IMS SOLUTION

US Patents: 8,992,089 B2 | 9,416,697 B2 | 9,909,469

INSTALLATION MANUAL

For Larger Print Version and Video Instructions – please see

LNENGINEERING.COM
IMSSOLUTION.COM

Thank you for purchasing the IMS Solution.
Development of the IMS Solution spanned several years and took five generations of prototypes and tons of real life, practical application testing before being released to the worldwide market.

The IMS Solution became the first Patented IMS Retrofit product on the market on March 31, 2015 receiving US Patent 8,992,089 B2. Currently it is additionally protected by US Patent 9,416,697 B2 and US Patent 9,909,469 as well.

In these recently revised instructions you will learn the basics associated with fitment of the IMS Solution. The developers of the product have also added many "silver bullets" to the instructions based on frequently asked questions posed by installers.

Due to revisions to the instructions, all installers (even those who have installed dozens of the product previously) should review them, as some things have changed, and other items have been more clarified, as the product has evolved in the market place.

Revised on March 4th, 2021.

Jake Raby (Raby Engine Development) | Charles Navarro (LN Engineering)
Inventors and Developers of the IMS Solution

WHAT FACTORY BEARING DOES MY ENGINE HAVE?

1997-1999: This engine featured a dual row bearing IMS.

2000-2001: These engines came from the factory with either a dual row or a single row bearing IMS. A single row flange measures 19.27mm deep and a dual row flange measures 13.34mm deep.

2002-2005: This engine featured a single row bearing IMS. Some late production 2005 models will have a non-servicable IMS.

2006-2008: These engines were fitted with a larger bearing, readily identifiable by the 22mm center nut, that is not serviceable without a complete teardown of the engine. Removal of the IMS bearing grease seal will ensure proper lubrication of the original bearing.

If the engine in your car has been replaced, it will have whatever IMS bearing was in production for that model year of manufacture for the replacement engine.

It is important to identify which bearing your engine has before ordering or attempting installation of a replacement IMS bearing. The correct kit must be used for your engine otherwise engine damage or failure may occur.

IMS RETROFIT & IMS SOLUTION

PRE-QUALIFICATION PROCEDURE

The following eleven step IMS Retrofit and IMS Solution Pre-qualification procedure was developed by Jake Raby at Flat 6 Innovations. During the initial development of the IMS Retrofit and IMS Solution, and components, some items of concern were noted from the very beginning, and over the years these procedures have been updated to address these, thus increasing the effectiveness of the IMS Retrofit and IMS Solution procedure.

This procedure has been employed at Flat 6 Innovations since the very first IMS Retrofit was performed, and to date it has resulted in a 100% success rate for the Flat 6 Innovations Preventative Service program. Having performed the very first IMS Retrofit, and after performing more IMS Retrofit / IMS Solution procedures than any other facility, a perfect record has been maintained by Flat 6 Innovations by employing these procedures verbatim. This means that today, roughly 20% of all engines that are inspected will fail this pre-qualification, and will require repairs to be made prior to the IMS Retrofit / IMS Solution installation.

The biggest mistake that can be made is assuming that every vehicle is healthy enough to have the IMS Retrofit / IMS Solution installed. The second biggest mistake that can be made, is not taking the pre-qualification procedure seriously. Please pay attention to each and every engine, and realize that not every engine is a viable candidate for IMS Retrofit / IMS Solution installation.

- ☐ **Perform controller interrogation (check for any Fault Codes, engine over-revs, Camshaft deviation #'s, etc…)**

- ☐ **Five (5) chain M96 engines are known for high camshaft deviation values due to abnormally high wear found on the timing chain adjuster wear pads. This can occur at low mileage points. Camshaft deviations found over 4 degrees must be addressed prior to performing the IMS Retrofit / IMS Solution installation. Failure to do this may result in a loss of valve timing during the procedure, or a Check Engine Light illumination immediately following the IMS Retrofit / IMS Solution installation. This will be due to camshaft deviations that are operating out of range.**

- ☐ **Perform Crankcase Manometer Test. Engines should read 4-6" of water column at sea level.**

- ☐ **Check over car complete, perform vehicle safety inspection, and listen to engine to determine overall condition. Inspect for any engine and/or gearbox oil and/or coolant leaks and document. Driving the car prior to the retrofit is recommended, as issues may be caught prior to the retrofit process.**

- ☐ **Drain engine oil and inspect how the oil looks while draining, inspect engine oil drain plug closely. Inspect for ANY debris. Again, any debris is concerning, and must be taken seriously. Engines can run perfectly, and exhibit no other symptoms of imminent failure, yet can be slowly dying due to debris laden oil.**

CONTINUED ON NEXT PAGE

IMS RETROFIT & IMS SOLUTION

PRE-QUALIFICATION PROCEDURE, CONT.

- [ ] **Remove engine oil filter, cut open and inspect for ANY debris. Look closely at the bottom of the factory filter canister, where debris often is collected. If ANY debris is present, the retrofit process must be aborted; and the source of the debris must be identified. Action must be taken to address these issues prior to the retrofit process being carried out. Retrofitting the IMSB of ANY engine that has wear metals, or other debris in the oil, will lead to collateral damages that can destroy the retrofitted IMS Bearing, as well as all other internally lubricated engine components.**

- [ ] **Remove Engine Oil Sump plate, inspect for debris. Removal of the sump plate is highly encouraged, as debris will lurk here that is not notable in the oil, or in the filter. Again, ANY debris of any sort is concerning, and must be investigated.**

- [ ] **During all oil, sump and filter inspections, remember that the tiniest particles are just as concerning as larger pieces. This is because they are even more easily mixed into, and suspended from the engine oil, allowing the debris to circulate all throughout the engine with damaging effects.**

- [ ] **Perform bore scope inspection of all cylinder bores. Watch closely for scoring and any signs of wear. Wear debris from failing / failed cylinders has been proven to be very damaging to all engine internals, including IMS Bearings.**

- [ ] **With the transaxle removed, inspect the Rear Main Seal bore to ensure the engine does not have a factory defect known as "crankshaft sag". If this exists oil leakage at the RMS will be a terminal condition that can't ever be remedied.**

- [ ] **Once the IMS Flange is removed, inspect the original IMS Bearing for signs of failure. Also, check for signs that the engine may have already experienced an IMS Bearing failure, and may have had another bearing fitted. Engines that have IMS shaft assemblies that have been through a failure are always damaged, and it is very important that these shafts are not fitted with any IMS Retrofit or IMS Solution products.**

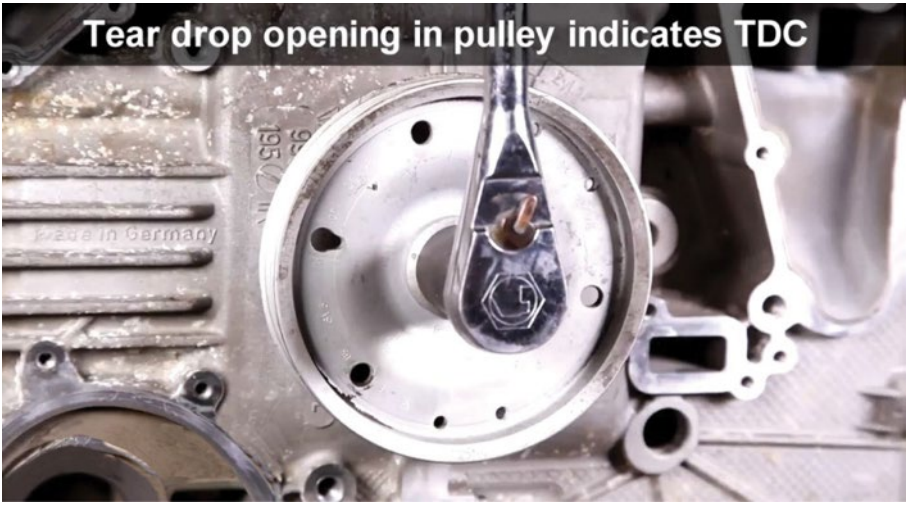
NOTE: Any and all fault codes, and / or symptoms of rough running, etc. must be addressed prior to IMS Retrofit / IMS Solution installation. It is imperative that ONLY healthy, good running engines be retrofitted.

