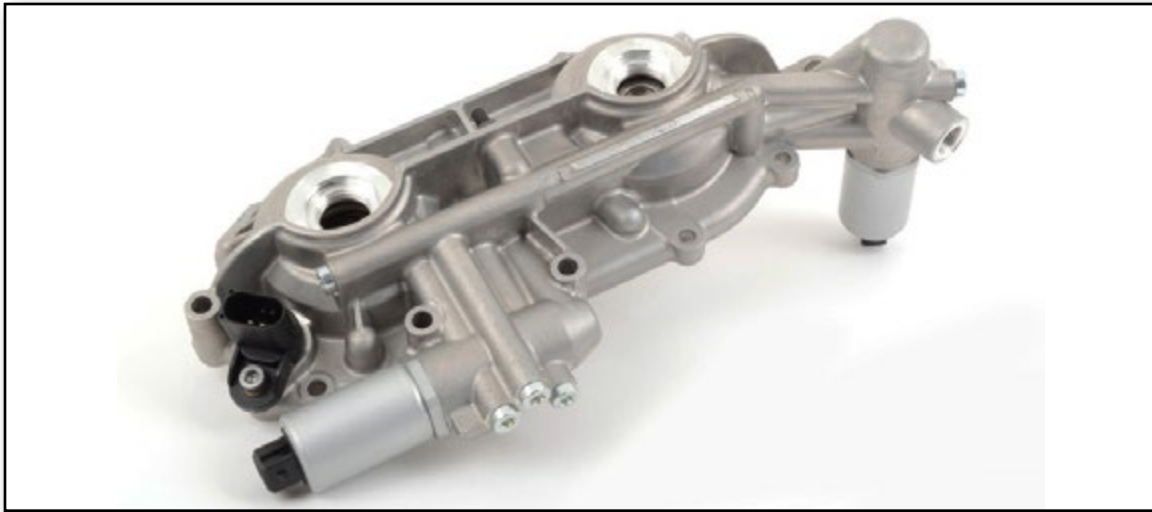




BMW M5X

Dual Vanos

Repair and Rebuild Instructions



Proper service and repair procedures are vital to the safe, reliable operation of all motor vehicles as well as the personal safety of those performing the repairs. Standard safety procedures and precautions (including use of safety goggles and proper tools and equipment) should be followed at all times to eliminate the possibility of personal injury or improper service which could damage the vehicle or compromise its safety.

INTRODUCTION

BMW M5x Dual Vanos Rebuild Kit Installation

BMW's Vanos variable valve timing system is one of the most recognized systems in the industry. There are a number of different designs, and they all work off of ingeniously simple mechanical principals. Their notoriety, however, is not likely to be from their design and performance, but more so from the fact that they frequently wear out. Luckily, the majority of the problems are caused by worn seals, which can easily be replaced. Today we're going to be installing our rebuild kit into the Dual Vanos unit that is found on the 6 cylinder M52TU, M54, and M56 engines. One of the symptoms of Vanos malfunction is the well known "Vanos rattle". In the case of the M5x engines, it's caused by excessive axial play in the Vanos piston bearings, and we offer new ECS bearing rings to remedy this problem. Installing the rebuild kit into your M5x Dual Vanos is a pretty easy project, and it'll restore smooth, consistent performance, some of which you may not even realize you've lost.

ECS Difficulty Gauge



1 - Easy Pro - 4
2 - Moderate Advanced - 3

Take your time and enjoy the project. You can generally complete it in an afternoon, but it's best to plan a whole day so you don't try to rush through it. The best advice, as always, is to read through these instructions first to familiarize yourself with the project and make sure you have all of the required tools on hand. You'll see that we don't get in-depth with disassembly until we get down to the Vanos unit itself. The work up to that point is fairly routine, and we're confident you can handle it. Thank you for looking to ECS Tuning for all your performance and repair needs. We appreciate your business!

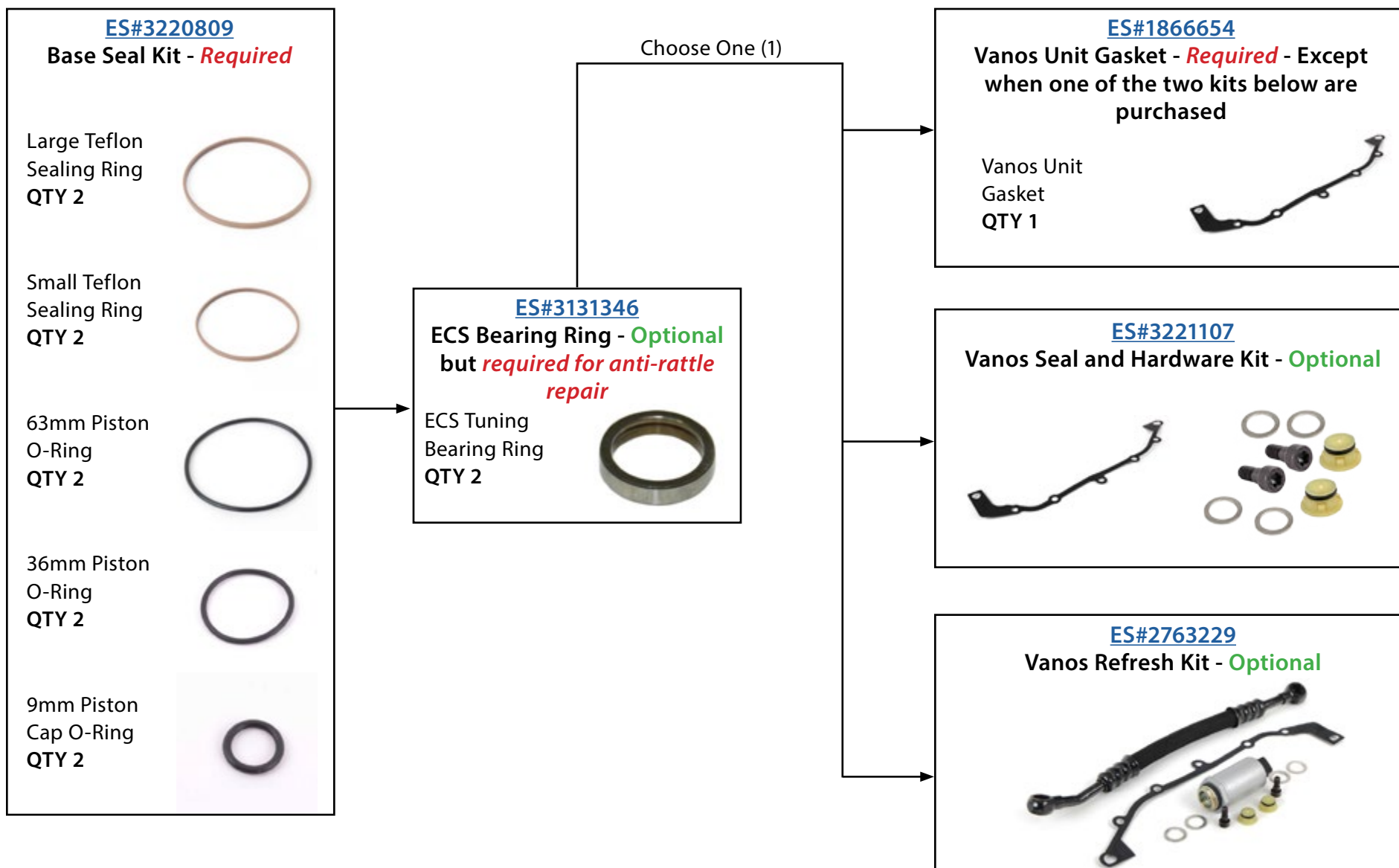
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This water pump and fan clutch tool kit will make disassembly much easier. [ES#2627584](#)

DUAL VANOS REBUILD COMPONENTS



REQUIRED TOOLS

Note: The tools required for each step will be listed by the step number throughout these instructions.

Standard Automotive Tools

- Protecta-Sockets (for lug nuts).....[ES#2221243](#)
- **3/8" Drive Ratchet**[ES#2765902](#)
- **3/8" Drive Torque Wrench**.....[ES#2221245](#)
- **3/8" Drive Deep and Shallow Sockets**.....[ES#2763772](#)
- **3/8" Drive Extensions**.....[ES#2804822](#)
- Hydraulic Floor Jack[ES#240941](#)
- **Torx Drivers and Sockets**[ES#11417/8](#)
- 1/2" Drive Deep and Shallow Sockets[ES#2839106](#)
- **1/2" Drive Ratchet**
- 1/2" Drive Extensions
- 1/2" Drive Torque Wrench[ES#2221244](#)
- 1/2" Drive Breaker Bar[ES#2776653](#)
- **1/2" Drive Impact Wrench**
- Air Nozzle/Blow Gun
- Bench Mounted Vise
- Crows Foot Wrenches
- **Hook and Pick Tool Set**[ES#2778980](#)

Required For This Install

Available On Our Website

- **1/4" Drive Ratchet**.....[ES#2823235](#)
- **1/4" Drive Deep and Shallow Sockets**[ES#2823235](#)
- **1/4" Drive Extensions**[ES#2823235](#)
- **1/4" Drive Torque Wrench**
- Plier and Cutter Set.....[ES#2804496](#)
- **Flat and Phillips Screwdrivers**[ES#2225921](#)
- Jack Stands[ES#2763355](#)
- Ball Pein Hammers
- Pry Bar Set.....[ES#1899378](#)
- Electric/Cordless Drill
- Wire Strippers/Crimpers
- Adjustable (Crescent) Type Wrenches
- Drill Bits
- Punch and Chisel Set
- Hex Bit (Allen) Wrenches and Sockets[ES#11420](#)
- Thread Repair Tools[ES#1306824](#)
- **Open/Boxed End Wrench Set**[ES#2765907](#)

Specialty Tools

- **400 Grit Sandpaper**
- **Exacto Knife**
- **Water Pump and Fan Clutch Tool Kit**.....[ES#2627584](#)

SHOP SUPPLIES AND MATERIALS

Standard Shop Supply Recommendations: We recommend that you have a standard inventory of automotive shop supplies before beginning this or any automotive repair procedure. The following list outlines the basic shop supplies that we like to keep on hand. Shop supplies with a hyperlink are available on our website.

- Hand Cleaner/Degreaser - [Click Here](#)
- Pig Mats - for protecting your garage floor and work area from spills and stains - [Click Here](#)
- Spray detailer - for rapid cleaning of anything that comes into contact with your paint such as brake fluid - [Click Here](#)
- Micro Fiber Towels - for cleaning the paint on your car - [Click Here](#)
- Latex Gloves - for the extra oily and dirty jobs - [Click Here](#)
- Medium and High Strength Loctite Thread lock compound - to prevent bolts from backing out - [Click Here](#)
- Anti-Seize Compound - to prevent seizing, galling, and corrosion of fasteners - [Click Here](#)
- Aerosol Brake/Parts Cleaner - for cleaning and degreasing parts
- Shop Rags - used for wiping hands, tools, and parts
- Penetrating oil - for helping to free rusted or stuck bolts and nuts
- Mechanics wire - for securing components out of the way
- Silicone spray lube - for rubber components such as exhaust hangers
- Paint Marker - for marking installation positions or bolts during a torquing sequence
- Plastic Wire Ties/Zip Ties - for routing and securing wiring harnesses or vacuum hoses
- Electrical tape - for wrapping wiring harnesses or temporary securing of small components

INSTALLATION NOTES

- **RH** refers to the *passenger side* of the vehicle.
- **LH** refers to the *driver side* of the vehicle.
- Always use the proper torque specifications.
- If applicable to this installation, torque specifications will be listed throughout the document and at the end as well.
- Please read all of these instructions and familiarize yourself with the complete process **BEFORE** you begin.

