

SYSTEM DESCRIPTION:

- BMW 2002 525i;M54 engine;A5S.325Z automatic transmission;
- INA mechanical belt tensioners for both belts
- belt-driven mechanical cooling fan with viscous clutch (controls fan speed)
- cooling cassette in front of the radiator (cools the ATF, PS, oil, & AC)
- electrically-heated thermostat
- auxiliary electric cooling fan
- auxiliary coolant pump from base of fan shroud on drivers side
- outside (shorter) belt turns the AC compressor
- inner (longer) belt turns alternator, water pump, & power steering pump

Brands (old/new):

Radiator Behr/Nissens

Water pump (it says INA on the plastic impeller)/Graf

Thermostat housing Behr/Wahler

Fan clutch Behr/Behr-Hella

Expansion tank (aka surge tank) Behr/Behr-Hella

Temperature switch ?/FAE

Coolant level switch ?/Vierol Vemo

Hoses BMW/(the name is ground off for some reason)

TODO:

Later, explain the (appreciable) difference between the removal of the fan shroud for a dry R&R (as in the alternator) and the wet R&R (as in cooling system).

The main difference is the order matters more in the dry R&R, and parts removal without destruction also matters more in the dry R&R.

MISTAKES:

- Did not take a picture ahead of time of the wiring behind thermostat.
- Subsequently screwed up the thermostat wiring causing extensive rework.
- Broke a bottom clip of the Nissens radiator because I put them on too early.
- Put expansion tank bottom hoses on too late; must do earlier in the sequence.
- Connected expansion tank electrics too late; must do earlier in the sequence.
- Put the bumpers on too early; lost drivers side and had to search for it.
- Didn't buy overflow hose; found small tear near nipple too late!
- Wished I had replaced smaller one-inch hoses (need to figure out which)
- Should have noticed radiator was 1/4" out of whack when putting rivets in!
- Installed plastic rivets too early; spend an hour cutting them out!
- Shroud bottom moved 1/4 inch after seating; had to be removed twice.
- Didn't expect coolant flowing out after initial draining; very wet mess.
- Couldn't check properly for leaks; should newspaper to catch bleeding drips.
- Broke surge tank nipple when removing clamp; need less forceful method.
- Broke radiator clip when removing nipple; need better technique described!
- Nissen radiator nipple is LARGER than Behr; need slightly bigger hose clamp.
- Forgot to write down hose clamp screw alignment; cost me much time adjusting.
- Need to find a hose clamp with a smaller less obtrusive tightening bolt.
- Need better way to clean transmission,oil,ps,ac radiators (made a royal mess).
- Need an 8 ft-lb range for a quarter-inch torque wrench (mine are too big).
- Mistakenly hammered on wp; need to use the tilt technique ahead of time.
- Coated anti-seize way too early on the wp shaft and flange; do later.
- Should have checked six locations on radiator for fit earlier on in the work.
- Should have done cooling system when I did my alternator & driver belts.
- When doing the cn90 rope trick, I forgot to leave a tab of tape; cost time!
- Should have removed upper hose earlier on in the DIY (makes job easier).

WHATIDID:

- Raise the front of the car.
- I used ramps to raise the front, but a jack with jack stands also work.

- Set the emergency brake
- Chock the rear wheels
- Protect yourself.
- Goggles will protect your eyes from splashed coolant & falling debris.
- Nitrile gloves will protect your hands.
- Remove the under-engine shroud pan
- Nine #2 Phillips one-twist bolts
- Drain the coolant
- Open the heater core valves
- Turn the ignition to the on position.
- Set the heater control to as hot as it will go (90F).
- Turn on the passenger compartment fans to their lowest setting.
- You should hear the auxiliary water pump continuously pumping.
- The Beisan says to locate & remove the engine jacket drain plug.
- They say it's on the passenger side.
- I located a "bolt" behind the air conditioning compressor; but left it.
- Remove the expansion tank cap?
- Locate the blue drain plug on the underside drivers side of the radiator.
- Place your collection container underneath the plug.
- BEFORE you turn the plug, notice it's parallel to the line of the radiator.
- Turn the plug 90 with pliers. so it's perpendicular to the line of the radiator
- Catch the coolant in your collection containers.
- Have plenty of rags on hand to clean up the spilled coolant.
- When coolant no longer drains, remove the key from the ignition.

VERY IMPORTANT TO NOTE HTE HOSE SEQUENCE

- Draw the hose sequence or snap photos of the underside shroud hose routing.
- Mark with chalk where the plastic clamps lie as positions may change.
- Locate the auxiliary pump at the bottom driver-side corner of the shroud.
- Press and pull to disconnect the auxiliary coolant pump harness connector.
- Slide the auxiliary pump medially out of the fan shroud sleeve by lining up the hose in its clamp and tugging gently toward the passenger side
- From above, follow the smaller of the two power steering hoses down until you reach a hose-to-hose clip shared with one of the radiator hoses; disconnect the radiator hose side of this clip and make a note of the location of the clip as it will move once you disconnect it.

- From below, for the upper of the two expansion tank hoses only, working your way from the passengers side to the drivers side, disconnect the three clips at the bottom of the fan shroud; then disconnect the one clip at the back of the fan shroud facing the engine.

- From below, for the lower of the two expansion tank hoses, working your way from the passenger side to the drivers side, disconnect the three clips on the bottom of the fan shroud and then disconnect the one clip on the side of the fan shroud.

- Mark with whiteout or nail polish or chalk where the clips line up with the hoses once the hoses are out (you'll see the indentations). Later you'll use these marks for reference or you'll transfer these marks to the new hoses in the same position.

If you're removing the radiator (and not just the fan shroud), it is helpful at this point to remove the upper radiator hose.

To remove the upper radiator hose, place a catch pan on the ground directly under the upper-hose-to-radiator fitting.

Lift the clips on each end of the upper radiator hose with a flathead

screwdriver. Then, with successively larger screwdrivers, twist into the crack between the radiator hose and the radiator, until the hose pops free without any force upward or downward.

Start with a 1/8" flathead screwdriver, then a 3/16", then 1/4", and by the time you use the 3/8" flathead screwdriver, the hose will be free without breaking the radiator neck (which is important if you plan on re-using the radiator and/or hose, as in an alternator repair).

With your 1/8" flathead screwdriver, lift up on the wire clamp on the thermostat side of the upper radiator hose and repeat the successive screwdriver twisting method to safely remove the radiator hose from the plastic thermostat housing with integral thermostat.

- From above, follow the wire out of the auxiliary water pump to the AUC (stink) Automatic Air Recirculation sensor on the driver's side in front of the alternator just under the upper radiator hose elbow.

Note: It helps if the upper radiator hose is removed prior.

Notice the orientation of this AUC sensor (electrical connector up, embossed lettering outward). You'll need that information for reassembly.

- While the Beisan recommends removing the electrical connector first, I think it's easier to first remove the diabolically German 2-inch by 3-inch AUC sensor housing and then removing the AUC sensor harness connector.

Remove the AUC sensor housing by wiggling and coercing it, mostly pushing up from the bottom of the AUC sensor housing and pulling the top of the AUC sensor housing away from the shroud. Then, once it's a bit loose, switch directions of force by pushing down on the AUC sensor housing, pulling the bottom of the AUC sensor housing away from the shroud. You have to just do it.

You don't really have to remove the AUC sensor electrical connector, but if you do, this is the first item to place in your parts bin.

