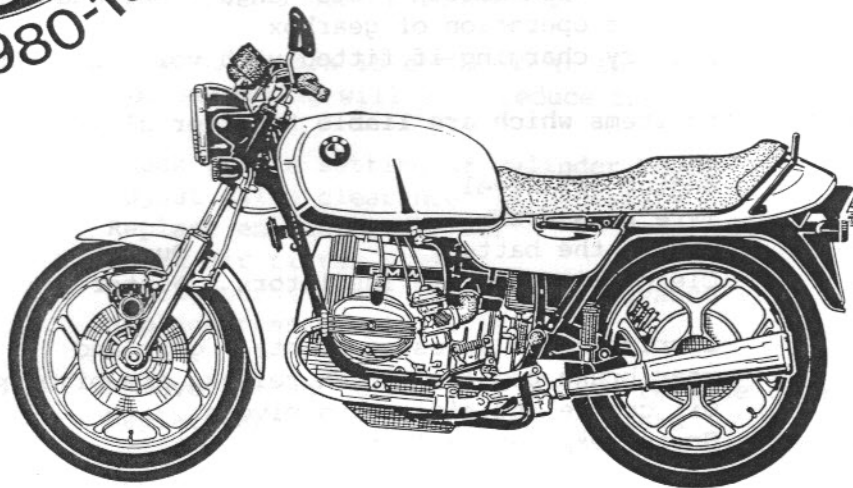


R - SERIES SERVICING

Mike Fishwick



Although it is a very reliable machine, the BMW Twin requires a certain amount of maintenance; the operations involved are not difficult, and are well described in the BMW Rider's Handbook. These operations can be divided into three classes - Inspection, Lubrication, and Adjustment. While all of these tasks can be combined into a 5000 or 10000 mile service procedure, certain of them are equally suitable to be carried out on a periodical basis, irrespective of distance covered.

The purpose of this bulletin is to suggest alternatives to the distance-related maintenance suggested in the BMW Rider's Handbook (Which is a very useful publication) and in some cases to provide greater detail. If you have not previously performed your own servicing, do take care - remember that your life, and those of others, could be affected! **If in doubt, ask!**

Inspection: The inspection of your machine before, during, and after use is the best guide to its' overall condition; if you cultivate an attitude of sympathy towards your machine you will become aware of a problem before it can develop into a serious fault.

Lubrication: Replacement of lubricants and filters is within the abilities of most owners, and is well documented. If you use your machine for short (Less than 20 miles) runs, replace the engine oil more often than specified - about every 2500 miles - as the oil will not become warm enough to drive out moisture.

Adjustment: These tasks include the tightening of cylinder heads, setting of valve clearances and contact breaker, and adjustment of the clutch; these operations are well documented, and do not require unusual tools.

Other adjustments, such as the setting of pre-load levels in the bearings of the Steering Head, Rear Fork, and Wheels, require tools which may not be available to all owners.

TIME-RELATED TASKS:

Daily/Before/In Use: Examine the general condition of the machine

Tyres - tread depth (2mm minimum)
Freedom from leakages (Oils, Fuel, Hydraulics)
Operation of all lights, indicators, and horns
Operation of warning lights
Operation of controls - particularly brakes
Free play in clutch and throttle cables
Operation of dampers and suspension system
Engine-easy starting, reliable idle, good throttle response and performance.
Transmission-smooth clutch engagement and correct operation of gearbox
Battery charging-if fitted with voltmeter

Weekly: Examine the items which are liable to alter slowly

Engine oil level
Tyre pressures
Charge the battery] During
Clean plug caps and insulators] Winter

Monthly:

Lubricate all greasing points - gear and rear brake pedals, clutch release arm pivot
Oil centre and side stand pivots
Grease exposed cable runs

3 Monthly:

Charge the battery
Check battery electrolyte levels
Clean and grease battery terminals
Lubricate rear wheel drive splines
Check float chambers for water content

6 Monthly:

Grease rear fork bearings
Remove and carburettor intake elbows and clean internally.

1 Year:

Change engine, transmission, and fork oil
Change brake fluid
Lubricate control cables and lever pivots
Clean alternator sliprings and brush box
Check battery charging system is able to maintain 12.5 volts with all lights etc on
Remove, clean, and lightly grease brake pads
Clean ignition coil(s) and coat with silicone grease or vasiline
Remove and grease exhaust pipe finned rings
Remove and grease silencer joints etc

(The above checks are most usefully made at the end of Autumn)

2 Years:

Lubricate centrifugal advance mechanism

3 Years:

Remove and regrease pivot bearings of gear and rear brake pedals, and clutch release arm (If post-1981 model without grease points)
Remove fuel tank, drain completely, and dry.

5 Years:

Remove, clean and grease the bearings of both wheels and the rear fork pivots
Strip carburettors and internally clean
Remove and grease front brake caliper spindles and caps of pre-'81 models
Remove gearbox and grease gearbox splines

10 Years: Replace fuel pipes and float chamber gaskets
Replace brake master cylinder seals
Replace Battery and Rectifier rubber mounts

DISTANCE-RELATED TASKS:

5000 MILES: Assuming that the above tasks are carried out on a regular basis, there will really be very little to do at 5000 mile intervals except changing the engine oil!

Change engine oil (Maximum)
Check transmission oil levels
Check and replace/regap spark plugs
Check and adjust carburettors

10000 MILES: A little more work is entailed at this interval, but regular inspection and minor servicing will also reduce the amount of work entailed.

Check torque setting of cylinder heads
Adjust valve clearances if necessary
Replace engine oil filter
Check air filter
Check operation of centrifugal advance
Replace transmission oils

20000 MILES: Remove, clean, and grease clutch release race
Replace starting carburettor gaskets

30000 MILES: Replace air filter (Approximate)
Replace carburettor needles and needle jets - approximate figure - see below

40000 MILES: Remove sump and check security of oil pump
pick-up strainer (Pre-'81 particularly)

MISCELLANEOUS ITEMS:

Timing Chains can last up to 50000 miles (Pre-1980 Duplex type) but the later simplex chains are usually past their best by 30000 or so. The symptom is a knocking from the crankcase area, particularly while idling and hot, when the hydraulic chain tensioner is insufficiently pressurised.

