1

General information

Introduction

The Peregrine EDi and the 1300 Series EDi are a family of turbocharged engines that have an electronic management system. The Peregrine EDi engines are designed for automotive applications and the 1300 Series EDi engines are designed for industrial and agricultural applications. The Peregrine EDi and the 1300 Series EDi engines are from Perkins Engines Limited, a world leader in the design and manufacture of high-performance diesel engines.

Perkins approved assembly and quality standards, together with the latest technology, have been applied to the manufacture of your engine to give you reliable and economic power.

Most of the general information which is included in the relevant User's Handbook (Chapters 1 to 6) has not been repeated in this Workshop Manual and the two publications should be used together.

To ensure that you use the relevant information for your specific engine type, refer to "Engine identification" on page 3.

Where the information applies only to certain engine types, this is indicated in the text by use of the engine model code letters, refer to "Engine identification" on page 3.

When reference is made to the "left" or "right" side of the engine, this is as seen from the flywheel end of the engine.

Special tools have been made available and a list of these is given in Chapter 16, Special tools. Reference to the relevant special tools is also made at the beginning of each operation.

Data and dimensions are included in Chapter 2, Specifications.

Read and remember the "Safety precautions" on page 4. They are given for your protection and must be used at all times.

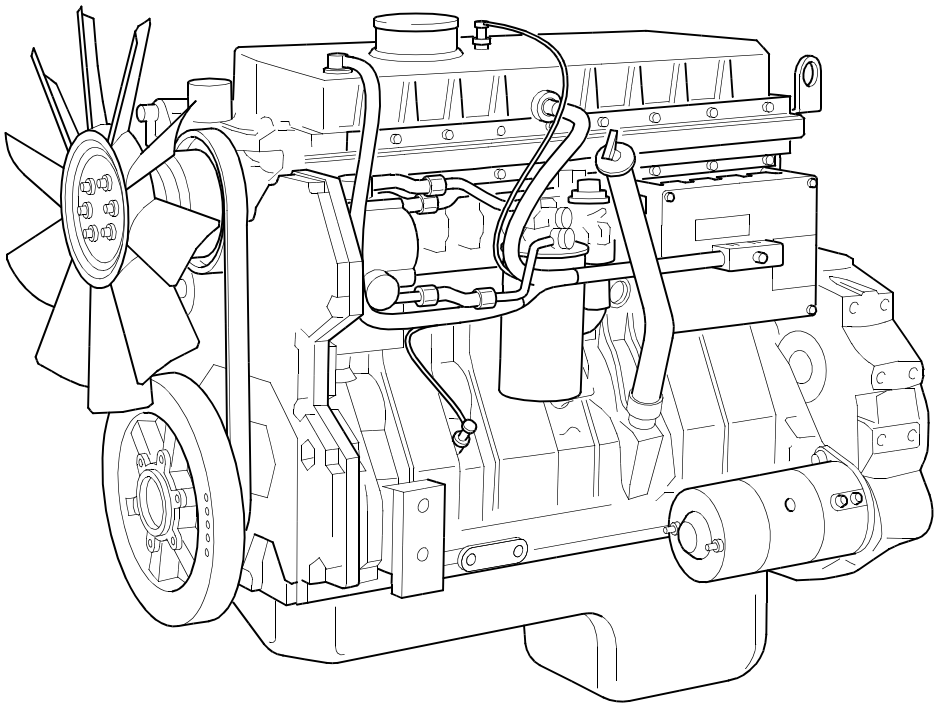
Danger is indicated in the text by two methods:

Warning! *This indicates that there is a possible danger to the person.*

Caution: *This indicates that there is a possible danger to the engine.*

Note: Is used where the information is important, but there is not a danger.

Engine views



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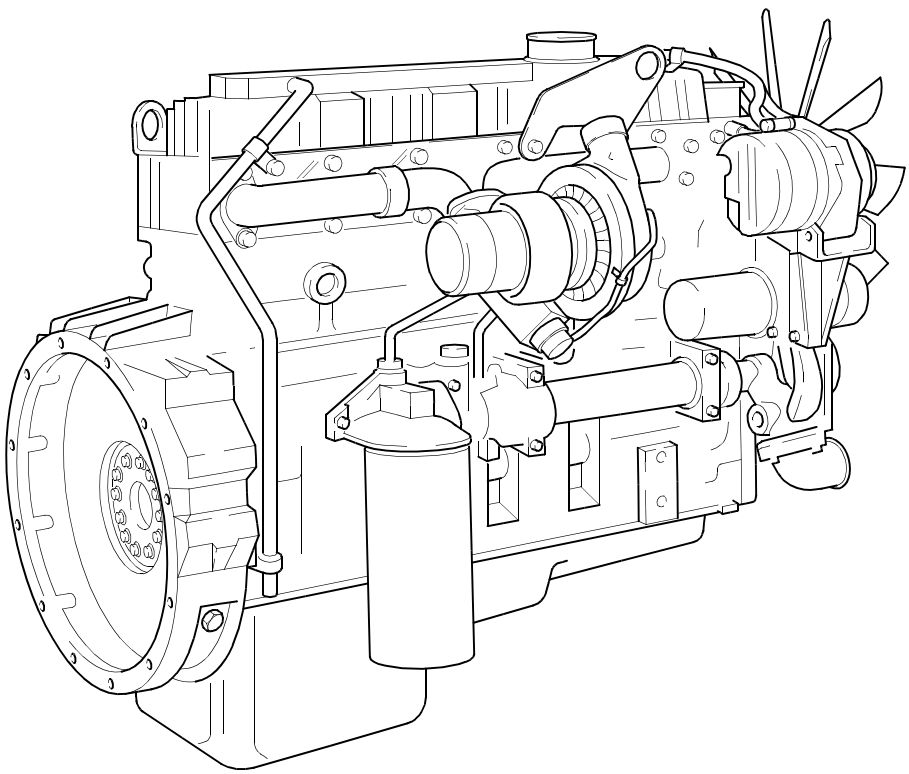


B

W250/1

POWERPART recommended consumable products

Perkins have made available the products recommended below in order to assist in the correct operation, service and maintenance of your engine and your machine. The instructions for the use of each product are given on the outside of each container. These products are available from your Perkins distributor.

POWERPART Antifreeze

Protects the cooling system against frost and corrosion. Part number 21825166.

POWERPART Compound

To seal the outer diameter of seals. Part number 1861147.

