

(1071cc)

THE MINI COOPER
"S"
TYPE

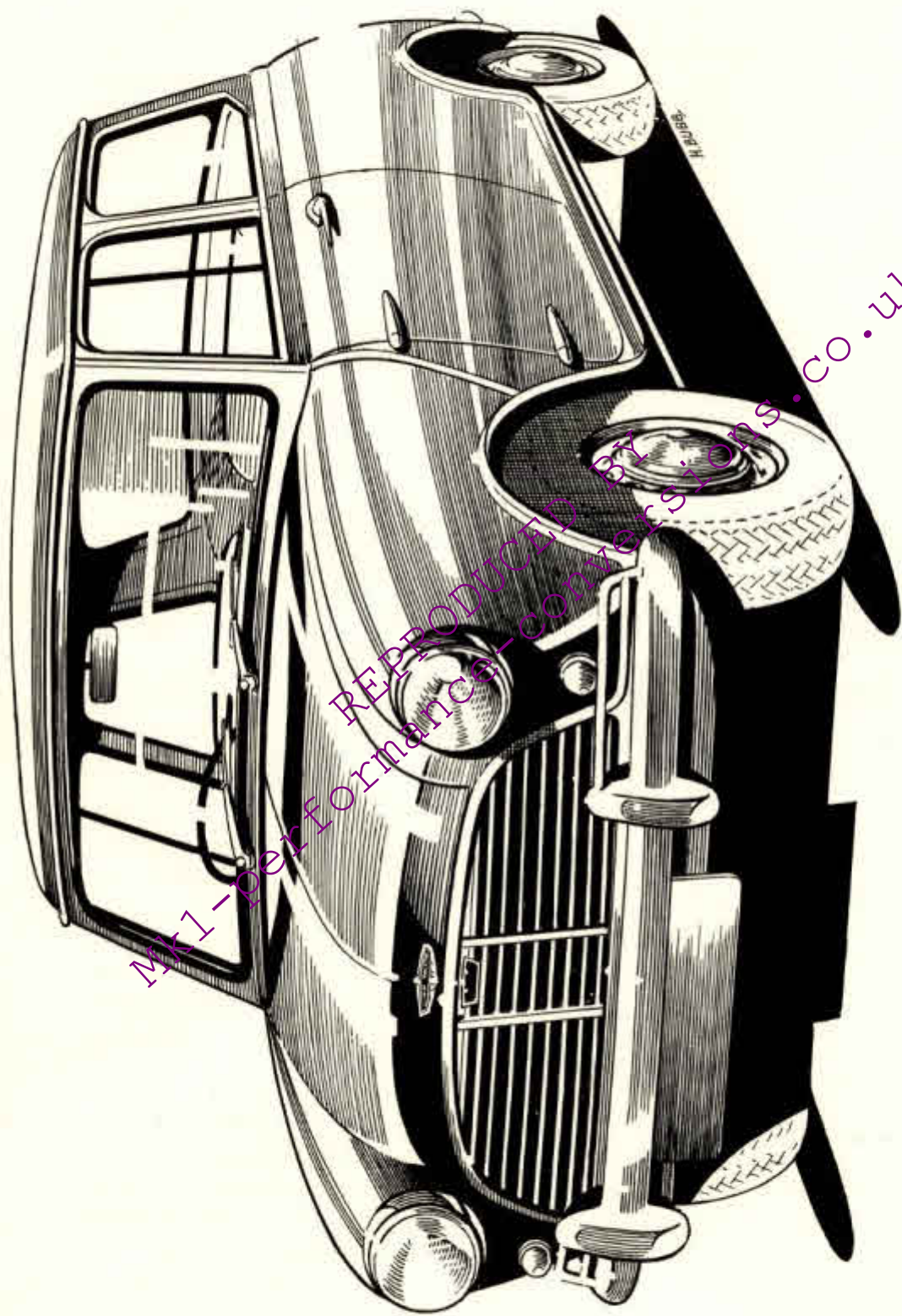


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ADO 50 S. The latest version of the Cooper variation of the Austin and Morris Mini models has only one immediately obvious external change. This is the use of 5.50-10 Dunlop SP tyres on a $4\frac{1}{2}$ in. rim for competition purposes or a $3\frac{1}{2}$ in. rim for general road work. Beneath the bonnet a 1071 c.c. engine with an over square bore-stroke ratio gives 70 b.h.p. as compared with 55 b.h.p. on ADO 50 without change in the peak speed of 6000 r.p.m., the car having a maximum speed in neutral conditions well in excess of 90 m.p.h.

THE COOPER "S" TYPE

When the Cooper versions of the Austin Seven and Morris Mini Minor were introduced in 1961, it was made plain that it was emphatically not designed as a sports car. Nevertheless modified versions have in fact scored 153 successes in motor events during 1962 which have included outright wins in the Swedish Rally, the German Rally and the British Saloon Car Championship. This excellent record has been continued