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'M.G.A.'

SPECIAL TUNING.

Issued by

M.G. CAR COMPANY LIMITED.

Proprietors : Morris Motors Ltd.

ABINGDON - ON - THAMES.

Phone : Abingdon 251. Grams : "Emgee" Abingdon.

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M.G. Technical Literature.

Issue 1.

1957.

FOREWORD.

This is another of the "M.G. Tuning Booklets" which have been issued in recent years. It deals specifically with the Series 'M.G.A.'.

The M.G.A. as delivered from the factory in its standard form, is tuned to give maximum performance with 90 octane gasoline 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 be clearly understood, however, that, whereas it is a simple matter to increase the power output of the engine, this increase in power must inevitably carry with it a tendency to reduce reliability. It is for this reason that the terms of the warranty 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 to give details for progressively increasing the 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.

Tuning hints are included for the racing enthusiasts who want to go to the limit and who have facilities to modify or make up special parts for their car. We hope this section will be of use to them.

GENERAL DATA.

ENGINE.

Type	B.P. 15 G.B. or 15. G.B. / U/H.
Number of cylinders	4.
Bore	2.875 in. (73.025 m.m.)
Stroke	3.5 in. (89 m.m.)
Capacity	90.88 cu. in. (1489 c.c.)
Firing order	1, 3, 4, 2.
Compression ratio :	8.3 to 1.
Capacity of Combustion Chamber (valves fitted).	38.2 to 39.2 c.c. (2.3 to 2.4 cu. in.)
Valve operation.	Overhead by push-rod.
Safe Maximum R.P.M. :	5,800
Valve Crash R.P.M. :	6,000
B.H.P. :	72 at 5,750 r.p.m.
B.M.E.P. :	133 at 3,850 r.p.m.
Torque : (Foot lbs.)	80.2 at 3,850 r.p.m.
Octane Rating :	Minimum requirements for knock - free operation. 87 - 90 Octane.
Cooling system	Thermo-syphon, pump and fan assisted.
Oversize Bore : 1st	.010 in. (.254 m.m.)
Max.	.040 in. (1.016 m.m.)

CRANKSHAFT.

Main journal diameter	2 in. (50.8 m.m.)
Minimum regrind diameter	1.96 in. (49.78 m.m.)
Crankpin Journal diameter	1.8759 to 1.8764 in. (47.65 to 47.66 m.m.)
Crankpin minimum regrind diameter.	1.8359 in. (46.64 m.m.)

MAIN BEARINGS.

Number and type	Three. Shell-type.
Material bottom half	Steel Backed. White metal.
Material top half	Steel Backed. White metal.
Length	1.375 in. (34.925 m.m.)
End clearance	.002 to .003 in. (.051 to .076 m.m.)
End thrust	Taken by thrust washers at centre main bearing.
Running clearance	.0005 to .002 in. (.0127 to .0508 m.m.)

CONNECTING RODS.

Length between centres	6.5 in. (165.1 m.m.)
Big-end bearings	
Material top half.	Steel Shell & Lead Indium.)Pt. No.
Material bottom half.	Steel Shell & Lead Indium.)1.H. 717 marked 'V.P.'
Bearing side clearance	.008 to .012 in. (.203 to .305 m.m.)
Bearing diametrical clearance	.0001 to .0016 in. (.002 to .04 m.m.)

GENERAL DATA. (Continued)

PISTONS

Type	Aluminium alloy.
Clearances :	
Bottom of skirt	.0017 to .0023 in. (.043 to .051 m.m.)
Top of skirt	.0035 to .0042 in. (.090 to .106 m.m.)
Oversizes	+ .010 in., + .020 in., + .030 in. + .040 in. (+.254 m.m.), (+.508 m.m.), (+.762 m.m.), (+1.016 m.m.)

PISTON RINGS.

Compression :	Plain	Top ring. (Chrome plated)
	Tapered	2nd. and 3rd. ring.
Width		.111 to .118 in. (2.81 to 3.0 m.m.)
Thickness		.0615 to .0625 in. (1.56 to 1.58 m.m.)
Fitted gap		.008 to .013 in. (.20 to .33 m.m.)
Clearance in groove		.0015 to .0035 in. (.038 to .089 m.m.)
Oil-control ring :		Slotted scraper.
Width		.1552 to .1562 in. (3.94 to 3.99 m.m.)
Thickness		.111 to .118 in. (2.81 to 3.0 m.m.)
Fitted gap		.008 to .013 in. (.20 to .33 m.m.)
Clearance in groove		.0016 to .0036 in. (.040 to .091 m.m.)

GUDGEON PIN.

Type	Clamped
Fit	.0001 to .00035 in. (.0025 to .009 m.m.)
	Hand push fit to 68° F.
Diameter	.6869 to .6871 in. (17.447 to 17.4523 m.m.)

