MK7 Fiesta ST180 Intercooler Testing

We recently took our AIRTEC Motorsport ST180 time attack Fiesta down to WG Motorworks to test out our range of intercoolers including our new stage 2 intercooler. We used our data logging thermometer using thermocouple sensors to measure the temperature at the intercooler inlet, the intercooler outlet and the ambient temperature.

Figure 1 - Stage 1, 2 and 3 intercoolers

We ran each intercooler on the car for five back to back runs followed by a loaded pull which simulates what it would be like for the car if it were to do a pull through a gear on the road. The loaded pull was done once the temperature had stabilised from the back to back runs.

We started with our stage 3 intercooler as this is already fitted to the car and then worked our way back to the stock intercooler. The car was running low boost, at this level we feel it is ideal for showing what our range of intercoolers can do. We were seeing peak inlet temperatures of around 180°C with this setup.

Firstly here is a graph showing the outlet temperature from the loaded runs on the car, the car was under load here for 21 seconds so gives a really good example of what to expect on the road if you were to accelerate through a single gear.

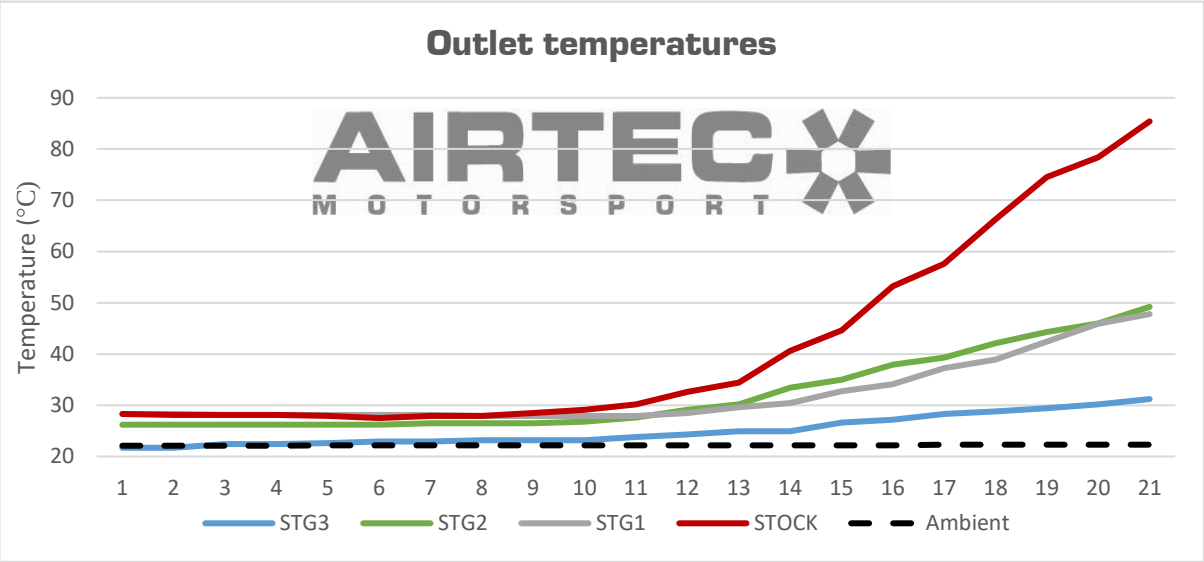

Figure 2 - Intercooler outlet temperatures on the loaded pull

The graph shows that as expected the stage 3 cooler performs the best with a temperature increase of just 10 degrees through the pull and also produces the most power as shown below, the stage 1 and 2 coolers are very similar with a 20 degree increase for both however when linked to the power graph below it shows that the stage 2 continues to make power and allows the car to make similar peak figures to the stage 3 as it can flow more volume of air when compared to the stage 1. They are both very capable of taking a lot of heat out of the air showing the effectiveness of the cores however the stock intercooler shows that it cannot keep up and temperature rises by nearly 60 degrees reaching a dangerously high temperature of 85°C.

