



## CHAPTER 7

### CONCLUSION & RECOMMENDATION

#### 7.1 Product design and development process

A systematic product design and development process help to fulfil project while Quality Function Deployment help in focus of customer needs which are the important aspect of product design and development.

#### 7.2 Testing prototype result

The information of prior prototype is useful in developing prototype in terms of mechanical design and production prototype. Although some part does not identical as design drawing but prototype can be test in each purpose. In addition, information of observe prototype's testing have an important value for further development because this value are effect on customer decision when product develop to manufacture phase. These information are size, weight, and thickness of volumetric faucet. Conclusions of prototype testing are show below:

##### 7.2.1 Flow rate and volume relationship

Volume of volumetric faucet varies proportionate with the change in flow rate change which has small deviated portion.

Water volume deviation = 2.22%

This deviation is also in range of engineering specification (15%). This means the deviation of volume is acceptable. But prototype can not work on flow rate lower than 4 litre/minute, which will be the information back to QFD method to balance and prioritize the customer requirement and engineering specification.

### 7.2.2 Open volumetric faucet's moment

Value of moment to turn volumetric faucet is directly related with friction of ball valve. It is observed that friction of ball valve vary along usage time. Average moment to turn volumetric faucet also effect the operation of ratchet because the ratchet design from initialize torsion spring moment after in lock position. If moment increase the release's ratchet lock also increase. This relationship can be analyzed by analytical prototype further.

Average moment for open volumetric faucet = 0.70 newton-metre

When comparing average moment for open volumetric faucet with regular ball valve, it shows that moment to open volumetric faucet is larger than moment to open ball valve 0.462 newton-metre and lower than value from prototype design. From this point its indicated that its has possibility on next develop to decrease moment for open volumetric faucet. And in the terms of customer who does not concern with engineering specification, prototype can be used for demonstration and let the customers test by themselves.

### 7.2.3 Release lock's ratchet moment

The average moment to release lock's ratchet mechanic can tell the feasibility for further development. If the ratchet lock need more moment to release it is possible that the ball valve concept can not work. New concept will be considering or redesign.

Average moment for release ratchet lock = 0.118 newton-metre

From the testing result the average moment for release ratchet lock is lower than calculation moment in design phase. It is confirm that mechanic or design ratchet can be further developed in this concept.

#### 7.2.4 Mechanic working feasibility

Overall of volumetric faucet working observation, the concept of ball valve with ratchet mechanism can work in reality but it needs further analysis and test. The testing also give more information of unexpected event which not in design. It is the stability of working. In some time of testing prototype, the ratchet lock can not release because the sticking of mechanism. These cause to explore prototype and rebuild again and again. Some water leak on prototype hosting occurs when then increase flow rate more than 6 litre/minute this can correct by using silicone seal.

### 7.3 Recommendation for further study

This prototype is one part in all of product design process, which need to further development. The information that get from this prototype is useful for refinement design or make decision on choice continue or terminate volumetric faucet project. The suggestion and comments on this project are list below.

#### 7.3.1 Accuracy and volume range of volumetric faucet

The faucet accuracy is dependent on many factors, such as flow rate, transmission gear system, lock's ratchet mechanic, and back moment of torsion spring. Some of these factors can test by use analytical model to reduce cost and time. The volume of volumetric faucet is depend on transmission gear and ratchet gear that can adjustable in design process.

#### 7.3.1 Transmission system

The alignment of transmission gear system is an important factor on faucet operate. It is include of the number of teeth and number of gear in system. Although this prototype does not focusing on transmission system but for further development gear system sub-function is directly effect on performance of faucet. The connection of gear system and measure volume system is possible to separate to two chambers and use permanent magnetic field for transferring torque to reduce water leakage problem.

### 7.3.2 Open/Close mechanism

Testing prototype show that ball valve concept can be used for open/close mechanic of volumetric faucet. This does not mean that the final product of volumetric has to use ball valve concept because these testing result focus on feasibility of open/close mechanism and not proof-of-performance, proof-of-assembly, and proof-of-production. If there is enough funding to do more research, ceramic valve is another choice of open/close mechanic on further development.