

“Insert some plastic here”
The e28goodies guide for swapping a 24v engine in your e28



by

e28
Goodies
.com

Contents

Introduction.....	3
The essentials	5
1. Oil pan.....	6
2. Accelerator bowden cable.....	9
3. The Gearbox and the driveshaft.....	9
4. Gear lever.	11
5. The cooling system.	13
6. Air filter.....	14
7. Power steering and A/C.....	15
8. Exhaust.	15
9. The engine mounts.....	15
10. Wiring.	18
11. The differential ratio selection.....	24
In conclusion.....	25

Introduction

Once upon a time there was a really smart Audi commercial.



Every time when I have to explain why the m52b28 is the most epic 6 cyl. non S (//M) engine, I'm thinking about that advert. Simply said the m52 combines all the good qualities you might look for, in a N/A engine.

The "technical updated" version is slightly better for a daily driver, because its equipped with the dual vanos which is improving the low rpm torque and maybe it's probably a liiiiiiiiiiiiiittle bit more efficient than the ordinary m52, but it's complicated.

M52 on the left, M52TU on the right. Obvious differences are the inlet manifolds and VANOS plastic covers.



For example every TU motor has that DISA valve, which is really pain in the arse at some point.

It has four (yes, **four**) oxygen sensors and if just one failed, you are going to have a bad time.

Also most of those engines are drive by wire, meaning no throttle valve steel cable, instead you have a pedal/sensor which you need to install properly and wire to the ECU.

And here comes the good, old, single VANOS m52b28.



It's reliable and efficient. Spares & consumables are affordable. It got plenty of hp / torque. Some easy mods are available to squeeze out some more power, and if that's not enough for you, some forced induction can be held as well. It got no DISA, just 2 LAMBDAs, CC is just a matter of attaching the bowden cable to the throttle body (if you already have CC) and no issues with AC idle.

Top of the pops!

It's the engine that turns gas into smiles per hour.

Choosing the right engine.

M52 is available in several BMW models - e36 328, e39 528, e38 728 and z3 2.8.

Now here is piece of an advice. Do yourself a favor and look for less abused engine.

I mean the m52 could handle lot of stress, flooring, redlining and stuff, but you know ... "You better be her first."

Picking an engine from e38 728 with an auto tranny seems a way better option than having it from an e36. With a LSD. Previously owned by a teen.

In this particular article, I'll be writing about swapping m52b28, taken out from e39 528i 98' with stick shift, into an e28 that was originally equipped with m20 & stick shift.

The essentials

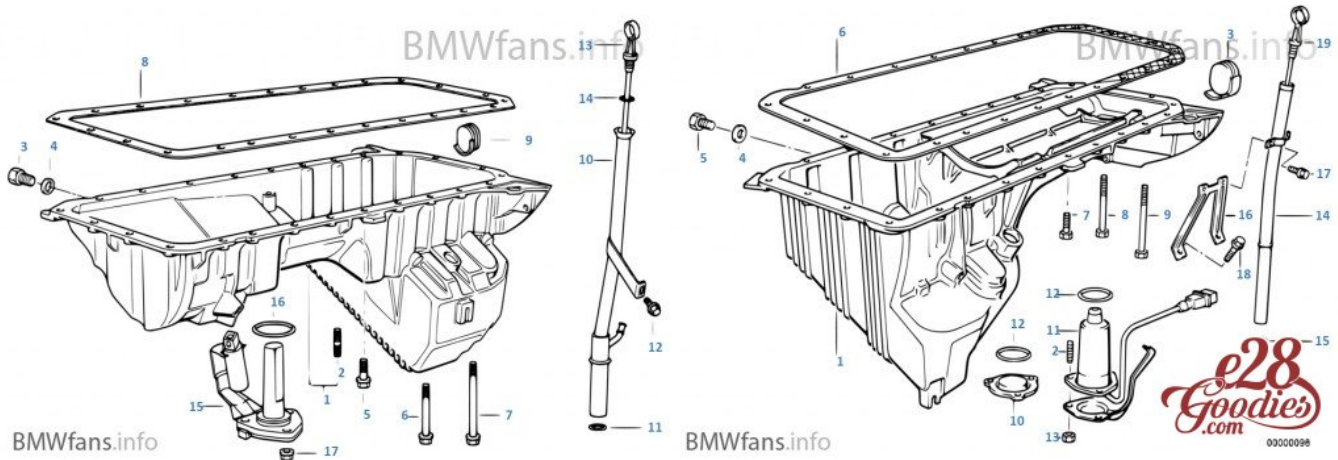
Make sure you will have the complete engine with all of its surroundings such as alternator, starter, hydraulic pump (steering), ac compressor, fuel rail, injectors, inlet and exhaust manifolds, throttle body, MAF sensor, oxygen sensors, complete engine harness, ECU, immobilizer + connector, transponder key ring & the chip from inside of the donor car key, flywheel, clutch plate, pressure plate, gearbox (**look below**), mechanical fan (they are pretty much same for all of the BMW engines, so take it only if you have a chance) ...