Crankcase Breather Valve discs may produce an "Oinking" noise at idle, which, if the valve is sealing properly - blow down the hose to check - can be cured by drilling a 1mm hole through the disc at the 50% radius point. If this does not effect a cure, check for air leaks into the crankcase through damaged rocker cover gaskets etc. The valve can be replaced by the later reed-valve type if necessary.

Carburettor Needles & Needle Jets wear slowly to increase the amount of fuel which is passed between them. The rate of wear is dependent upon the average engine speed, so causing the smaller, and therefore lower geared models to require replacement before the larger machines. Typical replacement mileages are:

R45/50/60/65 - 25000 R75/80 - 30000 R90/100 - 35000 (See SW Section Technical Bulletin No.3 for details)

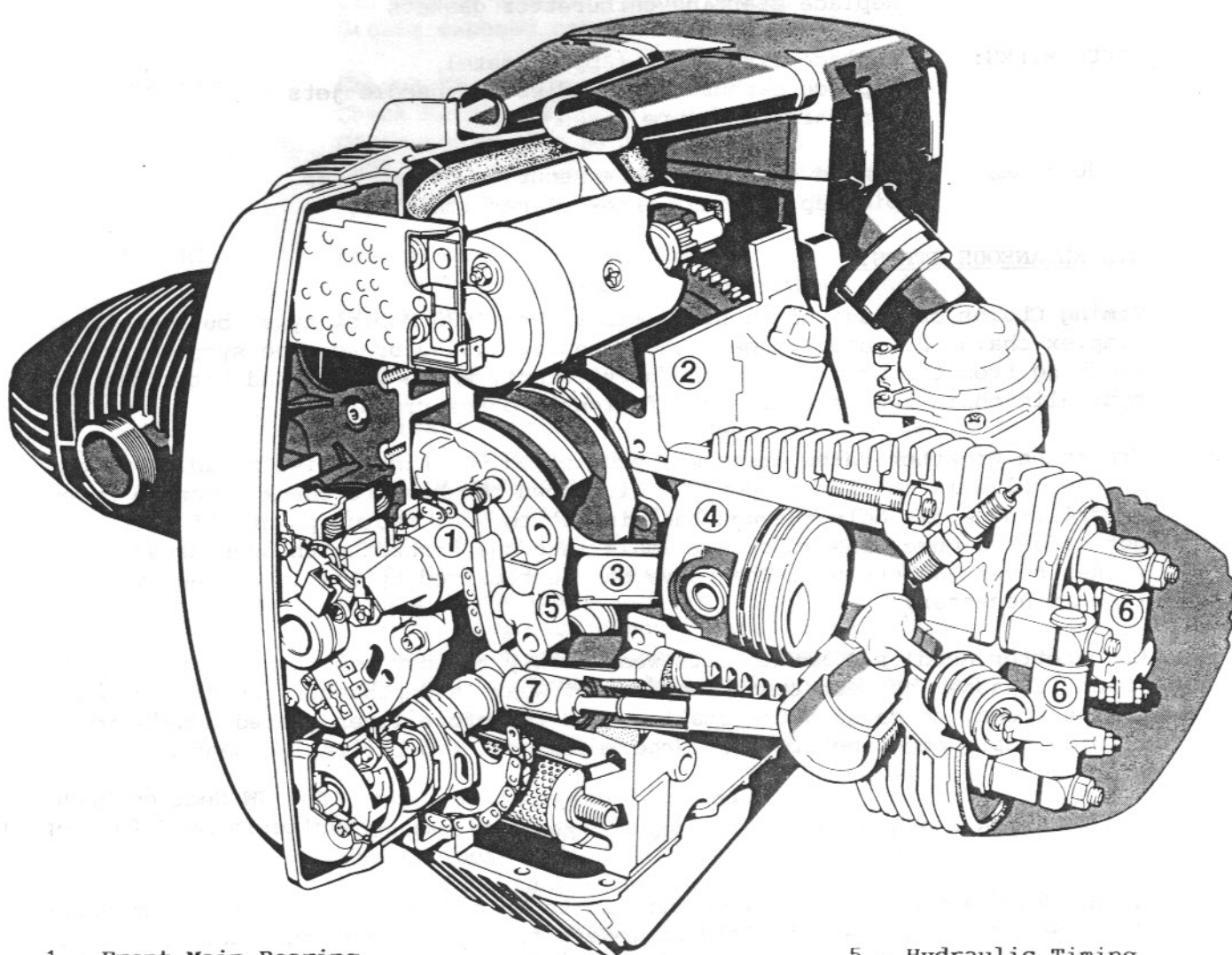
Fuel Additives are generally considered to be a Good Thing, as they compensate for the lack of tetraethyl lead in modern fuels, by providing lubrication for the exhaust valve guide, seat, and upper piston ring. They also reduce pinking by discouraging carbon build-up within the combustion chamber and on the rear of the inlet valve.

Boiling Rocker Covers can be a nuisance on pre-monolever models, and will eventually lead to corrosion of the threads between the rocker cover central stud and the cylinder head if the stud is a little loose. The answer is to drill a 5mm hole into the rocker cover, above the domed nut, to drain the compartment above it which fills with water. Also drill into the cylinder head, approx 10mm above the stud, to allow the water trap in the fins to drain into the rocker cover.

Wheel Bearings should be cleaned and regreased every 10000 miles, but are usually the most neglected items on any machine - particularly the inner rear bearing on machines with spoked wheels, which is difficult to remove! The outer rear bearing is without doubt the most vulnerable of the four used by the pre-Monolever machines, and should ideally be serviced at every tyre change, as, indeed, should all of them!

Do not be tempted to re-use the seals - they cost far less than a new bearing. Use clean white spirit to remove the old grease, and check it for signs of metal particles which may have scaled off the rollers and tracks - this is the first sign of a failed bearing.

If possible, occasionally check the pre-load torque of the bearings after cleaning, as this is a good guide to the general condition of the bearing.



- 1 - Front Main Bearing
- 2 - Crankcase
- 3 - Connecting Rod
- 4 - Piston

- 5 - Hydraulic Timing Chain Tensioner
- 6 - Rockers
- 7 - Cam Follower

Oil Additives: These products - such as Molyslip or Slick 50 - have been used for years, and certainly do no harm. They also appear to produce smoother operation, reduce engine oil consumption, and promote longer life. Slick 50 is also wonderful if used on the Steering Damper rack and pinion drive!

