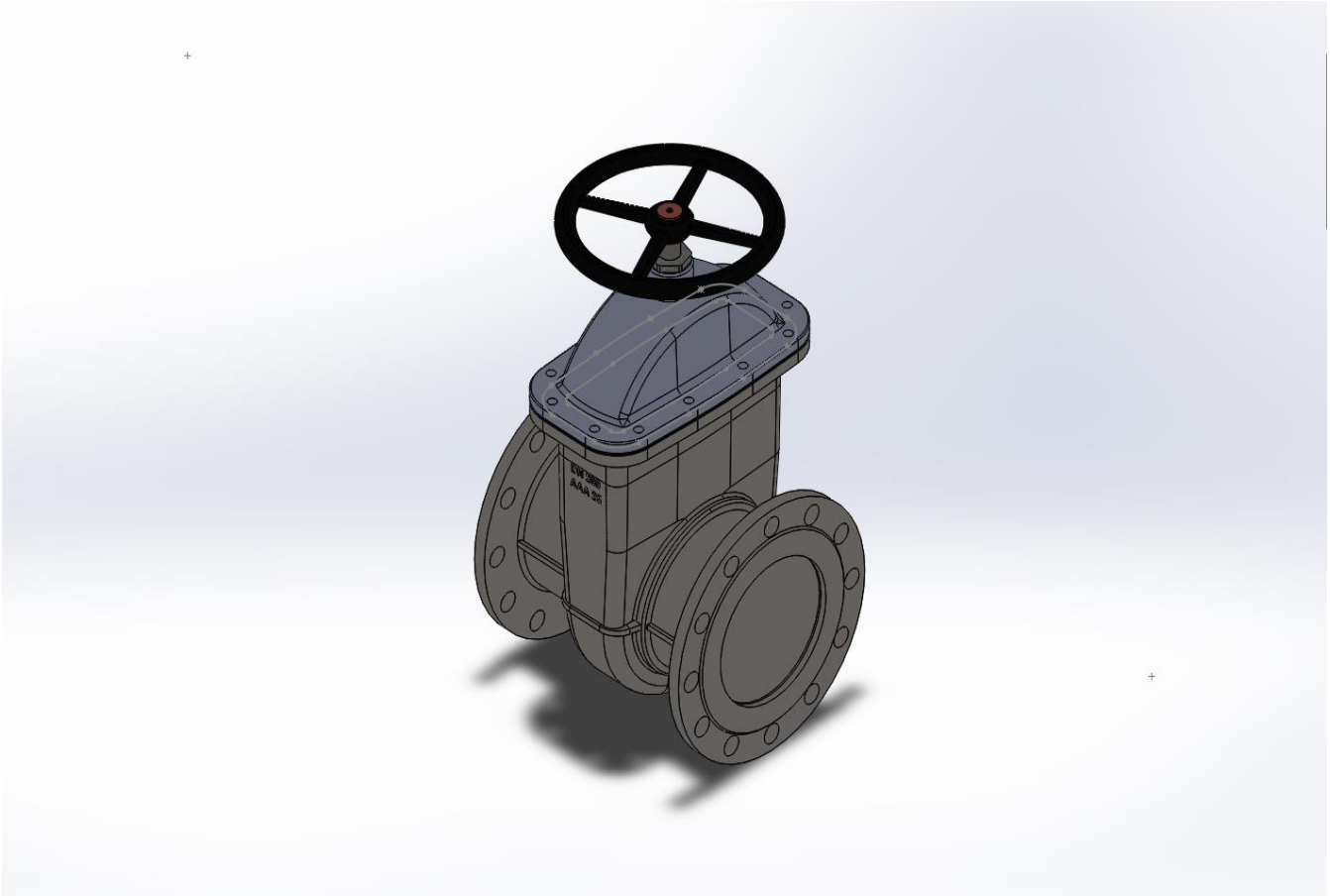
PROJECT 02: PART MANUFACTURING
Cast Steel Gate Valve

PROJECT GROUP 4

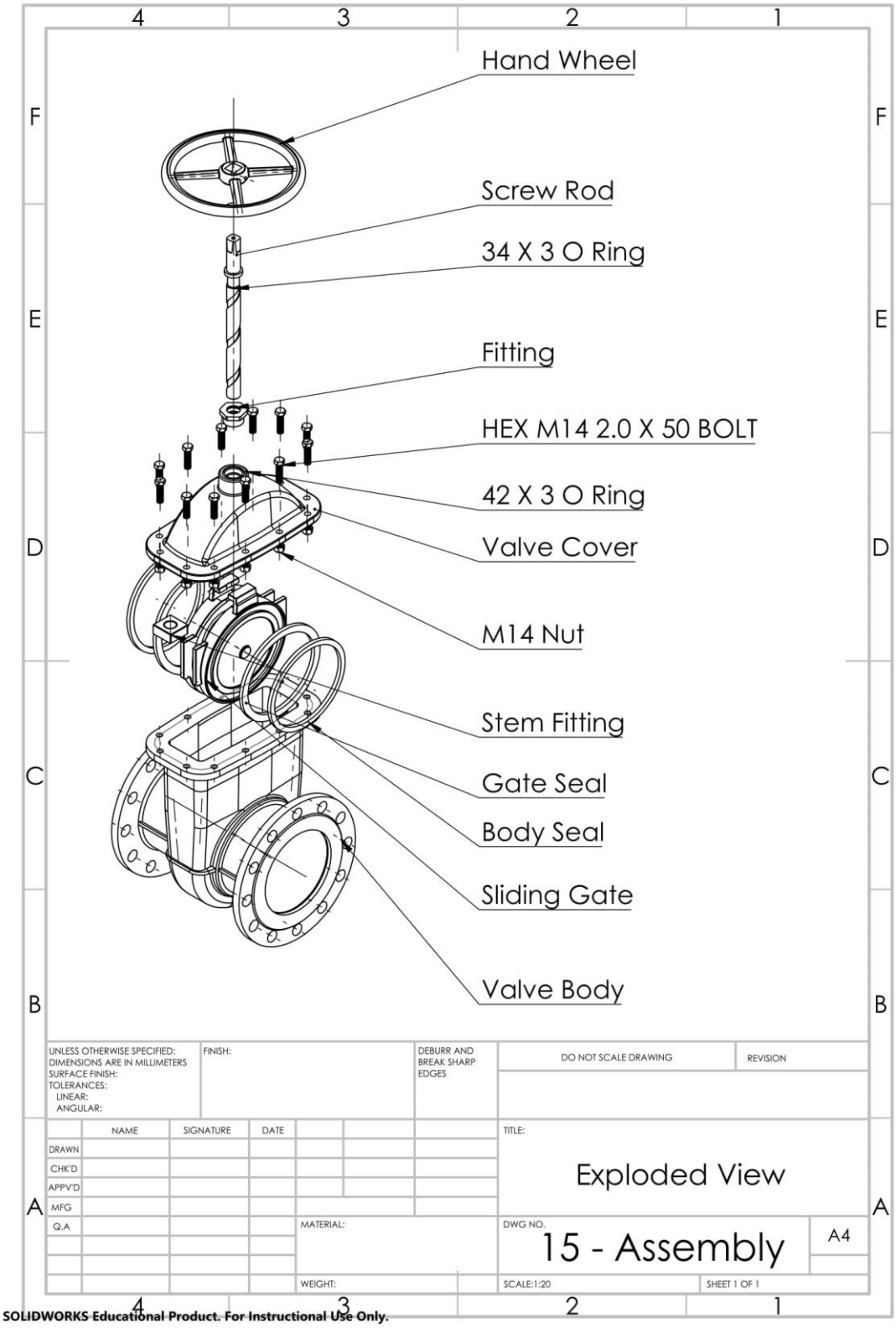
Atul Shrotriya
Baby Ramona Azad
Kari Naga Nikhil
Samarth Ramachandra
Sayyam Harshad Papalkar



Manufacturing Processes and systems ME 5326

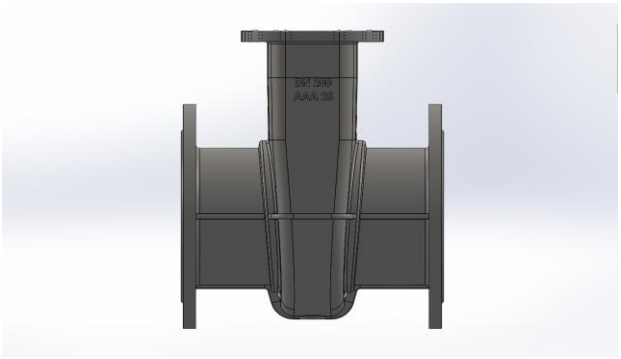
Professor: Sunand Santhanagopalan
TA: Himanth Kumar Talla

