

CONNECTING ROD NUT/BOLT

Connecting Rod Bolt	
First Pass	25 Nm (18 lb ft)
Final Pass	100 degrees
Connecting Rod Bore Diameter	
Bearing End	52.118-52.134 mm (2.0519-2.05252 in)
Pin End	23.007-23.017 mm (0.9058-0.9062 in)
Connecting Rod Side Clearance	0.070-0.370 mm (0.0028-0.0146 in)
Connecting Rod Straightness	
Bend - Maximum	0.021 mm (0.0083 in)
Twist - Maximum	0.04 mm (0.0157 in)
Connecting Rod Journal Diameter	49.000-49.014 mm (1.9291-1.9297 in)

CONNECTING ROD BEARING CLEARANCE

Connecting Rod Bearing Clearance	0.029-0.073 mm (0.0011-0.0029 in)
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Crankshaft Main Journal Diameter	55.994-56.008 mm (2.2045-2.2050 in)
Crankshaft End Play	0.050-0.380 mm (0.0012-0.0150 in)

MAIN BEARING CAP

<u>Crankshaft</u> Bearing - Lower Crankcase to Block - Bedplate	
First Pass	20 Nm (15 lb ft)
Final Pass	77 degrees
Crankshaft Main Bearing Bore Diameter	64.068-64.082 mm (2.5224-2.5229 in)
Crankshaft Main Bearing Clearance	0.031-0.067 mm (0.0012-0.0026 in)

CYLINDER HEAD SURFACE VARIATION

Surface Flatness - Block Deck	
Longitude	0.050 mm (0.002 in)
Overall	0.1 mm (0.004 in)
Transverse	0.030 mm (0.0012 in)

CYLINDER BLOCK

Cylinder Head Deck Surface Flatness	
Longitude	0.050 mm (0.002 in)
Overall	0.10 mm (0.0039 in)
Transverse	0.030 mm (0.0012 in)

CYLINDER BORE DIAMETER

Cylinder Bore Diameter CYLINDER BORE TAPER	85.992-86.008 mm (3.3880-3.3887 in)
Cylinder Bore Taper Maximum CYLINDER OUT OF ROUND	0.010 mm (0.0004 in)
Cylinder Bore Out-of-Round Maximum <u>CRANKSHAFT</u> JOURNAL DIAMETER & LIMIT	0.010 mm (0.0004 in)
<u>Crankshaft</u> Main Journal Diameter	55.994-56.008 mm (2.2045-2.2050 in)
<u>Crankshaft Main Bearing</u> Bore diameter	64.068-64.082 mm (2.5224-2.5229 in)
<u>Crankshaft</u> End Play <u>CRANKSHAFT MAIN BEARING</u> CLEARANCE	0.050-0.380 mm (0.0012-0.0150 in)
<u>Crankshaft Main Bearing</u> Clearance MAIN BEARING CAP	0.031-0.067 mm (0.0012-0.0026 in)
<u>Crankshaft</u> Bearing - Lower Crankcase to Block - Bedplate First Pass	20 Nm (15 lb ft)
Final Pass <u>CONNECTING ROD BEARING</u> CLEARANCE	77 degrees
<u>Connecting Rod Bearing</u> Clearance	0.029-0.073 mm (0.0011-0.0029 in)
<u>Connecting Rod</u> Bore Diameter Bearing End	52.118-52.134 mm (2.0519-2.05252 in)
Pin End	23.007-23.017 mm (0.9058-0.9062 in)
<u>Connecting Rod</u> Side Clearance	0.070-0.370 mm (0.0028-0.0146 in)
<u>Connecting Rod</u> Straightness Bend - Maximum	0.021 mm (0.0083 in)
Twist - Maximum	0.04 mm (0.0157 in)
<u>Connecting Rod</u> Journal Diameter <u>PISTON</u> CLEARANCE	49.000-49.014 mm (1.9291-1.9297 in)
<u>Piston</u> to Bore Clearance <u>PISTON RING</u> END GAP	0.010-0.041 mm (0.0004-0.0016 in)
First Compression Ring	0.20-0.35 mm (0.0078-0.0138 in)
Second Compression Ring	0.35-0.55 mm (0.014-0.022 in)
Oil Control Ring - Rails <u>PISTON RING</u> TO GROOVE CLEARANCE	0.25-0.75 mm (0.010-0.030 in)
First Compression Ring	0.040-0.080 mm (0.0016-0.0031 in)
Second Compression Ring	0.003-0.068 mm (0.0001-0.0027 in)
Oil Control Ring <u>PISTON RING</u> THICKNESS	0.024-0.176 mm (0.0009-0.0069 in)
First Compression Ring	1.170-1.190 mm (0.0461-0.0469 in)
Second Compression Ring	1.471-1.490 mm (0.0579-0.0587 in)
Oil Control Ring - Rail - Maximum	0.473 mm (0.0186 in)

Oil Control Ring - Spacer 0.96-1.04 mm (0.0378-0.0409 in)

PISTON RING GROOVE WIDTH

Oil Control 2.001-2.003 mm (0.0788-0.0789 in)

Second 1.52-1.54 mm (0.0598-0.0606 in)

Top 1.23-1.25 mm (0.0484-0.0492 in)

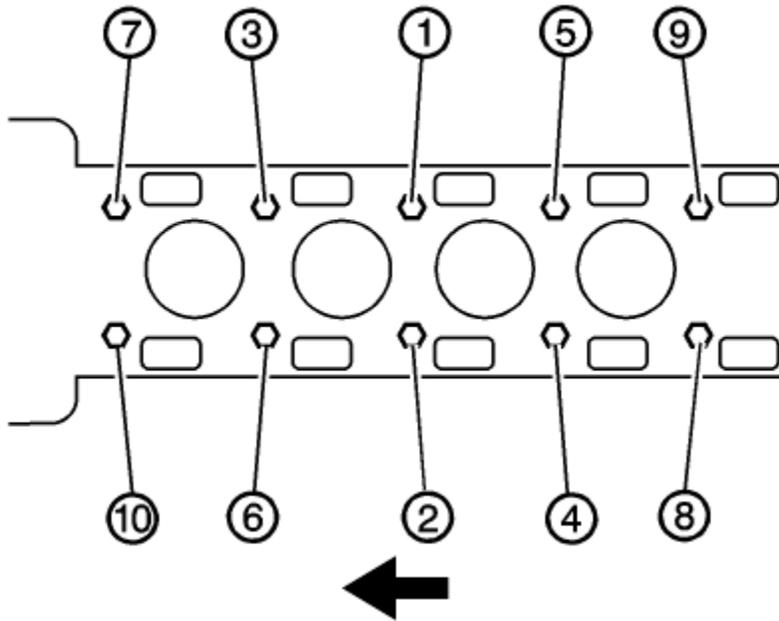
PISTON DIAMETER

Piston Diameter - @14.5 mm up 85.967-85.982 mm (3.3845-3.3851 in)

CRANKSHAFT PULLEY

Crankshaft Balancer Bolt
First pass 100 Nm (74 lb ft)

Final pass 125 degrees



Cylinder Head Bolt
First Pass 30 Nm (22 lb ft)

First Pass 155 degrees

CYLINDER HEAD BOLT RE-USABILITY

Note: Do not use any sealing material. Always use NEW cylinder head bolts.

INTAKE MANIFOLD

Intake Manifold to Cylinder Head Bolt 22 Nm (16 lb ft)

Intake Manifold to Cylinder Head Nut 22 Nm (16 lb ft)

CAMSHAFT BEARING CAP

Camshaft Cap Bolt 10 Nm (89 lb in)
MAIN BEARING CAP

Crankshaft Bearing - Lower Crankcase to Block - Bedplate
First Pass 20 Nm (15 lb ft)

Final Pass 77 degrees
ROD BEARING CAP

Connecting Rod Bolt
First Pass 25 Nm (18 lb ft)

Final Pass 100 degrees
CRANKSHAFT PULLEY

Crankshaft Balancer Bolt
First pass 100 Nm (74 lb ft)

Final pass 125 degrees
FLYWHEEL/FLEXPLATE

Flywheel Bolt - Automatic Transmission
First Pass 53 Nm (39 lb ft)

Final Pass 25 degrees

Flywheel Bolt - Manual Transmission
First Pass 53 Nm (39 lb ft)

Final Pass 25 degrees

OIL PUMP

Oil Pump Gerotor Cover Bolt 6 Nm (53 lb in)

EXHAUST MANIFOLD

Exhaust Manifold to Cylinder Head Nut 14 Nm (10 lb ft)

WATER PUMP

Water Pump Bolts 25 Nm (18 lb ft)

Engine Oil with Filter 5.0 quarts 4.7 liters)

Oil Pressure - minimum @ 1000 RPM (344.75-551.60 kPa (50-80 psi)

Application	Specification	
	Metric	English
Ignition Type	Coil-On-Plug	
Firing Order	1-3-4-2	
Spark Plug Torque	17-23 Nm	12.5-17 lb ft
Spark Plug Gap	0.9-0.75 mm	0.035-0.030 in

Fuel Pressure (Key ON, Engine OFF) 395-464 kPa (57-67 psi)
Should not decrease more than 34 kPa (5 psi) in 1 minute.

CRANKSHAFT PULLEY

Crankshaft Balancer Bolt
First pass 100 Nm (74 lb ft)
Final pass 125 degrees

INTAKE MANIFOLD

Bolt 22 Nm (16 lb ft)
Nuts 22 Nm (16 lb ft)

THROTTLE BODY

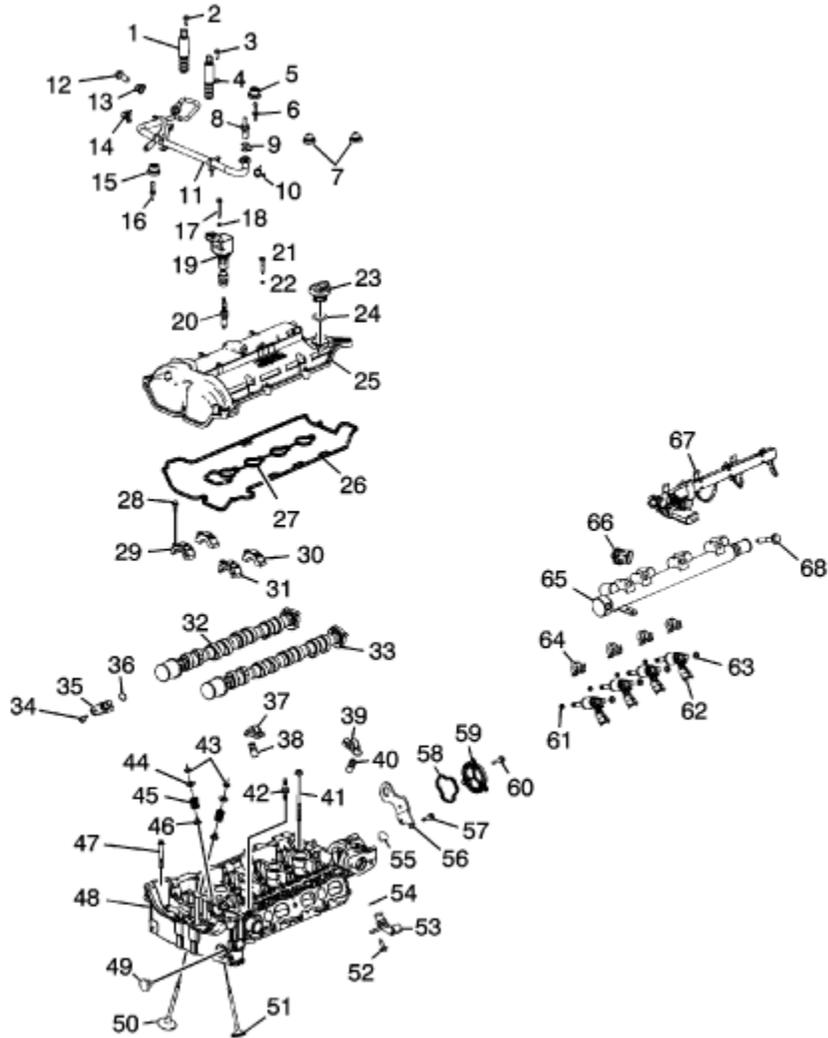
Throttle Body Bolt 10 Nm (89 lb in)
Throttle Body Nut 10 Nm (89 lb in)

Oil Pump Cover Bolt 6 Nm (53 lb in)

PISTON CLEARANCE

Piston to Bore Clearance 0.010-0.041 mm (0.0004-0.0016 in)
PISTON DIAMETER

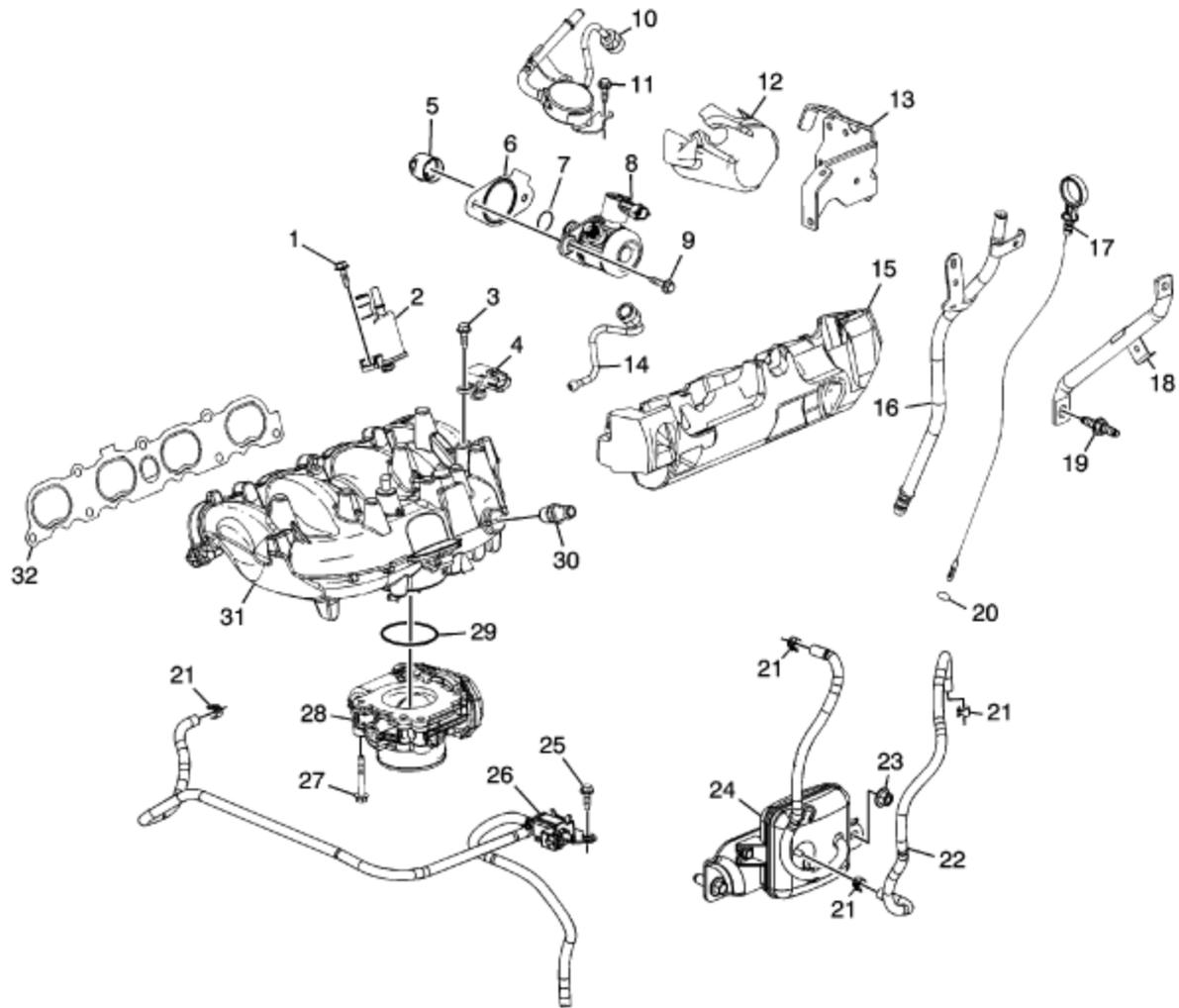
Piston Diameter - @14.5 mm up 85.967-85.982 mm (3.3845-3.3851 in)
Cylinder Head and Components