Control Cables: Although lubrication is not absolutely necessary, an annual application of thin oil or Slick 50 does help a lot. The best method is to use a small plastic funnel, the end of which is cut until it is a tight push fit over the ferrule at the end of the cable outer.

Front Forks: Changing the fork oil on an RS generally requires the removal of the handlebars - not a popular job! The use of a ground down hexagon key will permit the filler plugs to be removed easily, and the forks may be refilled by either a suitable syringe, or a funnel with a pipe fitted; A VW Golf GTI fuel filter, with a curved length of copper pipe attached is ideal.

BRAKE FLUID

Always use the recommended DOT 4 brake fluid - this is available at very low cost from your local discount VW spares dealer (Under £5 per litre for genuine ATE fluid) and change it or at least bleed the system annually.

DOT3 or DOT 4? DOT 3 fluid has a higher boiling point than DOT 4, but DOT 4 has a far higher boiling point than DOT 3 when a little water is added.

Silicone Fluid is advertised as being the answer to our prayers; it does not absorb water, or damage paint, is claimed to be a better lubricant for our brake cylinders, and is classed as DOT 5 - surely, then, it must be better? The answer is NO! As silicone fluid does not absorb water, it isolates it into globules, so reducing the boiling point of even slightly contaminated fluid to 100°C. It is **not** a good lubricant, particularly at low temperatures, and because it will readily absorb up to 15% air, it will promote lots of travel in the lever! It will also attack the seals in your braking system, but at least it really does not damage paintwork! All the manufacturers and Type Approval bodies have ceased work on silicone fluid, due to these unsurmountable problems, and so there is no such thing as a DOT 5 brake fluid! If your machine has been filled with this fluid, replace it now, strip and clean the Master Cylinder, and if possible replace the hoses.

STEERING HEAD BEARING ADJUSTMENT

The steering head bearings are required to be tightened until a certain amount of friction is produced, which controls the rate by which the forks rotate as the machine banks to either side. As the action of the steering head is too stiff, the machine will exhibit a tendency to fall at low speeds, and into slow corners; If it is insufficiently stiff, the steering will wander and feel generally uncertain. This level of tightening, or preload, therefore has a decisive effect upon the handling of the machine.

BMW dealers set the preload by use of a guage which measures the amount of effort required to rotate the forks, by comparing it to the pressure exerted by a calibrated spring. This tool is available from the BMW Club, but the setting may be made without it.

Tighten the steering head races until no free play can be felt, and then tighten a little more, until the forks do not fall from the central position, and a little stiffness can be detected in the central position **with the locking screw or ring secured.**

Ride the machine - if the races are too tight, the machine will tend to roll from side to side at about 30 mph with the handlebars held gently between finger and thumb. Mark the top yoke for ease of adjustment, and slacken by increments of about 4mm on the slotted lock ring (Or 2mm if fitted with a locking screw) until the rolling only takes place at very low speeds, but stops when you hold the bars normally.

LUBRICATION

Engine: Remember that the R-Series was designed during the mid-sixties, when engine oils which covered wide viscosity ranges such as SAE 5W-50 were unknown. The current recommendations for the R Series are listed in the Riders Handbook, which now also carries the requirement for the use of an "SF" temperature rated oil. These higher temperature rated lubricants will generally reduce oil consumption appreciably. Basically, an SAE 20-50 grade oil will cover everything except use in an ambient temperature over 105°F, when SAE 40 monograde oil should be used. Even SAE 15-50 lubricants reach their rated limit at 85°F.

Remember also that it takes about 20 miles for the oil temperature to reach a good working level, and begin to attain the thicker end of its viscosity rating; treat your engine gently until it warms up!

Although approval by BMW and dealers is a little variable, synthetic oils such as Mobil 1 and Castrol Syntrax are used with great success by many owners, and it would appear that their greater film strength amply compensates for their low cold viscosity rating. (Mobil 1 - SAE 5-50; Syntrax - SAE 10-60) These lubricants offer superb low and high temperature performance, with reduced losses due to their lower shear strength, and a longer life of 10 to 20,000 miles between changes, depending on usage.

Gearbox: The use of a multigrade oil is to be recommended, as the normal SAE 90 EP types begin to thin out at normal operating temperatures. 85-140 EP oils are available from both Shell (Spirax HD) and Bel-Ray (MC-2). The Bel-Ray product is more expensive, but does not appear to emulsify with moisture, and can also be used in the Rear Drive, although such use is not necessary. The Shell oil should not be used in the Rear Drive as it will promote frothing but is, however, readily available through specialist and agricultural dealers. Either oil will improve the quality of the gearchange, and also reduce the knocking at low idle speeds which all post-1981 models exhibit. The gearbox breathes through a hole in the centre of the battery earth bolt; do not direct a hosepipe onto this during cleaning operations. Lubricate the splines of the Input Shaft with Optimoly PL every five years to enable the clutch plate to free completely.

Drive Shaft: The only problem which is experienced is that of oil being transferred into the gearbox; this is generally due to overfilling, which is easy to do! The official volume of oil is 100cc, which can be well exceeded when filled to a level where the depth may be "Dipped" with a rod, as detailed in the Riders Handbook. Generally speaking, any overfilling will be transferred to the gearbox until 110cc remains. The driveshaft breathes into the gearbox via a slot above the rear gearbox seal.

Rear Drive: The only general problem is an occasional bout of frothing through the breather; this may be caused by a blocked breather, overfilling beyond the **bottom of the filler plug threads**, or the use of an unsuitable oil. Remember that not all SAE 90 EP oils are also suitable for the pressures produced within a hypoid gear train - always use "Hypoid" rated oils.

The pre-1981 Rear Drive is provided with a Witness Hole below the spindle nut; this communicates via angled drillings to the area immediately outside the main oil seal, so that any small leakages will be noticed before they become serious. It was a good idea, but as the hole soon became blocked with road debris, and could not be cleaned without stripping the entire Rear Drive, it was discontinued.

Rear Drive Splines: The recommended Molykote BR2 appears to be both expensive and hard to obtain, but an equivalent is available from any FIAT dealer, in the form of FIAT MRM 2 grease, used for drive shaft CV joints of FIAT and Lancia cars - their recommended alternative is Molykote BRM 2! Dip a thin screwdriver into the grease, and apply it into the splines on the wheel, rotating the screwdriver to wipe it clean against the splines.

