Oilhead Maintenance Manual

R850, R1100, R1150, R1200

Internet BMW Riders and Oilhead Riders

Edited by Carl Kulow

Send comments/corrections to
kulowc@indiana.edu

ISBN R-850-1100-1150-1200
Third Edition
2-25-02

The authors have done their best to produce accurate information. However, they assume no liability for any damage or injury caused by any errors or omissions in this manual. Use at your own risk.

TABLE OF CONTENTS

Section I – by Carl Kulow

Cold Engine and Drivetrain Procedures

Hot Engine and Drivetrain Procedures

Other procedures

TABLE OF CONTENTS (CONTINUED)

Section II – by Various Authors

Section III - Super Tuning! by Rob Lentini

Introduction

There are three main sections to this manual as follows:

Section I – by Carl Kulow

This section consists of basic maintenance procedures that were done on an R1150GS, 2001. Once you remove the various plastic covers from an R, RT or RS, the procedures should essentially be identical to those given here.

Section II – by Various Authors

Generally, this section contains more detailed instructions than those found in Section I, especially Stephen Karlan's very detailed write-ups. This section also contains procedures that are not part of the normal maintenance schedule.

Section III – by Rob Lentini

This section is the real masterpiece of this manual, containing Rob Lentini's "Zero = Zero" surging fix and other gems.

Note to RT and RS Riders: for many of the following procedures, you will need to remove the side panels as described in your owners manual "Service and Technical Booklet" except RT: instead of pulling the mirror off as the manual says, hold the back of the mirror (front of bike) with one hand while you hit the front outside corner of the mirror with the palm of your hand thus knocking the mirror off.

Note: When performing maintenance on your bike, be sure that you consult multiple sources of information such as your owner's manual, www.ibmwr.org/, and the various bike specific lists. Haynes, Clymer, and BMW have maintenance manuals with pictures and instructions that are invaluable – get one of each for your bike.

Service – Every 6K Miles

Engine oil and filter - change
Brake fluid – check
Brake pads – check
Clutch fluid – check
Sidestand – grease
Sidestand switch – check
Spark plugs – check
Valves – adjust
Throttle cables – check
Throttle Bodies - synchronize

Inspection – Every 12K Miles

Transmission gear oil – change
Rear drive gear oil – change (every 24K miles)
Fuel filter – change (every 24K miles)
Battery fluid level – check
Battery – electrolyte level, clean/grease terminals
Air filter – change
Alternator belt – change (every 36K miles, some R1100 at 24K miles)
Wheel bearing play – check
Swing arm bearing play – check
Spark plugs – change

Annual Service

Brake fluid – change
Clutch fluid – change (every 2 years)

TOOLS

socket set, metric
hex bit socket set (allen), metric (Sears)
ratchet
extensions
wrenches – open end/box, metric
hex wrenches (allen T-handle), metric
torque wrench
pliers
screwdrivers
feeler gauges
oil filter wrench
oil drain pan
motorcycle toolkit (BMW)
rubber gloves (dishwashing)
flashlight, minimag
measuring cylinder (photo store)
Twin Max or carb stix
Mityvac or “one man brake bleeder”
tire change tools (see tire change instructions)

PARTS

Parts

spark plugs
oil filter
air filter
brake pads
oil - 4 qt.
gear oil - 1 1/4 qt.
alternator belt
fuel filter, o-ring, clamps
crush washers for:
- oil drain plug
- transmission fill and drain plugs
- rear drive fill and drain plugs

Misc.

compressed air
anti seize paste
carb or brake cleaner
rags
BMW #10 grease
flexible tubing (tygon)
grease
chain lube
brake fluid (DOT 4)
distilled water

Cold Engine and Drivetrain Procedures

Check Alternator Belt

Tools	Parts
T-handle hex – 4mm	none

Note: In most cases the alternator belt does not need to be checked any more. Early models should have the pulley and belt upgrade that came out a few years ago. Current recommendations are that the belt is installed and adjusted, then not disturbed until 36K when replacement is specified.
1. Remove the four bolts holding the black plastic alternator belt cover at the front of the engine, 4mm T-handle hex.
2. Remove the cover by sliding it straight down.
3. Check the belt for cracks or shredding.
4. Check the belt tension, quite tight, ~1/4" deflection when you press on the center.
Note: Paul Glaves suggests that proper belt tension is when you can twist the belt ~90 degrees, midway between the pulleys. If you can twist it more than 90 degrees, it is too loose. If you cannot twist it 90 degrees, then it is too tight.
5. Leave the cover off for the valve adjustment procedure on the next page.

Change Alternator Belt

Tools	Parts
T-handle hex – 4mm	alternator belt
socket – 13mm	
ratchet	
wrench – 13mm	
torque wrench	

1. Remove the four bolts holding the black plastic alternator belt cover at the front of the engine, 4mm T-handle hex.
2. Remove the cover by sliding it straight down.
3. Loosen the 2 nuts and 1 bolt, 13mm, that hold the alternator – one is on top and one is on each side, thus allowing the alternator to pivot down.
4. Remove the old belt. (Some bikes have a pipe that traps the belt – loosen it enough to get the old belt out and the new belt in)
5. Install the new belt being sure it is properly seated.
6. BMW calls for a tensioning torque of 5.9 ft.lb. (8 Nm) on the adjuster bolt on the left side of the bike. You have to get at this bolt from the alternator side and you may have to lift the tank. Alternatively, you can pry the alternator up with a large screwdriver to tension the belt.
7. Once the belt is under proper tension, tighten the 2 nuts and 1 bolt, 13mm, to 15 ft.lb. (20 Nm).
8. Check the belt for proper tension (see above) and proper seating alignment.

Valve Adjustment

Tools	Parts
T-handle hex – 3mm, 5mm, 6mm	none
plug wire cap puller	
sparkplug socket	
short extension	
ratchet	
rag	
hex socket - 6mm	
long thin screwdriver	
box wrench – 10mm, 16mm (17 will work)	
small flashlight	
feeler gauges	
sharp awl	

1. Remember – engine cold!
2. Bike on centerstand.
3. Transmission in neutral.
4. Remove the black plastic valve cover protectors, if installed, using a 5mm T-handle hex wrench.
5. Remove the black valve cover strip by pulling outward on the end where the plug wire goes under it.
6. Pull the plug wire cap off the sparkplug using the special black plastic tool in your BMW tool kit.
7. Before removing the sparkplug, blow compressed air around the plug well – there is often dirt here that can fall into the cylinder when you remove the spark plug!!!

Note: If you do not have an air compressor, you can get a compressed air tank at any Xmart automotive department, or you can get a small can of compressed air at any photo or computer supply store.

8. Repeat again after turning the spark plugs a couple of turns.
9. Remove the spark plugs using the tool kit spark plug socket or 5/8 in. deep well very thin wall socket.

Warning!: It is very easy to get a spark plug socket stuck in the plug well. If your socket does not slide onto the spark plug easily, do not use it!!! Use the spark plug socket in the BMW tool kit instead. I welded a nut onto the end of my BMW socket so I could use a torque wrench on it when installing the spark plugs.

10. Place an oil drain pan under the valve cover.
11. Remove both valve covers using a 6mm hex socket and ratchet.

Note: Loosen the valve cover bolts until you can pull them part way out. They stay in the valve cover – do not try to pull them all the way out.

Note: The valve covers may stick slightly and you will need to tap them firmly with the palm of your hand or a rubber mallet.

Note: Be careful not to dislodge the black rubber vibration damper block in the bottom front of the valve adjustment area (not on some R1100).

12. Remove the black rubber timing hole plug, located above and behind the right side throttle body, using a long thin screwdriver to pry it off.
13.Turn the lower alternator pulley clockwise with a 16mm box wrench.
14. Insert a long screwdriver into the right side spark plug hole while turning the engine over.
15. When the screwdriver is almost pushed out the maximum, use a flashlight and start looking for the timing marks S – OT in the small timing window where you removed the rubber plug. (some R1100 = Z – S – OT)
16. Center the OT mark in the window.

Note: Also at OT, the arrow on the cam chain gear will be pointing straight out.

17. Wiggle the valve rockers in and out on both sides - both the intake and exhaust valve rockers for one side should wiggle slightly in and out, the rockers on the other side should be tight.
18. You will be adjusting the valves on the side where they all wiggle slightly as follows:

Valve Clearance

Intake = .006in. (.15mm)
Exhaust = .012in. (.30mm)

Valve Location

Intake Valves are to the rear (take air/gas in from the throttle body).
Exhaust Valves are to the front (exhaust to the exhaust pipes).

19. Adjust the proper valves, located as described above, using a 10mm box, 3mm hex T-handle, and feeler gauge(s) as given in the following steps.

Note: Each intake and exhaust has two valves each that are operated by a forked rocker. Correct procedure calls for you to use two identical feeler gauges simultaneously – one for gauging the valve you are adjusting, and the other as a spacer on the other valve. This is to prevent the rocker from canting while you are adjusting it. Many people get excellent results using only one feeler gauge and skip the spacer feeler gauge.

20. Insert the correct feeler gauge between the valve stem and the adjuster screw. There should be slightly firm drag on the feeler gauge – be sure that you do not have the gauge canted or curved as you are measuring.

Note: One method is to insert the feeler gauge and tighten the adjuster until the feeler gauge will not slide, then back off the adjuster a little until the feeler gauge begins to slide.

Note: You can use the “go, no go” method – a .008in. gauge should not go into the .006 intake; a .014 should not go into a .012 exhaust if adjusted properly. A .007 gauge will go into the .006 intake and a .013 gauge will go into the .012 exhaust, but will give a too tight drag.

21. If any valve needs adjusting, loosen the adjuster lock nut with a 10mm box wrench and turn the adjuster screw with a 3mm hex T-handle to get the correct clearance – slightly firm drag on the feeler gauge.
22. Slide the box wrench over the shaft of the 3mm hex T-handle and hold the adjuster screw with the 3mm hex T-handle while tightening the lock nut with the 10mm box wrench (6 ft.lb or 8 Nm)

Warning! It is very easy for beginning mechanics to strip low torque threads - eg. 6 ft.lb. Use a short grip on 10mm and smaller wrenches. It is also very easy to strip low torque threads with a torque wrench because many torque wrenches are improperly calibrated. Also, with click type torque wrenches it is very easy to not feel the click at low torque settings and then your torque wrench becomes a large breaker bar and you end up stripping the threads.

23. After tightening, double-check the clearance.
24. Rotate the engine 360 degrees to the same OT mark by turning the lower alternator pulley clockwise with a 17mm box wrench as in step 13.
25. Check the rockers on the other side for wiggle – they should all wiggle slightly
26. Now adjust the valves on this other side.
27. Clean the valve covers of any dirt or oil on its sealing edge.
28. Wipe the oil off the valve cover gasket to help ensure no oil leaks. Place it onto the head so that the edge with 3 notches goes to the top. Be sure all the notches are fit into the corresponding studs on the head.
29. Be certain the center donut gasket is in place on the valve cover!!!
30. Carefully replace the valve cover so as not to dislodge the center donut gasket.
31. Evenly tighten the 6mm hex bolts until they bottom out - 6 ft.lb (8 Nm).
32. Replace the small black rubber timing hole plug.

Warning!: Be careful!!! It is fairly easy to push it all the way through. I use a sharp awl and stab the plug in the center to hold it. I then place the plug so its right lip is under the timing hole edge and then use a long thin screwdriver to push the left lip into place.

33. Leave the black valve cover strips and the valve cover protectors off until you are done with the spark plugs in the next procedure.

Spark Plugs

Tools
T-handle hex –5mm, 6mm
plug wire cap puller
sparkplug socket
short extension
ratchet
rag
hex socket - 6mm
small flashlight
spark plug gauge
torque wrench
anti-seize paste

Parts
spark plugs

1. The spark plugs were removed in steps 1 – 9 of the preceding valve adjustment procedure. Be sure to read the Warning! following step 9 of the valve adjustment procedure.
2. Replace plugs every 12K miles.
3. Visually inspect the spark plugs and check each for abnormalities – carbon or oil deposits, burned or cracked electrodes, etc.
4. If installing new plugs (every 12K miles), check that they are still set at the factory set gap of .031 in (0.8mm).
5. Very lightly coat the plug threads with anti-seize.
6. Install the plugs by hand using only the spark plug socket to avoid any possibility of cross-threading them.
7. Torque the plugs to 15 ft.lb.(20 Nm).
8. Push the spark plug wire caps firmly onto the spark plugs.
9. Replace the black valve cover strips by putting the two rear tits into place at the spark plug wire and then pushing the front in until it snaps into place.
10. Replace the valve cover protectors using the 5mm hex T-handle – start the bottom center bolt first - short screw goes to the front.
11. Replace the alternator cover – try to get the oil line brackets lined up first and start the top right bolt first since you may need to push the oil line bracket to get the bolt started – same with the bottom right bolt.

Air Filter

Tools	Parts
phillips screwdriver	air filter
rag	
compressed air	

1. Remove the rear and then the front seats.
2. Unscrew the two phillips screws holding the air filter cover down (some bikes have clips).
3. Pivot the cover up.
4. Remove the old filter and inspect it for damage or replace it with a new one.
5. Place a rag tightly over the air intake where the air filter sat and blow all the dirt and dead bugs out of the filter housing and air horn.
6. Insert the air filter being careful to seat it properly.
7. If the cover hinges came unhooked from their holes, pivot the cover up as high as it will go and hook the hinge tabs into their holes by pivoting the cover down.
8. Fasten the cover by tightening the two phillips screws (or clips).

Warning!: The air filter housing is a prime candidate for a mouse nest and the air filter for use as nesting material. Especially after winter storage be sure to check your air filter. Or screen off the air horn opening during storage so mice can’t get in there in the first place.

Lube Side Stand and Center Stand

Tools	Parts
wire	none
grease gun	
chain lube	

1. Remove the debris from the small grease hole (not found on some R1100) at the rear of the pivot point on the side stand using a small wire or carb or brake cleaner if necessary.
2. Use a cone tip adapter on your grease gun to grease the side stand or use chain lube.

Note: Some bikes may have zerk fittings.

3. Spray the center stand pivot bushings with chain lube.

Lube and Adjust Clutch Cable (some R1100)

Tools	Parts
phillips screwdriver	#10 grease

1. Adjust maximum slack at the clutch lever
2. At the rear of the transmission pry the clutch release arm to release the clutch cable there
3. Lube both ends of the clutch cable with BMW #10 grease
4. Reattach the cable at the transmission
5. Using the knurled adjuster at the hand lever adjust to 12mm between it and the knurled locknut
6. At the clutch release arm loosen the 13mm locknut using a 13mm deepwell socket and swivel
7. Adjust the 10mm bolt to give 7mm freeplay at the hand clutch lever
8. Pull in the hand clutch lever while tightening the locknut at the rear clutch arm

Brake and Clutch Fluid

Tools	Parts
phillips screwdriver	brake fluid
towel	

Note: Some R1100's do not have a hydraulic clutch. See previous procedure.

Note: Brake fluid can ruin the bike's paint, so cover the tank and any painted or plastic parts with a towel if you are adding or changing fluid!!!

Front Brake Fluid Reservoir

1. Put the bike on the centerstand.
2. Turn the handlebar straight ahead so the reservoir on the right handlebar is level.
3. Check the fluid level in the sight glass of the reservoir.
4. Add only DOT 4 brake fluid if the level is at or below the LOWER level mark.

Rear Brake Fluid Reservoir

1. Put the bike on the centerstand.
2. Check the fluid level in the rear reservoir that is located on the right side just below the seat.
3. Add only DOT 4 brake fluid if the level is at or below the LOWER level mark.

Note: If either the front or rear is low on fluid, be sure to check the brake pads for wear! As the pads wear, more fluid is taken into the system.

Clutch Fluid Reservoir

1. Same as Front Brake Fluid Reservoir above, but on the left handlebar.

Brake and Clutch Fluid Replacement – Bleeding the Brakes

Note: BMW calls for a fluid change annually. Good brakes are too important to skip this relatively straightforward procedure.

Note: There are some devices that aid in bleeding the brakes as you replace the fluid:

1. Mityvac is a small hand held vacuum pump that sucks the brake fluid down and out through the bleeder nipple at each brake caliper. It is available at most auto parts stores.
2. Speed Bleeder is a one way valve bleeder nipple that replaces your stock bleeder nipples. It is available at www.speedbleeder.com

3. One Man Brake Bleeder is a one way valve that attaches to your stock bleeder nipple via a hose. It is available at some auto parts stores.
4. A turkey baster is handy for removing the old fluid from the reservoir before you add the fresh fluid. Once you use it for brake fluid, do not return it to the kitchen.

Note: If bleeding by the standard method of pumping the lever, do not pull the lever all the way to the handlebar or you will force the caliper piston too far out and possibly ruin the seal. This applies to the clutch and rear brake as well.

Note: On the 1150 GS, BMW has a plug or grub screw instead of a bleeder nipple on the right front brake caliper and on the clutch slave cylinder. BMW wants you to replace these with a bleeder nipple to bleed the system and to then reinstall the grub screw when you are finished.

Note: For brake bleeding procedures see page 42.

Brake Pads

Tools	Parts
phillips screwdriver	brake fluid

Note: Check front and rear pads for wear and replace them if they have less than 1 mm of pad left. Remove the right saddle bag so you can do a good inspection of the rear pads. See the section on brake pad replacement.

Warning: Due to a sticky rear brake retaining pin, the rear pads can wear out in only a few thousand miles. Clean the pin with fine emery paper and lube it with anti-seize. See the section on brake pad replacement.

Note: If either the front or rear brake fluid reservoir is low on fluid, be sure to check the brake pads for wear! As the pads wear, more fluid is taken into the system.

Note: Be sure to check the brake fluid reservoir after replacing the pads as fluid is forced back into the reservoir by the new thicker pads – the reservoir may be too full.

Battery Inspection

Tools
flashlight, minimag
phillips screwdriver
hex socket – 6mm
ratchet

Parts
distilled H_2O

Quick Check Method
1. Place the bike on the centerstand.
2. Remove the front seat.
3. Hold a minimag flashlight right up against the battery, at the expected electrolyte level, and next to the cell you are checking.

Note: I have a 4 cell minimag type flashlight that is brighter and works somewhat better than a minimag.

4. Gently rock the bike so that the battery electrolyte sloshes back and forth. It is this movement of the electrolyte that you are able to see.
5. Repeat for the other cells.
6. If the electrolyte level is low, follow the Standard Method below.
7. Reinstall the front seat.

Standard Method
1. Remove the seats.
2. Remove the right side black plastic panel below the fuel tank.
3. Remove the fuel tank bolt, 6mm hex socket, right side of fuel tank – be careful not to lose the nut on the inside and the bushing in between.
4. Slide the tank straight back as far as it will go.
5. Check the battery electrolyte level from in front of the tank.
6. Fill to the max level with distilled water only – use a squirt bottle with a small hose attached.
7. Clean and grease the battery terminals.
8. Reinstall the fuel tank being sure the black rubber connectors at the front of the tank are in place.
9. Buy a sealed maintenance free battery and skip steps 1 – 8.
10. Leave the tank off if you are doing a fuel filter change.

Warning: On bikes with Motronic 2.4 (1150), when you disconnect the battery or the battery dies, settings that are stored in the Motronic 2.4 memory are lost. After disconnecting the battery or removing the Motronic fuse (#5), switch on the ignition and then fully twist the throttle all the way open once or twice. This will restore the throttle valve settings to the Motronic memory. This does not apply to Motronic 2.2.

Fuel Filter

Tools
siphon
empty gas can
rubber gloves
pencil
hex bit socket – 6mm
socket – 8mm
ratchet

Parts
fuel filter
large tank o-ring
2 small hose clamps
2 tiny hose clamps

Note: The following is based on the procedure for my R1100R which should be similar to other oilheads.

1. Ride the bike until you are almost out of gas or siphon the gas from the tank.
2. Remove the seats.
3. Remove the right side black plastic panel below fuel tank.
4. Remove the fuel tank bolt, 6mm hex bit socket, right side of fuel tank.
5. Set the tank to the side of the bike – lawn chair with an old blanket to prevent scratching the tank.
6. With the tank on its side, remove the fuel pump plate, 8mm socket.
7. Disconnect the fuel overflow and vent hoses – the 2 small hoses inside the tank, noting which hose goes where.

Warning! Do not get any of the hoses mixed up! Label them.

8. Remove the pump unit from the tank.
9. Replace the fuel filter noting the direction of flow.
10. Reconnect the new fuel filter using the 2 small hose clamps.
11. Insert a new o-ring into the tank groove.

