Torque - Minimum tightening torques for normal assembly

METRIC NON-FLANGED HARDWARE

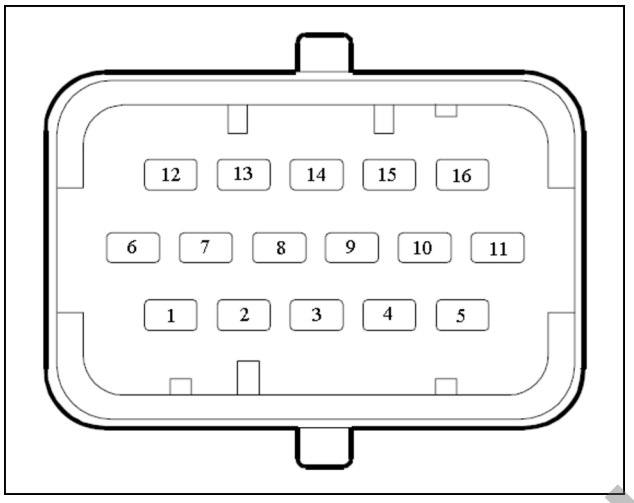
NOM. SIZE	CLASS 8.8 BOLT and CLASS 8 NUT		CLASS 10.9 BOLT and CLASS 10 NUT		LOCKNUT CL.8 W/CL8.8 BOLT	LOCKNUT CL.10 W/CL10.9 BOLT
	UNPLATED	PLATED W/ZnCr	UNPLATED	PLATED W/ZnCr		
M4	2.2 N·m (19 lb in)	2.9 N·m (26 lb in)	3.2 N·m (28 lb in)	4.2 N·m (37 lb in)	2 N·m (18 lb in)	2.9 N·m (26 lb in)
M5	4.5 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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EDC control unit pin out



