Torque - Minimum tightening torques for normal assembly

METRIC NON-FLANGED HARDWARE

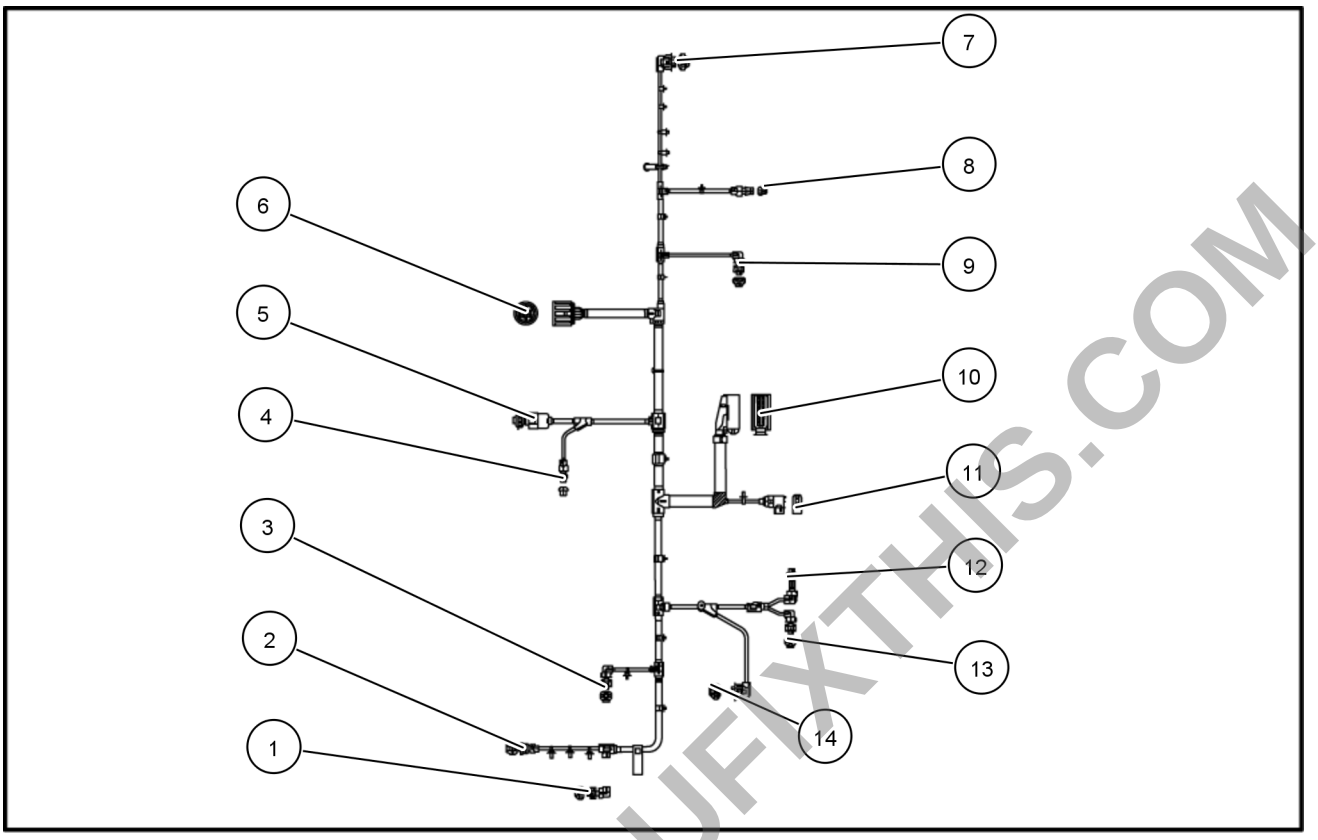
NOM. SIZE	CLASS 8.8 BOLT and CLASS 8 NUT		CLASS 10.9 BOLT and CLASS 10 NUT		LOCKNUT CL.8 W/CL8.8 BOLT	LOCKNUT CL.10 W/CL10.9 BOLT
	UNPLATED	PLATED W/ZnCr	UNPLATED	PLATED W/ZnCr		
M4	2.2 N·m (19 lb in)	2.9 N·m (26 lb in)	3.2 N·m (28 lb in)	4.2 N·m (37 lb in)	2 N·m (18 lb in)	2.9 N·m (26 lb in)
M5	4.5 N·m (40 lb in)	5.9 N·m (52 lb in)	6.4 N·m (57 lb in)	8.5 N·m (75 lb in)	4 N·m (36 lb in)	5.8 N·m (51 lb in)
M6	7.5 N·m (66 lb in)	10 N·m (89 lb in)	11 N·m (96 lb in)	15 N·m (128 lb in)	6.8 N·m (60 lb in)	10 N·m (89 lb in)
M8	18 N·m (163 lb in)	25 N·m (217 lb in)	26 N·m (234 lb in)	35 N·m (311 lb in)	17 N·m (151 lb in)	24 N·m (212 lb in)
M10	37 N·m (27 lb ft)	49 N·m (36 lb ft)	52 N·m (38 lb ft)	70 N·m (51 lb ft)	33 N·m (25 lb ft)	48 N·m (35 lb ft)
M12	64 N·m (47 lb ft)	85 N·m (63 lb ft)	91 N·m (67 lb ft)	121 N·m (90 lb ft)	58 N·m (43 lb ft)	83 N·m (61 lb ft)
M16	158 N·m (116 lb ft)	210 N·m (155 lb ft)	225 N·m (166 lb ft)	301 N·m (222 lb ft)	143 N·m (106 lb ft)	205 N·m (151 lb ft)
M20	319 N·m (235 lb ft)	425 N·m (313 lb ft)	440 N·m (325 lb ft)	587 N·m (433 lb ft)	290 N·m (214 lb ft)	400 N·m (295 lb ft)
M24	551 N·m (410 lb ft)	735 N·m (500 lb ft)	762 N·m (560 lb ft)	1016 N·m (750 lb ft)	501 N·m (370 lb ft)	693 N·m (510 lb ft)