NEVER, UNDER ANY CIRCUMSTANCE, IS IT PERMISSIBLE TO REMOVE A FAILED OR FAILING IMS BEARING AND REPLACE IT WITH AN IMS RETROFIT OR IMS SOLUTION PRODUCT. IMS RETROFIT AND IMS SOLUTION PRODUCTS, COMPONENTS AND PROCEDURES WERE DESIGNED FOR PREVENTATIVE PURPOSES ONLY.

1 **The procedure begins with a vehicle with the engine removed for better illustrative purposes.**

TIP You do not have to remove the engine to install the IMS Solution. The process can be accomplished by only removing the transaxle, clutch assembly, and flywheel, with exception of 911 models with Tiptronic transmission.

2 **Rotate engine clockwise to locate cylinder #1 TDC.**

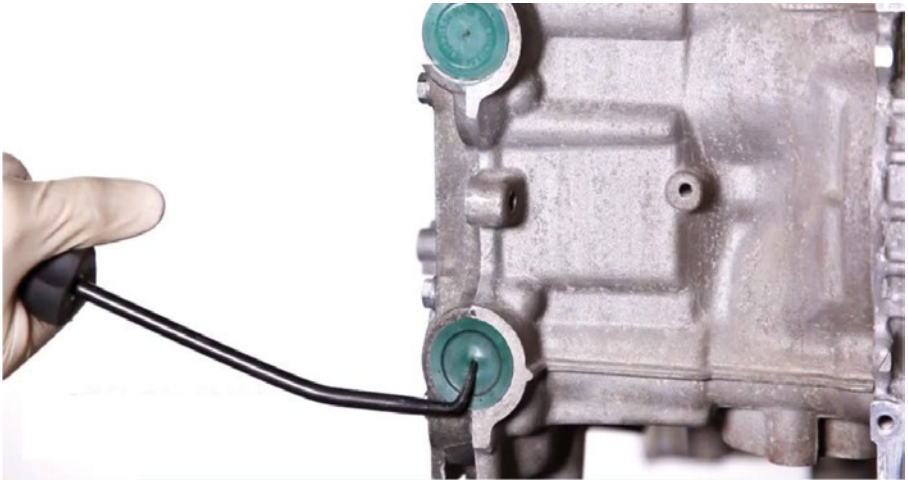


NOTE While cylinder 1 TDC and Cylinder 4 TDC have the same crankshaft position, the IMS Retrofit process can be carried out at cylinder 1, or cylinder 4 TDC without issues. This is due to the relaxed state of the valve train that is a constant between these two crankshaft positions.

3 **Lock engine in TDC position using crankshaft locking pin supplied with IMS pro tool kit.**

NOTE If the engine is fitted with an underdrive pulley, you may not be able to insert the locking pin without reinstalling the stock pulley. Carrying out the installation without the pin in place to lock the engine at TDC may result in engine damage.

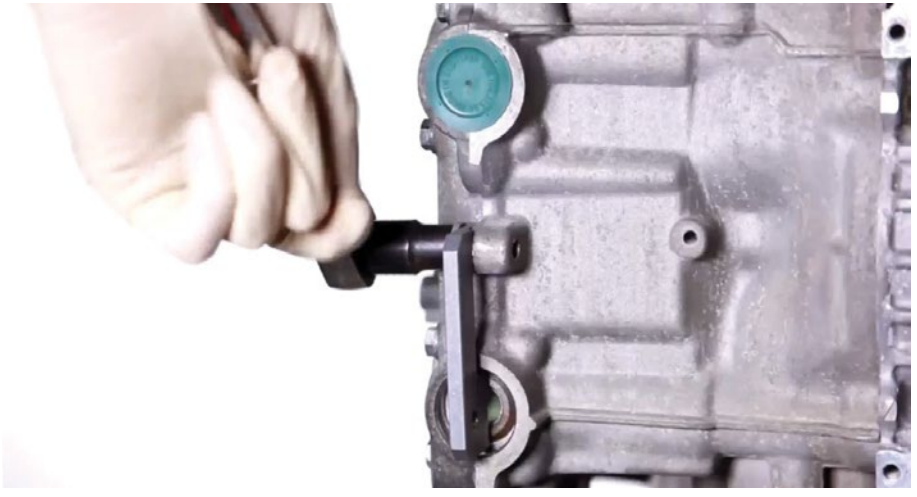
4 **Working at right side cylinder head, remove lower camshaft bore plug using a large pick. Remove and discard these bore plugs, and do not attempt to reuse them.**



NOTE Right side determined when facing flywheel

5

Lock right side camshaft in place using IMS pro tool kit camshaft timing jig. Use the shorter cam lock on 5-chain and longer one on 3-chain engines.



TIP

If the jig does not fit into camshaft easily, the engine may be out 180°. Remove crankshaft locking pin and rotate engine one full rotation and try to install camshaft jig again. If the locking tool still does not fit, verify cam timing and correct if cam timing deviation exceeds 6 degrees.

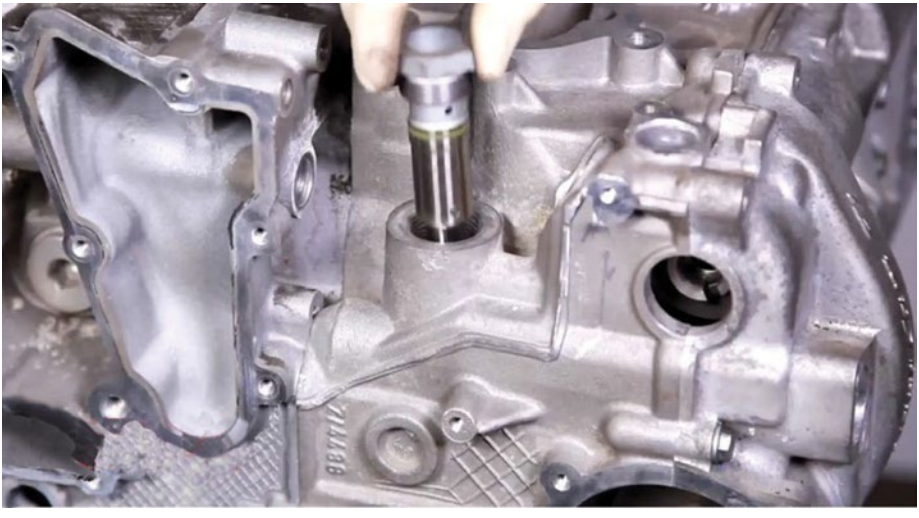
NOTE

Some installers prefer to lock camshafts on BOTH banks of the engine. This is a practice that is not required, and is a matter of personal preference. With the crankshaft, and one bank of camshafts locked, all timing chains will be held tightly in the proper position for a successful IMS Retrofit procedure. The optional second 3-chain locking tool is part of Faultless Tools engine assembly tool kit 106-29.

6

Remember to mark the original location of each timing chain tensioner for reinstallation, and be prepared to catch any dripping oil in a rag.

