R1100 - R850R Maintenance Guide

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PARTS - TOOLS

Tools
sockets
wrenches
torque wrench
hex sockets
hex wrenches
feeler gauges
oil filter tool
flashlight
measuring cylinder
Mityvac
digital volt meter
heat gun
tire change tools

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
-3 small = trans.drain, rear drive fill and drain
-1 medium = oil drain
-1 large = trans.fill

Misc.
compressed air
anti seize
carb cleaner
rag
BMW #10 grease
flexible tubing (tygon)

R1100 Maintenance Steps - Carl Kulow

Note: This overview section serves only as a step by step reminder for experienced workers. If you are unfamiliar with any procedure you should read the parenthetical reference article or Paul Glaves' Routine R1100 Service Article!

Note to R1100RT and R1100RS Riders: 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, you need to 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.

Check Alternator Belt

remove four bolts holding black plastic cover(4mm hex), remove cover, check belt for cracks etc., check belt tension, replace belt every 36K miles, leave cover off for valve adjustment (see Jon Diaz "Alternator Belt Adjustment")

Adjust Valves

remove black plastic valve cover protectors (5mm hex) if installed, remove black valve cover strip, pull plug wire using special black plastic tool in tool kit, blow out debris around plug using compressed air!!! repeat again after turning the spark plugs a couple of turns, remove spark plugs using tool kit socket or 5/8 in. deep well thin wall socket, place oil drain pan under valve cover, remove valve cover (6mm hex), remove black rubber timing hole plug, turn lower alternator pulley clockwise with 17mm box wrench, insert long screwdriver into plug hole while turning engine over, when it is pushed out the maximum start looking for timing marks Z - S - OT, center OT in window, adjust proper valves, intake = .006 in (.15mm), exhaust = .012 in (.30mm), using 10mm box, 3mm Allen, and dual feeler gauges, rotate engine 360 degrees and adjust valves on the other side, clean valve covers, wipe oil off gasket, be certain center gasket is in place on valve cover!!!, replace valve cover (see Stephen Karlan "Valve Adjustment")

Spark Plugs

replace plugs every 12K miles, visually check gap for damage, lightly coat plug threads with anti-seize, install, torque to 15 ft.lb.(20 Nm), replace plug wire, replace black valve cover strip, replace alternator cover (do top right bolt first!) replace valve cover protector (short screw to the front), replace timing hole plug

Replace Air Filter

replace air filter every 12K miles, remove front seat, unsnap two clips, lift cover, remove old filter, insert new filter seating bottom gasket carefully, install cover by pivoting up to align front hinge tabs, snap two rear clips

Lube and Adjust Clutch Cable

adjust maximum slack at clutch lever, at rear of transmission pry clutch release arm to release the clutch cable there, lube both ends of clutch cable with BMW #10 grease, reattach cable, using the knurled adjuster at the hand lever adjust to 12mm between it and the knurled locknut, at clutch release arm loosen the 13mm locknut using 13mm deepwell socket and swivel, adjust the 10mm bolt to give 7mm freeplay at the hand clutch lever, pull in the hand clutch lever while tightening the locknut at the rear clutch arm (see Paul Glaves and Bob Gorman "Clutch Adjustment")

Lube Front Shock Lower Mount

remove nut (15mm), remove bolt (14mm), lube bushing with BMW #10 grease, install bolt (second person needed at rear of bike), torque to 37 ft.lb. (50 Nm)

Lube Side Stand and Center Stand

grease fitting on some RS's only, others lube with WD40 if necessary

Check Brakes

check brake fluid levels front and back, check brake pads for wear, bleed brakes yearly (see Carl Kulow "Brake Pad Replacement" and Stephen Karlan "Brake Bleeding")

Inspect Battery

remove tank trim (R1100R) or side panels, remove tank bolt on right side, RS – remove screws that attach front of tank to fairing, slide tank back and set on chair, fill battery with distilled water, grease battery posts, leave tank off if doing a fuel filter change