NOTE: *M4 through M8 hardware torque specifications are shown in pound-inches. M10 through M24 hardware torque specifications are shown in pound-feet.*

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Wiring harness - Overview



Main harness

(1) Engine speed sensor (camshaft)
(2) Engine speed sensor (flywheel)
(3) High-pressure fuel pump
(4) Controller area network
(5) Connector to frame wiring
(6) Wire passage
(7) Oil pressure/temperature sensor
(8) Oil level sensor
(9) Coolant temperature sensor
(10) ECU
(11) Crankcase pressure sensor
(12) Clogged fuel filter sensor
(13) Fuel temperature sensor
(14) Air pressure/temperature sensor

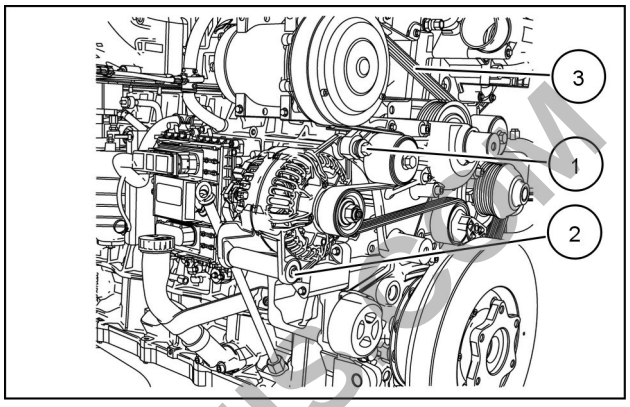
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Alternator - Remove

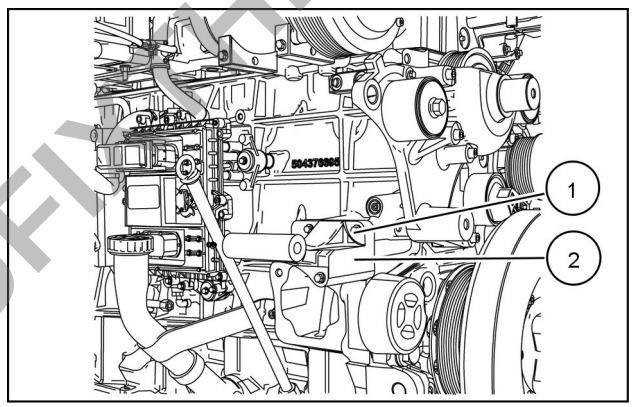
Prior operation:
Fan and drive Belt - Remove (B.50.A)

1. Remove the belt **(3)**.
2. Disconnect all electrical connections from the back of the alternator.
3. Remove the bolts **(1)** and **(2)** securing the alternator.



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4. Remove bolts **(1)** securing the mounting bracket **(2)** to the engine.



