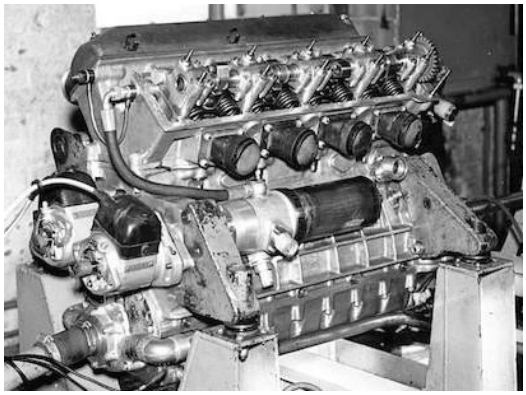
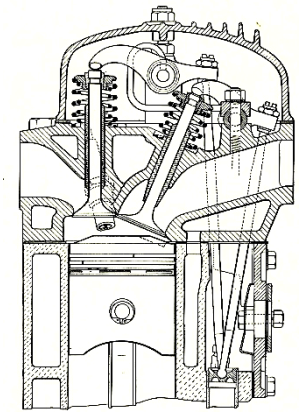
Fig. 31
PEP 469
!958 BRM P25
IL4 4.05''/2.95'' = 1.373
[102.87 mm/74.93] = 2,491 cc
272 HP @ 8,500 RPM

Camshaft cover removed to show hairpin valve springs. In 1960 these were replaced with coil springs as better spring steel became available.



DASO 1141

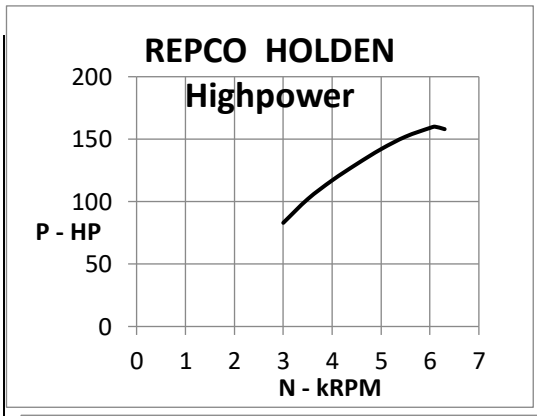


DASO 342

Fig. 32
PEP 371
1962 REPCO HOLDEN "Highpower"
IL6 3 1/8''/3 1/8'' = 1 143.8 cid
[79.375 mm/79.375] = 2,357 cc
160 HP @ 6,100 RPM

PEP	371
DASO	342
YEAR	1962
Make	REPCO
Model	HOLDEN
Vcc	2357
Ind. System	NA
Confign.	IL6
Bmm	79.375
Smm	79.375

N	P	MPS	BMEP
kRPM	HP	m/s	Bar
3	83	7.94	10.50
3.5	102	9.26	11.06
4	117	10.58	11.11
4.5	130	11.91	10.97
5	142	13.23	10.78
5.5	152	14.55	10.49
6	159	15.88	10.06
6.1	160	16.14	9.96
6.3	158	16.67	9.52



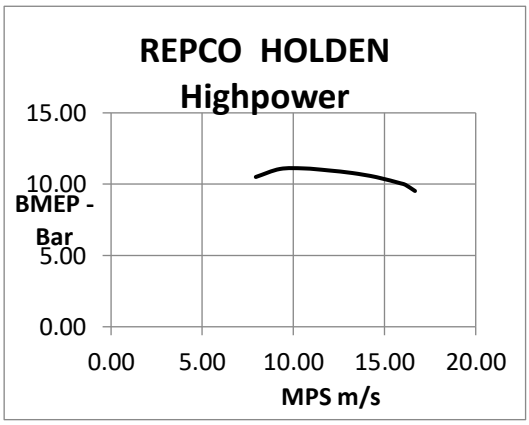
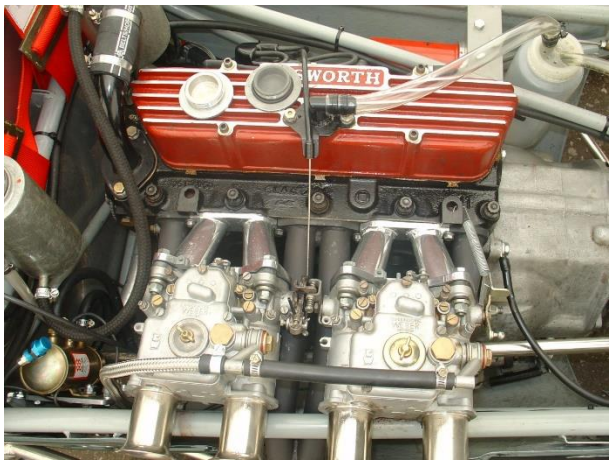


Fig. 33
PEP 260
1962 Cosworth Formula Junior Mk IV
IL4 85 mm/1 29/32'' [48.419 mm] = 1.756
1,099 cc
95 HP @ 7,500 RPM

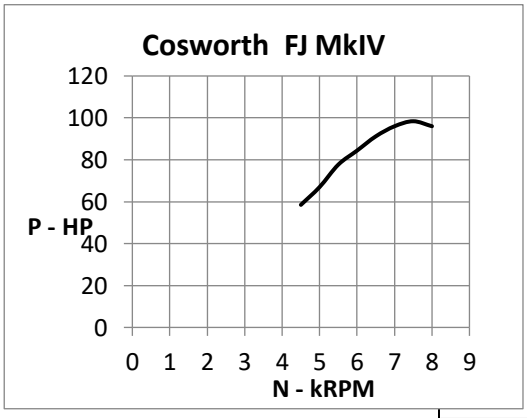


The Fig. may be a FJ Mk II, the original Ford 105E-based engine* with the basic Bore of 3 3/16'' [80.963 mm] = 997 cc and 75 HP. The Mk IV was bored out to the optional 1100 cc with a car weight penalty which did not offset the greater power. Externally same as Mk II.
***A section of the basic 105E is given in Note 81.**