PREPARATION AND SAFETY INFORMATION

ECS Tuning cares about your health and safety. Please read the following safety information. This information pertains to automotive service in general, and while it may not pertain to every job you do, please remember and share these important safety tips.

- Park your car in a safe, well lit, level area.
- Shut the engine off and remove the key from the ignition switch.
- Make sure any remote start devices are properly disabled.
- **ALWAYS** wear safety glasses.
- Make sure the parking brake is applied until the vehicle is safely lifted and supported.
- If using an automotive lift, be sure and utilize the factory specified lift points. Lifting a vehicle in an incorrect location can cause damage to the suspension/running gear.
- When lifting a vehicle using a jack, always utilize the factory specified lift points. Lifting a vehicle in an incorrect location can cause damage to the suspension/running gear. **ALWAYS** support the vehicle with jack stands.
- **ALWAYS** read and follow all safety information and warnings for the equipment you are using.



Never get underneath a vehicle that is supported only by a jack. Always make sure that the vehicle is securely supported on jack stands.

GETTING STARTED

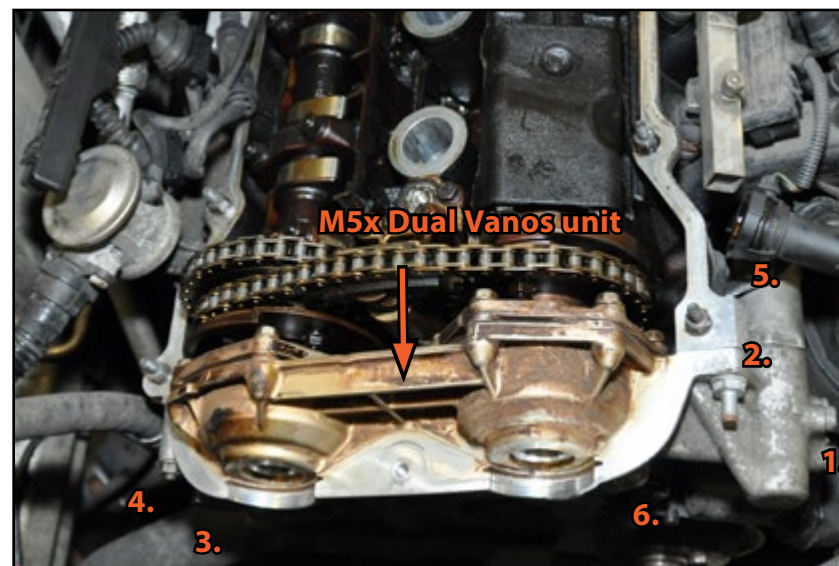
The Dual Vanos unit on an M5x engine is mounted on the front of the cylinder head where the Vanos pistons can connect to the ends of the camshafts. Unlike some, this Vanos unit can be easily unbolted without affecting the engine timing in any way, making it one of the simplest Vanos repairs.

Since getting to the Vanos unit only requires some basic component removal which we're sure you can handle, we're not actually going to cover the step by step process, but we will give you a quick outline of what you have to remove:

1. Remove the radiator fan and shroud.
2. Remove the cabin filter housing.
3. Remove hoses/harnesses around valve cover perimeter.
4. Disconnect ignition coils and move the harness out of the way.
5. Remove ignition coils.
6. Remove the valve cover.

Once you have the valve cover removed, you'll see the Vanos unit. Remove the items we've listed below (we've placed the step numbers in their approximate locations), then proceed to the next page to remove the Vanos unit.

1. Remove the Vanos oil hose.
2. Remove the engine lift bracket.
3. Disconnect the Vanos exhaust cam sensor.
4. Disconnect the Vanos exhaust solenoid.
5. Disconnect the Vanos intake solenoid.
6. Disconnect the thermostat electrical connector.

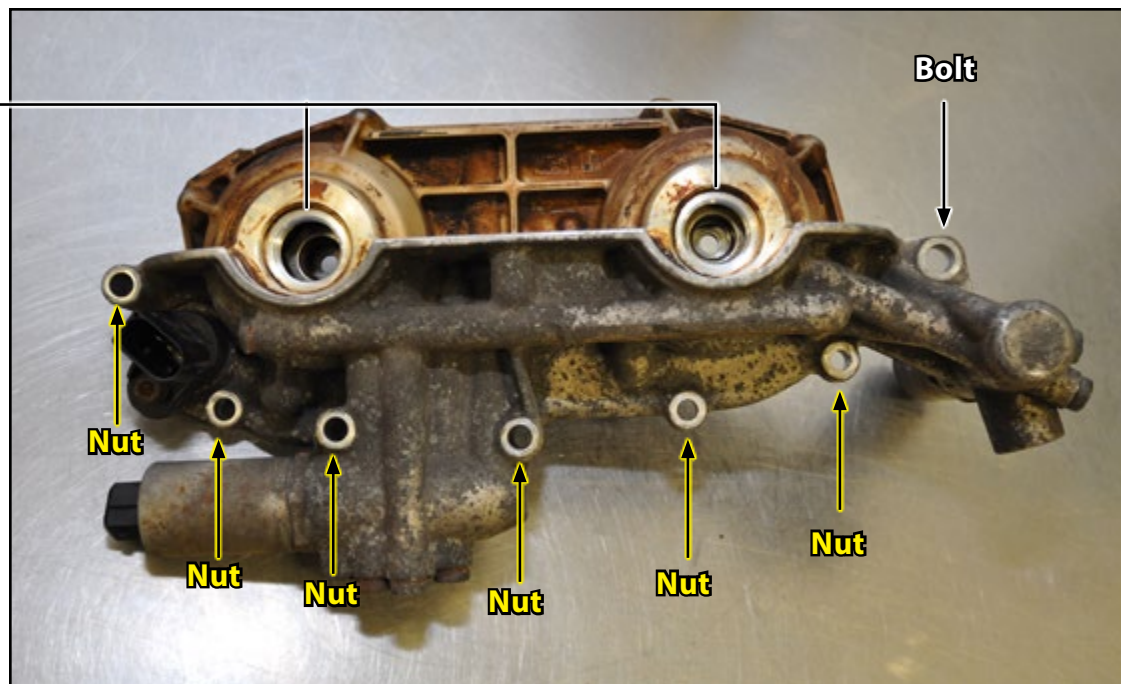
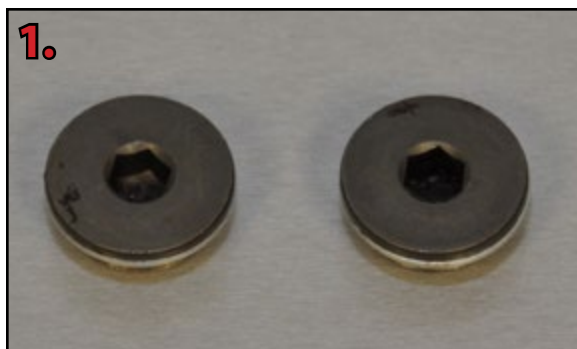


VANOS UNIT REMOVAL

A lot of oil will be lost during these steps, so be sure to catch as much as possible and cover the drive belts as well as the accessories to keep them clean.

To remove the Vanos unit, **first** you must remove the piston access plugs with an 8mm Allen socket. **Second**, pull out the two piston caps using needle nose pliers. **Third**, remove the two splined shaft bolts using a T30 Torx - these are LH (reverse) thread so don't be fooled.

With the pistons unbolted from the splined shafts, you're ready to remove the entire Vanos unit. All that remains are six nuts and one bolt. Remove the nuts using a 10mm socket, then remove the bolt using a 13mm socket. Now you can pull the Vanos unit off the front of the engine, and it's time to start the rebuild.

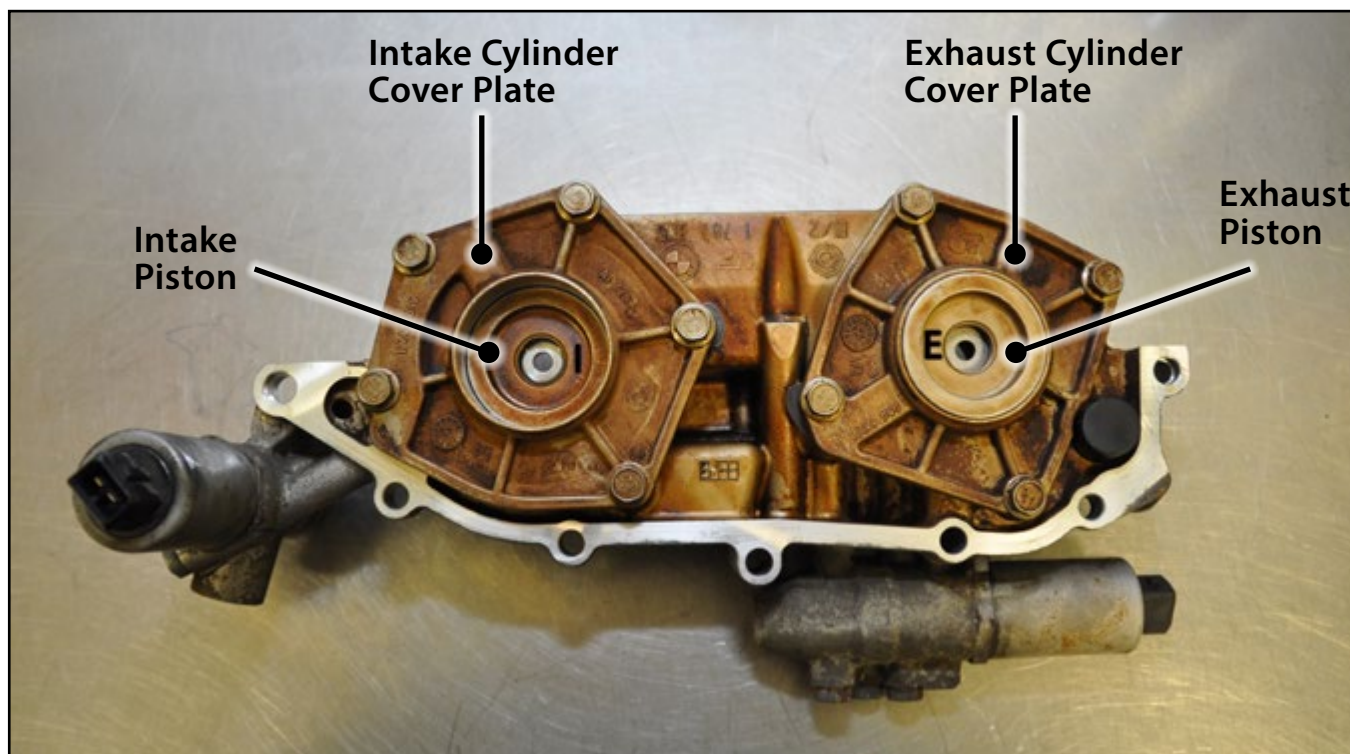


REBUILDING THE M5X DUAL VANOS

Step 1:

With the Vanos unit removed from the engine, familiarize yourself with it before taking it apart. Rest it on a bench so you are looking at the cover plates for the Vanos cylinders. Viewed from this side, the Intake cylinder is on the left, held on by five bolts, and the Exhaust cylinder on the right, held on by four bolts.

