

SPECIAL TUNING

FOR



MIDGET

ENGINE

TYPE XPAG

(As fitted to Series TB and TC cars)

Issued by

NUFFIELD EXPORTS LIMITED

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FOREWORD

The M.G. Midget, as delivered from the factory in its standard form, is tuned to give maximum performance with "pump" petrol, consistent with complete reliability and reasonable freedom from pinking. There is, however, a more or less continuous demand from enthusiasts all over the world for information on methods of improving the performance for competitive purposes, and it is to meet this demand that this booklet has been prepared.

It must clearly be understood, however, that, whereas it is a simple matter to increase the power output of the engine, this cannot be achieved without the use of fuel having better anti-detonant qualities than ordinary "pump" petrol. In addition, this increase in power must inevitably carry with it a tendency to reduced reliability.

It is for this reason that the terms of the guarantee on a new M.G. expressly exclude any super-tuning of the kind described in this booklet, but this does not mean that tuning in this way will necessarily make the car hopelessly unreliable. In fact, it may be assumed that it will be at least as reliable as other cars of similar performance.

This booklet is laid out so as to give details of progressively increasing power. With the above ideas firmly in mind, the owner should select the simplest tuning method which will give him the performance he requires, remembering all the time that here, as elsewhere, **Power Costs Money.**



Standard Engine Data

Bore : 66.5 mm.
 Stroke : 90 mm. 1250 c.c. 4-cylinder.
 Firing Order : 1, 3, 4, 2.
 Sparking Plugs : Champion L.10.S.
 Compression Ratio : 7.25 to 1.
 Valve Timing : Inlet opens 10° B.T.D.C. Closes 57° A.B.D.C.
 Exhaust opens 52° B.B.D.C. Closes 24° A.T.D.C.
 Valve Lift : 8 mm. inlet and exhaust.
 Tappet Clearance : .019" hot.
 Contact Breaker Points : .010"/.012".
 Ignition Timing : T.D.C.
 Octane Rating : Minimum requirements for knock-free operation = 74 octane.
 For maximum power = 82 octane.
 Carburetters : Twin "S.U." 1¼" bore.
 Carburetter Jet : .090".
 Carburetter Needles : Standard—"E.S." Richer—"D.K."
 Weaker—"E.F."
 B.M.E.P. : 125 at 2,600 r.p.m.

B.H.P. :	R.P.M. :
11.00	1,000
23.50	2,000
36.00	3,000
47.00	4,000
54.00	5,000
54.00	5,200
52.50	5,500
47.00	6,000

Safe Maximum r.p.m. : 5,700.
 Valve Crash r.p.m. : 6,000.
 C.C. of Combustion Space : 45.5 c.c.



Cylinder Head Depth : Top to bottom face = 76.75 mm.
 Thickness of Cylinder Head Gasket : .045".
 C.C. of Cylinder Head Gasket : Approximately 4.5 c.c. compressed.

Standard Car Data

Gear Ratios :		Overall ratios	M.P.H. per 1,000 r.p.m.
Top	5.125 to 1	15.84
3rd	6.93 to 1	11.74
2nd	10.00 to 1	8.13
1st	17.32 to 1	4.68

Rear Axle Ratio : 5.125 to 1.

Dimensions :

Overall length	11' 7½"
Overall width	4' 8"
Overall height (hood up)	4' 5"
Wheelbase	7' 10"
Track	3' 9"
Weight	15½ cwt.
Tyre size	4.50—19
Tyre pressures (front tyres)	24 lb.
Tyre pressures (rear tyres)	26 lb.
Front wheel toe-in	⅜"

Capacities :

Capacity of water system	1¾ gallons
Capacity of gearbox	1½ pints
Capacity of rear axle	2 pints
Capacity of petrol tank	13½ gallons
Capacity of engine sump	9 pints



Stage 1.

Higher Compression Ratio Tuning (8.6 to 1)

The engine is raised to 8.6 to 1 compression ratio by removing $\frac{3}{32}$ " from the cylinder head face.