CONTACT BREAKER UNIT

The 1969-79 models employ a system in which the contact breaker points are mounted on a circular plate on the front of the timing chest, while the automatic advance bobweights and cam are mounted on the camshaft nose. The auto advance unit is therefore in front of the contact breaker, which impedes access for contact breaker adjustment.

Careful rotation of the engine will improve matters, as will the use of a slim bladed screwdriver to attack the contact breaker clamping screw. Remember to set the contact breaker to maximum lift before checking or adjusting their gap.

If it is necessary to alter the static ignition timing, rotate the engine to provide easier access to the clamping screws, make a **small** adjustment, and tighten the screws before running the engine to check the timing.

Should the timing lamp reveal two close sets of timing marks, the cause will probably be a worn timing chain, but in more extreme cases may be either a badly worn cam lobe, which can be checked by measuring **both** contact breaker gaps, or a bent camshaft nose, which may be checked by use of a dial test indicator. It may be possible to carefully straighten the nose, but the easiest option is to fit an electronic ignition unit which uses optical triggering, such as a Pirana system - small variations in the position of the shutter disc will have no effect.

Maintenance is basic - check the gap (0.015") every 5000 miles, and lubricate the pivots of the auto advance unit every 2 years. In extreme cases it may be found that the cam lobes have partially (Or completely) siezed onto the camshaft nose; the entire auto advance unit may be easily withdrawn after removal of the central nut. **Take great care**, however, that this nut is not overtightened when being replaced - this is how the camshaft nose becomes bent, or in some cases even sheared off! Lubricate the cam lobes with a little grease every year or so.

The **capacitor** is mounted above the alternator, and is used to join the contact breaker wire to the black wire from the RH coil.

The engine front cover seals around the contact breaker via a rubber joint, which is usually difficult to replace accurately' a little lubrication, and the use of a torch to view through the ventilation slots, will help.

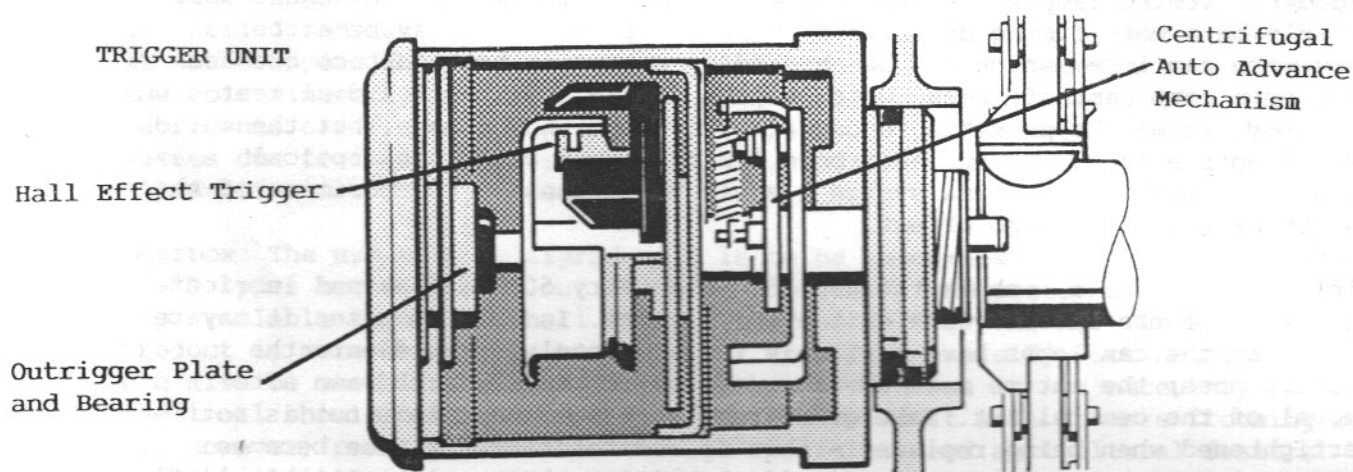
The 1979-80 models employ a contact breaker unit which is contained within a housing clamped to the timing chest, and coupled to the camshaft by a slotted coupling. This unit, which is basically the lower portion of a VW Polo distributor, has several advantages - it can be removed from the engine for easy adjustment or replacement of the contact breaker, the gap does not vary at speed due to the use of an outrigger bearing above the cam lobes, and the enclosed auto advance unit does not have the free play of the older type. It **is also interchangeable** with the later Electronic Ignition Trigger Unit, and can be easily fitted in case of an electronic failure, particularly if a suitable wire has been installed from the coil(s) to the Trigger Unit.

Maintenance is similar to the older type, but easier - the entire unit can be easily removed, and held in a vice, while the plate which carries the outrigger bearing can be removed for contact breaker replacement.

Every 2 Years or so oil the felt pad which lubricates the outrigger bearing (Sewing machine oil is ideal) grease the cam lobes, and work a little oil between the cam lobes and the main shaft. Lever out the oval shaped cover on the side of the unit, and rotate the coupling until the bobweight pivots and springs can be lubricated. Operate the auto advance unit to ensure that it is free, and returns completely. always replace the sealing O-ring, as they invariably leak if reused.

When fully advanced the bobweights make contact with plastic - covered stops; the plastic is therefore compressed, and gradually becomes thinner with the result that the range of the auto advance unit is increased, so providing a little extra advance at higher speeds. On the smaller engines it will therefore become necessary to slightly retard the static timing.

A variety of **after market electronic ignition systems** are available, the best value being the well-proven Boyer Bransden ID (Inductive Discharge) type, which has the advantage of retaining the contact breaker as its trigger; in the very unlikely event of electronic failure reversion to orthodox ignition is straightforward. This unit is particularly suitable for use with the 1979-80 type of contact breaker. The magnetically triggered Boyer Bransden capacitive discharge system dispenses with the auto advance unit, providing a modified, pre programmed advance curve. The optically triggered Pirana system retains the auto advance unit.



BOSCH ELECTRONIC IGNITION SYSTEM (Transistor Zundenlage)

This system is basically identical to that used on many cars, such as VW, BMW, Opel etc. It is magnetically triggered by a Hall Effect circuit contained within a housing which is otherwise identical to the 1979-80 contact breaker unit. The system comprises two units, the trigger unit and the amplifier unit.

Trigger Unit: The Hall Effect trigger is provided with 5 volts positive and negative power supplies, which are produced within the amplifier unit. Rotation of a steel shutter exposes the Trigger to a magnet, which causes it to change its output from positive (coils switched on) to negative (coils switched off) The Trigger Unit is connected to the Amplifier Unit by a three core cable, joined by a plug and socket above the alternator.

