



Note 123 Engine Weight as Installed

This website has given the best available data on engine weight but there are reservations about its value. There is usually no definition of what is included, so that there is plenty of scope for suppliers to state artificially low figures. An amusing anecdote about this concerns the delivery in 1966 of a Flat-H16 3 Litre BRM engine to Lotus for their type 43 – two mechanics went out to the lorry bringing it from Bourne but they had to call for another two strong chaps to help unload it!

What *can* be said with certainty is that the figure published, which can be called the “Bare Weight” (WB) is nothing like the figure needed by a car designer. That is the “Installed Weight” (WI) ready –to-race, including everything necessary to operate it and keep it running for the required duration.

Very little is available in the public domain on the ratio WI/WB. This Note can give only 2 such figures, for widely-different applications, but it was thought that visitors would like to see them discussed.

2013 Grand Prix engine WI/WB

Renault RS27
The Championship 2013 Grand Prix engine



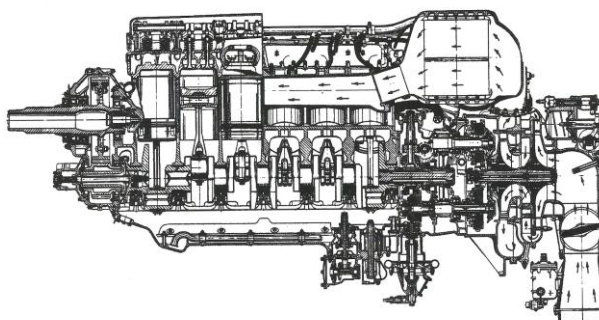
allf1.info

DASO 1134 (see refs. below) stated that “A current [2013] V8 weighs 120 kg with all ancillary components (such as radiators) included”. This was for a 90°V8 2.4 Litre Naturally-Aspirated engine whose WB was by FIA rule a minimum of 95kg. Lighter engines could have been built if it had not been for that rule:- Honda estimated that they *could* have produced a 78 kg unit (DASO 1121). The genuine ratio of WI/WB would then have been:-

$$WI = 78 + (120 - 95) = 78 + 25 = 103 \text{ kg};$$

$$WI/WB = 103/78 = \underline{\underline{1.33}}.$$

1943 Rolls-Royce (Packard-built) Merlin 100 Series WI/WB



Rolls-Royce Heritage Trust

Rolls-Royce Merlin 100 Series Aero Engine

DASO 328 p.677 gives very complete data on the engine WB and the additions to WI (contd. P.2).

		<u>Lb</u>
(A) Type V1650-3 <i>Merlin</i> 60 ^o V12 27 Litre engine, 2-stage mechanically-supercharged, intercooled <u>Deduct</u> crank-speed reduction gear (on limited data),	1,639 say, <u>(100)</u> WB	1,639 1,539
(B) Engine Mounting & Cowl		284
(C) Cooling system } (D) Water & Oil }		652
(E) Cooling system mounting, ducts & controls		116
(F) Intake & Exhaust systems, Starter, Engine Controls, Propeller & its Controls	624 say, <u>(324)</u>	300 WI 2,891
<u>Deduct</u> Propeller, etc (from limited data)		
		WI/WB = 1.88

Discussion

Looking at the weight *items* for the aero engine versus the Grand Prix unit suggests the following as additions to the ancillary 25 kg quoted above-

(B). The GP engine also does duty as an integral part of the chassis, and the cowl is part of the body so neither item needs to be included.		
(C). Already included in the 25 kg.		
(D). Not included: add water at, say, 10 Litres @ 1 kg/L		10 kg
Add oil at, say, 3 Litres usage (100km/litre (1121)) + 200% = 9 litres total @ 0.9 kg/L, take		8 kg
(E). Included in the 25 kg.		
(F). The GP engine has a substantial carbon fibre intake duct: add, say, The tuned exhaust systems are substantial pieces of pipework, add (from DASO 1121)		2 kg 15 kg
The starter should be included in the 78 kg.		
Additional weight		<u>35 kg</u>

$$\text{Then } WI/WB = (78 + 25 + 35)/78 = 138/78 = \underline{\underline{1.77}}$$

The author will be pleased to have factual comments on this deduction.

References

- DASO 328. The Development of Aircraft Engines and Fuels. R Schlaifer & S Heron. Boston. 1950.
 DASO 1121 Honda R&D website Technical Review F1 Special. December 2009.
 Source advised to DST by courtesy of Ron Rex, July 2015.
 DASO 1134. *F1 Racing*, September 2013.
-