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Aim of the Project

The Aim of the project is to design and build a lab scale anaerobic digester for Shannon ABC considering cost control and safe methane gas collection.

Objectives

- Research of anaerobic digestion on the purposes, designs, functions and any engineering standards.
- Design a lab scale anaerobic digester based on specific customer requirements, using a design study to select the optimum concept design.
- Spec and order components to be used in the project.
- Manufacture parts then assemble and build the prototype lab scale device.
- Perform initial test to test functionality.

Background

- Anaerobic Digestion is a natural process that involves microorganism to break down organic matters.
- Biogas and digestate is produced during the decomposition process.
- Biogas can be recovered to produce renewable energy such as electricity, heating and transportation fuel.
- The component have to be anti-corrosion to hold the corrosive gas and substance in the system.
- Anaerobic digester provides benefits like reduce waste disposal costs and extra income for the agriculture industry.
- Safety precautions have to be considered to ensure health and safety of the environment and the operator.

Design

There are some design constrains that had to be considered while developing the system:

Components	Constraints
Tanks capacity	5 Litre (x2)
Tanks Materials	Stainless Steel
Temperature	25 ~ 40°C
Motor Speed	20 ~ 50 rpm

The design work was initially carried out by hand sketching. After that, parts of the project were designed by using SolidWorks 3D software to create an assembly and drawings of the model. This approach allows student to download purchased parts SolidWorks model files from the supplier's website and provide an accurate final model design.

Material selection of each components were then discussed considering factors such as durability, cost-effectiveness, and ease of manufacturing.

Failure Modes and Effects Analysis (FMEA) was considered while finalizing the design to reduce potential defects and failures of the usage of anaerobic digester.

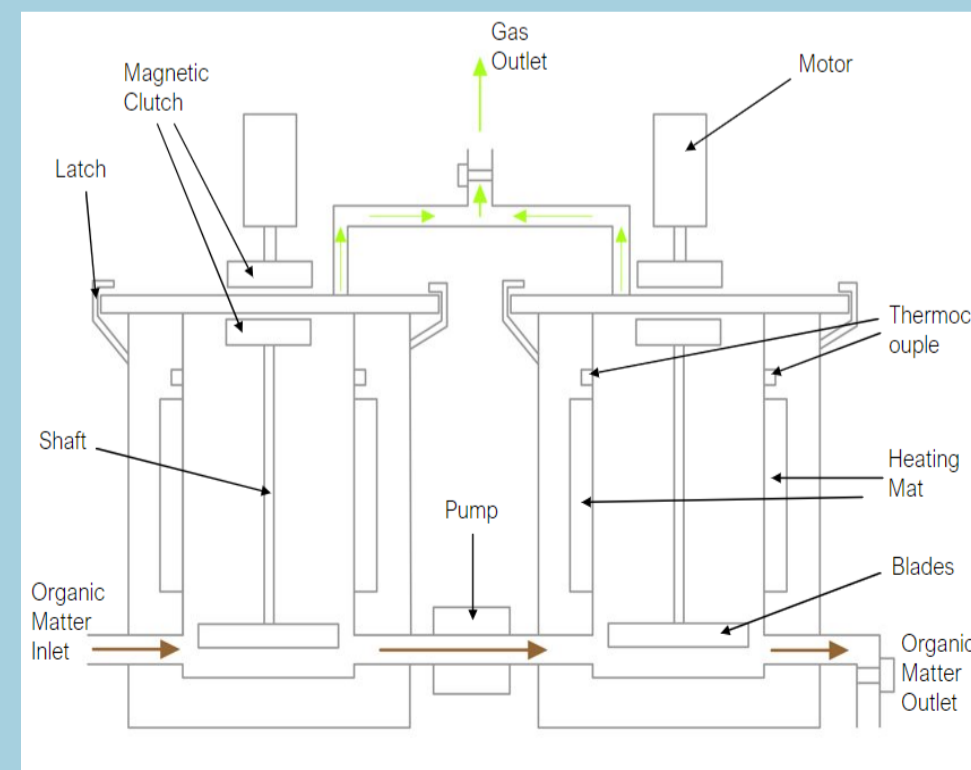


Photo of: Final Design Concept

Manufacture & Assembly

Workshop Manufacture

Some components of the anaerobic digester were manufactured manually in the engineering workshop such as shafts, motor legs and bearing holder plates. The stocks were ordered before starting the manufacture process. Lathe and Mill machines were used to manufacture the mentioned components.

