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Sequence VIE Information Letter 17-4
Sequence Number 4
December 15, 2017

ASTM consensus has not been obtained on this information letter. An appropriate ASTM ballot will be issued in order to achieve such consensus.

TO: Sequence VI Surveillance Panel

SUBJECT:
1. Statement Regarding Modifications to the Engine
2. Omission of Section 11.6.5.1
3. Correction to Annex A5.6
4. Revised Annex A17
5. Reuse of Fixed Cam Phasers
6. Editorial Correction to Section 9.4.4

1. During the November 16, 2017 Surveillance Panel Meeting the panel agreed that no modifications to the engine were to be performed unless authorized by the Surveillance Panel. Section 6.2 has been revised to include this statement.
2. During the November 16, 2017 Panel Meeting, the panel was informed that section 11.6.5.1 from D7589, the Sequence VID procedure, was inadvertently omitted from the VIE procedure. Section 11.6.5.1 has been added to the test method D8114 at the panel's direction.
3. Also, the panel was made aware of a mislabeling in Annex A5.6. The valve marked as 150F should be labelled 150E. Figure A5.6 has been corrected.
4. During the same meeting the panel agreed to replace the current Annex A17 with an updated Annex which includes the instructions on how to assemble the GM Short block engines for use. Table of Contents for Annex A17 has also been revised and EF-411 has been added to Section 7.
5. Finally, during the November 16, 2017 meeting, the panel agreed to allow the reuse of the cam timing fixed phasers. Section 9.4.20 has been revised to show that these phasers can be reused for as long as they remain serviceable and to reference the GM part number for these phasers.
6. Section 9.4.4 of the test method, incorrectly referenced Annex A3 instead of the correct Annex A7.

The test method has been revised to incorporate these changes. The text of the revisions is shown in the attachment. These changes are effective with the issuance of this letter.

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Attachment

c: http://www.astmtmc.cmu.edu/ftp/docs/gas/sequencevi/procedure_and_ils/VIE/il17-4.pdf
Distribution: Email

Revises D8114-17 as amended by Information Letter 17-3

Table of Contents - Revise A17 title tobe:

Non-Phased Cam Gear and Position Actuator Installation and GM Short Block Assembly Procedure Annex A17

6.2 *Test Engine Configuration*—The test engine is a specially built General Motors (GM) 3.6 L (LY7) engine (see X1.3). Mount the engine on the test stand so that the flywheel friction face is 3.0° ± 0.5° from the vertical with the front of the engine higher than the rear. The driveshaft angle shall be 1.5° ± 0.5° from engine to dynamometer. The driveshaft angle shall be 0° ± 0.5° in the horizontal plane. Do not alter, modify or rework any components of the engine unless authorized by the Sequence VI surveillance panel.

7.5 *Engine Assembly Lubricant*—Use EF-411 for coating of parts and where lubrication of threads, etc. is required.

9.4.4 New parts required for each new test stand installation (see X1.3) are listed in Annex A7.

9.4.20 *Non-Phased Camshaft Gears*—These gears (OHT6E-002-1 gear or GM 12640985, camshaft, exhaust & OHT6E-003-1 gear or GM part Number 12640986, camshaft, intake) will need to be installed by the end user prior to running the new engine break-in; they will be supplied with the engine when purchased. Install these gears in accordance with the instructions detailed in Annex A17. These gears may be used as long as they remain serviceable.

11.6.5.1 During the BSFC measurement cycle of a test, a stage restart may be conducted for any stage provided the average of any critical parameter, as detailed in Table 3, is projected to be out of the specified range for that stage, and provided the sixth reading of that stage has not been completed. If the sixth reading of any stage is completed, do not conduct a stage restart for that stage. Additionally, if the sixth reading of any stage is completed and a critical parameter average is out of the specified range for that stage, the test is considered invalid. Only one stage restart per stage as shown in Table 5 and no more that 4 stage restarts within a test are allowed. Document each stage restart in the comments section.

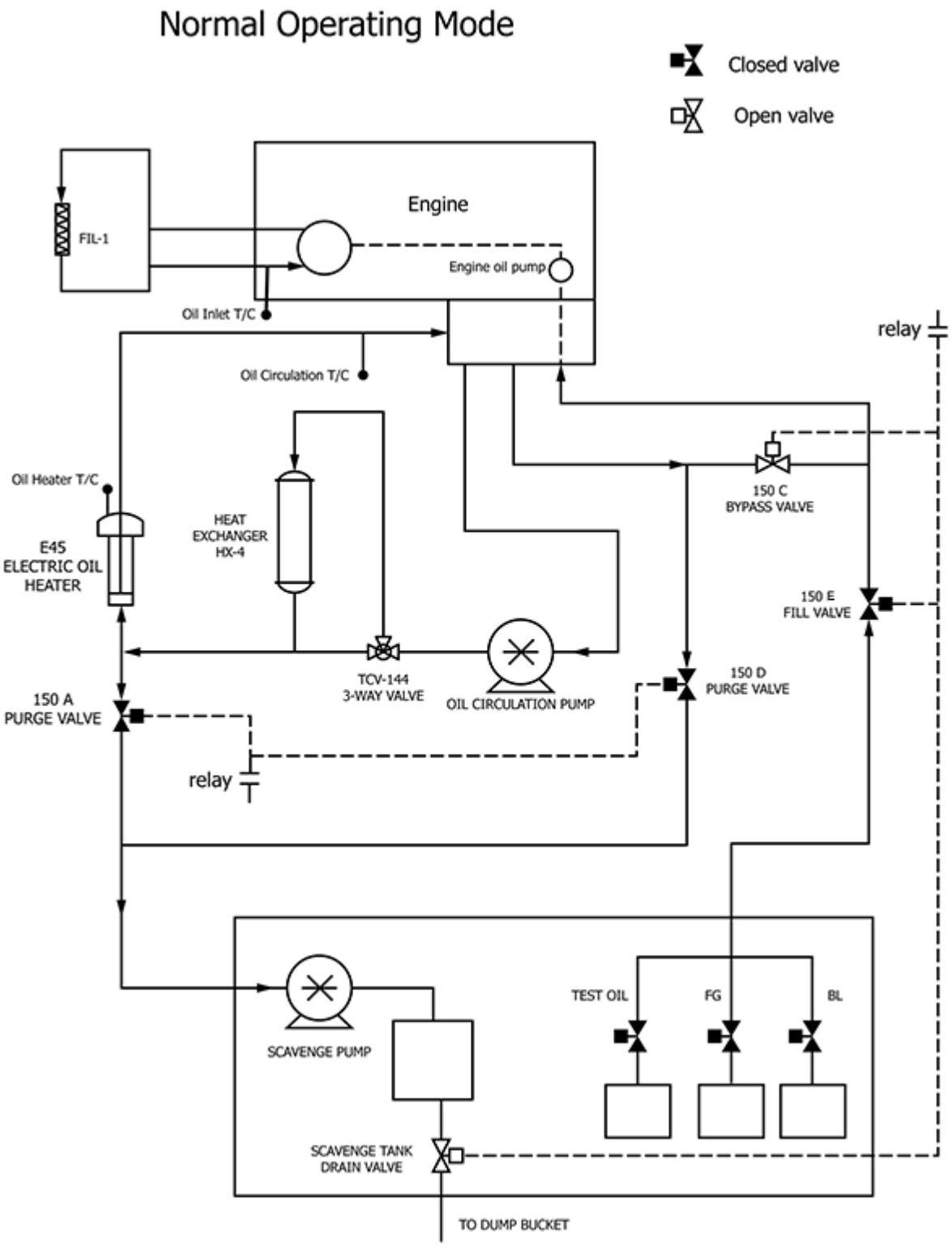


FIG. A5.6 External Oil System

A17. NON-PHASED CAM GEAR AND POSITION ACTUATOR INSTALLATION AND GM SHORT BLOCK ASSEMBLY PROCEDURE

Refer to 2012 Malibu Assembly Manual for additional details.

A17.1 Cleaning Procedure for the Head Assemblies

A17.1.1 Remove parts from package. Table A17.1 lists the kit components

A17.1.2 Spray parts with solvent, soak for 15 min to 30 min and repeat spray with solvent. Repeat this process as necessary until Corrosion Protective Coating (CPC) is removed from the parts. Two iterations of the process have been found to be sufficient.

A17.1.3 Spray parts with 50/50 mix of solvent and EF411, followed by air dry using clean dry compressed shop air to remove excess 50/50 solvent mixture. Clean off excess oil with paper towels.

A17.1.4 Inspect for damage and ensure acceptable level of CPC removed.

A17.2 Cleaning Procedure for the Short Block

A17.2.1 Remove engine short block from shipping container.

A17.2.2 Position the block such that the cylinder bores are facing downwards. Positioning the short block will reduce the potential for dissolved CPC penetrating the short block.

A17.2.3After air dry, wipe cylinder walls with EF411 while rotating engine to cover all wall area.

A17.2.4 Clean off excess oil with paper towels.

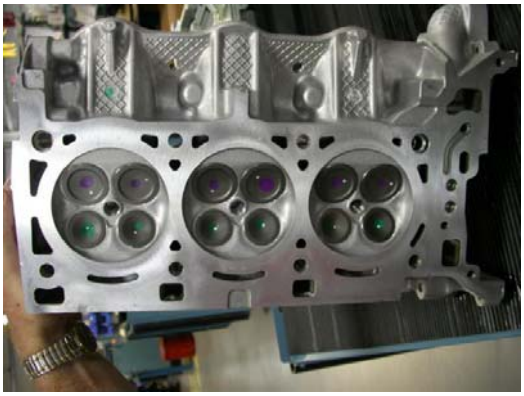
A17.3 Cylinder Head Installation/Camshaft Positioning

(WARNING- This engine is NOT free a free spin engine. The camshafts must be properly positioned in the cylinder heads prior to installation. Using a large open end wrench on the hex cast into the camshaft behind the number one journal, position the camshafts so the flat on the back of each camshaft is parallel to the gasket seating surface for the cylinder head rocker cover. See Fig A17.1)

Fig A17.1 Cam Positioning

Insure all four camshafts are positioned with flats parallel to rocker cover sealing surface.

(WARNING- Safety Hazard. Do not use the Cam Gear to position cams as the valve spring pressure may cause the cam to rotate after positioning and the leading edges of the cam gears are very sharp. As an added measure of protection, rotate the crankshaft so there are no pistons at Top Dead Center (TDC) during cylinder head installation)



Positioning the flats parallel, assures the cam lobes are all on a portion of the base circle and the engine will thereby be a free spin so you can rotate the crankshaft without the pistons hitting the valves. See Fig A17.2

Fig A17.2 Cylinder Head with Cams in Proper Orientation

A17.3.1 Right Cylinder Head Installation

A17.3.1.1 Clean the mating surfaces of the engine block, cylinder head and fastener bosses. DO NOT allow oil on the cylinder head bolt bosses.

A17.3.1.2 Insert dowel pin PN 12570326 in left and right side of block to align gaskets and install a NEW right cylinder head gasket using the deck face locating pins for retention, applying silicone to front part of gasket where timing cover will mate. See Fig A17.3

A17.3.1.3 Place the right cylinder head in position on the deck face.

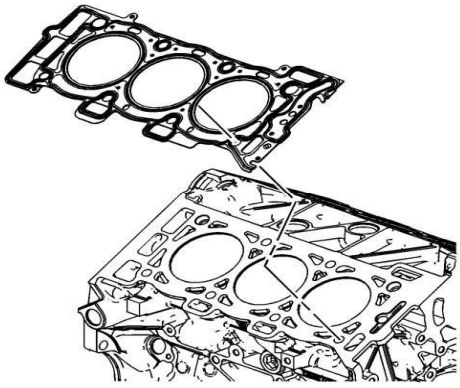


Fig A17.3 Head Gasket and Dowel Pin Installation

A17.3.1.4 Install new M11 cylinder head bolts. Tighten the first pass in sequence to 30 N·m. Tighten the second pass in sequence an additional 150º.