POWERPART Easy Flush

Cleans the cooling system. Part number 21825001.

POWERPART Gasket and flange sealant

To seal flat faces of components where no joint is used. Especially suitable for aluminium components. Part number 21820518.

POWERPART Gasket remover

An aerosol for the removal of sealants and adhesives. Part number 21820129.

POWERPART Griptite

To improve the grip of worn tools and fasteners. Part number 21820129.

POWERPART Hydraulic threadseal

To retain and seal pipe connections with fine threads. Especially suitable for hydraulic and pneumatic systems. Part number 21820121.

POWERPART Industrial grade super glue

Instant adhesive designed for metals, plastics and rubbers. Part number 21820125.

POWERPART Lay-Up 1

A diesel fuel additive for protection against corrosion. Part number 1772204.

POWERPART Lay-Up 2

Protects the inside of the engine and of other closed systems. Part number 1762811.

POWERPART Lay-Up 3

Protects outside metal parts. Part number 1734115.

POWERPART Metal repair putty

Designed for external repair of metal and plastic. Part number 21820126.

POWERPART Pipe sealant and sealant primer

To retain and seal connections with coarse threads. Pressure systems can be used immediately. Part number 21820122.

POWERPART Radiator stop leak

For the repair of radiator leaks. Part number 21820127.

Continued

Recommended torque settings

Notes:

- The torque tensions below apply to components lubricated lightly with clean engine oil before they are fitted.
- The setscrew for the upper idler gear is supplied with a sealant on its thread. Do not put lubricating oil on the thread of this setscrew.

Standard torques

Thread size	Flanged head fasteners				Non-flanged head fasteners			
	Nm	lbf ft	kgf m	Spanner size mm	Nm	lbf ft	kgf m	Spanner size mm
M6 x 1	11	8	1,1	8	8	6	0,8	10
M8 x 1,25	24	18	2,5	10	20	15	2,1	13
M10 x 1,5	49	36	5,0	13	41	30	4,1	16
M12 x 1,75	83	61	8,4	15	69	51	7,1	18
M16 x 2	209	154	21,3	21	174	128	17,7	24

Specific torques

Description	Nm	lbf ft	kgf m
Aspiration system			
Setscrew, breather pipe, bottom	49	36	5,0
Setscrew, breather pipe, top	83	61	8,4
Setscrews, turbocharger to exhaust manifold	66	49	6,8
Setscrews, turbocharger compressor housing to backplate	23	17	2,35
Setscrews, turbocharger turbine housing to bearing housing	13	9.6	1,3
Auxiliary equipment			
Nut, air compressor drive gear	149	110	15,21
Setscrews, air compressor mounting bracket to engine	115	85	11,9
Setscrews, air compressor to engine	62	46	6,4
Setscrews, air compressor to mounting bracket	66	49	6,7
Cooling system			
Setscrews, coolant filter flange to timing case	26	19	2,6
Setscrews, fan drive	22	16	2,2
Setscrews, fan drive pulley	7	5.5	0,8
Setscrews, fan belt tensioner to timing case	50	37	5,1
Setscrews, coolant pump pulley	7	5.5	0,8
Fasteners, coolant pump to timing case cover	7	5.5	0,8
Crankshaft assembly			
Setscrews, main bearings	See Operation 5-8		
Setscrews, main bearings (engine serial number 850000 or more)	See Operation 5-8		
Setscrews, pulley / damper assembly	217	100	22,0
Setscrews, rear oil seal housing to cylinder block	24	18	2,5
Cylinder head assembly			
Setscrews, cylinder head	See Operation 3-9		
Setscrews, engine lift brackets	60	44	6,0
Setscrews, exhaust manifold to cylinder head	81	60	8,3
Setscrews, rocker cover	18	13	1,8
Setscrews, supply manifold to cylinder head	27	20	2,8
Flywheel and flywheel housing			
Setscrews, flywheel	136	100	13,8
Setscrews, flywheel housing	108	80	11,0

To fit **Operation 3-2**

Special requirements

Consumable products	
Description	**Part number**
POWERPART Silicon rubber sealant	1861108

1 Clean the cylinder head and the rocker cover.

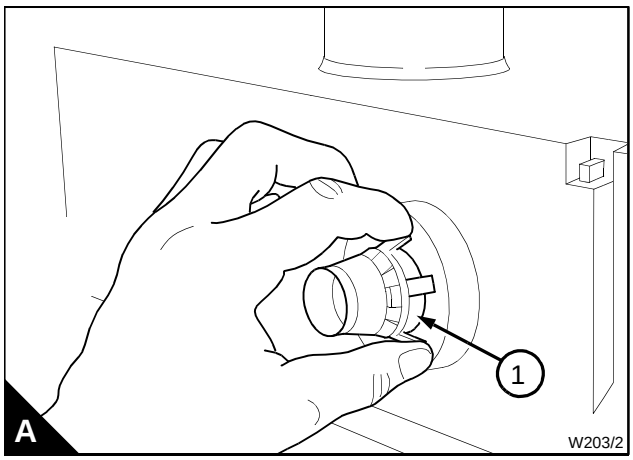
2 Renew the elements of the engine breather, if necessary, see Operation 3-3.

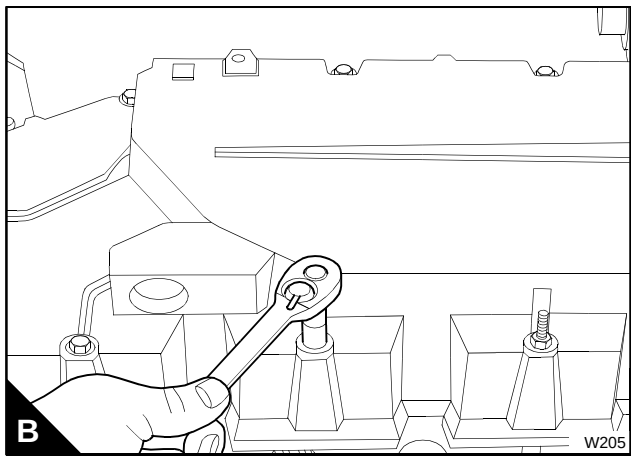
3 Renew the gasket for the rocker cover, if necessary.

4 Fit a new ‘O’ ring into the rocker aperture for the electrical connector.

5 Hold the rocker cover over the engine and push the rocker cover electrical connector for the wiring loom of the fuel injector units into its hole in the rocker cover. Ensure that the four tags (A1) engage on the rocker cover.