Note: The original o-ring swells and will not fit unless you let it “dry” for a few days.

12. Insert the pump unit into the tank.
13. Reconnect the 2 small hoses being sure to connect the striped hose to the striped hose using the 2 tiny hose clamps.
14. Evenly tighten the fuel pump plate, 8mm socket.
15. Install the fuel tank.
16. Check for any leaks

Miscellaneous

Tools	Parts
tire gauge	none
sockets	
hex bit sockets	
ratchet	
torque wrench	
powdered graphite	
T-40 Torx bit socket	

1. Check tires for nails, tread wear, damage, etc.
2. Check tire pressure.
3. Check rear wheel lug bolts, 17mm socket, torque to 105 Nm.
4. Check the front wheel – axle bolt, 30 Nm, - axle clamp bolts, 22 Nm.
5. Check all nuts and bolts.
6. Check all lights.
7. Check horn.
8. Check all air and oil hose clamps.
9. Check the throttle cables.
10. Check for debris in the throttle cable pulleys.
11. Check rotor rivets.
12. Lube locks with powdered graphite.
13. Check the front wheel bearing.
14. Check the rear wheel bearing.
15. Check the swing arm bearings.
16. Check the spokes front and rear – tap them with a box wrench, if they are properly tensioned they will “ping” at various pitches when tapped. If too loose, you will hear more of a thud sound – tighten the spoke until it pings, T-40 Torx. It is generally recommended that you do NOT try to true these wheels yourself, only tighten the occasional loose spoke.
17. Splines – it is generally considered that the splines do not require lube maintenance. If you find it necessary to do a spline lube see page 74 for a detailed procedure.

Sump Guard Removal (GS only)

Tools
socket – 10mm
ratchet
channel lock pliers

Parts
loctite(?)

Note: Before you do the test ride, remove the sump guard (skid/bash plate) from the bottom of the engine in preparation for the oil and filter change after your test ride. It is much more pleasant to do before the engine is hot.

1. Remove the four nuts holding the sump guard on, using a 10mm socket and ratchet

Note: If the rear (or front) studs come out with the nuts, loctite the studs into the engine block after you remove the nuts. Once off, the nuts can be removed by holding the rubber spacer with channel lock pliers. The rear nuts are self-locking and will remove more easily after a few removals. (R1100GS may have the self-locking nylock nuts front and rear).

2. Clean the stones, dirt, and dried mud from the sump guard plates.

Note: If you do not ride your GS offroad, you can consider leaving the sump guard plates off permanently for easier oil changes.

Test Ride Bike

1. Take the bike out for a test ride, ~15 min., to get the bike to operating temperature for the throttle body sync and fluid changes in the next several procedures.
2. After the ride, check for oil leaks around the valve covers.

Hot Engine and Drivetrain Procedures

(i.e. normal operating temperature)

Throttle Body Sync

Tools	Parts
Twin Max or carb stix	none
screwdriver, flat blade	
needle nose pliers	
wrench, 10mm	
house fans	

Note: If you are doing this procedure for the first time, you should seat the brass bypass screws and record the number of turns for each. Return the screws to where you found them. Also make a note of the number of threads at some reference point on the right throttle body cable adjuster. All this is so you can get back to the same starting point if you mess up.

1. Engine hot at the normal operating temperature of 5 bars on the RID.
2. Bike on the centerstand, transmission in neutral.

Note: If you are experienced with this procedure, it only takes a couple of minutes – including several double checks. If you have never done a throttle body (TB) sync or your TB's are really out of sync, it could take much longer and you should place 1 or 2 house fans blowing on your engine to help keep it from overheating.

Note: You may need to slacken the throttle body cables. See pages 53 - 59.

3. Turn on the Twin Max to warm up it up to help prevent drifting from the zero calibration setting.
4. Remove the vacuum hoses from the bottom of each throttle body (TB).
5. Attach the Twin Max hoses to each TB, left hose to the left TB, right hose to the right TB.
6. Calibrate the Twin Max by setting the sensitivity to max and then zero the needle.

Idle Speed Adjustment and Balance

7. Start the engine.
8. Turn the Twin Max sensitivity down if the needle is fluctuating too much, but get it back to or close to maximum sensitivity as you do the final adjustments.
9. Adjust the large brass bypass screw on each TB to get an idle speed of ~1100rpm - turn both out, counterclockwise, to increase the idle speed

- turn both in, clockwise, to decrease the idle speed.

10. Adjust the same large brass bypass screw on each TB to get the Twin Max to zero i.e. to balance the TB's at idle. You can turn just one of the screws for a minor adjustment, or both screws in opposite directions if the balance if off quite a bit. The screws should be within ~1/2 turn of each other when you are finished.
11. Shut the engine off and recheck that the Twin Max is still calibrated to zero.
12. Start the engine and double check the idle speed adjustment and balance.

"High" Speed Balance

Note: It used to be recommended to do this adjustment at ~3000 - 4000 rpm or normal cruising rpm where surging would be most noticeable. However, Paul Glaves points out that an adjustment at just off idle will be more accurate because any difference between the throttle plates, left to right, will be a higher percentage difference in the airflow and vacuum.

12. With the grip throttle, raise the rpm's to just off idle, ~1500 rpm.
13. The Twin Max needle should remain at zero, if not you will need to adjust the right side throttle body cable.
14. Loosen the right TB cable locknut, located just to the left of the right TB, using a 10mm wrench.
15. To get zero at off idle, turn the adjuster on the above cable as follows:

clockwise – moves the Twin Max needle left
counterclockwise – moves the Twin Max needle right

Note: Since the adjustment usually changes when you retighten the locknut, it may be easiest to turn the adjuster a little in the correct direction eg. 1/8 turn, and then tighten the locknut with the 10mm wrench while holding the adjuster with needle nose pliers. Now look at the Twin Max to check your adjustment at off idle. Keep repeating small changes of the adjuster and tightening the lock nut until you have zero at off idle.

16. Turn the engine off and recheck that the Twin Max is still at the zero calibration.
17. Start the engine and do a quick double check of the idle speed adjustment and the off idle (high) speed adjustment.
18. Turn the engine off and remove the Twin Max hoses from the TB's.
19. Reconnect the vacuum hoses to the TB's.

Note: For more detailed instructions see pages 53 - 59.

Engine Oil and Filter Change

Tools
oil filter tool
hex bit socket – 8mm
ratchet
torque wrench
rubber gloves
funnel
oil drain pan
rag

Parts
oil – 4 qts.
oil filter
crush washer - drain plug

1. Remove the sump plates (skid/bash plates) – see page 18 for instructions.
2. Be sure the engine is hot (go for a short ride).
3. Place the oil drain pan under drain plug (bottom right side of engine).
4. Wear rubber gloves - oil is carcinogenic, plus when you accidentally touch the hot headers!!! or get hot oil!!! on your hands it won't hurt as much.
5. Remove the oil drain plug located to the right of the oil filter, 8mm hex bit socket.
6. Remove the oil filter, oil filter tool and ratchet.
7. Remove the oil filler cap to help draining.
8. Let drain for ~10 min.
9. Use the rag to remove any dirt from around the drain plug area and from the oil filter well.
10. Install the drain plug with a new crush washer and torque to 23 ft.lb. (32 Nm).
11. Fill the new oil filter with fresh oil.
12. Apply a thin coat of oil to the new oil filter rubber gasket.
13. Install the new oil filter and give it ¾ - 1 turn after first contact.
14. Add 3.75 – 3.9 qts. of oil total (NOT 4 qts.!!!) using a funnel or oil spout.
15. Install the oil filler cap.
16. Run engine at idle for 2 – 3 min.
17. Wait ~10 min. and check to be sure the oil level is at the dot in the center of the sight glass.
18. Check for any oil leaks at filter and drain plug.

Note: You may get more consistent oil level readings if you put the bike on the sidestand for a few minutes and then put it on the centerstand.

Transmission Gear Oil Change

Tools
hex bit socket – 8mm
socket – 13mm
ratchet
short extension
oil drain pan
carb or brake cleaner
torque wrench
clear tubing (tygon)
funnel
measuring cylinder (photo store)
rag

Parts
gear oil, synthetic (75W/90) 1000cc
crush washers
- drain plug
- fill plug

1. Put the bike on the centerstand.
2. Place the oil drain pan under the drain plug.
3. Remove the drain plug on the right side of the transmission just above the brake pedal, 8mm hex bit socket. (some R1100 transmission drain plugs are just below the fill plug, hidden up the “tunnel”, 13mm socket).
4. Remove the fill plug on the right side of the transmission just above the drain plug, 8mm hex bit socket.
5. Clean the metal filings from the magnetic drain plug using a rag and carb or brake cleaner.
6. Install the drain plug using a new crush washer, torque to 22 ft.lb. (30 Nm). (Some R1100’s do not use a crush washer on the transmission drain plug). (Some R1100’s torque the drain plug to 17 ft.lb. (23 Nm)).
7. Fill the transmission with 1000cc (1.06 qt.) of synthetic gear oil using the flexible tubing and a funnel – fill to the bottom edge of the filler hole. (Some R1100’s specify 800cc – check your owners manual)

Note: I use tygon tubing from the hardware store – one end goes into the fill hole and a funnel is inserted into the other end.

8. Install the fill plug using a new crush washer, torque to 22 ft.lb. (30 Nm) (Some R1100’s torque the fill plug to 17 ft.lb. (23 Nm)).

Rear Wheel Drive Gear Oil Change

Tools
socket – 19mm
hex bit socket – 6mm
ratchet
oil drain pan
carb or brake cleaner
torque wrench
funnel
measuring cylinder (photo store)
rag

Parts
gear oil, synthetic (75W/90) 250cc
crush washers
- drain plug
- fill plug

1. Put the bike on the centerstand.
2. Remove the right saddle bag.
3. Place the oil drain pan under the drain plug.
4. Remove the drain plug on the bottom center of the rear wheel hub, 19mm socket.
5. Remove the fill plug at the rear of hub, 6mm hex bit socket.
6. Clean the metal filings from the magnetic drain plug using a rag and carb or brake cleaner.
7. Install the drain plug using a new crush washer, torque to 17 ft.lb. (23 Nm).
8. Fill the rear wheel drive with 250cc (0.26 qt.) of synthetic gear oil using a funnel – fill to the bottom inside edge of the filler hole threads.
9. Install the fill plug using a new crush washer, torque to 17 ft.lb. (23 Nm).

Sump Guard Installation (GS only)

Tools
socket – 10mm
ratchet

Parts
none

1. Reinstall the sump guard (skid/bash plates), 10mm socket.

Note: The front nuts with their metal sleeve will tighten up normally. However, the rear nylock nuts will not get tight because of the rubber spacers above the plates – so just tighten them until they are snug. (R1100GS may have the self-locking nylock nuts front and rear).

Other Procedures

Brake Pad Replacement

Tools
hex bit socket – 8mm
ratchet
hammer
punch (nail?)
screwdriver, flat blade
torque wrench

Parts
brake pads

Note: I have not done this procedure on an R1150GS yet, so the following is based on the procedure for my R1100R which should be similar.

Note: Many riders are particularly pleased with EBC pads which can be ordered through any motorcycle dealer from Tucker-Rocky.

Front Pads (2 sets) - - - - - all R1100's = EBC # FA246

Rear Pads - - - - - - - - - - - - - GS, R, RT = EBC # FA245
- - - - - - - - - - - - - - - - - - -RS = EBC # FA171

The EBC pads may not be a perfect fit. The front pads may need very gentle filing where they touch in the top inside corners (see where the paint is worn off on the OEM pads). The top rear corner of the rear outside pad needs some grinding or filing so that it fits - hold the EBC pad back to back with the opposite OEM pad (inside pad) to see where and how much of the backing plate to remove. This may sound like a hassle but it is quite easy to do.

Note: Anti-rattle springs - Some riders remove the anti-rattle springs from the original OEM pads by drilling them out and then riveting them to the new EBC pads which do not come with springs.

Note: Several riders on the GS list have reported that they are pleased with the Galfer pads and the EBC HH pads.

Note: Be sure that your front brake reservoir is not over full - less than max! You do not want to force brake fluid out the reservoir when installing the new pads! Cover your fuel tank as a safety measure to prevent accidental overflow of brake fluid from eating your paint!!!

Note: Pay special attention to the rear outside pad when inspecting for wear as many riders are wearing this pad out as early as 6K miles!

Front

1. Place the bike on the centerstand.
2. Remove the front caliper bolts that hold it to the fork leg, 8 mm hex bit socket
3. To remove the caliper, gently rock it back and forth on the rotor to spread the brake pads.

Warning! Do NOT compress the front brake lever while the calipers are removed!

4. Remove the keeper from top of the caliper with pliers.
5. Drive out the pin from wheel side with a hammer and punch
6. Remove the old pads.
7. Push the wheel cylinders in all the way with your thumbs.
8. Insert new pads (no anti-rattle spring on EBC pads).
9. Drive in the pin, turning it with a screwdriver so the keeper hole is on top.
10. Insert the keeper
11. Spread the pads again if necessary.
12. Install the caliper onto the rotor.
13. Install the caliper bolts, torque to 30 ft.lb. (40 Nm).
14. Pump the front brake lever until pressure returns!!!!!
15. Repeat for the other front caliper.
16. Pump the front brake lever until pressure returns!!!!!
17. Check the brake fluid level in the front reservoir.

Rear

Warning: Due to a sticky rear brake retaining pin, the rear pads can wear out in only a few thousand miles.

1. Place the bike on the centerstand.
2. Remove the saddlebags.
3. Remove the keeper from the pin.
4. Drive out the pin from the keeper side (drive toward the wheel).
5. Remove the caliper bolts that hold it to the rear drive, 8 mm hex bit socket.
6. To remove the caliper, gently rock it back and forth on the rotor to spread the brake pads.

Warning! Do NOT compress the rear brake pedal while the calipers are removed!

7. Remove the old pads.
8. Grind or file the EBC pads to fit (see note above).
9. Insert new pads.
10. Clean the pin with fine emery paper and lube it with anti-seize.
11. Drive the pin in.
12. Insert the keeper.
13. Install the caliper onto the rotor.
14. Install the caliper bolts, torque to 30 ft.lb. (40 Nm).
15. Pump the rear brake pedal until pressure returns!!!!!
16. Check the brake fluid level in the rear reservoir.

Tire Change

Tools
hex bit socket –6, 8mm
ratchet
socket – 17mm
screwdriver
pencil
wood frame of 2x2” (16” sq. OD)
bead breaker (JC Whitney)
balancing stand (homemade)
tire irons, 3
tire lube
paint brush (for applying lube)
valve core tool
heavy rubber mallet
razor knife
dish soap
compressed air supply
alcohol
rag
torque wrench
short extension
rear wheel axle adapter (BMW)
axle to fit adapter (BMW)
tape
grease

Parts
tires
wheel weights

Front Wheel Removal

1. Place the bike on the centerstand.
2. Weight the rear of the bike so it will not rock forward.
3. Remove both sets of calipers, 8mm hex bit socket to remove the 2 bolts holding each caliper to the bottom of the fork leg
4. To remove the caliper, gently rock it back and forth on the rotor to spread the brake pads.

Warning! Do NOT compress the front brake lever while the calipers are removed!

5. Remove the axle “nut” (bolt) from the left end of the axle, 17mm socket
6. Loosen the axle clamp bolts several turns, 6mm hex bit socket.
7. Note carefully the orientation of the speedometer drive unit so you get it installed correctly later on!!!
8. Insert a screwdriver into the end of the axle and pull and twist to remove the axle while supporting the tire (watch for the spacer on the right side).
9. Roll the wheel out.
10. Now is a good time to take a good look at the brake pads.
11. Check the front wheel bearing.

Front Tire Change

Hints: Warm the tires in the sun! A warm tire goes on much more easily.
When levering the last of the tire bead onto the wheel, be absolutely certain the opposite bead is not seated but rather squeezed into the middle of the wheel.
Put just the wheel, no tire on it, on the balancing stand and check for the heavy spot and use that rather than the tire stem for the heaviest spot.

Tire Removal

1. Place the wheel on the wooden support frame to prevent rotor damage (or remove the rotors, 5mm hex bit socket).
2. Mark the direction of rotation on the wheel so you don't put the new tire on backwards!
3. Remove the valve core with the valve core tool being careful not to let it get launched.
4. With the wheel in the wooden frame, break the bead all around on both sides with the bead breaker being careful that it does not slide into the wheel and scratch it
5. Lube the bead on one side with tire lube.
6. Pry off the first side with 2 or 3 tire irons (tape them with electrical tape or duct tape to avoid scratching the wheel).

Note: The GS has very thick rim edges and regular rim protectors do not fit. Also because of the thick rim edges, tire irons tend to slip off unless you insert them a little farther than usual.

Note: There is a bit of a trick to getting the second side off. Proceed as follows:

7. Lube both sides of the second bead extra well – this is the hard one to remove.
7. Stand the tire and wheel vertical
8. With 1 or 2 tire irons reach into the wheel and pry the second side over the edge of the wheel (pry it part way off) and hold it there under tension.
9. Take the heavy rubber mallet and pound the tire off the rest of the way.
10. Clean the wheel of any dirt. Clean off any old rubber from the wheel where the tire seals.
11. Remove the old wheel weights with a razor knife and alcohol.
12. Balance just the wheel to confirm (or not) that the valve stem is the heaviest spot. Mark the heavy spot if different than the valve stem.

Tire Installation

13. Align the painted tire balance dot with the tire stem or heavy spot on the wheel!!! and the correct direction of rotation!!!
14. Lube the first bead of the new tire and push it on with hands, knees, feet and tire iron.

15. Lube the second bead and push it down with hands, knees, feet ~ ¾ the way on.
16. Using three tire irons pry the tire on the rest of the way - the real secret is to be sure the opposite side of the tire is squeezed into the center of the wheel (use bead breaker if necessary).
17. Double check alignment of tire balance dots with the valve stem!!!
18. Double check the direction of rotation.
19. Insert the valve core, inflate to seat tire, inflate to 40 psi – you should hear a loud pop as each side seats.
20. Mix up some soap bubbles and check the bead/wheel seal on both sides and check the valve core for leaks.
21. Check that the thin tire ridge is evenly spaced all the way around the wheel.

Front Tire Balance

1. Insert the axle into the wheel and place on the balancing stand.
2. Determine balance by taping assorted weights to the wheel.
3. Precurve the whole weight ribbon to same curvature as the wheel.
4. Clean the wheel with alcohol before sticking the weight on.

Front Wheel Installation

1. (Reinstall the rotors if you removed them, 24 Nm plus Loctite 243).
2. Grease the axle lightly.
3. Roll the wheel in – geared ABS teeth to the left side of the bike.
4. Lift the wheel slightly and start the axle from the right side of the bike and insert the right side spacer and the left side speedo drive - the tab on top of the speedo drive goes in front of the tab on the inside of the left fork leg.
5. Tighten the axle nut (bolt),17mm socket, torque to 22 ft.lb.(30 Nm).
6. Gently pry the brake pads apart with a tire iron.
7. Install the calipers, 8mm hex bit socket, torque to 30 ft.lb (40 Nm).
8. Pump the front brake lever until pressure returns!!!!!
9. With the bike off the centerstand compress the front forks several times with the rear brake applied.
10. With the bike on the sidestand tighten the axle clamp bolts, 6mm hex bit socket, torque to 16 ft.lb (22 Nm).
11. Pump the front brakes!!!

Rear Wheel Removal

1. Place the bike on the centerstand.
2. Block up the bike under the catalytic converter so the rear tire is up off the floor
3. Put the bike into first gear.
4. Remove both saddlebags.
5. Remove the rear brake caliper by removing the caliper bolts that hold it to the rear drive, 8 mm hex bit socket.
6. To remove the caliper, gently rock it back and forth on the rotor to spread the brake pads.

Warning! Do NOT compress the rear brake pedal while the calipers are removed!

7. Remove the 4 wheel lug bolts and cone spacers, 17mm socket.
8. Roll the wheel out.
9. Check the rear brake pads.

Rear Tire Change

1. Same as the front.

Note: The rotor is recessed from the outside of the rim and should be OK without using the wooden frame, but be careful.

Rear Tire Balance

1. Same as the front EXCEPT:

a. Pry or push out the plastic hub cap in the center of the wheel.
b. The rear tire can be a real bear to get on – helps to have a long 18” tire iron.
c. To balance, attach the four hole axle adapter to the rear wheel using the lug bolts and spacer cones.
d. Reinstall the little plastic hubcap.