A17.3.1.5 Install new M8 bolts. Torque to 15 N·m. then tighten the second pass an additional 75º. See Fig A17.4.

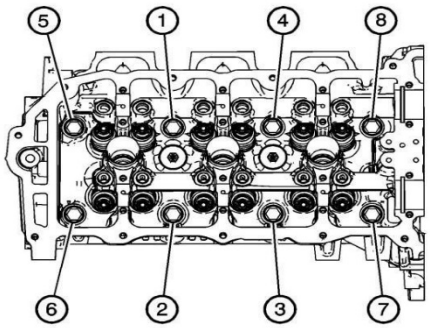


Fig A17.4 Torqueing Sequence for Right Side Cylinder Head

A17.3.2 Cylinder Head Installation-Left Side

A17.3.2.1 Clean the mating surfaces of the engine block, cylinder head and fastener bosses. Do not allow oil on the cylinder head bolt bosses.

A17.3.2.2 Install a NEW left cylinder head gasket using the deck face locating pins for retention, applying silicone to front part of gasket where timing cover will mate. See Fig A17.5

A17.3.2.3 Place the left cylinder head in position on the deck face.

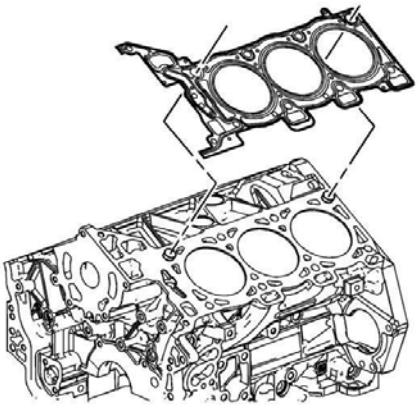


Fig A17.5 Head Gasket and Dowel Pin Installation

A17.3.2.4 Install new M11 cylinder head bolts. Tighten the first pass in sequence to 30 N·m. Tighten the second pass in sequence an additional 150º.

A17.3.2.5 Install new M8 bolts. Torque to 15 N·m. then tighten the second pass an additional 75º. See Fig A17.6. Assign an engine number and write on the back of each head with paint marker.

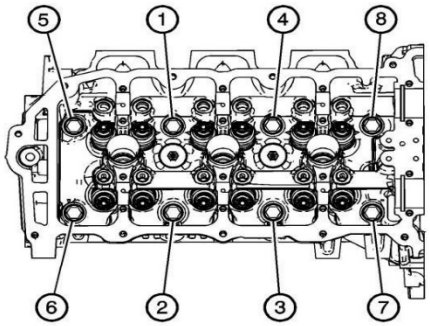


Fig A17.6 Torqueing Sequence for Left Cylinder Head

A17.4 NON-PHASED CAM GEAR AND POSITION ACTUATOR INSTALLATION PROCEDURE

A17.4.1 Ensure all four camshafts are positioned with flats parallel to rocker cover sealing surface. Positioning the flats parallel assures that the cam lobes are all on a portion of the base circle and the engine will thereby be a free spin so you can rotate the crankshaft without the pistons hitting the valves (see Fig. A17.7).

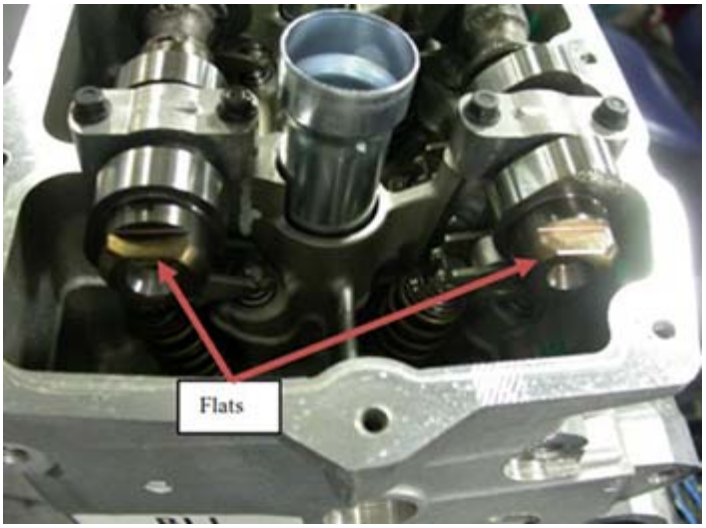


FIG. A17.7 Locating Camshaft "Flats"

A17.4.2 Install all four camshaft sprockets, that is, intakes on the inboard cams and exhausts on the outboard camshafts (see Fig. A17.8).

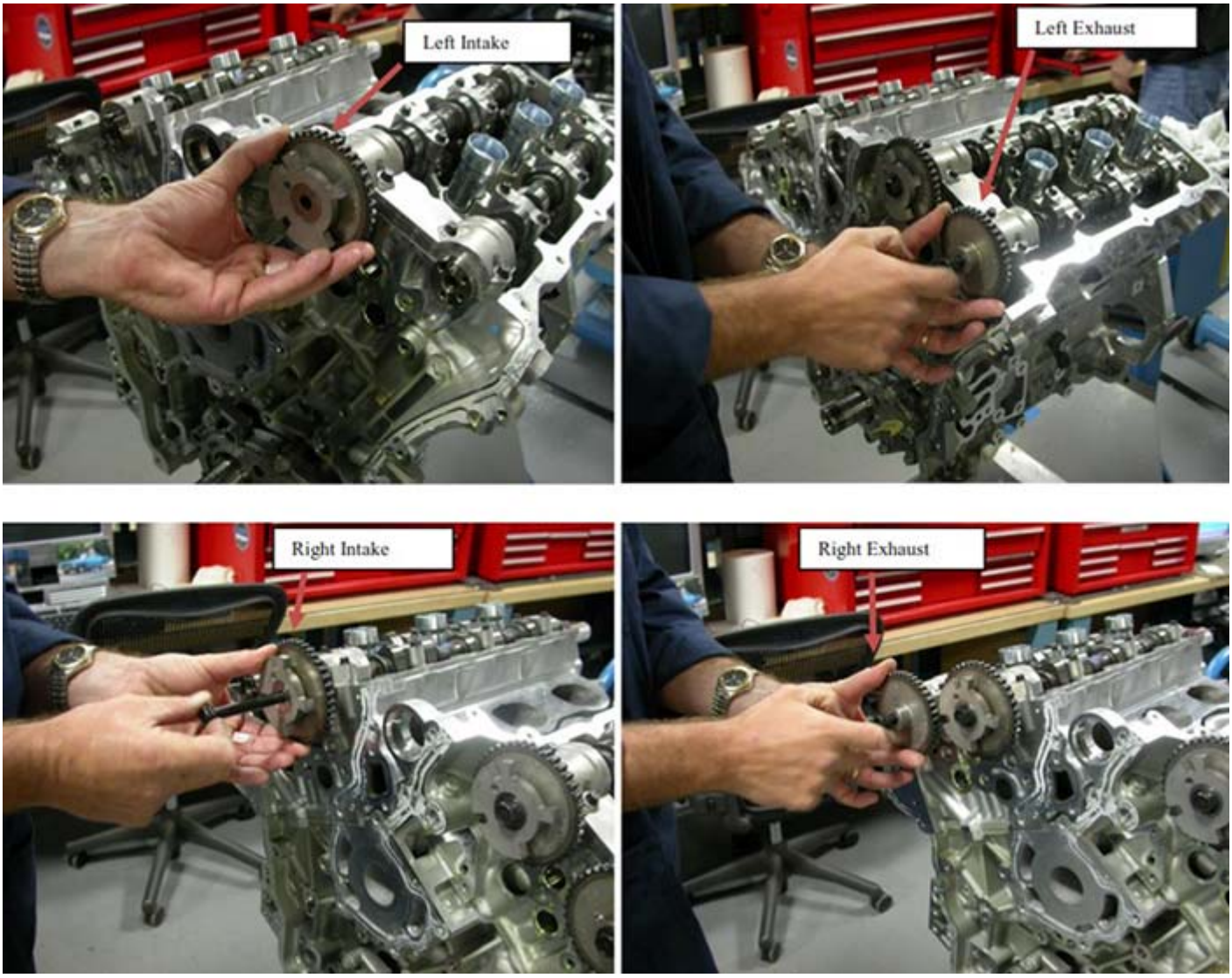


FIG. A17.8 Camshaft Sprocket Installation

A17.4.3 After installation of left side gears, torque all four fasteners to 58 N·m ± 7 N·m, holding camshafts on hex with open end wrench (see Fig. A17.9).

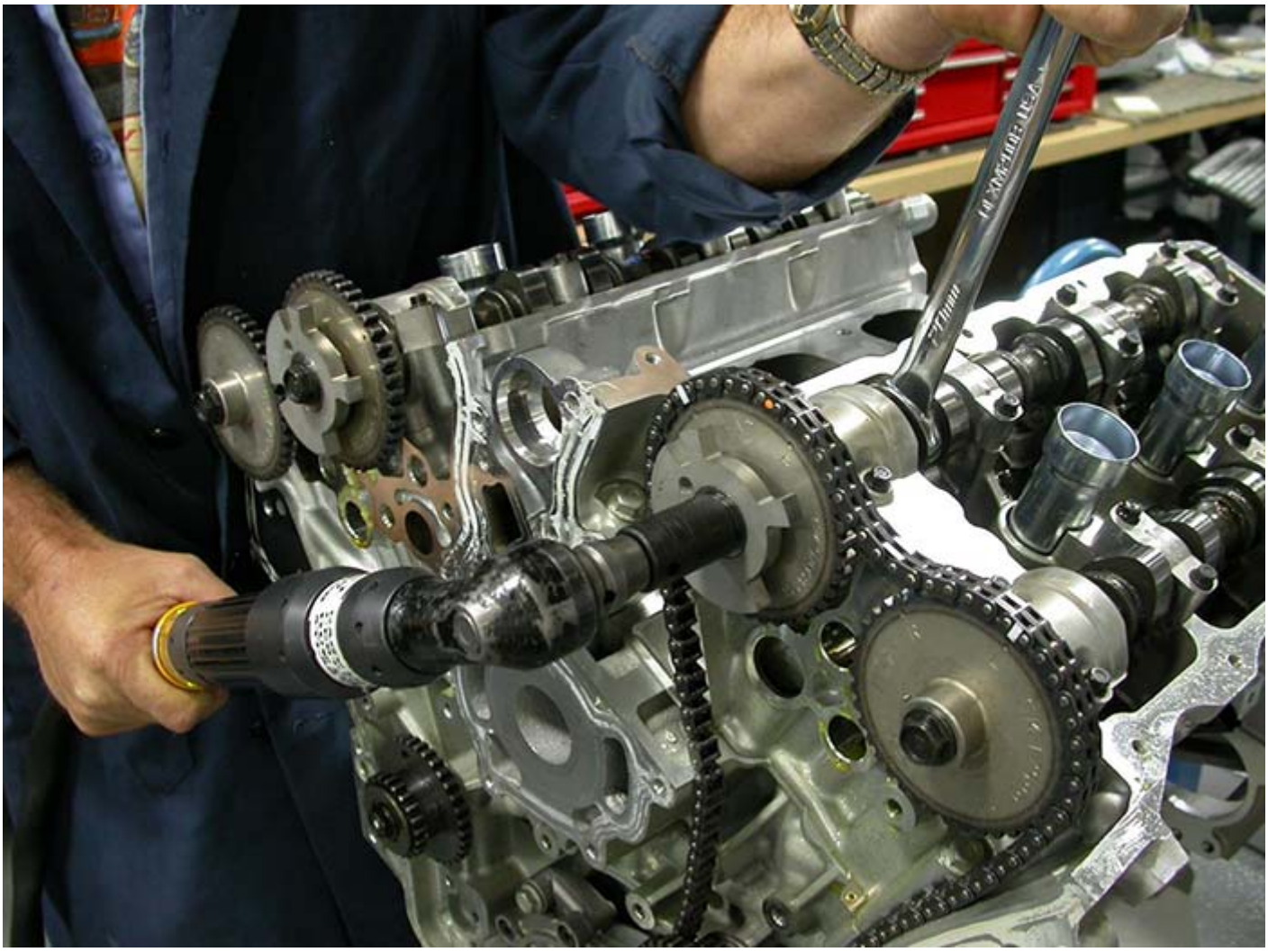


FIG. A17.9 Torquing Camshaft Sprocket Fasteners

A17.4.4 Install left chain assembly with left side idler gear (do not remove grenade pin), aligning white marks on chain with dots on camshaft gears identified as “L” Intake and “L” Exhaust on camshaft gears. Torque left side idler gear to 58 N·m ± 7 N·m (see Fig. A17.10).

