Note 99B
Friction-and-Pumping Mean Effective Pressure (FPMEP) for 4-Strokes
Additional experimental data

Note 99 gave a simple correlation of 4-Stroke FPMEP in the terms:-

$$FPMEP = K1 + K2.NP.(MPSP)^2$$

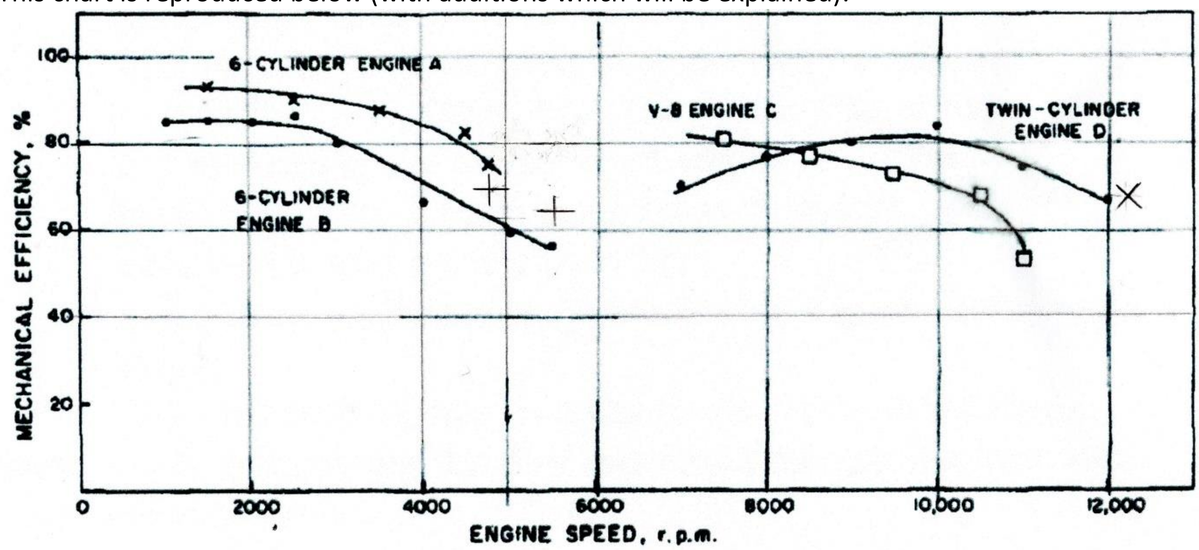
where NP = Peak RPM; MPSP = Mean Piston Speed @ NP (m/s);
for Racing engines K1 = 0.75 Bar; K2 = $9/10^7$;
for Touring engines K1 = 1 Bar; K2 = $25/10^7$;
and FPMEP is in Bar.

The reason for the differences in K1 and K2 between Racing and Touring engines is given in Note 99.

The FPMEP correlation has been used in the standard data and analysis tabulations of the Appendices of this website to provide an Estimated Mechanical efficiency (EEM) at Row 105.

Shell Research data

SAE 68765 in DASO 1230 (see ref . below, advised by courtesy of correspondent Stephen Cansick) provided at its Fig. 2 some Mechanical Efficiencies (EM) v. RPM for 2 Racing and 2 Touring engines. This chart is reproduced below (with additions which will be explained):-



Although the engines tested were identified only by letters A -D and no other data was given, three of the units can be identified and the appropriate data used to calculate EEM for comparison with the experimental figures. This has been done. The 4th ("B") is a matter for speculation. Calculations for EEM are given in Appendix 9.

Comments

Engine A

The 4,800 RPM peak point identifies this engine as:-

1964 Rolls-Royce FB60 (unit fitted in the Austin VanDenPlas Princess R).
IL6 3.75''/3.60'' [95.25 mm/91.44] = 1.042 3,909 cc. 175 BHP @ 4,800 RPM.

Touring K1 & K2 EEM = 70% (shown on the chart as + point) versus test EM = 76%.
A section of the FB60 is shown on P.2.

Engine C

Known to be the 1962 BRM V8 1.5L because Tony Rudd has acknowledged work by Shell Research on this engine.

Clearly, this was an early un-developed unit since EM drops suddenly to 53% @ 10,500 RPM. Its success in powering the 1962 Championships can only have come after that was put right. It seems from the Discussion of SAE680765 that this build, although a dry sump engine, had the crankshaft dipping into a pool of un-scavenged aerated oil in the crankcase.

As finally developed for 1962 the engine gave 197 BHP @11,000 RPM, for which EEM = 72% is calculated (Appendix 1).

Engine D

From information given to the author by the late Brian Lovell, former Managing Director of Weslake Research, it is known that this engine was that firm's WR22.

1964 Weslake WR22 Shell-financed, based on the 1962 BRM cylinder dimensions in order to have a direct comparison with that maker's engine, BRM (Owen) having bought a part share in Weslake. It was the first engine of the "Four-valve Renaissance", with a pioneering 32^0 Valve Included Angle (VIA) between 4 Valves-per Cylinder (4v/c). See "How many valves per cylinder" at P.10.

IL2 68.5 mm/50.8 = 1.348 374.4 cc. 59 BHP @ 12,200 RPM.

Racing K1 & K2 EEM = 68% (shown on the chart as X point) versus test EM = 67% @ 12,000 RPM.

Engine B

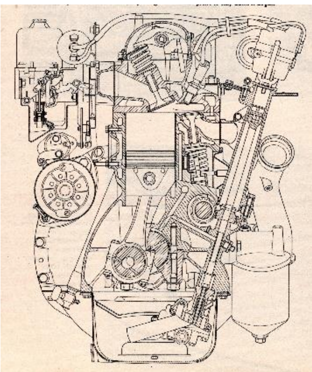
It is speculated that a 6 cylinder engine revving to 5,500 RPM pre-1968 could have been the Bristol 100C, the unit usually fitted in the type 450 production car. Details for this have been calculated.

1953 Bristol 100C

IL6 66 mm/96 =0.688 1,971 cc. 118 BHP @ 5,500 RPM.

Touring K1 & K2 EEM = 65% (shown on the chart as + point). The test EM for Engine B was 57%.

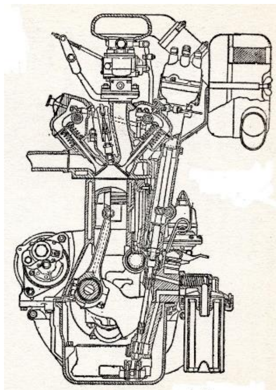
A section of the 100C is shown below.



Rolls-Royce FB60

DASO 865

Bristol 100C



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Conclusions

Note 99, used in the website data tabulations to calculate EEM, fits the Racing engine WR22 very well. For the Touring-class engine FB60 the value of EEM is "in the right ball-park", tho' 6%points low. If Engine B *was* the Touring-class Bristol 100C, then being too high by 8%points may be partially a result of the 100C EM being lowered by the extra rockers in its BMW 328-type valve gear.

Reference

DASO 1230 Some Applications of Basic Combustion Research to Gasoline Engine Development Problems G. Harrow..Shell Thornton Research Centre 1968.