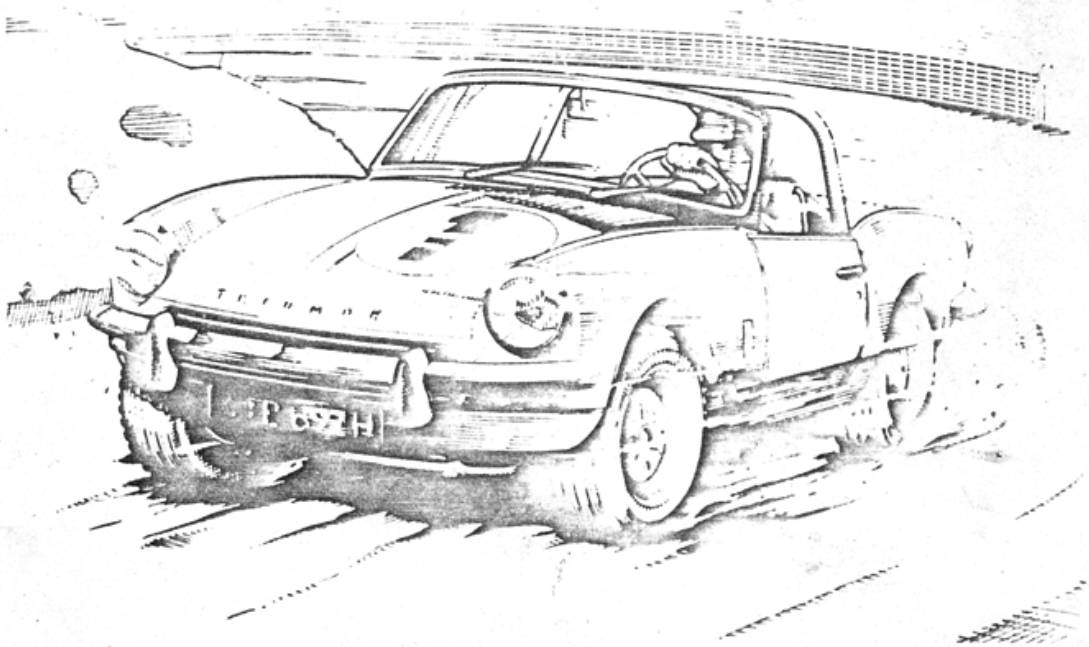
SPECIAL TUNING
for the
TRIUMPH SPITFIRE



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99-500301

SPECIAL TUNING DATA

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Model SPITFIRE 4 & MK.II & III **Sheet** La - 1 **Issue** 2

DESCRIPTIVE INDEX

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BODYWORK			
Headlamp Cowl Kit	99-500101	1	L 10
Bonnet Securing Strap	C-AJJ 3381	1	L 10
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BRAKES			
Brake pads - Ferodo DS 11	99-512539	1	L 10
SUSPENSION			
Front Spring Racing	211869	2	L 10
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Front Spring Standard	209033	2	L 11
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Rear Spring Racing	306677	1	L 12
Rear Spring Rally	307027	1	L 12
Rear Spring Standard	305894	1	L 12
Shock absorbers (adjustable) front	99-500012	2	L 13
Shock absorbers (adjustable) rear	99-500013	2	L 13
Suspension Conversion MK.II & III	C-AJJ 4056 *	1	L 13
PISTONS			
Flat Top +.020" set of 4	39267020	1	L 7
CRANKSHAFT			
1147cc	99-306549 ø	1	L 7
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8 port head (1147cc)	99-513964 ø	1	L 7
Cylinder head nut set	C-AJJ 4049 *	1	L 2
CAMSHAFT			
Stage II 45°, 45°, 65°, 65°	99-211030	1	L 7
CLUTCH ASSEMBLY			
Clutch cover assembly	99-212037	1	L 8
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Oil Cooler kit (13 row)	99-500102	1	L 10
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Exhaust manifold - competition	99-306716	1	L 10
Exhaust pipe	99-211922	1	L 10
Silencer	99-212070	1	L 10
EXHAUST MANIFOLD MK.III			
Exhaust manifold - competition	99-500008	1	L 4/1
INLET MANIFOLDS			
Inlet manifold - interim	99-306895	1	L 5
Inlet manifold Weber - front	99-211039	1	L 5
Inlet manifold Weber - rear	99-211040	1	L 5
CARBURETTERS			
Carburetter - Solex compound	99-211736	1	L 5
Carburetter - Weber 40 DCOE - front	99-306947	1	L 5
Carburetter - Weber 40 DCOE - rear	99-306948	1	L 5
Twin 1½" SU Carburetter kit	99-500201A	1	L 2/4
Accelerator Cable Kit	99-500104	1	L 4
Spring Hi-Lift fuel pump	99-139760	1	L 7