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Next operation:
Alternator - Install (A.30.A)

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ENGINE - Troubleshooting

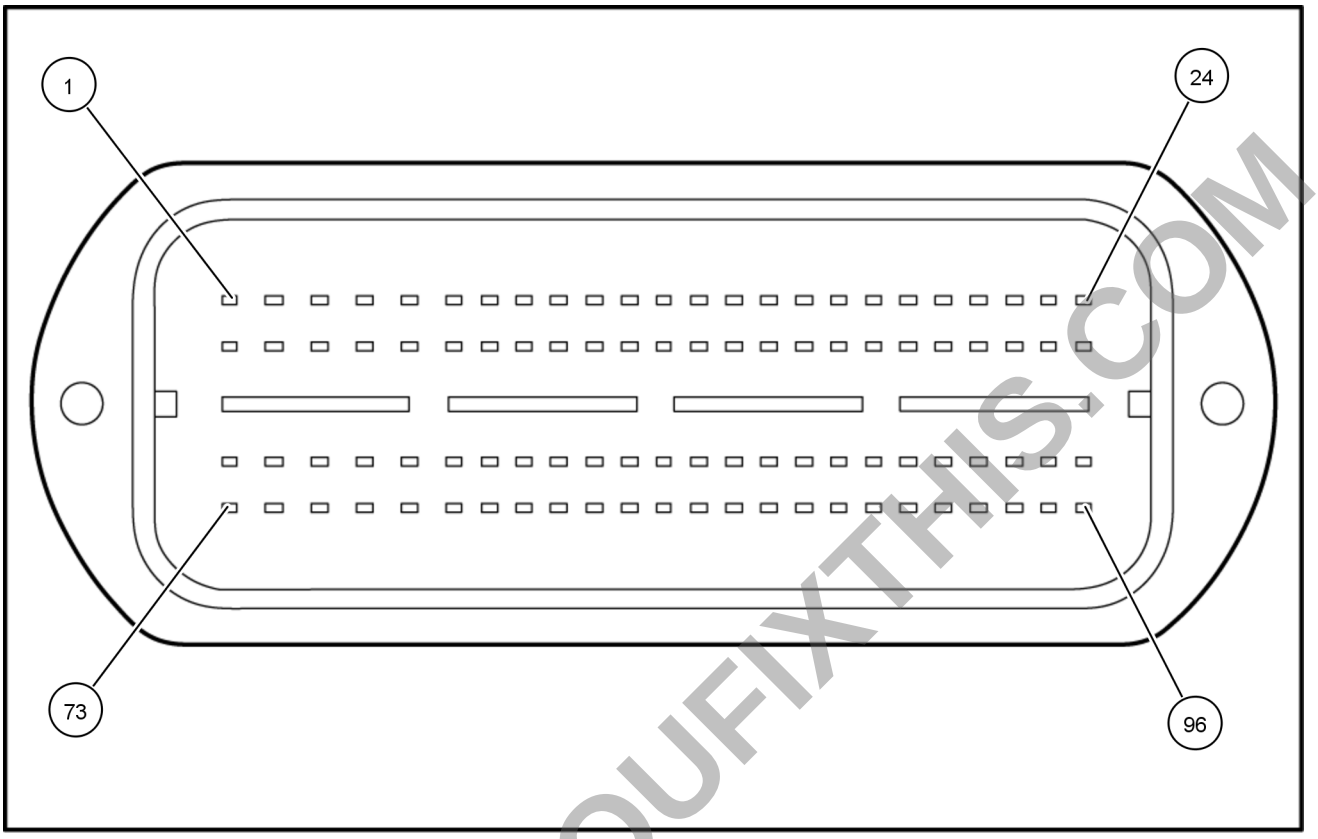
Problem	Possible Cause	Correction
Engine does not develop full power	Clogged air cleaner	Inspect and replace air cleaner if necessary
	Fuel line obstructed	Check for crimped fuel line. Inspect fuel lifter for cleanliness
	Low cylinder compression	Check engine compression
	Insufficient fuel injection	Repair at authorized shop
	Improper valve lash adjustment	Adjust valves to correct tolerances
	Burned, worn or sticking valves	Inspect and replace as necessary
	Blown head gasket	Replace head gasket
	Worn or sticking piston rings	Overhaul as necessary
Low oil pressure	Engine oil level low	Fill to proper level
	Wrong grade of oil	Replace with correct grade oil
	Clogged oil pump filter	Change oil and filter
	Faulty oil pressure relief valve	Replace relief valve
	Worn oil pump drive shaft gears, or broken oil pipe	Inspect oil system and components. Replace defective components
	Excessive main or connecting rod bearing clearances	Replace bearings or shaft if necessary
Engine will not stop	Faulty starter switch	Replace starter switch
Low cylinder compression	Burned, worn or sticking valves	Replace valves
	Bent valve stem	Replace valves
	Broken or weak valve spring	Replace valve spring
	Blown cylinder head gasket	Replace head gasket
	Worn or sticking piston rings	Replace piston rings
	Scored piston	Replace piston
Poor engine idling	Air in injection pump	Purge air from the system
Oil pressure warning light fails to operate	Bulb burnt out	Replace the bulb
	Oil pressure sensor is faulty	Replace oil pressure sensor
	Warning light circuit faulty	Replace warning light circuit
Engine knocks	Diluted or thin oil	Change engine oil and filter. Check for fuel in oil
	Insufficient oil supply	Check engine oil level
	Low oil pressure	Inspect lube system for restrictions
	Worn crankshaft thrust bearing	Replace thrust bearing
	Excessive flywheel runout	Replace flywheel
	Excessive connecting rod or main bearing clearance	Replace bearings
	Seized bearing	Replace bearing and affected component if necessary
	Clogged oil passage	Clean out oil passages
	Bent or twisted connecting rod	Replace connecting rod
	Crankshaft journals out of round	Rework or replace crankshaft
	Excessive piston to cylinder bore clearance	Replace piston with correct oversized piston
	Excessive piston ring side clearance	Replace piston rings
	Broken or damaged ring	Replace piston ring
	Excessive piston pin clearance	Replace piston pin or bushing
	Seized piston	Replace piston and, if necessary, engine block
	Piston pin retainer loose or missing	Replace retainer
	Improper valve lash adjustment	Adjust valve lash to specification
	Worn valve lifter	Replace valve lifter
	Excessive timing gear backlash	Replace all timing gears
Excessive oil consumption	Engine oil level too high	Remove excess oil
	Leakage in cylinder head gasket	Replace head gasket

