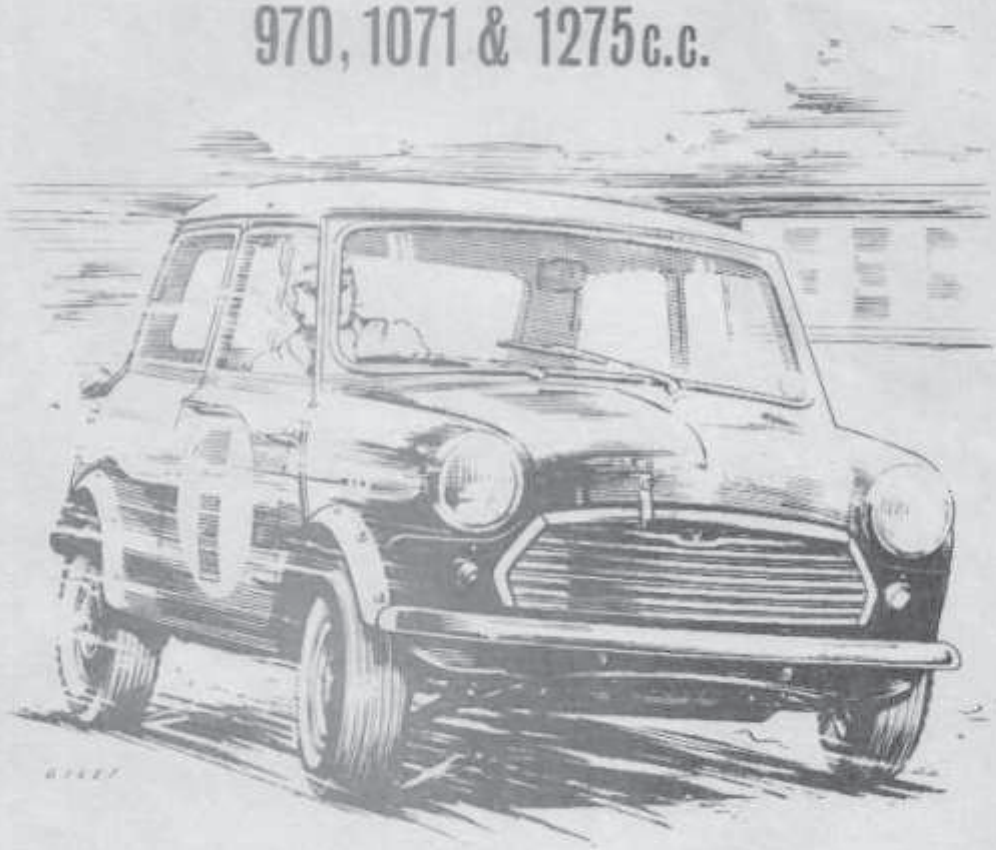
BMC

SPECIAL TUNING

FOR THE

MINI-COOPER 'S'

970, 1071 & 1275 c.c.



Issued by:
THE B M C SPECIAL TUNING DEPARTMENT
ABINGDON-ON-THAMES, BERKSHIRE, ENGLAND

2/6

C-AKD 5096

SPECIAL TUNING DATA

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SPECIAL TUNING DEPARTMENT, Abingdon, Berkshire, England

Model B.M.C. MINI COOPER 'S' **Sheet** Aa - 1 **Issue** 5

DESCRIPTIVE INDEX

Description	Part No.	Qty./Car	Sheet No.
BODYWORK			
Bonnet securing strap set	C-AJJ 3381 *	1	A-11
Narrow wing set for 3½" or 4½" wheels	C-AJJ 3316A *	1	A-8
Wide wing set for 5½" wheels	C-AJJ 3353	1	A-8
Pivotting single lamp bracket	C-AJJ 3318	1 or 2	A-9
Competition 4 lamp mounting bar complete	C-AJJ 3329	1	A-9
Rally padded seat covers	AKF 1650	2	A-9
B.M.C. Reclining seat (See Body Parts List for Part Numbers)		2	A-9
Dash Panel pair - Right Hand drive (Mk.I only)	C-AJJ 3330	1	A-11
Dash Panel pair - Left hand drive (Mk.I only)	C-AJJ 3331	1	A-11
Dash Panel pair - Mk.II cars only	C-AJJ 3373	1	A-11
Perspex window set	C-AJJ 3363	1	A-11
BRAKES			
DS 11 brake pad set - Cooper 'S' only	C- 8G 8996	1	A-8
VG 95 rear brake shoes - Cooper 'S' only	C- 8G 8997	2	A-8
VG 95 linings and rivets - Cooper 'S' only	C- 8G 8998	1	A-8
CAMSHAFT			
Full race, 50°, 70°, 75°, 45°, Lift 0.315"	C-AEA 648	1	A-1,Z-2
CARBURETTERS, etc.			
1½" Twin S.U. - R.H.D. (CP4 needles)	C-AUD 176	1	A-2
Installation Kit for 1½" Carbs. - R.H.D.	C-AJJ 3301	1	A-2
1½" Twin S.U. - L.H.D. (CP4 needles)	C-AUD 176	1	A-2
Installation Kit for 1½" Carbs. - L.H.D.	C-AJJ 3302	1	A-2
1½" Twin S.U. fixed jet type (BG needles)	C-AUD 165	1	A-4
Flared intake pipes for 1½" carbs. (Steel)	C-AEA 485	2	A-2
Flared intake pipes for 1½" carbs. (Glassfibre)	C-AHT 10	2	A-2
Fuel pump, dual type	AUF 400	1	A-9
Weber 45 D.C.O.E. carburettor	C-AHT 143	1	A-4
Installation kit for Weber carb. (incl. Manifold)	C-AJJ 3360	1	A-4
Cable - accelerator	C-AHT 85	1	A-4
CLUTCH			
Competition diaphragm spring assembly (orange)	C-AEG 481	1	A-4
Clutch driven plate	C-22G 247	1	A-4
DYNAMO, PULLEY AND FAN			
Pulley for reduced speed	C-AEA 535	1	A-2
Fan belt to suit pulley C-AEA 535	C-AEA 756	1	A-2
Fan belt short	C-AEA 539	1	A-2
2 blade fan	C- 2A 997	2	Z-3
Alternator mounting bracket	C-AHT 32	1	A-2
Locking plate - crankshaft pulley	C-AHT 146	1	A-2