-
- 1 - Camshaft Position Actuator Solenoid Valve - Intake
 - 2 - Camshaft Position Actuator Solenoid Valve Bolt
 - 3 - Camshaft Position Actuator Solenoid Valve Bolt
 - 4 - Camshaft Position Actuator Solenoid Valve - Exhaust
 - 5 - Upper Intake Manifold Sight Shield Grommet
 - 6 - Ball Stud
 - 7 - Upper Intake Manifold Sight Shield Grommet
 - 8 - Turbocharger Coolant Feed Pipe Fitting
 - 9 - Turbocharger Coolant Feed Hose Gasket
 - 10 - Turbocharger Coolant Feed Hose Clamp
 - 11 - Turbocharger Coolant Feed Hose
 - 12 - Turbocharger Coolant Feed Hose Bolt
 - 13 - Turbocharger Coolant Feed Hose Gasket

- 14 - Turbocharger Coolant Feed Hose Clamp
- 15 - Upper Intake Manifold Sight Shield Grommet
- 16 - Ball Stud
- 17 - Ignition Coil Bolt
- 18 - Ignition Coil Bolt Retainer
- 19 - Ignition Coil
- 20 - [Spark Plug](#)
- 21 - Camshaft Cover Bolt
- 22 - Camshaft Cover Bolt Retainer
- 23 - Oil Fill Cap
- 24 - Oil Fill Cap Seal
- 25 - Camshaft Cover
- 26 - Camshaft Cover Seal
- 27 - Camshaft Cover Seal
- 28 - [Camshaft](#) Cap Bolt
- 29 - [Camshaft](#) Cap
- 30 - [Camshaft](#) Cap
- 31 - [Camshaft](#) Cap
- 32 - Exhaust [Camshaft](#)
- 33 - Intake Camshaft
- 34 - Camshaft Position Sensor Bolt
- 35 - Camshaft Position Sensor
- 36 - Camshaft Position Sensor O-Ring
- 37 - Roller Finger Follower
- 38 - Hydraulic Lash Adjuster
- 39 - Roller Finger Follower
- 40 - Hydraulic Lash Adjuster
- 41 - Cylinder Head Bolt
- 42 - Coolant Air Bleed Fitting
- 43 - Valve Keys
- 44 - [Valve Spring Retainer](#)
- 45 - [Valve Spring](#)
- 46 - Valve Stem Seal
- 47 - Small Cylinder Head Bolt
- 48 - Cylinder Head
- 49 - [Timing Chain Guide](#) Bolt Access Hole
- 50 - Exhaust Valve
- 51 - Intake Valve
- 52 - Camshaft Position Sensor Bolt
- 53 - Camshaft Position Sensor - Intake
- 54 - Camshaft Position Sensor O-Ring
- 55 - Cylinder Head Gallery Plug
- 56 - Rear Lift Bracket
- 57 - Rear Lift Bracket Bolt
- 58 - Cylinder Head Cover Plate Seal
- 59 - Cylinder Head Cover Plate
- 60 - Cylinder Head Cover Plate Bolt
- 61 - Fuel Injector Seal
- 62 - Fuel Injector
- 63 - Fuel Injector O-Ring
- 64 - Fuel Injector Hold Down Clamp
- 65 - Fuel Rail
- 66 - Fuel Rail Pressure Sensor
- 67 - Fuel Injector Wiring Harness
- 68 - Fuel Rail Bolt

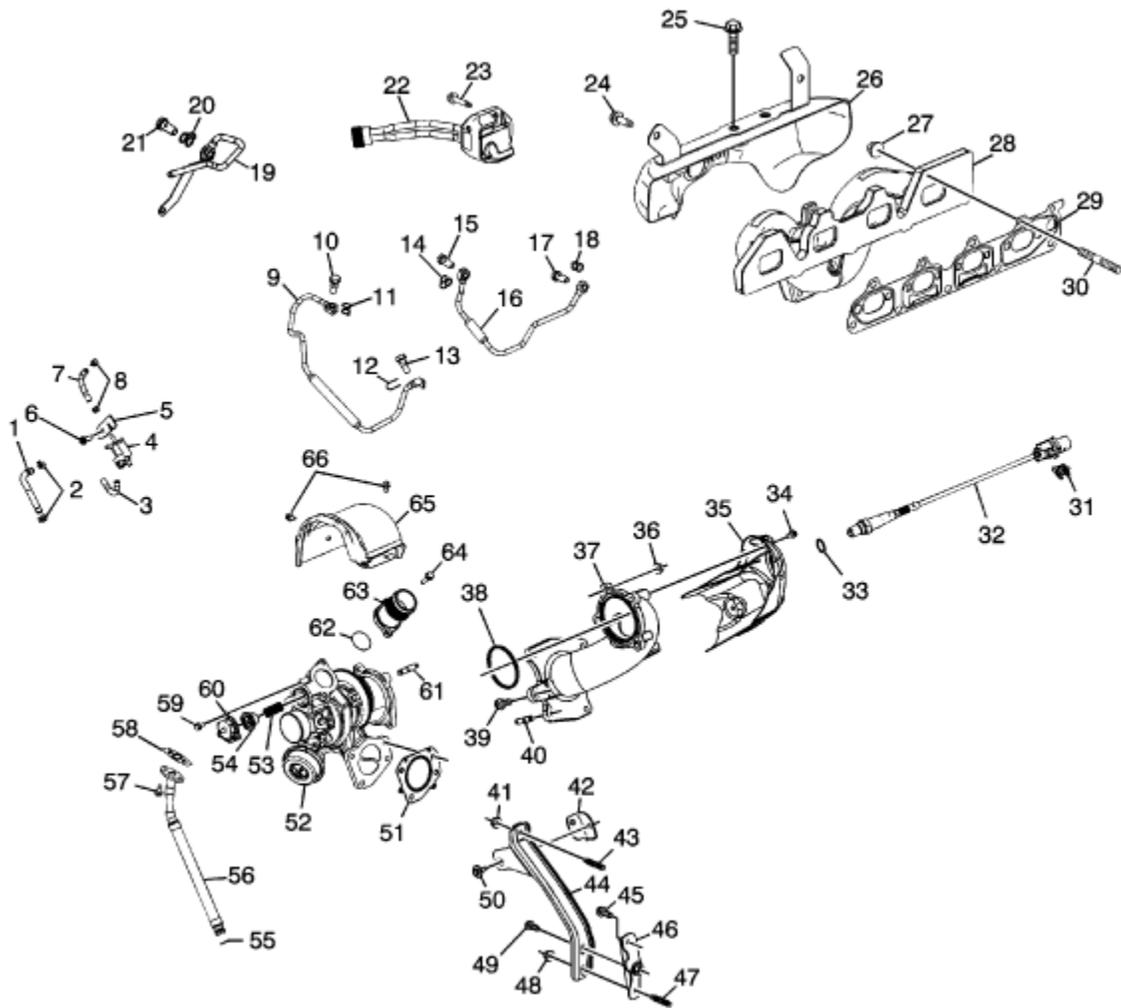
Intake Manifold and Components



-
- 1 - Evaporative (EVAP) Emission Purge Solenoid Valve Bolt
 - 2 - EVAP Purge Solenoid Valve
 - 3 - Manifold Absolute Pressure (MAP) Sensor Bolt
 - 4 - MAP Sensor
 - 5 - Fuel Pump Lifter
 - 6 - High Pressure Fuel Pump Gasket
 - 7 - High Pressure Fuel Pump O-Ring
 - 8 - High Pressure Fuel Pump
 - 9 - High Pressure Fuel Pump Bolt
 - 10 - Fuel Feed Line
 - 11 - Fuel Feed Line Bolt
 - 12 - High Pressure Fuel Pump Insulator
 - 13 - High Pressure Fuel Pump Cover
 - 14 - High Pressure Fuel Line
 - 15 - Fuel Injector Insulator
 - 16 - Oil Indicator Tube
 - 17 - Oil Indicator
 - 18 - Intake Manifold Brace
 - 19 - Intake Manifold Brace Stud
 - 20 - Oil Indicator O-Ring
 - 21 - Charger AIR Bypass Tube Clamp
 - 22 - Charger AIR Bypass Tube Assembly

- 23 - Charger AIR Bypass Valve Tank Assembly Nut
- 24 - Charger AIR Bypass Valve Tank Assembly, Some Models
- 25 - Charger AIR Bypass Valve Solenoid Bolt
- 26 - Charger AIR Bypass Valve Solenoid
- 27 - Throttle Body Bolt
- 28 - Throttle Body
- 29 - Throttle Body Seal
- 30 - Power Brake Booster Fitting
- 31 - [Intake Manifold](#)
- 32 - [Intake Manifold Gasket](#)

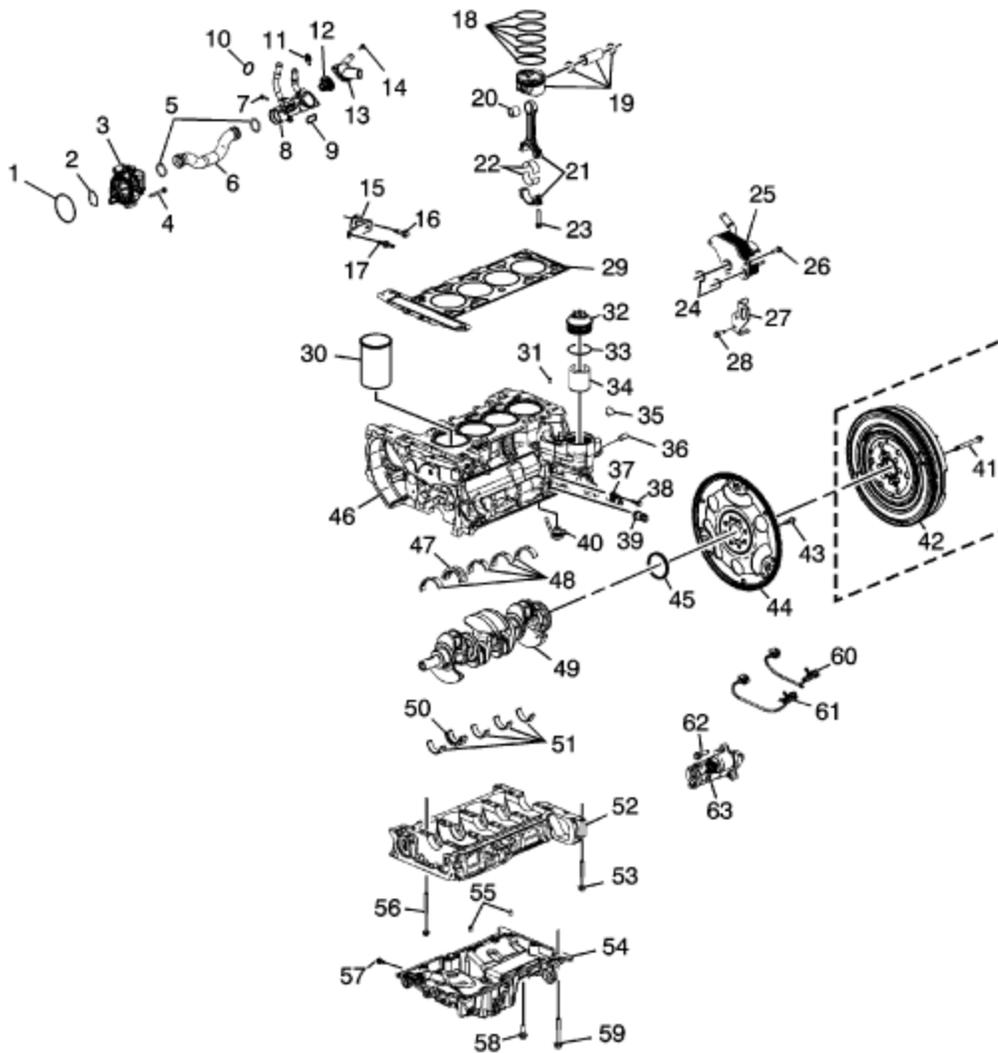
Exhaust Manifold and Components



-
- 1 - Turbocharger Wastegate Regulator Solenoid Hose
 - 2 - Turbocharger Wastegate Regulator Solenoid Hose Clamp
 - 3 - Turbocharger Wastegate Regulator Solenoid Hose
 - 4 - Turbocharger Wastegate Regulator Solenoid Valve Assembly
 - 5 - Turbocharger Wastegate Regulator Solenoid Valve Bracket
 - 6 - Turbocharger Wastegate Regulator Solenoid Valve Bracket Bolt/Screw
 - 7 - Turbocharger Wastegate Regulator Solenoid Hose
 - 8 - Turbocharger Wastegate Regulator Solenoid Hose Clamp