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EDC control unit Pin Out

Sensor and injector connector “B”



83113604 2

Connector side

ECU Pin	Function
01	Injector 4
02	Injector 6
03	Injector 5
06	Oil pressure/temperature sensor
07	Charge air pressure and temperature sensor
11	Rail pressure sensor
12	Fuel temperature sensor
13	Oil pressure/temperature sensor
17	Controller area network
18	Controller area network
25	Injector 4
26	Injector 6
27	Injector 5
31	Oil pressure/temperature sensor
32	Crankcase pressure sensor
35	Oil pressure/temperature sensor
36	Rail pressure sensor
37	Charge air pressure and temperature sensor
39	Coolant temperature sensor
42	Crankcase pressure sensor
49	Injector 1
50	Injector 2
51	Injector 3
58	High-pressure fuel pump
59	Fuel temperature sensor/coolant temperature sensor

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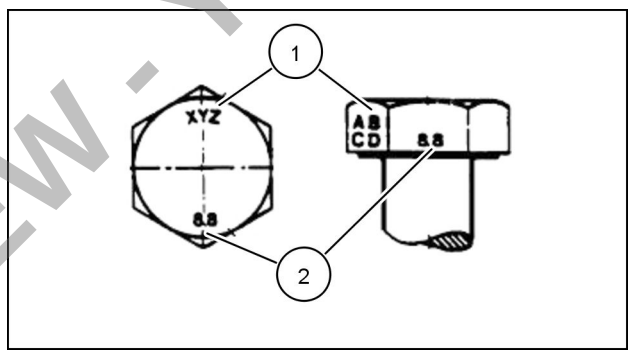
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METRIC FLANGED HARDWARE

NOM. SIZE	CLASS 8.8 BOLT and CLASS 8 NUT		CLASS 10.9 BOLT and CLASS 10 NUT		LOCKNUT CL.8 W/CL8.8 BOLT	LOCKNUT CL.10 W/CL10.9 BOLT
	UNPLATED	PLATED W/ZnCr	UNPLATED	PLATED W/ZnCr		
M4	2.4 N·m (21 lb in)	3.2 N·m (28 lb in)	3.5 N·m (31 lb in)	4.6 N·m (41 lb in)	2.2 N·m (19 lb in)	3.1 N·m (27 lb in)
M5	4.9 N·m (43 lb in)	6.5 N·m (58 lb in)	7.0 N·m (62 lb in)	9.4 N·m (83 lb in)	4.4 N·m (39 lb in)	6.4 N·m (57 lb in)
M6	8.3 N·m (73 lb in)	11 N·m (96 lb in)	12 N·m (105 lb in)	16 N·m (141 lb in)	7.5 N·m (66 lb in)	11 N·m (96 lb in)
M8	20 N·m (179 lb in)	27 N·m (240 lb in)	29 N·m (257 lb in)	39 N·m (343 lb in)	18 N·m (163 lb in)	27 N·m (240 lb in)
M10	40 N·m (30 lb ft)	54 N·m (40 lb ft)	57 N·m (42 lb ft)	77 N·m (56 lb ft)	37 N·m (27 lb ft)	53 N·m (39 lb ft)
M12	70 N·m (52 lb ft)	93 N·m (69 lb ft)	100 N·m (74 lb ft)	134 N·m (98 lb ft)	63 N·m (47 lb ft)	91 N·m (67 lb ft)
M16	174 N·m (128 lb ft)	231 N·m (171 lb ft)	248 N·m (183 lb ft)	331 N·m (244 lb ft)	158 N·m (116 lb ft)	226 N·m (167 lb ft)
M20	350 N·m (259 lb ft)	467 N·m (345 lb ft)	484 N·m (357 lb ft)	645 N·m (476 lb ft)	318 N·m (235 lb ft)	440 N·m (325 lb ft)
M24	607 N·m (447 lb ft)	809 N·m (597 lb ft)	838 N·m (618 lb ft)	1118 N·m (824 lb ft)	552 N·m (407 lb ft)	

