

Section 4
2/15/2016
Cylinder Head Assembly

Mark all cylinder heads with unique lab serial number.



Description of Operation

The cylinder heads are ordered as a complete assembly.

Cylinder heads are allowed to be reused for a maximum of three tests based on acceptable valve seat recession criteria guidelines.

All testing requires the use of new valves, springs, and seals for each test.

Maximum valve seat recession 0.005 in.

Maximum valve guide clearance 0.0037 in.

See Section 3 Sheets 6 & 7 for pre test measurement and rework guidelines.

Specification

1 12629058 Head Cylinder, Complete

REV	Date	Revision History

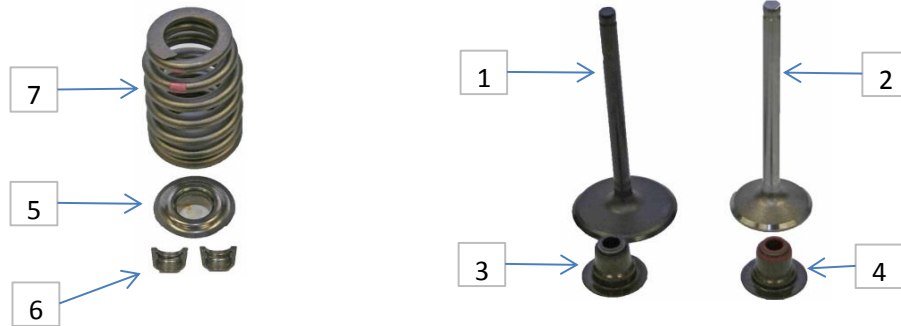
View	
Cylinder Head Complete	

Cylinder Head Assembly

GMOD

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Description of Operation

A Disassemble the cylinder head and inspect all components

Clean all new cylinder head and parts with engine degreasing solvent.

Spray all components with a 50/50 solution of engine degreasing solvent and EF-411.

New cylinder heads may also be cleaned using the Ultra Sonic Cleaner.

Used cylinder heads must be cleaned using the Ultra Sonic Cleaner.

Specification

- 1 12627971 Valve, Intake
- 2 12563064 Valve, Exhaust
- 3 12482063, Seal, Intake,
- 4 12482062 Seal, Exhaust
- 5 10166344 Cap, Spring, Retainer
- 6 10166345 Keeper, Valve Stem Key
- 7 12589774 Spring, Int. & Exh.

REV	Date	Revision History

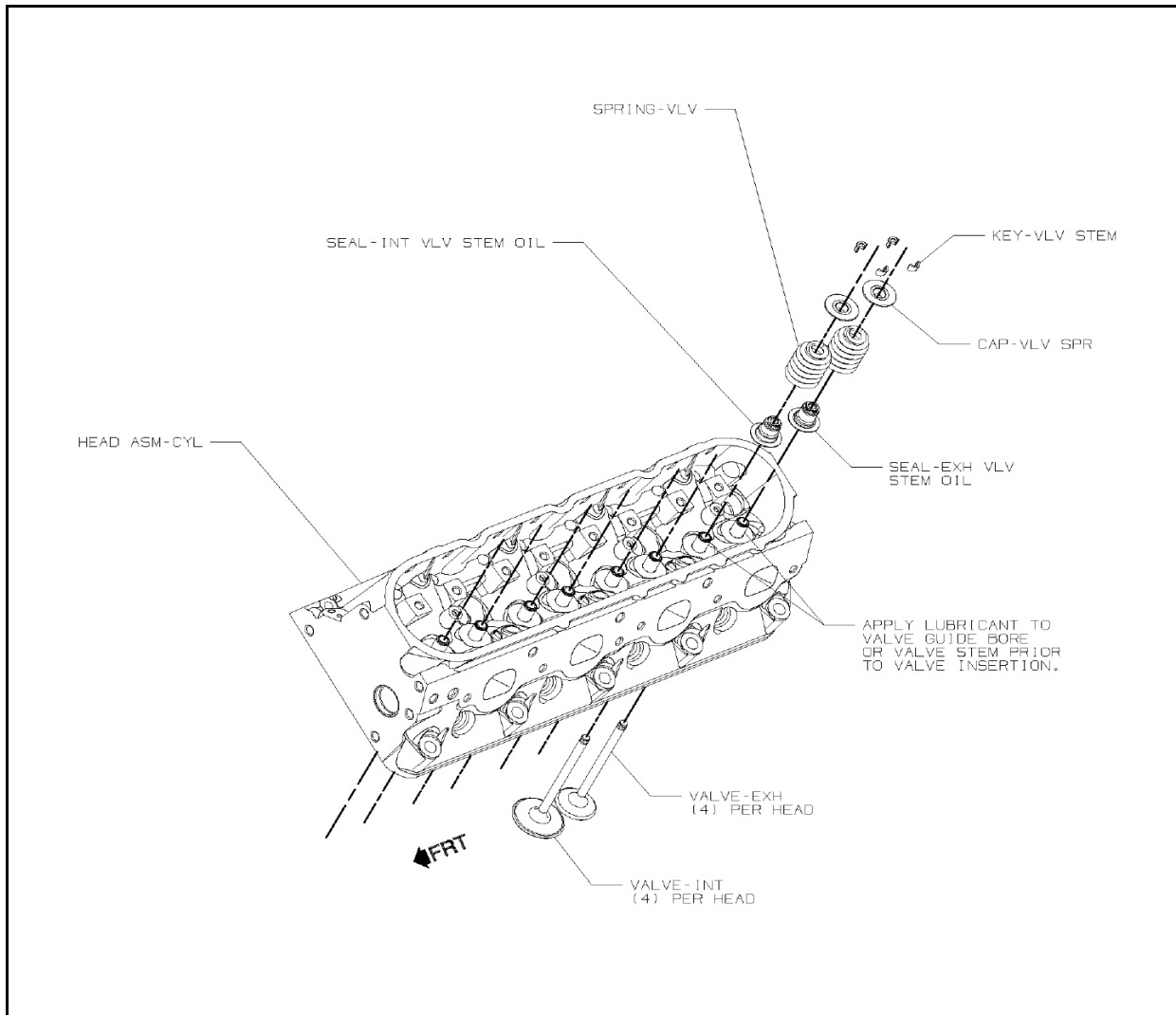
View	
Cylinder Head Components	

Cylinder Head Assembly

GMOD

Section
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Sheet
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Description of Operation

Specification

REV	Date	Revision History

View

Exploded View

Cylinder Head Assembly

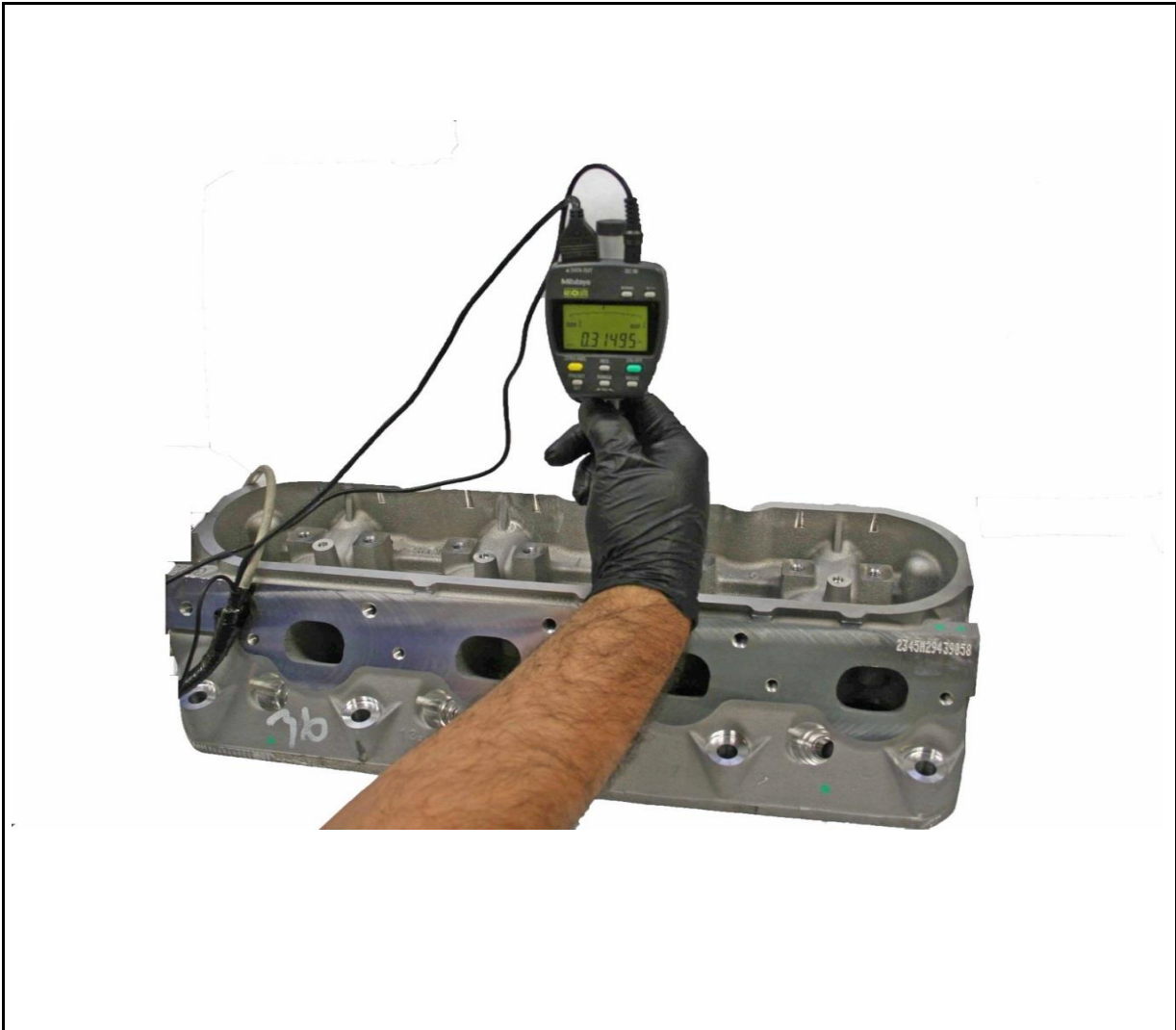
GMOD

Section

4

Sheet

3



Description of Operation

Measure valve guide and calculate operating clearance.