CONNECTORA 2

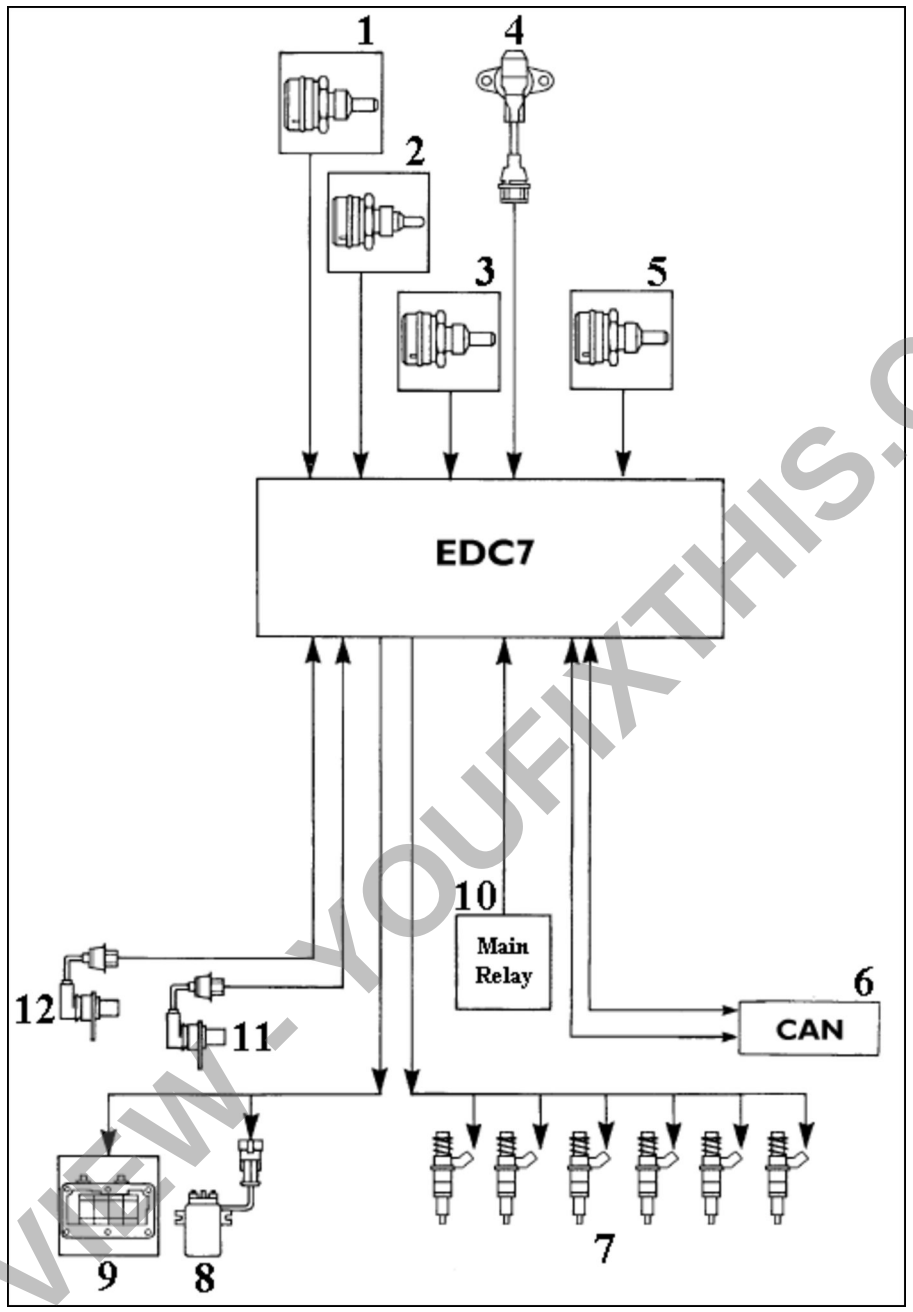
Connector A
Electro-injectors

ECU pin number	Wire color	Function
1	-	Free
2	-	Free
3	Black	Solenoid valve for electronic cylinder 4-5-6 injection
4	-	Free
5	-	Free
6	White	Solenoid valve for electronic cylinder 2 injection
7	Orange	Ground
8	Brown	Ground
9	-	Free
10	-	Free
11	Red	Solenoid valve for electronic cylinder 1-2-3 injection
12	Green	Solenoid valve for electronic cylinder 3 injection
13	White	Solenoid valve for electronic cylinder 1 injection
14	Blue	Solenoid valve for electronic cylinder 4injection
15	Gray	Solenoid valve for electronic cylinder 6 injection
16	Purple	Solenoid valve for electronic cylinder 5 injection

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Sensing system - Component diagram



COMPDIAGRAM2 1

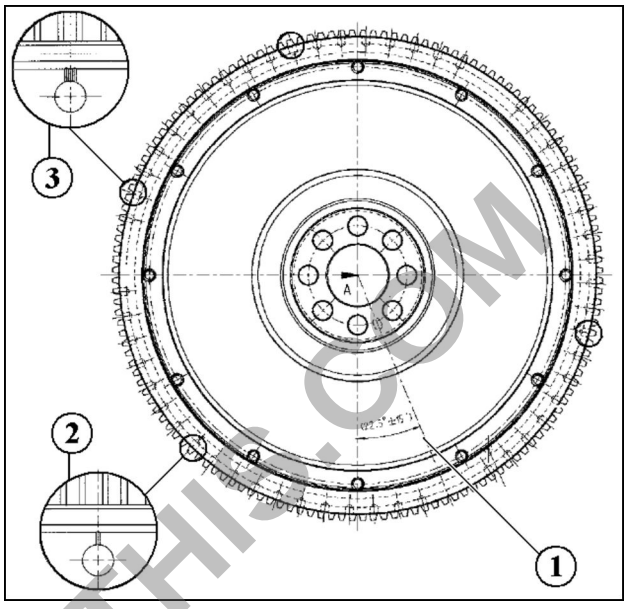
(1) Engine coolant temperature sensor
(2) Boost air temperature sensor
(3) Fuel temperature sensor
(4) Boost air pressure sensor
(5) Engine oil pressure/temperature sensor
(6) CAL L/H line
(7) Pump injectors
(8) Remote control switch for engine heater activation
(9) Engine heating resistance
(10) Main remote control switch
(11) Flywheel speed sensor
(12) Camshaft speed sensor