We recommend marking the Intake and Exhaust pistons with an "I" and an "E", using a permanent marker. They are the same, and even though they are interchangeable, the best practice is to reassemble all components where they were originally located, since they may wear in differently with the parts they are in direct contact with.



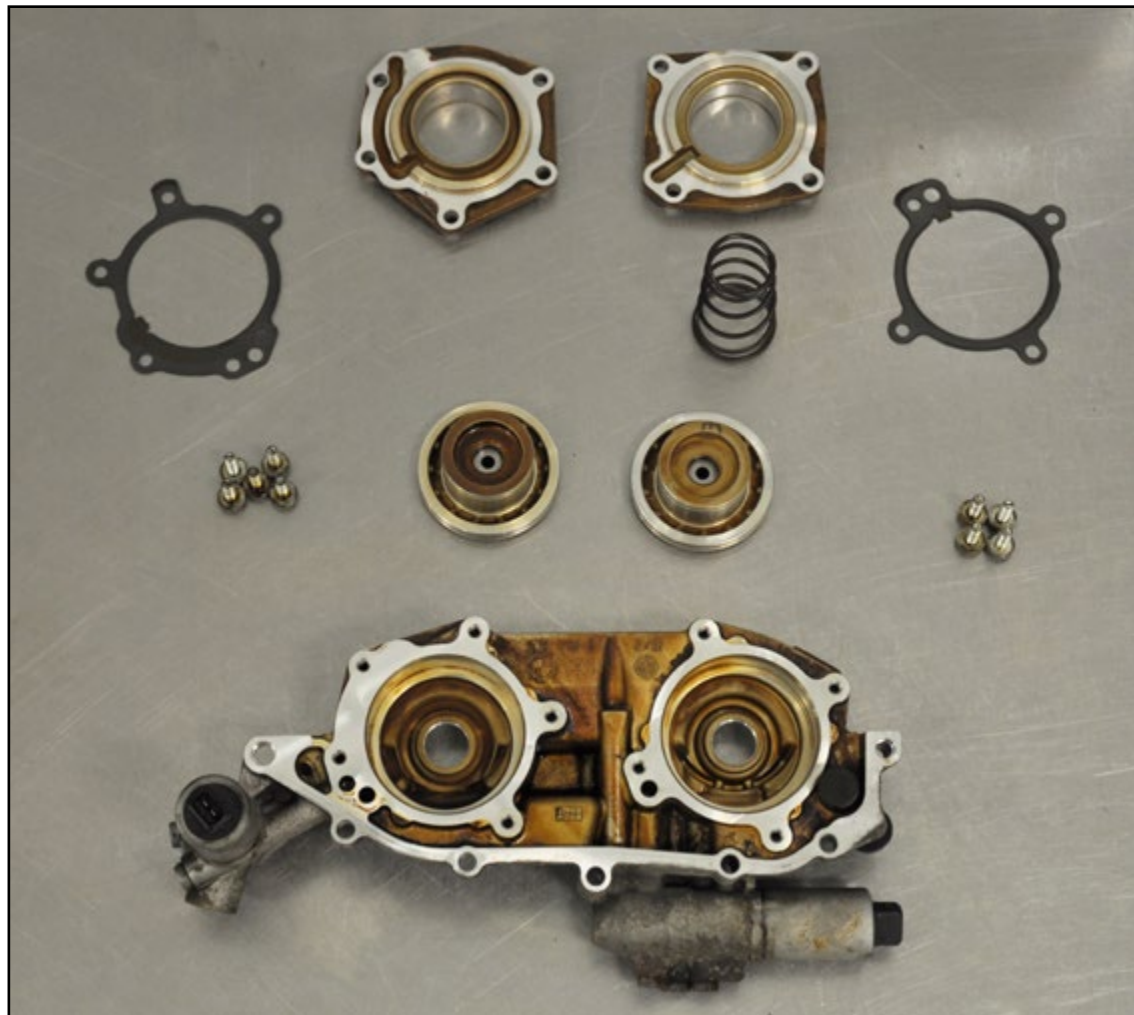
REBUILDING THE M5X DUAL VANOS

Step 2: 10mm Socket, Ratchet

Remove the cover plate bolts and disassemble the Vanos unit. As you remove the cover plate bolts for the exhaust cylinder, the spring behind the piston will push the cover plate off. It's best to hold down on the cover plate and remove the bolts, then allow the spring to push everything up. This will remove any possibility of spring tension causing thread damage as the bolts are removed.

Lay everything out and keep it organized as we have done on the right.

Thoroughly clean all parts, using extra care not to bend or distort the metal cover plate gaskets. These will be reused.



REBUILDING THE M5X DUAL VANOS

Step 3: Exacto Knife

Using an exacto knife, **carefully** cut the original Teflon seals and o-rings out of each piston. There will be **two** seals and **two** o-rings on **each** piston.

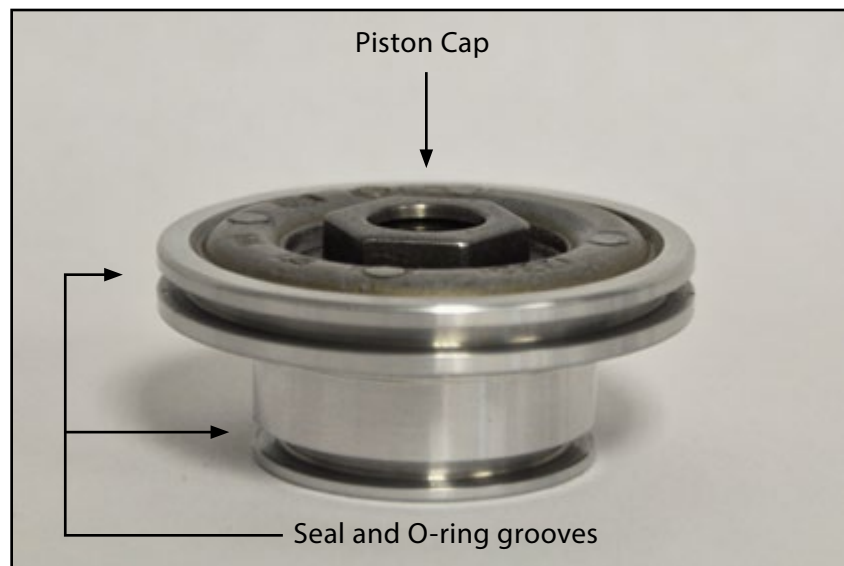
The original Teflon seals and o-rings will be difficult and dangerous to remove with any other type of device other than the fine tip of an exacto knife. Be careful not to score or scratch the surface or the grooves of the pistons.



Step 4:

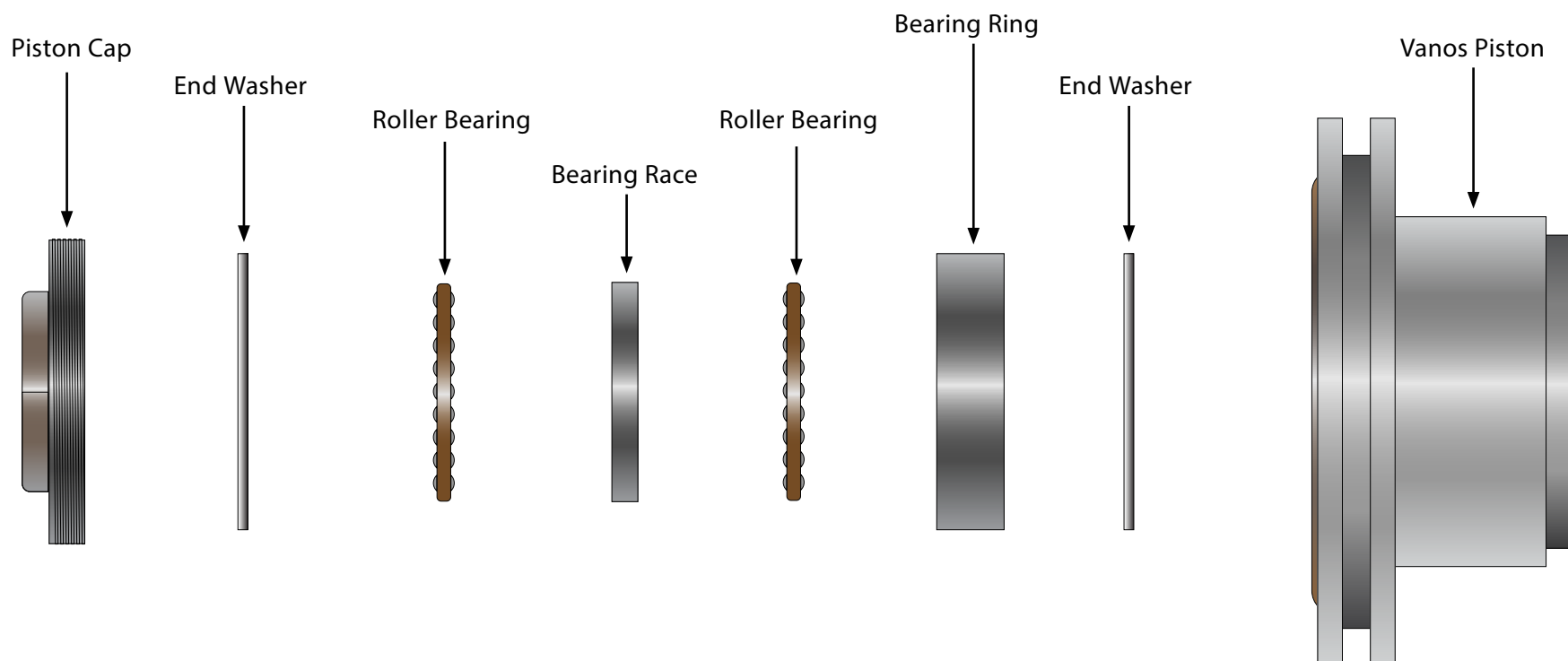
Make sure that both pistons have been thoroughly cleaned and that the seal and o-ring grooves are clean all the way around. Now, notice the large hex on the end of each piston, this is the piston cap. Before we install the new seals and reassemble the Vanos, we have to install the new bearing rings. There is one inside each piston, and we'll remove the piston caps to get to them.

Thoroughly read Pages 13-17, which explains piston repair and the theory of bearing ring installation, then continue on page 18 with the step by step hands on procedure.