1. Exploded view of the Assembly

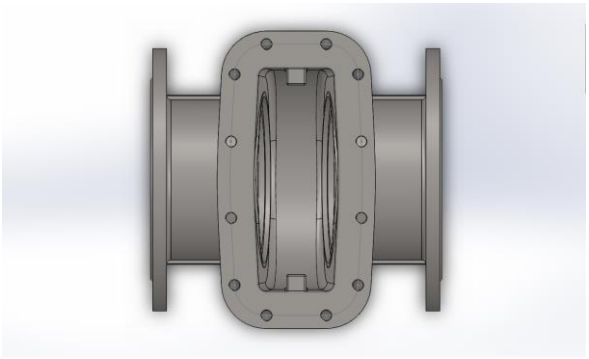


2. 3D drawings for each part

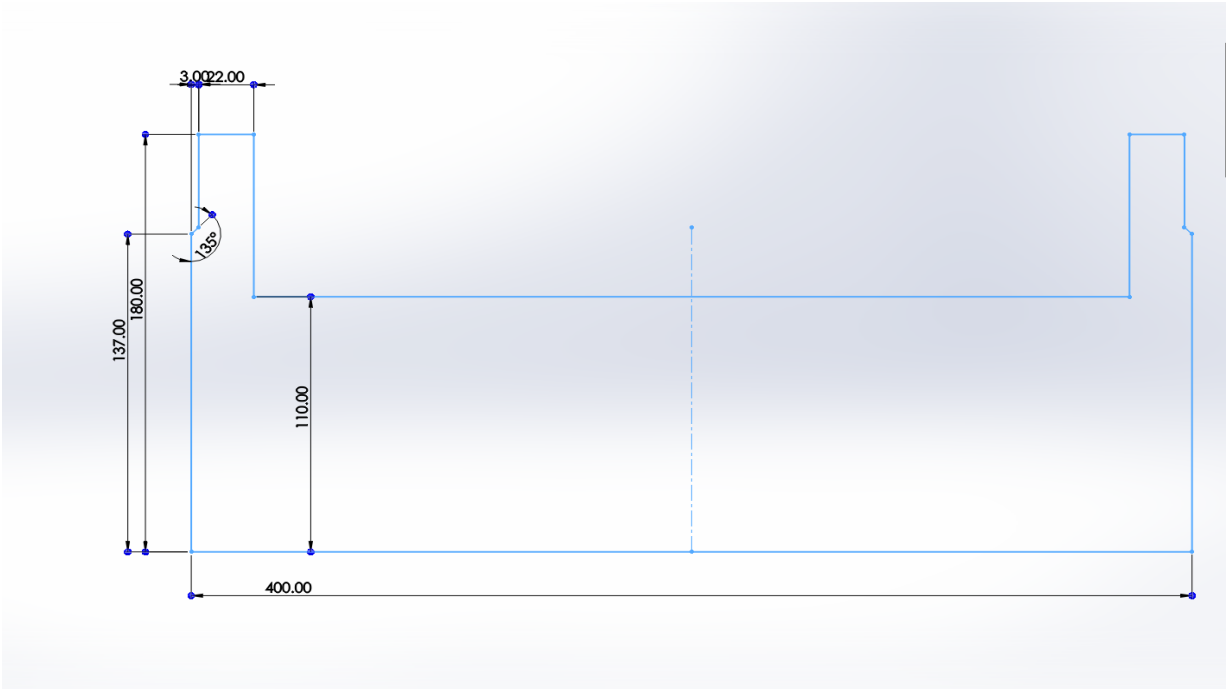
2.1 Valve Body



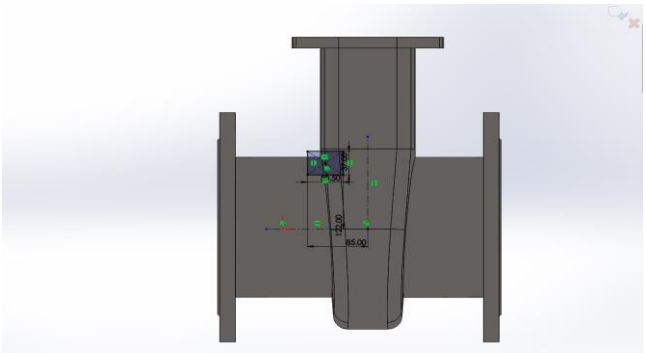
Front View

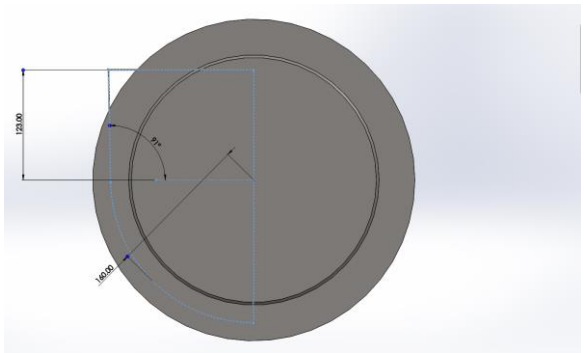


Top View

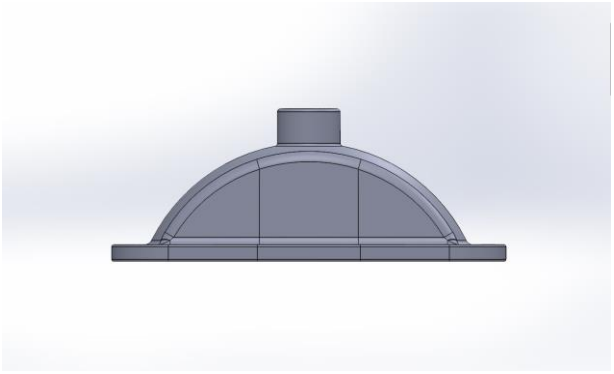


Dimensions related to the valve body



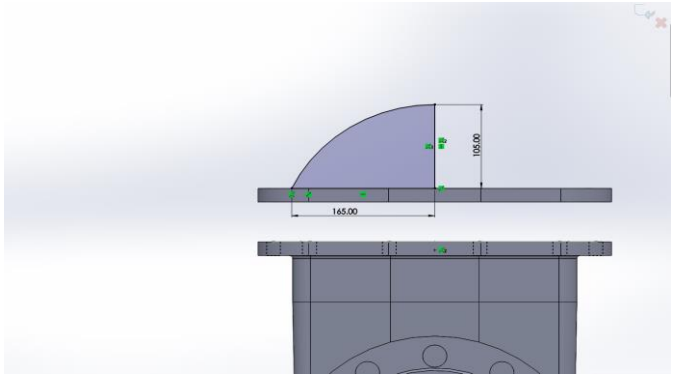


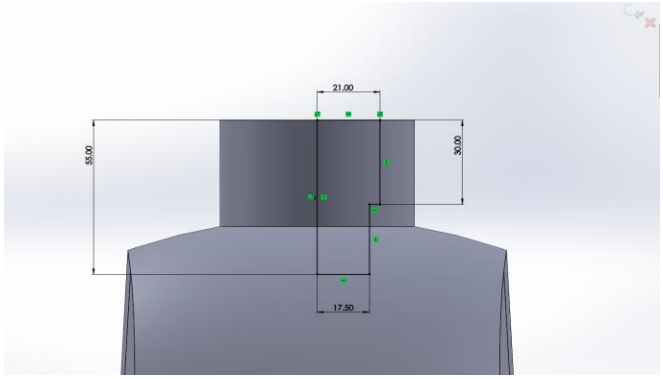
2.2 Valve Cover



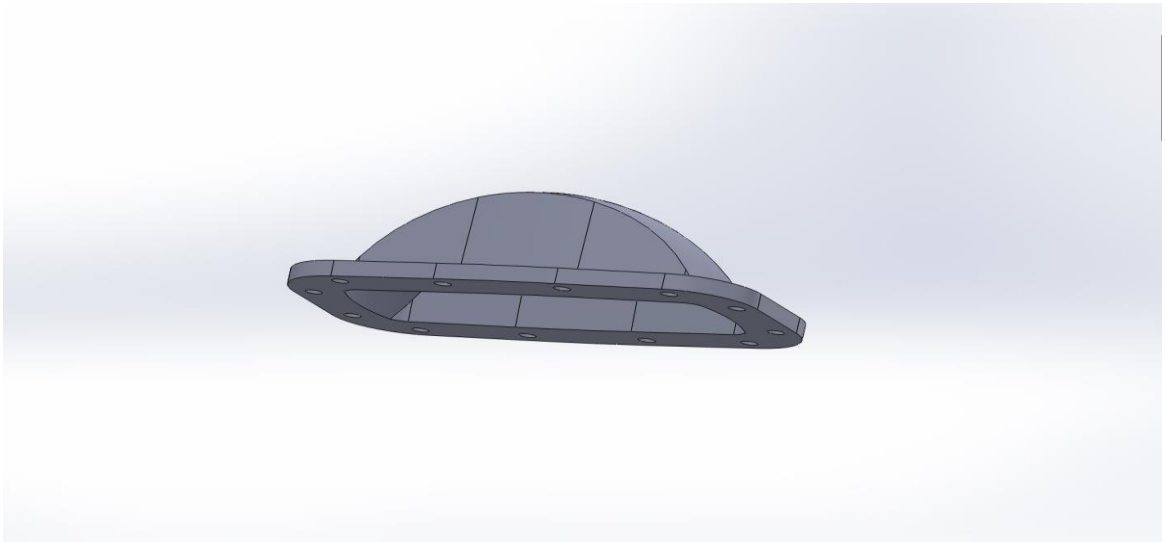
Front View

Top View



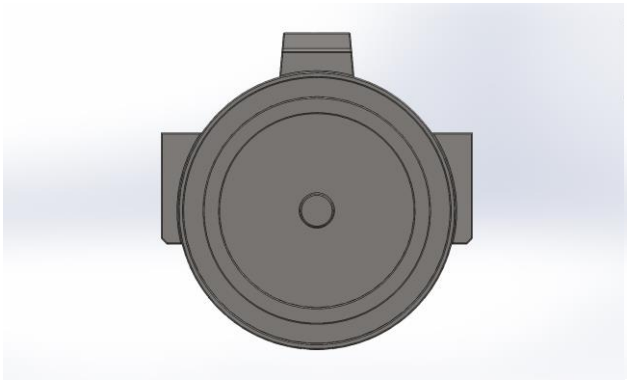


Dimensions related to Valve Cover



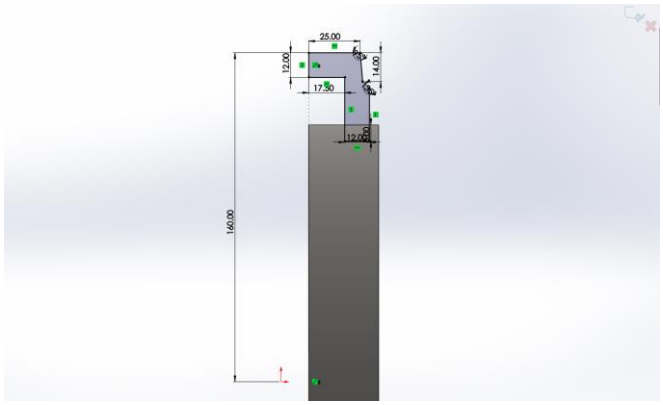
Isometric view

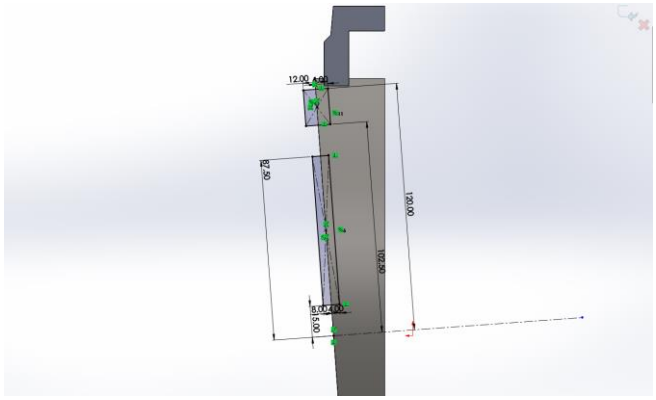
2.3 Sliding Gate



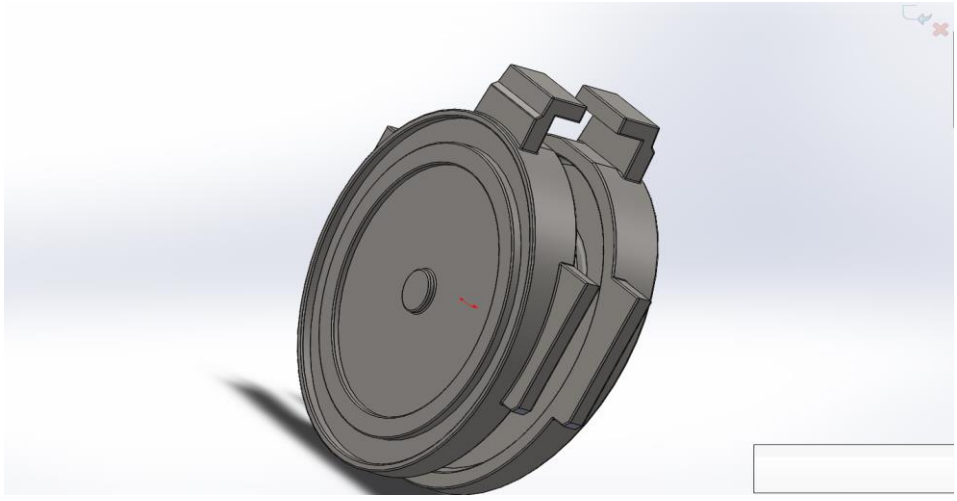
Front View

Side View





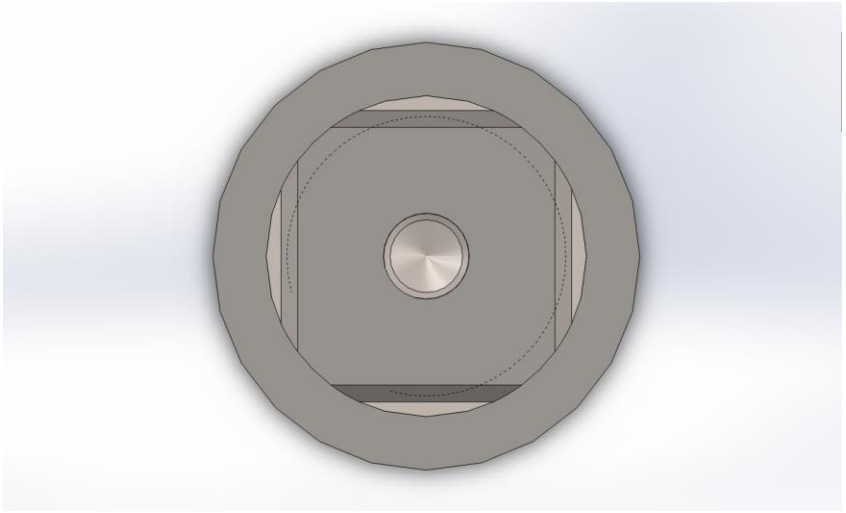
Dimensions related to Sliding gate