in the opening weeks of 1963 in course of which Cooper-Minis were first, second and third in their class in the Monte Carlo Rally and took third place overall in this exceptionally gruelling event.

For the coming year a new high performance version of the car, designated the S type, has been officially homologated. Structurally, and with one exception in appearance, the S type is indistinguishable from the current model but useful improvements have been effected in the braking system; cornering power has been raised to even higher levels; tyre life extended and substantial gains in power have been effected with a lowered piston speed.

In standard form the engine now develops 70 b.h.p. as compared with the previous 55 b.h.p. and this 27% increase in power, suffices to raise the top speed of the car in like proportion, so that the genuine maximum lies between 92 and 93 m.p.h.

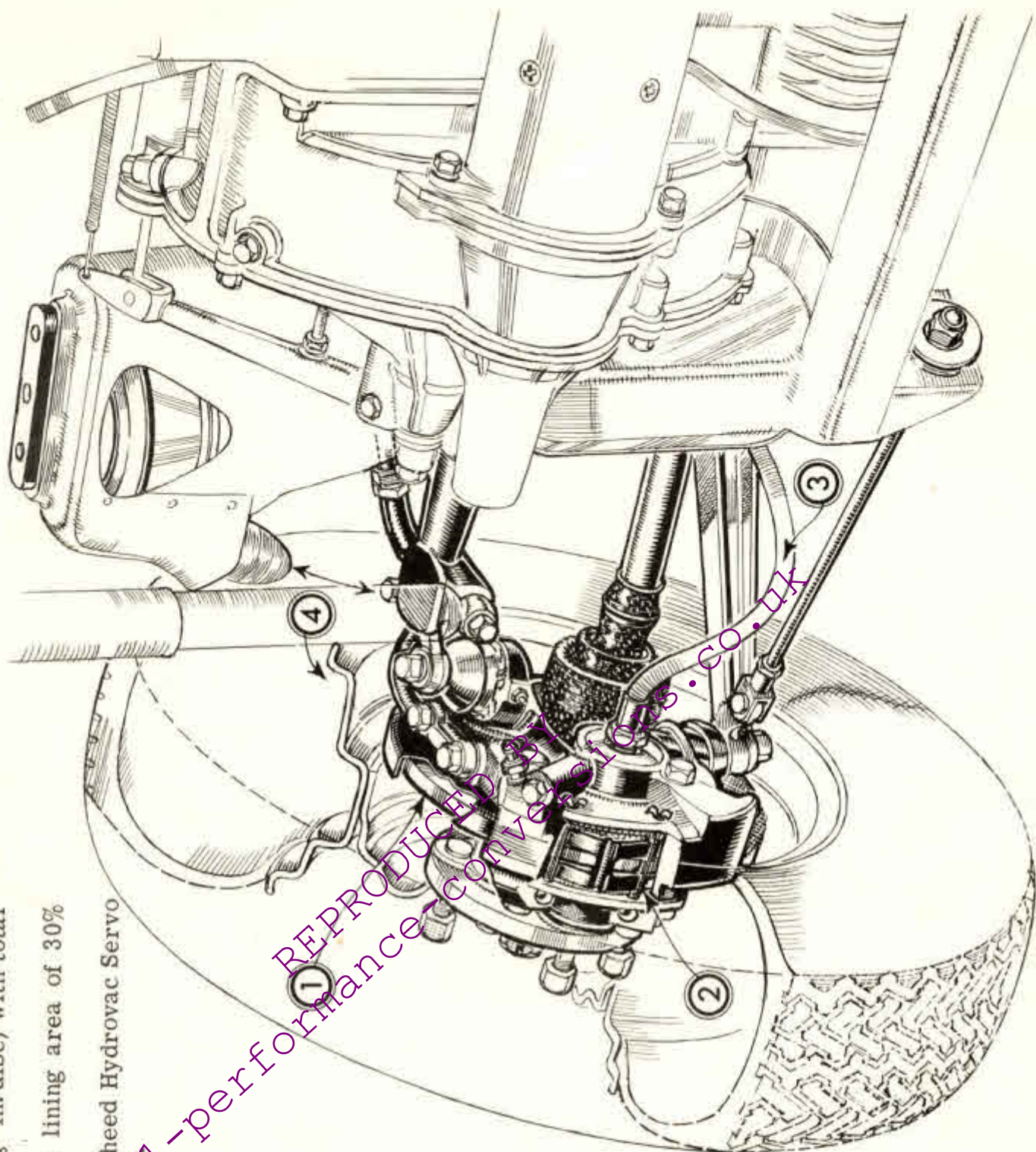
Before considering the many changes which have been made in the power unit, let us look at the external change and the modifications which have been made to the braking system.