7 **Working at left side cylinder head, remove timing chain tensioner.**



NOTE

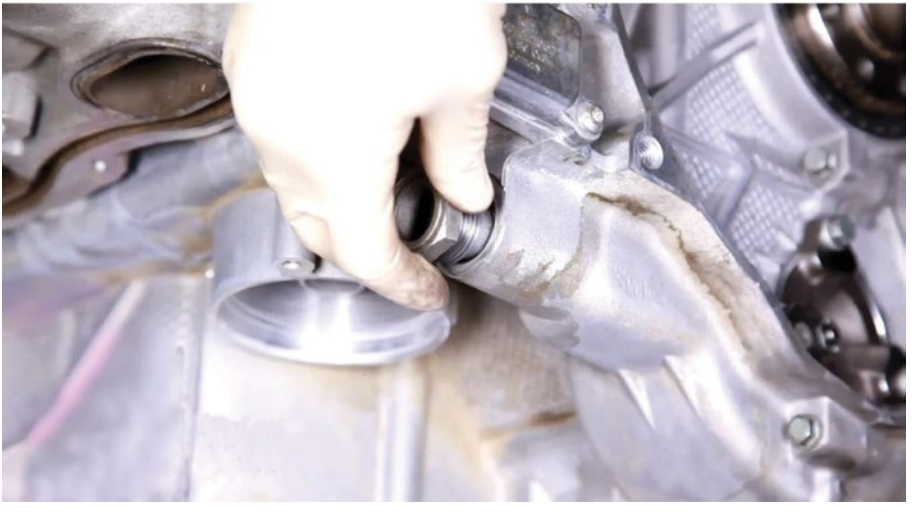
Left side determined when facing flywheel

8 **Working at right side cylinder head, remove timing chain tensioner.**

NOTE

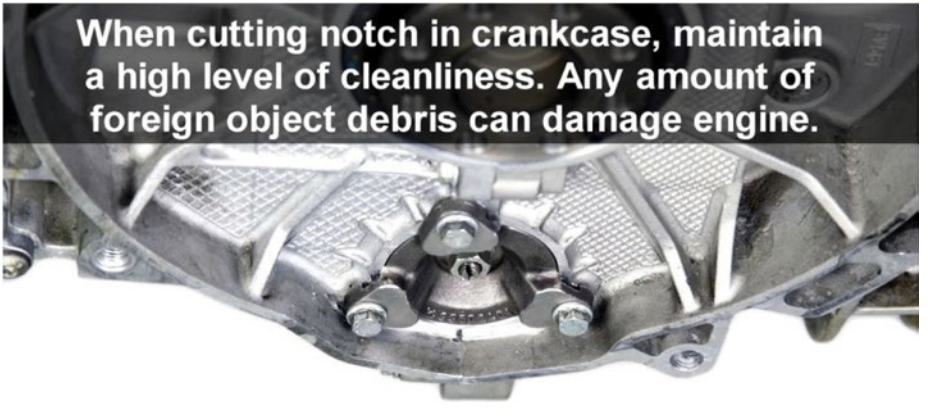
Right side determined when facing flywheel. Be prepared to catch any dripping oil with a rag.

9 **Working at flywheel side, remove IMS chain tensioner.**



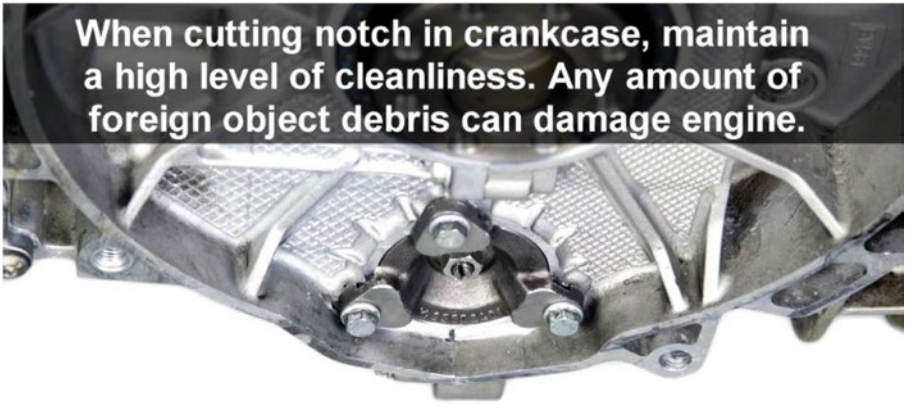
NOTE Be prepared to catch any dripping oil with a rag.

10 **The next part of the procedure is going to cut a notch in the crank case for the pressurized oil line that feeds the IMS Solution.**



NOTE There are a few different methods and many tools that you can use to create the notch in the crank case. The most important thing is to work slowly and do not remove too much material since the pieces cut off the crank case can not be replaced.

11 This procedure is showing a drill and hand tools to create the notch in the crank case.



12 Using the IMS Solution flange as a guide, mark the center of the crank case using an awl.

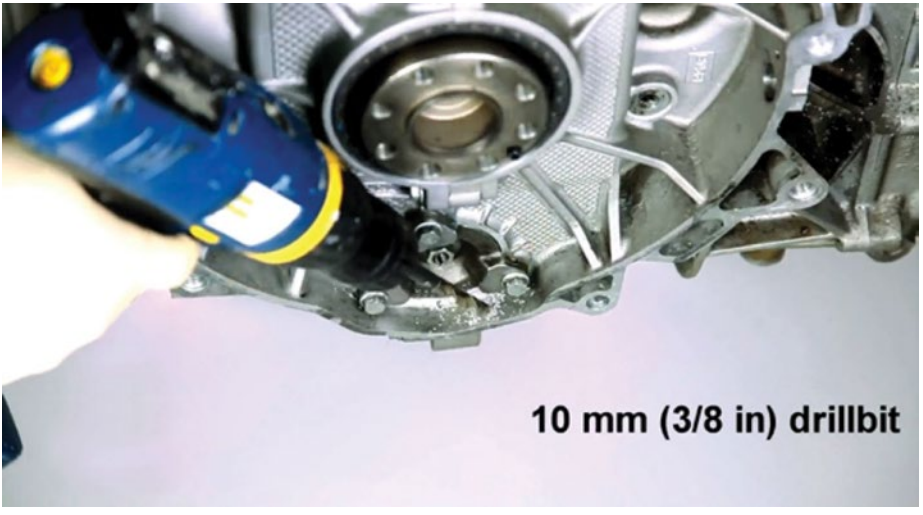
13 **Using a sharp punch, lightly tap it with a rubber hammer to create a pilot mark for your drill bit.**

14 **Using a 3mm (1/8 in) drill bit, drill a pilot hole in the crank case.**

NOTE

Be sure to leave or reinstall the old IMS flange on the engine prior to modifying the crankcase.