IDENTIFICATION

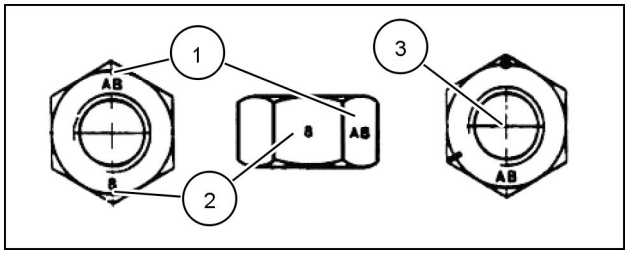
Metric Hex head and carriage bolts, classes 5.6 and up



20083680 1

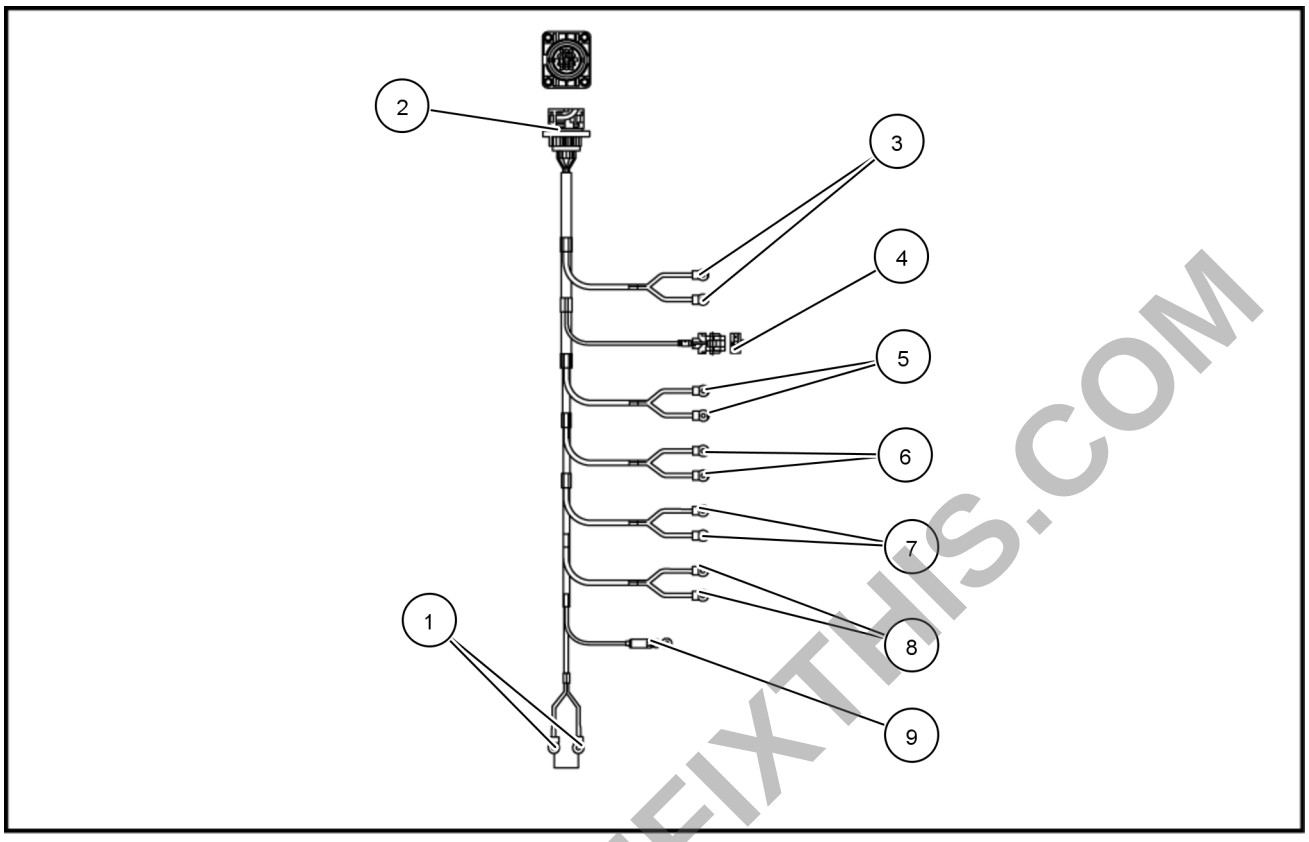
1. Manufacturer's Identification
2. Property Class