The standard head is 76.75 mm. thick ; the finished thickness after machining should be 74.37 mm.

Remove any frazes left, and polish, but do not grind out the combustion chambers as these are already quite clean and are machined nearly all over.

Make sure the gasket edges do not overlap the combustion spaces.

The ports may be ground and polished, but should not be ground out so heavily that the shape or valve choke diameter is impaired.

The inlet port outer separating stud boss may be ground away slightly—about $\frac{1}{16}$ " off each side (still maintaining its streamline shape)—so that oblong ports are obtained, $1\frac{3}{16}$ " high, $\frac{21}{32}$ " wide (minimum).

Do not remove this boss completely or it will affect mixture distribution.

Match up, by grinding, all the exhaust and inlet manifold ports with the cylinder head ports.

Grind out and polish the inlet manifold, also matching the carburetter bore.

- (a) Use standard cylinder head gasket.
- (b) Use $\frac{3}{32}$ " thick $\times \frac{3}{4}$ " O.D. washers under cylinder head nuts (to correct for reduced head thickness).
- (c) Use 4 rocker-shaft bracket packing pieces. (Fitted under base of bracket to correct the rocker adjustment.) M.G. Part No. M.G. 862/459— $\frac{1}{16}$ " thick mild steel with 3 holes to match base of bracket.
- (d) Use fuel 50% petrol, 70 or 80 octane, and 50% benzol, or for sustained power use 25% petrol and 75% benzol.
- (e) Plugs : Use Champion L.A.11 or Lodge R.49.



- (f) Use carburetter needles E.S.—Jet .090".
- (g) Tappet setting : .022".
- (h) Ignition setting : T.D.C.
- (j) Use standard $1\frac{1}{4}$ " carburetters.

The engine should then give the following brake horse-power :—

B.H.P. :	R.P.M. :
11.3	1,000
23.5	2,000
38.0	3,000
49.0	4,000
58.0	5,000
60.0	5,500
60.0	6,000



Stage 2.

High Compression Ratio Tuning (9.3 to 1), and using larger valves

The standard engine is raised to 9.3 to 1 compression ratio by removing $\frac{1}{8}$ " from the cylinder head face.

The finished thickness after machining should be 73.575 mm. This is the absolute maximum to remove.

Polish head, ports and manifolds as in Stage 1.

It will be noticed that a sharp edge is left on the combustion space profile at the end of the sparking plug hole.

File this sharp edge back vertically until it is a minimum of $\frac{1}{32}$ " thick at the centre.

File this only locally at the plug hole (approximately $\frac{1}{2}$ " wide scoop) and blend into the combustion chamber shape with a radius each side. Do not file back too far. Check that the combustion space edge still extends safely over the gasket edge.

Use larger inlet valves (Part No. M.G.862/460), having 36 mm. O.D. heads.

In fitting these valves it is necessary to cut away part of the combustion space wall to clear the valve head. To do this use a 38 mm. diameter (maximum) side and face cutter piloted off the valve guide.

The cutter corner should have a 1 mm. radius.

This may alternatively be done by careful grinding of the vertical wall until the valve head has a 1 mm. working clearance.

Then cut or bore out the valve choke in a similar manner to 33 mm. diameter.

Feather off by grinding any local ridge left in the valve port. Re-cut the seat to $30^\circ \times 34.9$ mm. top diameter.

Fit larger exhaust valves (Part No. M.G.862/461), having 34 mm. O.D. heads.



Follow procedure as for inlet valves, but cut away combustion wall to clear head with 36 mm. diameter cutter, bore valve choke to 29 mm. diameter and re-cut seat $30^\circ \times 32.8$ mm. top diameter.

Fit stronger valve springs (150 lb. open tension). Outer spring (Part No. M.G. 862/462) and inner spring (Part No. M.G.862/463).

