Non-Clogging SIMSITE® Structural Composite Impeller Converts Centrifugal pump into Sludge Handling Pump.

1 Introduction

Centrifugal Pumps are often employed in pumping processed aerobically digested sludge at Waste Water Treatment Plants. The problem is that hair and other stringy materials get caught in the Pump Impeller. As the Impeller gets clogged, the pump performance subsides

to zero. The clogged Impeller interrupts the treatment process and requires the operators to take the pump apart and clean it as often as a few times a day.

SIMS Pump CO. was tasked to investigate the possibility of re-designing of the Metallic Enclosed Centrifugal Impeller and Manufacturing a Non-Clogging SIMSITE® Structural Composite Impeller to resolve the pump clogging problem.

The customer specified that the Non-Clogging SIMSITE® Impeller must to fit into the existing Pump Casing and match a performance of the original metallic Impeller, therefore eliminating a need for a new Electric Motor.

The new Open face SIMSITE® Impeller was designed, built and tested. The SIMSITE® Impeller was tested on clear water to prove that the pump performance was not affected. After that the Pump with SIMSITE® Impeller was tested pumping 2" long 1/8" diameter nylon strings. The test clearly showed that the SIMSTE® Open Face Impeller was capable of pumping the strings without clogging or performance degradation. The Pump with Enclosed Impeller was incapable of processing the same amount of the strings.

Pic.1 SIMSITE® Structural Composite Non-Clogging Impeller.

2 Pump Description:

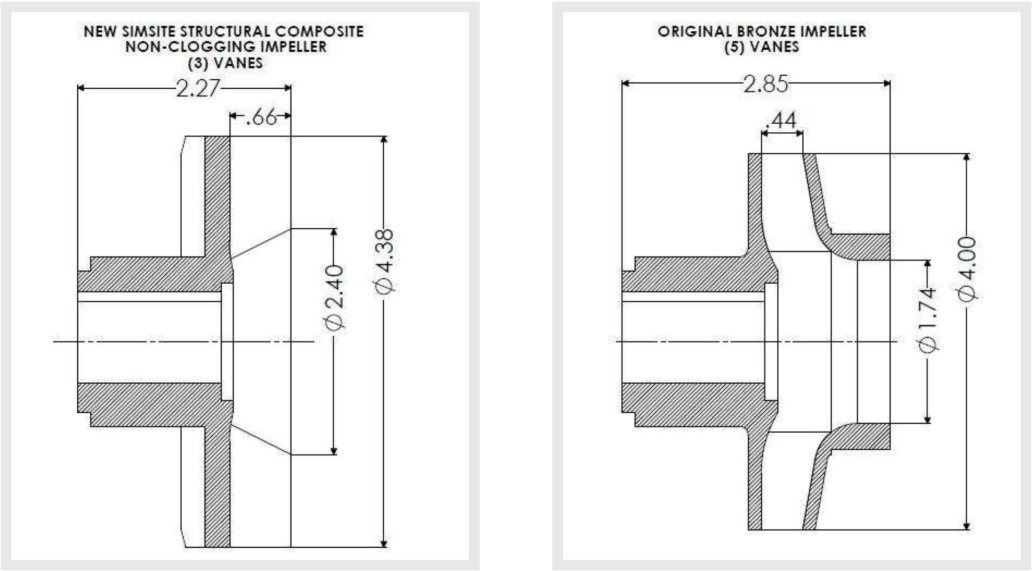
The subject pump is a vertical, overhang Impeller, close coupled design. The pump performance is 80 GPM at 48 Ft of Head. This performance is being achieved with a 2 Hp Motor running at 3500 RPM. The Pump Casing has a 2 inch suction and 2 inch discharge in an in-line configuration.

3 Non-Clogging SIMSITE® Open Face Impeller.

To design a proper SIMSITE® Structural Composite Non-Clog Impeller, we had to make drastic changes to the original Enclosed Bronze impeller.
First, the front shroud was removed. The second, the number of vanes was reduced; we opted for (3) three vanes versus original (5) five vanes. This opens up the channel between the vanes and reduces potential risk of clogging.

The back pump-out vanes were added on the Impeller Back Shroud preventing fibers from clogging a seal chamber. After these changes were made, the vanes geometry had to be adjusted to match the original performance.