Metric Hex nuts and locknuts, classes 05 and up



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83113602 2

Internal harness

(1) Injector 6
(2) Wire passage
(3) Injector 1
(4) Rail pressure sensor
(5) Injector 2
(6) Injector 3
(7) Injector 4
(8) Injector 5
(9) Electrovalve insert, engine brake

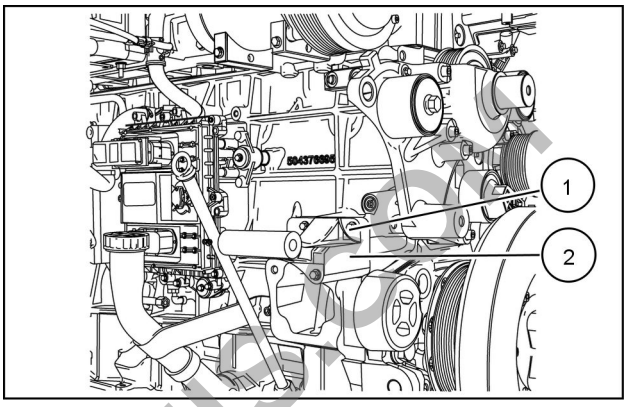
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Alternator - Install

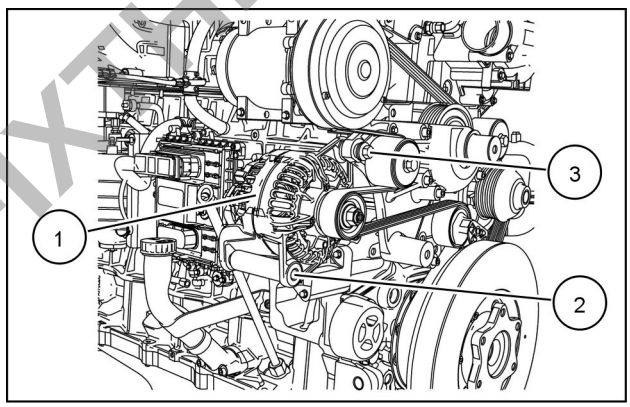
Prior operation:
Alternator - Remove (A.30.A)

1. Install the alternator support bracket **(2)** .
2. Torque the bolts **(1)** to **22 - 27 N·m** (**16 - 20 lb ft**).



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3. Set the alternator **(1)** on the support and loosely install the bottom through bolt **(2)**.
4. Install the top bolt **(3)** and torque to **22 - 27 N·m** (**16 - 20 lb ft**)
5. Torque the bottom through bolt **(2)** to **40 - 48 N·m** (**30 - 35 lb ft**).



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Next operation:
Fan and drive Belt - Install (B.50.A)