Service Specifications:

Valve stem diameter 0.313 in.

Valve stem to guide clearance, measured at top and bottom of valve guide .

Maximum 0.0037 in.

Specification

REV	Date	Revision History

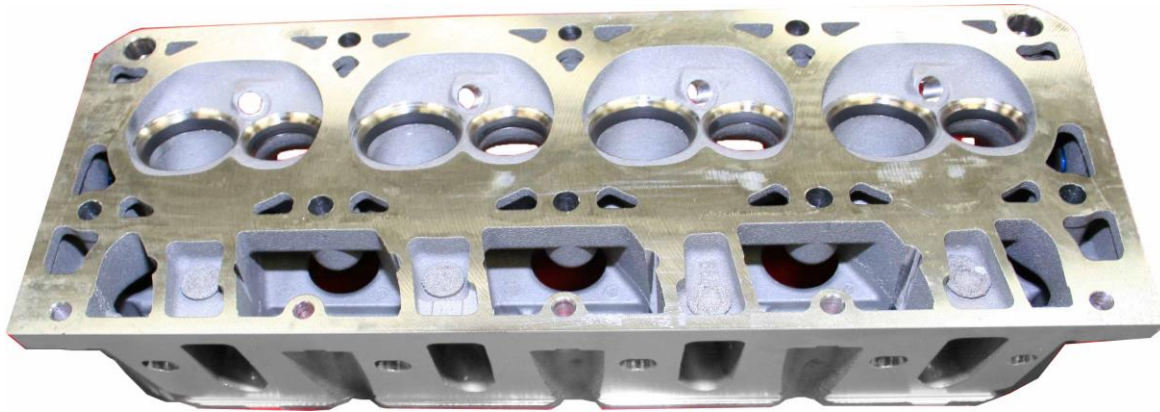
View	
Calculating Guide to Stem Clearance	

Cylinder Head Assembly

GMOD

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4

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All cylinder heads must use new valves, springs, and seals for each test



Description of Operation

Apply bluing to each valve face and install. Lightly rotate the valve to transfer the bluing material between the seat and valve face. Inspect the valve seat and face for proper contact. Measure and record pre-test valve seat heights according to Section 3 Sheet 6.

Clean the bluing material from the valves and seats and assemble the cylinder heads using new valve stem seals and springs.

As a final check, labs shall use a vacuum plate over the valve ports to check for proper sealing.

Note: If desired, new cylinder heads may be lightly lapped. See Section 3 Sheet 6 & 7 for direction.

Specification

REV	Date	Revision History

Cylinder Head Assembly

GMOD

View

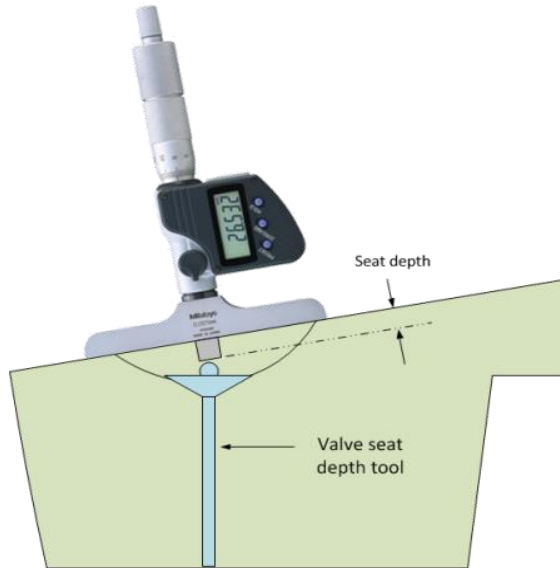
First Run Prep and Inspection

Section
4

Sheet
5

Procedure to Measure the Installed Valve Seat Heights

1. After lapping valves and checking contact areas, check the valve seat heights.
2. Clean cylinder head, taking care that the deck surface is free of nicks and scratches.
3. Install valve seat depth tool into valve pocket. Orientate the depth tool to the same location for each measurement in-case the ball is not centered on the valve.
4. Insure that depth micrometer is properly calibrated and zeroed on a flat surface.
5. Place the depth micrometer on cylinder head such that both ends of micrometer rest on either side of the combustion chamber.
6. Measure the depth to the ball on the end of the valve seat depth tool.
7. Record depth in thousands of an inch (0.xxx")



Description of Operation

Measure installed valve seat heights.

Record all seat height data on GMOD Engine Build Data Form 18.

Maximum valve seat recession for acceptable second run usage is no more than 0.005 inch Delta.

Specification

REV	Date	Revision History

View

Valve Seat Height Measurement

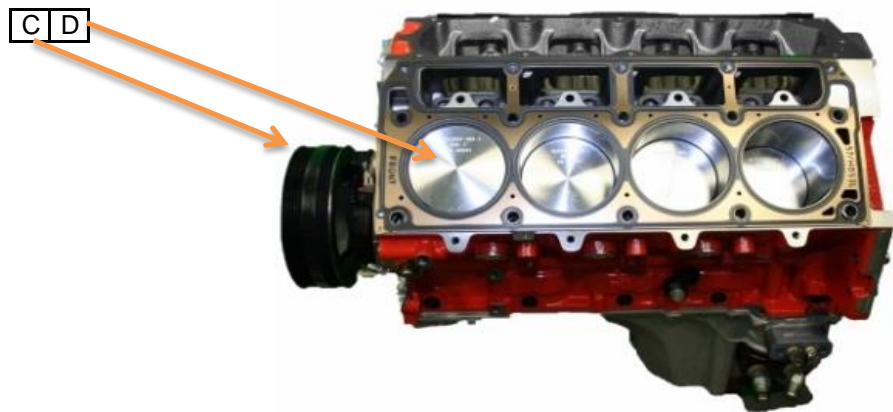
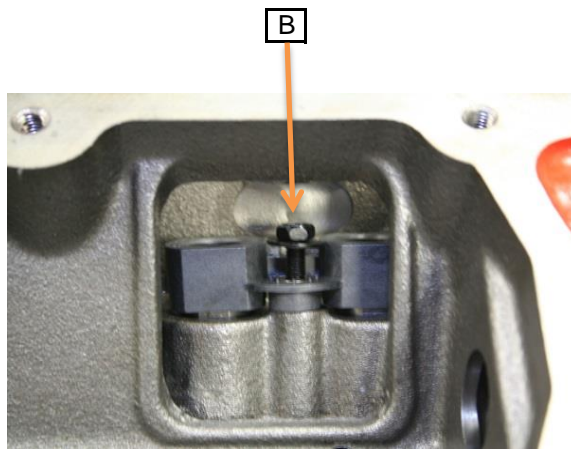
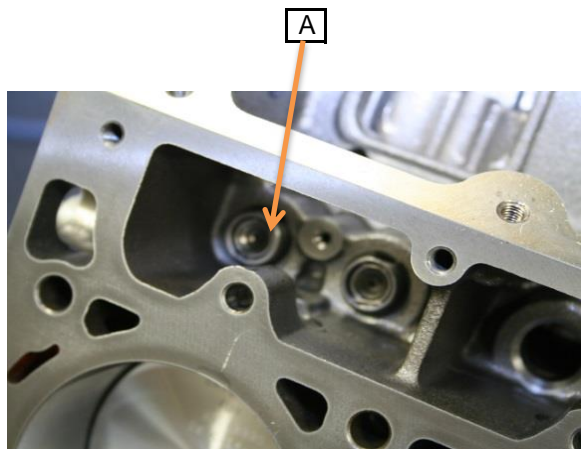
Valve seat height measurements are recorded for both pre-test and post-test cylinder heads. Maximum valve seat recession (change) is 0.005 inch.

