Simulation of FlangeCouplingFinal

Date: Sunday, 18 December 2022
Designer: Solidworks
Study name: Static Analysis Of Flange
Analysis type: Static

Table of Contents

Description

Stress Analysis of Flange Coupling at various points.
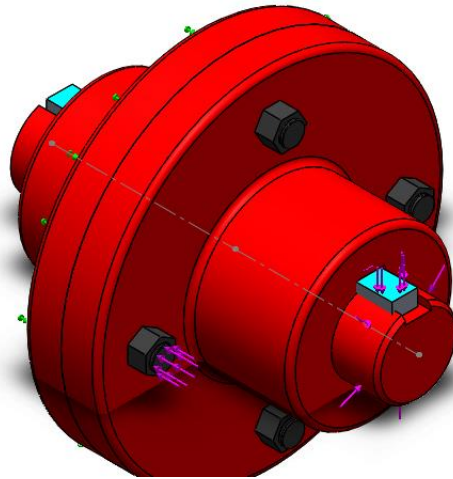1) Bolt
2) Nut
3) Key-way
4) Shaft
5) Flange

Assumptions:

1) Material used for the simulation is Insulated Mold Casting .
2) The analysis is done only for force and not of torque.
3) Poison ratio is kept at 0.33
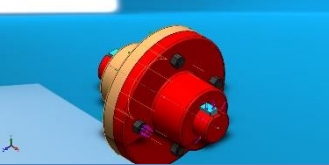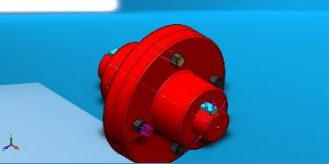4) Tensile Strength of the material is 273.
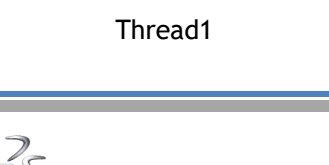
Model Information
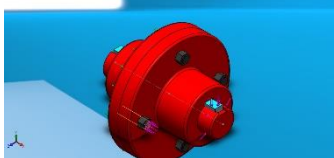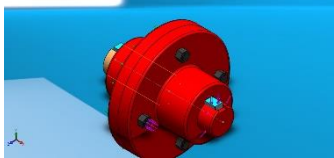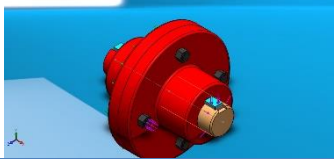
Model name: FlangeCouplingFinal
Current Configuration: Default

Solid Bodies

Document Name and Reference	Treated As	Volumetric Properties	Document Path/Date Modified
Fillet1	Solid Body	Mass:2.19214 kg Volume:0.000782907 m^3 Density:2,800 kg/m^3 Weight:21.483 N	C:\Users\Momin Khan\Downloads\Flange-20221218T061847Z-001\Flange\Flange.SLDPRT Dec 18 12:34:43 2022
Fillet1	Solid Body	Mass:2.19214 kg Volume:0.000782907 m^3 Density:2,800 kg/m^3 Weight:21.483 N	C:\Users\Momin Khan\Downloads\Flange-20221218T061847Z-001\Flange\Flange.SLDPRT Dec 18 12:34:43 2022
Thread1	Solid Body	Mass:0.0206132 kg Volume:7.36168e-06 m^3 Density:2,800.07 kg/m^3 Weight:0.20201 N	C:\Users\Momin Khan\Downloads\Flange-20221218T061847Z-001\Flange\bolt.SLDPRT Dec 18 12:02:22 2022
Thread1	Solid Body	Mass:0.0206132 kg Volume:7.36168e-06 m^3 Density:2,800.07 kg/m^3 Weight:0.20201 N	C:\Users\Momin Khan\Downloads\Flange-20221218T061847Z-001\Flange\bolt.SLDPRT Dec 18 12:02:22 2022
Thread1	Solid Body	Mass:0.0206132 kg Volume:7.36168e-06 m^3 Density:2,800.07 kg/m^3 Weight:0.20201 N	C:\Users\Momin Khan\Downloads\Flange-20221218T061847Z-001\Flange\bolt.SLDPRT Dec 18 12:02:22 2022
Thread1	Solid Body	Mass:0.0206132 kg Volume:7.36168e-06 m^3 Density:2,800.07 kg/m^3 Weight:0.20201 N	C:\Users\Momin Khan\Downloads\Flange-20221218T061847Z-001\Flange\bolt.SLDPRT

			Dec 18 12:02:22 2022
Boss-Extrude1	Solid Body	Mass:0.0242931 kg Volume:8.67612e-06 m^3 Density:2,800 kg/m^3 Weight:0.238073 N	C:\Users\Momin Khan\Downloads\Flange-20221218T061847Z-001\Flange\key.SLDPRT Dec 18 12:10:16 2022
Boss-Extrude1	Solid Body	Mass:0.0242931 kg Volume:8.67612e-06 m^3 Density:2,800 kg/m^3 Weight:0.238073 N	C:\Users\Momin Khan\Downloads\Flange-20221218T061847Z-001\Flange\key.SLDPRT Dec 18 12:10:16 2022
Thread1	Solid Body	Mass:0.00346695 kg Volume:1.2382e-06 m^3 Density:2,800 kg/m^3 Weight:0.0339761 N	C:\Users\Momin Khan\Downloads\Flange-20221218T061847Z-001\Flange\nut.SLDPRT Dec 18 12:02:23 2022
Thread1	Solid Body	Mass:0.00346695 kg Volume:1.2382e-06 m^3 Density:2,800 kg/m^3 Weight:0.0339761 N	C:\Users\Momin Khan\Downloads\Flange-20221218T061847Z-001\Flange\nut.SLDPRT Dec 18 12:02:23 2022
Thread1	Solid Body	Mass:0.00346695 kg Volume:1.2382e-06 m^3 Density:2,800 kg/m^3 Weight:0.0339761 N	C:\Users\Momin Khan\Downloads\Flange-20221218T061847Z-001\Flange\nut.SLDPRT Dec 18 12:02:23 2022
Thread1	Solid Body	Mass:0.00346695 kg Volume:1.2382e-06 m^3 Density:2,800 kg/m^3 Weight:0.0339761 N	C:\Users\Momin Khan\Downloads\Flange-20221218T061847Z-001\Flange\nut.SLDPRT Dec 18 12:02:23 2022
Chamfer1	Solid Body	Mass:0.426477 kg Volume:0.000152313 m^3 Density:2,800 kg/m^3 Weight:4.17947 N	C:\Users\Momin Khan\Downloads\Flange-20221218T061847Z-001\Flange\shaft.SLDPRT Dec 18 12:02:22 2022
Chamfer1	Solid Body	Mass:0.426477 kg Volume:0.000152313 m^3 Density:2,800 kg/m^3 Weight:4.17947 N	C:\Users\Momin Khan\Downloads\Flange-20221218T061847Z-001\Flange\shaft.SLDPRT Dec 18 12:02:22 2022

