A Project Report

On

DESIGN AND ANALYSIS OF A DIESEL FUEL PUMP

Submitted to

Central Institute of Tool Design, Hyderabad

In Partial fulfilment of the requirements for awarding the Certificate of

MASTER CERTIFICATE COURSE IN CAD/CAM

NSQF BATCH – 28

By

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Balanagar, Hyderabad

Department of CAD/CAM

CERTIFICATE

Certified that this MCAD/CAM project entitled Design and Analysis of Diesel Fuel Pump carried by Mr.**BANOTH MAHESH**, Mr.**KUNCHE BALAJI** And Mr.**RAMBHA ESWAR PRASAD NAIDU** bearing roll numbers 02, 05 And 06 from NSQF batch 28 and partial fulfilment for the award of **MASTER CERTIFICATE COURSE IN CAD/CAM (MCAD/CAM)** at the Central Institute of Tool Design, Hyderabad for a period of Six months during the academic year 2017-18. It is certified that all corrections/suggestions indicated for internal assessment have been incorporated in the report deposited in the department library. This project report has been approved as it satisfies the academic requirements in respect of MCTE project prescribed for the said certification.

Signature of the faculty In- charge Signature of the HOD

Signature of the Examiner

1.

2.

ACKNOWLEDGEMENT

We would like to thank **Department of CAD/CAM**, **Central Institute of Tool Design**, **Balanagar**, **Hyderabad**, for allowing us to do this project and for giving us resources and support to work on this project.

We are highly indebted to Mr. **CHANDRA SEKHAR**, Principle Director of CITD, Hyderabad, who has given me this opportunity to undergo for project in Central Institute of Tool Design.

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We would also thank with immense gratitude**,** Mr. **K. BABU RAO**, Engineer grade1 of CAD/CAM department of CITD, Hyderabad, for the constant support and guidance for the fulfilment of the project.

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We are thankful to members of CAD/CAM department, CITD, Hyderabad, for their valuable support and guidance.

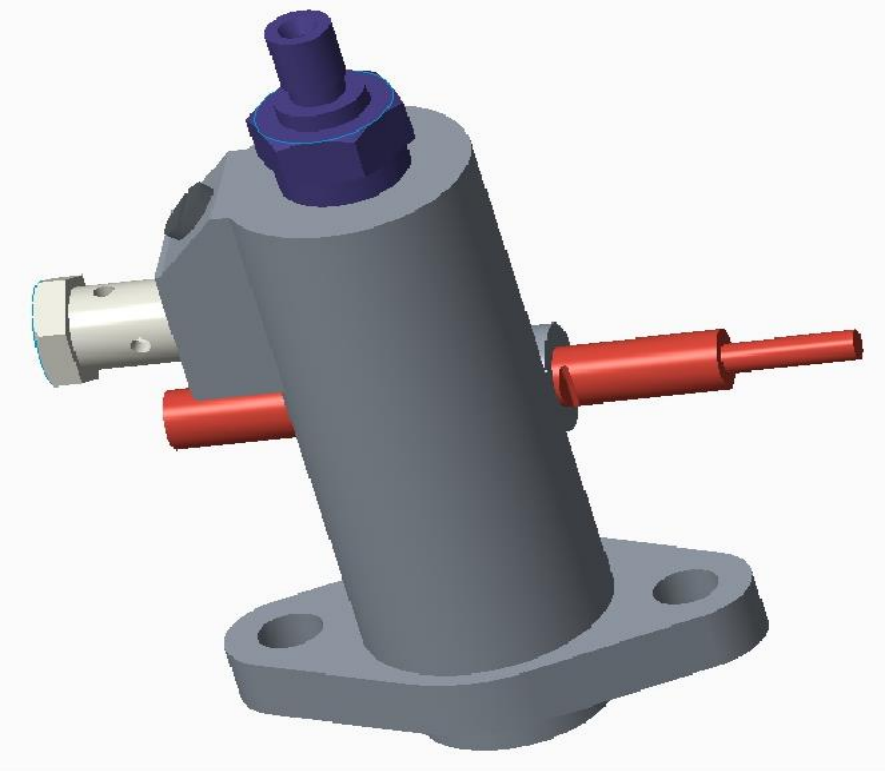
With a sense of achievement and satisfaction, as we reflect up on our project activity, we are filled with a deep sense of gratitude towards the few whose help and support was instrumental in the completion of the project Administrator.

ABSTRACT

Drone technology has skyrocketed over the past decade driving costs down and the number of potential applications up, one being agricultural crop monitoring. Normalized Difference Vegetation Index (NDVI) is an imaging technique used to visualize near infrared light, which happens to be a very good indicator of plant health and productivity. This project aims to explore the potential of Unmanned Aerial Vehicles (UAV's) using NDVI imaging for crop monitoring and assess the feasibility of the process by developing a UAV with a NDVI camera to create NDVI maps from the aerial crop images. These maps will be cross referenced with soil samples to check for proof of concept and accuracy. The final product will illustrate the feasibility, efficiency, and economic benefits of UAV NDVI crop imaging and offer a solution to the dated and tedious process of crop monitoring that is currently physically walking the field. A quad copter can achieve vertical flight in a stable manner and be used to monitor or collect data in a specific region such as Loading a mass. Technological advances have reduced the cost and increase the performance of the low power microcontrollers that allowed the general public to develop their own quad copter. The goal of this project is to build, modify, and improve an existing quad copter kit to obtain stable flight, gather and store GPS data, and perform auto commands, such as auto-landing. The project used an Aero quad quad copter kit that included a frame, motors, electronic speed controllers, Arduino Mega development board, and sensor boards and used with the provided Aero quad software. Batteries, a transmitter, a receiver, a GPS module, and a micro SD card adaptor were interfaced with the kit. The aero quad software was modified to properly interface the components with the quadcopter kit. Individual components were tested and verified to work properly. Calibration and tuning of the PID controller was done to obtain proper stabilization on each axis using custom PID test benches. Currently, the quadcopter can properly stabilize itself, determine its GPS location, and store and log data. Most of the goals in this project have been achieved, resulting in a stable and maneuverable quadcopter.

INTRODUCTION

DIESEL FUEL PUMP ASSEMBLY



- ## Problem Definition

  Make a model, assembly and automated drawing for a diesel fuel pump.

- ## What is a Diesel Fuel Pump

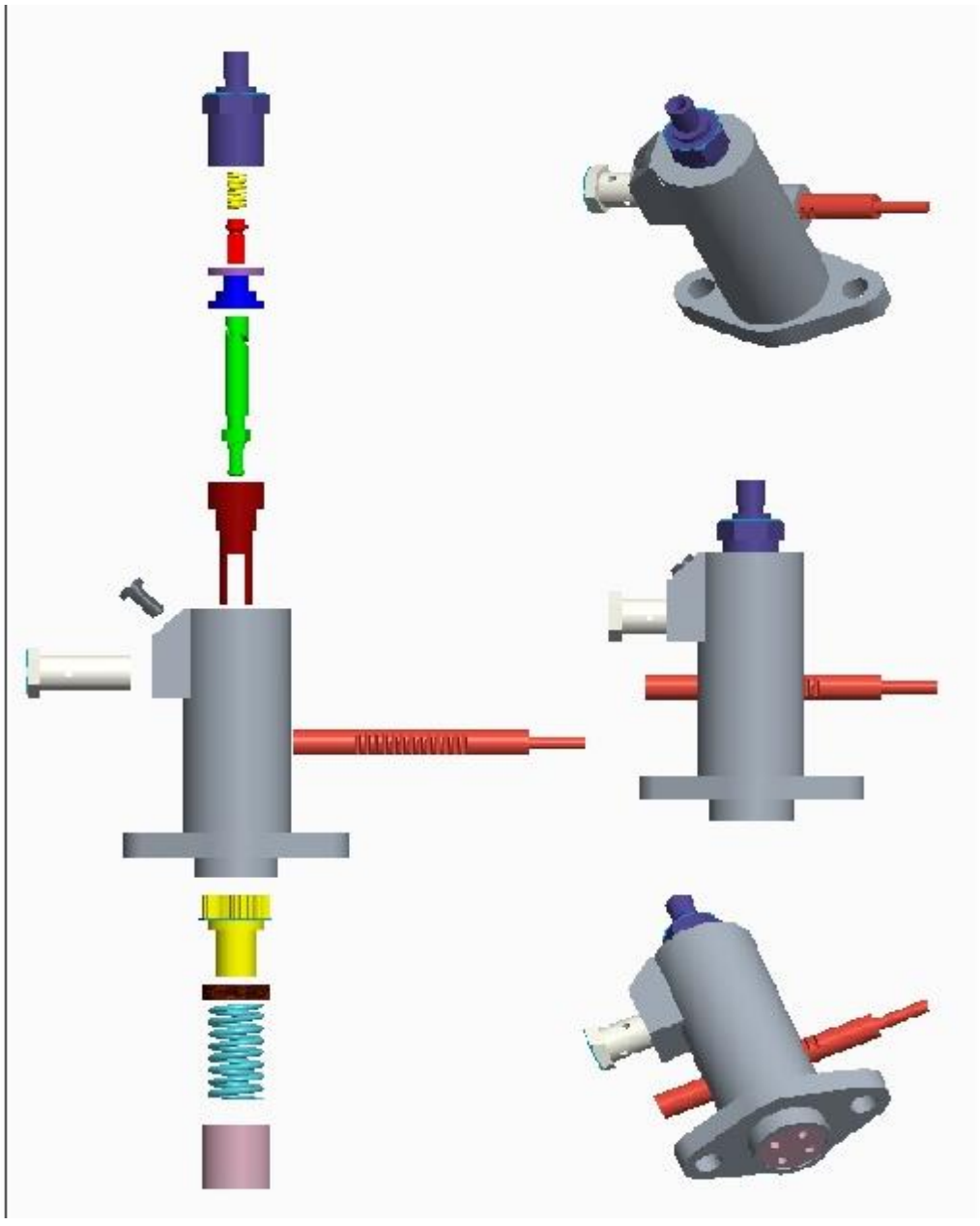
  The diesel fuel pump is the heart of the diesel engine delivering fuel to the diesel engine. Precisely delivered fuel maintains a rhythm or timing that keeps the engine running smooth. Simultaneously, the pump also controls the amount of fuel needed to gain the desired power. A fuel pump has two main functions to perform:

  1. It must start the fuel injection at the proper crank angle, late in the compression stroke of the engine,and
  2. It must force through the nozzle, into the cylinder, the exact quantity of the fuel needed to produce the desired power

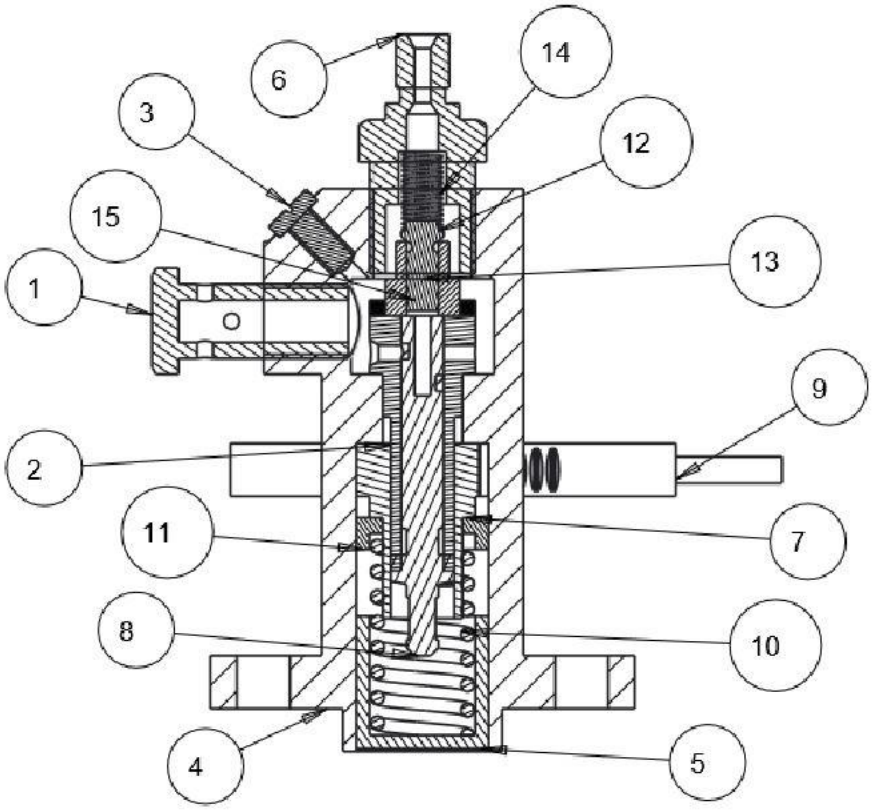
- ## Working of a Diesel Fuel Pump

In diesel engines, fuel is supplied at high pressure and quantity is regulated according to the load and speed of the engine. It has a precisely ground helical grooved plunger reciprocating in a ground barrel with the help of a cam. The plunger can be rotated in the barrel with the help of rack and pinion arrangement, to change the effective stroke of the plunger due to its helical groove also called a control edge. Both rack and pinion are positioned in the body. The plunger is reciprocated by a cam follower operated by a cam shaft and is returned by a return spring. The delivery valve above the plunger is responsible for the monitoring of the fuel supplied to the injector. It sits above the plunger on a valve seat. When the pressure in the gallery of the pump increases, the valve is pushed above and the fuel is delivered to the injector and when the pressure drops, the valve sits back in its position thus restricting the flow of fuel.