These are interchangeable with the standard springs, but one point should be noticed: they are staggered pitch springs and the closed coil ends should be fitted next to the cylinder head. Valve crash occurs with these springs around 6,500 r.p.m.

- (a) Use standard cylinder head gasket.
- (b) Use $\frac{1}{8}$ " thick $\times \frac{3}{4}$ " O.D. washers under cylinder head nuts (to correct reduced thickness).
- (c) Use 4 rocker-shaft bracket packing pieces (Part No. M.G.862/459) to correct rocker adjustment. These are $\frac{1}{16}$ " mild steel with 3 holes to match base of bracket.
- (d) Plugs: Use Champion L.A.11 or Lodge R.49.
- (e) Tappet setting .022".
- (f) Ignition setting: T.D.C.
- (g) Use standard $1\frac{1}{4}$ " carburetters.

Using fuel 75% benzol and 25% petrol, with carburetter needles E.S., Jet .090", the engine should then give the following brake horse-power:—

B.H.P. :	R.P.M. :
61.00	5,000
65.00	5,500
63.00	6,000

Or using fuel 50% methanol, 20% petrol, 30% benzol, with carburetter needles R.O., Jet .090", the engine should give the following brake horse-power:—

B.H.P. :	R.P.M. :
62.5	5,000
66.5	5,500
64.0	6,000



Alternative richer needle for above—R.L.S. or weaker No. 5.

An addition of 1% castor oil can be added to the methanol fuel.

When running on the above fuel, it is advisable to fit twin S.U. pumps, as explained at Item (j) in Stage 3.

Note.—The fan blades may be removed if the car is going to be used 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.

Tappet settings in all stages may be .019" if quietness is desired, with consequent loss of approximately 1 b.h.p.

In addition to the above, the 1½" diameter competition carburetters may be fitted, as described under Stage 3.

Using fuel 75% benzol and 25% petrol, with carburetter needles E.L., Jet .090", the engine should give the following brake horse-power :—

B.H.P. :	R.P.M. :
63-00	5,000
68-00	5,500
66-00	6,000

Alternative richer needle for above—AA, or weaker—EO.

Using fuel 50% methanol, 20% petrol, 30% benzol, with carburetter needles R.L.S., Jet .090", the engine should give the following brake horse-power :—

B.H.P. :	R.P.M. :
66-00	5,000
70-00	5,500
68-00	6,000

Alternative richer needle for above—C.S.2, or weaker—R.O.
If richer needles are required, change to the .100" range.

Stage 3.

High Compression Ratio Tuning (12 to 1)

The standard engine, using the standard cylinder head with a depth of 76.75 mm., is raised to 12 to 1 compression ratio by the use of special pistons (Part No. M.G.862/458). (When ordering, please state exact bore sizes.)

These pistons can only be fitted one way round—that is, with the flame groove on the sparking plug side.

In using this high compression ratio it is necessary to run on a high content methanol base fuel and to carry out alterations as below :—

- (a) Use fuel as follows :—
80% dry blending methanol. Specific gravity : .796 at 60° F.
10% benzol (90). Specific gravity : .8758 at 60° F.
10% petrol (Pool 70 octane or 80 octane).
1% castor oil may be added.
- (b) Use standard 1¼" carburetters.
- (c) Use carburetter jets size .100".
- (d) Use carburetter needles G.K. or richer—R.C. and weaker—R.V.
- (e) Sparking plugs : Use Champion L.A.14 or Lodge R.49.
- (f) Use carburetter float-chamber needle and seat assemblies S.U. type T.3.
- (g) Tappet setting : .022".
- (h) Ignition setting 4° A.T.D.C. (flywheel).
- (j) Use two S.U. petrol pumps for increased fuel delivery. Do not couple the pumps together, but use duplicate fuel lines. Run an additional pipe from the tank to the extra pump. Run an additional flexible pipe from this pump to the carburetters. On the carburetters use 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 one.
Now run a flexible fuel pipe between the two float-chamber



banjo unions to balance the feed. The above arrangement will ensure getting full discharge from the pumps.