- 9 - Turbocharger Oil Feed Pipe
- 10 - Turbocharger Oil Feed Pipe Bolt
- 11 - Turbocharger Oil Feed Pipe Gasket
- 12 - Turbocharger Oil Feed Pipe Gasket
- 13 - Turbocharger Oil Feed Pipe Bolt
- 14 - Turbocharger Coolant Return Pipe Gasket
- 15 - Turbocharger Coolant Return Pipe Bolt
- 16 - Turbocharger Coolant Return Pipe
- 17 - Turbocharger Coolant Return Pipe Bolt
- 18 - Turbocharger Coolant Return Pipe Gasket
- 19 - Turbocharger Coolant Feed Pipe
- 20 - Turbocharger Coolant Feed Pipe Gasket
- 21 - Turbocharger Coolant Feed Pipe Bolt
- 22 - Engine Coolant Heater
- 23 - Engine Coolant Heater Bolt
- 24 - [Exhaust Manifold Heat Shield](#) Bolt
- 25 - [Exhaust Manifold Heat Shield](#) Bolt
- 26 - [Exhaust Manifold Heat Shield](#)
- 27 - Exhaust Manifold Nut
- 28 - [Exhaust Manifold](#)
- 29 - [Exhaust Manifold Gasket](#)
- 30 - Exhaust Manifold Stud
- 31 - Oxygen Sensor Fastener
- 32 - Oxygen Sensor
- 33 - Oxygen Sensor Gasket
- 34 - Turbocharger [Exhaust Pipe Heat Shield](#) Bolt
- 35 - Turbocharger [Exhaust Pipe Heat Shield](#)
- 36 - Turbocharger Exhaust Pipe Nut
- 37 - Turbocharger [Exhaust Pipe](#)
- 38 - Turbocharger Exhaust Pipe Seal
- 39 - Turbocharger [Exhaust Pipe](#) Bolt
- 40 - Turbocharger [Exhaust Pipe](#) Stud
- 41 - Turbocharger Brace Nut
- 42 - Turbocharger Brace Bracket
- 43 - Turbocharger Brace Stud
- 44 - Turbocharger Brace
- 45 - Turbocharger Brace Bracket Bolt
- 46 - Turbocharger Brace Bracket
- 47 - Turbocharger Brace Bracket Stud
- 48 - Turbocharger Brace Nut
- 49 - Turbocharger Brace Bracket Bolt
- 50 - Turbocharger Brace Bracket Bolt
- 51 - Turbocharger Gasket
- 52 - Turbocharger
- 53 - Turbocharger Air Bypass Valve Spring
- 54 - Turbocharger Air Bypass Diaphragm Assembly
- 55 - Turbocharger Oil Return Pipe O-Ring
- 56 - Turbocharger Oil Return Pipe
- 57 - Turbocharger Oil Return Pipe Bolt
- 58 - Turbocharger Oil Return Pipe Gasket
- 59 - Turbocharger Air Bypass Valve Cover Bolt
- 60 - Turbocharger Air Bypass Valve Cover
- 61 - Turbocharger [Exhaust Pipe](#) Stud
- 62 - Turbocharger Air Cooler Outlet Pipe Seal
- 63 - Turbocharger Air Cooler Outlet Pipe
- 64 - Turbocharger Air Cooler Outlet Pipe Bolt
- 65 - Turbocharger [Heat Shield](#)
- 66 - Turbocharger Heat Shield Bolts

Engine Block and Components



- 1 - [Water Pump](#) to Engine Block Seal
- 2 - [Water Pump](#) Seal
- 3 - [Water Pump](#)
- 4 - Water Pump Bolt
- 5 - Outlet Pipe O-rings
- 6 - Outlet Pipe
- 7 - Coolant [Thermostat Housing](#) Bolt
- 8 - Coolant [Thermostat Housing](#)
- 9 - Thermostat Housing to Block Gasket
- 10 - Coolant [Thermostat Housing](#) Seal
- 11 - Coolant Temperature Sensor
- 12 - [Thermostat](#)
- 13 - Coolant Inlet
- 14 - Coolant Inlet Bolt
- 15 - Water Pipe Support Bracket
- 16 - Water Pipe Support Bracket Bolt
- 17 - Water Pipe Support Bracket Bolt Stud
- 18 - [Piston Ring](#) Assembly
- 19 - [Piston](#) Assembly
- 20 - Connecting Rod Bushing
- 21 - [Connecting Rod](#)
- 22 - [Connecting Rod Bearing](#)

- 23 - Connecting Rod Cap Bolt
- 24 - [Oil Cooler](#) O-ring
- 25 - [Oil Cooler](#)
- 26 - Oil Cooler Bolt
- 27 - Front Lift Bracket
- 28 - Front Lift Bracket Bolt
- 29 - [Cylinder Head Gasket](#)
- 30 - Cylinder Bore Liner
- 31 - Cylinder Head Alignment Pin
- 32 - [Oil Filter](#) Cap
- 33 - [Oil Filter](#) Cap O-ring
- 34 - [Oil Filter](#)
- 35 - Engine Block Gallery Plug
- 36 - Engine Block to Transaxle Alignment Pin
- 37 - Crankshaft Position Sensor
- 38 - Crankshaft Position Sensor Bolt
- 39 - Oil Pressure Switch
- 40 - [Piston](#) Oil Nozzle Assembly
- 41 - Manual Transaxle Flywheel to [Crankshaft](#) Bolt
- 42 - Flywheel - Manual Transaxle
- 43 - Automatic Transaxle Flywheel to [Crankshaft](#) Bolt
- 44 - Flywheel - Automatic Transaxle
- 45 - Crankshaft Rear Seal
- 46 - Engine Block
- 47 - [Crankshaft](#) Thrust Bearing - Upper
- 48 - [Crankshaft](#) Bearing - Upper
- 49 - [Crankshaft](#)
- 50 - Crankshaft Thrust Bearing - Lower
- 51 - [Crankshaft](#) Bearing - Lower
- 52 - Lower Crankcase Main Bearing Bolt
- 53 - Lower Crankcase Perimeter Bolt
- 54 - Engine [Oil Pan](#)
- 55 - Engine Oil Pan Alignment Pins
- 56 - Lower Crankcase Main Bearing Bolt
- 57 - Engine [Oil Pan](#) Drain Plug
- 58 - Engine Oil Pan Bolt
- 59 - Engine [Oil Pan](#) Long Bolt
- 60 - Knock Sensor - Rear
- 61 - Knock Sensor - Front
- 62 - Starter Bolt
- 63 - Starter

Timing Chain and Components

- 20 - Intake Balance Shaft Drive Sprocket
- 21 - Exhaust [Balance Shaft Bearing](#) Carrier
- 22 - Intake [Balance Shaft Bearing](#) Carrier
- 23 - Exhaust [Balance Shaft](#)
- 24 - Intake Balance Shaft
- 25 - Balance Shaft Rear Bearing
- 26 - [Water Pump](#) Drive Sprocket Bolt
- 27 - [Water Pump](#) Drive Sprocket
- 28 - [Balance Shaft](#) Drive Chain Tensioner Assembly Bolt
- 29 - [Balance Shaft](#) Drive Chain Tensioner Assembly
- 30 - Adjustable [Balance Shaft](#) Drive Chain Guide Bolt
- 31 - Adjustable [Balance Shaft](#) Drive Chain Guide
- 32 - [Balance Shaft](#) Drive Chain
- 33 - Balance Shaft Drive Chain Guide Bolt
- 34 - [Balance Shaft](#) Drive Chain Guide
- 35 - [Balance Shaft](#) Drive Sprocket
- 36 - Balance Shaft Drive Chain Guide
- 37 - [Balance Shaft](#) Drive Chain Guide Bolt
- 38 - Engine Front Cover Alignment Pins
- 39 - Engine Front Cover Gasket
- 40 - Oil Pump Cover Bolt
- 41 - Oil Pump Cover
- 42 - Oil Pump Gear
- 43 - [Oil Pump](#) Inner Rotor
- 44 - Engine Front Cover
- 45 - Engine Front Cover Bolt
- 46 - Crankshaft Front Oil Seal
- 47 - Crankshaft Balancer
- 48 - Crankshaft Balancer Bolt
- 49 - Engine Front Cover Bolt
- 50 - Oil Pressure Relief Valve
- 51 - Oil Pressure Relief Valve O-Ring
- 52 - [Water Pump](#) Sprocket Access Cover Bolt
- 53 - [Water Pump](#) Sprocket Access Cover
- 54 - Water Pump Sprocket Access Cover Gasket
- 55 - Belt Tensioner Bolt
- 56 - Belt Tensioner

Engine Mechanical Specifications

Engine Mechanical Specifications

Application	Specification	
	Metric	English
General Data		
● Engine Type	Inline 4 Cylinder	
● Displacement	2.0 L	122 CID
● RPO	LNF	
● Liter (VIN)	A, M	
● Bore	85.992-86.008 mm	3.3880-3.3887 in
● Stroke	86 mm	3.388 in
● Compression Ratio	9.2:1	
Balance Shaft		
● Bearing Clearance	0.030-0.060 mm	0.0012-0.0024 in
● Bearing Diameter - Inside - Carrier	20.050-20.063 mm	0.7894-0.7899 in
● Bearing Diameter - Outside - Carrier	41.975-41.995 mm	1.6526-1.6534 in
● Bearing Journal Diameter	20.000-20.020 mm	0.7874-0.7882 in
● Bushing Clearance	0.033-0.102 mm	0.0013-0.0040 in
● Bushing Diameter - Inside	36.775-36.835 mm	1.4489-1.4512 in
● Bushing Journal Diameter	36.723-36.743 mm	1.4458-1.4466 in
● End Play	0.050-0.300 mm	0.0020-0.0118 in
Block		
● Balance Shaft Bearing Bore Diameter - Carrier	42.000-42.016 mm	1.6535-1.6542 in
● Balance Shaft Bushing Bore Diameter	40.763-40.776 mm	1.6048-1.6054 in
● Crankshaft Main Bearing Bore Diameter	64.068-64.082 mm	2.5224-2.5229 in
● Cylinder Bore Diameter	85.992-86.008 mm	3.3880-3.3887 in
● Cylinder Bore Out-of-Round - Maximum	0.010 mm	0.0004 in
● Cylinder Bore Taper - Maximum	0.010 mm	0.0004 in
● Cylinder Head Deck Surface Flatness - Longitude	0.050 mm	0.002 in
● Cylinder Head Deck Surface Flatness - Overall	0.10 mm	0.0039 in
● Cylinder Head Deck Surface Flatness - Transverse	0.030 mm	0.0012 in
Camshaft		
● Camshaft End Play	0.040-0.307 mm	0.0016-0.0121 in
● Camshaft Journal Diameter	26.935-26.960 mm	1.0604-1.0614 in
● Camshaft Journal Diameter - Front	34.960-34.935 mm	1.3774-1.3764 in
● Camshaft Thrust Surface - with Camshaft Actuator Installed	30.020-30.175 mm	1.1828-1.1889 in
Connecting Rod		
● Connecting Rod Bearing Clearance	0.029-0.073 mm	0.0011-0.0029 in
● Connecting Rod Bore Diameter - Bearing End	52.118-52.134 mm	2.0519-2.0525 in
● Connecting Rod Bore Diameter - Pin End	23.007-23.017 mm	0.9058-0.9062 in
● Connecting Rod Side Clearance	0.070-0.370 mm	0.0028-0.0146 in
● Connecting Rod Straightness - Bend - Maximum	0.021 mm	0.0083 in
● Connecting Rod Straightness - Twist - Maximum	0.04 mm	0.0157 in
Crankshaft		
● Connecting Rod Journal Diameter	49.000-49.014 mm	1.9291-1.9297 in

Application	Specification	
	Metric	English
● Crankshaft End Play	0.050-0.380 mm	0.0012-0.0150 in
● Crankshaft Main Bearing Clearance	0.031-0.067 mm	0.0012-0.0026 in
● Crankshaft Main Journal Diameter	55.994-56.008 mm	2.2045-2.2050 in
Cylinder Head		
● Deck Straightness - in 150 mm (5.91 in)	0.05 mm	0.0019 in
● Deck Straightness - in 25 mm (0.985 in)	0.025 mm	0.0009 in
● Between Head Bolt Holes	0.030 mm	0.0011 in
● Surface Flatness - Block Deck - Longitude	0.050 mm	0.002 in
● Surface Flatness - Block Deck - Overall	0.1 mm	0.004 in
● Surface Flatness - Block Deck - Transverse	0.030 mm	0.0012 in
● Valve Guide Bore - Exhaust	6.000-6.012 mm	0.2362-0.2367 in
● Valve Guide Bore - Intake	6.000-6.012 mm	0.2362-0.2367 in
● Valve Lifter Bore Diameter - Stationary Lash Adjusters	12.013-12.037 mm	0.4730-0.4739 in
Lubrication System		
● Oil Pressure - Minimum - @1000 RPM	344.75-551.60 kPa	50-80 psi
● Oil Capacity	4.8L	5.0 quarts
Piston Rings		
● Piston Ring End Gap - First Compression Ring	0.20-0.35 mm	0.0078-0.0138 in
● Piston Ring End Gap - Second Compression Ring	0.35-0.55 mm	0.014-0.022 in
● Piston Ring End Gap - Oil Control Ring - Rails	0.25-0.75 mm	0.010-0.030 in
● Piston Ring to Groove Clearance - First Compression Ring	0.040-0.080 mm	0.0016-0.0031 in
● Piston Ring to Groove Clearance - Second Compression Ring	0.003-0.068 mm	0.0001-0.0027 in
● Piston Ring to Groove Clearance - Oil Control Ring	0.024-0.176 mm	0.0009-0.0069 in
● Piston Ring Thickness - First Compression Ring	1.170-1.190 mm	0.0461-0.0469 in
● Piston Ring Thickness - Second Compression Ring	1.471-1.490 mm	0.0579-0.0587 in
● Piston Ring Thickness - Oil Control Ring - Rail - Maximum	0.473 mm	0.0186 in
● Piston Ring Thickness - Oil Control Ring - Spacer	0.96-1.04 mm	0.0378-0.0409 in
Pistons and Pins		
● Pin - Piston Pin Clearance to Connecting Rod Bore	0.009-0.023 mm	0.0004-0.0009 in
● Pin - Piston Pin Clearance to Piston Pin Bore	0.005-0.015 mm	0.0002-0.0006 in
● Pin - Piston Pin Diameter	22.995-23.000 mm	0.9053-0.9055 in
● Pin - Piston Pin End Play	0.320-1.278 mm	0.0126-0.0503 in
● Piston - Piston Diameter - @14.5 mm up	85.967-85.982 mm	3.3845-3.3851 in
● Piston - Piston Pin Bore Diameter	23.005-23.010 mm	0.9057-0.9059 in
● Piston - Piston Ring Groove Width - Oil Control	2.001-2.003 mm	0.0788-0.0789 in
● Piston - Piston Ring Groove Width - Second	1.52-1.54 mm	0.0598-0.0606 in
● Piston - Piston Ring Groove Width - Top	1.23-1.25 mm	0.0484-0.0492 in
● Piston - Piston To Bore Clearance	0.010-0.041 mm	0.0004-0.0016 in
Valve System		
● Valves - Valve Face Runout - Maximum	0.04 mm	0.0016 in
● Valves - Valve Seat Runout - Maximum	0.05 mm	0.0020 in
● Valves - Valve Stem Diameter - Exhaust	5.935-5.950 mm	0.2337-0.2343 in

Application	Specification	
	Metric	English
● Valves - Valve Stem Diameter - Intake	5.955-5.970 mm	0.2344-0.2355 in
● Valves - Valve Stem to Guide Clearance - Exhaust	0.050-0.077 mm	0.0020-0.0026 in
● Valves - Valve Stem to Guide Clearance - Intake	0.030-0.057 mm	0.0012-0.0022 in
● Valve Lifters - Valve Lifter Diameter - Stationary Lash Adjuster	11.986-12.000 mm	0.0005-0.0020 in
● Valve Lifters - Valve Lifter-to-Bore Clearance - Stationary Lash Adjuster	0.013-0.051 mm	3.2210-3.2299 in
● Valve Springs - Valve Spring Load - Open - @22.5 mm	525.0-575.0 N. - Eng Spec.	
● Valve Springs - Valve Spring Load - Closed - @32.5 mm	245.0-271.0 N. - Eng Spec.	