Study Properties

Study name	Static 1
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\Momin Khan\Downloads\Flange-20221218T061847Z-001\Flange)

Units

Unit system:	SI (MKS)
Length/Displacement	mm
Temperature	Kelvin
Angular velocity	Rad/sec
Pressure/Stress	N/m^2
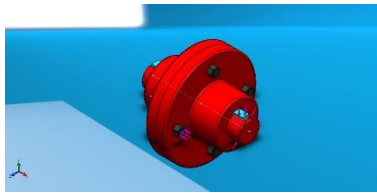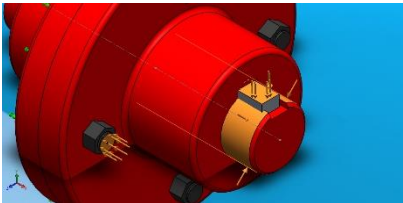
Material Properties

Model Reference	Properties	Components
	Name: 201.0-T43 Insulated Mold Casting (SS) **Model type:** Linear Elastic Isotropic **Default failure criterion:** Max von Mises Stress **Yield strength:** 2.25e+08 N/m^2 **Tensile strength:** 2.73e+08 N/m^2 **Elastic modulus:** 7.1e+10 N/m^2 **Poisson's ratio:** 0.33 **Mass density:** 2,800 kg/m^3 **Shear modulus:** 2.3e+10 N/m^2 **Thermal expansion coefficient:** 1.9e-05 /Kelvin	SolidBody 1(Fillet1)(Flange-1), SolidBody 1(Fillet1)(Flange-3), SolidBody 1(Thread1)(bolt-3), SolidBody 1(Thread1)(bolt-4), SolidBody 1(Thread1)(bolt-5), SolidBody 1(Thread1)(bolt-6), SolidBody 1(Boss-Extrude1)(key-6), SolidBody 1(Boss-Extrude1)(key-7), SolidBody 1(Thread1)(nut-2), SolidBody 1(Thread1)(nut-3), SolidBody 1(Thread1)(nut-4), SolidBody 1(Thread1)(nut-5), SolidBody 1(Chamfer1)(shaft-1), SolidBody 1(Chamfer1)(shaft-2)
Curve Data:N/A		

Loads and Fixtures

Fixture name	Fixture Image	Fixture Details
Fixed-1		**Entities:** 1 face(s) **Type:** Fixed Geometry

Resultant Forces				
Components	X	Y	Z	Resultant
Reaction force(N)	0.98002	0.888289	0.000106134	1.32269
Reaction Moment(N.m)	0	0	0	0

Load name	Load Image	Load Details
Force-1		**Entities:** 3 face(s) **Type:** Apply normal force **Value:** 1 N
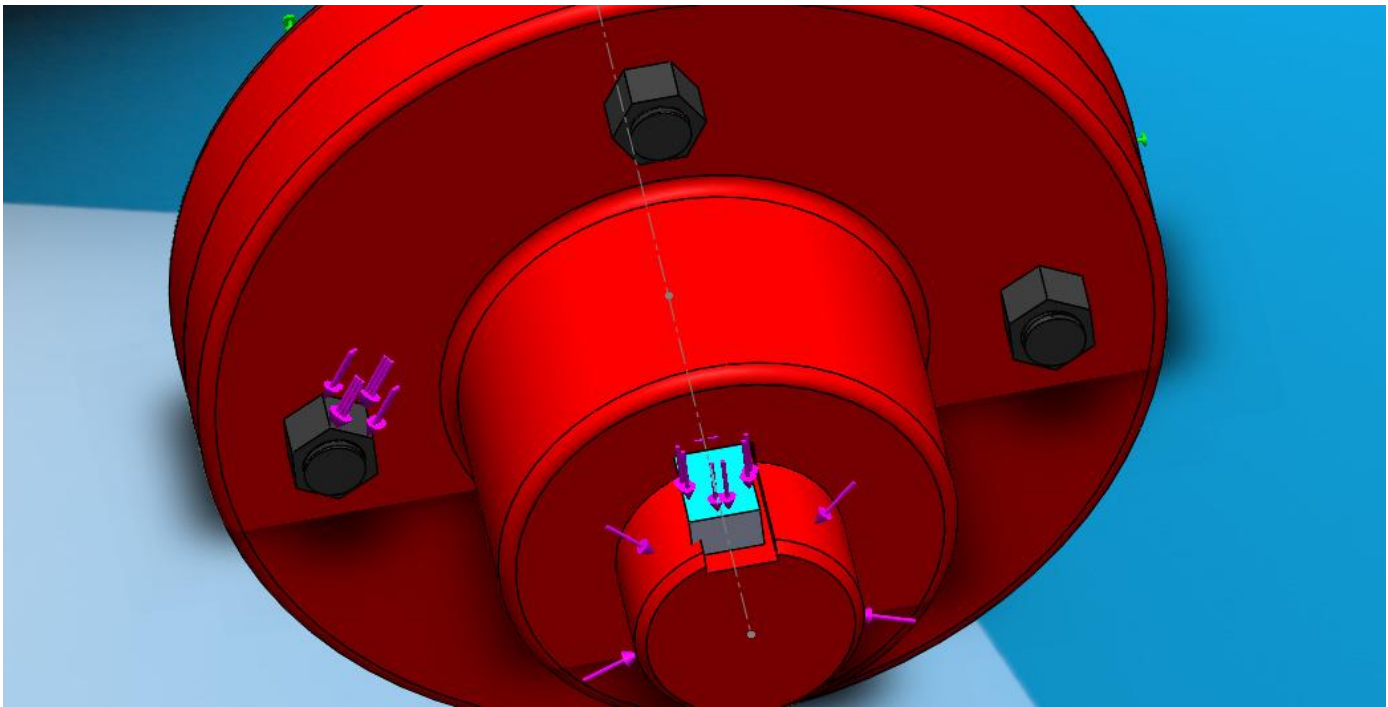
Image-1

