ANALYSIS REPORT OF 1550 KN FREE FLOAT BEARING

TITLE : - **ANALYSIS REPORT FOR 1550 KN FREE FLOAT BEARING REPORT**
Report no : - **LLX-PPB-03-2021-GB-03**

Summary: -

Analysis was done to find the stress levels incurred in the bearing at various parts, it was found that the stress levels in the pot and piston where 346.58 Mpa and 354.21 Mpa respectively which is slightly above the yield strength of the cast steel but below the ultimate tensile strength of the material. The stress levels on the ptfe is 75.573 Mpa which higher than the recommended level

Model: -

Bill of material: -

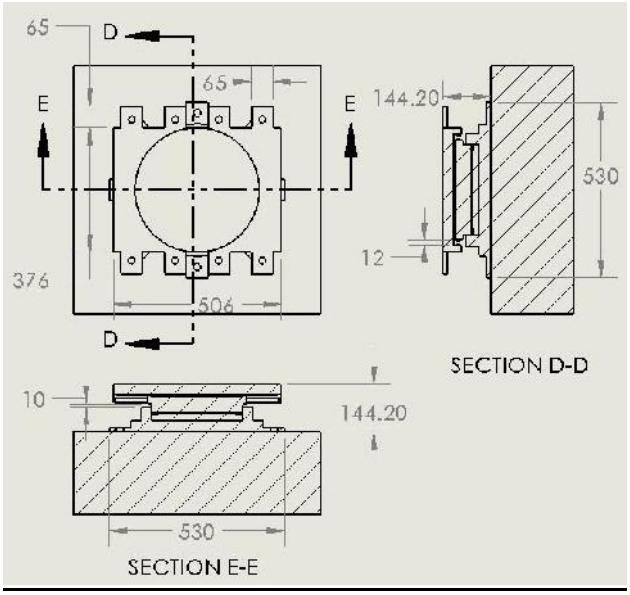
Sl. No.	Description	Size (mm)	Material	Qty (Nos)
1	POT	530 x 530 x 74	CAST STEEL	1
2	PISTON	506 x 506 x 55	CAST STEEL	1
3	TOP PLATE	300 x 300 x 52	CAST STEEL	1
5	ELASTOMERIC PAD	275 x 275 x 22	NEOPRENE	1
6	BRASS RINGS	275 x 275 x 4	BRASS	2
7	PTFE PAD	275 x 275 x 6	PTFE	1
8	STAINLESS STEEL PLATE	490 x 332 x 3	STAINLESS STEEL	1
9	STAINLESS STEEL STRIP	319 x 10 x 3	STAINLESS STEEL	4

Model details: -

- Total number of nodes: - 89271
- Total number of elements: - 48901
- Type of analysis: - static analysis