Cylinder Head Assembly	GMOD
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<u>Post Test Qualification and Re-Work Procedure</u> 1. Disassemble first run heads. 2. Visually inspect cylinder head and valve seats for unusual wear. 3. Measure and calculate valve guide clearance. Maximum clearance 0.0037 inch. 4. Scrape head gasket from deck surface. No sandpaper, scotchbrite pads or other abrasives which could transfer materials to the head surface may be used. 5. Check head deck for warping. Using a straight edge held diagonally across the cylinder head deck surface, measure the clearance between the straight edge and the head with a feeler gauge. Maximum 0.005" 6. Spray head with degreasing solvent and dry with compressed air. 7. Qualify re-use by measuring the delta between the pre and post-test measurements obtained from Section 3 Sheet 6 data. Maximum allowable seat recession 0.005 inch. 8. If qualified for second run, wash post-test cylinder heads using the ultra sonic cleaner to remove debris from combustion chamber and intake and exhaust ports. 9. Rinse with hot water and immediately spray with 50-50 mixture of degreasing solvent and EF411. 10. Using all new valves, lap valves using a water based valve grinding compound. Use Permatex Valve Grinding Compound, water mixed, item #80036. 11. Thoroughly clean lapping compound from valves and seats using water and a lint free rag. Be sure all lapping compound is removed. After cleaning lapping compound, spray entire head with degreasing solvent. Spray with, with 50-50 mixture of degreasing solvent and EF411 then blow dry with compressed air. 14. Apply bluing to each valve and install. Visually inspect for proper seating. The bluing ring should be a consistent width around the entire valve circumference and be positioned toward the middle of the face. If valves show proper seating appearance, clean all bluing from the valves and seats and continue assembling the heads for their second run as instructed in Section 3 Sheet 5			Description of Operation	
			Second run cylinder head cleaning and re-work guidelines.	
			Specification	
			Permatex Valve Lapping Compound Water Based #80036	
REV	Date	Revision History	View	
			Second Run Cylinder Head Re-work	
Cylinder Head Assembly		GMOD	Section	Sheet
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Section 5
2/15/2016
Long Block Assembly



Description of Operation

- A Install new lifters each test. Lubricate each set of lifters with EF-411 making sure to lubricate the needle rollers in each lifter.
- B Install the tappet guides and bolts torque to the fasteners to; 106 ± 10 lb. in.
- C Rotate the engine watching cylinder #1 intake valve closing to confirm engine is on the compression stroke for cylinder #1. Continue rotating the engine until cylinder #1 piston is at Top Dead Center.
- D Put a tape marking on the front balancer at the 12:00 position to indicate TDC #1 cylinder.

Specification

- 1 12576400 Lifter, Camshaft Roller. (16 per engine required)
- 2 19166182 Guide, Tappet (8)
- 3 11515139 Bolt, Guide, Tappet

REV	Date	Revision History

View	
Lifter Installation	
Lifter and Retainer Guide Installation	

Long Block Assembly

GMOD

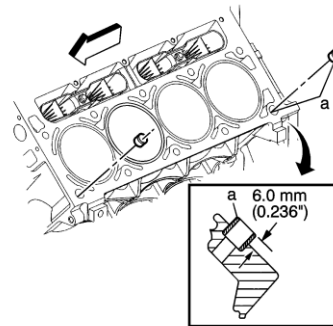
Section
5

Sheet
1

Note Red Tape Mark



Notch goes toward front of engine, right side shown



Description of Operation

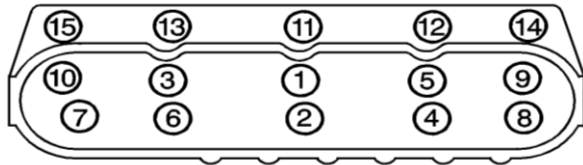
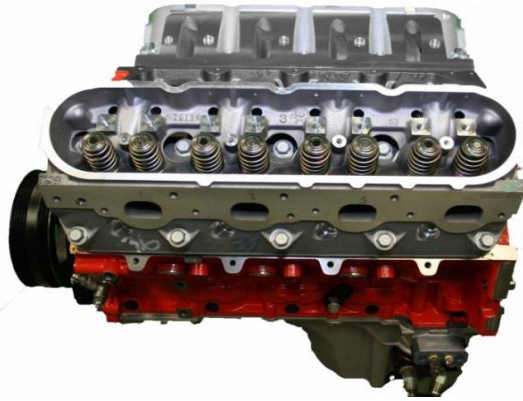
- A Install the cylinder head guide dowels if not already installed.
 - B Clean the engine block deck insuring there is no debris or surface imperfections before installing the cylinder head gaskets.
 - C Install both left and right cylinder head gaskets with locating Tab toward the front of the engine.
(No sealants allowed)
- Note: Head Gaskets are left and right side orientation specific.

Specification

- 1 12570326 Dowel, Cyl. Head, Locating (4)
- 2 12589226 Gasket, Cyl. Head (2)

REV	Date	Revision History
Long Block Assembly		GMOD

View	
Head Gasket	
Section	Sheet
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Step 1.
Tighten the M11 cylinder head bolts (1–10) a first pass in sequence to 22 ± 2 lb.ft.

Step 2.
Tighten the M11 cylinder head bolts (1–10) a second pass in sequence to $90^\circ \pm 2^\circ$

Step 3.
Tighten the M11 cylinder head bolts (1–10) a final pass in sequence to $70^\circ \pm 2^\circ$

Step 4.
Tighten the M8 cylinder head bolts (11–15) to 22 ± 2 lb.ft. Begin with the center bolt (11), alternating side-to-side, work outward tightening

Description of Operation

- A Install the cylinder heads
- B Install new cylinder head fasteners for each test. Any sealer on the new bolts is to be removed and the threads lightly lubricated with EF411 prior to use.
- C Follow the cylinder head torquing procedure as outlined in steps (1-4).

Specification

- 1 19258707, Bolt, Cyl. Head, Long (20)
 - 2 12558840, Bolt, Cyl. Head, Short (10)
- Note; All cylinder head fasteners are supplied through Chevy Performance

REV	Date	Revision History

View	
Cylinder Head Torquing	

Long Block Assembly

GMOD

Section
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4



A 1



B 3

B 2



Description of Operation

- A Remove all sealant from the under side of the rocker arm fasteners part number 12560961 prior to use.
- B New rocker arms, pushrods, and rocker arm fasteners are used for each test. Don't clean the rocker arms prior to use. Clean all other components with Engine Degreasing Solvent followed by 50/50 EF-411 and Engine Degreasing Solvent.
- C Properly position the rocker arm supports, pushrods, rocker arms, and loosely install all rocker arm fasteners. Follow the rocker arm tightening procedure outlined in Section 4 Sheet 6 for proper tightening to prevent valve to piston contact during tightening of the rocker arm fasteners.

Specification

- 1 12560961 Bolt, Rocker Arm
- 2 10214664 Rocker Arm, Roller Type
- 3 10238852 Pushrod
- 4 12552203 Support, Rocker Arm, Pivot

REV	Date	Revision History

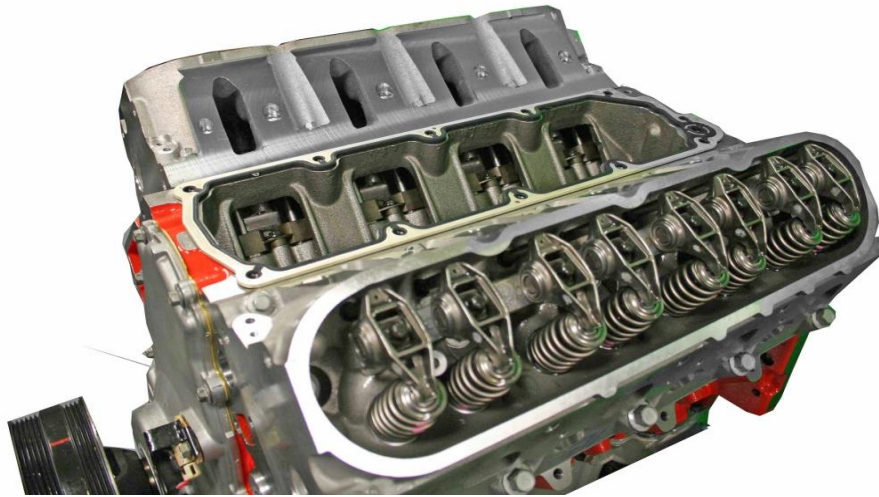
View	
Overhead Valvetrain	

Long Block Assembly

GMOD

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5

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5



Rocker Arm Fastener Torqueing Procedure

- 1 With the engine in the number 1 firing position (as positioned in Section 5 Sheet1) tighten the following rocker arm positions;
 - Exhaust valve rocker arm fasteners cylinders 1, 2, 7, and 8
 - Intake valve rocker are fasteners cylinders 1, 3, 4, and 5
 - Allow the lifters at least 60 seconds to leak down
- 2 Rotate the engine 360° in a clockwise direction aligning the red tape mark again at 12:00 Noon
 - With the engine in the number 6 firing position tighten the following rocker arm positions;
 - Exhaust valve rocker arm fasteners cylinders 3, 4, 5, and 6
 - Intake valve rocker are fasteners cylinders 2, 6, 7, and 8

Description of Operation

Lubricate all pushrods, rocker arms, fasteners, and valve stem tips with EF-411

Loosely install all rocker arm fasteners using a speed handle.

Follow the tightening procedure applying 22 ± 2 lb. ft.