Amplifier Unit: This 'Black Box' switches the coils in sympathy with the change in polarity of the output from the Trigger Unit. Power is taken from the Green/Blue wire, Earth from the Brown, and the coil(s) are connected to the Black. All connections are made via a multi-pin plug, which is secured by a wire clip.

Maintenance: Although BMW claim that this system does not require maintenance, it requires a little help to stay in top form:

Every **Two Years** disconnect the Trigger Unit plug and socket, and check that they are clean - the slightest amount of corrosion or dampness between the pins will bypass the Trigger Unit, and cause the Amplifier to stop switching. Should this occur while riding, the engine will stop, and the tachometer will read very high as it does so. It may restart, but will not pull or run cleanly - just like water in the contact breaker of an orthodox system!

Every **Two Years** lubricate the auto advance mechanism and outrigger bearing, as described above for the 1979-80 models.

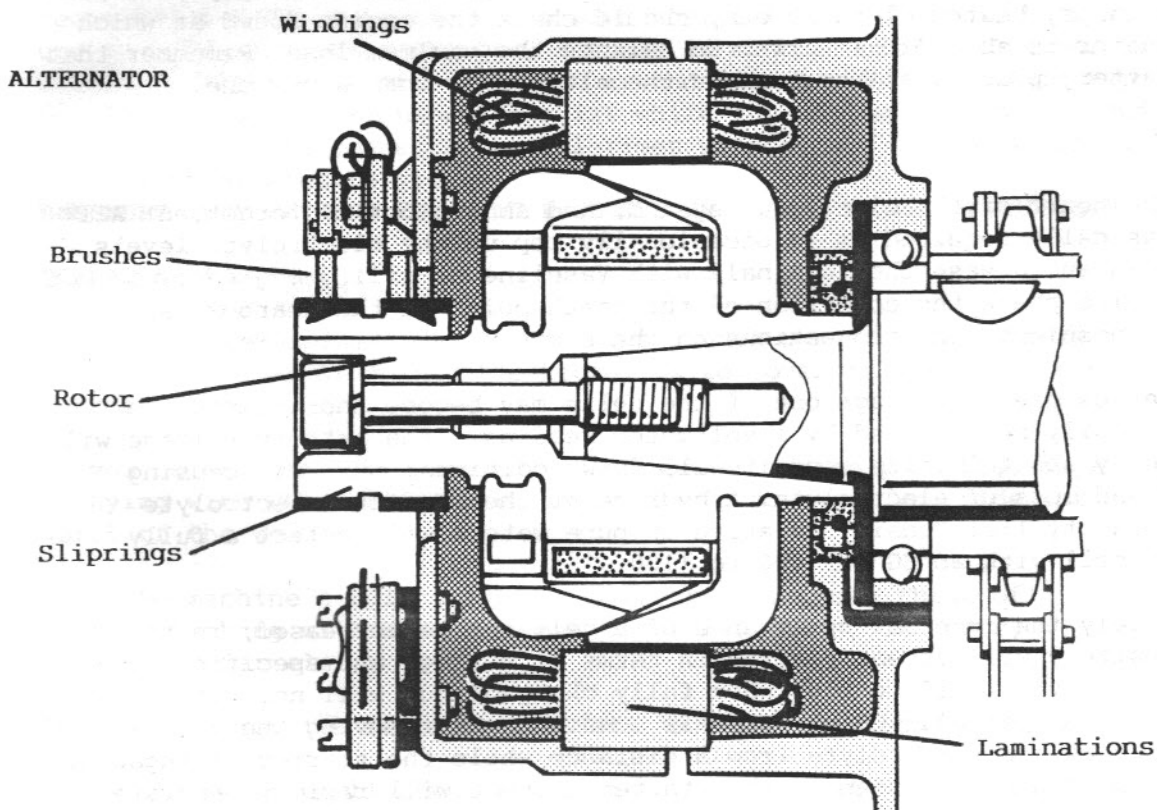
Every **Ten Years** remove the Amplifier Unit, clean its mating surface and that of its heat sink, and re-coat with a suitable heat transfer compound, which may be obtained from specialist electronic suppliers such as RS Components dealers etc. Apply an even and thin coating to each surface, taking care not to overtighten.

Due to the high voltages produced by this system, tracking will take place if the HT system contaminated with water or salt - spark plug hygiene is well worth the effort, particularly during winter, when a little salt can produce a rough and gutless engine! Take great care to clean the insides of the plug caps as well as the plug insulators, and coat their surfaces with silicone grease.

ALTERNATOR

At the beginning of winter it is a wise precaution to ensure that the alternator is in top form, otherwise you may experience that sinking feeling in the battery! Remove the engine front cover, taking care that it does not make contact with the live terminals of the rectifier. Run the engine, and check that the carbon brushes do not oscillate - this would be a sign of sliprings which have become eccentric.

Disconnect all the cables, taking care to note their positions - particularly the black and brown wires to the brush box. Remove the three socket screws, and withdraw the alternator stator from its spigot in the timing chest; careful use of a screwdriver may be necessary - take care not to damage the windings.



Check the positions of the brush springs, and make a sketch of their relative positions if you have not carried out this procedure before. Withdraw the brushes from the brushbox, noting that their copper tails should be on one side - a recess is provided for them in the sides of the brush box.

Carefully clean the alternator stator with a little white spirit, paying particular attention to the brush box, brushes, all insulators, and the windings. Spray with WD-40, wipe off, and leave to dry while cleaning the rotor and sliprings, including the gap between them. **Do not polish the sliprings - a dark brown coating is correct!** Ensure that the sliprings are not worn or ridged - if you suspect that they have become eccentric, check them with a dial test indicator, and have them skimmed if necessary.

Measure the brushes, and replace them if less than 10mm long on their outer edges - this is a soldering job. Refit the springs, and make sure that they are correctly positioned. Ensure that the edges of the stator laminations and the spigot in the timing chest are clean, and lightly grease them to ease replacement.