With competition in mind the 145 x 10 Dunlop S. P. tyres are now mounted on a 4½ J rim which gives an almost flat tread and an approximation to a rectangular section. The exceptional cornering power, and resistance to abrasion, of this tyre makes it highly suitable for its purpose but for normal motoring there is some sacrifice in "ride" and for those who are attracted by their superior performance of the S model, but do not perhaps hold a competition licence, there is the alternative of a 3½ J rim carrying a more conventionally shaped tyre which has superior absorption of minor shocks.

These wheel changes increase the track by 1" at front and 17/16" at rear on 4½ J rim with unchanged front track and 7/16" increased rear track on 3½ J rim. The outward displacement of the wheel, which is perforated to improve air flow over the braking system, has made it possible to increase the thickness of the front discs by 1/8" and their diameter by ½". The volume of metal which can act as a heat sink during braking is thereby increased by 80%.

In addition the area of each individual pad has been increased from 3.33 sq. in. to 4.32 sq. in. and the total swept area of the brakes from

1. 7% larger diameter (7½ in.) and 50% thicker ⅜ in. disc with total volume for heat absorption increased by 80%
2. Larger friction pads giving increase in front lining area of 30% with an increased thickness of 57%.
3. Brake fluid pressure boosted by 5½ in. Lockheed Hydrovac Servo to give 0.75 g. stop with 80 lb. pedal pressure
4. Wide (4½ J) rim for Dunlop SP tyres



263 sq. in. up to 283 sq. in. In order to obtain maximum durability and longevity a hard pad material is now used, and as this has a low, but stable, coefficient of friction excessive pedal pressure is eliminated by the introduction of a $5\frac{1}{2}$ " vacuum servo, the Lockheed Hydrovac. With this combination 0.75g stops can be made with a pedal force of 80 lbs.

THE COOPER "S" TYPE ENGINE

Externally it is hard to distinguish between the S Type engine and the standard model. Inside there are very considerable changes many of which stem from a radical revision of the stroke to bore relationship. The standard Cooper engine has a capacity of 997 cc. (60.9 cu. in.) with a bore and stroke of 62.43 x 81.28 mm. which gives an S : B ratio of 1.3 : 1; on the new engine a bore of 70.6 mm. together with a stroke of 68.26 mm. gives an S : B ratio of 0.97 and a capacity of 1071 cc. or 65.35 cu. in.