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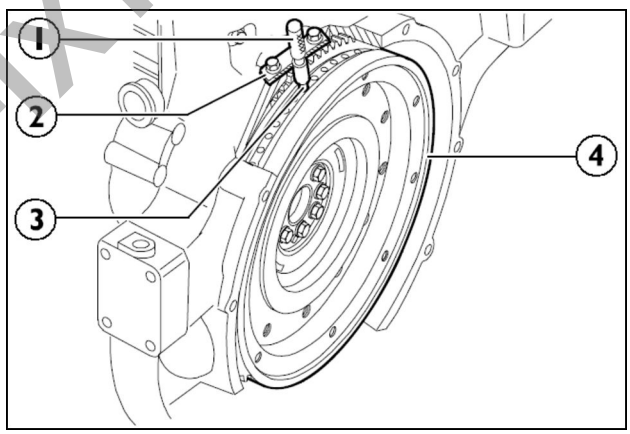
ENGINE - Service instruction - Finding Top Dead Center (TDC)

1. Using the tool **380000137**, turn the engine flywheel **(1)** in the direction of normal rotation until you see the hole with two reference marks **(3)**.
2. Continue to turn the flywheel until the following hole with one reference mark **(2)** can be seen. This marks TDC of the number one cylinder.



FLYWHEELF3C(B)2 1

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



TDCLOCATE2F3C 2

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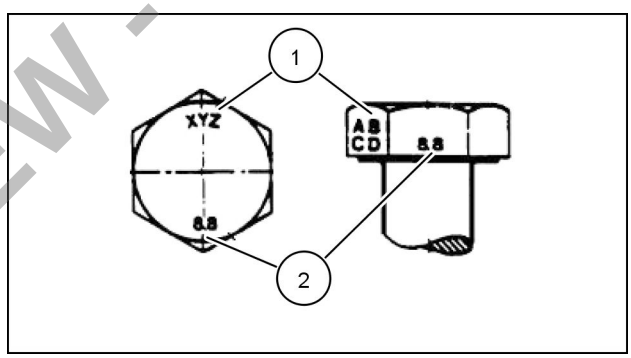
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METRIC FLANGED HARDWARE