Replace the brushes in their boxes, withdrawn sufficiently for the springs to press against their sides and hold them in position - if you cannot do this, guide them over the sliprings with a piece of thin card. Carefully replace the stator, secure it, and reconnect the wires. **CHECK THAT THEY ARE IN THE CORRECT PLACES!**

Press the brushes onto their sliprings, and visually check that they have made contact. Carefully pull the brush tails, and check that the brushes are returned by their springs. Turn on the ignition, and check that the red battery charge warning lamp is illuminated - if not, check again that the brushes are seated properly.

Measure the battery voltage, start the engine, check that the warning light goes out, and that the voltage increases. Remember that this will not begin until about 1500 rpm, or 900 rpm on the very latest (1992 spec) machines. If your machine is fitted with a voltmeter check its accuracy against another known meter; a small variable resistor for calibration purposes is fitted, which can be adjusted with an **insulated** screwdriver via the lampholder hole. (Some older types require the voltmeter to be opened up)

Your machine should be able to maintain 13.5 volts with all the (standard) lights and heated grips are turned on; users of high output headlamps, and/or auxiliary lamps, heated clothing etc, should check the engine speed at which the alternator is able (If at all!) to balance the maximum load. Remember that an aged battery place a higher load on the alternator than a new one.

BATTERY

This is the heart of the electrical system, and should not be forgotten! All that is basically required is to occasionally top up the electrolyte levels, and to clean and grease the terminals with Vaseline or silicone grease. Do not forget to also check the condition of the earth point on the gearbox casing, and when convenient, the connections on the starter motor solenoid.

When batteries die of old age one of the cells may become short circuited, which may easily be detected by a voltmeter reading - the battery voltage will be reduced by about 2 volts, and it will draw additional current, causing "Gassing" and loss of electrolyte. A hydrometer check of the electrolyte specific gravity (ie: Density relative to pure water) will detect a fully discharged cell with an SG of 1000 to 1100.

Alternatively the internal resistance of a cell may be increased; in this case the battery will appear healthy in terms of voltage and specific gravity of the electrolyte (1250 to 1300 when fully charged) but will not rotate the engine easily, if at all. Check for this condition by removing the filler plugs, and view the electrolyte **from a distance** while the starter is engaged; if a cell is of high resistance, the starter current will rapidly generate enough heat to cause it to boil.

When selecting a new battery remember that even if the capacity and maximum rated current of two batteries are about the same, a German battery (Bosch, Varta, Mareg, Sonnenschein) has to provide these values to DIN Standards, which are considerably higher than the SAE Standards employed by the Taiwanese etc! For example, the DIN standard requires that the rated current be passed for 60 seconds, rather than the 30 seconds required of the SAE Standard.

If you demand reliable starting of a 1000cc twin which has stood outside for a week in sub-zero temperatures by a two year old battery, you will require a DIN Standard battery; if you ride an R80 during the summer only, an SAE Standard should suffice; as in all other things, you get what you pay for!

BATTERY CHARGING

The alternator on a BMW twin may provide lots of power at high speeds, but is restricted at lower speeds by being driven at crankshaft speed - when riding slowly, with lights and heated grips etc in use, the battery will slowly run down. BMW therefore recommend that the battery be recharged every two weeks during winter; this is not always possible, and an alternative to this is simply to reduce the loading on the alternator to provide extra power for battery charging.

This reduction may be made by use of a 20 watt tungsten-halogen Pilot Lamp bulb, which is available from specialists such as Tim Harman. This is ideal for use in urban areas, and is almost indistinguishable from a dipped headlamp, except that it does not dazzle other people. Users of earlier RS and RT models will need to couple the unused lamp holder to the spare Grey/Black terminal on the connection board, while owners of monolever models can either run a new wire from the fusebox, or feed the Pilot Lamp from the existing parking light. **Do not** use a 20 watt bulb in the existing RS/RT parking lamp, as the reflector is made of plastic, and will be melted by the heat produced by the higher power!

Should your battery still require charging, the most convenient method is via the BMW power socket, which, unless your charger is of a particularly barbaric design, will NOT harm your rectifier diodes, electronic ignition system, heart pacemaker etc! Use of the socket for this purpose is, indeed, recommended by BMW. **Check that your plug is connected with the same polarity as the socket!**

If the charge current is restricted to about 2 amps, the only extra requirement will be to check the electrolyte level from time to time; ideally, use a constant-voltage charger, such as is manufactured by Gunson, and is available from Argus stores etc at around £20. A charger of this type simulates the conditions which exist while the engine is running, and may therefore be left connected at all times without any problems, and will not cause loss of electrolyte.

REMEMBER THAT BATTERY CHARGING PRODUCES HYDROGEN, WHICH IS EXPLOSIVE!

PREPARING FOR WINTER

Winter is always unkind to motorcycles - even BMWs! The only answer, if you do not bring the machine into the house, is to cover it with some type of anti-corrosive coating.

If you do not use your machine during winter, or only on good days, regular spraying with WD-40 or similar will do. If, however, you ride through the worst of the weather, the answer is:

Give the machine a full service - everything you can think of!
Coat everything with Waxoyl except the brake discs, exhausts, heads, and barrels.

Regularly spray the heads and barrels, and the handlebar controls, with WD-40.

If you have any doubt about the battery, replace it, and carry a set of lightweight jump leads. (2.5mm cable will do nicely)

By the end of the year your BMW will look disgusting, but will still be clean under its coating of filth! At the end of March you will be able to clean off the Waxoyl etc with white spirit and Jizer to reveal a pristine machine.

Laying Up for the winter will require the same general procedures, with the addition of emptying the float chambers and fuel tank - modern petrol will evaporate by about 60% during a six month period, leaving compounds which will promote carbon growth and poor performance.

REAR FORK PIVOT ADJUSTMENT

First make sure that the Drive Shaft tube is central about the drive shaft - if not it will foul the drive shaft as the suspension operates - by checking that the clearances on either side are equal, and screwing the threaded adjusters on each side to suit, after releasing their locknuts with the necessary 27mm socket, the outside diameter of which has been reduced to enter the frame lugs.

When the fork is centralised, and both adjusters are fully hand tight (To settle the bearings) tighten one locking nut. Slack off the other adjuster, and tighten it to a torque of 7-9 lb-ft. to preload the bearings. Hold the adjuster with a 6mm hexagon key, and tighten the lock nut as far as possible, using the spanner provided in the pre-1981 tool kit (It is still available at about £5) Fully tighten with the 27mm socket.

