

Automated Water Desalination Device Using Closed Circuit Reverse Osmosis (CCRO) Technology



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KFUPM Design Expo

Background

Desalination is the process of removing salts from water sources, and it is crucial due to global water scarcity. With only 1% of Earth's water being freshwater, and 1.1 billion people lacking access to clean water, desalination plays a vital role. The rising sea levels caused by climate change make this issue even more pressing. Reverse osmosis is a key desalination technique, that uses a semi-permeable membrane to filter out salts and contaminants. Total Dissolved Solids (TDS), measured in parts per million (ppm) or milligrams per liter (mg/L), is essential to consider in the desalination process to determine water quality. As climate change intensifies, leveraging desalination methods becomes crucial for sustainable water solutions.

Introduction

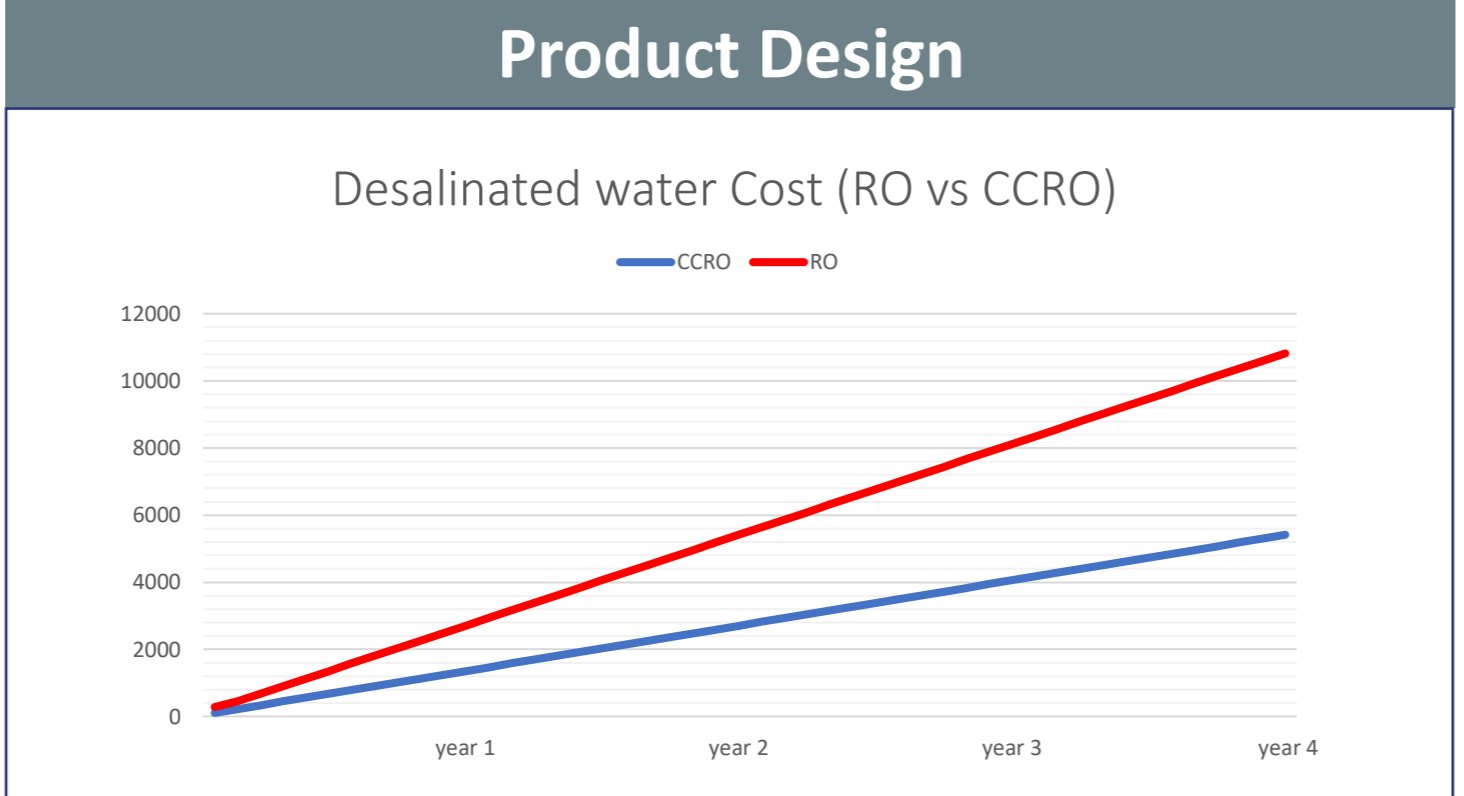
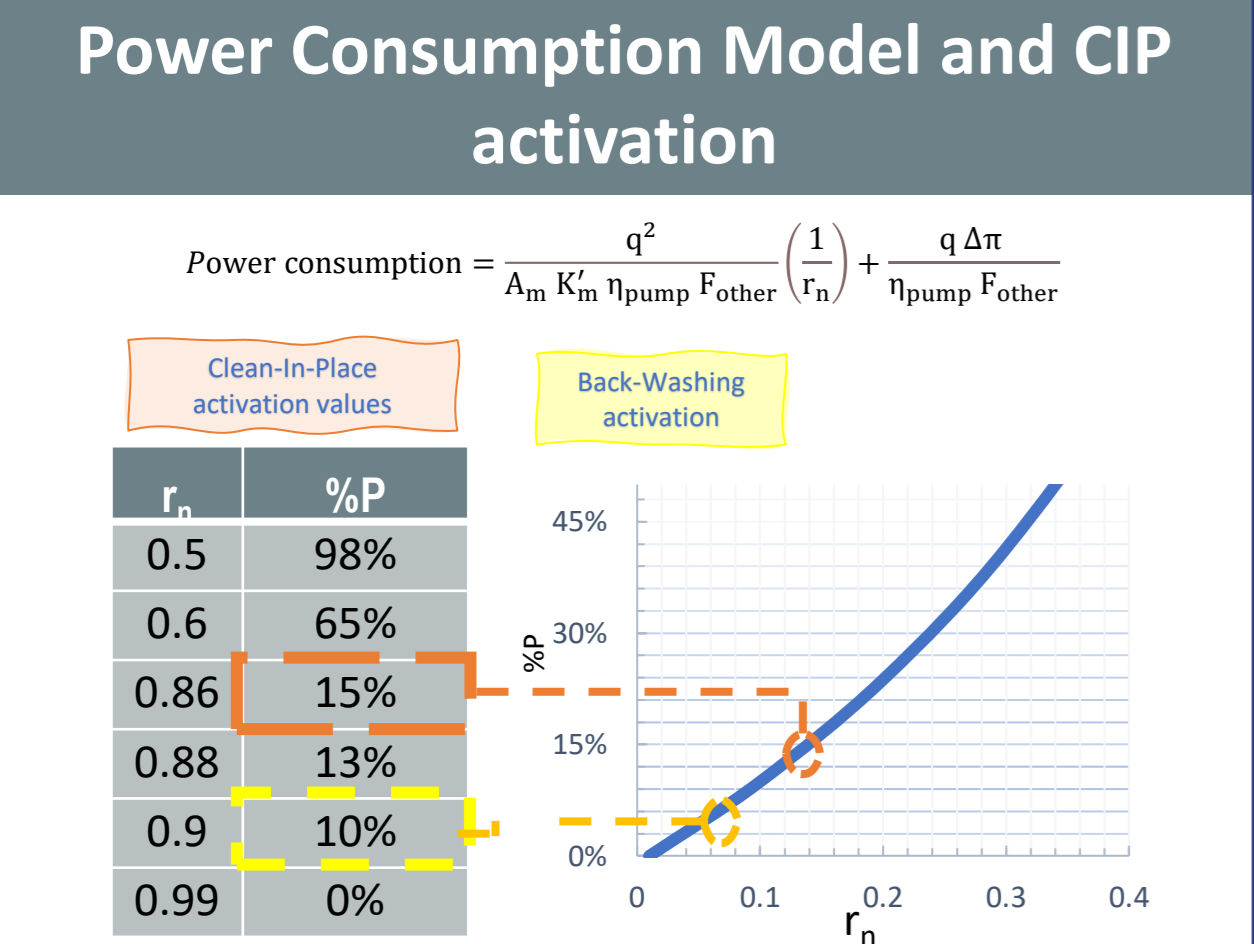
– Problem Statement
Design a desalination device that uses a new reverse osmosis technology that increases the purified water ratio and maximizes the produced distilled water.