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Problem	Possible Cause	Correction
	Oil loss past the pistons and rings	Replace piston rings
	Worn, broken, or sticking piston rings	Replace piston rings
	Clogged return hole of oil ring	Unclog return oil hole and replace rings
	Worn valves, guides, or seals	Replace valves, guides, or seals
	Leakage past oil seals and gaskets	Replace leaking seals and gaskets
	External oil leaks from engine	Locate leaks and repair
Engine overheats	Insufficient amount of coolant in the radiator	Fill coolant to proper level
	Hose connection leaking or collapsed hose	Tighten hose connection or replace hose
	Radiator leakage	Locate leak and repair or replace radiator
	Loose, worn, or broken V-belt	Adjust V-belt tension or replace belt
	Radiator fins bent or clogged	Straighten out and clean fins
	Radiator cap not sealing	Replace radiator cap
	Thermostat operating improperly	Replace thermostat cap
	Insufficient amount of oil	Fill to proper level
	Water pump operating improperly	Replace water pump
	Improper valve clearance	Adjust valve clearance to specification
	Restriction in exhaust system	Remove restriction
	Improperly installed cylinder head gasket	Replace head gasket
	Rust and/or scale clogged water ports	Backflush cooling system
	Extended engine idling	Shutdown engine during extended idling periods
Temperature gauge fails to reach normal operating temperature	Faulty temperature sender	Replace temperature switch
	Faulty thermostat	Replace thermostat
	Faulty temperature gauge	Replace temperature gauge
Engine does not start	Faulty starter switch	Replace switch
	Insufficient charging or complete discharge of battery	Check battery and charging system
	Lack of fuel	Fill fuel tank
	Air mixed in fuel system	Inspect fuel system for tightness
	Clogged fuel filter	Replace fuel filter
	Irregular or faulty fuel supply	Replace fuel supply
	Grid heater not heating	Replace grid heater
	Improper lubricating oil viscosity	Replace lube oil
	Clogged air cleaner	Replace air cleaner
	Burned out fuse	Replace fuse
Excessive Exhaust Smoke	Air cleaner dirty or restricted	Replace air cleaner
	Excessive fuel delivery	Replace injection pump, fuel delivery not adjustable
Engine stops while operating	Lack of fuel in fuel tank	Fill fuel tank
	Clogged fuel filter	Replace filter
	Air mixed in fuel system	Inspect for air leaks
	Burned out fuse	Replace fuse
Undesirable exhaust smoke (white or pale)	Excess engine oil	Drain oil to proper oil level
	Improper lubricating oil viscosity	Replace oil with specified viscosity
	Faulty injection pump	Replace injection pump
Undesirable exhaust color (black or light grey)	Unsuitable fuel	Replace fuel
	Excess injection	Replace injection pump
	Faulty engine component	Replace as required
	Over loading	Decrease load
	Clogged air filter	Replace filter

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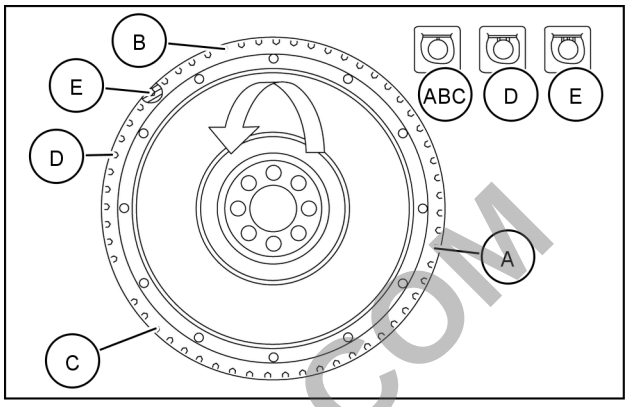
ECU Pin	Function
60	Rail pressure sensor
61	Crankcase pressure sensor
65	Engine speed sensor (flywheel)
66	Engine speed sensor (flywheel)
67	Engine speed sensor (camshaft)
68	Engine speed sensor (camshaft)
69	Shield on pin 65, 66, 67, 68
70	Electrovalve insertion engine brake
73	Injector 1
74	Injector 2
75	Injector 3
83	High-pressure fuel pump
86	Charge air pressure and temperature sensor
90	Charge air pressure and temperature sensor
95	Electrvalve insertion engine brake

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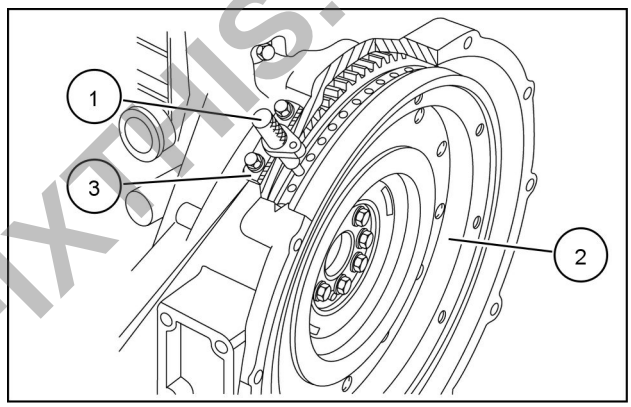
ENGINE - Service instruction - Finding Top Dead Center (TDC)

1. Using the tool **380000137**, turn the engine flywheel in the direction of normal rotation until you see the hole with two reference marks **(D)**.
2. Continue to turn the flywheel until the hole with one reference mark **(B)** can be seen. This marks TDC of the number one cylinder.