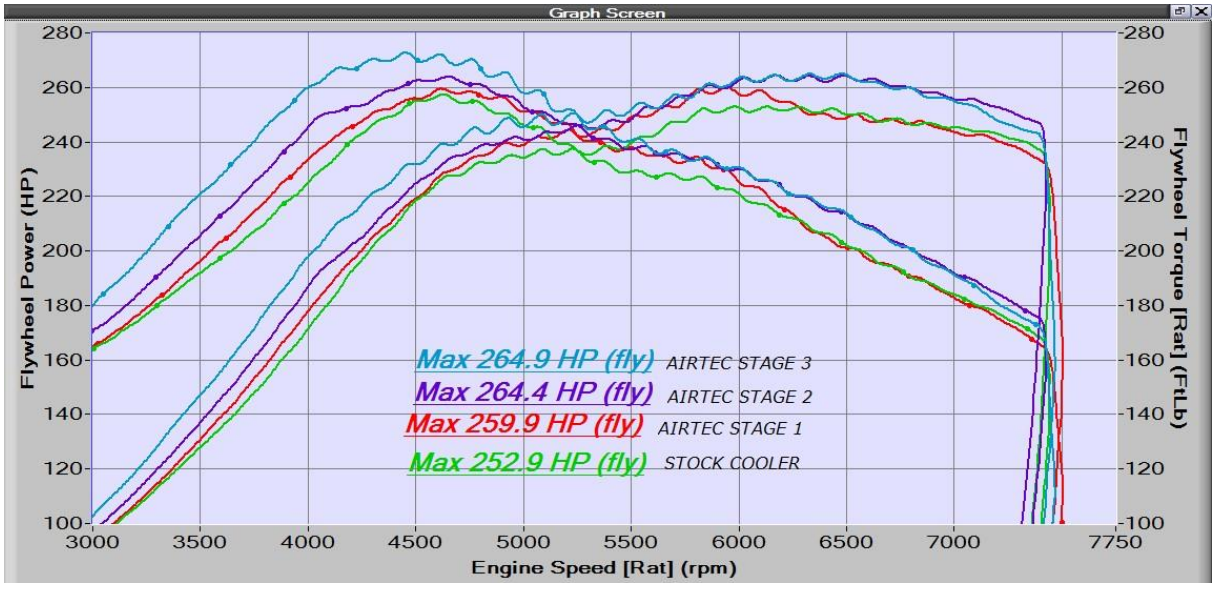

Figure 3 - Dyno graph for all 4 intercoolers

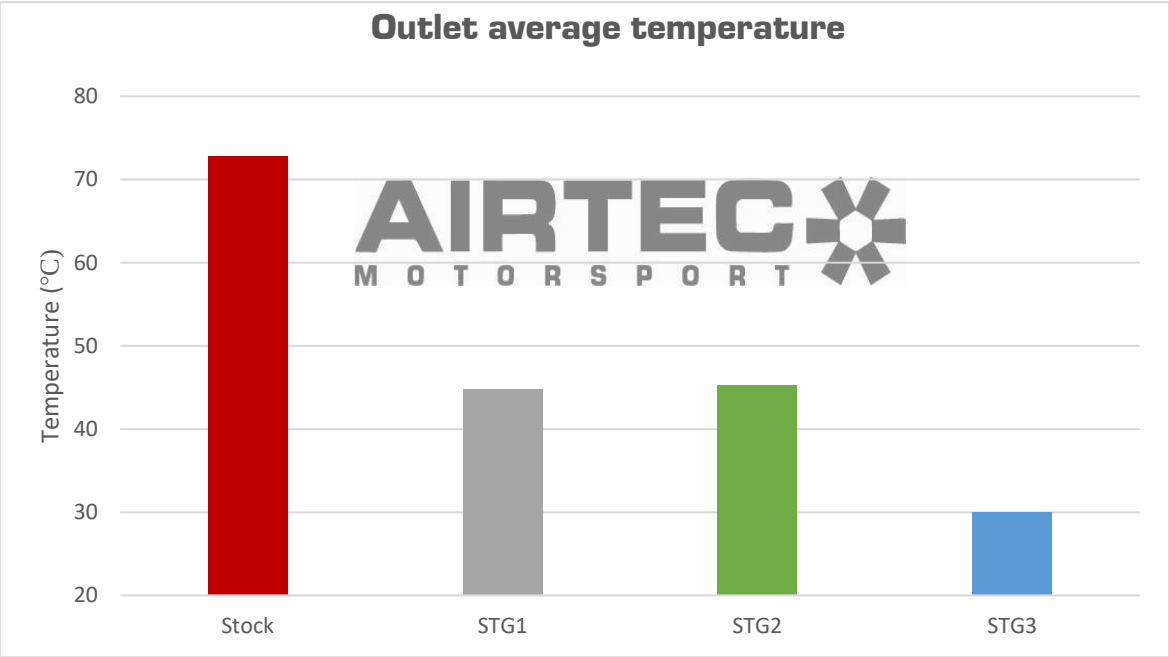

Figure 4 - Average outlet temperature during the back to back runs

Completing runs back to back allowed us to see how effective the intercooler is over time, as an example on track going down a straight where you would go through several gears the car would get hotter the longer you accelerate and so whilst you might get cool temps through the first gear you are going through what about the third or if the straight is long enough the fourth. The stock cooler struggled so much in these back to back runs we had to abort the fifth run as the outlet temperature was getting so high that we risked damaging the engine. The above chart shows the average peak temperature from the intercooler outlet from the five runs. As expected the bigger the cooler the lower the average temperature and what can be seen is that both the stage 1 and stage 2 coolers still have okay inlet temperatures throughout the five runs and the stock intercooler has extremely high average temperatures and as mentioned we were unable to run the fifth run as the temperatures were just getting too high on the stock cooler.