- With a 3/16th flathead screwdriver pry out (only) the (center) plastic rivet pin on the driver's side of the fan housing shroud near the upper hose until you can get needle nose pliers on it to pull that center pin out. Then pry out the base surrounding the center pin.

- Likewise, remove the rivet to the side of the expansion tank.

- Temporarily remove the expansion tank filler cap.

- With two 3/16" flathead screwdrivers, push in the two clips & pry up the escutcheon around the bleeder screw next to the expansion tank filler cap (that has the words ENTLUFTUNG molded into the top) and remove the escutcheon.

- Replace the expansion tank filler cap.

- Study how the M-shaped rubber seal at the top of the fan shroud sits.

- With your hands, pull up on the two-foot long M-shaped seal at the top of the fan shroud to remove it from the fan shroud.

- While the orientation is still fresh in your mind, mark the front of the rubber seal so that you don't waste time putting it back on correctly.

- With your hands, lift the top of the fan shroud up an inch or two and about an inch or two to the rear; you'll get about 4 inches of room to see the small hose that goes across from the expansion tank to a nipple on the drivers side.

If this is the OEM installation, that nipple will have a permanently crimped hose clamp that will need to be removed.

Agent99 suggests a replacement hose clamp of BMW part number 07 12 9 952 104 (http://www.realoem.com/bmw/showparts.do?model=DT53&mospid=47587&btnr=13_0918&hg=13&fg=10)

If you are not replacing the entire cooling system, then you must be careful in the next step as many of us (including me) have broken the nipple off attempting to remove the factory hose clamp. If you're replacing the entire cooling system, then it doesn't matter if you break the nipple off.

- The Beisan DIY tells you to pry open the original clamp next to the nipple on the driver's side, so that you can remove the hose. I disagree. You do not want to put ANY pressure on that brittle nipple. If you must remove the factory clamp, cut it off with wire cutters along the extruding crimp (away from the hose itself), or, gently dremel it off without putting pressure on the brittle radiator plastic nipple.

Note: It would be better if we could leave the factory clamp on & remove the entire nipple (gently); but nobody has proposed a viable method for non-destructive nipple removal.

- The nipple often snaps in half right at the edge of the groove for the o-ring. In addition the groove for the o-ring molded in has sharp corners rather than a rounded groove, further weakening the part such that it often snaps when working around it. Some report removing the old nipple with a 10mm socket pushed into the upper radiator hose opening, and pushed it on to the "clipped" end to push it closed enough so that it can be pried out of the radiator (putting a string on the socket in case it fell into the radiator).

<http://bimmerfest.com/forums/showpos...5&postcount=16>

Since this is my second removal, I merely had to remove the screwed on 11-13mm solid-band fuel-system-type hose clamp with a 3/16" flathead screwdriver. Make special note of the orientation of the hose clamp bolt as the fan shroud leaves little room for error; you'll want to replace the clamp with the bolt facing forward.

- However, to experiment with removal of the nipple sans destruction, I employed two 1/8" flathead screwdrivers to pull out the two side clips on the nipple, and then a third flathead screwdriver to twist-pry the nipple up from the horizontal junction with the radiator.

- Unfortunately, I broke the two clamps off so maybe next time I'll just insert a toothpick or something else that will give before the ears do.

- Then I substituted a 3/16" flathead screwdriver to twist-pry further.

- Then I twisted with a 1/4" flathead screwdriver.

- Finally, the nipple popped out when I used the 3/8" flathead screwdriver.
- Break out your 48mm hole-spacing fan hub bolt counterhold tool.
- Mine is labeled "M101022B BMW PULLEY HOLDER".
- Grab your favorite long thin 32mm (1 /14") fan clutch nut tool.
- Mine is labeled "M101022A BMW VISCOUS FAN NUT WRENCH (32mm)".
- Note that the upper radiator hose and the VANOS equipment gets in your way. If the upper radiator hose is in place, place the 32mm wrench in the 11 o'clock position & the counterhold tool in the 2 o'clock position. If the upper radiator hose was removed, place the 32mm wrench in the 12 o'clock position with the counterhold tool in the 2 o'clock position.
- In the 2 o'clock position, secure two of the fan hub bolts.
- Note that the bolts are arranged in a rectangle, not a square, so you may need to spin the fan to arrange the bolts so the tool fits on them.
- In the 11 o'clock position, place the 32mm wrench on the fan clutch nut.
- While holding the counterhold tool, turn the 32mm wrench clockwise to loosen the fan clutch nut. You may need to hit the wrench with a hammer to break the nut free (I did not need to but I did coat the waterpump shaft threads with anti-seize in my prior removal).
- Complete the clockwise twisting of the fan clutch with just the 32mm fan clutch removal tool as there is enough static friction in the waterpump so that you no longer need the counterhold tool.
- As the fan clutch gets close to dropping off the waterpump shaft, hold one of the plastic fan blades with one hand while the other hand twists the 32mm wrench clockwise, so that the fan clutch is gently removed.

Note: It helps if the upper radiator hose is removed prior.

- Remove the fan clutch nut (see separate instructions) with 32mm fan clutch nut wrench (1 1/4") and 48-mm hole spacing fan hub bolt counterhold tool.
- The Beisan says to lift the fan shroud up with your hands and pull the fan and fan-clutch assembly out toward the driver's side tilting and wiggling as necessary to get the fan out of the shroud; they say it will come out aiming at the driver's steering wheel; but I had difficulty, even with the upper radiator hose removed, so I just left the fan clutch, for now, inside the fan shroud, against the radiator.
- Beisan says to remove the fan shroud from the engine bay at this point but I don't see how you can with the expansion tank still attached, and its three hoses, and the electrical connector on the bottom still connected to the expansion tank.
- Temporarily remove the expansion tank bleed screw with a P3 Phillips screwdriver, so that the bleed screw interface with the fan shroud does not impede the removal of the expansion tank.
- Take a good long hard look at how the expansion tank hoses snap into the shroud at the bottom of the expansion tank (you'll need that later when you put them back).
- Note: When I removed my hoses, I noticed that I had crimped the top 25 inch long 1/2"OD, 1/4" ID overflow hose with the plastic nubs of the fan shroud. Don't do that!

- From above, dislodge, by hand, the top half of the expansion tank from the fan shroud by pulling the top of the expansion tank aft toward the windshield about a half inch away from the top of the fan shroud while separating the top of the expansion tank from the fan shroud with your other hand.

Dislodge the bottom half of the expansion tank, also from above, by grasping the two hoses at the lower end of the expansion tank and pulling them aft, toward the engine firewall until they separate from the plastic fan shroud clips.

- Note: If you're replacing the expansion tank, it may be easier to simply unclip the two hoses from the bottom of the expansion tank from underneath the vehicle.

- Replace the bleed screw outside the fan shroud hole, with a P3 Phillips screwdriver.

- By hand, pull the drivers side of the fan shroud up a few inches and at the same time pull the bottom hoses of the expansion tank completely away from the fan shroud.

- For some reason, this allowed a few ounces of coolant to flow into the catch pans which I had to re-position, not knowing from whence the fluid came.

- Then wiggle the driver side down and pull up on the passenger side of the fan shroud, allowing complete access to the expansion tank.

- Pull the entire end of the upper expansion tank 25 inch long 1/2"OD, 1/4" ID overflow hose back toward the windshield through the tunnel in the fan shroud directly adjacent to the upper portion of the expansion tank so that the hose is not impeding removal of the fan shroud

- If you haven't already, by hand, pull the fan clutch and fan assembly from the front of the fan shroud.

