



6.4L Rebuild and Assembly Guide

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SPECIAL TORQUE CHART

Bedplate mounting bolts (crankcase bolts)	See page 12	See page 12
Camshaft follower guide bolt/washer	114 lbf/in	13 Nm
Camshaft position (CMP) sensor	114 lbf/in	13 Nm
Camshaft thrust plate mounting bolts	23 lbf/ft	31 Nm
Connecting rod bolt (Initial)	33 lbf/ft	45 Nm
Connecting rod bolt (Final)	50 lbf/ft	68 Nm
Coolant (block) heater	30 lbf/ft	41 Nm
Coolant pump mounting bolts	23 lbf/ft	31 Nm
Coolant pump pulley mounting bolts	23 lbf/ft	31 Nm
Crankcase breather to valve cover	114 lbf/in	13 Nm
Crankcase breather drain fitting to crankcase	18 lbf/ft	25 Nm
Crankcase breather tube clip bolt	23 lbf/ft	31 Nm
Crankcase coolant drain plug (M16)	180 lbf/in	20 Nm
Crankshaft position (CKP) sensor	114 lbf/in	13 Nm
Cylinder head bolts (only use new bolts, note 3)	See page 11	See page 11
EGR cooler inlet temperature sensor (EGRT Inlet)	32 lbf/ft	44 Nm
EGR coolant system hose clamps	31 lbf/in	3.5 Nm
EGR cooler outlet temperature sensor (EGRT Outlet)	28 lbf/ft	38 Nm
EGR DOC tube to RB up-tube bolts & nuts	23 lbf/ft	31 Nm



EGR DOC tube to EGR cooler horizontal bolts	23 lbf/ft	31 Nm
EGR cooler vertical to EGR valve housing bolts	23 lbf/ft	31 Nm
EGR cooler vertical bracket mounting bolts	23 lbf/ft	31 Nm
EGR cooler horizontal to EGR cooler vertical flange	23 lbf/ft	31 Nm
EGR throttle body to EGR valve housing	88 lbf/in	10 Nm
EGR valve housing to intake manifold	88 lbf/in	10 Nm
EGR valve to EGR valve housing	88 lbf/in	10 Nm
Engine coolant temperature sensor (ECT)	159 lbf/in	18 Nm
Engine oil pressure switch (EOP)	124 lbf/in	14 Nm
Engine oil temperature sensor (EOT)	159 lbf/in	18 Nm
Exhaust backpressure (EP) connector to DOC tube	20 lbf/ft	27 Nm
Exhaust backpressure (EP) tube bracket nut	80 lbf/in	9 Nm
Exhaust backpressure (EP) tube nut to EP sensor	180 lbf/in	20 Nm
Exhaust backpressure (EP) tube nut to exhaust connector	180 lbf/in	20 Nm
Exhaust manifold flange studs	159 lbf/in	18 Nm
Exhaust manifold heat shield mounting bolts & nut	88 lbf/in	10 Nm
Exhaust manifold heat shield spacers to stud bolts	88 lbf/in	10 Nm
Exhaust manifold mounting bolts and stud bolts (note 4)	18 lbf/ft	25 Nm
Exhaust up-tube to exhaust manifold nuts	23 lbf/ft	31 Nm
Exhaust up-tube to turbo bolts	18 lbf/ft	24 Nm



Flywheel/flexplate bolts (only use new bolts, note 3)	See page 12	See page 12
Front cover mounting bolts	23 lbf/ft	31 Nm
Fuel cooler reservoir mounting bolts	114 lbf/in	13 Nm
Fuel filter cap	20 lbf/ft	27 Nm
Fuel fitting banjo bolt with copper washer (M12)	28 lbf/ft	38 Nm
Fuel fitting banjo bolt with steel washer w/viton insert (M12)	18 lbf/ft	25 Nm
Fuel fitting banjo bolt (M14)	35 lbf/ft	47 Nm
Fuel injector hold down clamp bolts	28 lbf/ft	38 Nm
Fuel injector return tube nut to check valve	28 lbf/ft	38 Nm
Fuel return passage plug (rear of cylinder head)	20 lbf/ft	27 Nm
Fuel supply and return tube clamp to upper oil pan	23 lbf/ft	31 Nm