FIG. A17.10 Alignment of Timing Marks, Left Side, with Grenade Pin Installed

A17.4.5 Install left side chain guides, left side tensioner and gasket. Torque tensioner and chain guide fasteners to 23 N·m ± 3 N·m (see Fig. A17.11).

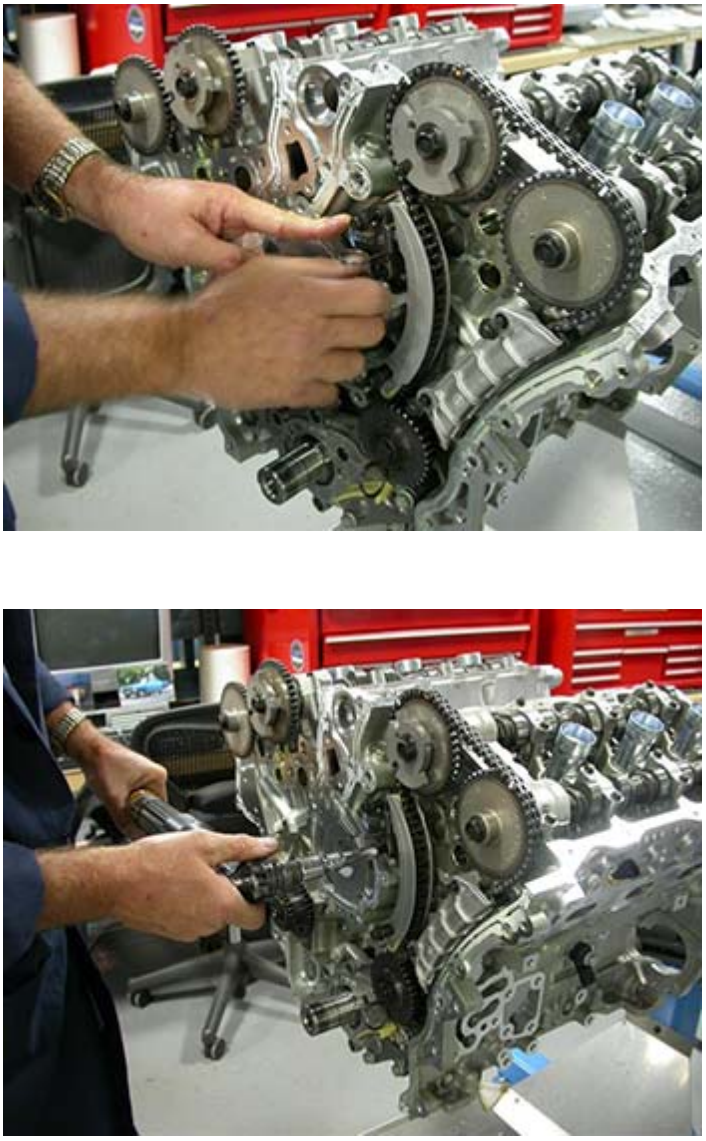


FIG. A17.11 Installation of Chain Guide, Tensioner and Gasket, Left Side

A17.4.6 Install right side idler gear and torque to 58 N·m ± 7 N·m, and verify the left side idler gear still has grenade pin holding chain assembly in proper position (see Fig. A17.12).

FIG. A17.12 Installation of Right Side Idler Gear

A17.4.7 Install crankshaft gear and align dot for left side chain alignment (see Fig. A17.13).

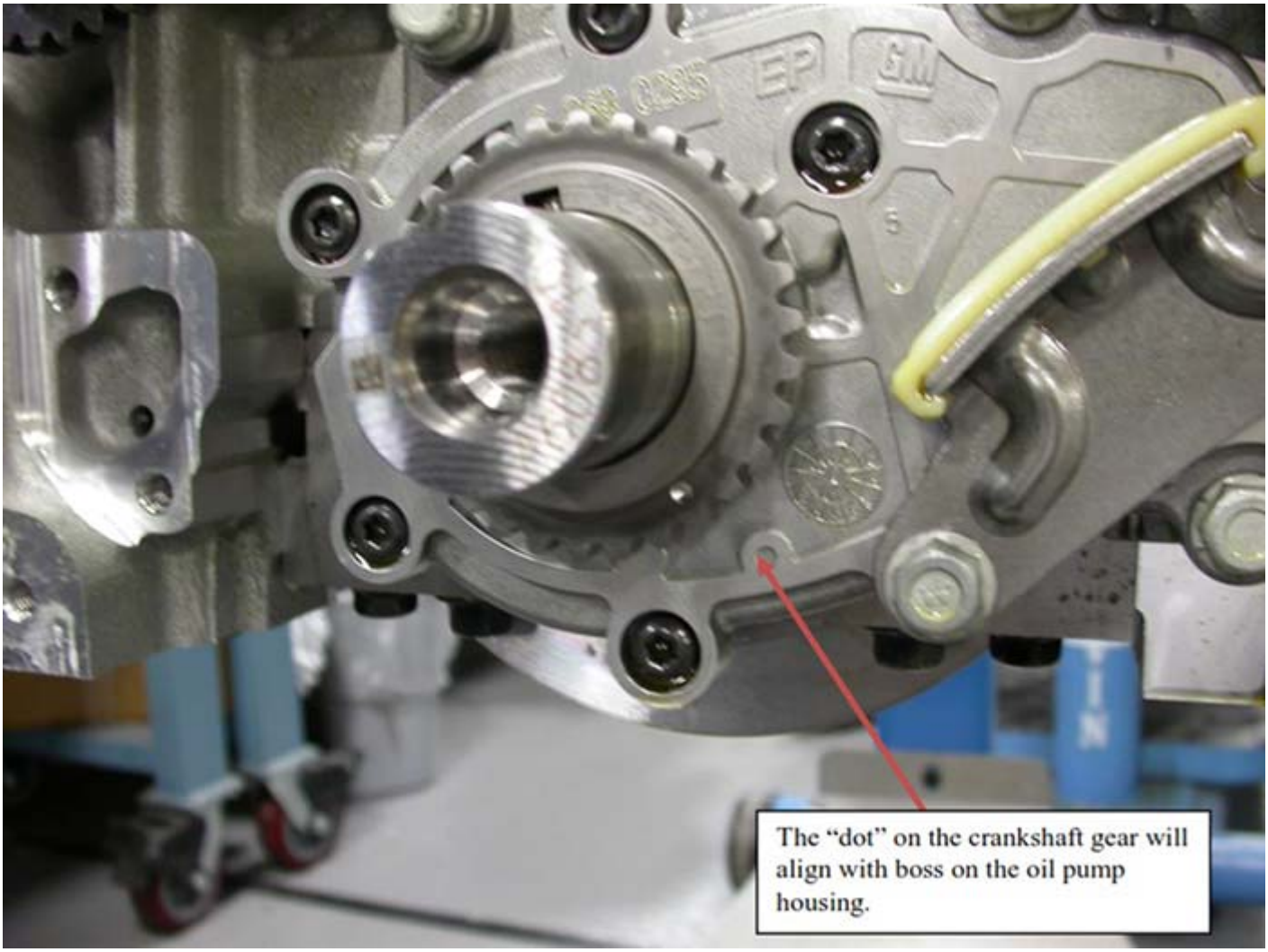


FIG. A17.13 View Showing Installation and Alignment Marks

A17.4.8 Install primary chain assembly over left, right idlers and crankshaft gears with white identification marks aligned with marks on all three gears (see Fig. A17.14).

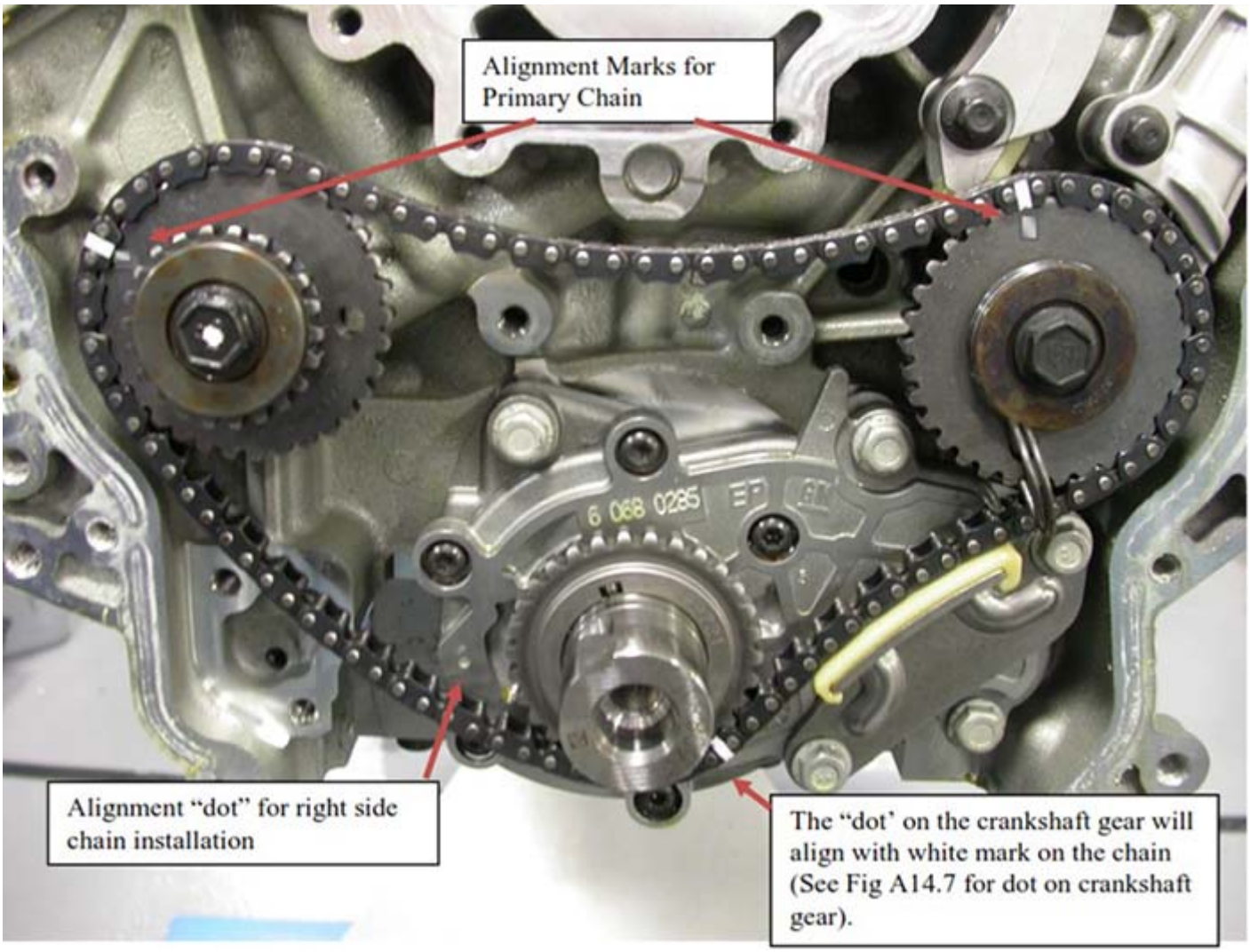


FIG. A17.14 Primary Chain Alignment Marks

A17.4.9 Install primary chain guides, primary chain tensioner and gasket. Torque tensioner and guide fasteners to (23 ± 3) N·m. Torque right side idler gear to (58 ± 7) N·m (see Fig. A17.15).

