Engine test report

Born CLS Bond™ Oil Additive

VOLVO-PENTA MD-1

Commisioned

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1) Introduction

During the spring of 2001, there were tests conducted with 2-stroke oil blended with an additive based on Advanced Lubrication Technology, Inc.'s Boron CLS Bond™. The test bench setup was a Husqvarna chainsaw engine HVA 346.

The purpose of the test was to study the claimed low friction performance of the product.
The tests were conducted in a test bench at the research laboratory in Sweden.

2) The product

The oil additive was delivered by Samvina AB and mixed at a ratio of 100:1 with HVA-blend fuel (RON 92)

Initial run and base performance was performed with Husqvarna 2T-LS oil mixed with a ration of 50:1 using HVA-blend fuel.

3) Test engine

Tests were conducted on a chain saw with the following technical specification:

Technical specification (Basic)	
Engine type	HVA 346
Engine id-Laboratory	00-01-1/A
Engine-id-manufacturer	99-5000 548
Stroke(mm)	42
Slaglängd(mm)	32,5
Cylinder volume(cm3)	45

Measured data according to:

UPPMÄTTA DATA	
Avgasperiod (deg)	147,5
Spolperiod Fr. (deg)	109
Inloppsperiod (deg)	138
Toppspel Fr. Cyl.kant	1,15
Toppspel Fr. 3mm f k	1,3
Vk (cm3)	4,8

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4) The tests, methods

The engine was run for 2 hours with HVA-LS 2-stroke oil following a performance test with temperature logging.
The tests were done at full throttle over 6,000-10,000 rpm, and for different A/F at constant 8,400 rpm.

In the following stage, the engine was treated with Boron CLS Bond™. The method was 15 hours running with a constant load on a bench test with a rich air/fuel mix at 7,200 rpm. The procedure was repeated over three days, for 5 hours /day.

After the Boron CLS Bond™ treatment, performance testing and temperature logging was performed once again.

5) Result

5a) Temperatures

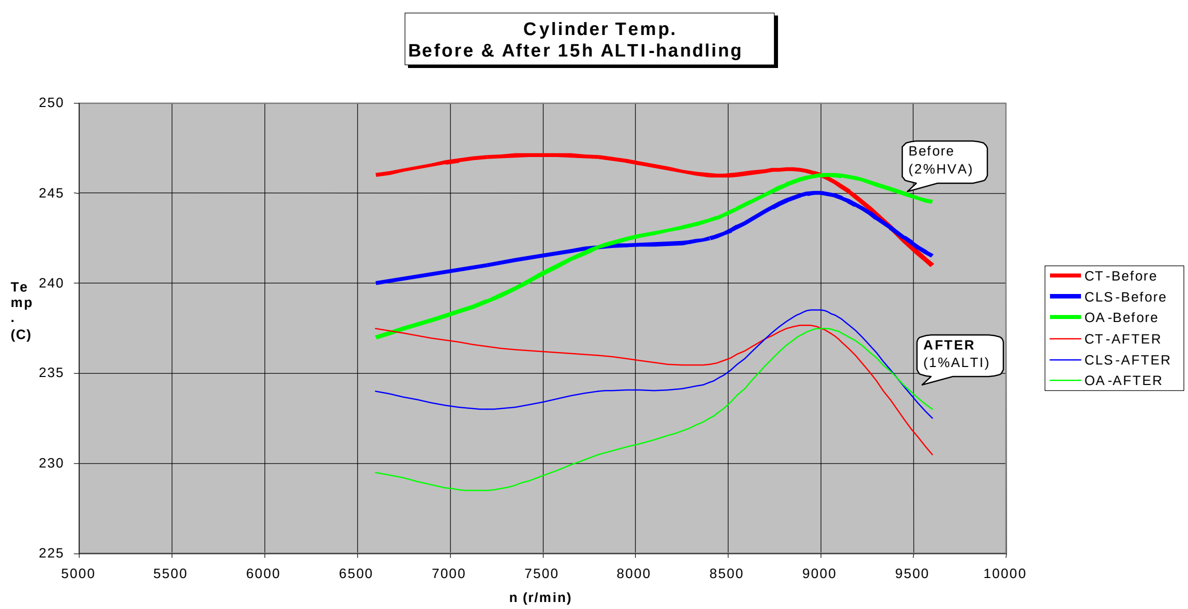
During the test as described in previous section, the cylinder temperature was logged. During the test, the conclusion was a decrease in the cylinder temperature. The decrease was highest right after starting up the engine.
Diagram 1 shows cylinder temperature as a function of horse power before and after treatment.
The förgasare has been adjusted to give the same A/F at 8,400 rpm.
Cylinder temperature was logged at three different locations in the engine. All three show a lower temperature after the treatment.

Diagram 1

Decrease of temperature by 7-10 C is significant. This was verified also at a constant rpm at different A/F.

5b) Performance

Performance as a function of rpm is logged in diagram 2 showing a significant improvement over the entire rpm register.