- ## Exploded View of the Diesel Fuel Pump:



- **X-Section view of assembly along with the Bill of Materials:**



S.No.	PART NAME	QTY	MATERIAL
1	BANJO_BOLT	1	MILD STEEL
2	BARELL_NEW	1	CAST STEEL
3	BLEED_SCREW	1	MILD STEEL
4	BODY	1	CAST IRON
5	CAM_FOLLOWER	1	C. STEEL
6	OUTLET_NIPPLE	1	MILD STEEL
7	PINION	1	CAST STEEL
8	PLUNGER	1	CAST STEEL
9	RACK_CUT	1	C. STEEL
10	RETURN_SPRING	1	SP. STEEL
11	SPRING_SEAT	1	MILD STEEL
12	VALVE	1	MILD STEEL
13	VALVE_SEAT	1	MILD STEEL
14	VALVE_SPRING	1	SP.S.
15	WASHER	1	COPPER

Drawing 21: Bills of Material

CHAPTER – 4
SOFTWARE USED IN THE PROJECT

4.1 Software

CAD Softwares are used to virtually visualize a component, before it is being manufactured. Now a day 's there are so many modeling software's available in the market, for example AUTOCAD, Pro/E or SOLID WORKS, CATIA, Unigraphics & solid woks etc. Each software has its own importance, based on user interface, in-built modules and so on. In this project, we used Solid works software for modeling the component. Simulation and to extracting the core and cavity.

CREO (OR) PRO-E

CREO is a suite of design software supporting product design developed by Dassault systems. It consists of apps, each with a distinct set of capabilities for a user role within product development. It runs on MS-Windows and provides apps for 2D design. 3D CAD feature modeling, 3D direct modeling, finite Element Analysis and simulation, schematic design, technical illustrations, and viewing and visualization.

works consists of the nine apps. The most important among them are discussed below:

Creo is a 3D design app for designing.

1. Creo is a standalone design app for interact directly with the geometry using a direct modeling approach.
2. Creo is the analyst app used for structural and thermal simulation. In this app consists of flow simulation also.
3. Creo drawing is a design app for engineers who want to create concept layout
4. Work in 2D, with the intention of ultimately evolving the design to 3D.
5. Creo sketch is a design app to quickly freehand a design idea in 2D.

is a 3D design app for designing. The reason of using among all the list of software is the easy to understand user interface and also because of the ease of extracting the core and cavity with the help of manufacturing module with minimum steps. Thus, we could create and design the component and mould with case and by saving a lot of time an effort.

This app of the creo/pro-e software package consists of different modules based on the area of software usage and are as follows:

a) Sketch
b) Part
c) Assembly
d) Drawing
e) Simulation
f) Flow simulation

g) Sheet metal

h) Mould tools

i) Surface

j) Mechanism

Along with these modules, there are also sub-types in each module. For example, in part module there are Solid, Composite, Sheet metal and bulk.

4.3 Ansys

Ansys is general purpose finite element analysis (FEA) software package. Finite element numerical method of a deconstructing a complex system into very small pieces (user designated size) called element. The software implements equations that governs the behaviour of these elements and solver them all; creating a comprehensive explanation of how the system acts as a whole. These results than can be presented in tabulate or graphical forms. This type of analysis is typically used for the designed and optimization of system for too complex to analyse by hand. Systems that make fir into this category are too complex due to their geometry, or governing equations.

Ansys is the standard FEA teaching tool within the engineering department at many colleges. Ansys is also used in civil and Electrical engineering, as well as physics and chemistry department.

Ansys provide a cost effective way to explore the performance of the products and processes in a virtual environment. This type of product development is termed as virtual Prototyping. With virtual prototyping techniques users can iterate various scenarios to optimize the product long before manufacturing is started. This

enables a reduction in level of risk, And in the cost of ineffective designs. The multifaceted nature of Ansys also provides a means of ensure that users are able to see the effect of designs on the whole behaviour of the product, be it electromagnetic, thermal, mechanical etc

GENERIC STEPS TO SOLVING ANY PROBLEM IN ANSYS

Like solving any problem analytically you need to define (1) your solution domain, (2) the physical model, (3) boundary conditions and (4) the physical properties. You then solve the problem and present the results.

In numerical methods, the main difference in an extra step called mesh generation. This is the step that divides the complex model in to small elements that become soluble in an otherwise too complex situation. Below describes the process in terminology. Slightly more attune too the software.

BUILD GEOMETRY Construct a 2 or 3 –D representation of the object to be modeled and tested using the work plane coordinates system in Ansys.

DEFINE MATERIAL PROPERTIES Now that the part exists, define a library of necessary materials that composed an object (or project) being modelled. This includes thermal and mechanical properties.

GENERATE MESH At this point Ansys understands the makeup of the part. Now define how the model system should be broken down into finite pieces.

APPLY PRESSURE Once the system is fully designed, the last task is to burden the system with constraints, such as physical loadings or boundary conditions.

OBTAIN SOLUTION This is actually a step because Ansys need to understand within what state (steady state, transient… etc.) The problem must be solved.

PRESENT THE RESULTS After the solution has been obtained there are many ways to present Ansys results, Choose from many options such as tables, graphs and contour lots

SPECIFIC CAPABILITIES OF ANSYS

STRUCTURAL

Structural analysis is probably the most common application of the finite element method is as it implies bridges and buildings, naval, aeronautical and mechanical structure such as ship halls, air craft's and machines housing as well as mechanical components such as pistons, machine parts and tools. Static analysis issued to determine displacement, stresses etc. under static loading conditions

ANSYS can compute both linear and non-linear static analysis. Non linearity can include plasticity, stress stiffening, large deflection, large strain, hyper elasticity, contact surface and creep.

STATIC ANALYSIS

A static analysis calculates the effects of steady loading conditions on a structure, while ignoring inertia and damping effects, such as those caused by time varying loads. A static analysis can however, include steady inertia loads (such as gravity and rotational velocity), and time varying loads that can be approximately as static equivalent loads (such as the static equivalent wind and seismic loads commonly defined in many building codes).

THERMAL ANALYSIS

A thermal analysis calculates the temperature distribution and related thermal quantities in a system component. Typical thermal quantities of interest are:

- The temperature distributions
- The amount of heat lost or gained
- Thermal gradients
- Thermal fluxes.

Thermal simulations play an important role in design of many engineering applications, including internal combustion engines, turbines, heat exchangers, piping system & electronic components. In many cases, engineers follow a thermal

analysis with a stress analysis to calculate thermal stresses (i.e. stresses caused by thermal expansions or contractions).

Modes of heat transfer

There are 3 modes of heat transfer they are:

- Conduction
- Convection
- Radiation

Conduction: Conduction refers to the transfer of heat between two solid bodies or two parts of the same solid body.

The basic law which governs the heat transfer due to conduction is given by FOURIER'S LAW which states the rate of heat transfer is linearly proportional to the temperature gradient.

$$q \alpha dt/dx \quad \Rightarrow q = -K\, dt/dx$$

Convection: Convection is a mode of heat transfer involving mass moment of fluids (liquid or gases). The law which governs the heat transfer due to convection is given by Newton's law of cooling.

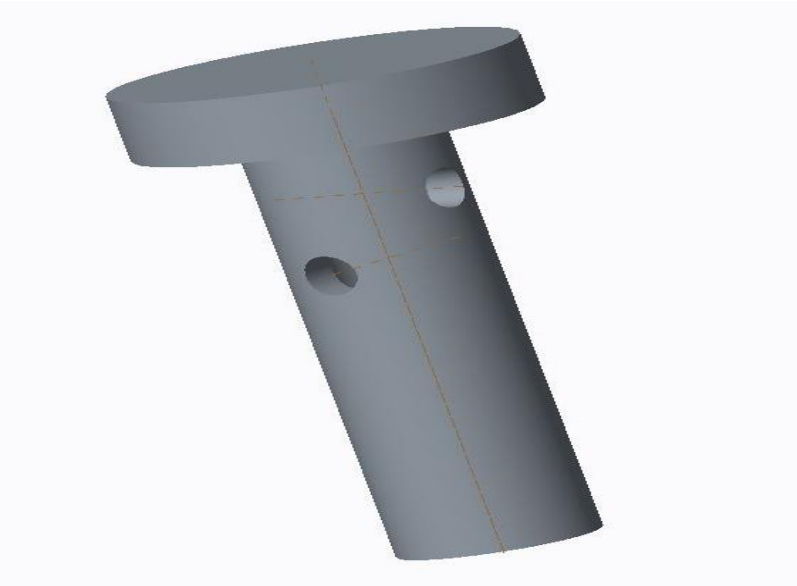
Radiation: Radiation is a mode of heat transfer between two bodies isolated in a vacuum. All bodies radiate heat energy. The rate at which energy is radiated by black body at which energy is radiated by black body at the absolute temperature is given by STEFAN BOLTZMAN LAW.