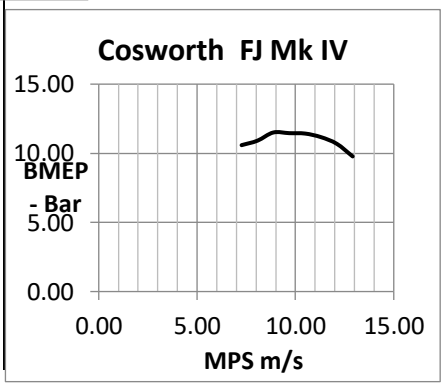
www.comp.f1/images

POWER CURVES

ThePEP	260
DASO	136
YEAR	1962
Make	COSWORTH
Model	FJ
Vcc	1099
Ind. System	NA
Confign.	IL4
Bmm	85
Smm	48.419



N	P	MPS	BMEP
kRPM	HP	m/s	Bar
4.5	58.5	7.26	10.59
5	67	8.07	10.91
5.5	77.7	8.88	11.50
6	84.4	9.68	11.45
6.5	91.2	10.49	11.42
7	96	11.30	11.17
7.5	98.4	12.10	10.68
8	96	12.91	9.77



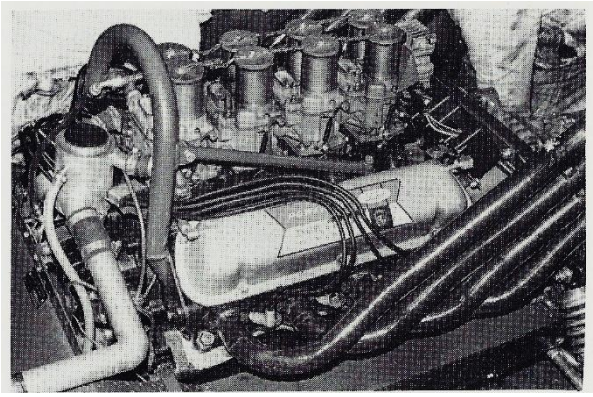


Fig. 34
PEP 109
1963 Ford Indy
90V8 3.76''/2.87'' = 1.310 254.9 cid
[95.504 mm/72.898] = 4,178 cc
376 HP @ 7,200 RPM
Based on the prodn. Fairlane unit, with Al-alloy block/heads; Bore reduced from 3.8'' to meet Indy NA rule of 4.2 Litres.
This push-rod engine achieved MVSP = 3.67 m/s by using *hollow* Fe/Cr/Ni valves.
With *solid* valves the MVSP (valve-bounce) limit would have been about 2.5 m/s with a corresponding reduction of RPM and therefore power.

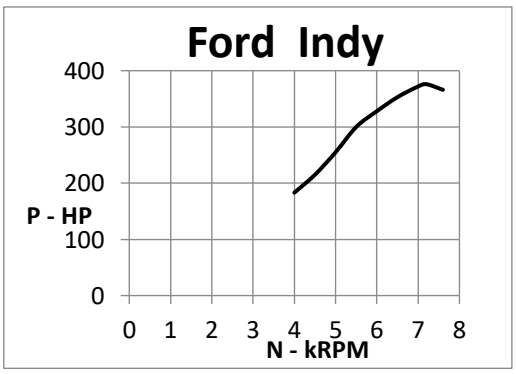
Fig. DASO 854

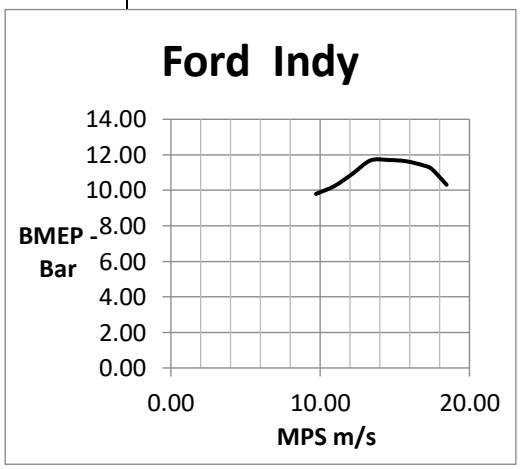
A Power Curve is shown on P. 17

POWER CURVES

PEP	109
DASO	55
YEAR	1963
Make	Ford
Model	Indy
Vcc	4178
Ind. System	NA
Confign.	90V8
Bmm	95.504
Smm	72.898

N	P	MPS	BMEP
kRPM	HP	m/s	Bar
4	183	9.72	9.80
4.5	215	10.93	10.23
5	255	12.15	10.92
5.5	300	13.36	11.68
6	328	14.58	11.71
6.5	353	15.79	11.63
7	372	17.01	11.38
7.2	376	17.50	11.19
7.6	366	18.47	10.31





These curves from DASO 55, a little later than DASO 54 from which App. 5 is entered, had Peak Torque at 6,000 RPM instead of 5,200. Presumably a slightly different spec./test report.

Fig. 35
PEP 463
1963 BMC Formula Junior
IL4 2 13/16''/2 11/16'' = 1.047
[71.4375 mm/68.2625] = 1,094.4 cc ("1095")
100 HP @ 7,300 RPM

www.comp.f1/images

Formula Junior rules required the crank stroke to be a production size. BMC went back to the short-stroke crank (2 11/16'') of the 1952 Minor 848 cc Series II and for the 1100 cc option bored out the block.