Mesh information

Mesh type	Solid Mesh
Mesher Used:	Blended curvature-based mesh
Jacobian points for High quality mesh	16 Points
Maximum element size	24.8725 mm
Minimum element size	2.2961 mm
Mesh Quality	High
Remesh failed parts independently	Off

Mesh information - Details

Total Nodes	120385
Total Elements	71768
Maximum Aspect Ratio	95.899
% of elements with Aspect Ratio < 3	84.4
Percentage of elements with Aspect Ratio > 10	3.66
Percentage of distorted elements	0
Time to complete mesh(hh;mm;ss):	00:00:28
Computer name:	

Resultant Forces

Reaction forces

Selection set	Units	Sum X	Sum Y	Sum Z	Resultant
Entire Model	N	0.98002	0.888289	0.000106134	1.32269

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	0.00128749	0.000800326	-0.000820947	0.00172398

Free body moments

Selection set	Units	Sum X	Sum Y	Sum Z	Resultant
Entire Model	N.m	0	0	0	1e-33

Study Results

Name	Type	Min	Max
Stress1	VON: von Mises Stress	3.092e-02N/m^2 Node: 119618	2.477e+04N/m^2 Node: 108214

FlangeCouplingFinal-Static 1-Stress-Stress1

Name	Type	Min	Max
Displacement1	URES: Resultant Displacement	0.000e+00mm Node: 46743	1.650e-06mm Node: 111897