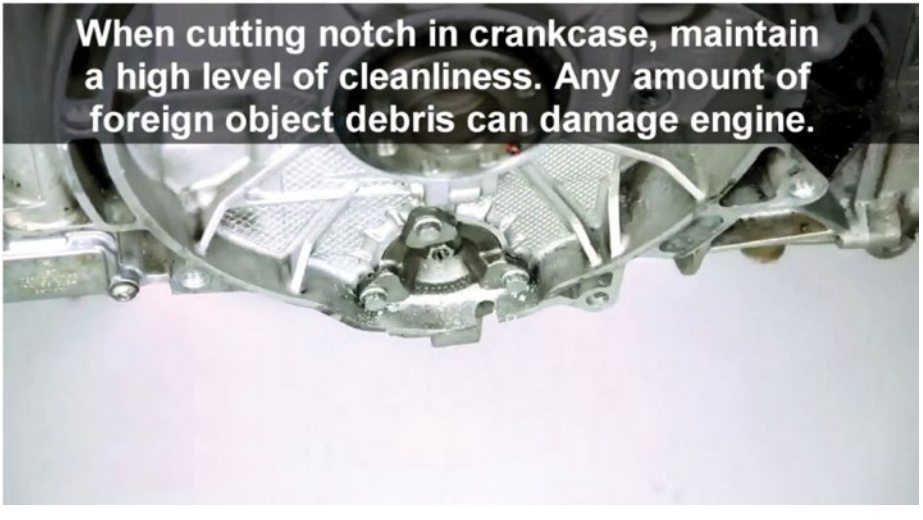
15 **Next, using a 10mm (3/8 in) drillbit, drill the final hole in the crank case.**



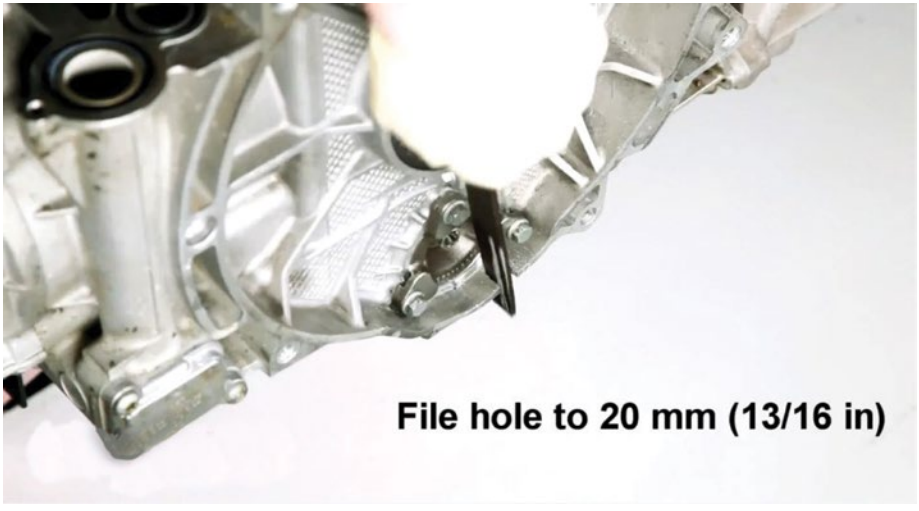
NOTE

Once the hole is drilled, clean the metal shavings from crank case.

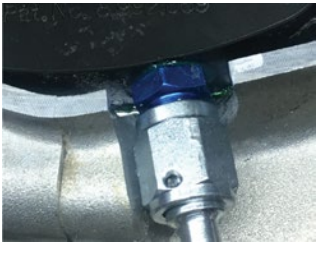
16 **Next, using a handsaw, cut two straight lines into drilled holes to remove outer piece of crank case.**



17 **Once outer piece of crankcase is cut away, use a flat file and open up the hole until it is large enough to fit oil fitting.**



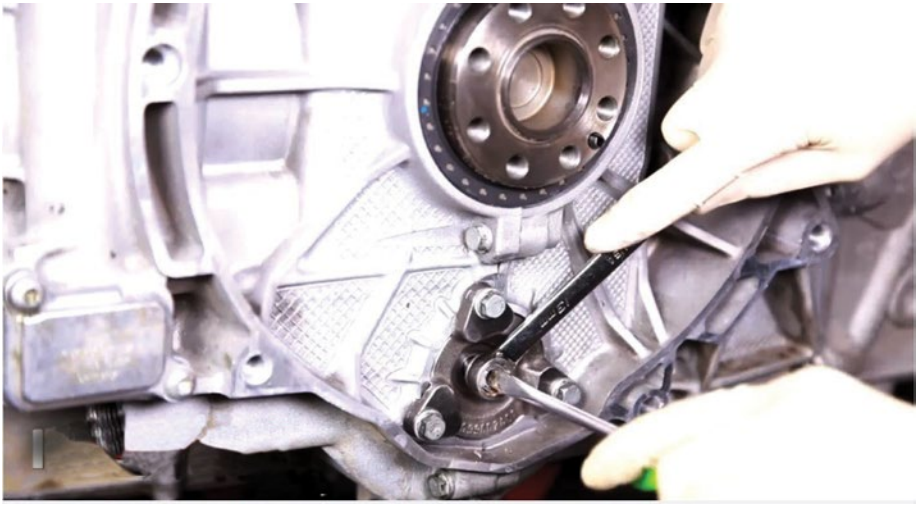
NOTE File hole to 20mm (13/16in). Be sure to remove equal amounts of the opening. This will ensure a proper fit of the IMS Solution oil fitting.



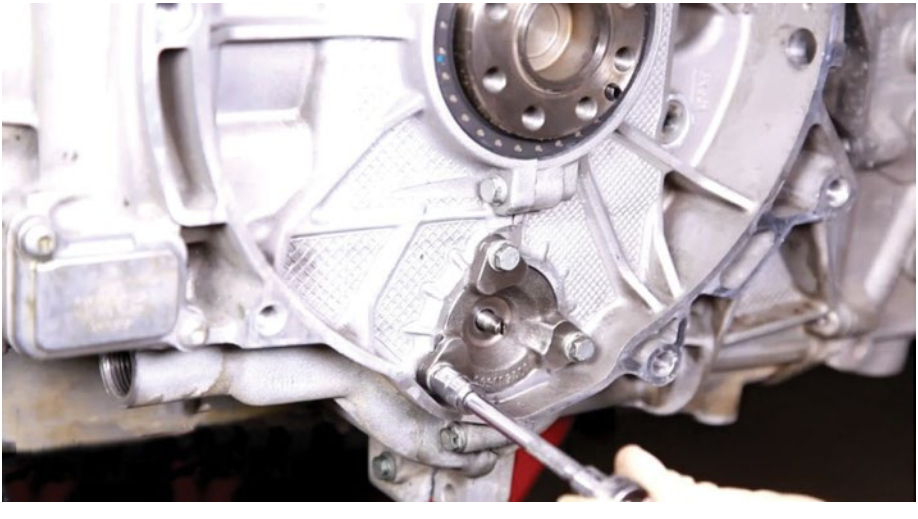
NOTE Some blocks may require more clearancing than others due to seemingly excessive casting differences.

18 **Using the IMS Solution's oil fitting as a guide, check that there is ample room on each side of the filed opening of crankcase.**

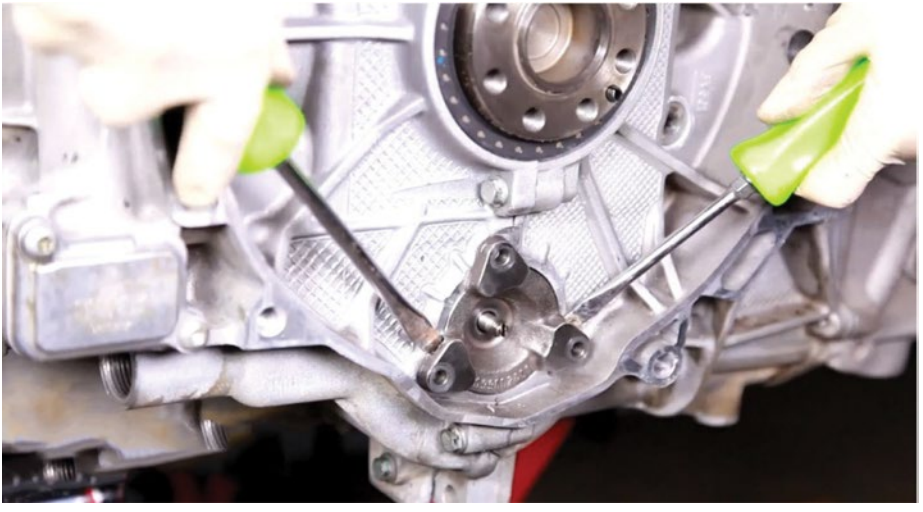
19 Using a flatblade screwdriver and a wrench, remove IMS center stud mounting nut.