Part details: -

i. Assembly



ii. Pot

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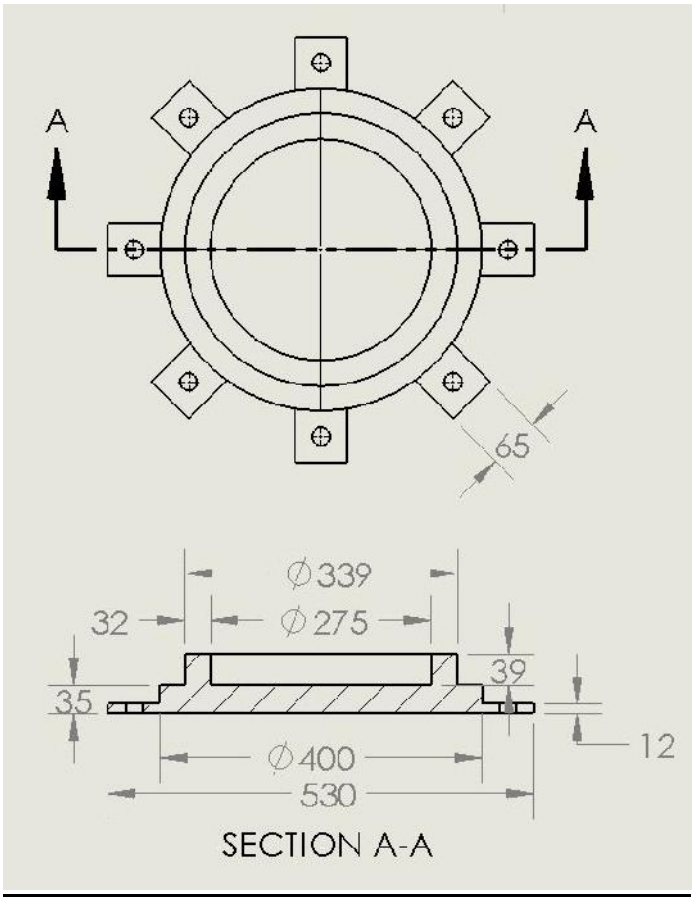
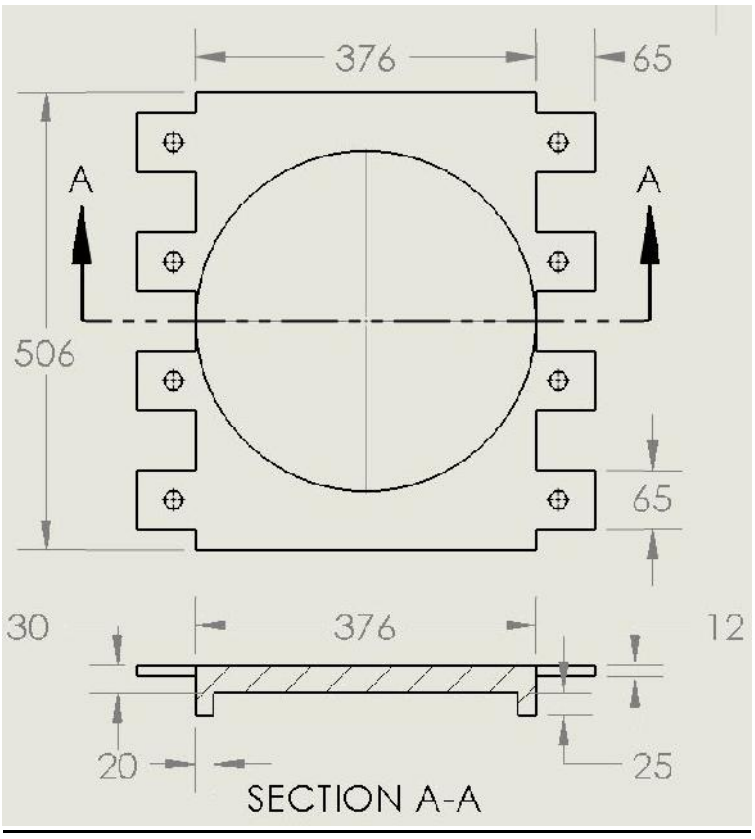
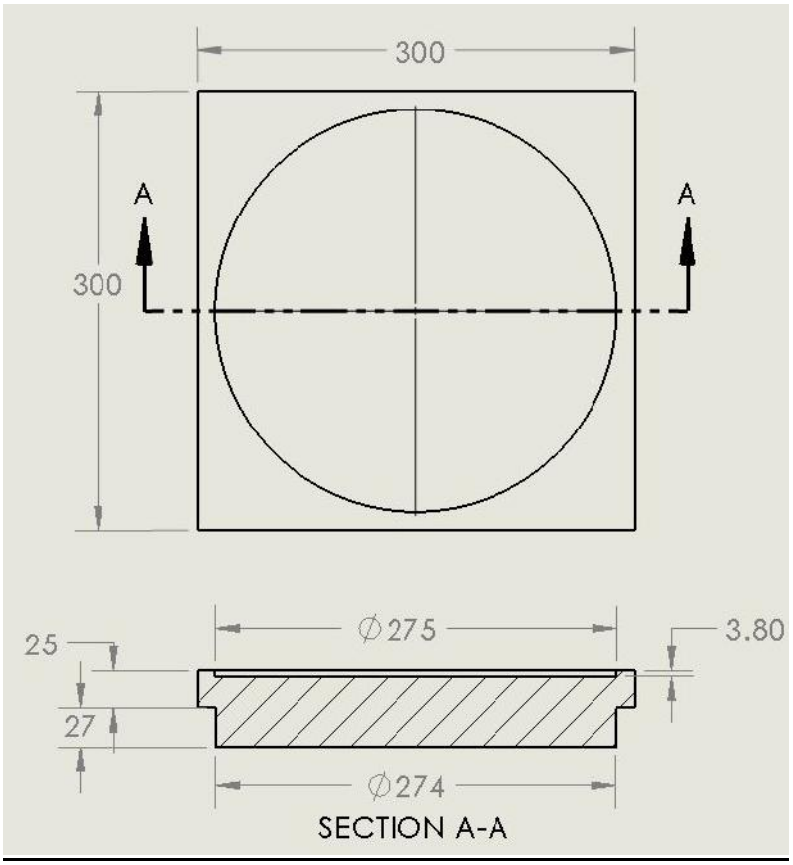