* New part

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SPECIAL TUNING DATA

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SPECIAL TUNING DEPARTMENT, Abingdon, Berkshire, England

Model B.M.C. MINI COOPER 'S' **Sheet** Aa - 2 **Issue** 5

DESCRIPTIVE INDEX (Cont'd)

Description		Part No.	Qty./Car	Sheet No.
EXHAUST				
Competition manifold for 970cc and 1071cc		C-AEG 432	1	A-2
Competition manifold for 1275cc only		C-AEG 365	1	A-2
Competition exhaust system for rallying		C-ARA 334	1	A-2
FINAL DRIVE GEARS				
3.938:1 ratio	(Wheel	C-22G 340	1	A-3
	(Pinion	C-22G 69	1	A-3
4.267:1 ratio	Wheel	C-22G 370	1	A-3
4.35:1 ratio	Wheel	C-22G 443	1	A-3
(See Sheet A-3 for other standard ratios)				
FLYWHEEL & PRIMARY GEARS				
Lightened steel flywheel (10½ lb. - 4.8 kg)		C-AEG 421	1	A-4
Crankshaft pulley locking plate		C-AHT 146	1	A-2
Primary gear set		C-AJJ 3370	1	A-5
GEARBOX				
Standard ratio gears (Straight cut)	- (1st motion shaft	C-22G 427	1	A-3
	(3rd speed gear	C-22G 429	1	A-3
	(2nd speed gear	C-22G 428	1	A-3
	(Laygear	C-22G 335	1	A-3
Close ratio gears (Helical cut)	- (1st Motion shaft	C-22A 985	1	A-3
	(3rd speed gear	C-22A 987	1	A-3
	(2nd speed gear	C-22A 986	1	A-3
	(Laygear	C-22G 210	1	A-3
Close ratio gears (straight cut) set		C-AJJ 3371	1	A-3
LITERATURE				
Tuning Booklet - Cooper 'S'		C-AKD 5096		
Binder for Special Tuning Sheets		C-AKD 5061		
Divider set for Binder		C-AKD 5093		
Tuning Data Sheet Set (All models)		C-AJJ 3333		
Ecurie Special Tuning Rosettes (1 pair)		C-AKD 5100	1	A-9
British Leyland Special Tuning Badges (1 pair)		C-AKD 5125 *	1	A-9
LIMITED SLIP DIFFERENTIAL				
Kit (for needles roller drive shafts only)		C-AJJ 3326	1	A-10
Kit (for rubber couplings only)		C-AJJ 3303	1	A-10
OIL COOLER & PICK UP				
Competition oil cooler kit		C-AJJ 3309	1	A-4
Oil pipe, short, heavy duty		C-AHT 3	1	A-4
Oil pipe, long, heavy duty		C-AHT 4	1	A-4
Oil pump pick-up pipe		C-AHT 54	1	A-4
Oil cooler cover		C-AHT 181 *	1	A-9

* New parts

continued on Sheet Aa - 3

SPECIAL TUNING DATA

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SPECIAL TUNING DEPARTMENT, Abingdon, Berkshire, England

Model B.M.C. MINI COOPER 'S' **Sheet** Aa - 3 **Issue** 5

DESCRIPTIVE INDEX (Cont'd)

Description	Part No.	Qty./Car	Sheet No.
PISTON			
Competition 3 ring flat top Std. Grade 3	C-AEG 019003	4	A-1
High comp. 4 ring flat top +.040" Grade 3	C-AEG 043043	4	A-1
High comp. 4 ring flat top +.020" (Set of 4)	8G 243223	1	A-1
SPARKING PLUGS			
Champion N64Y	C-37H 4208 *	4	A-2
Champion N57R	C-27H 5982	4	A-2
Champion N62R	C-37H 2149	4	A-2
Champion N60Y	C-37H 2148	4	A-2
SUMPGUARD			
Scottish Rally type sumpguard. Complete kit	C-AJJ 3320	1	A-11
SUSPENSION			
Competition hydrolastic units			
Rally setting - yellow	C-21A 1705	4	A-6
Race setting - red front	C-21A 1819	2	A-6
- double red rear	C-21A 1821	2	A-6
Progressive rear bump stop kit	C-AJJ 3313	1	A-7
Rear anti-roll bar kit complete	C-AJJ 3317	1	A-7
Steering rack - improved type R.H.D.	21A 1961	1	A-9
Steering rack - improved type L.H.D.	21A 1962	1	A-9
Tie rods - adjustable	21A 1092	2	A-8
Negative Camber set	C-AJJ 3364	1	A-8
Shockabsorber kit - for hydrolastic cars	C-AJJ 3362	1	A-6
VALVE GEAR			
Heavy 180 lb. valve springs (outer	C-AEA 524	8	A-1
(inner	C-AEA 652	8	A-1
(locating collar	C-AEA 654	8	A-1
Strengthened rocker shaft	AEG 399	1	A-5
Valve rocker screws, lengthened	C-AEA 692	8	A-1
Valve rocker spacer	C-AEG 392	3	A-5
Lightened tappet	C-AEG 579	8	A-5
Lightened steel camshaft sprocket	C-AEG 578	1	A-5
WHEELS			
Magnesium Alloy 4½" (Cooper 'S' only)	C-21A 1968	5	A-8
Alloy wheel installation kit (for C-21A 1968)	C-AJJ 3327	1	A-8
Magnesium alloy 5½" (Cooper 'S' only)	C-21A 2132	5	A-8
Wheel nut set (for 21A 2132)	C-AJJ 3361	1	A-8