6 Fit the rocker cover, fit and tighten the 13 setscrews (B) to 18 Nm (13 lbf ft) 1,8 kgf m.





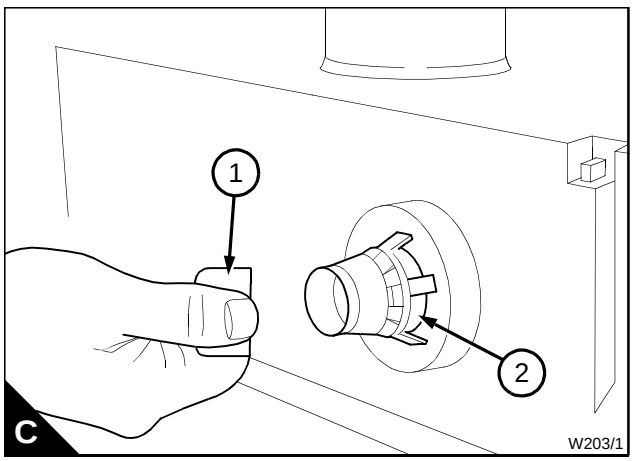
7 Connect the wiring loom (C1) for the fuel injector units, at the rocker cover electrical connector (C2).

8 Fit a new ‘O’ ring onto the breather tube.

9 Apply clean lubricating oil to the ‘O’ ring.

10 Fit the breather pipe into the cover.

11 Fit and tighten the top and bottom setscrews of the breather tube.



To inspect and to correct **Operation 3-12**

Special requirements

Special tools	
Description	**Part number**
Valve depth gauge	21825617 and 21825496

1 Remove the cylinder head, see Operation 3-8.

2 Put a small amount of low viscosity oil, for example calibration fluid, into the inlet and exhaust ports then check for leakage.

3 Wait five minutes, then check again for leakage.

Note: If no oil leaks past the valve seat, it does not need to be reground.

4 Ensure that the heads of the valves and the face of the cylinder head are clean.

5 Check the depth of the valves below the face of the cylinder head before the valve springs are removed. Put the valve depth gauge on the face of the cylinder head and set the dial gauge to zero. Carefully put the valve depth gauge in position over the head of each valve (A) and compare the measurement with the relevant Data and dimensions for the "Inlet and exhaust valves" on page 10.

6 If a valve is below the depth limit, check the valve depth with a new valve in position.

7 If the valve depth is still below the limit, the valve seat insert must be renewed, see Operation 3-19.

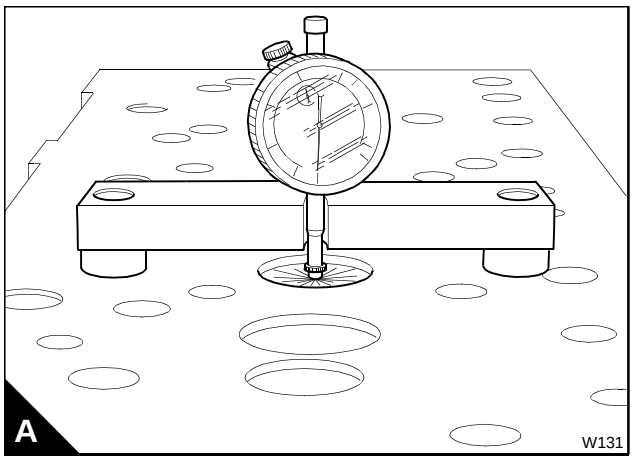
8 Remove the valves and valve springs, see Operation 3-10.

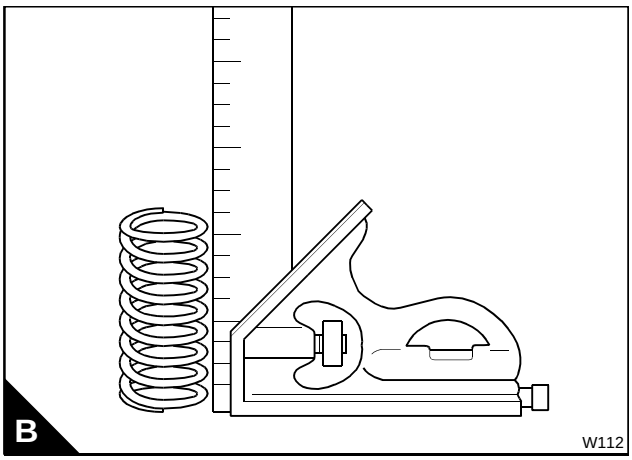
9 Visually inspect the condition of the collets.

10 Visually inspect the valve springs for corrosion, for damage or distortion.

11 Check that the end faces of the springs are square and flat.

12 Measure the free length of the valve springs (B) and compare it with the relevant Data and dimensions for the "Valve guides and springs" on page 11.





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4

Piston and connecting rod assemblies

General description

The aluminium alloy pistons have a cast iron insert for the top piston ring.

The two-piece pistons have an aluminium alloy skirt and a steel piston crown. The steel crown compensates for increased combustion pressures, and can be removed from the piston skirt, when the piston assembly is dismantled.

Both types of piston have recesses in the crown to allow clearance for the inlet and exhaust valves. The combustion bowl is off-centre.

A variation in the aluminium alloy along the length of the piston skirt controls expansion of the piston.

Each piston has two tapered compression rings and an oil control ring. The grooves for the piston rings have the same shape as their rings. The top compression ring is marked "TOP-UP" on its upper face, the second compression ring is marked “2nd-UP” on its upper face. The oil control ring is not marked, and new rings may be fitted either way up. The top compression ring has a round edge, the edge of the second compression ring is at an angle.

Combustion pressure is allowed to pass through the ring gaps to the underside of the compression rings. This maintains the correct contact between the face of the piston rings and the cylinder bore, to improve performance and reduce oil loss.

Axial location of the fully floating gudgeon pin is by circlips.

The connecting rods are "H" section forgings of steel. The small end is wedge shaped to improve strength and reliability. The overall length of the connecting rod is reduced by an angle of tilt to the big end bearing.

Jets fitted in the cylinder block spray lubricating oil onto the inner surface of the piston to cool the piston.

To fit **Operation 5-13**

1 Lubricate the thrust bearing with clean engine lubricating oil.

2 Slide the upper-half of the thrust bearing into position with the location tag fitted correctly in its recess. Ensure that the large lubricating oil hole in the bearing is toward the camshaft side of the engine.