Glow plug	124 lbf/in	14 Nm
Glow plug control module bolts and nuts (GPCM)	114 lbf/in	13 Nm
High pressure common rail (HPCR) mounting bolts	23 lbf/ft	31 Nm
High pressure common rail (HPCR) to fuel injector tubes	See pages 7 & 8	See Pages 7 & 8
High pressure fuel injection pump & pump-to-rail tube installation	See pages 7 & 8	See pages 7 & 8



High pressure fuel injection pump cover mounting bolts	114 lbf/in	13 Nm
High pressure fuel injection pump drive gear bolt	57 lbf/ft	78 Nm
High pressure fuel injection pump mounting bolts	45 lbf/ft	62 Nm
High pressure fuel tube nuts (all)	144 lbf/in	30 Nm
Intake manifold pressure sensor (MAP)	106 lbf/in	12 Nm
Intake air temperature 2 (IAT2) sensor	124 lbf/in	14 Nm
Intake manifold bolts and stud bolts	See page 12	See page 12
Lifting eye bolts	45 lbf/ft	62 Nm
Oil cooler to crankcase mounting bolts (M8)	23 lbf/ft	31 Nm
Oil filter base to cooler cover screws (M6 thread forming)	89 lbf/in	10 Nm
Oil filter cap	18 lbf/ft	25 Nm
Oil filter housing to filter base bolts	16 lbf/ft	22 Nm
Oil filter stand pipe bolt (M5 thread forming) W/new oil cooler	61 lbf/in	7 Nm
Oil filter stand pipe bolt (M5 thread forming) reusing existing oil cooler	30 lbf/in	3 Nm
Oil pan bolt - lower pan	114 lbf/in	13 Nm
Oil pan bolt - upper pan	114 lbf/in	13 Nm
Oil pan drain plug (see note 1)	32 lbf/ft	44 Nm
Oil pickup tube bolts	114 lbf/in	13 Nm
Oil pump housing bolts	16 lbf/ft	22 Nm
Oil pressure regulator plug	26 lbf/ft	35 Nm
Piston cooling jet mounting bolts (see note 2)	114 lbf/in	13 Nm
Rocker arm assembly bolts	See Page 8 & 9	See Page 8&9
Rear cover M10 (manual only)	45 lbf/ft	62 Nm
Rear cover M8 (man & auto)	23 lbf/ft	31 Nm



Thermostat housing hold down plate bolts	114 lbf/in	13 Nm
Turbocharger actuator mounting bolt	168 lbf/in	19 Nm
Turbocharger air inlet duct clamp	44 lbf/in	5 Nm
Turbocharger pedestal bolts	45 lbf/ft	62 Nm
Turbocharger to pedestal bolts	148 lbf/ft	201 Nm
Turbocharger crossover tube support mounting	79 lbf/in	9 Nm
Turbocharger heat shield bolts	96 lbf/in	11 Nm
Turbocharger oil supply banjo bolts (M12)	28 lbf/ft	38 Nm
Turbocharger oil supply stando fittings to center housings	35 lbf/ft	47 Nm
Turbocharger oil supply tube retaining bolt to oil cooler	114 lbf/in	13 Nm
Valve cover base bolts	114 lbf/in	13 Nm
Valve cover bolts and studs	80 lbf/in	9 Nm



Special Torque Specs cont.

HPCR Fuel Components Assembly Procedure

IMPORTANT: Hand start and hand snug tube nuts.

Step 1: Install injectors, clamps, and bolts. Hand start the clamp bolts.

Step 2: Rundown injector clamp bolts to 1.5 lb/ft (2 Nm). Injectors will seat while torquing.

NOTE: Injectors must be fully seated and snugged, but still moveable for high pressure connector and HP tube alignment.

Step 3: Install HP rail and hand start two rail mounting bolts.

NOTE: Rail must be moveable, but not loose.

Step 4: Remove four plastic caps from rail high pressure connectors (HPC's) and four caps from injector HPC's.

Step 5: Obtain four rail-to-injector jumper tubes from packaging.

Step 6: Install jumper tubes (one at a time) between rail and injectors. Fully hand start and seat tube nuts onto mating rail and injector HPC's.

Snug rail and injector tube nuts using inside-out step sequence (two inside nuts, then two outside nuts) using a tube nut click wrench set to 1.5 lb/ft (2 Nm).

Step 7: Final torque injector clamp bolts to 28 lb/ft (38 Nm).

Step 8: Final torque two M8 rail bolts to 23 lb/ft (31 Nm).

Step 9: Torque rail and injector tube nuts to 106 lb/in (12 Nm +2 / -0).