Specification

REV	Date	Revision History

View

Rocker Arm Tightening Procedure

Section

5

Sheet

6

Long Block Assembly

GMOD



Description of Operation

A Install Valley Cover Gasket , Valley Cover, and Fasteners.

Torque fasteners from inside out to 18 ± 2 lb.ft.

Specification

- 1 12610141 Gasket, Valley Cover
- 2 12598832 Cover, Valley
- 3 11518075 Bolt, Valley Cover

REV	Date	Revision History

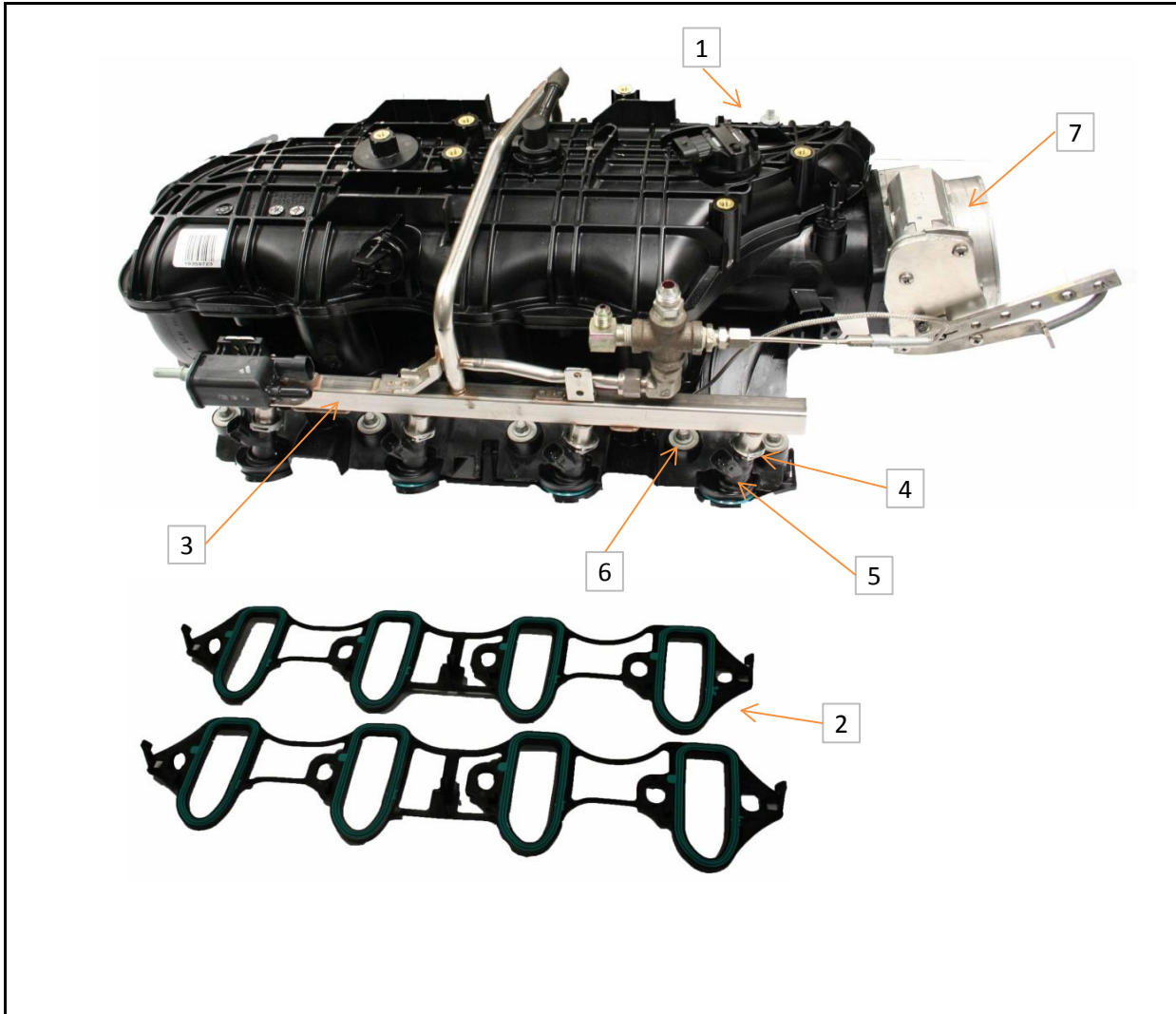
View	
Valley Cover Installation	

Long Block Assembly

GMOD

Section
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Description of Operation	
Intake plenum assembly	

Specification	
1	12644373 Assembly Intake Manifold
2	12600255 Gasket, Intake (2)
3	12621668 or 12660709 Rail, Fuel
4	12570620 Retainer Fuel Injector
5	12613411 Injector, Fuel
6	12575384 Fastener, Intake Manifold
7	12629992 Body Throttle, Modified

REV	Date	Revision History

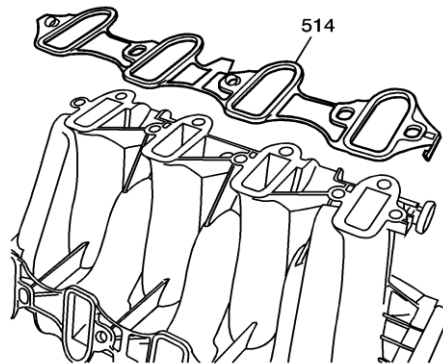
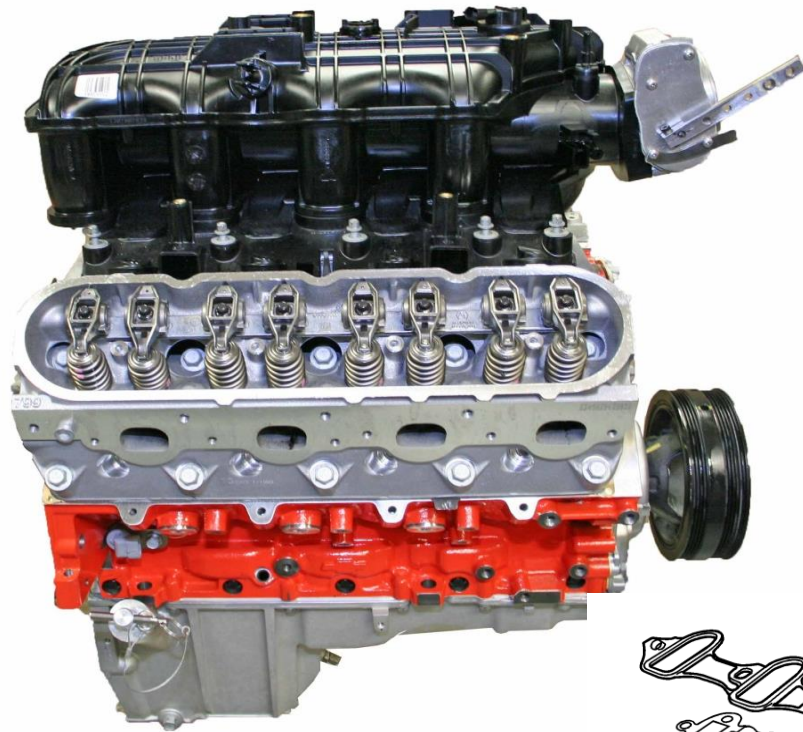
View	
Intake Plenum Assembly	

Long Block Assembly

GMOD

Section
5

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8



Description of Operation

Clean and inspect the induction system for any loose materials inside the runners from storage.

Install new gaskets on the intake plenum.

Install the assembly onto the assembled short block.

Tighten the intake manifold fasteners using a speed handle from the inside out to snug.

Specification

REV	Date	Revision History

View

Intake Manifold Installation

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Long Block Assembly

GMOD

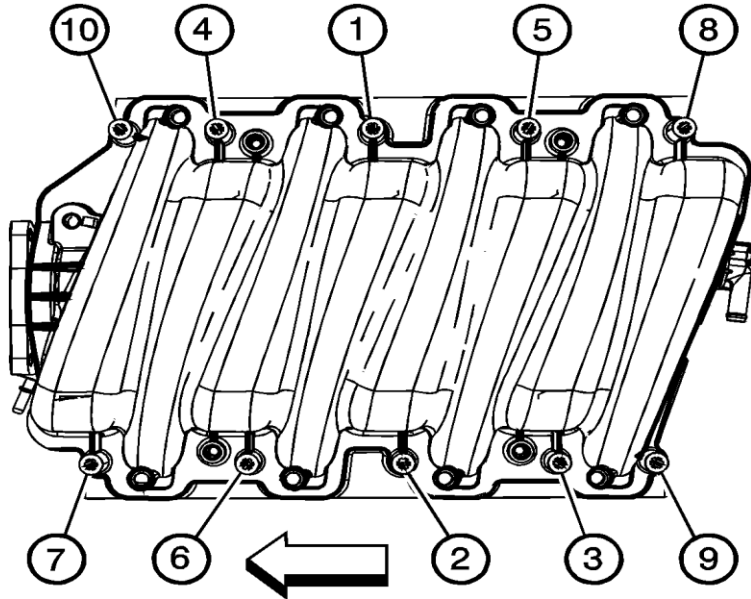
Section
5

Sheet
9

Description of Operation

Tighten the intake manifold bolts (1-10) a first pass in sequence to 44 ± 2 lb. in.

