



Analysis of Debris Effect on Heat Exchangers

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Introduction

The investigation into how commonly occurring debris can affect a heat exchanger’s efficiency.

Using the TecQuipment TD1007 heat exchanger testing apparatus to test and record data of efficiency with and without coverage.

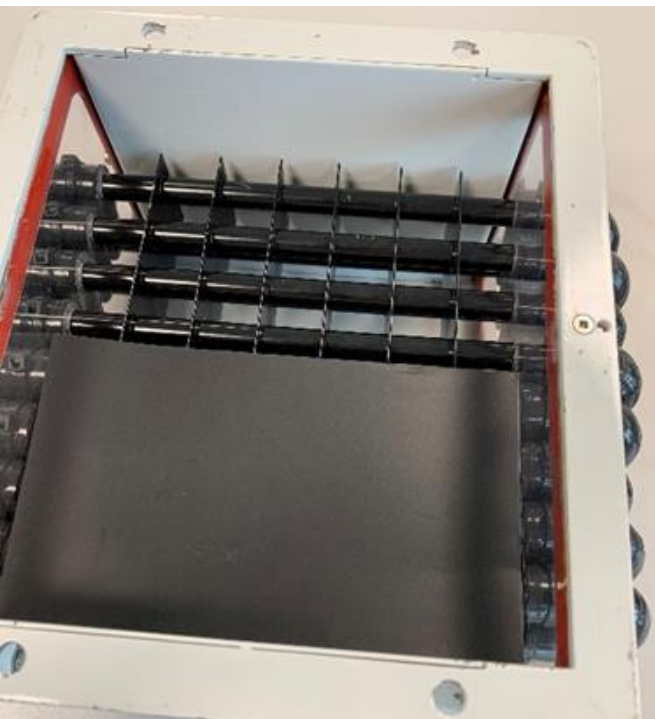
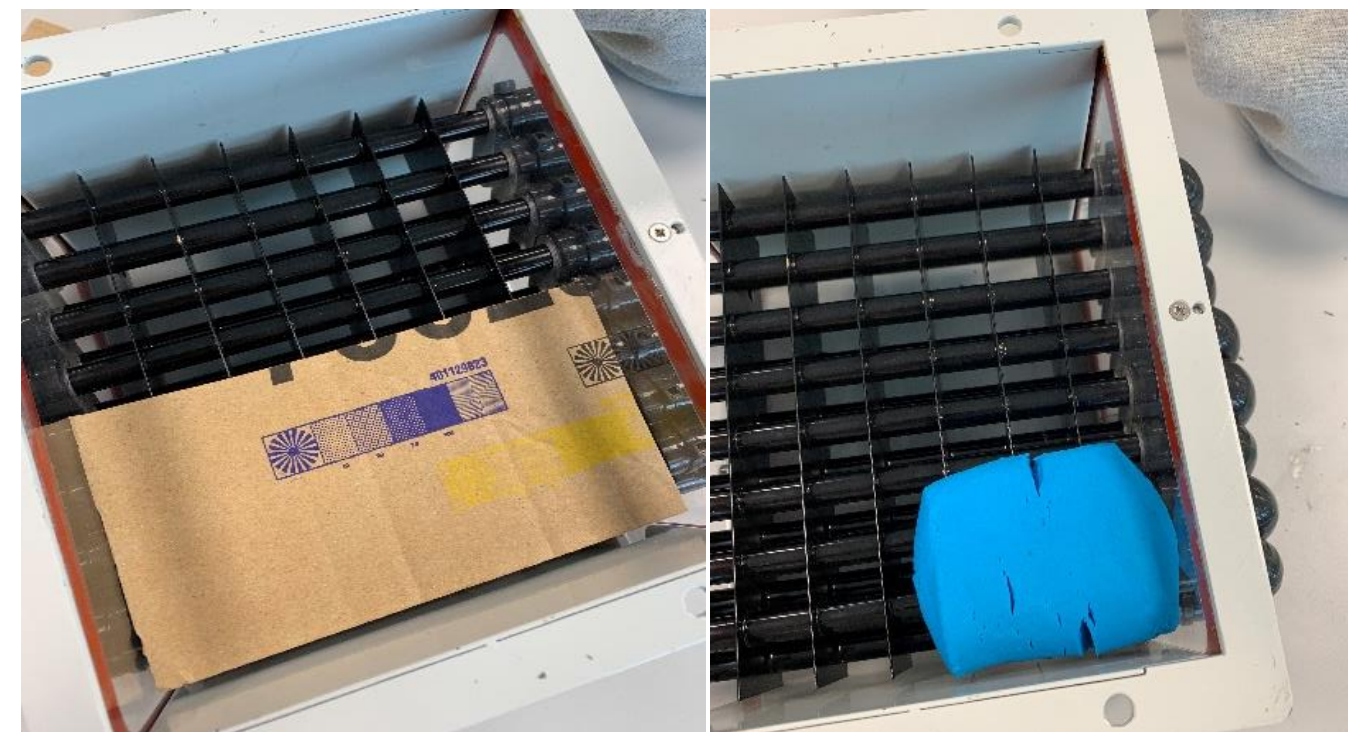
Project Aims

To see what effects are caused by debris and to what extent these effects, affect the heat exchangers efficiency.
Also to see how varied types of debris cause different effects if any at all.