Step 10: Mark tube nut and rail/injector threaded connection with a permanent marker. Turn tube nuts one flat (60 degrees).

High Pressure Pump and Pump-to-Rail HP Tubes Installation Procedure

Step 1: Install and final torque high pressure fuel injection pump to 45 lb/ft (61 Nm). Step 2: Install pump cover gasket and make electrical connections between pump and gasket. Install pump cover and fasten bolts.

Step 3: Remove four plastic caps covering supply, return, and high pressure rail connectors.

Step 4: Obtain left and right pump-to-rail high pressure tubes from packaging. Step 5:

Position tubes between pump and rails. Fully hand start and seat tube nuts onto mating pump and rail connections.

NOTE: Support tubes while hand snuging nuts to ensure proper joint assembly.

Step 6: Snug tube nuts to 1.5 lb/ft (2 Nm).

Step 7: Torque pump and rail tube nuts to 106 lb/in (12 Nm +2 / -0).

Step 8: Mark tube nut and rail/pump threaded connection with a permanent marker. Turn tube nuts one flat (60 degrees).



Injector-Pipe-Rail Sub-Assembly Process

Step 1: Place fuel injectors with clamps in head and snug bolts.

Step 2: Place and snug fuel rail (leave one thread loose).

Step 3: Place four fuel jumper tubes to injector/fuel rail and start 1–2 threads.

Step 4: Snug injector-side tube nuts to 1.5 lb/ft (2 Nm) (special torque sequence used).

Step 5: Snug fuel rail-side tube nuts to 1.5 lb/ft (2 Nm) (special torque sequence used).

Step 6: Final torque fuel rail mounting bolts.

Step 7: Final torque injector bolts (special torque sequence used).

Step 8: Final torque injector-side tube nuts to 106 lb/in (12 Nm +2 / -0) (special torque sequence used).

Step 9: Final torque fuel rail-side tube nuts to 106 lb/in (12 Nm +2 / -0) (special torque sequence used).

Step 10: Mark tube nut and injector threaded connection. Turn tube nuts one flat (60 degrees) (special torque sequence used).

Step 11: Mark tube nut and high pressure fuel rail threaded connection. Turn tube nuts one flat (60 degrees) (special torque sequence used).

NOTE: Torque components in the center two cylinders first, then torque the outer two cylinders last.

Fulcrum Plate / Rocker Arm Support Assembly

Step 1: Position crankshaft at approximate #1 and #4 cylinder TDC by observing damper dowel pin and clocking it to the 10:30 position (viewed from front of engine).

Step 2: Determine which cylinder is in firing position by installing pushrods and observing #3 intake and #8 intake.

Step 3:

- If #3 intake pushrod shows cam lift, this is #1 firing position. Torque fulcrum plates #1, #2, #7, #8 only (Steps 4–6).
- If #8 intake pushrod shows cam lift, this is #4 firing position. Torque fulcrum plates #3, #4, #5, #6 only (Steps 4–6).

Step 4: Partially run down both M10 bolts until they just contact fulcrum plate.

Step 5: Fully run down and torque inboard (upper) bolt to 45 lb/ft (62 Nm).

Step 6: Fully run down and torque outboard (lower) bolt to 45 lb/ft (62 Nm). Step 7: Rotate crankshaft 360 degrees to alternate cylinder TDC (dowel pin at 10:30).



Step 8: Identify remaining fulcrum plates per Step 3 and torque per Steps 4–6.

EGR Cooler Mounting Clamps

Horizontal Cooler

Step 1: Pre-torque EGR clamps to 88 lb/in (10 Nm).

Step 2: Loosen clamp nuts two full turns.

Step 3: Final torque to 69 lb/in (8 Nm).

Vertical Cooler

Step 1: Pre-torque EGR clamps to 75 lb/in (8.5 Nm).

Step 2: Loosen clamp nuts two full turns. Step 3:

Final torque to 57 lb/in (6.5 Nm).

Fuel Rail Pressure Sensor (FRP)

Step 1: Snug sensor hand tight to 1.5 lb/ft (2 Nm).

Step 2: Mark sensor and high pressure fuel rail connection with permanent marker. Turn sensor one flat (60 degrees).

