

M52tu-M54 VANOS Assembly & Timing Using G.A.S. Professional Cam Tool Kit

This procedure covers the reassembly of the BMW M54 & M52-tu VANOS system, which includes:

VANOS unit, secondary timing chain, secondary timing chain guides, primary and secondary timing chain tensioners, cam sprockets & related components, setting VANOS cam timing.

This procedure is required if you are doing any of the following:

- Replacing camshafts
- Replacing primary or secondary timing chains or guides
- Replacing cam sprockets or related components
- Replacing cylinder head
- Just want to reset VANOS cam timing

The following tools are required to complete this procedure:

- German Auto Solutions **Professional** Cam Timing Tool Kit.
- Quality torque wrench with a working range of 5-75 ft/lbs.
- 10mm socket
- 12mm deep well socket
- 13mm socket
- 19mm socket
- 22mm socket
- 32mm socket (combination wrench or a large adjustable will work but you won't be able to torque the timing chain tensioner)
- T30 male Torx driver (Will need to fit the torque wrench you will be using)
- E8 female Torx socket (Will need to fit the torque wrench you will be using, can substitute 1/4" 6 point socket)
- 8mm Allen driver (Will need to fit the torque wrench you will be using)
- 24mm open end wrench or large adjustable wrench

Recommended M54 parts replacement list with part numbers:

Required Part - Recommended Part - Recommended Based on Wear

- VANOS Unit Gasket - OEM Part # 11361433817
- VANOS Piston Oil Plug with O-ring - 2 required - OEM Part # 11361433513
- VANOS Oil Feed Fitting Sealing Washer - 2 required - OEM Part # 32411093596
- Pri Chain Tensioner Sealing Washer - OEM Part # 07119963418
- Secondary Timing Chain - OEM Part # 11311432177
- Secondary Chain Tensioner - OEM Part # 11311738700
- Intermediate Chain Guide - OEM Part # 11311722651
- Exhaust Cam Stud - 3 required - OEM Part # 11361432373
- Torx Head Bolt - 3 required - OEM Part # 11361432752
- LH Thread VANOS Piston Torx Bolt - 2 required - OEM Part # 11361748745
- Pri Chain Tensioner Spring - OEM Part # 11411706809
- Pri Chain Tensioner Piston - OEM Part # 11311703747
- Intake Cam Sprocket - OEM Part # 11361744263
- Exhaust Cam Sprocket - OEM Part # 11361744262
- Main Drive Sprocket - OEM Part # 11361438565

These instructions cover reassembly & timing only, and begin from the point of a completely disassembled VANOS system. If you are starting from a point that is less than fully disassembled, you can progress through the instructions until you find a state that applies to your situation. I highly recommend that you completely **read through the entire instructions before you begin** to familiarize yourself with the procedure.

If you cannot have a computer near by during this procedure, print off these [PDF instructions](#).

***** IMPORTANT - IMPORTANT - IMPORTANT - IMPORTANT - IMPORTANT *****

Make sure that you read each step fully from beginning to end before you perform any part of a step. Some steps contain multiple procedures, and some steps contain information at the end of the step, that is crucial to completing the step properly. We have had several people complete these instructions to make sure that every step is clear and understandable. The only time anyone ever encountered a problem was when they started a step before they read the entire step through first.

Mouse over images in the instructions to view full size



These instructions pertain to the German Auto Solutions 'M54 Professional Cam Timing Tool Set'. If you are using the German Auto Solutions 'M54 Personal Cam Timing Tool Set' please refer to the instructions for that tool kit.



This should be your starting point if you followed the complete VANOS disassembly procedure outlined on this website.

#1 Steps 2-5 further describe critical conditions that need to be in place before beginning the assembly procedure in step 6. If any of the conditions described in steps 2-5 have not been met, refer back to the disassembly instructions to correct the problem before proceeding.



#2 Crankshaft aligned to TDC timing mark.



#3 TDC lock pin in place.



#4 Cams locked down using the procedure outlined in the disassembly instructions.



#5 No primary timing chain tensioner or tool installed.