The drawing below compares the SIMSITE® Structural Composite Non-Clog Impeller with the original Enclosed Impeller.



Pic.2 Meridional Profile of Non-Clogging Impeller vs. Conventional Enclosed Impeller.

Pic.3 SIMSITE® Non Clogging Impeller next to Conventional Enclosed Impeller.

4 Pump Performance on Clear Water. Non-Clogging SIMSITE Impeller vs. Enclosed MetallicImpeller.

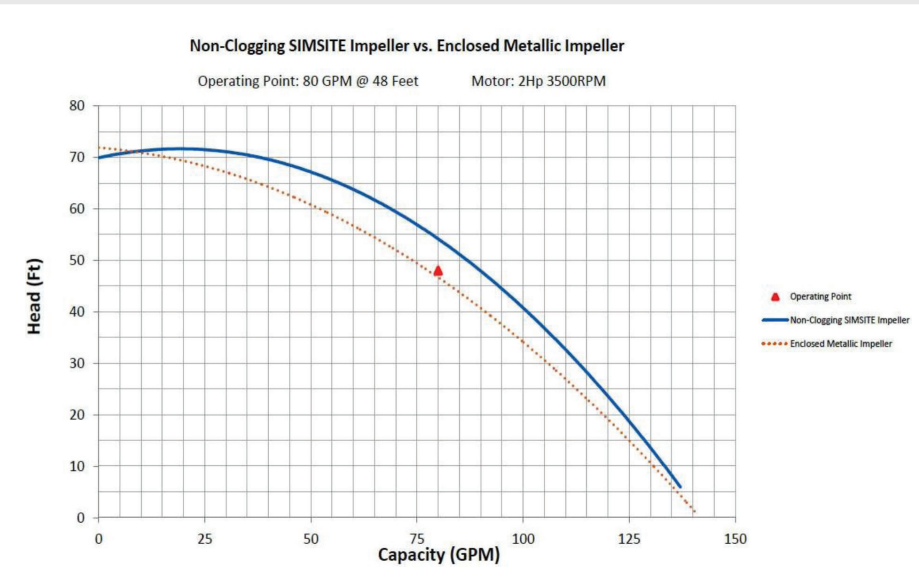
The Test Stand was built out of transparent piping allowing for observation of the flow circulation.

The subject pump was tested first in the Close Loop Test Stand on clear water with the Enclosed Metallic Impeller and then with the SIMSITE® Non-Clogging Impeller. Below is the picture of the Stand.

Pic.4 Pump on a Transparent Closed Loop Test Stand

The graph below shows the pump performance with the SIMSITE® Non- Clogging Impeller vs. the Enclosed Metallic Impeller.

It can be seen that the Non-Clogging Impeller matches and even outperform the Enclosed Metallic Impeller. This testing was done with clean water; no fibers had been added into the loop.



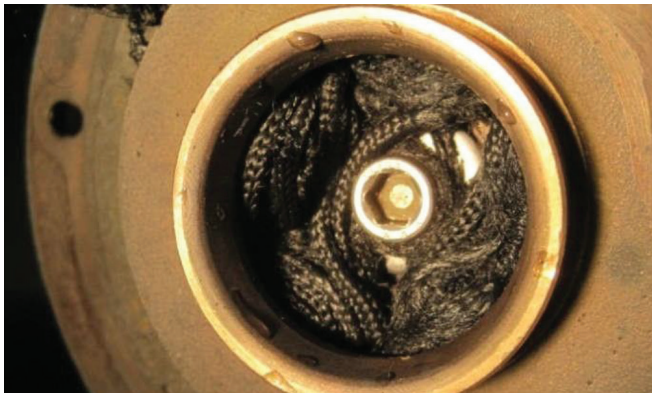
Pic. 5 Comparison of Pump Performance with SIMSITE® Non-Clogging Impeller vs. Conventional Enclosed Impeller.

5 Pump String Handling Capabilities.

Nylon strings were chosen to simulate fibrous material.
The 2 inches long, 1/8 inch diameter soft flexible nylon rope was cut for the test. The pictures below show an individual fiber and a number of them together ready for the String Handling Test.