20 Next, remove IMS flange mounting fasteners.



21 **Using two flatblade screwdrivers, gently and evenly lever off the IMS bearing flange, then remove from engine.**



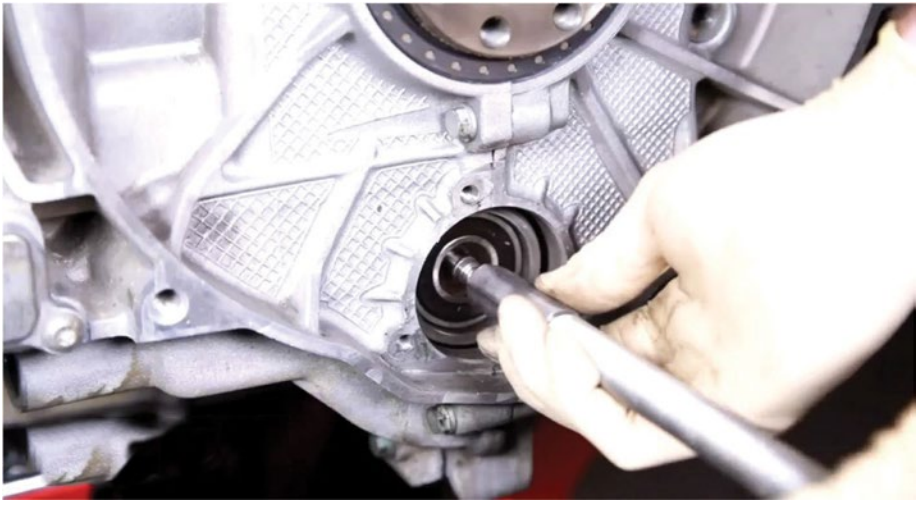
NOTE After removing the IMS flange, if the IMS shaft is not centered in the flange housing bore verify you are at TDC with cams locked. If the cams are out of timing or you have left the chain tensioner fitted under the A/C compressor, you may need to remove it to center the IMS before proceeding further.

22 **Using a pair of snap ring pliers, remove IMS bearing snap ring.**

NOTE **IMPORTANT! The original factory snap ring must be saved for re-installation later.**
Dual row bearings do not have an external snap ring. Be sure to account for and recover the wire lock remnants after extraction.

TIP Placing your finger or a flat blade screwdriver in the center of the snap ring when removing it, will prevent it from falling into the crankcase.

23 Screw the IMS pro tool kit threaded rod on to the IMS bearing flange center stud.



24 Slide puller body of threaded rod. Install puller washer and nut onto puller and lubricate.

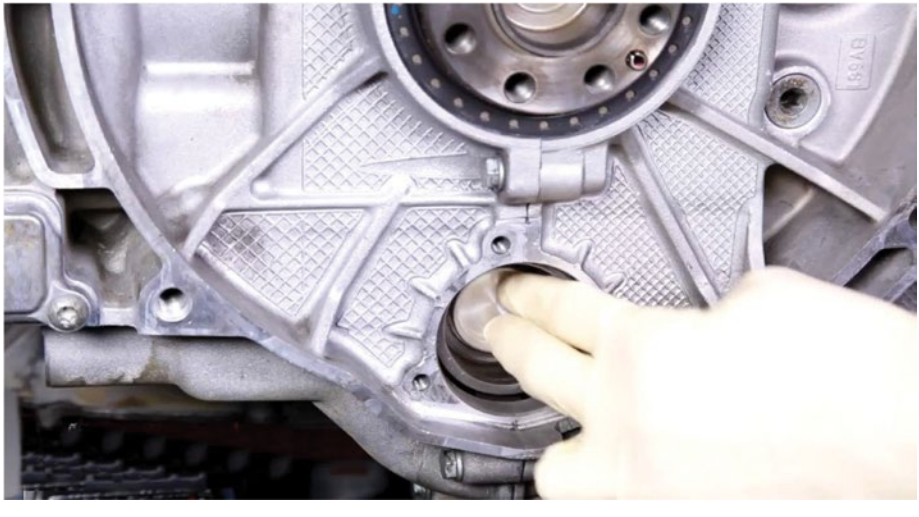
25 Using IMS Pro Tool Kit puller, extract bearing from intermediate shaft.

NOTE Hold threaded rod still while tightening nut on puller to extract bearing from intermediate shaft. Once bearing is extracted, thoroughly clean the inside of the intermediate shaft using a lint-free cloth.

NOTE If the center stud breaks during extraction, use the ez-out tool to remove bearing from center race after knocking the center stud into the IMS tube. It can be extracted later with a telescopic magnet.

TIP Watch for an oil release when the IMS Bearing is extracted.

26 Once clean, install intermediate shaft plug. Place plug into intermediate shaft...



NOTE If using an 06-08 adapter bushing with your IMS Solution, please use the provided IMS plug from the 06-08 adapter kit. **Plug must be installled prior to adapter bushing!**

27 **IMS plug installation tool is designed with collar to set plug to appropriate depth.**

NOTE Plug installation tool is part of the IMS Supplemental Tool Kit.

28 **...then using IMS plug installation tool, drive plug into intermediate shaft until the tool bottoms out. Ensure the plug fits the bore squarely, and tightly.**

NOTE There are variations in the inside diameter of the IMS tube. Although the supplied plug is tapered to fit most shafts, if the plug fits loose in the IMS tube, it is OK to omit the plug.

29 **Next, install the IMS Solution bearing for installation into the intermediate shaft. Place IMS solution bearing onto stud. Then take the bearing installer from the IMS pro tool kit and place it onto bearing.**

NOTE Some drivers will not allow fitting the 12-pt nut. Fitting of nut not necessary.

NOTE Secure into place using a IMS flange nut. Do not over tighten. Finger tighten ONLY.

TIP The Faultless IMS Tool can be used to install the new bearing. If installing the bearing conventionally, placing the bearing in the freezer will make installation easier as the part will contract some when cold.

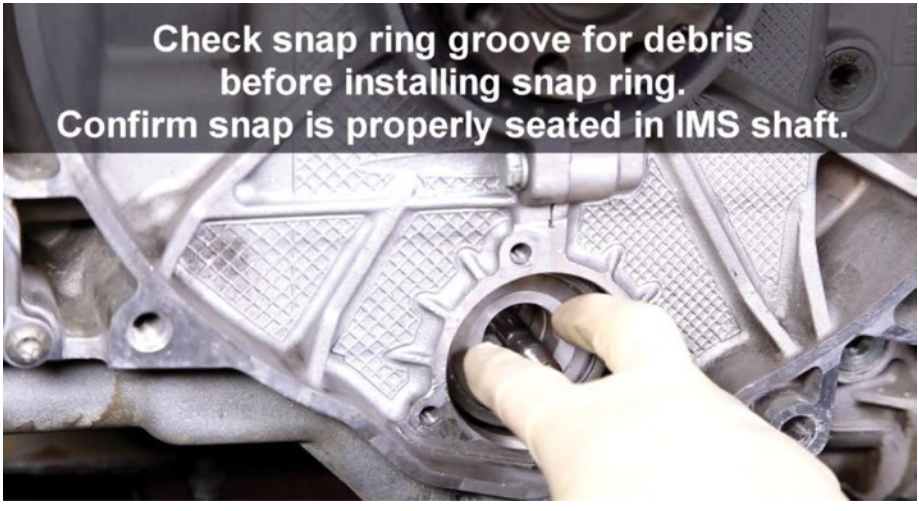
30 **Using supplied assembly lube, lubricate the outside IMS Solution bearing before installing. Align IMS Solution bearing with intermediate shaft.**

NOTE The o-ring located at the bottom of the center stud must remain there. It seals against the snout of the IMS flange. **Do not remove this o-ring.**

31 Then, using a soft face hammer, drive the IMS Solution bearing into the intermediate shaft.

32 Once bearing is fully installed and bottomed out, remove the installation tool from intermediate shaft.

33 **Place protective shim over IMS Solution bearing. With shim in place, install IMS bearing snap ring.**



NOTE

Check snap ring groove for debris before installing snap ring. Confirm snap ring is properly seated In IMS shaft.