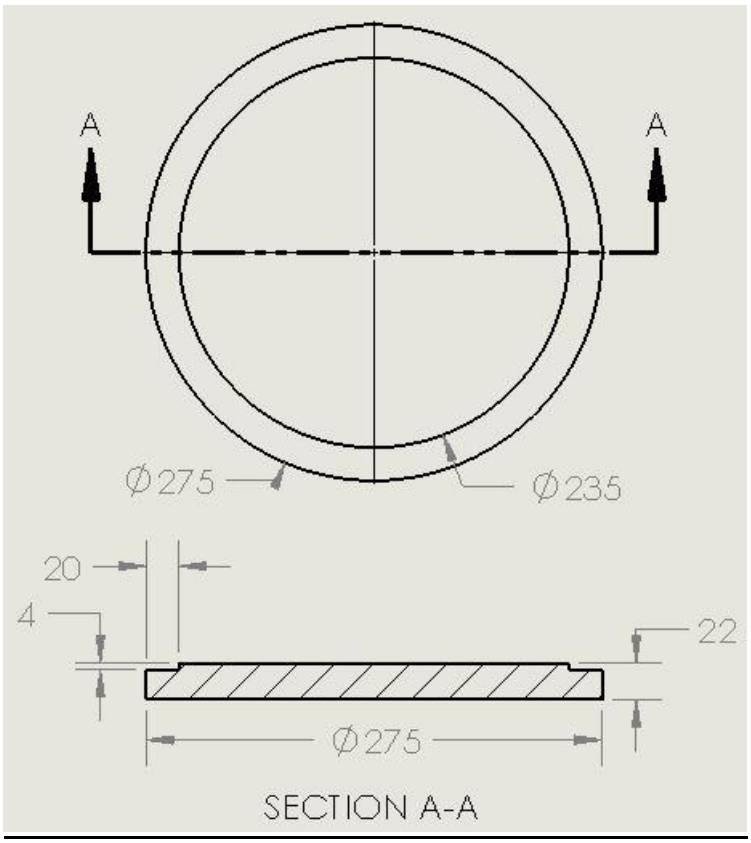
iii. Top plate



iv. Piston



v. Elastomeric pad



vi. Brass rings

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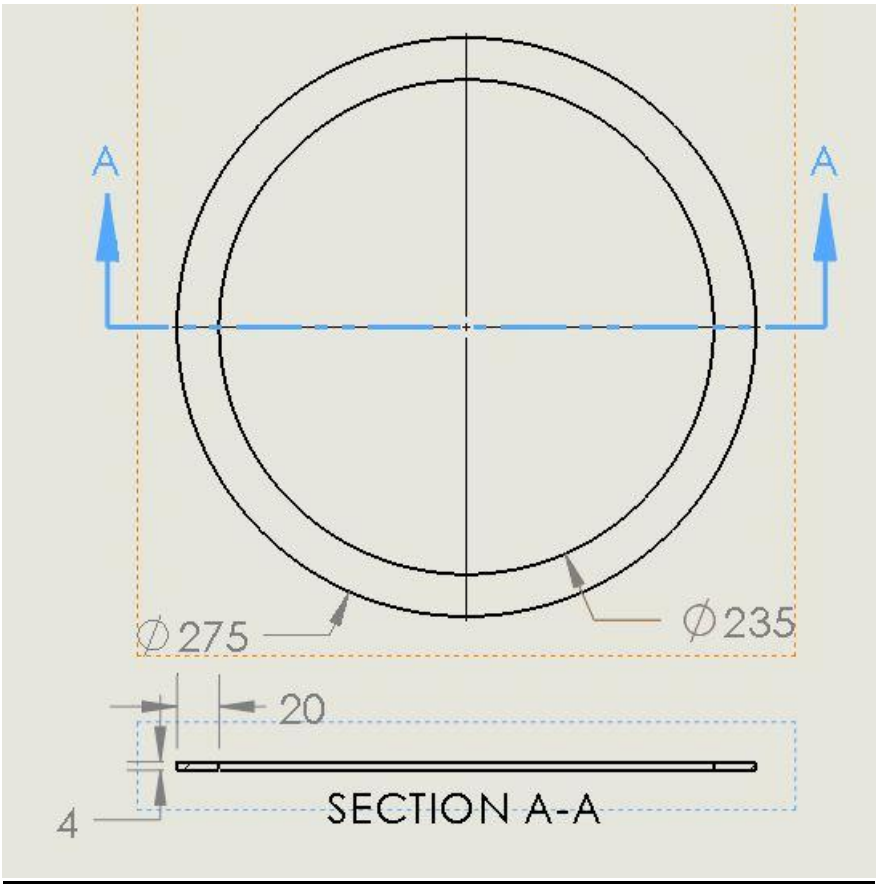

Assumptions: -

- Brass rings are considered as one whole entity.
- There is no clearance between pot inner diameter and piston outer diameter.
- Load application is considered as surface effect on the effective diameter on the top surface.