#6 Start by locating the main exhaust cam sprocket. Find the timing arrow on the sprocket, it will be aligned to the head surface in the next step.

EXHAUST CAM SPROCKET
INSTALLED POSITION.

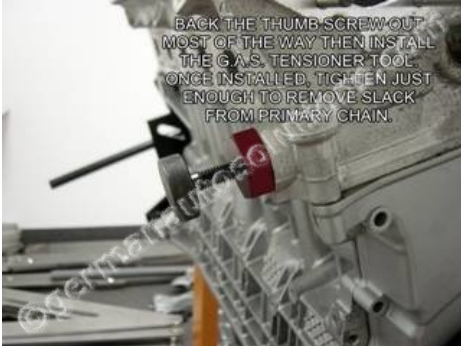
ARROW ALIGNED WITH
HEAD SURFACE.



#7

You need to slip the sprocket up under the timing chain and over the exhaust cam flange. Once slipped into place, rotate the sprocket counter clockwise to take up any chain slack. Compare the timing arrow location to the top surface of the cylinder head. They should line up as shown in the picture to the left. You will probably have to slide the sprocket off the cam flange several times while rotating it a link at a time until it lines up properly with the head surface.

BACK THE THUMB SCREW OUT
MOST OF THE WAY THEN INSTALL
THE G.A.S. TENSIONER TOOL.
ONCE INSTALLED, TIGHTEN JUST
ENOUGH TO REMOVE SLACK
FROM PRIMARY CHAIN.



#8

After unscrewing the German Auto Solutions tensioner tool thumb screw most of the way, install the tensioner tool into the OEM tensioner location and **tighten tensioner body just hand tight.**

Slowly tighten the thumb screw just until you feel a little tension. All you need to do here is take up the timing chain slack enough to verify that the exhaust sprocket is properly indexed to the chain.

EXHAUST CAM SPROCKET
INSTALLED POSITION.

ARROW ALIGNED WITH
HEAD SURFACE.



#9

Verify that the exhaust cam sprocket is still properly aligned to the cylinder head top surface. If not, fully loosen the tensioner and go back to step #7. Once you have verified proper alignment, install and torque the 3 hex studs shown to **20Nm-15ft/lb.** Medium strength (blue) threadlock is optional but suggested.



UPPER TIMING CHAIN GUIDE.
HELD IN WITH 2 TORX HEAD SCREWS

#10

You will now install the middle timing chain guide. This guides both the primary and secondary timing chains. Unless you have a very low mileage car, I suggest you replace it with a new OEM guide. The guide is held in place with 2 torx head bolts.

Torque to 10Nm-7.5ft/lb



- #11** Locate the secondary timing chain tensioner. If the lock pin is not still in place from the disassembly procedure, compress the tensioner and install the tensioner lock pin. The secondary chain tensioner is another recommended replacement item.



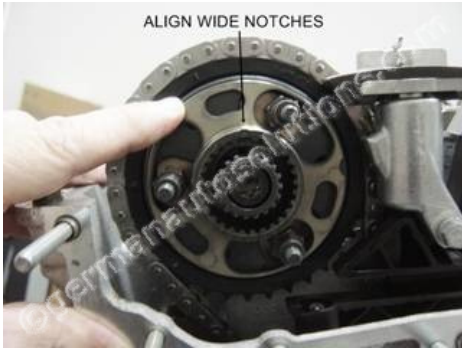
- #12** Install the tensioner, snug the 4 mounting bolts, then torque to **10Nm-7.5ft/lb.**



- #13** Locate the exhaust cam helix flange. Note the orientation shown. The wide gap goes up.



- #14** Apply some motor oil or assembly lube to the front and back surfaces and helix splines of the flange. Apply some motor oil or assembly lube to the exhaust cam helix splines. Slide the exhaust cam helix flange over the hex studs with the wide gap in the helix facing up.



#15

This is what it should look like. I'm holding it up with my finger because it wants to fall off if you don't. You will be installing the exhaust helix cup in the next step which will allow the helix flange to stay in place on its own. You might want to have it handy before you complete this step.