NOTE

When instaling the single row IMS Solution, you must re-use the original snap ring.

NOTE

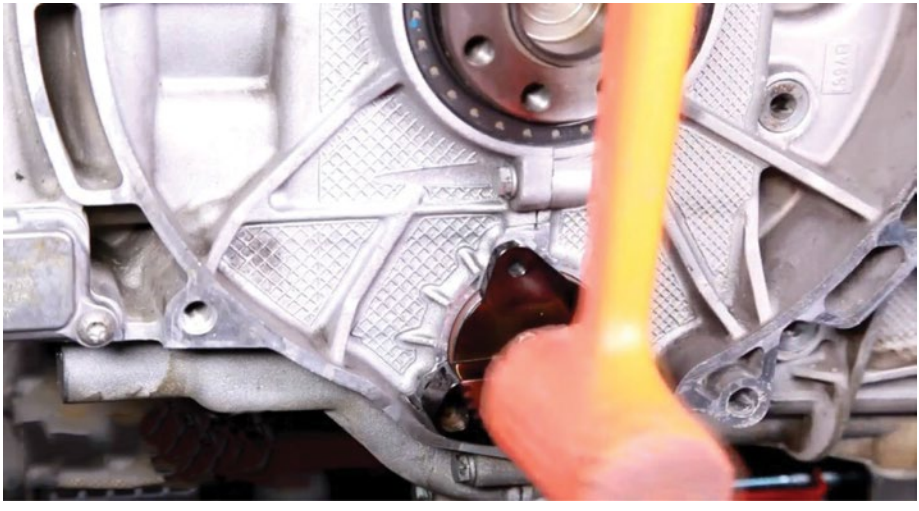
When installing the dual row IMS Solution, use the provided spiro-loc. If you are unfamiliar with how to install a spiro-loc, please refer to the Appendix A for instructions.

34 **Using the provided thread sealant, evenly coat threads of IMS flange oil fitting. This provides a better seal for the fitting and guards against the possibility of the fitting loosening over time.**

35 Next, install oil fitting into IMS Solutions bearing flange and tighten.

36 Using the provided assembly lube, lubricate bearing contact surface on IMS Solution flange.

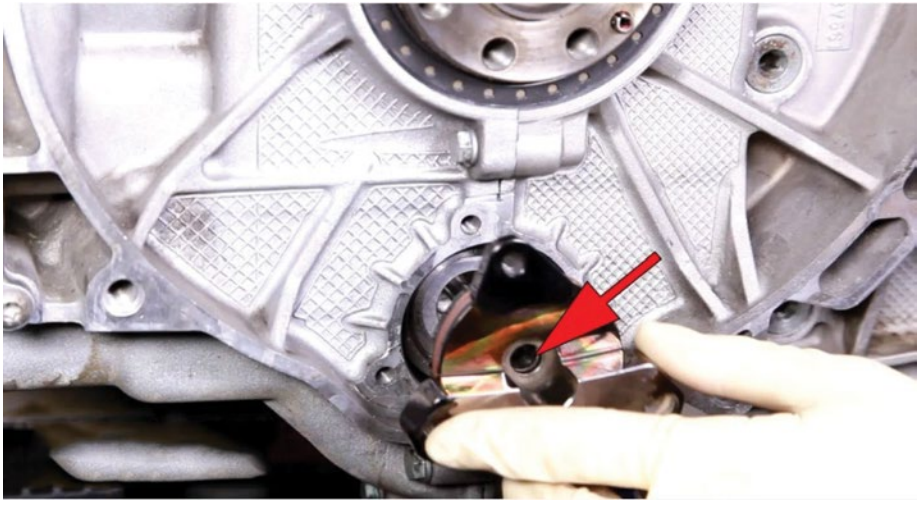
37 **Lubricate IMS Solution flange O ring using supplied assembly lube.**



NOTE

If the IMS housing bore in the block is damaged or the case shows signs of porosity, it is acceptable to use a non-hardening sealant (such as Curil-T) on the IMS flange.

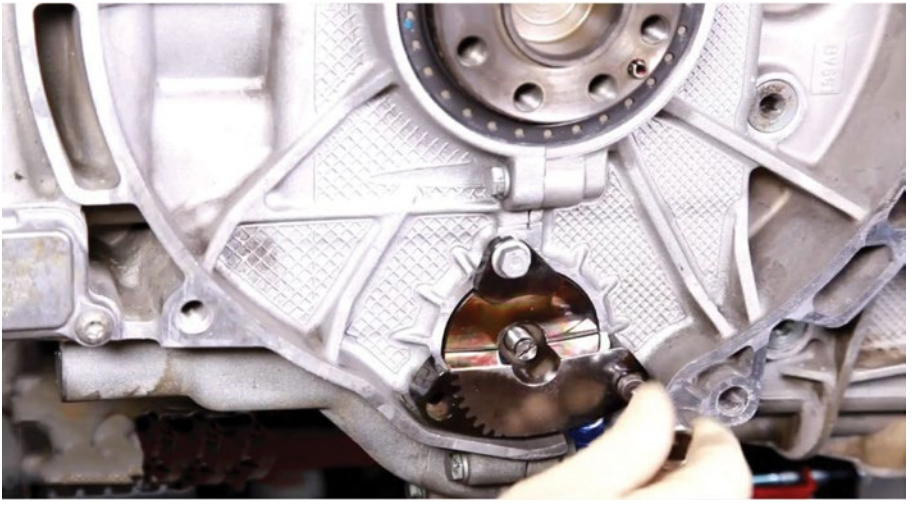
38 **Using assembly lube, lubricate IMS Solution bearing and install IMS solution flange into bearing by hand. Then using a soft face hammer, lightly tap the IMS Solution flange until it is flush with crank case.**



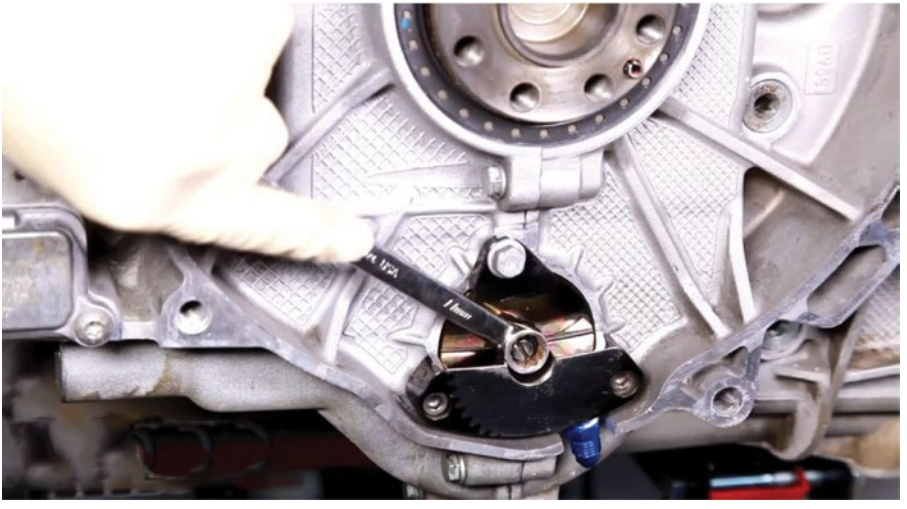
During assembly, ensure the o-ring inside the IMS Solution flange and the seal on the outer diameter of the IMS Solution flange are not cut or pinched.