Replace Fuel Filter

need: siphon, fuel filter, large o-ring, 2 small clamps, 2 tiny pencil size clamps, empty gas can, rubber gloves, 8mm socket, replace every 24K miles, siphon gas from tank, remove tank, with pencil mark orientation of plate to tank, with tank on side remove the fuel pump plate using 8mm socket, disconnect fuel overflow and vent hoses (two small inside hoses) remove unit from tank, replace fuel filter noting flow direction, reconnect using two small screw clamps, insert new o-ring into tank groove, insert unit into tank, reconnect two small hoses being sure to connect striped hose to striped hose using two tiny clamps, tighten plate, install tank, check for leaks (see Jon Diaz "Fuel Filter Change")

Test Ride Bike

(ride ~15 min. to get bike to operating temperature for throttle body sync)

Throttle Body Sync

attach carb stix to each throttle body, RS,RT = 1 1/2 and R,GS = 2 turns out, start bike, adjust brass screws to balance mercury at idle, check balance at 3500 rpm and adjust throttle cable on right side TB by loosening 10mm locknut and turning cable adjuster, replace TB vacuum hoses or caps, (see Bob Gorman and Jon Diaz and Stephen Karlan "Throttle Body Sync") (also see Bob Gorman and Rob Lentini “Throttle Position Sensor”)

Change Oil and Filter

replace every 6K miles, remove oil drain plug (8mm hex), remove oil filter and old gasket, install drain plug with new crush washer, torque to 23 ft.lb.(32 Nm), fill new filter with fresh oil, lube filter gasket with oil, install till it makes firm contact then ½ - ¾ turn at most!!!, add ~3.75 quarts of oil total (see Paul Glaves "Oil Change")

Check Transmission Fluid

replace every 12K miles, remove drain plug - right side just below fill plug, hidden up the “tunnel” (13mm socket), remove filler plug (8mm hex), remove metal filings from drain plug by squirting with carb cleaner, install drain plug with new crush washer, torque to 17 ft.lb (23 Nm), fill with 800cc of synthetic gear oil using flexible tubing, install filler plug with new crush washer, torque to 17 ft.lb (23 Nm)
Note: apparently new (1997?) transmission drain plugs do NOT use crush washers.

Check Rear Wheel Drive Fluid

replace every 12K miles, remove drain plug (19mm socket), remove filler plug (6mm hex), remove metal filings from drain plug by squirting with carb cleaner, install drain plug with new crush washer, torque to 17 ft.lb (23 Nm), fill with 230cc of synthetic gear oil (to bottom of threads), install filler plug with new crush washer, torque to 17 ft.lb (23 Nm)

Miscellaneous

check tires and pressure
check all nuts and bolts
check all lights
check all air and oil hose clamps
check for debris in throttle cable “pulleys” between throttle bodies
lube locks
check rotor rivets (see Paul Glaves “Routine R1100 Service”)

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.

Alternator Belt Adjustment - Jon Diaz

The following is not BMW factory procedure....use at your own risk.

I remove the left fairing panel, the airbox horn, and the front cover on the engine block. The belt needs to be tightened with a 6mm allen wrench from the rear (airbox) side of the alternator. The allen screw is blind. Do all this when the bike is cold or you will burn your elbow on the exhaust header.....

I loosen the three nuts on the front (one each side, and one at the very top) with a 13mm box-end wrench, and the alternator belt should go slack.

I then use a large flat-blade screwdriver to pry up the alternator, I get the allen wrench in the bolt, and put some sort of bar/screwdriver on the end of the allen wrench to give leverage. The book calls for 6 ft-lb., but since I don't have a wrench which could reliably go that low, I _lightly_ tension the belt and tighten just the nut on the allen screw. It does not take much. Then tighten the other two nuts.

The belt should not slide when you try to pull it. I try to tension the belt just enough that it doesn't squeak/chirp when I blip the throttle while the bike is warming up in the morning. It might take a few trial-and-errors, but looking at my old belt, it seems to work just fine.