#16

Locate the exhaust helix cup. Intake and exhaust cups are identical, but if you are reinstalling used cups, it's best to keep the cups matched to the cams they came off from. Apply motor oil or assembly lube to the helix cup inside and outside splines. Line up the wide teeth on the exhaust cam helix cup with the wide gaps on the camshaft and helix flange. Install the helix cup and push in about half way. You might have to fiddle with it a little bit to get it started.



#17

This is an easy but critical step. Lay the intake VANOS sprocket, exhaust VANOS sprocket, and secondary timing chain on the alignment sheet as shown on the left. Align the wide notch on the intake sprocket helix as shown on the sheet. While keeping the intake sprocket aligned to the sheet, keep repositioning the exhaust sprocket until they both line up with the outline. The exhaust sprocket technically does not have a front or rear so just pick a side to face up. As shown on the alignment sheet, the exhaust sprocket is symmetrical and has 3 possible correct orientations. This is hard to get wrong. If you have a one tooth misalignment it will be obvious.

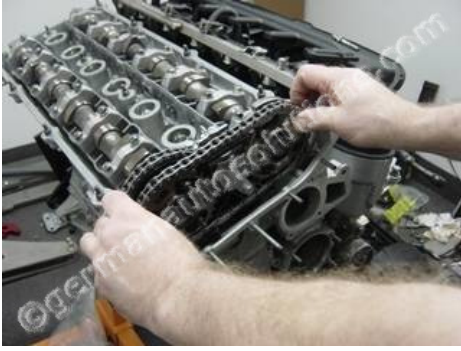


#18

Apply a film of oil or assembly lube to the front and back faces of both sprockets, the helix splines on the intake sprocket, and the helix splines on the intake cam before installation.

Preview steps 22, 23 and 24 before installing the chain and sprocket assembly. This will help you understand how the assembly will be positioned.

Grasp the chain and sprocket assembly as shown. As you lift the assembly off of the alignment sheet, keep the protruding section of the intake cam sprocket facing toward the engine. Slide the assembly onto the cams while keeping the wide notch on the intake sprocket splines facing up.



Slide the chain and sprocket assembly over the cams as shown.

- #19** Please ignore the fact that the exhaust helix cup is not shown installed in this picture. Your exhaust helix cup should be installed.



- #20** This is how it should look. Make sure everything lines up as shown in the picture.



- #21** Locate the intake helix cup and apply some motor oil or assembly lube to the outside and inside helix splines. Now install the intake helix cup using the same procedure you used for the exhaust side. Push the intake cup in until the splined section is flush with the sprocket as shown in the picture.



- #22** Install the 3 torx head bolts as shown. Tighten them finger tight, then loosen 1/4 turn.



#23

Locate the exhaust sprocket thrust flange and apply a film of oil or assembly lube to both sides. It doesn't have a front or back and is another symmetrical part. If you're fussy you can usually tell which side was originally facing out by looking at the polished contact areas. The side with shiny spots on the very outside edge (like in picture) faces outward.



Slide the exhaust thrust flange over the studs as shown.

#24

Make sure you slide the flange past the threaded portion of the studs and onto the larger round section.



#25

Locate the exhaust sprocket spring washer. Note the side marked "F" faces outward. Slip the spring washer over the studs like the thrust washer.



#26

Locate the exhaust cam sensor position plate.

Note the orientation, it has an arrow marking like the exhaust sprocket. The arrow needs to line up with the left head surface.



- #27** Install the sensor position plate as shown. Install the three 6mm hex nuts and leave them loose so that they are not preloading the spring washer.



- Locate the intake cam spring washer and apply some oil or assembly lube to the back side. Install over the threaded studs.
- #28** Note - the bent tabs face outward. Sometimes these will have a "FRONT" marking on the outside face.



- #29** Install the three 6mm hex nuts but leave them loose so that they do not preload the spring washer.



- #30** This is the completed chain & sprocket install ready for the timing alignment procedure. At this point all 6 hex nuts and all 3 torx bolts should be loose. You should be able to easily slide the helix cups in and out with no resistance. If there is any binding, you have something too tight, go back and find out what it is.
- Note - the intake helix cup will slide all the way out if pulled, the exhaust helix cup will pull out part way then stop, this is normal.