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3. The exact position of piston number one at TDC is obtained when the tool **380000150 (1)** fits into a hole in the flywheel **(2)** through the mounting surface of the engine speed sensor **(3)**.
4. Remove the tool **380000150 (1)**.

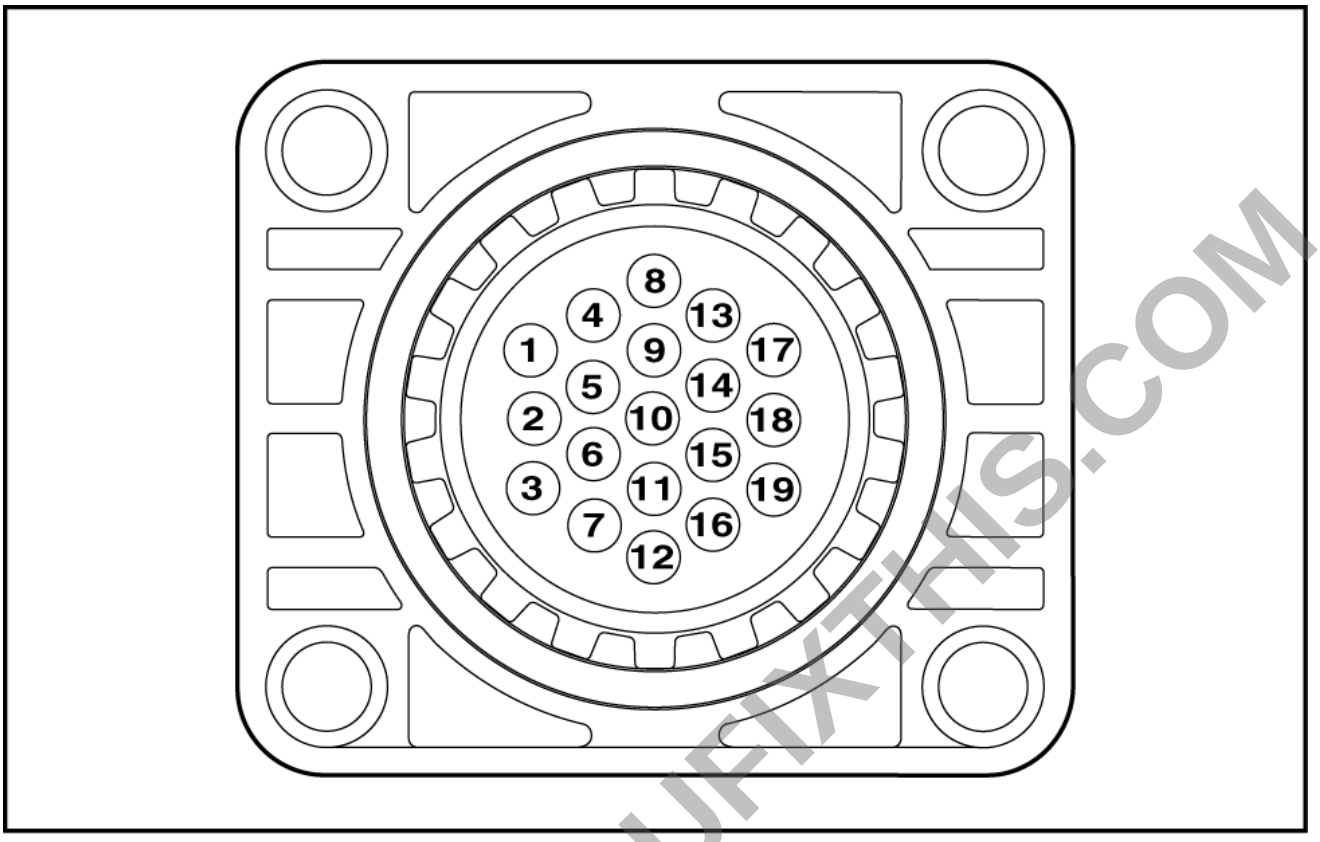


83116760 2

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Wire passage pin-out



83113605 3

ECU Pin	Function
01	Injector 1
02	Injector 2
03	Injector 3
04	Injector 1
05	Injector 2
06	Injector 3
07	-
08	Injector 4
09	Injector 5
10	Injector 6
11	-
12	Electrovalve insertion engine brake
13	Injector 4
14	Injector 5
15	Injector 6
16	Electrovalve insertion engine brake
17	Rail pressure sensor
18	Rail pressure sensor
19	Rail pressure sensor

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