Rear Wheel Installation

1. Gently pry the brake pads apart with a tire iron.
2. Roll the wheel into place.
3.Install the 4 lug bolts and cone spacers, 17mm socket, FIRST torque to 37 ft.lb. (50 Nm) THEN final torque to 77 ft.lb. (105 Nm).
4. Install the caliper, 8mm hex bit socket, bolt + lockwasher goes to the rear, bolt only goes through the ABS wire bracket, torque to 30 ft.lb (40 Nm).
5. Pump the rear brake pedal until pressure returns!!!!!

R1100 Routine Service – Paul Glaves

In this article we will cover the specifications and other information needed for a mechanically experienced R1100 owner to perform routine maintenance on his or her motorcycle. This article is not intended to teach the mechanically inexperienced owner everything they need to know about maintaining an R1100 motorcycle. From my experience, at least 90% of motorcycle maintenance is core knowledge of fundamental mechanic's technique. Ten percent is motorcycle model specific. We'll cover some of that fundamental 90%, but will mostly cover the specifications and procedures which specifically apply to the R1100. Please be careful. Maintenance of a high speed motor vehicle is serious business. Your valuable machine and your personal safety depend on your abilities. If you break something or ruin something it won't be BMW's fault. It won't be my fault. You are responsible for what you do and how you do it. Be careful!

BMW has used different terminology to describe maintenance intervals and requirements over the years. Back in the old days we did "5,000 mile services" and "10,000 miles services." At times we referred to "major services and minor services". At other times the terms "Service I" and "Service II" have been used as have the terms "BMW Service" and "BMW Inspection" The R1100 Repair Manual uses the following terminology:

Inspection I = 1000km (600 mile) Service
Inspection II = BMW Upkeep Service (equivalent to Service I or Minor Service)
Inspection III = BMW Inspection (equivalent to Service II or Major Service)
Inspection IV = Annual Service (to be performed at least once each year regardless of mileage)

The specified mileage intervals for Inspection II's and Inspection III's are in the technical information in the book(s) supplied with your R1100 motorcycle. All of those I have personally examined call for an Inspection II at 6,000 miles (10,000km) and each 12,000 miles thereafter. An Inspection III is called for at 12,000 miles (20,000km) and each 12,000 miles thereafter. These requirements translate as follows:

600 Miles - Initial service
6,000 Miles - Inspection II (Minor Service)
12,000 Miles - Inspection III (Major Service)
18,000 Miles - Inspection II (Minor Service)
24,000 Miles - Inspection III (Major Service)
Continuing - alternating major and minor services each 6,000 miles)

There may be variations or changes, so check the book that came with your motorcycle.

For simplicity and clarity for the balance of this article, I am going to use the terminology Minor Service and Major Service to describe the specified maintenance items.

Before going further, a word about the warranty and maintenance requirements. BMW provides a limited warranty which warrants the motorcycle against defects in materials or workmanship in the manufacture of the motorcycle. BMW expects that your motorcycle will receive the specified maintenance at the specified interval. BMW does not require that this maintenance be performed by certified mechanics at a franchised dealer. However, in the event of a malfunction or failure, determining whether or not the failure represents a defect in materials or workmanship in the manufacture of the motorcycle or

represents a failure due to a lack of maintenance or improper maintenance may be an issue. Do not take shortcuts! Do not neglect recommended maintenance! Document the maintenance you do!

I do not recommend that any owner perform the initial (600 mile) service on a motorcycle. More than maintenance is involved at this step. This is the dealer's opportunity to fully inspect the motorcycle after its initial use to detect anything which appears abnormal or defective in assembly or adjustment. Even experienced owner/mechanics usually lack the specific knowledge about their new bike to reliably perform this inspection. I do practice what I preach. Engle Motors in Kansas City has always done the initial service on our new bikes.

Lets look at the R1100 service requirements. This information is drawn primarily from the R1100RS/GS Repair Manual. There may be additional minor items specified for the R/RT models. Consult your dealer.

MINOR SERVICE:

Oil and Oil Filter: Drain the oil warm. Allow the engine plenty of time to drain. The oil is slow to drain down (and out). Find the oil filter - recessed at the left front bottom of the engine case. Remove the oil filter with the special oil filter wrench. Be careful not to allow spilled oil to burn your hand or arm. Fill the new filter with oil. Keep track of the amount of oil poured into the filter. Lightly oil the filter gasket. Tighten the filter finger tight and then 1/4 turn additional rotation. Add new oil to the engine. I add 3.5 quarts including the oil poured into the new filter. After a few minutes it may require one or two additional ounces of oil. Fill to the dot on the sight glass. Filling above the dot on the site glass appears to increase oil consumption and is not recommended.

Adjust Valves: The specifications for the valve adjustment are .006 inch (.15mm) intakes and .012 inch (.30mm) exhausts. Each cylinder has two of each type valve. Remove the front cover. Remove the spark plug connector. Use compressed air to blow the bugs and rocks out of the spark plug recess. Remove the valve covers. Set the engine to top dead center by centering the "OT" timing mark visible in the timing port on the right side of the engine. You will, of course, need to remove the rubber plug from the timing port in the side of the block. Find the cylinder with free-play in both valves at TDC. The rocker arms are forked to actuate both valves with a single pushrod. For precise adjustment, you should use two feeler gauges at the same time to eliminate any error from slight rocker arm tilt along the shaft. Loosen the locknuts and adjust the gap using a small allen wrench in the screw adjuster. Adjust so that there is light drag on the feeler gauge at the specified gap, and so that the next larger sized feeler gauge will not insert into the gap. For example, adjust each intake valve so there is light drag on the .006" feeler gauge and so that the .007" feeler will not insert into the gap. Rotate the engine exactly 360 degrees to TDC again. Adjust the valves for the other cylinder.

Before refitting the valve covers, remove and thoroughly clean all the oil off the gaskets and their mating surfaces. Installing oily gaskets will cause oil to continue to weep past the gaskets.

Check Battery: Inspect the battery to ensure that the electrolyte level is between the minimum and maximum marks. Top off to the maximum mark with distilled water. Check the connections for signs of corrosion. Clean the terminals and connections as required.

Check and Adjust the Alternator Drive Poly Belt: The alternator drive belt is located behind the front cover. The alternator is mounted so that it can slide vertically up or down when the retaining bolts are loosened. The lower retaining bolt on the left side (your right as you are facing the front of the engine) contains a geared adjuster. The adjustment specifications call for loosening the retaining bolts. Then tighten the geared adjuster using a torque wrench to 70 inch lbs = 5.9 foot pounds = 8 newton meters. This rotation raises the alternator and this properly tensions the belt. Tighten the other retaining bolts to hold the alternator in place with the proper belt tension. To check the tension of the belt without disturbing it, grasp one side of the belt midway between the pulleys and twist it 90 degrees. If it will twist much over 90 degrees it is too loose. If you cannot cause it to twist 90 degrees it is too tight. If the belt is too tight it places undue stress on the alternator bearings. If it is too loose it will squeal. Please note that the belts now in use by BMW will slightly squeal for a few seconds when the engine is started cold. This is normal. Do not attempt to make the belt so tight as to eliminate this cold start-up squeal. It will then be too tight.

Check the Spark Plugs: The spark plugs should be visually examined each Minor Service. You should not expect to need to replace them at this interval however. The early R1100's used spark plugs with three side electrodes. The current specification is for spark plugs with two side electrodes. Examine the electrodes for signs of wear and examine the insulator color. You are looking to find a very light tan insulator. A bright white with blisters would indicate a lean mixture or other cause of overheating. Consult any good motorcycle or car repair manual for the color spark plug pictures which show a number of fuel fouled, oil fouled, lead fouled, and other abnormal conditions. Apply a light coating of anti-seize to the threads when installing the spark plugs. Be careful not to get any anti-seize on either the electrodes or the insulator. The torque specification for the spark plugs is 15 ft. lbs (20nm).

Check the Brake Pads: Remove the brake caliper covers (lightly spread the cover using a small pry bar or screw driver and lift upward). Carefully examine the brake pads for wear. Do NOT assume since you brake properly as taught by the MSF and mostly use your front brakes - that the rear pads do not need to be checked. The R1100 motorcycles consume rear brake pads at a relatively short interval. Examine them each service, and expect to need to replace them every 20,000 to 30,000 miles. I know of cases where the pad was gone and the backing plate scored the disk in 12,000 miles. I've also seen them last 35,000 miles, but not a lot more. Even with proper braking technique the front pads are likely to outlast the rear pads 2 to 1. The minimum lining thickness is specified as 1.5mm (.06")

Check the Brake Rotors: Examine the brake disks for scoring and wear. BMW specifies a minimum thickness of 4.5 mm (.17 inches) for the front rotors and 4.6 mm (.18") for the rear rotor. Carefully examine the "rivets" which attach the front floating disks to their carriers. These wear, and need to be replaced when worn. Each rotor is mounted with two types - which may be identified as having a large hole or smaller hole in the center of the "rivet." Each thicker rivet with a small hole is located between groups of 3 of the thinner walled rivets with the larger holes. They affix with a small flat spring washer and a circlip located on the inside (wheel side) of the disk.

Grease the Side Stand and Center Stand: Grease the side stand and center stand (some models only). There is not much else to say about this service. Check that the center stand bolts are tight. The torque specification is 15 foot pounds. (21 nm)

Adjust the Clutch: Adjust the cable adjuster located at the handlebar end of the cable so that the distance (exposed threads) between the adjuster and the locking ring is 12mm (.47"). Then, at the rear of the transmission loosen the 13mm locknut and adjust the 10mm adjusting bolt so that the freeplay distance measured between the handlebar lever and its housing is 7mm (.28"). Freeplay is the distance the lever moves taking up the slack in the adjustment prior to actually beginning to disengage the clutch. Then pull the clutch lever in so that there is pressure on the 10mm bolt to hold it from turning, and tighten the 13mm locknut - just snug but not gorilla tight. I have seen cases where the locknut and adjusting bolt have loosened, so some blue Loctite 242 is appropriate at this location. Lubricate the clutch cable ends by applying grease where the barrels on the ends of the cables contact the clutch levers.

Synchronize the Throttle Bodies: Adjust the choke cable so there is approximately 1mm (.04") of free play in the cable. Rotate the handlebars fully to the right and adjust the cable from the twistgrip to the left throttle body so that there is approximately .5mm (.02") of free play in the cable. Using a mercury manometer (Carb Stix or equivalent) adjust the adjuster at the right throttle body to synchronize it to the left throttle body with the twist grip rotated so the engine is operating just above idle with no slack in the cables. Adjust the idle speed and balance the throttle bodies at idle by rotating the brass recirculating air screws on the upper rear of each throttle body. For more detailed instructions see the synchronization instructions in the article entitle Zero=Zero by Rob Lentini. If you have the new twin cable equipped engine, then synchronize by adjusting the freeplay on both cables equally to approximately 1mm.

Lubricate the Lower Front Shock Mount: Remove the lower front shock mounting bolt and the two black spacers which are located between the sides of the shock "eye" and the mounting bracket on the Telelever arm. Clean the bolt, the spacers, and the shock mount. Grease the shank of the bolt and apply a light smear of grease on both sides of each spacer. Reassemble and tighten the bolt. The torque specification is 43 nm (32 ft. lbs) for the early RS's and 50nm (37 ft. lbs.) for the later RS's, GS,s and RT's. Note - if your R1100 makes a strange clicking sound from the front end, it is likely that the lower shock mount needs to be greased.

MAJOR SERVICE:

For a Major Service, perform all of the service items called for in a minor service, and in addition perform the following:

Change the Transmission Oil: With the bike fully warmed up, drain the transmission oil and refill the transmission. The fill plug is readily identifiable on the right side of the transmission. The drain plug is not in the bottom of the transmission, where it would dump oil onto the catalytic converter and exhaust system. It is located beneath the fill plug on the right side of the transmission, recessed into the "tunnel" cast into the lower right side of the transmission case. BMW specifies 80, 90, or 80w90 wt gear oil. Consult your manual for the temperature ranges. Fill the transmission to the bottom of the fill hole threads. This is a specified quantity of 800cc. Use new sealing washers on the drain and fill plugs.

Change the Final Drive Oil: With the bike fully warmed up, drain the final drive oil and refill the final drive. Use the same gear oil as for the transmission. Fill the final drive to the bottom of the fill hole threads. This is a specified quantity of 230cc. Use new sealing washers on the drain and fill plugs.

Renew the Air Filter.

Renew the Fuel Filter: The fuel filter is located inside the fuel tank. As an aside - when I first serviced my K bike, I concluded that the fuel filter was installed in the most obnoxious manner possible. I had to remove the entire gas tank filler cap and remove and replace the filter located in the bottom of the tank. When I first serviced an R1100, I discovered that BMW had devised an even more obnoxious location for the fuel filter.

Locate and identify the two fuel hoses and two vent hoses beneath the right side of the fuel tank. Pull the two vent hoses loose at the inline connector. Clamp-off (I use small vice grips) both rubber fuel lines forward of where they attach to the hard black lines to which they connect. Remove the fuel lines where they connect and remove the tank. Drain the tank. Locate the metal plate affixed to the side of the tank in the tunnel where the tank straddles the engine. Remove the capscrews which attach the plate and fuel pump assembly to the tank. Retract the plate about one inch from the tank and loosen the two vent hoses connected to the inside of the plate, inside the tank. Carefully withdraw the fuel pump assembly - with the filter, fuel pump, and fuel level float arm - from the tank. It will seem like you are trying to extract about 7 inches of parts through a 5 inch hole - but by carefully positioning the float arm it will all come out without bending or breaking anything, and without force.

Remove the old fuel filter and install the new filter. To reinstall the plate you will need to use a new (large) sealing "O" ring for the plate. You will want to replace the crimp-on clamps on the two vent hoses with two very small screw-type or spring-type hose clamps. WARNING: These two vent hoses are submerged in gasoline inside the fuel tank. If the hose connections inside the tank leak, then fuel will leak out through the vent hoses. If this happens, you will be privileged to again remove the fuel tank and the fuel pump assembly to renew the clamps and stop the leak.

Check the Brake Fluid Level: Check the level of the brake fluid in the reservoirs and top off to the maximum fill line with DOT 4 brake fluid. You should plan on changing the brake fluid at least once each year, regardless of mileage. BMW specifies that when changing brake fluid or flushing the system the front (but not the rear) caliper pistons need to be recessed fully back into their bores. This is so fluid is forced out of the caliper cylinders and stale fluid is not trapped in the calipers. BMW specifies a special tool to retract the pistons. If you are careful not to damage the pads, you can retract the pistons with tapered wedges which should be left in place during the flushing operation to hold the pistons in the retracted position. Despite the fact that there are bleed nipples on the ABS system under the fuel tank, my Repair Manual only calls for bleeding the entire system at the wheel caliper bleed nipples.

Renew the Spark Plugs: The spark plugs should be replaced at the Major Service interval.

OTHER COMMENTS:

During both a major or minor service you should take the opportunity to thoroughly inspect your motorcycle. When you have the fuel tank removed, for example, is an excellent opportunity to examine electrical connections for signs of corrosion or wear, and to examine other parts and pieces hidden beneath the tank or behind the body work. Look for loose or worn fasteners. Get to know exactly what the various components are supposed to look like. Be systematic. Use good tools. Allow plenty of time - several hours at least - and go slowly and carefully. Do not get in “over your head” and if you do, consult your dealer or some other person experienced with R1100 maintenance.

Valve Adjustment - Stephen Karlan (Dali Meeow)

TOOLS NEEDED

newspaper (oil catcher)	flashlight	drain pan
med. screwdriver (pry)	3, 4, 5, 6 mm T handle Allen	plug tool
compressed air	torque wrench	2 sets gauges
hemostat for rubber plug	10mm box wrench	carb stix
5/8-in. or 17mm socket	pliers	

You must start with a cold engine. Put newspaper or drain pan under the cylinder heads to catch the oil drips. Remove alternator cover using 4mm Allen wrench. Check alternator belt for cracks and tension and then leave cover off for valve adjustment.

Remove round black rubber timing hole plug (size of quarter) located on right side of engine (above and to the rear of the cylinder head) by grabbing the edge of the plug with a hemostat (medical tweezers, marijuana roach holder) and pulling or carefully pry it out with a long screwdriver. Timing marks will be seen inside of this hole later on during the adjustment procedure.

Remove black plastic strip ("4 Valve" imprinted on part) covering the spark plug by hand. Remove plug wire from plug by using 2-inch long black plastic loop tool contained in your BMW tool kit. The purpose of the black plastic loop tool is to give you a handle to pull on that will pull the plug wire off the plug. Holding onto the loop end, point open side toward rear of bike while hooking the tool onto the plug wire boot, then pull out to remove the plug wire. Use compressed air to blow out plug hole before removing plug -- there will be dirt in that hole that you don't want in your cylinder !! At the very least, use a tube or straw to direct the air and lots of lung force. Remove spark plug using tool kit wrench. Place a pan/newspaper under the valve cover to catch the small amount of oil that will drip out when you loosen the four valve cover Allen screws. Loosen the Allen screws with a 6mm wrench and remove the valve cover; lightly tap if it's stuck.

With bike on centerstand and in neutral, use appropriate socket (5/8-in. or 17mm, depending on bike) to turn the lower alternator drive pulley (and engine) clockwise. Insert long screwdriver into either spark plug hole while turning engine over; when screwdriver is being pushed out, start looking for timing marks. Use a small flashlight to illuminate the flywheel marks. The marks, in order, are "Z", "S" and "OT". Center "OT" in the timing hole opening.

Optional method #1 for moving the cylinders into place: Instead of looking at the flywheel index marks, remove both spark plugs and put the bike on the center stand in 5th gear. Put a long screwdriver into either spark plug hole and push it against the piston crown. Rotate the rear wheel until the screwdriver projects the maximum distance out of the cylinder. Rock the engine by moving the rear wheel slightly back and forth to get the piston at the very top, OT.
With OT centered, the valves on one side of the engine will "wiggle" a little bit. If they do not "wiggle", check the valves on the opposite side of the engine. One side or the other must wiggle. Adjust valves using 10 mm box wrench, 3mm Allen and two feeler gauges.

BMW recommends the following two feeler gauge dance step. One gauge is used to adjust the intake (or exhaust) valve while the second feeler gauge is positioned under the adjoining intake (or exhaust) valve to stabilize and prevent the rocker from canting.

After the first valve is adjusted, the second valve will then be adjusted while the first is stabilized. To check if a valve is properly adjusted, attempt to insert the next thicker size of feeler gauge -- it should be too big to fit. The valve clearance may change as you tighten the lock nut. Experiment with tightening technique to maintain clearance as you tighten, and recheck the clearances after all four valves on one side have been adjusted.

The two exhaust valves are located nearest to the exhaust pipe. Adjust exhaust = .012 in (.30 mm). Adjust intake = .006 in (.15mm). Rotate engine 360 degrees, center OT in timing hole, and adjust the valves on the other side.

ROCKER ARM SIDEPLAY ADJUSTMENT
Mick McKinnon points out that there is one additional gap to check while the valve covers are off. The rocker arms, which are the vertical metal pieces that contain the valve adjustment nuts, will move up or down when pushed by hand. Measure the two gaps where the rocker arms contact the horizontal piece at the bottom. This horizontal piece has several names, including lower rocker arm bearing carrier (LRABC) and rocker arm end plate. This lower rocker arm bearing carrier (LRABC) is held in place by three T45 torx screws in a triangle pattern (on its side) and one large head bolt. The gaps should be between .05mm and .30mm. The smaller the gap the quieter the engine. The procedure is to loosen the 3 Torx screws and, after marking the lower head bolt, loosen it also. Snug them back up just enough to hold an adjustment and then tap the LRABC until you have about .05mm end play (gap). Check the gap after tightening because it may tighten up slightly as you torque the screws and bolts back to spec. Retorque the T45 torx screws to 15 ft.lb. Retorque the head bolt to 17 ft.lbs. and then turn the bolt an additional 180-degrees (torque it and then move the wrench through another half circle).

Clean valve covers and reinstall; the gasket surface MUST be free of all oil film or they won't seal. Be certain the center donut gasket is in place on the valve cover !!! Reinstall sparkplug, plug wire and valve cover strip; alternator cover - reinstall top right Allen bolt first; timing hole plug - be careful when reinstalling this plug that you do not push it all the way through, into the hole. Editors Note: One trick is to stab the rubber plug in the middle with a sharp awl to hold it in place while you carefully push the edges in with a long screwdriver.