CYLINDER HEAD.

Cylinder Head Depth	3.11/64" + 1/64" - 0".
Thickness of Cylinder Head Gasket.	.035" (compressed) (Pt. No. 1.H.696 up to Engine No. 15687).
Thickness of Cylinder Head Gasket.	.029" (compressed) (Pt. No. 1.H.1017 after Engine No. 15688).
C.C. of Cylinder Head Gasket	3.73 c.c.
C.C. of Combustion Space	38.2/39.2 c.c. (valves fitted).
C.C. of Piston Head below block face.	3.5 c.c.
C.C. of Piston concavity	4.85 c.c.
C.C. of plug centre hole	.2 c.c.
Inlet and Exhaust Manifold Gasket	Pt. No. 1.G. 2417.
Valve seat angle in cylinder head.	45°

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GENERAL DATA (Continued).

VALVES AND VALVE GEAR.

Valves		45° To Engine No. 4044) Seat angle in cylinder head 45°
Seat Angle	Inlet Inlet	45.1/2° From Engine No. 4045	
Seat Angle	Exhaust Exhaust	45° To Engine No. 4044 45.1/2° From Engine No. 4045)
Head diameter	Inlet Exhaust	1.5" (38.1 m.m.) 1.281" (8.73 m.m.))
Stem diameter	Inlet	$\frac{.34175"}{.34225"}$ ($\frac{8.74047 \text{ m.m.}}{8.69189 \text{ m.m.}}$)	Pt. No. 1.H. 653 Ceased Engine No. 23447.
	Inlet	$\frac{.3422"}{.3427"}$ ($\frac{8.69188 \text{ m.m.}}{8.70458 \text{ m.m.}}$)	Pt. No. 1.H. 1059 Commence Eng No. 23448.
	Exhaust	$\frac{.34175"}{.34225"}$ ($\frac{8.74047 \text{ m.m.}}{8.69189 \text{ m.m.}}$)	
Valve Lift		.357" (9.06 m.m.)	
Exhaust valve throat diameter.		$\frac{1.165"}{1.175"}$	
Inlet valve throat diameter		1.25"	
Valve stem to guide clearance.	Inlet	$\frac{.00155"}{.00255"}$	
Valve stem to guide clearance.	Exhaust	$\frac{.00105"}{.00205"}$	To Engine No. 4044
Valve stem to guide clearance.	Exhaust	$\frac{.00200"}{.00300"}$	From Engine No. 4045.
Valve rocker clearance :	Running	.017" (.432 m.m.)	Hot.
	Timing	.021" (.53 m.m.)	
Timing markings		Dimples on timing wheels.	
Chain pitch and number of pitches		3/8" (9.52 m.m.) 52 Pitches.	
Inlet valve :	Opens	16° B.T.D.C.	
	Closes	56° A.B.D.C.	
Exhaust valve :	Opens	51° B.B.D.C.	
	Closes	21° A.T.D.C.	

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GENERAL DATA (Continued).

VALVE GUIDES.

Length.	Inlet.	1.875" (47.63 m.m.)	Pt. No. 1G. 2882.	
	Exhaust.	2.281" (57.94 m.m.)	Pt. No. 1G. 2322. to Engine No. 4044.	
	Exhaust.	2.203" (56.96 m.m.)	Pt. No. 11G.193. From Engine No. 4045.	
Diameter:	Inlet.	$\frac{.5635"}{.5640"} \left(\frac{14.3129 \text{ m.m.}}{14.3256 \text{ m.m.}} \right)$	Pt. No. 1G. 2882. Ceased Engine No. 23447.	
	Outside.			
	Inside.	$\frac{.3438"}{.3443"} \left(\frac{8.7354 \text{ m.m.}}{8.7452 \text{ m.m.}} \right)$		
		Outside.	$\frac{.5635"}{.5640"} \left(\frac{14.3129 \text{ m.m.}}{14.3256 \text{ m.m.}} \right)$	Pt. No. 11G. 313 Commence Engine No. 23448.
		Inside.	$\frac{.34425"}{.34475"} \left(\frac{8.74269 \text{ m.m.}}{8.75665 \text{ m.m.}} \right)$	
		Exhaust Outside.	$\frac{.5635"}{.5640"} \left(\frac{14.3129 \text{ m.m.}}{14.3256 \text{ m.m.}} \right)$	Pt. No. 1G. 2322. Ceased Engine No. 4044.
	Inside.	$\frac{.3433"}{.3438"} \left(\frac{8.71982 \text{ m.m.}}{8.7354 \text{ m.m.}} \right)$		
	Outside.	$\frac{.5635"}{.5640"} \left(\frac{14.3129 \text{ m.m.}}{14.3256 \text{ m.m.}} \right)$	Pt. No. 11G. 193. Commence Engine No. 4045.	
	Inside.	$\frac{.34425"}{.34475"} \left(\frac{8.74269 \text{ m.m.}}{8.75665 \text{ m.m.}} \right)$		

Fitted height above head. .625" (15.87 m.m.)