Thus piston area is up by 28% and capacity by $7\frac{1}{2}\%$ with a 16% reduction in piston travel.

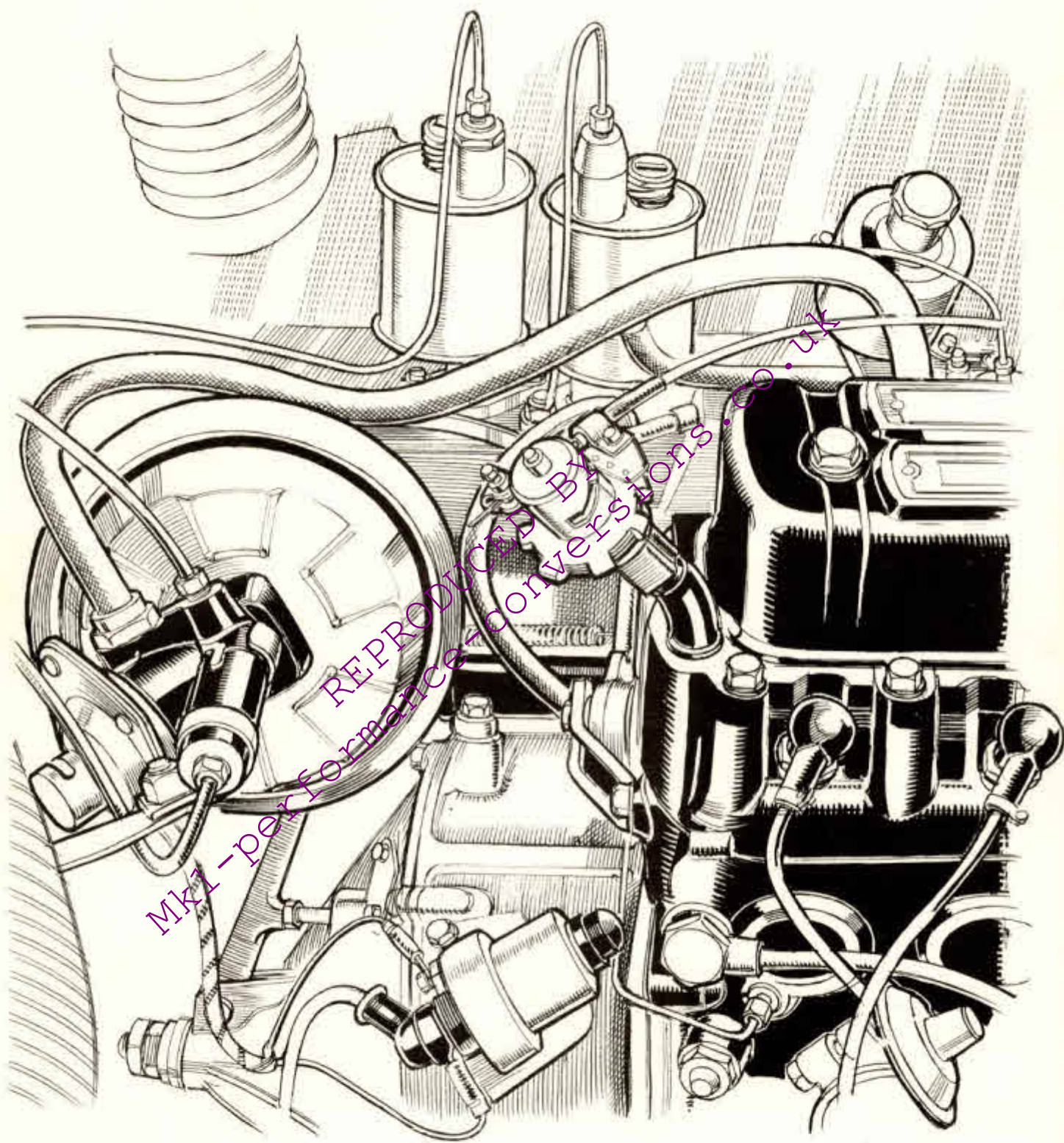
These changes have been effected by reducing the distance between the centres of the middle cylinders (Nos 2 & 3) from 3.25" to 3" and increasing the distance between the cylinder centre at each end from their adjacent bores from 2.78" to 3.031". This has necessitated an offset between the centre line of the connecting rod and the centre line of the big end (which may be either Vandervell VP 3 or Glacier Copper-Lead) and a reduction in the width of the main bearing from 1.0625" to 1".