Tighten the intake manifold bolts (1-10) a final pass in sequence to 89 ± 2 lb.in.



Specification

1 12575384 Bolt, Intake Manifold

REV	Date	Revision History

View

Intake Manifold Tightening

Section

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Long Block Assembly

GMOD



Description of Operation

The GMOD Test uses two right side rocker covers for test operations.

Care must be taken to ensure the rocker covers have been properly cleaned using the sonic cleaner to remove any deposits in the baffle area.

Install new rocker cover gaskets with new cover bolts and grommets for each test.

Tighten rocker cover retainer bolts to 106 ± 2 lb. in.

Specification

- 1 12637683 Gasket, Rocker Cover
- 2 12582224 Cover, Rocker
- 3 12577215 Bolt, Cover, Rocker w/Grommet

REV	Date	Revision History

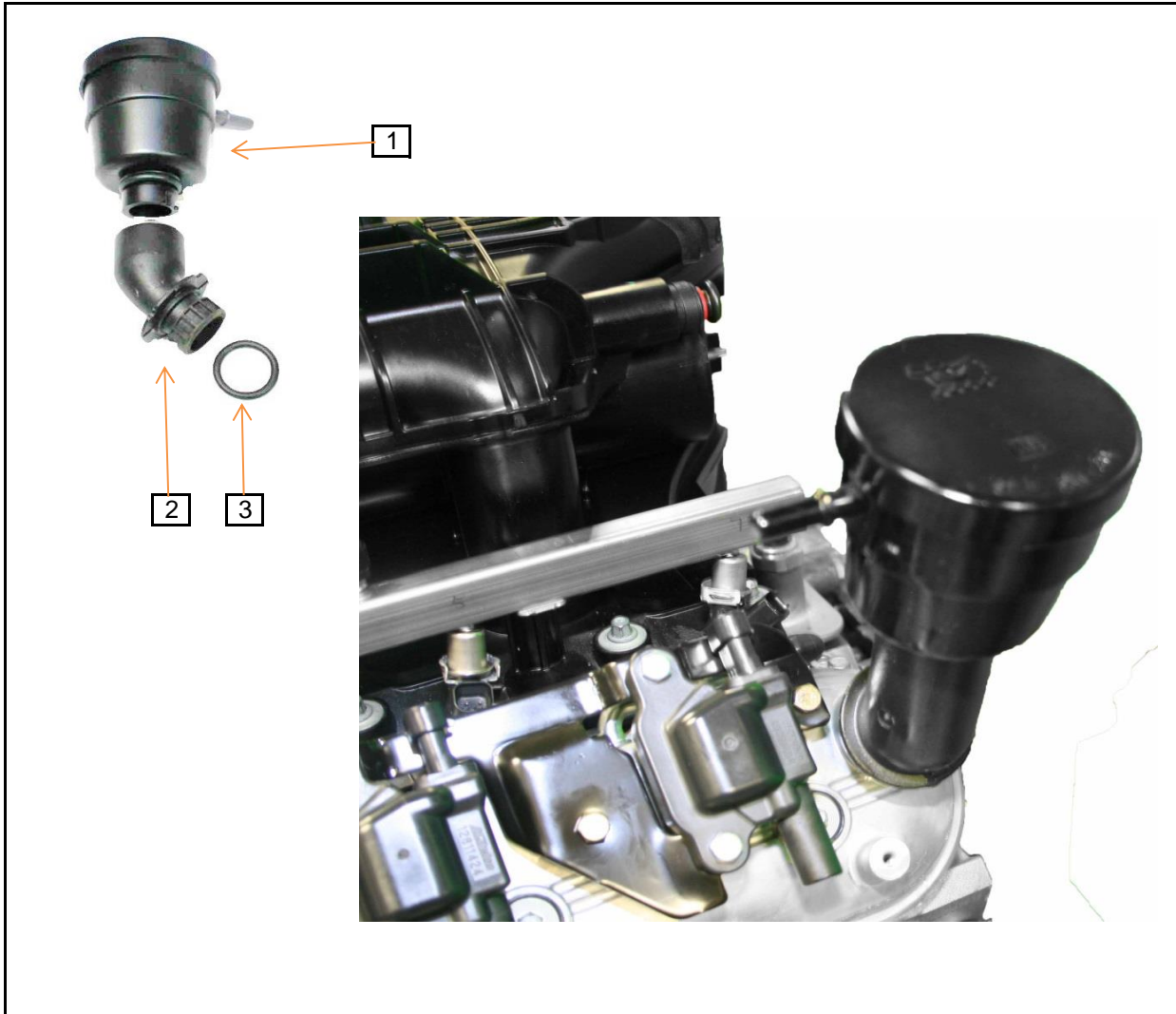
View

Rocker Cover Installation

Long Block Assembly	GMOD
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<p style="text-align: center;">Fuel Injector Flow Test Procedure</p> <p style="text-align: center;">Flow test the fuel injectors before each test:</p> <ol style="list-style-type: none"> 1. Use aliphatic naphtha (Warning —Flammable Health hazard.) as the calibration fluid. 2. Apply 276 kPa to the fuel rail. 3. Apply 13 V to the injector solenoid continuously. 4. Allow the injector to spray into a graduated cylinder capable of holding at least 250 mL. 5. Volume-check all injectors for 30 s and note the volume produced by each injector. 6. Observe the spray pattern that each injector produces; if the injector has a straight stream or dribbles, it must be discarded. 7. The eight injectors that are to be installed on an engine fuel rail shall produce volumes that are within 5 mL of each other. 8. Remove the solvent that is remaining in the injector from the flow check using compressed air. 			Description of Operation		
			<p>Install fuel rail with injectors to the intake plenum.</p> <p>Flow test the fuel injectors before each test according to the procedure on this page.</p> <p>Use a set of flow matched injectors with new "O" Rings for each test.</p> <p>Tighten the fuel rail retaining fasteners to 89 ± 10 lb.in.</p>		
			Specification		
			1	12621668 or 12660709 Rail, Fuel	
			2	12570620 Retainer Fuel Injector	
			3	12613411 Injector, Fuel	
			4	12580910 Bolt Fuel Rail	
REV	Date	Revision History	View		
			Fuel Rail Assembly Installation		
			Reference Section 4 Sheet 8 for Induction System Illustration		
Long Block Assembly		GMOD		Section	Sheet
				5	12



Description of Operation

Disassemble and clean the Camaro Oil Breather / Separator and install new "O" Ring seals for each test.

Specification

- 1 12653073 Oil Separator, Camaro
- 2 12584043 Extension, Oil Fill
- 3 12593348 Seal, "O" ring (2 each side)
- 12656319 O-ring large, Oil Separator

REV	Date	Revision History
Long Block Assembly		GMOD

View	
Camaro Oil Breather	
Section	Sheet
5	14



Modify coolant air bleed cross over tube by cutting air bleed tube flush.
 Drill and tap for 1/8 NPT.
 Use Aeroquip #4 braided line to connect air bleeds at front and rear to coolant system return.
 Use Coolant Pipe Assembly 12605716 on both front and rear of the engine.
 Slight bending for clearance at the rear of the engine is required.

Description of Operation

Modify coolant air bleed cross over pipe 12605716 by cutting the air bleed tube flush then drill and tap for 1/8 NPT. Use Aeroquip #4 fittings to connect coolant air bleeds to the return side of the coolant system.

Use a modified air bleed cross over pipe assembly 12605716 on both the front and rear of the GMOD Engine.

Use new "O"rings on the pipe assemblies each test. Torque the cross over tube fasteners to 106 ± 10 lb. in.

Torque the coolant inlet manifold fasteners a first pass to 11 ± 2 lb.ft. Tighten the coolant manifold fasteners a final pass to 22 ± 2 lb ft.

Specification

- 1 12605716 Pipe Assembly
- 2 11588715 Bolt Air Bleed Tube (4)
- 3 12602541 Seal "O"ring (4)

REV	Date	Revision History

View	
Coolant Manifold & Air Bleed	
Coolant Manifold & Air Bleed Modification	

Long Block Assembly

GMOD

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15



Description of Operation

Install the OHT Coolant Manifold Assembly.

Torque the coolant manifold fasteners a first pass to 11 ± 2 lb.ft.

Tighten the coolant manifold fasteners a final pass to 22 ± 2 lb ft.