The performance (91 HP/Litre) was remarkably good for an engine on petrol, vertically-valved and with same-side siamesed inlet ports and a centre siamesed exhaust port (compare it with the 8-port Cosworth Mk IV of 86 HP/Litre at Fig. 33).

Fig. 36
PEP 181
1965 BRM P80 Formula 2
IL4 2.825''/2.425'' = 1.165
[71.755 mm/61.595] = 996 cc
128 HP @ 9,750 RPM

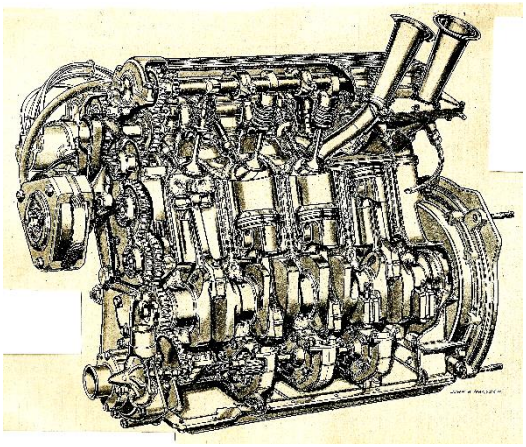


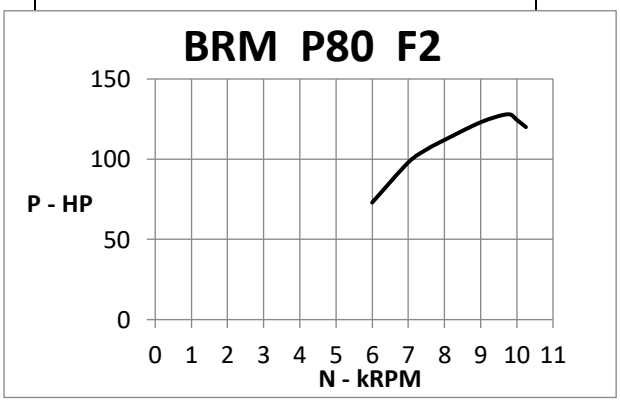
Fig. DASO 64

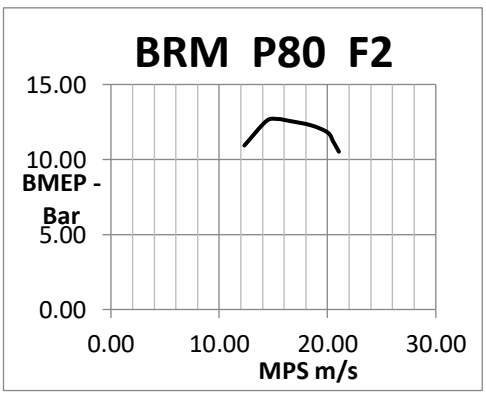
For 1966 the engine was redesigned to 74.63/56.95 = 1.310 (*M. Racing* Nov. 1966). Power rose to 136 HP @ 10,500 RPM (+6.3%). When Tony Rudd (DASO 40) related this increase to a reduction of CRL from 4.625'' to 4.125'' (-10.8%), it seems he was overlooking the B x S change. The ratio CRL/S only fell from 1.908 to 1.840 (-3.6%). This updates data given in Notes 62 and 73.

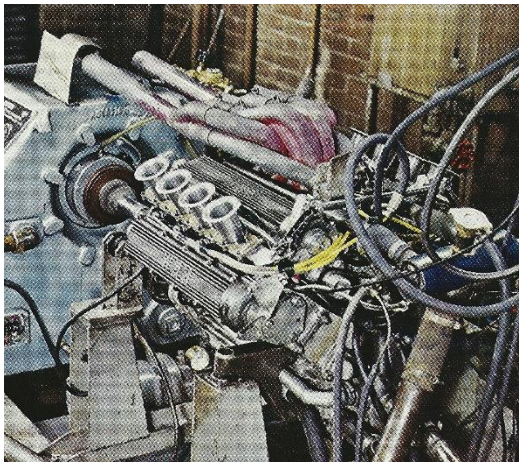
POWER CURVES

PEP	181
DASO	64
YEAR	1965
Make	BRM
	P80
Model	F2
Vcc	996
Ind. System	NA
Confign.	IL4
Bmm	71.755
Smm	61.595

N	P	MPS	BMEP
kRPM	HP	m/s	Bar
6	73	12.32	10.93
7	98	14.37	12.58
7.5	106	15.40	12.70
8	112	16.43	12.58
9	123	18.48	12.28
9.75	128	20.02	11.80
10	124.5	20.53	11.19
10.25	120	21.04	10.52







M. Sport April 1965

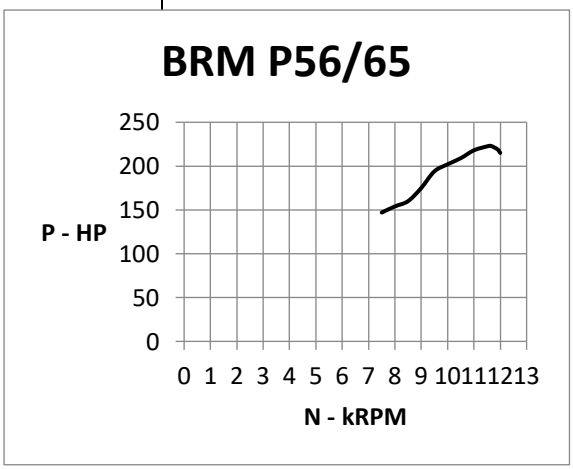
Fig. 37
PEP 470
1965 BRM P56
90V8 68.5 mm/2.0'' [50.8] = 1.348 1,498 cc
223 HP @ 11,650 RPM

This version of the P56 had downdraught inlet ports and inboard exhaust ports. This was a copy of the porting of the 1964 Ford "Indy Four Cam" (see Significant Other SO 17
The exhaust system on this running engine is dull red but at full speed would probably be cherry red.