3 Fit the lower-half of the thrust bearing (A1) to the main bearing cap (A3) with the location tag (A4) in its recess. Ensure that the bearing is fitted correctly in the cap and that the bearing and the crankshaft journal are clean. Lubricate the bearing with clean engine lubricating oil.

4 Put the bearing cap in position. Ensure that the arrow (A2) stamped on the bearing cap is toward the camshaft side of the engine.

5 Lightly lubricate the setscrews with clean engine lubricating oil.

6 Fit the setscrews to the main bearing cap, and tighten the setscrews gradually and evenly to the specific torques shown below:

WK, WL, WM, and WN engines - 157 Nm (116 lbf ft) 16,0 kgf m

WK, WL, WM, and WN engines (from engine serial number 850000) - 176 Nm (130 lbf ft) 18,0 kgf m

Caution: *For WP, WQ, WR, and WS engines, new setscrews must be fitted whenever bearing caps are fitted.*

WP, WQ, WR, and WS engines:

Tighten each main bearing cap setscrew evenly and gradually to 135 Nm (100 lbf ft) 13,8 kgf m.

Tighten each main bearing cap setscrew to 177 Nm (130 lbf ft) 18,0 kgf m.

7 Rotate the crankshaft two turns to ensure free movement.

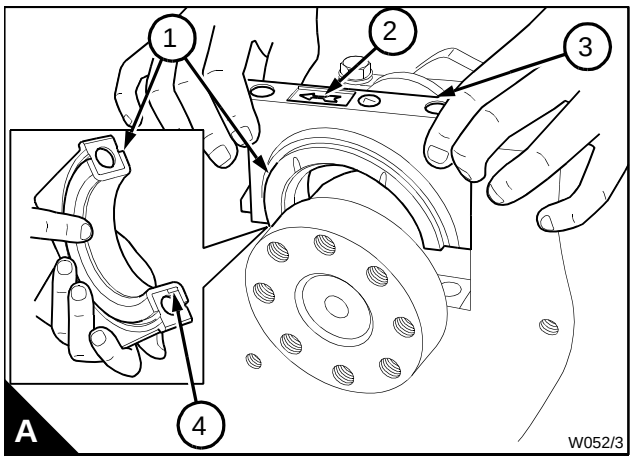
8 Check the crankshaft end-float, see Operation 5-11.

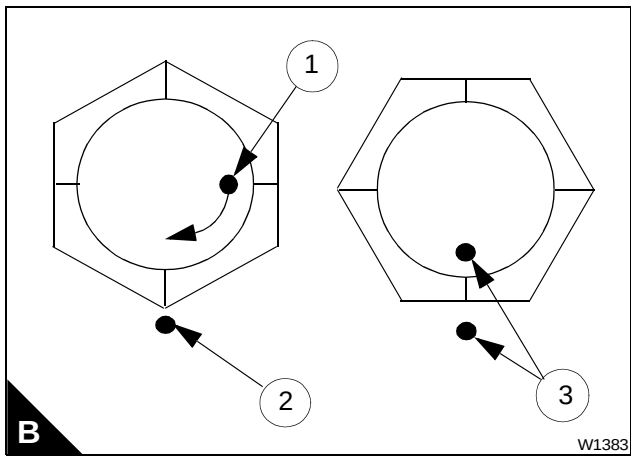
9 Tighten all the main bearing cap setscrews a further 90°. To do this, apply a mark (B1) to each setscrew head or socket spanner, and another mark (B2) at 90° clockwise on the crankcase surface as shown. Tighten each setscrew until the two marks align (B3).

10 Fit the lubricating oil sump, see Operation 10-10.

11 After the engine has been installed in the application, fill the lubricating oil sump to the correct level with an approved oil, see Chapter 5 in the User's Handbook.

12 Fill the cooling system.





To fit **Operation 6-6**

1 Clean and inspect all components for wear or damage. Inspect the timing case for cracks, especially around the channels for the engine fluids.