Specification

- 1 12630223 Gasket OHT Coolant Manifold
- 2 OHTGMOD-008-1 Coolant Manifold

REV	Date	Revision History

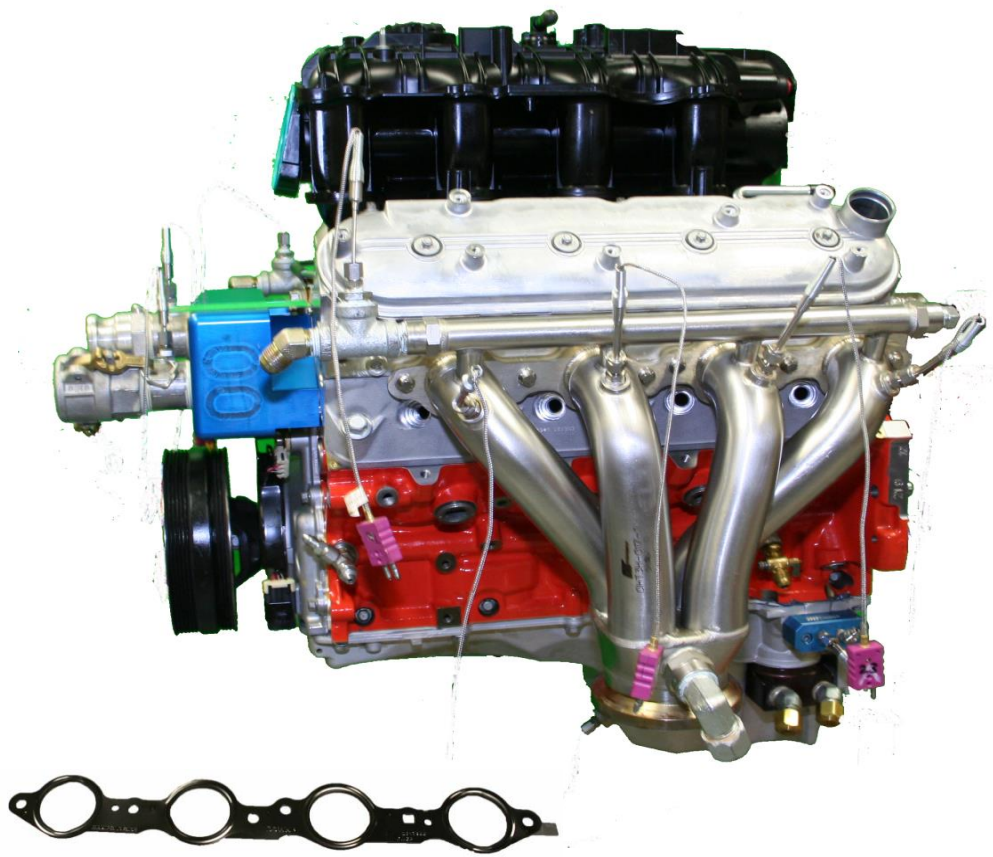
View	
Coolant Manifold & Air Bleed	

Long Block Assembly

GMOD

Section
5

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16



Description of Operation

If the engine is ready to go into the test cell, install the water cooled exhaust manifolds using new gaskets and tighten the manifolds working from the center out.

Tighten the exhaust manifold fasteners a first pass to 11 ± 2 lb.ft. with a second pass to, 15 ± 2 lb. ft.

Specification

- 1 OHTGMOD-017-1 Exh. Manifold Water Cooled, w/Takedown Tube
- 2 12617944 Gasket, Exh. Manifold

REV	Date	Revision History

View	
Water Cooled Exhaust Manifold	

Long Block Assembly

GMOD

Section
5

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Section 6

Final Dress and Instrumentation

2/15/2016

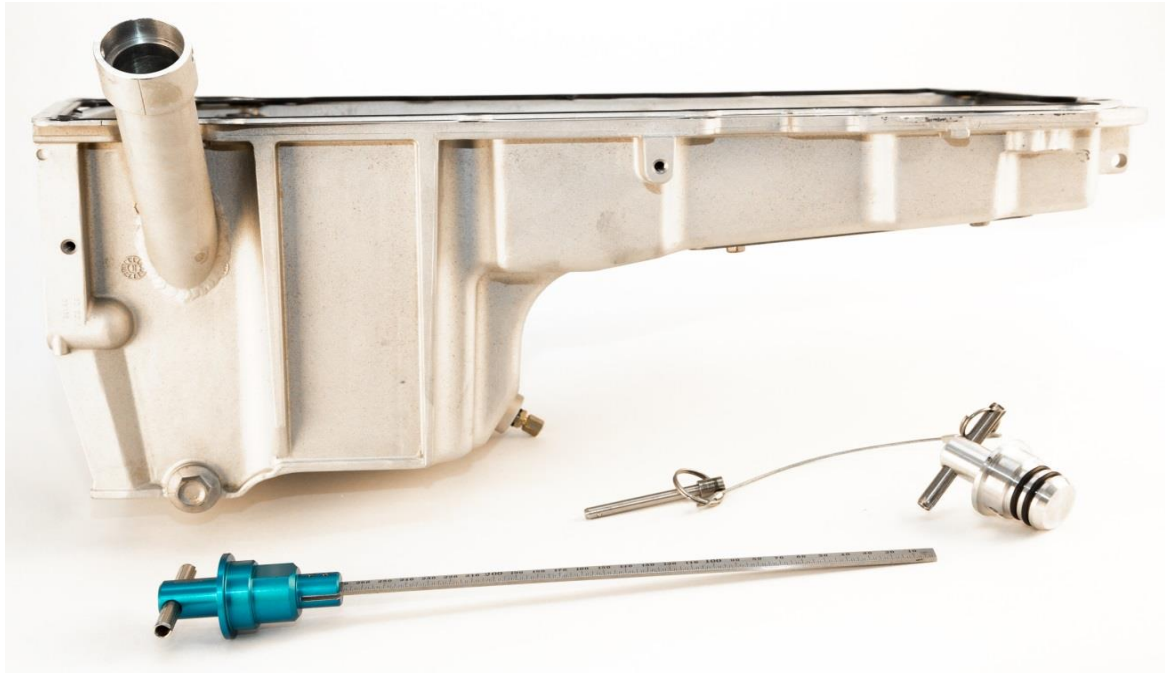
			Description of Operation	
			A	Install the flywheel to the crankshaft.
			B	Install flywheel bolts with GM RTV Sealer on the threads. Sealer required to prevent oil leak.
			C	Tighten the bolts in the sequence indicated
			D	<ol style="list-style-type: none"> 1. First pass to 20 Nm (15 lb ft) 2. Second pass to 50 Nm (37 lb ft) 3. Final pass to 100 Nm (74 lb ft)
			Specification	
			1	12571611, Flywheel
			2	OHTGMOD-203-1, Bolt, Flywheel
				GM RTV 12378521 or 88864346
REV	Date	Revision History	View	
			Flywheel Installation	
Final Dress		GMOD		Section
				6
				Sheet
				1

Section 7

OHT Hardware

2/15/2016

Description of Operation



Specification

- 1 OHTGMOD-005-1 Pan, Oil
- 2 OHTGMOD-005-18 Plug, Dipstick
- 3 OHTGMOD-005-25 Dipstick, Oil

REV	Date	Revision History

View

Oil Pan with Dipstick & Plug

OHT	GMOD
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Description of Operation

Specification

1 OHTGMOD-008-1 Manifold, Coolant

REV	Date	Revision History

View

Coolant Manifold

OHT

GMOD

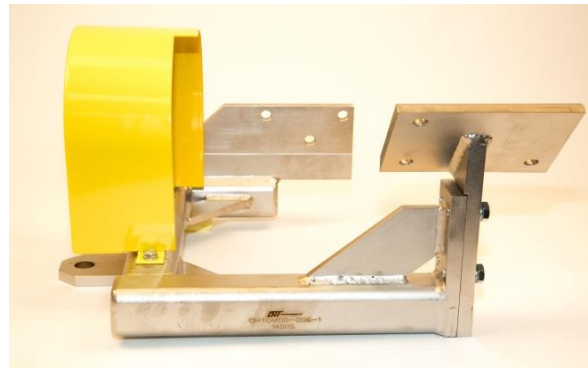
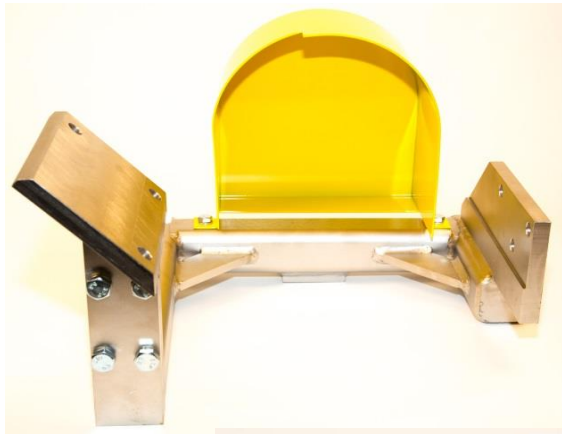
Section

7

Sheet

2

Description of Operation



Specification

1 OHTGMOD-006-1

REV	Date	Revision History

View	
Front Engine Mount Assembly	

OHT

GMOD

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3

Description of Operation



Specification

1 OHTGMOD-007-1

REV	Date	Revision History

View

Rear Engine Mount

OHT

GMOD

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			Description of Operation		
			Specification		
			1 OHTGMOD-004-1 Tool, Cam Bushing		
			View		
			Cam Bushing Installation Tooling		
OHT		GMOD		Section	Sheet
				7	5



Description of Operation

Specification

1 OHTGMOD-016-1 Block, Pressure, Oil

REV	Date	Revision History

View

Oil Pressure Block

OHT

GMOD

Section

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Description of Operation

Specification

1 OHTGMOD-017-1 Manifold, Exhaust Water Cooled with Take Down Tube

REV	Date	Revision History

View

Water Cooled Exhaust Manifold

OHT

GMOD

Section

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Sheet

7



Description of Operation

Specification

- 1 OHTGMOD-015-1 Cover, Rear
Replaces 19166179 which leaks oil

REV	Date	Revision History

View	
Rear Cover	

OHT

GMOD

Section
7

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Section 8

Ultrasonic Maintenance and Parts Cleaning Procedure

2-15-2016

Maintenance Procedure:

- 1) Turn on the pump in the ultrasonic machine to skim the oil off of the top. Use a hose with tap water to aid in spraying the oil out of the side skimmer.



