Low Speed Pre-Ignition: Efficiencies Darkside

As emission regulations have become tighter over the years and technology has advanced in engine design, this has lead to smaller and more efficient engines which have the fuel economy and performance consumers want. However, these designs and technologies have combined to produce some unintended consequences. One of these issues is Low Speed Pre-Ignition (LSPI), which can destroy a modern engine if the conditions are right.

LSPI events are random, infrequent occurrences that happen at low speed and high torque, and their causes are not completely understood. LSPI is sometimes referred to as “Super Knock” or “Mega Knock”. This is similar to “Normal” pre-ignition where the air/fuel mixture ignites before the spark plug fires. However, LSPI can occur rapidly and damage the engine components within one or two engine cycles. LSPI causes a massive increase in pressure, up to 20 MPa or more (normal combustion is only about 8 MPa). It is common for LSPI to damage the second ring land on pistons, as seen in the picture below.

Piston damage attributed to Low Speed Pre-Ignition

These events seem to happen most commonly in engines or vehicles with the following design elements.

- Small capacity engine compared to vehicle mass (e.g. Ecoboost Mustangs).
- Direct injection engines with the injector mounted into the side of the combustion chamber (as more fuel condenses on the cylinder).
- Turbocharged.
- Exhaust Gas Recirculation Valves.
- Low viscosity engine oils.
- Automatic or CVT transmissions which reduce the engine speed to below 2000rpm at highway speed.

These LSPI events are unpredictable. However, they seem to happen most commonly when the vehicle is cruising on the highway, with the transmission in its highest gear and the engine operating at very low rpm. When the driver attempts to overtake and goes wide open throttle, the transmission does not change down fast enough and the engine lugs. LSPI occurs and your piston has had an unplanned disassembly.

Lubrication specifications seem to be a factor in LSPI.
Engineers and scientists are still researching the exact cause of this phenomenon and one of the current ideas is the interaction of the air/fuel mixture and the oil film on the cylinder walls called “The Droplet Hypothesis”. This hypothesis claims that as condensed fuel is scraped off the cylinder walls by the piston rings, it mixes with the film of engine oil. Droplets of this mixture then get thrown into the combustion chamber where they auto-ignite and produce a destructive increase in pressure.

The International Lubricants Standardisation and Approval Committee (ILSAC), define the needs, parameters, licensing and administration of lubricant specifications. They are currently developing the new ILSAC GF-6 oil specification to minimise LSPI while allowing for lower viscosity grades of SAE0W-20 and lower. However, GF-6 is still years away.

Many studies have been conducted and it seems that the chemistry of the engine oil has an effect on the prevalence of LSPI and most major oil companies have a page on their website devoted to the topic. It seems that higher calcium concentration increases LSPI risk. Many vehicle manufacturers have developed their own oil specifications to prevent LSPI. General Motors has dexos1™GEN2 for its turbo petrol engines as do many others.

As there are many vehicles on the road that are susceptible to this problem, what can the average technician do to prevent LSPI for their customers?
• Ensure the correct and the latest specification of oil is used.
• Oil changes occur as stated by the service interval.
• Take steps to prevent carbon build-up in the engine.
• Ensure the intercooler is well maintained.
• Ensure the vehicle’s software is updated regularly.
• Educate the vehicle’s owners not to lug their engines.

The presence of low-speed pre-ignition is considered a major impediment to vehicle manufacturers’ efforts to aggressively downsize engines to reduce CO2 emissions. However, if they overcome LSPI we might see smaller, more powerful engines in the future. But for now, it is the engine oil manufacturers which are leading the way, and it is up to you and your customers to ensure the correct oil is in the engine.

LSPI: Efficiencies Darkside

The Droplet Hypothesis
Fuel and oil mix in the ring lands and a droplet enters the combustion chamber, which in the right conditions auto-ignites. Maybe?
Holden Captiva 2.0L Z20S1 Diesel Engine: Alternator Replacement

The VACC’s Technical Advisory Service regularly receives calls about how to remove the alternator from the Holden Captiva CG Series 1 with the 2.0L diesel engine. This is because the alternator is mounted in a position which is difficult to see clearly or access. This article will give you some options to remove the alternator efficiently.

2006 - 2011 Holden Captiva CG 2.0L Z20S1 / LLW

The workshop manual for the removal of the alternator is vague and makes it sound easy, which it is not. From my research and conversations with members of the trade, there are a few ways in which to remove the alternator. One is to remove the engine mount at the front of the engine and raise the engine. Another is to drop the engine and transmission out from the bottom on the K frame. However, the bumper removal method seems to be the most popular and least fiddly way.

Common Removal

1. Disconnect the battery.
2. Remove the engine cover. See Diagram #1
3. Remove the stone tray from under the front of the engine.