M5X DUAL VANOS PISTON REPAIR

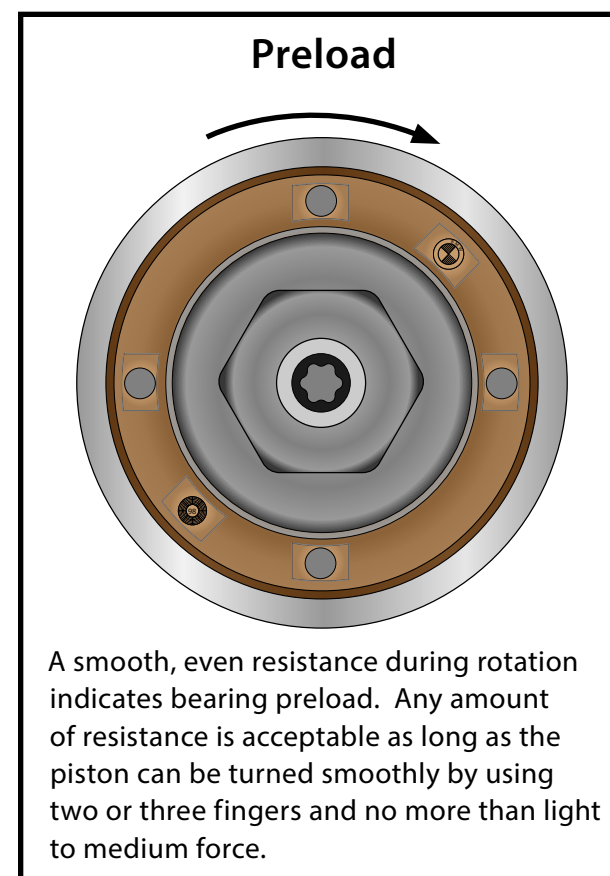
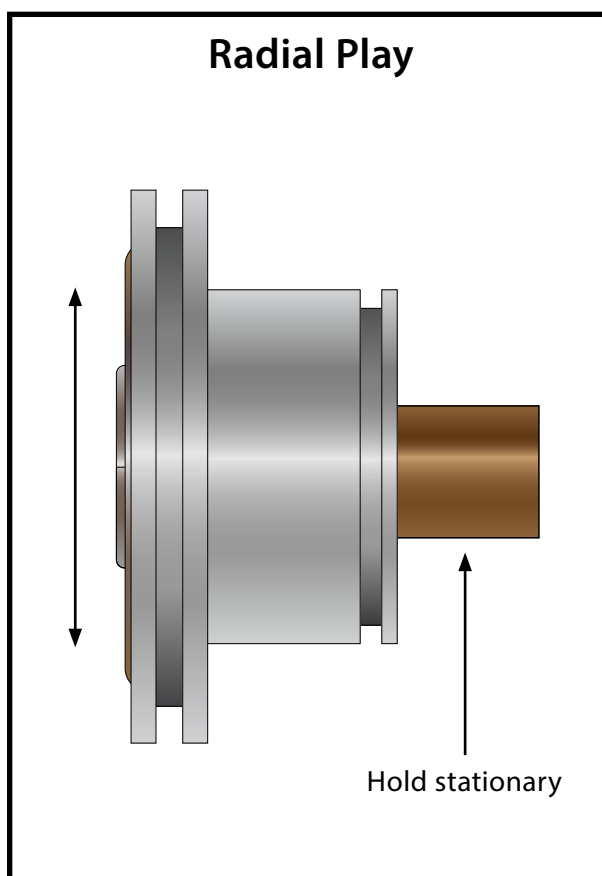
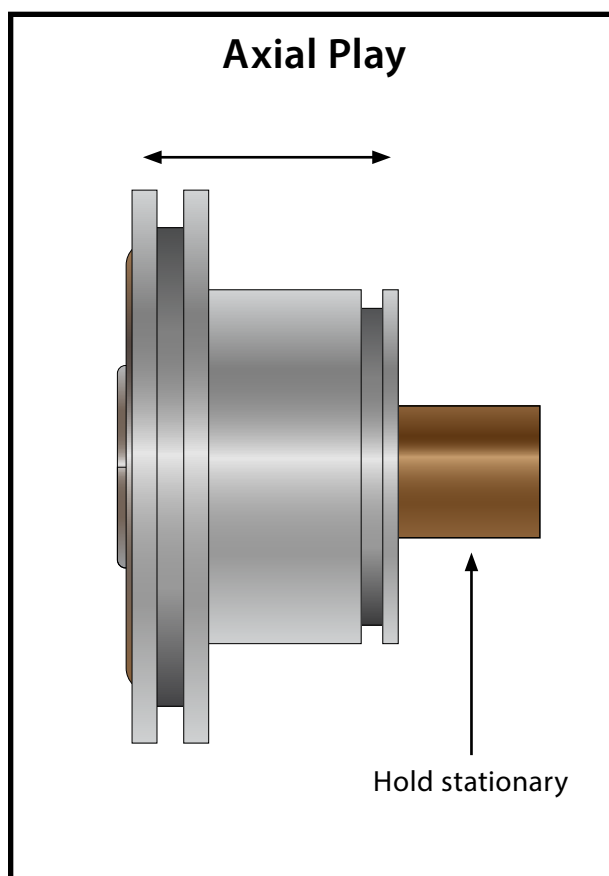
The actual Vanos “rattle” is caused by axial play in the bearings which are housed inside the piston. The key to solving this problem is to remove the axial play (tighten), and ideally, provide a slight preload on the roller bearings. To accomplish this, you’ll check the amount of play, install the new ECS bearing rings in place of the originals, then recheck the amount of play. Due to very strict tolerances and the different rates of component wear from car to car, some fine tuning may be required. After bearing ring installation, you may find that the bearings are still too loose (axial play), that they are too tight (not good), or that they have no axial play and a slight preload (perfect). If necessary, adjustments are made by removing material from either the new bearing ring (tightening the bearing) or the bearing race (loosening the bearing). This is a very critical adjustment, (approximately .005-.015mm), but it’s easy to do. We’ll show you how in just a little bit but first, use the exploded view below to familiarize yourself with all of the piston components, then continue on the next page.



M5X DUAL VANOS PISTON REPAIR

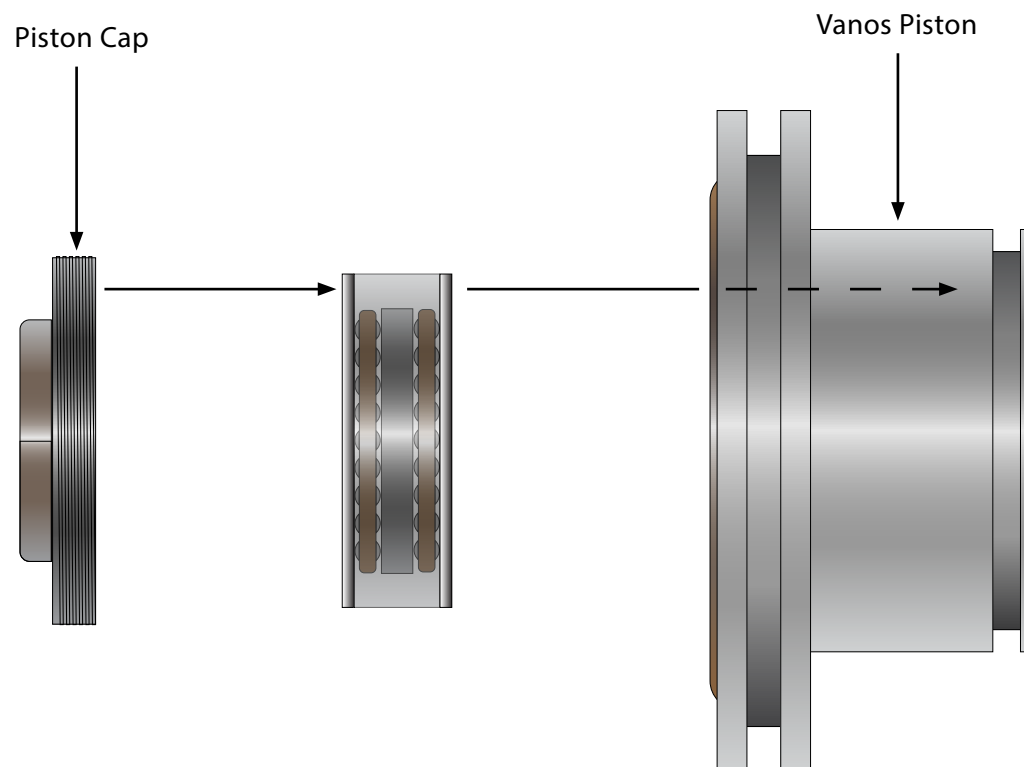
Axial Play, Radial Play, and Preload:

When the Vanos piston is mounted onto the end of the splined shaft, any in and out movement is axial play. This measurement is strictly determined by “feel” and is easily detectable. The key is holding the splined shaft stationary with one hand (they will move a little if you don’t), and gently moving the piston in and out with the other. Side - to - side, or radial play, which is felt by moving the piston left and right in relation to the splined shaft, is normal.



M5X DUAL VANOS PISTON REPAIR

When the piston is assembled, the bearing race and roller bearings fit inside the bearing ring (which we have made transparent in this illustration), and are then “sandwiched” in place as the end washers are seated against it. For Vanos rattle to be eliminated, there should be no clearance between the roller bearings, the bearing race, and the end washers.

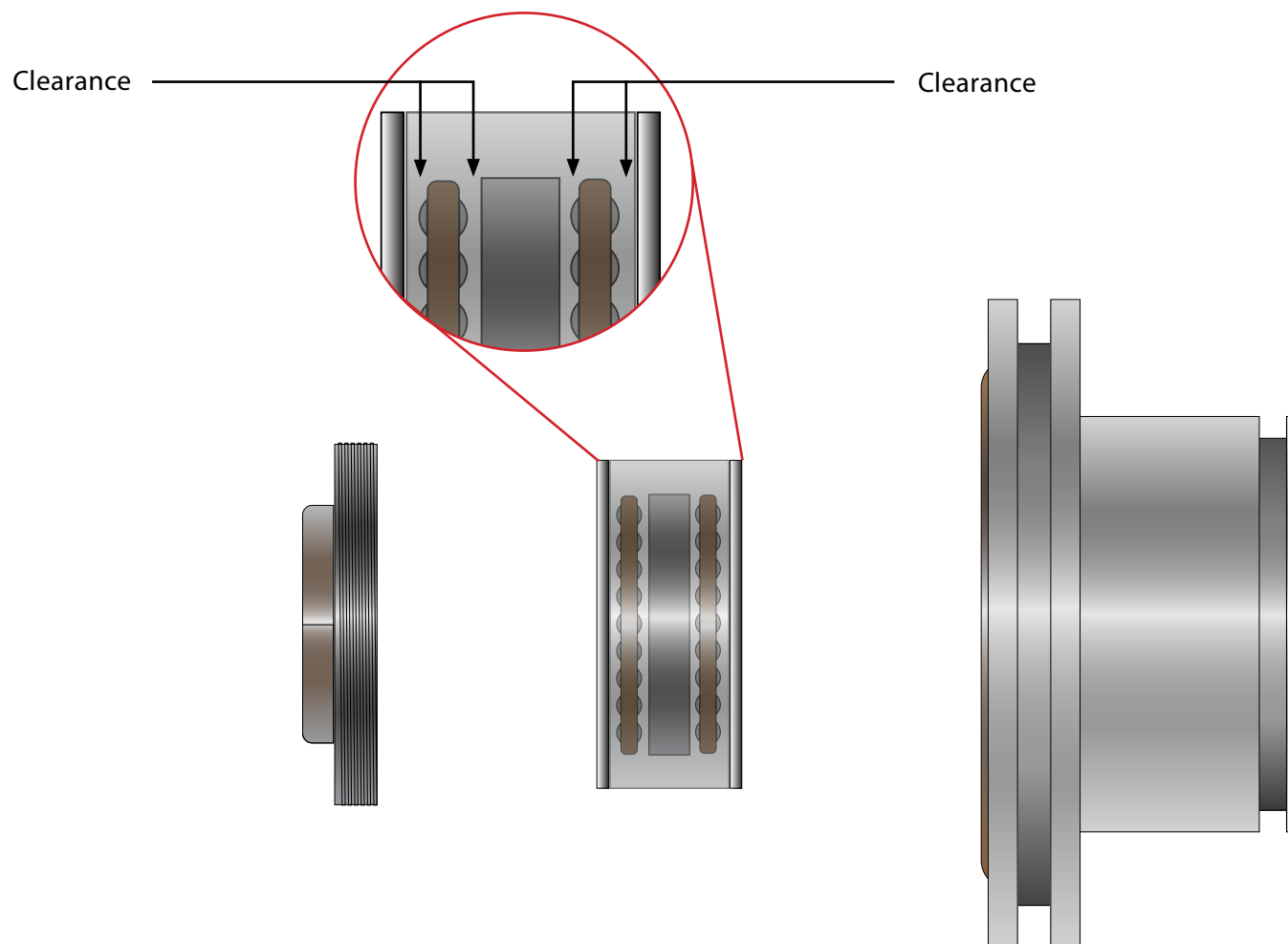


Q: What is the difference between the original bearing ring and the new ECS bearing ring, if an adjustment may still need to be made after installation?