2 Fit a new joint (A5) to the backplate.

3 Engage the backplate dowels (A3) and push the backplate onto the engine.

4 Lightly lubricate the threads and shoulders of the setscrews for the backplate with clean engine lubricating oil.

5 Fit and tighten the setscrews to 26 Nm (19 lbf ft) 2,6 kgf m.

6 Fit the camshaft, see Operation 6-8.

7 Fit the tappets into their original bores.

8 Fit the cylinder head, see Operation 3-9.

9 Fit the oil pressure relief valve together with its 'O' ring (A6).

10 Fit the idler gears, see Operation 6-4.

11 Fit a new coolant filter.

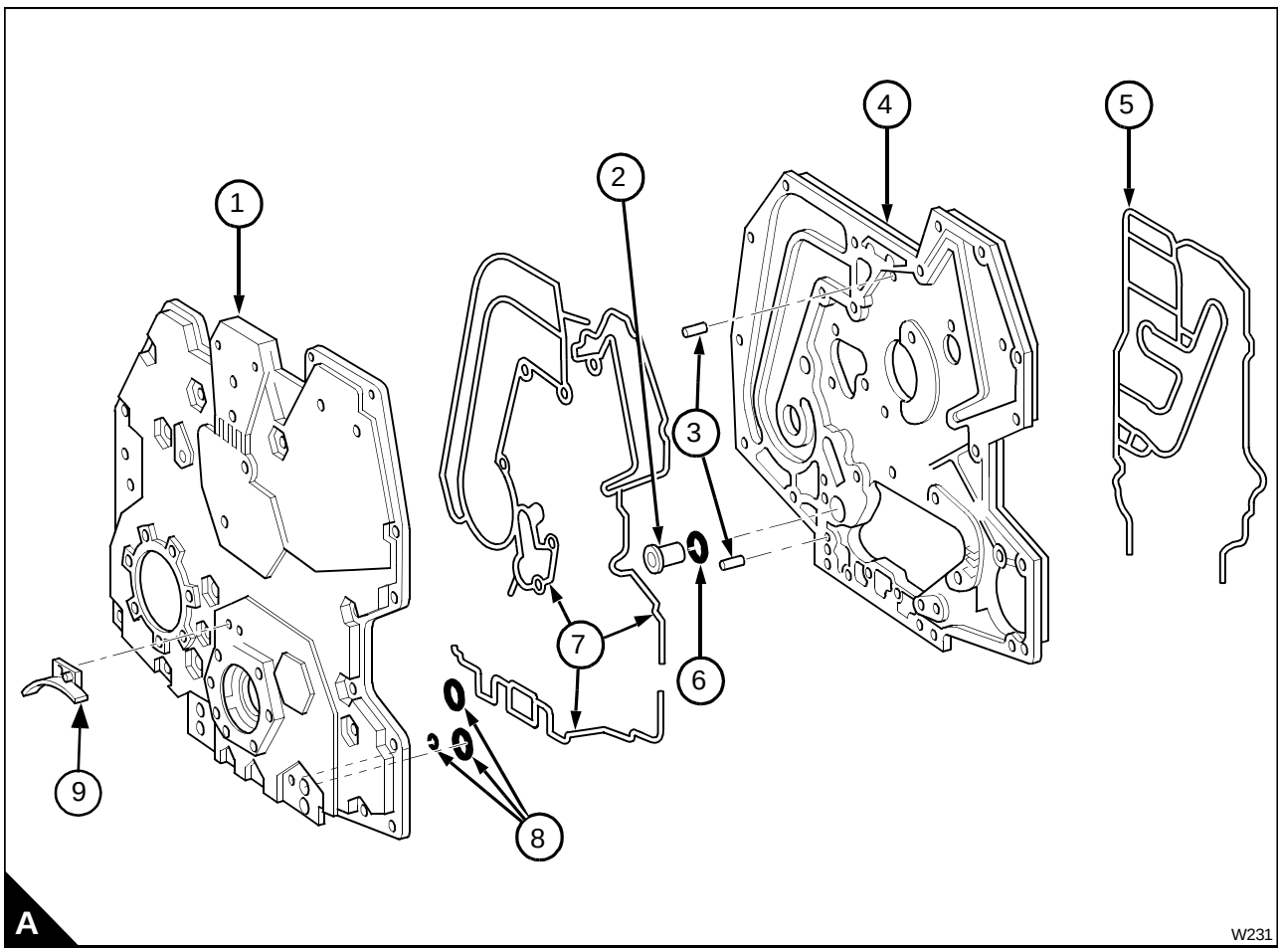
12 Fit the power steering pump, see Operation 15-2, the compressor, see Operation 15-1, and their mounting brackets, if removed earlier.

13 Fit the high-pressure pump, see Operation 10-22.

14 Fit the timing case cover, see Operation 6-2.

15 Fill the cooling system to the correct level.

16 Fill the lubricating system to the correct level with an approved oil, see Chapter 5 in the User's Handbook.



To check the actuator assembly of the waste-gate unit **Operation 9-8**

Notes:

- If the waste-gate valve does not operate at the correct pressure, it can affect the engine performance.
- If the valve opens at a low pressure, this can cause black exhaust smoke and loss of power at lower engine speeds.

***Cautions*:**

- *A high pressure setting can cause high cylinder pressures that can cause failure of the cylinder head gasket and can cause damage to the bearings and pistons.*
- *Do not apply an air pressure of more than 207 kPa (30 lbf/in^2) 2,1 kgf/cm^2 to the actuator. Higher pressures may damage the actuator.*
- *Do not operate the actuator rod (A3) by hand, because the calibration of the actuator will be affected, and this may cause damage to the engine.*

1 Disconnect the boost sensor pipe at the actuator.

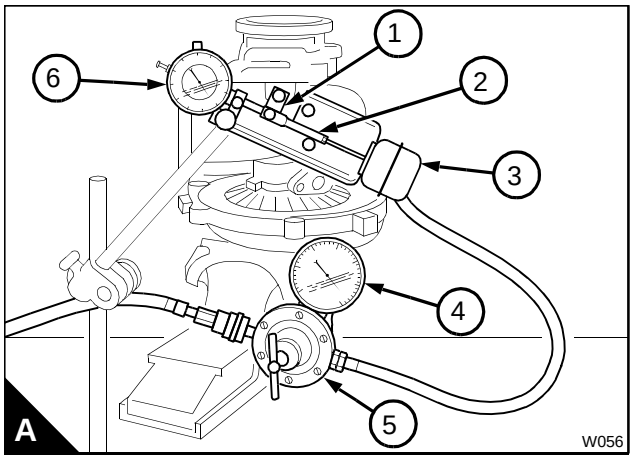
2 Connect the actuator to an air supply that has a pressure regulator (A5) and is fitted with an accurate gauge (A4).

3 Fasten a dial gauge (A6) to the turbocharger with its plunger in contact with the end of the actuator rod (A2), to measure the axial movement of the rod.

4 Slowly apply air pressure and check that the rod moves 0,381 mm (0.015 in) at 197 kPa (28.5 lbf in^2) 2,0 kgf cm^2. Ensure that the pointer returns to zero when the pressure is released.

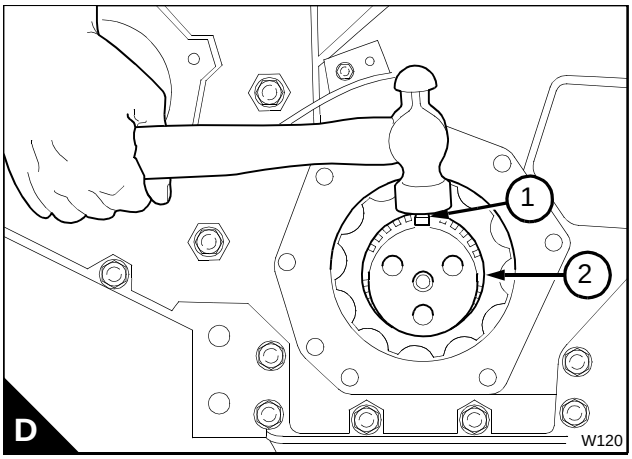
5 Repeat step 4 of the operation several times, to ensure that an accurate reading is obtained

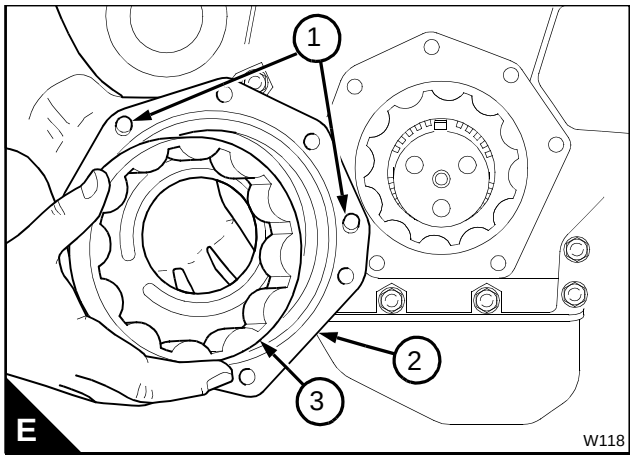
- If the axial movement of the rod is correct, no adjustment is necessary. Remove the air supply and remove the dial gauge.
- If the axial movement of the rod is wrong, adjustment is necessary, see Operation 9-9. Remove the dial gauge.



