

B.H.P. AND TORQUE TESTS WITH MK. I. H.R.G.-DERRINGTON LIGHT ALLOYCYLINDER HEAD FOR "B" SERIES B.M.C. 1500 ENGINE.

Comparative b.h.p. developed on Heenan & Froude dynamometer on "B" series engine with M.G.-A exhaust manifold, first with C/T M.G.-A cylinder head and then with H.R.G. L/A head, using same 1½" S.U. carburettors, both cylinder heads with 8.3-1 compression ratio.

	<u>C.I. Head.</u>	<u>H.R.G. Head.</u>
3,000 r.p.m.	40.7 b.h.p.	44 b.h.p.
4,000 r.p.m.	50.7 b.h.p.	60 b.h.p.
5,000 r.p.m.	56 b.h.p.	72 b.h.p.
Max. torque	75 lb.ft.	85 lb.ft.

M.G. 1588 ENGINE.

Comparative B.H.P. and torque figures obtained from standard engine fitted with 8.4 C/R pistons and standard cast iron cylinder head, and then fitted with H.R.G. cylinder head to standard specification as supplied, no variation to compression ratio or any other part. Engine tested with all equipment fitted, standard H.4 S.U. carburettors and straight through sound absorption silencer.

	<u>Standard</u>	<u>B.H.P. With H.R.G. head only</u>	<u>TORQUE Standard</u>	<u>lbs. ft. H.R.G. Head.</u>
2,000 r.p.m.	28	31.5	73	84
3,000 r.p.m.	48	55	85	96
4,000 r.p.m.	60.5	77.5	86	100.5
5,000 r.p.m.	73	89.5	77	95
5,500 r.p.m.	73.5	90	70	85

The above figures, which are on a truly comparative basis, no other modifications made other than changing over the cylinder heads and matching induction pipe, prove the overwhelming superiority of the 4-inlet port H.R.G. head over the makers' cast-iron head, not only for power but for greatly increased torque.

H.R.G. DERRINGTON LIGHT ALLOY CYLINDER HEAD MK. II

This famous replacement cylinder head for the "B" series B.M.C. engines has been re-designed and developed to suit the Mk.1622 cc. engine. Both types are interchangeable but the Mk. II engine. Once stocks of the Mk. I head have been sold, only Mk. II will be available and these can be fitted to 1489 and 1588 cc. engines.

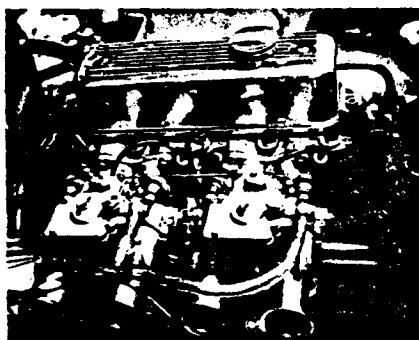
Initial development was carried out on the dynamometer with a completely standard fully equipped engine, including starter, dynamo, water pump, radiator fan, standard exhaust manifold, silencer and tail pipe, standard cam shaft, valves and springs for a true comparative test. Even the compression ratio was not increased when a direct increase in B.H.P. of 15% was obtained, more than with the standard cast iron head.

Using two Weber 42 DCOE twin choke carburettors 108.5 B.H.P. at 6000 R.P.M. has been achieved in comparison to 83.5 B.H.P. with Standard head, an increase of 30% more than standard.

An interesting fact is that with the 1489 cc. engine, the Mk. I type H.R.G. head gave 20% increase of power, the difference between the percentage increase being due apparently, to the improved porting, combustion chamber design, and larger valves. Fuel consumption in pints per B.H.P. hour shows a reduction of nearly 10% with the H.R.G. head.

The B.H.P. developed with atmospheric correction for true reading is shown below.