- Finally, remove the fan shroud from the engine bay, leaving the expansion tank still connected to the car.

- Disconnect the frail-looking electrical connector from the bottom of the expansion tank. Be careful. Do not remove the elbow-shaped black connection to the expansion tank; just unclip and remove the outer harness connector.

- For a dry R&R, the Beisans say to place the expansion tank at a high location in the engine bay but that only made my broken nipple leak more so I put it at about the same level it was prior when I did a dry replace.

- For a wet R&R, simply remove the two hoses at the bottom of the expansion tank if you haven't done so already in the process of disentangling the expansion tank from the fan shroud.

- As per the Beisans, I tried to keep the expansion tank 25 inch long 1/2"OD, 1/4" ID overflow hose high to keep coolant from draining out but whenever I raised the expansion tank, coolant drained out of the broken nipple on the radiator anyway.

Eventually, while I was working on putting the fan on the water pump, the expansion tank fell to the floor with a full thud, and I had to jam a branch of wood from my plants into the broken nipple end on the end of the hose to stave the bleeding mess.

- At this point, the fan is off, the shroud is off, and the expansion tank is connected but lying on the ground.

REMOVE RADIATOR:

- If you haven't done so already, remove the upper radiator hose.

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- Remove the lower radiator hose upper connection to the thermostat housing with integral thermostat by first lifting up on the retaining bar and then using the successive screwdriver twist widths trick as before.

- Be prepared for fluid to drain out from the lower end of the thermostat into your catch pan underneath.

- Remove the coolant temperature sensor electrical harness connector from the lower radiator hose by pressing on the clip and lifting straight up.

- Leave the temperature sensor in the lower radiator hose, for now.

- With a flathead screwdriver, lift up on the lower radiator hose radiator connection clip, and again use the successive width screwdriver twist trick to remove the lower radiator hose from the radiator. Due to the closeness of the radiator to the hose neck, you may need to insert your flathead screwdriver tip from below. I was able to access the neck-to-hose pry point with a Z-shaped screwdriver.

If you have trouble with the lower radiator hose to radiator connection, just leave it connected at that one end until you remove the radiator.

Remove radiator:

- With an 8mm socket, remove the two bolts holding the two clips at the top of the radiator.

Note: Each clip has 2 rubber insert boots; do not lose them; remove the four rubber boots for safekeeping.

At this point, it's still not at all obvious how the radiator comes out as lifting it with your hands doesn't seem to budge it much more than about a half inch at the top toward the windshield.

I re-read DIYs, all of which simply implied the radiator was already out by now.

Finally, I placed both hands under the passenger side corner of the radiator and bodily lifted up, thereby loosening that corner.

Repeating this bodily action on the drivers side lower corner, failed to dislodge the driver's side corner of the radiator.

Altogether, the DIYs make this radiator removal step sound all too easy. Finally I lay on my back on the soaking wet garage floor, and with a light (it was a rainy night), I was able to dislodge the

driver side corner from its bottom rubber boot.

An entire bird's nest of leaves and debris greeted me as I pulled the radiator backward away from the front of the vehicle.

Even with the radiator "loose", it was still hard to remove from the E39. The passenger side was hindered by the lower radiator hose still attached; and the drivers side was held up by the automatic transmission cooling hoses.

In fact, removing the radiator, once unbolted, was, so far, the most difficult step. I ended up going back to the lower hose and removing it by successively larger flathead screwdriver twists. Yet another spurt of messy coolant spewed into the catchbasins below the engine.

Removing the lower radiator hose turned out to be instrumental in providing that extra room to wiggle the passenger side as far over to the passenger side as possible to disentangle the driver side from the automatic transmission cooling hoses.

With your hands, lift the radiator out of the vehicle; yet again, a last dying gasp of coolant will spew forth onto your garage floor, making it a veritable lake beneath your feet.

At this point, I marked the medial and distal bottom hoses on the expansion tank, and removed them using the oft aforementioned successively larger flathead screwdriver twists with added pulling by hand. Yet another torrent of water spewed forth from the now open hoses.

At this point, it's a good idea to wash away with air or water the birds nests nestled amongst the automatic transmission cooler coils; however in a garage, additional water is problematic.

Take a look at the old and new expansion tank:

- The new expansion tank comes with the floating stick visual indicator.
- The new expansion tank comes with the upper overflow hose nipple attached.
- The new expansion tank does not come with a cap.
- The new expansion tank does not come with a bleeder screw.
- The new expansion tank does not come with a bleeder screw escutcheon.
- The new expansion tank does not come with the electrical level sensor.
- The new expansion tank does not come with the overflow hose.
- The new expansion tank does not come with the overflow hose clamp(s).

Agent99 found that it's important to put the rubber 25 inch long 1/2"OD, 1/4" ID overflow hose on the expansion tank nipple before connecting that rubber hose to the nipple on the radiator (notice that's the what you'd expect from the reverse of removal).

Transfer the rubber blocks on the bottom third of the old radiator to the new radiator.

REMOVE BOTH DRIVE BELTS:

- Draw a diagram of the belt pathways.
- The outside (shorter) belt turns the AC compressor
- The inner (longer) belt turns alternator, water pump, & power steering pump
- My larger belt went from the top of the alternator -> to the outside of the power steering pump --> to the engine-side groove of the crankshaft

pulley --> around the pulley almost 360 degrees to the idler roller upside down curling around the idler roller from the bottom --> then to the bottom of the water pump pulley and around the water pump --> then again upside down to the very bottom 15 degrees of the upper mechanical tensioner --> over to the top of the alternator pulley.

- My smaller belt went from the top of the compressor --> over to the top of the crankshaft pulley around the bottom of the crankshaft pulley --> over to the top 15 degrees of the lower mechanical tensioner --> back over to the bottom of the AC compressor pulley.

Find two 4mm or equivalent allen wrenches (5mm was too large) to place in the hold-fast holes when you release tension on the belts to keep the tension off until you're ready to replace the belts.

- To remove alternator belt (it has to come off first), from underneath the car (so that you can access the hold-fast tabs), place a 16mm box wrench on the lower mechanical tensioner and turn the box wrench clockwise; this will loosen tension so you can slip the 4mm allen wrench from underneath the car into the holes when the moving hole lines up with the stationary hole

- Once the lower mechanical tensioner is locked in the open position, slip the alternator belt off the pulleys.

- Optional: Spin the pulley of the lower mechanical tensioner with the belt removed; if you hear a "dry sound", it needs to be replaced.

- Note: If you wish to remove the pulley on the mechanical tensioner, you will need an L-shaped T50 Torx wrench or you will need to remove the fan shroud as there is not enough room for a socket or screwdriver T50 Torx wrench between the mechanical tensioner pulley and the lower lip of the fan shroud. However some say they don't sell the pulley separately so you need to remove both 13mm bolts holding the mechanical tensioner in place, one of which will be a bear to access.

- Access the upper mechanical tensioner 16mm leverage nut from above. Turn the wrench clockwise and this will lessen the tension on the belt so that you can slip the belt off after inserting your second spare 4mm allen wrench into the holes as they align with your tension.

IMPORTANT!!!!!!

- Make a special note of the routing of the corrugated tubing behind the electrical connector to the thermostat housing with integral thermostat and above the thermostat.

- Remove the electrical connection to the thermostat housing with integral thermostat by pressing the wire lock and pulling upward.