POWER CURVES

PEP	470	N	P	MPS	BMEP
DASO	545	kRPM	HP	m/s	Bar
YEAR	1965	7.5	147	12.70	11.71
Make	BRM	8	154	13.55	11.50
Model	P56/65	8.5	160	14.39	11.24
		9	175	15.24	11.62
Vcc	1498	9.5	194	16.09	12.20
Ind. System	NA	10	202	16.93	12.07
Confign.	90V8	10.5	209	17.78	11.89
Bmm	68.5	11	218	18.63	11.84
Smm	50.8	11.5	222.5	19.47	11.56
		11.65	223	19.73	11.44
		11.9	219	20.15	10.99
		12	215	20.32	10.70

A new "3 hemishere" combustion chamber in late 1965 increased power from 204 HP @ 10,500 RPM to 223 @ 11,650 (+9.3% power).



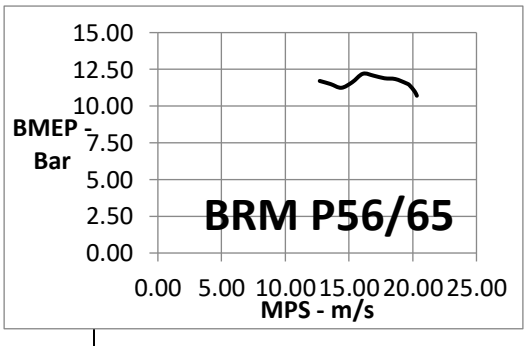


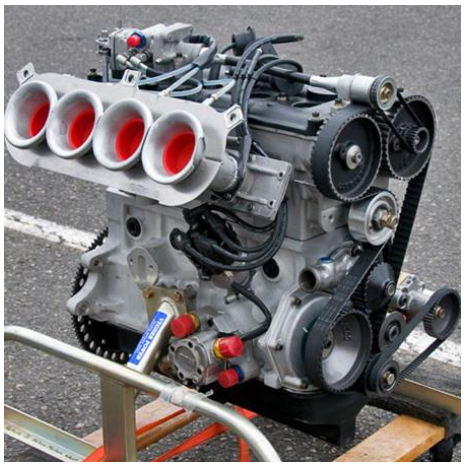
Fig. 38
PEP 180
1965 Cosworth SCA F2
IL4 3 3/16''/1 29/32'' = 1.672
[80.96 mm/48.42] = 997 cc
140 HP @ 10,250 RPM

A cutaway drawing of the 1964 version of this engine and its inlet tract is given in Note 73.
This had carburetters and produced 122 HP @ 9,000 RPM.

Fig. 39
PEP 468
1966 MaseratI Type 9 Grand Prix
60V12 70.4 mm/64 = 1.10 2,989 cc
360 HP @ 9,500 RPM

A cross-section of this engine is given in Note 6.

Fig. 40
PEP 183
1973 Cosworth BDG
IL4 90 mm/77.62 = 1.159 1,975 cc
275 HP @ 9,250 RPM



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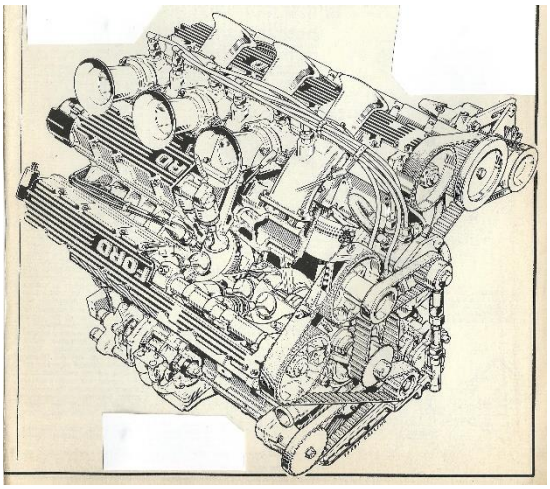
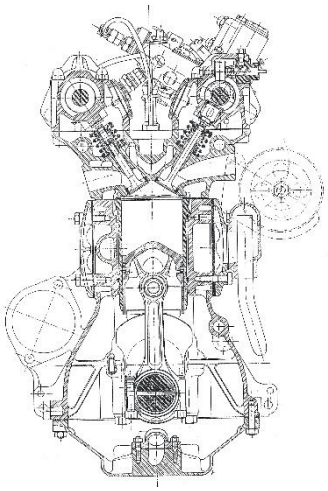


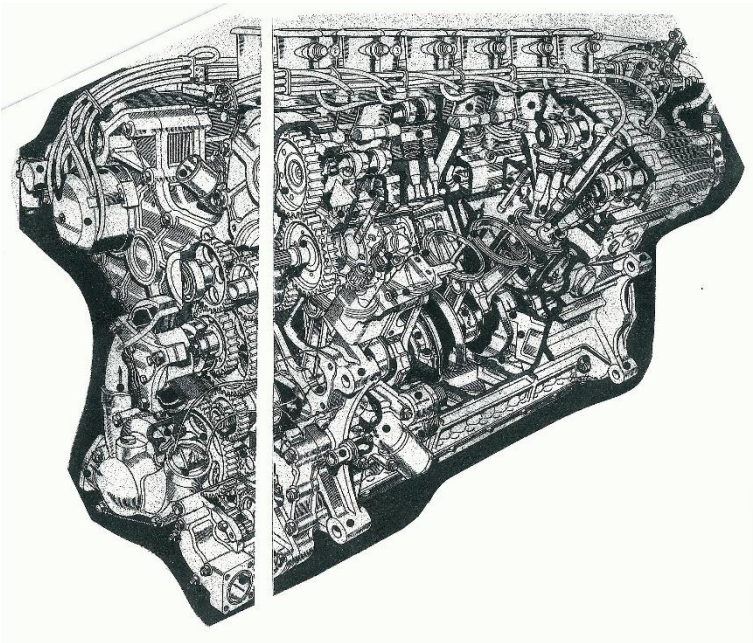
DASO 206

Fig. 41
PEP 294
1973 Cosworth GAA
60V6 100 mm/2.850'' [72.415] = 1.381
3,412 cc
440 HP @ 8,750 RPM

