TUNING THE MG XPAG ENGINES

Fitted to the Series TB, TC and TD

Reprinted from

Motoring

July and August 1957

TUNING THE MG XPAG ENGINES

Fitted to the Series TB, TC and TD

by Eric Blower

THE demand for tuning data for these engines is still exceeding all expectations, but the tuning booklets are unfortunately out of print and no longer available.

The principle of this article therefore is to give in condensed form the details of the tuning given in the tuning publications for the XPAG engines for the 'TB' and 'TC' models and the XPAG/TD engines as fitted to the 'TD' Midgets.

With the exception of the 'TD' (Mark II) with the TD3 engines, all cars were delivered from the factory in standard untuned form, tuned to give maximum performance with pump petrol consistent with complete reliability and freedom from pinking.

Whereas it is a simple matter to increase the power output of the engine, it cannot, of course, be achieved without the use of a fuel having better anti-detonation qualities, the No. 1 pump fuels available today, of a high-octane rating.

The information as set out is to provide progressively increasing power, bearing in mind that the simplest tuning method should be chosen to give the performance required, remembering all the time here, as elsewhere, that POWER COSTS MONEY:

Standard Car Data: 'TB', 'TC', 'TD'

Bore	66·5 mm.
Stroke	90 mm.
Cubic capacity	1250 c.c., 4-cylinder.
Sparking plugs	Champion L10S up to Engine No. XPAG/TD2/22734. Champion NA8 commencing at Engine No. XPAG/TD2/22735.
ıg order	1, 3, 4, 2.
ıpression ratio	7·25 : 1.
ıve timing (up to Engine No. XPAG/TD2/24115):	
Inlet valve opens	11° B.T.D.C.
closes	87° A.B.D.C.
Exhaust valve opens	82° B.B.D.C.
closes	24° A.T.D.C.
Valve timing (commencing at Engine No. XPAG/TD2/24116):	
Inlet valve opens	5° B.T.D.C.
closes	45° A.B.D.C.
Exhaust valve opens	45° B.B.D.C.
closes	5° A.T.D.C.
Valve lift	8 mm.
Tappet clearance	Up to Engine No. XPAG/TD2/24115—·019 in. Commencing at Engine No. XPAG/TD2/24116—·012 in.
Contact breaker points	Up to Engine No. XPAG/TD2/24488—·010 to ·012 in. Commencing at Engine No. XPAG/TD2/24489—·014 to ·016 in.
Ignition timing	T.D.C. fully retarded, points just breaking.
Octane rating	Minimum requirements for knock-free operation = 74 octane. Maximum power = 82 octane.
Carburetters	Twin S.U. 1¼ in. bore.
Carburetter jets	·090 in.
Carburetter needles	Standard: ES. Richer: EM. Weaker: AP.
B.M.E.P.	125 at 2,600 r.p.m.
Safe maximum r.p.m.	5,700.
Valve crash r.p.m.	6,000.
Capacity of combustion space	45·5 c.c.
Cylinder head depth (top to bottom face)	76·75 mm.
Thickness of head gasket	·045 in.
Capacity of head gasket	Approx. 4·5 c.c. compressed.
Clutch pressure springs	Up to Engine No. XPAG/TD/9407—130–40 lb., red. Commencing at Engine No. XPAG/TD2/9408—150–5 lb., brown.

Standard Car Data: 'TB' and 'TC'

	Overall	*m.p.h. per* 1,000 *r.p.m.*
Gear ratios:		
Top	5·125	15·84
Third	6·93	11·74
Second	10·00	8·13
First	17·32	4·68
Rear axle ratio	5·125 : 1.	
Dimensions:		
Overall length	11 ft. 7½ in.	
width	4 ft. 8 in.	
height (hood up)	4 ft. 5 in.	
Wheelbase	7 ft. 10 in.	
Track	3 ft. 9 in.	
Weight	15¼ cwt.	
Tyre size	4·50—19.	
Tyre pressure—front	24 lb.	
rear	26 lb.	
Front wheel toe-in	⅛ in.	
Capacities:		
Water system	1¾ gallons	
Gearbox	1½ pints	
Rear axle	2 pints.	
Petrol tank	13½ gallons.	
Engine sump	9 pints.	