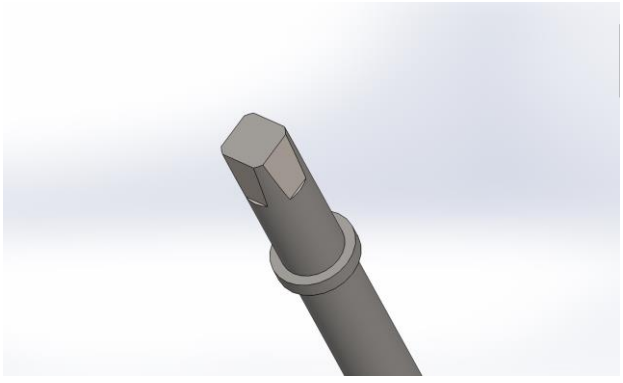
Isometric View

2.4 Screw Rod

Front/ Side view



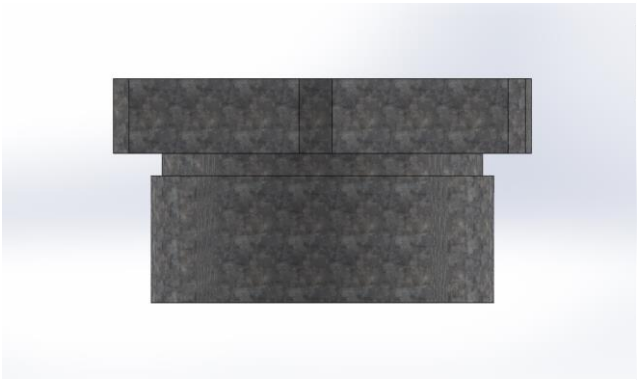
Top View



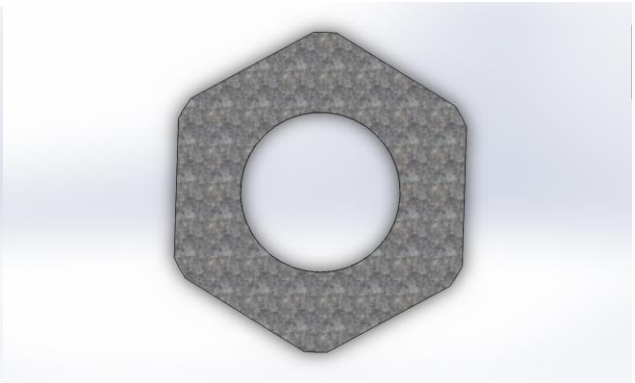
2.5 Packing Seal

Top View

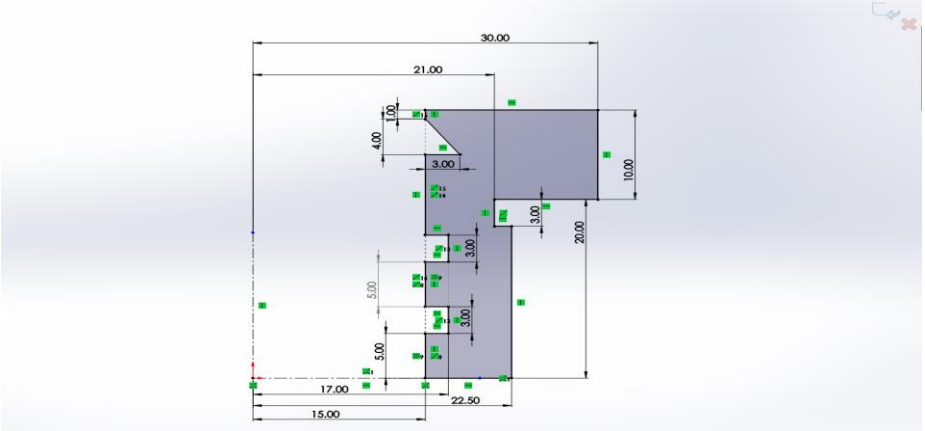
2.6 Fitting



Front View



Top View

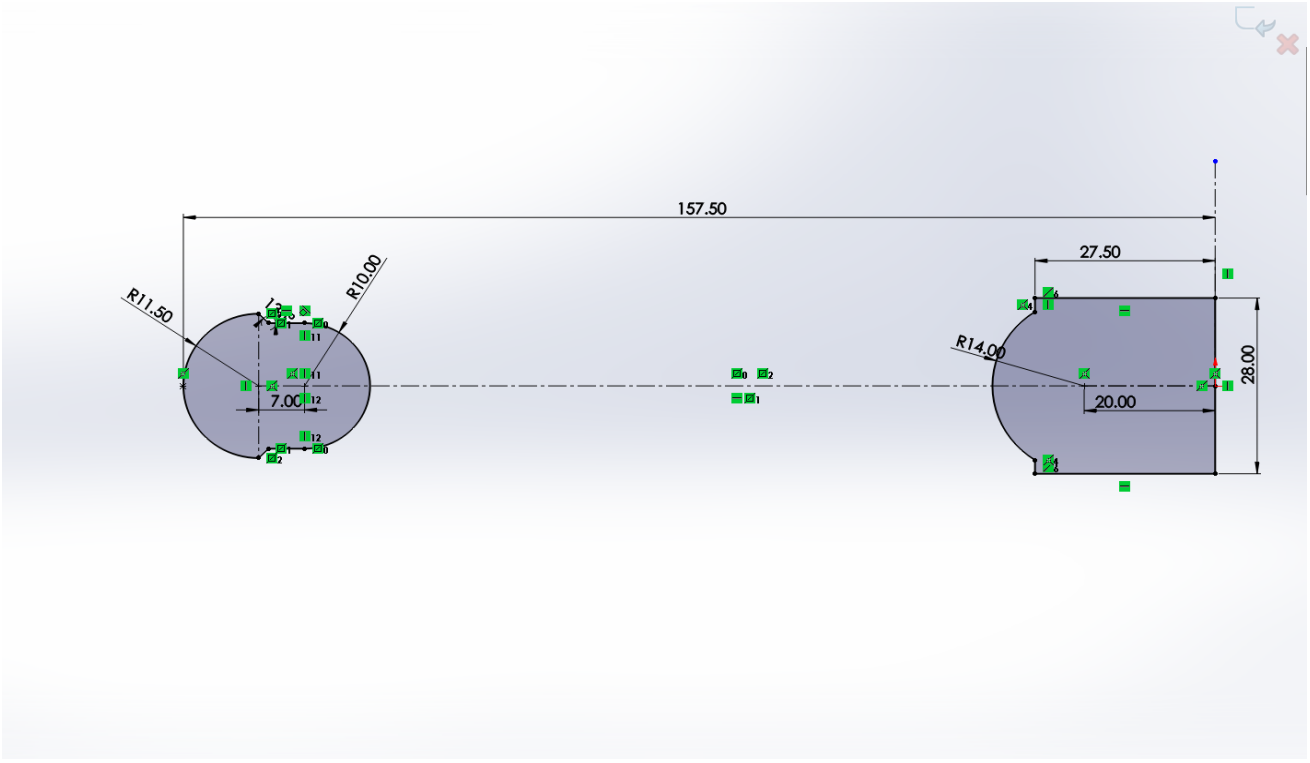


Dimensioning

2.7 Hand Wheel

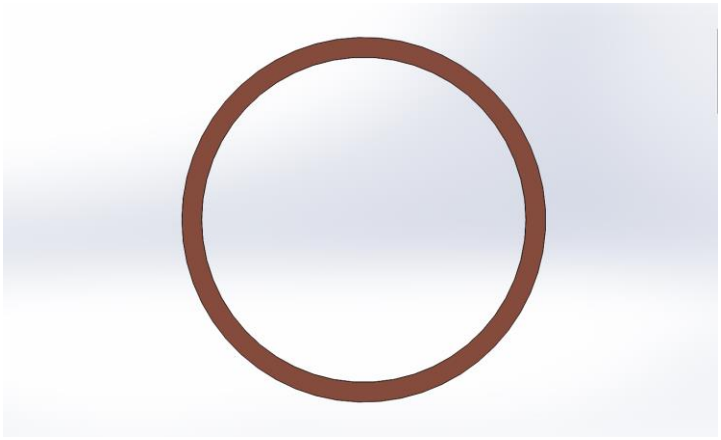
Front View

Top View



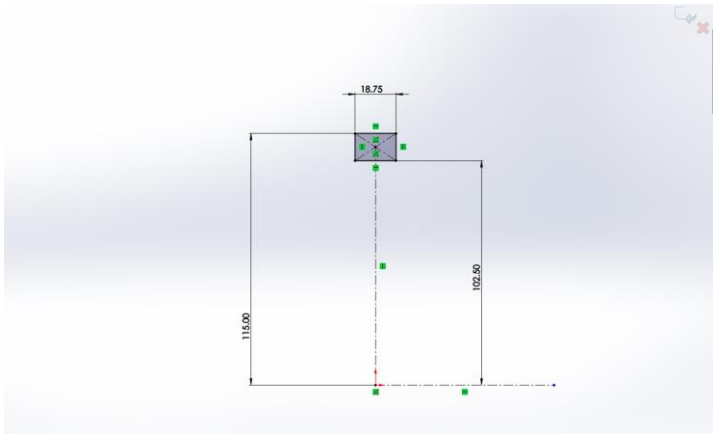
Dimensioning of Hand Wheel

2.8 Body Seal



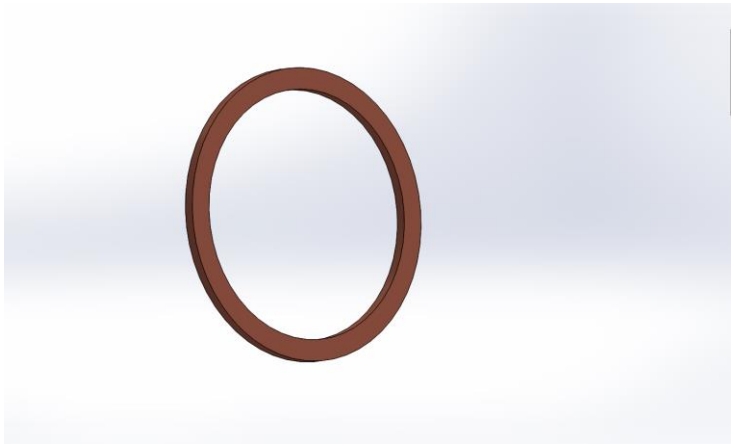
Front View

Isometric View

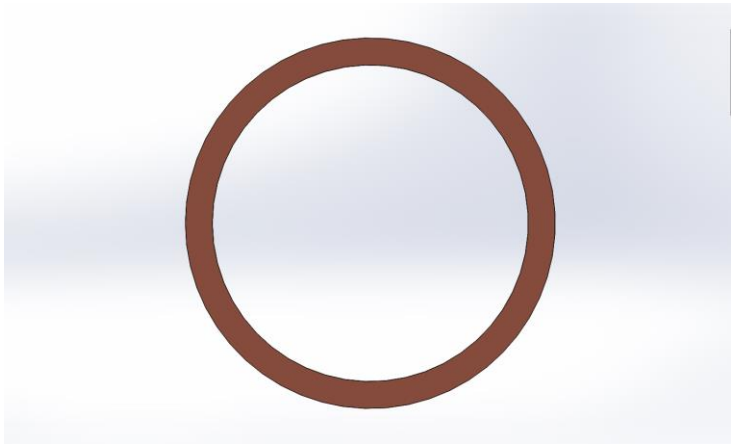


Dimensioning

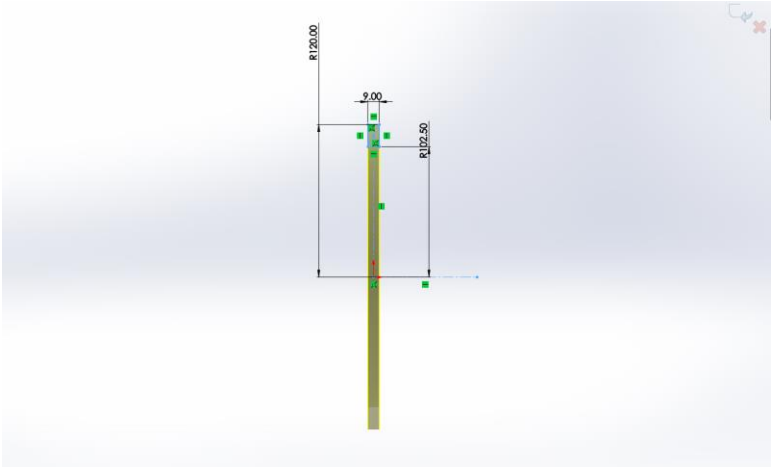
2.9 Gate Seal



Isometric View



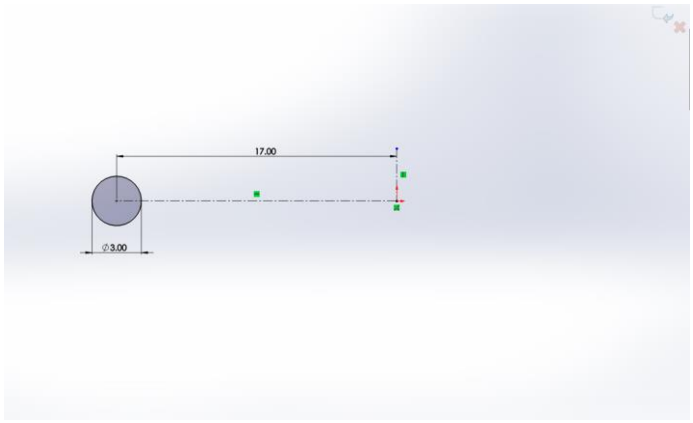
Front View



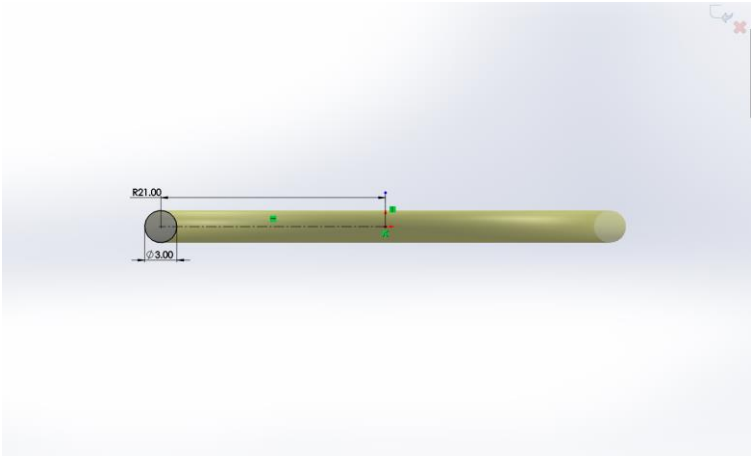
Dimensioning

2.10 O – Ring

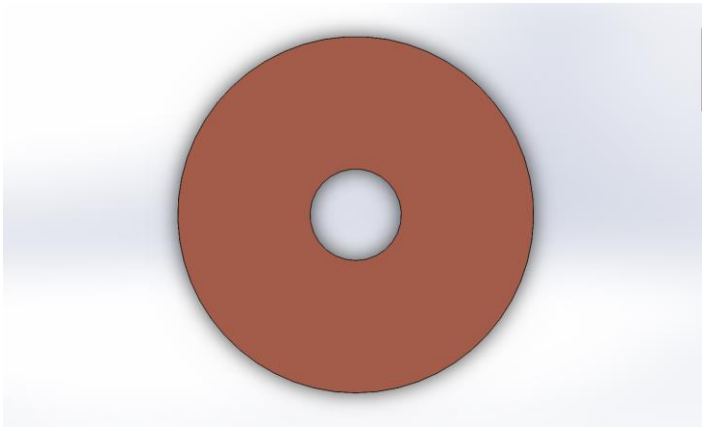
Top View