* New or corrected part numbers
ø Parts no longer available from the Factory.

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Description	Part No.	Qty/Car	Sheet No.
IGNITION			
Distributor - competition	99-211461	1	L 8
Spark Plugs - Champion L5 MK.I & II	99-119414	4	L 9
LITERATURE & INSIGNIA			
Special Tuning Booklet, Spitfire	99-500301		
British Leyland Special Tuning Lapel Badge	C-AHT 200		
British Leyland Special Tuning Emblems	C-AKD 5125		
British Leyland Special Tuning Woven Badge	C-AHT 333		
British Leyland Special Tuning Tie	C-AHT 402		
British Leyland Special Tuning Cuff Links	C-AHT 396		
British Leyland Special Tuning Rally Jacket:			
Small (38")	C-AHT 352		
Medium (40")	C-AHT 353		
Large (42")	C-AHT 354		
Ex Large (44")	C-AHT 355		

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The engines in these cars are already tuned to a fairly high degree in standard form, but further power can be obtained at the expense of some tractability at lower speeds. In many cases much improvement will be obtained by careful attention to detail and the use of correct equipment. Full information on the correct method of dismantling and assembling these cars is contained in the Workshop Manual Part No. 511243. Use this for all general data, nut tightening torque and clearances other than where this booklet makes special notes that non-standard settings should be used.

Copies of up-to-date RAC Forms and Recognition are available ONLY from the RAC Competitions Department, 31 Belgrave Square, London S W 1, who will also be able to advise on the eligibility of modified cars.

Although the Spitfire in standard tune provides a sports car with excellent reliability and performance, it must be accepted that any increase in performance above the standard specification will result in increased wear rate and produce additional stresses in all the mechanical components, thus resulting in a shorter working life. It is suggested therefore that owners contemplating increasing the performance of their models select the simplest form of tune which meets their requirements.

Cylinder Head

Smooth out the interior of the port straight through to the valve pocket. Concentrate on providing a direct flow from the port to the bottom of the valve pocket rather than increasing the diameter of the port. The boss separating the two ports should be nicely shaped, but carefully ground to exactly split the gases between each port. Grind and polish underneath the valve seat and in the valve choke area of the port as per sheet, to ensure an easy gas flow throughout the head. The inlet valve seat should not be more than .020" (.5m/m) wide, and situated on the very outside edge of the inlet valve.

After the valve seats are cut and the valves lapped in, excess material on the inside of the seat can best be removed with a 70° cutter after which the bottom edge should be smoothed into the port. For improved performance use larger inlet valve Part No. 126893, but the seat should be blended into the port as described previously. The best diameter for the inlet port is 1¼" (32 m/m) and an old inlet valve should be ground to this diameter as a check. As the port is ground you can check that the valve will slide through the port right up to the inlet guides. If there is a light ledge do not enlarge this to make the wall smooth, rather leave the ledge than grind this out to a large pocket.

The exhaust ports should be ground out to approximately 1.1/16" (27 m/m) squar Check how near the water jacket is to the base of the exhaust port, but otherwise grind out as much as possible right through to the exhaust valve throat. The exhaust seat width should be .032" (.8m/m) with the seat on the outside edge of the valve.