FlangeCouplingFinal-Static 1-Displacement-Displacement1
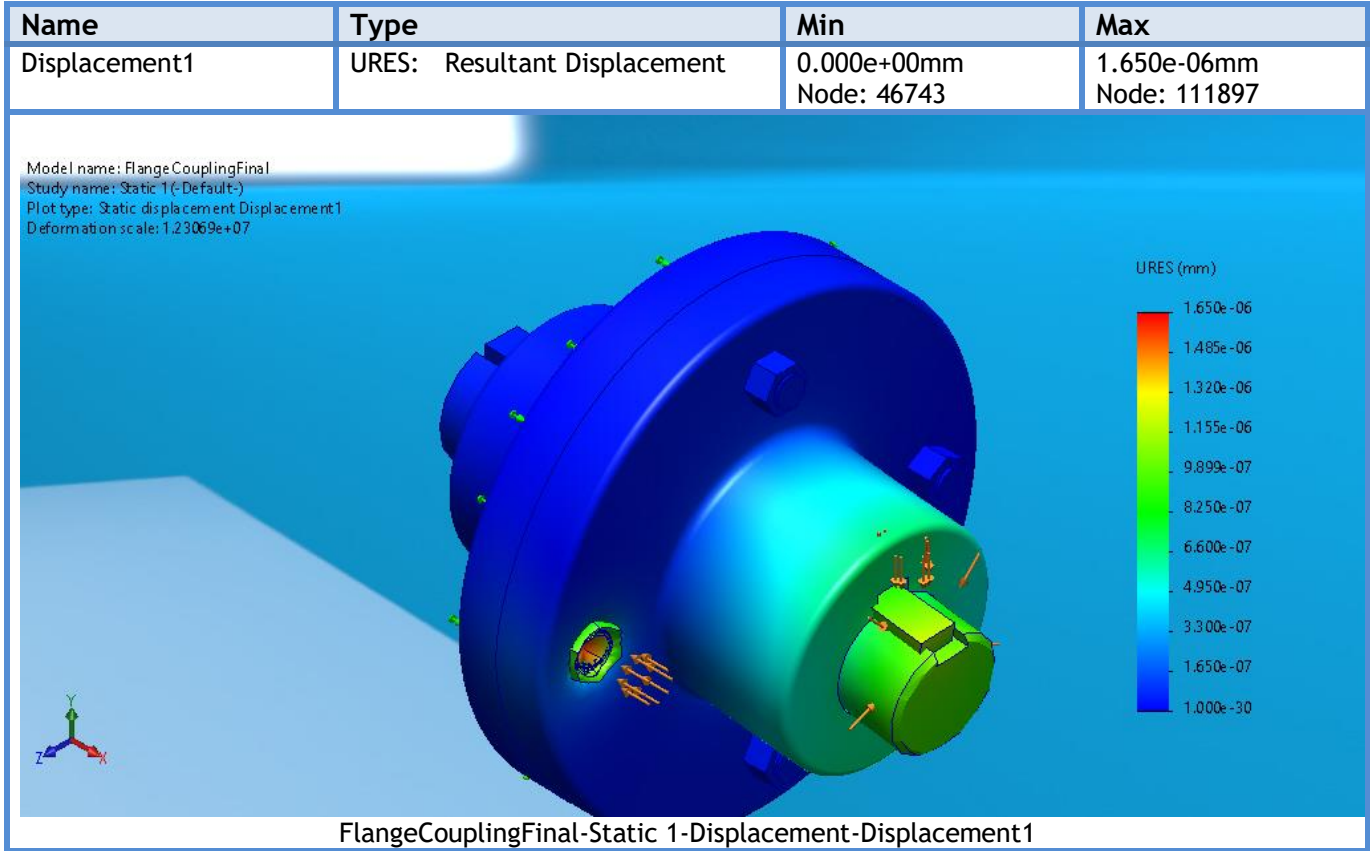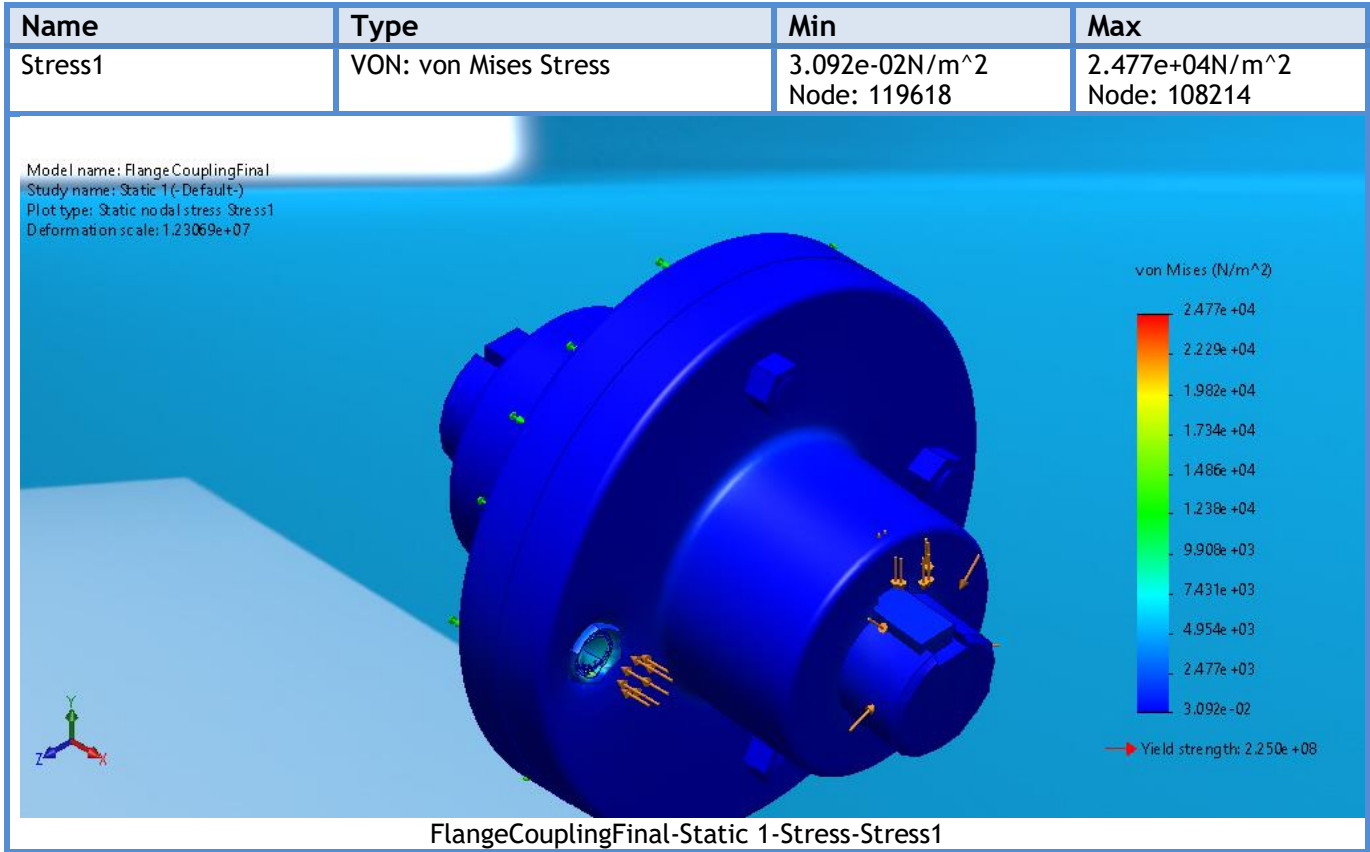
Name	Type	Min	Max
Strain1	ESTRN: Equivalent Strain	9.172e-13 Element: 71370	2.582e-07 Element: 64860

FlangeCouplingFinal-Static 1-Strain-Strain1

Name	Type
Displacement1{1}	Deformed shape

FlangeCouplingFinal-Static 1-Displacement-Displacement1{1}

Image-2

von Mises (N/m^2)

3.423e+05
3.081e+05
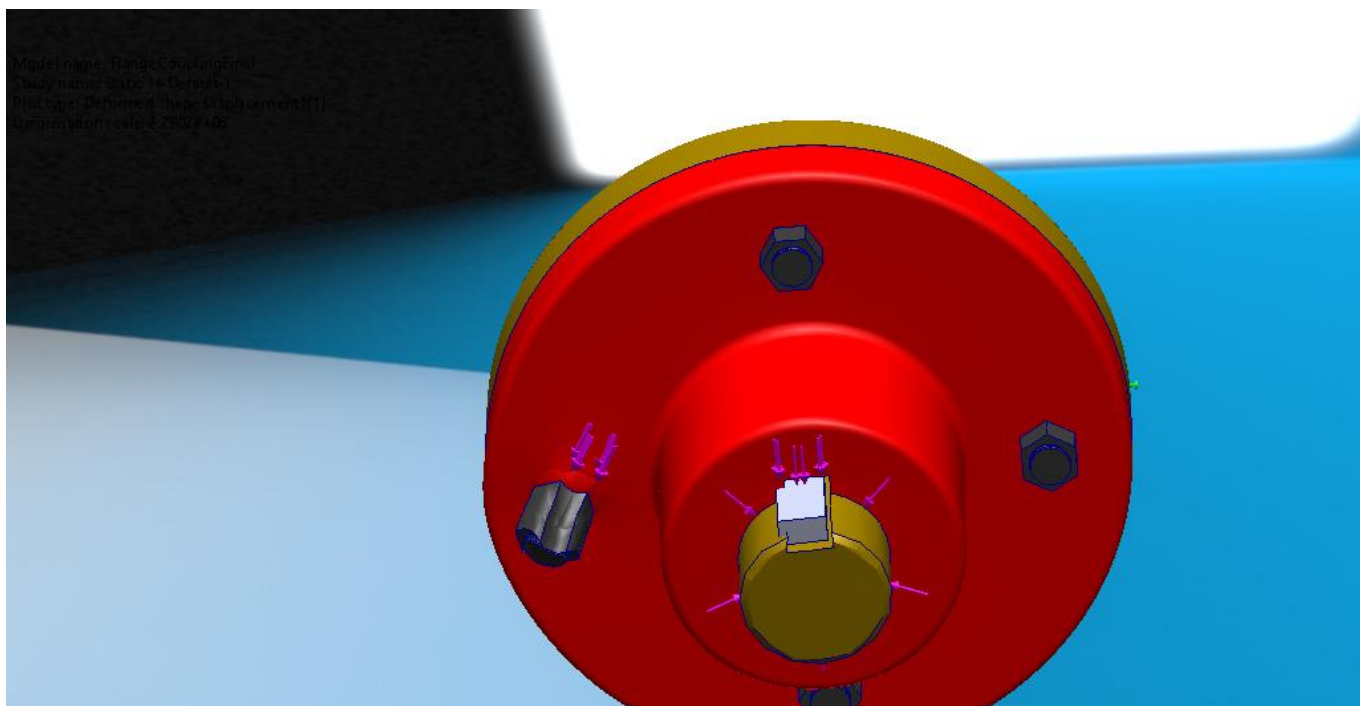2.739e+05
2.396e+05
2.054e+05
1.712e+05
1.369e+05
1.027e+05
6.847e+04
3.423e+04
4.049e-01