A: The new ECS Tuning bearing ring is actually much narrower than the original, getting the adjustment very close, so fine tuning is a quick and easy procedure.

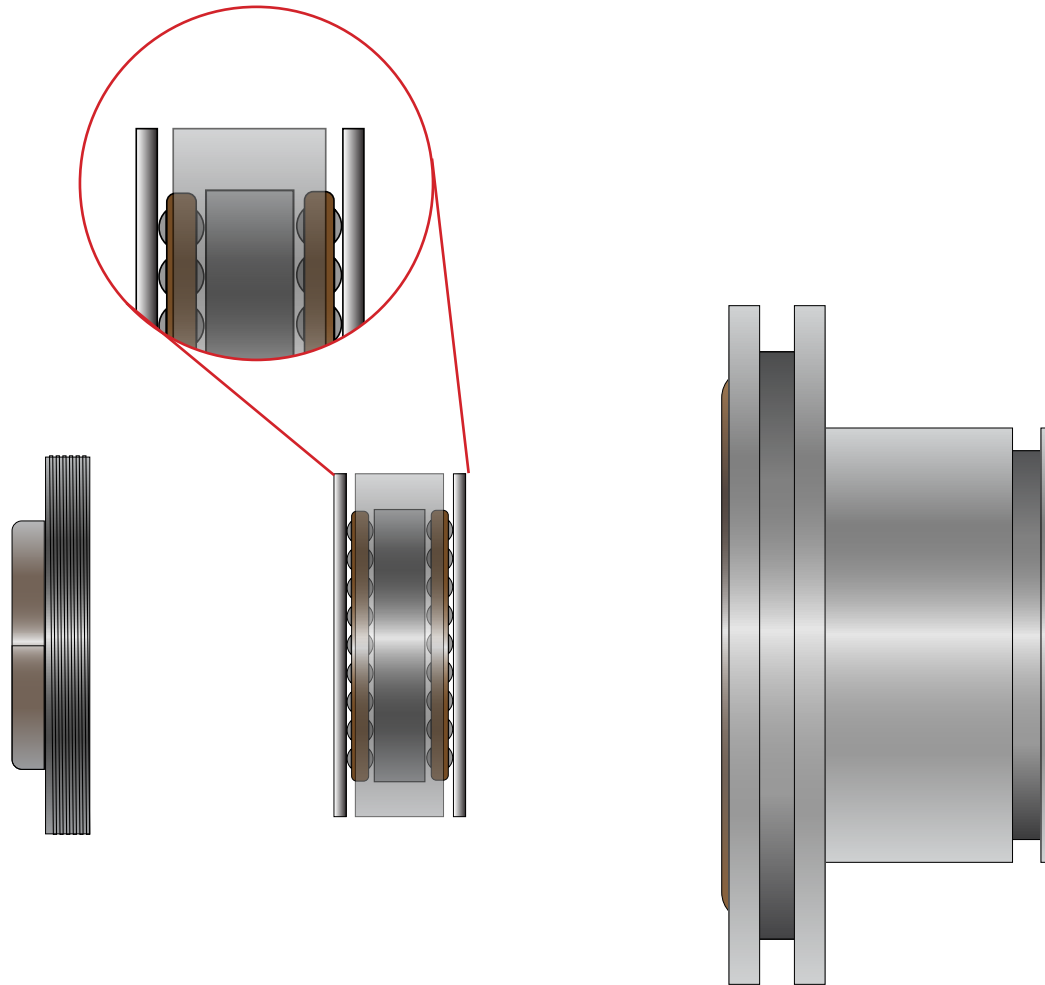
M5X DUAL VANOS PISTON REPAIR

This illustration shows the cause of axial play in the bearings. There is clearance between the roller bearings, the bearing race, and the end washers. The bearing ring in this case is, in effect, too wide. The clearance is eliminated by decreasing the width of the bearing ring until all axial play is removed.



M5X DUAL VANOS PISTON REPAIR

In this illustration, the bearings would be too tight. The bearing ring in this case is, in effect, too narrow. When the piston is assembled, the end washers will “crush” the bearings as they attempt to seat against the bearing ring. In this situation, since you cannot increase the width of the bearing ring, to solve the problem you would decrease the width of the bearing race.

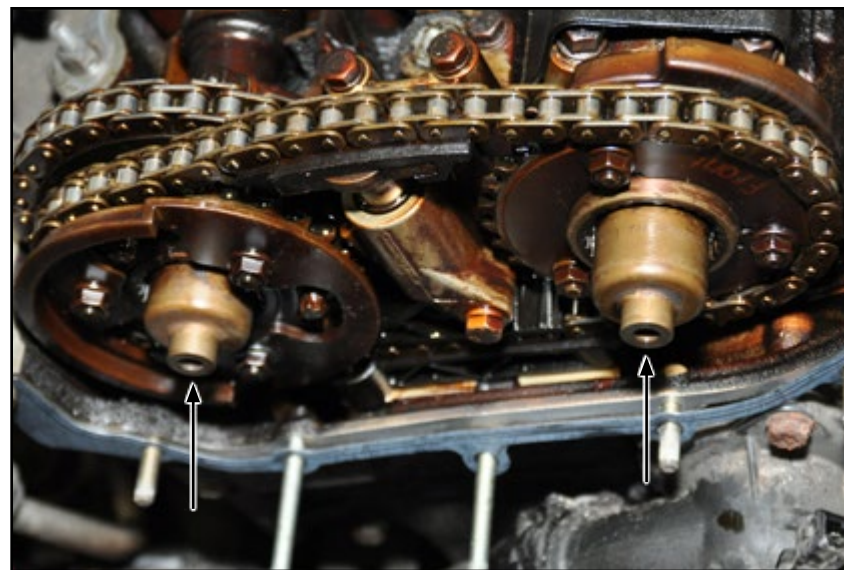


REBUILDING THE M5X DUAL VANOS

Step 5:

Now that you understand the theory, we'll get back to it. The picture on the right shows the splined shafts in the end of each camshaft. This is where each of the Vanos pistons is secured with a T30 splined shaft bolt.

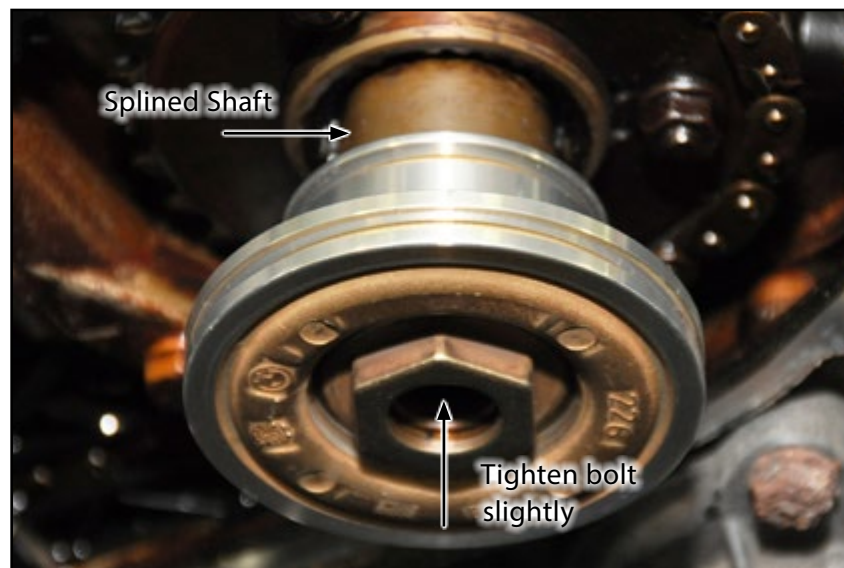
One at a time, we're going to mount the Vanos pistons onto the end of the intake cam and check for axial play. We're using the intake cam simply because the splined shaft is easier to get to.