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Both inlet and exhaust valves may now have the roughness on the head ground smooth after they have all been carefully ground into their respective seats and numbered.

The compression ratio can be raised on the MK.I and MK.II 1147cc cars by machining .040" (1.0㎜) from the cylinder head giving 9.75:1. For higher compression ratios an absolute maximum of .056" (2.0㎜) may be removed. Offer up the cylinder head gasket to the machined surface, and mark the outline to ensure that any further grinding does not allow the gasket to overlap the combustion chamber. Grind a slight crescent shaped area to take off the sharp edge above the sparking plug bore and smooth off all the sharp edges around the combustion chamber water jacket holes, etc., after the milling operation.

A new exhaust manifold Part No. 99-306797 will be required on the Spitfire MK.I & II, it will be necessary to modify the engine breather pipe to allow clearance.

On the MK.III engine with 1296cc capacity the new 8 port cylinder head has larger valve diameters than the MK.II version. The standard head is 2.960" (75㎜) thick. This head can be milled to a maximum of .110" (2.8㎜) which results in a combustion chamber capacity of approximately 24.5cc. The exhaust ports may be enlarged as much as possible using the manifold gasket size as the datum, but be careful not to grind too much material from the bottom of the port because of the closeness of the water jacket. After all machining, valve grinding and polishing etc., has been completed measure the combustion chamber volume with a graduated pipette to ensure that the combustion chambers are all within .2cc of each other.

When tightening the cylinder head use the standard torque of 40 lbs. ft. (6 kg.m) unless the thicker head nuts contained in kit No. C-AJJ 4049 are used in which case it is possible to increase the torque to 50 lbs. ft (7.6 kg.m).

Cylinder Head

Model	Spitfire 4 MK.II	Spitfire MK.III.IV & Triumph 13/60	Triumph 1300	Triumph 1 00
Gasket Volume	4.07	4.48	4.48	4.07
Comb. Chamber Volume	30.70	34.12	37.6	35.81
Clearance Volume	35.8	40.24	43.7	40.95
Machine to .5 ratio	.027"	.028	.033	.030
raise C/R 1.0 ratio	.056"	.053	.062	.062
by 1.5 ratio	-	.075	.088	.090
Amount to machine off for 1 cc	.013	.0118	.0116	.013
Std. Comb. Chamber depth	.431	.460	.500	.49
Head Part No.	305792	147390	307871	304947

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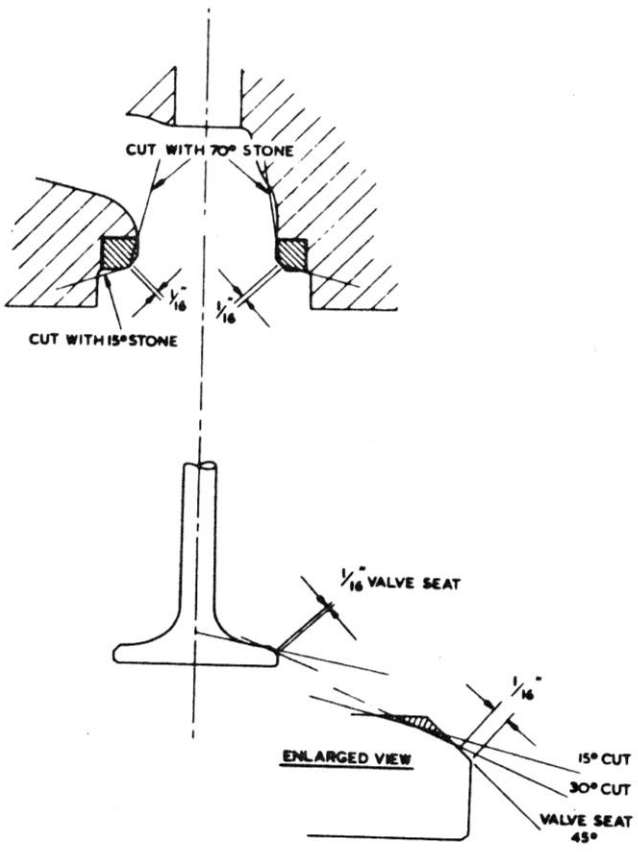
Model SPITFIRE **Sheet** L – 3 **Issue** 2