– Constraints

- ❖ Lifespan of Filters
- ❖ Source Water Limitation
- ❖ Size Limitation
- ❖ Flow Supply Pressure

– Target Specifications

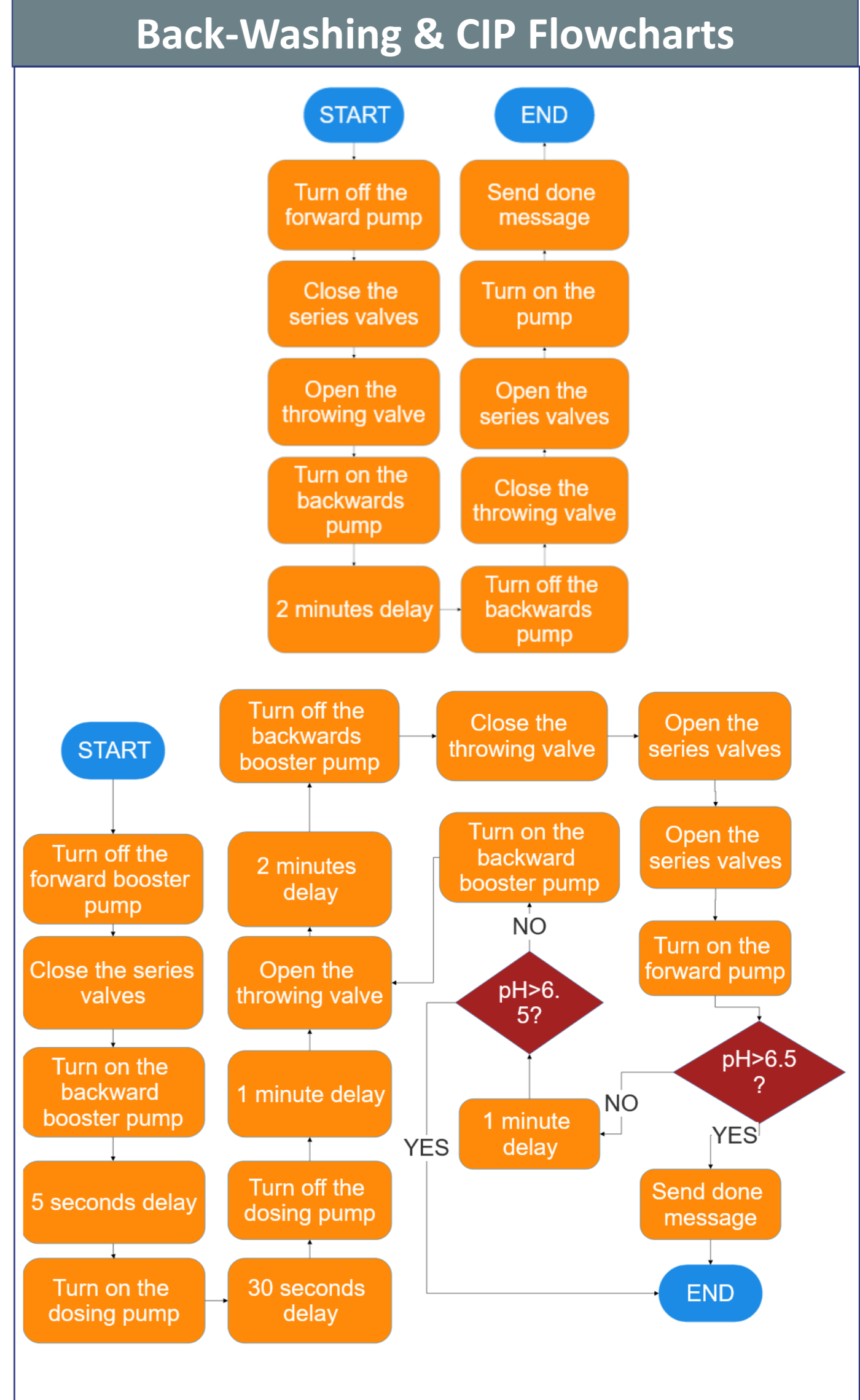
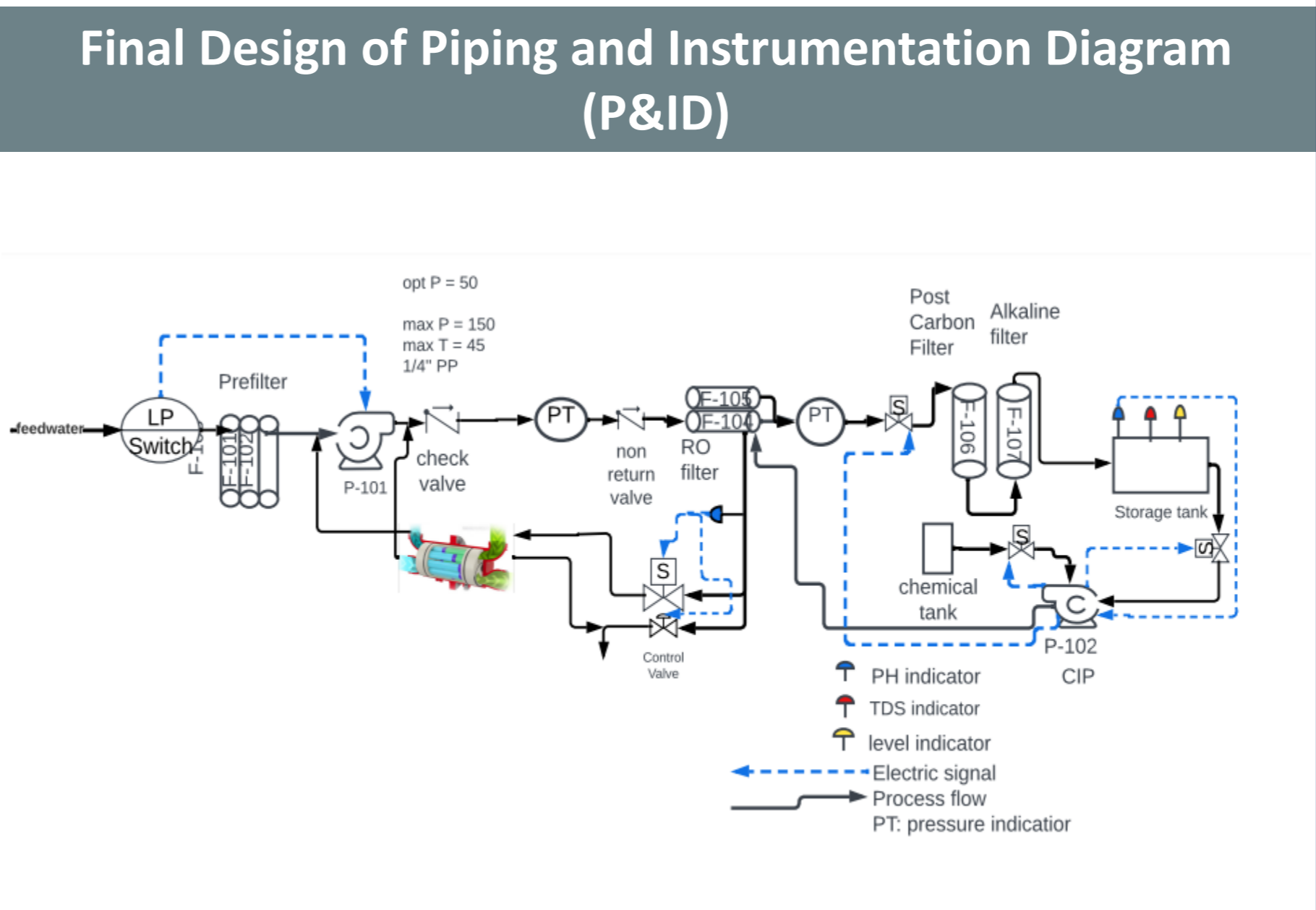
- ❖ Increase Recovery Rate (from 15 to 60%)
- ❖ Capacity (25 liters per hour)
- ❖ Size (470×300×200 mm)
- ❖ TDS (Target: Less than 100 ppm)
- ❖ Production Rate