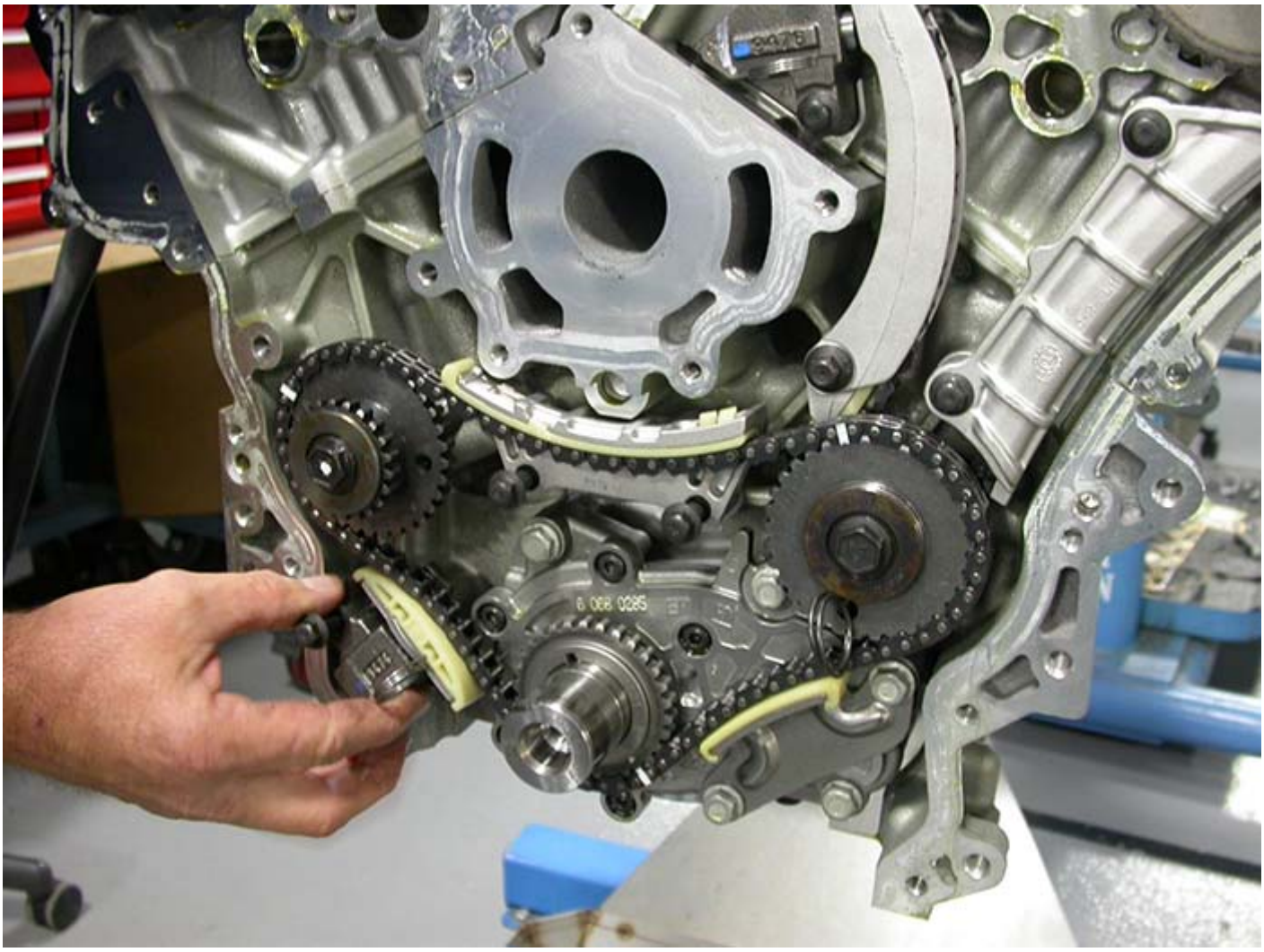
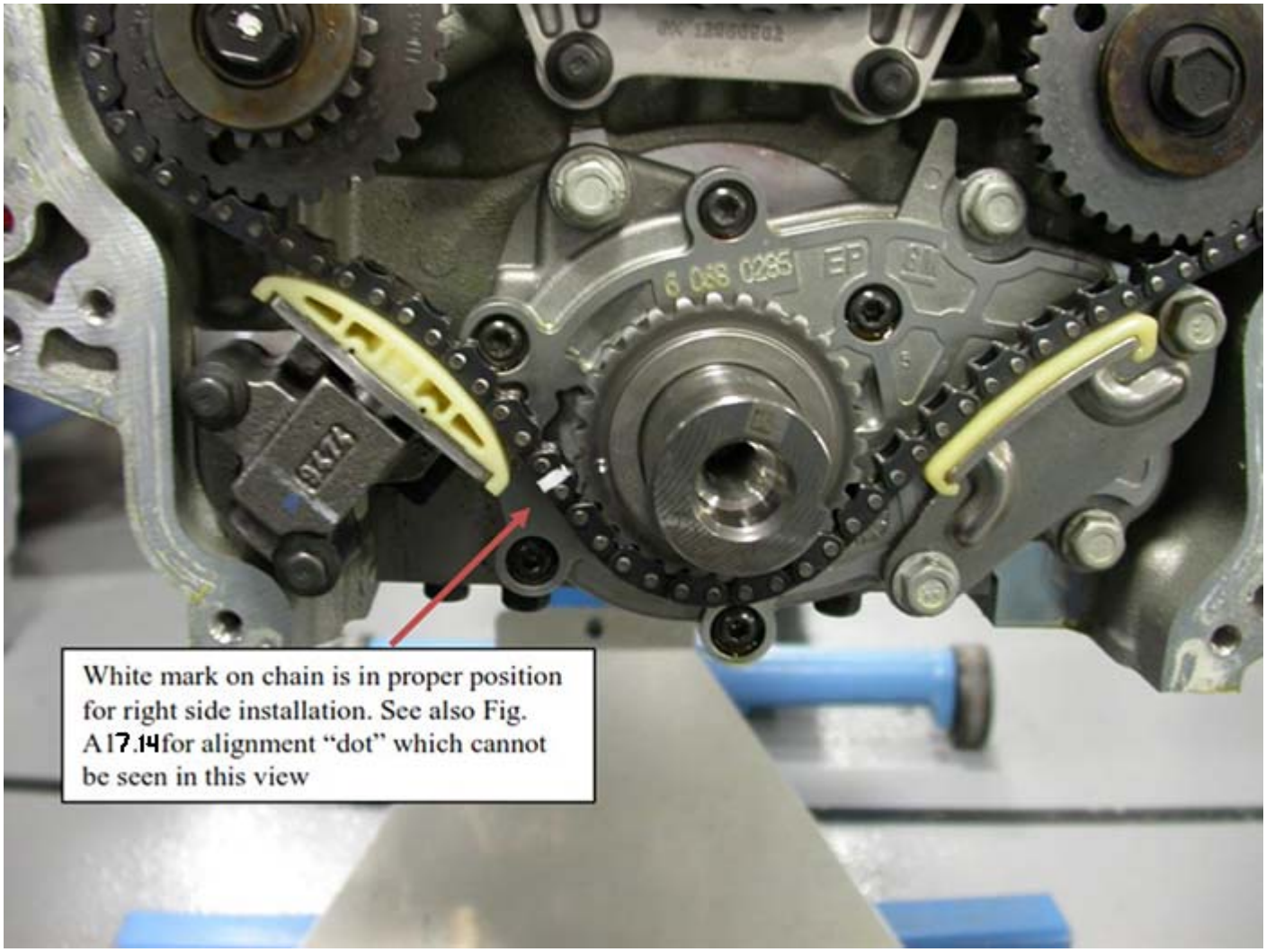


FIG. A17.15 View Showing Installation of Primary Chain Tensioner and Guides



A17.4.10 Remove grenade pin from left side idler and rotate crankshaft to right side alignment marks. Verify the dot on crankshaft gear aligns with the mark on timing chain and boss on oil pump housing (see Fig. A17.14 and Fig. A17.16).

FIG. A17.16 View Showing Timing Proper Alignment

A17.4.11 Observe the hole in right side idler gear as shown by pen and align right side chain over idler with white link positioned at hole in right side idler and white marks positioned on cam gears at “R” Exhaust and “R” Intake (see Fig. A17.17).

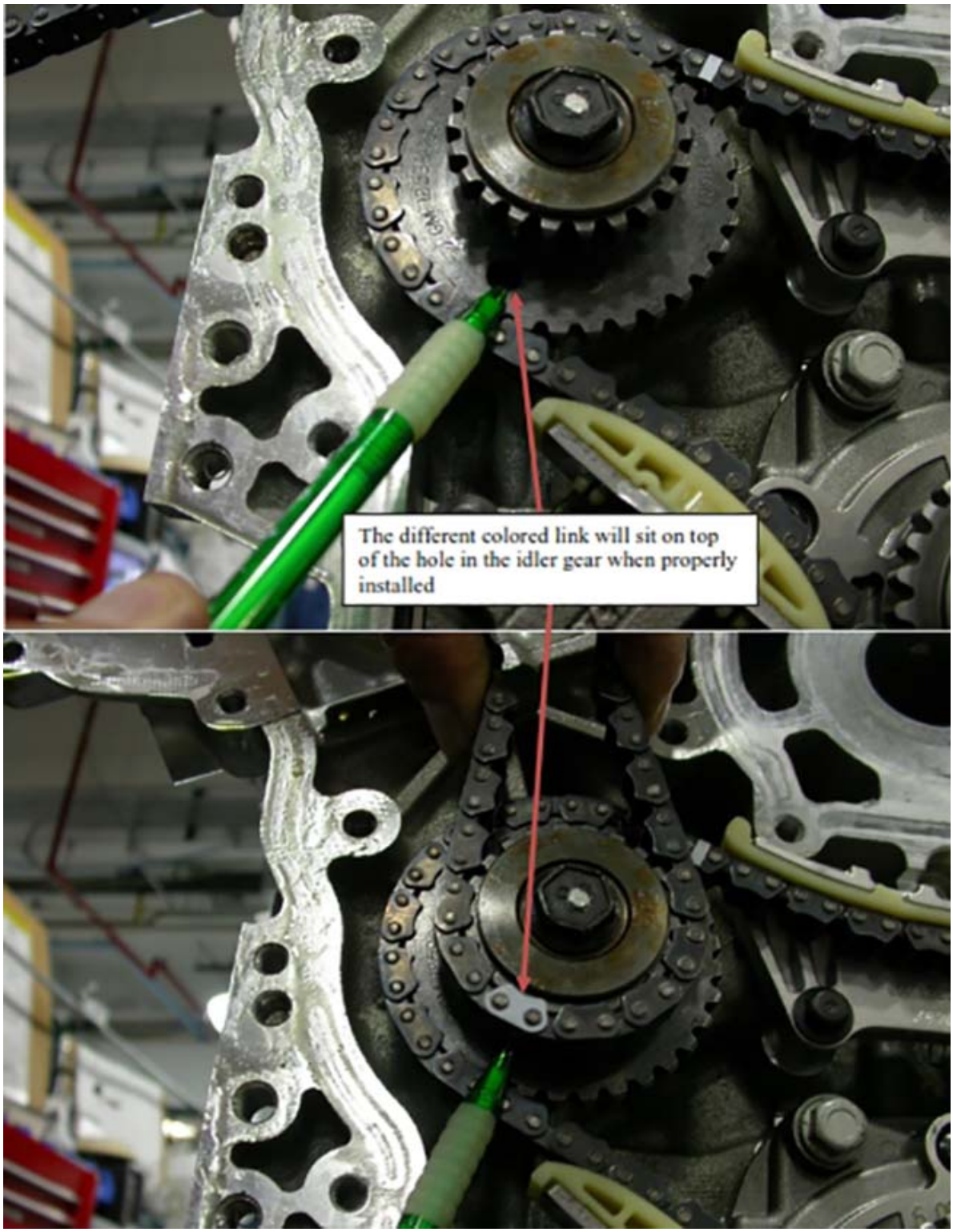


FIG. A17.17 View Showing Proper Gear Alignment for Right Side

A17.4.12 Holding chain together, install chain guides and tensioner. The right bank is the hardest chain to keep tension on during the assembly process. Torque tensioner and chain guides to 23 N·m ± 3 N·m (see Fig. A17.18).