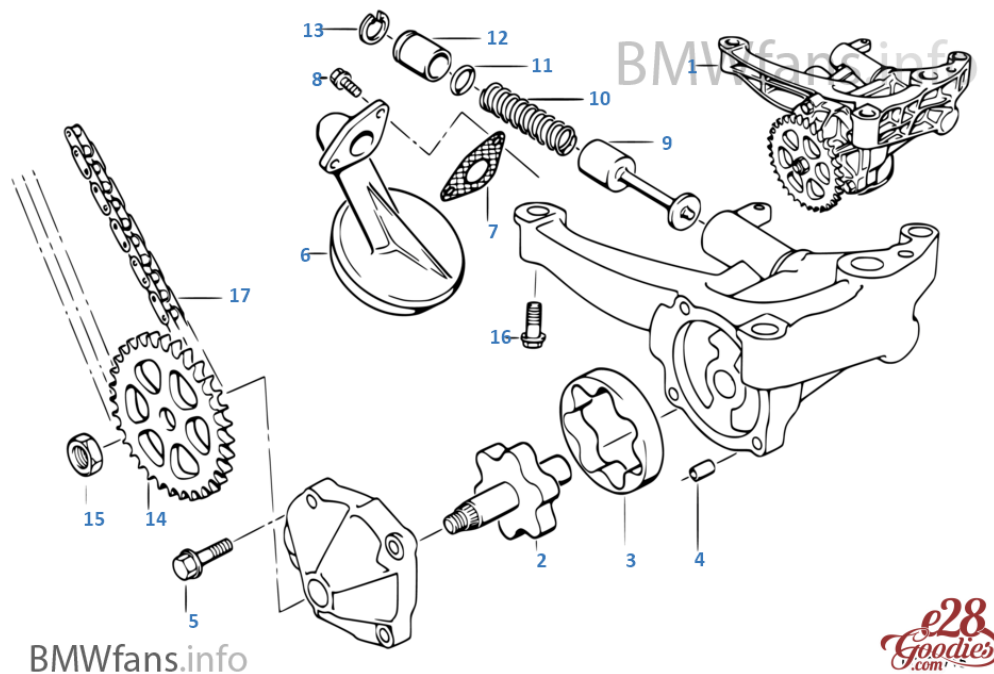
Or in other words, everything except the radiator, air filter box and engine mounts (right time to say, they wouldn't work for e28).

1. Oil pan.

e36/e39/e38/z3 on the left and e34 (needed for the swap) on the right.



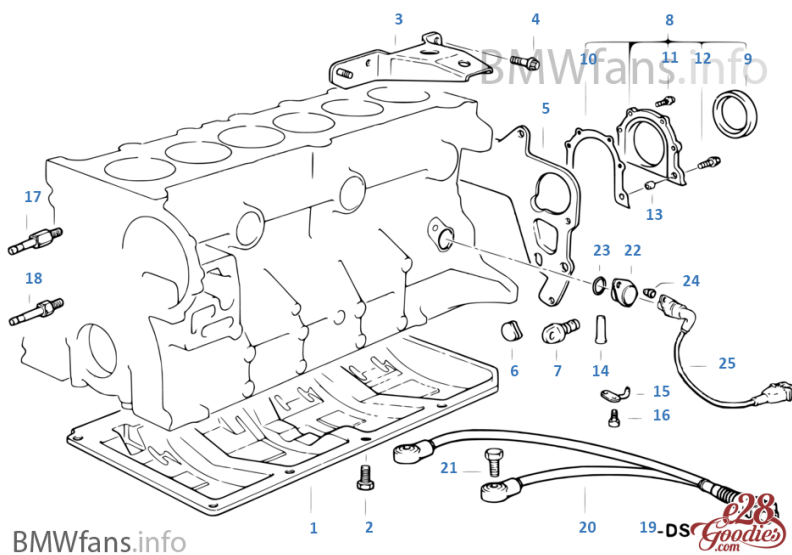
Since the oil pan collector of the e28 engines is placed in front of the front axle and e36/e39/e38/z3 oil pan sumps are behind it, you got only one option here – sourcing an oil pan from e34 m50b20/5 (m52 and m50 oil pans are the same, difference is only in the collector positioning). You will need also the e34 m50b20/5 dipstick and suction pipe from the engine – #6