* New Part

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Model B.M.C. MINI COOPER 'S' Sheet A - 1 Issue 7

These engines are tuned to a fairly high degree in standard form, but further power can be obtained at the expense of some tractability at lower speeds. Full information on dismantling and assembly is contained in Workshop Manual Part No. AKD 4935.

Copies of up-to-date R.A.C. Forms of Recognition are available ONLY from the R.A.C. Competitions Department, 31 Belgrave Square, London S.W.1., who will also be able to answer any queries concerning eligibility of modified cars.

Cylinder Head

Remove all frazes from combustion chambers and ports, but leave the locating sleeves in place when matching the manifold ports. Raise the compression ratio either by fitting flat top pistons to 1071cc and 1275cc engines, or machining the cylinder head only on 970cc. Removing 0.012" (.305 %) from the head face reduces the capacity by approximately 1cc. Fitting 3 ring pistons C-AEG 190 (4 off) or 4 ring pistons 8G 2432 (1 set) with the head volume 21.4cc will make the compression ratio 11:1 on 1071cc and 12:1 on 1275cc engines. C-AEG 190 is only available in standard size, but is a 3 ring competition piston.

Examine the water ways to ensure all sand and core wires have been removed. Use the standard head gasket AEG 226 and ensure that there are no burrs at the base of the head studs.

Bore

Engines may be bored up to +.040" (1.016 %) but DO NOT RE-CHAMFER TOP EDGE OF BORE as gasket burning may result. Use flat top 4 ring pistons C-AEG 043043 (4 off) or dished top Forged competition piston set C-AJJ 337743 (1 off). 1275cc bored +.040" equals 1311cc. Calculate appropriate combustion chamber capacity to give required compression ratio. 12:1 is the best maximum, the 100 octane fuel is required.

Dished top piston sets 8G 2434 may give slightly more power, but the block will have to be machined to within .010 in. (.25 %) of the piston crown at T.D.C. to give the required compression ratio.

Camshaft

For rallying, use the latest standard camshaft AEG 510 to give reasonable low speed pick-up, but for racing and maximum power fit camshaft C-AEA 648. (See Sheet Z-2 for camshaft details). This camshaft will require longer tappet adjusting screws C-AEA 692, or machine 0.050" from base of rocker shaft brackets if using standard screws.

Valve Springs

Standard valve springs will avoid undue load on the valve gear, but stronger ones are available to increase valve crash speed to 8,400 r.p.m. The new bottom locating collar must be used in place of the existing standard part.

Valve spring inner	C-AEA 652	8 off
Collar - locating	C-AEA 654	8 off
Valve spring outer	C-AEA 524	8 off

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SPECIAL TUNING DATA

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Model B.M.C. MINI COOPER 'S' **Sheet** A – 2 **Issue** B

Carburetters

On right hand drive cars, fit 1¾" carburetter pair C-AUD 178 using installation kit C-AJJ 3301, or for left hand drive cars use carburetters C-AUD 176 and kit C-AJJ 3302. These carburetters are fitted with blue piston springs AUC 4587 and CP4 needles. Use flare pipes C-AEA 485 (steel) or C-AHT 10 (glassfibre) to reduce turbulence at carburetter intake. Track testing may show the following needles and ignition settings to be best, but may be modified to suit the particular engine. The standard distributor is quite satisfactory.

	Static Ign. setting	Needle	Part No.
970cc	12° B.T.D.C.	CP4	AUD 1118
1071cc	7° B.T.D.C.	MME	AUD 1265
1275cc (cam C-AEA 648)	2° B.T.D.C.	BG	AUD 1067
1275cc (cam AEG 510)	2° B.T.D.C.	7	AUD 1006

Plugs

Champion N57R (C-27H 5982), N62R (C-37H 2149) or N60Y (C-37H 2148) are recommended for racing, and N64Y (C-37H 4208) are more suitable for rally work and fast road use.

Exhaust Manifolds

Fit the homologated competition exhaust manifold C-AEG 365 for 1275cc or C-AEG 432 for 970 and 1071 engines. The standard exhaust system is quite satisfactory for power, but a special system for rally use Part No. C-ARA 334 is available, which is shielded and has an upswept tailpipe.

Dynamo

To avoid damage to the dynamo at high speed, it is advisable to fit larger dynamo pulley C-AEA 535 together with longer fan belt C-AEA 756. The coil should be remounted upright on the wing panel at the rear of the engine to reduce the load on the dynamo brackets. Where regulations permit running without a dynamo, use standard water pump pulley 2A 601 and short fan belt Part No. C-AEA 539.

A spare fan belt of the correct type can be clipped around the water pump and timing cover for a quick changeover if one breaks during competition.