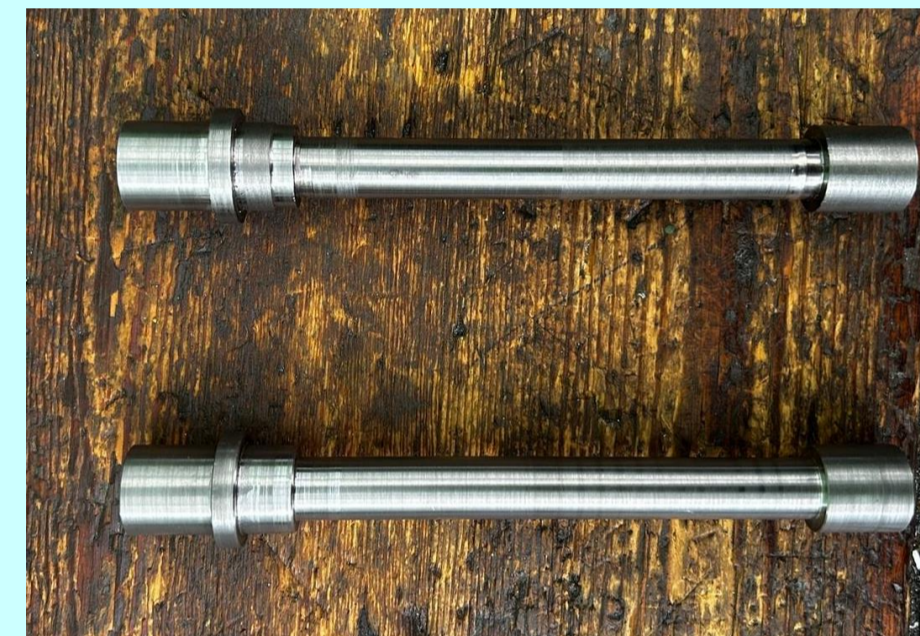


Photo of: Shafts after manual manufacture

CNC Machining

The bearing holders, shaft magnet holders and the motor magnet holders were manufactured on the CNC mill machine. Programming of the machines were done in the SolidCam software before starting the manufacture process. The CNC mill was used to manufacture high tolerance components as the holders are required to hold the components together.