R.P.M.	<u>Standard Head 9.2 C/R 1½" S.U. Carbs.</u>	<u>H.K.G. Head 9.2 C/R 1½" S.U. Carbs.</u>	<u>H.R.G. Head 9.2 C/R 1½" S.U. Carbs.</u>	<u>H.R.G. Head Twin Choke 42 DCOE Weber Carbs.</u>
2000	29.5	32.5	34.5	36
2500	39	41.5	45.1	47.5
3000	50.5	52.5	57	60
3500	61.5	63.5	68	70.5
4000	71	74.5	78	82
4500	82	85	88	93
5000	86.5	94	96	102
5500	86.5	97	100.5	107
6000	83.5	93.5	103.5	108.5

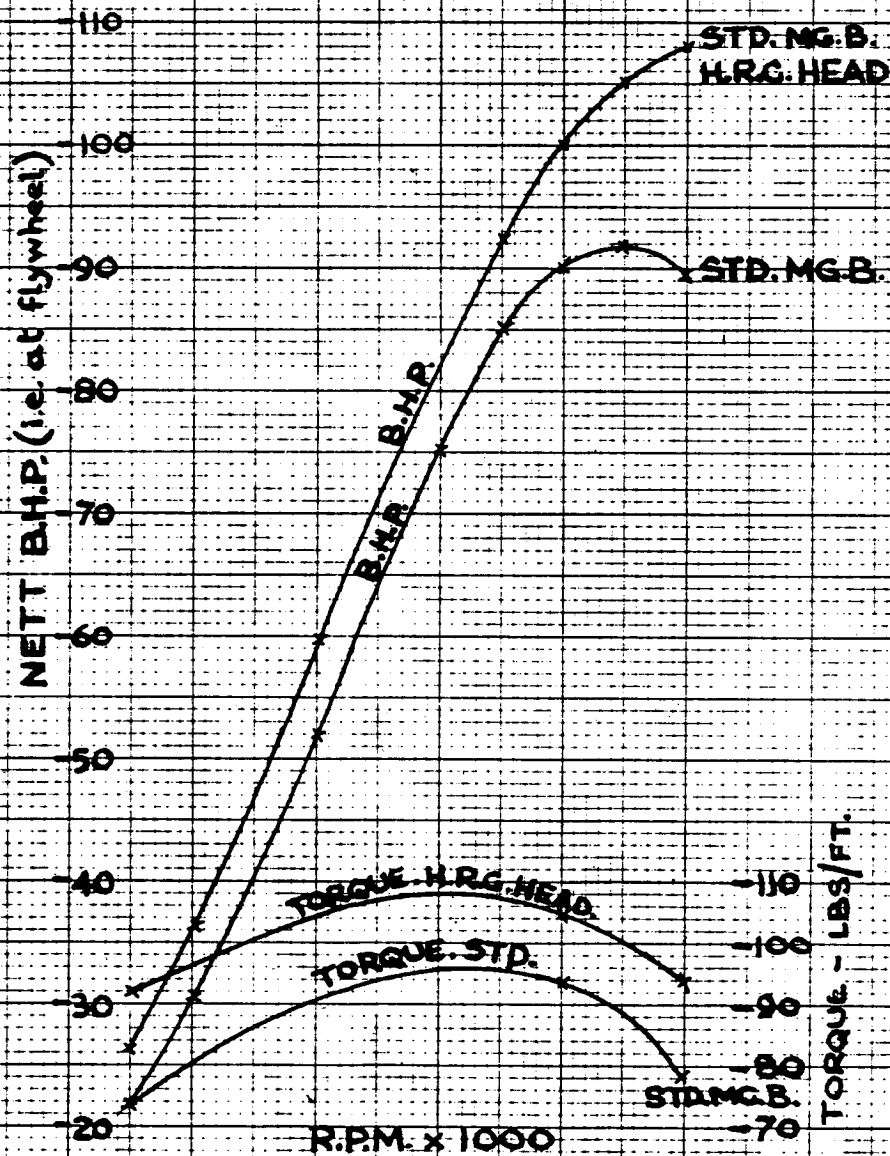


TEST ON STANDARD M.G.B. ENGINE:- 5000 MILES.

