Project Deliverable B: Need Identification and Problem Statement

GNG 1103 – Engineering Design

Faculty of Engineering – University of Ottawa

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Client Needs: (Weighted 1=Low priority, 4=High priority)

**Reproducible and Thorough Tests (4)**

* Not a one-off test
* Flexible (Can change test material and run another test)
* Can simulate several different conditions
  + Variable speeds and temperatures, different fluids, density/composition of test material
* Show results of each test proving the effects of erosion

**Safe (3)**

* No pressurized system (work at atmospheric conditions)
* Can’t exceed certain rpm
  + RPM could be kept under 2000 as below this value allows erosion test result to be obtained within a week
* Sturdy construction
* Temperature of fluid doesn’t exceed 40C

**Cost effective (2)**

* Easy to find materials
* “Beg, borrow, and steal” (Her words)

**Aesthetics (1)**

* No concerns on noise
* Should look presentable, doesn’t need to be exquisite

**Time (3)**

* Within time to design day
* 2 weeks to 1 month -> should see erosion
* Simulate 2 years of use

**Problem Statement:**

Design and build a device that is able to accelerate erosion testing on a variety of sample materials. It must be able to repeat several experiments with different samples, be able to show results in 2 weeks to a month, be cost effective, and pose no risk to the users due to solid construction.

The challenge is to develop a versatile erosion testing method that accommodates a variety of materials, ensuring a comprehensive evaluation of their erosion resistance in rotating environments. The test should be characterized by its efficiency, allowing for quick assessments (within weeks) without compromising accuracy, repeatability, or safety. The need comes from the absence of a standardized erosion test capable of simulating various conditions while providing reliable and timely results. The goal is to address this gap by designing an erosion test environment that not only considers different material properties but also incorporates safety measures, enabling repeated evaluations without sacrificing precision, cost-efficiency, or the ability to simulate different environmental conditions.

**Research and User Benchmarking:**

* Many examples found online use a high pressure jet of water aimed at the centre of a brick or piece of stone.
  + This acts to simulate the erosive effects of water on a rock sample, however might not be effective on all sample type.
* Other examples have a motor that spins a sample submerged in a tub of fluid

**Unknowns:**

Temperature dependence: if we change the temp how does that affect the material.

Liquid type: the sample erosion test uses water, when designing the components we may to determine what happens when we operate in an environment in different pH

Liquid Density: do we want to allow for liquid with different density