Material data: -

1. **Cast steel: -**
   - Density: - 7854 kg/m^3
   - Tensile yield strength: - 340 Mpa
   - Ultimate tensile strength: - 570 Mpa
   - Young's modulus: - 21,000 Mpa
   - Poisson's ratio: - 0.3
   - Bulk modulus: - 16,667 Mpa
   - Shear modulus: - 7,692.3 Mpa
2. **Neoprene: -**
   - Density: - 140 kg/m^3

- Young's modulus: - 1.4 * 10^{-3} Mpa
- Poisson's ratio: - 0.45
- Bulk modulus: - 4.667 * 10^{-3} Mpa
- Shear modulus: - 4.8276 * 10^{-3} Mpa

3. **Brass: -**
   - Density: - 8267 kg/m3
   - Tensile yield strength: - 367.4 Mpa
   - Ultimate tensile strength: - 502 Mpa
   - Young's modulus: - 99,950 Mpa
   - Poisson's ratio: - 0.345
   - Bulk modulus: - 107,470 Mpa
   - Shear modulus: - 37,156 Mpa
4. **PTFE: -**
   - Young's modulus: - 540 Mpa
   - Poisson's ratio: - 0.46
   - Bulk modulus: - 2,250 Mpa
   - Shear modulus: - 184.93 Mpa
5. **Stainless steel: -**
   - Density: - 7750 kg/m3
   - Tensile yield strength: - 207 Mpa
   - Ultimate tensile strength: - 586 Mpa
   - Young's modulus: - 195,000 Mpa
   - Poisson's ratio: - 0.27
   - Bulk modulus: - 169,300 Mpa
   - Shear modulus: - 73,664Mpa
6. **Concrete: -**
   - Density: - 2300 kg/m3
   - Tensile ultimate strength: - 5 Mpa
   - Compressive ultimate strength: - 41 Mpa
   - Young's modulus: - 30,000 Mpa
   - Poisson's ratio: - 0.18
   - Bulk modulus: - 15,625 Mpa
   - Shear modulus: - 12,712 Mpa

Loading conditions: -

Vertical load: - 1550 KN
Pressure due to vertical load on bearing: -
= 1550 * 1000 / (π * 376^2 / 4) = **13.9594 Mpa**

Horizontal load: - 600 KN
Pressure due to horizontal load on bearing: -
= 600 * 1000 / (π * 376^2 / 4) = **5.4036 Mpa**

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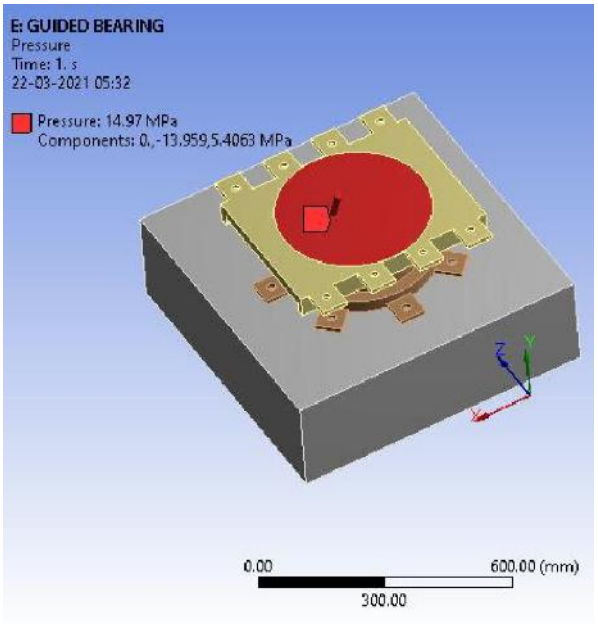
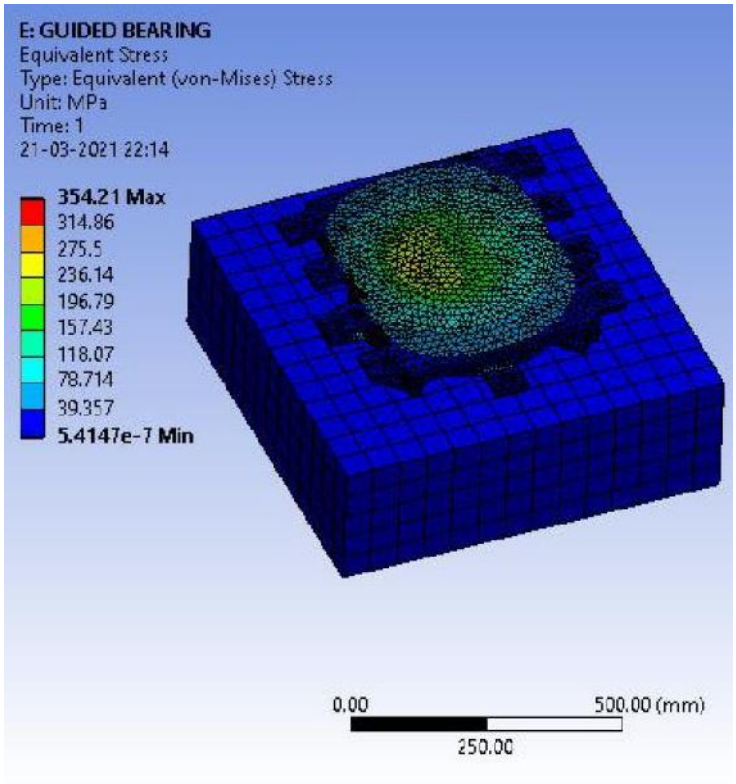


Constraints: -

- Bottom of the concrete is considered as fixed support and there are no external supports in the model elsewhere.