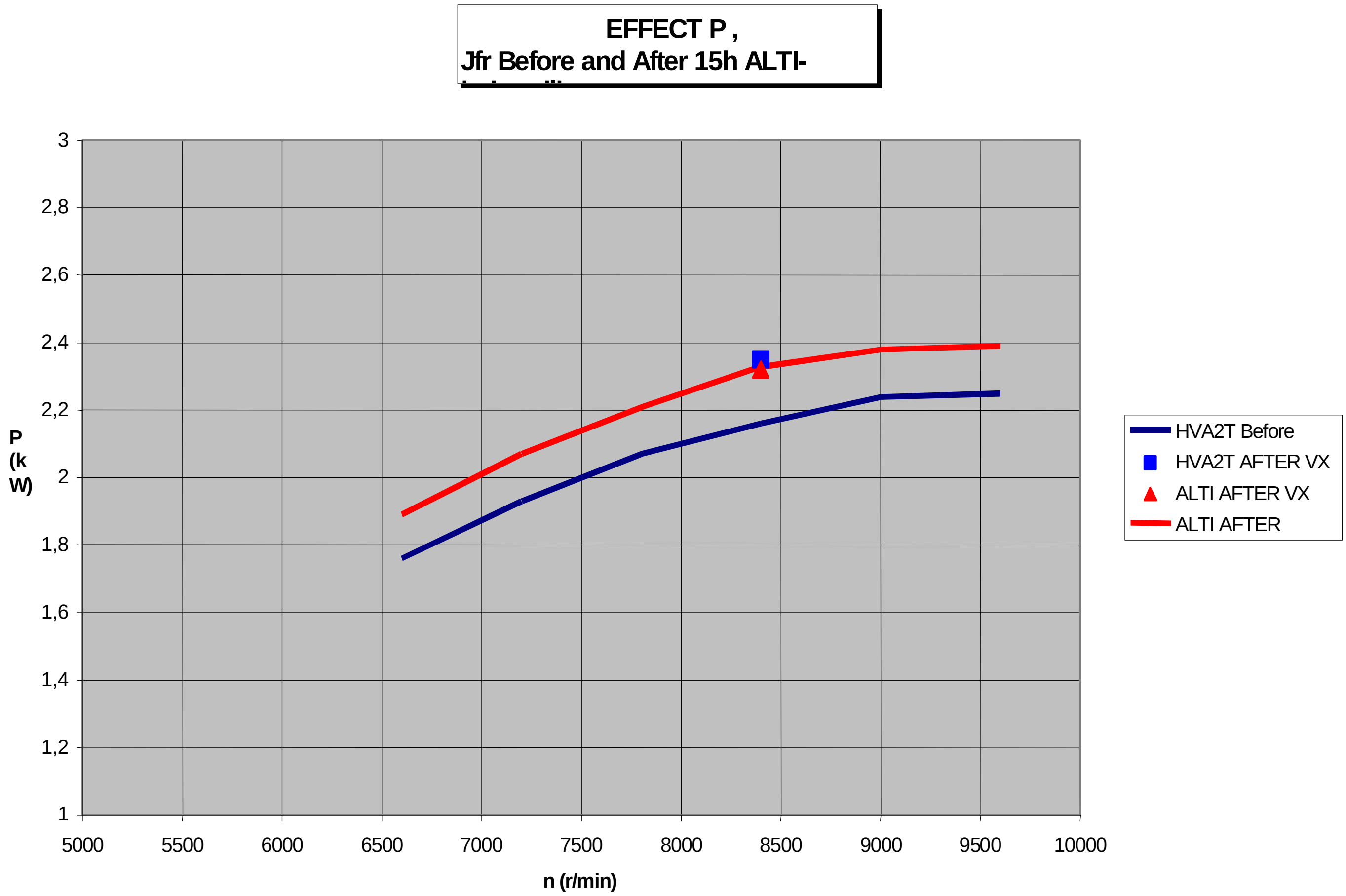


Diagram 2

In this test, the carburettor has been adjusted in order to give the same constant A/F at 8,400 rpm. The effective mean pressure Pme as a function of rpm show an increase from 3.45 to 3.7 Bar. The conclusion of this is an increase of performance by 7%-8%.

If this step should be taken with only a reduction of friction, the result is surprisingly good. A caution, however, only 2 hours of run time was allowed for the initial run before the treatment.

For pistons and cylinders, 2 hours is fully sufficient, however, for the crank some more time might be necessary. Even if extreme, based on our experience in testing engines, the increase of performance will be well above 5%.

One theory is whether a more effective combustion has been the reason of the increase of performance. A shift between the standard 2 stroke oil and the Boron CLS Bond™ 2 stroke oil indicates that this is not the reason for the result. The measured torque and emission temperature gives the indication that this is not the case.

Comparing the emission temperature with a constant A/F, the temperature is slightly higher. This indicates a higher combustion pressure gives the higher performance. The explanation of this might be the CLS Bond mix is increasing the compression ratio due to the bonding of Boron to all metal surfaces. However, this is not the whole explanation for the increased performance due to the decreased cylinder temperature.

Conclusion

Most likely the combination of lower friction is the main factor to the result. Further investigation is necessary to determine the cause by measure the combustion pressure with a pressure gauge. By doing this test, Pmi could be determined and compared with the effective Pme. This will give the friction Pf.

$$Pf = Pmi - Pme$$

Distribution of performance increase and temperature decrease will most likely wary between different engines depending on the increased compression.

Based on the result and conclusions. The result is very interesting and gives a base for further investigations.