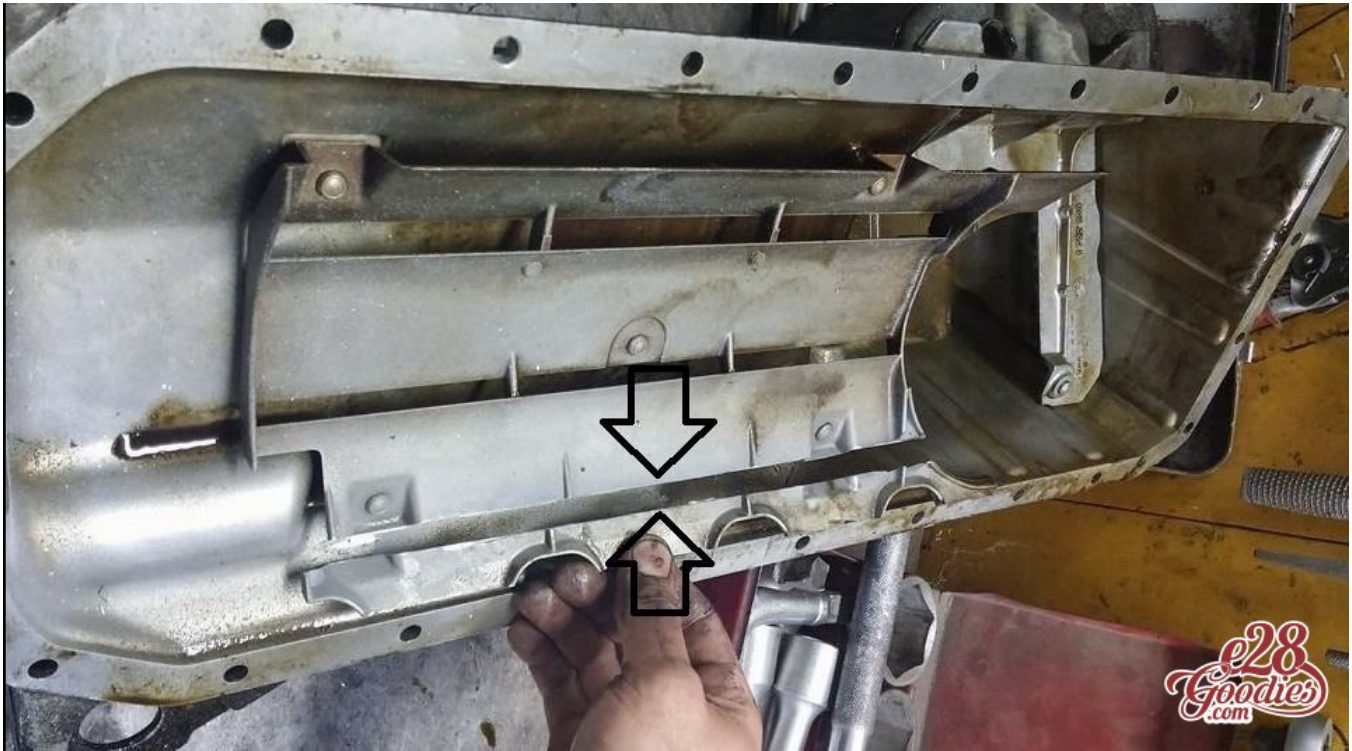
Oil pan and suction cup replacement takes about an hour, and it's nothing more than unscrewing and screwing back a few bolts.

The little tricky part is the oil deflector. On m50 it's attached via rivets to the oil pan. On m52 few bolts are holding it under the crankshaft – you will be able to see it, once you remove the original m52 oil pan. So simply remove all #2s till #1 is free to go and then throw it away - you won't need it.



BMWfans.info

You need to cut off 25mms of the right side of the deflector on the m50 pan.



That will grant some clearance needed for the fit. The deflector (yellow arrow) will drop with a few millimeters below the oil pan frame (red line). Degrease and clean the pan well after that. You don't need any alloy dust in your lubrication system. Then just put the new oil pan gasket (p.n. 11131437237) on and bolt back the m50 oil pan.



2. Accelerator bowden cable. e36 m52 bowden cable is required, it doesn't have to be brand new. You can use the e38 and e39 cables, but the e36's cable is just with the right length for your needs.

3. The Gearbox and the driveshaft.


Now, let's make clear first the fact that **ALL** m20, m40, m42, m43, m50 and m52 engines are with same gearbox bolt pattern which basically makes the transmissions interchangeable, no matter if they were made by Getrag or ZF.

But ... there are few differences.

№1. The m20 engine is tilted 20 degrees compared to 30 degrees for the rest of the listed engines. So if you are trying to fit m20 gearbox (complete waste of time and money according to me and gearbox ratios below) to any other engine pointed above, it's optimal working angle will not be the same as the engine's, thus lubrication will be compromised, you'll need a custom transmission beam/mounting and you'll need to adjust the shifter linkage.

№2. The gear ratios. Here is a chart for the different engines.

Engine/Gears	1 st	2 nd	3 rd	4 th	5 th
M20B20	3.83	2.02	1.32	1.00	0.81
M20B25 M20B27	3.83	2.20	1.40	1.00	0.81
M40B16/18 M43B16/18 M42 & M44 (IS) M50B20 M52B20	4.23	2.52	1.66	1.22	1.00
M50B25 M52B28	4.20	2.49	1.66	1.24	1.00



The ZF and the Getrag.

Basically all gearboxes in the chart above are made by Getrag, except the m20b20, m50b25 (e34 btw) and m52b28 (which are using ZFs). There are rumors on the web, which are claiming ZF boxes are stronger than the Getrags and could handle more hp and torque. We can't confirm if that's true or not, but on this particular case (my swap), the getrag 220 (m43b18) is doing great so far. (FYI abusing the clutch at high speeds is what kills the gearbox). The factory ZFs applied to the m50b25 in e34 and m52b28 in e36/39/38 are using larger output flange, which is slightly bigger than normal.

Respectively the stock driveshaft flange and the guibo are slightly bigger (left) than normal too.



Good news are the m10 and m30 gearboxes are with the larger flanges and guibos, so basically if you decide to go with the original for the m52b28 ZF gearbox, you will need to source an m10/30 driveshaft (and bigger guibo too ofc.).

If you decide to go with a Getrag, which will be reasonable since they are easier to find, cheaper and also strong enough to handle the m52b28 power, your stock m20 driveshaft will fit plug and play and you will be ready to go in no time.