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

Brake Pad Replacement - Carl Kulow

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.

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!!!

Pay special attention to the rear outside pad when inspecting for wear as many riders are wearing this pad out as early as 10K miles!

<u>Front</u>
remove front caliper bolts - 8 mm hex
to remove caliper, gently rock it back and forth on rotor to spread brake pads
remove keeper from top of caliper
drive out pin from wheel side
remove old pads
push wheel cylinders in all the way with thumbs
insert new pads (no anti-rattle spring on EBC pads)
drive in pin, turn with screwdriver so keeper hole is on top
insert keeper
spread pads again if necessary
install caliper onto rotor
install caliper bolts, torque to 40 Nm (30 ft.lb.)
pump front brake

repeat for other front caliper

pump front brake!!!!!

check fluid level in reservoir

Rear (GS, R, RT)
remove bags
remove keeper from pin
drive out pin from keeper side (drive toward wheel)
remove caliper bolts - 8 mm hex
remove caliper, rock back and forth on rotor to spread pads
remove old pads
grind or file EBC pads to fit (see above)
insert new pads
drive in pin
insert keeper
install caliper onto rotor
install caliper bolts, torque to 40 Nm (30 ft.lb.)
pump rear brake!!!!!
check fluid level in reservoir

Rear (RS)
same as above except:
pry off plastic caliper cover
drive out both pins from the wheel side
remove curved spring keeper from pins

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.

Spongy Brakes Fix – Simon Evans

Fiddling with the R1100GS this morning, I removed the handguards for cleaning and to top up the brake master cylinder (the spate of warm weather in the UK having caused a re-ocurrence of that perennial old bugbear - the “Spongy brake – or the ohmigodthelevercumsbacktothebar syndrome”).

Accidentally, I knocked off the lower plastic cover under the brake lever housing and hey!, what's this - a large screw that appears to wind into the master cylinder or the piston...

DING! [the sound of the penny dropping]...

I twiddled it in half a turn and, presto!, no more spongy brakes..!!!!! This ranks on a par with the discovery of gold in the Yukon, or oil in the North Sea... Brembo, I love you again..<HBG>

I've checked with my dealer and the screw is used to dial out the individual tolerances of each brake system at the factory, and works on the piston itself. Ducati Brembos have a similar setup, but with a knurled nut.

Caution says wInding it in too far could cause a lock-up as there must be a certain amount of `give` in the system to allow the piston to clear the master cylinder hole on brake release. Half a turn maximum should be fine, and even a quarter makes a B-I-G difference... just make sure the wheel still rotates freely after brake application and release, and you should be OK..

So here’s the quick step by step 30 second fix:

1. Remove cover from front of brake lever assembly (one screw facing forwards at bottom of switchgear cluster).

2. Behind cover find one large grub screw with red paint dot.

3. Turn grub screw one-quarter to one-half turn clockwise only!!!
Make absolutely sure that there is still some freeplay in the system or else you risk brake lockup in use!!! Try spinning the front wheel as you pull the lever and “dial in” the amount of freeplay you require.

4. PRESTO! No more spongy brakes.

(Note: This is NOT a fix for AIR in your brake lines!)

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!

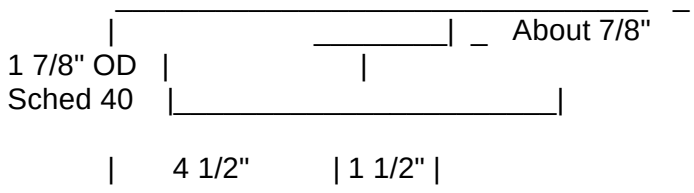
R1100 Lube Change Tool - Mick McKinnon

Has anyone attempted to drain their transmission lube on a new RT yet? Here is a tip on how to make the job just a little less-messy.