Standard Car Data: 'TD' Midget

	Overall	*m.p.h. per* 1,000 *r.p.m.*
Gear ratios:		
Top	5·125	14·42
Third	7·098	10·412
Second	10·609	6·966
First	17·938	4·12
Rear axle ratio	5·125 : 1.	
Dimensions:		
Overall length	12 ft. 1 in.	
width	4 ft. 10⅛ in.	
height	4 ft. 5 in.	
Wheelbase	7 ft. 10 in.	
Track—front	3 ft. 11⅛ in.	
rear	4 ft. 2 in.	
Weight	17¼ cwt.	
Tyre size	5·50—15.	
Tyre pressure	18 lb. front and rear.	
Front wheel toe-in	Nil.	
Capacities:		
Water system	1¾ gallons.	
Gearbox	1¼ pints } Hypoid 90.	
Rear axle	2¼ pints } Hypoid 90.	
Petrol tank	12½ gallons.	
Engine sump	9 pints.	

Stage 1

The engine is raised to 8·6 : 1 compression ratio by removing $\frac{3}{32}$ in. from the cylinder head face, reducing the head depth to 74·37 mm. after machining. Remove any frazes left and polish, but do not grind out the combustion chambers as these are already quite clean and machined nearly all over. The gasket edges must not overlap the combustion spaces.

The ports may be ground and polished but should not be so ground as to impair the shape or valve choke diameter.

Grind away slightly the outer separating stud boss, about $\frac{1}{16}$ in. of each side, still maintaining its streamline shape so that oblong ports are obtained 1 $\frac{1}{16}$ in. high, $\frac{13}{16}$ in. wide, minimum. Do not remove the boss completely or it will affect mixture distribution.

Match up by grinding all the exhaust and inlet ports with the cylinder head ports and grind out and polish the inlet manifold to suit the carburetter bore.

Use the standard cylinder head gasket and insert $\frac{3}{32}$ in. thick by $\frac{1}{4}$ in. O/D washers under the cylinder head stud nuts in order to correct for the reduced cylinder head thickness.

In order to maintain the correct rocker adjustment use rocker shaft packing pieces $\frac{1}{16}$ in. thick mild steel with three holes to match the base of the rocker, inserted between the head and the rocker pedestals.

The tappet clearances, up to and including Engine No. XPAG/TD2/24115, can with advantage be opened up to ·022 in. Use Champion LA11 or Lodge R49 plugs, the standard carburetters, needles, and jets, and set the ignition at the standard setting, i.e. T.D.C.

With the high-octane fuels available the engine should give 60 b.h.p. at 5,500 r.p.m.

Stage 2 (Using Larger Valves)

The compression ratio is increased to 9·3 : 1 by removing $\frac{1}{8}$ in. from the gasket face of the cylinder head, the finished head thickness after machining being 73·575 mm. This should be regarded as the absolute maximum to remove.

Polish the head, ports, and manifolds as in Stage 1.

The sharp edge left on the combustion space profile at the end of the sparking plug hole should be filed back vertically at the plug hole in a $\frac{1}{4}$ in. wide scoop until it is a minimum of $\frac{3}{32}$ in. thick at the centre with a radius on each side. Do not file back too far, and check that the combustion space edge still extends safely over the gasket edge.

Fit the larger inlet valves having 36 mm. O/D heads. This will necessitate cutting away part of the combustion space wall to give the necessary clearance for the valve head, using a 38 mm. diameter side and face cutter, the cutter corner having a 1 mm. radius piloted off the valve guide.

Alternatively, carefully grind the vertical wall until the valve head has a 1 mm. working clearance. Cut or bore out the valve choke in a similar manner to 33 mm. diameter. Grind away any local ridge left in the valve port and recut the valve seat to 30° by 34·9 mm. top diameter.

To fit the larger exhaust valves having 34 mm. O/D heads follow the procedure as for the inlet valves, cutting away the combustion space wall with a 36 mm. diameter cutter. Bore the valve choke to 29 mm. diameter and recut the valve seat to 30° by 32·8 mm. top diameter.

