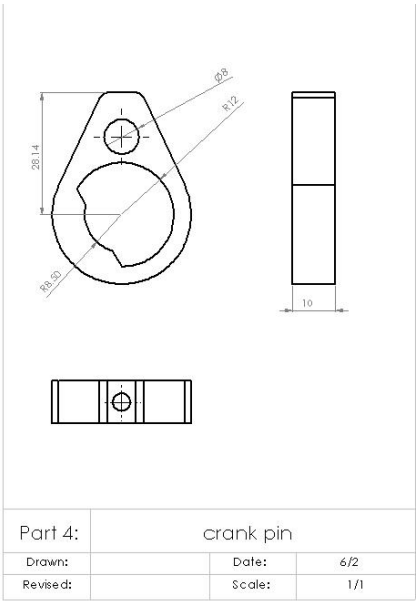
Part 4:	bearing		
Drawn:		Date:	6/2
Revised:		Scale:	1/1



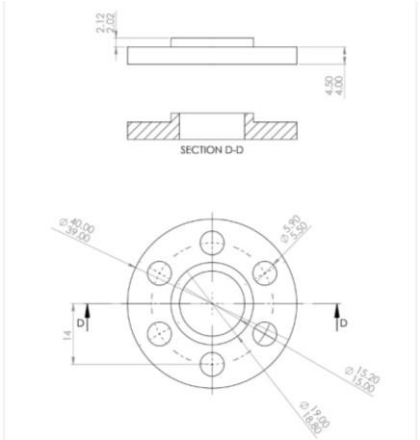
Part 4:	crank pin		
Drawn:		Date:	6/2
Revised:		Scale:	1/1



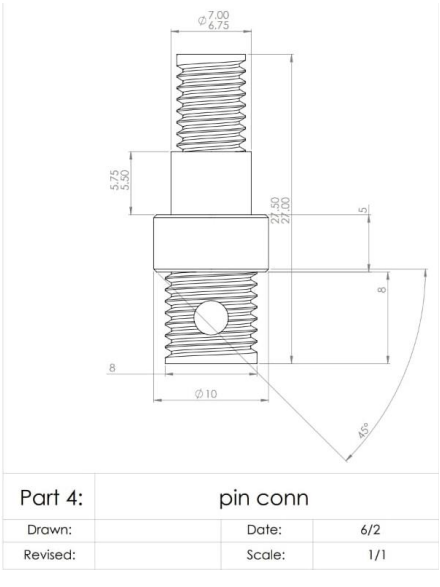
Part 4:	**power screw**		
Drawn:		Date:	6/2
Revised:		Scale:	1/1



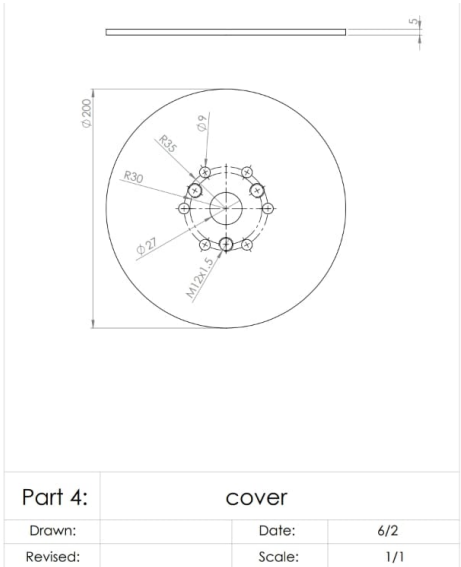
Part 4:	crank pin		
Drawn:		Date:	6/2
Revised:		Scale:	1/1



Part 10:	Cover		
Drawn:		Date:	6/2
Revised:		Scale:	2/1



Part 4:	pin conn		
Drawn:		Date:	6/2
Revised:		Scale:	1/1



Part 4:	cover		
Drawn:		Date:	6/2
Revised:		Scale:	1/1

Final calculations

Motor selection

- Name: NEMA 23
- Current up to 2 A
- Holding torque: 7 kg.cm, work with 12 volts
- Power 120.6 watt
- Deg/ step
- Motor weight: 0.45 kg
- Length: 51mm
- Loads: 6 wires

Final Calculation Sheet for the Design.

Bracket Calculation

Forces: 500, 100

No. of Bearing Bolts = 2

$L_{Total} = 756\,mm$ $\quad L = 19.8\,mm$

$L_{Actual} = 686\,mm$

$L_{Actual/2} = \frac{686}{2} = 343\,mm$

[1] Force: 100 N

Due to Moment

$F \times L = \frac{F_{m_1}}{L}(n_1 L_1')$

$100 \times 343 = 2 F_{m_1} L \Rightarrow F_{m_1} = 879.5\,N$

[2] Force: 500N Due to Moment Assume Radius of the Bearing $R = 27\,mm$

$500 \times R = 2 L F_{m_2} \Rightarrow F_{m_2} = 346.15\,N$

Due to Shear:

$F_{ex_3} = \frac{F_n}{\mu x n} = \frac{500}{0.45 \times 2} = 555.56\,N$

$F_{ext} = F_{m_1} + F_{m_2} + F_{ex_3} \Rightarrow F_{ext} = 1781.2\,N$

Bolt of Bearing

Total Torque = $T_1 + T_2$

assume:

$d_m = \frac{d_o - d_c}{2}$

$= \frac{8 - 7.065}{2}$

$= 0.4675$ mm

$2.5 = F_i \cdot \frac{d_m}{2} \frac{\mu' + \tan\alpha}{1 - \mu' \tan\alpha} + \mu'_s F_i \frac{d_{ms}}{2}$

$T_1 = 0.3527$ N $\quad T_2 = 2.147$ N

$F_i = 812.233$ N ← initial Force

μ' ← assume

Material$_1$ Steel

Material$_2$ Aluminum

$\therefore \mu = 0.45 = \mu_s$

$\tan\alpha = \frac{P}{\pi d_m} = \frac{1}{\pi * 0.4675} = 0.6808$

$2\beta = 60$

$\therefore \beta = 30$

$d_{m_c} = \frac{S + a}{2}$

$= \frac{14 + 9.5}{2} = 11.75$

$\mu' = \frac{\mu}{\cos\beta} = \frac{0.45}{\cos(30)} = 0.5196$

$\sqrt{(\frac{\sigma}{2})^2 + \tau^2} \leftarrow \tau_{max}$ | assembly $\leq \frac{\sigma_y}{2n}$ assume $n = 2$ $\rightarrow \sigma_y \geq 41.43$ MPa

Material → St 34 = σ_y = 190MP

$\square$ ← due To assembly

$\sigma = \frac{F_i}{A_c} = \frac{812.233}{39.2} = 20.719$ MPa

$\tau = \frac{16 T_1}{\pi d_c^3} = 5.098 * 10^3$ Pa

Guide Nut

Because of $F_y = 200N$

∴ Total axial Force will act on Power screw equal $= 200 * 2 = 600\ N = F_a$

∴ Power screw → Trapizoidal

∴

$2\beta = zero$

$\beta = 15°$

$d_i = d_o - P - 0.5$

∴ $d_i = 8 - 2 - 0.5$

$d_i = 5.5\ mm$

assume $P = 2\ mm$

$d_o = 8\ mm$

$H = 9.5\ mm$

$n = 2$

$\sigma_y = 370\ MPa$

Material → Brass Cu Zn 37 F45

∴ $d_m = \frac{d_o - d_i}{2} + 0.25$

$d_m = 1.5\ mm$

[1] Due To Bearing Pressure

$$\frac{1}{BP_{all}} \times \frac{F_a}{\frac{\pi}{4}(d_o^2 - d_i^2)} \leq N$$

∴ $N \geq 1.33$

[2] Based on σ

$$\sigma = \frac{F_a * \frac{P}{4}}{\frac{\pi d_o N * (\frac{P}{2})^3}{12}} * \frac{P}{4} \leq \frac{\sigma_y}{n}$$

∴ $N = 0.387$

Based on Shear Stress:

$$\tau = \frac{3V}{3A} = \frac{3 * f_a}{2(\pi d_m * N)\frac{P}{2}} \leq \frac{\sigma_y}{2n}$$

$$\therefore N = 2.0647$$

$$\therefore \text{largest } N \Rightarrow \text{Due To Shear Stress} = 2.0647$$

$$\therefore H = N * P$$
$$= 2.0647 * 2$$
$$= 4.1294$$
$$= 4$$

Power Screw

axial force.

Max force = 600N

$T_1 = F_a * \frac{d_m}{2} * \frac{\mu' + \tan\alpha}{1 - \mu' \tan\alpha}$

$= 311.2695 \ N_{mm}$

$T_2 = F_a * \frac{d_{ms}}{2} * \mu_s$

$= 330 \ N_{mm}$

$T_{Total} = 311.2695 + 330$

$= 641.2695 \ N_{mm}$

$= 0.64 \ N_{mm}$

Motor Selection.