VALVE SPRINGS.

Free Length.	Inner.	1.31/32 in. (50 m.m.)
	Outer.	2.3/64 in. (51.99 m.m.)
Fitted Length.	Inner.	1.7/16 in. (36.51 m.m.)
	Outer	1.9/16 in. (39.69 m.m.)
Number of working Coils.	Inner.	6.1/2.
	Outer.	4.1/2.
Pressure: Valve open.	Inner.	50 lb. (22.7kg).
	Outer.	105 lb. (47.6 kg)
Valve closed.	Inner	30 lb. (13.6 kg)
	Outer	60.1/2 lb. (27. kg.)

GENERAL DATA. (Continued)

TAPPETS.

Type	Flat base. Barrel Type.	
Diameter:	Body	13/16 in. (20.64 m.m.)
	Working face.	9/16 in. (14.29 m.m.)
Length		2.293 to 2.303 in. (58.25 to 58.5 m.m.)

ROCKERS.

Outside diameter before fitting	.751 in. (19.07 m.m.)
Inside diameter (reamed in position)	.616 to .620 in. (15.65 to 15.74 mm)
Bore of rocker-arms.	.7485 to .7489 in. (19.01 to 19.02 m.m.)
Rocker ratio.	1.426 : 1.

CAMSHAFT.

Journal diameters.	{ Front	1.78875 to 1.78925 in. (45.43 to 45.44 m.m.)
	{ Centre	1.72875 to 1.72925 in. (43.91 to 43.92 m.m.)
	{ Rear	1.62275 to 1.62325 in. (41.22 to 41.23 m.m.)
End Float		.003 to .007 in. (.076 to .178 m.m.)
Bearing: number and type	Three. Thinwall steel-backed white metal.	
Outside diameter (before fitting)	Front	1.920 in. (48.76 m.m.)
	centre	1.860 in. (47.24 m.m.)
	rear	1.754 in. (44.55 m.m.)
Inside diameter (reamed in position)	Front	1.790 in. (45.47 m.m.)
	centre	1.730 in. (43.94 m.m.)
	rear	1.624 in. (41.25 m.m.)
Clearance.		.001 to .002 in. (.0254 to .0508 m.m.)

ENGINE LUBRICATION SYSTEM.

Oil pump	Eccentric rotor.	
Type	75 to 80 lb/sq. in. (5.3 to 5.6 kg/cm ²).	
Relief pressure valve operates	3 in (76.2 m.m.)	
Relief valve spring: Free length.	2.5/32 in. (54.77 m.m.) at 16 lb.	
	Fitted length. (7.26 kg.) load.	
Identification colour.	Red spot.	

Oil filter.

Type	Tecalemit
Capacity	1/2 pint (.28 litre)

Oil pressure.

Normal running.	Minimum	30 lb/sq.in. (2.1 kg/cm ²)
	Maximum	80 lb/sq.in. (5.6 kg/cm ²)

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GENERAL DATA (Continued)

TORQUE WRENCH SETTINGS.

Cylinder head nuts.	50 lb/ft. (6.91 kg/m).
Main bearing nuts.	70 lb/ft. (9.7 kg/m).
Connecting rod set screws	35 lb/ft. (4.83 kg/m).
Clutch assembly to flywheel	50 lb/ft. (6.91 kg/m).

FUEL SYSTEM.

Carburetter	S. U. Twin H.4. Semi-downdraught.
Make and type	1.1/2 in. (38.1 m.m.)
Diameter	G.S (Richer C.C., Weaker No.4)
Needle	.090 in. (2.29 m.m.)
Jet	Pt. No. A.U.C. 8019.
Carburetter Piston.	Red. (Pt No. A.U.C. 4387).
Piston spring.	

AIR CLEANER

Make and type	Vokes - oil-wetted.
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FUEL PUMP.

Make and type	S.U. electric - High pressure.
Delivery test.	10 gals. per hr. (45.4 litres per hr.)
Suction lift.	33 in. (83.8 cm.)
Output lift.	48 in. (121.9 cm.)

COOLING SYSTEM

Type	Pressurised radiator. Thermo-syphon, pump and fan assisted.
Thermostat setting.	70° - 72° C. (158° - 162° F.)
Quantity of anti-freeze	
15° frost	1 pint (.57 litre)
25° frost	1.1/2 pints (.85 litre).
35° frost	2 pints (1.1 litres.)