The states the rate at which energy is radiated by black body through a unit surface area is proportional to the fourth power of absolute temperature.

$$\text{i.e } Q \alpha \sigma A T^4$$

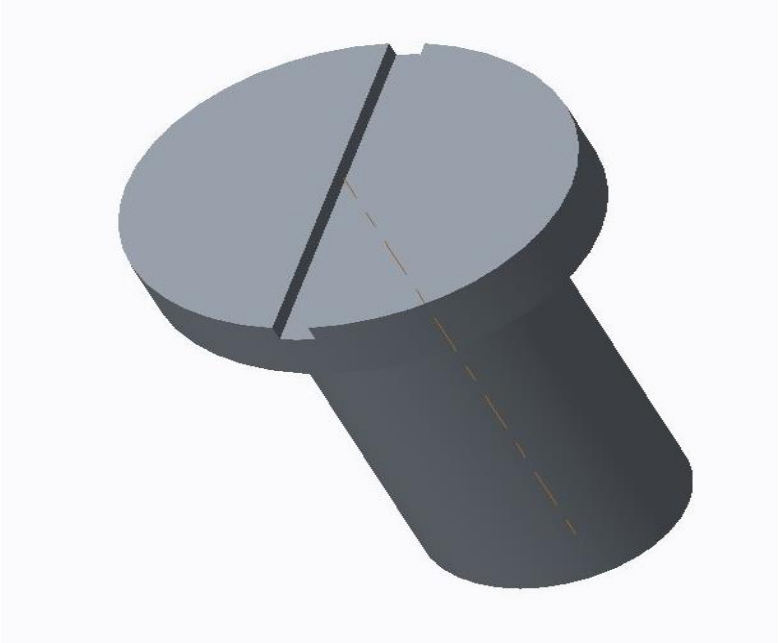
Parts Of Diesel Fuel Pump

1.BANJO BOLT

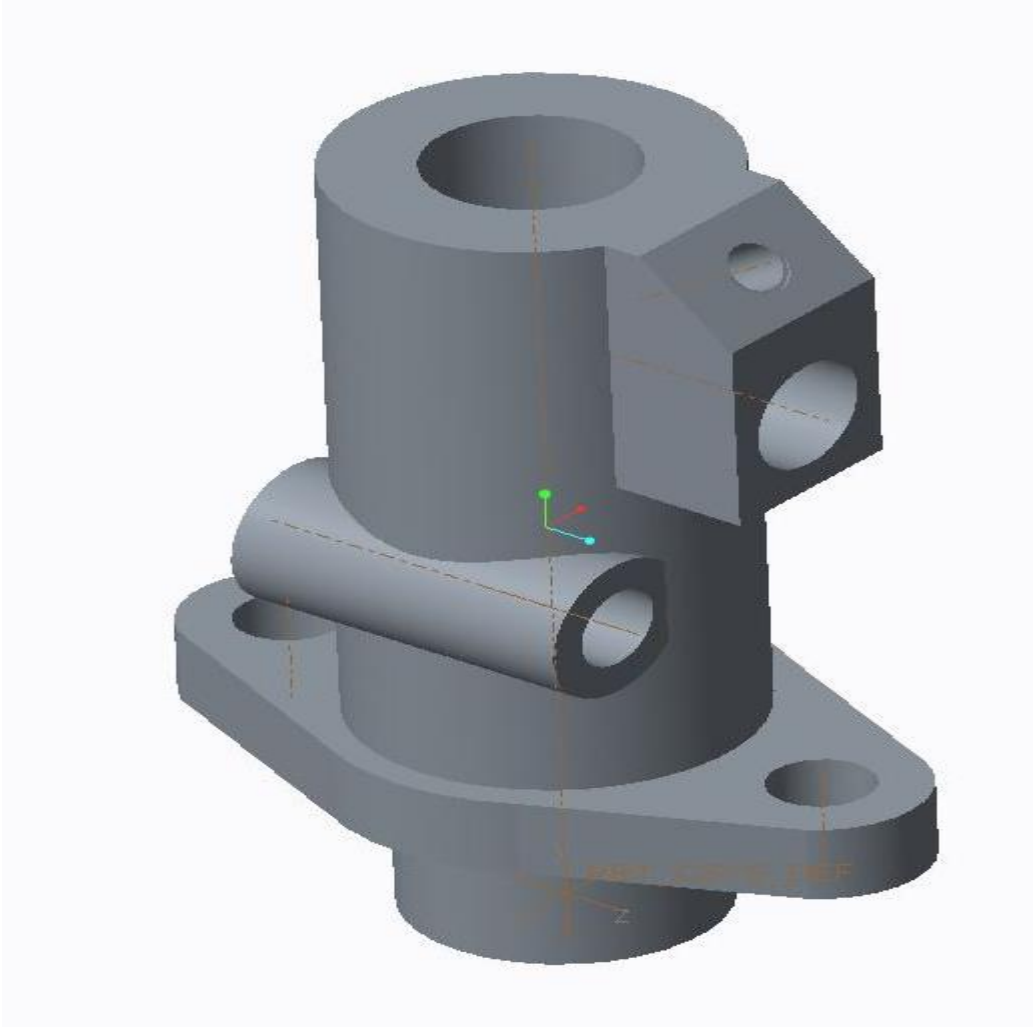


2.BARREL

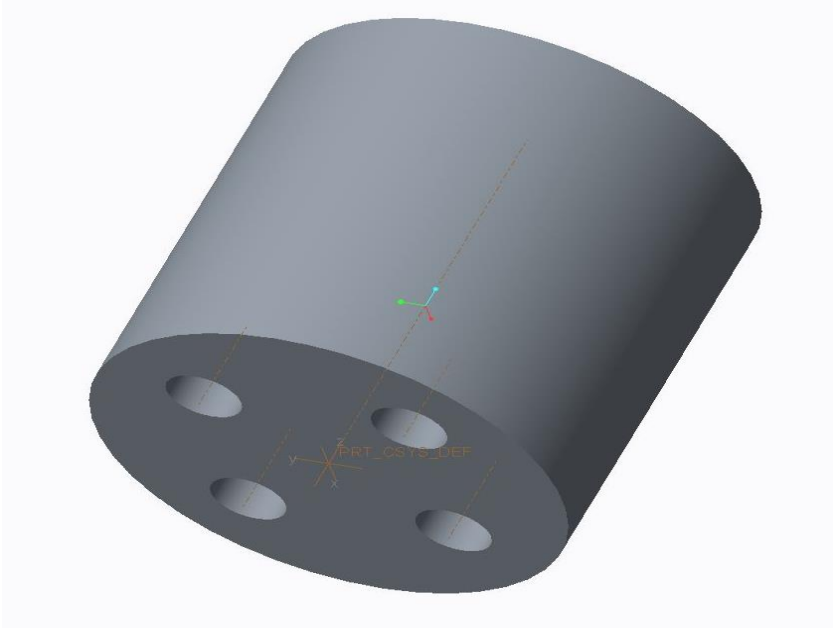
3.BLEED SCREW



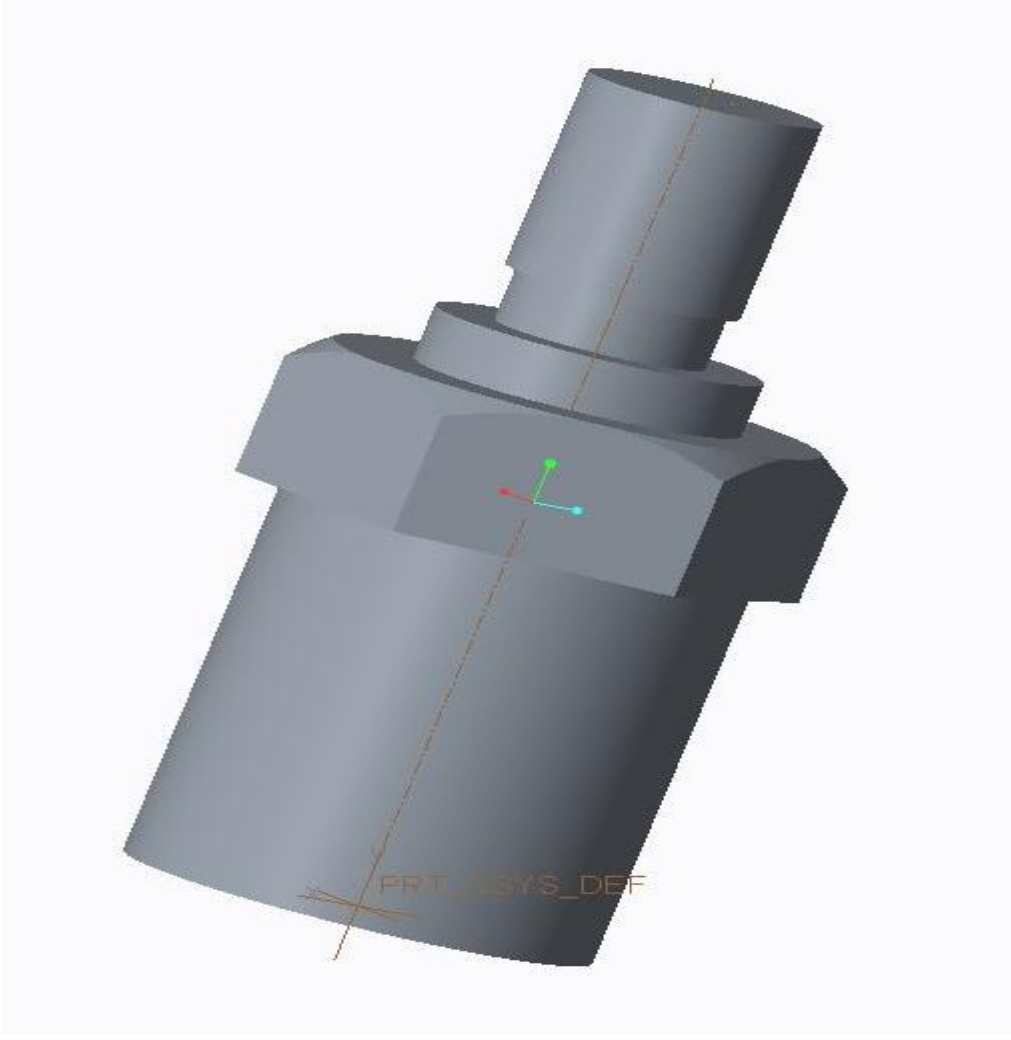
4.BODY



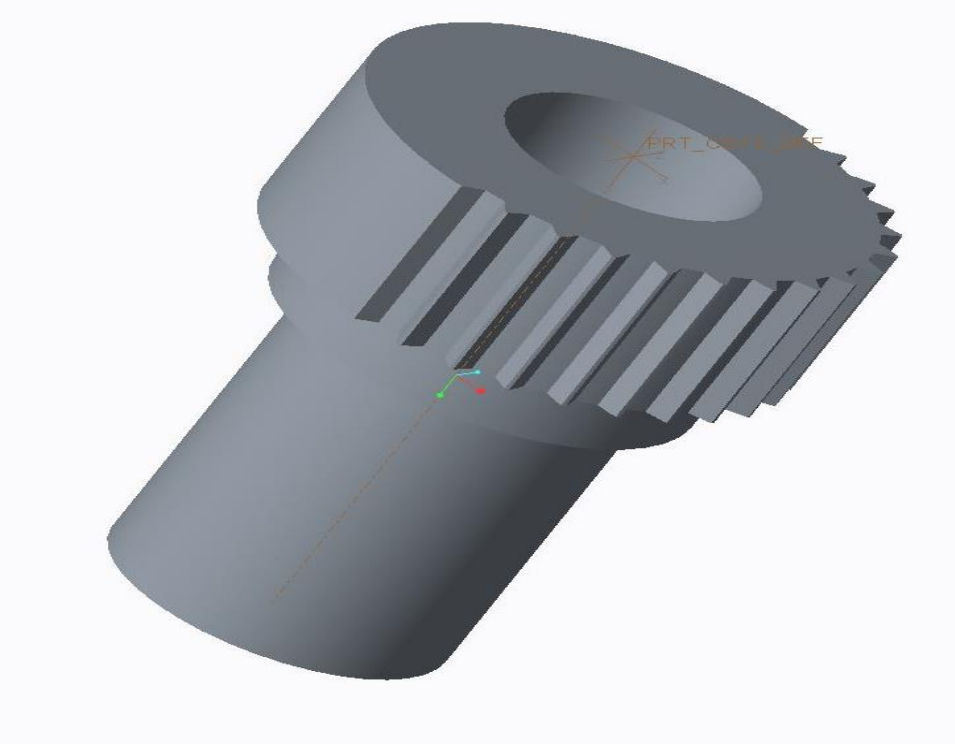
