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DECEMBER 2, 2021

GROUND ENGAGEMENT TOOL

DCT TEST RESULTS

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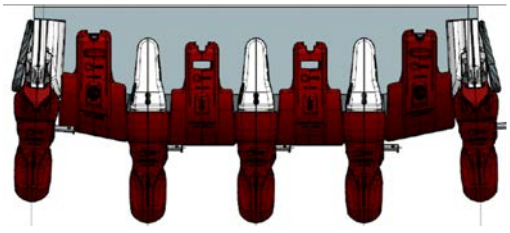
TEST RESULTS

During the summer of 2021, Induspec performed deep cryogenic treatment (DCT) of several large bucket teeth. The work was performed in conjunction with a confidential mining company and two different brands of bucket teeth were treated and ultimately tested in real mine operation. We think that real life testing is incredibly important. Thousands of academic articles are available showing the effectiveness of DCT in a lab. However, you don't care about how things work in a lab, it needs to work on your site!

Bucket teeth before Induspec DCT treatment

Our partner mine used the teeth on a bucket which uses five (5) bucket teeth and it is known that the off-cab side end tooth, in what we call "Position 5" is always the first to wear out. While the teeth start at a nominal length of 24", they are changed when they have worn down to 13.5".



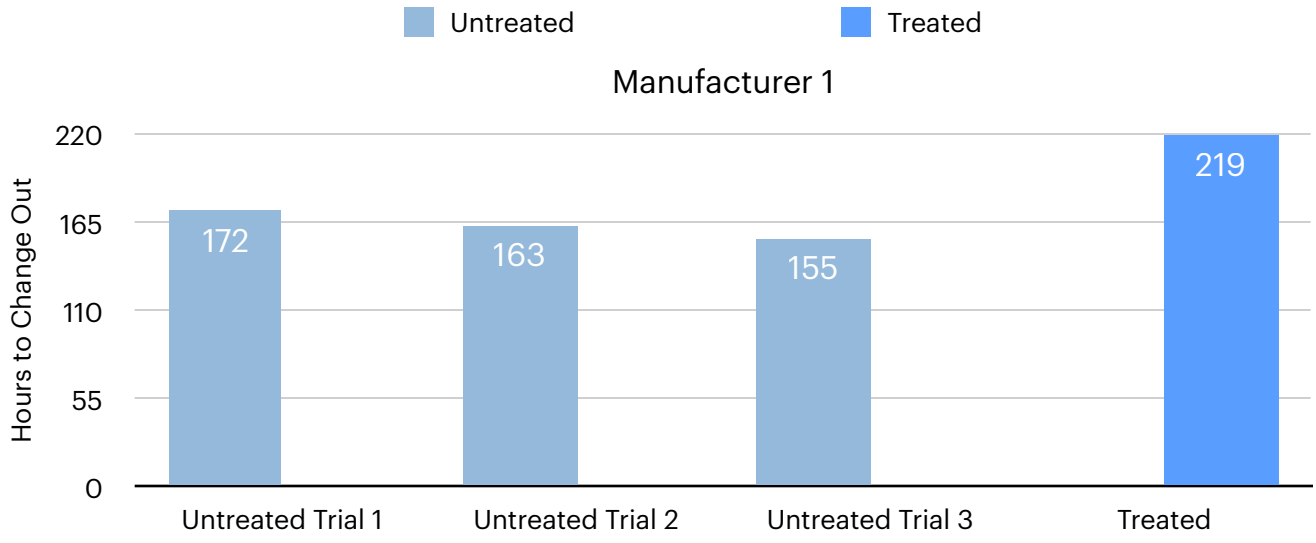
1 2 3 4 5

Typical Bucket Configuration

MANUFACTURER 1

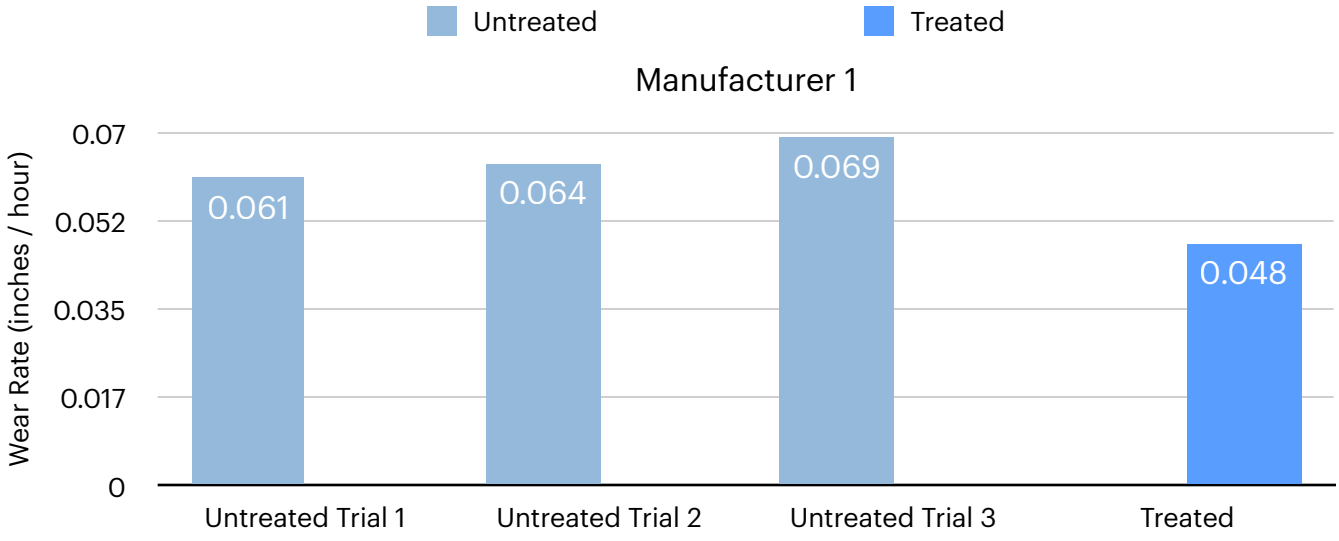
The un-treated teeth from Manufacturer 1, over the course of three tests, lasted for an average of 163 hours of operation before the tooth in position 5 was worn down to 13.5". Of course, there was some