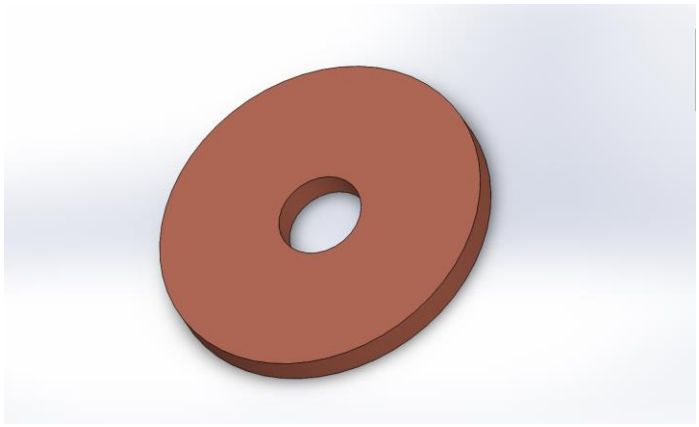
Dimensioning



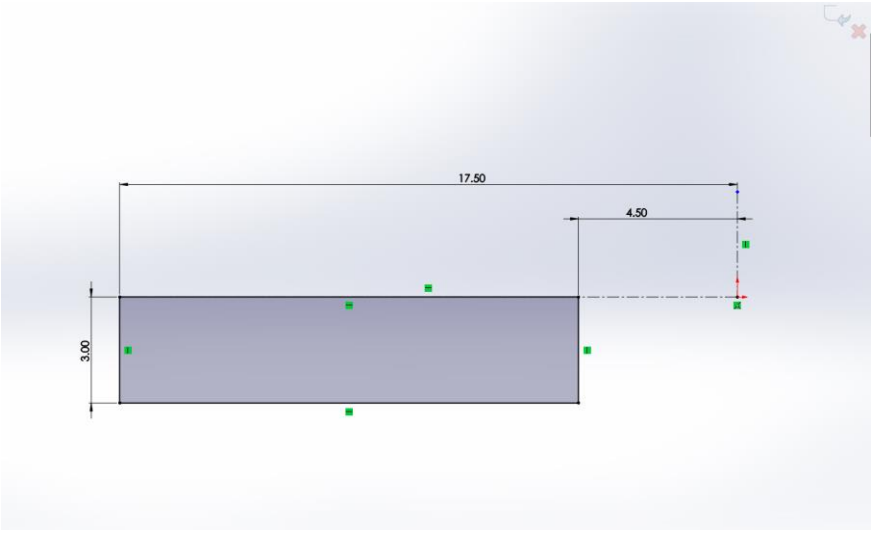
2.11 M8 and M16 Washer



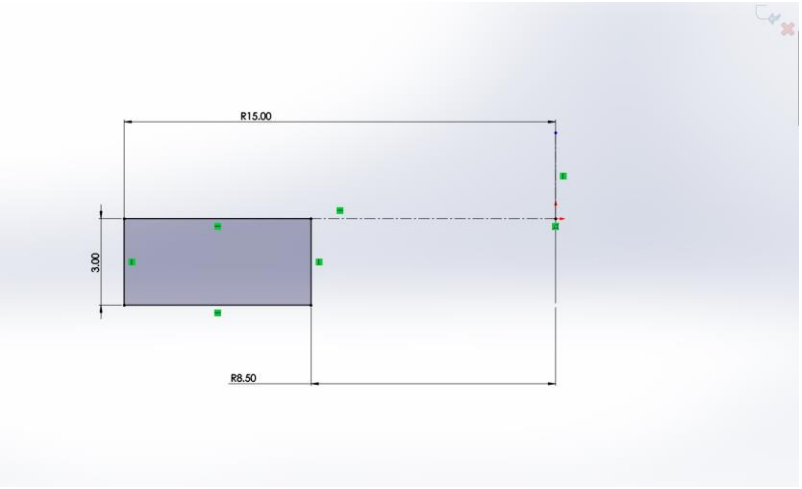
Top View



Isometric View

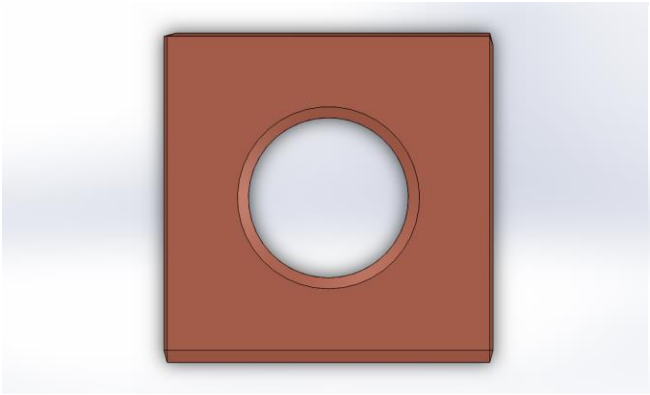


Dimensioning of M8 Washer

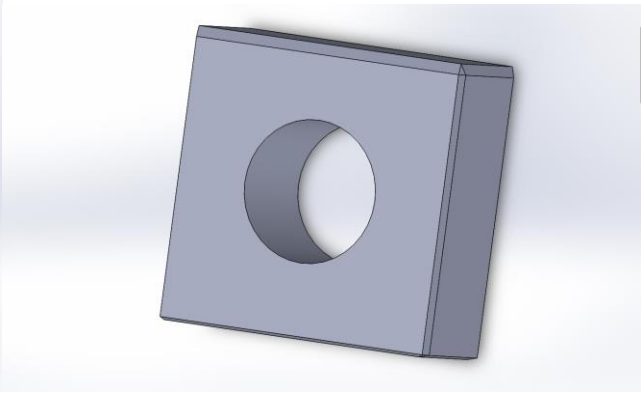


Dimensioning of M16 Washer

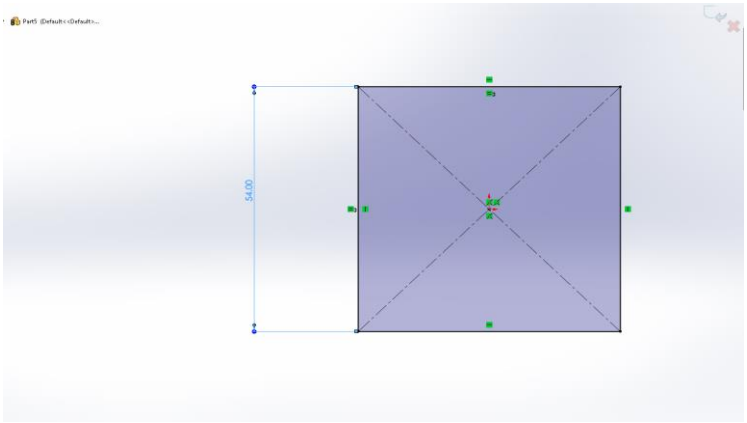
2.12 Stem Fitting



Front View

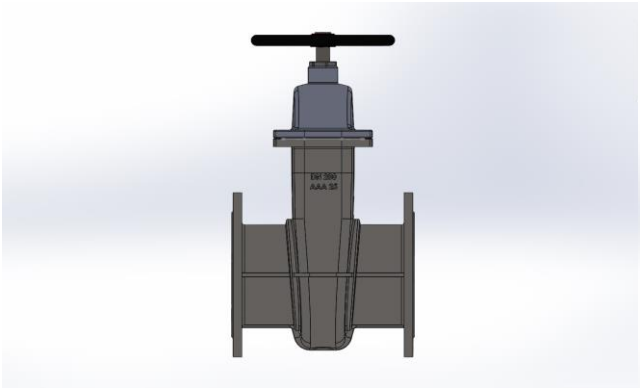


Isometric View

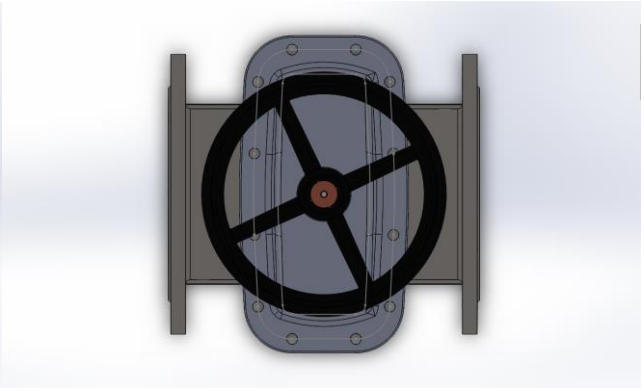


Dimensioning

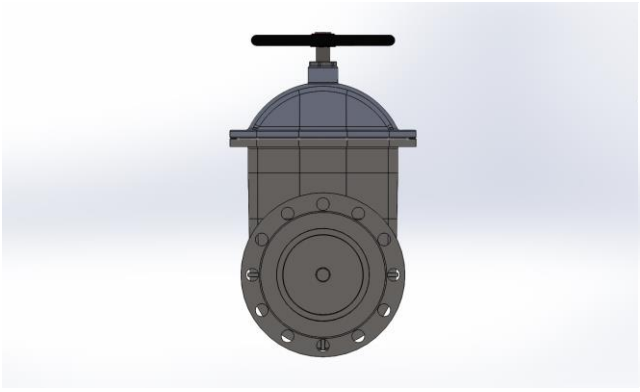
2.13 Assembly



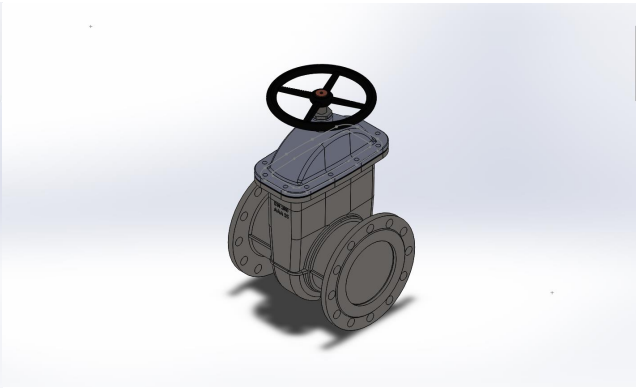
Front View



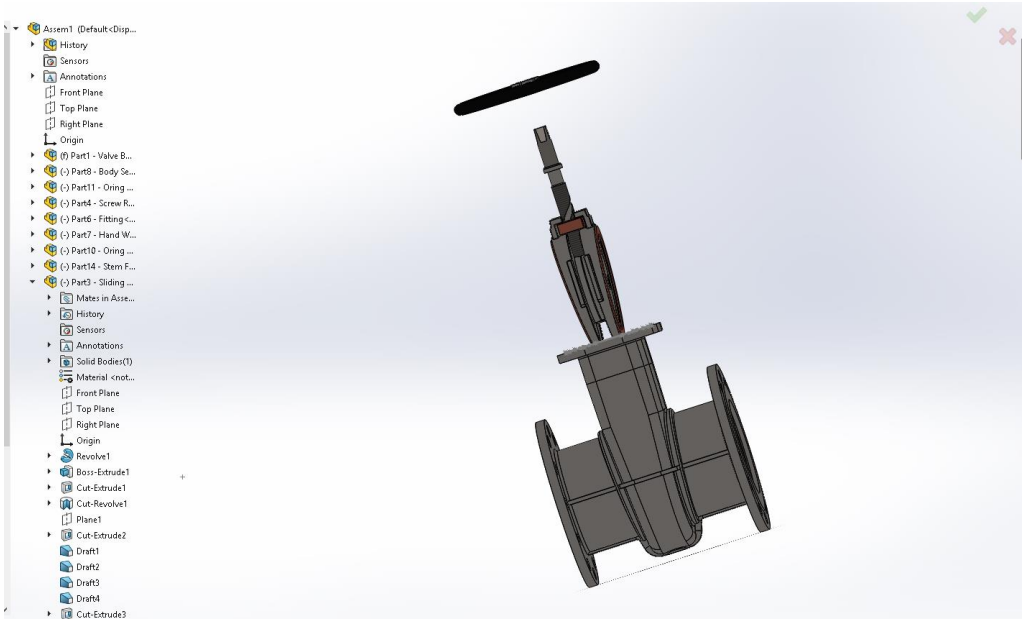
Top View



Side View

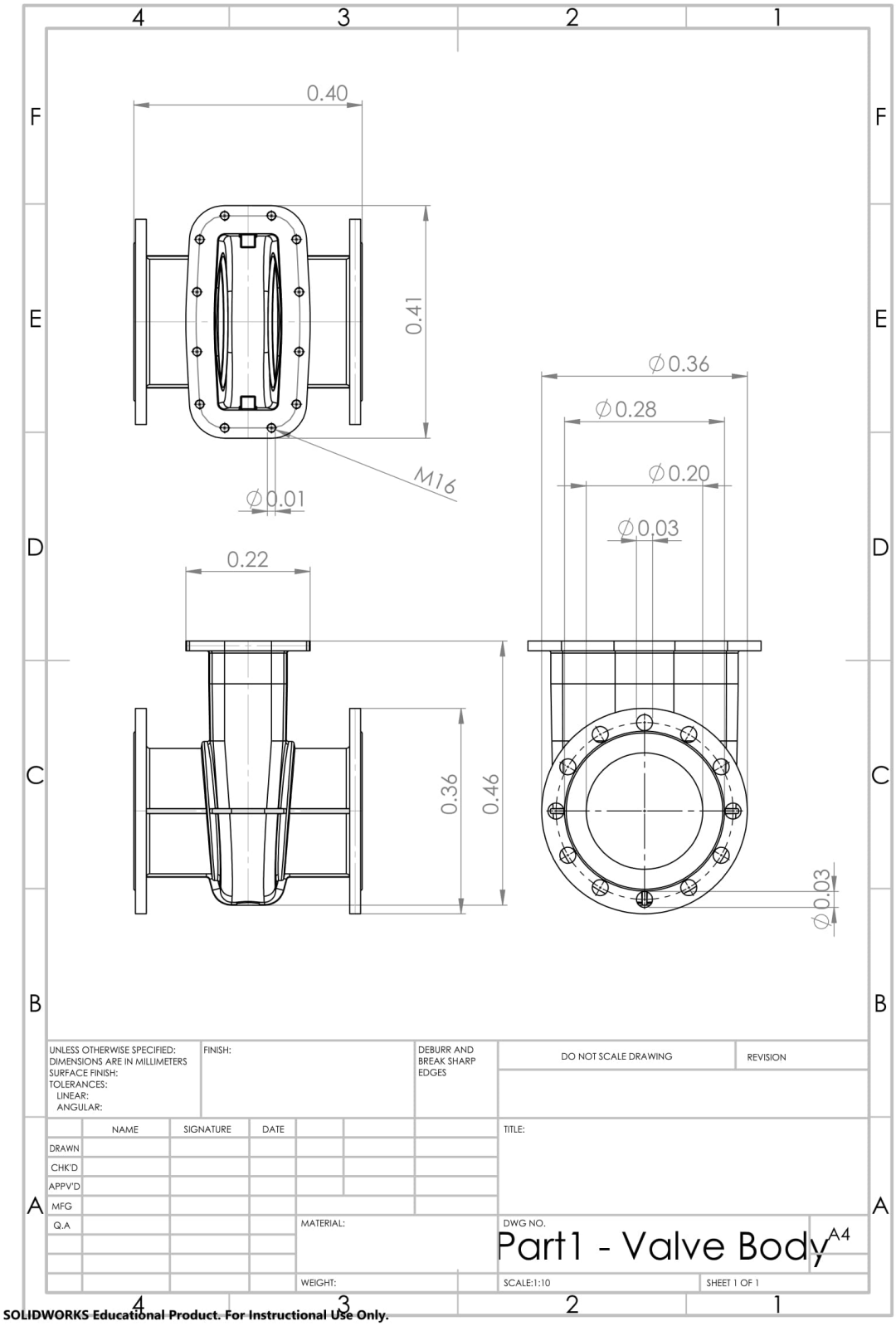


Isometric View

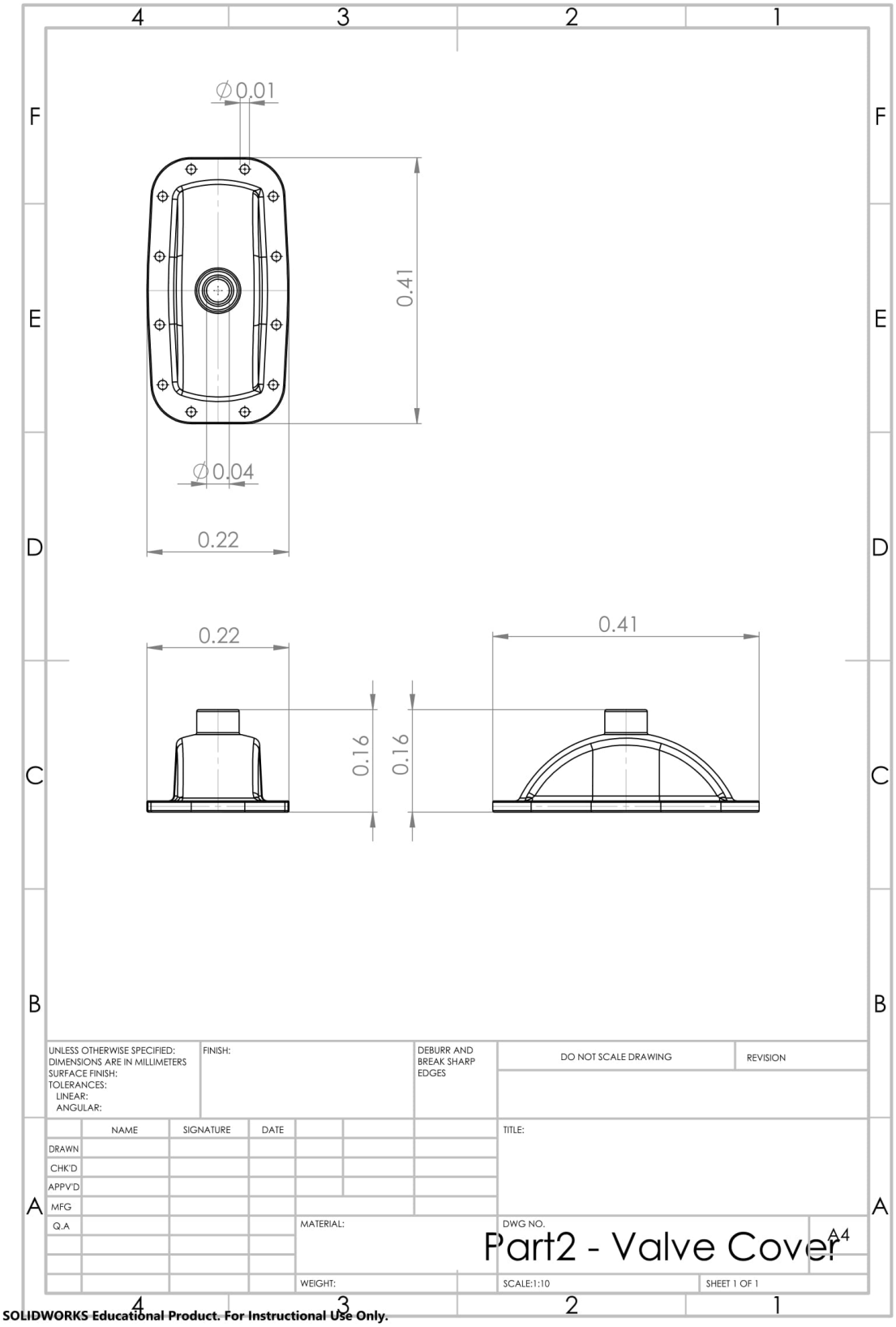


3. 2D drawings for each part

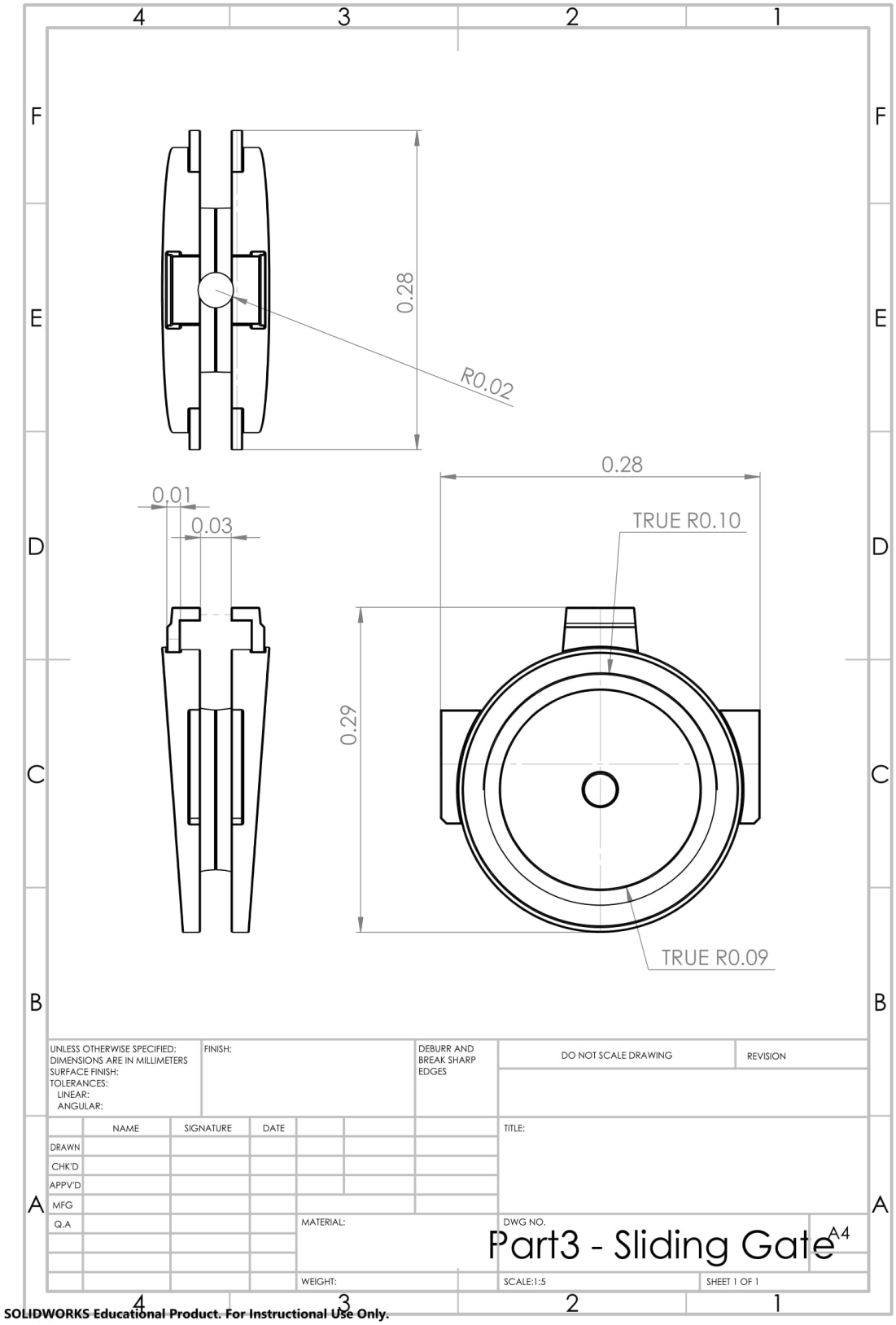
3.1 Valve Body