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

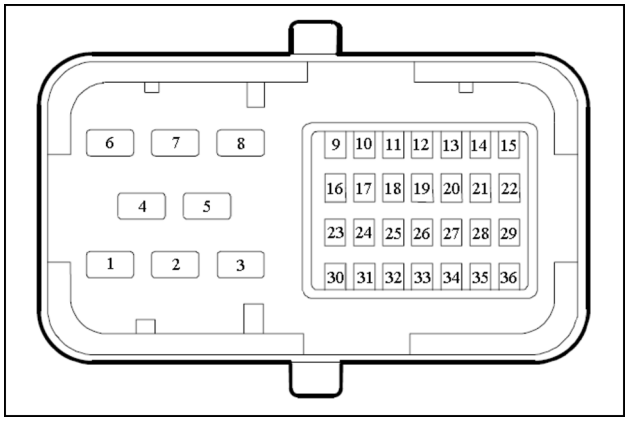


20083680 1

1. Manufacturer's Identification
2. Property Class

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CONNECTORC 3

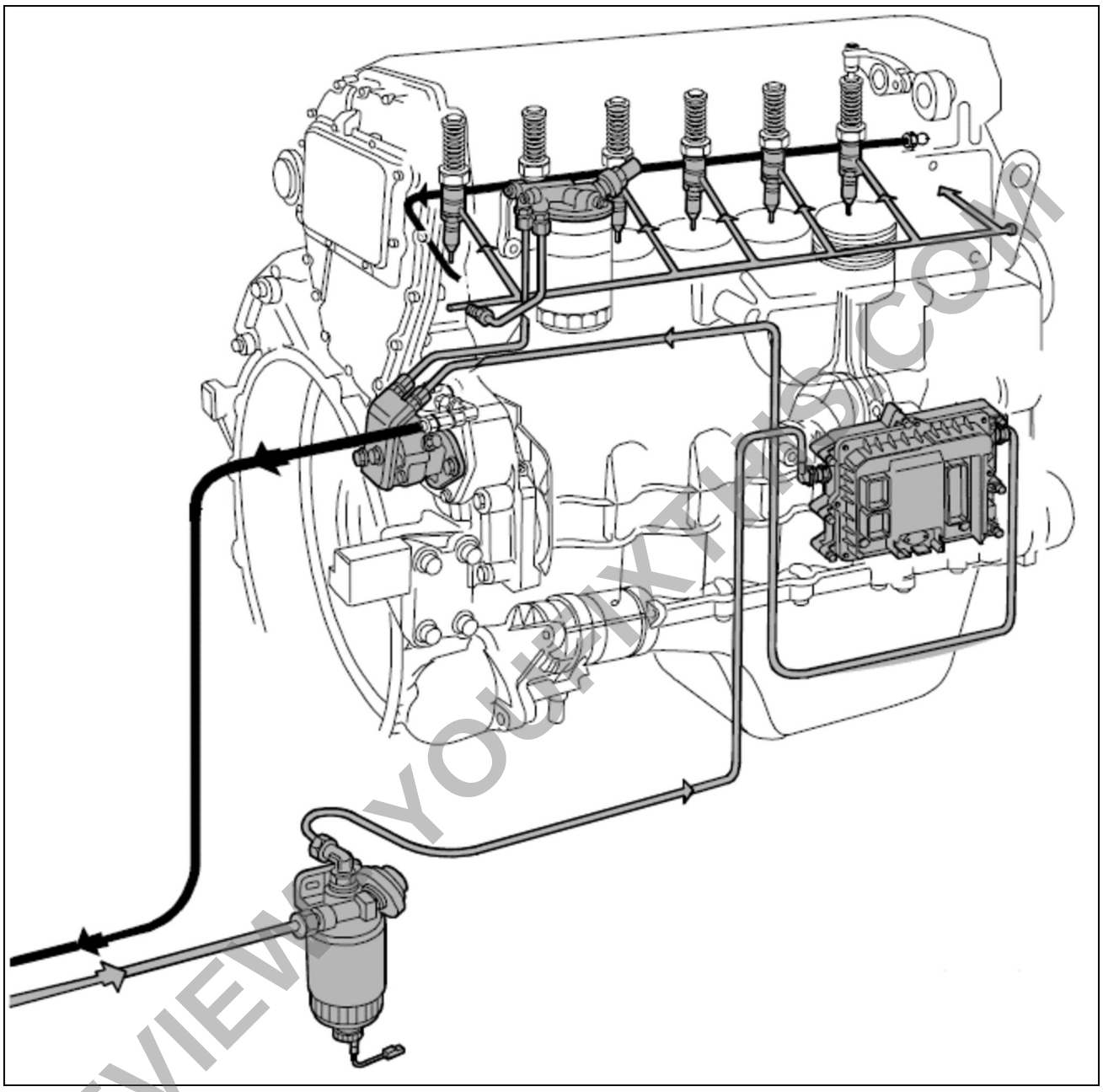
Connector C
Sensors

ECU pin number	Wire Color	Function
1	Brown	Ground
2	-	Free
3	Black	Ground
4	-	Free
5	-	Free
6	-	Free
7	-	Free
8	-	Free
9	White	Camshaft sensor (power supply)
10	Red	Camshaft sensor (shielded ground)
11	-	Free
12	-	Free
13	-	Free
14	-	Free
15	Pink	Coolant temperature sensor (power supply)
16	-	Free
17	-	Free
18	Orange/Black	Fuel temperature sensor
19	Black	Flywheel sensor (shielded ground)
20	Brown	Ground
21	-	Free
22	-	Free
23	White	Flywheel sensor (signal)
24	Brown	Engine oil temperature/pressure sensor (pressure ground)
25	White	Air temperature/pressure sensor (pressure ground)
26	Yellow	Coolant temperature sensor (ground)
27	Orange/Black	Engine oil pressure/temperature sensor (temperature signal)
28	Blue	Engine oil pressure/temperature sensor (pressure signal)
29	-	Free
30	White	Ground
31	-	Free
32	Orange	Engine oil pressure/temperature sensor (power supply)
33	Red	Air temperature/pressure sensor (power supply)
34	Green	Air temperature/pressure sensor (pressure signal)
35	White/Red	Fuel temperature sensor
36	Orange	Air temperature/pressure sensor (temperature signal)

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FUEL AND INJECTION SYSTEM - Overview



FUELSCHEMAF3C 1

Fuel is supplied via a fuel pump, pre-filter and filter, six pump injectors governed by the camshaft via rocker arms and by the electronic control unit.

