V.W. DERRINGTON LTD
AUTOMOBILE ENGINEERS & MANUFACTURERS
159-161, LONDON RD., KINGSTON-ON-THAMES, ENGLAND

TUNING THE "A" SERIES B.M.C. ENGINE USED ON A.30 & A.35. MORRIS MINOR & 1000, and AUSTIN HEALEY SPRITE

The "A" series engine as delivered from the factory is a very hard wearing and reliable power unit, but most responsive to tuning for better performance. It must however, be emphasised that whilst it is easy to tune, for increased power output, this must create a tendency to reduce reliability and increase the rate of wear. This need not be a deterrent against tuning, for a properly serviced and driven Morris Minor, fully tuned, covered 45,000 miles in highly developed form, before needing reconditioning which only necessitated reboring, renewing of bearings and replacement of valve springs and timing chain. When used for competition and racing, an owner is obviously prepared to risk failure or reliability upon an extensively tuned engine, producing nearly double its designed power output. Certain parts in the original design which, whilst quite suitable for normal road use, are changed for improved components, of greater suitability for high speed use.

All the modifications offered, have been developed by us firstly upon the dynamometer, and proved upon the road and track, since being first introduced in 1953, and we can justly claim greater experience than that of any other firm, benefitting by such long and extensive development. The success of our modifications has led to their being extensively copied, proving that "imitation is the sincerest form of flattery". Many have been adopted by the Works Competition Department and recommended by them, proving the effectiveness of the equipment.

The various components have been so designed that the earlier types will fit the later ones, thus O.H.V. Minor accessories can be fitted to the "1000" and A.30 to A.35 models. Purchasers of equipment for the earlier models can thus transfer the parts, upon acquiring a later model. In view of the larger cubic capacity of the A.35 type engine, the improved lubrication system and type of bearings used, larger carburetters giving better breathing at higher revolutions are supplied for these models, than for the 803 cc models.

The main essential in obtaining the greatest increase of torque and power is by improving the aspiration, and it has been proved that a suitably designed twin carburetter unit, with a carburetter feeding directly into each of the siamesed ports, gives the best results. 20° semi-downdraught S.U. carburetters have been adopted as the ideal, allowing a free exhaust manifold design and being more reliable than a steeper angle of semi-downdraught carburetter. The S.U. is the easiest type of tune, and does not suffer from partial blockage of fixed jet carburetters with minute jets. The carburetters are mounted on to cast aluminium alloy inlet stubs, with a copper tube balance pipe of the most efficient diameter, this being fitted with expansion joints which allow for heat expansion and contraction without leaking or inducing stresses, which would cause the throttle spindles to bind. Larger bore carburetters are not advisable for other than high maximum speeds, for low speed torque and consequent acceleration are adversely affected, and the increase in maximum is insufficient to fully compensate for the drop in acceleration. It is of far greater importance to have first class acceleration, which is in continual use on crowded roads, than to have a few extra m.p.h. on maximum speed, so rarely obtainable today. Only for racing, where the revolutions are rarely likely to be below 5000 r.p.m., can larger 1¾" bore carburetters efficiently be used, provided the ports are suitably modified to be able to pass the extra volume of mixture.

The cooler the incoming gases are, the greater the weight of mixture taken in each stroke, and the more mixture which can be efficiently burned, the greater the power that is produced. Thus, a cold air intake from the front will provide considerably cooler air than from the engine compartment, amounting to a difference of nearly 100°F. under racing conditions. A large truncated pipe conducts the cold air into an open box feeding both carburetters and can be adapted to all models. Where the cold air box is not used, ram pipes to give the most effective length to the incoming column of air, can be used with beneficial results. Ram pipes can also be used in addition to the cold air box providing this is suitably deepened.