Yield strength: 2.827e+08
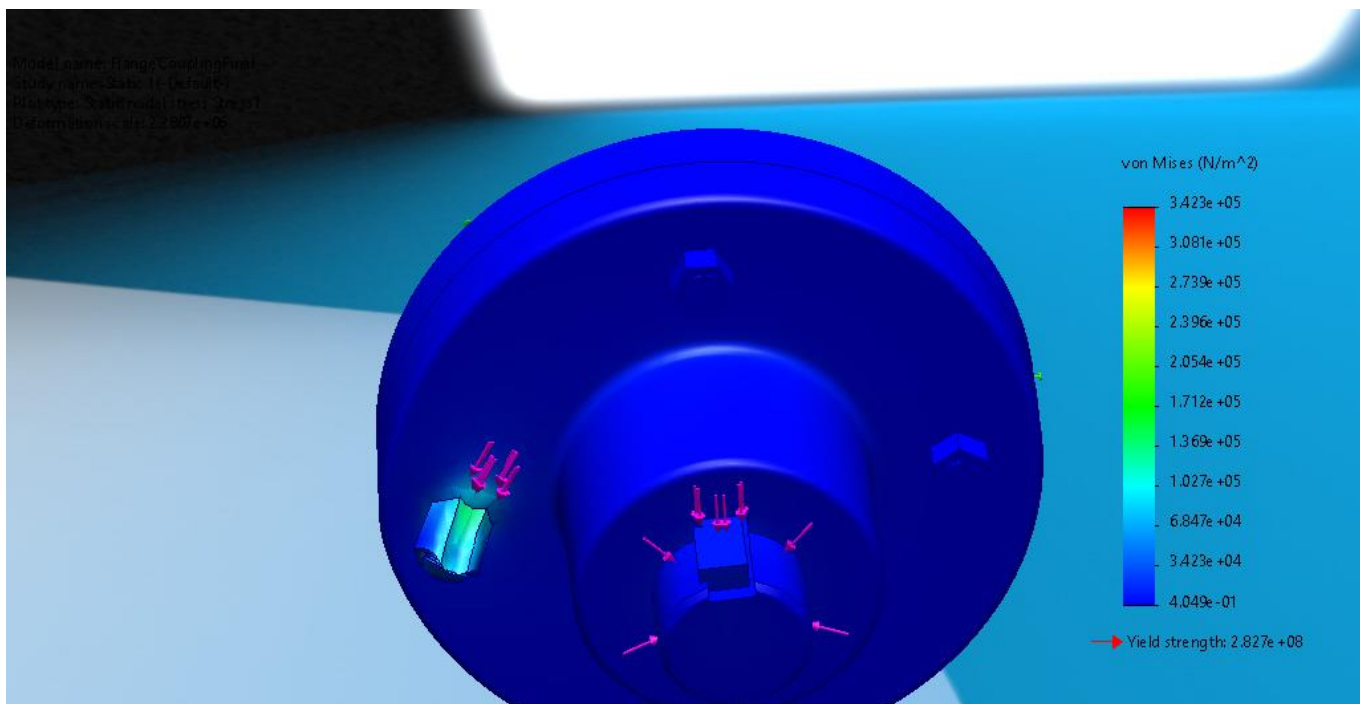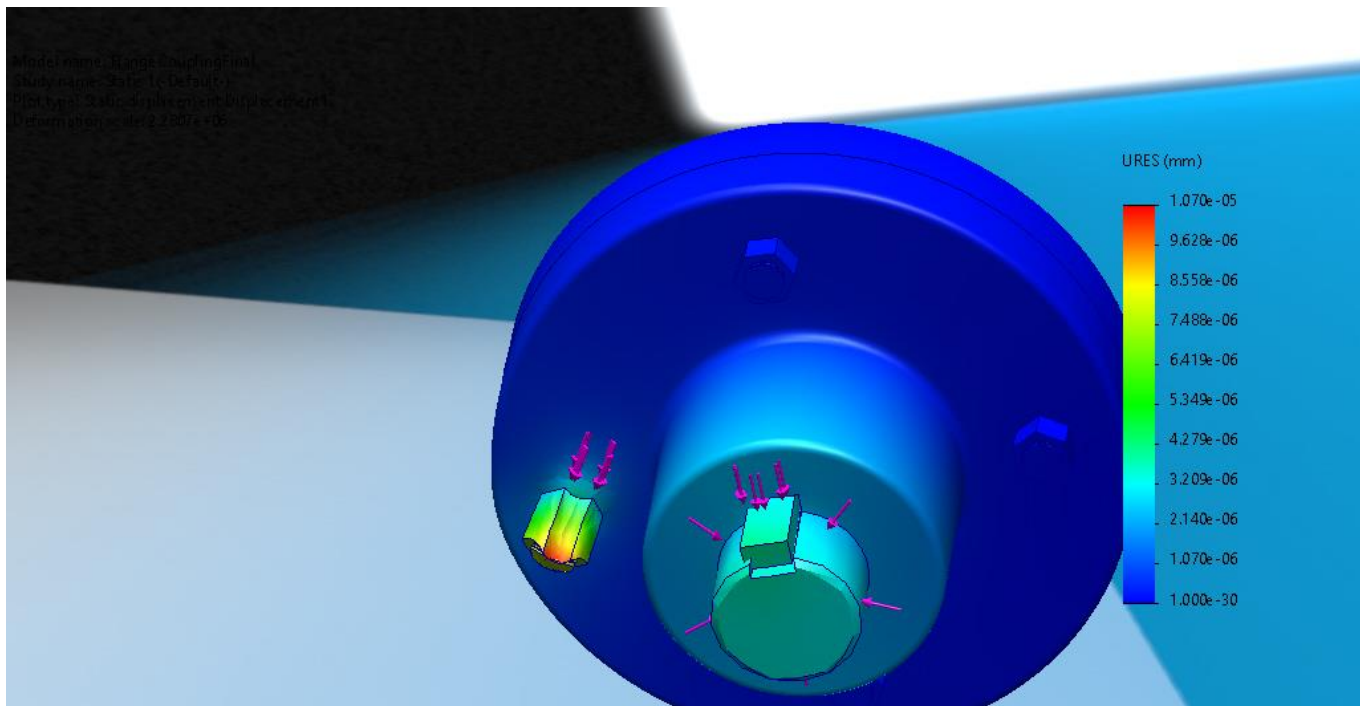