The competition valve springs, 150 lb. open tension, which are interchangeable with the standard springs, should be fitted with the closed coils next to the cylinder head. Valve crash with these springs occurs around 6,500 r.p.m. Cylinder head gaskets, washers, rocker shaft packing pieces, plugs, tappet settings, ignition timing, carburetters, etc., as Stage 1.

With the No. 1 pump fuels and standard needles and jets, brake-horse-power developed should be 66·5 at 5,500 r.p.m.

Note. The fan blades may be removed if the car is to be driven generally above 40 m.p.h., but for trials work, slow hill-climbing, and traffic work they should be retained. The fan takes approximately 1 b.h.p. to drive.

Where applicable, tappet settings may be set at ·019 in. if quietness is desired, with a consequent loss of approximately 1 b.h.p. In addition, the $1\frac{1}{4}$ in. diameter competition carburetters may be used as in Stage 3. When the No. 1 pump fuel is used in conjunction with the EL needle the engine should develop 68 b.h.p. at 5,500 r.p.m. Alternative richer needle for above AA, or weaker EO.

Stage 3

The engine, using the standard cylinder head with a depth of 76·75 mm., is raised to 12 : 1 compression by the use of special pistons. When ordering please quote exact bore sizes.

These pistons must only be fitted one way round, that is with the flame groove on the sparking plug side. In using this high compression it is necessary to run on a high-content methonal base fuel and to carry out alterations as below:

Use fuel as follows:

80 per cent. dry blending methonal, specific gravity ·796 at 60° F
10 per cent. benzol (90), specific gravity ·8758 at 60° F.
10 per cent. petrol (70- or 80-octane).
1 per cent. castor oil.

Use the standard $1\frac{1}{4}$ in. carburetters with jet sizes increased to ·100 in. and carburetter needles GK, or richer RC, or weaker RV. Use Champion LA14 or Lodge R49 plugs. Change the float-chamber needle and seat assemblies to S.U. type T3.

Tappet settings can be increased to ·022 in. where applicable, that is up to and including Engine No. XPAG/TD2/24115. Set ignition timing at 40° A.T.D.C. (flywheel). Two S.U. pumps should be used for increased fuel delivery. The pumps should not be coupled together, duplicate fuel lines being employed, with an additional pipe from the tank to the extra pump. From this pump runs an additional flexible pipe to the carburetters, using a double-feed banjo union on each float-chamber, one pump line to feed the rear float-chamber and one pump line to feed the front float-chamber. To balance the feed, run a flexible pipe between the two float-chamber banjo unions.

By following the above arrangements a full discharge will be obtained from the pumps.

The engine should then give a maximum of 74 b.h.p. at 5,800 r.p.m., which can be increased to 76 b.h.p. at 5,800 r.p.m. by the fitting of the larger inlet and exhaust valve and 150 lb. valve springs as in Stage 2.

A still further increase can be obtained by the fitting of the $1\frac{1}{4}$ in. diameter competition carburetters. To do this it is necessary to grind out the inlet manifold at the outer bores to $1\frac{1}{4}$ in. diameter to match the carburetters. Or, better still, fit the 'TF' 1500 c.c. engine inlet manifold. As it is not possible to grind the manifold right through to $1\frac{1}{4}$ in. diameter taper off in about a $\frac{1}{4}$ in. length to $1\frac{3}{8}$ in. diameter, maintaining a minimum of $1\frac{3}{8}$ in. diameter right through, or otherwise a minimum area of 1·5 sq. in.

Light aluminium pistons with additional return springs above in the dashpots are used in these carburetters. In order to obtain maximum power these springs can be removed, but it is preferable that they be left in position to ensure good pick-up and general carburation smoothness.

The carburetters should be fitted with ·125 in. jets and VE needles, or richer VG, or weaker VA.

On the same fuel and with other conditions as stated for Stage 3, including large valves, etc., the engine should give the maximum power of 80 b.h.p. at 6,000 r.p.m. On a 100 per cent. methanol fuel, using the ·125 in. jets and VJ needles, or richer VL, or weaker VI, the maximum power should be 83 b.h.p. at 6,000 r.p.m.