5.CAM FOLLOWER



6.OUTLET NIPPLE



7.PINION

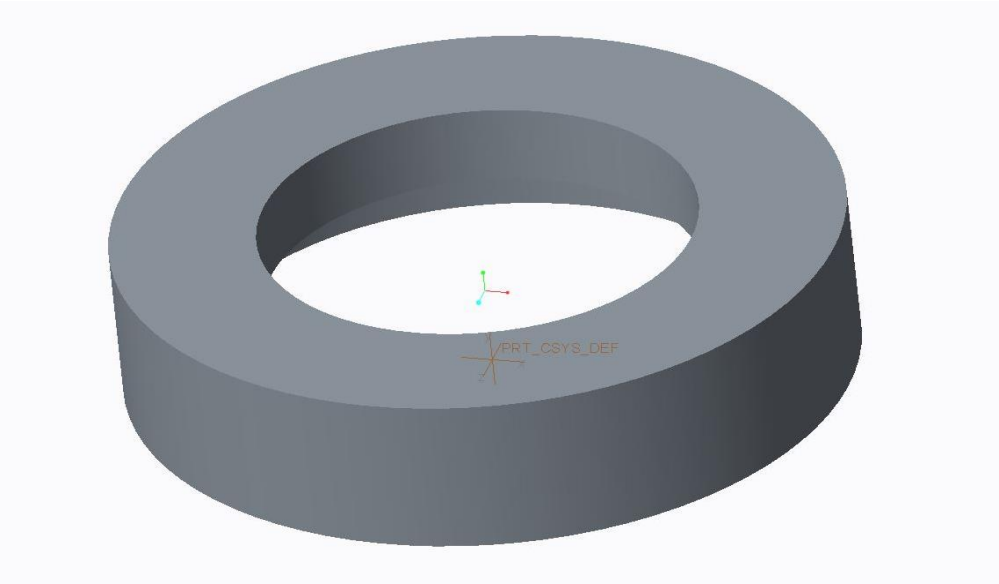


8.PLUNGER

9.RACK

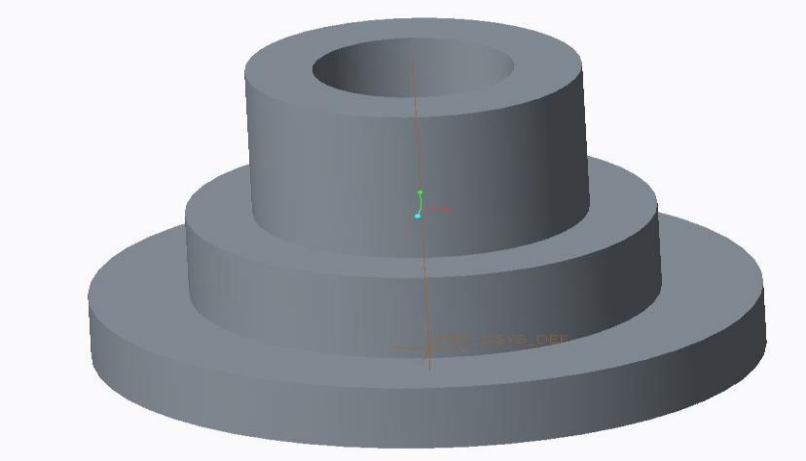
10.RETURN SPRING

11.SPRING SEAT



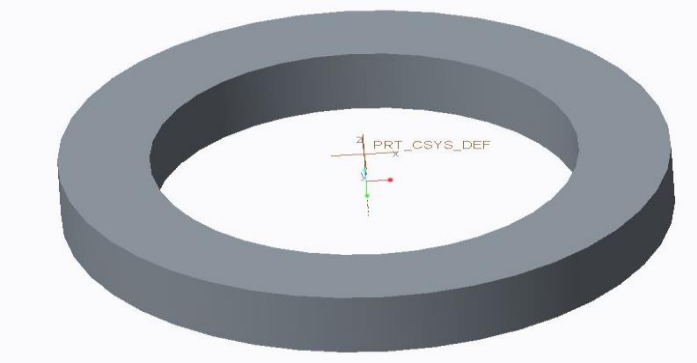
12.VALVE

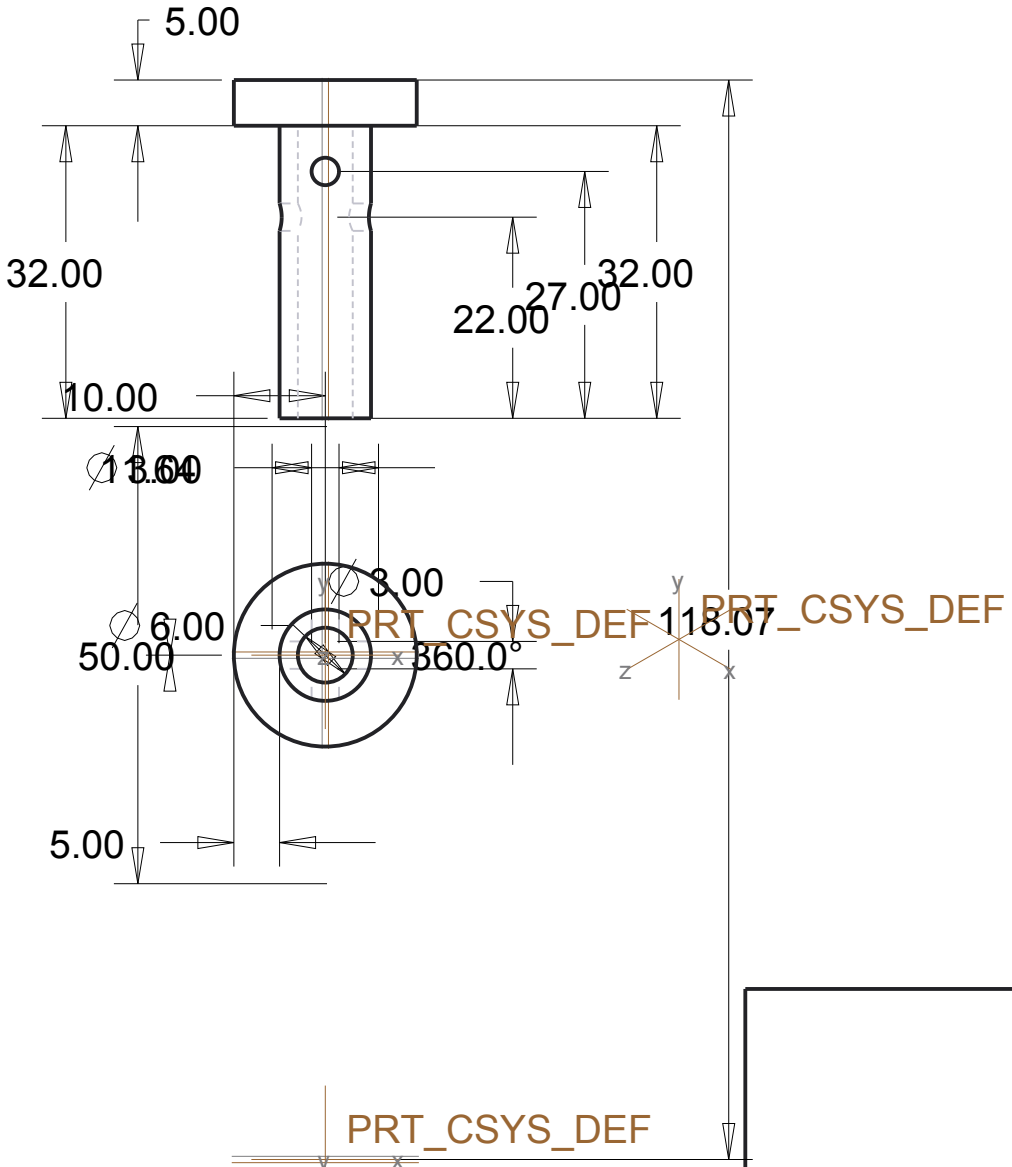
13.VALVE SEAT



14.SPRING

15.WASHER

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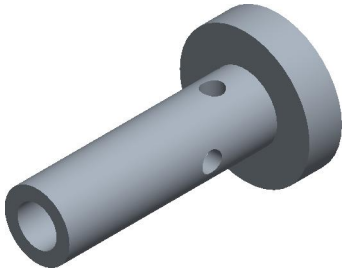
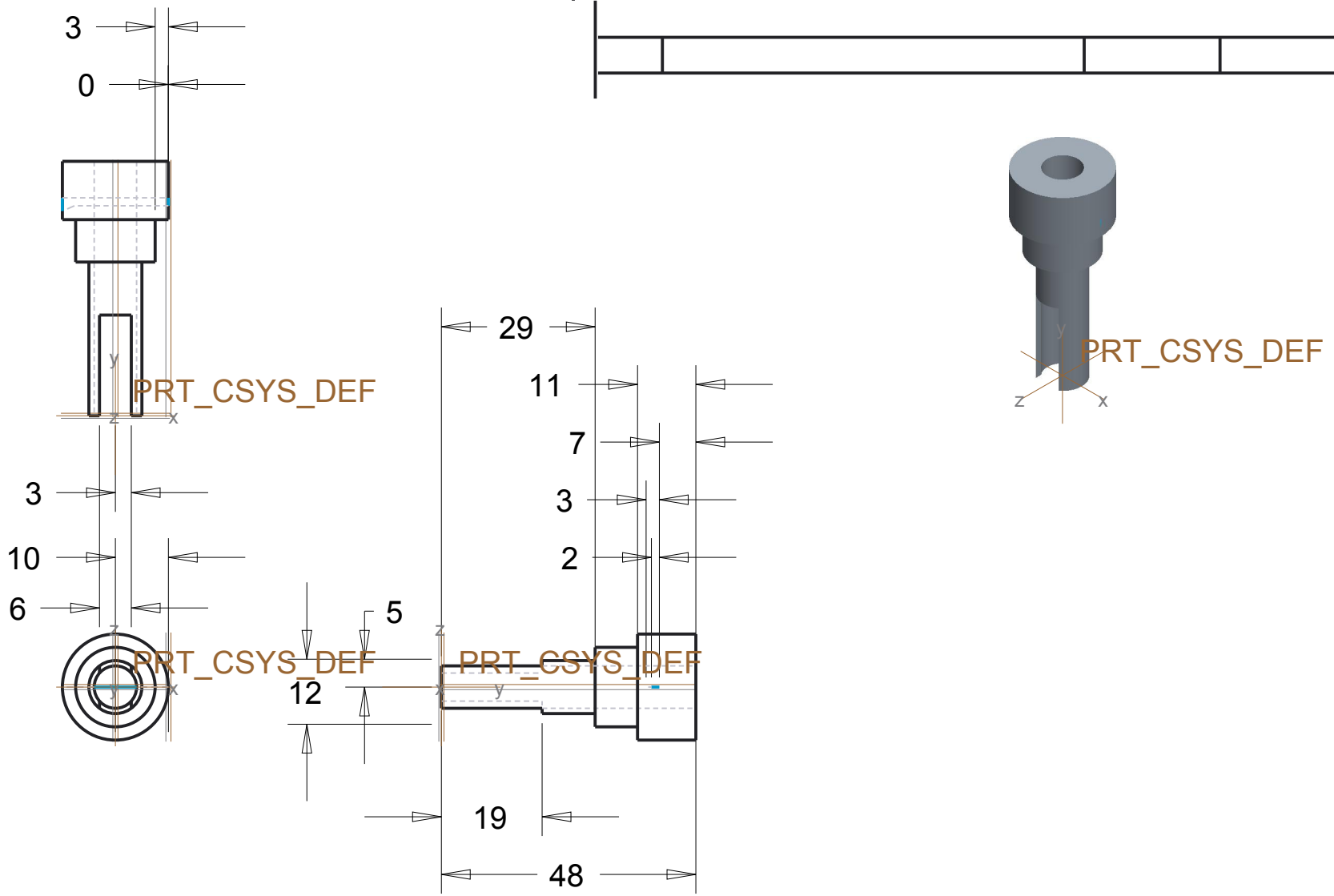