FIG. A17.18 View Showing Chain Guide and Tensioner Installation

A17.4.13 Remove grenade pin from right side chain tensioner (see Fig. A17.19).

FIG. A17.19 View Showing Grenade Pins from Right Side Tensioner Removed

A17.4.14 Check alignment on all four cam gears, primary chain idlers, and crank gear (see Fig. A17.20 and Fig. A17.21).

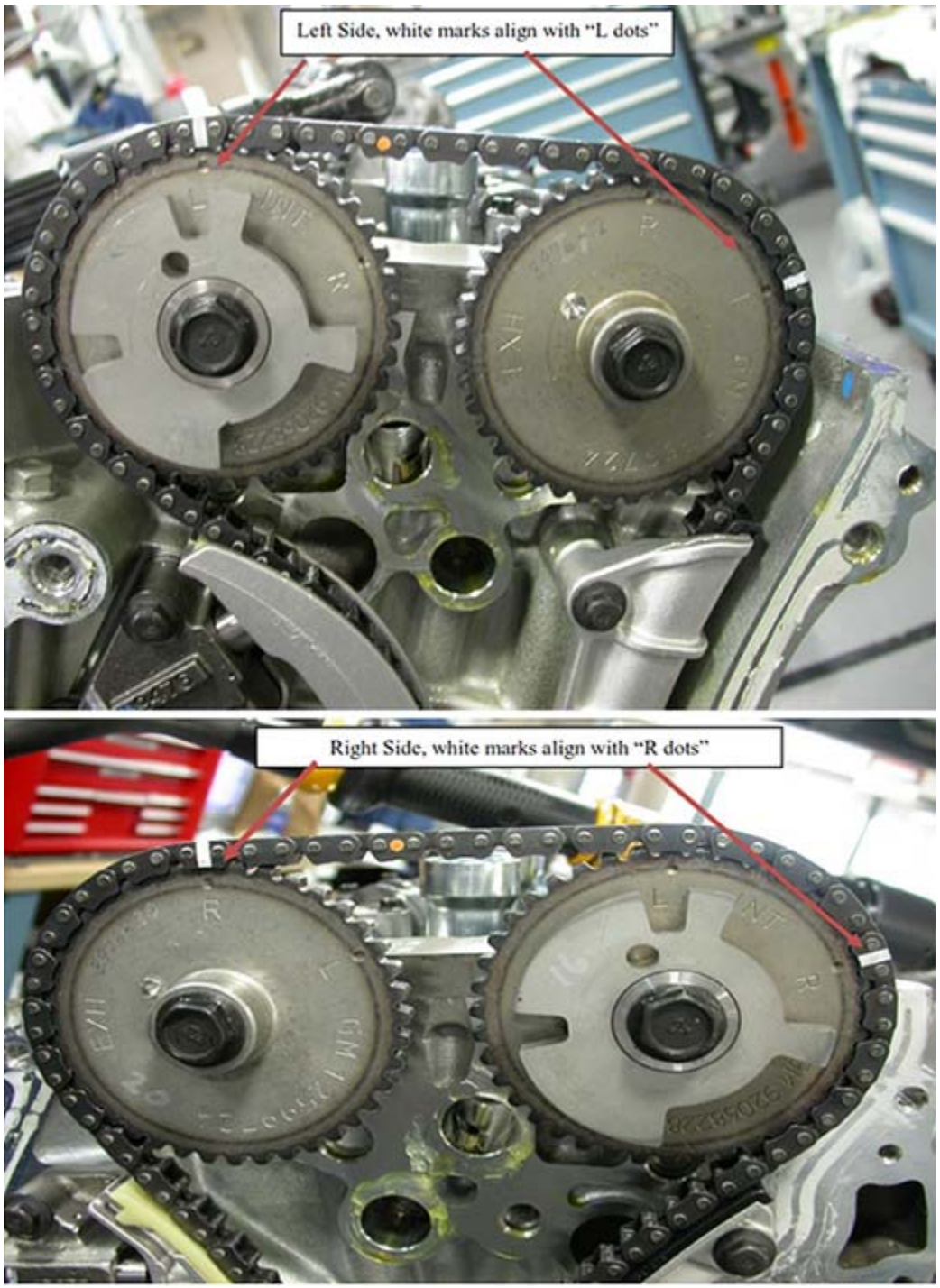


FIG. A17.20 Views Showing Proper Alignment, Left and Right Chains

FIG. A17.21 Right Side Chain and Idler Alignment Marks

A17.4.15 Rotate crankshaft backward (counter clockwise just past left side alignment and then back to left side alignment and check white marks for proper alignment. Rotate crankshaft clockwise to right side alignment and check marks. Ensure that chain assemblies do not jump on gears.

A17.4.16 Install 8 mm (0.315 in.) guide pins into the cylinder block positions as shown in Fig. A17.22.

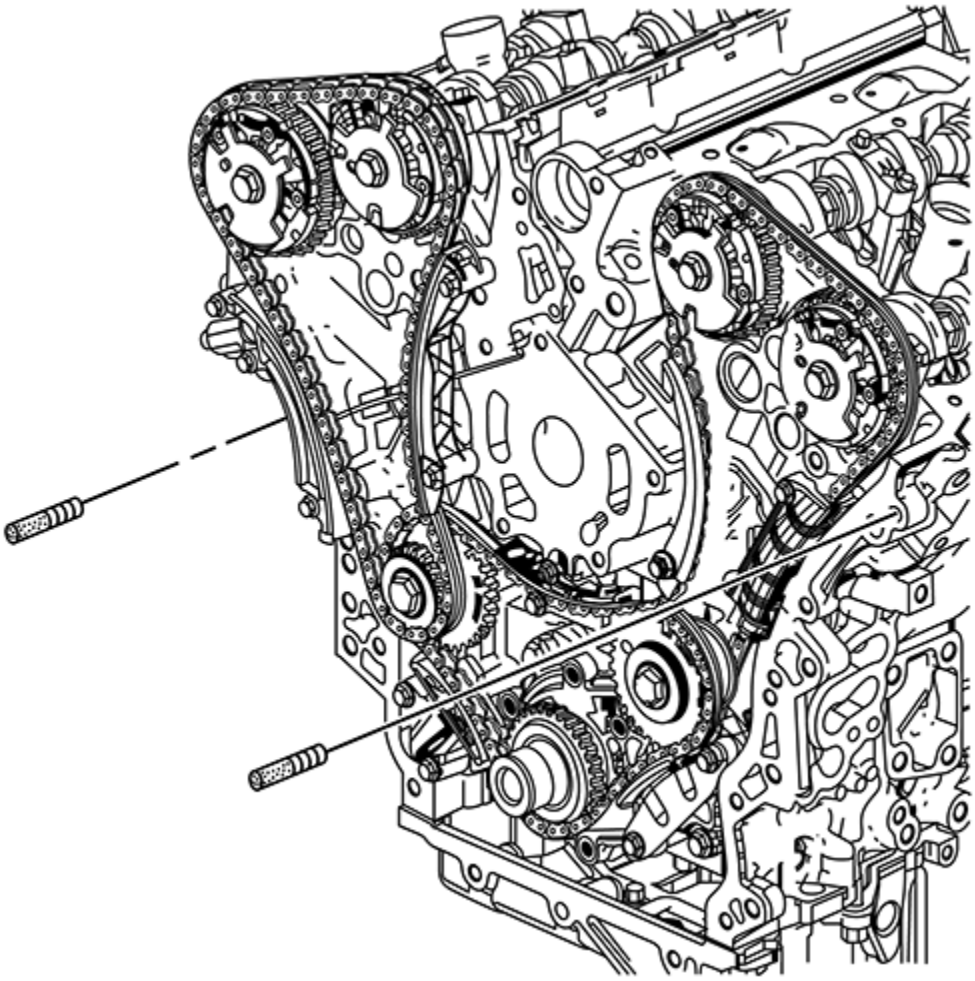


FIG. A17.22 Location of Guide Pins

A17.4.17 Inspect front cover to cylinder block seal. Install existing seal or replace with a new seal if existing seal is damaged or otherwise unusable (see Fig. A17.23).

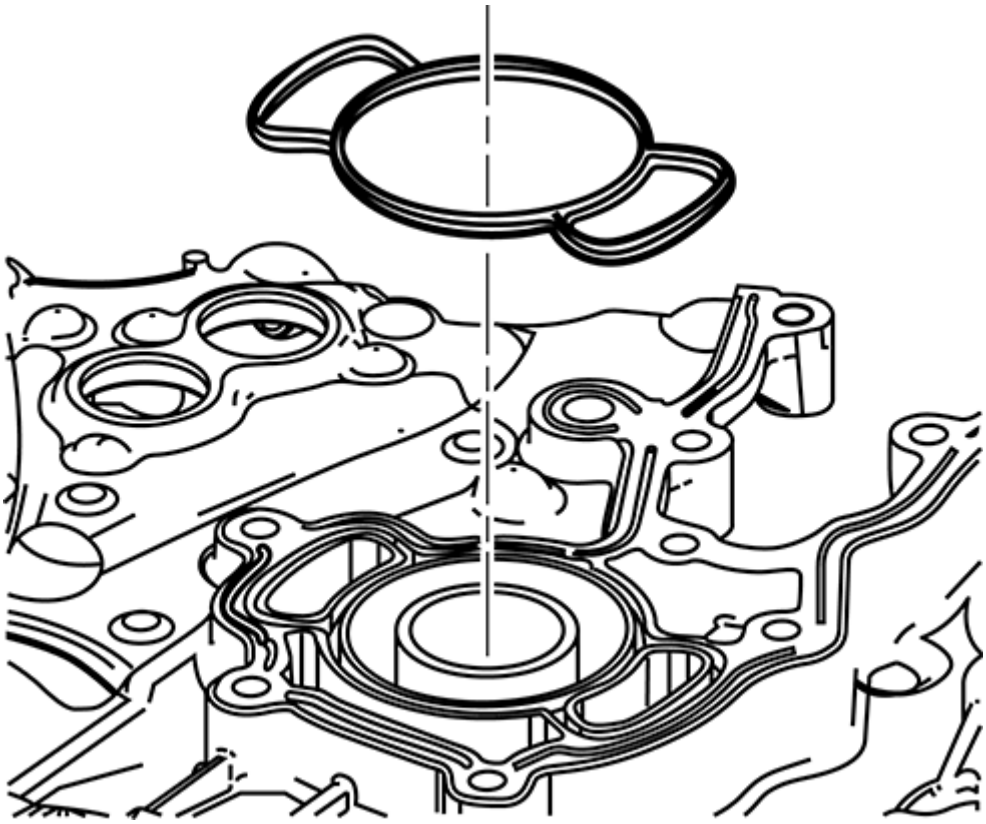


FIG. A17.23 Location of Front Cover Seal

A17.4.18 Place a 3 mm bead of RTV sealant, GM P/N 12378521 on the engine front cover as shown in Fig. A17.24(1).