The piston speed at 6000 r.p.m. is now 2700 ft/min, whereas on the standard engine it is 3200 ft/min.

The stiffness of the crankshaft and the projected area of the main bearings, have been fortified by a substantial increase in diameter from 1.75" to 2" and in addition to this the shaft is now Nitrided to give an extremely hard surface.

It is worth noting that all these changes are based upon experience gained in formula Junior racing in which the Cooper Company have used modified B.M.C. 'A' type engines with considerable success. Other detail refinements include:-

1. A completely new connecting rod with the big end split at right angles to the cylinder axis and the little end embracing a 0.8125" diameter piston pin.
2. A modified oil pump as developed for the Formula Junior power unit; the oil galleries have also been enlarged.



BOOST This drawing shows the neat installation of the Lockheed Hydrovac servo which permits the use of hard pads, highly resistant to fade and wear, with pedal pressures not exceeding 100 lb.

3. The cylinder head has a cast combustion chamber to give an unchanged compression ratio of 9.0:1, but both the inlet and the exhaust valve are in Nimonic 80 with a welded on stellite tip. Again in common with the Formula Junior engines they run in guides made from Hidural 5 which is a copper/nickel alloy.
4. The valve rockers are steel forgings modified from the standard "A" series and as used on the Formula Junior engines.
5. The valve springs exert a pressure of 140 lb. which will, over a long term, ensure freedom from valve crash up to 7200 r.p.m. which is the equivalent of 105, 82, 53, and 32 m.p.h. in the various ratios.

"S" TYPE TRANSMISSION

Although the transmission on the S Type is almost identical to that used on the standard Coopers, needle roller bearings are used on the second and third main shaft gears and INA bearings in the idler gear and first motion shaft.