Clutch Adjustment - Paul Glaves

The clutch adjustment at the hand lever specified as 7mm when resistance is felt is a bit deceptive, or at least ambiguous. Proper clutch adjustment procedure - which BMWNA says is critical to proper clutch operation is:

a. adjust the knurled adjuster at the hand grip so that exactly 12mm is between the knurled adjuster and the knurled lock ring.

b. Loosen the 13mm lock nut on the adjusting pin (small bolt) on the clutch lever at the rear of the transmission. Rotate the 10mm head on the adjusting pin until there is 7mm play when the clutch lever is pulled, measured as shown in the owners (riders) manual. Tighten the locknut. Old trick: To keep the adjusting pin from rotating out of adjustment as you tighten the lock nut, simply pull in the clutch. This puts pressure on the pin and keeps it from turning if the threads are clean. What is light resistance? They are really talking about free play, where the pull is only against a small spring and not against the clutch pressure plate spring itself. This is an easy one finger pull up until you are trying to compress the pressure plate spring.

Clutch Adjustment - Bob Gorman

A just released service bulletin revises the clutch freeplay specification to 12mm between the knurled nuts and 7mm at the lever. This is revised from 10mm and 5mm respectively.

It appears that improper clutch adjustment has been the cause of many shifting problems. In order to obtain the new clearances you'll need to adjust the clutch at the motor. You can have your dealer do it next time you have service or you can easily do it yourself.

Equipment:
13mm deep well socket
10mm socket
socket swivel attachment
socket wrench
6" socket extension
13mm box end wrench cutoff to 2"

Procedure:
Place the extension on the wrench
place the swivel on the end of the extension
place the 13mm socket on the swivel

approach from the left side of the bike
reach in and just crack loose the 13mm locking nut at the rear of the tranny
place the 2" 13mm box end over the locknut. This will keep it from turning

remove the 13mm socket and replace it with the 10mm socket
reach in and back out the 10mm adjusting nut until you achieve spec.
give the 10mm nut another 1/2 turn

remove the 2" 13mm wrench from the locking nut
replace the 10mm socket with the 13mm socket
reach in and tighten the lock nut.
In the process the 10mm will regain that 1/2 turn you put in.

The entire adjustment takes, maybe, 2 minutes.

Brake Bleeding - Stephen Karlan (Dali Meeow)

R1100 and R850 yearly maintenance requires replacing (by bleeding) the brake fluid.

RECOMMENDED FLUIDS
Use only fluids from a new, never-been-opened container. The manual calls for: BMW DOT4, Castrol Disc Brake, DOW ET 504 Shell Donax DOT 4, Hydraulan DOT 4. None of these is a synthetic. Use the recommended fluids. Synthetics (DOT 5) are not approved and may not be compatible with the R1100.

WARNING: Brake fluid wrecks (eats) paint immediately and must NOT come in contact with any part of your bike!!!

Place bike on center stand for easiest access. The front brake reservoir is located on the right handlebar and is part of the brake casting. The reservoir top measures 2-inches x 1 7/8-inches and is held on with four screws; rotate and secure the handlebar so that the top is level. Protect the bike with a large plastic garbage bag under the front reservoir and the right front bike area; place paper towels or rags on top of the plastic to capture any brake fluid that escapes. The rear reservoir is a clear plastic bottle located on the right rear of the bike; you must remove the side fairing piece to see it. When working with the rear reservoir, the right-side plastic fairing parts must be removed and a plastic bag may be taped so that it is held behind the reservoir and drapes down to protect the area where fluid might leak from the rear reservoir.

WARNING: Maintain fluid in the reservoir at all times (do NOT allow air into the brake lines)!!!

METHOD ONE:
Mityvac(r) is a hand-held vacuum pump that attaches to the bleeder valve on the caliper and pulls brake fluid from the reservoir, through the brake line and nipple, into a plastic line and deposits the fluid into a cup built into the tool. There is a plastic model (Part NO. 7000) and a metal model. The plastic version is available from some WalMart Stores for approx. $25. Metal models cost about $60 and are available from Mac Tools (part number MV4000) and Snap-On Tools (private vendors who sell to auto repair shops and may be found in the telephone book), and from Imparts at 1-800-325-9043, part number 29900. Sears also sells a vacuum pump (about $35) and a brake bleeder kit (about $10) which work well.

A Mityvac(r) vacuum pump tool is designed for bleeding brakes; read the Mityvac information you receive with the tool. If you are not using a Mityvac or similar tool, the difference will be explained in the paragraphs under Method Two. Both methods will yield the same excellent result if performed properly.

Replace the fluid in the handle-bar mounted reservoir by using a turkey baster or other device to get the old fluid out and then refill with new fluid, and do the same with the reservoir under the seat on the right side of the bike. (Protect your paint and use something (cup/paper/rags) to catch the drips from the turkey baster, because the turkey baster will drip.) Fill the reservoirs with one of the recommended fluids. Now follow the cycle of the four basic steps.

Cycle of four basic steps: (1) Create suction at the bleeding nipple which is on the caliper, (2) Drain most of the fluid from the reservoir by opening the bleeding nipple , (3)

Close the bleeding nipple while fluid is STILL COMING OUT and BEFORE the reservoir is empty, (4) Add more fluid to the reservoir and start this cycle again. Memorize step #3.

The brake nipple is located on the caliper body. Stand to the left side of the bike and look at the front wheel. The tire is mounted on the rim. The brake disc (rotor) is smaller than the rim, made of shiny metal with holes bored in it. At the one o'clock position there is a black metal caliper with the word "BREMBO" in metallic relief on the body. A rubber hose containing the brake fluid is attached to the top of the caliper. Also on the top of this black caliper is a rubber cap that covers the metal nipple. The nipple sticks up, has a hole in its center, is smooth and round at the top and the base is a six-sided bolt. Remove the rubber cap and clean the nipple before using it.. When the nipple bolt is rotated (looking down at it) counter-clockwise it becomes loose and brake fluid may flow out of the brake system through the center hole.

Position the bike and secure the handle bar so that the handle-bar reservoir is level with the ground or slightly tilted so that the hose connection is the lowest point. Using an 11mm box end wrench or socket to open the nipple may help prevent problems if it is very tight. Start on the left front caliper (furthest from the reservoir). Open the reservoir top.

Step one: Attach the Mityvac suction hose to the nipple and pump the tool to create suction. Make certain the reservoir on the tool is attached and the tool is functioning; and you might even try reading the manual for the tool. Pump the tool to create a vacuum. Consider the following: You may wish to seal the nipple-hose connection area with grease so that ambient air is not sucked into the hose. In this way, if there was no air in the brake system there will be no air in the spent fluid cup. Many mechanics don't seal the nipple-hose connection with grease because air in the spent fluid does not affect the bleeding procedure, they do not mind seeing the air bubbles because the spent fluid will be discarded and they do not check it for bubbles, and therefore they consider greasing the nipple as an unnecessary bother.

Step two: Slowly and carefully open the nipple and observe the fluid level in the bike reservoir carefully. When you look at the hose that is attached to the nipple you will see bubbles in the hose. The bubbles are from air being sucked into the line around the nipple area as well as any air that may be in the system. Step three: When the amount of fluid in the reservoir decreases by 50%, turn off the flow by tightening the nipple (clockwise). As you are tightening the nipple, the Mityvac must still contain some vacuum , some fluid flow must be taking place so that air can not enter the system, and the reservoir must contain some fluid. Step four: Add brake fluid when 50% or more of the fluid has been vacuumed (drained, suctioned) from the bike reservoir. Repeat these four steps until the fluid appears clear in the tube leading to the Mityvac reservoir jar. When the fluid is clear, tighten the nipple and replace the rubber cap. Move to the right front caliper of the bike and repeat the four steps until the fluid appears clear again. When finished with the right side, replenish the brake reservoir and replace the cap and screws. Fluid should be at the top of the reservoir site window.

Move to the rear disk and bleed the rear reservoir from the nipple on the rear caliper until the fluid is clear. Replace the rubber cap on the nipple, replenish the reservoir and replace the cap on the rear.

After the fluid has been completely replaced and all nipples are tight, check that the front and rear reservoirs are filled and secure. Slowly pump the front brake lever, then pump the foot pedal until there is a solid feel. Continue pumping the brakes for a few minutes, then recheck the reservoir level and refill if necessary.

WARNING: You must pump both front and rear brakes to confirm that they are responding with a solid feel BEFORE you ride the bike!!!

Note on brake fluid level: Before replacing brake pads, remove brake fluid so that it is NOT at the maximum level. New brake pads will take up some of the brake fluid space in the system; if the brake fluid is at maximum level it probably will overflow the reservoir.

METHOD TWO.
No Mityvac is used in Method Two. This method is used by many auto mechanics who use the brake master cylinder to create the pressure needed to force fluid through the brake lines. You will not be using the suction created by the Mityvac.

Replace the fluid in the handle-bar mounted reservoir as described in Method One.

There are still four basic steps in Method Two, but number one has been changed. The steps now read: (1) Keep the reservoir cover in place to prevent fluid from squirting up (which will create havoc with your paint) and attach a drain tube and jar to the caliper nipple to catch any fluid that will be drained from the nipple. Pump the brake lever to insure that the system can create pressure. Now, pull the lever gently (as in applying the brake) while you perform the next two steps. Do NOT allow the lever to return to its open position until the next two steps are complete!!! (2) Gradually open the bleeding nipple at the disk caliper approximately 1/2 turn (3) Close the bleeding nipple while fluid is STILL COMING OUT and BEFORE the reservoir is empty, (4) With the caliper nipple closed and the reservoir cover still in place, release the lever. Understand and memorize step #3. With this method you are replacing the brake fluid one “squirt” (i.e. one press of the brake lever) at a time and repeating until clear fluid emerges from the drain tube connected to the bleeder valve. Keep an eye on the reservoir during these steps and refill whenever it goes down to 50%.

Be extremely careful with the bike's brake fluid in the handle-bar mounted reservoir!!!

Follow the same procedure that is described in Method One. Start on the left front and bleed the fluid until it is clear in color. You must close the bleeding nipple to turn off the flow by tightening the nipple while the fluid is still coming out, and this means maintaining a small amount of pressure on the brake lever and maintain some fluid flow. If you take the pressure off the brake lever while the fluid is still coming out, you may introduce air into the brake system and this is bad. Read "Air in the System" below. (You may be able to locate a "One Man Brake Bleeder" which is a one-way valve that attaches to the bleeder nipple and prevents air from entering through the bleeder nipple. When using this, instead of opening and closing the bleeder valve, you just pump the master cylinder until the fluid runs clear and being careful to keep brake fluid in the reservoir. Do not let the reservoir run dry; this will pump air into the system.) You are finished with the left side when discharging fluid is clear and the caliper nipple is tight. Repeat this procedure with the front right caliper. Make certain the front brakes are finished, the front nipples are tight, and the front reservoir cover is secure with the four screws. It is now time to bleed the rear brakes using the same procedures.

Attach the drain tube and jar to the rear caliper nipple and repeat the four steps with the rear brakes. Gently and carefully actuate the rear brake while releasing the nipple on the rear brake. Observe the rear reservoir closely and replenish as needed. Discontinue pumping when the fluid is clear; close the nipple as fluid is gradually flowing out.

After the fluid has been completely replaced and all nipples are tight, check that the front and rear reservoirs are filled and secure. Slowly pump the brake lever, then pump the foot pedal until there is a solid feel. Continue pumping the brakes for a few minutes, then recheck the reservoir level and refill if necessary.

WARNING: You must pump the brakes and be certain the brakes are responding with a solid feel BEFORE you ride the bike!!!

TROUBLE SHOOTING

AIR IN THE SYSTEM --- The brake system works with brake fluid. You push on the brake lever and this force is transmitted to the brake piston at the discs and causes the pads to grip the discs. The more you pull on the brake lever, the more pressure you put on the discs and the faster you stop. There is fluid in the brake lines that transmit this force; you cannot compress this liquid fluid. But if there is air in the brake lines, even a little, this will cause problems because air compresses. If you pull on a brake lever and there is air in the brake line, the air will compress and less force will be transmitted to the brake pads.

If you feel air in the brake lines (spongy brakes), you MUST bleed the brakes until all of the air is expelled!!! If air is allowed to remain in the line, it will compress when the brakes are actuated and will not give you firm and steady pressure on the pistons and pads. This will result in uneven and dangerous braking. Soft or spongy brakes feel as though they are not working because they are not working. The best procedure is to work so that no air enters the system. If it does get into the system, you must expel all air from the system.

AIR IN REAR BRAKE SYSTEM
If you get air in the brake system, especially the rear brake system, you will want to start the corrective process by bleeding from the ABS nipple under the tank. Do this because air bubbles, which rise, may be trapped in the higher ABS area. Then continue with either Method One or Method Two. See: TWO OPTIONS.

UNRESPONSIVE BRAKES
If you still have an unresponsive brake system after bleeding the brakes and after following the procedures recommended here, you may have water in the system or an ABS problem. Do not ride the bike! Seek professional help.
TWO OPTIONS
The ABS system has a bleeding nipple under the gas tank. You do NOT have to bleed from this nipple. Old brake fluid will be totally flushed when bleeding from both front and rear caliper nipples. Bleeding from under the tank will neither hurt nor help your brake system. The nipple at the ABS unit under the tank may be bleed before starting with the front nipples at the calipers. Some shops bleed at the ABS under the tank, some do not. Under tank bleeding is recommended by the BMW manual. However, you should bleed from under the tank if your bike experiences problems outlined in the paragraphs: " AIR IN REAR BRAKE SYSTEM" or "UNRESPONSIVE BRAKES'

Brake pads may be retracted (pushed in) while bleeding the brakes. A minute amount of brake fluid will be forced into the system with this maneuver. There are contrary opinions about whether this procedure is beneficial. Note: The pads may be pulled in by suction when Method One is used in bleeding the brakes. Retracting the brake pads is part of the bleeding procedure recommended in the BMW manual.

SPEED BLEEDER (a new third method)
This new product is a one-way valve that looks similar to the standard bleed nipple at the caliper, but replaces it. It operates like the standard bleed nipple, opening when turned counter-clockwise and allowing brake fluid to flow from the nipple at the caliper. The advantage of the Speed Bleed is that it is manufactured with a check valve that prevents air from entering the brake system at the nipple. Turning the Speed Bleeder clockwise closes it, just like a standard brake nipple. This will simplify bleeding the brakes because you will not have to open and close the nipple every time you pump brake fluid out and air will not enter the system from the nipple.

Each Speed Bleeder costs approximately $8.00. The manufacturer has been accurate in determining the correct thread size; if you are not certain about sizing, ask him. You will need one Speed Bleeder for each brake caliper, and one for the nipple under the tank if you are bleeding from this ABS location.

The contact information is: Speed Bleeder Products, P.O. Box 306, Lemont, Illinois 60439, (630) 739 - 4620 phone, (630) 739 - 9626 fax, eMail to: speedbleeder@super-highway.net and web site at http://www.speedbleeder.com

The Speed Bleeder has operated as advertised in our limited trials. Several BMW riders are using this product, and all reported results have been positive. This author has had excellent results. When using these, ensure that (1) air is not entering the system through the Speed Bleeder's check valve, that (2) air is not entering the brake line through the threaded area between the caliper and the Speed Bleeder, and that (3) the Speed Bleeder is closed and will not permit fluid to escape at the conclusion of bleeding the brakes. A firm brake lever after bleeding will normally mean that the Speed Bleeder worked correctly. Exercise the same precautions and the same "firm brake lever" test you must make when using the standard nipple. Warning: When installing these, do not seat them too far into the caliper. They must be seated only far enough to prevent brake fluid from escaping. I have a report of one person who broke a Speed Bleeder off in the caliper.
The complete version of this article is available at www.ibmwr.org

Changing the Fuel Filter on an R1100RS - Jon Diaz

Here is the procedure to change your R1100RS fuel filter. It took me about 90 minutes the first time....but hopefully, things will go more quickly for you!

Purchase the following before you start: a new fuel filter, a new sealing O-ring for the fuel pump plate, and two standard BMW fuel line clamps just like the ones used on the fuel lines by the right side throttle body (point to these on your bike if your parts jockey doesn't understand). Let your sealing O-ring lie out for a few days before starting the job.....I didn't and had trouble later. Let the fuel level run down, way down, so low you don't think you can make it back to the gas station. It still won't be low enough so you might want to siphon out from the top as well. Get as much fuel out as possible. Drain, swirl the bike, drain some more. OK?

Remove the left and right fairing panels, the seats, and the right fuel injector cover. Unplug the right fuel injector wire and the fuel pump harness. The fuel delivery hoses run behind the cross-over throttle cable, and most people will have too many fingers to keep all that stuff plugged in. Remember that there are also two screws tying the upper fairing to the gas tank, and two little screws holding the left and right inner panels (the ones with the rocker switches/RID) to the gas tank. Those screws must be removed.

Remove the screw holding down the back of the gas tank, and keep track of the grommets used to fill the gap between the frame and the tank. They like to fall out....

Unplug the vent lines right next to the airbox, and loosen both fuel line clamps. The top fuel line is holding the fuel....when you pull it, you will need to drain into a gas can until it stops, otherwise there will be a tremendous mess. When it is done draining, remove the other hose and lift the tank off the bike.

I laid the tank on a towel on my garage floor, right side down. Mark the orientation of the pump plate and then loosen it; carefully pull the inside vent lines off the plate, and gently rotate the whole assembly out. Hold the assembly with your right hand, and use your left hand to guide the fuel level sender and fuel pump screen through the hole in the side of the tank.

I carried the fuel pump/filter works to the bench. Anyone familiar with a K-bike will recognize everything here except the fuel filter is held in with compression clamps. I pried those clamps off, pulled the hoses from either end, removed the old filter and inserted the new one, and tightened the works down with the aforementioned screw-type clamps.

Look at the fuel level sender rod while you have the parts out. There should be an E-ring type circlip holding the float to the rod, but some of the early bikes were missing these and had their floats bobbing around the tank rather than registering fuel level.

I carried the assembly back to the gas tank. The O-ring must be pressed down into the groove, the vent lines forced back on the plate, and install the plate exactly as removed. Start all six screws, and tighten in a cross pattern. I tilted the tank back up after this operation to try and get the O-ring to leak. After 30 minutes or so, nothing had come out. I would suggest doing this as well to avoid having to re-remove the tank to fix a leak.

Reinsert the fuel tank, and the lines pretty much fall into place. I added some gas to the tank because you don't want to run these roller cell fuel pumps dry for any reason. I would also coat the fuel injector and fuel pump connector pins with dielectric grease to deal with the moisture and corrosion that the bike sees daily in some cases. Reinstall all body work and all the screws you removed.

Tighten the clamps on the fuel lines and reattach the vent lines by the airbox. Start the bike, check for leaks, and if all is well, ride the hell out of it for another year!

External Fuel Filter Modification - Rob Lentini

After I bought my ’87 K75S I soon found it interesting (and strange) that the fuel filter was installed inside the fuel tank! Most fuel-injected cars that I’ve worked on have external filters, so I wondered about the theory and reasoning for designing the filter location this way, but it wasn’t a big deal on that K. One can quite easily access the filter by removing the fuel filler cap assembly and then reach into the tank with tools and a hand to remove and replace the filter per BMW service intervals. Mind you, one still has to run the tank mostly dry and then contend with modern fuel carcinogens on his or her skin (use surgical gloves!). But, filter replacement isn’t a big deal on K bikes.

Type 259 Boxers (Oilheads) are a completely different story, however. Sure, the filter is (for some reason) still mounted in the tank like the K bikes, but the big difference is you can’t see the filter from the filler opening regardless of whether the filler assembly is removed or not. You can’t even reach the dang thing with your hands. Besides, you don’t even want to attempt to blindly remove and replace the filter this way or your hand or tools would likely damage the fuel level float rheostat assembly ($$$)!

On my RS, with close similarities to RTs, GSs, Rs, Cs and I suspect the S, the fuel filter is part of one main assembly that holds the fuel pump, fuel level float/rheostat and filter all together as one unit. This unit is, in turn, mounted to the right/inside flat surface of the fuel tank using a circular flange fastened by six Allen head machine screws. A large "O" ring seals the interface to prevent leaks. To replace the fuel filter, one must remove the fuel tank and them remove the above assembly to gain access to the fuel filter. Even careful removal of the assembly from the tank risks damage to the fragile fuel level float mechanism since the darn thing is a tight squeeze in the fuel tank and needs some "maneuvering" to get it free and clear.