NEMA23

$d_m = \frac{d_o - d_c}{2}$

$d_c = d_o - P * 0.5$

$= 8 - 2 * 0.5$

$= 5.5$

$d_m = \frac{8 - 5.5}{2} + 0.25$

$= 1.5$

$\mu = 0.2$

$\mu' = \frac{\mu}{\cos\beta} = \frac{0.2}{\cos 15}$

$= 0.207$

$\tan\alpha = \frac{P}{\pi d_m}$

$= \frac{2}{\pi * 1.5}$

$= 0.424$

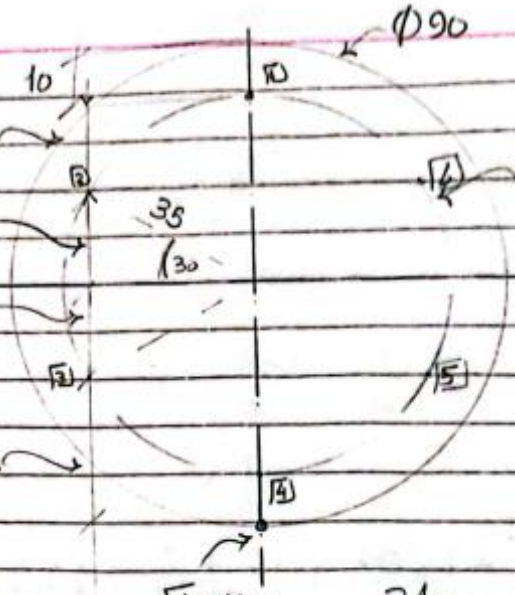
$\mu_s = \mu = 0.2$

~~Steel~~ / Steel

$d_{ms} = d_i$

$= 5.5$

Bracket



- Bolt (1)

$l_1 = 90 - 10 = 80$ mm

- Bolt (2) = Bolt (6)

(Rotational assume)

$l_2 = 90 - 10 - (45 - 10 - 35\sin 30)$

$l_2 = 62.5$ mm

- Bolt (3) = Bolt (5)

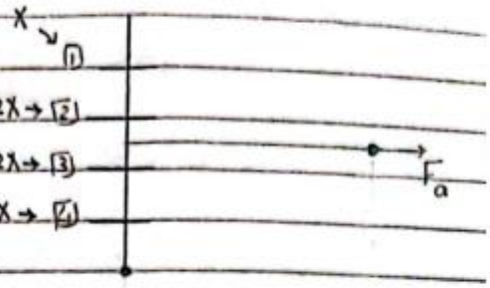
$l_3 = 45 - 35\sin 30$

$l_3 = 27.5$ mm

- Bolt (4)

$l_4 = 10$ mm

Forward ↓



$F_a = 200\ N$ ← normal Force

Due To normal Force (F_n)

$$F_{ext_1} = F_n = \frac{F}{n} = \frac{200}{6} = 33.33\ N$$

Due To Moment (F_m)

$$F_a * L = n_1 F_1 l_1 + n_2 F_2 l_2 + n_3 F_3 l_3 + n_4 F_4 l_4$$

$$200 * 45 = 1 * F_1 * 80 + 2 * F_2 * 62.5 + 2 * F_3 * 27.5 + 1 * F_4 * 10 \rightarrow (1)$$

$$\frac{F_1}{l_1} = \frac{F_2}{l_2} = \frac{F_3}{l_3} = \frac{F_4}{l_4}$$

$$\therefore F_1 = \frac{F_2 * l_4}{l_2} = 1.28 F_2 \rightarrow (2)$$

$$\therefore F_3 = \frac{F_2 * l_3}{l_2} = 0.44 F_2 \rightarrow (3)$$

$$\therefore F_4 = \frac{F_2 * l_4}{l_2} = 0.16 F_2 \rightarrow (4)$$

From 1, 2, 3 and 4

$$9000 = 102.4 F_2 + 125 F_2 + 24.2 F_2 + 1.6 F_2$$

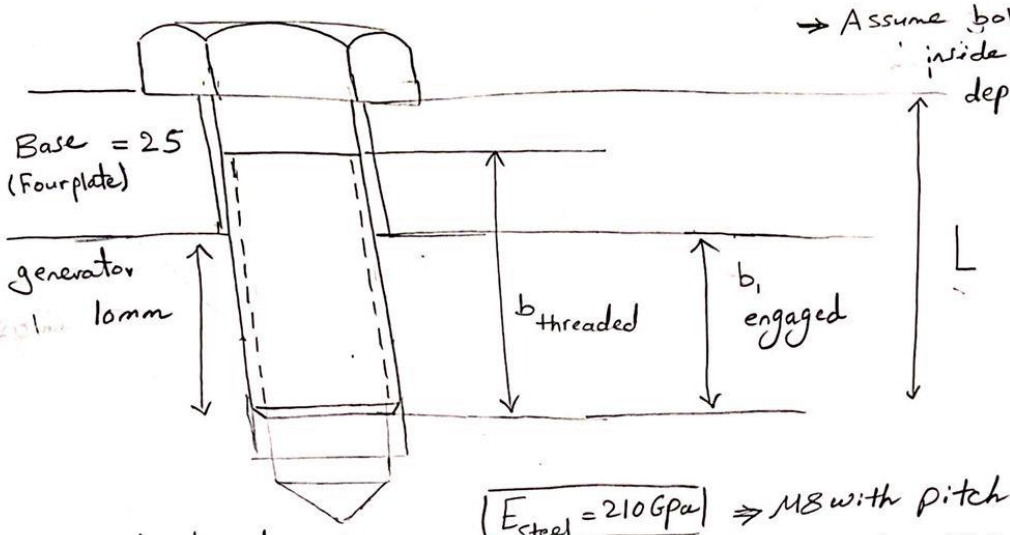
$$\therefore F_2 = 35.55\ N$$

$$\therefore F_1 = 45.504\ N \qquad \therefore F_1 \leftarrow F_{ext_2} = 45.504\ N$$

$$\therefore F_3 = 15.642\ N$$

$$\therefore F_4 = 5.688\ N$$

$$F_{ext_{total}} = F_{ext_1} + F_{ext_2} = 78.837\ N$$



$E_{steel} = 210\,GPa$ ⇒ M8 with pitch 1mm

$A_c = 39.2\,mm^2$

$d_c = 7.064\,mm$

$d_o = 8\,mm$

$d_m = 7.532mm$

d_o L b P

→ M8 * 35 * 18 * 1

a = 9.5 (hole diameter)

S = 14mm (across Flat)

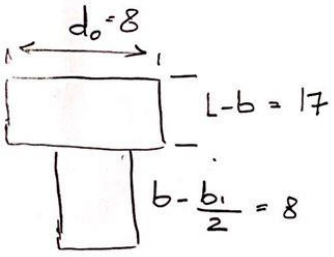
Length = Base thickness + engaged length from generator

= 25 + 10 = 35 mm

↳ standard length ✓

b = 18 mm

b_1 = 20 mm (soft metal)



Bolt Stiffness

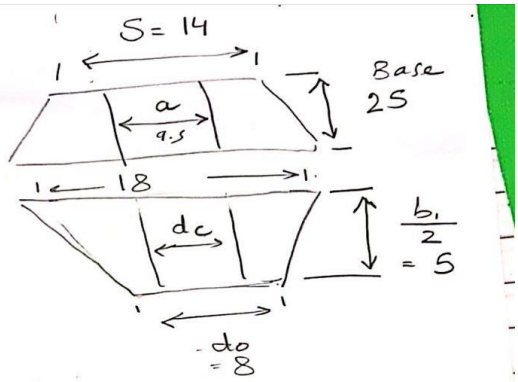
$$C_1 = \frac{EA}{L} = \frac{210 * 10^3 * \frac{\pi}{4} * 8^2}{17}$$

$$= 620926.548\ N/mm$$

$$C_2 = \frac{EA}{L} = \frac{210 * 10^3 * 39.2}{8} = 1029000\ N/mm$$

$$\frac{1}{C_b} = \frac{1}{C_1} + \frac{1}{C_2} \rightarrow C_b = 387249.6134\ N/mm$$

Joint stiffness — $\varnothing 18$ ✓✓
$\varnothing 64$



$$d_{m_1} = \frac{14+18}{2} = 16$$

$$d_{m_2} = \frac{18+8}{2} = 13$$

$$C_1 = \frac{E * \frac{\pi}{4}(d_{m_1}^2 - a^2)}{L}$$

$$= \frac{210 * \frac{\pi}{4}(16^2 - 9.5^2) * 10^3}{25}$$

$$= 1093509.863 \text{ N/mm}$$

$$C_2 = \frac{210 * 10^3 * \frac{\pi}{4} * (d_{m_2}^2 - d_c^2)}{5} = 3928715.526 \text{ N/mm}$$

($d_{m_2}^2 = 13^2$, $d_c^2 = 7.064^2$)

$$\therefore C_J = 5022225.389 \text{ N/mm}$$

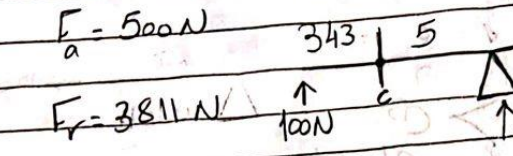
Bearing calculations:

For Bearing, according to with group 2b

Bearing (B)