Fig. 42
1959 Borgward RS
IL4 80 mm/74 = 1.081 1,488 cc
165 HP @ 8,000 RPM
This engine had Direct Fuel Injection,
It was designed for a sports-racing car but was fitted by the Rob Walker team into a 1958 Cooper chassis for Stirling Moss to drive in F2 races in 1959. He won 4 consecutively and finished 3rd in his last event with the car. Chris Bristow won 3 other races with the same car.

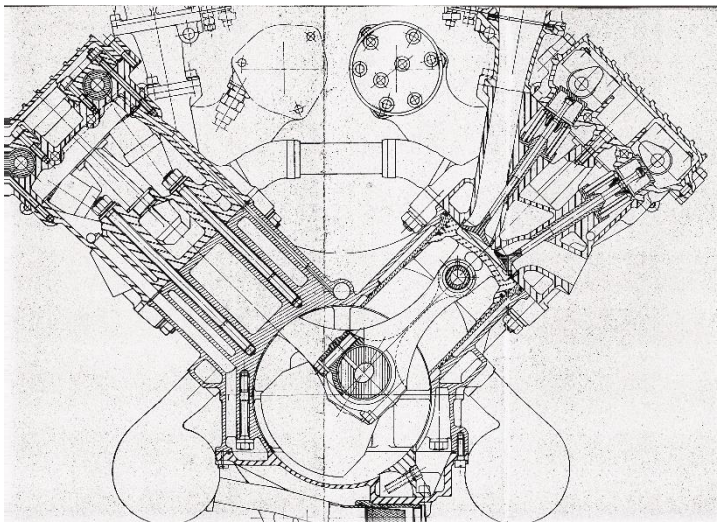


DASO 205



DASO 654

Fig. 43
1966 Weslake Gurney Eagle
60V12 72.8 mm/60 = 1.213
2,997 cc
410 HP @ 10,500 RPM (DASO 58)
Representing a redesign into
PEP 124
1974 Weslake WRP-190
60V12 75 mm/56.5 = 1.327
2,995 cc
464 HP @ 10,750 RPM
The PP was determined by an independent test to settle a contract dispute.
Apologies for the split in the illustration, caused by it being spread originally over 2 pages.

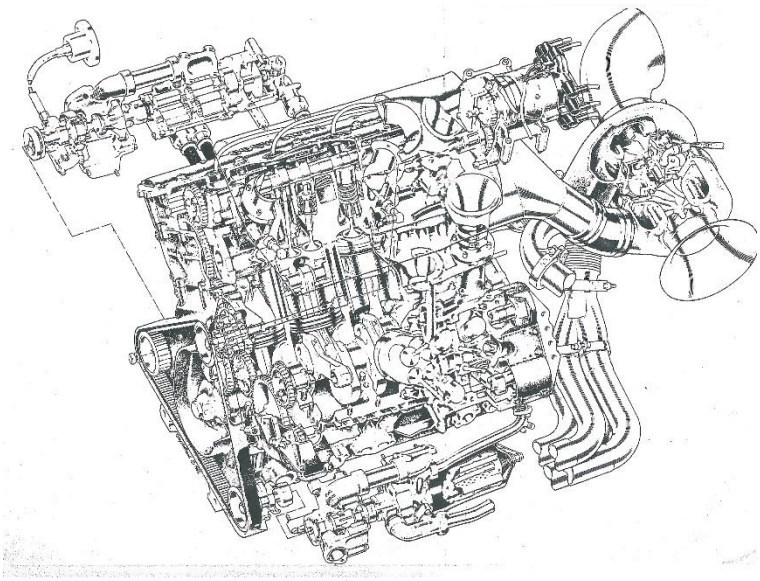


DASO 485

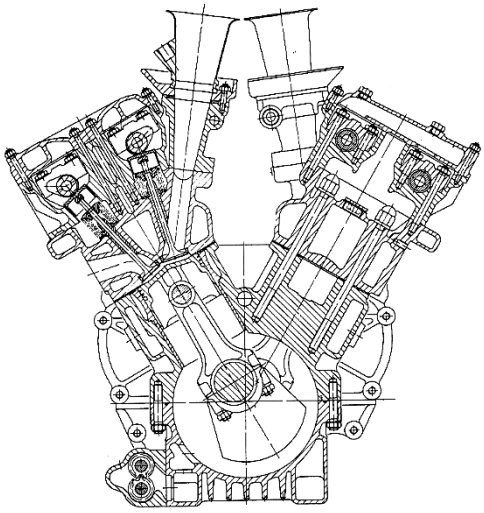
Fig. 44
PEP 449
1977 Renault CH1 F2
90V6 86 mm/57.3 = 1.501 1,997 cc
310 HP @ 11,000 RPM

The CH1 (designated after Claude Hardy, a late engineer on the project), with a stroke reduction to 42.8 mm for 1.5L, became the basis of the 1st TurboCharged Grand Prix engine (EF1). The B/S ratio at 2.009 was excessive, leading to "Top-end" limit on RPM, so it was eventually redesigned in 1985 to 80.1/49.4 = 1.621 (EF15).