Valve seat and cylinder head modifications to improve gas flow



Standard Valve Head Sizes

	Inlet	Exhaust
Herald 12, 12/50	1.308"	1.152"
Herald 13/60 Spitfire III & IV	1.308"	1.172"
Spitfire 4 and MK.II	1.245"	1.152"

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Model SPITFIRE **Sheet** L - 4 **Issue** 2

Valve Springs

Standard valve springs will avoid undue load on the valve gear but the valve crash speed can be raised by lightening the standard rockers and taking excess material off the push rod cups after checking that they are perfectly straight and true. Stronger valve springs are available as a set Part No. 99-136487.

Carburetters

On the MK.I and MK.II cars the inlet manifold is located by sleeves into the cylinder block.

These are removed and the manifold ground out to the larger diameter. Once the manifold locating nuts are tightened ensuring the ports are perfectly in position, drill two $\frac{1}{8}$" diameter (3.17㎜)holes through the manifold flange into the head to a depth of $\frac{1}{4}$" (6.35㎜).

This is to allow two short lengths of brazing rod to act as dowls for future assembly. A pair of $1\frac{1}{2}$" SU carburetters may be fitted simply by grinding out the inlet manifold to $1\frac{1}{2}$" diameter and gradually tapering this through to the cylinder head face. All the necessary parts including the twin carburetters and throttle cable kit are contained in Kit 99-500201A.

The No. 5 needles, blue springs as fitted to these carburetter are correct for a normal road going MK.III car, but may need some adjustment or changes for other capacities or for stages of tune. (A new exhaust manifold part number 99-306797 will be required on the Spitfire MK.I and MK.II). On the 1300cc MK.III car use exhaust manifold 99-500008, which can then be connected into the existing exhaust system.

Throttle Linkage

The normal rod operated throttle linkage is not sufficiently sensitive for further stages of tuning. This may be converted to a cable type of operation regardless of whether $1\frac{1}{2}$" or the original $1\frac{1}{4}$" carburetters are being used. Accelerator cable kit Part No. 99-500104 contains all the necessary parts and fitting instructions for this installation.

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Solex Compound Carburetter

A b32 PAIA Solex Carburetter is available Part No. 99-211736 and is recommended for use with the interim stage tune.

A new manifold Part No. 99-306895 will be required to adapt this carburetter.

Compound Carburetter Settings

Choke	23 primary	25 secondary
Main	112.5 primary	140 secondary
Air correction jet	190 primary	190 secondary
Pilot	50 primary	50 secondary
Emulsion tube	70	70
Starter petrol jet	145	
Needle Valve	1.75	
Needle Valve washer	1/m	

Weber Carburetter

Twin 40 DCOE carburetters Part No. 99-306947 and 99-306948 are available for use with the 1147cc engine and are suitably jetted for the Stage II camshaft. Any variations may require slightly different jets. These carburetters should be fitted to a new inlet manifold Part No. 99-211039 FRONT and 99-211040 REAR.

Weber Carburetter Settings

Choke	33.35 m/m
Auxiliary Venturi	4.50
Main Jet	1.30
Idling Jet	50 F8
Pump Jet	0.40
Starting Jet	60 F5
Emulsion Tube	F 15
Air correction jet	1.75
Needle Valve	2.0
Float Level	8.5

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INTERIM STAGE TUNE

The interim stage giving 70 bhp requires very little modification to the basic engine, the differences being confined primarily to the fitting of a solex compound carburetter with suitable inlet manifold, a four branch exhaust system and raising the compression ratio to 9.75:1 by machining the face of the original head by 0.040" to give a combustion chamber depth of 0.388".