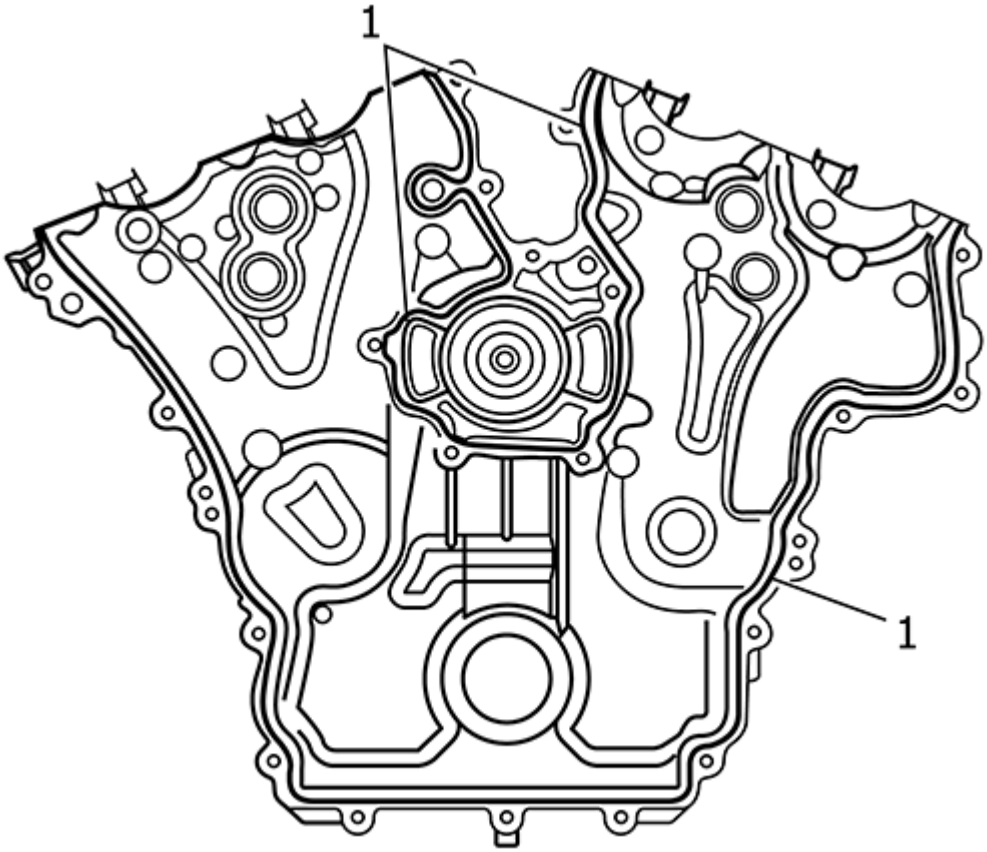


FIG. A17.24 Location of RTV Bead Placement

A17.4.19 Place the engine front cover onto the guide pins and slide into position (see Fig. A17.25).

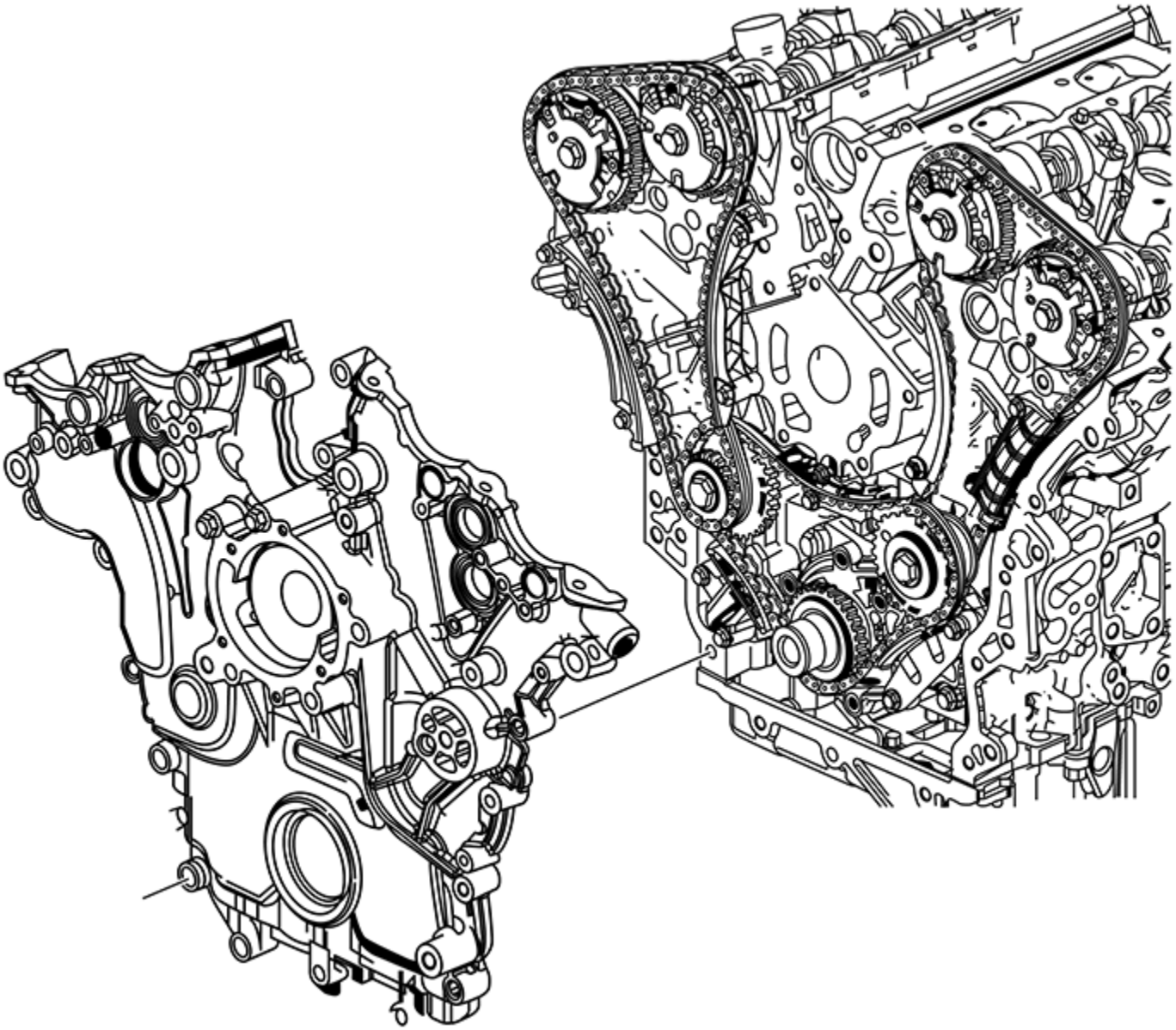


FIG. A17.25 Installation of Front Cover

A17.4.20 Loosely install the front cover bolts and install the engine front cover sound deadener (see Fig. A17.26).

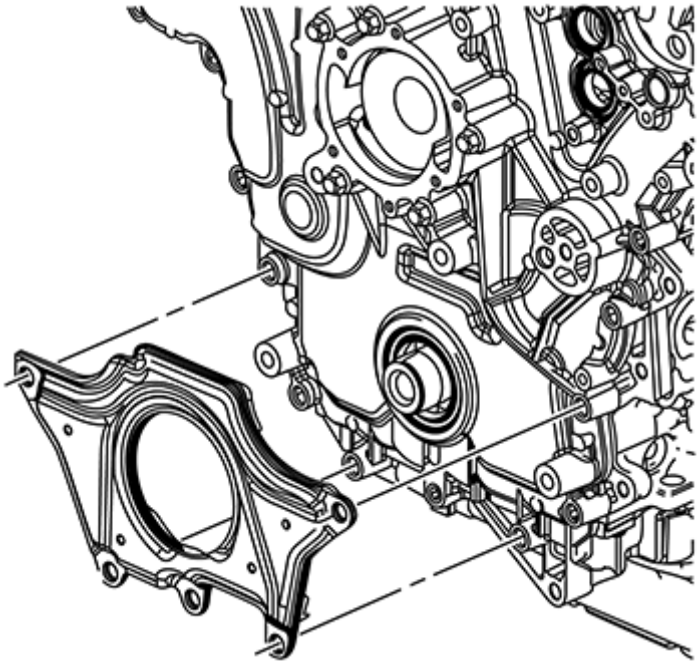


FIG. A17.26 Front Cover Sound Deadener Installation

A17.4.21 Tighten the engine front cover bolts in the sequence shown in Fig. A17.27 (1-22). Torque to 20 N·m. Tighten an additional 60° using the sequence shown (1-22).

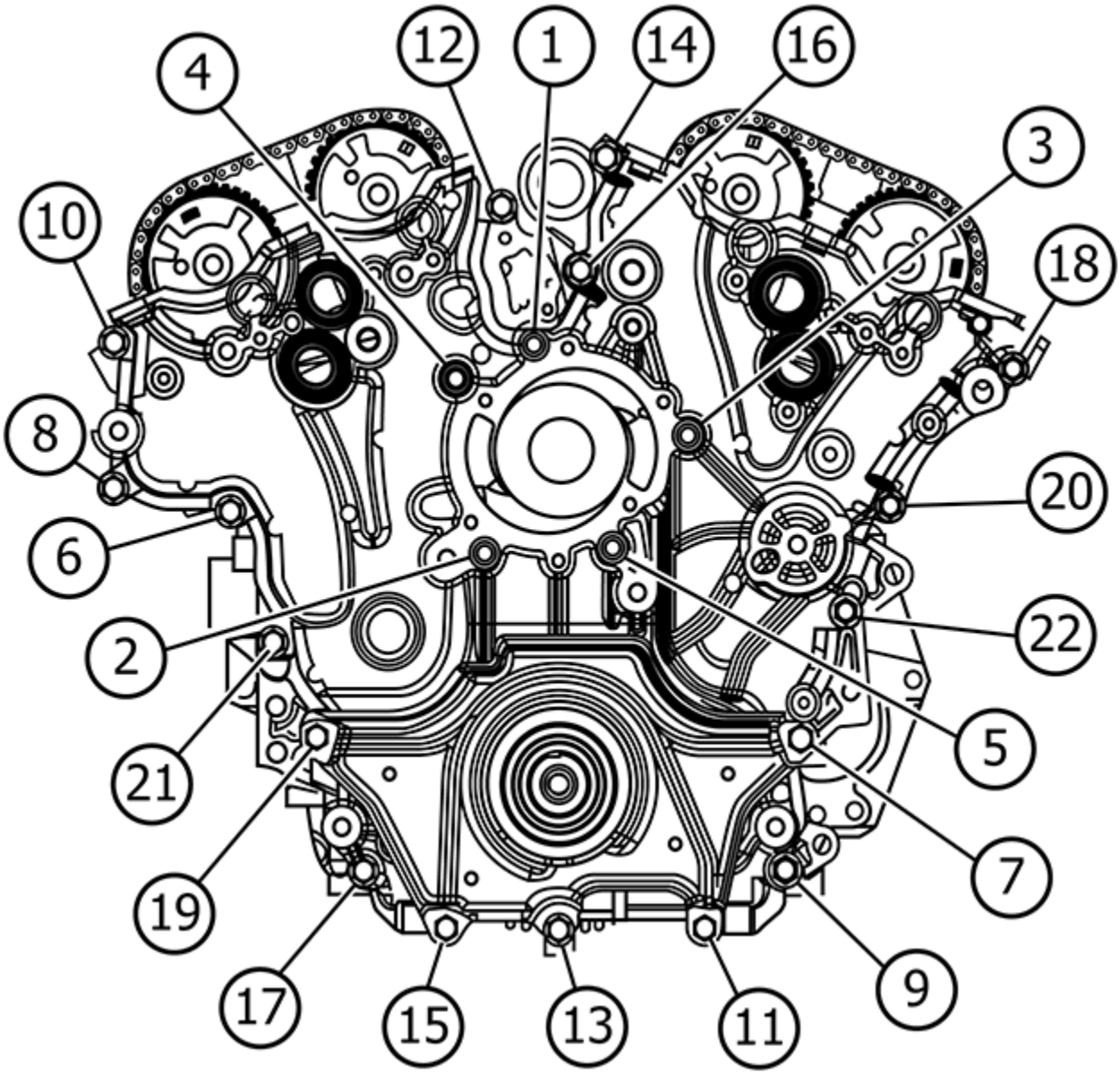


FIG. A17.27 Tightening Sequence for Front Cover

A17.4.22 Install the modified Camshaft Position Actuators as shown in Fig. A17.28. Torque bolts to 10 N·m. See Fig A17.29