MONOLEVER REAR WHEEL STUDS

The recommended torque setting for the rear wheel studs is so high that the only risk is that of leaving them slack! Even with the spanner and its extension it is very difficult to tighten fully; Coat the threads with a little grease, and you may stand a chance of stressing the studs correctly. Don't worry - BMWs don't break easily!

VALVE REPLACEMENT

It is said that BMW Twins tend to drop their exhaust valves into the cylinders when they grow old - this unpleasant thought is denied by BMW, who blame persistent over revving as the real culprit, but it is confirmed by several independent repair specialists as a fact of life; probably the truth is somewhere between, with a carefully driven machine not giving problems. Some R45s have been known to suffer from this, at about 35,000 miles, and some R80s at about 50,000. At least one sensibly-used R100RS has covered over 150,000 miles without even removing the heads; The choice is yours!

BRAKE PAD DE-LAMINATION

The original equipment "Textar" brake pads fitted to the 1981-84 models - the first fitted with Brembo brakes - are well known for their tendency to deteriorate during prolonged damp conditions by swelling and separating into layers. This rate of deterioration is increased if the machine is not used during winter, and stored in damp conditions. The ATE pads fitted to pre-1981 models do not appear to suffer from this problem.

Although most modern asbestos-free pads are susceptible to this illness by varying degrees, the use of Ferodo or Lockheed pads will reduce it to minimal levels, reduce wear on the discs, and also provide more progressive "feel", particularly at low speeds.

Pad life will be extended if, after washing the machine, or at the end of a long wet ride, make sure that the brakes are well used, in order that the pads and disc drillings are dried out before storage.

TAIL PIPE DEPOSITS

A good guide to the overall mixture strength is the colour of the tail pipe deposit; a black, sooty deposit indicates an excessive richness, while whiteness shows an overweak mixture. When set correctly, the tail pipes should show a deposit which is medium grey at low speeds, and light grey at higher speeds. these deposits will take some little time to accumulate, unless the mixture strength is over rich; a long run, or a week of commuting will provide sufficient deposits to provide a good guide to the internal conditions. **Unleaded** fuel, however, always produces a sooty appearance, regardless of mixture strength.

VALVE CLEARANCES

A certain clearance is specified between the valve stem and the tip of the rocker to ensure that small clearances exist between throughout the valve train - between the cam lobe and follower, the follower and pushrod, pushrod and rocker, rocker bearings, and rocker and valve. Oil is therefore able to enter each gap to prevent wear, and valve lift will commence at the desired position of the camshaft. The size of this clearance is dependent upon the size of the engine, the materials used (Aluminum or iron) and the design of the cam lobes. In the case of modern BMW twins it is:

Model	Inlet	Exhaust
R45/65	0.006	0.008
OTHERS	0.004	0.006

*NB - All dimensions
shown in inches

Procedure: As the clearance is set with the cam lobe at zero lift, it is essential that the camshaft is set accurately in the correct position. On BMW Twins the best method of achieving this is to position the crankshaft in the Top Dead Centre position on the compression stroke **for the cylinder being checked.**

- (a) Remove rocker covers and front cover of engine, and the rubber grommet over the flywheel timing marks.
- (b) Rotate engine **clockwise**, using the socket screw in the alternator rotor (6mm key) until the **inlet** valve of the cylinder has **just closed**. The piston is now rising to the TDC position.
- (c) Continue to rotate the engine until the TDC mark on the flywheel (**OT**) has lined up with the datum mark on the crankcase. Both valves may now be checked.
- (d) Check the valve clearances, gently levering the rocker arm away from the valve stem - this will ensure that the total clearance between the valve and camshaft is taken up.
- (e) If it is necessary to adjust the clearance, be sure that you:

- (1) Hold the (inner) adjuster with one spanner (12mm) while slackening the (outer) locking nut. This will ensure that the setting is not disturbed more than necessary. Slack off the lock nut only as little as is necessary to rotate the adjuster.

- (2) Make your adjustment in very small steps - remember that one turn of the adjuster is equal to 0.040" Set the clearance so that the feeler gauge cannot be pulled out; the clearance will increase slightly as the adjuster is drawn into the rocker when the lock nut is tightened.

- (3) Hold the (inner) adjuster while tightening the (outer) lock nut, and check the clearance, which will be correct if the feeler gauge can just be pushed in and out of the gap.

The valve clearances specified for BMW twins are very small - a typical car will be around 0.012" while some are up to 0.028" - so do not be discouraged if it takes a little time to set them! Remember that an error of 0.001" is a change of 25%!

IGNITION TIMING

The ignition timing may be checked by two means, statically - with the engine stopped, and therefore in the retarded condition, or dynamically, with the engine running, using a timing lamp to observe the operation of the centrifugal advance unit, viewing both the retarded and advanced settings.

Static: With the ignition 'on' and a voltmeter connected between the black wire (+) on the contact breaker unit and earth (-) rotate the engine until the meter reads 12 volts. The contact breaker will now have just opened, and the 'S' mark should be aligned correctly. If you have electronic ignition the plugs may be connected and laid across the cylinder head to provide visual indication of the spark, instead of using the voltmeter. If adjustment is necessary, set the crankshaft to the "S" mark, and rotate the contact breaker in an **Anticlockwise** direction until the contacts open (Or the spark occurs)

Dynamic: With the engine warmed up, connect a suitable timing lamp to one of the plug leads. The Inductive type of lamp is to be preferred, as these clip around the insulation of the plug lead, and do not involve the use of bare high voltage connectors. With the engine at idle, the 'S' mark should be aligned, and as the engine speed is slowly increased it will move upwards, being replaced by the "Z" mark at about 3000 rpm.

It may be found that the "S" and "Z" marks do not both align, as the advance unit wears with use to increase its range by about 4° or so. Generally speaking, the R100 engines prefer to be slightly advanced at speed, while the R45/65 prefers a little retard, and the R80 would sooner be correctly timed. Remember that the fully advanced setting is the important one.

CLUTCH ADJUSTMENT

The purpose of the clutch adjustment procedure is to set the release arm to the position where it will provide the maximum amount of leverage when the clutch diaphragm spring is providing the maximum opposing pressure, and to also provide a certain amount of free play between the components of the clutch release bearing, pushrod, and clutch pressure plate.

Pre-1981 Models: Adjust the cable length so that the clutch release arm makes an angle with the cable inner of just under 90° and set the pushrod adjuster (On the release arm) to give the cable 3-4mm of free play in the cable.