Debris

When it came to look at debris and how it could be used, a simulation of debris was determined to be the best way forward. To simulate the debris, different thicknesses of cardboard were used to simulate more common debris. To simulate insulating debris, modelling clay was used, this provided a extra layer of insulation to further hinder the heat exchanger and to simulate mud and soil. The simulated debris can be seen below.

As seen below the simulated debris pictured on the 16 tube heat exchanger



Here is the simulated coverage placed on the 16 tube finned design heat exchanger.



The testing apparatus that was used TecQuipment TD1007.

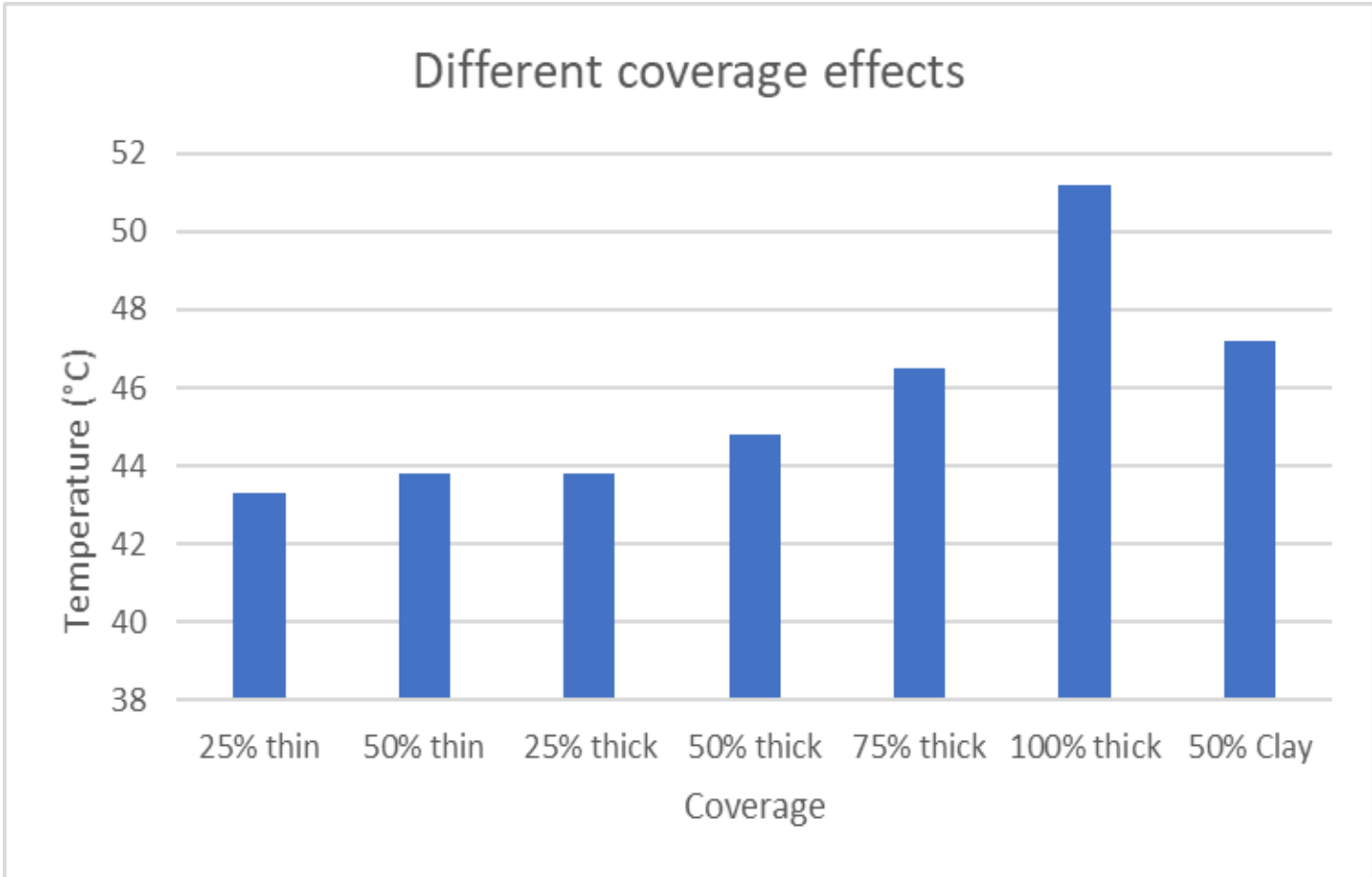


The picture above shows the real world example of debris build up on Porsche 911.

This table shows the testing carried out with zero coverage on the heat exchanger, this was done to find the optimal flow rate.

Coverage	0%
Flow rate L/min	Temp out C°
2.25	56
2	56
1.5	54
1	51
0.5	43
0.3	42

The bar chart below shows the results of different coverages and how much they caused the temperature to rise..



Results

The results and findings from the experiments were very interesting. Ranging from an increase of just 0.3° C with 25% coverage to 8.2°C with a full 100% coverage. The main increases came from using the thickness cardboard. The insulated debris used in conjunction with the 50% coverage, the clay/insulation caused the temperature to raise another

Conclusions

The conclusions from this investigation are as follows. Small increases were observed from the thinner cardboard coverages whereas larger increases were seen with the thicker corrugated cardboard and the insulation debris. The overall conclusion confirms the effects and how damaging they are to heat exchangers efficiency.

Pictured below is the 16 tube heat exchanger, a different design to the 32 tube used in the investigation.



References

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Wakabayashi, H. (1987, December 8). Plastic Part Resistant To De-icing. United States.