

The Research Design and Manufacturing of an Impeller Water Pump



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Aim of the Project

To design the design and creation of an impeller water pump that functions in the most efficient way possible.

Background

An impeller water pump is a type of pump that uses centrifugal force to increase the velocity and pressure of water when pumping it from one location to another.

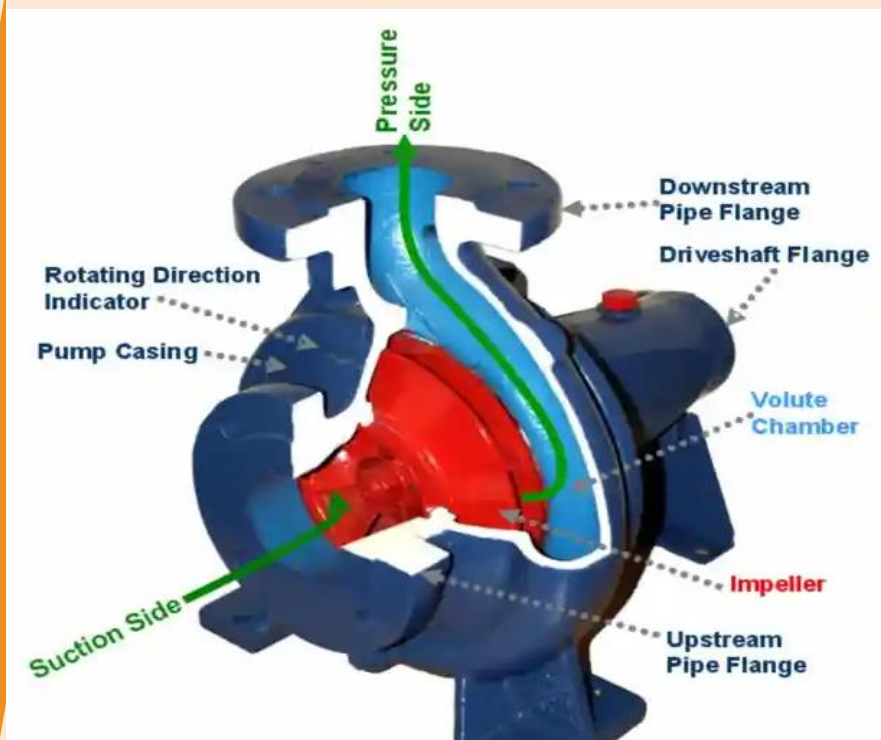


Figure 1; Impeller pump diagram

There is many different types of impeller pump, and they are used in residential environments for hot water circulation, industrial environments for waste management and agricultural environments for irrigation systems.

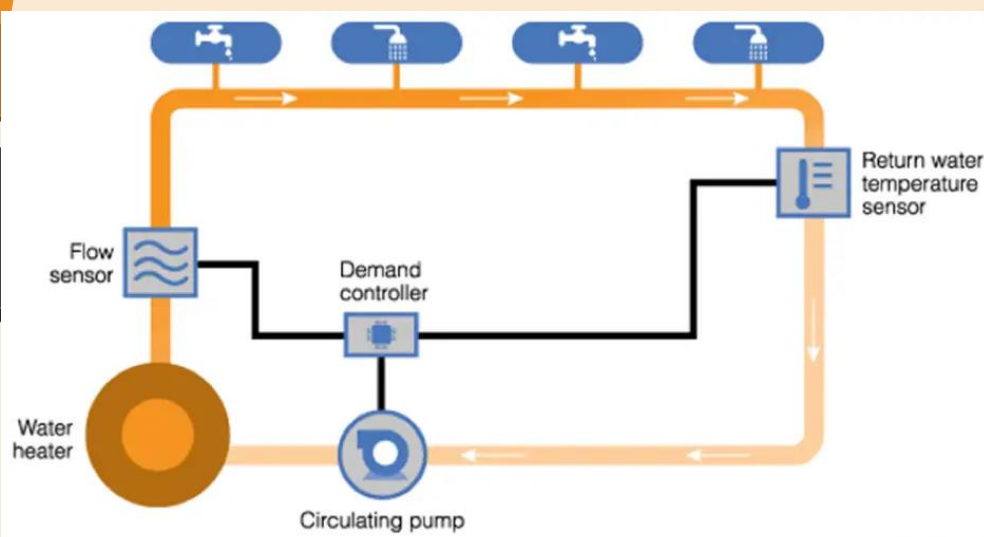


Figure 2; Hot Water Circulation Schematic

Initial Designs

Once sufficient background research was done on the different types of pumps 3 initial designs were made.