Picking a gearbox is totally up to you, but if we have to make any sort of conclusion:

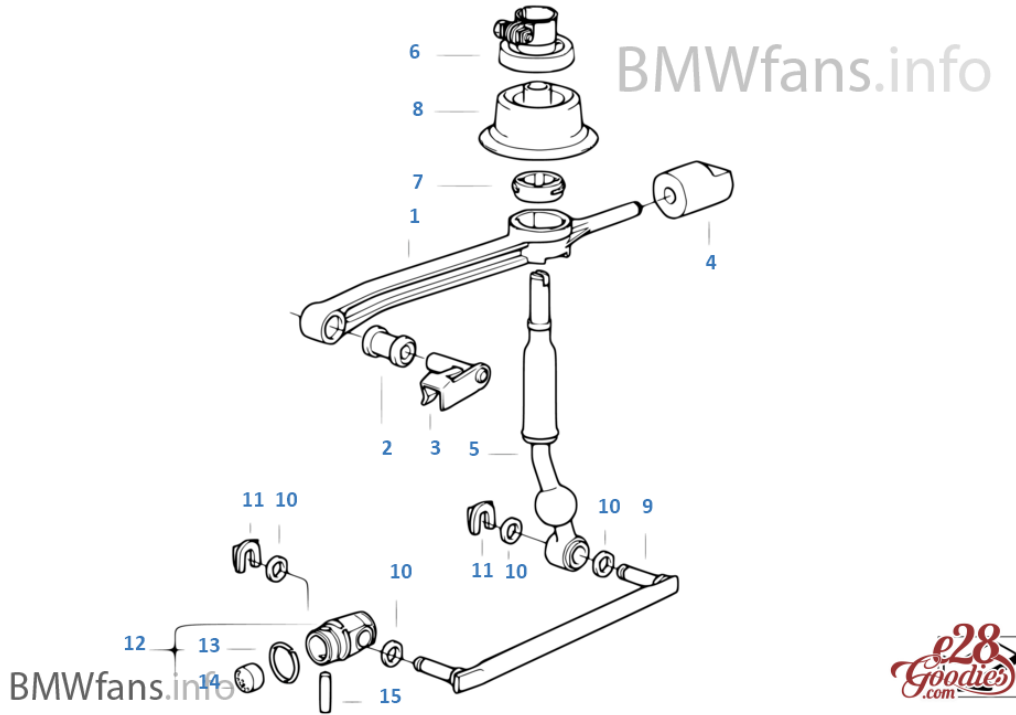
If your goal is a totally track day/drift e28, you better find a ZF.

If you are going for a pumped daily, good for a spirited driving from time to time, they you should be fine with a Getrag.

Note that if you use the ZF with e28goodies engine mounts you'll need to modify the upper gearbox ribs, the tunnel insulation and hammer in the transmission tunnel itself, to get enough clearance.

4. Gear lever.

I used a linkage from e36 - fits with little modification, depending on your e28's manufacture year. You can also use the e28 floor mounted gear lever.



The e36 rubber boot (#8) fits also:

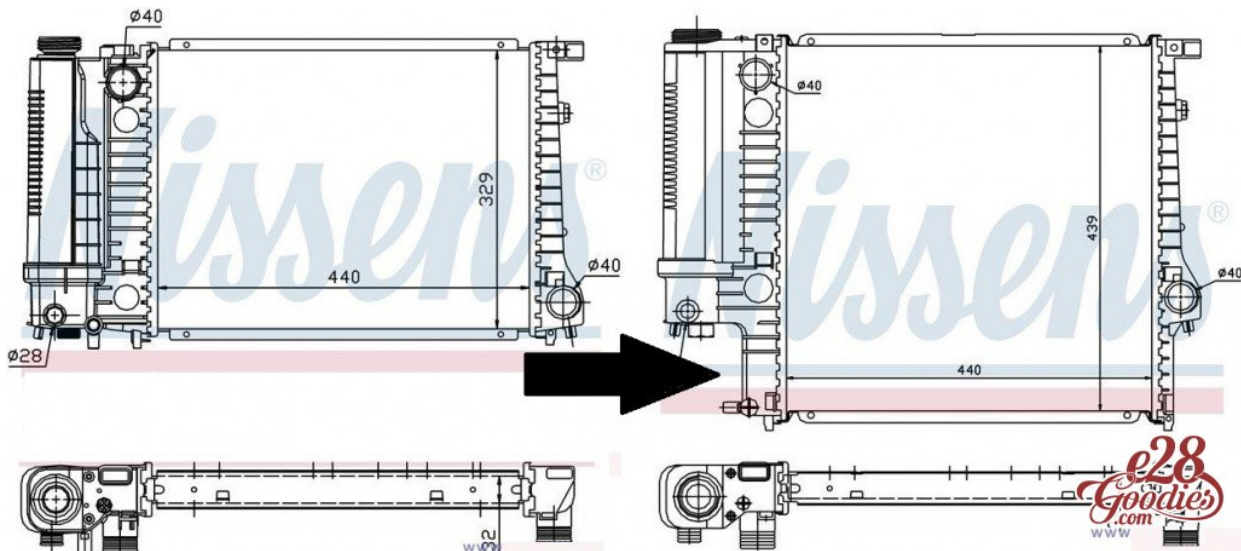


The only thing you need to do is simply grind the tiny rubber bushing with the bracket from any e36 and weld it to the e28 chassis after you adjust the shifter.