IGNITION SYSTEM .

Sparking plugs	Champion N.5. (was previously called N.A.8.)
Size	14 m.m.
Plug gap	.019 to .021 in. (.48 to .53 m.m.)
Coil	Lucas H.A.12.
Distributor	Lucas Type D.M.2 Later models D.M.2. P.4.
Distributor contact points gap.	.014 to .016 in. (.35 to .40 m.m.)
Suppressors type	Lucas No. 78106.A. fitted on each H.T. cable.
Timing.	7° B.T.D.C

GENERAL DATA (Continued)

CLUTCH.

Make and type	Borg & Beck A.6.G. Single dry-plate.
Diameter	8 in. (20.3 cm.)
Facing material	Wound yarn - "Borglite".
Damper springs	6.
Colour	White with light Green strips.
Release lever ratio.	9 : 1.
Details of Clutch Pressure Springs:	6 springs x 165/175 lb. Black/Yellow. Pt. No. 3H.2914 up to Engine No. 16225. After Engine No. 16225, 180/190 lbs. Cream & Green. Pt. No. 1H. 1024.

GEARBOX.

No. of forward speeds	4.		
Synchromesh.	2nd, 3rd, and 4th. gears.		
Ratios: Top	1.0 : 1.		
3rd.	1.374 : 1.		
2nd.	2.214 : 1.		
1st.	3.64 : 1.		
Reverse.	4.76 : 1.		
Overall ratios: Top	4.3 : 1.) 17.00 12.372. 7.678 4.670	M.P.H. per 1000 R.P.M.
3rd.	5.908 : 1.		
2nd.	9.520 : 1.		
1st	15.652 : 1.		
Reverse	20.468 : 1.		
Speedometer gears ratio	5 : 12.		

Optional Axle ratio:	<u>Overall Ratios.</u>	<u>M.P.H. per 1000 RPM.</u>
Top	4.55 : 1	16.1
3rd	6.25 : 1	11.7
2nd	10.07 : 1	7.26.
1st	16.55 : 1	4.42.
Reverse	21.61 : 1	3.38.

Alternative Axle Ratio:	<u>Overall Ratios.</u>	<u>M.P.H. per 1000 RPM.</u>
Top	4.1 : 1	17.8.
3rd.	5.63 : 1	13.
2nd.	9.06 : 1	8.05.
1st.	14.9 : 1	4.9
Reverse	19.5 : 1	3.74.
Top	3.9. : 1.	18.7
3rd.	5.36 : 1.	13.7
2nd.	8.63 : 1.	8.46.
1st.	14.2. : 1.	5.15.
Reverse	18.6 : 1.	3.94.

GENERAL DATA (Continued).

STEERING.

Type	Rack and Pinion.
Steering wheel turns - Lock to lock.	2.2/3
Steering wheel diameter	16.1/2 in.
Camber angle	1° positive to 1/2° negative on full bump.
Castor angle.	4°
King-pin inclination	9° to 10.1/2° on full bump
Toe-in	Wheels parallel.

GENERAL DATA (Continued).

STEERING (Cont'd).

Track : Front
Rear

Disc wheels 47.1/2 in. (1.203 m.)
Wire wheels 47.7/8 in. (1.216 m.)
Disc wheels 48.3/4 in. (1.238 m.)
Wire wheels 48.3/4 in. (1.238 m.)

FRONT SUSPENSION

Type

Independent coil.

Spring detail :

To Car No. 15151 From Car No. 15152.

Coil diameter (Mean)

3.238 in. (82.24 mm) 3.28 in. (82.25 mm)

Diameter of wire

.498 in. (12.66 mm) .54 in. (13.72 mm)

Free Height

9.28 ± 1/16 in. 8.88 ± 1/16 in.

(23.49 cm ± 1.6 mm) (22.55 cm ± 1.6 mm)

Number of free coils

7.5 7.2
6.65 ± 1/32 in. (16.89 cm ± .8 mm)

Static laden length

905 lb. (410.27 kg.)

Static laden length at
load of

4 in. (10.16 cm).

Maximum deflection

Piston type.

Dampers (Front)

REAR SUSPENSION

Type

Semi-elliptic.

Spring Detail

Number of leaves

6.
1.3/4 in. (44.45 mm)

Width of leaves

7/32 in. (5.56 m.m.)

Gauge

450 lb. (203.7 kg.)

Working load

3.60 in. (91.44 mm.)

Free camber

Piston type.

Dampers (Rear)

PROPELLER SHAFT.

Type

Tubular, Reverse spline.

Make and type of joints

Hardy Spicer, Needle roller.

Propeller shaft length

31.3/8 in. (79.69 cm)

(between centres of joints)

38.13/32 in. (97.44 cm).

