Heat Transfer F1

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Let's make a nice summary of input and output of heat. You're losing heat through convective heat transfer, the air rushing over the car, and radiant heat transfer coming from the bodywork. Heat input is mostly coming from the engine, and a bit from the sun beaming down on the bodywork. Let's start by evaluating the heat loss through convection.

$$\dot{Q}_{conv} = h_c * A * \Delta T \tag{1}$$

h_c is the heat transfer coefficient. This coefficient is dependent on many variables like the medium, the speed of flow, the viscosity of the medium, and many more. A is the area over which the medium flows, and ΔT is the difference in temperature between the body and the medium.

Convective Heat Transfer Coefficient for Air
The convective heat transfer coefficient for air flow can be approximated to

$$h_c = 10.45 - v + 10 * v^{1/2}$$

`https://www.engineeringtoolbox.com/convective-heat-transfer-d_430.html`

Taking an average speed of 180 km/h or 50 m/s this gives a heat transfer coefficient of

$$h_c = 10.45 - 50 + 10 * \sqrt{50} = 31.2 \frac{W}{m^2 K}$$

since this is all super rough I'm not looking up the surface area of an F1 car, I'll approximate it instead, don't think I'll be off by more an order of magnitude. These things are pretty damn long, but most of the heat is going to come from the back, so let's say that the part behind the driver is about 1.5m wide and 1.5m long, maybe 0.7m high. we'll just act like it's a box, giving an area of a little under $9m^2$. Probably way off here but it's only an approximation. Very hot day out, air temp of 50 degrees, let's say the car is about to disintegrate at 240 degrees centigrade

$$\dot{Q}_{conv} = h_c * A * \Delta T = 31.2 * 9 * 190 = 53kW$$

, with these numbers the car wouldn't be able to cool itself enough so I'm way off, but we're approximating here.
Engine heat input
One bhp is about 750W so the 1000 bhp of an F1 car is about 750 kW. They've reached about 50% thermal efficiency so you're dumping 750kW of heat energy into the engine bay, which is a fuckton.

Radiant energy output
This is what it has all been about, here we use the Stefan Bollzman equation

$$\dot{Q}_{rad} = \epsilon * \sigma * A * (T_1 - T_2)^4$$

σ is the Stefan-Boltzmann Constant, which is equal to $5.6703 * 10^{-8}\ \frac{W}{m^2K^4}$. ϵ is the emmissivity of the material, let's compare polished metal with an emissivity of about 0.03 to pure black with an emissivity of 0.98. I don't have a fucking clue how to make a proper approximation, but I'll guess y'all have to make due. Closest easy option is taking all surrounding objects to have the same surface temperature, averaging the asphalt and normal grass and stuff and on an extremely hot day all that won't be hotter than about 40 degrees. We'll take the bodypanels to be about as hot as carbon fibre can handle IIRC at 240 degrees and ΔT becomes 200 degrees.

$$\dot{Q}_{rad} = 5.6703 * 10^{-8} * \epsilon * 9 * 200 = 0.0001 * \epsilon W$$

This is such an insanely low amount, we're talking about milliwatts while everything else is spitting out kilowatts of energy. The radiant energy output of the car will be completely immeasurable.

radiant energy input
This is rarely higher than $1kW/m^2$, let's say a little less than half of our surface is exposed to direct sunlight, $4m^2$. This gives 4kW of heat input from the sun, extremely little when compared to the output of the engine, but quite decent when compared to the results I got for the airflow. According to these "calculations" all teams should instantly start sticking aluminium foil to every surface they can find, guess this shit's to complicated for the back of a napkin.