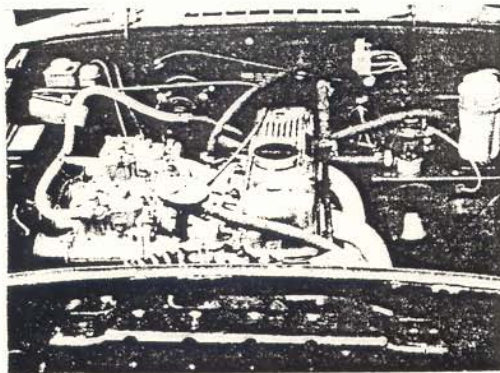
Same engine fitted with H.R.G.-DERRINGTON
Light Alloy Cylinder Head; Std. $1\frac{1}{2}$ " S.U.'s; 2 Camshaft.

(Results corrected to S.T.P.)

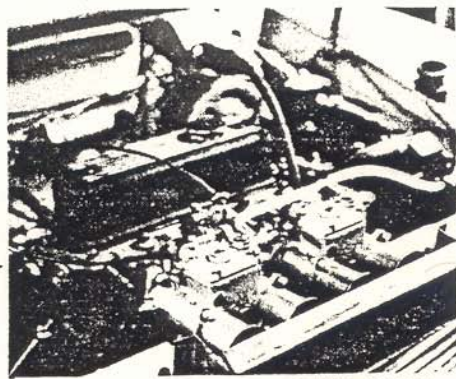
July 23rd. 1963



— The DERRINGTON-H.R.G. 4 PORT LIGHT ALLOY
— CYLINDER HEAD for all B.M.C. 'B' series ENGINED CARS —



FITTED TO 1967 MG-B.



FITTED TO 1800 TRANSVERSE ENGINE

The design of the DERRINGTON/H.R.G. head has been progressively improved with each Mk.No. the latest Mk.IV being re-designed for the 1800 engine, though it will fit all engine sizes from 1496 c/c to 1800 with outstanding results. Inlet & exhaust ports have been designed for maximum gas flow, being hand finished. Inlet valves are the largest which can be accommodated in the combustion chambers. At extra cost, the heads can be supplied specially prepared and finished for racing, highly polished ports & combustion chambers, Hydural valve guides giving maximum heat dissipation with minimum frictional resistance, racing quality valves having hard chrome plated stems and stronger valve springs. Provided rocker geometry is correct, to minimise side thrust, valve guide wear is negligible.

A cylinder head with separate inlet ports for each cylinder will always deliver more power than one with siamesed ports, therefore the H.R.G.4 inlet port L/I head can always exceed the maximum power possible to produce from the standard head, with far more torque from even low revolutions. A cylinder head in light alloy, due to better heat dissipation, allows of a higher compression ratio being used with its increase of power and torque, and reduction in fuel used. Thus, the H.R.G. head is normally made with a ratio higher than standard, the ultimate ratio being dependent on the piston used. Even if the normal C/R is retained, the H.R.G. head delivers more power and torque on 10% less fuel than the cast/I head. B.H.P tests at 5,000 R.P.M give a 23% increase on the 1498 c/c engine, 15% on the 1622 c/c and 12% on the 1800 model, the variation being due to improved combustion chamber and port design on the later engines.

The H.R.G. cylinder head, because of better heat dissipation, runs much cooler than the cast iron head, so it is of great value in the prevention of over-heating under extreme heat or racing conditions. Normally twin H.L. (1½") S.U semi-d/d carburetters are used, but for the Mk.IV H6 (1½") are recommended, though for maximum performance, two twin choke DCE WEBER carburetters should be used, one choke per cylinder. For road use size 40 will give better low speed torque and economy than size 45, which should be used for racing with the higher torque range and maximum power developed. WEBER carburetters have proved to give greatly superior torque and maximum power in comparison to standard S.U., improving acceleration to a marked degree, with 10% higher maximum speed and 12% better fuel consumption, owing to their greater efficiency. A single horizontal twin choke would not give even distribution on 4 ports, so cannot be used, on other than siamesed inlet ports.