Overall length

2 in. (50.8 m.m)

Diameter

REAR AXLE

Make and Type

B.M.C. "B" type, three-quarter-floating.

Ratio : Standard

10 / 43

Optional

9 / 41

Adjustment

Shims

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GENERAL DATA (Continued)

ELECTRICAL EQUIPMENT.

System	12 volt. Positive earth.
Charging system	Compensated voltage control
Battery	Two. 6 volt. Lucas S.G. 9.E.
Starter Motor	Lucas 4 brush. M. 35. G.
Dynamo	Lucas C. 39.P.V. 2.

BRAKES.

Type	Lockheed hydraulic. (Front and rear)
Size.	10 in x 1.3/4 in. (25.4 cm. x 44.45 mm)
Front	Two leading shoes.
Rear	Single leading shoe.
Drum size	10 in. (Front and rear)
Lining dimensions	9.6 in x 1.3/4 in. (24.38 cm. x 44.45 mm)
Lining area :	67.2 sq. in. (433.55 cm.2)
Front	67.2 sq. in. (433.55 cm.2)
Rear	
Material	Ferodo. D.M. 12.

WHEELS

Type :	Ventilated Disc.	4. J. x 15.
	Wire (Optional)	4. J. x 15 and 48 spoke

TYRES

Size	5.60 - 15.
Tyre pressures :	Normal.
	Fast motoring.
	Competition work, and sustained
	High speed motoring.

Front.	17 lb/sq. in.	(1.2 kg/cm ²)
Rear.	20 lb/sq. in.	(1.4 kg/cm ²)
Front	21 lb/sq. in.	(1.48 kg/cm ²)
Rear	24 lb/sq. in.	(1.69 kg/cm ²)
Front.	23 lb/sq. in.	(1.62 kg/cm ²)
Rear	26 lb/sq. in.	(1.83 kg/cm ²)

CAPACITIES.

	Imp.	U.S.	Litres.
Engine Sump (Incl: Filter)	7 pts.	8. 1/2 pts.	4.00
Gearbox	4 pts.	5 pts	2.27
Rear Axle	2.3/4 pts.	3. 1/4 pts.	1.56
Cooling system	10 pts.	12 pts.	5.67
Steering rack	1/2 pt.	.6 pt.	.28
Fuel tank	10 gals.	12 gals.	45.4
Brake system	1 pt.	1.2 pts.	.568

GENERAL DATA (Continued)

GENERAL DIMENSIONS

Wheelbase	94 in. (238.8 cm).
Overall length	156 in. (396.2 cm)
Overall width	58 in (147.3 cm)
Overall height	50 in. (127.0 cm).
Ground clearance	6 in. (15.24 cm).
Weight : fully equipped with tools, spare wheel, oil, water, and 2 gallons of fuel (2.5 U.S, 9.1 litres)	1988 lb. (901.81 kg).
Turning circles	28 ft. (8.534 metres).

Stage M.G.A. - 1.

Tuning by port polishing.

An increase of some 3 B.H.P. can be had by general attention to the cylinder head and port polishing as detailed below :-

Lightly grind and polish the exhaust and inlet ports throughout. They should not be ground out so heavily that the shape or valve choke diameters are impaired.

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. Make the bore of the manifold a gradual taper from the carburetter end to the cylinder head port, grinding away any ridges left by machining during manufacture.

Do not grind out the combustion spaces, as these are already quite clean and partly machined, but remove any frazes and lightly polish all over. Any enlargement around the combustion walls may cause the cylinder head gasket to overlap and destroy the efficiency of the seal. Also the compression ratio will be lowered and the tuning will be ineffective.

On engines prior to 17151, it is necessary to grind out and enlarge the inlet port at the neck to Illustration S.K. 7092. Make up a sheet metal template to the dimensions given and fasten it to a long bolt so that it may be used as a gauge when grinding out the inlet ports.

On engines prior to 4046, bore out the exhaust port valve throat to the dimensions given on the **same** illustration, at the same time **reducing** the length of the exhaust valve guide and boss by $3/32$ " at the port end.

All engines after Engine No. 4045 have the increased diameter exhaust throat and the shortened guide. All engines from Engine No. 17151 have the enlarged inlet port neck.

The illustration shows the peak of the combustion chamber ground slightly away to a $3/16$ " radius. This need only be done if the cast point is rather thin and sharp; if the casting is stubby and round-ended it may be left alone.

The engine should then give approximately 75 brake horse power at 5750 r.p.m.

It is sometimes found beneficial, but not essential, to fit the richer carburetter needles 'C.C.'.

Stage M.G.A. - 2.

Tuning for middle range acceleration.