Pic.7 Simulation of fibrous Material

The pump with the Enclosed Metallic Impeller was tested first.
This test was started running the pump at the operating point at 80 GPM. and slowly dropping the fibers into the loop. The first 25 or so fibers were dropped in a few at a time and immediately the Pump Capacity dropped by 20 GPM down to 60 GPM. The pump was still moving the fibers through but not as well; the fiber had started to come out of the discharge clumped together. As we added more fibers the capacity continued to drop until it was down to less than 40 GPM. At this point all the fibers were in the system but there were not any fibers circulating in our test stand.
Upon inspection of the Enclosed Metallic Impeller it was found that a large majority of the fibers have become intertwined with the blade of the impeller.

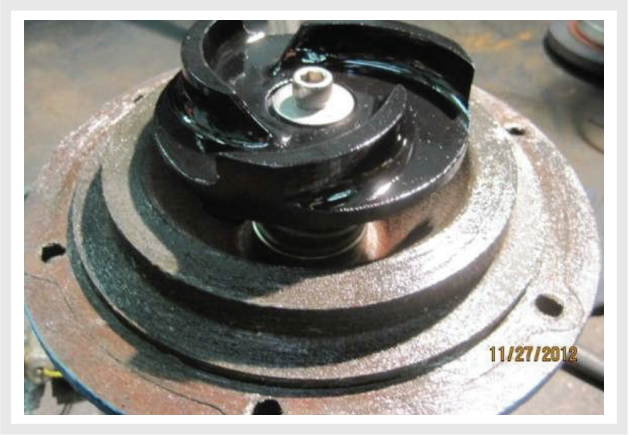


Pic. 8. Clogging of Enclosed Impeller.

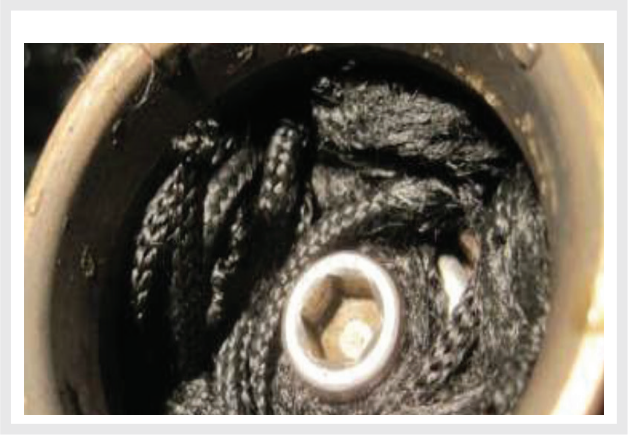
The pump was disassembled and fit with the Non-Clogging SIMSITE® Impeller. The same String Handling Test was performed. The pump was set up to run at the operating point.
The 25 strands of fibers were introduced into the Test Loop.

The pump performance was not changed, and we observed fibers circulating through the Test Stands freely.

The Non-Clogging SIMSITE® Impeller handled the fibers without any issue; no drop in performance was detected, no noticeable vibration or noise were detected either. We ended up putting roughly (75) seventy five of the fibers into the Test Loop and the Non-Clogging SIMSITE® Impeller kept on pumping the fibers through.



Pic. 9. SIMSITE® Non Clogging Impeller not clogged by the fibers



Pic. 10. Enclosed Impeller.

The Test Stand was drained, and upon inspection of the pump it was found that the Non-Clogging SIMSITE® Impeller was absolutely clear from the fibers. Meanwhile the fibers were collected at the lowest point of the Loop, into the Suction of the Pump Casing.

This fact proves that the Non-Clogging SIMSITE® Impeller is working as it was intended, permitting the pump to handle the stringy materials.

6 Conclusion.

A centrifugal pump can be adapted to unintended services by modifying and/or upgrading the Pump Components.

A Pump String Handling Capability can be greatly improved by proper Impeller design, utilizing advantages of an Open Face Impeller.

A proper Impeller design allows the differently shaped Open Face Impeller to match the performance of the Enclosed Impeller.

Additionally, manufacturing the Impeller from SIMSITE Structural Composite will further enhance the pumps Corrosive Resistance. SIMSITE® Impellers will never corrode in Sewage, Salt water, Chlorinated Water and any other services.