Step 6: T30 Torx, Ratchet

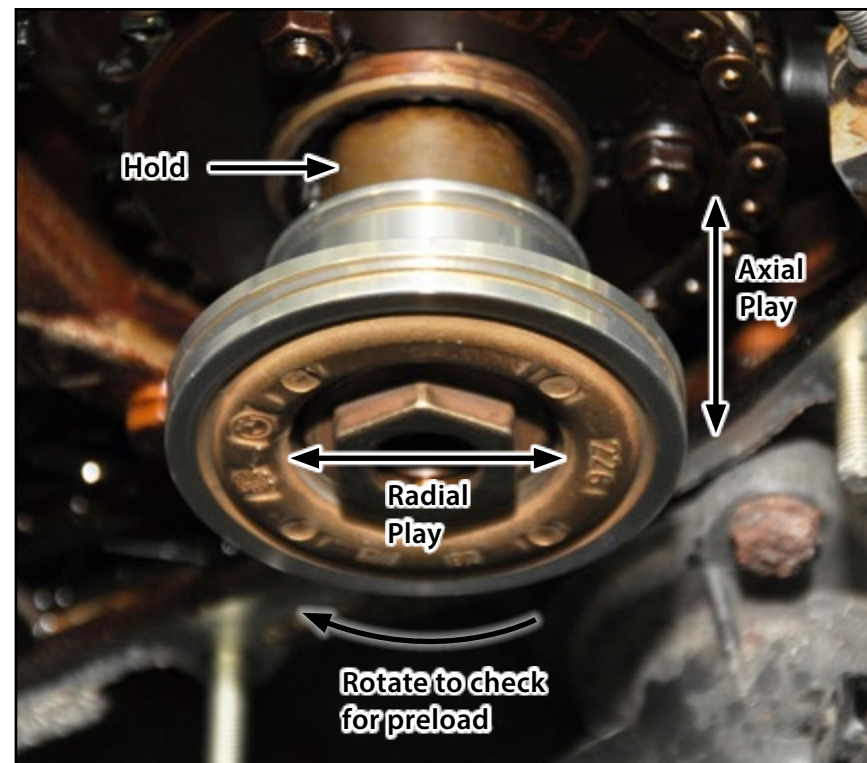
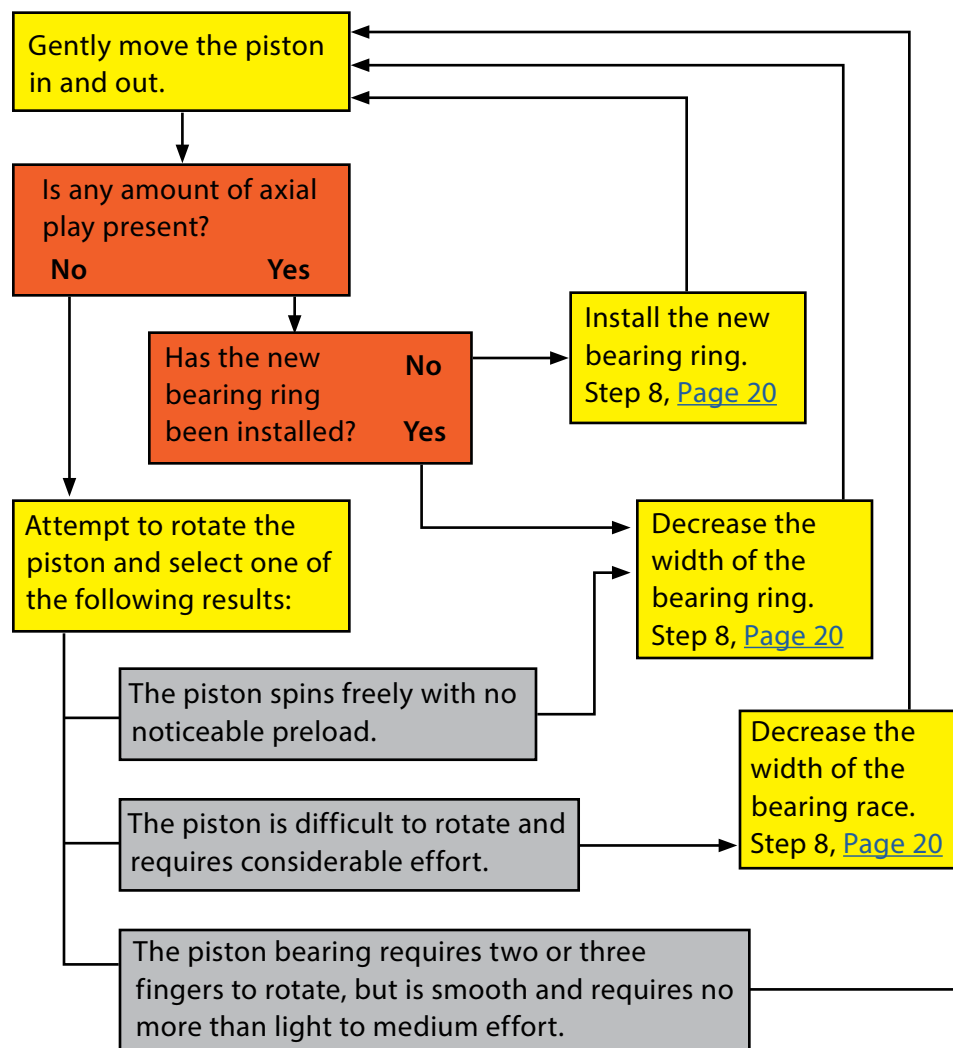
Now, install one of the pistons onto the end of the intake camshaft and tighten the bolt slightly using a ratchet.

You do not need to fully tighten or torque the bolts, they only need to be tight enough to securely hold the bearing race to the splined shaft. A loose bolt here would feel like axial play and throw off your adjustment.



REBUILDING THE M5X DUAL VANOS

Step 7: Now it's time to check for axial play in the Vanos piston. First, using one hand, hold the splined shaft to keep it from moving. Next, follow the flow chart below to check and adjust axial play/preload of the Vanos pistons.



Remember, radial play is normal.

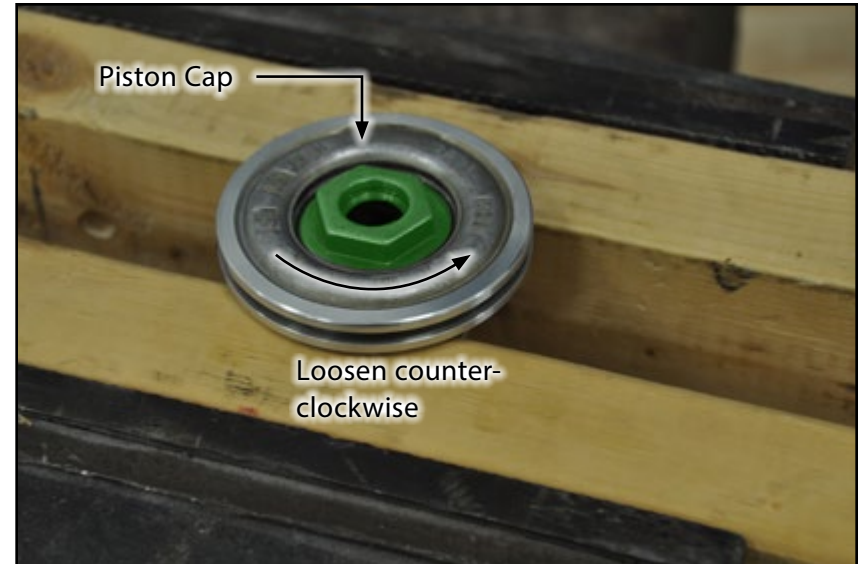
Preload and axial play are set perfectly! Make sure to complete this for both pistons, then skip to Step 14 on [Page 23](#) to continue.

REBUILDING THE M5X DUAL VANOS

Step 8: 24mm Socket, 1/2" Impact Wrench

The piston cap must be removed so we can get to the components inside. You'll have to hold the piston in a vise, and there are only a couple safe ways of doing this. **You must not damage or distort the piston in any way, or it will be ruined, so be careful.** If you have nylon vise jaws, they will work perfect, and the only other alternative is a couple pieces of wood as we have done here.

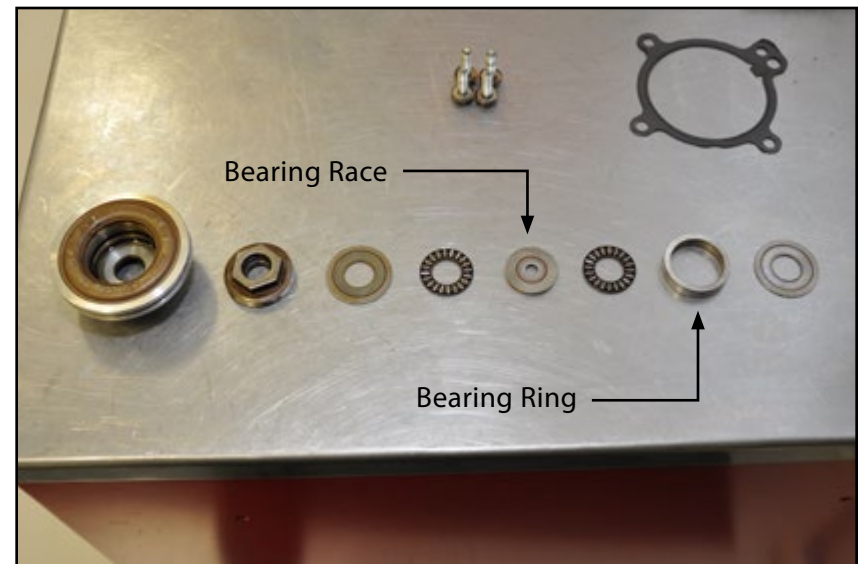
Once the piston is securely held, use an impact wrench to loosen the piston cap. It's not actually that tight, but you'll find that the piston will still rotate slightly in the vise jaws, and it's the rapid shock of the impact that will loosen it. If it doesn't loosen at first, tighten the vise to limit spinning as much as possible and give the nut multiple "blips" with the impact.



Step 9: Magnet, Small Angled Pick

Once you have removed the piston cap, remove the individual components and lay them out in order. Clean everything thoroughly - if these aren't spotless it can throw off your axial play/preload - then locate the bearing race and the bearing ring.

- ▶ If this is the initial installation of the bearing ring, remove the original bearing ring from the line up and replace it with the new one, then skip to Step 12 on [Page 22](#).
- ▶ If you have already installed the new bearing ring and are adjusting the bearing ring clearance, go to Step 10 on [Page 21](#).
- ▶ If you have already installed the new bearing ring and are adjusting the bearing race clearance, go to Step 11 on [Page 21](#).



REBUILDING THE M5X DUAL VANOS

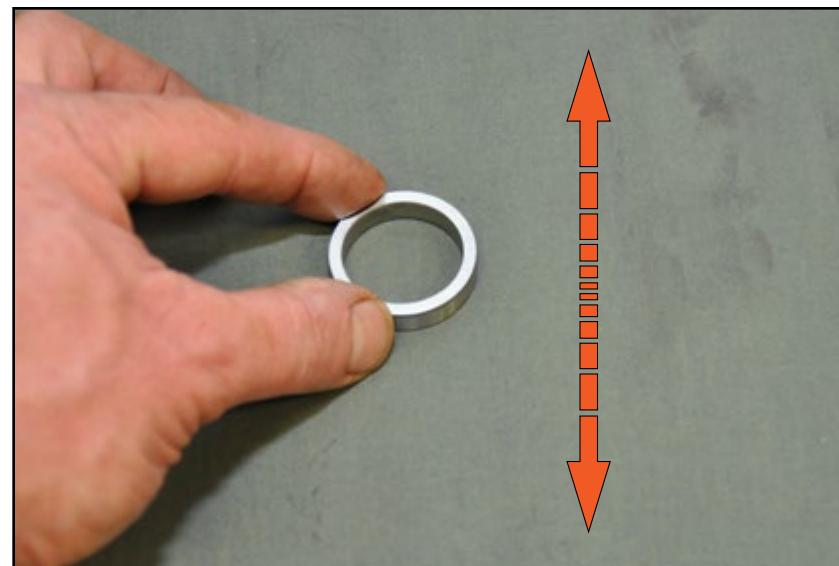
Step 10: 400 Grit Sandpaper

To tighten the bearing (when axial play or no preload is present) - sand the bearing ring using the following procedure:

1. Place a sheet of 400 grit sandpaper on a solid, flat surface.
2. *Using medium pressure, sand one surface of the ring back and forth 6-8", approximately 30-40 times.*
3. Rotate the ring 90 degrees, and repeat the sanding procedure.
4. Flip the ring over and repeat the sanding procedure.
5. Rotate the ring 90 degrees and repeat the sanding procedure.

This procedure will remove a very small amount of material, approximately .004 - .006mm from the total thickness of the ring.

Thoroughly clean the bearing ring and continue with step 12 on [Page 22](#).