If most importance is placed on initial and middle range acceleration an improvement of two to three brake horse power may be gained in the lower ranges by fitting camshaft Pt. No. 1.H. 603. (Standard M.G. Z.B. Magnette).

This has a timing Inlet Opens 5° B.T.D.C. - Inlet Closes 45° A.B.D.C., Exhaust Opens 40° B.B.D.C. Exhaust Closes 10° A.T.D.C.

The valve lift is .322" (8.1778 m.m.).

The standard distributor may be used but a distributor with correct advance curve for ~~for~~ use with this camshaft is Pt. No. 1.H. 1036. (Standard M.G. Z.B. Magnette).
Ignition setting should be 4° B.T.D.C.
The tappet setting should be .015".

Top end performance will only be slightly impaired between 5000 and 6000 R.P.M.

If desired the head may be tuned by port polishing as laid down in Stage M.G.A. - 1.

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Stage M.G.A. - 2.A.

Tuning for middle range with Higher Compression Ratio.

If increased middle range performance is required, carry out fitting of camshaft etc. as M.G.A. 2, and fit flat top pistons 9.0 to 1 ratio, Pt. No. 1.H.1178.

Ignition setting should range between 4° and 2° B.T.D.C.

19
Stage M.G.A. - 3.

Higher Compression Ratio Tuning. (9.0 to 1.)

Carry out the procedure for tuning by port polishing as Stage M.G.A. - 1.

The compression ratio is raised to 9.0 to 1 by fitting new flat top pistons :-

Part No. 1.H.1178. (Piston complete with rings and gudgeon pin).

Use N.5. Champion plugs, but N.3. may be required for hard driving.

Ignition setting should be approximately 4° B.T.D.C.

Carburettor needles 'C.C.'.

The engine should then give 78 - 80 brake horse power at 6000 R.P.M.

High Compression Ratio Tuning 10.1. to 1.

Carry out the procedure for port polishing as Stage M.G.A. - 1.

The compression ratio is raised to 10.1 to 1 by fitting special raised top pistons, Part No. LH.1108 complete with rings and Gudgeon pins.

The raised portion on the piston head is shaped to match the combustion space and the piston will only fit one way round, that is with the sloping face of the raised head towards the sparking plug side.

Also, grind away the point on each combustion space as Illustration below, SK.7092, otherwise this will foul the raised portion of the piston head. Check the clearance at this point by putting a small blob of plasticine locally on the piston head, when at the top of the stroke, and drop the cylinder head over the studs. Examine the impression and ensure a lateral clearance of $1/16"$ from the raised head of the piston. These pistons are for special competition purposes, they have increased clearances over the standard pistons and may give some increase of oil consumption.

The above pistons have fully floating gudgeon pins of diameter increased to $7/8"$, and will require new connecting rods:-

2 off Pt. No. AEH.431.	} Use in balanced sets.
2 off Pt. No. AEH.433.	

With the above high compression ratio, it is essential that the cylinder head gasket be clamped efficiently. Check the cylinder head face and if not dead flat, have the face lightly and accurately surface ground or fine machined.

Use Super Premium 100 Octane Gasoline.

N.5. Champion Plugs for normal driving, but N.3. required for hard driving.

Ignition setting 20° B.T.D.C.

Carburetter Needles. 'C.C.'.

The engine then gives 86 Brake Horse Power at 6000 R.P.M.

Stage M.G.A. - 4A.

Tuning with High Compression Ratio 10.1 to 1 and larger carburetters.

Tune engine as procedure for Stage M.G.A. - 4.

Fit 1.3/4" dia. S. U. Carburetters, Pt. No. AUC.780, these are fitted with .100 jets and K.W. Needles. Alternative needles, Richer R.F., Weaker K.W.1.

A new inlet manifold Pt. No. AEH.200 will be required. This manifold has a 5/8" dia. bypass hole in the balance pipe.

Polish this manifold as explained in Stage M.G.A. - 1.

To prevent vibration of the carburetters, it is advisable to use a Synthetic Rubber Gasket (Pt. No. AHH.5791.) between the carburetters and the manifold, and a 1/8" thick double coil spring washer under the carburetter fixing nuts, so that the carburetters may be left not quite tightened solid. Wire the nuts in pairs to prevent them becoming slack.

No air cleaners are arranged for these carburetters, but the standard ones would be suitable if bored out to 1.13/16" dia. and fixing nuts and vent holes altered to match the 1.3/4" carburetter flange. These carburetters will not give a large improvement, but the engine should give about 88 Brake Horse Power at 6000 R.P.M.

OTHER SPECIAL ITEMS

Valves.

If an exhaust valve is desired with a longer service life, or more resistant to burning, Valves Pt. No. 1.H. 1025, which have a Bright Ray hard face, are available.

Brakes.