His first publication produced while still in school, was on how to convert an Austin 7 into a lightweight “Austin 750 Special”. It sold out in 10 days.

While in the RAF, he raced cars in his spare time and realised that many workshop manuals are not well designed. This lead him to produce the first Haynes manual in 1966 on the Austin Healey Sprite. This was also a sell-out. These early successes lead to over 200 million Haynes Manuals sold around the world to date.

The company that John founded and the body of work that it has produced has been a great asset to automotive technicians around the world.

The VACC’s Technical Department acknowledges the great contribution that John and the Haynes Publishing Group has made to the automotive industry and is saddened to hear of his passing.

The air box, intake hose and intercooler inlet hose must be removed to gain access to the alternator.

This is all you can see of the alternator with the engine in the vehicle.
Bumper Removal

1. Remove the 3 screws in each wheel arch that attach to the front bumper.
2. Remove the 9 screws on the front under-side of the bumper.
3. Remove the front grill.
4. Remove the headlight assemblies from both sides (3 bolts) and disconnect the harness from the fog lights.
5. Remove the 10 plastic retainer clips from the upper edge of the bumper.
6. Pull the edges of the front bumper out, sideways from the wheel arches and cut-outs for the headlights to unclasp the bumper from the vehicle. See Diagram #3
7. The bumper should now come away from the front of the vehicle.

Fan and Radiator

1. Disconnect the wiring harness from the radiator cooling fan assembly.
2. Remove the 6 bolts and remove the fan assembly downwards under the vehicle.
3. Remove the 2 upper brackets from the radiator (2 bolts on each). See Diagram #4
4. Remove the 2 lower radiator mount bolts.
5. Leaving all radiator hoses and A/C lines attached you should be able to move the radiator assembly towards the front of the vehicle to allow access to the alternator.

Alternator Removal

1. Disconnect the wiring B+ connector and field windings.

With the engine out, removal would be a breeze

With the mounts removed, but with the radiator and A/C hose still attached the radiator, intercooler and condenser can be moved out of the way far enough to remove the alternator.

Some technicians remove the alternator from the top, others from the bottom with the bumper still in place.
Common Problems

These alternators have been known to have regulator problems which will require the alternator to be removed.

Another common issue is a diesel leak from the fuel feed lines that go into the high-pressure pump, which is mounted above the alternator. Diesel will leak into the alternator, which can cause it to fail. Holden has issued a recall for these vehicles to have the fuel lines replaced. See details below.

RECALL: Fuel Line Feed Hose

PRA No. 2018/16643

Campaign number: A172117810

Date published: 6 March 2018

MY2007-2010 Holden CG Captiva with 2.0L Diesel Engine (LLW)

A fracture on the fuel feed hose connector may cause the fuel feed hose to disconnect and leak fuel. A fuel leak could result in an engine stall or an engine bay fire, posing a risk of injury to the vehicle occupant(s) and other road users. Affected customers are invited to contact either Holden Customer Care by phoning 1800 033 349, or their nearest Holden Dealer to arrange vehicle inspection and repair.

Variations

After some more conversations with some Holden technicians from two different dealerships, here are two other options.

Option 1

1. Complete all steps in “Common Removal” (page 4663).
2. Remove the front engine mount.
3. Remove the power steering pump and move aside with the hose still attached. See Diagram #6
4. Raise or lower the engine as required to remove the alternator.

Option 2

1. Complete all steps in “Common Removal” (page 4663).
2. Complete all steps in Fan and Radiator (page 4664).
3. Then remove the alternator from under the vehicle.

The time to complete an alternator replacement seems to be 2.5 to 3 hours depending on your method.

For more information on the Holden Captiva, log on to Tech Online or call VACC’s Technical Advisory Service.

We would like to thank the team from Get Wrecked 4x4 for their assistance with this article.

(03) 9360 5555
Driven by
A THIRST FOR KNOWLEDGE

Master new technologies and systems by learning from global industry experts
automotive.training@au.bosch.com
Email Bosch to receive the latest national 2019 Technical Training Program

<table>
<thead>
<tr>
<th>Category</th>
<th>Course Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>Electrical and Electronics</td>
<td>Electronic Fundamentals and Sensor Diagnosis</td>
</tr>
<tr>
<td></td>
<td>Electronic Battery Management</td>
</tr>
<tr>
<td></td>
<td>Hybrid &amp; Electric Vehicle Systems</td>
</tr>
<tr>
<td>Alternative Drives</td>
<td>Engine Management System</td>
</tr>
<tr>
<td></td>
<td>Gasoline Direct Injection</td>
</tr>
<tr>
<td></td>
<td>Ignition System Diagnosis</td>
</tr>
<tr>
<td>Gasoline</td>
<td>Vehicle Braking Systems</td>
</tr>
<tr>
<td></td>
<td>Vehicle Dynamics Control</td>
</tr>
<tr>
<td></td>
<td>Advanced Driver Assistance Systems</td>
</tr>
<tr>
<td>Chassis and Braking</td>
<td>Common Rail System Diagnosis</td>
</tr>
<tr>
<td>Diesel</td>
<td>On-Board Diagnosis</td>
</tr>
<tr>
<td>Diagnostics and Test Equipment</td>
<td>Pass-Thru Programming</td>
</tr>
</tbody>
</table>
Mitsubishi 4J11 / 4J12: Valve Clearances