BMW recommends that the fuel filter be replaced every 24,000 miles, or 12,000 miles if fuel is of poor quality. I can vouch from experience that only one bad load of water-contaminated fuel is enough to clog these filters and bring the motor (and your ride!) to a halt. I therefore decided early on with my K to replace this filter more often. I wanted to do the same on my R1100RS but soon discovered the process was a hassle. Was there a better way?
There is a better way! I’ve found a sanitary and safe method of installing either the OEM BMW filter or a less expensive aftermarket variety conveniently outside of the tank where it may be easily serviced in minutes. Here’s how:

DISCLAIMER:

This is a non-stock, non-BMW approved method of placing the fuel filter outside of the tank. Some others and I believe this to be safe if correctly accomplished by a knowledgeable person using proper parts, procedures and tools. DO THIS AT YOUR OWN RISK.

MATERIALS REQUIRED:
1. 6 ft of 5/16 (7.9 – 8.00mm) fuel injection hose. It is VERY important to ONLY purchase fuel injection-rated hose since up to 42 psi exists in the fuel system! It's expensive (~$4.00 per ft) but don't EVEN consider regular hose.

2. Original (expensive!) BMW filter or steel-bodied Deutsch FF401 or FF424 filter (both Deutsch's are the same except for unneeded hose adapters/clamps with the FF424) available at Auto Zone (~$2.00). The FF401/424 are for various and sundry small and big car gas and diesel engines ranging up to MOPAR 440 cubic inch V8s. Another suitable filter is the larger Deutsch FF507. DON'T use the Fram G2 nylon-encased equivalent. The high 42 psi fuel pressure could burst a non-metallic fuel filter case!

3. 8 fuel injection hose clamps, size 12.5 or 13mm (or inch equivalent). These are the typical BMW style "squeeze together" clamps, NOT worm gear types. Again, these are also available at BMW or auto parts stores. You only really need 6 of these since two on your bike are reusable, but 8 if you want all new hardware.

4. Size 28 "Adel" aircraft cable clamp to belay the fuel filter to the transmission. This clamp fits the Deutsch filter. A larger diameter clamp will be required for the BMW filter since it's slightly wider. Clamps are available at some specialized hardware stores, electrical shops, or alternatively the filter could be plastic cable-tied (with rubber cushioning). I recommend a clamp.

5. New sealing "O" ring for the fuel pump assembly.

6. Longer brake line clamp screw, 4 x 22mm with ~3mm spacer

PROCEDURE (in accordance with tank and fuel filter removal/replacement steps of the BMW or Haynes manual, plus those below):

PHOTOS: filter1, filter2, filter3, filter4, filter5
view photos at:
http://www.ibmwr.org/r-tech/oilheads/extern_fuel_filter.shtml

1. Drain (siphon dry) and remove the fuel tank. Don't forget to disconnect the two electrical connectors! Observe and label which hose you removed from the tank to each plastic fuel distribution line that goes between the cylinders (through the engine from right to left). You'll also need to disconnect the two small rubber vent lines at their unions above the right throttle body.
2. Remove the fuel pump assembly from the tank (six Allen screws).

3. Observe the fuel filter mounted on the removed fuel pump assembly. Loosen the four crimped hose clamps and remove the filter and two short fuel hoses. One of the fuel hoses has a 180-degree bend, for reference.

4. Replace the filter, two hoses and four crimped clamps with ONE 10" length of new fuel injection hose and two new fuel injection clamps. Loop the new hose 180 degrees to bypass the entire fuel filter setup you just removed. Be sure to align the hose and clamps for neatness and non-interference with the fuel level float.

5. Reinstall the fuel pump assembly (with new "O" ring) onto the tank. Be careful to NOT over torque the six Allen head screws, since the nut plates in the tank are known to sometimes strip out.

6. Observe the two fuel injection hoses leaving the outside of the tank from the pump assembly. The UPPER hose is the "return" hose and the LOWER is the "supply" or pressure hose.

7. Replace the UPPER fuel injection hose with the same length new hose. Use another new clamp at the fuel pump end.

8. Replace the LOWER fuel injection hose with all of your remaining new hose. It will be cut twice later. Again, use a new clamp at the fuel pump end.

9. Install the tank. Don’t forget the electrical connectors and vent lines. Smile! You will NEVER have to remove it again for filter replacement!
10. Install the UPPER "return" hose, with new clamp, to the UPPER plastic distribution line.

11. Run the entire length of the LOWER "supply" hose along and under the UPPER "return" hose. Continue to route it towards the rear, above the clamp holding the steel brake lines, then inside and out to the right BETWEEN the two brake lines just forward of the rear subframe mounting boss casting on the transmission.

12. Mount your new filter using the cable clamp, the 4mm diameter longer screw and the spacer in place of the screw where the brake lines are clamped to the transmission casting below the right throttle body. The filter fuel direction arrow should be pointing forward. The center fuel filter circumvential flange on the Deutsch should be forward of the clamp.

13. Carefully gauge the correct length of fuel hose needed to make a neat 180-degree turn and connection to the input (rear end) of the fuel filter. Cut and install the "supply" hose to the rear of the filter using another new clamp. Position the open ends of the clamp down before tightening.

14. Now install the remaining length of fuel hose to the outlet (forward end) of the filter, again using a new clamp. Feed the new hose forward, up and inside of the

inlet tract of the right throttle body towards the input of the LOWER "supply" plastic distribution line.

15. **NOW THIS IS IMPORTANT!** Cut the remaining hose to allow a smooth generous arc that contacts the cylinder finning and does NOT interfere with throttle operation. Start longer than you think and trim a little at a time to allow for a smooth arc and NO throttle mechanism interference on the right throttle body. Now install your last new clamp at the LOWER "supply" plastic distribution line.

16. **RECHECK ALL WORK, SANITIZE THE LAYOUT, RECHECK THROTTLE OPERATION, DOUBLE CHECK ARROW DIRECTION ON THE FILTER!**

17. If all looks OK, start the engine and check for leaks.

18. Test ride the motorcycle. After the ride, AGAIN check for throttle interference. If you made the forward loop long enough the hose will generously clear the throttle mechanism.

Well, that's it! You can now change out the filter in minutes and with no hassle. You will never have to go into your tank again. The aftermarket Deutsch filter is cheap, works fine, and encourages replacement every major service at 12,000 miles—a good practice. The Deutsch also works fine in Ks.

ONE FINAL NOTE:
I personally thank noted wrench Joe Katz for this "loop" installation method, for which I give him full credit. I had originally installed a much smaller filter along the "supply" line without a loop above the right throttle body. This seemed to work until I observed that the Fram 3606 filter I was using at the time would inhibit fuel flow at wide open throttle, dropping fuel pressure and causing fuel starvation initially on the right cylinder—NOT good! Curiously, the similarly sized Deutsch FF330 I previously had installed didn't cause this. Anyway, I wanted to use the larger OEM size filter but couldn't see the obvious "Katz" solution. Thanks, Joe! As always, questions are welcome. Happy Wrenching!

Editor's Note: R1100GS/1150GS riders are placing the external fuel filter on top of the air box.

Synchronizing R1100 Throttle Bodies - Bob Gorman

This is and will continue to be a hot topic amongst R1100 owners. Properly synched throttle bodies will greatly reduce surging and vibration but getting them synched and keeping them synched is probably the most difficult of any BMW motorcycle to date. Dealers were required to purchase a $1000.00 special instrument in order to properly synch the big twin but it can be done with the conventional Carb-Stix. It is easier with the special tool which electrically dampens the sensitivity of the throttle operation but I have had very good luck with the Carb-Stix for over 50,000 miles.

First attach the Carb-Stix to the each throttle body by removing the black vacuum hose on the underside and attaching the Carb-Stix. It is not necessary to plug off the removed vacuum hoses. If you have fuel injector covers on your bike remove the right side cover only. We will perform the synching operation with the bike running. It must be at normal operating temperature, but take care to not let it overheat. If you cannot complete the operation in 5 minutes then let the bike cool a bit and try again or use a fan to keep cool air flowing over the bike.

There are only two adjustments that can be performed on the R1100 throttles, idle and throttle cable. The idle adjustment is accomplished by turning the brass screw on each throttle body. They are big screws so you can't miss them. DO NOT set the idle speed by manipulating the throttle stop screws like the older twins. The starting point for the idle screw setting is 1 1/2 turns out for the RS and RT and 2 turns out for the R and GS. Before setting the idle make sure you loosen the right side throttle cable. There can not be any pull on either cable.

Start your bike and notice the mercury level rise in both columns. Take care when dealing with mercury, it is extremely toxic. Turn each brass screw slightly in or out to get the mercury levels dead even. The actual level is not important, we just want both columns to be equal. When adjusted correctly the screws should be within 1/2 turn of one another.

Now we'll go to the throttle cable. Only the right side is adjusted. The throttle cable is a single cable that extends from the throttle grip to the left throttle body and then continues over to the right throttle body. By manipulating only the right side we are synching the right with the left. All we care about is that both throttle bodies are pulling equal vacuum. With the bike running raise the rpms and watch the mercury level rise. We want them to rise together and stay even at all rpms. This is easier said than done. Don't worry too much if they are off slightly. Your target point is just when all the slack is removed from the cable but before there is so much tension that your idle is affected.

Make sure the columns are close at 4,000 rpms, the dreaded surging range. Some tuners like to use the throttle lock to keep the rpms even but I prefer to continue to raise and lower the rpms instead. Be careful not to chop the throttle suddenly from high rpm's, as this can potentially suck mercury into the motor. If you need to make an adjustment loosen, or slacken in BMWese, the 10mm lock nut on the cable nipple. Turn the cable nipple in or out being careful not to turn the cable housing at the same time. Keep checking to make sure the cable turns freely in the nipple. Make small adjustments, 1/2 half turn in or out can make a difference. Once you get the mercury columns to rise together and settle fairly closely at various rpms you are done. Secure the lock nut and check one more time.

If you still feel you just don't have it right you can always have you dealer use the BMW Synchro on it.

Throttle Body Sync - Jon Diaz

How To Synch Those R1100 Throttle Bodies!

As an R1100 pilot, you've likely felt it: that little hum in the turn signal switch or the vibrating mirror you can't see out of or worst case, a bike that surges so badly at part throttle you can't ride smoothly. It's all part of those first days of R1100 ownership, and very easy to deal with.

When you twist the R1100 throttle, the cable actuates a cam on the left throttle body, which in turn actuates a cable that crosses over to the right throttle body. The cross-over cable tends to stretch during those first few months of use, and this is why the cylinders fall 'out of sync' with one another at part-throttle settings and give you fuzzy mirrors.

I purchased a mercury manometer (Carb Stix) from my local dealer to use for this procedure. It consists of rigid plastic tubes sitting in a reservoir of mercury at one end, with flexible hosing attached to the other end to plug onto the taps at the throttle bodies. You will also need a 10mm box-end wrench, a flat-blade screwdriver, and needlenose pliers.

Temperature of the motorcycle engine is critical to the success of this operation. I like to run my bike for at least 15 minutes before returning to the garage to perform the operation. Too hot an engine is bad as well, so avoid excessive idling or traffic during your warm-up period. If it is really hot outside, use a room fan in front of each cylinder to provide a little cooling breeze and temperature stability.

After the warm-up ride, place the bike on the centerstand. Remove the black plastic injector covers if your bike has them, remove the vapor recovery tubes from the bottom side of each injector body, and insert the hoses from the Carb Stix onto the exposed taps. Hang the Carb Stix from the ceiling with a bungee cord or something similar so you can see the mercury levels easily from the right side of the bike.

Then loosen the locknut on the cable adjuster on top of the right-side

throttle body cable, because this is where you will make the part-throttle adjustment. There is no need to fiddle with the cable adjuster on the left-hand throttle body.

Start the bike. The mercury should come up a few inches in each tube, and if they are at different levels, this indicates a different amount of air is being drawn by each cylinder. Using the bypass screws on the top rear of each throttle body, align the two levels. Small rotation (i.e. less than half a turn) of the screws should be all that is required to achieve this.
Once the idle balance is set, you should do a part-throttle setting to ensure that the butterflies are opening identically. Use about 2500 rpm. Hold the throttle open at the set speed, and adjust the knurled portion of the right side throttle body cable adjuster with your other hand to align the mercury levels. When the levels are even, let the bike return to idle (checking alignment again!), and if all is well, tighten the locknut on the cable adjuster, making sure that the adjuster does not rotate with the locknut and mess up your adjustment. Sometimes it is easier to hold the knurled adjuster with a set of needle-nose pliers while you tighten the locknut with your 10mm wrench. Recheck after tightening, as the adjustment may change when turning the locknut.

Congratulations, you have done your first throttle synch. Now go out and ride until you can't see out of your mirrors again.....

Throttle Body Synch – Stephen Karlan (Dali Meeow)

An out-of-synch condition develops (R850 and R1100) because the throttle body cables stretch or because they lose their adjustment. The result is vibration, sometimes unreal vibration.

The following procedure, which I call the Gorman/Diaz Balance, was developed by Bob Gorman and Jon Diaz from Chicago. It is a fast and simple procedure that can yield dramatic riding improvement.

The 1994-96 models have a crossover synch cable; the 1997 model has left and right throttle cables attached in an upside down "Y" pattern. Use these instructions for the 1994-96 models. If you have a 1997 model, look for the ['97 -] and follow the instruction inside the brackets and disregard the instruction given immediately prior to the ['97 -] brackets.

Overview:
The throttle bodies will be synched at two rpm levels.

The low rpm synch will be done first. With the bike at idle (1,000 to 1,200 rpm), the large brass bypass screws will be adjusted. (LBBS in the Glossary at the end of this article will help you find this part.)

The high rpm synch will be done last. With the bike at 2,500 to 4,000 rpm, the right side crossover synch cable will be adjusted. (RSCSC in the Glossary at the end of this article will help you find this part.) ['97 - right side throttle cable will be adjusted.]

Tools needed:
mercury manometer (carb stix) and a way to secure it (several places to obtain the carb stix are given at the end of this article)
small pliers or needle nose pliers
10 mm wrench
flat screwdriver
pencil and paper.

Setting Up:
Remove the right side black plastic fuel injection plug cover for access to the right side crossover synch cable ['97- remove cover for access to right throttle cable]. If you have a lower fairing, remove it to allow air to reach the cylinders and to prevent cooking the fairing. With the bike on the center stand, retract the side stand, put the transmission in neutral, turn on the bike and warm up the engine. Jon Diaz
suggests a more enjoyable way to warm up the engine -- take a ride.
Position a fan near the front tire with its output directed at the cylinders equally to avoid overheating, or use two fans, one directed to each cylinder. If your bike has a Rider Information Display (RID), allow the oil to heat up to 5 bars, otherwise idle the bike for five minutes.

Secure the mercury manometers (carb stix) on the right side of the bike, where most of the work will take place. Use any method that secures the carb stix (and the hazardous mercury) vertically while the bike is running, such as hanging the carb stix from the ceiling.

There is one black tube attached to the under side of each throttle body. Remove both black (vapor recovery) tubes and you will expose the brass nipples that point down. Attach one of the carb stix's flexible plastic tubes to each brass nipple. Make certain that the carb stix's plastic tubing does not touch hot exhaust parts; the tubing will melt. There is no need to plug the black vapor recovery tubes.

Starting the Adjustment:
Loosen the right side crossover synch cable by loosening the 10mm lock nut and turning the knurled knob counter clockwise to ensure that there is slack ['97- loosen right throttle cable] .

Count the turns you make to lightly seat both the right and left large brass bypass screws by turning them clockwise with a flat screwdriver. Record this information for possible trouble shooting later.

As a starting point, back out both large brass bypass screws 1 1/2 turns for an RS or RT; 2 turns for an R or GS.

Start the engine. The bike may idle rough because it is not in synch. Do not be concerned about a rough idle at this time. If the bike will not idle at all due to air starvation, back both large brass bypass screws out by 1/4 turn (ccw) until the bike maintains a rough idle.

If the bike is idling too fast, reduce the air flow by screwing both large brass bypass screws clockwise (cw) in increments of 1/4 turn. If the bike is idling too slowly, increase the air flow by screwing both large brass bypass screws counter clockwise (ccw) in increments of 1/4 turn. At some point you will not be able to decrease or increase the idle speed by moving the large brass bypass screws. Return to the setting immediately prior to the point where the idle was not changed by moving the large brass bypass screws.

You now have the large brass bypass screws at the starting point for the low rpm synch.

LOW RPM SYNCH:
With the throttle at idle (1,000 to 1,200 rpm on the tachometer) and the bike at normal operating temperature, turn the right large brass bypass screw clockwise until the mercury columns in the carb stix are at an equal height. If moving the right large brass bypass screw does not accomplish equal height mercury columns, then reset the right LBBS to its starting point and turn the left LBBS clockwise until the mercury columns in the carb stix are at an equal height. The amount the mercury column rises or falls, its actual height, is not important. What is important is that both left and right mercury columns are the same (equal) height.

The goal is to balance the throttle bodies with the large brass bypass screws open as little as possible (minimum counter clockwise opening). Bob Gorman notes that, when adjusted correctly, the screws should be within 1/2 turn of each other.

If the bike does not adjust by turning the LBBS clockwise (in), or if the idle speed is too low (below 1,000 rpm), change the starting point of the low rpm synch by backing out both LBBS (counter clockwise) by an additional 1/4 turn.

HIGH RPM SYNCH:
When performing the high rpm synch, you will be moving the throttle up to 4,000 rpm. Move the throttle slowly to avoid sucking mercury into the engine.

The right side crossover synch cable has already been loosened ['97- right throttle cable has already been loosened]. The knurled knob should turn without turning or binding the crossover synch cable.

Adjust the knurled knob so that the mercury columns rise together as the rpm rises. You may need several turns to take up the slack you created earlier. Some riders adjust the mercury column heights with the rpm steady at 2,500, some with the rpm steady at 4,000, and some make this adjustment so that the columns are fairly equal while the throttle is being opened from 2,000 to about 4,000 rpm. The mercury columns should be fairly equal if the throttle is held steady or while the throttle is increasing rpm from 2,000 to 4,000.

After adjusting the knurled knob so that the mercury columns are equal, tighten the 10mm lock nut and recheck the mercury levels. If tightening the lock nut moves the knurled knob and upsets the adjustment, hold the knurled knob with small pliers or needle nosed pliers to maintain the adjustment. If holding the knob does not work, measure the amount of mercury column error after tightening the lock nut. Recording this measured error, loosen the lock nut and add the amount of measured error to the mercury column before tightening the 10mm lock nut. This objective is to have equal mercury column heights after the lock nut is tightened.

Test your work by checking the mercury level at idle and at 2,500 rpm. If not equal, you should begin again with the adjustment process at "Low RPM Synch".

Trouble shooting:
If the valves are not properly adjusted and are not equal side-to-side, the cylinders will not be getting an equal amount of air-fuel and the throttle bodies cannot be balanced.
Check that the air supply tube-throttle body connection is aligned, that the air supply tubes are fully seated at both ends and that the clamps are correctly aligned when tightened.
If, after satisfactorily completing the synch, the bike begins to vibrate wildly, check to see if a small stone or other debris has become lodged in the throttle cable pulley. This is a common problem.

~~~~~~

Where to buy carb stix, mercury:

Precision Manufacturing Services at 800-237-5947 was selling the Motion Pro brand for $36.95 + shipping in 1996.

J.C. Whitney has a Motorcycle Accessories and Parts Catalog for $1. They show several types of vacuum gages and mercury manometers. Their address is P.O. Box 3000, LaSalle, Illinois 61301, phone 312-431-6102; fax 312-431-5625.
~~~~~~

Donelson Cycles Inc. at 800-325-4144 was selling the Motion Pro brand for $34.45 including shipping in 1996.

Ask you favorite cycle shop or mail order company for their price.