Results: -

Equivalent stress on the bearing: -



Total deformation on the bearing: -

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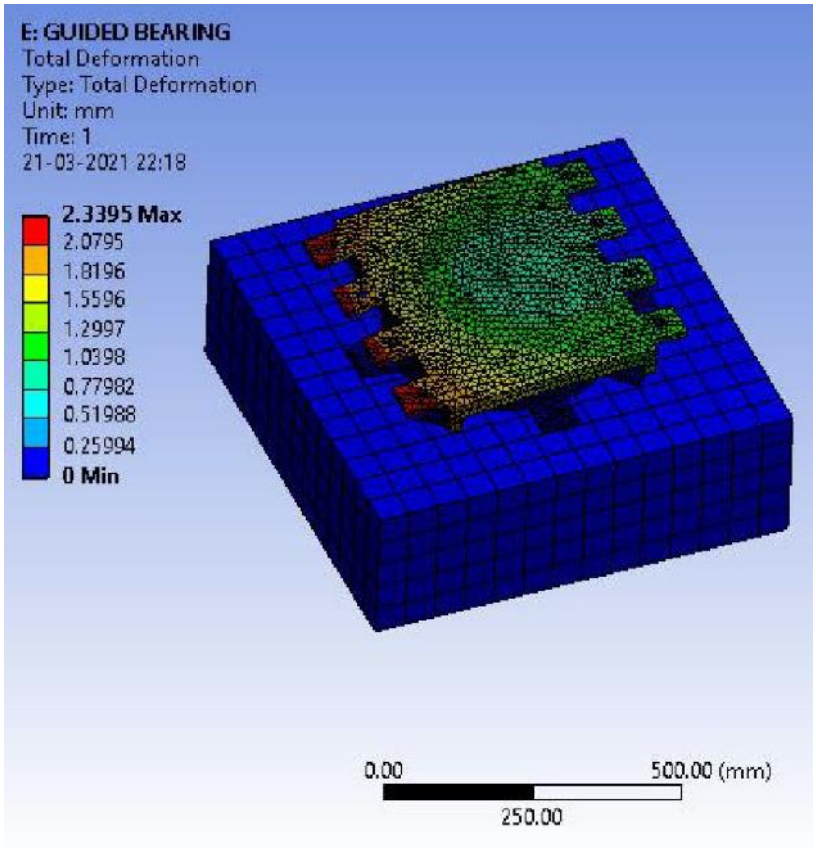
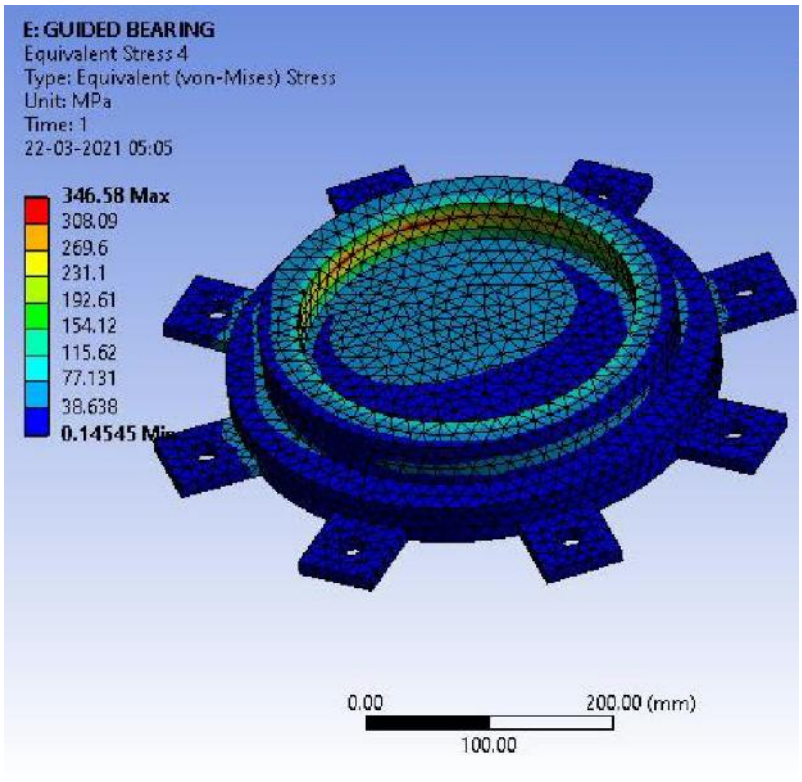