Hex Flange Head Bolts

Thread Diameter	Torque (lbf/ft)	Torque (Nm)	Wrench Size (mm)
Thread Diameter	Standard	Metric	Thread Diameter
M6 x 1	114 lbf/in	13 Nm	M6 x 1
M8 x 1.25	23 lbf/ft	31 Nm	M8 x 1.25
M10 x 1.5	45 lbf/ft	62 Nm	M10 x 1.5
M12 x 1.75	79 lbf/ft	107 Nm	M12 x 1.75



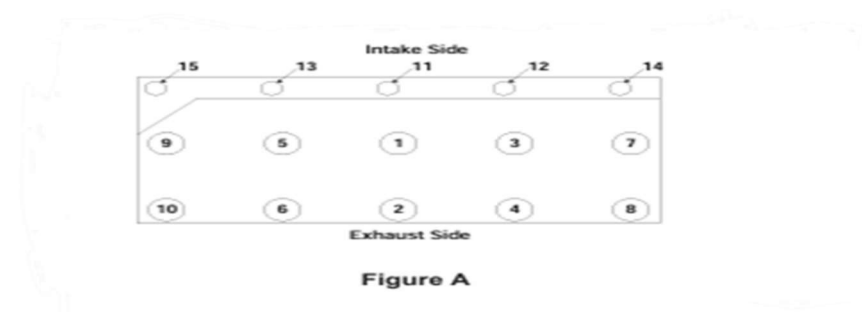
Hex Head Bolts

Thread Diameter	Torque (lbf/ft)	Torque (Nm)	Wrench Size (mm)
M6 x 1	6	8	10
M8 x 1.25	15	20	13
M10 x 1.5	30	40	16
M12 x 1.75	51	69	18
M16 x 2	128	173	24

Pipe Thread Bolts

Pipe Thread	Torque (lbf/ft)	Torque (Nm)
1/8" NPT	7.5	10.2
1/4" NPT	10	13.6
3/8" NPT	15	20.4
1/2" NPT	25	34.0
3/4" NPT	30	40.8

Cylinder Head Bolts



Oem Head Bolts (M16-series torque-to-yield)

These MUST BE NEW on every rebuild.

OEM torque sequence (10 main bolts per head):



1. Lubricate threads & washers with clean engine oil.
2. Torque each to 70 lb·ft (95 Nm) in sequence.
3. Back off and retorque to 115 lb·ft (156 Nm).
4. Angle tighten 90° in sequence.
5. Angle tighten additional 90°.

Only use angle torque steps after proper initial torque to ensure correct clamp load.
 Smaller M8 head cap fasteners (where applicable) are generally 23 lb·ft (31 Nm). ARP
 STD Grade 425 Studs 250-4203 Torque Specs

1. Stud Installation into Block
 - Studs are installed into the block by hand only — do not torque them down hard into the block threads. This avoids damaging block threads.
2. Head & Nut Torque Procedure (after head is seated)
 - Use ARP Ultra-Torque assembly lubricant on stud threads, nuts, and washers for consistent clamping force.
 - Tighten the head stud nuts in 3 equal steps to the final torque: □ 膝 M16 head studs (numbers 1-10): ~275 ft-lb final torque.
3. Inner Row (OEM) Bolts- If any OEM-style inner row bolts are used (number 11-15), torque those to ~23-30 ft-lb.

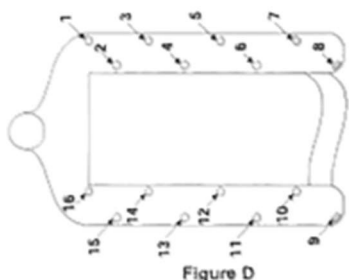


Figure B

Flywheel Bolts

- Step 1: Torque the bolts to 1-5 lbf/ft (1.4-7 Nm) in the numerical sequence shown above.
- Final step: Torque the bolts to 69 lbf/ft (94 Nm) in the numerical sequence shown above.

Intake Manifold Bolts



- Step 1: Install bolts 1 through 8 finger-tight.
- Step 2: Torque bolts 9 through 16 to 8 lbf/ft (11 Nm).
- Final step: Torque all bolts to 8 lbf/ft (11 Nm) in the numerical sequence shown.