Make sure that cylinder head VANOS gasket surface is perfectly clean with all traces of the old gasket removed.

#31

Wipe off the mounting surface of the German Auto Solutions VANOS Timing Plate Tool then slide it over the studs and dowels as shown.

Any pieces of old gasket material or dirt caught between the plate and head could have a minor effect on timing accuracy.



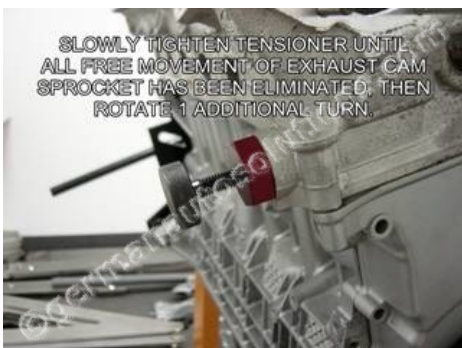
#32

Secure the timing tool in place using OEM VANOS mounting hardware as shown. Lightly tighten the 2 nuts and 1 stud. You want the plate to be held firmly, but there is no need to over tighten. 6-7ft/lbs is plenty if you feel the need to torque them.



#33

Remove the 2 **LEFT HAND THREAD** torx head screws from their storage locations and screw them into the intake and exhaust helix cups. If the cups have been pushed forward you will have to pull them back toward the plate in order to start the screws. These only need to be lightly snugged.

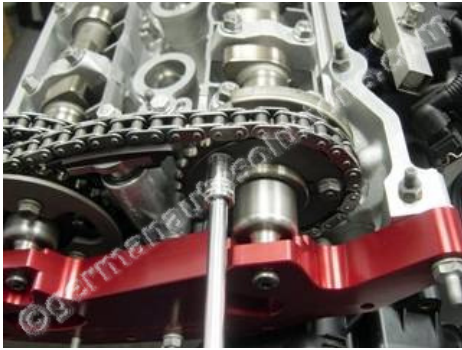


#34

In this step we will pretension the primary timing chain. The tension is not overly critical. Once all the slack is taken out of the chain, further tightening does not accomplish anything. **If you severely over tighten the tensioner you could damage the timing chain or guide.** I found the easiest way to set proper tension without over tightening is to firmly grasp the exhaust sprocket, (the one furthest from the front of the engine that the primary chain wraps around) and wiggle it back and forth. Tighten the tensioner slowly until you can no longer wiggle the exhaust sprocket, then tighten one more revolution.



- #35** Next, press down on the secondary chain tensioner and remove the lock pin. Everything will now be in proper alignment.



- #36** Tighten the 6 hex nuts on the intake and exhaust sprockets. The bottom ones are accessible through the window openings on the timing plate. These do not affect timing, they only preload the spring washers against the sprockets to keep them from vibrating against the cam flanges during operation. **Snug them up good at this point but do not torque them yet.**



- #37** Next tighten the 3 torx head screws on the exhaust sprocket. These screws lock the relationship between the intake and exhaust VANOS sprockets which sets the proper timing. They are the only screws that lock the timing in place. **Snug them up good at this point but do not torque them yet.**



- Next remove the German Auto Solutions VANOS timing plate. Don't forget to return the left hand thread torx screws to their storage locations to prevent them from getting lost.
- #38** **While leaving all the other hardware tight**, one at a time, remove each of the 6 hex nuts, clean the threads, apply threadlock, and torque to the spec shown. **Since you are only removing one piece of hardware at a time there is no danger of anything moving out of position.** The BMW manual does not specify threadlock on these, but I feel that medium strength (blue) threadlock adds a margin of safety and has no down side. The torx bolts are held captive by the exhaust sproket spring washer & cannot be removed at this point.
- Torque the 3 torx bolts to 20Nm-15ft/lbs, and the 6 hex nuts to 10Nm-7.5ft/lbs.**



#39

You can now remove the tensioner tool and install the OEM tensioner. Use a new sealing washer.