We also looked at intercooler efficiency, this is an easy equation to show how effective the intercooler is at getting the outlet temperatures to the ambient temperature. 100% here would mean that the intercooler can get the air out of the intercooler to be at the same temperature as the ambient air, something that just isn't possible. An effective intercooler should be operating above 90%. The equation is:

$$Efficency = \frac{Inlet - Outlet}{Inlet - Ambient}$$

The below table and graph shows that our stage 3 intercooler is able to have a really high efficiency here for each of the 5 runs at 96% or over and then we can see that at this power level the stage 2 intercooler starts really strong and slowly it dips down to 90% which still shows how effective it can be and then the stage 1 again starts strong for the first run but it struggles to deal with the repeated runs which is what is expected at this power level as it is just outside what we recommend for this intercooler and the stock intercooler makes an okay start but very quickly tails off from there and the efficiency did increase in run 4 but this is because the car was pulling back the boost and timing to reduce the temperatures it was seeing and so the temperatures on the inlet side lower than the previous runs meaning the intercooler didn't need to work so hard but also resulted in less power.

Intercooler efficency				
	STG3	STG2	STG1	STOCK
Run 1	96%	94%	97%	91%
Run 2	97%	92%	93%	75%
Run 3	96%	92%	89%	71%
Run 4	96%	90%	86%	77%
Run 5	96%	90%	85%	