Fig. 45
PEP 380
1978 Cosworth DFX
90V8 3.373''/2.256'' = 1.495 161.3 cid
[85.6742 mm/57.3024] = 2,643 cc
850 HP @ 9,500 RPM



DASO 62



DASO 938

Fig. 46
PEP 297
1979 Alfa Romeo Type 1260
60V12 78.5 mm/51.5 = 1.524 2,991 cc
525 HP @ 12,300 RPM

Fig. 47
PEP 173
1981 Matra MS81
60V12 79.7 mm/50 = 1.594 2,993 cc
525 HP @ 12,200 RPM

Matra 's original V12 of 1968 had downdraught inlet ports but by the MS81 these had been replaced by conventional cross-flow ports. The illustration (of the Talbot-Ligier JS17 installation) shows the multi-pipe exhaust system which was always a feature and which gave it a unique sound.

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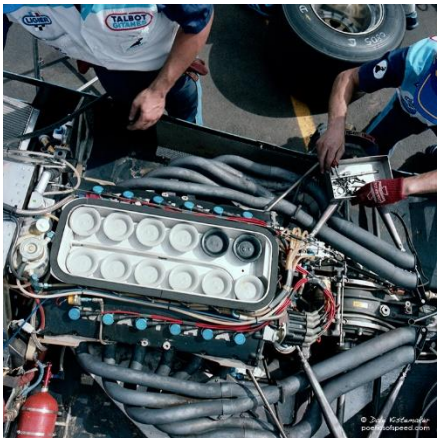
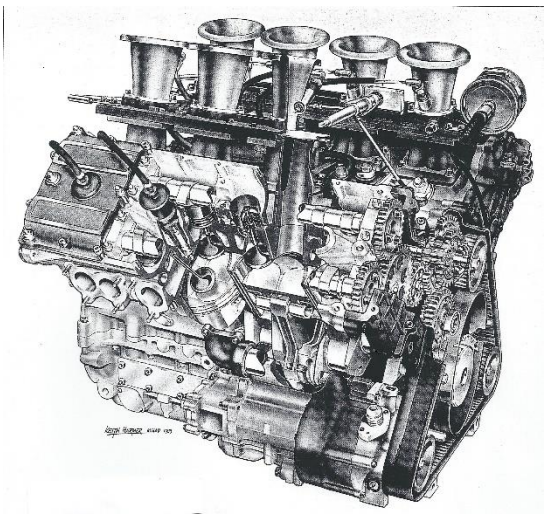




Grand Prix 85 p.61

Fig. 48
PEP 131
1983 Cosworth DFY
90V8 90 mm/58.8 = 1.531 2,993 cc
520 HP @ 11,000 RPM

Showing "H" section con.-rods, a change from the DFV "I" section.

See also Note 88.

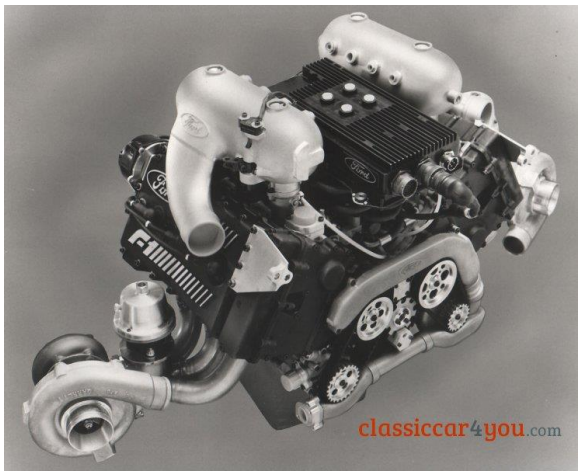
Fig. 49
PEP 450
1984 Renault EF4
90V6 86 mm/42.8 = 2.009 1,492 cc
700 HP @ 11,000 RPM
A cross section of the EF4 series is given in Note 89. (Continued on P. 23]

1984 Renault EF4 continued.

As reported under Fig. 44, by making the basis of their 1.5L TurboCharged Grand Prix engine a de-stroked 2L CH1 F2 engine, Renault ended up with an excessive B/S ratio of 2.009. As part of the process of trying to remove the limit this imposed on RPM, because of the accepable Mean Valve Speed for a steel Coil-Spring Valve-Return System, J.P.Boudy invented the "Gas Spring". This is illustrated in "Progress over 64 years of Grand Prix racing" at Fig. PA2-5. This became the standard architecture for GP racing engines in the early '90s. With development it enabled the B/S ratio to be raised ultimately to 2.5 with RPM reaching 20,000 and 300 HP per Litre by 2006.

Fig. 50
1987 Cosworth GBA
120V6 77 mm/53.6 = 1.437 1,498 cc
1,000 HP @ 12,000 RPM

The Bore of this engine was chosen as 77 mm, smaller than would otherwise have been used, because there were indications that the FIA were going to reduce TurboCharged engine capacity to 1.2 Litres.



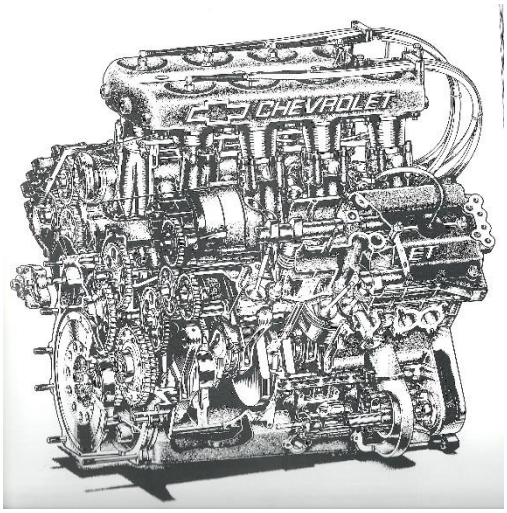


Fig. 51
1992 Ilmor 265B Chevrolet
90V8 88 mm/54.4 = 1.618 2,647 cc
745 HP @ 12,500 RPM

Despite having the camshaft drive at the crank output end, theoretically a "quieter" source than the front (as on the Cosworth DFV, DFX and DFY), the initial engines suffered damaging vibrations in the system. This was cured by a pendulum damper, a solution which was kept secret until 2006.