I bought a foot of Schedule 40 plastic pipe ($.69) and cut it in half.Next I cut away most of one end (Looking at the end of the pipe, cut straight down) about 1 1/8" of the end gets removed. Make your second cut perpendicular to the pipe about 1 1/2 inches in from the end. The plastic pipe is 1 1/2" ID pipe that comes out to just about 1 7/8" OD. The schedule 120 (thinner) pipe would work just fine here too but I couldn't find any at my local hardware store.

What you are trying to make is an adapter that will slide inside the hole in the right side lower cover (the aluminum colored one) and just slip 'under' the casting for the transmission drain plug. With this little $.69 tool, draining your transmission is a MUCH cleaner job. No gear lube drippin' of MY right side! :)>

Crude ASCII ART:



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 for Dummies – 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.

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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.
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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.
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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.

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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.

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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.
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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 "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 for Dummies - 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 aabsolutely 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.

Oil Change - Paul Glaves

1. Warm up engine thoroughly
2. Turn off engine
3. Place motorcycle on center stand
4. Place drain pan under the drain plug in the bottom of the oil pan
5. Remove oil filler plug to let air into crankcase
6. Take 8mm allen wrench and carefully remove the plug without burning yourself
7. Let oil all drain into the drain pan.
8. Take 3/8 drive ratchet with short extension and BMW filter wrench in hand.
9. Locate the oil filter in the recess in the oil pan casting
10. Remove the oil filter
11. Fill the new oil filter with fresh engine oil.
12. Oil the oil filter rubber gasket ring which contacts the machines block surface
13. Install the oil filter until finger tight plus 1/4 turn or torque to 8 ft. lb. (11 Nm)
14. Re-install the drain plug with a NEW crush washer - snug but not gorilla tight or torque to 23 ft.lb. (32 Nm)
15. Add the remaining amount of the specified quantity of the specified viscosity oil to the crankcase (~3.75 quarts)
16. Re-install the oil filler cap
17. Start engine
18. Turn off engine
19. Wait several hours and check the oil level in the sight glass. The level must be above the bottom of the ring. On the dot is as specified, and must not be above the top of the ring.

Leaking Cam Covers and Oil filler Cap - Stephen Karlan (Dali Meeow)

If you own an R850 or R1100 BMW and there is excessive grime or some messy oil leaks around the oil filler cap or the black plastic cam covers at the rear of the cylinders, then your bike might benefit from some high temperature O rings. The original O rings are made of soft materials and will deform after extended use and heat.

The solution is two-fold. While you are changing O rings, also check the plastic for any casting flash. This hint comes from Rob Lentini, who suggests that you run your fingers over the inside of the plastic parts and feel for bumps or rough spots created when the parts were made. Many plastic parts have this bump or ridge and, if it has not been smoothed, it provides a path for oil to leave the engine. Take fine wet-dry sandpaper or a fine file and smooth off any bumps.

Thanks to Bob Gorman for identifying the problem. He said, "For some reason BMW choose to use an o-ring made out of a very soft material. Over time this material will loose its 'O' and become flattened, allowing oil to easily flow around the seal." Even the Viton O rings will wear over time, but that should be measured in years.

The second part of the solution is to replace the O rings with a high temperature material called Viton. These are made for aircraft and are used in extreme conditions --they work well in the BMW. There are several sources for these Viton O rings, such as a local seals or bearing shop listed in the Yellow Pages. Here are step-by-step instructions for replacing the O rings:

REPLACING THE OIL FILLER O RING.

Do this with the engine cold. Locate the black plastic oil filler cap on the top of the left cylinder and remove it. Inspect the filler cap and check the O ring on the bottom to be certain that it is soft and not damaged. Do not remove the O ring on the inside of the filler cap, this is not the one you want to replace. Put the filler cap aside.