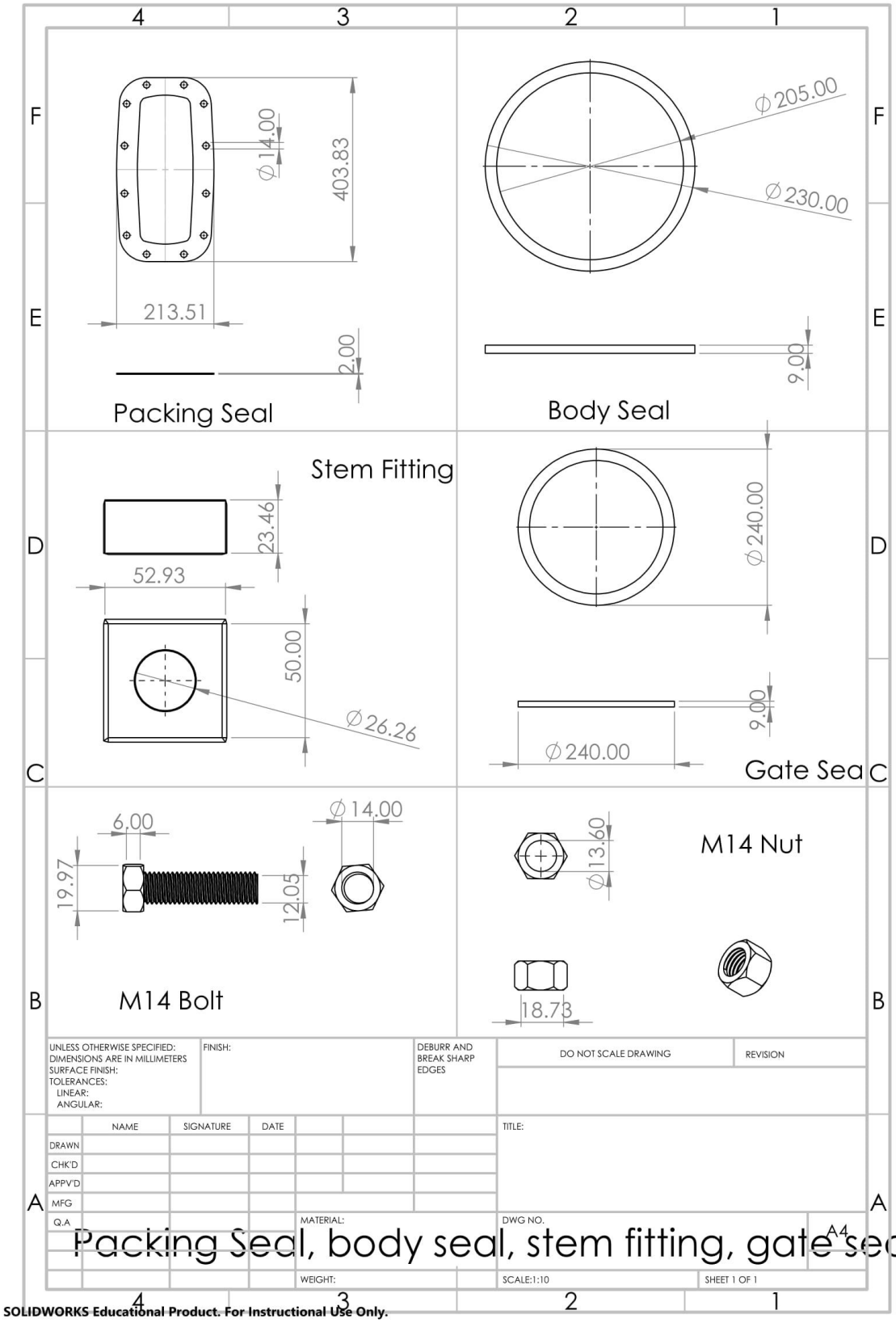
3.2 Valve Cover



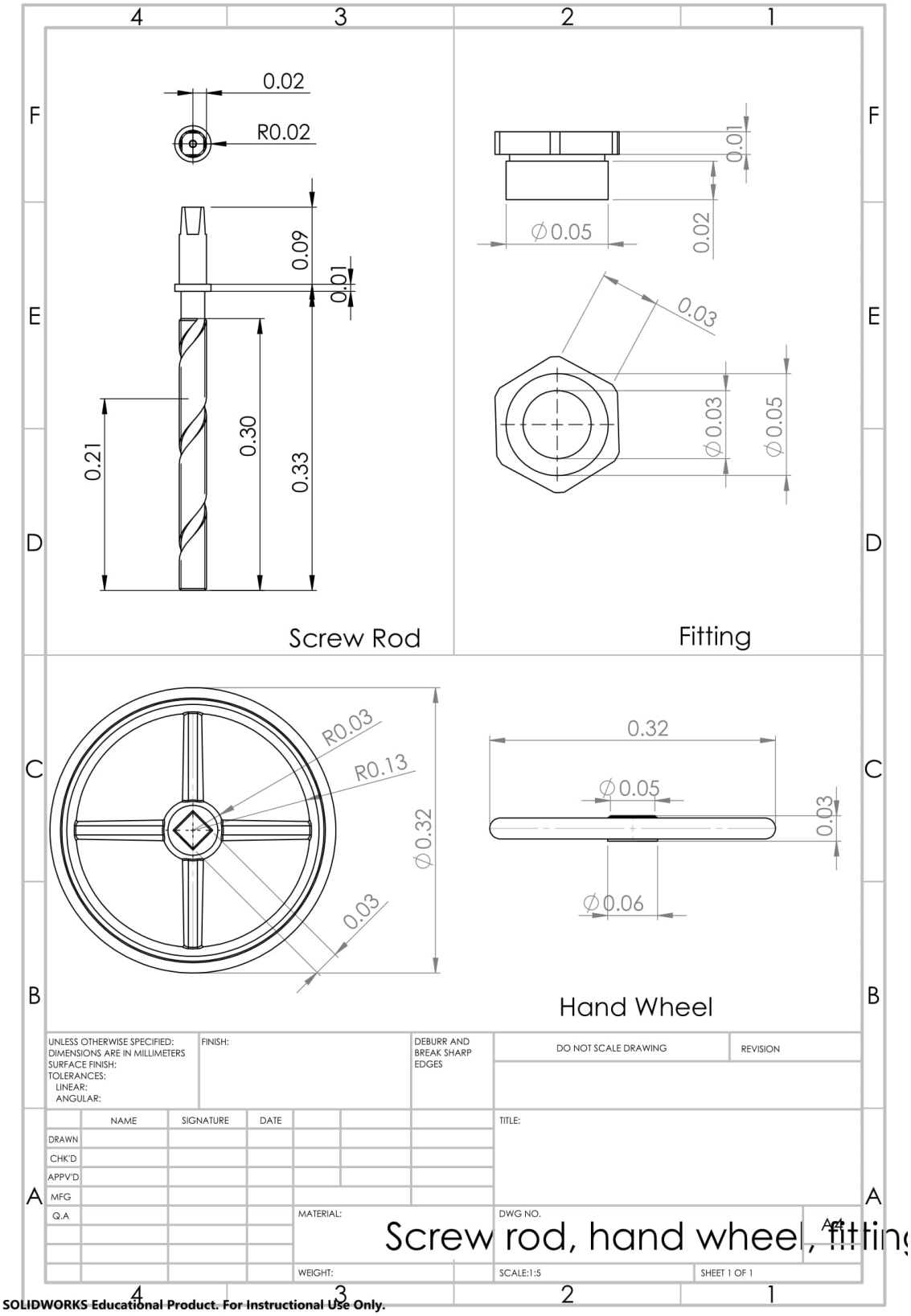
3.3 Sliding Gate



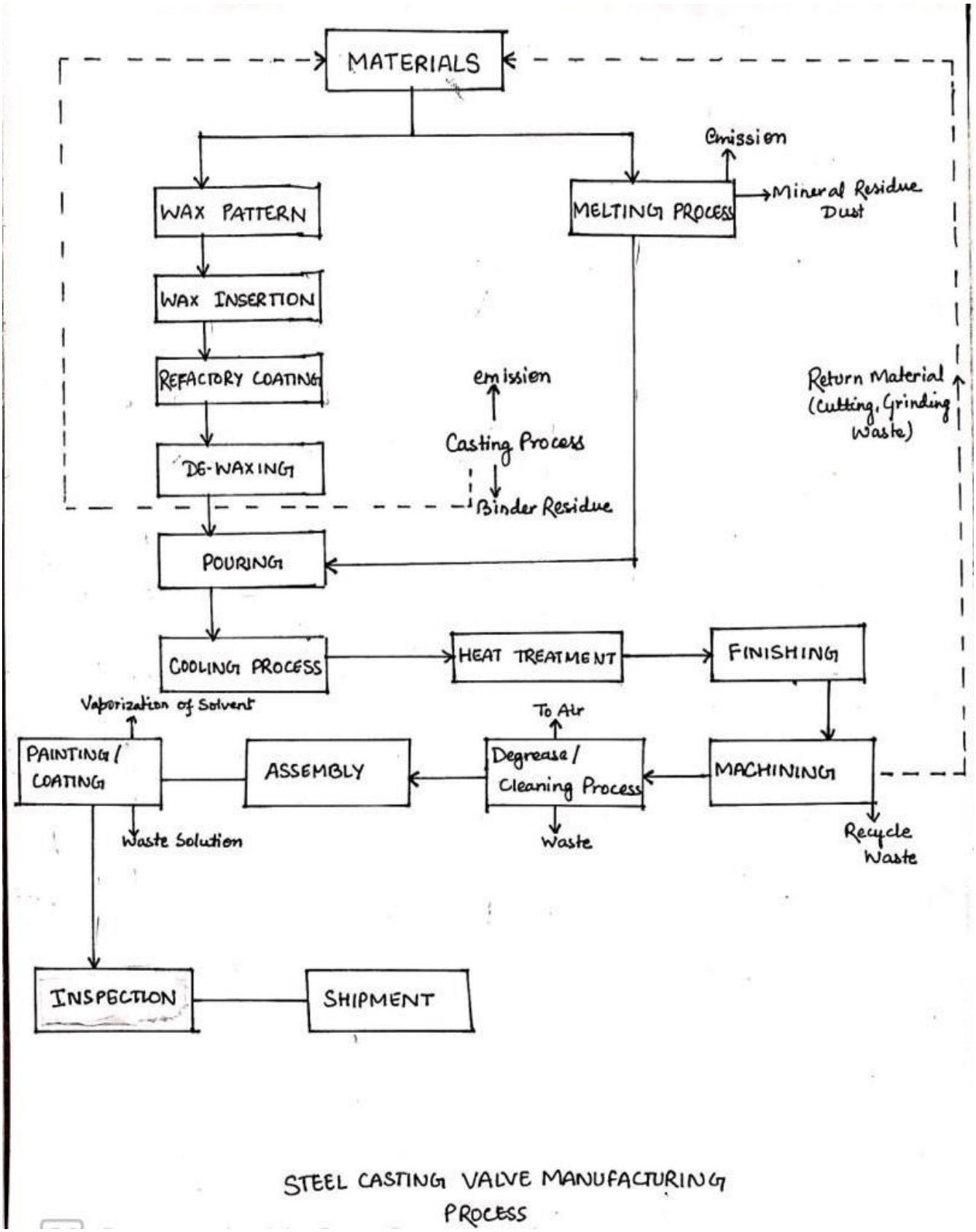
3.4 Packing Seal – Body Seal – Stem Fitting – Gate Seal – M14 Bolt – M14 Nut



3.5 Screw Rod – Fitting – Hand Wheel



4. Floor Plan Layout



STEEL CASTING VALVE MANUFACTURING PROCESS

5. Cost Analysis

Assumptions: Facility efficiency: 90%
Working days per year: 305
Work Shifts: 8-hr shift per day
Production rate: 10,000 units/year

Parts	Cost
Valve Body and Cover	$ 129.6
Body Seal/ gate Seal	$ 21.6
Hand Wheel	$ 43.2
Screw Rod	$ 21.6
Hex Nut/ Screw/ Bolts	$ 43.2
Sliding Gate	$ 172.8
Total	$ 432

Total Material/ Casting and Machining Cost	$ 432
Direct Labor Cost	$ 200
Manufacturing Overhead Cost	$ 168
Total Cost of Assembly	$ 800

MANUFACTURING TRAVELER

Part no.: 0001
Description: Assembly
Start Date: 04/25/2020