39 Coat IMS Solution flange fastener with supplied thread sealant.

40 Once IMS Solution flange is flush with crankcase, install IMS Solution flange fasteners finger tight.



41 **Using a wrench and a flat blade screwdriver, install IMS flange center stud nut. Do not torque nut yet.**



42 **Once center stud nut has been a installed finger tight, torque IMS flange bolts. Once the IMS flange bolts have been torqued, torque the IMS flange center nut.**

NOTE

IMS flange fastener torque: 10Nm(7ft-lb)

NOTE

Center IMS flange nut torque must be at least 12 ft/ lb, but not to exceed 20 ft/lb. Loctite can be used on the threads of the 12 pt nut. Blue or green wicking Loctite can be used.

43 **Lubricate the o-ring on IMS Solution's spin-on oil fillter adapter using clean engine oil.**

44 **Once the o-ring has been lubricated with clean engine oil, install IMS Solution oil filter adapter into engine. Hand tighten oil filter adapter. Then, torque oil filter adapter.**

NOTE

Spin-on Oil Filter Adapter must be installed using SPOFA spanner wrench, which is part of the IMS Supplemental Tool Kit.

Spin-on oil filter torque: 24Nm(18ft-lb)

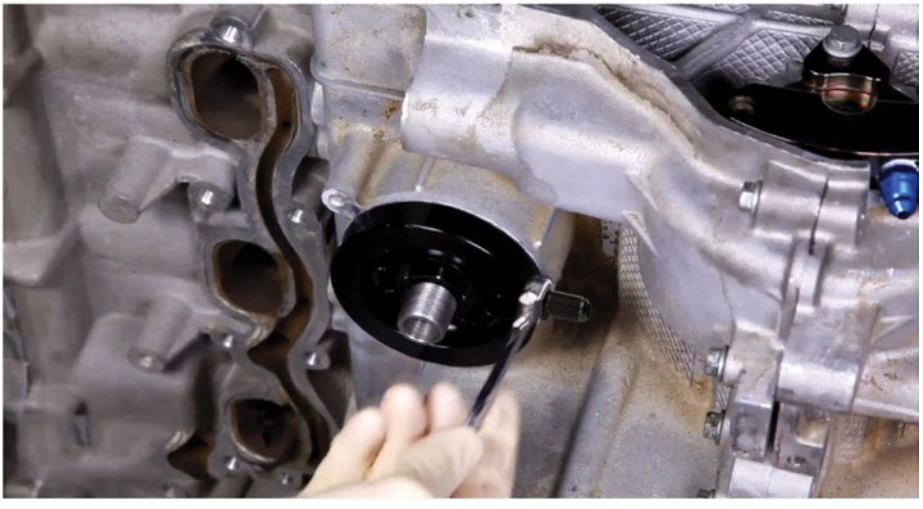
IMPORTANT

NOTE

In some rare cases the factory did not clock the threads for the oil filter housing properly. If you are working with one of these crankcases, the spin on filter adaptor will tighten in a position that will not allow the oil fitting to be installed into the filter adaptor. The fitting will impact the crankcase and will not have an orientation as pictured in step 45 on the next page. This is a rare instance, however it occurred enough for our team to develop a special shim and include it with all IMS Solution kits.

Only fit the IMS Solution Spin On Filter Adaptor shim, IF your particular engine indexes the oil fitting in a position where it is required.

45 **Using supplied thread sealant, coat threads on oil filter adapter oil fitting (black fitting with o-ring). Install fitting into IMS Solution oil filter adapter and tighten.**



46 **In the next steps, you will fit the IMS Solution oil feed hose to the Spin On Filter Adaptor, and the IMS Solution Flange. The completed hose assembly should appear like the photo below.**

NOTE

IMPORTANT: It is critical that the oil feed line does not bind, rub or interfere. Although the line is fitted with a protective sleeve, chafe guard (not supplied) should be used to protect the oil line from rubbing or making contact with other surfaces.

47 **Install steel braided hose onto IMS flange finger tight. Then, install onto IMS Solution spin-on oil filter adapter finger tight. Next, tighten both ends of steel hose fittings. Thread sealant is optional, but recommended on these surfaces.**

NOTE

Thoroughly clean the inside of steel braided hose before installing.

48 **Install supplied oil filter onto IMS Solution oil filter adapter.**
Do not pre-fill filter with oil before installing.

NOTE

NAPA Gold 1348 or WIX 51348 filters are recommended for use with the IMS Solution.

TIP

In track vehicles with the BRS 2 quart deep sump, NAPA Gold 1068 or WIX 51068 filters can be used for extra capacity.

INSTALLATION

COMPLETE

Installation is now complete. Once the engine is reassembled and other components have been reinstalled, start engine and run until oil light is no longer illuminated.

TIP

Quickly starting and shutting off the engine 4-5 times will help to achieve oil pressure faster. Repeat this step two additional times. Check and top up engine oil as needed.

TIP

Do not pull the DME or Fuel Pump relays in hope of achieving oil pressure without the engine starting, the M96 engine will seldom achieve oil pressure in this manner.

NOTE

IMS Solution is designed for 5,000 miles / 6 months oil change intervals. Joe Gibbs Racing DRIVEN DT40 motor oil is recommended. DRIVEN XP9 is required for track use.

IT IS IMPORTANT TO READ AND UNDERSTAND CRITICAL POST PROCEDURE NOTES.
PLEASE SEE NEXT PAGE.

CRITICAL

POST PROCEDURE NOTES

NEVER, UNDER ANY CIRCUMSTANCE, RETROFIT AN ENGINE THAT HAS SUFFERED AN IMS BEARING FAILURE!

- **ALWAYS** use the eleven step IMS Retrofit Pre- Procedure checklist when qualifying any vehicle for an IMS Retrofit.
- **ALWAYS** perform an oil service when carrying out any IMS Retrofit procedure. Never reuse old oil, no matter how clean you believe it may be.
- When sealing up crankcase sump plates, following the pre- procedure inspection, use a nominal amount of sealant. Liberal amounts of sealant will mix into the oil and find their way to the oil pick up tube, blocking oil flow, and killing the engine.
- After initial start up of the engine that has been retrofitted, check all flange surfaces, and oil lines for signs of oil leakage.
- With the vehicle back on the ground completely, check the IMS Solution oil feed line for contact with all its surroundings, especially the rear sway bar.
- Extreme caution must be given to vehicles with aftermarket rear sway bars. These are larger in outside diameter and therefore are more probable to have conflicts with the IMS Solution oil feed line.
- Use common sense, take your time, and pay attention! You can't rush success, but you can rush failure!
- Follow the registration directives provided with your kit to activate your warranty.
- IMS Solution LLC strongly recommends using a magnetic oil drain plug in all IMS Solution / Retrofit equipped engines. Visit LNengineering.com for more info.

IMS SOLUTION

The only Intermediate Shaft Bearing solution protected by three US Patents.

Patent No. US 8,992,089 B2

Jacob Dean Raby

INVENTOR

UNITED STATES PATENT

The Commissioner of Patents and Trademarks has received an application for a new and useful invention. The requirements of law have been complied with, and it has been determined that a patent on the invention, known as

LAYSHAFT END BEARING RETROFIT WITH EXTERNAL POSITIVE OIL PRESSURE DELIVERY

shall be granted under the laws of the United States of America. Therefore, this United States Patent grants to the person or persons having title to this patent the right to exclude others from making, using, or selling the invention throughout the United States of America for the term of the patent.