Design 1 was a typical conical impeller design with a centre inlet and radial outlet.

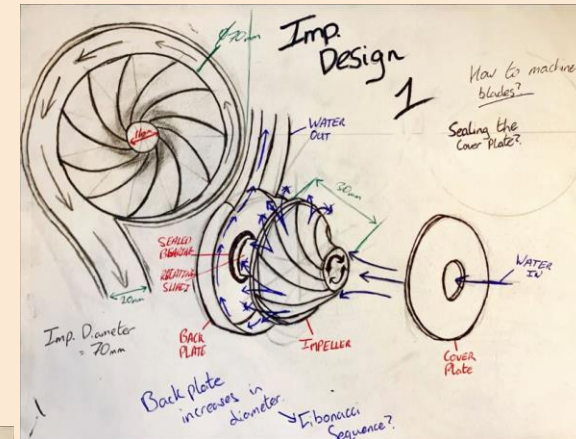


Figure 3; initial design 1

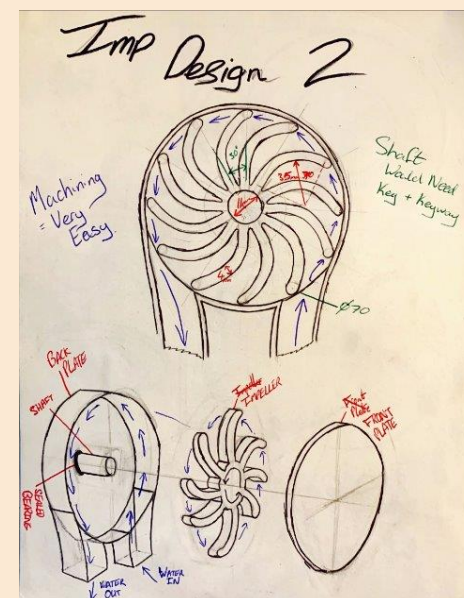


Figure 4; Initial design 2

Design 3 utilized a closed impeller with a centred inlet and a radial outlet.

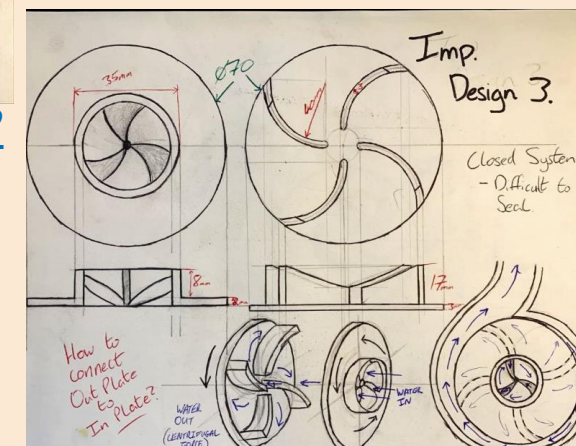


Figure 5; Initial design 3

All 3 designs were then compared using a point system to choose the best design to proceed with.

	Design 1				
	1	2	3	4	5
Ease of Manufacture		2			
Effectiveness			2		
Durability				2	
Uniqueness	2				

	Design 2				
	1	2	3	4	5
Ease of Manufacture				2	
Effectiveness		2			
Durability			2		
Uniqueness		2			

	Design 3				
	1	2	3	4	5
Ease of Manufacture		2			
Effectiveness			2		
Durability				2	
Uniqueness					2

Figure 6; comparison tables

Design 3 received the most point and was the design we decided to proceed with

Improvements

The design that was selected went through multiple revisions to improve on different aspects of the pump

- The impeller was switched from a closed design to open for ease of machining.
- An inducer was added to the centre of the impeller to improve water distribution.
- A clear acrylic top to the casing was added so the inner workings were visible during operation.