Crankshaft Pulley Locking

When fitting the crankshaft pulley, care should be taken that the keyway is a good fit to the key. After fully tightening the large securing bolt a special locking plate C-AHT 146 should be fitted by means of the damper screws to lock this bolt. This is not suitable for Pulley 8AG 305, but is designed for separate pulley and damper AEG 454 and 12A 367.

Alternator Fitting

An alternator kit is not available, but a list of all necessary parts is supplied with special cast alternator mounting bracket C-AHT 32. This is designed to take Lucas 11AC Alternator 13H 2131 in place of the existing dynamo. This will then cope with extra lights, heated screens, etc. for rallying, or can be used for continual stop-start motoring where the dynamo output may not be adequate.

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Model B.M.C. MINI COOPER 'S'
970cc, 1070cc, 1275cc

Sheet A - 3 Issue 7

ALTERNATIVE TRANSMISSION GEARS

Alternative gearbox and final drive gears are available for these vehicles. The gearbox ratios are as shown, top gear being direct in all cases.

GEARBOX RATIOS & GEARS

	Std. Ratio (helical)	Close Ratio (helical)	Std. Ratio (spur)	Close Ratio (spur)
1st & Rev. ratios	3.200	2.568	3.077	2.573
2nd gear ratio	1.916	1.780	1.875	1.722
3rd gear ratio	1.357	1.242	1.307	1.255
1st Motion Shaft	See	C-22A 985	C-22G 427	C-22G 430
2nd Speed Gear	Parts	C-22A 986	C-22G 428	C-22G 431
3rd Speed Gear	List	C-22A 987	C-22G 429	C-22G 432 *
Laygear	AKD 3509	C-22G 210	C-22G 335	C-22G 306
1st Motion Shaft	20 teeth	23 teeth	20 teeth	22 teeth
2nd Speed Gear	28 teeth	29 teeth	27 teeth	28 teeth
3rd Speed Gear	24 teeth	25 teeth	23 teeth	24 teeth
Laygear teeth	26,23,19,13	24,21,17,13	25,22,18,13	23,20,17,13

A stronger Layshaft 22A 1371 is now available, and should be fitted for competition use. Ensure all other parts are in a good condition.

These gears must be fitted in sets, and can be used in all Mini Cooper 'S' gearboxes, Mini Cooper 998cc gearboxes, 848cc Mini Gearboxes after Engine Number 815140, and 1100s fitted with 'B' type gears only (See Mechanical Parts List). They are NOT suitable for cars with all synchromesh gearboxes.

On all earlier Minis and 997cc Mini Coopers it may be possible to fit a complete late type transmission assembly to accept the close ratio gears. For further information refer to the parts list.

NOTE

When assembling gearbox, reverse the dismantling procedure but note the following points. Fit the 1st Motion Shaft from inside gearbox WITHOUT its ball race. Engage 2nd Gear before fitting assembled mainshaft from inside gearbox WITHOUT its ball race. Close the first motion shaft and mainshaft together, ensuring the spigot bearing is in position, and lower the assembly onto the selectors. Fit ball races to both shafts.

* A special Close Ratio Straight Cut Gear Set C-AJJ 3371 in high duty material is now available for severe use, containing the latest layshaft and new bearings.

ALTERNATIVE FINAL DRIVE GEARS

RATIO (Teeth)	3.444 (18/62)	3.647 (17/62)	3.765 (17/64)	3.938 (16/63)	4.133 (15/62)	4.267 (15/64)	4.35 (15/65)
Wheel	22A 411	22G 940	22A 401	C-22G 340	22G 101	C-22G 370	C-22G 443
Pinion	22A 413	22A 399	22A 399	C-22G 69	22G 99	22G 99	22G 99

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Rocker Shaft

A strengthened rocker shaft AEG 399 is now fitted in production, but earlier engines may be identified by the locating screw in the end pedestal. To fit the latest shaft, a new drilled pedestal 12G 1807 and a new tapped pedestal 12G 1806 will be required, together with two of the original plain pedestals AEG 166. Ensure that pedestal 12G 1807 lines up with both the oil drilling in the cylinder head and in the rocker shaft.

To reduce friction, the coil spring rocker spacers can be replaced by solid distance tubes Part No. C-AEG 392 (3 off) and washers AEG 168 (6 off). The washers should normally be either side of the end pedestals, but may be moved to ensure each rocker is immediately above the valve stem. It may be necessary to machine the side of some pedestals to get the rocker central, but the correct order of assembly must then be maintained. The latest standard valve rockers 12G 1221 can be further lightened by careful grinding at the sides only so that the strength is not reduced.

Lightened Tappets and Sprocket

Specially machined tappets C-AEG 579 are now available which are a little lighter than the standard version, thus reducing the loading on the camshaft and raising valve bounce r.p.m.

A lightened steel camshaft sprocket C-AEG 578 is also available. Note that this is NOT suitable for any 'B' series engines as the timing would then be incorrect. This also applies to the standard steel sprocket AEA 696.

Primary gears

Primary gears are now available with special steel-backed bushes to prevent breakage during competition use. Primary Gear C-AEG 3134 must be used with special Thrust Washer C-AEG 3137, and are therefore only available as a Primary Gear Set C-AJJ 3370. They should be assembled with just a smear of engine oil. The latest production primary gear 22G 1053, which is fitted with an oil slinger, also has improved bushes which may be satisfactory for competition use.

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Model B.M.C. MINI COOPER 'S' Sheet A - 5 Issue 6

Rocker Shaft

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Model B.M.C. MINI COOPER 'S' **Sheet** A - 6 **Issue** 5

SUSPENSION MODIFICATIONS

Cone Rubber Type

For cars running at the normal trim height heavy duty shock absorbers are available for the front, Part No. 21A 2095.