Adhesives, Fluids, Lubricants, and Sealers

Application	Type of Material	GM Part Number	
		United States	Canada
# 6 Intake Rear Camshaft Cap	Sealant	12378521	88901148
Balance Shaft Bearings	Engine Oil	12346184	10953495
Cam Lobes	Engine Oil	12346184	10953495
Crank Sensor O-ring	Engine Oil	12346184	10953495
Cylinder Bores	Engine Oil	12346184	10953495
Cylinder Head Plugs	Sealant	12345382	10953489
Engine Block Threaded Plugs	Sealant	12346004	10953480
Engine Block to Bedplate	Sealant	12378521	88901148
Engine Oil	Engine Oil	12346184	10953495
Engine Oil Level Indicator Tube O-ring	Lubricant	12345501	992704
Fuel Injector O-rings	Engine Oil	12346184	10953495
Fuel Injector Tip Insulators	Engine Oil	12346184	10953495
Intake and Exhaust Valve Stems	Lubricant	12345501	992704
Main Bearings	Lubricant	12345501	992704
Oil Filter Cap - Threads and O-ring Lead-in Chamfers	Engine Oil	12346184	10953495
Oil Pan to Bedplate Joint	Sealant	12378521	88901148
Oil Pump - Pump Elements	Engine Oil	12346184	10953495
Oxygen Sensor Threads	Anti-seize	12397953	-
Piston Pin to Piston/Rod - Pin Bores of Piston and Rod	Engine Oil	12346184	10953495
Rod Bearings - Rod Pins of Crankshaft	Engine Oil	12346184	10953495
Stationary Hydraulic Lash Adjusters	Lubricant	12345501	992704
Timing Chain Guide Bolt Access Hole Plug	Sealant	12345382	10953489
Valve Rocker Arm/Valve Tip	Lubricant	12345501	992704
Water Feed Tube O-rings	Lubricant	12345579	1974984
Water Pump Drain Plug	Sealant	12346004	10953480

Fastener Tightening Specifications

Application	Specification	
	Metric	English
A/C Compressor to Block Bolt	22 Nm	16 lb ft
Balance Shaft Adjustable Chain Guide Bolt	10 Nm	89 lb in
Balance Shaft Fixed Chain Guide Bolt	12 Nm	106 lb in
Balance Shaft Retaining Bolt	10 Nm	89 lb in
Block Coolant Plug	15 Nm	11 lb ft
Block Heater Bolt	10 Nm	89 lb in
Cam Cover to Cylinder Head Bolt	10 Nm	89 lb in
Cam Cover to Ground Cable Bolt	10 Nm	89 lb in
Cam Cover to Ground Cable Stud	10 Nm	89 lb in
Camshaft		
● Camshaft Cap Bolt	10 Nm	89 lb in
● Camshaft Position Actuator Solenoid Valve Bolt	10 Nm	89 lb in
● Camshaft Position Sensor Bolt	10 Nm	89 lb in
● Camshaft Timing Chain Tensioner	75 Nm	55 lb ft
● Exhaust Camshaft Position Actuator		
● First Pass	30 Nm	22 lb ft
● Final Pass	100 degrees	
● Intake Camshaft Position Actuator		
● First Pass	30 Nm	22 lb ft
● Final Pass	100 degrees	
Catalytic Converter Stud	50 Nm	37 lb ft
Chain Guide Access Hole Plug	90 Nm	59 lb ft
Charger AIR Bypass Bolt	25 Nm	18 lb ft
Charger AIR Bypass Nut	25 Nm	18 lb ft
Connecting Rod Bolt		
● First Pass	25 Nm	18 lb ft
● Final Pass	100 degrees	
Coolant Jacket Plug	35 Nm	26 lb ft
Crankshaft Balancer Bolt		
● First Pass	100 Nm	74 lb ft
● Final Pass	125 degrees	
Crankshaft Bearings - Lower Crankcase to Block - Bedplate		
● First Pass	20 Nm	15 lb ft
● Final Pass	77 degrees	
Crankshaft Position Reluctor Ring	15 Nm	11 lb ft
Crankshaft Position Sensor Bolt	10 Nm	89 lb in
Cylinder Head Bolt		
● First Pass	30 Nm	22 lb ft
● Final Pass	155 degrees	
Cylinder Head Front Chain Case Bolt	30 Nm	22 lb ft
Cylinder Head Oil Gallery Plug	35 Nm	26 lb ft
Cylinder Head Opening Plate Bolt	10 Nm	89 lb in

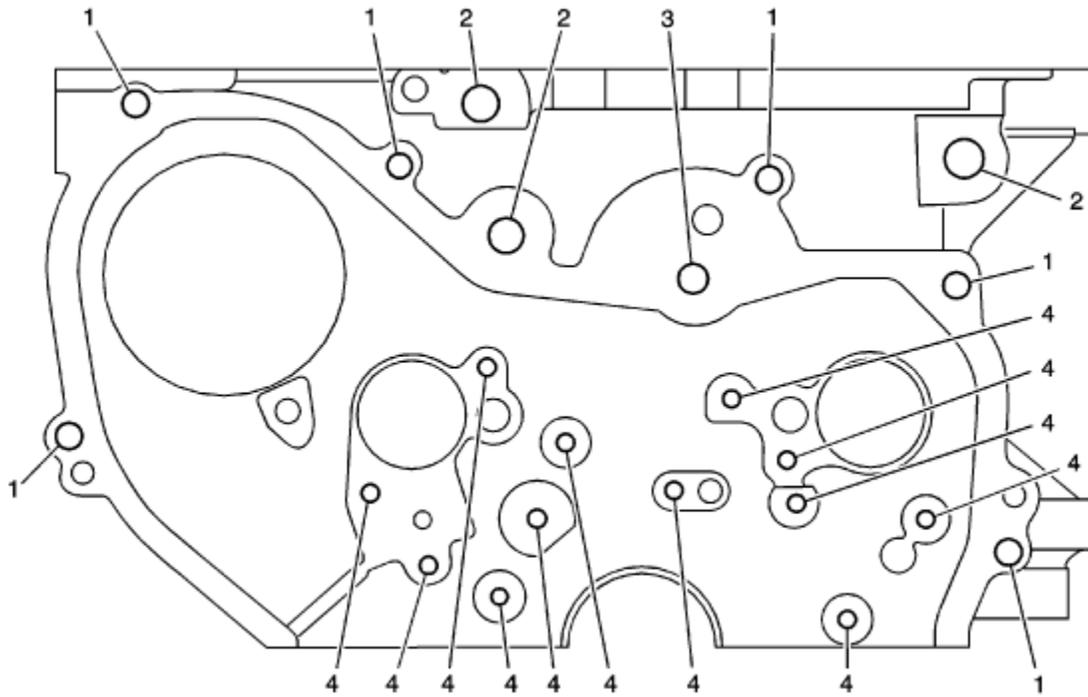
Application	Specification	
	Metric	English
Drive Belt Tensioner Bolt	45 Nm	33 lb ft
Engine Coolant Temperature Sensor	20 Nm	15 lb ft
Engine Lift Bracket Front Bolt	25 Nm	18 lb ft
Engine Lift Bracket Rear Bolt	25 Nm	18 lb ft
Engine Mount to Intermediate Bracket	65 Nm	48 lb ft
Engine Mount to Midrail Nuts	100 Nm	74 lb ft
Exhaust Manifold Heat Shield Bolt	25 Nm	18 lb ft
Exhaust Manifold to Turbocharger Stud	10 Nm	89 lb in
Exhaust Manifold to Cylinder Head Nut	14 Nm	10 lb ft
Exhaust Manifold to Cylinder Head Stud	15 Nm	11 lb ft
Flywheel Bolt - Automatic Transmission		
● First Pass	53 Nm	39 lb ft
● Final Pass	25 degrees	
Flywheel Bolt - Manual Transmission		
● First Pass	53 Nm	39 lb ft
● Final Pass	25 degrees	
Front Cover to Block Bolt	25 Nm	18 lb ft
Fuel Pipe Bracket Bolt	10 Nm	89 lb in
Fuel Pressure Dampener Bolt	10 Nm	89 lb in
Fuel Pressure Sensor	33 Nm	24 lb ft
Fuel Pump Bolt - High Pressure	15 Nm	11 lb ft
Fuel Pump - High Pressure Line	30 Nm	22 lb ft
Fuel Pump - Low Pressure Line	30 Nm	22 lb ft
Fuel Pump Cover	10 Nm	89 lb in
Fuel Rail Bolts	22 Nm	16 lb ft
Generator to Block Bolt	22 Nm	16 lb ft
Ignition Coil Bolt	10 Nm	89 lb in
Intake Manifold Brace Bolt	22 Nm	16 lb ft
Intake Manifold to Cylinder Head Bolt	22 Nm	16 lb ft
Intake Manifold to Cylinder Head Nut	22 Nm	16 lb ft
Intake Manifold to Cylinder Head Stud	15 Nm	11 lb ft
Knock Sensor Bolt	25 Nm	18 lb ft
Lower Crankcase to Block Perimeter Bolt	25 Nm	18 lb ft
Oil Cooler Bolts	22 Nm	16 lb ft
Oil Filter Adapter Cover	22 Nm	16 lb ft
Oil Gallery Gerotor Cover - Rear Bolt	6 Nm	53 lb in
Oil Gallery Plug - Cylinder Head	35 Nm	26 lb ft
Oil Gallery Plug - Rear - Block	60 Nm	44 lb ft
Oil Level Indicator Tube Bolt	10 Nm	89 lb in
Oil Pan Baffle Bolt	14 Nm	10 lb ft
Oil Pan Bolts	25 Nm	18 lb ft
Oil Pan Drain Plug	25 Nm	18 lb ft

Application	Specification	
	Metric	English
Oil Pressure Switch	26 Nm	19 lb ft
Oil Pump Gerotor Cover Bolt	6 Nm	53 lb in
Oil Pump Pressure Relief Valve Plug	40 Nm	30 lb ft
Oxygen Sensor	42 Nm	31 lb ft
Piston Oil Squirter	15 Nm	11 lb ft
Power Steering Pump Bolt	25 Nm	18 lb ft
Power Steering Tensioner Bolt	22 Nm	16 lb ft
Spark Plug	20 Nm	15 lb ft
Starter Motor to Block Bolt	53 Nm	39 lb ft
Thermostat Housing to Block Bolts	10 Nm	89 lb in
Throttle Body Bolt	10 Nm	89 lb in
Throttle Body Nut	10 Nm	89 lb in
Timing Chain Adjustable Guide Bolt	10 Nm	89 lb in
Timing Chain Fixed Guide Bolt	12 Nm	106 lb in
Timing Chain Oil Nozzle Bolt	10 Nm	89 lb in
Timing Chain Tensioner Bolt	10 Nm	89 lb in
Timing Chain Upper Guide Bolt	10 Nm	89 lb in
Turbocharger Air Bypass Valve Cover Bolt	7 Nm	62 lb in
Turbocharger Air Cooler Outlet Pipe Bolts	25 Nm	18 lb ft
Turbocharger Brace Bracket Bolt	22 Nm	16 lb ft
Turbocharger Brace Bracket Bolt	50 Nm	37 lb ft
Turbocharger Brace Bracket Stud	25 Nm	18 lb ft
Turbocharger Brace Nut	50 Nm	37 lb ft
Turbocharger Bracket Bolt	58 Nm	43 lb ft
Turbocharger Coolant Feed Pipe Bolt	20 Nm	15 lb ft
Turbocharger Coolant Feed Pipe Mounting Bolt	10 Nm	89 lb in
Turbocharger Coolant Return Pipe Bolt	20 Nm	15 lb ft
Turbocharger Exhaust Pipe Heat Shield Bolt	10 Nm	89 lb in
Turbocharger Exhaust Pipe Nut	50 Nm	37 lb ft
Turbocharger Exhaust Pipe Stud	50 Nm	37 lb ft
Turbocharger Heat Shield Bolt	10 Nm	89 lb in
Turbocharger Nut	30 Nm	22 lb ft
Turbocharger Oil Feed Pipe Bolt	20 Nm	15 lb ft
Turbocharger Oil Return Pipe Bolt	10 Nm	89 lb in
Turbocharger Wastegate Regulator Solenoid Valve Bracket Bolt	7 Nm	62 lb in
Vent Tube to Cylinder Head	15 Nm	11 lb ft
Water Jacket Drain Plug	20 Nm	15 lb ft
Water Pipe Support Bracket Bolt	10 Nm	89 lb in
Water Pump Access Cover Bolt	10 Nm	89 lb in
Water Pump/Balance Shaft Chain Tensioner Bolt	10 Nm	89 lb in
Water Pump Bolts	25 Nm	18 lb ft
Water Pump Drain Plug	20 Nm	15 lb ft