Modifications to the cylinder head comprise raising the compression ratio by machining the face, according to the compression ratio of pistons to be used, re-shaping the combustion chambers and all the ports for maximum gas flow and combustion, balancing individual combustion chambers for equal compression ratio, and final finishing, by grinding the highly polishing, which in addition to increasing the thermal efficiency, slows down the rate of carbon deposit, keeping the degree of tune for considerably longer periods, and reducing the tendency to pinking. All this work is of high precision, with carefully matched and balanced ports on both head and manifolds, when these parts are supplied together.

The inlet ports and seatings are modified to obtain maximum speed to gas flow, resulting in "good filling", so necessary for the best torque and power output. This work, using inner valve springs with the standard outer springs, is included upon our Stage I cylinder head tune at £17.10.0d., which is above our competitors' Stage II tune at considerably higher cost.

Stage II cylinder head tune is advised only for racing, due to the reduced torque obtained under 5000 r.p.m. but is compensated for by the additional power attained, over these revolutions. In addition to Stage I work, the ports and valve seatings are enlarged, larger valves with re-designed heads for better gas flow, are fitted, the stronger outer and inner valve springs are fitted, and will enable the maximum results to be obtained from a standard cast iron cylinder head, of siamesed inlet port design. A light alloy head with separate inlet ports, is under development, preliminary results being most encouraging, but this will not be marketed until proved by continual bench, road and track testing, to give the reliability and the results to be expected of such a necessarily expensive component.

The loading of the cams and valve gear can be reduced, resulting in higher revolutions before valve bounce, by the fitting of our light alloy tubular push rods, developed and tested by racing, over the past twelve months. These weigh only half the weight of the standard steel push rods, and do not flex or crush under high revolutions. It is however advisable to increase the clearance between the push rods and the tunnels to give more space for oil return. The tunnels are bored vertically and the push rods set at 10° so it is only necessary to chamfer the tunnel holes through the head at opposite sides, top and bottom. Extensive developments and testing, have resulted in the production of highlift overlap camshafts, which produce better torque, considerably improved acceleration and higher maximum speeds, yet are perfectly tractable and have even better fuel consumption than the standard camshafts. Interchangeable on all 803 cc and 948 cc engines. Three special camshafts have been produced, with varying characteristics, according to the results desired.

Stage I shaft gives approximately 3 B.H.P. more with good torque up to maximum revolutions. Stage II shaft gives a further increase of 3 B.H.P. more with even better torque, whilst Stage III has good torque and produces approximately 3 B.H.P. more at 700 r.p.m. higher, than the preceding shafts. The Stage II shaft gives better fuel consumption figures than even the standard camshaft. All the shafts are interchangeable on both 803 cc and 948 cc engines, used on all models.

For racing with the 948 cc engines, flat top high compression pistons are being produced which will increase the compression ratio with the standard combustion chamber, to approximately 9.5 to 1, and with a modified cylinder head to nearly 11 to 1. Whilst an engine will attain 7,000 r.p.m. fully modified, it is most inadvisable to use these speeds and expect continuous reliability.

For the ultimate development of maximum power from the engine, the crankshaft and fly-wheel clutch assembly can be statically and dynamically balanced for higher revolutions, than as manufactured. This reduces the internal stresses which absorb power, and renders the engine considerably smoother. Connecting rods and pistons can also be balanced to a finer degree than standard and the flywheel lightened, or substituted by a light alloy flywheel weighing approximately one half the weight, of standard, for better acceleration.

Lightened connecting rods are available, which are not reduced in strength by the method of lightening employed. The rough stamping is ground and highly polished to reduce oil drag and increase the resistance to surface cracking and eventual fracture, and only excess metal is removed from the big end and little ends to reduce the weight by 3 to 4 ozs. on each rod. These lightened rods improve the acceleration and reduce the loading on the crankshaft, which with standard rods, has an average life of 20 mins. at 7,000 r.p.m. continuous. For racing, connecting rods with solid eyes are available, using floating gudgeon pins, in place of the standard type with split eyes and clamped pins, which are more prone to failure. Both types can be supplied standard finish or lightened polished and balanced, at extra cost.