Compression ratio	9.75:1
Power	70 BHP
Maximum speed	96 MPH
Accel. 0 to 60 MPH	13.5 secs
Accel. Standing ¼ mile	19.2 secs
Carburetter type	Solex 32 PAIA
Sparking plugs	Champion L-87Y
Ignition setting (Static)	12° BTDC
Crankcase breathing	Mod. open circuit
Valve clearances (cold)	0.010"

Pistons & Cylinder Bore

As the main factor when increasing power output is to raise the compression ratio it is essential that the engine is in good order.

If bore wear should not exceed 0.005" solid skirt pistons assemblies 139267 which were introduced at engine number FC 2449 should be fitted. These pistons are available in grade sizes. (F) 2.7254" (69.22%), (G) 2.7258"(69.235%), (H) 2.7262" (69.24%).

Connecting Rods

The standard connecting rods are made of a high quality material and were introduced from engine numbers FC 30193, these rods being essential when attempting tuning work of engines built prior to FC 30193.

Clutch

The Spitfire 4 and MK.II clutch assemblies have been superseded by stronger clutch unit 514300. The original unit may be modified to the latest specification.

Clutch Part No.	Total Clamping Load	Blue Spring	Red Spring	Yellow & Green Sprir
510446	815 lbs.	6 @ 95 lbs.	3 @ 80 lbs.	-
513662	855 lbs.	9 @ 95 lbs.	-	-
514300	945 lbs.	3 @ 95 lbs.	-	6 @ 110 lb

To ascertain the clutch assembly fitted to your vehicle check colours of the springs against chart above.

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STAGE II

The Stage II tune is an extremely comprehensive racing conversion, which makes possible a power output of 90 bhp approximately. This is achieved by using a four port cylinder head Part No. 99-513964 which when fitted gives a compression ratio of 10.5:1. A modified camshaft Part No. 99-211030 and distributor 99-211461. Twin 40 DCOE carburetters Part No. 99-306947 and 99-306948 together with inlet manifolds Part Nos. 99-211039 and 99-211040 and a four branch exhaust manifold system Part No. 99-306716.

Cylinder Bore and Pistons

Check bore wear for ovality and taper if results do not exceed 0.005" the new piston assembly 99-139267 may be fitted. Oversize pistons .020" are also available under Part No. 99-13926720. The gudgeon pin is slightly off set from the piston centre line, for correct assembly FRONT is stamped on the piston face which coincides with the dimple of the gudgeon pin. It is imperative the piston face is not marked or stamped in any way.

Crankshaft & Connecting Rods

The competition crankshaft Part No. 99-306549 should be fitted with bearings Part No. 14011 and thrust washers Part No. 141207.

Strengthened connecting rods were introduced at engine number FC 30193. These later rods should be fitted in sets when undertaking tuning and are available under the original part number 138549.

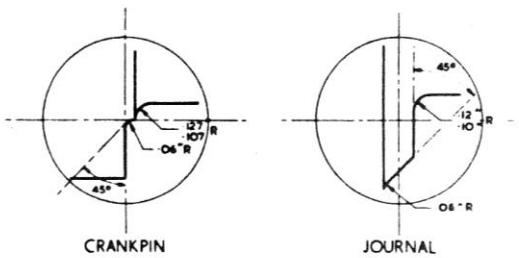


Diagram showing chamfer and radii dimensions on crankshaft 99-306549 which must be adhered to when crank grinding is undertaken.

Camshaft

The race camshaft Part No. 99-211030 is fitted as per Workshop Manual. For valve timing reference Sheet L - 9.

Fuel Pump

A stronger spring Part No. 99-139760 will increase the fuel pressure from $2\frac{1}{2}$ to $3\frac{1}{2}$ lb/sq.in. Gaskets may be added between pump flange and cylinder block to reduce excess pressure.

Cylinder Head

For maximum performance and efficiency to be achieved the cylinder head 99-513964 can be polished and gas flowed provided the combustion chambers are not distorted during the process.

It is important to ensure the correct installation of the water tube 138135 to this cylinder head.

Engine Breather

The sealed breathing system must not be retained when undertaking high forms of tune as the Stage II. This system must be modified by the blanking off of the closed circuit valve unit, and directing the air breather from the rocker cover into a catch tank.