$F_a = 500N$

$F_r = 3811 N$



$\therefore \frac{W_A}{C_o} = \frac{500}{3.4 * 9806.65} = 0.0149$

$\therefore e \simeq 0.37$

$\therefore \frac{W_A}{W_R} = \frac{500}{3811} = 0.1341$

assume V=1

$\therefore X = 0.4 \quad Y = 1.6$

inner diameter = 20mm

$C_5 = 3.4$ tan

$\therefore F_e = X_i \cdot V \cdot F_r + Y_i \cdot F_a$

$\therefore F_e = 0.4 * 1 * 3811 + 1.6 * 500 = 2324.4 N$

$\therefore$ life in million revs $= \frac{L_h * 60 * N}{10^6} =$

$L_h = 24$

assume the Pitch control will work all day

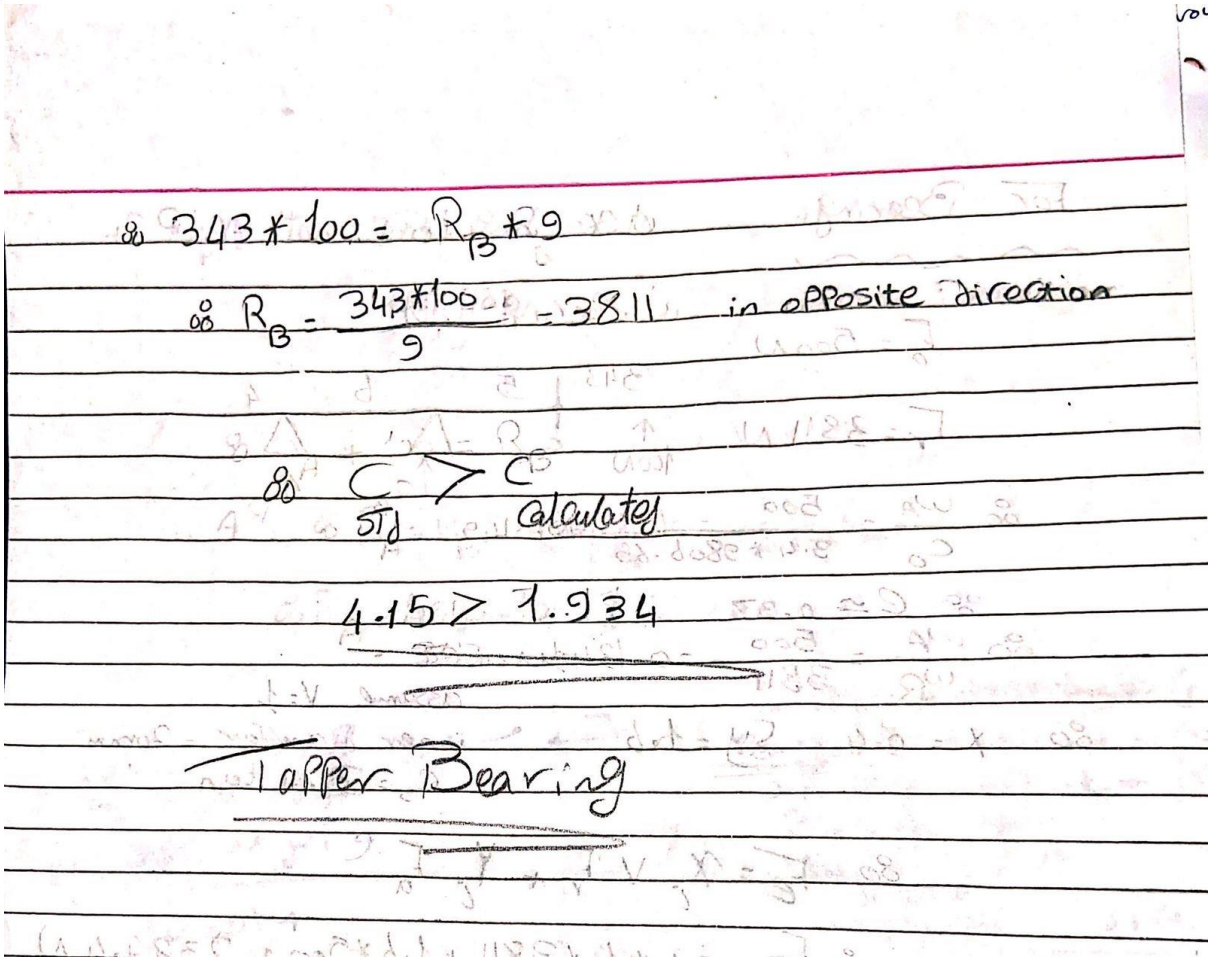
$n = 3$

$\therefore C = F_e \sqrt[n]{\text{life in million revs}}$

NEMA 23 $\rightarrow N = 400$

$\therefore C = 1933.978$ kg

$= 1.934$ Ton



$\therefore 343 * 100 = R_B * 9$

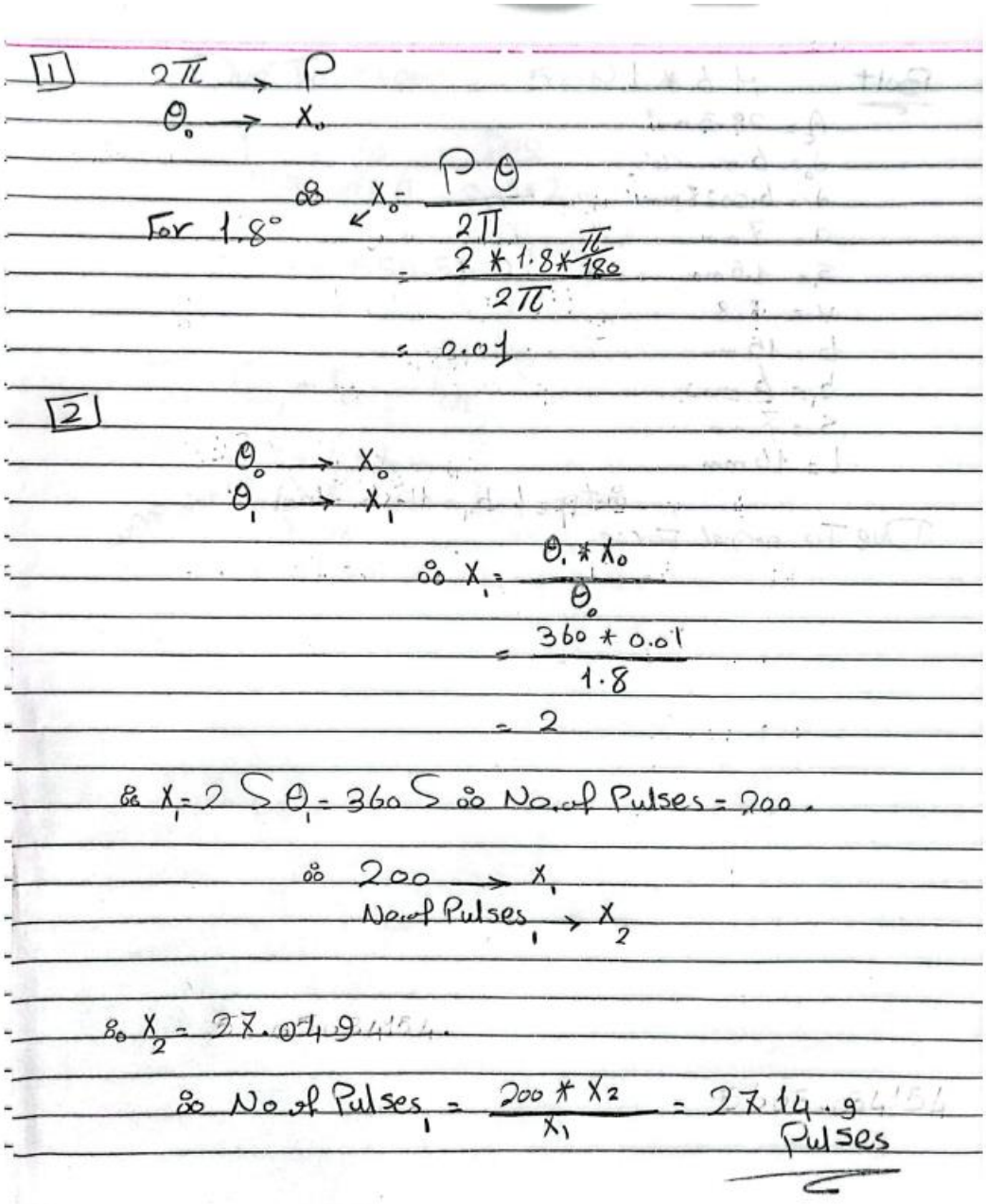
$\therefore R_B = \frac{343*100}{9} = 3811$ in opposite direction