If the mercury comes out of the reservoir (because it tipped over or the cat hit it), you can get it from Chaparral Motorsports 1-800-841-2960 part# 315-0441 for $9.99.
~~~~~~

Glossary:

RSCSC - Right side crossover synch cable ['97- right throttle cable].
On the right side of the bike, forward of the fuel injection plugs and between the engine and the throttle body, you will find this vertical cable. The cable is secured on a bracket with a lock nut on the bracket and a knurled knob above the lock nut. After loosening the lock nut, turning the knurled knob will either lengthen or shorten the cable. If the top of the cable is pulled gently up, it should come out of the knurled knob. This is the mechanism that must be adjusted to vary the mercury columns.

LBBS - Large Brass Bypass Screw:
On the right side of the bike, on the outer surface of the throttle body tube is a large brass bypass screw with a slotted (NOT Phillips) head that faces toward the rear of the bike. If you were to place a screwdriver on the screw, the handle of the screwdriver would point toward the right rear turn signal. This large brass bypass screw is approximately one inch forward of the black plastic air intake tube. You are looking for it on the right side because it is easier to locate there; there are fewer things in the way. You can see the large brass bypass screws easily when standing near the turn signals. If you look on the left side, you will find a similar
large brass bypass screw. The official BMW Repair Manual calls this a "recirculating air screw" at page 00.27.

~~~~~~

Note: The throttle cables on many 1994-96 bikes were replaced with Teflon coated units (warranty service bulletin #2748 dated 7/3/96) because the inner cable was sticking. The improved cable was installed at the factory after the following VIN number:

R1100RS	0312537
R1100GS	0381479
R1100R	6379238
R1100RT	0440499
R850	from start of prod.

If the older type is installed on your bike, and if it has not been replaced, see your dealer because some older cables caused significant balancing problems.

~~~~~~

Author's note: I tape new throttle cables open to speed-up stretching and break in. The original throttle body synch work by Jon Diaz can be found at http://www.ibmwr.org/rtech/R11-throttle-sync.html Bob Gorman's original throttle body synch work appeared in a local newsletter and the original tune-up manual.
~~~~~~

Throttle Position Sensor - Bob Gorman

The throttle position sensor is located on the left throttle body. It is the black box with an electrical plug extending from the bottom. The sensor is what ties the mechanics of the throttle cable to the electronics of the Motronic.

The Motronic needs to know the position of the throttle so it can regulate gas flow, timing, and other engine management functions. As you turn the throttle, voltage is adjusted up and down in the sensor and relayed to the Motronic.

If you pull down the rubber cap from the electrical connector on the sensor you will notice 4 wires. The wire closest to the rear (number 1 – red/white) is effected by throttle openings up to 1/8th turn. Most surging occurs at very small throttle openings so we want to make sure that the baseline voltage is correct. Our goal is to equate a closed mechanical throttle with .370 to .400V.

Place the positive lead of the DVM (Digital Volt Meter) up into the plug corresponding to wire number 1(red/white). On the newer bikes there is an internal seal around the wire so use a needle or paperclip to penetrate the seal and make contact with the wire. Attach the ground wire to a good unpainted bolt.

Turn on the bike but do not start. Note and record your initial TPS voltage so you can go back to it if necessary. The voltage should read between 370 - 400mV. If not you'll need to loosen the two screws holding the sensor in place and slowly rotate it one way or the other until the correct voltage is achieved. Don't worry about messing it up, you can't. After the sensor reading is set, tighten the sensor screws.

One last step, if the voltage during the setup process went above 400mV then a fault may have been generated in the Motronic. This is easily reset by pulling the number 5 fuse from the left and then replacing it. The Motronic is now reset and the throttle position setting is right on spec.

Throttle Position Sensor - Rob Lentini

Note: the following information has been updated in the "Zero = Zero R1100 Throttle Position Sensor Tuning" article in the Super Tuning section of this manual. The following information is intended primarily for people who wish to adjust their TPS but do not want to change the factory sealed throttle body stop screw on the throttle body.

Here's what I know about Throttle Position Sensor (TPS) settings on my bike an R1100RS. I also suspect that this information will apply to the R1100 GS, RT, and R also.

Locate connector #1 on your TPS - it is to your right as you face the TPS or the rear most connector (red/white wire). All of my readings were taken with a high quality Fluke 79 Digital Voltmeter (DVM) with the positive lead to the TPS and the negative to the engine block. I used a paper clip to probe inside the TPS connector. Readings may be taken with the engine running or not, though I observed a very slight (2-3mv) change between the two states. Ignition must be on, engine cutoff switch in the on position, and the sidestand retracted to make a reading.

The voltage range at #1 is .370 - .400 volts at idle to a smooth increase with throttle to 4.77 volts at about 1/3 throttle opening. There is no further increase to wide open throttle. Thus this part of the TPS appears to control idle and off-idle primarily. Publicized idle values as set by the BMW analyzer are the source of the above .370 - .400 figures. These values appear valid, though changes to individual machines may be advantageous.

It appears that for machines operated primarily at higher altitudes (above perhaps 4000 ft.), setting pin #1 TPS voltage to .370 or even slightly lower can improve performance. Conversely, if a machine is operated at sea level, #1 could be set for .400 to fatten up the fuel/air mixture slightly.

Performance-wise here is what I observed and concluded:

-TPS #1 values of .370 or less reduce surging, reduce throttle response, and increase backfiring tendencies. Too low a setting could cause pinging, overheating, and catalytic converter damage.

-TPS #1 values closer to .400 or even slightly above don't necessarily increase surging, but they do improve throttle response and reduce backfiring. Too high a setting could violate emissions regulations, damage a catalytic converter, and increase fuel consumption.

Throttle Screw and TPS Adjustment - Stephen Karlan (reviewed by Rob Lentini)

I. The Problems.

Surging -- A condition of increasing and decreasing power, cycling back and forth, when the throttle is held absolutely steady at a fixed rpm (such as 3,500 rpm while using a throttle lock, tape or rock-solid hand). The electronic control system is hunting (up and down) for the correct air/fuel mixture and the engine is not responding to throttle input but to electronic sensors.

To minimize surging, the throttle plate screws (two) and the Throttle Position Sensor (one TPS on the bike) are adjusted using a voltmeter. (There can be other factors, but an incorrectly set TPS is the 95% problem.)

Vibration -- Shaking or oscillating. When the throttle is held in a fixed position, the vibration is constant and unchanging. It may vibrate more at one throttle opening (rpm) than at another; i.e. it may vibrate more at idle (or is more noticeable at idle) than at 3500 rpm.

To minimize vibration, the throttle bodies (one for each cylinder on each side of the bike) are balanced using mercury columns.

Ensure that the valves have proper clearances before starting any fine tuning and that plugs and wires are operating correctly. Instructions on performing a valve adjustment can be found at http://www.ibmwr.org/rtech/r1100_valve_adjust.html

II. The Approach.

It is quite possible that a bike has both a surging (throttle plate screws and TPS) and a vibration (throttle body) problem. With these instructions, you will address the surging and vibration problems in that order. If you do not have a surging problem, DO NOT adjust your TPS ! If you do not have a surging problem, DO NOT adjust your TPS ! If you are not sure about your problem, then do not continue with these instructions and, instead, balance the throttle bodies using "Throttle Body Balance for Dummies". In fact, I strongly recommend that you balance the throttle bodies at least twice before you use the instructions in this article. Throttle body balancing is relatively fast and easy to accomplish and, you will need to balance the throttle bodies as part of setting the throttle plate screws and TPS.

In addition to surge and vibration, some bikes will present an idle anomaly in which the idle will be too high. The idle problem, which is nothing more than an idle in excess of 1200 rpm, occurs most frequently on GS and R models after resetting the throttle plate screws and the TPS. This problem is addressed at the end of the TPS adjustment instructions. Idle speed also is addressed in "Throttle Body Balance for Dummies" if you are only performing a throttle body balance.
The basic knowledge about adjusting the TPS and basic throttle settings to obtain optimal engine response is the work of Rob Lentini; his Zero=Zero article appeared in MOA's Owners News and is on the IBMWR web site at http://www.ibmwr.org/tech.html.

This article does not present significant or new procedures, it has been written for newbies and simply goes into greater detail. It was designed to help you find the right

part to tweak. These instructions assume that you know almost nothing about the bike, where parts are located, or how it functions. The priority here is to help you diagnose and adjust the bike, not engineering or theory. You may need detailed instructions the first time you do the adjustment; subsequent adjustment will require much less information. If you run into problems, contact the author by private eMail or at (305)255-1010. For another perspective on setting the TPS, look at Rob Lentini's original work which has already been cited.

III. How to set the TPS on the R850 and R1100

WARNING: BMW does not approve of this procedure. BMW warns that "The sealed stop screws on the throttles must not be tampered with, or else the basic idle flow setting will have to be reset by the manufacturer." There is a Throttle Position Sensor article by Bob Gorman and an early Throttle Position Sensor article by Rob Lentini that present ways to set the TPS without resetting the throttle stop screws. These do not violate the BMW warning and these may be used before resorting to this procedure. The author of this article assumes no liability for any damage or injury to you or your bike caused by any errors or omissions.

Read through these instructions, and also "Throttle Body Balance for Dummies", before you pick up a wrench or screwdriver. Find the parts before you start. This will save work and cursing time.

Begin with a cold engine and do not start the engine until after the TPS has been adjusted. Place bike on center stand with side stand retracted. You will need two special tools, a digital volt meter (DVM) for setting the TPS, and a set of mercury manometers (also called carb stix or mercury columns) for setting the throttle bodies.

12 Steps to Throttle Set Screw / TPS Adjustment

1. Loosen throttle cable (left side)
2. Loosen throttle body crossover synch cable (right side)
3. Back out the left throttle plate stop screw (underneath left side)
4. Attach DVM to red-white TPS wire #1 (rear) - ignition on
5. Move TPS to obtain zero reading (.006 volts) and lock TPS
6. Move left throttle plate stop screw to obtain .370 volts and lock screw
7. Large brass bypass screws in, bike on, warm engine, rough idle expected
8. Turn the large brass bypass screws out in 1/4 increments if bike will not idle; attach carb stix
9. Set right throttle plate stop screw using carb stix
10 Reduce TPS in increments of 0.020 if idle exceeds 1100-1200 rpm
11. Reset throttle cable (left side) to .5 mm free play
12. Perform the "Throttle Body Synch for Dummies".

Each of the 12 steps above is explained below, with a detailed explanation of how to find and adjust the correct part. All of the information on Step 1 will follow the Step 1 heading.

Step 1. Loosen throttle cable (left side)
Here are four (A-D) ways to find the throttle cable. Use all of these the first time you use these instructions to ensure that you have the correct part.

(A) Starting at the front edge of the seat, if you were to hang a string onto the left side of the bike, it would contact the black plastic air intake duct (2 1/4 inch diameter tube) about 11 to 13 inches down. Follow this black plastic duct or tube forward to where it is attached to a metal tube or duct that is 3 1/2 inches long with plastic and metal parts all over it. Everything related to the TPS adjustment is attached to this metal duct, or a similar metal duct in the right side. For our purposes, the metal duct has a top and bottom area, an outside and an inside area (close to the body of the bike). There is a bracket on the inside area where two cables are vertically attached. The cable closest to the metal duct (forward outside) is the throttle cable.

(B) Starting at the rear of the large finned metal engine cylinder that sticks out on the left side, the throttle cable is approximately two inches to the rear of this location and close to the engine.

(C) The throttle cable can be generally located by first locating two plug-type wires on the top of the metal duct, and from this point look down and between the metal duct and the bike.

(D) There is an easily removable (and frequently lost or missing) three-sided plastic cover with a round bottom that clips onto the top front area of the metal duct. This plastic cover comes off by pulling it upward and toward the front of the bike. Take this plastic cover off (no tools necessary) and the throttle cable is close to the location where the inside of the plastic contacted the metal duct.

Now that you have located the general area of the throttle cable, by careful inspection you will see that two cables come into the same area and mount on one metal bracket or metal plate located on the inside area of metal duct. [On 1997 models there is one cable only, the throttle cable. Disregard the references to other cables.] The cable that is the furthest from the engine is the throttle cable (still forward outside). To make certain you have the correct cable, move the throttle on the right handlebar and this should move the throttle cable that you have identified on the left side. (You may need another person to move the throttle on the right side of the bike while you watch the cable on the left side.) If the left side cable does not move, you have not located the throttle cable. Move the throttle on the handlebar and look on the left side for a moving cable that matches the information above. Now check the cable next to the throttle cable by moving the choke lever on the left handlebar and watch the choke cable move; do no loosen the choke cable. There is a third cable to the rear of these two which is the crossover synch cable; this is on its own mount and need not be loosened or adjusted in any way.

If you are not certain you have found the throttle cable, either find another BMW rider with an R bike and ask for help finding it, or go pester your local mechanic.

This is a tight area in which to work and so you will remove the three-sided plastic cover with the round bottom that mounts on the gas intake area. There are two plugs on top of the metal duct that were covered by the three-side plastic piece you have removed; these are fuel injection controls. The front plug of the two may be removed by depressing (press in) on the wire clip on the plug and then lifting the plug from its mounting. After removing both the three-sided plastic cover and the fuel injection plug, there will be more room in which to work.

You are now ready to loosen the throttle cable, which was the whole purpose in finding this cable. You must loosen the lock nut, the six-sided nut that sits on top of the bracket,

with a small wrench (counterclockwise). There is a metal piece that is threaded into the lock nut which can now be loosed with your fingers by turning it in a clockwise direction. Loosen the lock nut as needed so the cable is loose. Check this by twisting the throttle on the handlebar; you must be able to give at least a 45-degree turn on the throttle and see that the throttle cable is loose. Now depress (squeeze) the wire clip on the fuel injection front plug and replace the plug you previously removed.

Step 2. Loosen throttle body crossover synch cable (right side)
After loosening the throttle cable, it's time to move on and to look at the right side of the bike. Go to the same general area on the right side as you were examining on the left. There are fewer controls and only one cable. Here are two ways (A, B) to find the right crossover synch cable.

(A) There is a metal 2 1/4 inch diameter tube (similar to the left side but with fewer black plastic or cable items attached to it) that also continues into the large finned cylinder (as it does on the left side). There also may be a three-sided plastic guard with a round bottom if you have an RS or R (not on the GS or RT, and not there if it has been lost). From the metal tube area, look into the side of the bike to see a single cable mounted on a metal bracket; it is the only cable in the area.

(B) The right crossover synch cable is located about two inches from the rear of the large finned cylinder and close to the engine.
First remove the three-sided plastic cover with the round bottom if there is one. Next loosen the lock nut that is located near the top of the bracket (turn counter clockwise). After the lock nut is loose you can loosen the cable by screwing (clockwise) the metal piece that is above the lock nut. Screw until the cable is loose. The loose cable can be seen below the metal bracket.

Step 3. Back out the left throttle plate stop screw (underneath left side)
It's now time to return to the left side of the bike. When the throttle on the handlebar is twisted, it not only moved the cable you have now loosened, it also moved a metal flange piece that comes in contact with a metal plate. There are two ways to find this metal flange piece and the left throttle plate area.

(A) Check instructions for Step 4 and find the TPS. If there were an imaginary line that passed through the right TPS screw and then continued through the round metal body on which the TPS is mounted, that line would intersect the left throttle plate stop screw. When you move the throttle on the handlebar you also are moving the metal flange piece that contacts the left throttle plate stop screw.

(B) The metal throttle flange is located near the inside of the metal 2 1/4-inch diameter tube and is very low and near the inside of the tube. The easiest way to see this is to put your head on the ground just forward of the rear tire and to look up. This is an awkward position but the metal flange piece is easy to touch. The screw, that limits how far it can close, is located on a metal plate above the flange. This screw determines the distance between the flange and the throttle plate. [If you see an adjustment screw on a long arm, this is related to the throttle advance (adjusts the "choke"); this is NOT the screw you are looking for.]

Now that you have found the flange and screw, you now must figure out how to adjust the screw. Loosen the silver metal clamp that secures the black plastic air intake hose to the metal throttle body and rotate the clamp for a more unobstructed working area;

remove the hose if necessary. Remove (cut off) the plastic cable tie that secures a wire if it obstructs the working area. Replace the cable tie, hose and clamp when finished with the throttle plate screw adjustment. The physical manipulation that is described in the next paragraph (especially on RS models) is a challenge to your stamina and will take time, patience and any odd-ball tool that works. If you find a tool that makes this easy, please please please contact this author with your hint.

Your job is to loosen the 10 mm lock nut (counterclockwise) using a small wrench, and then loosen the 8 mm stop screw (counterclockwise) using a wrench or a screwdriver so that the metal flange piece does not contact the screw at all. If you loosen the screw a few turns you should be able to see a gap between the end of the screw and the metal flange piece. You must see a gap, which means the left throttle is closed. There must be a gap !

Step 4. Attach DVM to red-white TPS wire #1 (rear) - ignition on
The TPS is mounted on the outside of the left 2 1/4 inch metal tube you have been working around; it is a black flat plastic cover that measures 2 1/2 inches wide x 2 inches high with the word Bosch imprinted on it. This cover is attached by two allen-head screws through the cover and the allen-head screws describe a horizontal line.
There is a prong attached to the bottom of the TPS, and a rubber boot that covers the bottom of this prong. The prong can be removed easily by depressing the wire, which acts like a latch, and pulling down. Do not remove the prong. Nothing bad will occur if you do remove the prong from the body of the TPS, but for this adjustment the prong must be attached.

The rubber boot that surrounds and protects the wiring that enters the bottom of the TPS must be moved out of the way. Exert only enough force on the rubber boot to wiggle it down far enough to expose about 1/2 inch of the four wires that enter the prong. The wire furthest to the rear is coded; it is white and red and called wire #1. Insert a sewing needle, a paper clip or other sharp and thin metal (electrical conducting) object up and into the plastic housing where the white and red wire enters the prong.

Step 5. Move TPS to obtain zero reading (.006 volts) and lock TPS
Attach the ground probe (lead) of your digital volt meter (DVM) to the spring of the side stand or some other grounded metal object. Attach the other probe (lead) to the object inserted into the white and red wire. With the bike on the center stand, with side stand retracted, and with engine cut-off switch on the right handle bar indicating "on", turn the ignition key to "on" but DO NOT start the bike.

Read the DVM and record this TPS value for possible future reference. Do not remove the TPS screws; loosen them so that the TPS can be moved (adjusted). Turning the TPS slightly in one direction will increase the voltage; turning it in the other direction will decrease the voltage. Turn the TPS until the observed voltage decreases to about .006 or .005 volts, which probably is as low as the voltage will go. If it will go no lower, that's okay. DO NOT continue to turn the TPS after it reaches its minimum value, which is close to zero. Start at a high value (.300) and turn the TPS until it reaches the low value (.006 or .005) and stop. [Note: Some digital voltmeters have an autorange function; below a certain value they will read in millivolts. The .006 may read as 6 MV, which is the same as .006 volts. Don't let the decimal places confuse you.]

Stop moving the TPS just when the voltage stops decreasing and lock it down there. At this point we say the TPS is at zero. The throttle position is also at zero. The TPS is

now locked and set. This is the last TPS adjustment you will need; it is now set. You will not change the position of the TPS again !! [Author's note: The throttle opening is at zero and the TPS value is at zero, which explains Rob Lentini's title of "Zero-Zero" for this procedure.]

Step 6. Move left throttle plate stop screw to obtain .370 volts and lock screw.
With the ignition still on, turn the left throttle plate stop screw clockwise (CW). By turning the screw, the flange will be moved away from the throttle plate. Continue turning the throttle plate stop screw until the voltage starts to rise, and continue until you reach 370 millivolts (.370 volts). Stop there, and lock it down with the lock nut. Blip the throttle several times to check the accuracy and repeatability of the 370 millivolts. Readjust the throttle plate screw if necessary. Remove the DVM, remove the object inserted into wire #1, replace the rubber boot onto the TPS.
There is a possibility that .370 millivolts will not be the correct adjustment value for your bike. This will be explained in Step 10.

Step 7. Large brass bypass screws in, bike on, warm engine, rough idle expected
On the right side of the bike, on the outer surface of the throttle body tube, is a large brass bypass screw with a slotted (NOT Phillips) head that faces toward the rear of the bike. If you were to place a screwdriver on the screw, the handle of the screwdriver would point toward the right rear turn signal. This large brass bypass screw is approximately one inch forward of the black plastic air intake tube. You are looking for it on the right side because it is easier to locate there; there are fewer things in the way. You can see the large brass bypass screws easily when standing near the turn signals. If you look on the left side, you will find a similar large brass bypass screw. The official BMW Repair Manual calls this a "recirculating air screw" at page 00.27.

Count and record the turns you make to lightly seat both the right and left large brass bypass screws by turning them clockwise with a flat screwdriver.

Position a fan near the front tire with its output directed at the cylinders equally to avoid overheating, or use two fans, one directed to each cylinder. If your bike has a Rider Information Display (RID), allow the oil to heat up to 5 bars, otherwise idle the bike for five minutes. It will idle rough because it is not in synch. Do not be concerned about a rough idle at this time.