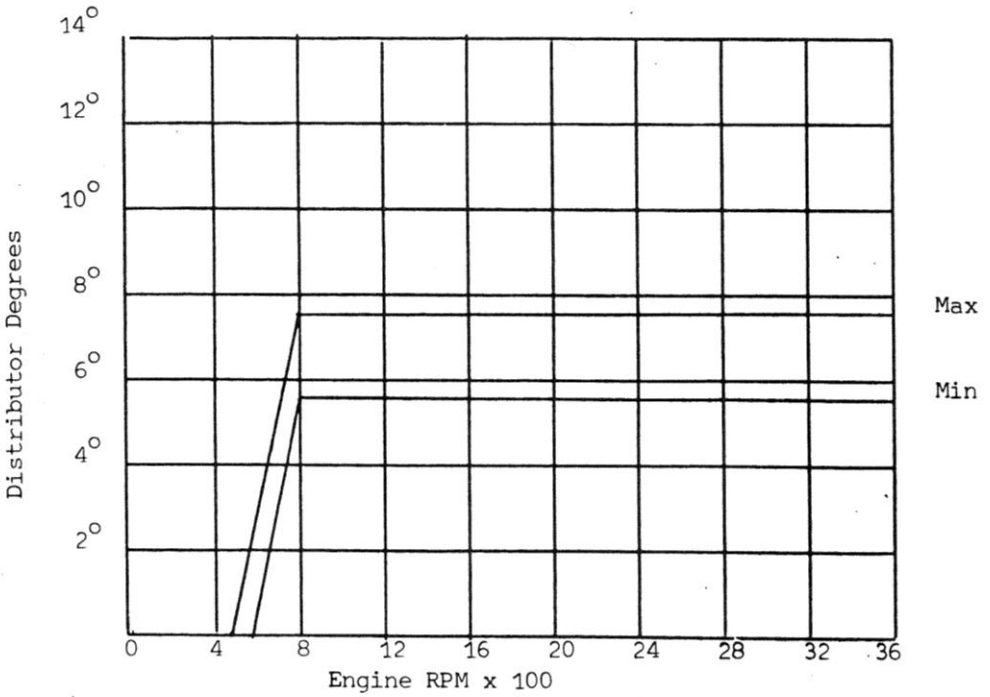
It is possible to fit the rocker cover 134654 together with filler cap 113569 to overcome this problem of engine breathing.

Clutch & Gearbox

Due to the increased torque transmitted from the Stage II tune, it is essential to fit a diaphragm type clutch Part No. 99-212037 and driven plate 99-139665. A stronger set of gears Part No. 500103 are available which are closer ratios making them more suitable for competition use.
The new ratios are 1st/rev 2.93, 2nd 1.78, 3rd 1.25.

Distributor

The fibre heel of the contact breaker tends to bed in from new and dry cam lobes accelerate wear, thus reducing the gap and affecting ignition timing. The lobes should therefore be lightly lubricated, and the gap rechecked after a short period of running. The centrifugal advance for distributor 99-211461 is shown in diagram below, the vacuum unit is not used.



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STAGE II DATA

Compression ratio	10.5:1
Power	90 bhp
Maximum speed	107 mph
Accel. 0 to 60 mph	10.6 secs.
Accel. Standing ¼ miles	18.3 secs.
Carburetter type	Weber 40 DCOE
Sparking Plugs	Champion L5
Ignition setting (static)	2° BTDC
Crankcase breathing	Mod. open circuit
Distributor (Delco Remy)	Stanpart 99-211461
Valve clearance (cold)	.010" (.254㎜)
Valve guides	Part No. 58923
Length (inlet)	2.06"
Bore (inlet)	0.312" - 0.313"
O/Dia (Inlet)	0.501" - 0.502"
Length (exhaust)	2.25"
Bore (exhaust)	0.312" - 0.313"
O/Dia (exhaust)	0.501" - 0.502"
Valve guide protrusion above cylinder head top face	0.749" - 0.751"
Valve springs	1.58"
Free length	1.58"
Length at full lift	1.018"
Load at full lift	118 lbs
Total number of coils	6¼
Camshaft	Part No. 211030
Inlet opens	45° BTDC
Exhaust closes	45° ATDC
Inlet closes	65° ABDC 290°
Exhaust opens	65° BBDC
Maximum lift	0.368"

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Le Mans Headlamp Cowls
Mk.II & III Spitfire only

Perspex headlamp cowls are available as a kit under part number 99-500101. This kit contains the necessary quick release screws and fitting instructions and will protect the light units from damage.