- 2) Ensure that the ultrasonic machine is powered OFF. The transducers can fail if the ultrasonic machine is left on.



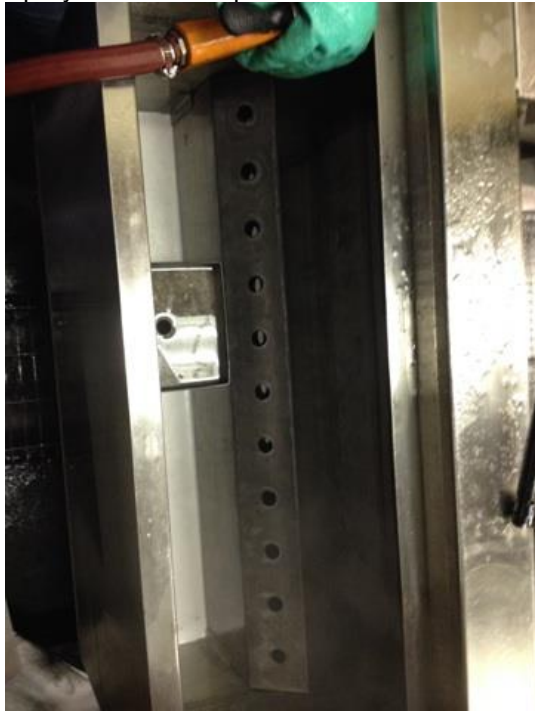
- 3) Drain ultrasonic machine main unit and oil separator bin.



- 4) Spray out residue from inside of the main unit of the ultrasonic machine towards the drain.



- 5) Spray out the oil separator bin on the left of the ultrasonic cleaner and drain.



- 6) Fill the oil separator bin with water and turn on the pump to purge the lines of all contaminants. This will pump into the main unit of the ultrasonic cleaner and will need to be rinsed down the drain once the pump is turned off.
- 7) Close the drain valves and fill the main unit of ultrasonic machine $\frac{1}{4}$ of the way with water from the tap, if the water is not clear drain and spray out the ultrasonic machine to rid it of all contaminants and refill with tap water.
- 8) Fill the ultrasonic machine with tap water up above the $\frac{3}{4}$ mark of the ultrasonic machine main unit and skimmer unit.
- 9) Power the ultrasonic machine back on and set the heat to a minimum of 140°F. This step will take about 5 – 6 hours.



- 10) Add solution once ultrasonic machine reaches a minimum of 140°F. DO NOT add the degreasers until the ultrasonic machine has reached a temperature of 140°F.
 - a. 5 ½ gallons of ultrasonic solution 7
 - b. ½ gallon of ultrasonic solution B
 - c. Change the soap and water solution at least after every 25 h of use.
*Note: The solution shown above is based upon the MOT-500NS model (158 gallon capacity), please adjust the solution rate to 0.035 gallons (4.48 oz) of ultrasonic solution 7 to one gallon of water and 0.003 gallons (0.38 oz) of ultrasonic B to one gallon of water for larger or smaller units.
- 11) De-aerate the ultrasonic machine solution for a minimum of 2 hours by powering the Ultrasonic transducers on at a minimum temperature of 140°F.
- 12) As water evaporates from the ultrasonic bath between soap change intervals, return the bath to the fill line prior to each use with tap water.

The engine block Post Hone Cleaning Procedure is in Section 3, Sheet 1.

Parts Cleaning Procedure:

- 1) Ensure Ultrasonic Machine is on at a minimum temperature of 150 + or - 10°F.
- 2) Cycle the pump in the ultrasonic machine to skim the oil off of the top prior to washing every engine block for a minimum of 15 minutes.
- 3) Place GMOD engine hardware on Ultrasonic Machine lift table.
- 4) Lower Ultrasonic Machine lift table, close the hydraulic lid, and turn on ultrasonics and oscillation movement to the lift table.
- 5) Leave GMOD engine hardware in the Ultrasonic Machine for 60 minutes + or – 15 minutes.
- 6) Remove the GMOD engine hardware and spray with hot water for one minute. DO NOT spray the hardware over the ultrasonic cleaner bath.
- 7) Immediately after spray the GMOD Hardware with 50/50 EF411 and Solvent to remove the water and prevent rust and oxidation flash over.

Section 9

GMOD Special Test Equipment

2-15-2016

- **Sunnen Equipment**
 - Model SV-10 Honing Machine
 - Honing stones: DHH7GMH55, DHH7RMH907, DHHB7534
 - SHO965 honing fluid
 - Honing Filter PF105 (5 micron)
 - Matts CV-1100
- **Surface Finish Measurement Equipment**
 - Mitutoyo Surftest SJ410
 - Deep Groove Stylus (5 μ m tip): 12AAB409
 - Skid Nose Piece: 12AAC755
 - 50 mm Extension: 12AAG202
 - Surface Analyzer support plate (See GMOD Test Stand Manual, Appendix F)
- **Ultra Sonic Engine Cleaner**
 - Tierra Tech MOT-500NS or larger size
- **Build Measurement Equipment**
 - Starrett No270 Tapered Gage
 - Dial Bore Gage for measuring the bores
 - Master Ring gage 99.000 mm (3.900")
 - Bore Measurement Ladder (See GMOD Test Stand Manual, Appendix H)
- **Additional Equipment**
 - Suitable certified scale for measuring the initial oil fill

Section 10

Parts List

2/15/2016

GMOD Parts from Chevy Performance Warehouse

Description	Part Number	Quantity per engine	Part Replacement
Block, GMOD with main bearing caps and AN	88958771	1	6 tests
Crankshaft, w/reluctor	12588612	1	6 tests
Pin, piston	12570512	8	each test
Rods, conn includes bolt and cap	12649190	8	each test
Camshaft	12625437	1	6 tests
Head-cyl w/valves installed	12629058	2	3 tests
Seal Kit, Intake valve, quantity of 8 per bag	12482063	1	each test
Seal Kit, Exhaust valve, quantity of 8 per bag	12482062	1	each test
Bolt, head long	19258707	20	each test
Bolt, head short	12558840	10	each test
Camaro Oil Cooler	12607900	1	as needed
O ring seal for cooler	12613165	4	each test
Dyno Wiring Harness	GMOD Harness	1	as needed
Engine Controller, GMOD 1013	GMOD 1013	1	as needed
Throttle Pedal Simulator	xx031519aa	1	as needed
Manifold, Intake ASM	12644373	1	as needed
O-ring kit, Coolant AN Core plugs	GMW395	1	each test
O-ring, Coolanet Large Core Plugs	MS92794	8	Each test
O-ring, Camaro oil separator	12656319	2	each test

GMOD Parts Purchased From GM Dealership

From Dealers	Part Number	Quantity per engine	Part Replacement
Plug, block oil gallery	12573460	1	each test
Plug, Main Oil Gallery	14090911	1	as needed
Head Locator Dowels	12570326	4	as needed
Pin, Transmission Location	1453658	2	as needed
Core plug hole	9427693	1	each test
Bolt, Lifter Guide	11514139	8	6 runs only
Bolt, Cam Thrust Plate	11561455	6	6 runs only

Gasket, Oil Pan	12612350	1	each test
Gasket, Oil Pan Cover	12611384	1	each test
Oil Pickup tube, includes seal	12608579	1	seal each test
Seal, Oil Pump Pickup Tube	12584922	1	each test
Bolt, pickup tube	11519133	1	6 runs only
Deflector, CR/SHF oil	12611129	1	as needed
Nut, deflector and oil pickup tube	11609746	9	6 runs only
Bolt, Oil Pan	11515758	1	6 runs only
Bolt, Oil Pan long	12554990	2	6 runs only
Key, cr/shf balr	12561513	1	6 runs only
Sprocket-CR/SHF	12556582	1	6 runs only
	12634105 or	1	
Harmonic Balancer	19300488		as needed
Bolt, Harmonic Balancer	12557840	1	each test
Bolts, flywheel	11569956	6	each test
Seal, Crankshaft rear	89060436	1	each test
Rear Cover	49166179	1	Use OHT part
Bolt, rear housing	11588723	12	6 runs only
Dipstick tube	12625031	1	as needed
Seal, dipstick tube	24504031	1	each test
Cam thrust retainer plate	19244460	1	6 runs only
Sprocket, Cam	12591689	1	each test
Bolt-camshaft spkt	11561283	3	each test
Throt Body	12629992	2	no
Pump ASM-Oil	12586665	1	6 runs only
Bolt-O/PMP	11515758	4	6 runs only
Tensioner, Timing Chain W/Bolts	12626407	1	each test
Chain ASM-TMG	12646386	1	each test