There is a black plastic ring still in the cylinder head. Locate the black tab at the rear of the ring that mates with a small depression in the cylinder head; observe this tab because you must line up the tab when you reinstall the plastic ring later. The O ring that you want to replace is located on the outside edge of this black plastic ring; this O ring is the only thing holding the black plastic ring in place. Remove the black plastic ring carefully by placing your pinky finger in the oil filler hole and pulling up gently or by prying it out (try a flat-head screwdriver). When it is out, use your fingers or a small flat-head screwdriver to remove the old O ring on the outside of the plastic ring, check the plastic, and install the smallest of the Viton O rings (Parker #214) from the set of three that you will

need for this installation.

Reinserting the black plastic ring can be tricky. It is a tight fit and you do not want to crack it. Lubricate (with oil) the part and line it up (black tab) and try to push it in by hand. Repeat several times. If that does not work, install the oil filler cap back into the black plastic ring (both plastic pieces now mated) and align the black tab on the ring with the cylinder depression. Lubricate and tap gently. If you tap too lightly, nothing will happen and you will have to tap again slightly harder. If you tap too hard, you may crack the plastic ring. You are better off tapping too gently and then trying it a second or third time. In other words, be careful. Total time: five minutes.

REPLACING THE CAM COVER O-RINGS.

Do this with the engine cold. On the R1100RT, the side fairings must be removed. On the R, RS and GS, nothing must be removed. Locate one of the Cam Cover O rings on the back surface of the cylinder head. It is a black, oblong piece of plastic located 5.5-in. down from the top and 4.5-in. in from the side of the cylinder head. It is located low on the back surface of the cylinder head, below the large black fuel intake tube. The Cam Cover is held in place with two allen-head screws that measure exactly 2-in. from the center of one to the center of the other. Remove the allen-head screws and, using a small flat-head screwdriver or other similar tool, pry the black cover away from the cylinder. It should come out easily. Use the same small flat-head screwdriver to gently pry the O ring out of its channel in the black cover. Check the black cover for casting flash & smooth out with steel wool or small file. Install the new Viton O ring (Parker #219) by hand. With the new O ring in place, position the cover over the hole and install the allen screws by hand. Check the alignment and then tighten the allen screws alternately a few turns at a time so that the cover seats itself in the hole evenly. Do not over torque; the allen screws are going into aluminum !! Total time: Four minutes each side. Plan to install these the same day you get them, it is that fast and easy.

Editor's Note: If you have trouble finding the O-rings locally, Stephen can get you a set and send them to you for $8. Contact him at e-mail to dali@netrox.net or Stephen Karlan, 9700 Haitian Drive, Miami, Florida 33189 or call him at 305-255-1010

R1100RS Driveshaft And Clutch Spline Lube - Kit Vercella

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

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Super Tuning!

R1100 Throttle Position Sensor Tuning - Rob Lentini

Background

Since the "R1100 Fuel Injection/Surging/Fixes" series I have continued to investigate how the Throttle Position Sensor (TPS) works. My aim was to develop the best procedure for a curious, competent home mechanic to adjust this component for best performance and least "surging", the scourge of many oilhead boxers. I went about this slowly, carefully, and enlisted the help of others--in particular Jim Roche, AKA "Dr. Curve". Based on valuable input from Jim and several months of experimentation on my R1100RS and other owner's oilheads, I think what follows is a sound, repeatable, and accurate method of adjusting the Throttle Position Sensor (TPS) for optimum performance and driveability.

By way of review from my previous posts, recall that I found that the TPS voltage on white-red wire #1 (from the rear) of the TPS connector should be set to .400 volts with the throttle closed. I stated that the commonly reported range of .370-.400 was in the "ball park" but that .370, the low side, could cause reduced throttle response and surging. I was correct in this as far as I had taken it at the time. I know more now.