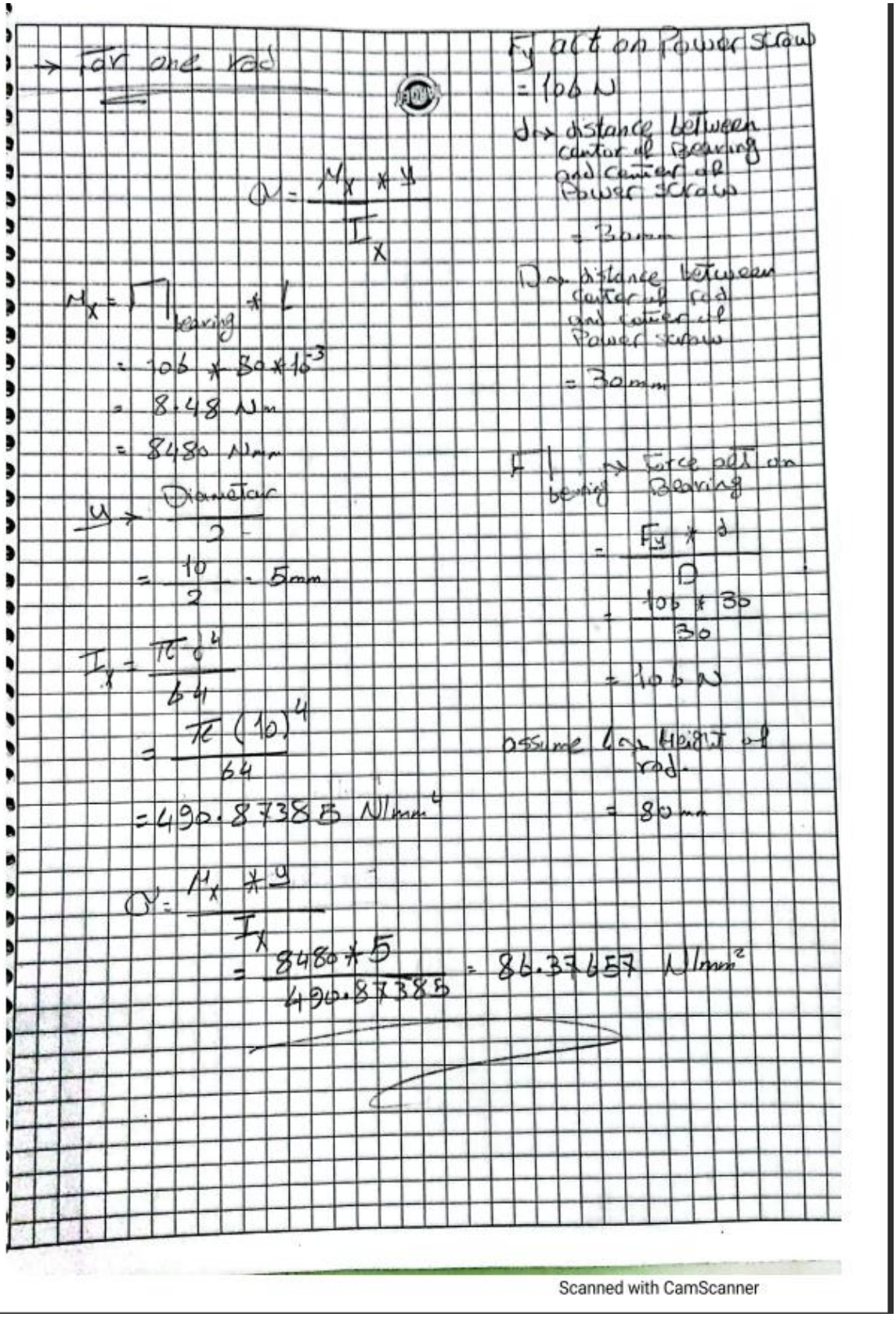
$\therefore C_{std} > C_{calculated}$

$4.15 > 1.934$

Topper Bearing

Electrical calculations:





Scanned with CamScanner

Check the design by software programs

Material(s)

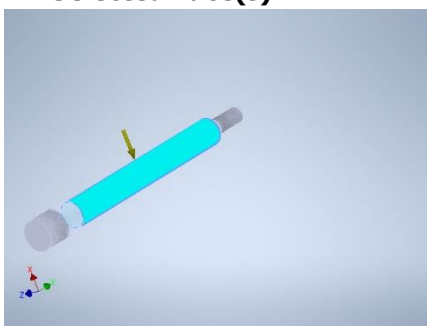
Name	Aluminum 6061	
General	Mass Density	2.7 g/cm^3
	Yield Strength	275 MPa
	Ultimate Tensile Strength	310 MPa
Stress	Young's Modulus	68.9 GPa
	Poisson's Ratio	0.33 ul
	Shear Modulus	25.9023 GPa
Part Name(s)	Post.ipt	

Operating conditions

Force:1

Load Type	Force
Magnitude	106.000 N
Vector X	0.000 N
Vector Y	-106.000 N
Vector Z	0.000 N

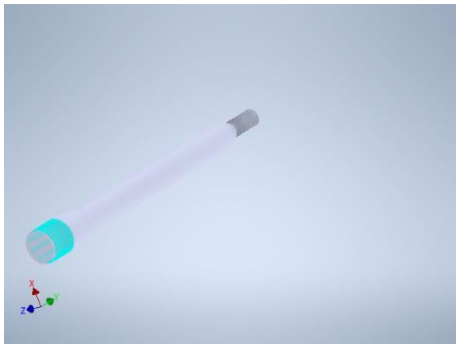
Selected Face(s)



Fixed Constraint:1

Constraint Type	Fixed Constraint

Selected Face(s)



Results

Reaction Force and Moment on Constraints

Constraint Name	Reaction Force		Reaction Moment	
	Magnitude	Component (X,Y,Z)	Magnitude	Component (X,Y,Z)
Fixed Constraint:1	0.000409603 N	-0.0000288874 N	0.00000104247 N m	0.000000948233 N m
		0.00038777 N		0.000000422355 N m
		0.000128742 N		-0.000000096016 N m

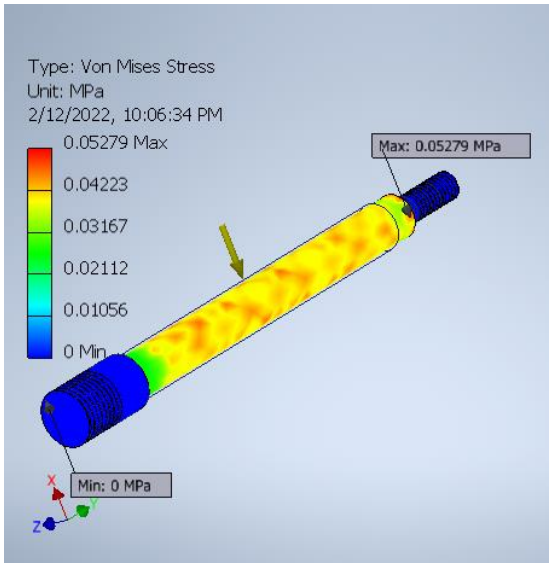
Result Summary

Name	Minimum	Maximum
Volume	8778.21 mm^3	
Mass	0.0237012 kg	
Von Mises Stress	0.00000097461 MPa	0.0527897 MPa
1st Principal Stress	-0.0108258 MPa	0.0347742 MPa
3rd Principal Stress	-0.0680101 MPa	0.00293435 MPa
Displacement	0 mm	0.0000324011 mm
Safety Factor	15 ul	15 ul
Stress XX	-0.0657986 MPa	0.0102107 MPa
Stress XY	-0.0137988 MPa	0.0142638 MPa
Stress XZ	-0.00925252 MPa	0.00843194 MPa
Stress YY	-0.0130933 MPa	0.0215793 MPa
Stress YZ	-0.015969 MPa	0.0184085 MPa
Stress ZZ	-0.061951 MPa	0.0111463 MPa
X Displacement	-0.00000207768 mm	0.00000213094 mm
Y Displacement	-0.00000000017465 mm	0.0000324008 mm
Z Displacement	-0.00000209422 mm	0.00000212661 mm
Equivalent Strain	0.0000000000127561 ul	0.00000074369 ul
1st Principal Strain	-0.000000000000377326 ul	0.000000536826 ul
3rd Principal Strain	-0.000000703277 ul	0.00000000106884 ul
Strain XX	-0.000000647107 ul	0.0000000913111 ul
Strain XY	-0.000000266363 ul	0.000000275339 ul
Strain XZ	-0.000000178604 ul	0.000000162765 ul

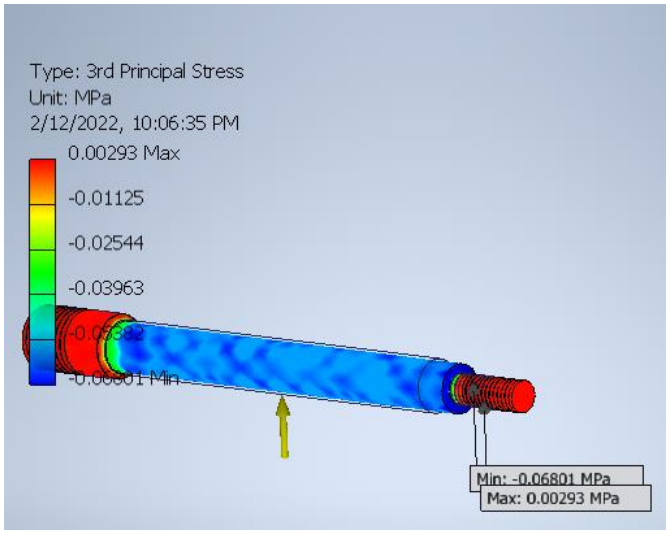
Strain YY	-0.0000000498174 ul	0.000000442455 ul
Strain YZ	-0.000000308256 ul	0.000000355345 ul
Strain ZZ	-0.000000629964 ul	0.000000133333 ul

Figures

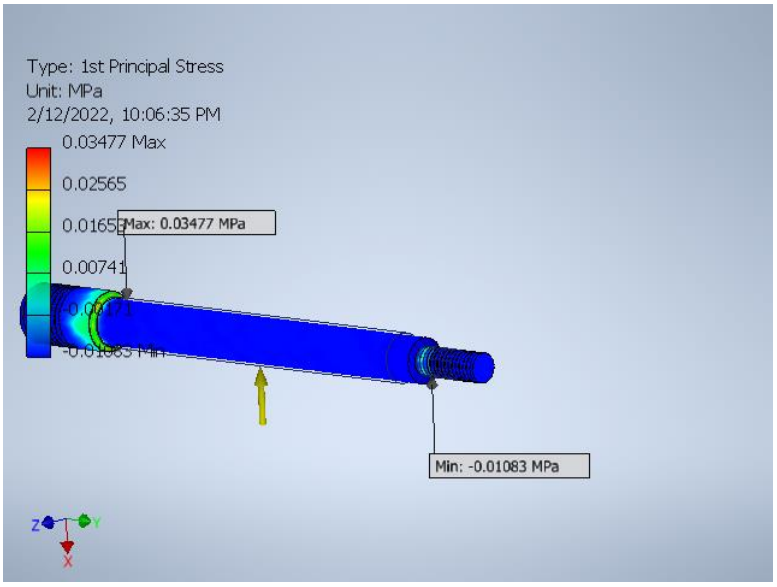
Von Mises Stress



1st Principal Stress



3rd Principal Stress



Project

Part Number	Assembly
Description	STEP AP214
Revision Number	ANY
Designer	Hisham
Cost	$0.00
Date Created	2/12/2022