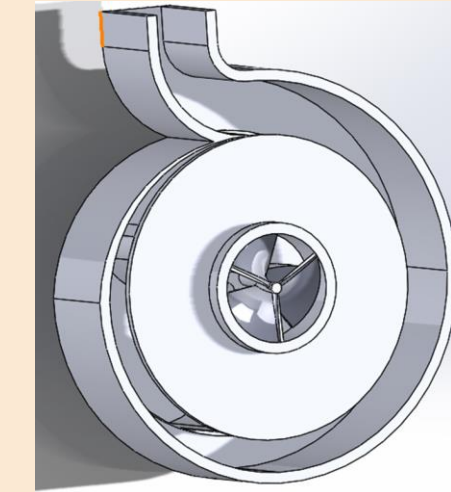


Figure 7; SW Model Pump

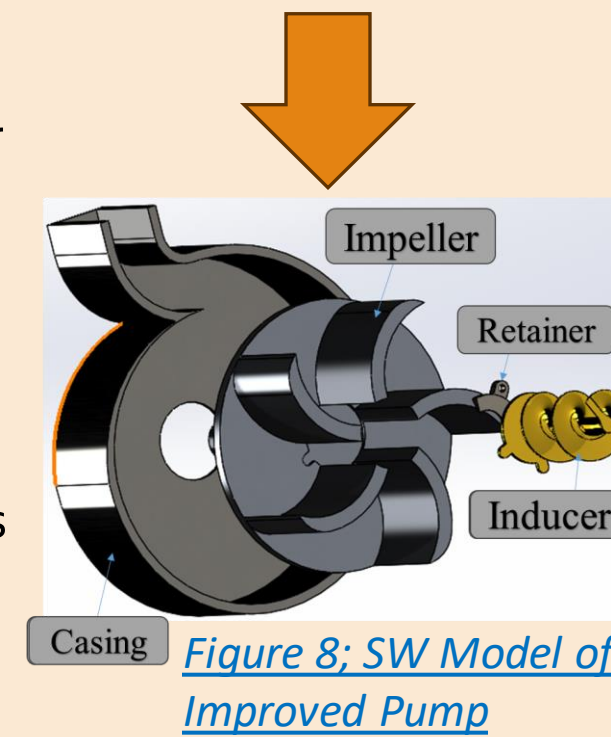
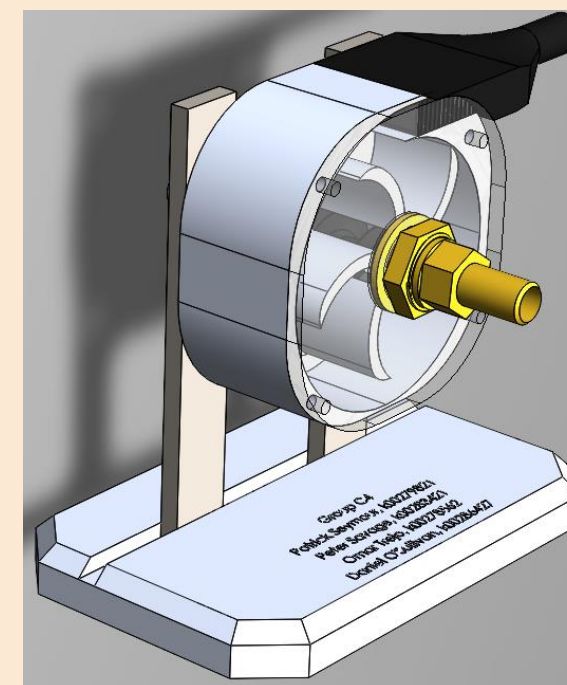


Figure 8; SW Model of Improved Pump

Final Design

After deciding on a design for the pump a couple of auxiliary pieces were designed and added such as a hose connection, a stand and an outlet adaptor.

This SolidWorks assembly shows the final design of the pump will all added components and was used as our reference point when machining the components.



Manufacturing

The majority of the components were machined on manual machines, including the lathe, mill and drill press. The blade portion of the impeller piece was machined on the Spinner CNC machine due to its complex geometry. Additive manufacturing was also utilised to produce the inducer component. In regard to tolerancing certain allowances were made for the completed assembly, considering the combination of CNC and manually produced components. Such as, allowing for extra clearance on the CNC piece to account for imperfections in the manual processes,



Conclusion

After much research and many designs revisions we were successful in manufacturing our own impeller water pump. There were a few challenges during the project but through good coordination and teamwork we overcame each of them. Our design was aimed to be efficient unique and durable. We made the best possible use of multiple kinds of machining, machining techniques and different materials. Overall, the project has helped us to increase our skills and to better the understand everything that goes into the design and manufacturing of a product