Step 8. Turn the large brass bypass screws out in 1/4 increments if bike will not idle; attach carb stix

If the bike will not idle at all, back both large brass bypass screws out in increments of 1/4 turn until the bike will sustain a rough idle.

Secure the mercury manometers (carb stix) on the right side on the bike, where most of the work will take place. Use any method that secures the carb stix (and the hazardous mercury) vertically while the bike is running , such as hanging the carb stix from the ceiling.

There is one black tube attached to the under side of each throttle body. Remove both black (vapor recovery) tubes and you will expose the brass nipples that point down.

Attach one of the carb stix's flexible plastic tubes to each brass nipple. Make certain that the carb stix's plastic tubing does not touch hot exhaust parts; the tubing will melt. There is no need to plug the black vapor recovery tubes.

Step 9. Set right throttle plate stop screw using carb stix.
At this time, locate the right throttle plate screw (mirror image position of the one on the left side). The screw will have a lock nut similar to the one on the left side. If it is difficult to manipulate the lock nut and screw, you have located the correct hardware.

With the bike warm and the fan on, look at the mercury columns. If they are not at an equal level, loosen the lock nut on the right side throttle plate and adjust the screw in or out until the mercury columns are equal. If the bike will not idle, then turn both large brass bypass screws out another 1/4 turn.

Step 10. Reduce TPS in increments of 0.020 if idle exceeds 1100-1200 rpm
After adjusting the right side throttle plate screw to get equal mercury columns, look at the rpm. Ideally, rpm is now 1100 to 1200. Some bikes will have an abnormally high idle; as high as 1800 rpm or more. This is most prevalent in GS and R models. To correct the high idle, return to Step 6 and place one lead of the digital volt meter (DVM) back on the red and white wire of the TPS and ground the other lead. DO NOT move the Bosch black TPS. Reset the left throttle plate screw (the left rear screw with lock nut that was difficult to adjust) and reduce the TPS voltage by 0.020 volts (from .370 to .350) by turning the throttle plate screw. Continue with the rest of the Steps in order after Step 6. If the idle is still too high, continue to reduce the TPS value by increments of 0.020 until the desired idle is reached.

Step 11. Reset throttle cable (left side) to .5 mm free play
Reset the left side throttle cable for about .5 mm of free play. Check this by twisting and releasing the throttle several times and then rechecking the free play.

Step 12. Perform the "Throttle Body Synch for Dummies", which is part of the R1100 Maintenance Guide and also has been submitted for inclusion in the IBMWR Web site.

Throttle Cable and “Choke” Cable Replacement, and Service of the Cable Junction Block on a Late Model Oilheads - Bryan Lally

Bikes effected:

These instructions are for an R1100RS with the cable junction block (crank wheel) throttle cable. It should be a very similar operation on any of the oilheads except for the differences in fairings and trim parts. These instructions do not apply to bikes with the crossover cable throttle arrangement.

Why did I do this?

The fast idle cable on my oilhead (at 3400 miles) started to "stick." When the fast idle lever was moved from the normal position to the detent or start position, the cable worked normally. But when the lever was returned to the normal running position, the cable would go very slack and the throttle butterflies would not return to the idle stops. Putting tension on the throttle cable would cause the fast idle cable to snap back to its normal state (and the butterflies would close).

After some thought and considerable pulling and wiggling of cables, I decided I needed to take a good look at the junction block assembly.

Short Story

The fast idle cable pulls on a small ramp, which pushes on a flat on the crank wheel, turning the wheel and opening the throttle butterflies by way of two short cables. The ramp acts like a wedge between the flat on the wheel and the slot that the ramp slides in. There is a return spring for the fast idle ramp and cable located at the junction block assembly. The ramp would not release from its wedged position; it was being held in place by the tension supplied by the throttle butterfly return springs through the short cables. As soon as the throttle handgrip was turned, the ramp was released from contact with the crank wheel and returned to its rest position by the fast idle cable return spring. The junction block assembly was put together completely dry, with plastic sliding on plastic. A small amount of grease was used to lubricate the ramp and the slot that it rides in; this eliminated the clamping effect on the ramp and fixed the problem. In my opinion, this should not have been assembled dry.

Replacing Throttle Cables on Junction Block (new style) Oilheads

Remove the seats.

Remove left and right fairing pieces.

Remove the air snorkel that feeds air to the air cleaner.

Remove the fuel injector covers.

Unplug the wires that trigger the fuel injectors at the injectors, or else they will be in the way.

Remove the two screws that connect the upper fairing to the front of the gas tank, and the two screws that connect the fairing insert pieces to the front of the gas tank.

Remove the throttle cable from the twist grip (remove the small cover that the cable goes into).

Remove the fast idle cable from the fast idle lever (pry off the "choke" cover, and unscrew the large screw).

Remove the short throttle cables from the pulleys on the throttle bodies and unscrew the adjusters from the throttle bodies.

Unplug the gas tank connector from the wiring harness, and remove the connector from the tab on the frame.

Snip the cable ties that hold the fast idle cable and the throttle cable - there are several.

Pull the right hand short throttle cable so it comes out _under_ the crankcase ventilation hose. Remember when you put things back together that it goes _over_ the hose.

Pull the throttle cable out also under the crankcase ventilation hose.

Note where the left side cables exit the bike.

Now remove the cable junction block. This is the small plastic piece that the cables disappear in to. Removal is done from the right side of the bike. There is a clip on the underside of the block, which must be held down while the block is pulled out. I had to slightly bend the tab that holds the fuel tank electrical connector up so that the cable junction block would clear it on the way out. Then I was able to wiggle the cable junction block out underneath the crankcase ventilation hose.

Note: the manual says to remove the engine block end of the crankcase ventilation hose. I was able to leave this attached. The hose clamps are the use once kind that require special pliers to replace, and there is very little room to use a screw type hose clamp. Don't remove this hose unless you really have to. If you have a tip here, I'd like to hear it.

With the cable junction block out, it should be clear how to replace the throttle and fast idle cables.

The crank wheel is held in place with an E clip; remove the clip and you can take the crank wheel out. Now you can clearly see the sliding ramp that needs lubrication. Any kind of grease should work fine for this application.

Assembly is the reverse of disassembly (I always enjoy reading that). Don't forget the cable ties. You will also have to do a complete throttle body sync when you've got it all assembled. You should not have to readjust the TPS.

Motronic Fault Codes - Stefan Hegnauer

Warning!: Although unlikely, it may be possible to screw up the Motronic. I take no responsibility of any kind if you do so - in other words, it is your risk, and you are on your own if something fails. If you are not absolutely sure you can handle this, do not attempt this procedure!

Note 1: There is no connection of the Motronic (diagnostic unit) to any lights

Note 2: This is strictly for R1100R/RS/GS/RT, Motronic 2.2. I have no idea about the Motronic 2.4 of the R1100S and R1150 family.

1. Get an analogue Voltmeter (digital ones are usually not fast enough, so you could get wrong readings)
2. Hook it up between pin 1 of the diagnostic connector and ground (battery -, chassis), switch ignition on (if you don't start or just very briefly turn the engine, codes 1122 and 1133 will show, which is normal)
3. With a separate wire, connect the same pin 1 to ground for at least 5 seconds, then remove the wire
4. The needle of the voltmeter should go to nearly zero for about 2.5 seconds, then rise again to almost 12V
5. A series of short dips towards zero follows - count the number of dips
6. A short pause of 2.5 seconds follows
7. Steps 5 and 6 are repeated 3 times with perhaps different numbers of dips
8. You have now four counts, this is the Motronic diagnostic code (see table below)
9. The whole sequence, beginning with the 2.5 seconds dip of 4 above, repeats over and over until prompted again (step 3)
10. The next error code (if any) is shown after prompting

Example: one dip - pause - one dip - pause - two dips - pause – two dips - pause - long dip - pause (repeat) => code 1122

Motronic Codes

0000	no further fault stored
1111	CO potentiometer
1122	Hall signal 1
1133	Hall signal 2
1215	Throttle butterfly angle sensor
1223	Engine temperature sensor
1224	Air temperature sensor
2341	Oxygen sensor at limit
2342	Oxygen sensor signal invalid
2343	mixture setting at limit
2344	Oxygen sensor shorted to ground
2345	Oxygen sensor shorted to 12V
4444	no fault stored

To erase fault memory: pull fuse 5 for a few seconds.

Most of the information given above comes from the BMW booklet "*BMW Diagnose - Test Instructions Motronic*", # 01 71 9 789 901. This booklet is about the K1100 but seems to be valid for the R1100 as well, at least in part.

One can get additional information for both Motronic and ABS - again, strictly for the R1100 series with Motronic 2.2 and ABS II. Usual disclaimers apply.

Motronic Throttle Position Setting:
- same setup as for Motronic error codes (i.e. voltmeter or high impedance test light on pin 1 of the diagnostic connector)
- switch ignition on
- connect pin 3 to ground and keep it grounded
- if the TPS is set correctly the voltage should read about 0V (check by twisting the throttle slightly open - the voltage should rise to about 12V)
- rotate the pot if needed, recheck
- remove ground from pin 3
Note: make sure the 'choke' lever is not in action

ABS II:
- voltmeter on pin 2
- turn ignition on
- meter will indicate about 11V steady with no faults stored
- count eventual dips towards zero volts
- fix the cause of the fault and cancel code

ABS II Codes:
1 front pressure modulator
2 rear pressure modulator
3 front sensor
4 rear sensor
5 battery voltage low
6 ABS relay
7 ABS control unit
8 sensor gap front or rear

ABS II Canceling Error Codes:
this has been reported before. Just for reference:
- ground pin 2
- switch ignition on
- push ABS button for at least 8 seconds
- release ABS button
- switch ignition off and remove ground from pin 2

Notes:
- I remember having seen a code 9 once, but cannot remember to what it belongs
- ABS can store only one fault at a time
- codes 1 - 4 are latching, i.e. they don't go away automatically once the fault is fixed
- codes 5 - 9 are self-canceling as soon as the ignition is switched off and on again (the fault does not persist!)
- the ABS output signal will need some filtering due to short spikes

Most of the information given above comes from the BMW booklet "*BMW Diagnose - Test Instructions for Antilock Braking System (ABS)*", # 0171 9 798 811 (5.90). The booklet is about the ABS I, but seems to be valid for the ABS II as well.

LED Fault Code Reader – Henry de Kuijer

You can use an LED to read the fault codes mentioned in the write-up above. Instead of blips on your meter, you will count LED flashes of light.

Here is the prototype: http://www.xs4all.nl/~hkuijer/jpg/Motronic/FrameSet.htm

The pictures will give you a good idea of the simple setup. The switch is to hook pin 1 to ground for 5 sec. to start the diagnostic. The resistor is 2k2, on the high side, but I don't know what the output of the motronic is. The best is, it works.

Analog Fault Code Reader – Rob Lentini

I finally got around to trying this out, and it works perfectly. Without turning or starting the engine, I first got 1133. Then I reset per step 3 and got 1122. Final reset and I got 0000, just as I should have.

If I did the procedure with the engine running, I got 4444 right from the get go.

I used a Fluke 79 DVM which has a fast-acting analog bar at the bottom of the display.

In fact, it was so easy that I will start performing this on any bike I work on.

R1100RS Driveshaft And Clutch Spline Lube - Kit Vercella

Editor's Note: A spline lube is no longer listed by BMW as a regular maintenance procedure on recent model bikes. If you have an early model R1100, you should perhaps include a spline lube.

First a few introductory comments are in order. The following procedure is the result of having done this particular service only once. It is certainly possible that those who have more experience can offer some refinements to the procedure below; thus, making the entire job more efficient.

This write-up is based on having done this service on a non-ABS 1993 R1100RS. If you have a different model Oilhead and/or if your bike is ABS-equipped, the procedure may be somewhat different.

If this is your first stab at this service, set aside AT LEAST ONE FULL DAY. You will want to use the opportunity to clean and inspect various components that you won't have occasion to remove on a regular basis.

Be organized. Make notes and label parts if necessary.

I would recommend that you have access to a BMW shop manual, which not only outlines this entire procedure, but provides the necessary torque values for reassembly and offers a bit more detail to the steps below.

Before you begin, you will need a few things in addition to your basic tools:

- 12mm hex wrench socket
- Loctite 243 (I used Loctite 271) threadlock
- heat gun
- (2) M8 X 1.25mm metric bolts (about 80-100mm long)
- BMW lube #10 (or the substitute of your choice)
- 30mm socket
- good music (no Bee Gees or Barry Manilow, please)

Okay, here we go.

Place the bike on the centerstand. As an ounce of prevention, tie the centerstand to the front wheel. Although probably not necessary, I secured the front forks to the floor,

Remove the seat.

Remove the left and right side fairing panels.

Remove rear fender extension/license plate holder.

Remove rear wheel. (Be sure not to lose the spacer between the wheel and the rear drive assembly).
Unbolt the rear brake caliper and tie it off to the rear footpeg assembly.

Remove the bolt that holds the strut to the rear drive.

Loosen front hose clamp on the driveshaft housing boot and pull the boot loose from the driveshaft housing. (Note: if oil pours out from the boot, plan on replacing either the rear transmission seal or the oil seal in the rear drive unit).

The shop manual recommends draining the oil from the rear drive unit. However, if you keep the rear drive unit upright after removal, draining isn't necessary.

Remove rear bearing retaining bolts on the driveshaft housing. These are the two large hex bolts located opposite one another on the driveshaft housing just forward of the rubber boot. Since the bolt threads are covered with threadlock, it is necessary to heat the bolts with a heat gun (BMW recommends to a maximum temperature of 120C). I applied heat to each bolt for 4-5 minutes. Remove right bolt with a 12mm hex wrench socket and a breaker bar (bolt is torqued to 105Nm). Remove the 30mm locknut on the left bolt and then remove the left bolt. No muscle is necessary since this bolt is only torqued to 7Nm.

Pull rear drive unit from driveshaft. Remember to keep rear drive upright if you didn't drain the oil.

Remove the two front bearing retaining bolts on the driveshaft housing. These bolts are identical to the ones you just removed, but located opposite one another on the forward part of the driveshaft housing. Follow same procedure.

Remove the shock absorber while supporting the driveshaft housing.

Pull the driveshaft housing off.

Pull the driveshaft from the transmission spline. Using a large screwdriver for leverage worked well.

This is a good time to clean and inspect the splines on the driveshaft, rear drive unit, and the rear of the transmission. Check the U-joints for excessive play. Also, check the four needle bearings and their races in the driveshaft housing. Be sure that they are sufficiently greased.

So far so good? Have a sandwich and change the audio tape or CD. Remember: no Bee Gees or Manilow.

Next you need to remove the transmission in order to be able to clean and lube the clutch splines. But, unfortunately you have to strip more stuff off of your bike.

Remove the fuel tank. See Jon Diaz's fuel filter change instructions if you haven't done this before.

Remove battery.

Unplug the electrical connector for the air temperature sensor on the air box cover.

Remove air box cover & air intake snorkel.

Remove the four nuts holding down the battery tray.

Remove the three screws which secure the air box assembly. One screw is located at the rear of the air box and one screw on each side near the front of the air box. Later you will remove the air box assembly itself.

Disconnect the breather hose from the air box and the wire harness that fits into a slot at the front of the air box.

Remove the rear brake fluid reservoir from its bracket.

Remove the rear brake line from its bracket.

Unplug the connector for the brake light switch located near the rear brake fluid reservoir.

I don't recall if it was necessary, but I removed the right front footpeg assembly.

Unplug the connector for the oxygen sensor on the exhaust pipe.

Remove the bolt holding the muffler to the left rear footpeg assembly.

Unbolt and remove the muffler. Check the two rubber mounts for the muffler. In the past three years, I have discovered three broken mounts. (I think they are about $8 apiece).

Right about now you are seriously wondering whether you will ever get your beloved bike back together again. Fear not. Just continue to be organized and methodical. If you are so inclined, consider the power of prayer :-) .

Remove the two bolts that hold the rear frame assembly to the transmission.

Loosen the two bolts at the front of the rear frame assembly These are the pivot points when the rear frame is to be tilted upward.

Remove the long bolt at the rear of the struts which attach near the steering head.

Disconnect the clutch cable from the transmission.

Remove the plastic cover from the starter and remove the starter itself. If I recall, you will have to disconnect the wire for the sidestand neutral switch. (I had disabled this switch years ago).
Now unless I have forgotten something, you are just about ready to tilt the rear frame assembly upward in order to remove the transmission. But first make sure that any wires, hoses, or cables won't be pinched or stretched when the frame is tilted. You might have to cut a few zip ties to prevent this. Pay particular attention to the throttle and "choke" cables. I didn't and apparently stretched the suckers. This required that I readjusted and re-synched the throttle bodies after reassembly.

Loosen the hose clamps holding the air intake tubes to the throttle bodies and pull the intake tubes loose.

At this point I don't recall whether I was able to remove the air box assembly, or whether the rear frame had to be partially tilted upward first. (Hey, remember I only did this once). But, it should be obvious to you once you have reached this point.

Unless I have forgotten something, you're now ready to lift the rear frame. You can either tilt the rear frame upward and connect it with a strap to the handlebars or, as I did, suspend the frame from the ceiling. Either way, you are simply making room to slide out the transmission.

Disconnect the two electrical wires (oil pressure sensor?) coming from the rear of the transmission. If you remove the sensor itself, expect some transmission fluid to leak out.

There are six bolts holding the transmission to the engine. First remove the bolts in the upper left corner and the lower right corner. In their place screw in BMW mandrels (part #23 1 280) or make your own mandrels from two M8 X 1.25mm bolts. I bought two hex bolts 100mm long & cut the heads off. By screwing these into the bolt holes, the mandrels serve as a guide on which to slide the transmission out & to reinstall it.

Remove the remaining transmission bolts and slide the transmission out.

Well, you did it. Now grab a camera & take a picture of whatever is left standing of your pride and joy.

Thoroughly clean and inspect the clutch splines on the transmission. Lube the clutch and driveshaft splines with BMW lube #10 (or the substitute of your choice). Don't over lube the clutch splines.

Before refitting the transmission, you might want to inspect your clutch.

Now reassemble everything in reverse order. No, don't reassemble everything backwards; reassemble everything in the reverse order of how you removed it. :-)

When refitting the bearing retainer bolts into the driveshaft housing, remember to apply a thin coat of threadlock to the threads. Then torque to specs. Be methodical, make sure that everything fits properly and torque all fasteners to specs. If you didn't have any serious difficulty up to this point, you shouldn't have any problem the rest of the way.

After everything is finally buttoned down, hold your breath, fire up the bike and go for a test ride. Park bike, scream like Ed McMahon just gave you one of those 4-foot $10,000,000 checks, and slam a well-deserved beer.

See ya back here in another 40,000 miles.

(continued on next page)

A few torque values:

fixed bearing retainer bolts (on right side of driveshaft housing)	150 Nm(105?)
idler bearing retainer bolts (on left side of driveshaft housing)	7 Nm
locknut on idler bearing retainer bolts	105 Nm
transmission to engine case bolts	22 Nm
brake caliper bolts	40 Nm
shock absorber bolts (RS 8.8 screw)	43 Nm
(RS 10.9 screw, GS,R,RT)	50 Nm
strut to rear drive	43 Nm
long bolt connecting struts to frame	47 Nm
rear wheel lug nuts	initial: 50Nm/final: 105Nm
rear frame to transmission	47 Nm

A few torque values:

fixed bearing retainer bolts (on right side of driveshaft housing)	105Nm
idler bearing retainer bolts(on left side of driveshaft housing)	7Nm
locknut on ilder bearing retainer bolts	105Nm
transmission to engine case bolts	22Nm
brake caliper bolts	40Nm
shock absorber bolts	43Nm
strut to rear drive	43Nm
long bolt connecting struts to frame	47Nm
rear wheel lug nuts	initial: 50Nm/final: 105Nm
rear frame to transmission	47Nm

Super Tuning!

"Zero = Zero" Method for Adjusting BMW Oilhead Throttle Position Sensor To Reduce or Eliminate Engine Surging - Rob Lentini

Need:
Many BMW R259 "Oilhead" Boxers surge at constant throttle settings and low to moderate speeds. Precise adjustment of the Throttle Position Sensor (TPS), one of the two most important input sensors of the Motronic fuel injection system, is critical in reducing or eliminating surging.

History:
Since 1994, BMW and dealer service personnel have not totally satisfied their customers in solving this problem. At least one factory "service bulletin" has addressed this issue with mixed results.