Status

Design Status	WorkInProgress

Custom

Sending System	SolidWorks 2021
Preprocessor	SwSTEP 2.0

Physical

Mass	2.72988 kg
Area	288091 mm^2

Volume	657132 mm^3
Center of Gravity	x=33.5176 mm y=69.5663 mm z=76.4006 mm

Note: Physical values could be different from Physical values used by FEA reported below

Material(s)

Name	Aluminum 6061	
General	Mass Density	2.7 g/cm^3
	Yield Strength	275 MPa
	Ultimate Tensile Strength	310 MPa
Stress	Young's Modulus	68.9 GPa
	Poisson's Ratio	0.33 ul
	Shear Modulus	25.9023 GPa
Part Name(s)	base flange.ipt Post.ipt hexalobular socket pan head_iso_ISO 14583 - M8 x 16 x 13.5 - 4.8-N.ipt holder.ipt Blade shaft.ipt Crank2.ipt Base.ipt Crank Pin.ipt Pin 1.ipt Roof flange.ipt Connecting Rod.ipt Slider.ipt	

Name	Steel	
General	Mass Density	7.85 g/cm^3
	Yield Strength	207 MPa
	Ultimate Tensile Strength	345 MPa
Stress	Young's Modulus	210 GPa
	Poisson's Ratio	0.3 ul
	Shear Modulus	80.7692 GPa

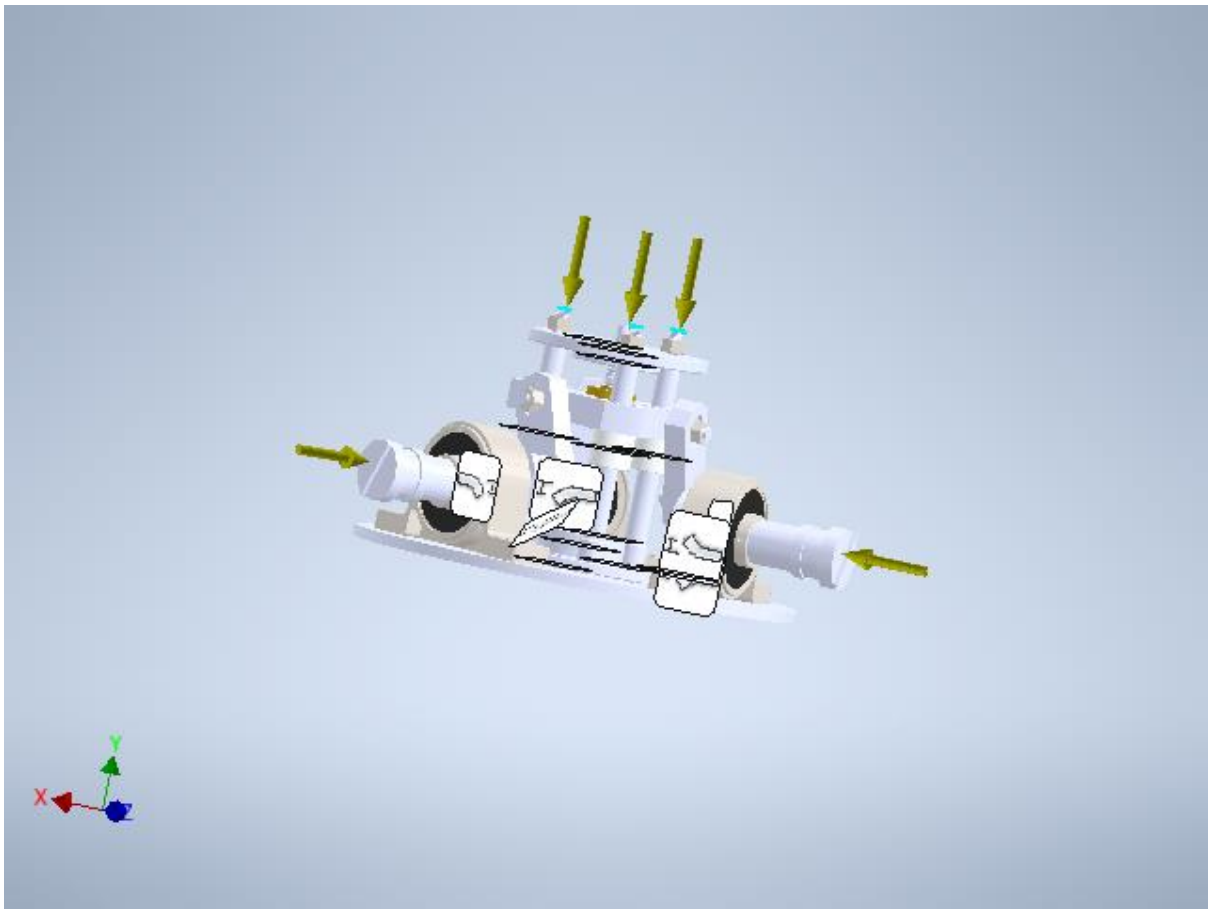
Part Name(s)	hex nut gradec_iso_ISO - 4034 - M6 - N.ipt hex thin nut gradeb_iso_ISO - 4036 - M5 - N.ipt KP004 Pillow block bearing 20mm diameter.ipt cuscinetti lineari LME10UUx29.ipt 607-2z2.ipt	
Name	Stainless Steel	
General	Mass Density	8 g/cm^3
	Yield Strength	250 MPa
	Ultimate Tensile Strength	540 MPa
Stress	Young's Modulus	193 GPa
	Poisson's Ratio	0.3 ul
	Shear Modulus	74.2308 GPa
Part Name(s)	LeadScrew 8mm x 2mmPitch.ipt	
Name	Brass, Soft Yellow	
General	Mass Density	8.47 g/cm^3
	Yield Strength	103.4 MPa
	Ultimate Tensile Strength	275 MPa
Stress	Young's Modulus	109.6 GPa
	Poisson's Ratio	0.331 ul
	Shear Modulus	41.1721 GPa
Part Name(s)	LeadScrew Nut 8mm x 2mmPitch.ipt	

Operating conditions

Force:1

Load Type	Force
Magnitude	46333.000 N
Vector X	0.000 N
Vector Y	-46333.000 N
Vector Z	0.000 N

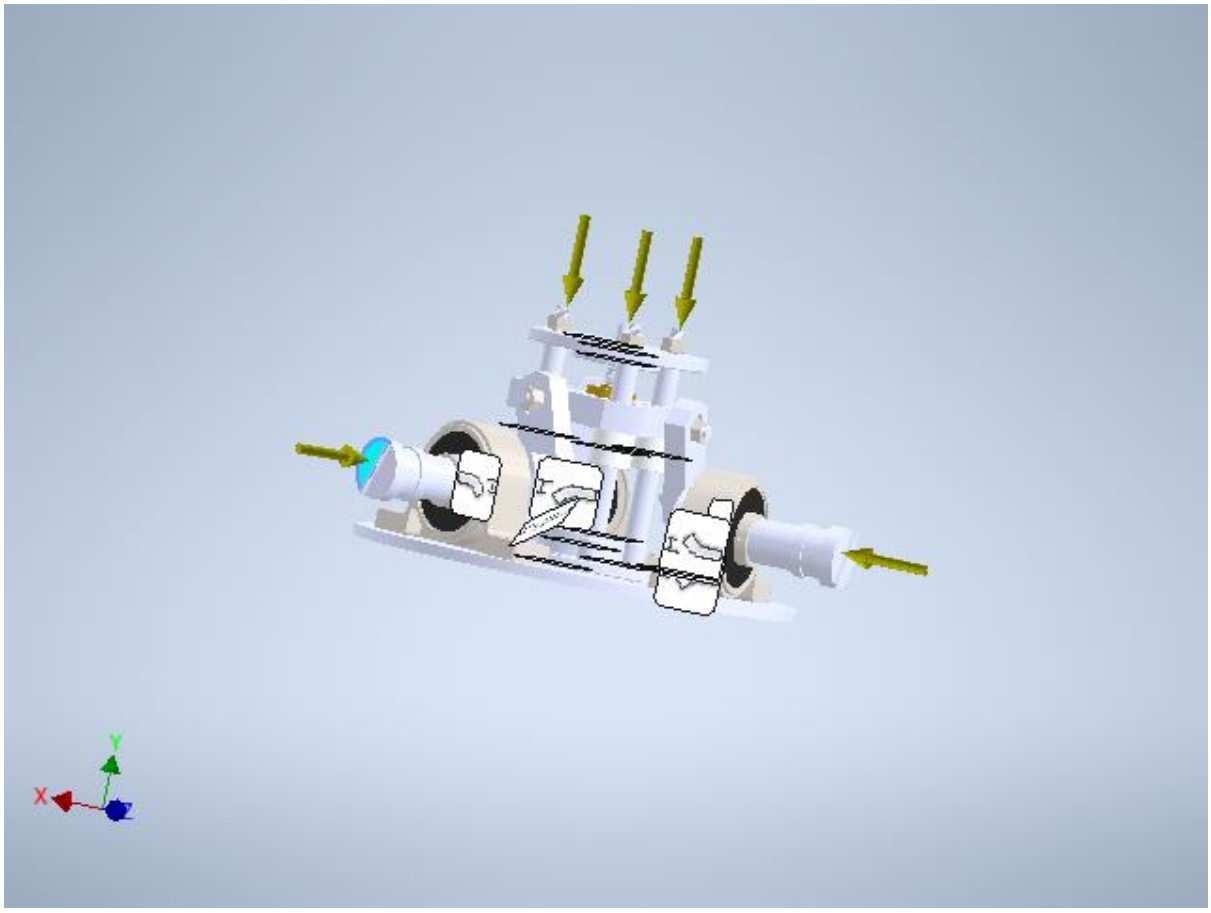
Selected Face(s)