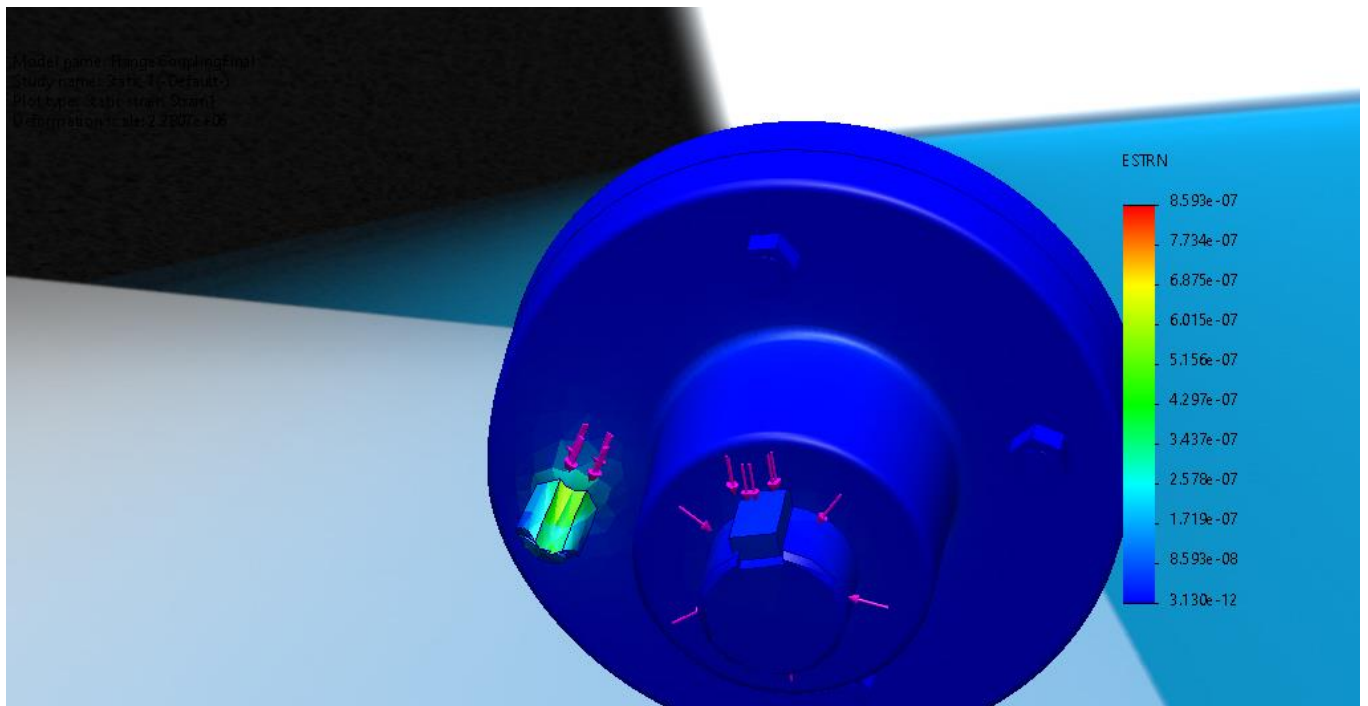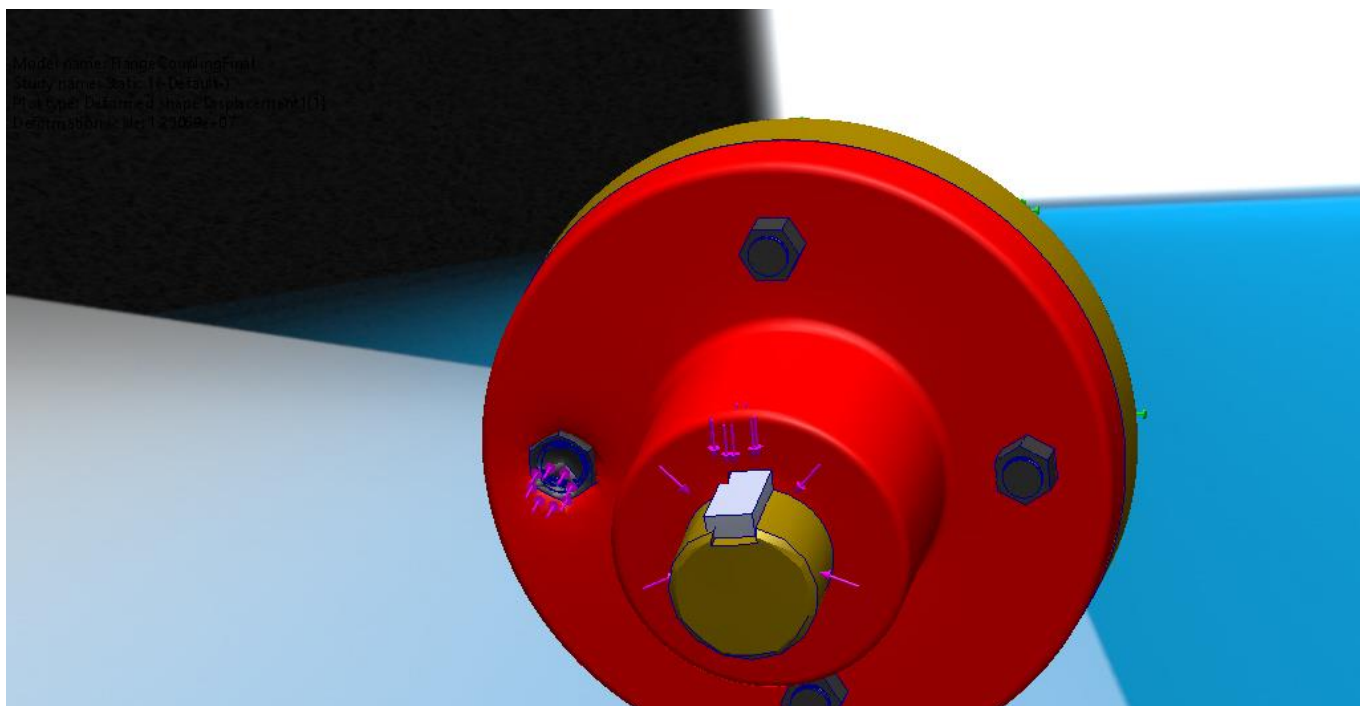