Equivalent stress on the pot: -



Equivalent stress on the piston: -

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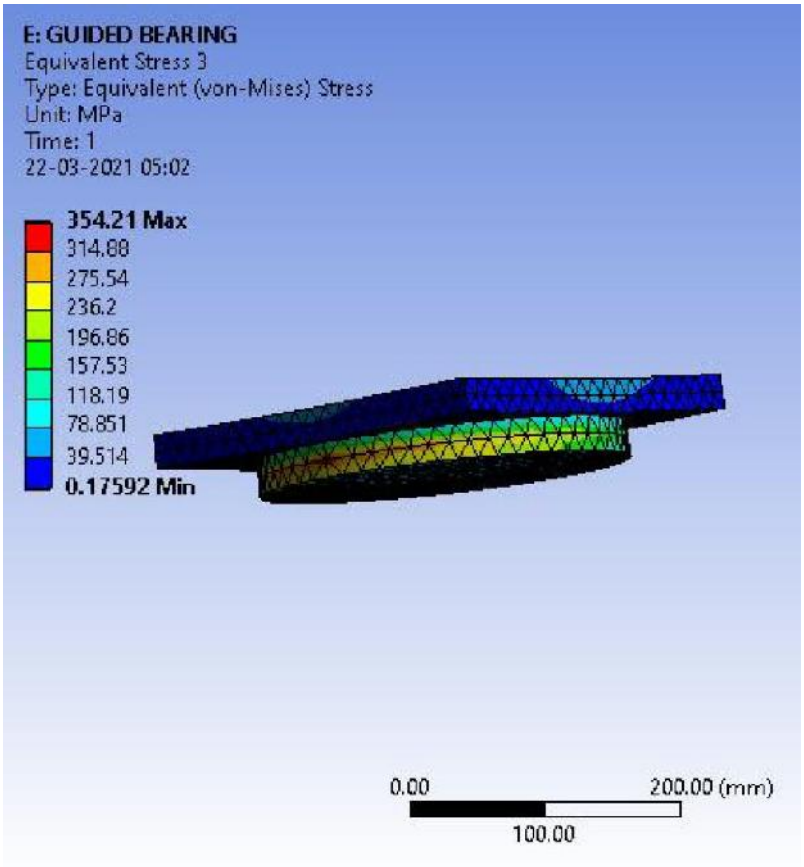
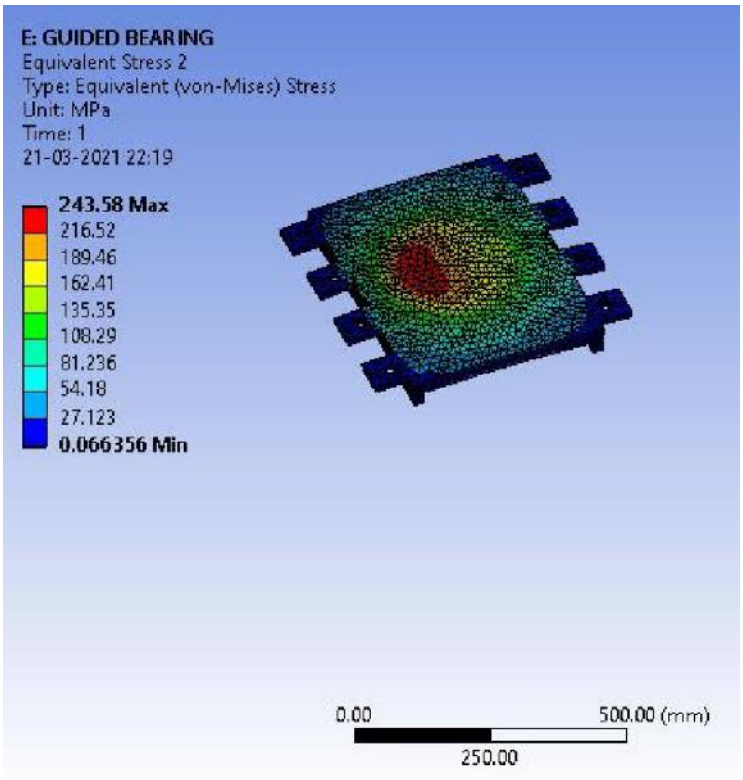