Application	Specification	
	Metric	English
Water Pump Sprocket Bolt	10 Nm	89 lb in

Thread Repair Specifications

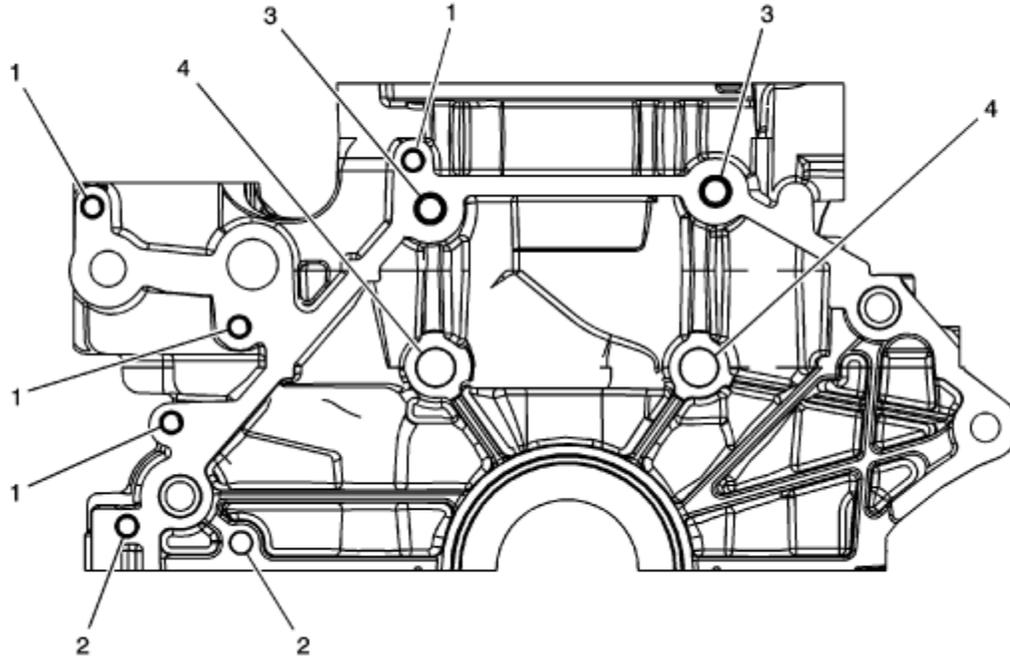
Engine Block - Front View



Engine Block - Front View

Service Call Out	Thread Size	Insert	Drill	Counterbore Tool	Tap	Driver	Drill Depth		Tap Depth	
							Maximum	Maximum	Maximum	Maximum
J 42385-850							MM	IN	MM	IN
1	M8 x 1.25	210	206	207	208	209	23.5	0.93	18.5	0.73
2	M12 x 1.75	855	856	857	858	859	33.5	1.32	26.5	1.04
3	M10 x 1.5	215	211	212	213	214	24.5	0.96	19.5	0.77
4	M6 x 1	205	201	202	203	204	20	0.787	16	0.63

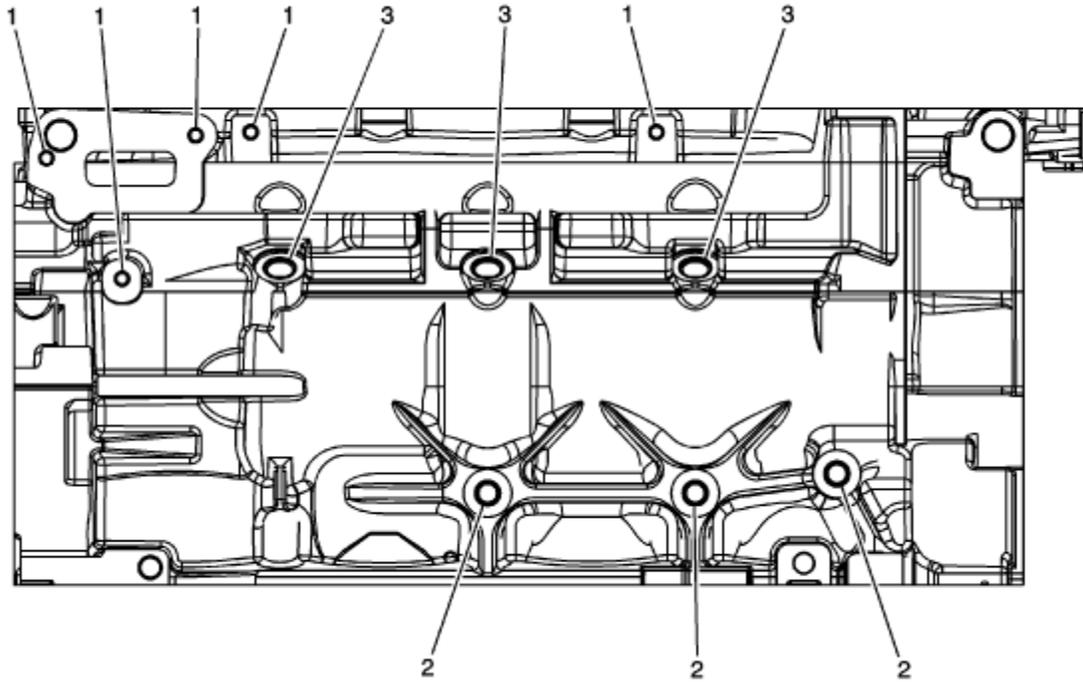
Engine Block - Back View



Engine Block - Back View

Service Call Out	Thread Size	Insert	Drill	Counterbore Tool	Tap	Driver	Drill Depth		Tap Depth	
							Maximum	IN	Maximum	IN
J 42385-850							MM	IN	MM	IN
1	M8 x 1.25	210	206	207	208	209	24	0.945	THRU	
2	M10 x 1.5	215	211	212	213	214	29	1.161	THRU	
3	M12 x 1.75	855	856	857	858	859	39	1.535	33.5	1.32
4	M16 x 1.5	860	861	862	863	864	21	0.827	15	0.59

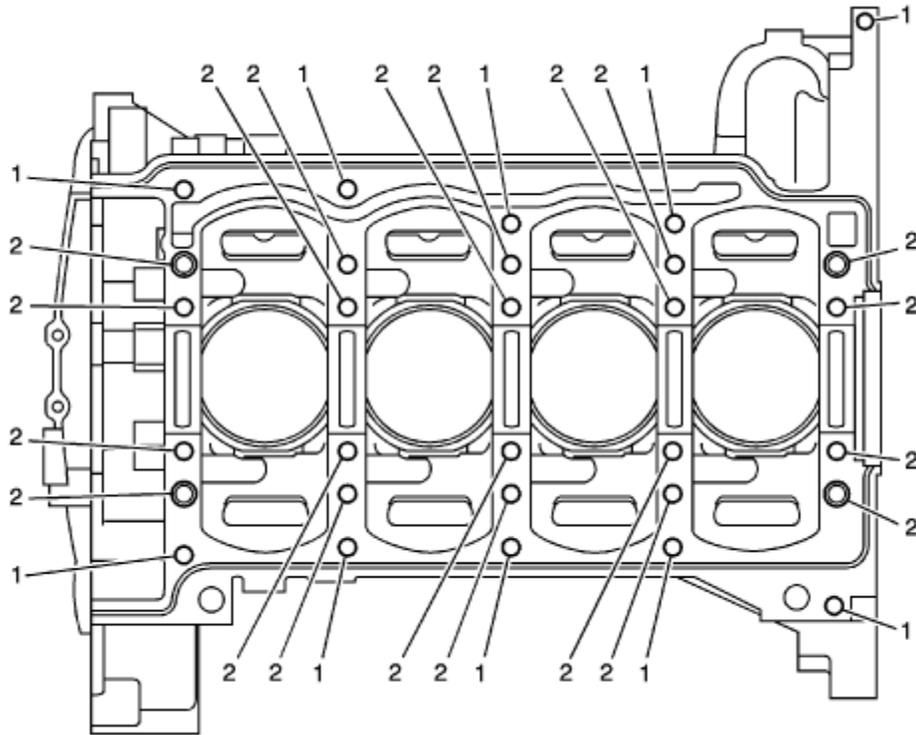
Engine Block - Right Side View



Engine Block - Right Side View

Service Call Out	Thread Size	Insert	Drill	Counterbore Tool	Tap	Driver	Drill Depth		Tap Depth	
							Maximum	IN	Maximum	IN
J 42385-850							MM	IN	MM	IN
1	M6 x 1	205	201	202	203	204	22.5	0.886	16	0.63
2	M10 x 1.5	215	211	212	213	214	34	1.339	27	1.063
3	M12 x 1.75	865	856	857	858	859	19.5	0.768	12.5	0.49

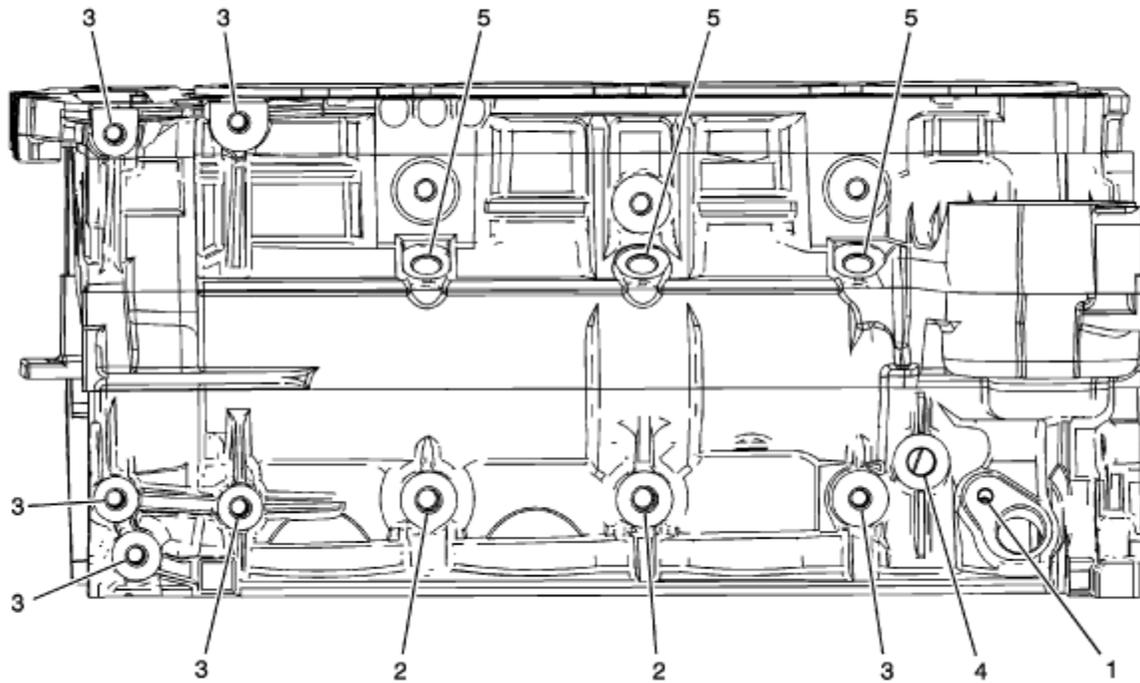
Engine Block - Bottom View



Engine Block - Bottom View

Service Call Out	Thread Size	Insert	Drill	Counterbore Tool	Tap	Driver	Drill Depth		Tap Depth	
							Maximum	IN	Maximum	IN
J 42385-850							MM	IN	MM	IN
1	M8 x 1.25	210	206	207	208	209	28	1.102	22	0.87
2	M10 x 1.5	514	511	N/A	512	513	60	2.362	53.5	2.11

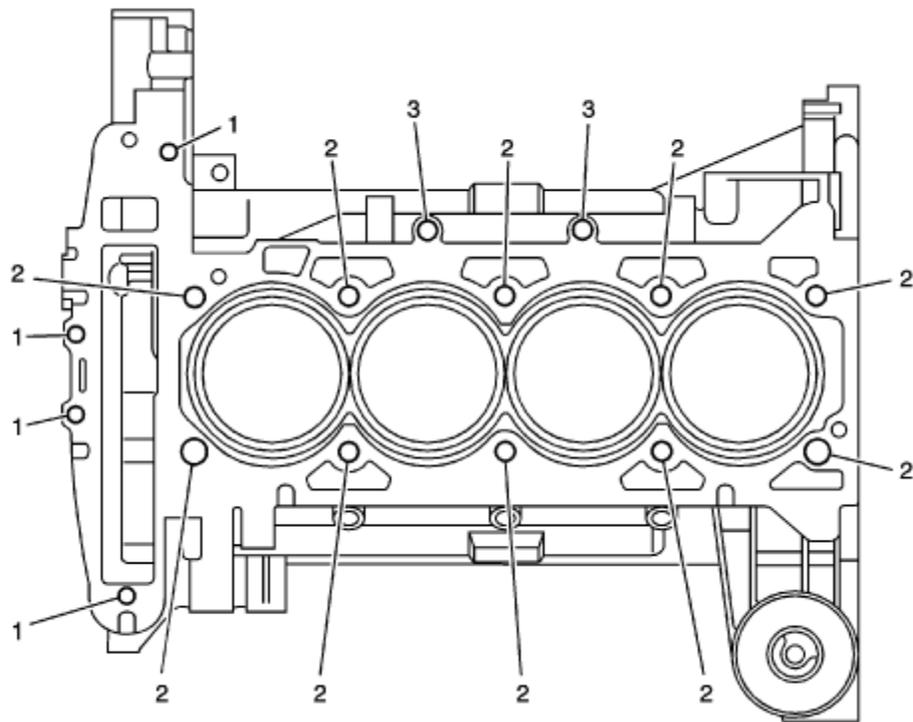
Engine Block - Left Side View



Engine Block - Left Side View

Service Call Out	Thread Size	Insert	Drill	Counterbore Tool	Tap	Driver	Drill Depth		Tap Depth	
							Maximum	IN	Maximum	IN
J 42385-850							MM	IN	MM	IN
1	M6 x 1	205	201	202	203	204	20.5	0.807	16.5	0.65
2	M10 x 1.5	215	211	212	213	214	23.5	0.925	18	0.71
3	M8 x 1.25	210	206	207	208	209	30.5	1.201	22.5	0.89
4	M12 x 1.75	865	856	857	858	859	15.5	0.61	12.5	0.49
5	M12 x 1.75	865	856	857	858	859	19.5	0.778	12.5	0.49