March 31, 2015
Date of Issue

Michelle K. Lee
Director of the USPTO

APPENDIX A

SPIRO-LOC INSTALLATION

The spiro-loc is a thin clip that is shaped like a spring. It is known for its excellent wrist pin retention ability.

First you should gently pull apart the spiro-loc, resembling a coil. This will allow you to easily "walk" the lock in to the groove. Start a leading edge of the spiro-loc at one of two places, 8 o'clock or 2 o'clock, then using a flathead mini screwdriver push the lock down into the groove and "walk" the lock around the hole until the entire lock is installed. See fig. 1, 2, 3 and 4.

Make sure the lock is sitting flat and bottomed out against the inside edge of the lock groove. Next repeat the same procedure but start on the opposite side of where you started before. Walk the lock around again making sure it is securely locked into place. Please use caution and make sure the lock is flush all the way around. Sometimes the lock is damaged during installation or debris gets into the grove and the lock does not properly seat, leading to engine failure. It is very important to check all locks once they have been installed and once again a final time when the engine is being assembled.

1.

2.

3.

4.

Warning: do not overstretch spiro-locs! Do not reuse spiro-locs!

APPENDIX B

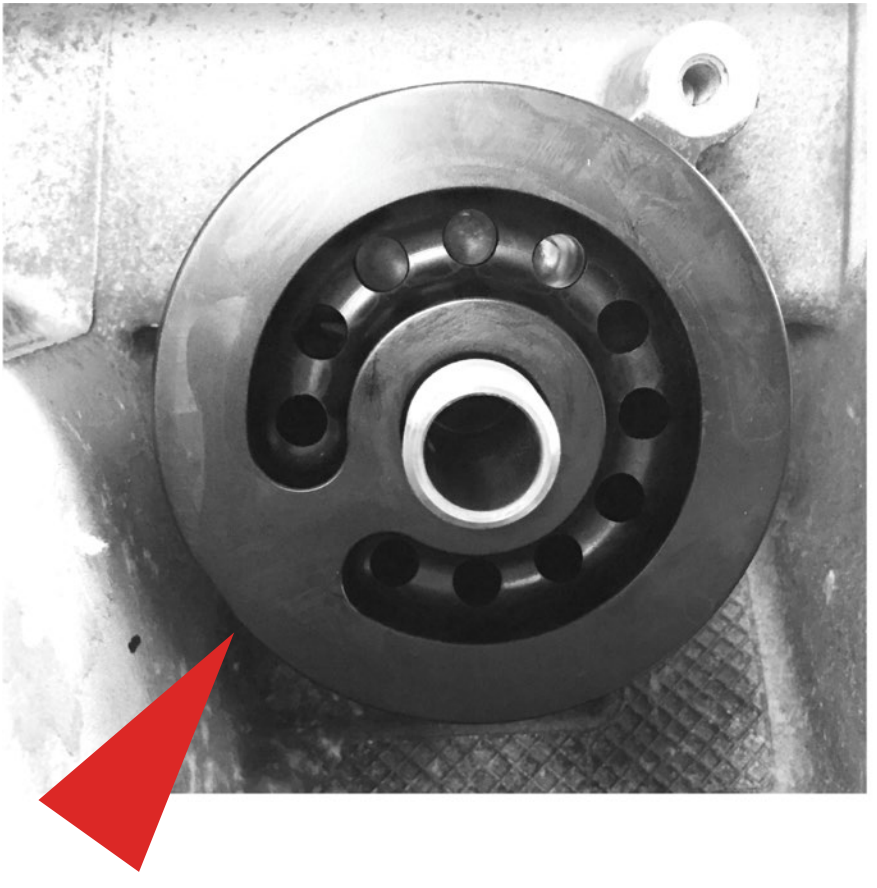
POSITIONING OF THE OIL PORT

TECHNICAL SERVICE BULLETIN 05-16

Subject: **Positioning of oil port during installation of Spin-on Oil Filter Adapter**

Applies to: **Single Row IMS Solution, Dual Row IMS Solution**

PROBLEM: Depending on how the engine block was machined, proper positioning of the the filter adapter's side oil port (for the oil feed line) may not be possible.

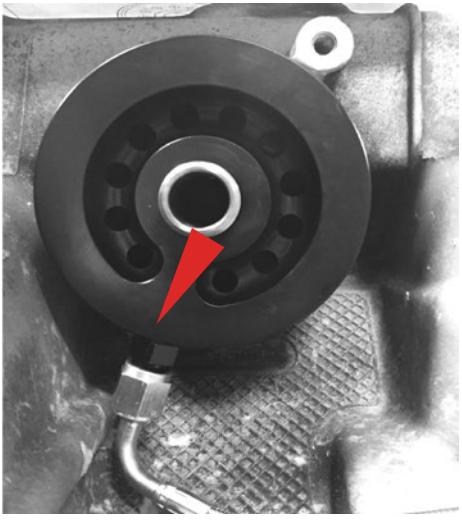


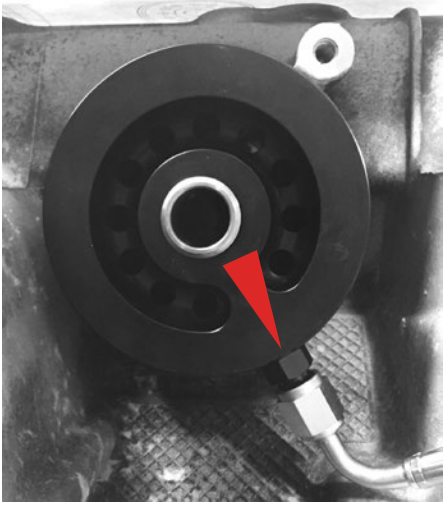
WRONG! Improper position of the oil port will not allow for oil feed line installation.

APPENDIX B

POSITIONING OF THE OIL PORT

SOLUTION: **Use a shim to correct the position of side oil port and allow for installation of the oil feed line. Most common shim is included in your IMS Solution kit, however, if a thicker shim is required, use this bulletin to determine the required thickness and contact LN Engineering. The shim will be provided free of charge.**



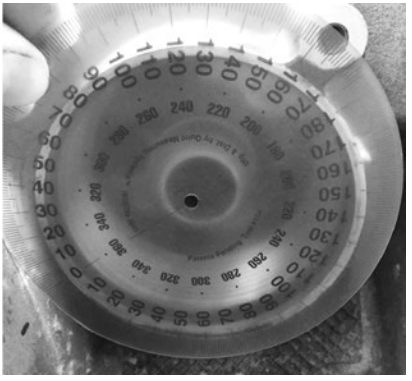


Any position between far left and far right shown here is correct for clocking the filter adapter.

APPENDIX B

POSITIONING OF THE OIL PORT

STEP 1: Use a degree wheel to determine how many degrees the adapter needs to be re-clocked. You can cut out and use the degree wheel attached here.



STEP 2: Using the table below determine the required thickness of the shim. Contact LN Engineering LLC to receive your shim free of charge.

Required rotation	Shim thickness (inch)
30 deg	.010
60 deg	.020
90 deg	.030
120 deg	.040
150 deg	.050

LN Engineering LLC
125 Gladiolus St, Momence, IL 60954
Phone: 815-472-2939
email: support@lnengineering.com

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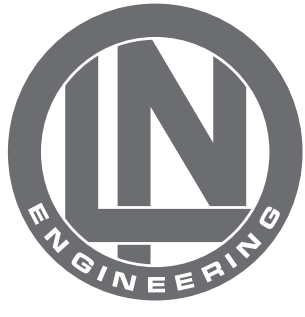

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