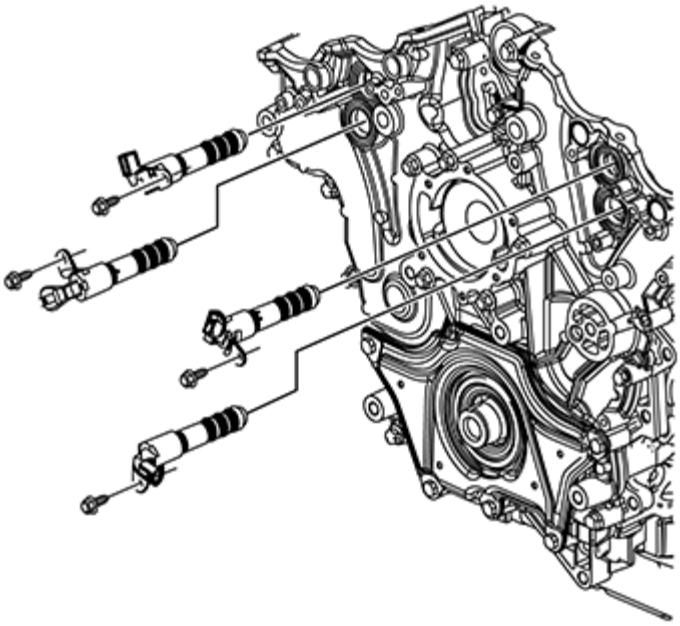
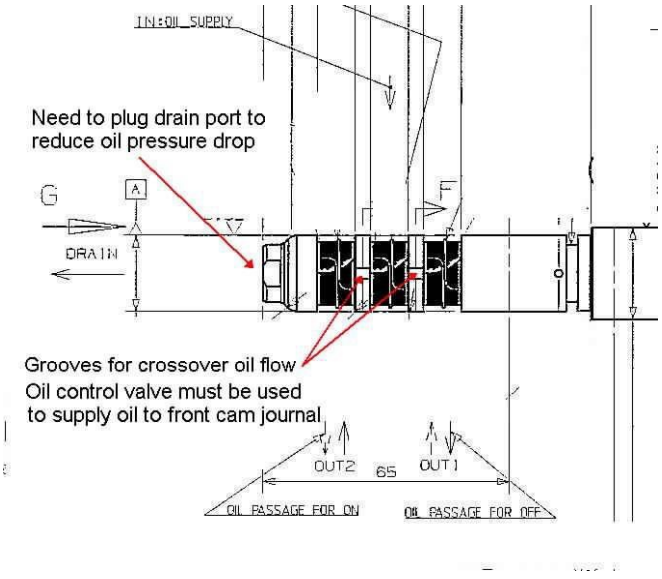


FIG. A17.28 Cam Position Actuator Location



For Sequence VIE-F test operation, the camshaft phaser oil control valves must be in place to provide lubrication to the front camshaft journals. The control valve drain ports must be welded closed to reduce excessive oil hemorrhaging through the control valves during engine operation as the valves are positioned in a manner that allows complete drainage through the spool valves.

Fig A17.29 Cam Position Actuator Modifications

A17.5 Camshaft Cover Installation

A17.5.1 Wipe the camshaft cover sealing surface on the left cylinder head with a clean, lint-free cloth.

A17.5.2 Place a bead 8 mm in diameter by 4 mm in height of RTV sealant, GM P/N 12378521 or equivalent, on the engine front cover split lines (See Fig. A17.30).

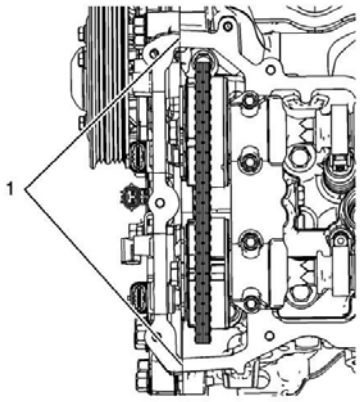


Fig A17.30 Cam Cover Sealant Placement, Left

A17.5.3 Place the left camshaft cover into position onto the left cylinder head (See Fig. A17.31).

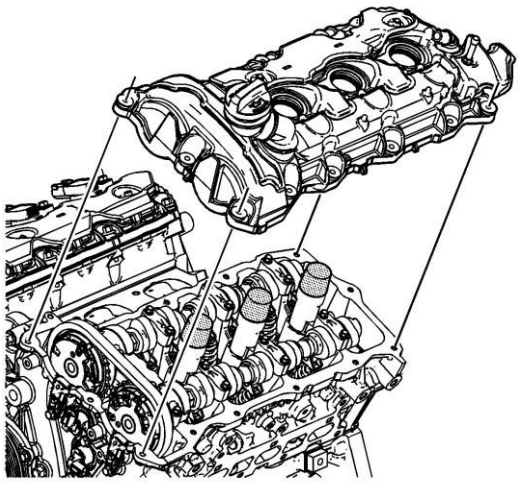


Fig A17.31 Cam Cover Installation, Left

A17.5.4 Tighten the left camshaft cover bolts in the sequence shown 10 N·m (See Fig A17.32)

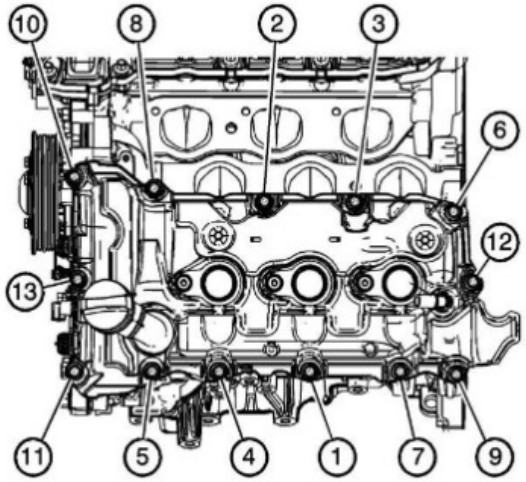


Fig A17.32 Left Cam Cover Torqueing Sequence.

A17.5.5 Install the NEW spark plugs into the left cylinder head. PN OHT6D-043-1, tightening to 18 N·m (See Fig A17.33)

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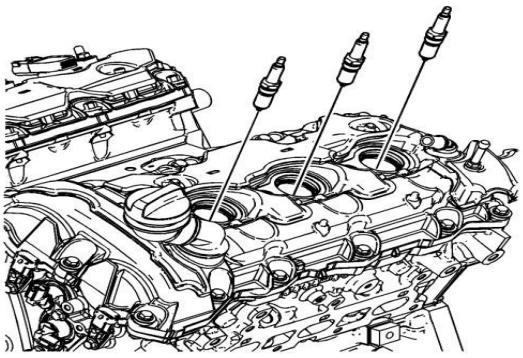

Fig A17.33 Spark Plug Installation

A17.5.6 Install the ignition coils, tightening to 10N·m (See Fig A17.34)

A17.5.7 Install flowed injectors on a cleaned fuel rail.

A17.5.8 Repeat the same procedure for the right side camshaft cover

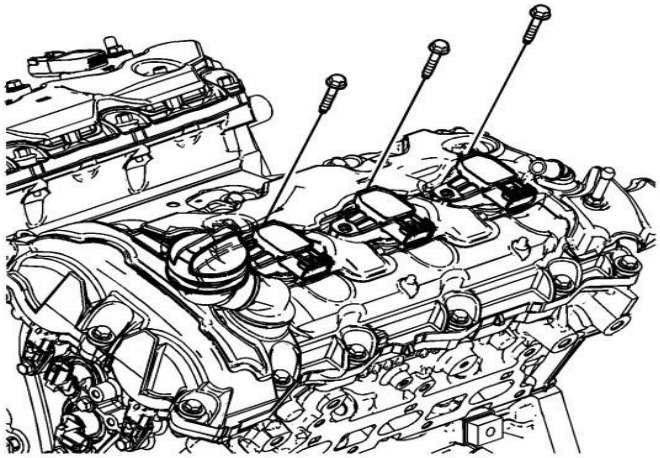

Fig A17.34 Coil Installation

A17.6 Intake Manifold Installation

A17.6.1 Install the Intake plenum, p/n 12597853 with new intake manifold gasket (See Fig A17.35)

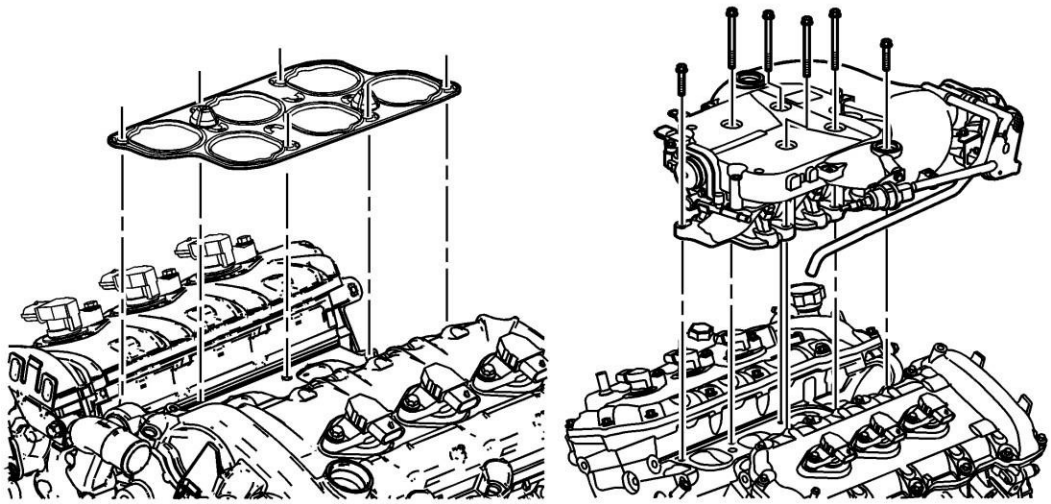

Fig A17.35 Installing the intake manifold

A17.6.2 Tighten the intake manifold bolts in a circular pattern starting from the center and moving outward to 23 N·m.
A17.6.3 Place the intake manifold brace to the engine front cover and intake manifold (see Fig A17.36 (1)) and tighten to 10 N·m and install and tighten the intake manifold brace bolt (See fig A17.36 (2)) to the engine front cover to 65 N·m.
.