DASO 62

Fig. 52
PEP 330
1993 Ilmor 2175A
72V10 86.6 mm/59.4 = 1.458 3,499 cc
696 HP @ 12,800 RPM
A cutaway illustration of this engine is given in
The" 3rd Naturally-Aspirated Era Part 2" at Eg. 82.
The designation was a way of concealing the F1 intent
of the engine- 2 x 175 = 350, the capacity in cc of one cylinder!

Fig. 53
1994 Ilmor 500I Mercedes-Benz
72V8 97 mm/58 = 1.672
3,498 cc
1024 HP @ 9,500 RPM

Designed in secret to take advantage with a specially-built engine of a Indy 500 rule intended for modified stock units. Powered the Penske PC23, driven by Al Unser Jr, won the race and was promptly banned.

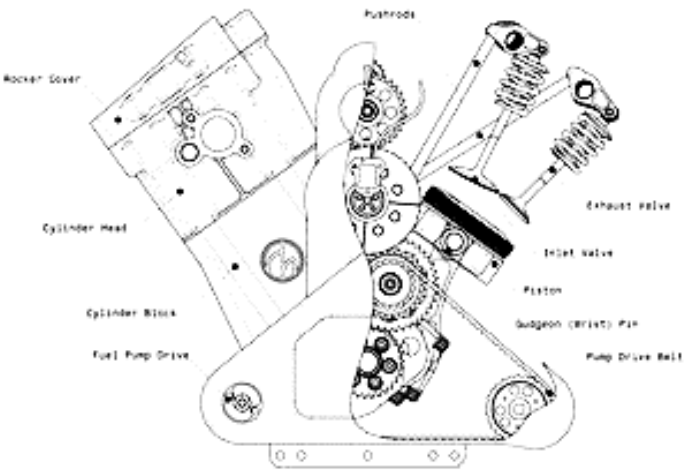


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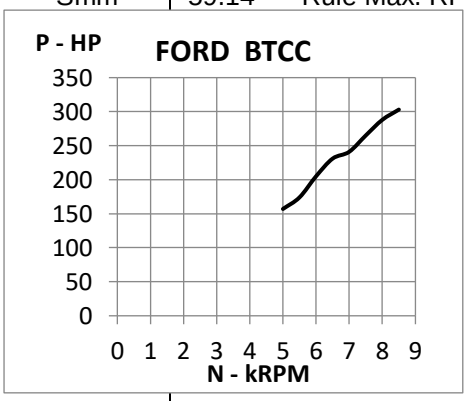
Fig. 54
PEP 348
1995 Ford BTCC
60V6 84.5 mm/59.14 = 1.429 1,990 cc
303 HP @ 8,500 RPM

The Power Curve shown below was unusual for a modern car in that the power peak was not reached before the BTCC rule maximum of 8,500 RPM.

DASO 419

POWER CURVES

PEP	348	N	P	MPS	BMEP
DASO	419	kRPM	HP	m/s	Bar
YEAR	1995	5	157	9.86	14.12
Make	Ford	5.5	174	10.84	14.23
Model	BTCC	6	205	11.83	15.36
		6.5	231	12.81	15.98
Vcc	1990	7	241	13.80	15.48
Ind. System	NA	7.5	265	14.79	15.89
Confign.	60V6	8	288	15.77	16.19
Bmm	84.5	8.5	303	16.76	16.03
Smm	59.14	Rule Max. RPM			



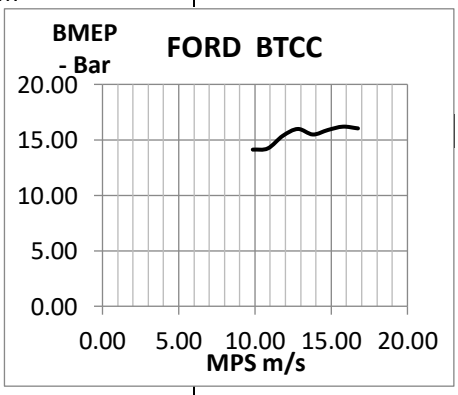


Fig. 55
PEP 852
1998 AUDI BTCC
IL4 85 mm/88 = 0.966 1,997
310 HP @ 8,250 RPM

Figure is 1996 spec.

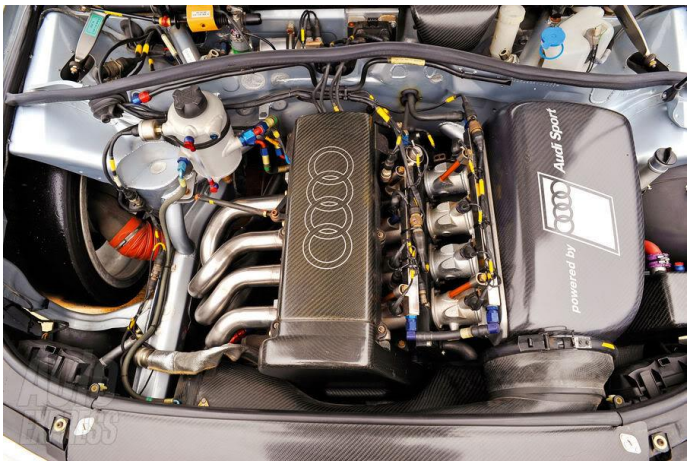


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Fig. 56
PEP 445
1935 ERA B
IL6 2 17/64''/3 ¾'' = 0.604
[57.547 mm/95.25] = 1,487 cc
177 HP @ 7,000 RPM

Section is actually a C-type with a finned inlet manifold, with slight internal differences from B-type – stronger con. rods with a larger diameter gudgeon pin and a higher piston crown.