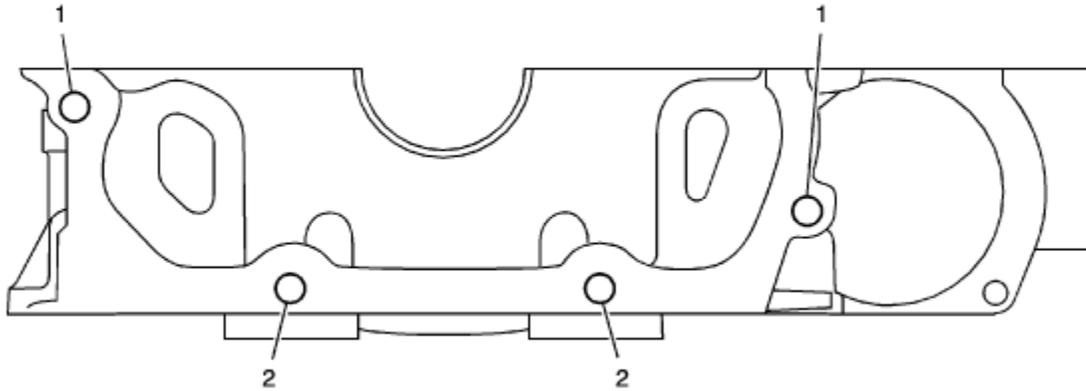
Engine Block - Top View



Engine Block - Top View

Service Call Out	Thread Size	Insert	Drill	Counterbore Tool	Tap	Driver	Drill Depth		Tap Depth	
							Maximum	IN	Maximum	IN
J 42385-850							MM	IN	MM	IN
1	M8 x 1.25	210	206	207	208	209	23.5	0.925	18.5	0.73
2	M11 x 1.5	507	504	N/A	505	506	77.5	3.053	70	2.758
3	M12 x 1.75	865	856	857	858	859	13.5	0.531	12.5	0.49

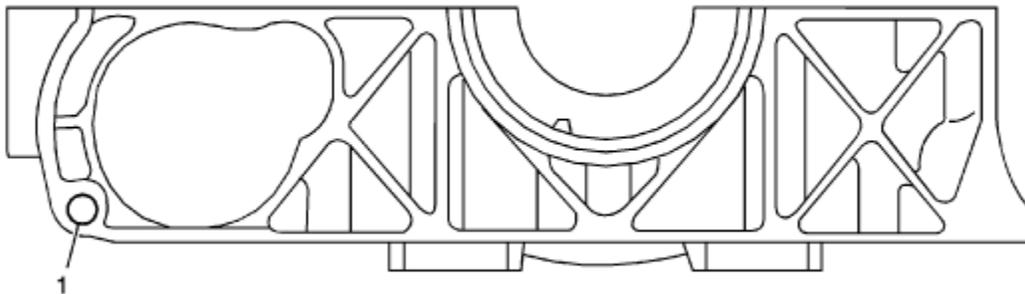
Lower Crankcase - Front View



Lower Crankcase - Front View

Service Call Out	Thread Size	Insert	Drill	Counterbore Tool	Tap	Driver	Drill Depth		Tap Depth	
							Maximum	Maximum	Maximum	Maximum
J 42385-850							MM	IN	MM	IN
1	M8 x 1.25	210	206	207	208	209	23.5	0.925	18.5	0.73
2	M8 x 1.25	210	206	207	208	209	30.5	1.201	25.5	1.00

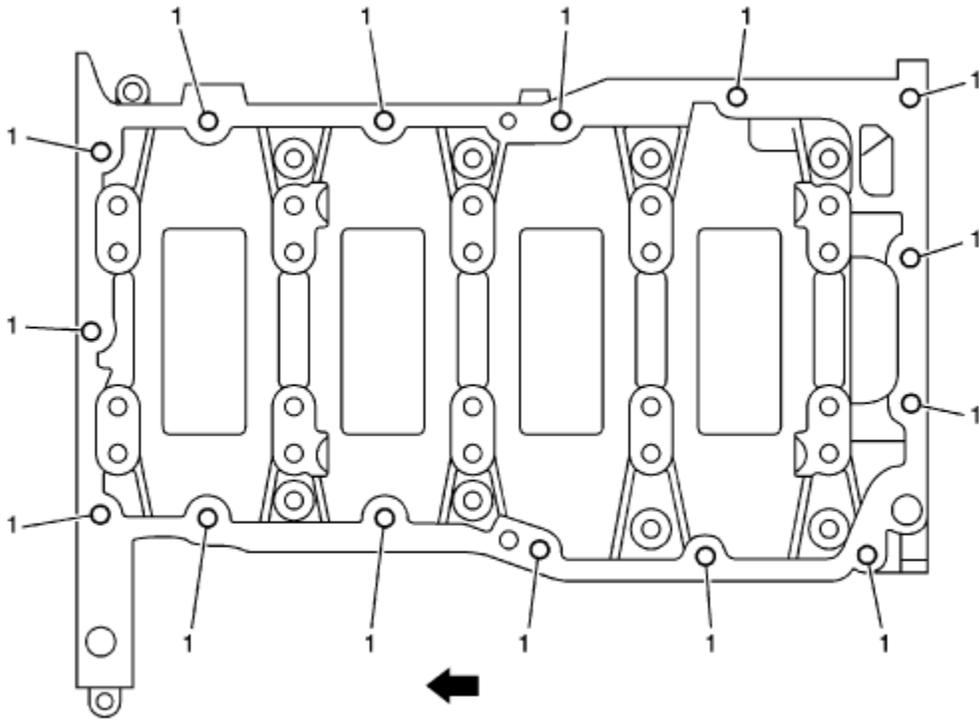
Lower Crankcase - Back View



Lower Crankcase - Back View

Service Call Out	Thread Size	Insert	Drill	Counterbore Tool	Tap	Driver	Drill Depth		Tap Depth	
							Maximum	Maximum	Maximum	Maximum
J 42385-850							MM	IN	MM	IN
1	M10 x 1.5	215	211	212	213	214	29.5	1.161	THRU	

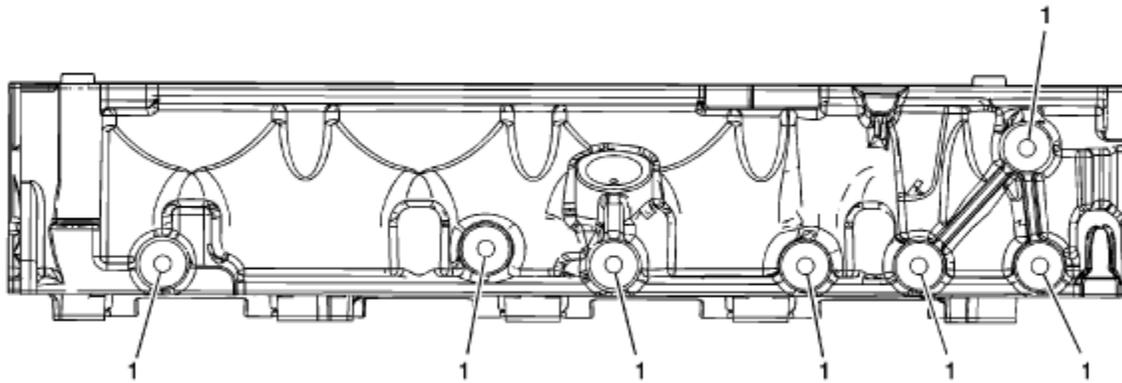
Lower Crankcase - Bottom View



Lower Crankcase - Bottom View

Service Call Out	Thread Size	Insert	Drill	Counterbore Tool	Tap	Driver	Drill Depth		Tap Depth	
							Maximum	IN	Maximum	IN
J 42385-850							MM	IN	MM	IN
1	M8 x 1.25	210	206	207	208	209	23.5	0.925	18.5	0.73

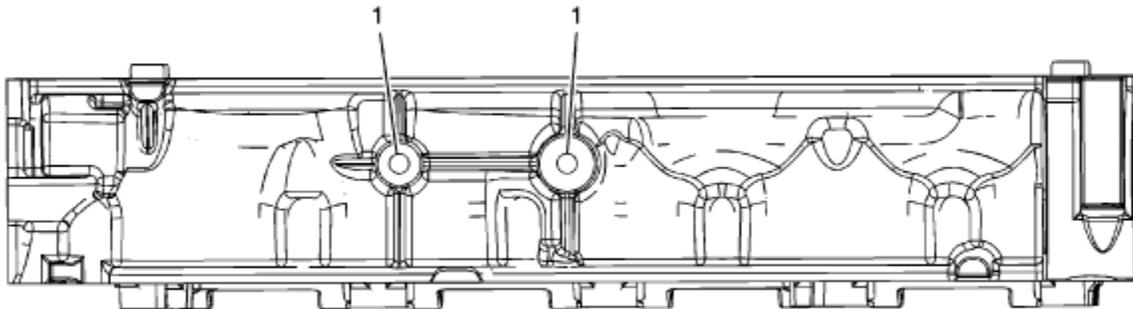
Lower Crankcase - Right View



Lower Crankcase - Right View

Service Call Out	Thread Size	Insert	Drill	Counterbore Tool	Tap	Driver	Drill Depth		Tap Depth	
							Maximum	Maximum	Maximum	Maximum
							MM	IN	MM	IN
1	M10 x 1.5	215	211	212	213	214	34	1.339	27	1.063

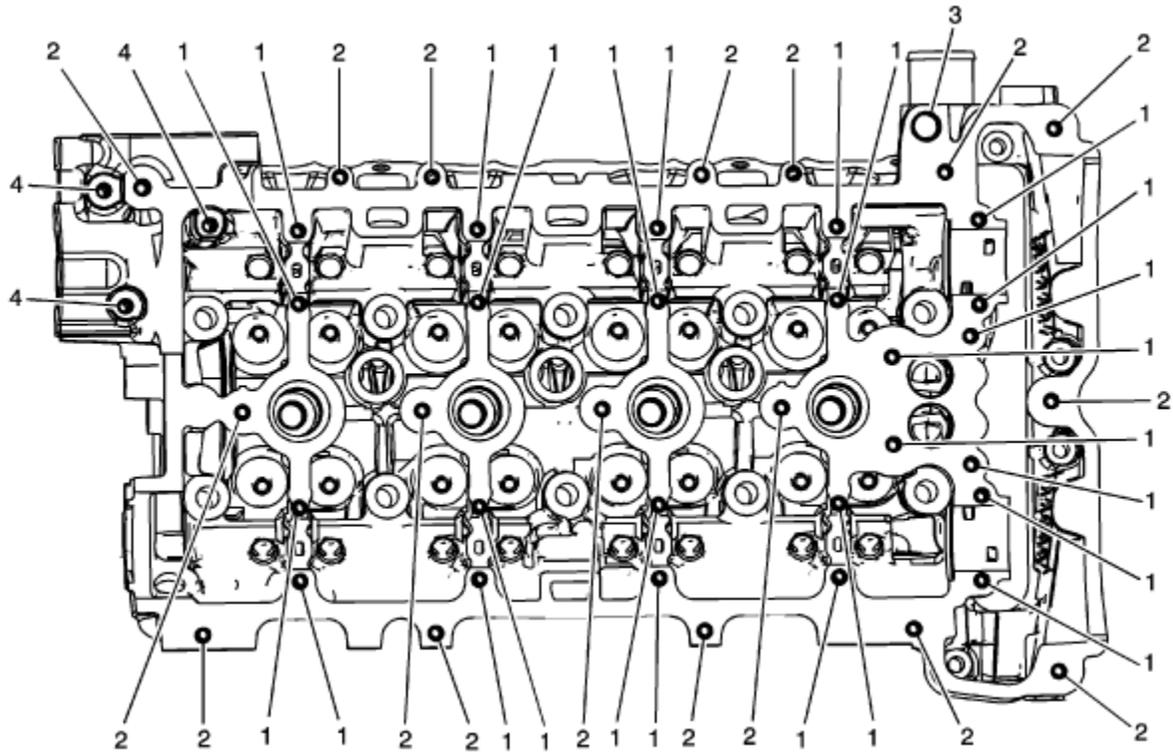
Lower Crankcase - Left View



Lower Crankcase - Left View

Service Call Out	Thread Size	Insert	Drill	Counterbore Tool	Tap	Driver	Drill Depth		Tap Depth	
							Maximum	Maximum	Maximum	Maximum
							MM	IN	MM	IN
1	M8 x 1.25	210	211	212	213	214	34	1.339	27	1.063

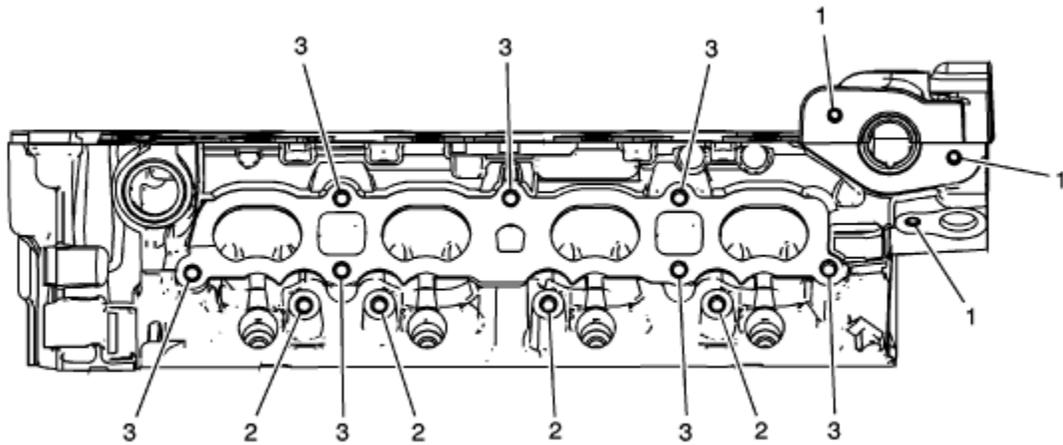
Cylinder Head - Top View



Cylinder Head - Top View

Service Call Out	Thread Size	Insert	Drill	Counterbore Tool	Tap	Driver	Drill Depth		Tap Depth	
							Maximum	IN	Maximum	IN
J 42385-850							MM	IN	MM	IN
1	M6 x 1	205	852	N/A	203	204	23	0.906	19	0.748
2	M6 x 1	205	201	202	203	204	20	0.787	16	0.63
3	M14 x 1.75	856	857	N/A	858	859	THRU		THRU	
4	M8 x 1.25	854	853	N/A	208	209	30	1.182	27	1.063