After many consecutive applications of the brakes during competition driving, some brake fade may be experienced with the standard linings.

Competition linings or lined shoes are available. (see list).

With fair competition driving, these linings will be free from fade, but will give a harder pedal effort on application.

Brake drum life will be decreased.

Balancing of road wheel and tyre assemblies.

To obtain the smoothest steering, free from all steering wheel kick, and to eliminate any tendency to front wheel patter, especially at speeds around 70 M.P.H. and over, it will be found beneficial to have the front road wheel and tyre assemblies statically and dynamically balanced. This usually results in balance weights being fitted on both sides of the rims, but this dynamic balancing is well worth while. Balance may require rechecking every few thousand miles, if the car suffers brake locking etc, as this may again put the tyres out of balance enough for the effect to be felt.

It is advisable to keep front tyres in good condition and free from uneven tread wear. This can sometimes be done by changing tyres from front to rear before uneven wear develops.

Pick the best tyres for use at the front (or those that have even tread wear and run true) before they are dynamically balanced.

Balancing a tyre which has flats or uneven wear is not usually very successful. In some cases the tread can be buffed true but this is not an economic way of using rubber.

Oil Cooler.

An aluminium alloy oil cooler is available. This is supplied complete with high duty flexible hoses and can easily be mounted on the floor behind the radiator grill, as depicted in the Illustration S.K. 7139.

Clutch.

Up to Engine No. 16225 the clutches were fitted with pressure springs Pt. No. 3.H. 2914 (Black and Yellow marking), 165/175 lbs. load. Some delay in clutch take up may be experienced, when making very fast up gear changes. If a quicker take up is desired, clutch pressure springs Pt. No. 1.H. 1024 (Cream and Green marking), 180/190 lbs. load can be fitted.

All engines after 16225 are fitted with the 180/190 lbs. springs and these clutches should be capable of handling most competition work, but if a high duty clutch is required, then a competition clutch assembly, Pt. No. AHH 5457, is available. This may be expected to give a somewhat sharp take up, but will stand any amount of hard work.

Sparkign Plugs and suitable alternatives.

<u>Champion.</u>		<u>Lodge.</u>		<u>K.L.G.</u>
N.5.	=	H.L.N.	=	F.E. 70.
N.3.	=	3. H.L.N.	=	F.E. 100.

Note :- Previous designation of Champion Plugs was
N.A. 8 for N.5. and N.A. 10 for N. 3.

Some arduous conditions may call for sparking plugs in the Racing range such as Champion N. 58.R. was N.A. 12, Lodge R.L. 47, or K.L.G. F.E. 220.
It is advisable to refer to the plug representatives for advice on the full range available.

Close Ratio Gearbox.

Close ratio gears are available giving gearbox ratios of :-

3rd. 1.268 to 1, 2nd. 1.62 to 1. 1st. 2.45 to 1.

The following parts are required to rebuild your standard box to these ratios :-

Part No.	1.H. 3297	1st. Motion Shaft	1 off.
" "	1.H. 3298	Laygear.	1 off.
" "	1.H. 3299	2nd. Speed Mainshaft Gear	1 off.
" "	1.H. 3300	3rd. Speed Mainshaft Gear	1 off.

Rear Axle Ratios.

With the combination of the 4.55, 4.3, 4.1 and 3.9 to 1 Axle Ratios available and the standard and close ratio gears for the gearbox it should be possible to obtain a combination of conditions suitable for most competition purposes.

Water Thermostat.

For sustained maximum power and speed, such as in road racing conditions it is advantageous to remove the thermostat. This will ensure the maximum water flow at all times the engine is on full output.

Petrol Pump.

Check the fuel flow of your petrol pump by removing the two float chamber tops complete with the fuel lines.

Unclip the main fuel line and reassemble it alongside the car, so that the two float chamber tops (complete with needles and levers) can be held over a 2 or more gal can.

Switch on the pump and check time for 1 gal to flow.

The Standard engine uses a maximum of approx. 5.7 gals. an hour, and the engine tuned to Stage 4.A. uses approx. 7 gals. an hour.

A good pump may flow 9 gals. an hour, but a pump needing attention may only flow 6 gals. an hour.

If a pump is required which will give a flow with a wide safety margin 'S.U.' fuel pump, Pt. No. A.U.A. 73 is available.

The mounting bracket will need slight alteration to mount this pump and the fuel lines reset to suit.

Valve Springs.

The valve bounce R.P.M. on the standard engine is 6000 R.P.M. and the valve springs, operating mechanism and drive are safely stressed to maintain this.

If for very special competition purposes it is desired to raise the valve bounce period to 6300/ 6400 R.P.M. then Outer Springs Pt. No. 1.H. 1111, and Inner Valve Springs Pt. No. 1.H. 1112 are available.