- The thermostat housing with integral thermostat is held on with four bolts, three of which are 10mm and the other is 13mm. Remove these four bolts with a socket wrench, taking notice of the way the 13mm bolt also holds the engine hook.

- By hand, pry the thermostat housing with integral thermostat away from the engine block, wiggling it to drop it down from the engine hook plate and above the corrugated hose.

- Note the lack of a gasket and sealant; there is just a rubber ring which comes with the new thermostat housing with integral thermostat.

- Clean the old gasket off the engine block, making sure the mating surfaces are clean and smooth to avoid leaks later:

- Cn90 suggests we turn the ignition to the 2nd position, set the heater control to 90 degrees on both sides, and with the heater core now open, we flush the thermostat openings with a garden hose. However I'm in a garage, so I'll skip that rather messy step.

Remove water pump:

The fan pulley is held onto the water pump with four 10mm bolts. Hold the fan pulley in your hand and the four 10mm bolts will spin out easily. Do not remove the four bolts! Otherwise, when you pull off the pulley by hand, it could shoot off and fall on the floor and chip, like it did to me. Only loosen the four 10mm nuts that hold the water pump to the engine block. Then pull or tap gently on the plastic water pump pulley to loosen it. Once loose, complete your removal of the four 10mm bolts and remove the water pump pulley.

The water pump itself is held onto the block with four 10mm nuts. Loosen these four 10mm nuts and softly tap the side of the water pump with a rubber mallet to separate it from the block.

Position the coolant catch basin below the water pump. Once the water pump is loose, pull it out of the engine block. If you weren't already tired of coolant spilling on your garage floor, you should be by now.

Again note the lack of a gasket and sealant; the water pump also uses just a rubber ring which comes with new the water pump.

Don't coat the water pump shaft and flange with anti-seize paste yet. Make a final check for debris and a smooth mating surface. Use a brass wire brush to clean the mating surface. Insert the water pump into the engine block; it will only go in one way. Unfortunately, the fit is so tight that I couldn't get the 10mm nuts on the four shaft threads. At first, I hit the water pump shaft with a 32oz rubber mallet. But that didn't really work. I finally pushed it in with one hand, a little off center, so as to get the nut to thread one or two revolutions on a shaft; then I moved my off-center pressure to each shaft in turn, until all the nuts were on a thread or two. By hand, with a 3-inch extension but no handle, I tightened them cross-wise, a turn or two at a time until I could no longer turn by hand. Tighten the four water pump 10mm nuts to 8 ft-lbs (or hand tight + 1/2 turn). Now coat the water pump shaft and flange with anti-seize paste yet. Orient the four holes in a rectangle on it's long end. Place the water pump pulley on the water pump flange oriented the same. Cross tighten the four water pump pulley 10mm bolts to xx ft lbs. Since these are steen going in steel, they seem to tighten more quickly. I only got less than a turn with the wrench on.

Thermostat:

Make a final check of the thermostat housing mating surface.
With clean gloves, coat the rubber o-ring with lube.
Before you insert the thermostat housing, check the routing of the corrugated wire to ensure it's in the position it was originally in.
Insert the thermostat housing with integral thermostat into the engine block.
This goes in easily.
By hand, insert the three 10mm and one 13mm bolts and twist a few threads.
With a 3-inch extension but no handle, tighten the three 10mm bolts hand tight.
Cross tighten the three 10mm bolts to xx ft lbs.
With a 3-inch extension tighten the one 13mm bolt hand tight.
Cross tighten the one 13mm bolt to xx ft lbs.
Squirt a hit of di-electric grease into the thermostat harness connector and connect by pushing downward.
abc

Re-install radiator:
Compare the old and new radiator.
The new radiator comes with attached blue drain plug
The new radiator comes with detached lower fan shroud plastic clips
The new radiator does not come with the lower rubber bumpers.
The new radiator does not come with the lower rubber bumpers.

With the old radiator lying flat with the bottom facing you, lay the new radiator on top in the same orientation.
With whiteout, write the date in the place where the oem sticker was on the original radiator.
Notice the old radiator has two lower plastic black clips attached.
Notice they fit only one way, with a twisting action.
Insert the new radiator fan shroud plastic clips in place & twist.(NO!)
--> I broke the passenger side radiator clip on the AC compressor!
Take a look where the lower bumpers go on the radiator and on the vehicle.
Transfer rubber bumpers from the bottom third of the old radiator to the new radiator. NO! My drivers side bumper fell off.
--> The drivers side bumper fell off near the underside of the PSP and I had to dig for it for ten minutes to find it (black on black).
Make sure you have a LOT of light (I did this out and in, in the dark!)
Lower the new radiator into place.
I found it hard to clear the automatic transmission & power steering hoses at the drivers side, so I found myself pushing against the AC hoses on the passenger side to fit the radiator in place.
drat! It was too hard to drop the radiator in from the top.
So I went underneath and tried to push it up. Double drat!
Soon I disabused myself of that notion.
Back from the top I go ...

OK. It's in but this is gonna be hard to explain.
Put the radiator in from the top, and push toward the drivers side hoses and wiggle, and push toward the passenger side hoses, and wiggle.
Then, when you have about 10 inches still out, drop under the car, and, get this, PUSH UP! Then, wiggle. Finally it dropped into place.

Since I broke one of the new flimsy black plastic lower radiator clips I decided to move the old seemingly sturdier clips to the new radiator. They twist off with some difficulty (I was worried that these were one-way twists, but they came off with a clockwise 90 degree twist (facing the clip) and went with a 90 degree counter clockwise twist. I had to push

them and tilt them from the back to disengage from the radiator.

Well, putting the passenger side rubber bumper turned out to be easy; but the drivers side was nasty. So, I take back what I said about not putting the driver's side bumper on first.

That was not easy, but, I had to remove the radiator about half way, and put the drivers side bumper on. Then reposition it, and then put the passenger side bumper on.

I can easily envision an indy who would just give up on those bumpers and not put them in where, over time, the additional stress that might result could break a plastic radiator component.

From below, double check the bumpers are in place and that they are fully seated in their pans. At first, both bumpers were hanging over the edge, so make sure that the bottom metal of the radiator links up and overlaps the edge of the transmission cooler in front of it at the bottom (hard to explain).

From below, twist-insert the two plastic clips that will eventually hold up the fan shroud.

Install both topside radiator clips with one 8mm bolt and two rubber wells each and hand tighten.

abc

Either install a new temperature switch in the lower radiator hose or move the old temperature switch to the new radiator hose taking care to always use a new o-ring (see details later).

I used a new FAE temperature switch.

In the old lower radiator hose the temperature switch will be in place. Press the two tabs on the side of the temperature switch and pull outward. This will remove the temperature switch.

It is critical to note that the green OEM o-ring will be flattened!

Do not re-use that original o-ring; you will have leaks!

With clean gloves, slip the new o-ring in place and lube it with o-ring lubricant.

With whiteout, label the date on the radiator hose.

Lubricate the o-rings in the new hose.

Spurt some di-electric grease into the electrical connector.

With a 1/8" flathead screwdriver, pull up on the black u-shaped clip on the radiator side of the hose; and do the same for the nickel-plated clip on the thermostat housing side of the lower radiator hose.

Push insert one end into the thermostat housing; you may need to twist slightly to align as it only goes on one way, then push simultaneously.

Push insert the other end of the lower radiator first into the radiator.

Re-connect the lower radiator hose temperature switch electrical connector.