7 Use a hammer to carefully fit the key (D1) into its recess in the crankshaft nose (D2). Do not damage the key.

8 Lightly lubricate the outer rotor (E3) with clean engine lubricating oil. Fit the outer rotor into the pump body (E2).





9 Fit a new 'O' ring (F1) into its recess in the pump body.

10 WK, WL, WP, and WQ (7,6 litre) engines, lubricate the main lip of the front oil seal with clean engine lubricating oil. WM, WN, WR, and WS (8,7 litre) engines, do NOT lubricate the seal.

Caution: *Lubrication of the front seal used on WM, WN, WR, and WS (8,7 litre) engines may reduce the life of the seal and affect its performance. Seals are not interchangeable between 7,6 litre and 8,7 litre engines due to seal thickness and material.*

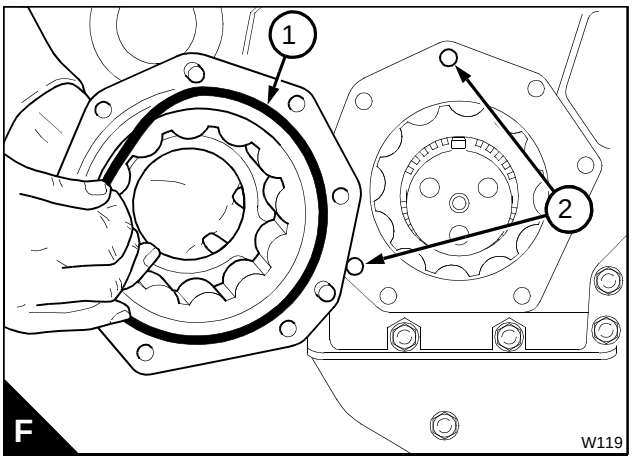
11 Fit the pump body, ensure that the outer rotor is in mesh with the inner rotor. Ensure that the dowel pins (E1) in the oil pump body engage with the holes (F2) in the timing case cover.

Caution: *Fit a short setscrew at the 2 o-clock and the 3 o-clock positions.*

12 Fit the remainder of the setscrews, and tighten all the setscrews.

13 Fit the crankshaft pulley / damper assembly, see Operation 5-2.

14 Fill the sump to the correct level with an approved lubricating oil, see Chapter 5 in the User's Handbook.



Phase 2: End-of-injection

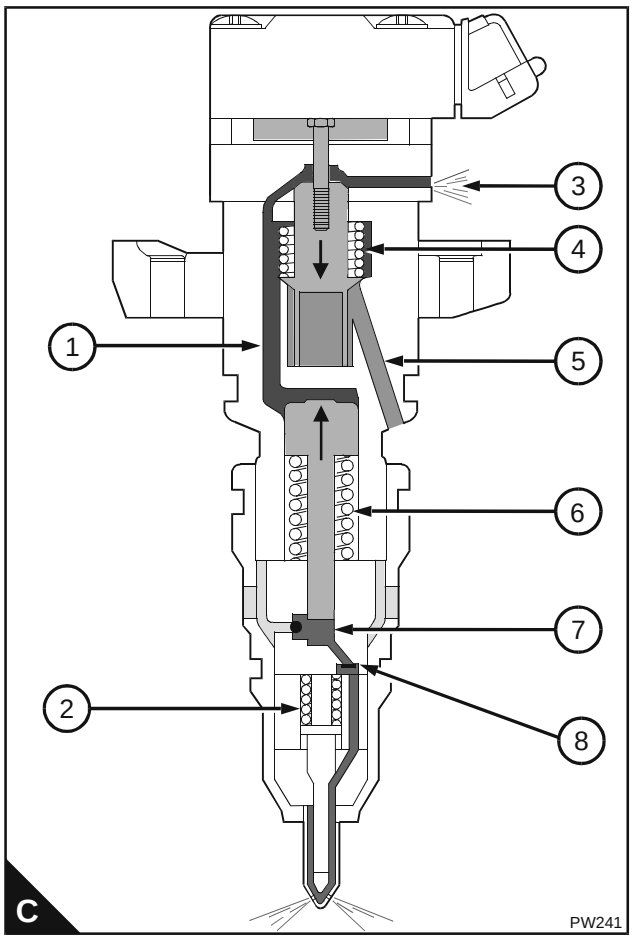
The engine control module de-energises the solenoid to start the end-of-injection.

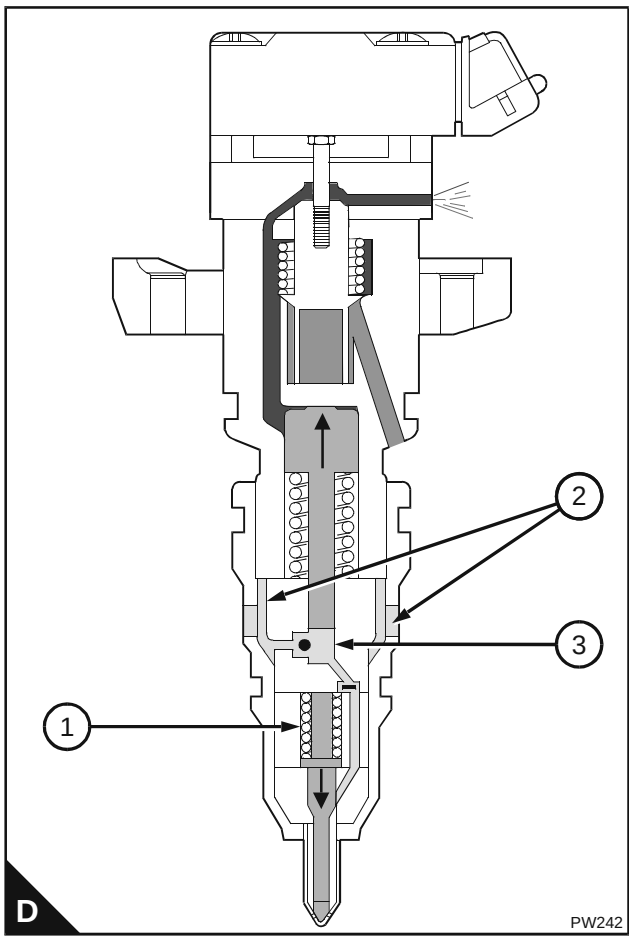
When the solenoid is de-energised, the pressure of the spring (C4) moves the valve up, this closes the oil inlet port (C5), and opens the oil outlet port (C3). The oil chamber is now closed to oil at injection control pressure and the oil pressure in the chamber is allowed to discharge through the outlet port into the rocker cover.