5. The cooling system.

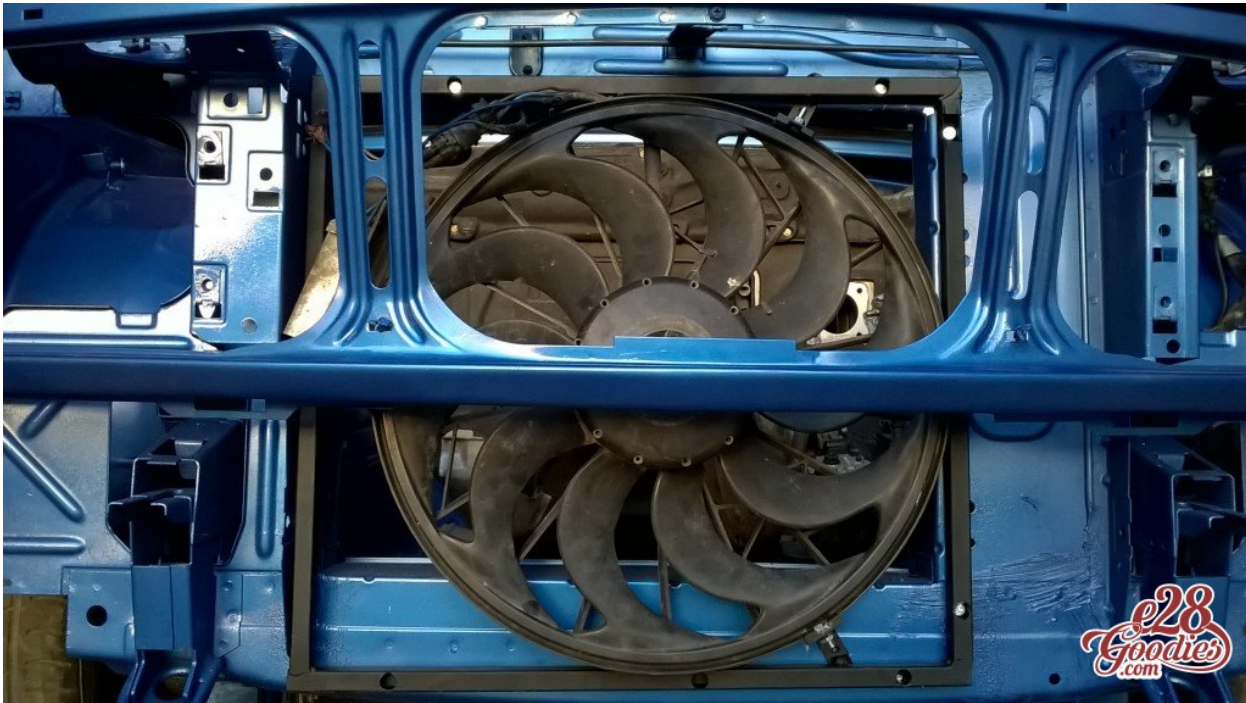
I bought a brand new radiator for 6 cyl. e36 with an AC. e36s equipped with ac got slightly bigger radiators. The black arrow shows the difference:



Besides of the precise fitment, its good because of few more reasons:

1. The expansion tank is integrated in it and that saves some space.
2. It got that thread on the side for a temp sensor which can control an electric fan.
3. Since the m52 is a common engine for an e36, finding proper hoses isn't much of an issue for this swap.
4. e36 fan shroud can be used.

I made a custom frame for the e36 A/C fan:



6. Air filter

You might be able to fit the original for the m52 air box into the e28 bay, but the easiest way is using a cone filter. Period.

7. Power steering and A/C.

You will need someone experienced in TIG welding to get that done, since pipe customization for the A/C is a must.

A/C compressor inlet and outlet threads are with totally different angles compared to the compressors used on m20 and m30.

Because of the same reason you will need to customize the power steering hoses, also the one for the high pressure should be extended with 90 mm (if we take the m20 high pressure hose length for a base).

8. Exhaust.

It's a totally custom thing. What I did is just simply copying the curves of the OEM e28 exhaust, converting the whole system to a single pipe using a center and rear mufflers.



9. The engine mounts.

This is the last and most important thing for the mechanical part of the swap.

Once again – there isn't a combination of the OEM mounts which allows you to fit m52 into the e28 bay.

So it's custom again. After a lot of trials and errors we have our perfect **engine mounts kit**.

If you choose to fabricate them by your own, here are few hints:

They have to:

- Clear the servo unit. Most people prefer to use smaller units sourced from various cars, but the stock one is just great if you did it right.



- Lift the engine, so you don't have to worry for the oil pan clearance anymore, but not too much so you will have enough space left for a strut bar and clear the transmission tunnel.



– Properly align the engine. Failing to do so will cause stress over some details and that will lead to premature wear of rubber components such as engine rubber mounts, tranny rubber mounts, guibo, drive shaft support bearing. The other benefit of the proper alignment in my case is the possibility of using an e36 fan shroud (on the e36 radiator) without any modifications.