I would not yet install the new upper radiator hose (with bleed screw).

I would not yet install the new expansion tank.

I would not yet install the new fan clutch.

I would not yet install the shroud.

-

Replace the alternator belt first:

Write the date on your belt, using whiteout.

Refer to your diagram drawn before you removed the drive belts.

Wrap the longer belt first, around the crankshaft, then completing the loop.

Using a 16mm socket wrench with a 2.5-inch extension, turn clockwise to provide the maximum looseness to align the belt, then pull out the 4mm allen wrench pin.

Replace the ac belt second:

Write the date on your belt, using whiteout.

Refer to your diagram drawn before you removed the drive belts.

Wrap the longer belt first, around the crankshaft, then completing the loop.

Using a 16mm socket wrench with a 2.5-inch extension, turn clockwise to provide the maximum looseness to align the belt, then pull out the 4mm allen wrench pin.

Install the new expansion tank with a new bypass hose.

- Cut off the old 25 inch long 1/2"OD, 1/4" ID bypass hose from the old expansion tank if you are re-using it.

Use needle-nosed pliers to peel the clamp off from the open end.

When I did this, the metal reinforced expansion (aka surge tank) nipple broke off.

If you are re-using the electrical coolant level sensor, twist it counter clockwise 90 degrees to remove. Unusually for Germanic connectors, there are no diabolical tabs to press. Just twist and pull out.

Additionally, there are no o-rings to lubricate or replace in that coolant level sensor.

The only thing I did was put a dab of di-electric grease in the two pronged electrical connector before connecting the new sensor to the new expansion tank by twisting 90 degrees clockwise.

Transfer the old bleed screw or a new bleed screw to the new expansion tank.

Lubricate the new expansion tank cap dual o-rings and loosely fit onto the new expansion tank.

Loosely put the 11-13mm solid band screw type hose clamp on both ends of the 25" long, 1/2" OD, 1/4" ID overflow (bypass) hose.

Do not tighten the reservoir side of the snake hose yet because this may need to be disconnected later to install the fan shroud.

abcd

Fan clutch:

Mark the fan clutch with the date, and the fan if it's new, with whiteout.

With a 5mm hex socket, remove the three bolts holding the plastic fan onto the fan clutch by holding with one hand and twisting the bolts off with the other.

Inspect the fan blades for damage.

Install the fan onto the fan clutch using the three 5mm allen bolts.

Following the cn90 trick, facing the fan clutch nut, tape a two-foot strand of leather shoelace (or equivalent) clockwise around the fan clutch nut.

I wasn't sure if I should Loosly insert the fan shroud in the car, the fan and clutch inside the shroud, and the expansion tank hoses connected to the fan shroud.

So, I decided to first install the expansion tank onto the fan shroud outside the vehicle.

When I tightened the hose clamp, I found out that the bolt interfered with the fit, so I had to move the clamp bolt to a position that did not interfere with the fitting of the expansion tank.

Loosly fit the fan blade and clutch with the string taped on clockwise into the fan shroud, lying against the radiator.

If you're re-using the expansion tank overflow hose, mark one end R for radiator, and the other E for expansion tank.

Loosly slip the expansion tank overflow hose over the expansion tank nipple.

Thread the expansion tank overflow hose through the hole in the fan shroud.

I set the bolt parallel to the top of the expansion tank, and tightened it on the expansion tank nipple. There must be empty space between the top of the expansion tank and the bottom of the hose on the nipple.

Now we have the expansion tank snapped in place on the fan shroud, with the expansion tank hose cinched at the expansion tank nipple and going through the rectangular hole in the fan shroud along the top of the fan shroud.

At this point, we take that assembly over to the vehicle and loosly fit the fan shroud into place.

Temporarily remove the expansion tank bleed screw.
Tighten the expansion tank nipple end 11-13mm solid plate hose clamp.

At this point, you're juggling three things:

- Fan shroud
- Attached expansion tank & hose
- Fan and fan clutch with attached string

At this point, I had trouble attaching the radiator nipple 11-13mm solid band hose clamp so I had to lubricate the outside of the tip of the hose. The bolt needs to go parallel to the radiator, under the radiator nipple, between the top of the radiator and the bottom of the outside of the hose on the nipple. since I know the size is right (it was on there before), I must conclude that the Nissens nipple is fatter than the Behr nipple. I double checked placing a brand new BMW nipple bought from the dealer, and the Nissens is definitely larger! I tried a larger 14-16mm clamp, but it was too big. Went back to the 11-13mm clamp and slightly widened it even though it's a solid band clamp.

Start over:

- Grease the Nissens nipple and the outside of the hose
 - Mark on the radiator where the Nissens nipple bulb lines up (you want the clamp on the radiator side of that bulb)
 - Insert the clamp on the hose such that the line of the bolt almost lines up with the line of the top of the radiator.
- You can not put the bolt on top because it will interfere with the fan shroud; you must have the bolt on the bottom, as it turns out, at a slight angle downward, where the bolt head is closest to the engine.

I'm hoping the expansion tank hoses will go on AFTER the expansion tank is fitted to the shroud!

From under the car I still need to line up the shroud on the clips, one of which fell off when the fan hit it just now.

From the bottom, there are four tabs on the bottom of the fan shroud which are critical to line up into their slots. The two corner tabs go into a corner slot and the two bottom tabs go into the two plastic pieces previously twisted onto the radiator.

Make sure the clutch is sitting safely against the radiator.

As soon as the shroud bottom clips are in place reconnect the fan clutch nut to get the fan weight off.

- Reconnect the fan clutch nut (see separate instructions) with 32mm fan clutch nut wrench (1 1/4") and 48-mm hole spacing fan hub bolt counterhold tool.

It's critical to get the shroud in place and then asap get the fan clutch nut on.

It's also critical to NOT have the upper radiator hose in your way for all these machinations.

I forgot to leave a flap of tape sticking out so that was a pain to get the tape off the fan nut (the 32mm wrench wouldn't fit over it).

I had to use an 18" tweezers to rip the tape off (lesson learned).

I then spun the fan clutch nut on ccw using the 32mm wrench until the water pump started turning.

I put the expansion tank bleeder screw in loosely to help prevent the top of the expansion tank from flopping about.

The shroud just did not fit right, so, after a while, from the bottom, I reversed the direction of the two original clips, and it seemed to sit down a quarter inch further which seems about right. Note to self make better note of the position!

Now it's time to hook up the lower expansion tank hoses.

I pulled the u-shaped clip on both hoses, and aligned them back where they came from originally in the clips of the fan shroud.

It was a big mistake not to hook the two bottom expansion tank hoses when I had the expansion tank in my hand before clipping it into the fan shroud! Lesson learned. It's just too hard to get the hoses on from under the car, without pushing back down on the expansion tank. As I push up, the entire shroud lifts up.

I should take it apart but I have both nipples on the expansion tank and radiator cinched up so I don't want to do that.

Here's what I should have done:

- I should have practice routed the two hoses on the fan shroud, then removed them from the fan shroud clips to hook them to the bottom of the expansion tank, inside first then outside.
The inside hose should go on first, then the outside hose, and then the expansion tank should be clipped into the shroud and then the hoses should be final routed, just like the practice route clipping into the fan shroud clips.

It would be helpful to have had someone push down on the expansion tank from the top as I struggled to push the two hoses up from the bottom; in the end, I put the old radiator on top of the expansion tank with some heavy parts on top of that.

abcde begin

rmostat cover bleeder hole, install screw and close bleeder.

rmostat cover bleeder hole, install screw and close bleeder.