If the car is to be lowered, a maximum of 0.312" (7.9 %) may be removed from both the front and the rear struts, but modified shock absorbers must be fitted, to ensure that the shock absorber and its mounting brackets are not strained. Armstrong Patents Ltd., Beverley, Yorkshire manufacture various competition shock absorbers modified to suit lowered suspension and different travel. It is essential to move the brake pipe away from the top of the rear suspension arm, to prevent this being damaged by contact with the rear bump stops.

Hydrolastic Type Suspension

There have been changes in production specifications affecting parts fitted to cars with Hydrolastic suspension, and it is advisable to use the latest standard Cooper 'S' suspension for normal rally use. The Mechanical Parts Lists show the changepoints at which the latest Helper Spring 21A 1806 and Rear Strut 21A 1805 were fitted. Early cars MUST have these fitted at the same time as Front Displacer 21A 2012 and Rear Displacer 21A 2014 are fitted. Rear Strut 21A 1805 is 9¾" (24.76 cm) long in standard form, which will aid identification. Displacers 21A 2012 and 2012 have 1 and 2 Silver bands respectively, but have identical suspension characteristics as those with blue markings. There is no stronger or stiffer unit and the chart shows the various identification colours against the part numbers.

Alternative Hydrolastic Units

		EARLY CARS		LATE CARS	
		Marking	Part No.	Marking Bands	Part No.
Normal	- front	NIL	21A 1477	1 orange or green	21A 1804 or 2008
	- rear	NIL	21A 1703	1 orange or green	21A 1804 or 2008
Stiff	- f.& r.	1 yellow band	C-21A 1705 ⊕	2 orange bands	21A 1811
Hard	- front	1 red band	C-21A 1819	1 blue or silver	21A 1872 or 2012
	- rear	2 red bands	C-21A 1821 ⊕	2 blue or silver	21A 1874 or 2014

After fitting new displacer units take great care that they are located properly and ensure that the ball sockets do not become displaced at the start of pressurising. Take the pressure up to 400 lb./sq. in. (28.1 kg.cm^2) and wait at least 20 minutes for vehicle to settle, before reducing to the correct running pressure of 263 lb./sq.in. (18.41 kg./cm^2) for early cars or 282 lb./sq.in. (19.74 kg./cm^2) for cars with the latest struts, etc.

Shock Absorbers for Hydrolastic

Hydrolastic units incorporate internal dampers, but for certain types of rally use, shock absorbers can be fitted to the front using the parts in Shock Absorber Kit C-AJJ 3362.

⊕ These parts are no longer available. Use later parts with new rear strut and helper springs.

* See Mechanical Parts List for changepoints.

(See also Sheets A-7 & A-8)

SPECIAL TUNING DATA

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Model MINI COOPER 'S' (Hydrolastic Only) **Sheet** A - 7 **Issue** 6

Rear Bump Buffers (Hydrolastic cars only)

Fitting Rear Bump Buffer Kit, Part No. C-AJJ 3313 will control the nose-up attitude on fierce acceleration, and will improve the handling of the car when the rear is heavily laden.

Raising Ride Height

Front units C-21A 1819 (1 red band) incorporate a .180" spacer to give the greatest ride height and are as hard as later units (See A-6). If the front loading is especially high packing washers can be used PROVIDING THE DRIVE SHAFTS REMAIN HORIZONTAL.

Excessive packing of the displacer struts can be dangerous and under no circumstances should a washer thicker than 0.150" (3.81 %) be fitted. Spacers are shown 'A' are available as follows:

0.050" (1.27 %) thick - Part No. 21A 356
0.080" (2.03 %) thick - Part No. 21A 463
0.100" (2.54 %) thick - Part No. AJH 5322
0.150" (3.81 %) thick - Part No. 21A 1845

Cars should not normally be run with pressure exceeding 300 lb./sq. in. (21 kg./cm^2) but to compensate for extra weight on the front i.e. sump guard and extra lamps, it is satisfactory to fit stronger rear helper springs 21A 1806 to early cars. As well as affecting the handling, damage will result if the car is driven whilst making continual contact with the rebound stops.

Ensure the Hydrolastic pump pressure gauge is occasionally checked against a steam gauge or similar accurate equipment.

Lowering Ride Height

For circuit racing on relatively smooth tracks, the suspension may be lowered by machining accurately 0.2" (5.1 %) from the front displacer pistons, and 0.3" (7.6 %) from the rear displacer strut. Before refitting these parts, it is ESSENTIAL to see that the ball sockets 'B' still seat properly, if necessary by filing or drilling to clear any ridges. Do not use the standard rear bump buffers, but if the parts in kit Part No. C-AJJ 3313 are considered to provide too much resistance, bump stops 21A 1728 R.H. and 21A 1729 L.H. may be used with special securing screws and washers. It is essential to pack the rebound stops to compensate for the lowering of the car to ensure suspension movement is controlled. Fit anti-roll bar kit C-AJJ 3317 and the Silver and Double Silver displacers to late cars, together with rear struts 21A 1805 and helper springs 21A 1806. *

After allowing the new displacer units to settle as explained on Sheet A-6, the pressure can be lowered until the car is just clear of the bump stops. Note that the car will settle lower when the fluid is cold, and DO NOT use pressures less than 220 lb./sq.in. (15.5 kg./cm^2). It does not matter if the pressures are uneven from side to side.

* See also Sheets A-6 & A-8 and Mechanical Parts List AKD 3509 for Changepoints.