It was at this point that Jim Roche was most helpful. Jim, as many may recall, set a flying mile top speed record with an early R1100RS. It was Jim who clued me into the importance of monitoring and adjusting the second of the two TPS potentiometers, white-gray wire #3 from the rear, the high speed side of the equation. As I had previously found, wire #1 covers idle to about the 1/3 open throttle region, and wire #3 takes over from about 1/6 throttle to WOT (wide open throttle). Above about 3/4 open Jim reported that the oxygen sensor is ignored and the fuel air ratio is mainly set by TPS wire #3. Jim's RS performed best with WOT voltage at #3 under 4 volts, in his case 3.91. Above this the plugs got sooty, and top speed performance was lost. But, at 4 volts or slightly higher (.400 or higher at #1), throttle response at lower RPMs was improved, leading me to conclude more TPS voltage (to an extent) was the hot setup. I've since learned better.

Theory - "Zero = Zero"

I wondered how BMW had come up with their TPS adjustment procedure of changing a digital reading on their analyzer from a "0" to "-0-". What this gave was the reported voltage range of .370-.400 volts with the throttle closed. But, I reasoned, what was the basis for closed throttle? Sure, the stop screws sealed with blue paint set the "standard" throttle opening, but I wasn't all that convinced

this was a good starting point. What is the standard opening fixed by the blue paint? Is it air flow, gap between the butterfly and bore or, arghhh(!) "x" number of turns from full closed? I wondered, if .370-.400 volts "should" be what equates to a proper opening for idle, perhaps screwing out the throttle stop on the left throttle body should yield .000 volts at the TPS. Well, guess what? I have done this very procedure on my RS with great results. I repeated this on a friend's GS with equally good results. Then, just recently, I checked another strong running RS and found that if the TPS reads about ..000 volts at zero throttle opening it is SET JUST RIGHT! So "zero = zero". If set this way, throttle response is very good, surging is nil, and top speed is as good as it gets (wire #3 is under 4.00 volts WOT, at least on RSs).

Procedure

Prerequisite: Be skilled with a digital voltmeter (DVM) and have good mechanical skills. You will need a quality DVM and a mercury manometer. Valves should be correctly adjusted (for left to right balance) and all required service performed as prescribed!

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

You want to go for it? Here goes:

1. Loosen the throttle free play at the at the outside / forward adjuster on the left throttle body and make sure you also have free play at the crossover synch cable by adjusting the cable on the right throttle body.

Note: In the following steps be sure that you know the difference between the THROTTLE BODY STOP SCREW and the BRASS BYPASS SCREW!

2. Loosen the lock nut and unscrew the left throttle body stop screw (under and inside of the throttle body) counterclockwise (CCW) about three turns until you can see a gap between the end of the screw and the flange it pushes on to open the throttle. (Note: early R's had no locknut, just an interference fit. The locknut is 8mm and the stop screw is 7mm - however this may vary from model to model. A thin 7mm ignition wrench works well on the stop screw as does a stubby screwdriver. Working room is limited, so use patience!). Once you have made this adjustment you are assured the left throttle is FULLY closed. Be sure!

3. Attach the DVM to ground and the TPS white-red wire #1. Probing with a paper clip is one method of reaching the contacts. Turn on the ignition, be sure the engine cutoff switch is in the on or run position, and retract the sidestand. Don't start the engine.

4. Loosen the two screws securing the TPS. Adjust the TPS by slowly turning it within its slots until the observed voltage decreases to about .006 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 travel. Stop just when the voltage stops decreasing and lock it down there.

5. With "zero = zero" set, now turn the left throttle body stop screw clockwise (CW) until the voltage starts to rise, and continue until you reach .370 volts. Stop there, and lock it down with the jamnut if so equipped. Blip the throttle several times to check accuracy and repeatability. Readjust if needed. There! You are forever done with the TPS adjustment! But, keep going. It's time for the previously described "super-accurate throttle body synch method"...

Warning: Be sure the throttle stop screw lock nut is LOCKED down before proceeding with the next step! It may back out completely from engine vibration.

6. Connect the mercury manometer to both throttle bodies. Now warm up the engine. It will idle rough because of mis-synch. Don't worry. Use a fan to avoid overheating, but get 5 bars on the RID oil temp if so equipped.