Force:2

Load Type	Force
Magnitude	125.000 N
Vector X	-62.500 N
Vector Y	-0.000 N
Vector Z	108.253 N

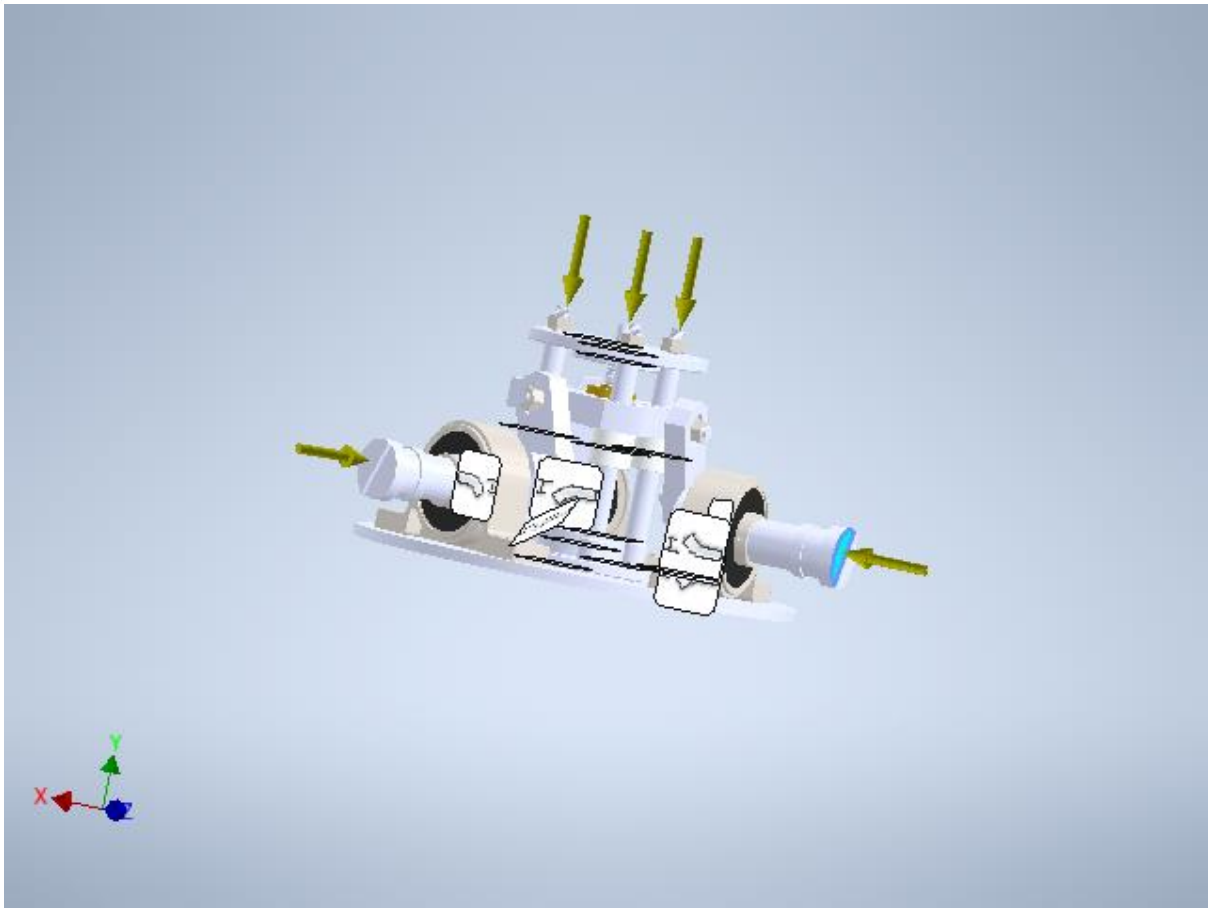
Selected Face(s)



Force:3

Load Type	Force
Magnitude	125.000 N
Vector X	125.000 N
Vector Y	-0.000 N
Vector Z	-0.000 N

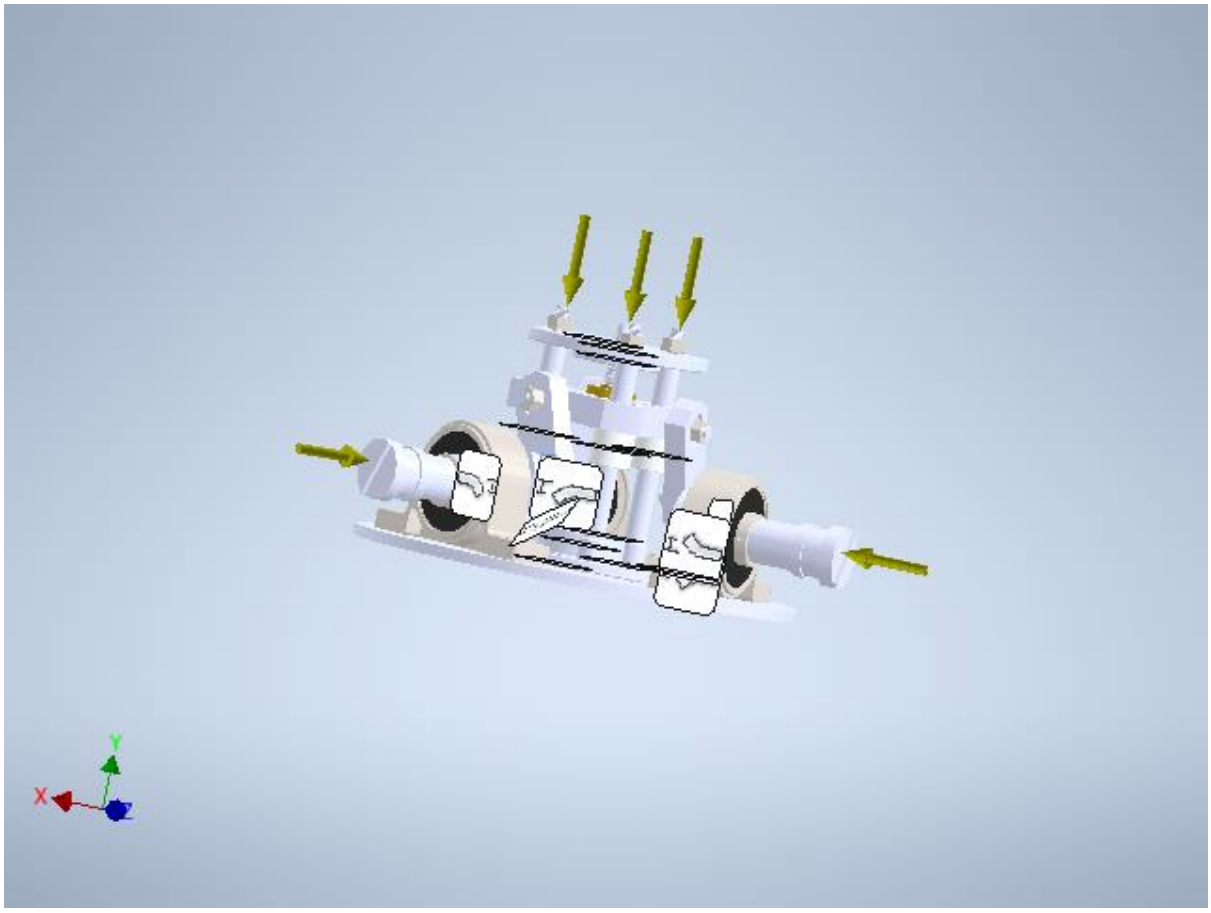
Selected Face(s)



Force:4

Load Type	Force
Magnitude	125.000 N
Vector X	-62.500 N
Vector Y	-0.000 N
Vector Z	-108.253 N