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SPECIAL TUNING DATA

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Model B.M.C. MINI COOPER 'S' Sheet A - 8 Issue 6

Adjustable Tie Rods

The castor angle of the front wheels can be varied by fitting Tie Rod Adjuster 21A 1092. The existing tie rod should be cut off 13.687" (347.7 %) from the centre of the bolt holes in the fork, and then threaded 1¾" (44.5 %) using ½" UNF die.

This should only be carried out when reliable equipment is available to check the steering geometry, and when adequate knowledge is available as to the results. The correct castor angle is 3°, but this should not be varied by more than + or - 2°. An adjustment in length of 0.10" (2.5 %) corresponds to 1° variation. Shorten tie rod to increase castor angle, and lengthen to decrease. Carefully retrack front wheels afterwards.

Negative Camber

The camber angle on production cars can vary from 1° positive to 3° positive, but longer bottom Suspension Arms C-21A 2115 R.H. and C-21A 2116 L.H. are available as a pair Part No. C-AJJ 3364 to alter the car to a nominal 1½° negative camber. When fitting these special bottom arms it is ESSENTIAL to secure a plate ⅛" (3.2 %) thick 1" x 1.½" (25 % x 38 %) UNDERNEATH the REBOUND platform of the TOP suspension arms. Fix these by drilling and tapping two small holes in each arm to take countersunk screws through the plates. The screws should then be peened over to prevent them coming out.

Brakes

On the Cooper 'S' only, fit competition DS11 brake pad set C-8G 8996 (1 off) together with the harder VG 95 rear brake shoes C-8G 8997 (2 off). Alternatively, the existing shoes may be relined using VG 95 brake lining set C-8G 8998 (1 off). Check that all brake pipes are in good condition and cannot chafe. Check the hoses are not twisted or starting to perish. For rally use, a light coil spring can be fitted over the hoses to protect them from stones, and the disc shield should be partially cut away to provide maximum ventilation.

Alloy Wheels

Magnesium alloy road wheels are available with 4½" (114 %) rims for the Mini Cooper 'S' only, Part Number C-21A 1968, 5 off required. These will need a wheel installation kit C-AJJ 3327 containing 18 special wheel nuts and self-adhesive balance weights. Narrow wing extension set C-AJJ 3316A is necessary for legal safety reasons when using 4½" wheels to ensure bodywork covers the tyres. These will also prevent mud from splashing up with normal wheels.

5½" (140 %) wide magnesium wheels are available to special order Part No. C-21A 2132 (5 off) which require special wheel nuts available in set C-AJJ 3361. Wide wing extensions C-AJJ 3353 will then be required for these wheels.

These wider wheels are suitable only for the Cooper 'S'. DO NOT EXCEED the correct wheel nut torque of 43 lb.ft. (5.94 kg.m.) on any wheels.

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SPECIAL TUNING DATA

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Model B.M.C. MINI COOPER 'S' **Sheet** A - 9 **Issue** 4

Fog and Spot Lamp Mounting

Additional driving lamps can be mounted in front of the grille without restricting the accessability of the distributor, fan belt and oil filter by using easily detachable brackets.

When fitting four extra lamps, use Competition Mounting Bar C-AJJ 3329, which is designed to swing forward after releasing two of the three fixing bolts.

One or two extra lamps can be separately mounted using Pivotting Lamp Bracket C-AJJ 3318, which takes only one lamp, and hinges forward to give access through the grille.

Fuel Pump

When regulations permit, fuel pump AUF 400 has dual electrical components and can be connected up in place of the existing pump, or moved inside the car and re-piped. Ensure that all connections are in perfect condition and that the pipes cannot chafe anywhere. See Mechanical Parts List for details of the twin fuel tank if this is not already fitted.

Seat Covers

Where regulations insist on the use of standard seats, additional support can be obtained by using Rally Padded Seat Cover AKF 1650 on the front seats.

Reclining Seats

B.M.C. reclining front seats are now available, which also give additional support. These are stocked in standard trim colours for both left and right.

Grey/Tartan Red R.H. 24E 537, L.H. 24E 541
(See Body Parts List AKD 3510 for other colours)

Steering Rack

For really arduous rally conditions, fit rack 21A 1961 R.H.D. or 21A 1962 L.H.D., which were fitted to all Cooper 'S' cars from Car No. 992021 R.H.D. and 995102 L.H.D.

Badges and Transfers

"British Leyland Special Tuning" self-adhesive badges are now available in pairs under Part No. C-AKD 5125. They are in a vinyl material and are practically indestructible.

"Ecurie Special Tuning" rosette waterslide transfers are still available in pairs, Part No. C-AKD 5100.

Oil Cooler and Cover

An oil cooler is essential for competition or very fast road use, but for normal use in the winter it is beneficial to keep the oil from becoming overcooled. Cover C-AHT 181 is designed to fit any size of factory oil cooler and can easily be fitted or detached.