7. LEAVE THE LEFT THROTTLE BODY STOP SCREW ALONE! Lightly seat both brass bypass screws which are located on the outside of the throttle bodies, facing the rear. Adjust the right throttle body stop screw to get perfectly equal mercury in both columns.

8. Now adjust the crossover synch cable for equal mercury readings at 2000-4000 rpm. I start just off idle and then check at 2000, 3000, and 4000 rpm. I adjust for the best compromise. If you get the just off idle close, then everything should fall in place. That’s where adjustment is most critical. It will definitely help if you've got the new improved low friction throttle cable that is a warranty item from you dealer! Use the throttle to increase RPM, not the "choke" lever when synching!

9. Finally, adjust both brass bypass screws counterclockwise (CCW) about 1/2 turn for equal mercury levels and an appropriate idle speed of about 1100 rpm You might want your test idle even higher, around 1200, because on the road idle speed is lower. That's what I do.

10. Reset throttle cable free play to .5 mm (see step 1 above) and you are finished! Inspect your work and test ride.

NOTE: I've run across two minor problems with the above procedure involving GS and R oilheads. Here they are, and the fixes:

A. TOO HIGH A FINAL IDLE SPEED DESPITE BYPASS SCREWS BEING SEATED.

My instructions are to set the left stopscrew to .370 volts, which approximates the lower value of .370 - .400 that others such as Jon Diaz have reported as the normal TPS range. On some machines this setting will result in a higher than normal idle speed, say around 1400 RPM, that cannot be reduced by going CW with the bypass screws.

FIX: Reduce the TPS voltage with the left stop screw in increments of .020 volts (.370, .350, .330, etc) and resynch with the right stop screw until an idle speed of 1000 RPM is achieved with the bypasses closed. Then open the bypasses and re-synch with them to achieve a final idle speed of 1100-1200 RPM.

B. ENGINE WON'T RUN AFTER "ZERO=ZERO" WITH BYPASSES SEATED.

I ran across this problem while working on an R1100R.This may occur on other GS/R types since the throttle bodies are different than RS/RT versions. I pulled my hair for awhile until I opened the bypasses equally 1/2 turn CCW and the motor idled (albeit very slowly). The INITIAL opening (BMW spec) of the bypasses on RS/RT machines is 1 1/2 turns, and on the GS/Rs is 2 1/4 turns making the "control" of the bypasses on the GS/Rs much more pronounced.

FIX: After setting the TPS to zero=zero it is time to do the super-accurate mechanical synch with the right stop screw. On some machines, notably GSs and Rs, you may have to open the bypasses some to get the machine to idle so as to perform the mechanical synch. If necessary (and don't do this if not required), EQUALLY open each bypass 1/4, 1/2, or whatever turns or fractions thereof is required for the motor to idle. The less open the better, because we want to do this mechanically and minimize bypass irregularities.

So in summary, what have we done? We set the TPS for zero volts at zero throttle plate opening. Then we opened the left plate to .370 volts followed by an accurate synch. Pretty simple, and it WORKS! You will notice very good cold starting, good throttle response, little if any surging, and good top end. Let me know how this works for you. This same procedure will apply to R1100 RS/GS/RT/R and R850R machines.

REVISED "ZERO=ZERO" FOR '97 OILHEADS

'97 Oilheads have the new throttle cable distribution box under the battery area on top of the engine. Here is a revised "zero=zero" TPS procedure for these newer bikes, though it's hardly changed.

The difference between the old system and new is the fact that the throttle cable from the twistgrip goes to a distribution box located underneath the battery area. The throttle cable attaches internally to a bellcrank wheel. Then two cables leave from the wheel to each throttle body, so there is no crossover synch cable

at all. Another cable enters the distribution box from the start lever. When actuated, this cable pulls a tab across that contacts a flange on the wheel, opening the throttles a prescribed amount for starting.

