# *Tracking Wheel*

***Background***

In December 2017 ASAsoft, a Victoria, BC based manufacturer of polymer power line insulators, reached out to Dennis Hore, an Associate Professor of the University of Victoria (UVIC), to create a partnership focused on researching the material performance of polymer insulators. Specifically, how certain material properties such as hydrophobicity change as an insulator is exposed to contaminates. Understanding how these contaminants accumulate and interact with surface and bulk polymer requires a controlled test environment in which insulators can be contaminated and then subjected to high voltages. Such requirements are satisfied by an electromechanical test apparatus known as the tracking wheel.

Completed as a joint effort between UVIC's Science Machine Shop and Department of Chemistry's Electronics Shop, the proposed tracking wheel design consists of the following primary components (Figure 1):

1. Rotor
2. Lift
3. Tanks
4. High Voltage Contactor
5. Frame

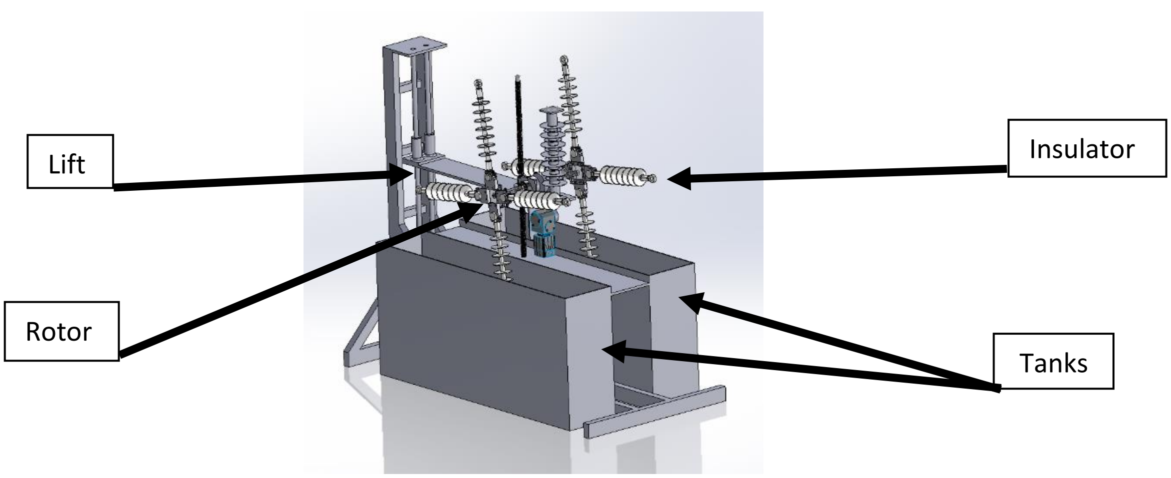


**Figure 1: Tracking Wheel Apparatus (Isometric View)**

***Control System Design***

To achieve complete automation of the electromechanical assembly it is first required to understand what actions it must perform. A tracking wheel test simply consists of repeating a specified number of test cycles. Each cycle Is composed of the following four steps (Figure 2).

Step 1: Contaminate
The insulator is submerged in the contaminant solution.

Step 2: Drip
After being submerged the excess contaminant solution drips off the insulator

Step 3: Energize
The user specified voltage is applied to the active end of the insulator

Step 4: Idle
After being energized, the insulator in position 2 drains of any excess charge and sits idle for contamination

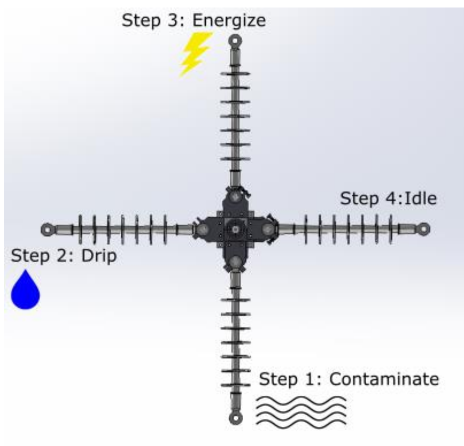


Figure 2: Tracking Wheel Cycle Diagram

Therefore, to complete the proposed tracking wheel design, a control system must be implemented which addresses the following objectives:

1. Fully automates all actuations of the high voltage source, rotor motor and lift motor to perform each step in an aforementioned test cycle
2. Repeat a specified number of cycles
3. Allows the user a means of inputting test parameters
4. Provides multiple safety measures and fail-safe operation
5. Monitors and displays test progress
6. Alerts the user of system malfunctions

To meet these requirements, a PLC based control system was assembled with off the shelf components. The design primally relies on the discrete switching of relays to energize motors and HV sources in a control sequence. An off the shelf HMI was ideal for providing a means of inputting test parameters and providing alerts and feedback.