Whilst a new induction pipe has to be used, the exhaust ports are the same as standard, so the standard exhaust manifold can be used, but the tubular extractor exhaust manifold delivers more power and is necessary for full output. The L/A head is interchangeable with the standard head, except for the water heater valve which has to be re-positioned, an adaptor being available. Special valves and springs are fitted, which allow up to 6,500 R.P.M being reached and provided connecting rods have been lightened and balanced with the crankshaft, flywheel and clutch assembly, stronger valve springs will allow of 7,000 R.P.M at which revolutions 137 B.H.P has been attained on a 10-1 C/R on the 1800 engine, with full face camshaft fitted.

A cold air intake, supplying cool air for carburation, instead of the very hot air in the engine compartment, has been proved by the increase in maximum speed, to improve the power output by 8%.

This, therefore, is one of the cheapest methods of "buying power" but cannot be used with any method of air filtration, so should be used only for racing. Ram pipes on S.U.'s can also give a few per cent increase of power, these being fitted as standard on WEBER carbs.

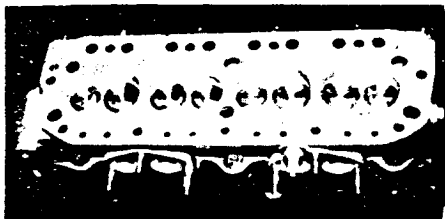
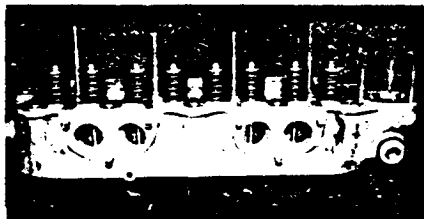
Recent development work by B.M.C. and by ourselves, has shown that on the same C/R more power and better torque is obtained by the use of slightly hollowed pistons, than by flat tops, due to the better combustion chamber shape. Higher ratios are effected by machining the face of the cylinder head a maximum of .040" and a similar amount from the top of the cylinder block. The face must also be recessed under the edge of the exhaust valve where this overlaps the bore, otherwise the valve would touch and bend, with disastrous results under valve bounce or float. This is the usual practice on high efficiency engines and no harm maintained by packing up the rocker standards or by fitting shorter push rods.

One of the greatest advantages of this cylinder head is the reduction in running temperature of the coolant by approximately 20° C. and even with a high compression ratio special racing plugs have not been found necessary, KLG.FE.75 having been found to be adequate, used with a 10-5-1 compression ratio in races up to 60 miles.

The H.R.G. head has been extremely successful when used for racing and provided the face has not been weakened by over machining, the correct gasket used, stout washers under the head nuts, and not tightened over 40 lbs ft. the head should give long and reliable service.

It is of course most valuable for normal use on the road owing to the greatly increased torque from 1,000 R.P.M upwards and a similar increase of power which has not even reached its peak at 6,000 R.P.M. and is limited only by the valve bounce, or other factors. A car fitted with the H.R.G. head is most flexible and careful fuel consumption tests have shown an improvement of at least 10% on the same carburettors, when suitably set for road use. The H.R.G. head gives such an increase of power and torque that a lower axle ratio can beneficially be used. Engine revolutions are lowered in relation to road speeds, reducing wear and improving fuel consumption, various alternative ratios being available. Bearing reliability can be improved by the fitting of an oil radiator supplied as a complete kit with flexible high pressure pipes and connections. Under racing and high speed conditions in air temperature over 80F the oil cooler reduces the working temperature of the oil by 20° C improving bearing reliability and lowering oil consumption.