Post-1981 Models: Adjust the cable length to give a dimension of 200mm between the rear face of the gearbox front flange (Where the clutch cable outer is seated) and the forward face of the release arm (Against the cable inner) and set the pushrod adjuster to provide 3-4mm of free play in the cable.

OIL FILTER

Although BMW recommend that the oil filter be replaced every 5000 miles, it must be remembered that this is based upon the Five Series models which were produced during 1969. Since then lubricants have improved considerably, with sludge deposits now being virtually unknown. Extension of the filter life to 10000 miles is therefore quite acceptable, and is in line with most modern cars.

When replacing the filter element, ensure that your dealer sells you the correct type - models with the thermostatic oil cooler - RS and RT models - use a longer element than the others. Both lengths of element are available in rigid and bendy types, the bendy type being far easier to replace, particularly if the machine is fitted with crash bars and a fairing.

Always replace the "O" ring below the filter cover, and also the shim and gasket if damaged. Replace the shim into the filter housing first, and fit the gasket and "O" ring onto the cover. the older filter elements required small "O" rings to seal their ends, but later elements have built-in seals.

CARBURETTOR ADJUSTMENT

(See SW Section Tech.Bulletin No.3)

WARNING

Remember that it is easy to damage the carburettor-do not force anything! Also remember that petrol-particularly Lead Free-is not only inflammable, but is also bad for your health. White Spirit is preferable as a cleaning medium.

ADJUSTMENT

If the carburettors are to be correctly adjusted it is essential that they be in good condition, otherwise the effort involved may well be wasted in a futile attempt to cure basic problems such as wear, air leaks, and blockages by adjustment. (See SW Section Technical Bulletin No.3 for details)

Given that the carburettors are in good condition, ensure that the engine is really hot - say after a 20 mile ride - that the float chambers are free of water, and the starting carburettors are in the "Off" position (Their levers should be in the lower position.)

Check that the throttle return springs are in good condition, and that the throttle spindles are well lubricated. If the throttles do not always fully close it may be necessary to bend the lower spring anchor to provide a little more pressure on the throttle arm.

The use of a metal extension between the spark plug and the cap is very useful - **DO NOT remove the plug caps when the engine is running...** it will damage the coils, and possibly yourself!

The use of vacuum gauges is not absolutely essential - it is possible to obtain a smooth engine without their use, and the R75/5 carburettor is not, indeed, provided with a vacuum gauge connection - but they do make the task easier, quicker, and far more accurate. The best type are the simple ones - tubes with one end in a reservoir of mercury, and the other connected to the vacuum take-off at the front of the carburettor. It is, of course, possible to manufacture your own, using water as the medium, but the length of the tubes will be greater.

Idle Adjustment:

1. Slack off the throttle cable adjusters to provide 2-3mm of play.
2. Adjust the Throttle Stop screws to obtain the required idle speed, and an equal level of vacuum (ie: Mercury) on each cylinder.
Remember that to raise the vacuum/mercury level for a given engine speed the throttle of that carburettor must be closed, and that this action will reduce the engine speed, so reducing the vacuum level on the other cylinder. The reverse will, of course, take place if the throttle is opened.
3. When the engine is idling at a reasonable speed and equal vacuum levels, progressively weaken the Idle Mixture - by screwing the adjusters clockwise - until the cylinder begins to run roughly. Richen by turning the adjuster back a quarter of a turn.
4. The idle speed will probably have risen during this process - reduce to the required level.
5. Using a clean screwdriver, short circuit each spark plug extension to the cylinder head, and note the reduction in engine speed. Make small adjustments to the Idle Mixture until both cylinders are able to take the strain equally.

By shorting the spark plugs, we are comparing the power being developed by each cylinder - this is the product of the throttle opening and the mixture strength. As we know that the throttles are opened by identical amounts (ie the vacuum levels are identical) any difference must be caused by mixture.

It is therefore possible to have a very rough idle, with identical vacuum levels, if there is a large difference in mixture strength...the makers of vacuum gauges never tell you!

Pick Up Adjustment:

6. Reduce the free play of the throttle cables to a minimum - about 1mm - and slowly open the throttles until movement of the mercury columns is observed.

7. Adjust the cables until both columns fall from the Idle level together, but return to the Idle level when the throttle is closed.

One column will probably rise before the other - the throttle of the 'lower' side is therefore further open than that of the 'higher' side.

At this point in the proceedings it may be observed that one column rises and one falls - the 'falling' throttle is opening, and the 'rising' throttle is not opening.

8. Progressively tighten the locknuts of the cable adjusters, and check the vacuum levels as you do so, making small adjustments as required. Vacuum levels should be within 0.5 of a centimetre or less.

9. Open the throttles slowly, and allow the engine to run to around 4000 rpm; observe the vacuum levels, which should be reasonably close. At this stage they are controlled by the movement of the Pistons - any gross difference is likely to be caused by defective diaphragms or air leaks into the Upper Chamber.

10. Any signs of intermittent variations in vacuum levels are usually caused by air leaks - likely sources are the rubber mounting tubes, or loose cylinder head adaptors. Leaks from either source are manifested as severe vibration when the throttles are closed at high speed, when the high vacuum levels produced will draw air through any imperfect joint.

Colourtune:

The BMW twin - at least in one litre form - has such a variable combustion characteristic that use of a Colourtune to set the mixture strength will actually result in an over rich idle mixture. It would appear that the mixture in the area of the spark plug is far weaker than in the rest of the combustion chamber, and is therefore unrepresentative of the average conditions.

Needle Position:

In general, the BMW twin prefers to run as weak as possible, subject to performance levels not deteriorating. The benefits of using the No.2 (Next to lowest) Needle Position on the majority of engines with is now well proven (With the exception of the R80/7 and R100S & RS of 1978 vintage) in terms of power, smoothness, and economy. Even the current monolever R100RT will benefit. An American tester recorded an extra 3 bhp after similar changes to an R100GS with US-spec 32mm carburettors.

Needle Adjustment:

Adjustment of the Needle Position on the older type of carburettor is performed by pulling or pushing the Needle in the required direction, and simultaneously twisting it.

When adjusting the Needle position on these older types of carburettor it is essential that care is taken not to bend it, or damage the surface - hold it between FINGER AND THUMB only, and if necessary grip the Needle with a piece of fine abrasive paper (eg: 400 grade wet and dry) taking care to wipe the surface afterwards.