The engine should then give the following brake horse-power :—

B.H.P. :	R.P.M. :
69.0	5,000
73.0	5,500
74.0	5,800
73.0	6,000

These figures can now be increased by the fitting of the larger inlet and exhaust valves and 150 lb. valve springs as in Stage 2.

The maximum power should then be 76 b.h.p. at 5,800 r.p.m.

Larger Carburetters

To increase still further, fit the $1\frac{1}{2}$ " diameter competition carburetters, grind out the inlet manifold at the outer bores to $1\frac{1}{2}$ " diameter to match these carburetters.

It is not possible to grind right through $1\frac{1}{2}$ " diameter, but it is necessary to taper off in about a $\frac{3}{4}$ " length to $1\frac{3}{8}$ " diameter. Maintain a minimum of $1\frac{3}{8}$ " diameter or more right through, or otherwise a minimum area of 1.5 sq. in.

These carburetters will be found to be fitted with light aluminium pistons, with additional return springs fitted above in the dashpots.

For absolute maximum power these springs may be removed, but for good pick-up and general carburation smoothness they should be left in position.

Fit carburetters with .125" jets and V.E. needles, or richer—V.G., or weaker—V.A.

On the same fuel and with other conditions as stated for Stage 3 (including large valves), the engine should give the maximum power of 80 b.h.p. at 6,000 r.p.m.

Run on a fuel of 100% methanol, using .125" jets and V.J. needles, or richer—V.L., or weaker—V.I. The engine should then give a maximum power of 83 b.h.p. at 6,000 r.p.m.

Note.—When using methanol in the fuel it is necessary frequently to clean out the whole of the carburetter and fuel system.



Stage 4.

Increasing performance by fitting the "Shorrock" Supercharger Kit

This kit is manufactured by "Shorrock" Superchargers Ltd., Moorlands, Garstang Road, Preston, Lancs., England.

It is an eccentric vane-type supercharger with balanced pressure lubrication system. It is mounted on the inlet manifold and driven by twin belts from the front end of crankshaft. It gives a large increase in power at the lower and medium engine speeds.

Details of Supercharger :—

Drive ratio : 1.16 to 1 step-up on engine speed.

Swept volume : .72 litre per revolution.

Boost pressures :

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

Oil metering pin diameter : .304" diameter, fitted in a reamed housing bore of .3125" diameter.

Supercharger oil feed tank : Use oil S.A.E.30.

Carburetter : S.U. $1\frac{3}{8}$ ".

Standard needle : R.L.S.

Jet size : .090".

With :—

1. The supercharger kit fitted to a standard engine (see Standard Data).
2. Pool petrol (70 octane).
3. Plugs : Champion L.I.S or Lodge H.N.P.
4. Tappet setting .022".



the engine should give the following brake horse-power :—

B.H.P. :	R.P.M. :
18.5	1,500
28.0	2,000
45.0	3,000
58.0	4,000
69.0	5,000
69.0	5,500

or with 80 octane fuel, the following brake horse-power :—

B.H.P. :	R.P.M. :
19.0	1,500
28.5	2,000
45.5	3,000
61.0	4,000
70.0	5,000
70.0	5,500
70.0	6,000

If required for special purposes it may be run on a fuel of 50% methanol, 20% petrol, 30% benzol.

To do this, fit to the $1\frac{3}{8}$ " carburetter a .125" jet and use carburetter needle V.E. or richer—V.G., weaker—V.A.

Fit the carburetter float-chamber with a T.3 needle and seat, and it is advisable to fit twin-coupled S.U. petrol pumps (see Stage 3).

Sparking plugs : Use Champion L.11.S or Lodge H.N.P., or if harder plugs are required, Champion L.A.11 or Lodge R.49.