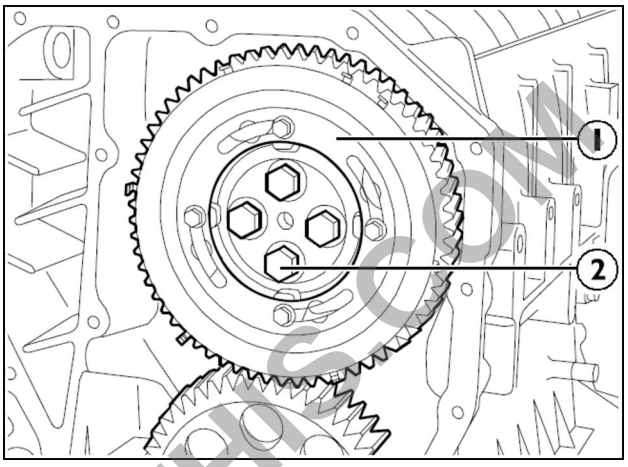
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Camshaft Gear - Remove

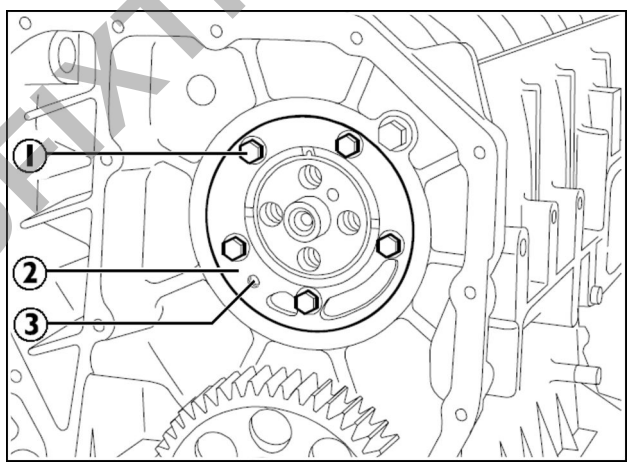
Prior operation:
Blowby re-circulation system - Remove (B.60.A)

1. Loosen and remove the screws **(2)** and remove the gear **(1)** fitted with the phonic wheel.



CAMGEARF3C 1

2. Remove the screws **(1)** securing the shoulder plate **(2)**.
3. Using a mounting screw **(1)**, insert it into the threaded hole **(3)** on the shoulder plate **(2)**.
4. Turn the screw clockwise to remove the shoulder plate **(2)**.
5. Remove the sheet gasket.



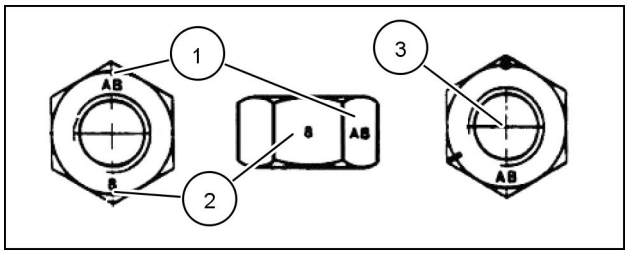
SHOULDERPLATE 2

Next operation:
Valve drive Camshaft - Timing adjust (B.10.A)

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Metric Hex nuts and locknuts, classes 05 and up



20083681 2

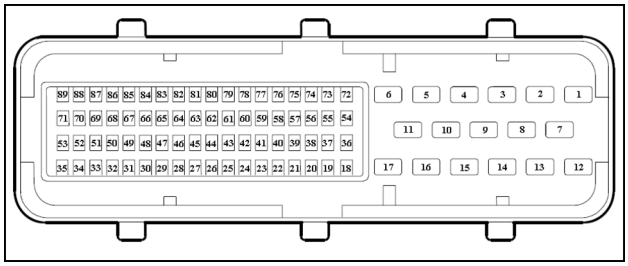
1. Manufacturer's Identification
2. Property Class
3. Clock Marking of Property Class and Manufacturer's Identification (Optional), i.e. marks **60 °** apart indicate Class 10 properties, and marks **120 °** apart indicate Class 8.