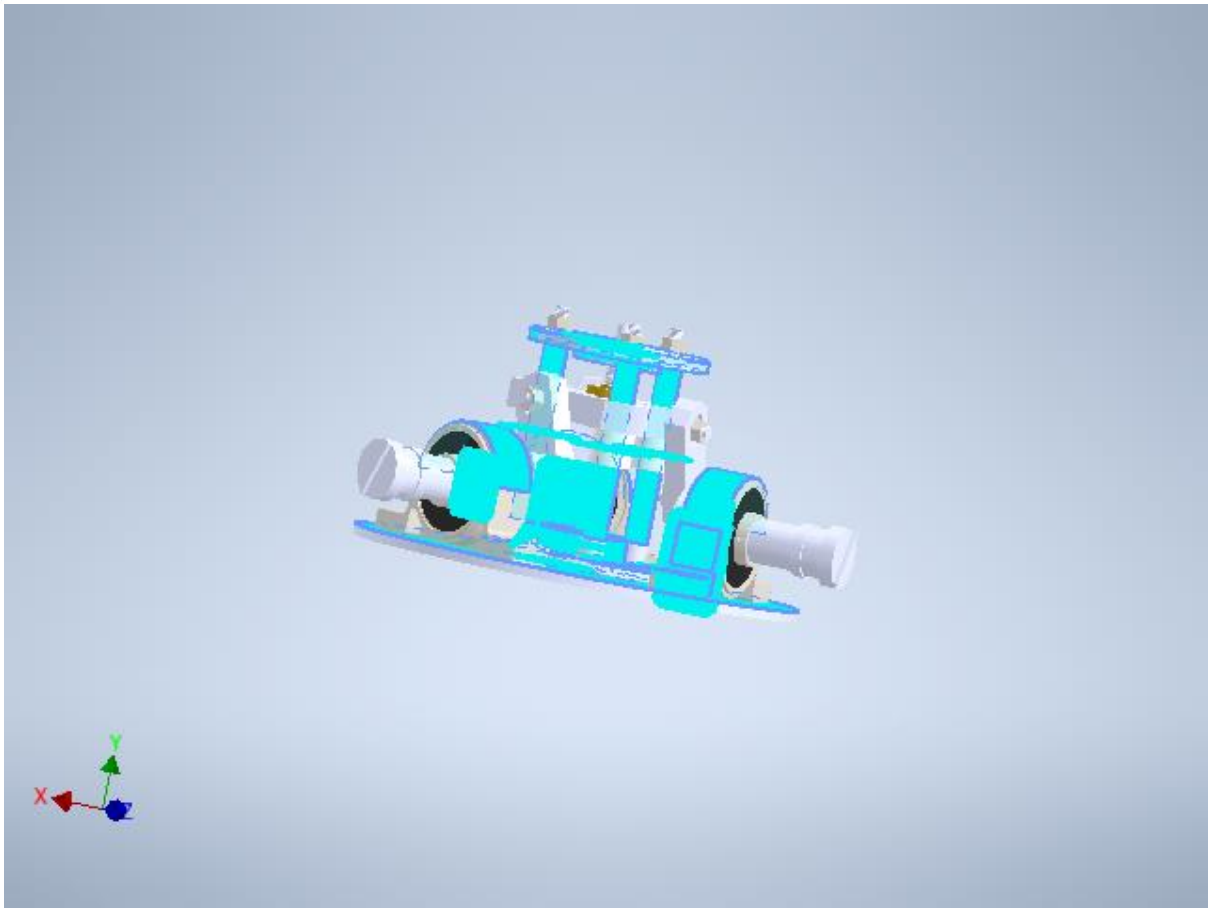
Selected Face(s)



Fixed Constraint:1

Constraint Type	Fixed Constraint

Selected Face(s)



Results

Reaction Force and Moment on Constraints

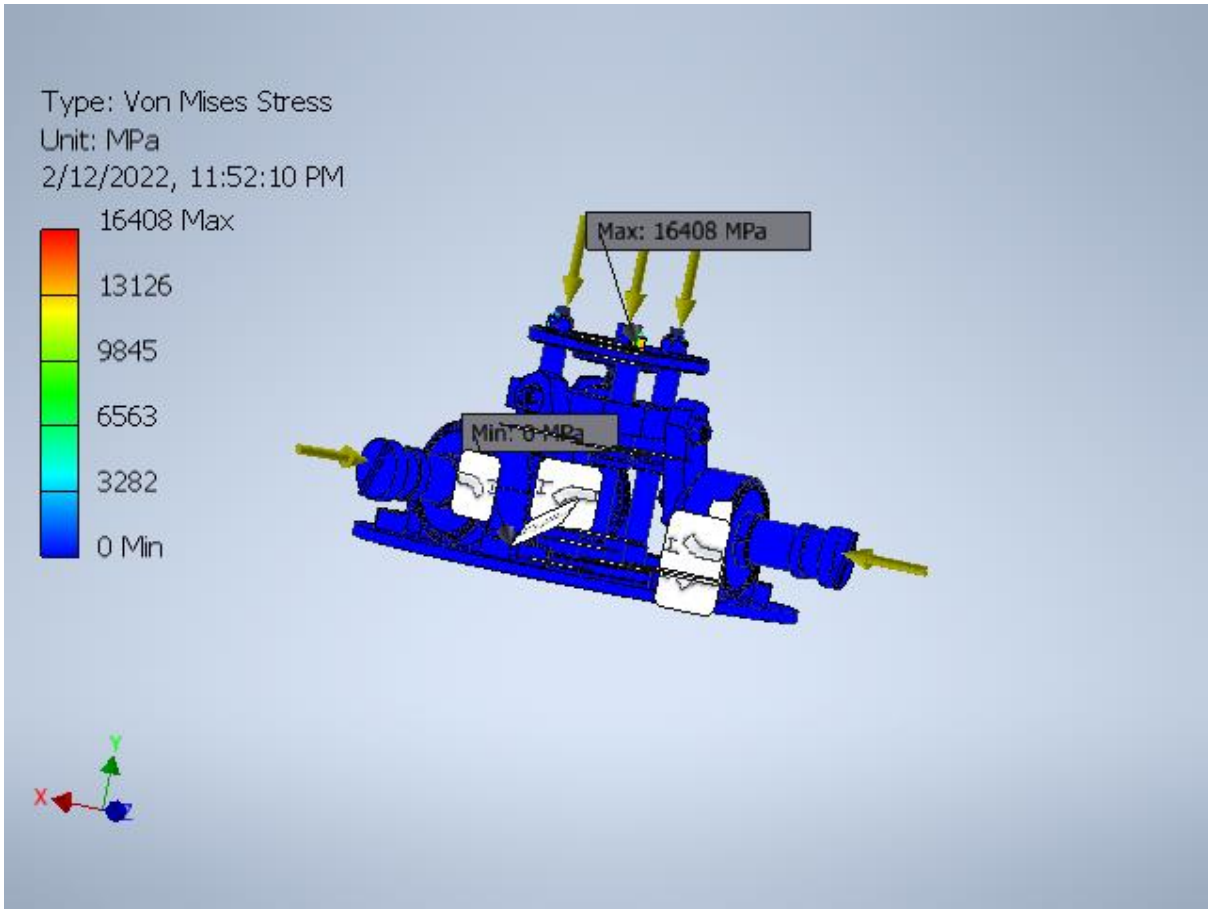
Constraint Name	Reaction Force		Reaction Moment	
	Magnitude	Component (X,Y,Z)	Magnitude	Component (X,Y,Z)
Fixed Constraint:1	46333 N	0 N	35.9039 N m	-17.4196 N m
		46333 N		1.90437 N m
		0 N		31.3373 N m

Result Summary

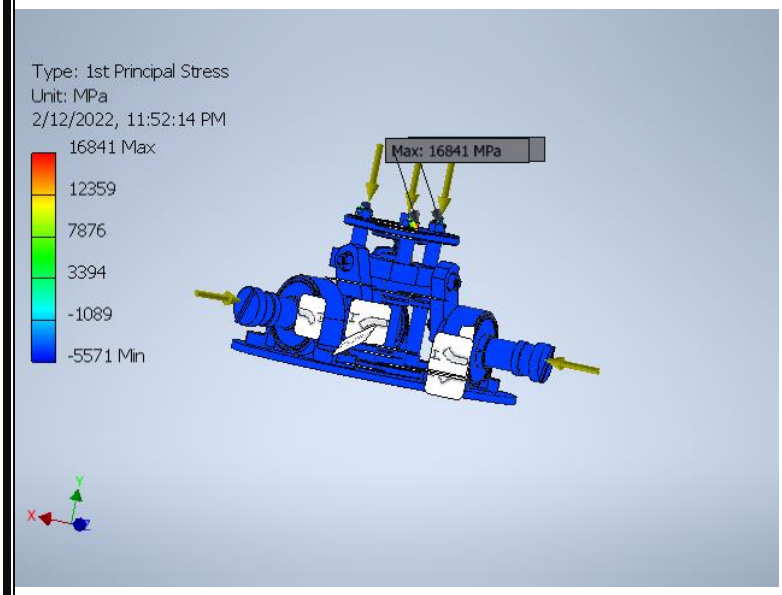
Name	Minimum	Maximum
Volume	657137 mm^3	
Mass	2.72995 kg	
Von Mises Stress	0.000000000000933154 MPa	16407.8 MPa
1st Principal Stress	-5571.19 MPa	16841.1 MPa

3rd Principal Stress	-23074.2 MPa	3542.31 MPa
Displacement	0 mm	0.729001 mm
Safety Factor	0.0167604 ul	15 ul
Stress XX	-15691.1 MPa	16090.1 MPa
Stress XY	-5444.89 MPa	8431.51 MPa
Stress XZ	-2934.91 MPa	2970.16 MPa
Stress YY	-14585.2 MPa	7191.48 MPa
Stress YZ	-7398.02 MPa	4980.4 MPa
Stress ZZ	-11056.8 MPa	12191.1 MPa
X Displacement	-0.221511 mm	0.126868 mm
Y Displacement	-0.690232 mm	0.00251231 mm
Z Displacement	-0.15555 mm	0.190746 mm
Equivalent Strain	0.000000000000000143707 ul	0.228198 ul
1st Principal Strain	-0.000293635 ul	0.185187 ul
3rd Principal Strain	-0.267221 ul	0.000266896 ul
Strain XX	-0.124703 ul	0.17069 ul
Strain XY	-0.105105 ul	0.162756 ul
Strain XZ	-0.0566535 ul	0.057334 ul
Strain YY	-0.189136 ul	0.0440324 ul
Strain YZ	-0.142806 ul	0.0961383 ul
Strain ZZ	-0.0886122 ul	0.110605 ul
Contact Pressure	0 MPa	6875.32 MPa
Contact Pressure X	-5310.66 MPa	4231.31 MPa
Contact Pressure Y	-5657.51 MPa	4879.7 MPa
Contact Pressure Z	-4272.89 MPa	3238.66 MPa