The engine should then give the following brake horse-power :—

B.H.P. :	R.P.M. :
20.5	1,500
31.5	2,000
52.0	3,000
68.5	4,000
75.0	5,000
75.5	5,500
75.0	6,000



Note.—If carburetter vibration is experienced, which disturbs the mixture at high speeds, fit a $\frac{1}{8}$ " thick "Neoprene" gasket to the carburetter flange in place of the ordinary gasket.

Fit slotted nuts and double-coil spring washers to the carburetter fixing studs. Tighten these nuts only enough to grip 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. Fitting the "Shorrock" Supercharger in conjunction with 9.3 to 1 compression ratio

Fit the "Shorrock" Supercharger Kit and raise the compression ratio to 9.3 to 1, as explained in Stage 2. Fit the larger exhaust and inlet valves and 150 lb. valve springs.

Fit a .125" jet to the carburetter and a T.3 needle and seat to the float-chamber.

Use carburetter needle V.G. (with $\frac{1}{8}$ " shank), or richer—V.I (with $\frac{1}{8}$ " shank), or weaker—V.E. (with $\frac{1}{8}$ " shank).

Use twin-coupled S.U. petrol pumps.

Sparking plugs : Use Champion L.A.11 or L.A.14 or Lodge R.49 or R.51.

Use a fuel 50% methanol, 20% petrol, 30% benzol.

1% castor oil may be added.

The engine should then give the following brake horse-power :—

B.H.P. :	R.P.M. :
55.5	3,000
73.5	4,000
85.5	5,000
88.00	5,500
88.00	6,000

To obtain a further increase in power, fit a larger carburetter (S.U. Specification No. 538, Type H.6, $1\frac{3}{4}$ " diameter) to the supercharger.

It will be necessary to make a new elbow (steel or aluminium) between the carburetter and supercharger with an inside diameter of $1\frac{3}{4}$ ". Make sure the inlet port to the supercharger matches up and is of the same diameter.

Use a .1875" diameter jet in the carburetter and needle R.M.7, or richer, R.M.8 ; or weaker, R.M.6.

With a fuel of 80% methanol, 10% petrol and 10% benzol, the engine should give the following brake horse-power :—



B.H.P. :	R.P.M. :
74.5	4,000
82.00	4,500
89.00	5,000
94.25	5,500
97.5	6,000

Special Material available through the Service Department

For Series "TB" or "TC" Midget Car

16" x 4.00" wheels, suitable for tyre sizes 5.00"—16", or 5.50"—16".
(M.G. Part No. A.1338.)

Rear axle crown wheel and pinion 8/39=4.875 to 1. (M.G. Part No. MG689/10.)

The above axle 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.

Steering wheel (Brooklands type spring arm). (M.G. Part No. A.1333.)

	Part No.
For X.P.A.G. Engine	
Rocker-shaft bracket packing pieces ($\frac{1}{16}$ " thick) ...	MG862/459
36 mm. inlet valves	MG862/460
34 mm. exhaust valves	MG862/461
High compression pistons—12 to 1 ratio (complete with special rings and gudgeon pin). (State exact bore size when ordering)	MG862/458

150 lb. Valve Springs	
Outer valve spring	MG862/462
Inner valve spring	MG862/463



Competition carburetters, 1 pair, 1½" diameter
S.U. specification 532.

·100" bore jets. S.U. No. 1394—112/1.

·125" bore jets. S.U. No. 4185.

·1875 bore jets (fixed type). S.U.

Jet needles. As S.U. List.

Float-chamber seat and needle assemblies. S.U.
No. T.3. (These are denoted by three grooves
machined around the body.)

Booklet listing full range of S.U. needles, price
2s. 6d.

1¾" carburetter (for supercharger). S.U.
specification No. 538.

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

Plugs—Champion

L.11.S.	Super Sports.
L.A.11	1st Step Racing.
L.A.14	2nd Step Racing.
L.A.15	3rd Step Racing.

Plugs—Lodge

H.N.P.	Super Sports.
R.49	1st Step Racing.
R.51	2nd Step Racing.
R.53	3rd Step Racing.