Proof that the Final Product Meets Specifications

Product Specifications Assessment:

- 1. Recovery Rate (60%)**
Utilizing advanced reverse osmosis, our product efficiently recycles tap water with a 60% recovery rate, achieved through system optimization to minimize wastewater.
- 2. Capacity:**
The system, designed for 25 L/h capacity, achieves effective distillation and delivery through high-capacity components and a calibrated process.
- 3. Size:**
The product is meticulously designed for specified dimensions, ensuring portability and easy installation under various settings like kitchen sinks. Thoughtful engineering maintains size limitations without compromising performance.
- 4. TDS (Target: Less than 100 ppm):**
Using advanced reverse osmosis membranes, the product consistently maintains a TDS level below the specified target of 100 ppm. The design effectively blocks dissolved salts and impurities, ensuring high-quality water for various applications.
- 5. Production Rate:**
The production meets expectations, delivering the designated volume of distilled water per hour. This is achieved through an optimized distillation process, ensuring efficient water production while maintaining desired quality.



Conclusion

In conclusion, the development and implementation of the CCRO (Closed Circuit Reverse Osmosis) system represent a significant stride toward addressing the critical need for a sustainable and efficient water supply in homes, offices, and schools. Through meticulous design and engineering, we have successfully created a system that meets or exceeds stringent water quality standards while considering factors such as energy efficiency, scalability, and user-friendliness. The project's success lies in its potential to contribute to water security, health, and productivity in diverse settings.