Table 1 - Intercooler efficiency in the back to back runs

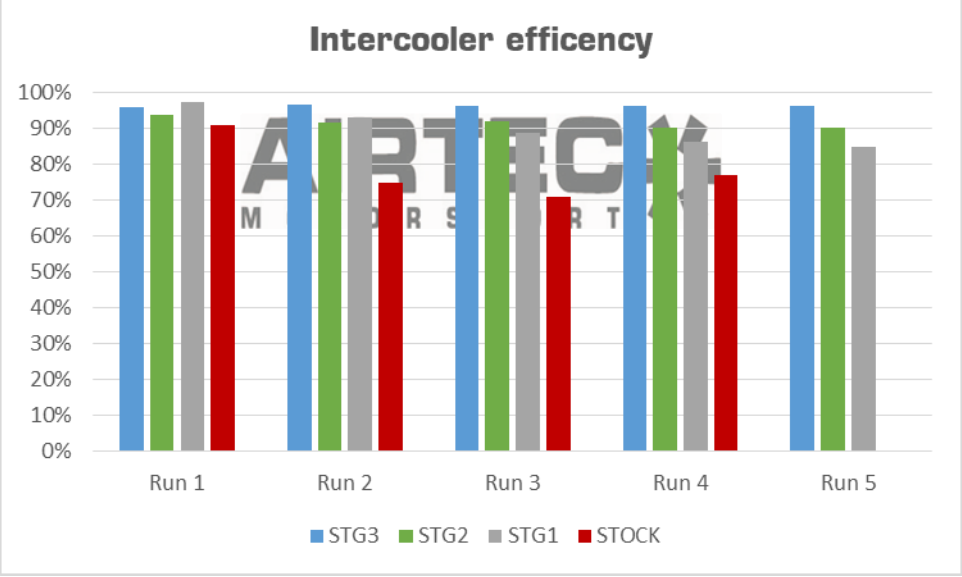

Figure 5 - Intercooler efficiency in the back to back runs

In conclusion, if you want the best intercooler no questions asked at any power level in a fiesta ST then go for the stage 3. It'll do the power you ask and cool your temps time and time again, that is clear from the data. If you want the full height look and can't quite stretch to a stage 3 then a stage 2 will do the job the majority of the time on cars pushing their power up to the 300hp mark and if the car is just going to be lightly modified and the owner is on a budget then the stage 1 is the perfect cooler, the core is highly effective as can be seen in the data when it is first pushed and at a lower power than what we were running here the cooler would be just as highly effective time and time again. The stock intercooler has no place here with dangerously high temperatures at the end it would very quickly cause damage to the engine. If you still have a stock intercooler on your car get ordering the AIRTEC cooler that suits your needs and throw that stock one in the bin!

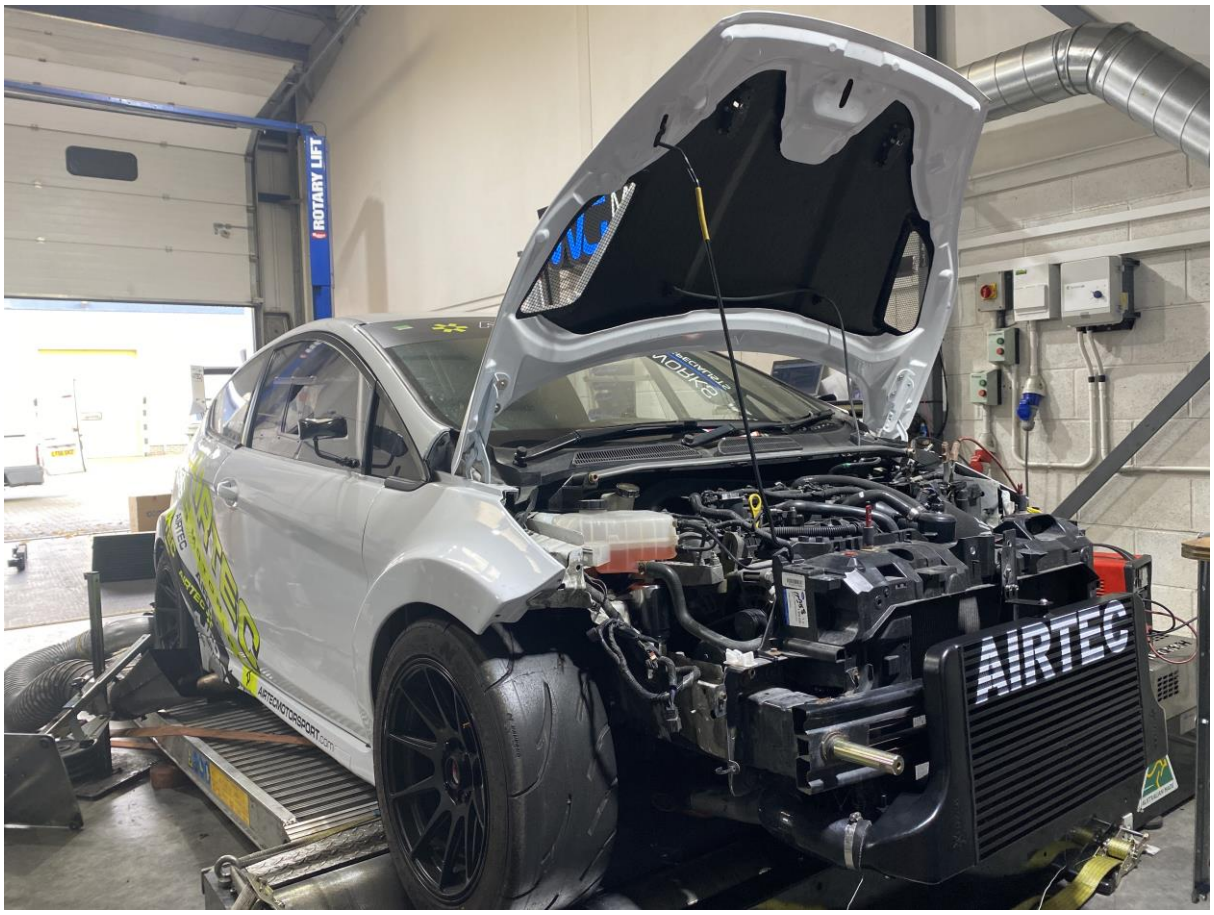

Figure 6 - Our stage 3 intercooler looking mighty on the dyno