1.BANJO BOLT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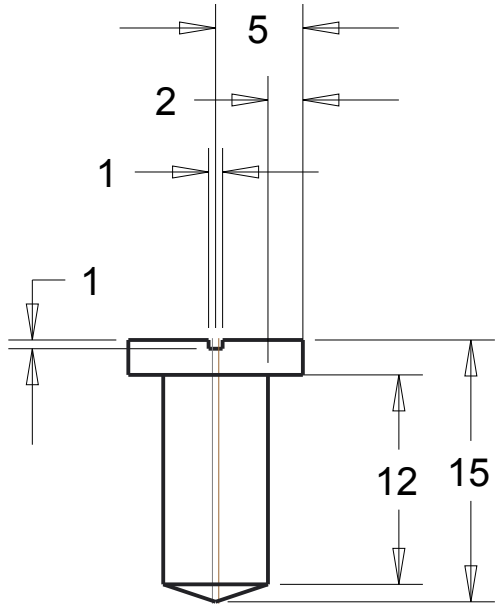
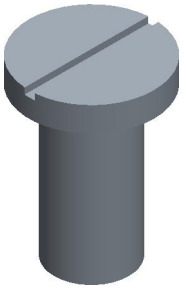
2.BARREL





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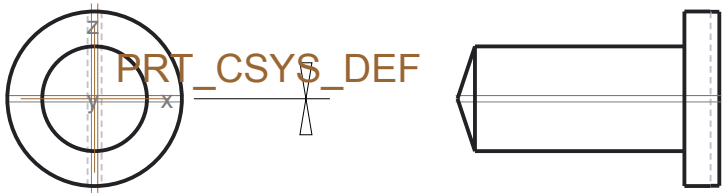

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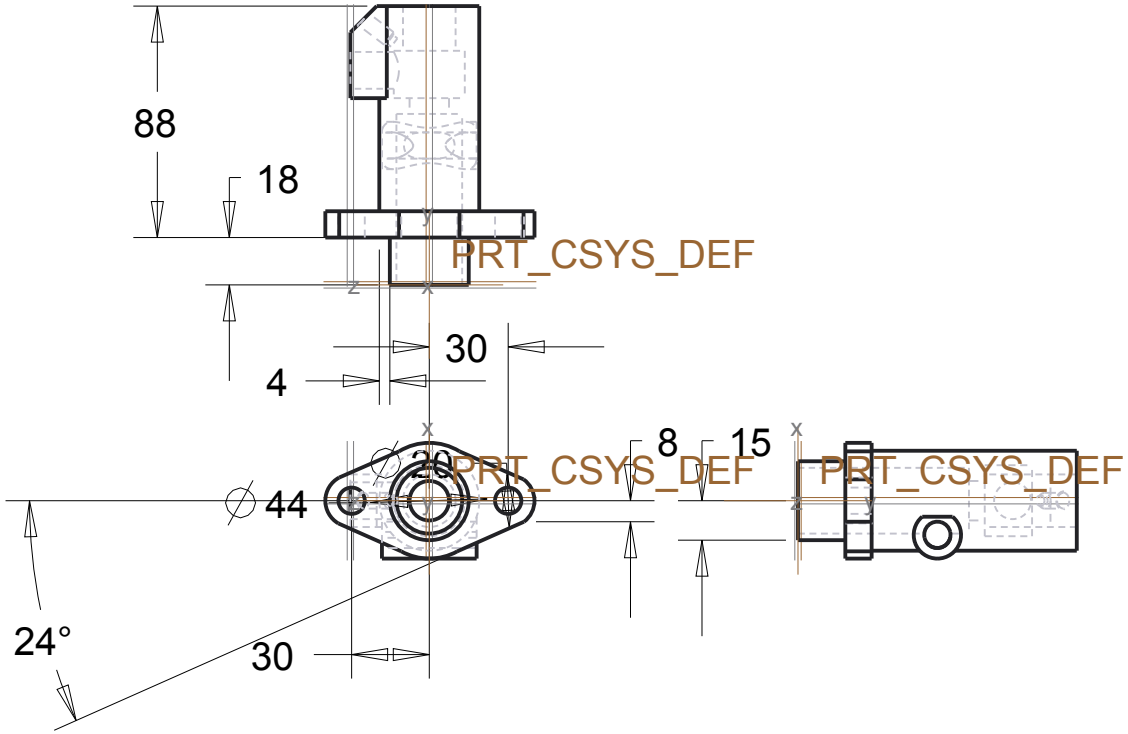
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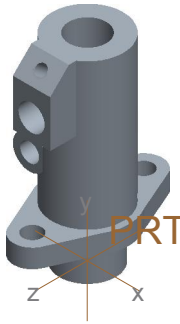
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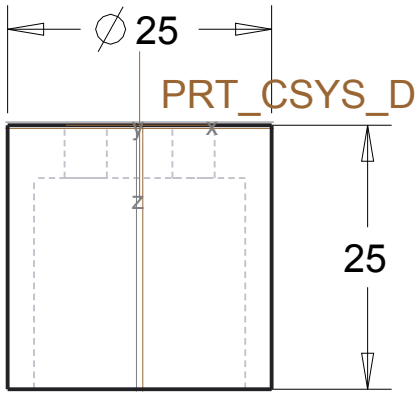

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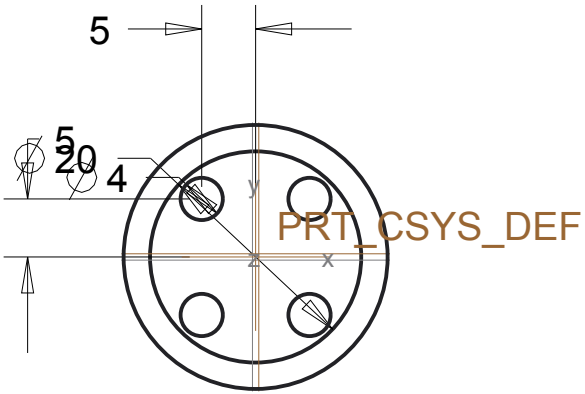

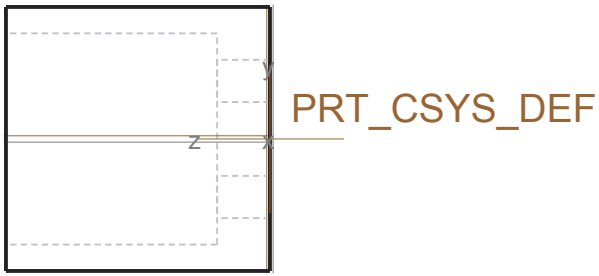

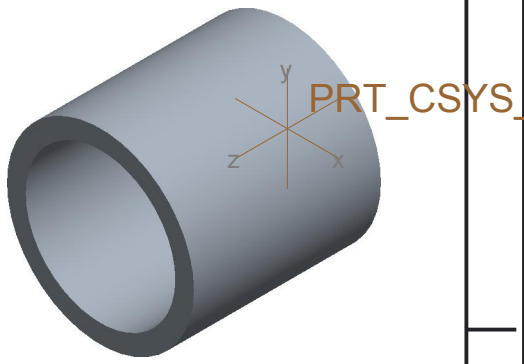

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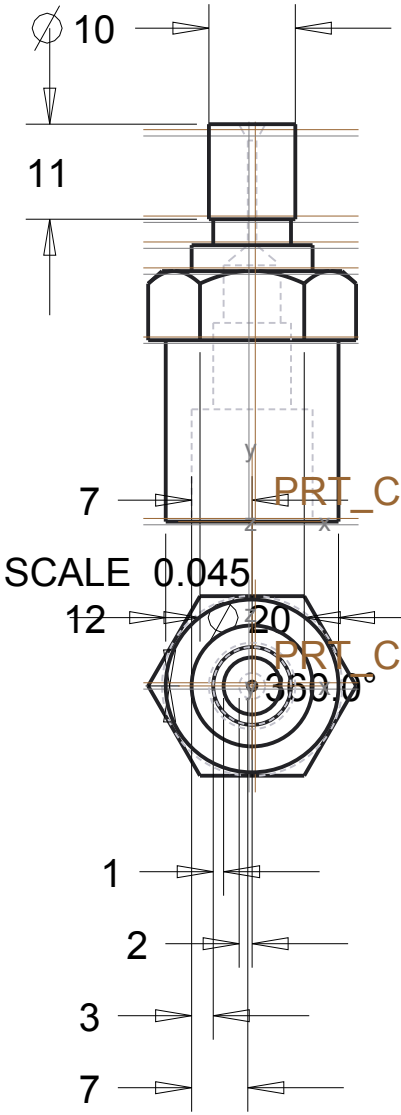

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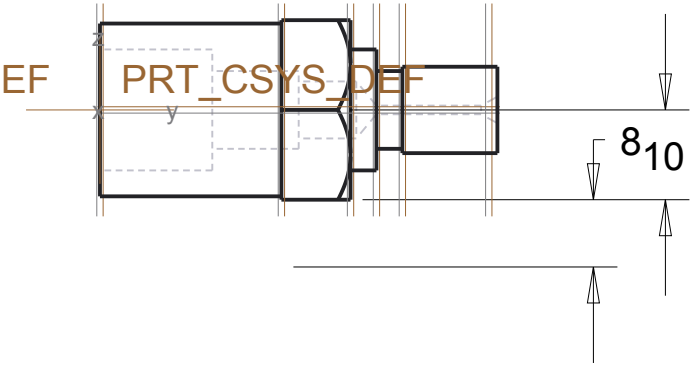
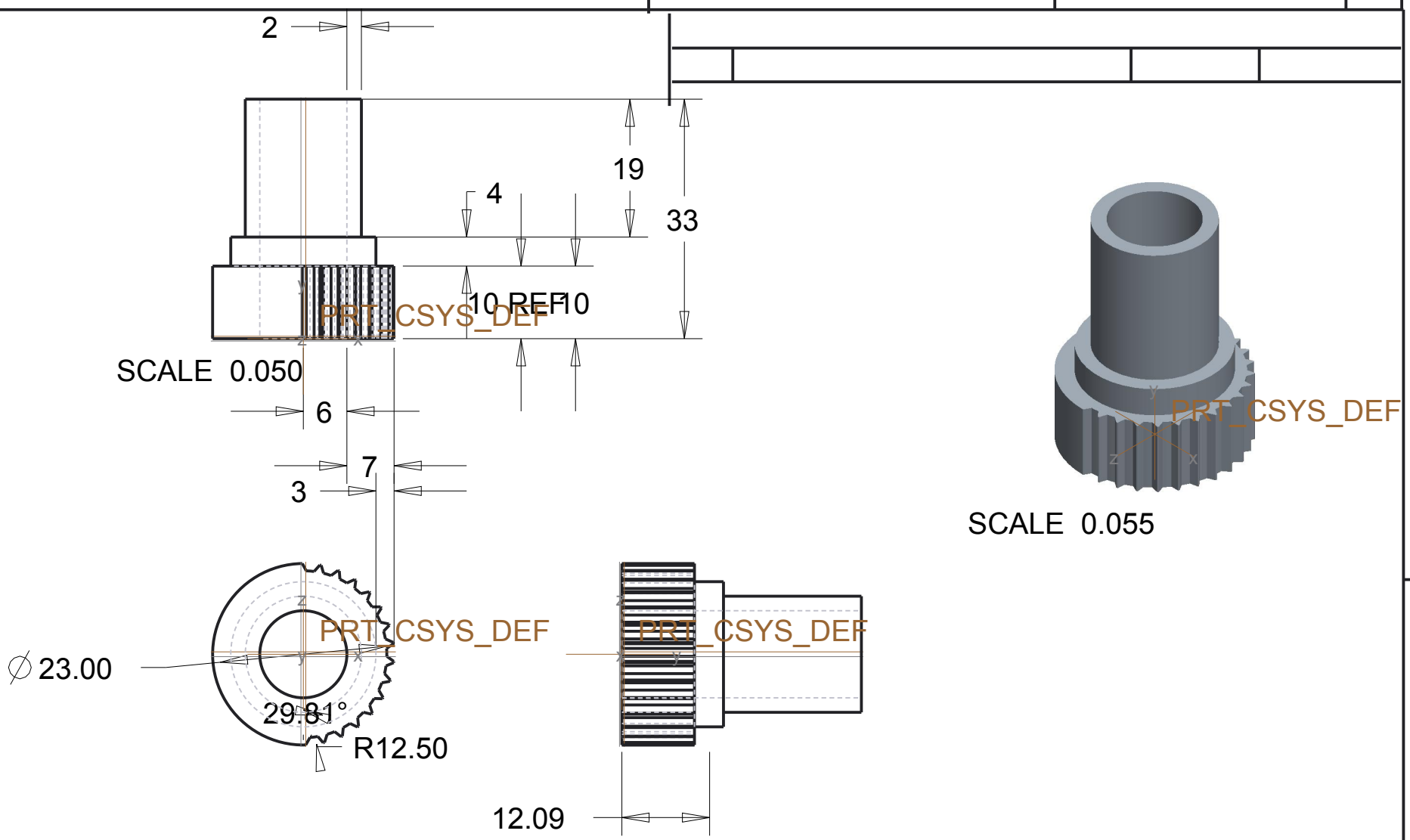