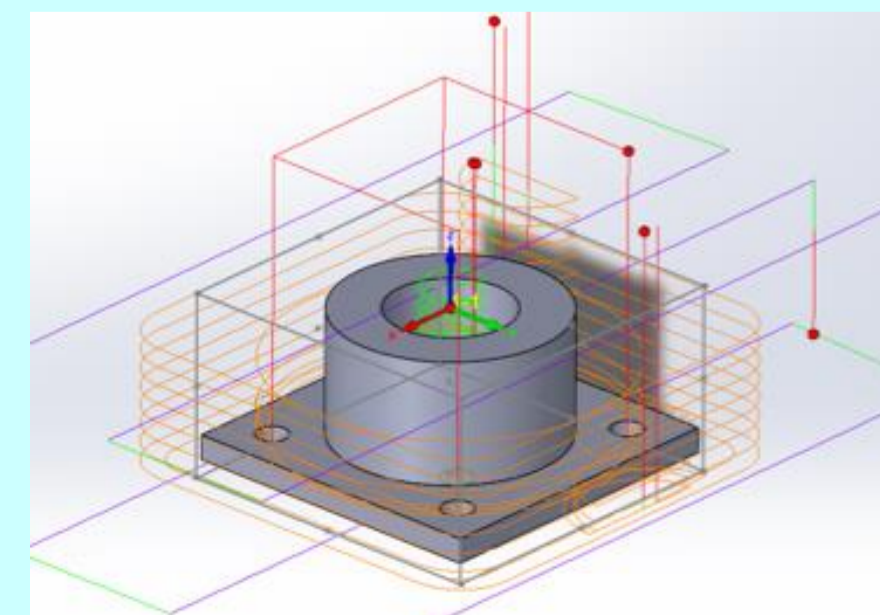


Photo of: Lid Thread Fitting with CAM tool paths

Conclusion

- Research of the project was very important to gain basic knowledge for developing the project work.
- With the include of design study, the final design of the anaerobic digester had been approved by the customer (Shannon ABC) and was designed to prevent defects and failure.
- The duration provided for manufacturing and assembling wasn't sufficient for the group to finish the components and assembly. However, some components were manufacture within the short period of time with the teamwork of group members.
- The remain manufacture and the assembly process of the prototype will continue to develop as an individual project for the group members.
- The test plan of the prototype was included in the project work for future testing.

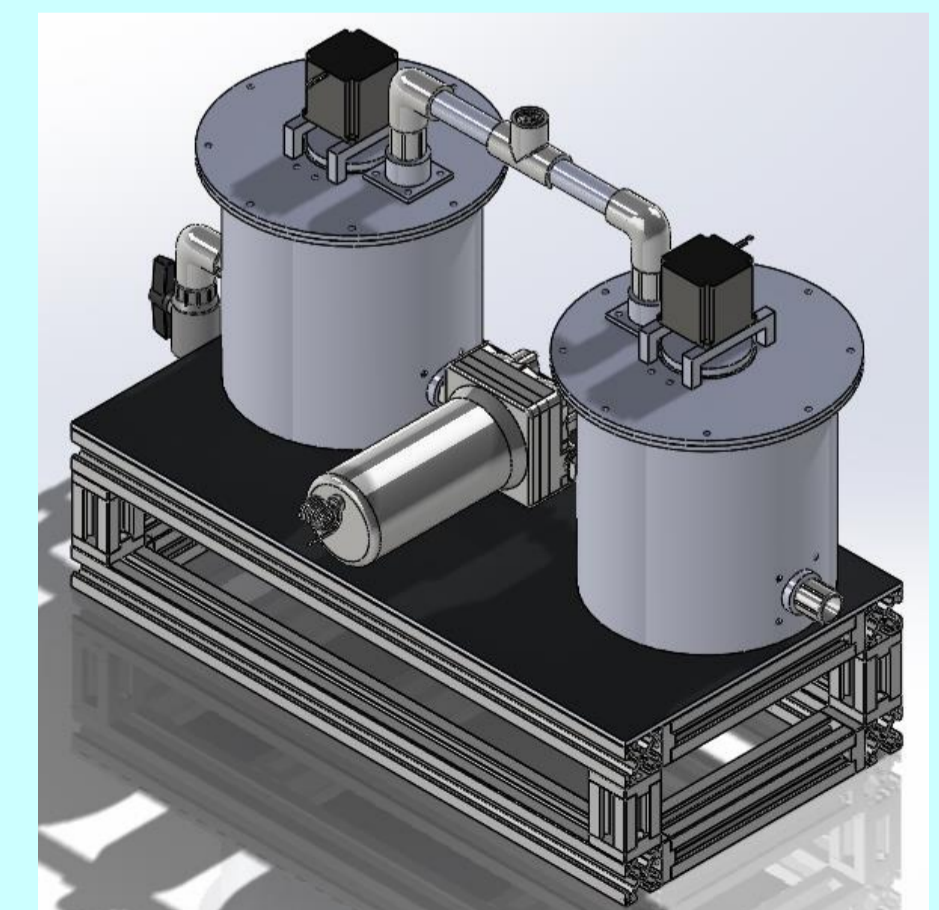


Photo of: 3D model of the Anaerobic Digester