Bonnet Straps

Leather securing straps are available as a set Part No. C-AJJ 3381, these are to ensure the bonnet cannot fly open during competitive events. A rubber toggle set part number C-AJJ 4016 is also available to serve the same purpose. The design of these allow speedier operation.

Brakes

Ferodo DS11 front brake pads part number 99-512539 are available for competition purposes.

Rear shoes to specification VG 95/1 are recommended for racing purposes only and can be identified by blue marks on the ends of each lining.

Due to the harder material of competition linings the pedal effort is increased. This may be counteracted by fitting a Servo unit obtainable with necessary brackets under part number 514600.

Oil Cooler

For racing and prolonged high speed driving the oil temperature may exceed the recommended limit.

By installing an oil cooler unit it will assist in stabilising the oil temperature and consequently oil pressure will be maintained at a desirable figure.

Oil Cooler Kit 99-500102 contains all the necessary hoses, unions and fitter adaptors to ensure positive and easy installation.

For winter motoring, when quicker warm up of the oil is required, oil cooler cover C-AHT 181 should be fitted, but remember to remove it for competition use, or when warmer weather returns.

Exhaust Manifold

For maximum efficiency, a competition exhaust manifold is available for 1147cc engines under part number 99-306716, for 1296cc engine exhaust manifold 99-500008.

Both manifolds may be used with exhaust pipe 99-211922 and silencer 99-212070.

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SUSPENSION TUNING

Modifications to the suspension will normally effect the handling characteristic of the car and will give either more oversteer or understeer. These terms are recognisable as follows :

Understeer

The vehicle will tend to go straight on when the front wheels are turned towards lock.

1. Stiffen front springs.
2. Fitting a front anti-roll bar or increasing the diameter of bar.
3. Raising front suspension (increasing in positive camber).
4. Increasing rear tyre pressures above recommended figures.
5. Decreasing front tyre pressures (must equal at least recommended figures).

Oversteer

The vehicle will tend to spin when front wheels are turned towards lock.

1. Stiffen rear springs.
2. Reducing diameter of front anti-roll bar.
3. Lower front suspension (premature contact of bump stops).
4. Increasing front tyre pressure above recommended figures.
5. Decreasing rear tyre pressure (must equal recommended figures).

Front Road Springs

Front road springs are available under the following part numbers.

Part No.	Free Length	Fitted Length	Fitted Load	Rate	Identification
209685	12.59" (319.8m/m)	7.80"±.09"	718 lbs	150 lbs/"	Green paint on coils
210566	12.21" (310.2m/m)	7.42"±.09" (188.5m/m±2.29m/m)	718 lbs	150 lbs/"	Light blue paint on coils
211869	9.95" (252.73m/m)	7.50"±.09" (190.5m/m±2.29m/m)	690 lbs	282 lbs/"	Nil
209033	10.97" (278.6m/m)	8.18"±.09" (207.8m/m±2.29m/m)	790 lbs	284 lbs/"	Nil

For Rally use (2 up) us front spring part number 209033 in conjunction with rear spring part number 307027.

For circuit racing (1 up) use front spring part number 211869 in conjunction with rear spring part number 306677.

When fitted to a car of standard weight at kerb front spring part number 210566 lowers the ride height by .65" and by 1.25" for MK.III. Rear spring 211869 lowers by .5" and 1.62" for MK.III. Spring part number 209033 raises the MK.I and MK.II by 1.065".

Mk.III has been raised with production spring 214144.