6 OUTLET NIPPLE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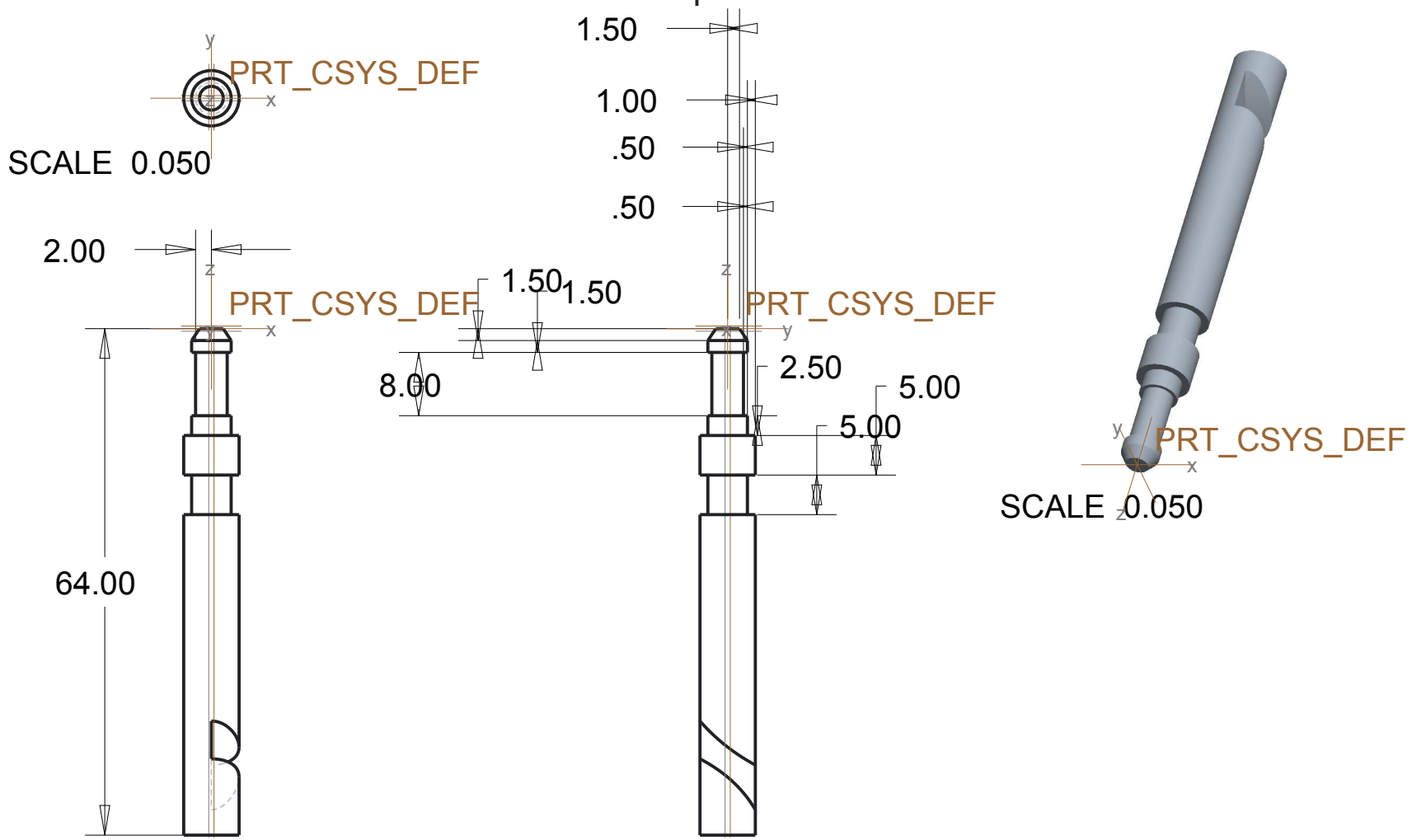
7.PINION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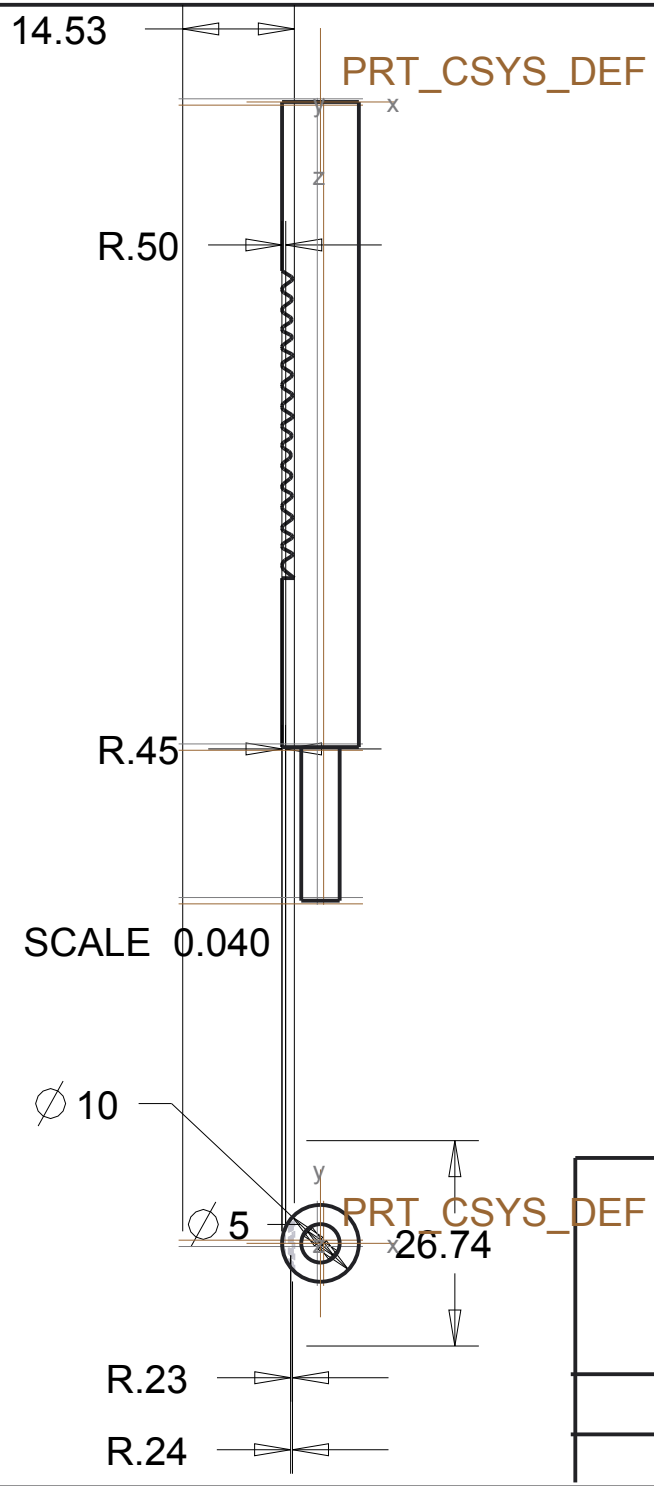
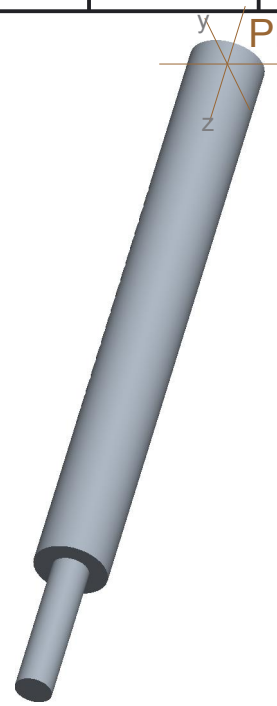
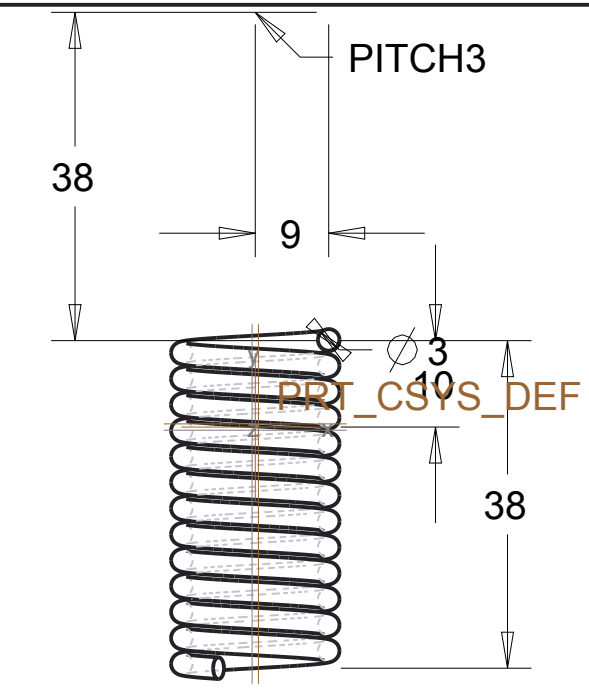
8.plunger





SCALE 0.040

9.RACK



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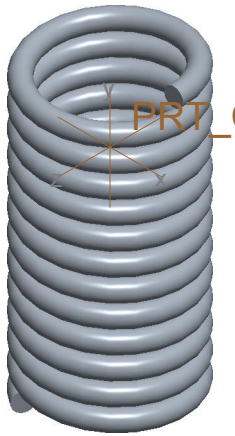
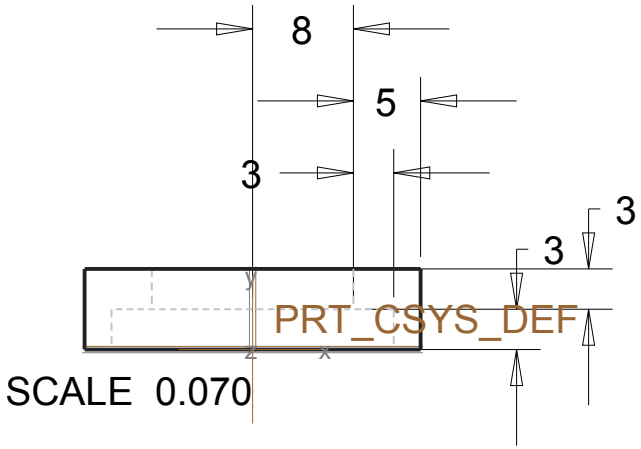