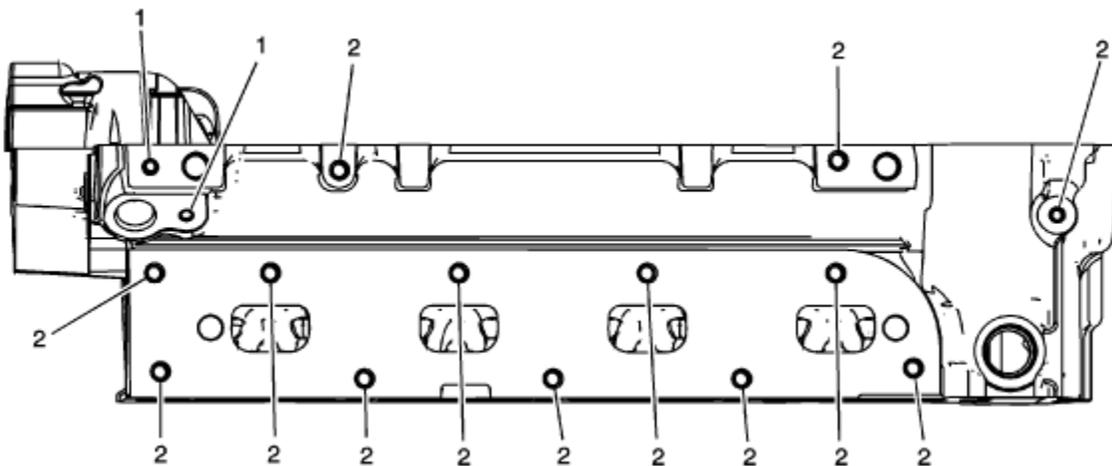
Cylinder Head - Intake Manifold Deck View



Cylinder Head - Intake Manifold Deck View

Service Call Out	Thread Size	Insert	Drill	Counterbore Tool	Tap	Driver	Drill Depth		Tap Depth	
							Maximum	Maximum	Maximum	Maximum
J 42385-850							MM	IN	MM	IN
1	M6 x 1	205	201	202	203	204	20	0.787	16	0.63
2	M8 x 1.25	210	206	207	208	209	20	0.787	16	0.63
3	M8 x 1.25	205	201	202	203	204	16	0.630	12	0.473

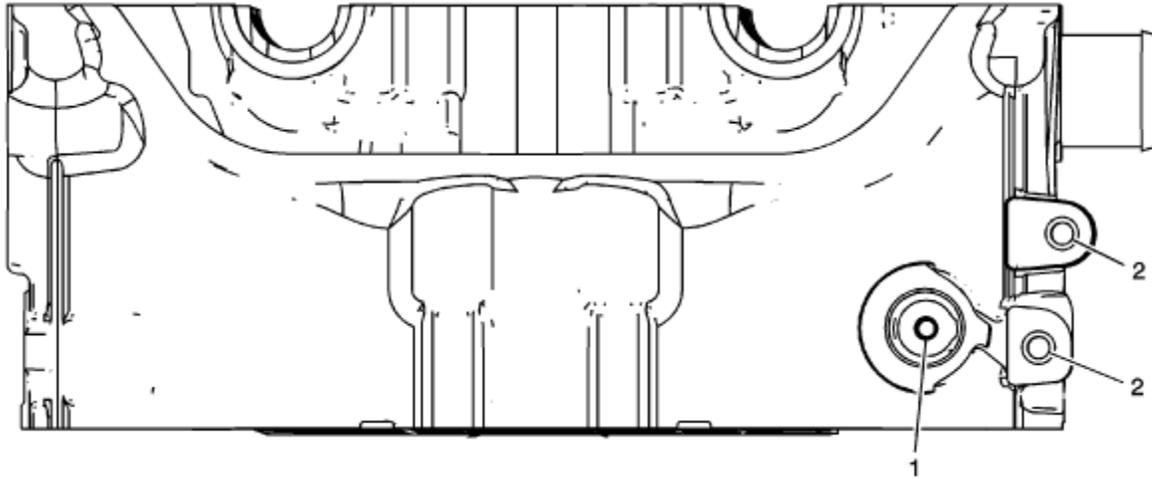
Cylinder Head - **Exhaust Manifold** Deck View



Cylinder Head - Exhaust Manifold Deck View

Service Call Out	Thread Size	Insert	Drill	Counterbore Tool	Tap	Driver	Drill Depth		Tap Depth	
							Maximum	Maximum	Maximum	Maximum
J 42385-850							MM	IN	MM	IN
1	M6 x 1	205	201	202	203	204	20	0.78	16	0.63
2	M8 x 1.25	210	206	207	208	209	25	0.984	20	0.78

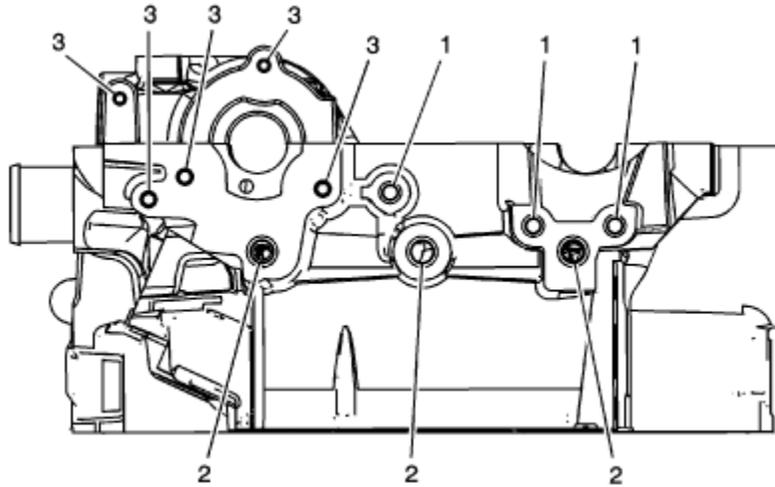
Cylinder Head - Front View



Cylinder Head - Front View

Service Call Out	Thread Size	Insert	Drill	Counterbore Tool	Tap	Driver	Drill Depth		Tap Depth	
							Maximum	Maximum	Maximum	Maximum
J 42385-850							MM	IN	MM	IN
1	M6 x 1	205	201	202	203	204	20	0.787	16	0.63
2	M8 x 1.25	210	206	207	208	209	25	0.984	20	0.787

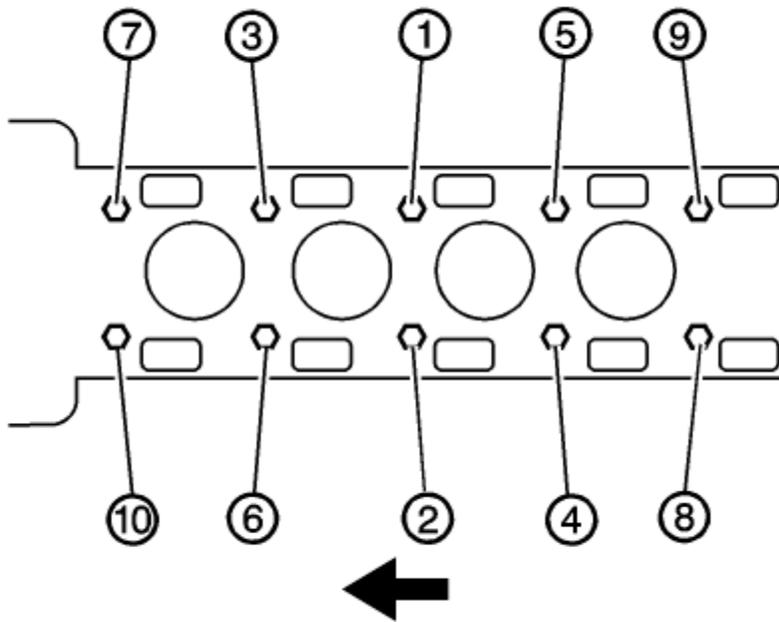
Cylinder Head - Back View



Cylinder Head - Back View

Service Call Out	Thread Size	Insert	Drill	Counterbore Tool	Tap	Driver	Drill Depth		Tap Depth	
							Maximum	IN	Maximum	IN
J 42385-850							MM	IN	MM	IN
1	M8 x 1.25	210	206	207	208	209	25	0.984	20	0.787
2	M12 x 1.75	865	856	857	858	859	18	0.709	14	0.551
3	M6 x 1	205	201	202	203	204	20	0.787	16	0.63

CYLINDER HEAD BOLTS



Cylinder Head Bolt
First Pass 30 Nm (22 lb ft)

First Pass 155 degrees

CYLINDER HEAD BOLT RE-USABILITY

Note: Do not use any sealing material. Always use NEW cylinder head bolts.

INTAKE MANIFOLD

Intake Manifold to Cylinder Head Bolt 22 Nm (16 lb ft)

Intake Manifold to Cylinder Head Nut 22 Nm (16 lb ft)

CAMSHAFT BEARING CAP

Camshaft Cap Bolt 10 Nm (89 lb in)
MAIN BEARING CAP

Crankshaft Bearing - Lower Crankcase to Block - Bedplate
First Pass 20 Nm (15 lb ft)

Final Pass 77 degrees

ROD BEARING CAP

Connecting Rod Bolt
First Pass 25 Nm (18 lb ft)

Final Pass 100 degrees

CRANKSHAFT PULLEY

Crankshaft Balancer Bolt

First pass	100 Nm (74 lb ft)	
Final pass FLYWHEEL/FLEXPLATE	125 degrees	
Flywheel Bolt - Automatic Transmission First Pass	53 Nm (39 lb ft)	
Final Pass Flywheel Bolt - Manual Transmission First Pass	25 degrees 53 Nm (39 lb ft)	
Final Pass <u>OIL PUMP</u>	25 degrees	
<u>Oil Pump</u> Gerotor Cover Bolt <u>EXHAUST MANIFOLD</u>		6 Nm (53 lb in)
<u>Exhaust Manifold</u> to Cylinder Head Nut <u>WATER PUMP</u>		14 Nm (10 lb ft)
<u>Water Pump</u> Bolts		25 Nm (18 lb ft)

Cleanliness and Care

An automobile engine is a combination of many machined, honed, polished, and lapped surfaces with tolerances that are measured in ten thousandths of an inch. When any internal engine parts are serviced, care and cleanliness are important. A liberal coating of engine oil should be applied to friction areas during assembly to protect and lubricate the surfaces during initial operation. Throughout this section, it should be understood that proper cleaning and protection of machined surfaces and friction areas are part of the repair procedure. This is considered standard shop practice even if not specifically stated.

When valve train components are removed for service, they should be retained in order. At the time of installation, they should be installed in the same locations and with the same mating surfaces as when removed.

Replacing Engine Gaskets

Tools Required

J 28410 Gasket Remover

Gasket Reuse and Applying Sealants

- Do not reuse any gasket unless specified.
- Gaskets that can be reused will be identified in the service procedure.
- Do not apply sealant to any gasket or sealing surface unless called out in the service information.

Separating Components

- Use a rubber mallet to separate components.

- Bump the part sideways to loosen the components.
- Bumping should be done at bends or reinforced areas to prevent distortion of parts.

Cleaning Gasket Surfaces

- Remove all gasket and sealing material from the part using the J 28410 or equivalent.
- Care must be used to avoid gouging or scraping the sealing surfaces.
- Do not use any other method or technique to remove sealant or gasket material from a part.
- Do not use abrasive pads, sand paper, or power tools to clean the gasket surfaces.
- These methods of cleaning can cause damage to the component sealing surfaces.
- Abrasive pads also produce a fine grit that the oil filter cannot remove from the oil.
- This grit is abrasive and has been known to cause internal engine damage.

Assembling Components

- When assembling components, use only the sealant specified or equivalent in the service procedure.
- Sealing surfaces should be clean and free of debris or oil.
- Specific components such as crankshaft oil seals or valve stem oil seals may require lubrication during assembly.
- Components requiring lubrication will be identified in the service procedure.
- When applying sealant to a component, apply the amount specified in the service procedure.
- Do not allow the sealant to enter into any blind threaded holes, as it may prevent the bolt from clamping properly or cause component damage when tightened.
- Tighten bolts to specifications. Do not overtighten.

Separating Parts

Important:

- **Disassembly of the piston, press fit design piston pin, and connecting rod may create scoring or damage to the piston pin and piston pin bore. If the piston, pin, and connecting rod have been disassembled, replace the components as an assembly.**
- **Many internal engine components will develop specific wear patterns on their friction surfaces.**
- **When disassembling the engine, internal components MUST be separated, marked, or organized in a way to ensure installation to their original location and position.**

Separate, mark, or organize the following components:

- Piston and the piston pin
- Piston to the specific cylinder bore
- Piston rings to the piston
- Connecting rod to the crankshaft journal
- Connecting rod to the bearing cap A paint stick or etching/engraving type tool are recommended. Stamping the connecting rod or cap near the bearing bore may affect component geometry.
- Crankshaft main and connecting rod bearings
- Camshaft and valve lash adjusters
- Valve lash adjusters, lash adjuster guides, pushrods and rocker arm assemblies
- Valve to the valve guide
- Valve spring and shim to the cylinder head location
- Engine block main bearing cap location and direction
- Oil pump drive and driven gears

Use of Room Temperature Vulcanizing (RTV) and Anaerobic Sealant

Pipe Joint Compound

Important: 3 types of sealer are commonly used in engines. These are room temperature vulcanizing (RTV) sealer, anaerobic gasket eliminator sealer, and pipe joint compound. The correct sealer and amount must be used in the proper location to prevent oil leaks. DO NOT interchange the 3 types of sealers. Use only the specific sealer or the equivalent as recommended in the service procedure.