When the pressure in the oil chamber is less than the total pressure of the spring (C6) and the fuel in the fuel chamber, the piston moves up into the oil chamber.

When the piston moves up, the pressure of the fuel in the fuel chamber reduces rapidly. This causes the flat valve to close. As the piston continues to move up, the fuel pressure above the flat-valve becomes less than the fuel pressure below it and the valve is kept closed.

The initial rapid reduction of pressure in the fuel chamber allows the spring (D1) to close the nozzle needle. As soon as the nozzle needle closes it fills more space in the nozzle, which causes the pressure below the flat valve to increase rapidly. This opens the nozzle needle again and a small amount of fuel is injected, then the pressure reduces again and the nozzle needle closes. Fuel injection ends.





Flywheel housing

To remove and to fit **Operation 13-4**

Warning! *The flywheel housing weighs 33,5 kg (73.87 lbs). Use lift equipment or obtain assistance to lift the flywheel housing.*

To remove

1 Remove the starter motor, see Operation 14-3.

2 Remove the flywheel, see Operation 13-1.

3 Release the housing setscrews and remove the housing.

4 Remove and discard the camshaft 'O' ring, from the rear face of the crankcase.

To fit

1 Ensure that the rear face of the cylinder block and the faces of the housing are clean and free from damage.

2 Fit a new camshaft 'O' ring into its recess in the rear face of the crankcase.

3 Fit the housing (B2) and tighten lightly the setscrews.

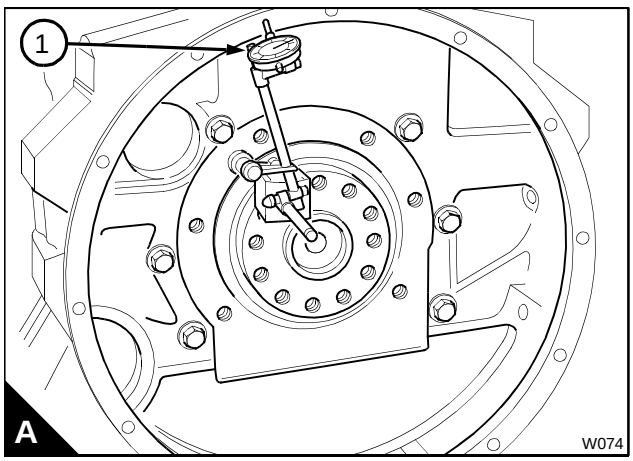
4 Check the housing run-out (B) with a dial test indicator (B1) at the 3 o'clock, 6 o'clock, 9 o'clock and 12 o'clock positions. The maximum tolerance is given in the relevant Data and dimensions for the "Flywheel and housing" on page 18. If any adjustment is necessary, it must be made on the housing and the run-out checked again.

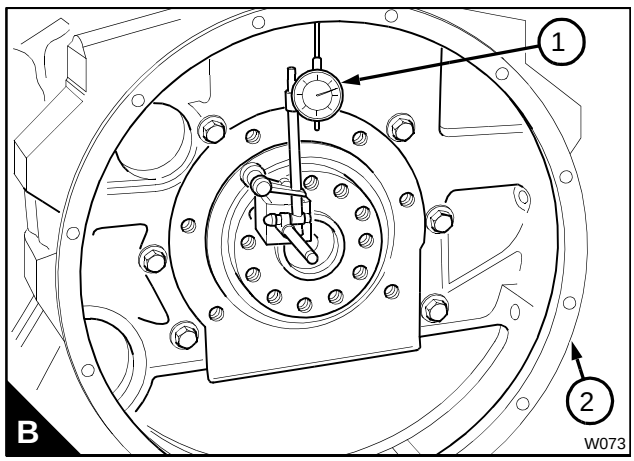
5 Tighten the setscrews to 136 Nm (100 lbf ft) 13,8 kgf m.

6 Check the housing alignment (A) with a dial test indicator (A1) at the 3 o'clock, 6 o'clock, 9 o'clock and 12 o'clock positions. Ensure that the crankshaft is pushed fully toward the front of the engine for each measurement. The maximum tolerance is given in the relevant Data and dimensions for the "Flywheel and housing" on page 18. Any necessary adjustment must be made on the housing and not on the cylinder block.

7 Fit the flywheel, see Operation 13-2.

8 Fit the starter motor, see Operation 14-3.

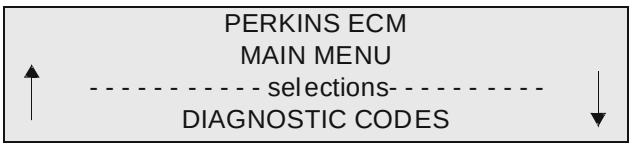




General description **Operation 17-3**

The diagnostic tool has a display (A1), that shows information to the user.

During the operation procedures in this chapter, the information shown on the display will be represented by the illustration below:



The display can show a maximum of four lines of text.

It may also show some arrows.

These arrows (A10) indicate that more information is available, press the scroll-up key (A2) or the scroll-down key (A3) to obtain it.

This arrow (A9) indicates that more information is available, press the scroll-right key (A4) or the scroll-left key (A5) to obtain it.