So the cable at each throttle body is just that, the throttle cable for that particular side. It is essentially as if the throttle cable has a "Y" upstream as the older Rs did.

To do the TPS procedure loosen the free play adjusters on each throttle body. Then do everything else the same as far as TPS adjustment with the left TB plate closed up. When the TPS is "zero=zero", adjust the left throttle stopscrew for the .370 prescribed. Then start the engine as described and adjust the right TB stop screw for equal mercury. Then adjust the left TB cable for about .5mm free play and synch the right TB to the left using the right TB cable free play adjuster. Finalize your idle speed and synch with the previously closed bypass screws. You're done!

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.

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.

3. 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.

R1100 Tire Change - Carl Kulow

Front Wheel Removal

before removing, check rim for dents!!! out of round and runout
RS: remove fender and fork covers - top=3mm, side=5mm and 3mm
remove both sets of calipers - bolts through forks, 8mm (rock back and forth on rotor to spread pads for easy removal)
remove axle nut (bolt) - R=17mm, RS=18mm
loosen axle clamp bolts - 6mm
pull axle out with screwdriver while supporting tire (watch for spacer on right side and speedo drive on left side)
roll wheel out
(check front brake pads and check front wheel bearing by hand)

Front Tire Change

place wheel on wooden support frame to prevent rotor damage or remove rotors
mark direction of rotation on wheel
remove valve core
break bead all around on both sides
lube bead both sides (tire lube or dish soap)
pry off first side with two tire irons (tape to avoid scratching wheel)
pry second side part way off from inside wheel with tire iron(s) and then pound the rest off by hand using a rubber mallet (tire and rim vertical)
lube first bead and push on with hands and knees
align tire balance dots with tire stem!!! and correct direction of rotation!!!
lube second bead and push down with hands, knees, feet ~ 3/4 on
using three tire irons pry tire on -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)
double check alignment of tire balance dots with valve stem!!!
double check direction of rotation
insert valve core, inflate to seat tire, inflate to 40 psi

Front Tire Balance

determine balance by taping weight to wheel
remove old weights with razor knife and alcohol if necessary
precurve whole weight ribbon
clean wheel with alcohol before sticking weight on
warm weight adhesive to get good stick

Front Wheel Installation

reinstall rotors, if you removed them 24 Nm plus Loctite 243
grease axle lightly
roll wheel in
insert right side spacer and left side speedo drive
insert axle from right side
tighten axle nut (bolt) R=17mm RS=18mm 22 ft.lbs.(30 Nm)
gently pry brake pads apart with tire iron
install calipers 8mm - 30 ft.lbs.(40 Nm)
pump front brakes until pressure returns!!!
with bike off centerstand compress front forks several times with rear brake applied
tighten axle clamp bolts -6mm 16 ft.lbs.(22 Nm)
RS: reinstall front fender
pump front brakes!!!

Rear Wheel Removal

before removing, check rim for dents!!!
block up bike under catalytic box
put bike into first gear
remove both saddle bags
RS: remove rear fender
pull out center wheel cover with hook on shock tool
remove four lug bolts - 17mm, watch for spacer on right side
roll wheel out
(check rear brake pads!!!)

Rear Tire Change

same as front

Rear Tire Balance

same as front
use four hole adapter and lug bolts to balance

Rear Wheel Installation

roll wheel in
install spacer on right side
install four lug bolts, snug with lug wrench
torque to 37 ft.lbs. (50 Nm)- 17mm, then torque to 77 ft.lbs.(105 Nm)
align notch on center wheel cover and install

Tools

Allen socket set
small torque wrench
BMW tool kit
3 tire irons
rubber mallet
bead breaker (JC Whitney)
balancing stand (homemade)
valve core tool
rear wheel adapter and axle
hacksaw
razor knife
wheel weight ribbon
hair dryer
duct tape
tire lube or dish soap
paint brush (for applying lube)
alcohol
grease