- Re-connect the two hoses at the bottom of the expansion tank.

- Locate the auxiliary pump at the bottom driver-side corner of the shroud.
- Press and pull to disconnect the auxiliary coolant pump harness connector.
- Slide the auxiliary pump medially out of the fan shroud sleeve by lining up the hose in its clamp and tugging gently toward the passenger side
- From above, follow the smaller of the two power steering hoses down until you reach a hose-to-hose clip shared with one of the radiator hoses; disconnect the radiator hose side of this clip and make a note of the location of the clip as it will move once you disconnect it.

- From below, for the upper of the two expansion tank hoses only, working your way from the passengers side to the drivers side, disconnect the three clips at the bottom of the fan shroud; then disconnect the one clip at the back of the fan shroud facing the engine.

- From below, for the lower of the two expansion tank hoses, working your way from the passenger side to the drivers side, disconnect the three clips on the bottom of the fan shroud and then disconnect the one clip on the side of the fan shroud.

- Mark with whiteout or nail polish or chalk where the clips line up with the hoses once the hoses are out (you'll see the indentations). Later you'll use these marks for reference or you'll transfer these marks to the new hoses in the same position.

If you're removing the radiator (and not just the fan shroud), it is helpful at this point to remove the upper radiator hose.

To remove the upper radiator hose, place a catch pan on the ground directly under the upper-hose-to-radiator fitting.

Lift the clips on each end of the upper radiator hose with a flathead screwdriver. Then, with successively larger screwdrivers, twist into the crack between the radiator hose and the radiator, until the hose pops free without any force upward or downward.

Start with a 1/8" flathead screwdriver, then a 3/16", then 1/4", and by the time you use the 3/8" flathead screwdriver, the hose will be free without breaking the radiator neck (which is important if you plan on re-using the radiator and/or hose, as in an alternator repair).

With your 1/8" flathead screwdriver, lift up on the wire clamp on the thermostat side of the upper radiator hose and repeat the successive screwdriver twisting method to safely remove the radiator hose from the plastic thermostat housing with integral thermostat.

- From above, follow the wire out of the auxiliary water pump to the AUC (stink) Automatic Air Recirculation sensor on the driver's side in front of the alternator just under the upper radiator hose elbow.

Note: It helps if the upper radiator hose is removed prior.

Notice the orientation of this AUC sensor (electrical connector up, embossed lettering outward). You'll need that information for reassembly.

- While the Beisan recommends removing the electrical connector first, I think it's easier to first remove the diabolically German 2-inch by 3-inch AUC sensor housing and then removing the AUC sensor harness connector.

Remove the AUC sensor housing by wiggling and coercing it, mostly pushing up from the bottom of the AUC sensor housing and pulling the top of the AUC sensor housing away from the shroud. Then, once it's a bit loose, switch directions of force by pushing down on the AUC sensor housing, pulling the bottom of the AUC sensor housing away from the shroud. You have to just do it.

You don't really have to remove the AUC sensor electrical connector, but if you do, this is the first item to place in your parts bin.

- With a 3/16th flathead screwdriver pry out (only) the (center) plastic rivet pin on the driver's side of the fan housing shroud near the upper hose until you can get needle nose pliers on it to pull that center pin out. Then pry out the base surrounding the center pin.

- Likewise, remove the rivet to the side of the expansion tank.

- Temporarily remove the expansion tank filler cap.

- With two 3/16" flathead screwdrivers, push in the two clips & pry up the escutcheon around the bleeder screw next to the expansion tank filler cap (that has the words ENTLUFTUNG molded into the top) and remove the escutcheon.

- Replace the expansion tank filler cap.

- Study how the M-shaped rubber seal at the top of the fan shroud sits.

- With your hands, pull up on the two-foot long M-shaped seal at the top of the fan shroud to remove it from the fan shroud.

- While the orientation is still fresh in your mind, mark the front of the rubber seal so that you don't waste time putting it back on correctly.

- With your hands, lift the top of the fan shroud up an inch or two and about an inch or two to the rear; you'll get about 4 inches of room to see the small hose that goes across from the expansion tank to a nipple on the drivers side.

If this is the OEM installation, that nipple will have a permanently crimped hose clamp that will need to be removed.

Agent99 suggests a replacement hose clamp of BMW part number 07 12 9 952 104 (http://www.realoem.com/bmw/showparts.do?model=DT53&mospid=47587&btnr=13_0918&hg=13&fg=10)

If you are not replacing the entire cooling system, then you must be careful in the next step as many of us (including me) have broken the nipple off attempting to remove the factory hose clamp. If you're replacing the entire cooling system, then it doesn't matter if you break the nipple off.

- The Beisan DIY tells you to pry open the original clamp next to the nipple on the driver's side, so that you can remove the hose. I disagree. You do not want to put ANY pressure on that brittle nipple. If you must remove the factory clamp, cut it off with wire cutters along the extruding crimp (away from the hose itself), or, gently dremel it off without putting pressure on the brittle radiator plastic nipple.

Note: It would be better if we could leave the factory clamp on & remove the entire nipple (gently); but nobody has proposed a viable method for non-destructive nipple removal.

- The nipple often snaps in half right at the edge of the groove for the o-ring. In addition the groove for the o-ring molded in has sharp corners rather than a rounded groove, further weakening the part such that it often snaps when working around it. Some report removing the old nipple with a 10mm socket pushed into the upper radiator hose opening, and pushed it on to the "clipped" end to push it closed enough so that it can be pried out of the radiator (putting a string on the socket in case it fell into the radiator).

<http://bimmerfest.com/forums/showpos...5&postcount=16>

Since this is my second removal, I merely had to remove the screwed on 11-13mm solid-band fuel-system-type hose clamp with a 3/16" flathead screwdriver. Make special note of the orientation of the hose clamp bolt as the fan shroud leaves little room for error; you'll want to replace the clamp with the bolt facing forward.

- However, to experiment with removal of the nipple sans destruction, I employed two 1/8" flathead screwdrivers to pull out the two side clips on the nipple, and then a third flathead screwdriver to twist-pry the nipple up from the horizontal junction with the radiator.

- Unfortunately, I broke the two clamps off so maybe next time I'll just insert a toothpick or something else that will give before the ears do.

- Then I substituted a 3/16" flathead screwdriver to twist-pry further.

- Then I twisted with a 1/4" flathead screwdriver.

- Finally, the nipple popped out when I used the 3/8" flathead screwdriver.

- Break out your 48mm hole-spacing fan hub bolt counterhold tool.

- Mine is labeled "M101022B BMW PULLEY HOLDER".
- Grab your favorite long thin 32mm (1 /14") fan clutch nut tool.
- Mine is labeled "M101022A BMW VISCOUS FAN NUT WRENCH (32mm)".

- Note that the upper radiator hose and the VANOS equipment gets in your way. If the upper radiator hose is in place, place the 32mm wrench in the 11 o'clock position & the counterhold tool in the 2 o'clock position. If the upper radiator hose was removed, place the 32mm wrench in the 12 o'clock position with the counterhold tool in the 2 o'clock position.