Engine of "Romulus" R2B

18/5/2019

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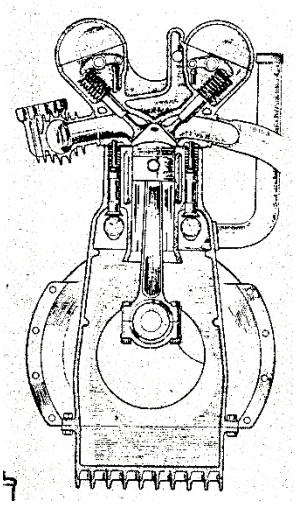
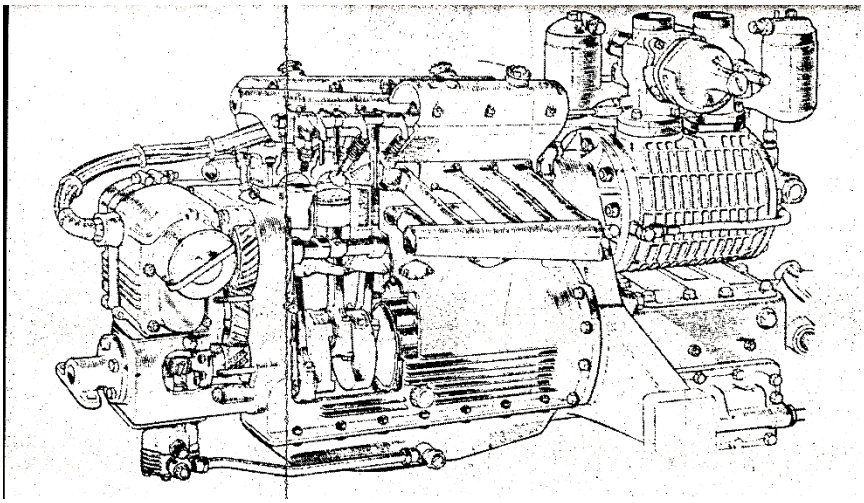


DASO 489



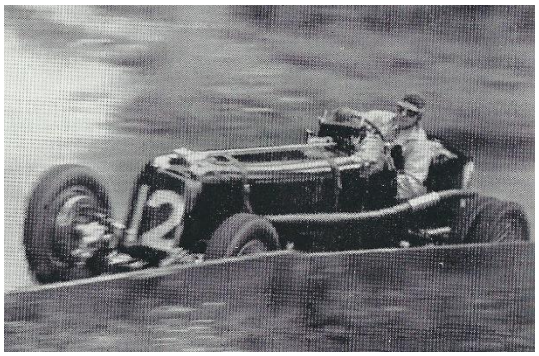
DASO 489

Fig. 57
PEP 446
1937 ERA C
IL6 2 17/64''/3 ¾'' = 0.604
[57.547 mm/95.25] = 1,487 cc
230 HP @ 7,500 RPM

The figure emphasises the size of the Zoller vane-type supercharger, mounted between the driver's legs.

Fig. 58
PEP 447
1938 ERA D
IL6 2 15/32''/4 13/64'' = 0.587
[62.706 mm/106.759] = 1,978 cc
340 HP @ 6,500 RPM

Externally the D-type engine was the same as the C-type shown on Fig. 57. As a change from engine illustrations, the single R4D car is shown, as driven by Raymond Mays to numerous hill-climb successes. This is setting a new record at Prescott in 1939.

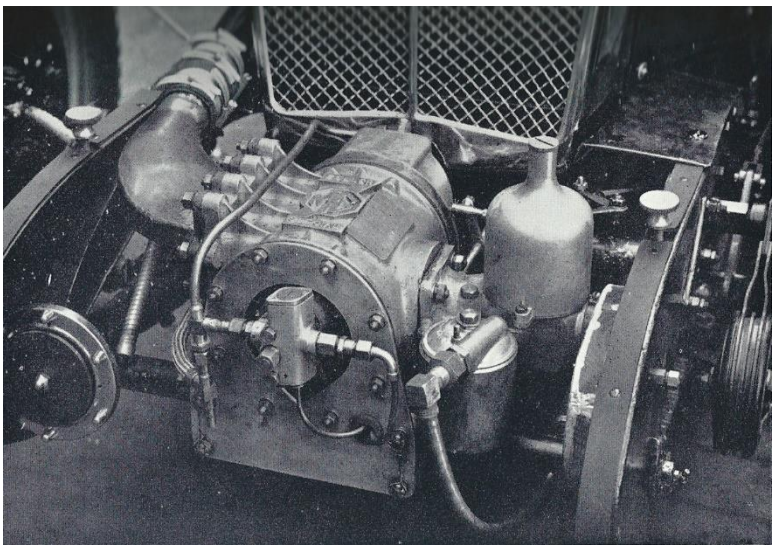


DASO 446

Note the doubled rear wheels. These had been found a winning advantage by George Abecassis on a 2L Alta at the very twisty Crystal Palace circuit in late 1938 (it may have been used previously in hill climbs). The idea anticipated by 27 years the wide tyres which began in GP racing in 1965.

Fig. 59
PEP 417
1936 MG Q/EX127
IL4 57 mm/73 = 0.781
745 cc
123 HP @ 7,200 RPM

This is the Zoller vane-type supercharger on the road-racing Q-type. The installation was the same on the streamlined EX127 record car.



DASO 139