Finish Date: 05/07/2020
Req. Date: 05/17/2020

Part	Operation	Quantity	Status
Valve Body & Cover	Investment Casting	1	Completed
Hand Wheel	Die Casting	1	Completed

Screw Rod	Cutting, Turning, Threading and Surface Finishing	1	Completed
Sliding Gate	Die Casting	1	Completed

6. Manufacturing Process for each Unique Part

6.1 Valve Body and Cover

Material: Cast Steel

Manufacturing Process: Investment Casting

It is the oldest known metal forming techniques, also called Lost-Wax Process. The wax process starts with wax injection into a pattern where flow channels are added onto the valve components. Each component receives 7-9 coats of refractory shell material. After that, the molds are removed in the de-wax area and is given a hot water wash to remove residual wax. Molds are then transferred to the baking furnace, brought upto a temperature of 800°C and maintained for 2 hours. Molds are then staged near the furnace for the baking process. The molten metal when it meets the standard chemical composition is then poured into the molds. This is the basic process involved in casting of valve body and cover.

Why Investment Casting?

- Reliability: gives a reliable control of the process and repeatability
- Tolerances: the tolerance of ± .005” is not always possible with any other casting process.
- Lower tooling cost
- Better for environment: the use of wax patterns eliminates the expensive revisions and metal scrap. Also, investment casting produces parts that are net or near shapes which eventually reduces the secondary machining and labor cost.
- Intricate Design: features like logo, product ID etc. can easily be incorporated in the part. Holes, splines, slots, thread profiles is easy to cast with the use of investment casting to reduce the secondary machining time and total cost.

6.2 Body Seal

Material: Nitrile Rubber (High chemical resistivity).
Manufacturing Process: usually bought from other sources.

6.3 Gate Seal

Material: Stainless steel (Safe Material Interception and excellent durability)

Manufacturing process:

6.4 Hand Wheel

Material: Ductile Iron
Manufacturing Process: Die Casting

Why Die Casting?
It accurately produces sharp defined, smooth metal parts. Also, it's easy for mass production.

6.5 Screw Rod

Material: Aluminum/ Brass/ Bronze (Depending upon the gate valve)
Manufacturing Process:

6.6 Hex Nut

Material: Carbon Steel

Manufacturing Process:

6.7 Sliding Gate

Material: Cast Steel

Manufacturing Process:

Why Die Casting?

It accurately produces sharp defined, smooth metal parts. Also, it's easy for mass production.

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