- In the 2 o'clock position, secure two of the fan hub bolts.
- Note that the bolts are arranged in a rectangle, not a square, so you may need to spin the fan to arrange the bolts so the tool fits on them.
- In the 11 o'clock position, place the 32mm wrench on the fan clutch nut.
- While holding the counterhold tool, turn the 32mm wrench clockwise to loosen the fan clutch nut. You may need to hit the wrench with a hammer to break the nut free (I did not need to but I did coat the waterpump shaft threads with anti-seize in my prior removal).
- Complete the clockwise twisting of the fan clutch with just the 32mm fan clutch removal tool as there is enough static friction in the waterpump so that you no longer need the counterhold tool.
- As the fan clutch gets close to dropping off the waterpump shaft, hold one of the plastic fan blades with one hand while the other hand twists the 32mm wrench clockwise, so that the fan clutch is gently removed.

Note: It helps if the upper radiator hose is removed prior.

- Replace the bleed screw outside the fan shroud hole, with a P3 Phillips screwdriver.
- Disconnect the frail-looking electrical connector from the bottom of the expansion tank. Be careful. Do not remove the elbow-shaped black connection to the expansion tank; just unclip and remove the outer harness connector.

Connect the expansion tank coolant level sensor electrical harness. This too, I should have done while the expansion tank was unclipped from the shroud earlier on because I had to unclip the coolant temp switch to access it and I couldn't see which way it went on. I should have done a test connect and drawn lines or just connected it when the expansion tank was loose in the engine compartment.

I put the escutcheon on the expansion tank and shroud, after temporarily removing the bleeder screw. Put the bleeder back.

Now I need to add the rivets and the M-shaped sleeve.

Note: I would NOT want an indy doing this because there are too many places for them to give up in the interest of (their) time!

At this point, you fine tune the fan shroud setting:

1. The rivet holes must line up
2. Mid way down, on both sides, a tab must line up
3. Near the bottom, on both sides, a tab must line up
4. Just below that, on both sides, the rubber bumpers must be set right
5. At the bottom corners, another tab must line up
6. On the bottom edge, the two clips must line up
7. At the top edge, the M-shaped seal must line up

Push in the M-seal so that it seats properly, taking note of the markings you made on it before you removed it.
Clip in the expansion tank escutcheon simply by pressing down (after temporarily removing the bleeder screw and then replacing it)
Pop the two new rivets in with a mallet (for some reason, they were hard).
That was the dumbest thing I ever did; it cost me more than an hour!
Connect the auc sensor by clipping the two feet at the bottom first, and the lifting up to push in the locking tab at the top.
Connect the connector to the aux water pump (which I forgot to connect when i wsa down there).

Oh oh. I see the bottom clips all came out on the fan shroud to the radiator! I have to take stuff apart and re-do that. Oh for the love of God. I can easily see an indy leaving it this way but I have to take the rivets back out and re-position the shroud.
No wonder they went in a little difficult.

Upper radiator hose:
Mark the date on the hose
Grease the two o-rings
-Lift up the two u-shaped clips with a 1/8" flathead screwdriver
Clip the thermostat end first.
Then clip the radiator neck end.

Lastly, 6-inch tie wrap the upper radiator hose to corrugated wire as per hte original configuration at the bleeder screw.

abcde end

From the cn90 "the trick on how to fill the M54" DIY,
<http://www.bimmerfest.com/forums/showthread.php?t=449008>
- Mark each bleed screw with a dot of whiteout (so you can measure turns)
- Buy 2 gallons (8 quarts) of Prestone Extended Life antifreeze.
- Use 5.5 quarts of pure Antifreeze. (Prestone Extended Life)
- Use 5.5 quarts of soft tapwater (distilled is OK but overkill)
- There are 11.1 quarts total in the I6 according to the Bentley.
- Remove expansion tank cap and expansion tank bleed screw.
- Place a six-inch diameter short-stem funnel (1 inch long x 1 inch wide)
- Fill coolant up to the reservoir neck until it stops filling.
- For me, that was less than a gallon at first.
- Some air is trapped in the lower radiator hose (outside the engine)
- Give it a good 5 minutes to settle there.
- Fill again until coolant fills to the neck,
- this is about 3 inches above "KALT" mark.
- I used up a gallon and a half (6 quarts) until it slowed down settling.
- You can hear it bubbling through the engine if it's quiet outside
- Check for leaks under the engine, just in case
- With a P3 Phillips screwdriver, open upper radiator hose bleed screw 1 full turn
- air will come out slowly because the hole in the tstat housing is small.
- Keep filling (up to 11.1 quarts) as the expansion tank level falls.
- When coolant comes out, close the bleed screw.
- Don't start the engine yet, repeat those steps a few times.
- Then start the engine, and refill as needed to the Kalt level.
- The Kalt level is where the top of the stick is level with the top of the opening in the expansion tank.

- Note in the beginning, it's ok to fill to the neck because it will settle down as air is expelled from the engine.
- Follow I6 bleeding instructions here:
<http://forums.bimmerforums.com/forum/showthread.php?t=1423821>
- If you have removed the Water pump then you will need about 1.0 to 1.25 gallons of mixed coolant to refill and bleed the system
- If you have removed the Water pump AND the Lower radiator hose then you will need about 1.5 to 1.75 gallons of mixed coolant to refill and bleed the system
- If you have changed the thermostat you will need about .5 to .75 gallons of mixed coolant to refill and bleed the system
- There is no need to drill a hole in your new thermostat, see video and photos below showing the bleed hole in the thermostat cover.
- Never open a bleeder screw or the expansion tank when the engine is hot, this is the same as having a crack in your radiator and does not aid in the proper bleeding of the system
- Take care when tightening the bleeder screws as the OEM screws are plastic and can be stripped or damaged easily.
- Jacking or inclining the front of the car 6 inches or more will speed up the process but is not required.

1. With car still on ramps from the new radiator overhaul ...

With expansion tank cap off and car cold,
turn on key to run position (do not start the car),
set HVAC system to 90 degrees and fan on low.
You can hear the aux pumping and see it coming through at the top of the expansion tank

Initially, you'll need to add a couple of quarts of water as the water circulates through the block.

Check under the car with a light for leaks.

When the level stabilizes.

2) Remove the bleeder screws from thermostat cover and expansion tank.

Add coolant as necessary until water flows from thermostat bleeder hole.

When fluid flows through the bleeder holes, close the bleeder screws.

4) Continue to fill expansion tank until air free coolant flows from the bleeder screw on the expansion tank, you will need to keep the expansion tank filled to top to complete this step. When no more bubbles then install and close the bleeder. Note I found even a half turn was enough although a full turn was fine.

5) Fill coolant in expansion tank to near top of tank then install the filler cap.

6) Now take the car for a drive and get it warmed up to temperature, at least a 10 min drive, try to get some higher RPM driving in as well (like a short section of open road)

7) Park car and let cool to ambient temperature (at least a couple of hours) then check the level of coolant in the expansion tank. If it is empty then repeat the bleeding process above, if after a repeat it is still empty then you have a bigger issue such as a leak or a damaged head gasket. If the level is low then top up to the full cold level indicated on the tank or slightly above.

8) Monitor coolant level for several drive cycles adding coolant as needed to maintain the full cold level, coolant level should stabilize in one or two drive cycles.

The rest is regular tap or distilled water.

Don't put the engine bottom cover on until you've driven a couple of days and look for leaks.

Optionally, fix your power steering reservoir hose if it is leaking, by cutting off a half inch or so and putting a new clamp on.

Either install the new separate plastic fan blades onto the fan clutch or transfer your old plastic fan blades onto your new fan clutch.

Reinstall the fan shroud.