Note. With a methanol fuel it is necessary frequently to clean out the whole of the carburetter and fuel system.

Stage 4

The increase in power output in this instance is obtained by fitting a Shorrock eccentric-vane-type supercharger with a balanced pressure lubrication system, which will give a large increase in power at the lower and medium engine speeds. It is mounted on the inlet manifold and driven by twin belts from the crankshaft pulley. Full details of the fitting are supplied with the supercharger kits. It has a drive ratio of 1·16 : 1 step-up on engine speed and a swept volume of ·72 litre per revolution with the following boost pressure:

r.p.m.	*lb./sq. in. boost (approx.)*
1,000	1·5
2,000	2·5
3,000	3·8
4,000	5·5
5,000	6·0

The oil metering pin is ·304 in. in diameter fitted in a reamed housing bore ·3125 in. diameter.

Early-type superchargers had a separate oil feed tank in which S.A.E. 30 oil should be used, but later kits were supplied with the oil feed to the supercharger taken direct from the main engine oil supply.

The kits are normally supplied with a single S.U. $1\frac{1}{8}$-in. carburetter fitted with a jet ·090 in. in diameter and an RLS carburetter needle.

With the supercharger kit fitted to the standard engine, Champion L11S or Lodge R49 plugs, tappet clearances at ·022 in. according to Engine No., and No. 1 pump feed the engine should give a power output of 70 b.h.p. at 5,000 to 5,500 r.p.m.

It can, of course, for special purposes be run on a fuel of 50 per cent. methanol, 20 per cent. petrol, and 30 per cent. benzole, but this necessitates the use of the ·125 in. jet to the carburetter and VE needle, or richer VG, or weaker VA.

Fit a T3 needle and seat to the float-chamber and fit the twin S.U. pumps. Use Champion L11S or Lodge HNP or, should harder plugs be required, use Champion LA11 or Lodge R49. The power should then be 75 b.h.p. at 5,000 to 5,500 r.p.m.

If the mixture is disturbed at high speeds through vibration use a $\frac{1}{8}$ in. thick neoprene washer to the carburetter flange in place of the ordinary gasket. Better still, of course, mount the float-chamber independently of the carburetter, etc.

When fitting a neoprene gasket use slotted nuts and double-coil spring washers on the carburetter fixing studs. Tighten these nuts only enough to grip the carburetter firmly. Drill the studs through the nut slots and lock with wire from one stud to the other around the carburetter body.

Stage 5

Fit the Shorrock supercharger kit in conjunction with a compression ratio of 9·3 : 1 as Stage 2, with the larger inlet and exhaust valves and 150-lb. valve springs.

Fit the ·125-in. jet to the carburetter and the T3 needle and seat to the float-chamber. Use carburetter needles VG, or richer VI, or weaker VE, all with a $\frac{1}{8}$-in. shank.

Use the twin coupled S.U. petrol pumps, Champion LA11 or LA14 or Lodge R49 or R51 sparking plugs, and a fuel of 50 per cent. methanol, 20 per cent. petrol, and 30 per cent. benzole, with 1 per cent. castor oil added, when the engine should produce 88 b.h.p. at 5,500 r.p.m. A further increase in power can be obtained by fitting the $1\frac{3}{4}$-in. carburetter to the supercharger, although this will necessitate a new elbow in either steel or aluminium, with an internal diameter of $1\frac{1}{2}$ in., fitted between the carburetter and the supercharger. The inlet port to the supercharger should match up and be of the same size.

With a jet diameter of ·1875 in. and the needle RM7, or richer RM8, or weaker RM6, and a fuel of 80 per cent. methanol, 10 per cent. petrol, and 10 per cent. benzole the engine should develop 97·5 b.h.p. at 6,000 r.p.m.