INCH NON-FLANGED HARDWARE

NOMINAL SIZE	SAE GRADE 5 BOLT and NUT		SAE GRADE 8 BOLT and NUT		LOCKNUT GrB W/ Gr5 BOLT	LOCKNUT GrC W/ Gr8 BOLT
	UN-PLATED or PLATED SILVER	PLATED W/ZnCr GOLD	UN-PLATED or PLATED SILVER	PLATED W/ZnCr GOLD		
1/4	**8 N·m (71 lb in)**	**11 N·m (97 lb in)**	**12 N·m (106 lb in)**	**16 N·m (142 lb in)**	**8.5 N·m (75 lb in)**	**12.2 N·m (109 lb in)**
5/16	**17 N·m (150 lb in)**	**23 N·m (204 lb in)**	**24 N·m (212 lb in)**	**32 N·m (283 lb in)**	**17.5 N·m (155 lb in)**	**25 N·m (220 lb in)**
3/8	**30 N·m (22 lb ft)**	**40 N·m (30 lb ft)**	**43 N·m (31 lb ft)**	**57 N·m (42 lb ft)**	**31 N·m (23 lb ft)**	**44 N·m (33 lb ft)**
7/16	**48 N·m (36 lb ft)**	**65 N·m (48 lb ft)**	**68 N·m (50 lb ft)**	**91 N·m (67 lb ft)**	**50 N·m (37 lb ft)**	**71 N·m (53 lb ft)**
1/2	**74 N·m (54 lb ft)**	**98 N·m (73 lb ft)**	**104 N·m (77 lb ft)**	**139 N·m (103 lb ft)**	**76 N·m (56 lb ft)**	**108 N·m (80 lb ft)**
9/16	**107 N·m (79 lb ft)**	**142 N·m (105 lb ft)**	**150 N·m (111 lb ft)**	**201 N·m (148 lb ft)**	**111 N·m (82 lb ft)**	**156 N·m (115 lb ft)**
5/8	**147 N·m (108 lb ft)**	**196 N·m (145 lb ft)**	**208 N·m (153 lb ft)**	**277 N·m (204 lb ft)**	**153 N·m (113 lb ft)**	**215 N·m (159 lb ft)**
3/4	**261 N·m (193 lb ft)**	**348 N·m (257 lb ft)**	**369 N·m (272 lb ft)**	**491 N·m (362 lb ft)**	**271 N·m (200 lb ft)**	**383 N·m (282 lb ft)**
7/8	**420 N·m (310 lb ft)**	**561 N·m (413 lb ft)**	**594 N·m (438 lb ft)**	**791 N·m (584 lb ft)**	**437 N·m (323 lb ft)**	**617 N·m (455 lb ft)**
1	**630 N·m (465 lb ft)**	**841 N·m (620 lb ft)**	**890 N·m (656 lb ft)**	**1187 N·m (875 lb ft)**	**654 N·m (483 lb ft)**	**924 N·m (681 lb ft)**

NOTE: *For Imperial Units,* ***1/4 in*** *and* ***5/16 in*** *hardware torque specifications are shown in pound-inches.* ***3/8 in*** *through* ***1 in*** *hardware torque specifications are shown in pound-feet.*