Torque to 70Nm-52ft/lbs.



#40

Remove the camshaft locking blocks.



#41

Remove the crankshaft TDC locking tool.



#42

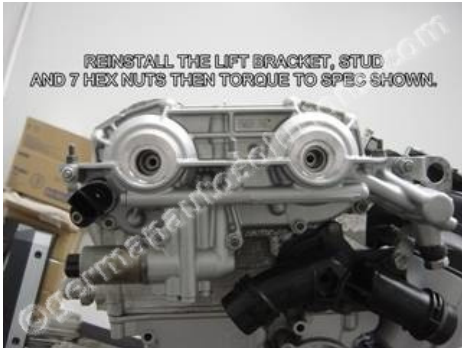
Apply some RTV gasket sealer to the two areas shown in the picture, install a new VANOS gasket over the studs and dowels, then apply some more RTV at the same locations on the outside face of the gasket.

I highly recommend Permatex "Ultra Grey" for all engine assembly applications where a RTV sealant is required.



INSTALL NEW VANOS ASSEMBLY GASKET,
THEN INSTALL VANOS ASSEMBLY.

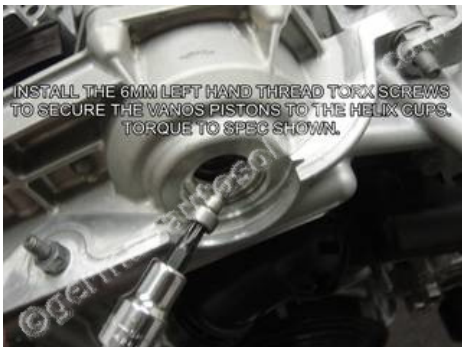
#43 You can now slide the VANOS unit into place.



REINSTALL THE LIFT BRACKET, STUD
AND 7 HEX NUTS THEN TORQUE TO SPEC SHOWN.

Install the OEM VANOS mounting hardware and lift bracket.

#44 Torque the 6mm hex nuts to 10Nm-7.5ft/lbs, and the 8mm stud to 24Nm-18ft/lbs.



INSTALL THE 6MM LEFT HAND THREAD TORX SCREWS
TO SECURE THE VANOS PISTONS TO THE HELIX CUPS.
TORQUE TO SPEC SHOWN.

#45 Install the 2 **LEFT HAND THREAD** torx head screws to secure the VANOS pistons to the helix cups. I recommend a drop of medium strength threadlock here as well. Torque to **10Nm-7.5 ft/lbs**.



INSTALL NEW O-RINGS ON
OIL PLUGS THEN PUSH THEM
INTO THE VANOS PISTONS
UNTIL THEY SNAP INTO PLACE.

#46 Locate the piston oil plugs. The O-rings on these tend to harden and need to be replaced. BMW does not sell the O-rings for the plugs separately. New plugs with O-rings cost less than \$2.00 each. I recommend just replacing the entire plug rather than trying to find O-rings that fit the used plugs.

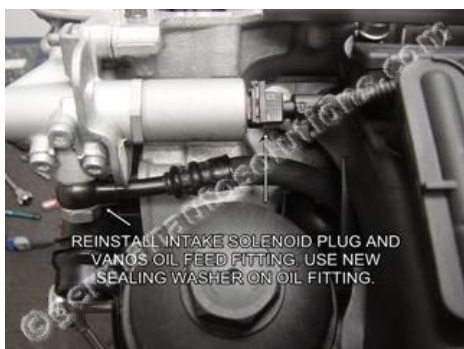
Apply some oil or assembly lube to the O-rings then push the plugs into the VANOS pistons until they snap into place.



- #47** Install new sealing washers on the access plugs then install and torque the plugs to **50Nm-37ft/lbs.**



- #48** Reinstall the exhaust cam position sensor plug and the exhaust VANOS solenoid plug.



- #49** Install the intake VANOS solenoid plug and the VANOS oil feed line. Use new sealing washers on the oil feed fitting. Torque the oil fitting to **32Nm-24ft/lbs.**
You are now finished with the VANOS system timing and assembly.