All H.R.G. cylinder heads are supplied complete with valves ground in and spring assemblies fitted ready for use. The kit of parts supplied with the cylinder head includes all necessary studs and nuts, clamping bars for the exhaust manifold, universal jointed sparking plug spanner and tommy bar, throttle control bracket, competition cylinder head and port gaskets.



JUNE 1970

DERRINGTON-H.R.G. CYLINDER HEAD.

	E.	s.	d.	US\$
Mark V head kit with valves & springs, assembled	95	0	0	232.00
Machining face .025" for higher C/R (at time of ordering)	1	10	0	3.50
" " .040" " " " "	2	10	0	6.10
Race preparation, special finish, valves, Midural guides, springs	25	0	0	60.70
Inlet pipe, balanced, for H.4, HS.4, or H.C carburettors	11	0	0	26.70
" assembly with twin H.6 SU carburettors, linkages & fuel pipes	40	0	0	97.10
" " " 40 DCOE WEBERS, suitably set	60	0	0	145.60
" " " 45 DCOE " " "	66	0	0	159.20
" (2) for 40 or 45 to fit H.R.G. head	10	0	0	24.30
9-1 pistons flat top for 1496 c/c c/* rings & 11/16" pins	12	10	0	30.35
" " " 1588 c/c " " C/S only	10	0	0	24.30
" " " 1622 c/c " 3/4" " S+L & C/S	14	0	0	34.00
Water valve adaptors, repositioning heater valve away from head	1	10	0	3.65
Head kits, packing in strong hardboard box & carriage	1	0	0	
" " " postage (2 parcels)	1	5	0	
TSA and CANADA in two separate parcels				16.00

For posting overseas, the cylinder head weighing 21 lbs is boxed in one parcel, the valves being numbered for correct assembly and included with all the other parts in a separate parcel, this method of despatch avoiding expensive shipping charges.

FITTING AND SERVICING INSTRUCTIONS FOR THE DERRINGTON/H.R.G. ALUMINIUM CYLINDER HEAD FOR THE "B" TYPE ENGINE, 1496 - 1796 c/c FITTED TO THE M.G. CARS, OTHER B.M.C. MODELS AND MAKES USING THE "B" SERIES ENGINE.

Aluminium heads require a little extra care in fitting and servicing, due to the increased heat expansion of the metal itself, compared with cast iron, but this extra trouble will be more than repaid in the advantage gained, due to the better heat conductivity of the metal, which permits the compression ratio to be increased by at least one ratio, bringing in turn the benefits of extra power and lower fuel consumption.

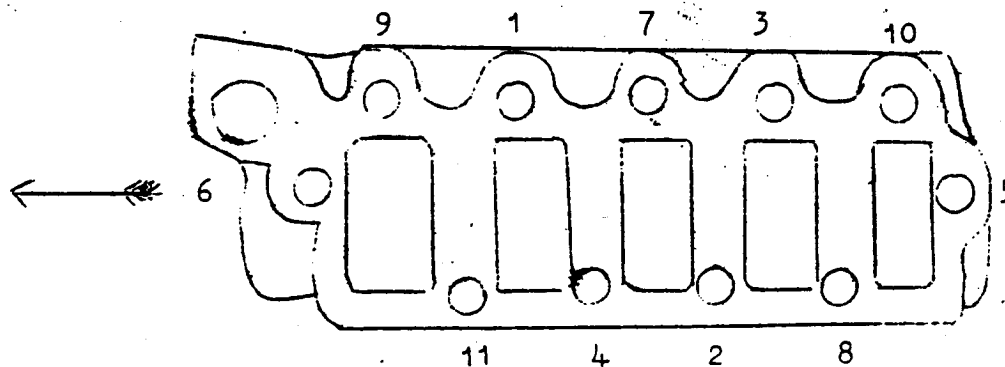
If these natural advantages are combined with the latest practice in port and combustion chamber design, phenomenal results are obtained, from the improved design of the Derrington/H.R.G. head, due to the separate inlet ports, shaped for maximum gas flow.