SCALE 0.055

10.RETURN SPRING



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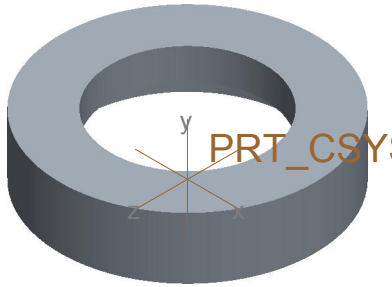

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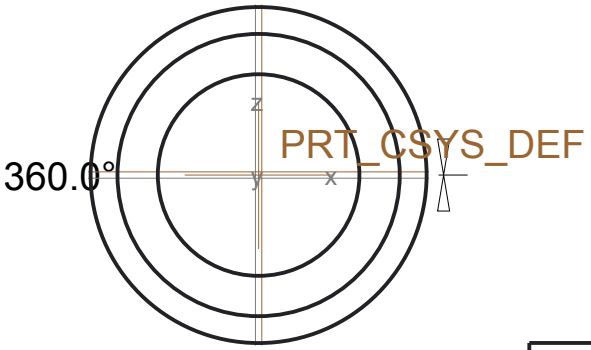


11.SPRING SEAT

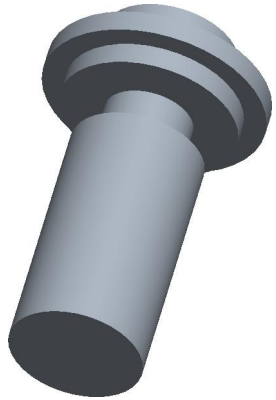
PRT_CSYS_DEF

PRT_CSYS_DEF

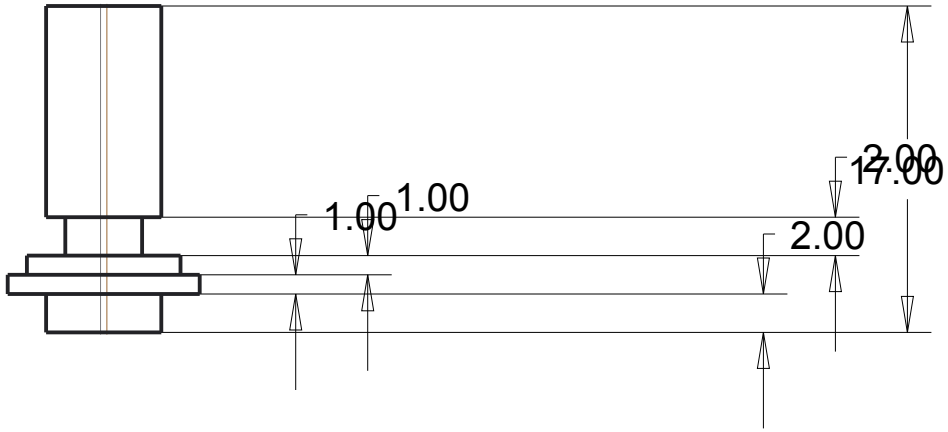
360.0°

SCALE 0.100

3.00

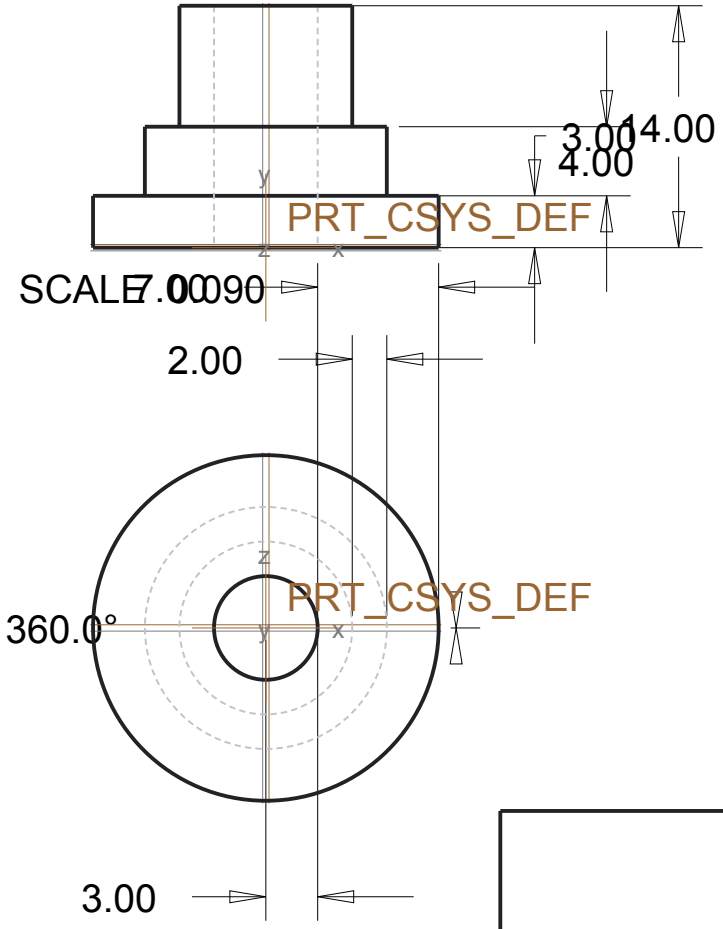


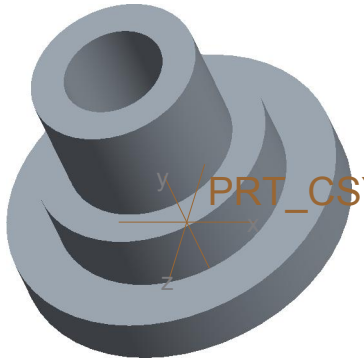
SCALE 0.120



12.VALVE

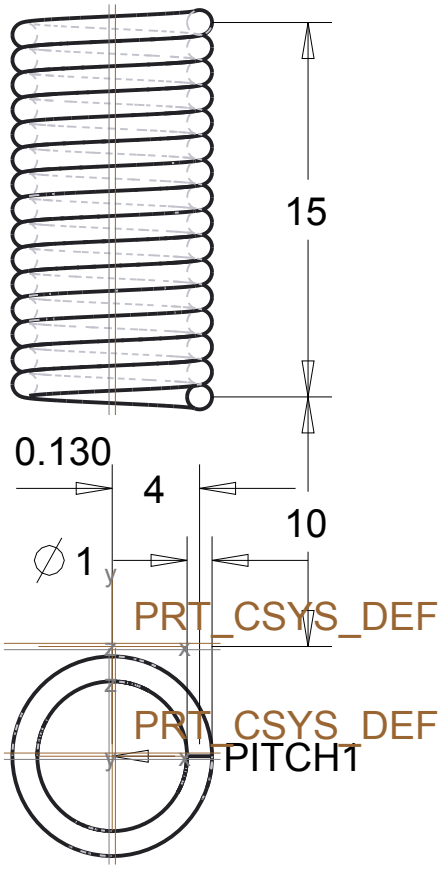
PRT_CSYS_DEF





SCALE 0.090

13.VALVE SEAT



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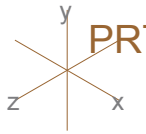
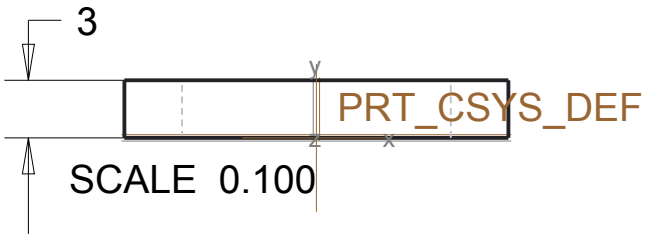
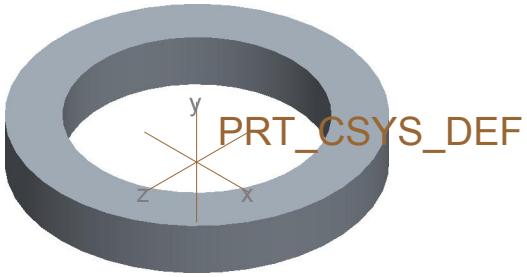


PRT_CSYS_DEF

14.SPRING





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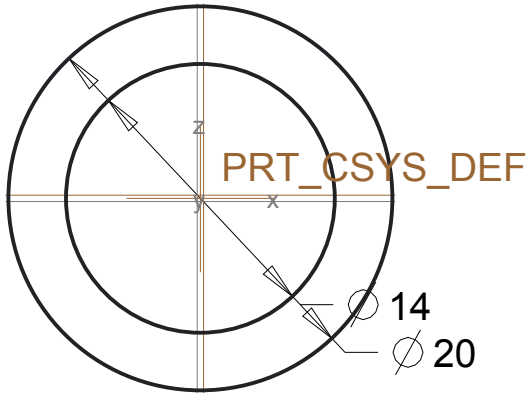
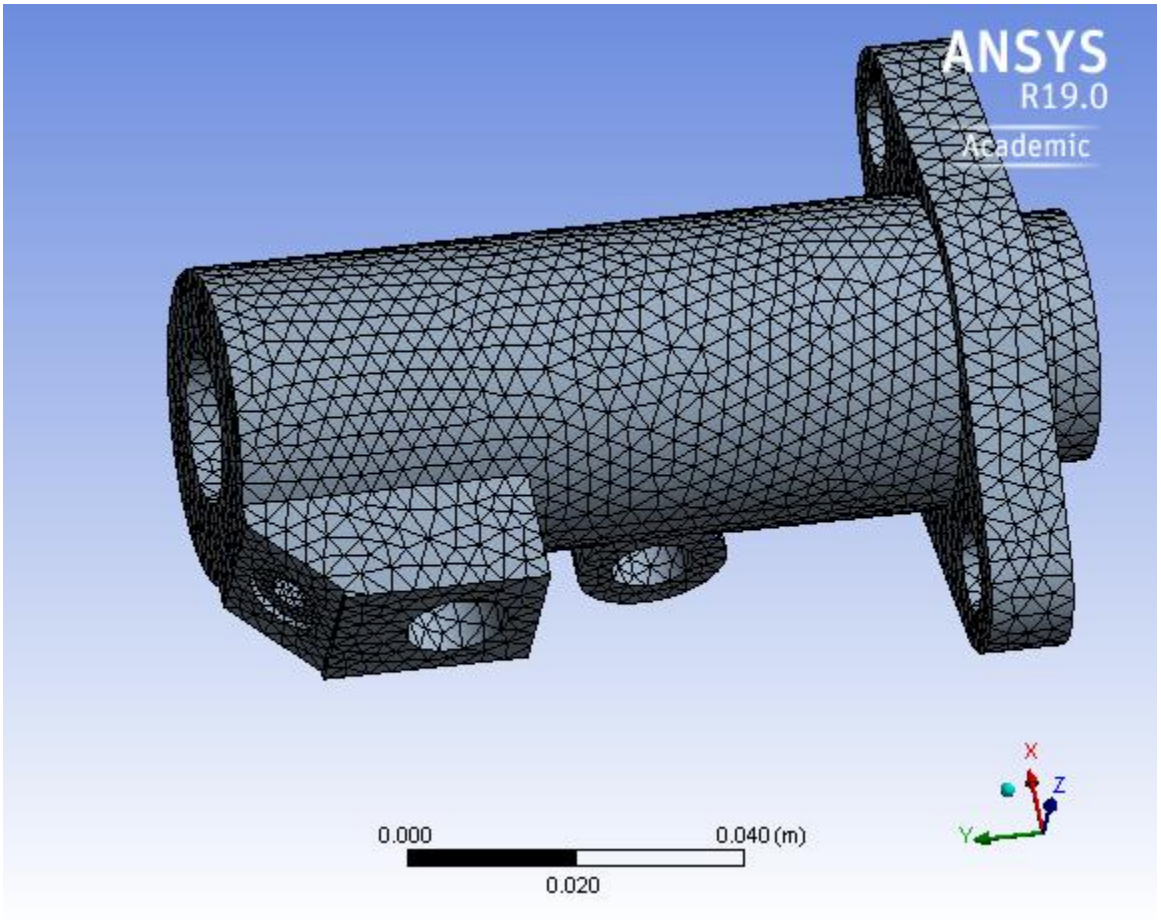