Image-3
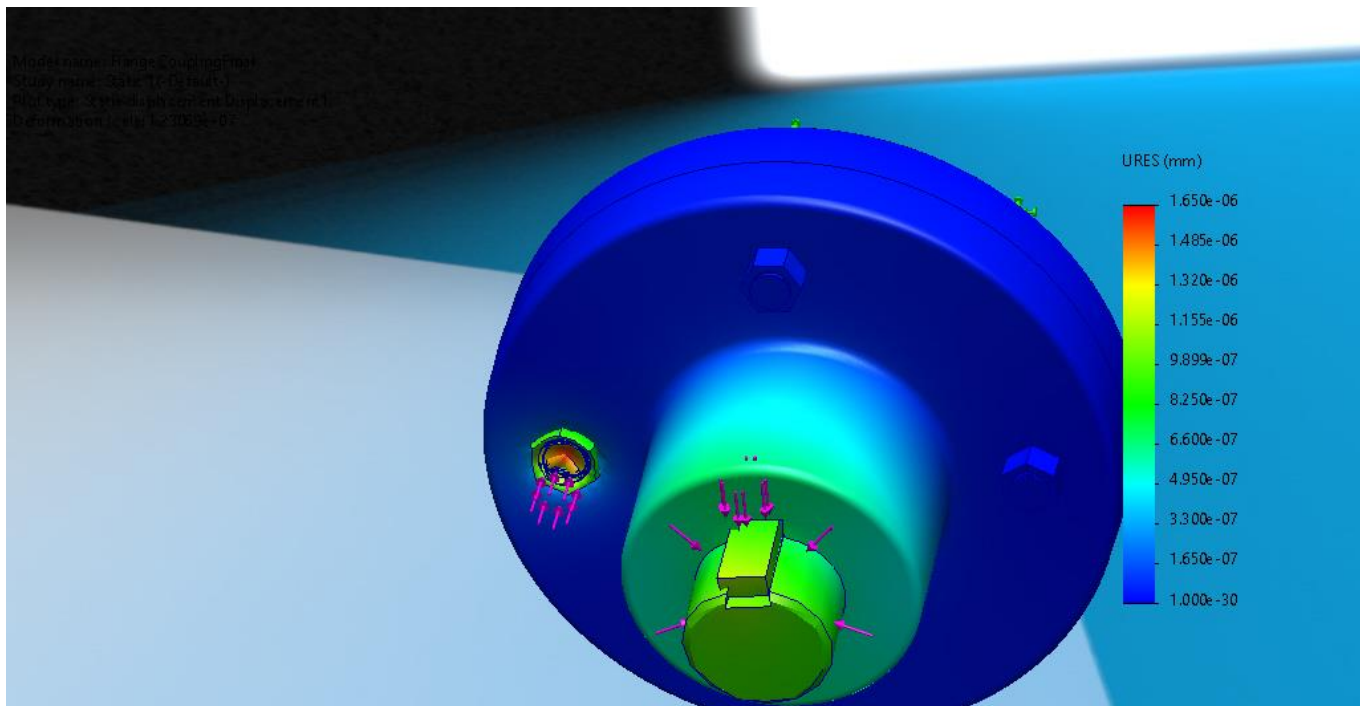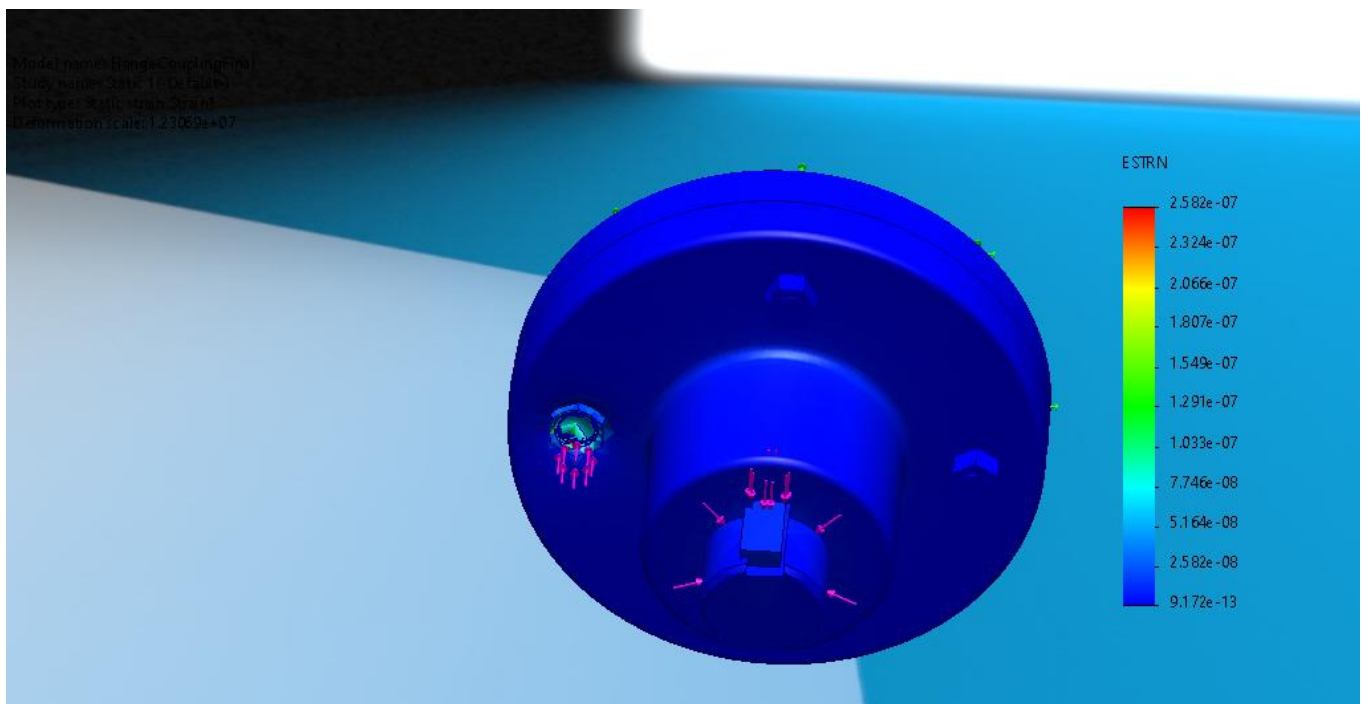
Image-4