GMOD Parts Purchased From GM Dealership

Cover asm-eng frt w/ bolts, cam sensor, se	12633906	1	as needed
Breakdown of the front cover ASM			
Front Cover	12600326	1	as needed
Camshaft Position Sensor	12591720	1	as needed
Sensor bolt	11588712	1	as needed
Sensor wire assembly	12627501	1	as needed
Bolt, Front cover	11515758	8	6 runs only
Gasket, eng frt Cover	12633904	1	each test
Seal, eng frt Cover	12585673	1	each test
Flywheel	12571611	1	as needed
Bolts, flywheel	11569956	6	
pushrod	10238852	16	each test
Rocker	10214664	16	each test
Rocker arm bolts	12560961	16	each test
Support, valve rocker arm pivot	12552203	2	as needed
Lifter	12576400	16	each test
Guide, tappet	19166182	8	6 runs only
Gasket, Rocker Cover (LH & RH)	12637683	2	each test
Rocker cover, RH	12582224	2	as needed
Oil Fill Tube	12584043	2	as needed
Seal, Oil fill tube	12593348	2	each test
Bolt, Rocker Cover	12577215	8	6 runs only
Head Gaskets	12589226	3	each test
Gasket, Intake	89060413	2	each test
Valve, intake	12627971	8	each test
Valve, exhaust	12563064	8	each test
Spring, Valve	12589774	16	each test
Cap, Vlv Spr	10166344	16	each test
Key, VLV SPR	10166345	2	each test
Plug, cyl head	11610259	1	as needed
Pipe ASM -eng cool air bleed	12605716	2	as needed
Cover, engine coolant air bleed	12602540	2	as needed
Bolt-Engine Cool Air Bleed Pipe and cover	11588715	4	no
Seal, Coolant cross-over tube and cover	12602541	4	each test
Gasket, Water Pump	12630223	2	each test
Gasket, Valley	12610141	1	each test
Spark Plugs AC Delco, 41-110	12621258	8	each test
Coil, Ignition	12611424	8	as needed

GMOD Parts Purchased From GM Dealership

coil jumper wires	12579355	2	as needed
Brackets-coil	12580353	2	as needed
Bolts-coil	11516424	8	as needed
Stud, Ign coil brkt to cvr	12554211	10	as needed
Plug wires, ACCEL 9059C		8	as needed

Sensor, Oil Pressure	12621234	1	as needed
Sensor, coolant	12608814	1	as needed
Sensor ASM-Crankshaft posn	12585546	1	as needed
Bolt-CR/SHF posn sensor	11515756	1	as needed
SENSOR ASM-KNOCK	12623730	1	as needed
Sensor, O2	12581966	2	as needed
Camaro oil separators	12653073	2	as needed
Gasket, exh manifold	12617944	2	each test
O ring seal for cooler	12613165	4	each test

Cover ASM, valley (W/ Bolts / gaskets)	12598832	1	as needed
Bolt, Valley	11518075	11	as needed
Air filter	92196275	1	as needed
Air Box	92230374	1	as needed
Sensor, MAF	15865791	1	as needed
Duct	92196314	1	as needed
Seal Kit, Injector	19169305	8	each test
Retainer, Injector	12570620	8	each test

<u>Components of the Intake Manifold Assm</u>			
Manifold, Intake	12638038	1	as needed
Gasket, Int Manif	12600255	1	each test
Screw, fuel rail mounting	12580910	4	as needed
Throt Body	12629992	1	as needed
Stud, ACV mounting	11588398	1	as needed
Nut, ACV mounting	12580908	1	as needed
Screw, ACV	12580909	1	as needed
Seal - ACV	12589235	1	as needed
Sensor, MAP	12644228	1	as needed
Fastener, manifold	12575384	10	as needed
Purge Solenoid	12639220	1	as needed
Harness _ EVAP Emis CNSTR	12574897	1	as needed
Injector	12613411	8	each test
Valve asm fuel pressure serv vlv	12568158	1	as needed

GMOD Parts Purchased From GM Dealership

Cap, Fuel pressure serv vlv	25532662	1	as needed
Ground bracket	12593800	1	as needed
Fuel rail w/o injectors	12621668	2	as needed
Fuel rail w/o injectors, alternative	12660709	1	as needed
MAP sensor retainer	12615934	1	as needed

GMOD Parts Purchased from OHT

Description	Part Number	Quantity per engine	Part Replacement
BEARING, ENGINE SET (MAIN, CONN ROD	OHTGMOD-001-1	1	each test
TOOL, RING INSTALLATION	OHTGMOD-003-1		
TOOL, CAM BEARING INSTALLATION	OHTGMOD-004-1		
PAN, OIL, MODIFIED	OHTGMOD-005-2	1	as needed
Heat sheild. Oil pan left	GMOD-005-32	1	as needed
Heat sheild. Oil pan right	GMOD-005-33	1	as needed
MANIFOLD, COOLANT IN / OUT	OHTGMOD-008-1	1	as needed
BLOCK, PRESSURE, OIL, REAR	OHTGMOD-016-1	1	as needed
MANIFOLD, EXHAUST, WATER COOLED, IN	OHTGMOD-017-1	1	as needed
PISTON, RUN 1	OHTGMOD-898-1		each test
PISTON, RUN 2	OHTGMOD-899-1		each test
PISTON, RUN 3	OHTGMOD-900-1		each test
PISTON, RUN 4	OHTGMOD-901-1		each test
PISTON, RUN 5	OHTGMOD-902-1		each test
PISTON, RUN 6	OHTGMOD-903-1		each test
O-RING, THRUST, CAM, GMOD	OHTGMOD-200-1	1	each test
O-RING, SHORT, REAR COVER, GMOD	OHTGMOD-201-1	1	each test
SEAL, LONG, REAR COVER, GMOD	OHTGMOD-202-1	1	each test
RING, ENGINE SET, SPECIAL TEST, GMOD, RUN 1	OHTGMOD-03898-1		
RING, ENGINE SET, SPECIAL TEST, GMOD, RUN 2	OHTGMOD-03899-1		
RING, ENGINE SET, SPECIAL TEST, GMOD, RUN 3	OHTGMOD-03900-1		
RING, ENGINE SET, SPECIAL TEST, GMOD, RUN 4	OHTGMOD-03901-1		
RING, ENGINE SET, SPECIAL TEST, GMOD, RUN 5	OHTGMOD-03902-1		
RING, ENGINE SET, SPECIAL TEST, GMOD, RUN 6	OHTGMOD-03903-1		
RING, SPECIAL TEST, TOP, RUN 1	GMOD03898-TOP1		
RING, SPECIAL TEST, TOP, RUN 2	GMOD03899-TOP2		
RING, SPECIAL TEST, TOP, RUN 3	GMOD03900-TOP3		
RING, SPECIAL TEST, TOP, RUN 4	GMOD03901-TOP4		
RING, SPECIAL TEST, TOP, RUN 5	GMOD03902-TOP5		
RING, SPECIAL TEST, TOP, RUN 6	GMOD03903-TOP6		
RING, SPECIAL TEST, SECOND, RUN 1	GMOD03898-SECOND1		
RING, SPECIAL TEST, SECOND, RUN 2	GMOD03899-SECOND2		
RING, SPECIAL TEST, SECOND, RUN 3	GMOD03900-SECOND3		
RING, SPECIAL TEST, SECOND, RUN 4	GMOD03901-SECOND4		
RING, SPECIAL TEST, SECOND, RUN 5	GMOD03902-SECOND5		
RING, SPECIAL TEST, SECOND, RUN 6	GMOD03903-SECOND6		
RING, RAIL	GMOD03X-01		

GMOD Parts Purchased from OHT

RING, EXPANDER	GMOD03X-02		
O-RING, THRUST, CAM, GMOD	OHTGMOD-200-1	1	each test
Rear Cover	OHTGMOD-015-1	1	
O-RING, SHORT, REAR COVER, GMOD	OHTGMOD-201-1	1	each test
SEAL, LONG, REAR COVER, GMOD	OHTGMOD-202-2	1	each test
MOUNT, FRONT, ENGINE	OHTGMOD-006-1		
MOUNT, REAR, ENGINE	OHTGMOD-007-1		
HOUSING, OBERG ASSEMBLY, W/ Teflon	OHT6A-012-4		
Gasket, Teflon, Oberg Housing	OHTGMOD 096-1		
FILTER, OBERG, 6", 60 MICRON	OHT6A-013-3		
Heat shield. Oil pan left	GMOD-005-32		
Heat shield. Oil pan right	GMOD-005-33		
Bolt, Flywheel	OHTGMOD-203-1	6	As needed

Section 11

Reagents

2-15-2016

Engine Build

- EF-411 Engine Assembly Lubricant
- Petroleum Jelly containing 100% White Petrolatum for holding the front and rear cover orings
- GM RTV 12378521 or 88864346 for the oil pan corners and flywheel bolt threads.
- Teflon Tape for plug/pipe threads not to come in contact with oil
- No. 2 Permatex Sealer for under the head of the side main cap bolts and oil gallery plug

Engine Degreasing Solvent

- Mineral Spirits meeting ASTM Specification D 235 Type II Class C
- Organic Solvent Penmul L460

Sunnen

- Sunnen Honing Fluid SHO-965

Ultrasonic Cleaner Chemicals

Purvis Industries

- Ultrasonic B Degreaser
- Ultrasonic 7 Soap

Brulin US Solution

- 815 GD
- 815 QR-DF