Special Materials Available for 'TB' or 'TC' Midgets

4·00×16 wheels, suitable for tyre sizes 5·50—16 or 6·00—16.
Rear axle crown wheel and pinion 8/39 = 4·875 : 1.
The above ratio gives:
16·67 m.p.h. per 1,000 r.p.m. with 4·50—19 tyres = 100·02 m.p.h. at 6,000 r.p.m.
17·15 m.p.h. per 1,000 r.p.m. with 4·75—19 tyres = 102·90 m.p.h. at 6,000 r.p.m.
17·6 m.p.h. per 1,000 r.p.m. with 5·00—19 tyres = 105·6 m.p.h. at 6,000 r.p.m.

Special Materials Available for XPAG Engines 'TB', 'TC', and 'TD' Midgets

Rocker shaft bracket packing pieces $\frac{1}{16}$ in. thick.
36 mm. inlet valves.
34 mm. exhaust valves.
High-compression pistons 12151 complete with special rings and gudgeon pins.
Outer valve spring (150 lb.).
Inner valve spring (150 lb.).
Competition cylinder head gasket.
Competition carburetters $1\frac{1}{2}$ in. diameter. S.U. Spec. 532.
·100-in. bore jets.
·125-in. bore jets.
·1875-in. bore jets.
Jet needles as S.U. list
Float-chamber needle and seat assemblies T3 (identified by three grooves machined around body).
Booklet of S.U. needle range.
$1\frac{3}{4}$-in. carburetter (for supercharger).

} S.U. Carburetter Co. Ltd., Wood Lane, Erdington, Birmingham 24.

Plugs:

Champion:	L11S	Super Sports.
	LA11	1st Step Racing.
	LA14	2nd Step Racing.
	LA15	3rd Step Racing.
Lodge:	HNP	Super Sports.
	R49	1st Step Racing.
	R51	2nd Step Racing.
	R53	3rd Step Racing.

Lucas high-performance coil type BR12. (Standard Q12 coil is satisfactory up to 6,000 r.p.m. BR12 is good up to 8,000 r.p.m.)
Lucas 4VRA vertical magneto (Lucas Part No. ENM2002). The advance curve is suitable for the XPAG engine. When fitting a magneto it is necessary to indent the tappet cover to clear the body and move the position of the breather pipe elbow.
Competition clutch assembly ($7\frac{1}{4}$ in. dia.).
Competition clutch plate (driven) ($7\frac{1}{4}$ in. dia.).
Clutch springs, competition type, 150 lb., light blue ($7\frac{1}{4}$ in. dia.).
Competition clutch assembly (8 in. dia.).
Competition clutch plate (driven) (8 in. dia.).
Clutch springs, competition type, 205 lb., light grey (8 in. dia.).

Special Materials Available for 'TD' Midget

Combined water temperature gauge and oil pressure gauge. (This item fitted as standard from Chassis No. TD13914.)
4·50×15 wheels suitable for tyre sizes 6·00—15.
Rear axle crown wheel and pinion 8/39 = 4·875 : 1.
Gearbox speedometer pinion for above.
Gearbox speedometer gear for above.
Gear ratios with 9/41 axle:

	Overall	*m.p.h. per* 1,000 *r.p.m.*
Top	4·875 : 1	15·195
Third	6·752 : 1	10·97
Second	10·09 : 1	7·34
First and reverse ..	17·06 : 1	4·34

Rear crown wheel and pinion 9/41 = 4·555 : 1.
Gearbox speedometer pinion for above.
Gearbox speedometer gear for above.
Gear ratios with 9/41 ratio:

	Overall	*m.p.h. per* 1,000 *r.p.m.*
Top	4·55 : 1	16·259
Third	6·309 : 1	11·81
Second	9·429 : 1	7·85
First and reverse ..	15·942 : 1	4·64

Oil pump spring (fits inside existing spring and raises pressure to 60–80 lb./in.
Flexible oil pipe, pump to filter, or filter to block.*
* Can only be fitted to engines with throw-away type of oil filter.

M.G. CAR COMPANY LIMITED
SALES DIVISION
(Proprietors: MORRIS MOTORS LIMITED)

OVERSEAS BUSINESS
NUFFIELD EXPORTS LIMITED
(Proprietors: MORRIS MOTORS LIMITED)

COWLEY • OXFORD • ENGLAND

36/21 (10422)