

## Note 129



### Mercedes F1 Thermal Efficiency and Power output

Data comes from various Mercedes press releases as reported on the i/net.

#### Maximum Fuel Flow Rate

The current FIA F1 regs from 2014 still limit the fuel flow rate on a rising scale up to a max at 10,500 RPM and above at **100 kg/hr.**

[The race ration was 100 kg but was raised to 105 in 2017 when the wider cars and tyres were introduced.]

This is with the regs fuel of 94.25% petrol + 5.75% bio.

2018 TV showed all engines ran up to 12,000 RPM, 14.3% above the max fuel speed. It may be that the mixture is set at ,say, 8% rich at 10,500 and progressively weakens to 5% lean at 12,000, which should be tolerable without burning out pistons or exhaust valves.

#### Ideal Power Output

Mercedes have stated that the reg max fuel flow rate equates to Ideal Power of 1,240 kW. The calorific value of their Petronas fuel mixture is therefore 12.4 kW.Hr/kg.

[Equivalent to  $1547.72 \times 12.4 = 19,192$  BTU/lb. This is 2.5% higher than the 18,718 BTU/lb which was calculated for generic petrol + ethanol in a synthesis of 24 June 2014.]

1,240 kW = 1,662 BHP = 1,685 PS.

As the Mercedes Power Unit from Brixworth is built in a German-owned firm it is probable that their powers are quoted in metric HP, i.e. Pferdstärke, PS.

#### 2014 Thermal Efficiency (ThE) and Peak Power (PP)

A 2015 release stated that ThE was 45% in 2014,

so PP =  $0.45 \times 1,685$  PS

= 758 PS.

This power includes the power from the current taken from the battery, which of course is derived originally from the fuel. By FIA reg the additive power is limited to

120 kW = 163 PS;

Therefore the Internal Combustion Engine (ICE) had a power of:-  $758 - 163 =$  **595 PS.**

This agrees with the usual mention in the Press at the time of 600 "Horsepower".

#### 2018 ThE and PP

A Sept. 2017 release stated that ThE was then "more than 50%".

Try 51.5%,

then PP =  $0.515 \times 1,685$  PS

= 868 PS

Deducting the max permitted power of 163 PS from the Energy Recovery System, as before, gives ICE power as:-

= **705 PS**

This is 110 PS greater than 2014, where the Mercedes release quoted + 109 PS.

It was stated that the figure was not as run in 2017, so it is assumed it was for the spec. to be raced in 2018.

#### Possible sources of extra ICE Power

Mercedes did not give any data on how the approx. 18% extra ICE power was produced in 4 years of FIA-controlled development, but they might include:-

- Higher Combustion Efficiency from "Turbulent Jet Ignition";
- Higher Compression Ratio;
- Higher TurboCharger Efficiency .