Slide the new fan clutch with blades assembly inside the fan shroud but do not thread the fan clutch onto the water pump shaft just yet. The Fan Shroud should fit nicely on the appropriate clips.

Thread the fan clutch & blade assembly onto the water pump shaft by using the cn90 rawhide rope trick, making sure to remember to turn counterclockwise to thread it on the shaft.

Then use the 32mm wrench to give it a quick tighten action.

There is no need to torque it down as engine rotation will tighten it.

Since the E39 is notorious for having air pockets, keep the front end raised on ramps (or jack stands). Follow one of the bleeding procedures. Check your coolant level daily for at least one week.

EVERYTHING BELOW IS CONJECTURE AS IT NEEDS STILL TO BE DONE & UPDATED!
(these notes below are from a DRY R&R; i will be updated for my wet R&R).

REPLACE SHROUD:

Make sure your original belt diagram is handy (you'll refer to it a lot!).

- Put the alternator/ps/wp serpentine belt back on as before, this time using the pin to keep tension off the belt while your fingers are in there. If there's any slack, you put it on wrong (ask me how I know). Again, the original paper diagram is invaluable!

- When the alt/ps/wp belt is as aligned as you can get it with the set pin in the upper tensioner, only then should you remove the set pin and align the last inch of the belt on the pulleys just right by turning clockwise with the 16mm socket wrench on the alt/ps/wp mechanical tensioner.

- Clean the expansion tank coolant temperature sensor electrical connector with MAF sensor cleaner (xylene) and when dry, add a dab of dielectric grease.

- Reconnect the expansion tank coolant temperature sensor connector but don't make the mistake I made which was to connect with the wires above the ac hose; the wires must be below the ac hose.

- Rethread the expansion tank 25 inch long 1/2"OD, 1/4" ID overflow hose through the top of the fan shroud

- Reconnect the nipple and pipe clamp. Don't make the mistake I did, thinking I could leave this for later because as soon as

I removed the bleed screw in the expansion tank, fluid leaked out of the radiator hole due to the expansion tank being above that hole. When you press the nipple down into the radiator, make sure it goes all the way until the seam is small (I used a soft rubber mallet).

- Make sure the hose-clamp bolt is at south position, closest to the radiator and furthest from the fan shroud. I used a 7mm quarter-inch socket for security when tightening.
- Place the shroud approximately in place with the drivers side up about six inches higher and replace the expansion tank hoses (I struggled for half an hour trying to get the two hoses in the bottom of the expansion tank to snap back into place). Finally I re-removed the bleeder screw, tilted the expansion tank about 1/2 inch at the top away from the fan shroud, and snap, the bottom hoses snapped into place instantly. Lesson learned.
- Replace the bleeder screw using a P3 Phillips screwdriver.
- Tape and wrap about 2 feet of rawhide on the fan nut.
- Place fan clutch assembly inside the fan shroud.
- Position fan shroud as close to perfect on the top and put on eye protection and then go down underneath the car to move hoses about and position the fan shroud back in the two (2) plastic clips at the bottom and one in each bottom corner (2). There is a clip on the sides (2), about a third of the way up, and a clip near the top on the sides (2) for a total of about 8 clips.
- Unfortunately for me, my careful taping of the fan clutch fell off when I tried to keep the heavy fan out of my way by tying it to the car. Lesson learned. Don't try that.
- Retaping the rawhide on from the driver's side (there is no access on the passenger side of the fan shroud due to the fact the expansion tank is now firmly in) and wrapping it around the fan clutch nut, it was easy to spin the fan on straight; took less than a minute to get the fan nut spun onto five or six threads until it almost bottomed on the shoulder of the water pump shaft.
- When the string falls off, tighten the nut (counter clockwise) by holding the fan with your left hand and turning the 32 mm wrench counter clockwise (the water pump hub won't spin due to belt tension). After about 10, fifteen degree twists of the 32mm wrench, you'll feel the nut tighten and the water pump hub will finally move.
- Bringing the 45-mm hole spacing counterhold tool from the driver's side, UNDER the upper hose (it won't work any other way), twist the fan hub with the 32mm wrench until the right set of holes seats in the hole and slot of the counterhold tool. Tighten as desired. (Personally, I couldn't get more than a couple of degrees of movement.)
- Nudge the fan shroud into its final seating position, taking care to inspect the two rivet holes at top (2), the clips on the bottom third on the side (2), the clips at each bottom corner (2) and the two clips on the bottom (2) for a total of 8 clips.
- The top should be aligned so that you can replace the two-foot long rubber M-shaped seal at the top of the fan shroud. Press along the entire length of both channels of the M-shaped seal to confirm proper positioning.
- Temporarily remove the expansion tank filler cap.
- Align the two clips and the word ENTLUFTUNG for the escutcheon that goes around the bleeder screw next to the expansion tank filler cap. and snap into place by wiggling the expansion tank and fan shroud as you press down on the escutcheon.
- Replace expansion tank filler cap.
- From above, replace the plastic rivets at each corner of the shroud.
- Pick up the AUC sensor housing out of your parts box and locate the holes in the fan shroud just below the upper radiator hose elbow where it snaps into place on the fan shroud.

- Orient the diabolically German 2-inch by 3-inch automatic air recirculation AUC sensor housing with the electrical connector facing upwards and the embossed letters facing to the driver's side outside of the car. Notice the hooks at the top of the housing face down and the hooks on the bottom face up, while the flap at the very bottom opens horizontally. Place the two bottom hooks in first, then lift up while pressing in so that you can place the top hooks next. The bottom flap should land over the bottom shelf of the fan shroud connection point. At this point, I noticed my bottom shelf was broken, probably when I manhandled the AUC out the first time.

- Place a dab of dielectric grease in the electrical connector for the AUC and connect the AUC sensor wiring connector making sure to keep the wires below the upper radiator hose elbow.

- From above, locate the electrical connector for the auxiliary pump and place a dab of dielectric grease on the connector before feeding it down dangling to where you can reach it below.

- From underneath, align the auxiliary pump with its holder on the fan shroud and slide in from the center toward the drivers side until the marks you made prior on the hose align with the clips on the fan shroud.

- Press the electrical connector for the auxiliary fan onto the auxiliary fan until you hear it click tight.

- From above, follow the smaller of the two lines emanating from the bottom of the power steering reservoir to the hose-to-hose clip for the lower expansion tank hose and connect the two hoses together at the point noted before you originally removed this clip.

- From below, for the lower expansion tank hose only, working your way from the drivers side to the passenger side, connect the clip on the side of the fan shroud; and lastly connect the three clips at the bottom of the fan shroud.

- From below, for the upper of the two expansion tank hoses only, working your way from the drivers side to the passenger side, connect the clip on the edge of the fan shroud facing the engine; and then connect the three clips at the bottom of the fan shroud.

- Voila! The fan shroud is now reattached.

REFERENCES:

Beisan E39 Fan & Shroud Procedure:

http://www.beisansystems.com/procedures/e39_fan_procedure.htm

Airos

<http://www.bimmerfest.com/forums/showpost.php?p=5040253&postcount=1>

CN90 ENTIRE COOLING SYSTEM REPLACEMENT

<http://bimmerboard.com/forums/posts/199986>

.stic housing : 10 NM or 89 in-lb or very little ft-lb

Engine lifting bracket 22 Nm -17 ft-lb

Coolant pump

M6 10 Nm

M8 22 Nm

Pulley to pump 10 Nm