Equivalent stress on the top plate: -



Equivalent stress on the stainless steel plate: -

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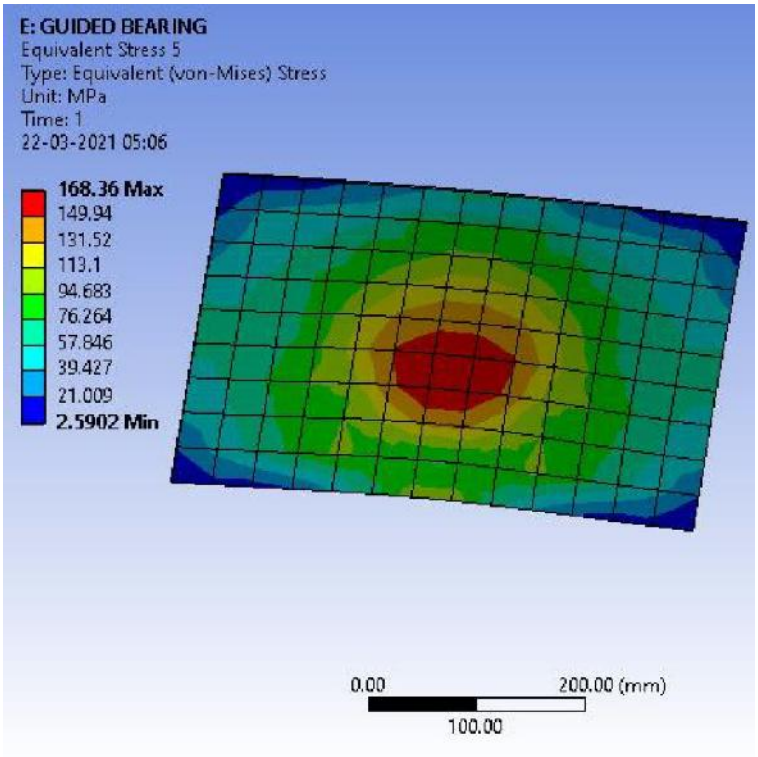
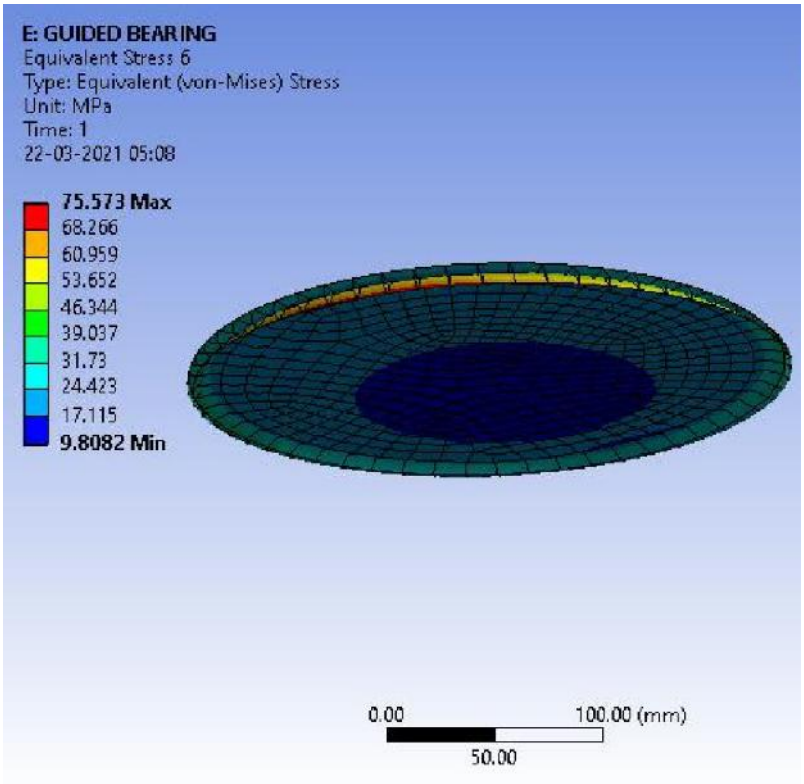