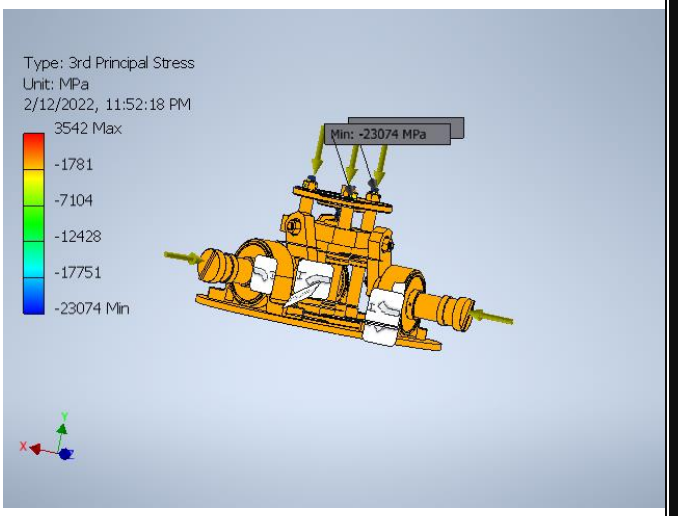
Von Mises Stress



1st Principal Stress



3rd Principal Stress



Control code

system | Arduino 1.8.19 (Windows Store 1.8.57.0)

File Edit Sketch Tools Help

system

```
#define POTENTIOMETER_PIN A0


#include <LiquidCrystal.h>
/*
 * nema23
 */
//define No. of Cycles of Nema 23
const int Stepper_Cycles = 2715;
// define pins numbers
const int Stepper_dirpin = 9;
const int Stepper_steppin = 8;
const int Stepper_enpin = 11;

// initialize the library by associating any needed LCD interface pin
// with the arduino pin number it is connected to
const int rs = 12, en = 11, d4 = 5, d5 = 4, d6 = 3, d7 = 2;
LiquidCrystal lcd(rs, en, d4, d5, d6, d7);
void setup()
{
    /*
   * nema23
   */
  // set up the LCD's number of columns and rows:
  lcd.begin(16, 2);
  pinMode(Stepper_steppin,OUTPUT);
  pinMode(Stepper_dirpin,OUTPUT);
  pinMode(Stepper_enpin,OUTPUT);

  digitalWrite(Stepper_enpin,LOW);
}

void loop()
{
  /*
   * wind speed sensor
   */

  float sensorValue = analogRead(POTENTIOMETER_PIN);
  float voltage = (sensorValue / 1023) * 5;
  float wind_speed = mapfloat(voltage, 0.4, 2, 0, 32.4);
```

Done uploading.

```
Sketch uses 2648 bytes (1%) of program storage space. Maximum is 253952 bytes.
Global variables use 45 bytes (0%) of dynamic memory, leaving 8147 bytes for local variables. Maxim
```

system | Arduino 1.8.19 (Windows Store 1.8.57.0)

File Edit Sketch Tools Help

system

```
  digitalWrite(Stepper_enpin,LOW);
}

void loop()
{
  /*
   * wind speed sensor
   */

  float sensorValue = analogRead(POTENTIOMETER_PIN);
  float voltage = (sensorValue / 1023) * 5;
  float wind_speed = mapfloat(voltage, 0.4, 2, 0, 32.4);
  float speed_mph = ((wind_speed *3600)/1609.344);


  digitalWrite(Stepper_dirpin,HIGH); // Enable direction
  for(int x=0; x<Stepper_Cycles;x++)
  {
    digitalWrite(Stepper_steppin,HIGH);
    delayMicroseconds(500);
    digitalWrite(Stepper_steppin,LOW);
    delayMicroseconds(500);
    }
    delay(1000);

   digitalWrite(Stepper_dirpin,LOW); // Enable opposite direction
   for(int x=0; x<Stepper_Cycles;x++)
  {
    digitalWrite(Stepper_steppin,HIGH);
    delayMicroseconds(500);
    digitalWrite(Stepper_steppin,LOW);
    delayMicroseconds(500);
    }
    delay(1000);
}

float mapfloat(float x, float in_min, float in_max, float out_min, float out_max)
{
  return (x - in_min) * (out_max - out_min) / (in_max - in_min) + out_min;
}
```

Done uploading.

```
Sketch uses 2648 bytes (1%) of program storage space. Maximum is 253952 bytes.
Global variables use 45 bytes (0%) of dynamic memory, leaving 8147 bytes for local variable
```

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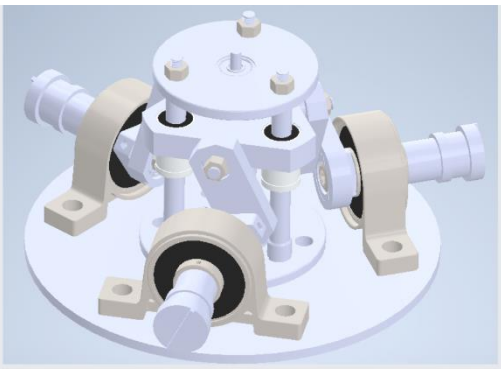
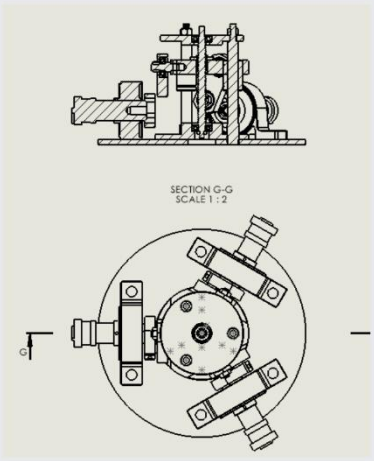
Process sheet

Post	Turning
Crank	CNC
Connecting rod	CNC
Slider	Turning+Milling
Cover	Turning+drilling
Cover bearing	Turning
Crank pin	Turning
Base	Turning+Drilling
Power screw	Turning
Pin connection	Turning

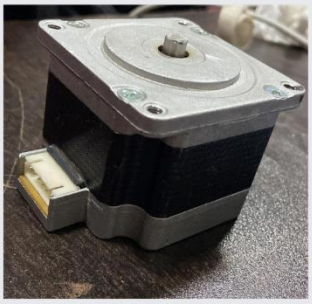
Product brochure





plummer block

Bearing 607



Stepper Motor_ NEMA 23
up to 3 A
holding torque 0.65 N.m

motor holder
dia. 80mm
3* M7

coupler

connecting rod
Height 58mm
outer dia. 19mm at depth 8mm
inner dia. 15mm at depth 2mm
center distance 35mm

slider
outer dia. 45
3 M19*
inner dia. 11 mm
three pin holes dia 7

cover of base bearing
3 M4*
outer dia. 40
inner dia. 15

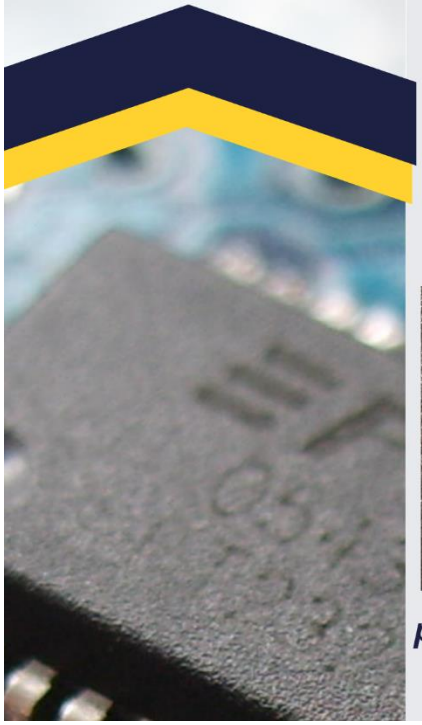
Power screw with its guide nut
height 107 mm
M8x2

crank
center distance between two circles
18mm

crank holder
outer dia. 23mm
inner dia. 20 mm

Base Dia. 90
*6*M8 holes*
*6*M5 holes*
Height 16 mm
*3*M10 holes*

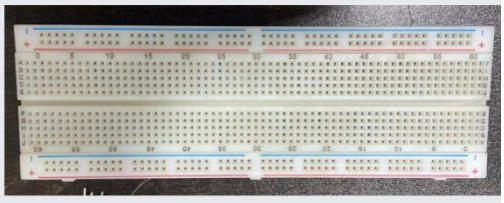
Control parts



Driver for stepper motor

Arduino MEGA

potentiometer (10K)



Breadboard

Main specifications

Material	Crank: Al 70/75 Rod: Al 20/11
Torque produced on power screw	0.64 N.m
RPM on power screw	400
Mass	989 grams
Weight	9.702 N
Height	183mm
Operation voltage on the motor	12 volts
Operation current on the motor	3 A
Price	3500

Final product