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Suspension

Spring packings are available under part number 125441, which on a car of standard weight increases the ground clearance by .62". These should be restricted to one off per spring and fitted between the upper spring plate and suspension brackets. The packings are .375" (9.525m/m) thick.

Particular springs and packings correspond with the following Commission Numbers:

Spring Part No. 209685	FC1 to FC3214
Spring Part No. 210566	FC3215 to FC39527
Spring Part No. 210566) & Packing " " 125441)	FC39528 to FC50564
Spring Part No. 209685	FC50565 onwards
Spring Part No. 214144	Introduction of MK.III productic

Rear Road Springs

Rear road springs are available under the following part numbers.

Part No.	Leaf Thickness	No. of Leaves	Laden Camber	Load	Rate
305894	0.2188" (5.537m/m)	7	1.88neg$\pm$.13" (47.752m/m$\pm$3.302m/m)	945 lbs	166 lbs/"
305894	0.2188 (5.537m/m)	7	1.88 neg$\pm$.13" (47.752m/m$\pm$3.302m/m)	862 lbs	166 lbs/"
307027	.2188 4 off (5.537m/m) 0.3125" 3 off (7.924m/m).	7	1.88 neg$\pm$.13" (16.45m/m)	945 lbs	290 lbs/"
306677	0.2188" (5.537m/m)	7	1.88 neg$\pm$.13" (47.752m/m)	821 lbs	166 lbs/"

To achieve maximum road holding for racing purposes, rear road spring, part number 305894 may, as an alternative to fitting spring part number 306677, be modified to give a $3\frac{1}{2}^{o}$ negative camber on rear wheels with the car in racing trim and start line condition as follows:-

Remove the spring from the vehicle and remove the clips which bind the spring leaves together. Counting the main leaf as number one, reverse the third leaf. This would involve reversing the clips on the leaf and grinding flush the convex dimple locating the rubber buttons of the end of the leaf. If the car is considerably lightened for spring work and short circuit racing and when a full fuel tank is not required it may be necessary to reverse other leaves to achieve the desired $3\frac{1}{2}^{o}$ negative camber. This modification is not recommended for normal road use when luggage is carried.

For rally use (2 up) use rear spring, part number 307027 in conjunction with front spring, part number 209033.

For circuit racing (1 up) use rear spring, part number 306677 in conjunction with front spring, part number 211869.

SPECIAL TUNING DATA

Issued by: BRITISH LEYLAND SPECIAL TUNING DEPARTMENT
ABINGDON-ON-THAMES • BERKSHIRE • ENGLAND

Model SPITFIRE **Sheet** L - 13 **Issue** 2

Suspension

When fitted to a car of standard weight, spring part number 307027 lowers the curb height by 0.5" (12.7%). Deflection of this spring is far less than standard springs thus giving a higher ride height with 2 up than standard spring, but lower curb height static.

Spring 306677 lowers car 0.84" and alters the rear camber by 2.5 degrees. Spring 305894 is modified as detailed on Sheet L - 12. A car of standard weight is lowered by 0.54" approximately.

It is essential that the rear wheel alignment is checked and corrected if necessary. Adjustment is made by removing or adding shims to the forward end plate of the rear axle radius rods at the point where they bolt up to the chassis. The rear wheel alignment at curb is 1/16" to $\frac{1}{8}$" toe out. With 2 up 0 to 1/16" toe in. Removing shims increases the toe in, and addition of shim decreases the tow in.

Suspension Conversion

The road holding and general handling may be improved for MK.II & MK.III Spitfire owners by installing the Suspension Conversion kit part number C-AJJ 4056.

This kit contains the latest MK.IV Spitfire rear Pivotting spring assembly with the heavy duty Shockabsorbers and front anti-roll bar together with all the necessary parts to allow fitment to the earlier cars.

Shock Absorbers

Adjustable competition shock absorbers are available under the following part numbers :

Front 99-500012 Rear 99-500013

These units are specially designed for the Spitfire, with the required settings of bumps and rebound. The units are adjustable both front and rear and give positive control, that is needed in competition.