variation due to ground conditions. In fact, there was a variability of about ± 5%. However, when a Deep Cryogenically Treated tooth was put into the #5 position, something remarkable happened. Instead of lasting for 163 hours, the tooth lasted for 219 hours. A 34% improvement!



34% Improvement in wear life

When measuring the wear rate, we see similar results! In position 5, the wear rate is significantly lower for the cryogenically treated tooth than it's untreated comparisons.



31% Decrease in wear rate

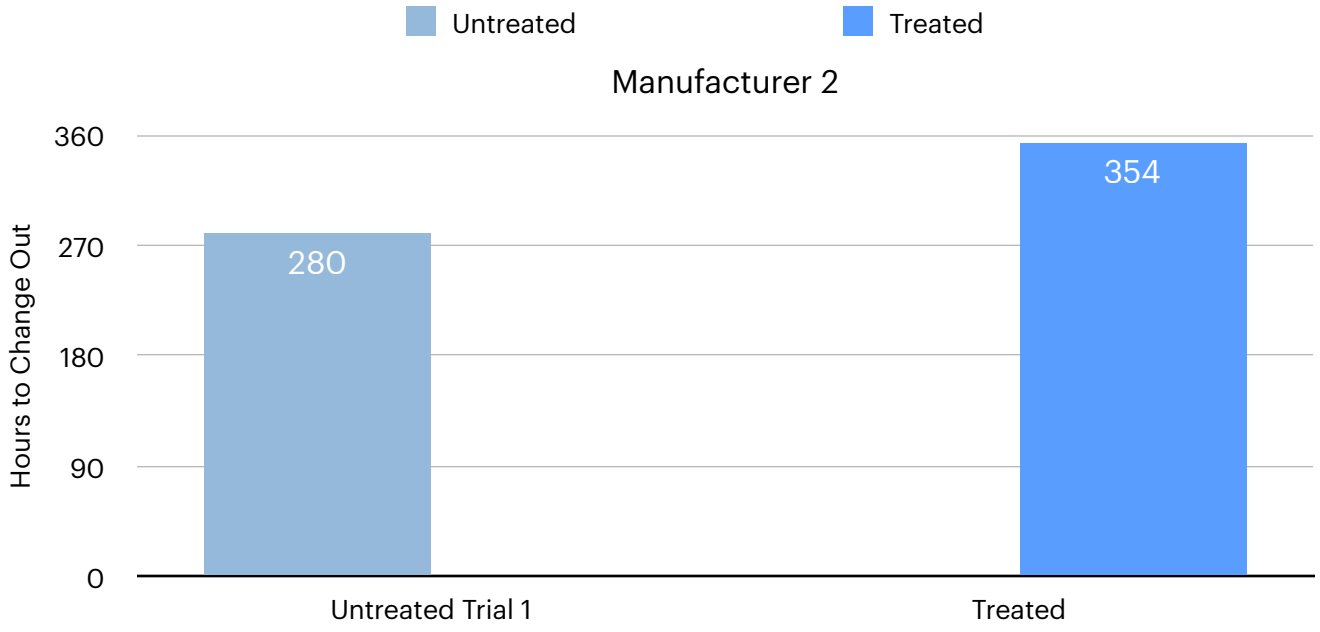
While the un-treated teeth wore at an average rate of 0.065 inches / hour, the cryogenically treated tooth wore at only 0.045 inches / hour; a 31% improvement!

Similar improvements were observed in position 3 (32% improvement) and in position 4 (31% improvement).

MANUFACTURER 2

For Manufacturer 2, a slightly less rigorous testing protocol was undertaken consisting of only two tests. In the first test, deep cryogenically treated teeth were set in positions 3, 4 & 5 whereas in test 2 only untreated teeth were used.

In test 1, the teeth wore down to 13.5" after 354 hours whereas the untreated teeth only lasted 280.5 hours. DCT provided a 26% improvement in the life of the teeth! Comparing wear rates, we see that the deep cryogenically treated #5 tooth wore at a rate of 0.028" / hour of operation while the untreated tooth wore at 0.036" / hour. DCT provided a 22% improvement in wear rate!



31% Improvement in wear life

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CONCLUSIONS

An improvement in bucket tooth life of 34% and 26% respectively were observed when the bucket teeth of two different manufacturers were deep cryogenically treated by Induspec. The tooth wear rate was decreased by 31% and 22% respectively corresponding well with the observed life extensions.

In real life, these exciting test results mean two important things:

1) By utilizing Induspec's deep cryogenic process, bucket tooth change-outs can be reduced by 20 - 30% depending upon the brand of bucket teeth being utilized

2) If you are like this mine, all teeth on a large excavator are changed when one tooth reaches the minimum useable length. Based on this common sense approach, savings can be optimized by only cryogenically treating the teeth, or tooth, that are wearing the fastest!

If you would like to learn more about this exciting technology or discuss our test results in more detail, please feel free to contact us.

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