It is advised that these springs be used only for very special events, as if used under everyday conditions, the cams and followers will have a shorter service life.

The springs will not necessarily give an increase in brake horse power, but will extend the same horse power up to valve bounce.

This is sometimes useful in enabling a lower gear to be retained, still maintaining the same maximum speed with increased power for acceleration.

List of Special Parts Available

	<u>Part No.</u>
Exhaust Valve (High Duty)	1H.1025.
Oil Cooler (Kit) (see Illustration SK.7139 for fitting)	AHH.0088 .
Brake Shoe Lined Assembly. (Lined with Ferodo VG 95/1 Competition facings).	AHH.5603.
Brake Linings (VG 95/1) and Rivets (1 set)	AHH.5604.
Bonnet Straps and plates (1 pair)	AHH 5518/9.
Wire Wheels (60 spoke with 4.1/2" Alum Alloy rims 15" dia.)	AHH.8000.
Wire Wheels (60 spoke with 4.1/2" Steel rims (15" dia.))	AHH.8001.
Competition Clutch Assembly (Extra High Duty).	AHH.5457.
Crown Wheel and Pinion. (10/41) 4.1 to 1 ratio.	ATB.7240 (Pair)
Speedometer for 4.1 ratio M.P.H.	BHA.4060.
Speedometer for 4.1 ratio K.P.H.	BHA.4061.
Crown Wheel and Pinion. (11/43) 3.9 to 1 ratio.	ATB.7236 (Pair)
Speedometer for 3.9 ratio M.P.H.	BHA.4068.
Speedometer for 3.9 ratio K.P.H.	BHA.4069
Crown Wheel and Pinion. (9/41) 4.55 to 1 ratio.	ATB.7146.
Speedometer for 4.55 ratio M.P.H.	17H.295.
Speedometer for 4.55 ratio K.P.H.	17H.296.
Piston (Complete with rings and gudgeon pins) Flat Top 9.0 to 1 ratio.	1H.1178
Piston Complete, Raised Head 10.1 to 1 ratio. (Including rings, Piston 1H.1109 and Gudgeon pin 1H.1110.)	1H.1108.
Connecting Rods (for use with 10.1 to 1 pistons having fully floating gudgeon pins)	AEH.431. R.H. (2 & 4) AEH.433. L.H. (1 & 3)
Carburettors 1.3/4" dia. (1 pair).	AUC.780.
Inlet Manifold for 1.3/4" dia. Carburettors.	AEH.200.
1st Motion Shaft.	1H.3297.
Laygear	1H.3298.
2nd. Speed Mainshaft Gear.	1H.3299.
3rd. Speed Mainshaft Gear.	1H.3300.
Valve Springs - Outer) See Special Note	1H.1111.
Valve Springs - Inner.) (Valve Springs.)	1H.1112.
Synthetic Rubber Gasket. (for 1.3/4" Carbs.)	AHH.5791.

List of Special Accessories available.

	<u>Part No.</u>	
Sliding Side Screens	AHH 5731.	R.H.
	AHH 5732.	L.H.
'Ace' Mercury wheel discs (Set 4.)	97H. 676.	R.H.
	97H. 675.	L.H.
Rimbellishers (Set 5.)	AHH 8002.	
Badge Bar	AHH 5565	
Fog Lamp	ADH 785.	
Bracket for Fog Lamp	AHH 5521.	R.H.
or	AHH 5520.	L.H.
Twin Horns (High Note)	ACC 5238.	
Heater Kit	AHH 5422.	
Radiator Blind	AHH 5536.	
Overall Tonneau Cover	AFH 2626.	R.H.D.
	AFH 2628.	L.H.D.
Luggage Carrier	AHH 5495.	
Adjustable Steering Column	AHH 6012.	
Tyres, Road Speed 5.90 x 15	AHH 5523.	
Radio (Kit) 'Radiomobile'		
Windscreen Washer (Kit)	AHH 5683.	
Ash Tray (Tunnel Mounting)	AHH 5539.	
Cold Air Ventilation (Kit)	AHH 5532	
Wing Mirrors	BHA 4066.	R.H. or L.H. Wing.
Competition full width windscreen (Aluminium & Perspex)	AFH 2591.	
Cigar Lighter c/w Leads. (Casco Tex)	AHH 5759.	
Steering Wheel (Wood rim, light alloy, Italian Style.)	AHH 5800.	
Cylinder Head Assembly. Complete with :- { Valves. { Springs. { Exhaust and Inlet Manifold { Studs, Nuts, and Gaskets fitted	1.H. 1159.	} Polished ports { and matched { manifolds by { Laystall Eng. { Co. Ltd. { and supplied { as a complete { unit.