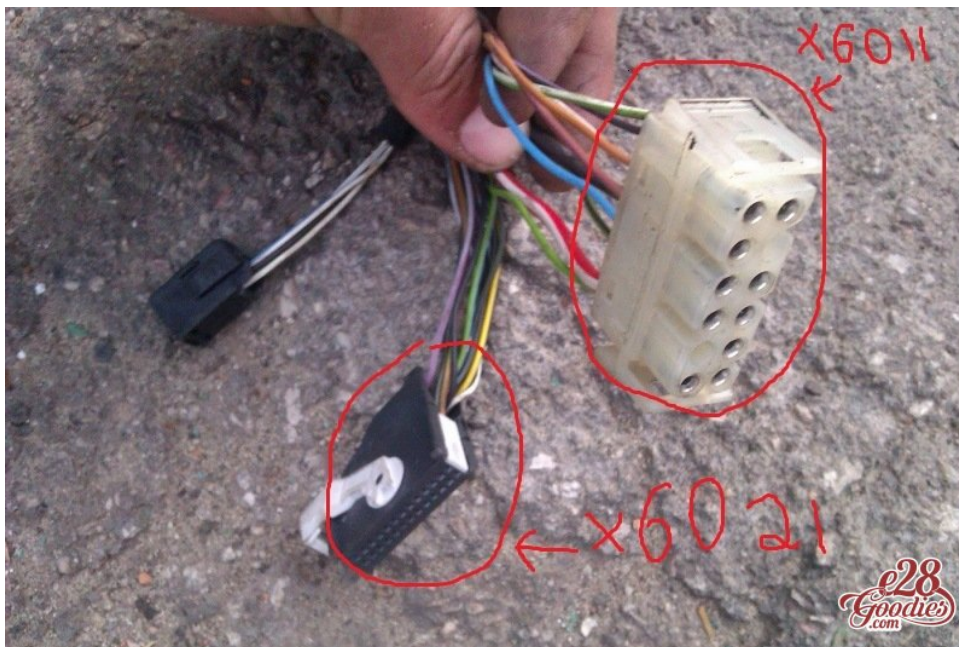




10. Wiring.

Now this is the “messy” part of the swap. If you aren’t experienced in the electrical stuff, I suggest to get someone who is. Anyways I’ll try to explain it as simple as possible – dummies style. As I said, this swap is based on an e39 m52, so if you are using engine from another model, it is quite possible for connectors to be different, different wire colors, pin location etc., so you will need to obtain some wiring diagrams for your donor car and make your own harness. We have the e39 m52 wiring diagrams in our Library section.

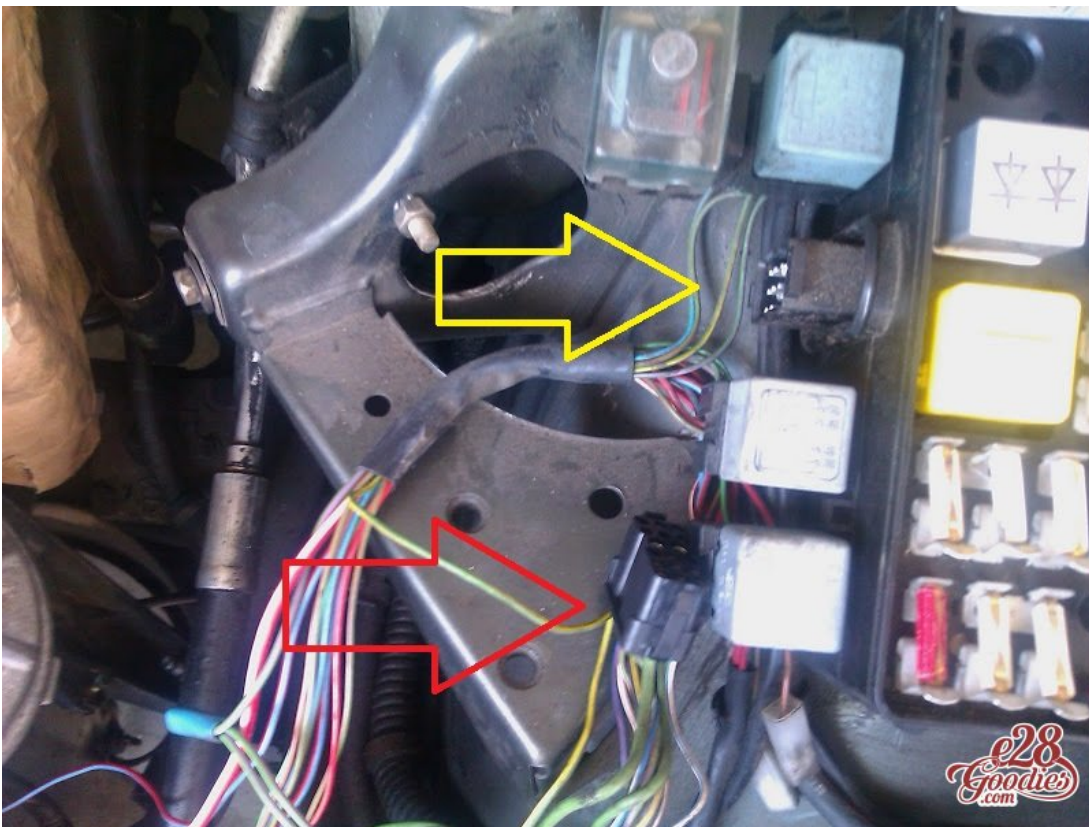
The e39 engine had these two connectors - X6021 (11 pin) and X6011 (26 pin)