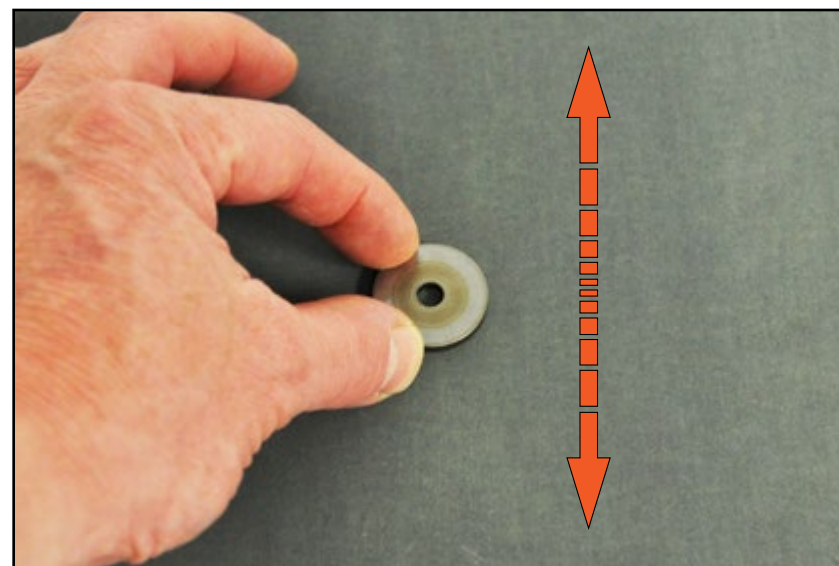
Step 11: 400 Grit Sandpaper

To loosen the bearing (when excessive force is required to rotate piston) - sand the bearing race using the following procedure:

1. Place a sheet of 400 grit sandpaper on a solid, flat surface.
2. *Using medium pressure, sand one surface of the race back and forth 6-8", approximately 30-40 times.*
3. Rotate the race 90 degrees, and repeat the sanding procedure.
4. Flip the race over and repeat the sanding procedure.
5. Rotate the race 90 degrees and repeat the sanding procedure.

This procedure will remove a very small amount of material, approximately .004 - .006mm from the total thickness of the race.

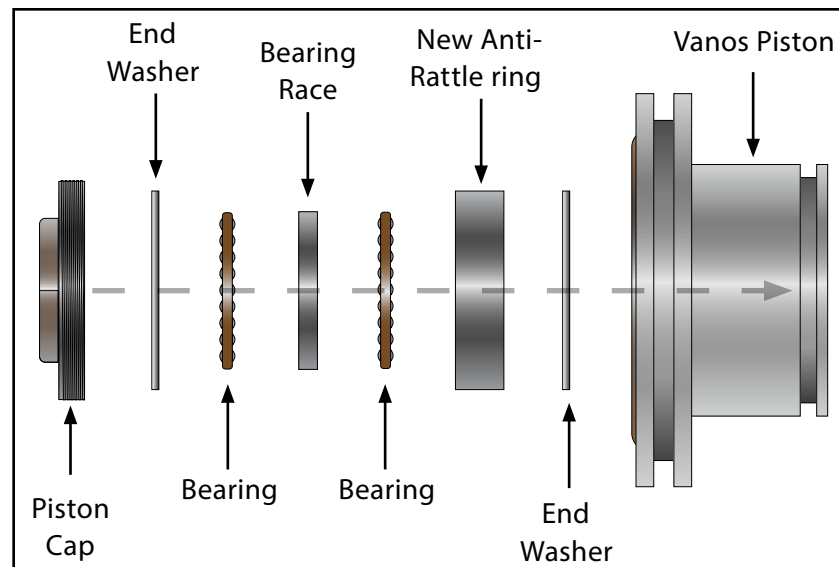
Thoroughly clean the bearing race and continue with step 12 on [Page 22](#).



REBUILDING THE M5X DUAL VANOS

Step 12:

Reassemble the Vanos piston using the new bearing ring. Make sure all components are fully seated, then thread the piston cap in by hand until it too is fully seated.



Step 13: 24mm Socket, 1/2" Impact Wrench

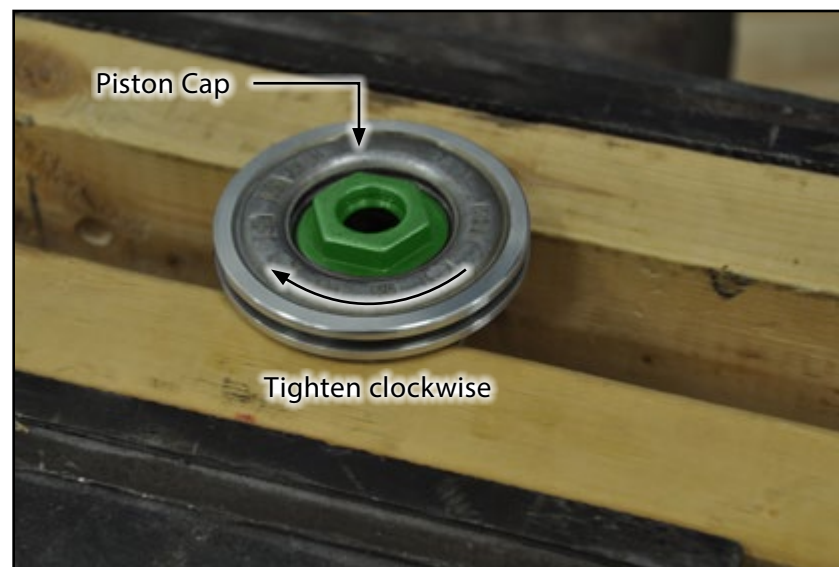
Once the piston is assembled, secure it again in the vise with protective jaws, then use the impact wrench to tighten the piston cap. It doesn't have to be excessively tight, a few "blips" with the impact is all it takes.



Repeat step 7 on [Page 19](#).



You may have to perform an adjustment procedure as many as three or four times in order to achieve the proper bearing preload.



REBUILDING THE M5X DUAL VANOS

Step 14:

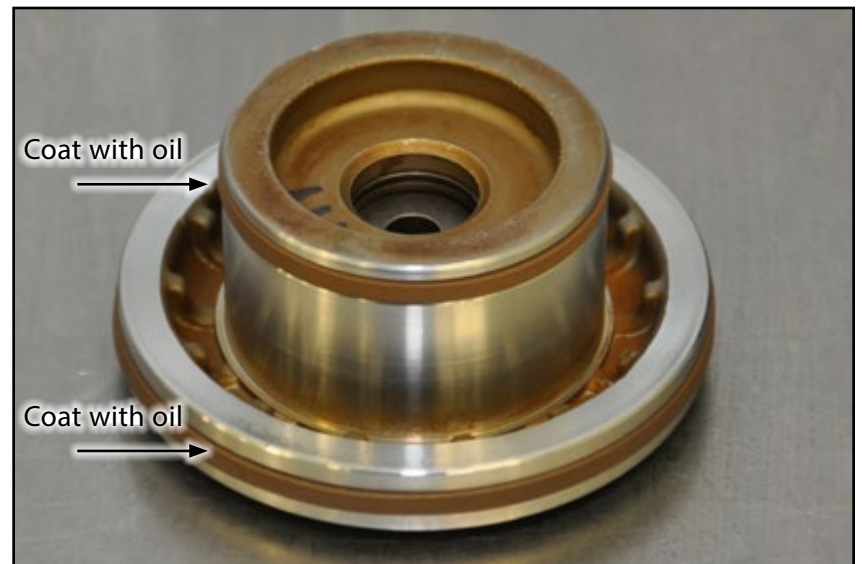
Carefully install the new rubber o-rings into the piston grooves, making sure they are not twisted.



Step 15:

Warm the new Teflon seals in hot tap water, then carefully install them by starting them in the groove on one side of the piston, seating them all the way around as far as possible, then stretching them over the opposite edge with your fingers. Once they are fully seated, allow them to cool for a few minutes to return to their normal size.

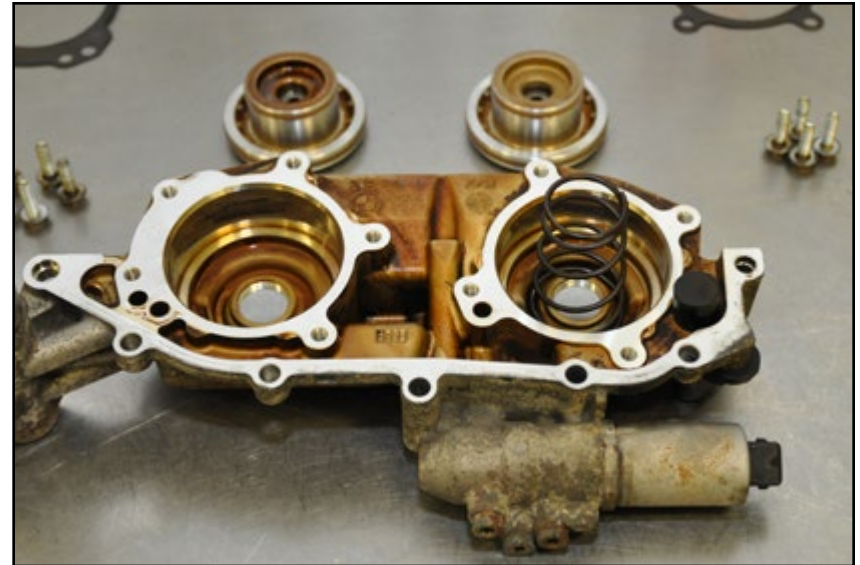
Coat the Teflon seals with clean engine oil.



REBUILDING THE M5X DUAL VANOS

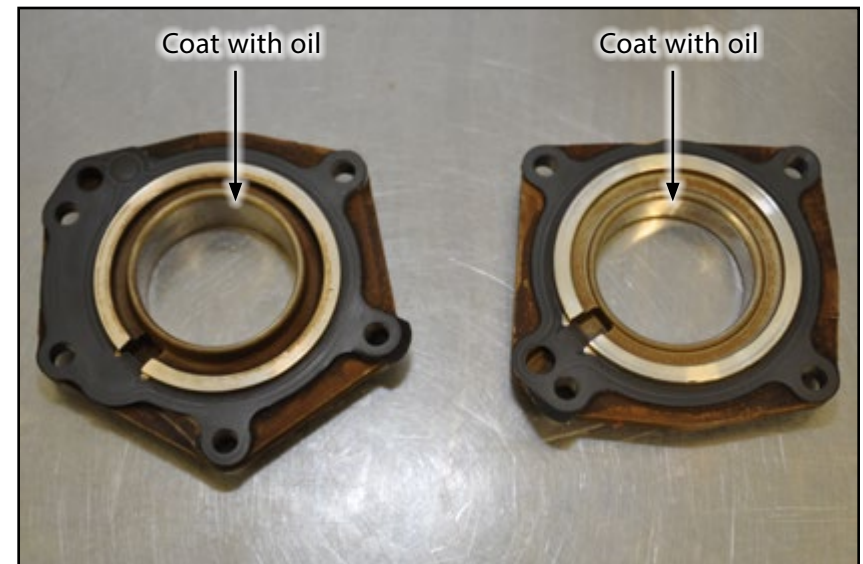
Step 16:

Prepare to reassemble the Vanos unit. Make sure you locate the intake and exhaust pistons on the correct side, and place the spring into the Vanos housing on the exhaust side.



Step 17:

Place the metal gaskets onto their corresponding Vanos cylinder cover plate, then coat the bore of each cover plate with clean engine oil.