"S" TYPE OPTIONAL EXTRAS

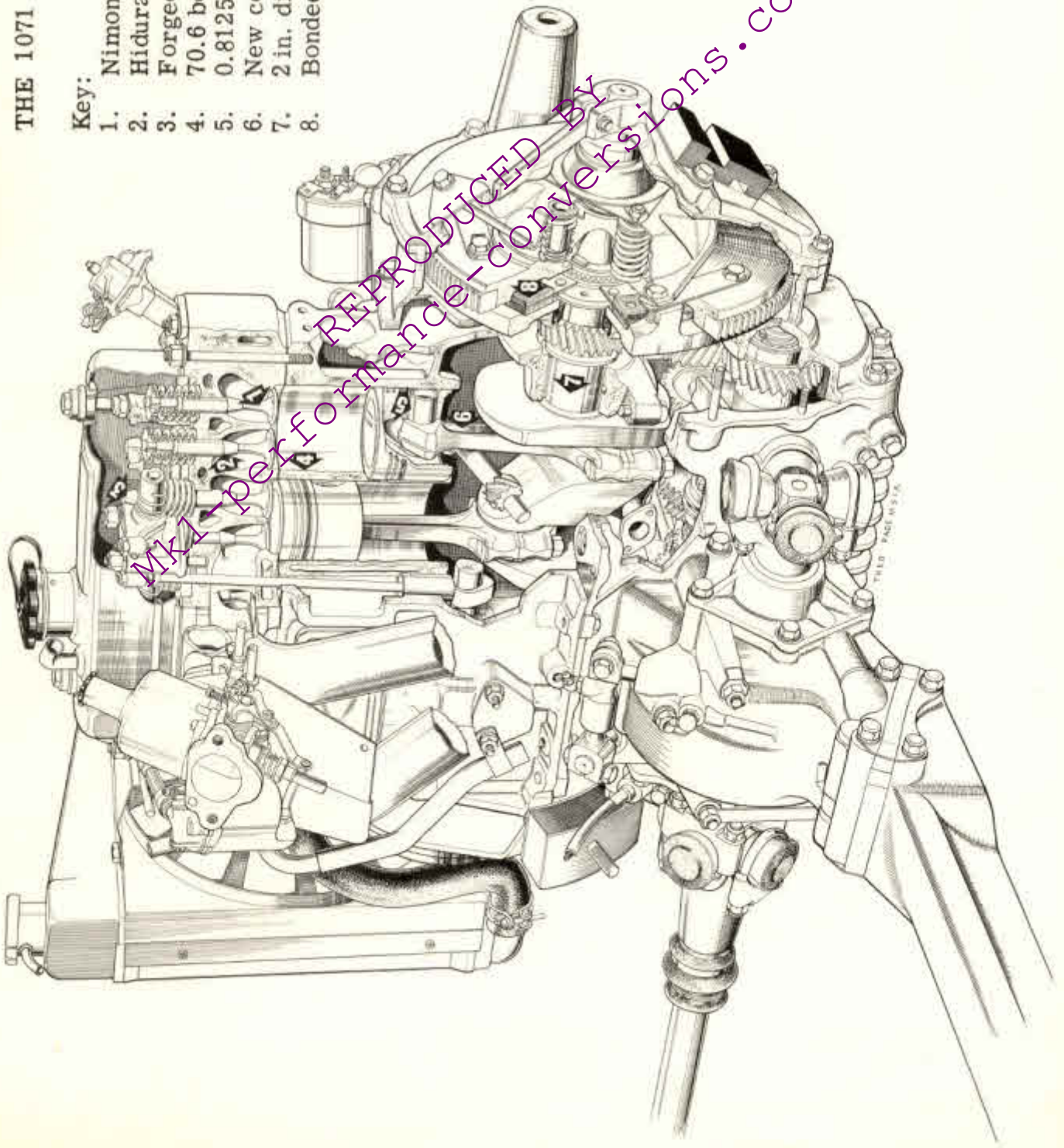
The S Type can be ordered with the following added equipment:-

1. Extra fuel tank which doubles range
2. Oil Cooler
3. Sump Guard

THE 1071 c.c. MINI COOPER "S" ENGINE

Key:

1. Nimonic valves with Stellite tips.
2. Hidural valve guides.
3. Forged Rockers.
4. 70.6 bore.
5. 0.8125 in. dia. pin pressed in to small end.
6. New connecting rod with horizontal split on big end.
7. 2 in. dia. Nitrided crankshaft giving 68.26 m.m. stroke.
8. Bonded clutch lining and double springs.



CHANGES IN MINI COOPER "S" SPECIFICATION

The following changes are related to the Specification given in "The Austin Seven Cooper and the Morris Mini Cooper" issued in August 1961 with the Reference TRL/10/61.