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Model B.M.C. MINI COOPER 'S' **Sheet** A - 10 **Issue** 1

Limited Slip Differentials are available for these cars as follows:

	Part No.	Qty.
LIMITED SLIP DIFFERENTIAL KIT (For cars with rubber drive couplings only including Mini, Cooper, 1100 and Moke)	C-AJJ 3303	1
LIMITED SLIP DIFFERENTIAL KIT (For cars with needle roller drive shafts only)	C-AJJ 3326	1

N.B. The rubber drive shaft couplings can be replaced to take the needle roller drive shafts and limited slip differential by using the following standard parts:

End cover		22G 419	2
Seal - for end cover		22G 423	2
Collet - for driving flange		22G 424	4
Seal - rubber, for flange		22A 1202	2
Washer - plain		22A 1201	2
Washer - spring		LWZ 510	2
Setscrew - for driving flange		22A 1104	2
Nut - for bolt		LNZ 205	8
Driveshaft Assembly R.H. *	Cooper 'S' only	21A 1857	1
Driveshaft Assembly L.H. *	Cooper 'S' only	21A 1858	1
Driveshaft Assembly R.H. *	Mini & Cooper only	21A 1852	1
Driveshaft Assembly L.H. *	Mini & Cooper only	21A 1854	1

If a conventional differential is required after converting to needle-roller couplings, differential gears 22A 1151 (2 off) and driving flange 22A 1152 (2 off) will be required.

Replacement pawls C-22G 417 (8 off) are available for both limited slip differential units.

N.B. These units are not desirable for use on the road, and such use will also cause excessive wear.

* See Mechanical Parts Lists for breakdown of these Driveshaft Assemblies if required.

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Sumpguard

A very substantial sumpguard as used by the works is available as a complete kit Part No. C-AJJ 3320 including all necessary mounting plates and rubbers. This guard weighs 35 lbs. (16 kg.) and should not be confused with other guards of less robust construction, but it will reduce the ground clearance.

Bonnet Straps

Leather securing straps are available as a set, Part No. C-AJJ 3381.

Dash Panels

Aluminium dash panels with a black crackle finish are available for the Mk.I bodies. These are drilled to take a 3" (76 %) tachometer on the driver's side, the remainder being left blank to enable the owner to position switches and other instruments as he requires. Part No. C-AJJ 3330 R.H. Drive, or C-AJJ 3331 L.H. Drive.

Similar dash panel pairs C-AJJ 3373 will shortly be available in glass fibre for Mk.II bodies, but without any holes so that they will suit Home or Export cars.

Perspex Windows

Perspex Window Sets C-AJJ 3363 are now available for Mk.I or Mk.II bodies. The perspex Back-light fits direct to the Mk.II aperture, but a paper template is supplied to convert this to suit the Mk.I aperture. The template should be placed on the OUTSIDE of the perspex and the surplus trimmed off. The perspex Quarter light fits direct into cars without the Deluxe hinged quarter light using rubber surround 14A 6825 R.H. and 14A 6826 L.H.

Overheating

It is essential that a reliable calibrated guage is used to determine the actual running temperature before being convinced that overheating is being experienced. High pressure radiator caps raise the boiling point of water, and the Cooper 'S' is normally fitted with a 13 lb. per sq. in. cap, which raises the boiling point to 246°F (119° C).

Various likely causes of overheating are listed on Data Sheet Z-3 and a larger water pump is now available for the Cooper 'S'. It will be necessary to grind away part of the block casting to clear the pump rotor, and the clearance should be carefully checked before fitting. A new bottom hose 12A 1550 will be required to suit the large bore of the new pump 12G 1771.

Gearbox Mounting

Severe rally conditions and harsh use of the clutch may cause early failure of the standard gearbox mounting rubber at the end of the remote control. An improved rubber mounting is now available, which should be used in conjunction with a strengthened mounting bracket and support strap. All necessary parts are contained in Gearbox Mounting Kit C-AJJ 3366. (NOT suitable for Mini gearboxes without remote control).

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Model GENERAL **Sheet** Z - 1 **Issue** 3

The following information is issued in order to facilitate the choice of a suitable final drive ratio for any particular application.

The table indicates the wheel revoluations per mile for the tyre size commonly used on B.M.C. vehicles. From this the vehicle speed per 1000 engine revolutions per minute can be calculated using the formula.

$$\text{M.P.H./1000 R.P.M.} = \frac{60000}{\text{axle ratio} \times \text{wheel revs per mile}}$$

or

$$\text{K.P.H./1000 R.P.M.} = \frac{96560}{\text{axle ratio} \times \text{wheel revs per mile}}$$

This formula gives the speed in direct top gear only but the equivalent road speed in any intermediate gear can be calculated by dividing this by the gearbox gear ratio.

Tyre Size & Type (Dunlop)	Wheel revs per mile @ 30 MPH	Tyre Size & Type (Dunlop)	Wheel revs per mile @ 30 MPH
520 x 10 C41	1058	145 x 13 SP	934
145 x 10 SP	1095	165 x 13 SP	892
520 x 10 CW44	1060	175 x 13 SP	874
500 x L10 R7	1053 *		
		520 x 14 C41	865
550 x 12 C41	960	550 x L14 R7	807 *
145 x 12 SP	980	560 x 14 C41	853
155 x 12 SP	960	590 x 14 RS5	842
550 x 12 CW44	955	590 x 14 C41	831
		145 x 14 SP	892
520 x 13 RS5	914	155 x 14 SP	873
520 x 13 C41	917	165 x 14 SP	854
560 x 13 C41	884		
550 x L13 R7	840 *	550 x L15 R7	775 *
590 x 13 RS5	871	560 x 15 C41	814
590 x 13 867	867	590 x 15 RS5	807
600 x L13 R7	807 *	590 x 15 C41	803
		600 x L15 R7	747 *
		165 x 15 SP	820

* Wheel revs @ 100 M.P.H.

For further information contact the tyre manufacturers direct.

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Model GENERAL **Sheet** Z - 2 **Issue** 6

The following chart shows details of the various B.M.C. camshafts produced for 'A' series in-line and transverse engines.