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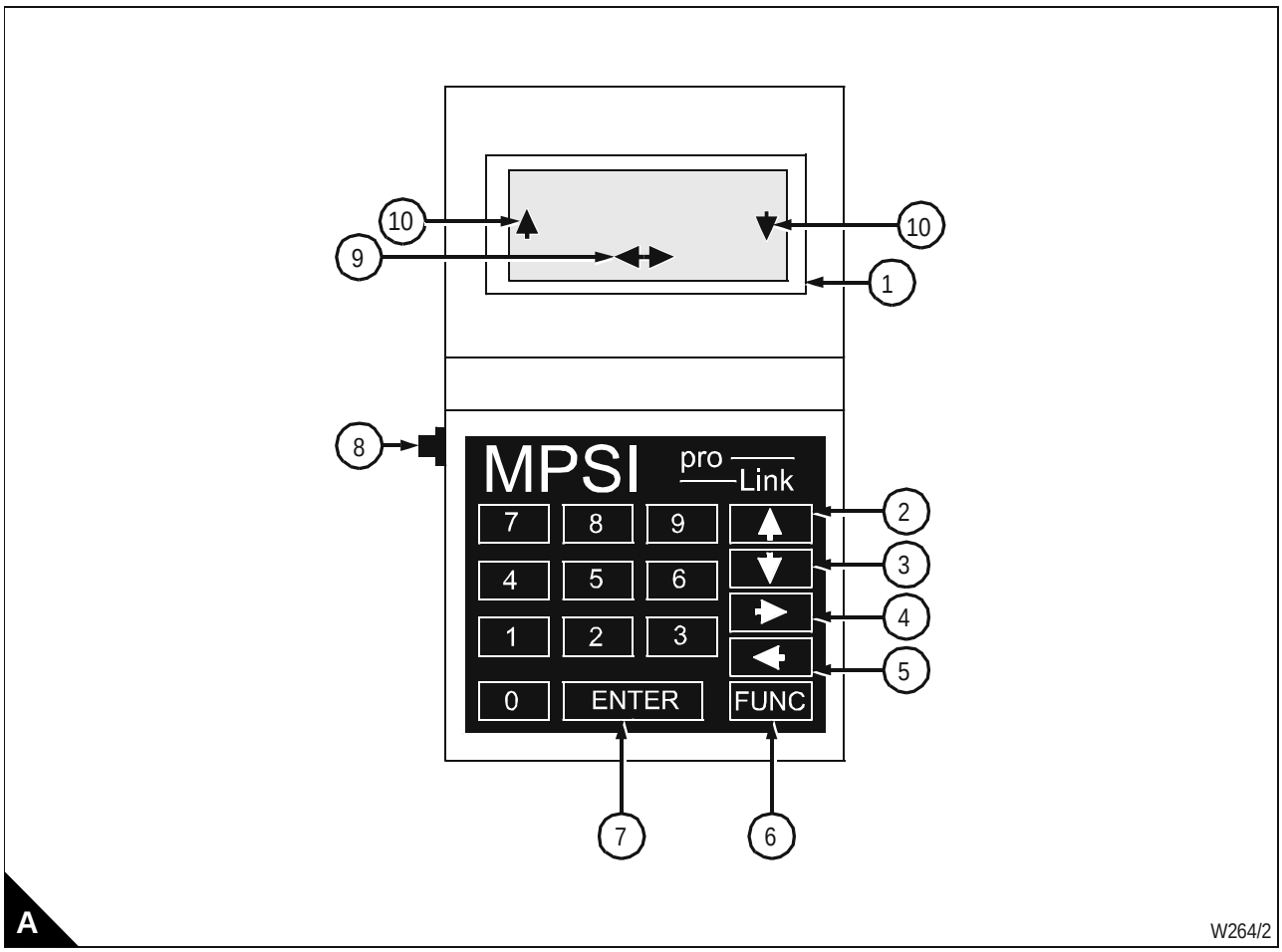

Flash codes

Flash code	Condition description	Comments	Probable causes
111	No errors found	-	-
112	Electrical system voltage B+ out of range: high	ECM voltage is continuously more than 18v	Charging system fault
113	Electrical system voltage B+ out of range: low	ECM voltage is continuously less than 6.5v. Cause of no start/misfire	Low battery voltage. Loose connections. High resistance in circuit
114	Engine coolant temperature signal out of range: low	Defaults to 180 °F (82 °C). No fast idle. Signal voltage less than 0.127v	Circuit or sensor short circuit to earth
115	Engine coolant temperature signal out of range: high	Defaults to 180 °F (82 °C). No fast idle. Signal voltage greater than 4.6v	Open circuit. Sensor failure
121	Manifold absolute pressure signal out of range: high	Defaults to ECM setting. Low power. Slow acceleration. Signal voltage greater than 4.6v	Sensor failure
122	Manifold absolute pressure signal out of range: low	Defaults to ECM setting. Low power. Slow acceleration. Signal voltage greater than 4.6v	Short circuit to earth. Sensor failure
123	Manifold absolute pressure fault: in range	Defaults to ECM setting. Low power. Slow acceleration	Hose or MAP sensor blocked
124	Injection control pressure signal out of range: low	Defaults to open-loop control. Underrun at low idle. Signal voltage less than 0.039v	Short circuit low. Open circuit. Sensor failure
125	Injection control pressure signal out of range: high	Defaults to open loop control Underrun at low idle. Signal voltage greater than 4.897v	Short circuit high. Sensor failure
131	Speed control signal out of range: low	Signal voltage less than 0.152v Engine at low idle only	Short circuit to grid, or open in circuit. Sensor failure.
132	Speed control signal out of range: high	Signal voltage greater than 4.55v. Engine idle only	Short circuit to reference voltage or 12 volts. Sensor failure
133	Speed control signal fault: in range	Speed control position does not match the idle validation switch. Kept to 0% of Speed control position	Speed control failure
134	Speed control position does not match the idle validation switch	Kept to 0% of Speed control position	Speed control and idle validation switch failure
135	ECM low idle validation switch circuit faulty	Speed control position does not match the idle validation switch. Kept to 50% of Speed control position. Engine speed limited	Idle validation switch failure
141	Vehicle speed signal out of range: low	Speed sensor signal is less than 0.48v (0 Kmh/mph). Cruise control and PTO disabled. Engine speed limited	VSS sensor open circuit or short circuit to earth
142	Vehicle speed signal out of range: high	Speed sensor signal is greater than 4.492v (0 Kmh/mph). Cruise control and PTO disabled	Short circuit to reference voltage or 12 volts
143	Wrong number of pulses per revolution from the camshaft position sensor	Intermittent signal	Poor connection or camshaft position sensor failure
144	Interference found at the camshaft position sensor	ECM found excessive external inputs	Interference. Injector unit voltage short circuit to earth
145	No signal from the camshaft position sensor but the injection control pressure has increased	Found by the ECM	Short circuit to earth. Open circuit. Sensor failure