On other models than Sprite, considerably improved results can be obtained from the fitting of our Deep Note Exhaust System, employing a straight through sound absorption silencer. The front pipe, silencer and tail pipe are of equivalent diameter, so there is no loss of power caused by restriction or expansion. It is important to keep the gas speed constant and thus obtain extractor action. No alterations to the manifold can be made with the single carburetter manifold owing to the restriction imposed by the design. The exhaust branch casting is an adaption to the standard exhaust manifold for providing an easy flow from the centre siamesed port, through the hot spot.

opening, after the swan neck inlet has been sawn off level. The casting bolts on over the whole opening, no welding being necessary. The extractor type of tubular manifold provides the maximum results possible, this having been fully developed and the design based upon racing car practice. It saves weight, being less than half that of the casting, developing a minimum of 3 B.H.P. more than any other variation.

As similar production engines deliver varying maximum B.H.P., we are expressing the results given by the various modifications upon a percentage basis instead of H.P. readings, which could be misleading. The twin carburetter unit gives approximately 27% at 500 r.p.m. higher, plus modified cylinder head approximately 40%, exhaust branch casting approximately 10%, extractor manifold approximately 18%, and the Deep Note Exhaust System approximately 17%.

With the increase in power given by the modifications, improvements in braking, suspension and raising the final drive ratio may be considered necessary. Improved braking can be obtained by the use of the metallic bonded brake linings, commonly termed "non-fade". Whilst harder pressure is needed, the linings more effectively retard and do not suffer from "fade" when used under arduous conditions. Thus, life of the linings is usually longer. To overcome the additional pressure needed with anti-fade linings, the Baldwin Brake Booster can be fitted, the combination then giving the maximum braking possible from the present sized brakes. For the front brakes a larger Lockheed assembly is available, increasing the ratio of retardation in comparison to the rear brakes.

Front suspension, high speed steering and cornering can be vastly improved by the fitting of our anti-roll bar, which has been scientifically designed to effectively control diagonal roll. It counteracts the tendency of the rear wheel to lift, thus giving better rear wheel adhesion. Each bar is designed for the particular model and only marketed after successful development and testing. Wherever possible, existing bolts or drillings are used for the attachments for ease of fitting and prevention of structural weaknesses. Special hydraulic valves to give a harder rate of dampening to both front and rear shock absorbers, can be supplied. Rear shock absorbers should be replaced with an adjusatble type of shock absorber which can be set for a "soft" or "hard" ride, as required. These are now available, British made, at a very competitive price, approximately half the cost of the Continental type.

Variations of axle ratio can be made according to conditions required. Usually for circuit racing it is better with a tuned engine, to retain the standard ratio for good acceleration and high speed, but for sprint use and hill climbs a higher figure ratio would give better results, whilst for long distance road racing or high speed touring a lower figure ratio will benefit, by lowering the engine revolutions in relation to the road speed, reducing rate of engine wear and improving fuel consumption.

A revolution counter (or tachometer) is most valuable, if only to ensure that maximum safe revolutions will not be exceeded, and the drive can either be taken from the end of the camshaft or, more simply and cheaper, from the end of the dynamo. This method of drive has proved to be reliable, quiet and trustworthy. An electronic type of revolution counter can also be fitted, this being operated from the distributor, and will be available at a very competitive price.

COMPARATIVE ROAD PERFORMANCE FIGURES - 1957 MORRIS MINOR 1000 (1,839 miles)

Between car as delivered, then fitted with modified cylinder head, and finally with twin carburetter unit. All figures are average of runs in opposite directions.

	Standard	Plus mod.head	Plus twin carb. unit
0 - 30 m.p.h.	6.3 secs.	5.6 secs.	5 secs.
0 - 50 "	16 "	14.1 "	12 "
20 - 60 " top gear	29.8 "	26.5 "	23.4 "
Max.3rd gear	58 m.p.h.	64 m.p.h.	66 m.p.h.
Max.top gear	64 "	78 "	Over 80 (limit speedo)

AUSTIN A.35. 1958 model, 2-door saloon, 15,000 miles

Comparative performance figures between car standard as delivered, then fully modified with twin S.U. carburetter unit, extractor exhaust manifold, straight through Deep Note exhaust system, modified H/C cylinder head, harder sparking plugs and anti-roll bar, and finally with our special overlap camshaft.