Image-5

Image-6

Image-7

Image-8

Image-9

Model name: FlangeCouplingFinal
Study name: Static 1 (-Default-)
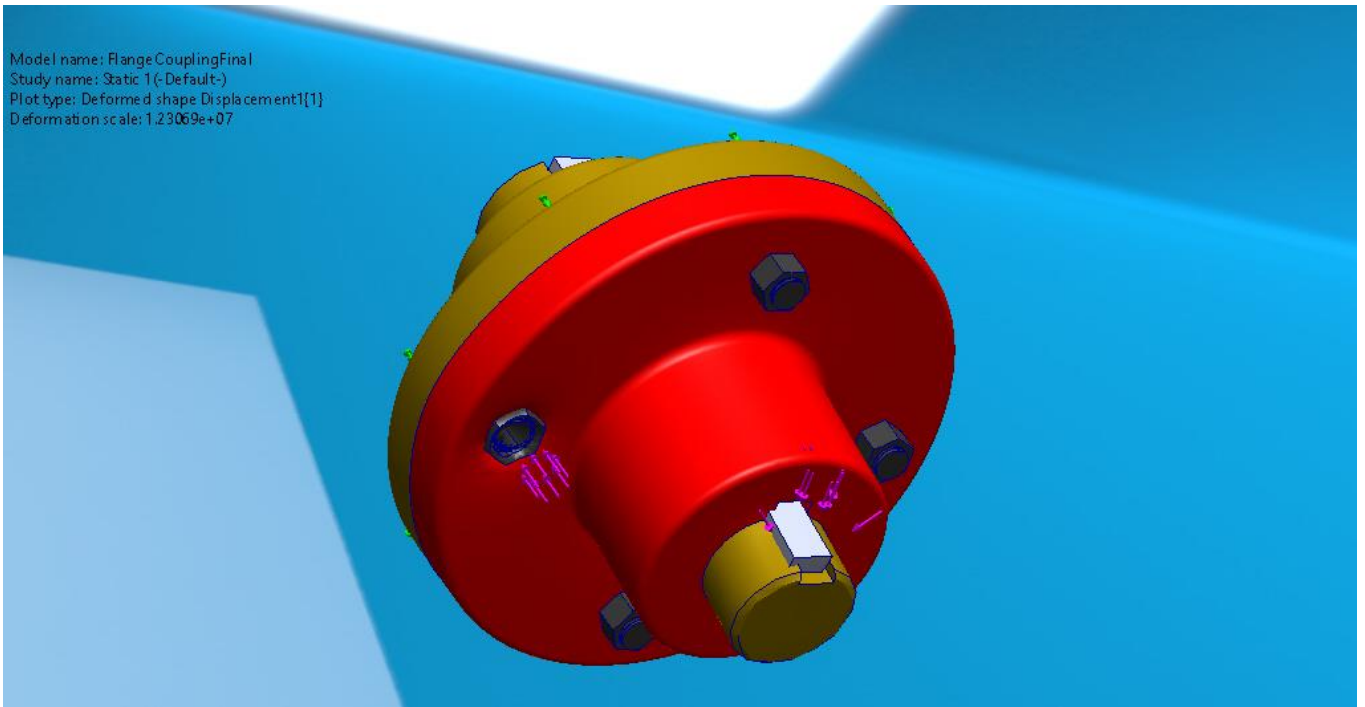Plot type: Deformed shape Displacement1{1}
Deformation scale: 1.23069e+07

Image-10

Conclusion

Direct load of 1N or 10N is applied at the end of the nut and it is evident that the nut's material is even carbon steel or insulated Mold Casting the nut fails . So the Nut is not suitable for the tangential load While the Flange and shaft bears the forces. All the simulations are done on SOLIDWORKS.