Before fitting a Mk.IV cylinder head the face of the cylinder block must be relieved under the exhaust valve where the tip of the valve overlaps the bores. This is necessary in case valve bounce or float should set in, which gives a greater lift than the cam and more particularly when a higher lift camshaft is being used.

CARBURATION. Using the original twin H.4.S.U. carburettors avoids purchasing new instruments, but H.6 will give a higher performance, maximum performance being obtained from two twin choke DCOE Webers, providing one choke per port. Needles on H.4 will need to be changed to A.M. (up to 1622 c/c), B or UVD for 1796 c/c.

In fitting aluminium heads the most important points are:-

1. See that the head is free on the cylinder head studs, it should drop over the studs under its own weight, if not, check that the studs are true to the cylinder block face: a bent stud can cause trouble.
2. The head nuts must not be over tightened, if a torque wrench is used ³⁸⁻⁴⁰~~35-38~~ ft./lbs. should not be exceeded. Be sure to use the large thick steel washers supplied, under the cylinder head nuts to spread the load. On no account tighten down without the washers. Tighten the nuts in the following order, doing each nut up a little at a time.



Top of Head.

This will ensure that the head is evenly pulled down. It is wise to check the stud nuts after the engine has been run and reached normal running temperature and then allowed to cool down again. Light alloy heads must only be removed when cold, undoing nuts gradually in the same order.

/continued.....

3. Do not use an all metal gasket, always use the combined metal and asbestos type. The standard M.G. Gasket Ref. AEH.768 (steel copper asbestos) is quite satisfactory.
4. See that the surface of the head, gasket and cylinder block are absolutely clean.
5. Be sure to see that the engine is never run short of water, serious distortion is likely to occur in this event.

The Valves used are special H.R.G. inlet, standard MG.A. or B. exhaust. Valve springs, collars, collets, shrouds etc., are standard MG.B parts. Valve seat angles are as standard, namely 45° . When heads are supplied less valves, the latter must be ground in before use.

The Valve Guides are HR.G. design with ^{Shoulder} ~~spring lock rings~~, but dimensionally MG.B.

The Plugs recommended are:- K.L.G. FE.75 or 80 for all normal running.
K.L.G. FE.100 or FE.220 for competition purposes.

The special plug spanner supplied will facilitate plug fitting. It is advisable to smear the thread of the plug with a little liquid or flake graphite before fitting as this will prevent the possibility of plugs sticking in the aluminium. Do not overtighten plugs and thus strain L/A threads, tommy bar supplied gives suitable leverage.

The Tappet or Rocker clearances should be adjusted to .017"-.019" for both inlet and exhaust valves. 015-017 MC-13.

The Ignition should be set to 7° - 8° before T.D.C. at 9.3 CR. 5° - 6° at 10.3 CR.

Further Tuning is possible with the Derrington/H.R.G. Head. The compression can be raised further by machining the underside of the head; .030" off the head will raise the compression ratio to 10 to 1. With this ratio only premium grade fuels should be used. For maximum performance the use of twin choke carburettors will again be beneficial and as the head has 4 separate inlet ports, these are readily accommodated.

If the head has been machined to increase the compression ratio; it is wise to check that the valve heads do not foul the top of the cylinder block. The lift of the standard camshaft for the MGA is .357". If there is any likelihood of this valve touching, particularly the exhaust valve, the block must be relieved at this point. This can be done by using a rotary file or small grinding wheel in a portable electric drill, care being taken only to remove metal under the valve head. These remarks apply equally well to the standard cast iron head.

Throttle and Choke controls vary according to model and year of manufacture and it is therefore impracticable to supply a standard kit for all applications. It may be necessary to lengthen and/or reposition the flexible Bowden controls.

Heater Connections and controls also vary and may require slight re-arrangement.