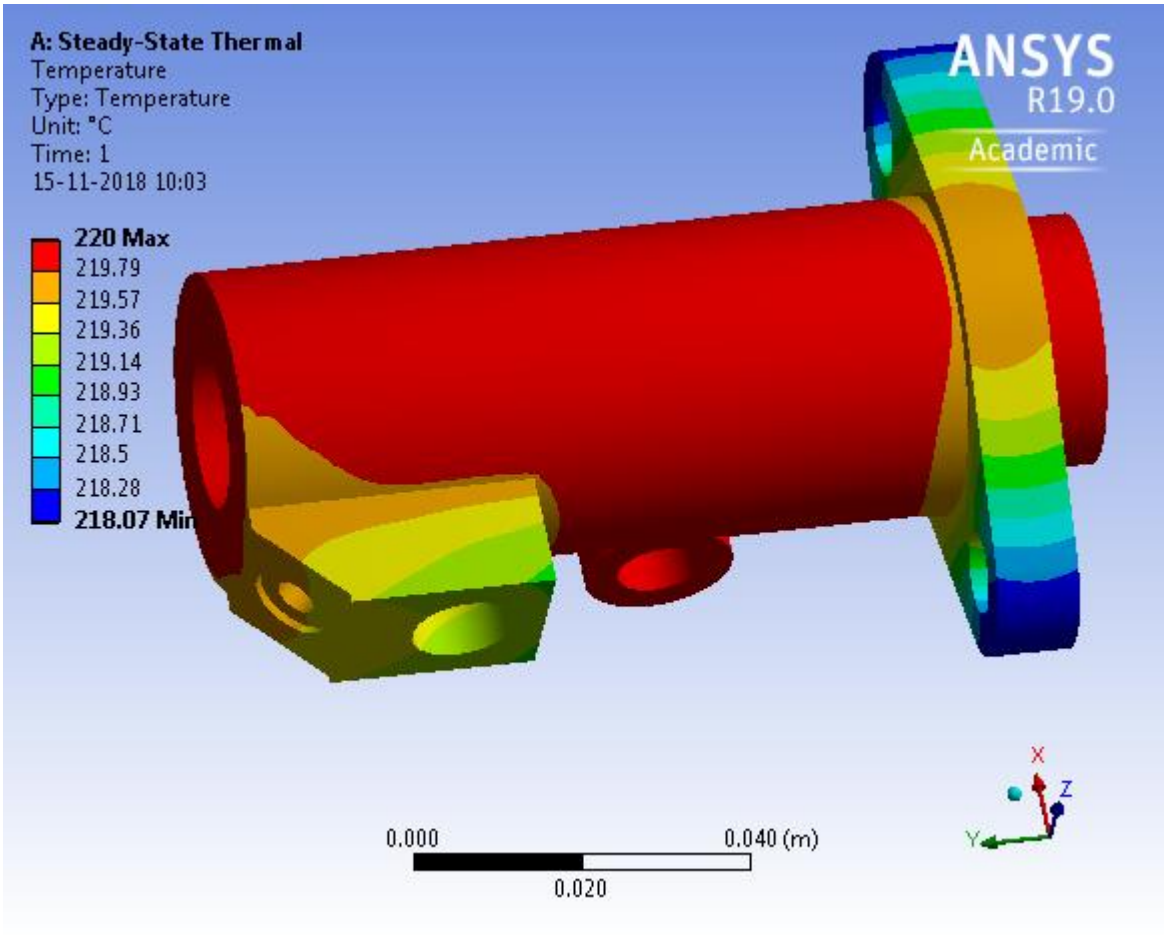
15.WASHER

THERMAL ANALYSIS ON DIESEL FUEL PUMP

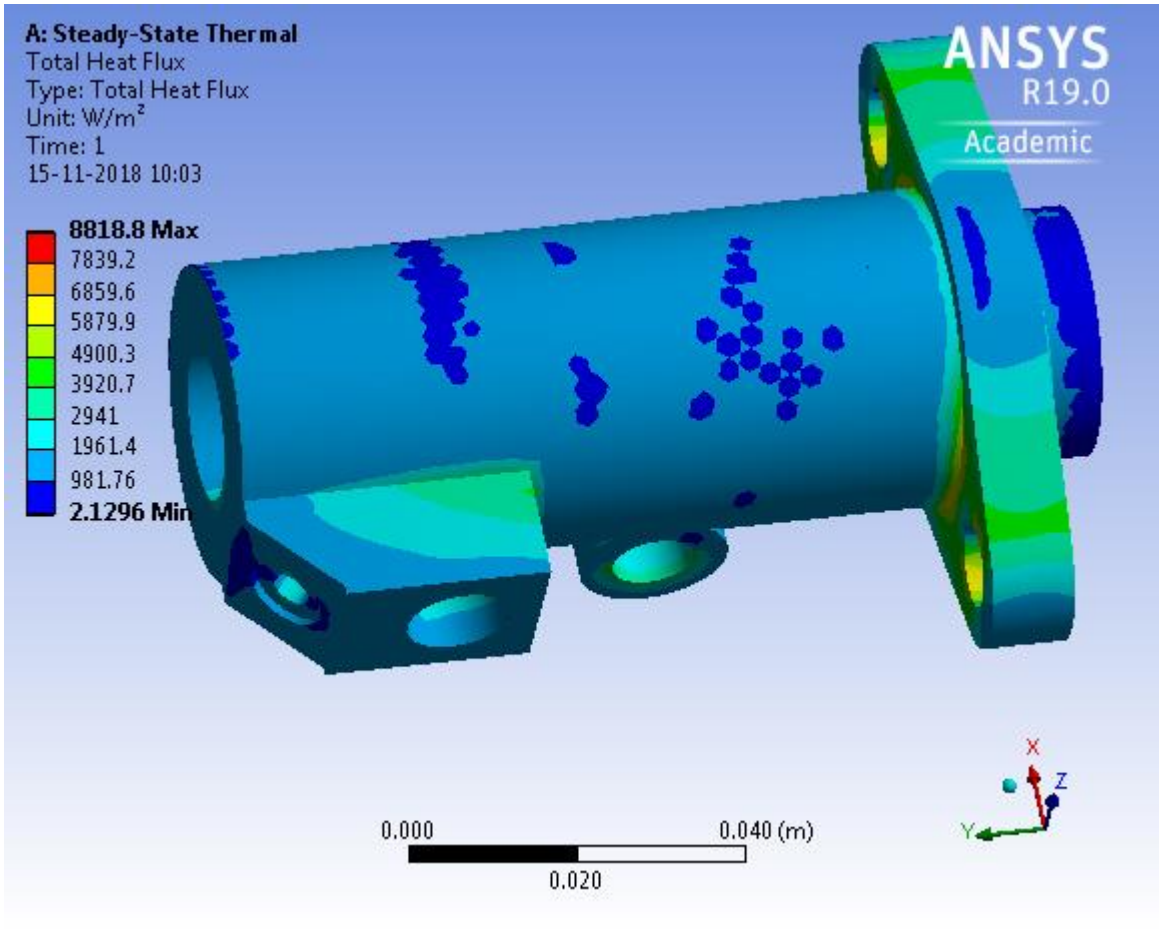
MESH



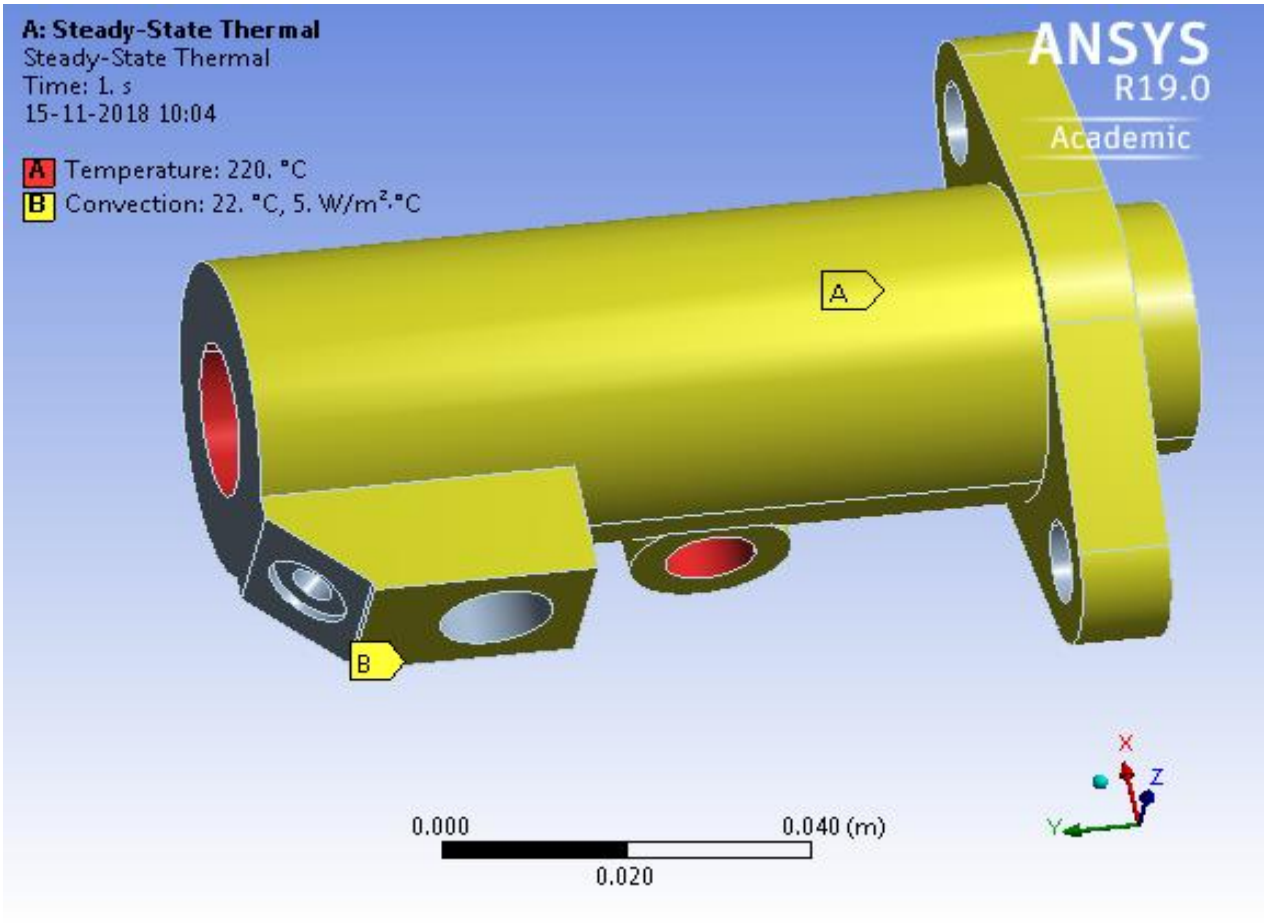
TEMPERATURE



HEAT FLUX


A: Steady-State Thermal
Total Heat Flux
Type: Total Heat Flux
Unit: W/m²
Time: 1
15-11-2018 10:03
8818.8 Max
7839.2
6859.6
5879.9
4900.3
3920.7
2941
1961.4
981.76
2.1296 Min
ANSYS
R19.0
Academic
0.000
0.040 (m)
0.020
X
Z
Y

THERMAL


A: Steady-State Thermal
Steady-State Thermal
Time: 1. s
15-11-2018 10:04
A Temperature: 220. °C
B Convection: 22. °C, 5. W/m²·°C
ANSYS
R19.0
Academic
A
B
0.000
0.040 (m)
0.020
X
Z
Y