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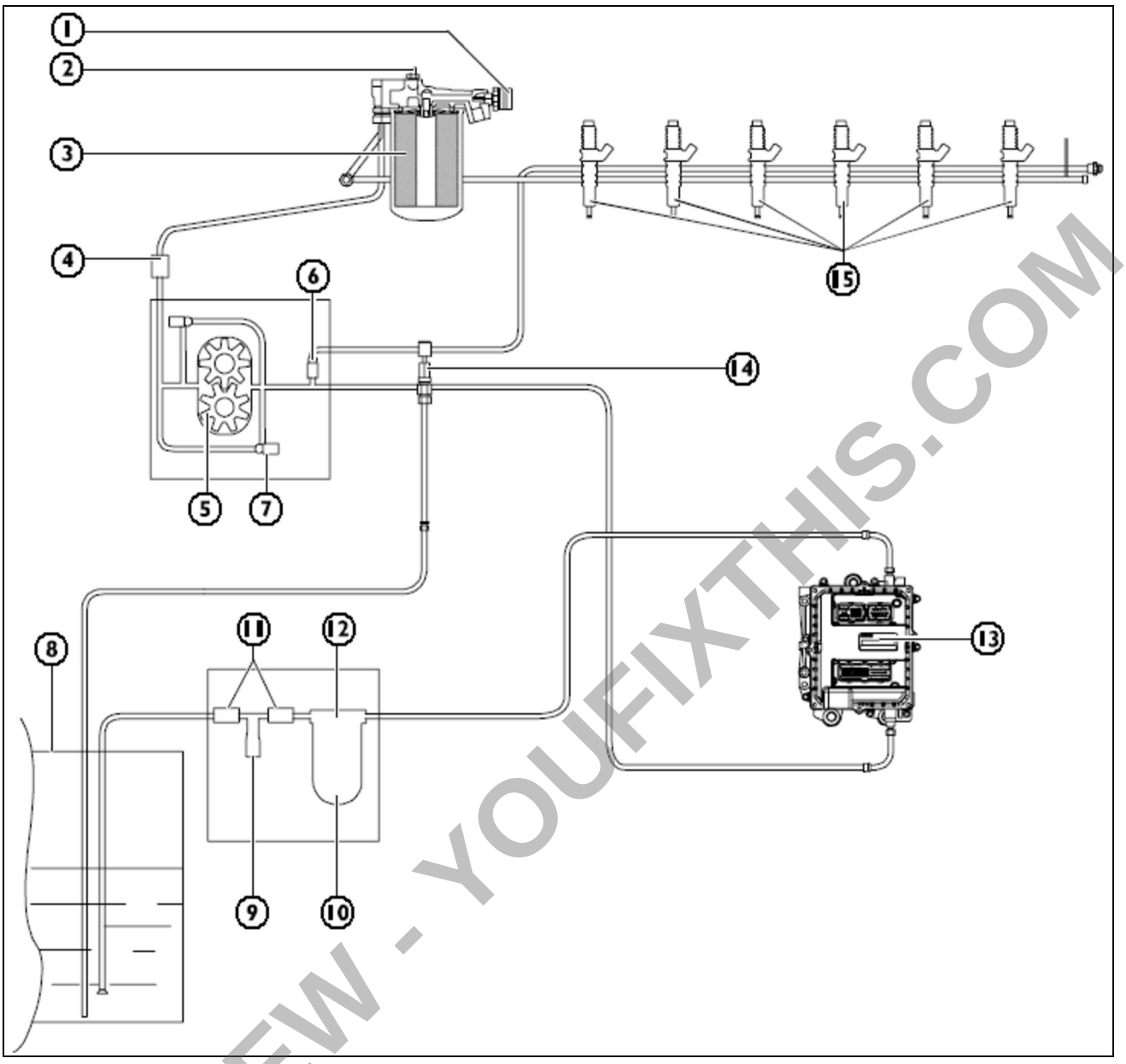
CONNECTORB 4