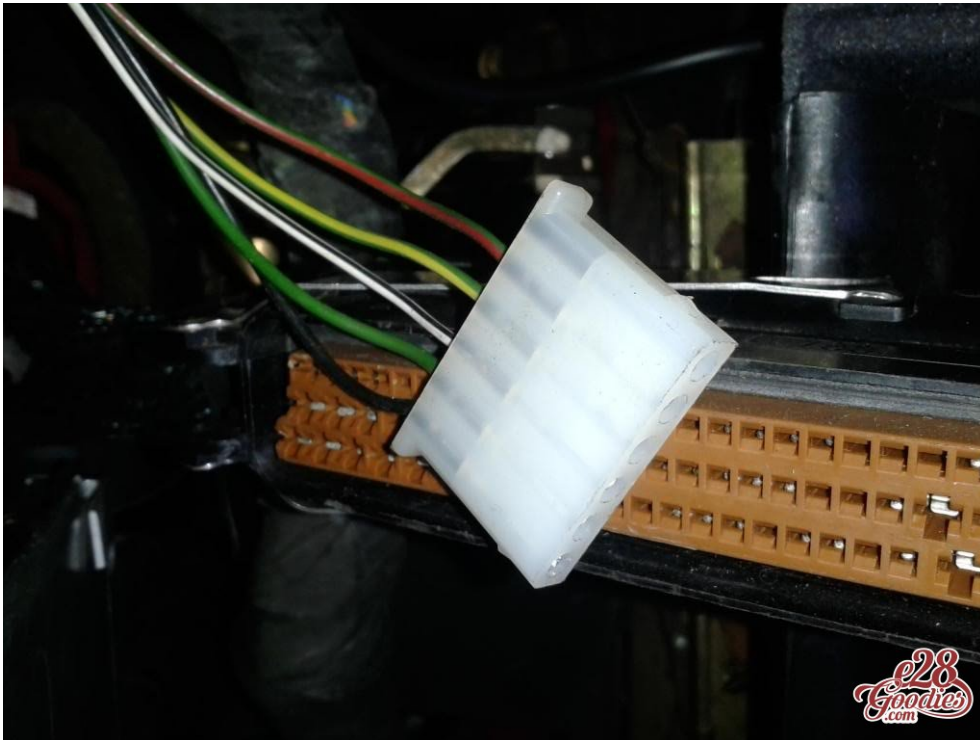
Also you should have the EWS (immobilizer) module connector



On the other hand there are 2 connectors on the e28 wiring harness. The C101 connector (red arrow) which connects to the side of the fuse box (yellow arrow) (best thing to do would be to cut it off from your old engine)



And the C103 which is located just above the glove box.



X6021

Pin #	Function :	Connects to :
1	Oil pressure dash lamp	Pin 5 on C101 connector
6	Tachometer	Pin 1 on C103
12	Speed signal	*
20	Activation/Drive-away protection	Pin 4 on the EWS3 connector



* The speed signal is important. Without it the engine **WILL** run in a limp mode causing rev limiter to drop down to 5.3k rpm. Rumors over the web says that you have to connect this pin to the **brown/red** wire, which is located on one of the three connectors on the gauge cluster, but probably this will work if your engine is from e36 or z3 since they got their speed signals from the sensor on the differential cover (same as e28). e39 and e38 are using can bus signal from the abs module and most likely it wouldn't work this way. Anyways I skipped this part with the hinting and just gave the ecu to a guy who modified it and the signal wasn't needed anymore. Solved.

X6011

Pin #	Function :	Connects to :
1	Fuse carrier/engine electronics	Pin 12 & 16 on c101 connector
2	DME control unit	Pin 6 on c101 connector
7	Fuel pump	Pin 86 on the fuel pump relay
9	Alternator dash lamp	Pin 1 on c101 connector
12	Fuel pump	Pin 85 on the fuel pump relay



EWS 3

Pin #	Connects to :	Fuse (if needed)
1	Starter	
2	Ignition key	
4	Pin 20 on X6021 connector	
5	Key transponder ring	
9	Ground (-)	
10	Always hot (+) from the battery	5A
11	Always hot (+) from the battery	5A
12	Key transponder ring	