	Standard	Modified	Plus Camshaft (Stage II)
0 - 30 m.p.h.	7 secs.	5.6 secs.	4.8 secs.
0 - 50 "	19 "	12.6 "	10.6 "
0 - 70 "	46 "	30.8 "	24.8 "
Max. 3rd gear	67 m.p.h.	70 m.p.h.	74 m.p.h.
Max.top gear	73 "	Over 80 (limit speedo)	90 "
20 - 50 3rd gear	Not taken	8.2 secs.	8.3 secs.
Miles per gal. No.1 fuel	38 m.p.g.	36 m.p.g.	39 m.p.g.

NORMAL TUNING - A.30, A.35, MINOR 1000 & similar engined cars
EQUIPMENT AND PRICES.

	£. s. d.	$
HEADS, fully modified, with valve springs (in exchange)	17. 10. 0.	49.00
" extra cost for outright sale or against return own head... ...	10. 10. 0.	29.40
GASKET copper and asbestos 3/6d. (49 cents) ditto decarb. set	-. 8. 6.	1.19
" Corrujoint H/C 2/9d. (39 cents) " " "	-. 8. 0.	1.12
INNER VALVE SPRINGS either 803 cc or 950 cc model, per set	-. 8. 0.	1.12
TWIN S.U. CARB. UNITS with inductions, controls, fuel pipe 803 cc. ...	17. 10. 0.	49.00
" " " " " " " " 950 cc. ...	17. 10. 0.	49.00
CAMSHAFTS, Stage I (plus £3.7.6d. $9.45 deposit) exch. price	6. 0. 0.	16.80
" Stage II " " " " " "	7. 10. 0.	21.00
" Stage III " " " " " "	9. 0. 0.	25.20
LIGHT ALLOY TUBULAR PUSHRODS, 2/3rds weight of standard parts, set ...	4. 0. 0.	11.20
FLAT TOP H/C PISTONS - approx. 9.5 - 1 ratio. Price per set	7. 10. 0.	21.00
ROCKER COVERS, cast L/alloy, highly polished quick acting filler cap..	4. 12. 6.	12.95
FLYWHEEL, Light alloy, steel faced, weight 10 lbs. (standard 21 lbs)..	12. 10. 0.	35.00
BALANCING crankshaft, flywheel, clutch assembly (not incl.dismantling)	5. 10. 0.	15.40
HIGH TORQUE CLUTCH ASSEMBLY, including plate, with special linings ...	6. 0. 0.	16.80
EXHAUST BRANCH CASTING and gasket (for MINOR, A.35 or TURNER)	1. 10. 0.	4.20
EXTRACTOR TYPE TUBULAR EXHAUST MANIFOLD, Minor, A.35 Sprite & Turner..	10. 0. 0.	28.00
DEEP NOTE straight through exhaust system - all models	3. 15. 0.	10.50
ANTI-FADE TYPE BRAKE LININGS, per set	3. 15. 3.	10.54
ANTI-ROLL BAR with brackets, clamps & rubber bushes, A.30, 35, Sprite, OHV Minor & 1000, and Turner	4. 17. 6.	13.65
4.3 RATIO CROWN WHEEL & BEVEL PINION, Minor 1000 or 4.55 for Sprite, with special roller races and distance pieces	12. 15. 0.	35.70
REV. COUNTER HEADS, 0-6500 r.p.m. 4" dia. with flexible drive and angle drive reduction box fitted to dynamo (5" heads £1 extra). ...	11. 10. 0.	32.20
BRACKET for fitting rev. counter head under instrument panel	1. 0. 0.	2.80
VARIFLOW adjustable SHOCK ABSORBERS for rear only, per pair	5. 5. 0.	14.70
DAMPER VALVES, stronger for front or rear, per pair..	1. 10. 0.	4.20