Equivalent stress on the PTFE: -



Equivalent stress on the brass rings: -

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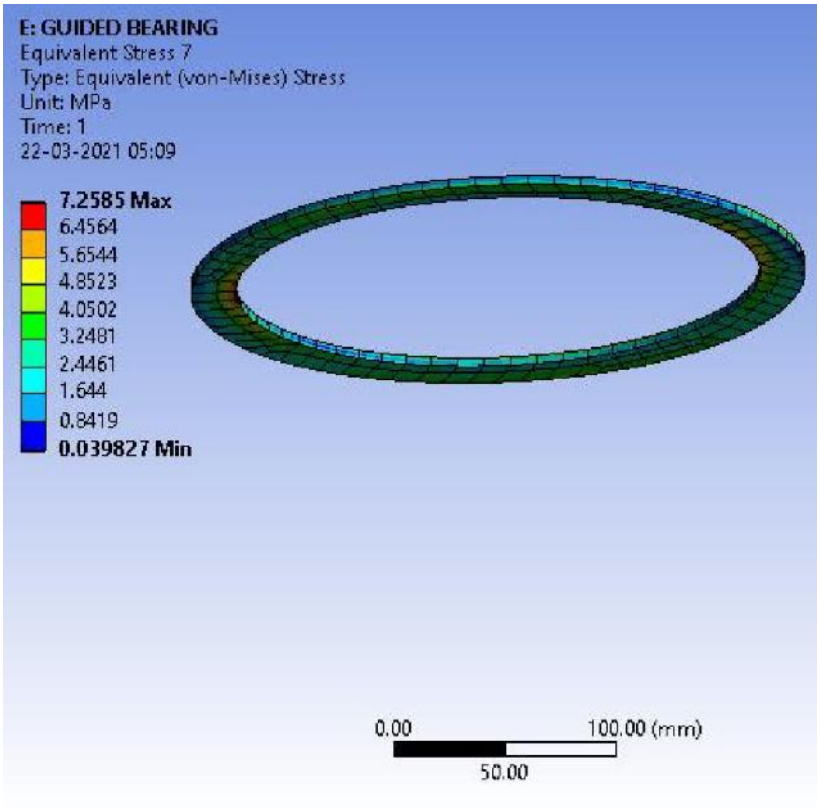
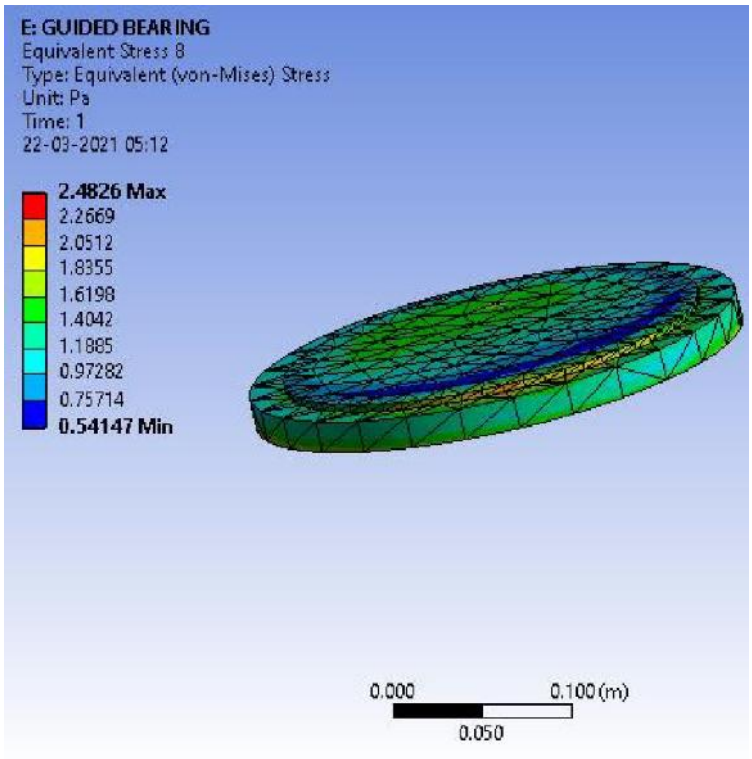
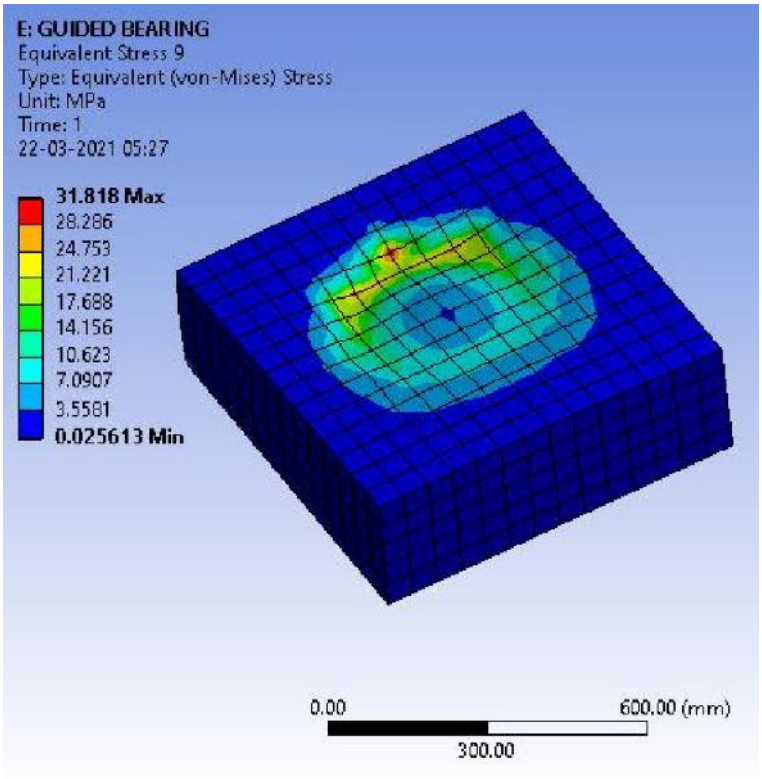


Equivalent stress on the elastomeric pad: -



Equivalent stress on the concrete: -



Conclusion: -

The stress on the PTFE 75.573 Mpa on the edges of the surfaces connected to the piston which is higher than the permissible limit of 60 Mpa. This is due to horizontal load recommended to increase the size of the ptfe to sustain the load.

From the above analysis it is found that stress levels on the pot and piston is above yield strength of the material used (cast steel) where the yield strength is 340 Mpa. Incase the design can be accepted in the case of ultimate tensile strength since the bearing is subjected to ultimate limit state then these stress levels are acceptable.

Since the stress levels on concrete is 31.818 Mpa any grade above M35 would be preferable.

And for the rest of the parts in the bearing the stress induced in these parts is below the yield stress of these materials hence no need to change the grade of these materials

References: -

i. IRC 83 – PART III – 2018

********** THE END **********

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