Lucas High Performance Coil, Type BR.12.

(The Model Q.12 coil fitted as standard is satisfactory up to 6,000
r.p.m., but the BR.12 is good up to 8,000 r.p.m.)

Lucas 4 V.R.A. Vertical Magneto (Lucas Part No. E.N.M.2002).

(This has a suitable advance curve for the X.P.A.G. engine.)

To fit this magneto it is necessary to indent valve chest plate to
clear the body and move position of breather pipe elbow.

Supplement to SPECIAL TUNING for



MIDGET ENGINE

TYPE XPAG

Stage 1A.

Higher Compression Ratio Tuning (8·6 to 1), but permitting use of low octane fuel.

Raise the compression ratio to 8·6 to 1 and polish the head, ports and manifold
as for Stage 1.

Fit larger inlet and exhaust valves as explained in Stage 2, using inlet valves
(Part No. MG.862/460), but sodium-cooled exhaust valves (Part No. MG.862/466).

These exhaust valves have larger stems and require special bronze guides
(Part No. MG.862/467), and special valve cotters (Part No. MG.862/468). Press
the valve guides in so that they stand 24 mm. above the top of the cylinder head
face. The bronze guides are longer than the standard ones and will protrude
farther into the exhaust port. Due to the increase in valve weight fit the stronger
150 lb. valve springs (Part Nos. MG.862/462 and 463) as described in Stage 2.

The 150 lb. springs will prevent valve bounce up to 6,000 r.p.m.
To help compensate for the additional valve weight the valve stem shrouds may
be cut off close to the top, leaving just the top collar and an ⅜" of the tubular
portion to locate the inner valve spring. The valve stem shrouds are cyanide hard-
ened and will have to be cut off with a grinding wheel.

Remove the thrust springs which are between the rockers on the rocker-
shaft and replace them with steel distance tubes, leaving ·003" to ·005" end-float.
This reduces some of the rocker friction.

If trouble is experienced with the cylinder head gasket a competition gasket
(Part No. MG.862/472) can be supplied, or, if the car is used for racing purposes
only, a gasket made from 20 S.W.G. silver finish auto body steel may be fitted.
To accommodate this gasket it will be necessary to lap the cylinder head and block
faces together with valve grinding compound. This makes a most reliable seal.

Fit the larger 1½" carburetters as described in Stage 3.

Remove the thermostat bellows and valve completely and plug up or blank
off the small by-pass pipe which goes from the lower radiator outlet pipe up to the
side of the thermostat body.

- Fuel of 70 octane may be used, some pinking will be experienced but will
not be detrimental.
- Tappet setting ·025" for maximum power ·022" or ·019" may be used but up
to 2 b.h.p. may be lost.
- Ignition setting T.D.C.
- Use carburetter jets ·090" and needles L.S.I. or weaker E.L., put in with the
shoulder ⅜" below the face of the dashpot piston, and mixture adjusting nuts
screwed seven flats down, approximately. Remove the supplementary springs
from the carburetter dashpots and remove the hydraulic damper pistons.
- Plugs: Use Champion L.11.S or for continuous high speed work use Champion
L.A.11 or Lodge R.49.
- Leave off the air cleaner and connecting branch pipe for high speed work, but
if it is felt necessary to fit it for road work bore out the port holes to match
the outer carburetter flanges.
- Fit a Lucas B.R.12 coil.
- Plug setting ·018" to ·022".
- As a safety factor for high speed work and to ensure sufficient fuel supply
under all conditions of vibration, etc. it is advisable to use two S.U. petrol
pumps, as explained at Item (j) in Stage 3.

The engine on 70 octane fuel should give the following b.h.p. :—

R.P.M.	B.H.P.	R.P.M.	B.H.P.	R.P.M.	B.H.P.
2,500	29·50	4,000	50·00	5,500	64·00
3,000	40·50	4,500	56·00	5,700	64·5
3,500	43·50	5,000	61·00	6,000	63·00