REBUILDING THE M5X DUAL VANOS

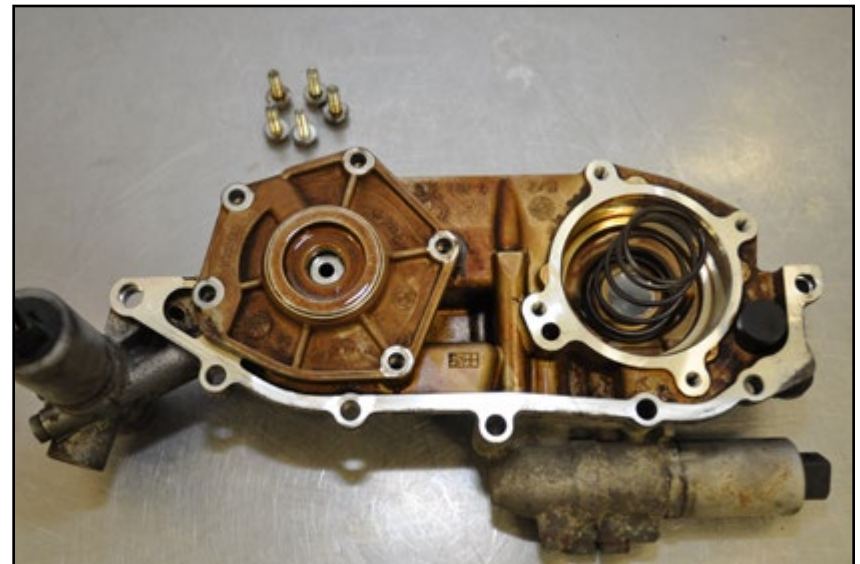
Step 18:

Gently push each piston into its corresponding cover plate, rocking it back and forth gently as required so the Teflon seal seats easily into place.



Step 19:

Install the intake cover plate and piston, gently rocking the piston back and forth as necessary to guide it into the piston bore.



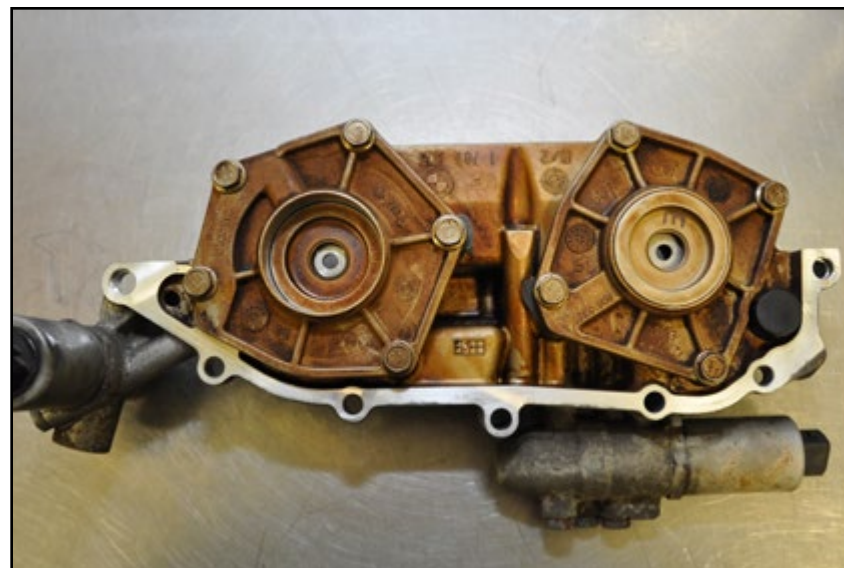
REBUILDING THE M5X DUAL VANOS

Step 20: 10mm Socket, 1/4" Torque Wrench

Install the exhaust cover plate and piston, again gently rocking the piston back and forth as necessary to guide it into the piston bore. You will have to work against the spring tension on this piston, and once it is installed, hold the cover plate against the Vanos housing, and install the bolts.

Install the intake cover plate bolts as well, then torque them all in an alternating fashion to 10 Nm (7 Ft-lbs).

Just to double check the operation, push the pistons in and out to make sure they operate smoothly. The exhaust will require additional effort to overcome the spring tension.



Step 21:

You're almost ready to reinstall the Vanos unit. Remember the piston caps you pulled off? The o-rings are no doubt shot, just like the one in the LH photo, so we've included new ones. If you purchased a hardware or refresh kit, you'll have new caps w/o-rings. If not, remove the old o-rings, - you may have to use an exacto knife - then clean up the piston caps and install the new 9mm o-rings.

It's time to reinstall the Vanos unit!



FINAL INSTALLATION STEPS

Installing the rebuilt Vanos unit is as easy as taking the old one off, but here's a few points about the job:

- Be sure and clean all surfaces thoroughly before reinstalling components.
- Be sure to use a new Vanos unit gasket.
- Push the Vanos Intake piston all the way into the Vanos unit to make installation easier.
- Torque all fasteners to the proper specification.

TORQUE SPECIFICATIONS

Piston Access Plugs.....	50 Nm (37 Ft-lbs)
Spline Shaft Mounting Bolts (Reverse Thread).....	8 Nm (6 Ft-lbs)
Valve Cover Fasteners	8 Nm (6 Ft-lbs)
Vanos Intake and Exhaust Cover Plate Bolts	10 Nm (7 Ft-lbs)
Vanos Oil Line Banjo Fitting	32 Nm (24 Ft-lbs)
Vanos Unit Mounting Nuts and Bolt	8 Nm (6 Ft-lbs)

TORQUING TIPS

Torque to Yield or “Stretch” Bolts

Many bolts will have a torque specification listed in the format - xx Nm (xx Ft-lbs) + xx degrees. These bolts are torque to yield bolts, commonly referred to as “stretch” bolts. The correct procedure for torquing these bolts is:

Stage One - Torque the bolt(s) to the initial Nm or Ft-lb specification. If there is more than one, be sure to torque them in the correct sequence.

Stage Two - Tighten or “stretch” the bolt(s) the additional specified number of degrees. If there is more than one, be sure to follow the correct sequence.

Note - Some bolts may have two or more stages of torquing before the final stage of “stretching” the bolts.

When tightening more than one bolt in a specified sequence, be sure to mark each fastener with paint **immediately** after performing the final stage or “stretching” of the bolts. This will ensure that you keep track of which bolts have already been “stretched”.

All Torque to Yield bolts should only be used once and should be replaced each time they are removed. If they are reused, they will not be able to achieve the proper clamping force with the specified torque.

Lubrication

Torque specifications are always listed for a dry fastener (**no** lubrication) unless specified otherwise.

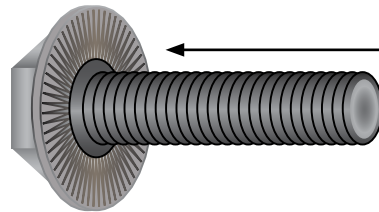
Some fasteners require lubrication on the threads -or- on the contact surface while torquing. These fasteners will be listed with the specific location and type of lubrication required. Always follow manufacturers recommendations exactly.

Lubricating a fastener that is intended to be installed dry and then torquing it to factory specifications will increase the clamping force and stress on the fastener and components, which can result in damage or failure.

Do not lubricate the threads of any fastener unless it is specifically recommended by the manufacturer.

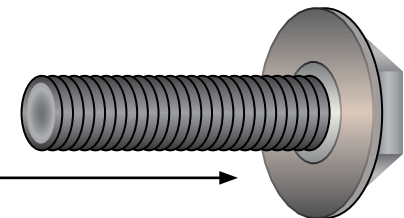
Ribbed vs. Non-Ribbed Bolts

Ribbed and Non-Ribbed bolts in the same location generally require a different torque specification.



A ribbed bolt is identified by the ribs on the contact surface

A non-ribbed bolt is identified by the smooth contact surface

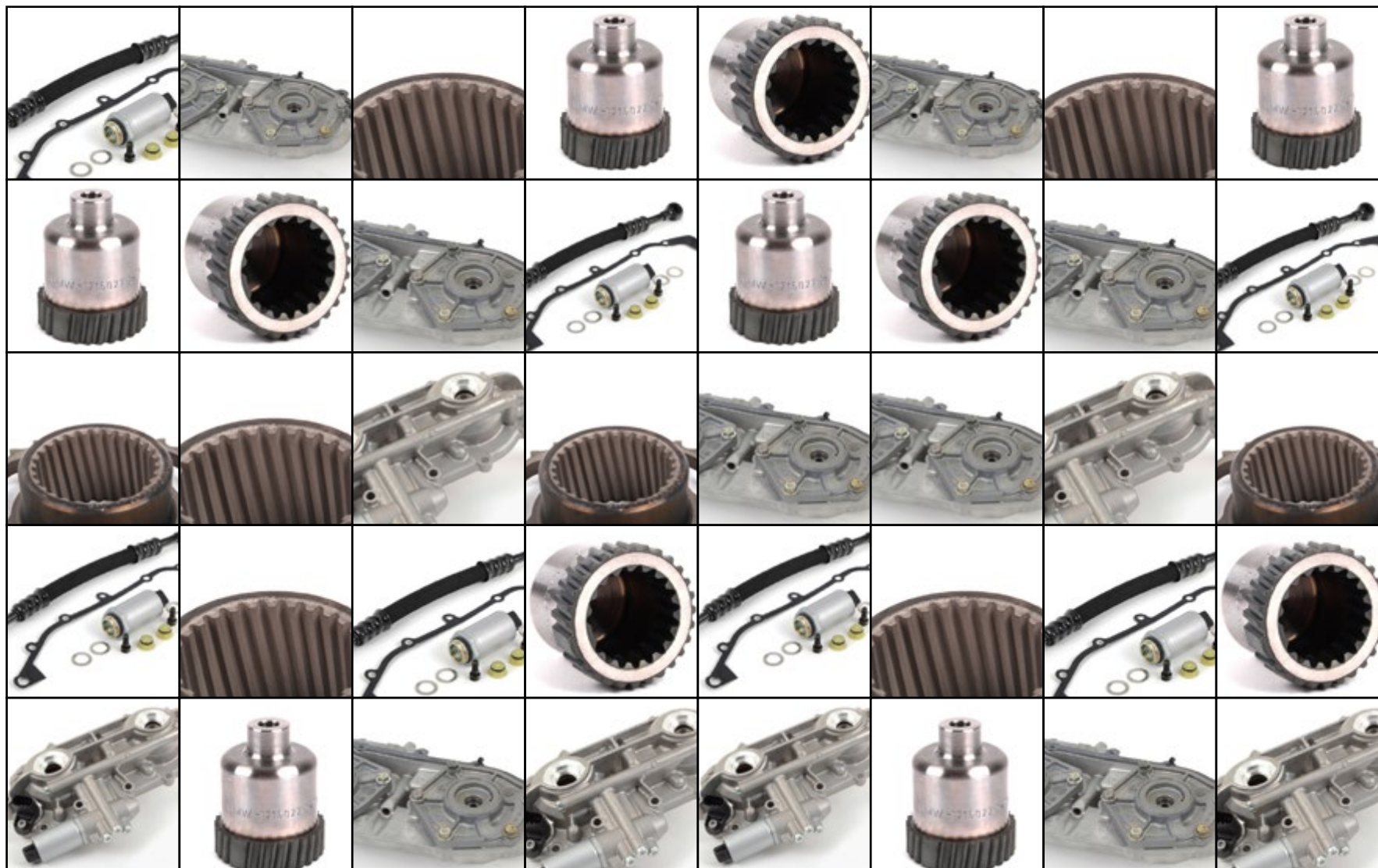


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Your M5x Dual Vanos rebuild is complete!



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