

# TUNING THE XPAG ENGINES

Fitted to the Series TB, TC and TD (PART ONE)

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.
Firing order .. .. .	1, 3, 4, 2.
Compression ratio .. .. .	7.25 : 1.
Valve 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.
Carburettors .. .. .	Twin S.U. 1½ in. bore.
Carburettor jets .. .. .	·090 in.
Carburettor 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'

Gear ratios:	Overall	m.p.h. per 1,000 r.p.m.
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 .. .. .	15½ cwt.	
Tyre size .. .. .	4.50—19.	
Tyre pressure—front .. .. .	24 lb.	
rear .. .. .	26 lb.	
Front wheel toe-in .. .. .	½ in.	
Capacities:		
Water system .. .. .	1½ gallons	
Gearbox .. .. .	1½ pints	
Rear axle .. .. .	2 pints.	
Petrol tank .. .. .	13½ gallons.	
Engine sump .. .. .	9 pints.	

## Standard Car Data: 'TD' Midget

Gear ratios:	Overall	m.p.h. per 1,000 r.p.m.
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. 10½ in.	
height .. .. .	4 ft. 5 in.	
Wheelbase .. .. .	7 ft. 10 in.	
Track—front .. .. .	3 ft. 11½ in.	
rear .. .. .	4 ft. 2 in.	
Weight .. .. .	17½ cwt.	
Tyre size .. .. .	5.50—15.	
Tyre pressure .. .. .	18 lb. front and rear.	
Front wheel toe-in .. .. .	Nil.	
Capacities:		
Water system .. .. .	1½ gallons.	
Gearbox .. .. .	1½ pints	} Hypoid 90.
Rear axle .. .. .	2½ pints	
Petrol tank .. .. .	12½ gallons.	
Engine sump .. .. .	9 pints.	

## Stage 1

The engine is raised to 8.6 : 1 compression ratio by removing ⅜ 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 ¼ in. of each side, still maintaining its streamline shape so that oblong ports are obtained 1⅞ in. high, ⅜ 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 carburettor bore.

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( CONTINUED )

Use the standard cylinder head gasket and insert  $\frac{3}{8}$  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  $\frac{1}{8}$  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  $\frac{1}{2}$  in. wide scoop until it is a minimum of  $\frac{1}{32}$  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  $1\frac{1}{2}$  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  $1\frac{1}{2}$  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  $1\frac{1}{2}$  in. diameter competition carburetters. To do this it is necessary to grind out the inlet manifold at the outer bores to  $1\frac{1}{2}$  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  $1\frac{1}{2}$  in. diameter taper off in about a  $\frac{1}{4}$  in. length to  $1\frac{3}{8}$  in. diameter, maintaining a minimum of  $1\frac{1}{8}$  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.

*Details of Stages 4 and 5, and lists of special materials available, will appear in our next issue.*

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