Connector B
Chassis

ECU pin number	Wire	Function
1	-	Free
2	7151	+30 positive
3	7153	+30 positive
4	-	Free
5	0151	Ground
6	0151	Ground
7	-	Free
8	7151	+30 positive
9	7151	+30 positive
10	0151	Ground
11	0151	Ground
12	0094	Preheating actuation enable relay ground
13	-	Free
14	-	Free
15	-	Free
16	-	Free
17	-	Free
18	-	Free
19	-	Free
20	-	Free
21	-	Free
22	-	Free
23	-	Free
24	-	Free
25	-	Free
26	5173	Ground
27	5174	Ground
28	0173	Ground
29	5163	EDC system diagnostic switch power supply (presetting)
30	-	Free
31	-	Free
32	-	Free
33	-	Free
34	Green	CAN - L line (ECB)
35	White	CAN - H line (ECB)
36	-	Free
37	-	Free
38	-	Free
39	-	Free
40	-	+15 positive
41	-	Free
42	-	Water in fuel detection sensor (signal)
43	-	Free
44	-	Free
45	-	Free

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FUELSCHEMA2F3C 2

(1) Temperature sensor
(2) Bleed valve
(3) Secondary fuel filter
(4) By-pass valve
(5) Fuel supply pump
(6) Integrated valve
(7) Pressure relief valve
(8) Fuel tank
(9) Priming pump
(10) Primary fuel filter
(11) Check valve
(12) Heater
(13) Electronic control unit
(14) Fuel return union with built in valve
(15) Pump injectors

Valve working pressures within the fuel system:

- By-pass valve - **0.3 - 0.4 bar** (**4.4 - 5.8 psi**)
- Integrated valve - **3.5 bar** (**50.8 psi**)
- Pressure relief valve - **5 bar** (**72.5 psi**)
- Check valve - **0.1 bar** (**1.5 psi**)
- Fuel return union with built in valve - **0.2 bar** (**2.9 psi**)

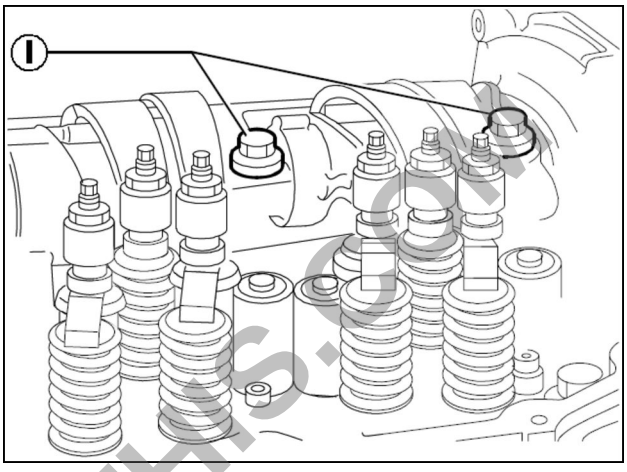
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Valve drive Rocker assembly - Remove

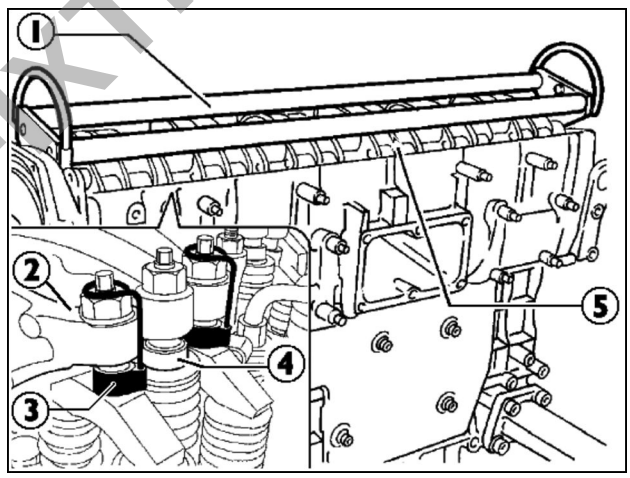
Prior operation:
Valve cover - Remove (B.10.A)

1. Remove the bolts **(1)** securing the rocker shaft to the cylinder head.



ROCKERSHAFTF3C 1

2. Use the tool **380000128 (3)** to constrain the shoes **(4)** on the rocker arms **(2)**.
3. Apply tool **380000148 (1)** to the rocker shaft **(5)** and remove the shaft **(5)** from the cylinder head.



ROCKERSHAFT 2

Next operation:
Valve drive Rocker assembly - Install (B.10.A)

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