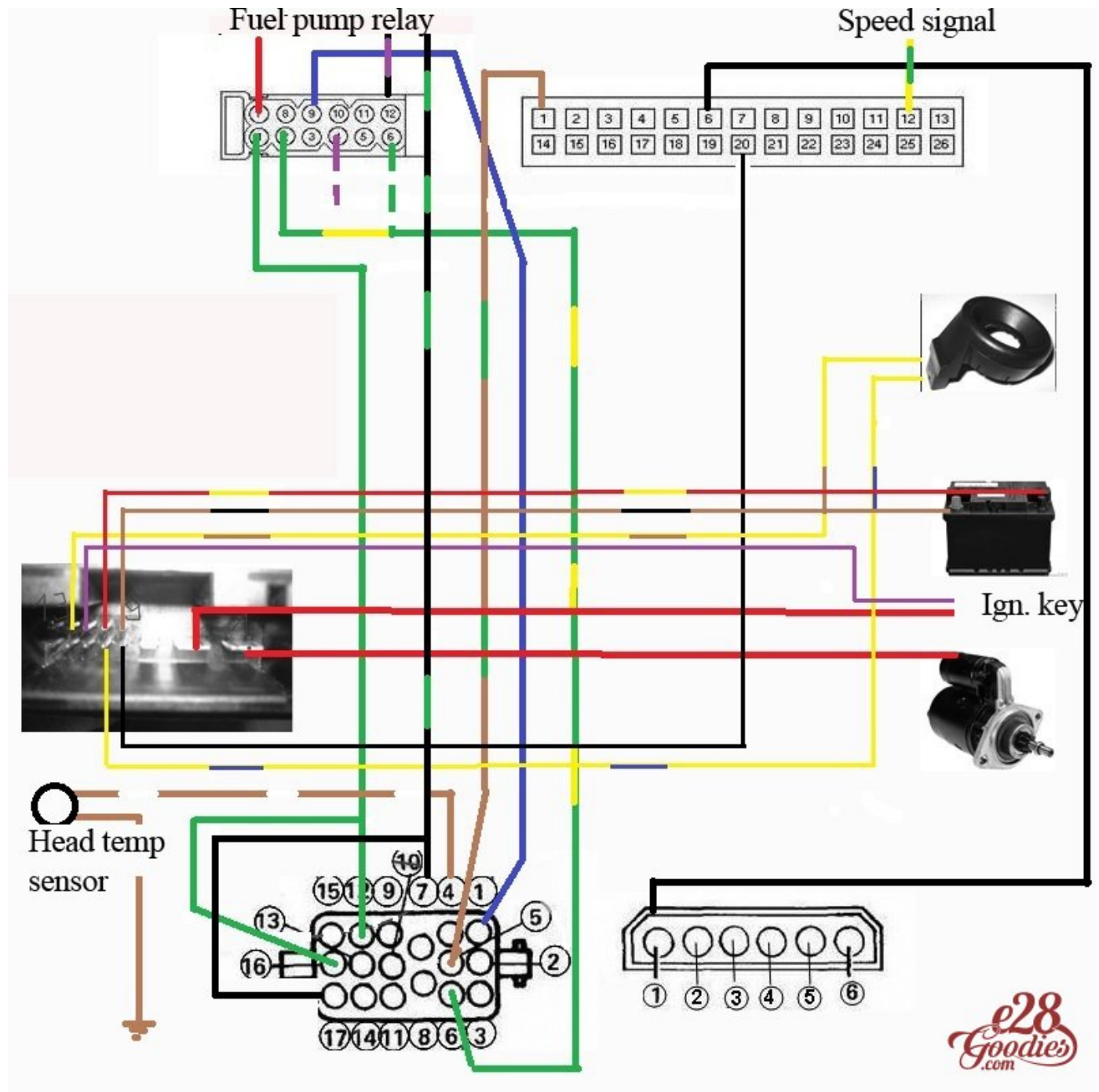
Don't forget to attach the transponder chip from the donor car ignition key to the transponder reading ring, in order to get the immobilizer to cooperate. This can be solved too with an ECU modification - an EWS delete, thus you'll save on space for the unnecessary components. The m52 ECU fits nice and clean on the place of the stock ECU.

The last wire-related thing concerns the temp gauge on the dash. The m52 uses one temp sensor. It sends info to both of cluster and the ECU. The M52 sensor and the e28 dash work on totally different resistance ranges, so you need to put the temp sensor from your old engine. Most m52s got tapped spare hole on the head where it can be placed. It wouldn't fit like a charm, since the old BMW sensors are way bigger, so you need to do a custom adaptor. (We can supply it)



After you bolt the sensor, you just need to wire it to pin #4 of the C101 connector and your temp gauge would work with the new m52.

Here is a very crude wiring diagram that might help you:



11. The differential ratio selection.

e28s are using 2 types of differentials. typ188 and typ210 and any of those can be LSD (Limited slip differential, kind of magic that makes the car sliding easier, doing 1/4 mile better and allowing you to enjoy the RWD in the winter) That means the diameter of the crown gear inside of the diff case is 188 or 210 mms. All e28s except 535 and m5 are using the typ188 and the rest are with typ210. Both of those diffs are having same input flange, so whatever you pick as a gearbox and driveshaft will fit your differential. There is plenty of info written on the web about the gear ratios and how they affect the acceleration and the top speed, we might spend some time discussing this in another blog post, but for now let's just say you might consider a different ratio diff after swapping the b28. Another good thing is that most of the e36s and e34s are using typ188 and there are so many options about gear ratio select. Anything from 2.56:1 to 4.45:1. What suits you best is a matter of a personal choice.

During our work we've developed the following products that will make your life easier:

[Steel 24v engine mounts and tranny beam](#)

[Steel tranny beam](#)

[Stainless steel engine mounts](#)

[Hydrobooster adaptor hose](#)

[Coolant sensor adaptor](#)

[E34 oil pan kit or 24v power bundle](#)

[Any of our brake upgrades](#)

In conclusion

The effort/result ratio for the m52 swap is really good and the performance you get from the m52b28 is comparable to the M30B34/M30B35, while fuel economy is most likely not. Hopefully this guide will help you in making an informed decision on how to proceed with updating the performance of your 30 years old family saloon. E28goodies does not take any responsibility for any harm/damages resulting from altering your vehicle's drivetrain/powertrain.