Part Nos with	8G 712	12G 165	AEG 148	88G 229	AEG 510	C-AEA 731	C-AEA 648
pin type oil	2A 297	AEA 630		2A 948			
pump drive.	2A 571			12A 122			
Marking	-	2 rings	-	1 ring	1 ring	3 rings	AEA 649
Cam lobe width	$\frac{3}{8}$"	$\frac{3}{8}$"	$\frac{1}{2}$"	$\frac{3}{8}$"	$\frac{1}{2}$"	$\frac{3}{8}$"	$\frac{1}{2}$"
Standard use	Mini	1100 & Midget	Cooper'S' Midget II	Cooper 997cc	Cooper'S' 1966 •		Racing
Inlet opens BTDC	✕ 5°	✕ 5°	@ 5°	✕ 16°	@ 10°	@ 24°	@ 50°
closes ABDC	45°	45°	45°	56°	50°	64°	70°
Exhaust opensBBDC	40°	51°	51°	51°	51°	59°	75°
closesATDC	10°	21°	21°	21°	21°	29°	45°
Inlet period	230°	230°	230°	252°	240°	268°	300°
Exhaust period	230°	252°	252°	252°	252°	268°	300°
Cam lift	.221"	.250"	.250"	.250"	.250"	.252"	.315"
Valve lift	.285"	.318"	.318"	.318"	.318"	.320"	.394"
Running Clearance	.012"	.012"	.012"	.015"	.015"	.015"	.015"
	(.30 %)	(.30 %)	(.30 %)	(.38 %)	(. 38 %)	(.38 %)	(.38 %)
Part Nos with ‡	12A1065	12G 726	AEG 522	C-AEG567	C-AEG542	-	C-AEG 529
spider pump drive	+	+	⊖AEG 537				
Cam lobe width	$\frac{3}{8}$"	$\frac{3}{8}$"	$\frac{1}{2}$"	$\frac{1}{2}$"	$\frac{1}{2}$"		$\frac{1}{2}$"
Markings	-	-	-	AEG567	AEG543		AEG 530
	-	2 rings	-	-	1 ring		-

For identification see markings and cam lobe width ($\frac{3}{8}$" = 9.5%, $\frac{1}{2}$" = 12.7%)

✕ For checking, set rocker clearance to .019" (.48%)

@ For checking, set rocker clearance to .021" (.53%)

• Fitted from Engine No. 9F-SA-Y/40006

⊖ Fitted to 1275cc Midget and Sprite with engine prefix 12CC-

\+ Fitted to automatic versions of Mini or 1100 range

‡ Part No. 12G 729

N.B. See Mechanical Parts List of appropriate vehicle for full details of changepoints, etc.

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Overheating

Assuming that the cylinder head gasket is not leaking due to distortion and that the correct sparking plugs, ignition timing and mixture are being used, check the running temperature with an accurately graduated gauge. Note the boiling points under pressure - 5 lb/sq.in. 226°F, 7 lb/sq.in. 232°F, 13 lb/sq.in. 246°F and refer to the pressure on the cap.

If excessive temperatures are confirmed, possible causes may be found amongst the following paragraphs.

Examine bottom hose 2A 245 on 'A' series engines in case heater outlet portion protrudes into the main bore. Cut off surplus with a sharp knife or replace if there is any sign of flaking. The water pump should be checked to ensure clearance between vane and body is no more than .020 to .030 in. (.508 to .762 %). The water pump intake bore should be as large as possible and the grinding of a slight taper into the bore will also assist flow. Ensure fan belt tension is adequate.

Assuming the thermostat is working correctly, overheating can result if it is removed without fitting blanking sleeve 11G 176 in its place. Alternatively, the by-pass connection between the head and water pump may be sealed on 'A' series engines.

If the car is fitted with a heater, overheating in traffic can often be prevented by opening the water valve and running the heater so that this acts as an extra radiator. For running under hot conditions, it may be desirable to fit a thermostat which opens at a lower temperature, such as 13H 3584 (74°C, 165°F).

After continual use in dusty conditions, the radiator core may become partially blocked, possibly with leaves and insects. This can be cleared by compressed air or a jet of water used in the opposite direction to normal air flow.

Obstructions to air flow, such as badges, extra lights and rally plates can all cause overheating, and should obviously be reduced as much as possible. If a sump guard is fitted, it is essential to use a large capacity oil cooler, and this is also desirable for competition or motorway use. On the Mini, Cooper and Cooper 'S', use a cooler such as that contained in kit C-AJJ 3309. On the M.G.B. Midget and Sprite full details of oil cooler installations are shown in the Mechanical Parts Lists, but a larger M.G.B. oil cooler is available to Part No. C-ARO 9875, and Part No. ARO 9809 can be fitted to the Midget and Sprite.

On the Mini Cooper 'S', the radiator efficiency has now been improved by changing from 13 gills per inch (25.4 %) to 16 gills per inch (25.4 %). This may be checked by counting vertically the number of horizontal fins in a given height of the radiator core. The latest Part No. ARA 2064 MUST be used with the correct cap ARA 2161 and improved top hose 12G 1164 on the 'S' only. This same radiator ARA 2064 and cap ARA 2161 can also be used on the Mini Cooper, but top hose 12G 104 must be used on this model.

For the Mini range, 6 bladed Fan 2A 998 and Stiffener 2A 803 are the most efficient for cooling. The 11 bladed Plastic Fan 12G 1305 is quietest, but for racing 1 or 2 off 2 bladed Fan C-2A 997 may be used with stiffener 2A 803.

The latest thermostat Part Nos. are as follows:

13H 3584 (74°C, 165°F), 13H 3585 (82°C, 180°F), 13H 3586 (88°C, 192°F).

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