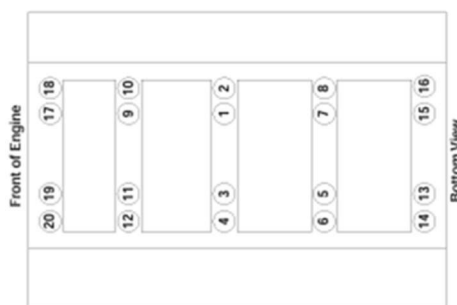


Figure E

Main Bearing Bolts

Bottom View

- Step 1: Torque the bolts to 110 lbf/ft (149 Nm) in the numerical sequence shown.
- Step 2: Torque the bolts to 130 lbf/ft (176 Nm) in the numerical sequence shown.
- Final step: Torque the bolts to 170 lbf/ft (231 Nm) in the numerical sequence shown.

MAIN BEARINGS – CLEARANCE TARGETS

Build Type	Oil Clearance
Stock / Daily	0.0023" - 0.0028"
Heavy Tow	0.0027" - 0.0032"
Performance / Tuned	0.0030" - 0.0035"
Race / Extreme	0.0035" - 0.0040"



CONNECTING ROD BEARINGS – CLEARANCE TARGETS

Build Type	Oil Clearance
Stock / Daily	0.0018" - 0.0023"
Heavy Tow	0.0022" - 0.0027"
Performance / Tuned	0.0025" - 0.0030"
Race / Extreme	0.0030" - 0.0035"

THRUST & SIDE CLEARANCE

Component	Specification
Thrust Bearing (Race)	0.007" - 0.009"
Rod Side Clearance (Race)	0.014" - 0.018"
Crankshaft End Play (Standard)	0.005" - 0.007" (0.04 - 0.20 mm)
Crankshaft End Play (High HP)	0.0065" - 0.010"

MEASUREMENT & ASSEMBLY NOTES

- Measure at 90° to the parting line
- Dial bore gauge and micrometer required (0.0001" resolution)
- Torque caps to the final specification during measurement
- Log each journal individually
- Verify oil pressure mechanically on first fire
- Measure crankshaft end play using a feeler gauge or dial indicator



PISTON RING END GAP SPECIFICATIONS

Application	Ring Type	End Gap Range	Typical Target / Notes
Standard / Performance	Top Compression Ring	0.012" – 0.020"	Typical target ~0.016"
Standard / Performance	Second Compression Ring	0.036" – 0.076"	Large gap to prevent pressure stacking
Standard / Performance	Oil Control Ring Rails	0.015" – 0.035"	Typical target 0.056" – 0.076"
High Horsepower (1000+ HP)	Top Compression Ring	0.020" – 0.024"	Increased gap for high boost and heat
High Horsepower (1000+ HP)	Second Compression Ring	0.036" – 0.076"	Large gap to prevent pressure stacking
High Horsepower (1000+ HP)	Oil Control Ring Rails	0.009" – 0.029"	Usually not filed unless out of spec

6.4L POWERSTROKE – CYLINDER BORE SPECIFICATIONS

Section	Item	Specification
Standard Bore	Standard Bore Size	3.866" – 3.868" (MAX)
Oversize	.010" Over	3.876"
Oversize	.020" Over	3.886"
Oversize	.030" Over	3.896"
Oversize	.040" Over	3.906"
High Output Note	Additional Clearance	Add +0.001" clearance for applications exceeding 800 HP
Cylinder Finish	Crosshatch Angle	37°
Cylinder Finish	Final Hone	280-grit stone
Cylinder Finish	Final Finish	Plateau brush



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Engine Break-In Guidance – 6.4L Power Stroke

Oil Type Recommendations

Use standard engine oil only during the break-in period.

- 10W-40/15W-40 for bearing clearances under 0.0035"
- 20W-50 for bearing clearances 0.0040" and greater

(race or loose-clearance engines)

Special break-in oils or additives are not required. Modern diesel engine oils already contain sufficient anti-wear additives to protect bearings and piston rings during break-in.

Running Guidelines – First 1,000 Miles

- Do not allow the engine to idle for more than 10 minutes at a time
- Operate the engine at moderate RPM
- Avoid heavy load, towing, or sustained high RPM
- Change the engine oil at 1,000 miles to remove break-in debris and metal particles

Camshaft Note:

The 6.4L Power Stroke uses a hydraulic roller camshaft, which does not require a camshaft break-in procedure. No special cam break-in oil or process is necessary.

Oil Filter & Debris Inspection

Inspect the oil filter periodically during the first 1,000 miles.

- A small amount of fine metal particles in the filter is normal during break-in
- Excessive metal debris is a serious warning sign



If excessive metal is found:

- Stop running the engine immediately

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