- Pipe joint compound is a pliable sealer that does not completely harden. This type sealer is used where 2 non-rigid parts, such as the [oil pan](#) and the engine block, are assembled together.
- Do not use pipe joint compound in areas where extreme temperatures are expected. These areas include the [exhaust manifold](#), head gasket, or other surfaces where gasket eliminator is specified.
- Follow all safety recommendations and directions that are on the container. To remove the sealant or the gasket material, refer to Replacing Engine Gaskets ([See: Replacing Engine Gaskets](#)).
- Apply the pipe joint compound to a clean surface. Use a bead size or quantity as specified in the procedure. Run the bead to the inside of any bolt holes. Do not allow the sealer to enter any blind threaded holes, as it may prevent the bolt from clamping properly or cause component damage when the bolt is tightened.
- Apply a continuous bead of pipe joint compound to one sealing surface. Sealing surfaces to be resealed must be clean and dry.
- Tighten the bolts to specifications. Do not overtighten.

RTV Sealer

- RTV sealant hardens when exposed to air. This type sealer is used where 2 rigid parts, such as the lower crankcase and the engine block, are assembled together.
- Do not use RTV sealant in areas where extreme temperatures are expected. These areas include the [exhaust manifold](#), head gasket, or other surfaces where a gasket eliminator is specified.
- Follow all safety recommendations and directions that are on the container. To remove the sealant or the gasket material, refer to Replacing Engine Gaskets ([See: Replacing Engine Gaskets](#)).
- Apply RTV to a clean surface. Use a bead size as specified in the procedure. Run the bead to the inside of any bolt holes. Do not allow the sealer to enter any blind threaded holes, as it may prevent the bolt from clamping properly or cause damage when the bolt is tightened.
- Assemble components while RTV is still wet, within 3 minutes. Do not wait for RTV to skin over.
- Tighten bolts to specifications. Do not overtighten.

Tools and Equipment

Special tools are listed and illustrated throughout this section with a complete listing at the end of the section. These tools, or their equivalents, are specially designed to quickly and safely accomplish the operations for which they are intended. The use of these special tools will also minimize possible damage to engine components. Some precision measuring tools are required for inspection of certain critical components. Torque wrenches and a torque angle meter are necessary for the proper tightening of various fasteners.

To properly service the engine assembly, the following items should be readily available:

- Approved eye protection and safety gloves
- A clean, well lit, work area
- A suitable parts cleaning tank
- A compressed air supply
- Trays or storage containers to keep parts and fasteners organized
- An adequate set of hand tools
- Approved engine repair stand
- An approved engine lifting device that will adequately support the weight of the components

Special Tools

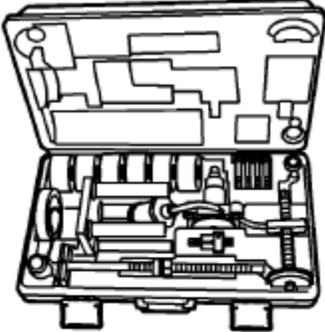
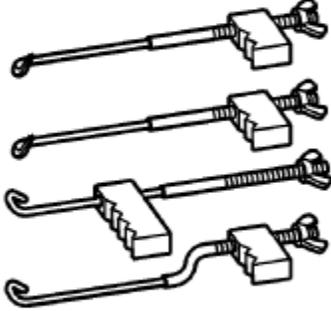
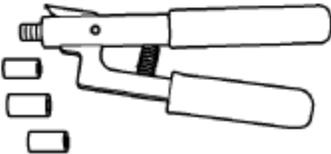
Illustration	Tool Number/Description
	<p data-bbox="967 457 1089 478">EN 45680-850</p> <p data-bbox="850 499 1206 520">Cylinder Liner Removal and Installation Kit</p>
	<p data-bbox="987 814 1070 835">EN 46327</p> <p data-bbox="911 856 1146 877">Timing Chain Retention Tool</p>
	<p data-bbox="987 1171 1073 1192">EN-46745</p> <p data-bbox="891 1213 1169 1234">Piston Pin Clip Remover/Installer</p>

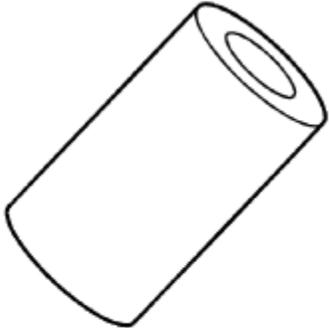
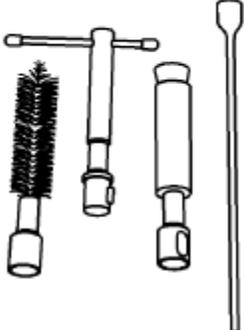
Illustration	Tool Number/Description
	<p data-bbox="857 373 1203 443">EN-46745-4 Piston Pin Clip Remover/Installer Adapter</p>
	<p data-bbox="927 730 1133 800">EN-47836 Piston Ring Compressor</p>
	<p data-bbox="873 1087 1187 1157">EN-47909 Injector Bore and Sleeve Cleaning Kit</p>

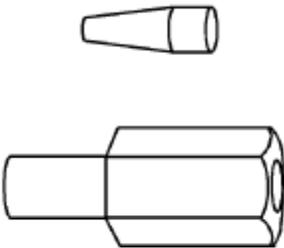
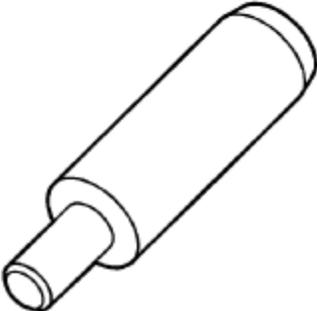
Illustration	Tool Number/Description
	<p data-bbox="987 373 1073 394">EN-48266</p> <p data-bbox="899 415 1161 436">Injector Seal Installer and Sizer</p>
	<p data-bbox="987 730 1073 751">EN-48585</p> <p data-bbox="915 772 1144 793">Crankshaft Balancer Guide</p>
	<p data-bbox="987 1010 1073 1031">J 2619-01</p> <p data-bbox="971 1052 1089 1073">Slide Hammer</p>
	<p data-bbox="997 1205 1062 1226">J 7872</p> <p data-bbox="894 1247 1166 1268">Magnetic Base Dial Indicator Set</p>
	<p data-bbox="997 1400 1062 1421">J 8062</p> <p data-bbox="878 1442 1182 1463">Valve Spring Compressor - Head Off</p>

Illustration	Tool Number/Description
	<p>J 8087 Cylinder Bore Gage</p>
	<p>J 9666 Valve Spring Tester</p>
	<p>J 28410 Gasket Remover</p>
	<p>J 28428-E High-Intensity Black Light Kit</p>
	<p>J 34115 Sprocket Bearing Installer</p>
	<p>J 35667-A Cylinder Head Leakdown Tester</p>

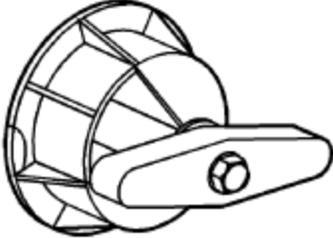
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	<p data-bbox="992 291 1065 315">J 36017</p> <p data-bbox="943 331 1114 354">Valve Seal Remover</p>
	<p data-bbox="984 581 1073 604">J 37281-A</p> <p data-bbox="956 621 1101 644">Injector Remover</p>
	<p data-bbox="992 869 1065 892">J 38188</p> <p data-bbox="862 909 1195 932">Cylinder Head Broken Bolt Extractor Kit</p>
	<p data-bbox="992 1146 1065 1169">J 42067</p> <p data-bbox="927 1186 1130 1209">Rear Main Seal Installer</p>

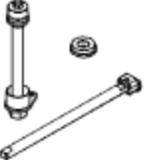
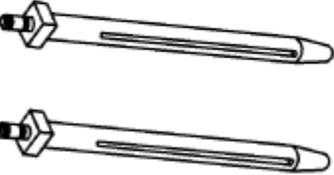
Illustration	Tool Number/Description
	<p data-bbox="954 373 1105 436">J 42385-850 Thread Repair Kit</p>
	<p data-bbox="922 646 1138 709">J 43649 Valve Spring Compressor</p>
	<p data-bbox="841 842 1219 905">J 43650 Balance Shaft Bearing Remover and Installer</p>
	<p data-bbox="889 1041 1170 1104">J 43963 Valve Spring Compressor (off car)</p>
	<p data-bbox="927 1329 1130 1392">J-43966-1 Connecting Rod Guides</p>

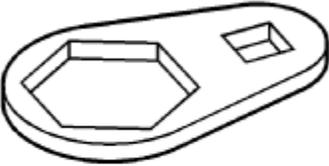
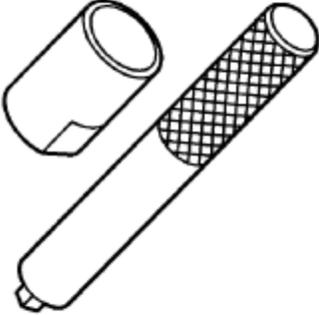
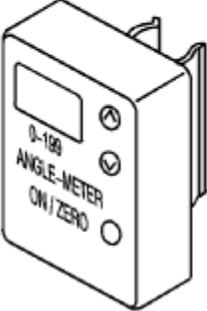
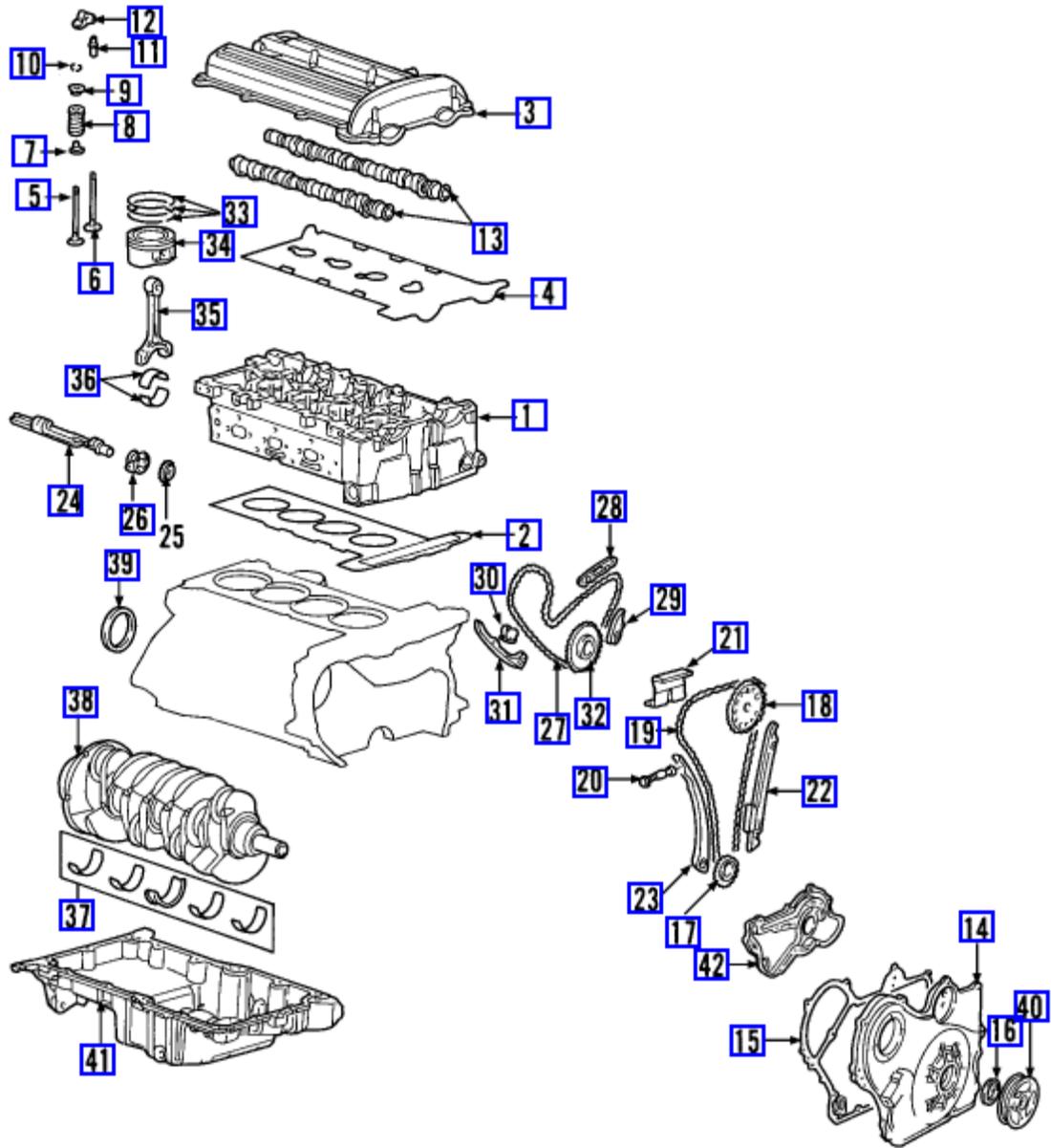
Illustration	Tool Number/Description
	<p data-bbox="992 375 1062 394">J-44887</p> <p data-bbox="954 415 1102 434">Oil Filter Cap Tool</p>
	<p data-bbox="992 732 1062 751">J 45027</p> <p data-bbox="967 772 1089 791">Tensioner Tool</p>
	<p data-bbox="992 1089 1062 1108">J 45059</p> <p data-bbox="979 1129 1081 1148">Angle Meter</p>

Illustration	Tool Number/Description
	<p data-bbox="992 1579 1062 1598">J 45299</p> <p data-bbox="963 1619 1094 1638">Engine Preluber</p>

Parts Information		OEM Part #	Price
Engine			
Engine Assembly		19181846	\$3588.39
Labor Information		Skill Level	Mfg. Warranty
Engine Diagnose/Test			
Oil Leak, Diagnosis		B	0.0
Replace			
Complete Assembly Without Transfer Of Parts <i>Does Not Include: Transfer Of Any Part Of Engine Or Replacement Of Optional Equipment.</i>		B	0.0
Complete Assembly With Transfer Of Parts <i>Includes: Transfer All Fuel & Electrical Units. Does Not Include: Transfer Of Optional Equipment.</i>		B	8.8
Long Block <i>Includes: R&I Engine And Transfer All Necessary Components Not Supplied With Long Block.</i>		B	0.0
Short Block <i>Includes: R&I Engine And Transfer All Necessary Parts.</i>		A	0.0
Overhaul/Rebuild <i>Includes: Measure Cylinder Bores, Crankshaft & Pistons For Proper Size & Hone Cylinders. Renew Pistons, Rings, Pins, Main & Rod Bearings, Grind Valves & Tune-Up.</i>		A	0.0

Engine



Engine