Caveat:
Performing the following procedure is not BMW approved and may void the warranty if a failure has a "causal" relationship with this non-approved procedure.

Prerequisite:
Performer should be a reasonably skilled mechanic with knowledge of Motronic fuel injection theory of operation. He/she needs a quality Digital Voltmeter, a mercury or electronic manometer and common tools . All scheduled maintenance should be performed prior to this procedure. Specifically, ignition timing, spark plugs, valve clearances, Motronic coding plug and checking for throttle housing inlet manifold air leaks should be performed per BMW procedures. On rare occasions, the main electrical harness has also been at fault. ALL warranty procedures should be requested, performed and documented on a warranty-covered motorcycle prior to attempting this adjustment. The following should be performed only after there is NO warranty recourse left or warranty in effect. Doing this procedure could be at your own risk.

Note:
"Oilhead" BMW spark plugs are Bosch FR6DDC of dual "side electrode" configuration. The author has found that standard "over the center electrode" plugs, specifically Autolite 3923, contribute to smoother running and less surge. Simply replacing the OEM Bosch plugs with the Autolite 3923 gapped to .028" could solve some surging and obviate the need for TPS adjustment. Change from non-BMW plugs at your own risk. And....

IF YOU HAVE NO COMPLAINTS WITH YOUR BIKE, LEAVE IT ALONE!

Procedure (reference BMW or Haynes manual for location of components):

1. Generously loosen the free play at the throttle cables to both left and right throttle bodies (note '96 and newer "Oilheads" have a different throttle cable mechanism--see manuals)
2. Unscrew the left throttle body throttle stop screw (under and inside of the throttle body) counterclockwise (CCW) about three turns or until you can see a gap between the end of the stop screw and the flange it pushes on to open the throttle. You are now assured the left throttle is FULLY closed. This is important! ("Zero" throttle opening).
3. Attach the Digital Voltmeter (DVM) black lead to frame ground and the red lead to the red/white wire going to the TPS connector located on the left cylinder throttle body. The TPS is a black plastic 2" by 2" square module with a connector on the bottom. Gently pulling the rubber connector boot down will expose the four wires entering the connector to the TPS. Probing and pushing up with a paper clip is one method of reaching the red/white wire's contacts. Put the DVM red lead on the paper clip, turn on the ignition and engine cutoff switch, and retract the sidestand. You should see an indication on the DVM near zero. Be SURE you are on the DC Volts selection.
4. Loosen the two Allen head screws securing the TPS. Adjust the TPS by slowly turning it within its slots until the observed voltage decreases to about .006 DC volts. It will probably go no lower, which is OK. DO NOT turn it any more as the wiper of the pot has already reached the end of electrical travel. Stop turning the TPS just when the voltage stops decreasing and then turn it in the opposite direction to increase the DVM by .004. Lock it down there. Going slightly up by .004 volts will ensure your are not going "below" zero volts and this will typically result in a "zero" value of .010 volts. Be careful of DVMs which "autorange" and can confuse readings! ("Zero" TPS voltage .006 +.004 volts = .010)
5. With "Zero = Zero" set (zero throttle plate opening and zero voltage), turn the left throttle body stop screw clockwise (CW) until the voltage starts to rise. Continue turning until you reach .370 - .400 volts, the voltage the BMW analyzer looks for the TPS at idle to cause a digital signal to "flop" or change symbology. Lock down the stop screw with the jam nut if so equipped (early units are an interference fit). Blip the throttle several times to check accuracy and repeatability of the voltage to be within .370 - .400 volts. Readjust the stopscrew (not TPS Allen screws!) if needed. Following this, reset the left throttle cable free play to .5mm. Now you are forever done with the TPS adjustment.
6. Connect the mercury or electronic manometer to both throttle bodies. Prior to starting the engine, use a common screwdriver to lightly close both rear-facing brass air bypass screws on the throttle bodies, then open them to:

    R1100 RS/RT: 1 1/2 turns from closed
    R1100 GS/R: 2 1/4 turns from closed
    R850R: 2 1/4 turns from closed

Start and warm up the engine to get 5 bars on the RID oil temperature if so equipped. Idle will be rough due to the need to synchronize left to right throttle bodies. Use a big rear-facing fan from the front of the bike to control cooling, if required.

7. After warm up, LEAVE THE LEFT STOP SCREW ALONE! (The one used to set .370- .400 volts). Adjust the right throttle body stop screw to get perfectly equal mercury in both columns or electronic indication.
8. Adjust the right throttle body cable for equal mercury readings at just off idle, around 1500 RPM. Use the throttle to increase RPM, not the "choke" start lever when synching.
9. Finally, adjust both brass bypass screws individually or together in conjunction with the manometer to yield a proper idle speed of 1000-1100 rpm and equal mercury or vacuum readings. Closing the bypass screws will decrease RPM; converse for opening them. On rare occasions where proper idle speed cannot be set with the bypass screws, return to step 5 and incrementally increase or decrease the stop screw voltage from the .370 - .400 setting then repeat subsequent steps. Raising the stop screw voltage will increase idle RPM and decreasing it will lower idle RPM.
10. Inspect your work and test ride, perhaps re-performing synch using ONLY the bypass screws and right throttle cable to "fine tune."

Summary:
The TPS was set for zero volts at zero throttle plate opening (+.004 volts to assure not going "low"). Then the left throttle body TPS was set using the stop screw to .370 - .400 volts followed by an accurate synch of the right throttle body.

Results:
This is a simple procedure and it has worked on countless "Oilhead" BMWs. You will notice good throttle response, best possible fuel consumption, little if any surging and good top end. Properly performed, emissions are unaffected if not improved.

Advanced Ignition Timing - Rob Lentini

Most manufacturers set the ignition timing for the typical vehicle with poor fuel quality in mind. Modest performance gains may be achieved by REASONABLE increases in initial advance. Just like my K75S, the R1100 is no exception.

Assuming you are NOT experiencing ANY pinging or detonation, you can easily advance the ignition timing by about 3 degrees. Here's how to do it:

- Remove the small rubber timing hole cover on the clutch bellhousing (just inside the right throttle body).

- Remove the black cover on the front of the engine. This covers the alternator drive pulleys/belt.

- Notice on the lower (crankshaft) pulley that the three timing plate securing screws are exposed, and that the timing plate (which the Hall transmitters are mounted on) can slide CW and CCW in three slotted holes.
- Put the tranny in 5th gear and, while observing the flywheel with a good flashlight, move the rear wheel to rotate the engine. You will be looking for "OT" (top dead center), "Z" (full advance) and "S" (the 6 degree initial advance mark).

- Warm the engine and observe, with a timing light, where initial advance is taking place. With the engine at 1000 RPM or less, the advance will be very close to "S". Turn off the motor, loosen the three screws holding the Hall transmitter plate, and tap the plate in a CCW direction from the front to the end of slot travel. Tighten down the three screws and recheck the timing. Be SURE the idle RPM is 1000 or less! If your R1100 is like mine, the timing will be advanced 50% further than the "OT" to "S" mark, for about 9 degrees of initial advance. If so, put everything back together and, if during your test ride you detect no noticeable detonation, you are in business. I recommend only Premium fuel if the ignition is advanced. Never use less than the BMW-recommended Mid grade fuel if the ignition is not advanced.

Valve Lash Increase - Rob Lentini

If you are like me, try this. I like low and mid-range driveability and throttle response. My R1100RS would not idle for several minutes on cold mornings until I increased valve lash. Increasing valve lash FIXED the problem, and I've lost no discernible top-end power. Increased valve lash is equivalent to closing the valves sooner--"milding" the cam timing.

Set the valves COLD from/to:

Intake:	Spec: .006"	to:	.012"
Exhaust:	Spec: .012"	to:	.014"

Your idle will be MUCH smoother and throttle response immediate but controllable. Increase in valve noise is minimal. Valves will run cooler.

Results of Increased Valve Lash and Advanced Timing - Rob Lentini

The following results were obtained from several runs on a dyno with my 1994 R1100RS:

1. Advanced timing (9 degrees) results in a 2 - 4 horsepower increase across the entire RPM range. The 4 horsepower increase was in the meat of the power band, from 6000 RPM and up. There was no detonation.

2. The average torque and horsepower, across the entire 4th gear roll-on range, 3500 - 7500 RPM, was improved by increased valve lash.

2. Increased valve lash and advanced timing (9 degrees) netted an average torque increase of 3.1 and an average horsepower increase of 4 over stock valve lash and stock timing (6 degrees).

Non-OEM (Original Equipment Manufacturer) Plugs for the R1100/850 Oilhead - Rob Lentini

The BMW Internet lists have been ablaze lately over spark plugs! Why has a simple item been such a popular subject of discussion? Here's why…

Many of you are aware (sadly so!) of the surging that is common in many of the R1100/850 series BMW Oilheads. This subject itself has been one of much discussion and I took some time to investigate it myself on my personal '94 R1100RS. My work led to my four part series on "R1100 Fuel Injection/Surging/Fixes", and later my "Zero=Zero" effort on getting the Throttle Position Sensor (TPS) optimized for best performance. However, along the way in doing this I learned that spark plug performance and selection can play an important part in overall performance of the R259 Boxer.

Being a thrifty person (a nice way of saying "cheap"!), I have habitually looked for aftermarket service item parts that meet or exceed OEM requirements but are more readily available and less expensive. Wear items like brake pads, oil filters, air filters, and spark plugs are open-discussion items for me and it wasn't long after my Dec '95 purchase of a used '94 R1100RS that I began the process that had ended with the sale of my '87 K75S.

I'd had good luck with Autolite 4153 plugs in my K and I was eager to avoid the extravagant price of the OEM Bosch plugs of about $10 fame. So armed with my Autolite and Champion spark plug catalogs, I cross-referenced to the point of the best possible match: Autolite 3923 and Champion RC9YC plugs. But wait; here's the difference.

The '94-spec OEM Bosch plugs for the R1100RS are FR5DTC, a unique three ground electrode setup that surrounds the center electrode from the side. The Autolite 3923 and the equivalent Champion RC9YC plugs are standard single ground electrode "over" the center electrode as many of us are familiar with. Would these "standard" plugs work?

I took the dive, bought Autolite 3923s, set the gap to the BMW specification of .031" or .8mm, and went for a ride. They worked great! I even noticed smoother power characteristics and somewhat less surging, and this was in early '96 before I began my above-mentioned Injection/TPS experiments in earnest. So

you see, I've been using non-OEM plugs in my oilhead since about March 1996 (about 28K miles) with TOTAL success.

By the way, BMW changed their own plug spec to a two-electrode variety in July 1996 under the auspices of the "Low Friction Throttle Cable" service bulletin #2748 which was an attempt to solve the surging I was investigating at that time. In so doing, BMW revised the specified plug to the two-electrode Bosch FR6DDC, a slightly hotter running tip. Some have reported the newer Bosch plug is an improvement, but many other riders I have communicated with say the Autolite or Champion plug is, in most cases, quite superior in operation and surging minimization.

What's my favorite? Autolite. They exhibit minimal wear during the 12,000 mile specified service life and the center electrode color (on my RS) is a perfect medium to light tan on the insulator. My experience with Champions (in K-bikes) is satisfactory--quite good actually--but the Autolites seem to win out in life expectancy, electrode wear, and have a performance edge that I "think" I can feel. Perhaps this is just a prejudice, though.

Some riders have reported that the non-OEM Autolites or Champions are 1/8" longer than the original Bosch plugs. I don't find this to be the case with the Autolites. The measured length from the crushed gasket to the tip of the electrode is 22.5mm on the original 3-electrode FR5DTC and 23mm on the Autolite 3923. Perhaps the length of the FR6DDC is slightly shorter and/or the Champion RC9YC is slightly longer equating to the reported difference. I haven't measured the Champion, but in any case there have been no reported interference problems and all of these plugs are 14mm, ¾" reach and take a 5/8" socket. Use a 12 point thinwall socket to clear the small cylinder head access hole.

So here are your options, gapped at .031" or .8mm:

OEM:

Bosch FR5DTC (3-electrode)
Bosch FR6DDC (2-electrode)

Non-EOM:

Autolite 3923 (1-electrode)
Champion RC9YC or RC9YC4 (1-electrode)

(Note: If you are hard-core Bosch, their 1-electrode Autolite 3923 equivalent is the F6DC)

One VERY good thing about these non-OEM plugs is their availability and price. For example, you can purchase the Autolites at a store such as Auto Zone or

Checker for about $1.20 each and then get a $.50 rebate each on top of that. What a deal for better performance!

Throttle Body Butterfly Bushing/Seal Wear - Rob Lentini

Problems with throttle body synchronization and accomplishment of "zero=zero" may, but rarely, be caused by wear or failure of the throttle butterfly shaft bushings and/or seals. While these parts are not currently available for replacement (though may be shortly), here's how to tell if you have this rare wear problem:

Spray carb cleaner, propane, or simply WD-40 at the throttle shaft pivot area with the engine running and listen for RPM speed-up. These bushings/seals are located just outside of the cable wheels on each throttle body—the arcing grooved wheel that encloses the throttle cable for each cylinder throttle body. The area to be sprayed is between the surface of the cable wheel and the throttle body casting. When spraying, avoid the intake of the air box "horn" on the left side of the engine or you may get false RPM increases from inhalation of the solvent into the air box.

A speed-up indicates the solvent is being "vacuumed" past a bad bushing and/or seal and is being pulled into the cylinder as more "fuel." Try this procedure at idle and at, say, 3000 RPM to pick up rotational differences of the throttle shafts. If you detect RPM increase you have little recourse other than a warranty claim or throttle body replacement at your expense. Subsequent parts availability may soften this expense in the future.

Editor's Note: You might also experience an increase in RPM if you have an air leak at the large hose clamps - front and back of the throttle bodies (especially the front clamp). So avoid spraying there when checking the butterfly seal or better yet, check them by spraying before you do the above procedure and tighten the hose clamps if necessary.

GS Intake Manifolds and Cat Code Plug "Hop Up" An R1100RS/RT! - Rob Lentini

Many BMW "Oilhead" riders spend big bucks chasing more horsepower with expensive exhaust systems, magic Motronic microchips, even camshaft and head modifications. I've wondered whether many of these riders have defined what it is they want to "improve"?

I don't know about you, but absolute high RPM power is NOT why I purchased a BMW. Superior broad torque, "user friendly" power delivery and fuel economy is what I seek in an engine. Top speed advocates often perform expensive modifications to a BMW for only a modest peak horsepower increase. Then the machine may be less rideable and reliable on the street. Not my style, thank you! I prefer strong roll-on power for normal every day commuting, sport riding and touring.

When I learned about a simple way of getting almost 5 more peak mid-range horsepower from my '94 R1100RS while increasing and smoothing power delivery from 3000 to 6500 RPM for less than $35, I was all ears! Here are the facts…

Anthonie Mans posted an interesting test on the Internet BMW Riders/Oilheads lists performed by "Das Motorrad", a Euro motorcycle magazine. All that was done to a stock R1100RS (same engine as in the RT) was to give it a dynamometer baseline run and then replace the intake manifolds (black tubes connecting the airbox to the throttle body intakes) with those from a GS. Then they dyno'd the RS again. Here were their reported results in Newton Meters of Torque and Metric Horsepower:

RPM	Torque (GS tubes)	Torque (RS tubes)	HP (GS tubes)	HP (RS tubes)
2000	86	87	24	25
2500	85	86	29	30
3000	92	89	41	39
3500	90	89	44	43
4000	92	83	52	47
4500	96	96	62	62
5000	102	99	73	72
5500	106	102	82	80
6000	101	96	86	81
6500	92	92	87	87
7000	86	91	86	90
7500	79	85	84	90

If you plot these torque and horsepower curves you will notice a much smoother power delivery across the RPM range and an average power increase of 2.28 horsepower from 3000 to 6000 RPM – right in the meat of where most of us ride. But would the dyno results pan out on the road? I purchased and installed a set of these manifolds to find out.

Part numbers and cost for the GS tubes (manifolds) are:

Left: 13 71 1 341 405	$13.99
Right: 13 71 1 341 406	$19.40

A reasonable sum, I'd say!

The GS manifolds are 247 mm long and have a 47 mm inside diameter. They are MUCH longer than the RS variety which measure 127 mm and have a 51 mm inside diameter. You can't confuse them!

To install the new tubes you will find it easiest to remove the throttle bodies from the rubber cylinder head intake spigots. Loosen the two clamps that secure each end of the RS intake tubes and then loosen the spigot clamp. Push the tube/throttle body assembly slightly into the air box to achieve separation of the throttle body from the spigot. It's now easy to separate the throttle bodies from the intake tubes and replace the tubes with the GS types. Be careful to align the non-symmetrical GS tubes with their casting indices aligned up and down with the throttle body casting marks. The GS tubes are also (as the part numbers indicate) different for left and right as opposed to the identical RS tubes, which may be interchanged. Reinstall the throttle bodies into the spigots, observing the index "tang" alignment. Double check the tightness of all six clamps you loosened to do the installation. Following installation, perform normal throttle body synchronization though the adjustment may hardly change. By the way, this modification will not affect "Zero=Zero" adjustment of the Throttle Position Sensor if previously performed (re: "Bench Wrenching", BMW Owners News, May 1997).

So how does this $35 "hop-up" perform? Here are the plusses and minuses:

First, Jon Diaz (who performed the mod to back up my data)…

"Rode to work today. Bike seems livelier from idle to 5K.....really seems to jump up off the bottom. One big thing I noticed was the increase in intake noise....even with earplugs in, its a lot louder."

My take, after an initial 500 miles of testing…

Plusses:

- Improved roll-on power.
- Engine revs more quickly.
- Bike accelerates in the next higher gear almost like it did with the RS manifolds in the next lower gear.
- Overall gearing now seems "shorter" (lower) when matched with the increased low RPM torque.
- Average power delivery is smoother and stronger from idle to red line.
- Marginally less fuel consumption (at steady speeds).
- The bike is easier to ride!

Minuses:

- Increased intake noise (honk) from the longer length tubes. (resonance). GS riders won't notice this since it must be identical to GSs.
- Top end is reduced by about 4 MPH.
- Acceleration from 6500 RPM in 5th gear to top speed is reduced from RS levels.

But wait, the story is not over! If the GS intake manifolds worked so well, how effectively would fuel injection reprogramming optimize the system even more? Having experimented with the Motronic fuel injection on my RS, I knew there were six different "maps" stored in the computer which are activated by different "Cat Code Plugs." So, to complete the GS intake "clothes" makeover, I replaced the RS yellow Cat Code Plug with the GS pink unit. This connects different coding plug terminals and activates the GS map instead of the RS'. The coding plug is located in the electrical box under the seat, one row forward of the fuses. Look in your owner's manual for reference. If you replace (or even temporarily remove) the coding plug, you should uninstall the 5th fuse from the left of the fuse bay for a few seconds and then reinstall it to reset the injection memory and clear any "faults."

Part number and cost for the GS Cat Code Plug is:

61 36 8 366 625 $5.99

So, how did <u>BOTH</u> the GS manifolds and coding plug, all for ONLY $39.38, work in my RS? To find out I went on a 580 mile loop from Tucson through the Arizona high country, a varied ride that encompassed Tucson's 2600 feet altitude all the way to the "Rim Country" at 9200 feet. This route is along the famous "Coronado Trail", US 191 (formerly US 666), and it was a superb workout of low and high speed cornering, accelerating, and trailing throttle, especially coming back home to Tucson through the Salt River Canyon. Verdict?

I was very pleased with the improvement in throttle response, low and mid range power, and about a 5-10% increase in fuel economy! I noted smaller throttle openings for a given cruising speed and a complete lack of backfiring that my RS had always suffered from with the Staintune “touring” system I have installed. With smaller throttle openings for a given load, accurate throttle body synch adjustment will be more important. Nonetheless, I was delighted with the results!

In summary, I think the GS intake manifolds with GS Cat Code Plug is an effective and inexpensive modification that will give an RS/RT more “grunt” where most riders need it, with little top end sacrifice. Heck, do most of us really need increased performance above 6500 RPM (120 MPH+)? That’s where the above reported horsepower figures intersect. I’ll settle for “real world” roll-on improvements with inexpensive BMW parts!

Note: The GS Cat Code Plug can, in some instances, cause hard starting and cold running problems in some RT’s and RS’s. If this is the case on your bike, simply revert to the standard Yellow Cat Code Plug. Most of the performance benefits from this modification are derived from the intake manifolds.