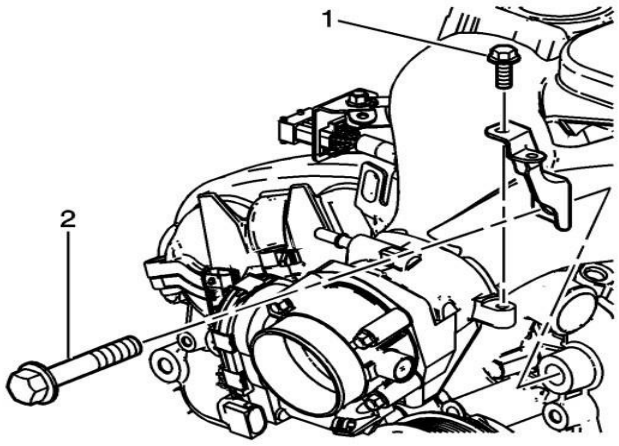

Fig A17.36 Installation of Intake Manifold Brace

A17.7 Exhaust Manifold Installation

A17.7.1 Place the right exhaust manifold, exhaust manifold gasket and bolts as an assembly in position on the right cylinder head. Install the exhaust manifold bolts into the right cylinder head and tighten to 25 N·m (See fig A17.37).

A17.7.2. Place the right exhaust manifold heat shield in position, and tighten the exhaust manifold heat shield bolts to 10 N·m (See fig A17.37).

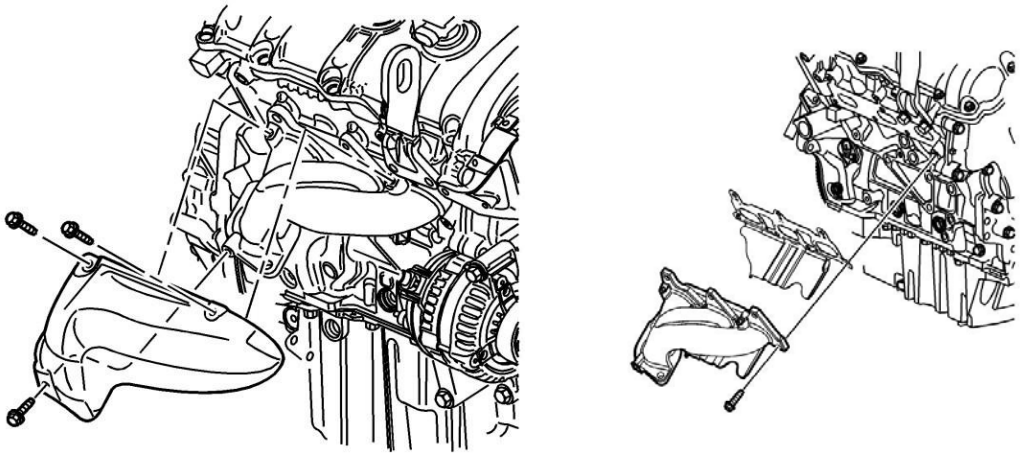

Fig A17.37 Exhaust Manifold and Shield Installation

A17.7.3 Repeat the same procedure for the left side exhaust manifold.

A17.8 Front Balancer Installation

A17.8.1 Install OHT Holding Fixture (View Not Shown)

A17.8.2 Use the Kent Moore J-41992-B[1], nut, bearing and washer to install the crankshaft balancer

A17.8.3 Apply lubricant to the inside of the crankshaft balancer hub bore (See Fig A17.38) Do not lubricate the crankshaft front oil seal or crankshaft balancer sealing surfaces. The crankshaft balancer is installed into a dry seal.

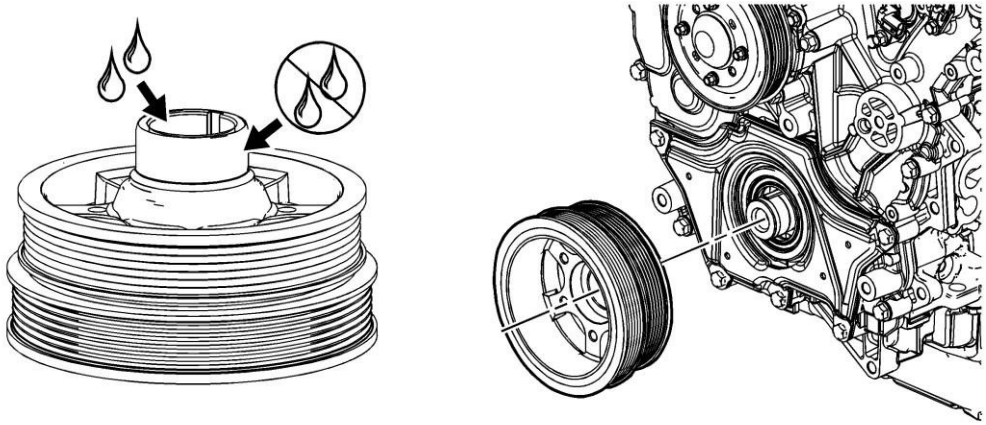

Fig A17.38 Crankshaft Balancer Lubrication and Placement

A17.8.4 Place the crankshaft balancer in position on the crankshaft. Ensure the crankshaft balancer keyway is aligned with the crankshaft key.

A17.8.5 Thread the J 41998-B in the crankshaft. Ensure you engage at least 10 threads of the J 41998-B before pressing the crankshaft balancer in place. Push the crankshaft balancer into position by tightening the nut on the J 41998-B until the large washer bottoms out on the crankshaft end.

A17.8.6 Tighten the crankshaft balancer bolt to **100 N·m.** Tighten the crankshaft balancer bolt an additional **150 degrees**. (See Fig A17.39)

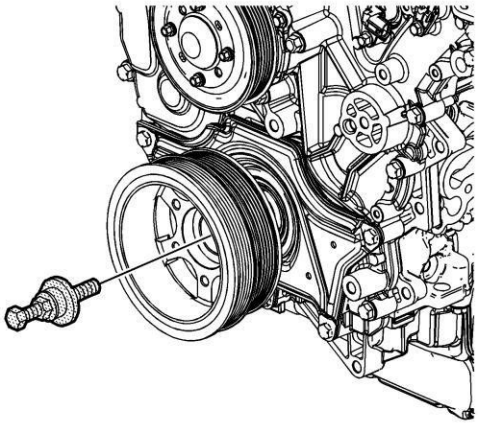

Fig A17.39 Crankshaft Balancer Bolt Installation

[1] Kent Moore tools are available through Bosch at https://gmtoolsandequipment.com

*(***Warning-** The crankshaft key is not designed to carry the load for the timing chain and oil pump drive. The clamp load applied by the balancer bolt is the load carrying mechanism. If this step is not properly performed, engine failure will result)

A17.9 Flywheel Installation

A17.9.1 Install the OHT Flywheel and new fasteners (See Fig A17.40)

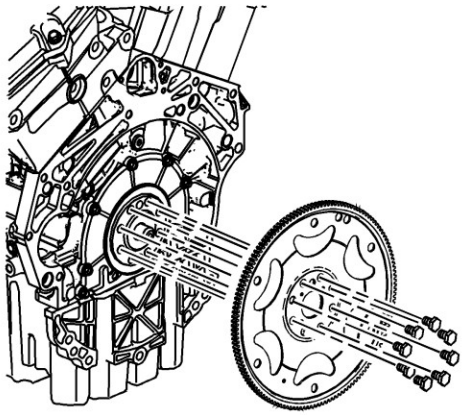

Fig A17.40 Flywheel Installation

A17.9.2 Install OHT Holding Fixture (View Not Shown) part number OHT6E-004-1[2]

A17.9.3 Tighten the NEW engine flywheel bolts to 30 N·m. Tighten the NEW engine flywheel bolts an additional 45 degrees.

[2]Available from OH Technologies, Inc. 9300 Progress Parkway Mentor, OH 44061-5039

A17.10 Oil Pan and Final Parts Installation

Tools required:

Kent Moore EN 46109 Guide Pin Set[3]

A17.10.1 Position the oil pan (see 6.6.5.11) onto the block. Loosely install pan bolts. Make certain a new oil pick up tube O ring is installed. Tighten in the sequence shown. The 8 mm bolts (1-11) torque to 23 N·m. The 6 mm bolts (12, 13) torque to 10 N·m. See Figure A17.41

A17.10.2 Install oil gallery plug on side of block. Torque to 30 N·m.

A17.10.3 Install a cleaned oil filter adapter. Torque to 23 N·m.

A17.10.4 Install cleaned coolant in and out housings with new gaskets. Torque to 10 N·m.

A17.10.5 Install coolant plug at rear of block. Ensure drilled hole it at top.

A17.10.6 Install crank position sensor. Torque to 10 N·m.

A17.10.7 Install and route injector and coil harness.

A17.10.8 Install modified PCV on bank 1 intake manifold.

A17.10.9 Install front OHT motor mount.

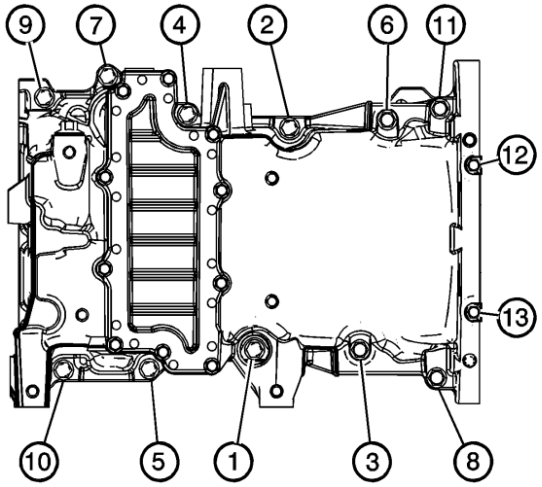

Fig A17.41 Oil Pan Tightening Sequence

[3] Kent Moore Tools are available through Bosch at https://gmtoolsandequipment.com

Table A17.1 Short Block Engine Parts

Qty	Part No.	Description
1	12650231	Timing Chain Kit
1	12646464	Gasket Kit
1	12645465	SPROCKET-CR/SHF
1	12645465	Sprocket
1	12641093	HEAD ASM-CYL (W/ VLV)(LH,LY7)
4	12636175	Solenoid
1	12641095	HEAD ASM-CYL (W/ VLV)(RH,
1	12634318	Oil Filter Gasket
1	12630223	Water Pump Gasket
1	12625923	Thermostat Gasket
1	12623514	GUIDE ASM-TMG CHAIN
1	12623513	GUIDE ASM-TMG CHAIN
1	12622550	Seal, Water Pump
1	12615626	SENSOR ASM-CR/SHF POSN
1	12612839	SPROCKET ASM,TMG CHAIN
1	12612838	SPROCKET ASM,TMG CHAIN
1	12608750	Seal, CR/SHF Front Oil
1	12600462	GUIDE ASM-TMG CHAIN
1	12600461	GUIDE ASM-TMG CHAIN
1	12597417	GUIDE ASM-TMG CHAIN
4	12593717	Seal, CM/SHF Pos Actuator sol valve
1	12576263	Ex Man Gasket
1	12576262	Ex Man Gasket
4	12570326	Pin, Head Location
1	12566837	Oil Pump Pick-up Seal
2	11610796	Bolt
4	11588734	Head Bolt, Short
4	11588279	Bolt
6	11588255	Bolt
1	11588252	Bolt - HVY HX FLG HD Red Body
1	11569873	Crankshaft Balancer Bolt
1	11561751	Plug, Eng Block Oil Gallery
6	11561619	Bolt
16	11518863	BOLT,CYL HD
1	19206165	Block, Short HFV6
1	12597853	Intake Plenum