Specification No.	English	Metric
6. Front track	3½" Rim - 3' 11 ¹⁷ / ₃₂ "	1.21 m.
	4½" Rim - 4' 0 ¹⁷ / ₃₂ "	1.235 m.
7. Rear track	3½" Rim - 3' 10 ⁵ / ₁₆ "	1.18 m.
	4½" Rim - 3' 11 ⁵ / ₁₆ "	1.20 m.
14. No. of cylinders and dimensions	4 x 1.795 x 2.685 in.	4 x 70.6 x 68.26 mm.
15. Cylinder capacity	65.35 cu. in (60.9 cu. in)	1071 cc. (997 cc.)
16. Piston area	24.35 sq.in. (18.96)	156.2 (122-44)
18. Output BHP	70 (55)	72 cv. (56)
20. HP/Piston area	2.88 (2.9)	0.455 (0.458) cv/sq.cm.
21. At		
a. crankshaft speed	6000 r.p.m. (6000)	
b. piston speed	2690 ft/min (3200)	19.1 (m/sec)
c. Lanchester corrected piston speed	2930 ft/min (2930)	19.1 (m/sec)
22. Max B.M.E.P. Max torque	142 p.s.i. (135) 62 lb/ft (54.5)	97 kg/sq.cm. 7.82 m/kg.
23. At crankshaft speed	4500 r.p.m. (3600)	
24. Stroke Bore ratio	0.968 (1.3:1)	
29. No.& type of main bearings	3 Vandervell VP3	
30. Size of main bearings	2 in dia x 1 in (1.75 x 1/16)	50.8 mm x 25.4 mm. 44.46 x 27 mm)
31. Type of big end	Vandervell VP3 or Glacier copperlead	
48. S. U. Type HS2 x 2		
110. Lockheed 5½" Hydrovac		
114. Disc dia & pad area (F)	7½ dia x 0.375" thick (7.0 x 0.25")	19.05 cm. x 0.95 cm.
	4.32 sq. in. x 4	27.9 cm x 4
116. Total swept friction area	122 sq. in. (Front)	785 sq. cm (A)
	283 sq. in. (Total)	1885 sq. cm. (Total)

117. Type of wheel	10 x 4½ rim or 3½"		
119. Tyre section	145 x 10 SP or 5.00 L x 10		
165. Sump	8½ pts. including filter		4.85 litres
175. Valve timing	I.O. 16° BTDC	E. O. 51° BBDC	
	I.C. 56° ABDC	E.C. 21° ATDC	
183. Power per unladen weight			
a. Long ton	131.2 (93.6)		53.8 cv/kg
b. Short ton	107 (83.5)		(38.4)
184. Top gear displacement			
a. Litres long ton mile	3640 (3300)		
b. Litres /1000 kg/km			2175 (2035)
c. cu. in short ton/mile	1940 (1820)		
185. Capacity weight			
a. Litres long ton	1.79 (1.68)		
b. Litres/1000 kg.			1.77 (1.67)
c. cu. in./short ton	212 (212)		
186. B.H.P. Frontal area	5.02 sq. ft. (3.58)		57.3 cv/sq. m.
190. Road Speeds at Max torque 4500 r.p.m.			
Top	67 m.p.h. (53.6)		110 k.p.h. (86)
Third	53.5 " (43.2)		86.5 " (69)
Second	35 " (28.0)		56.6 " (45)
First	20.8 " (16.4)		34.0 " (27.3)
192. Road speed at 1000/ft.min piston speed	32.6		
193. Road speed at 5 m/sec. piston speed			52.5 k.p.h. (44.2)
194. Piston area weight			
a. 48 sq.in./long ton	(39.4)		
b. 42.6 sq.in./short ton	(35.0)		
c. 260 sq. cm./1000 kg.			260 sq. cm/1000 kg.
195. Swept friction area/ weight			
a. sq. in./long ton	483		
b. sq. in./short ton	430		
c. sq. cm/1000 kg.			3170

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		Standard Final Drive 3.765 : 1		Optional Final Drive 3.44 : 1	
	<u>Gearbox Ratio</u>	<u>Overall Ratio</u>	<u>Road speed at 1000 r.p.m.</u>	<u>Overall Ratio</u>	<u>Road speed at 1000 r.p.m.</u>
Top	1.00 : 1	3.765 : 1	14.7 m.p.h.	3.44 : 1	16.1 m.p.h.
3rd	1.242 : 1	4.68 : 1	11.8 "	4.28 : 1	12.9 "
2nd	1.78 : 1	6.7 : 1	8.28 "	6.13 : 1	9.02 "
1st	2.57 : 1	9.7 : 1	5.72 "	8.85 : 1	6.26 "
Reverse	2.57 : 1	9.7 : 1	—	8.85 : 1	—

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