2012 – 2015 Mitsubishi Outlander ZJ 2.0L / 2.4L
2015 – 2017 Mitsubishi Outlander ZK 2.0L / 2.4L
2017 – 2019 Mitsubishi Outlander ZL 2.0L / 2.4L

The third generation Outlander went on sale in the Australian market in 2012 and with it came the 4J1 range of engines. These are inline, four-cylinder petrol, SOHC engines. The 2.0L 4J11 and the 2.4L 4J12 are mechanically similar except for different bore and stroke dimensions. This article will give an overview of the operation of their Variable Valve Timing and Variable Valve Lift systems as well as the procedure to adjust the valve clearances.

MIVEC (Mitsubishi Innovative Valve timing Electronic Control system) was first used in 1992 in the Mirage with the 4G92 engine and is the brand name which Mitsubishi use on all of their engines with variable valve timing. The basic MIVEC system consists of a camshaft phaser as apart of the camshaft sprocket.

The ECU controls the valve timing by sending a signal to a solenoid valve which directs engine oil to one side or the other of the phaser to advance or retard the valve timing, this is similar to many other engine designs (See Diagram #2). The MIVEC system on the 4J1 range of engines has an additional feature of Variable Valve Lift.

The Variable Valve Lift system is only used on the intake valves and its purpose is to reduce the pumping losses during the intake stroke which increases efficiency. To adjust the valve lift there are some extra components added to change the pivot point of the intake rocker which will increase or decrease the valve lift. See Diagram #3

The valve clearance must be checked every 60,000 km, or if there is excessive noise from the engine. Specifications:

**Intake:** See procedure

**Exhaust:** 0.20 ± 0.03 mm [cold]

---

**Diagram #2**

MIVEC and VVL System Components

- MIVEC Camshaft Phaser
- Worm shaft
- Maximum Lift Stop
- Coupling
- Segment Gear
- Align timing marks
- Variable Valve Lift Motor
- Minimum Lift Stop

---

**Diagram #1**

Align timing marks

4667
There is a position sensor at the rear of the rocker assembly to measure the valve lift and the ECU will send a signal to an actuator motor mounted on the front of the head on the intake side (See Diagram #5). As this motor turns it drives a worm shaft which then moves the gear segment.

See Diagram #9

The gear segment will change the position of the control shaft, which will move the centre rocker arm which is in contact with the camshaft intake lobe. The centre rocker arm then pushes the swing cam which is mounted on a shaft on top of the rocker assembly. The swing cam then pushes on the intake rocker which opens the intake valve.

See Diagram #3

The combination of these Variable Valve Timing and Variable Valve Lift systems allows the SOHC 4J1 engine family to be more powerful, efficient and compact than the DOHC engines it is replacing. However, there are some things to be aware of when servicing and repairing them and a complicated procedure to adjust the valve clearances.

Disassembly

1. Ensure that the engine is COLD.
2. Turn the ignition OFF.
3. Remove engine cover, two bolts.
4. Remove PCV and breather hoses from the valve cover. See Diagram #4
5. Remove wiring harness connectors to the ignition coils.
6. Remove the ignition coils.
7. Remove the Valve lift control motor. See Diagram #5
8. Remove the Valve Lift Control Motor bracket. See Diagram #6
9. Remove the valve cover. NOTE: Remove the cover in the direction of the spark plug tube to avoid damaging the spark plug tube oil seal. See Diagram #12
10. Remove the valve cover gasket and discard.
Intake Valve Clearance Measurement

**NOTE:** You must use a dial gauge to measure the amount of valve lift as the oil clearance between the rocker arm and control shaft makes it difficult to measure the valve clearance with a feeler gauge.

1. Remove the injector connectors and move wiring harness out of the way.
2. Install special tool MB992854 to the intake side of the cylinder head, which is a folded metal plate to mount a magnetic dial gauge. See Diagram #7
3. Install special tool MD998913 to the dial gauge. This is an extension to the dial gauges probe. See Diagram #7
4. Turn the engine clockwise to align the timing mark on the head to the timing mark on the timing chain sprocket. Ensure the mark on the crankshaft pulley aligns to the TDC timing mark on the timing cover. See Diagram #2
5. With 12 point 24 mm socket fitted to a tension wrench slowly rotate the worm screw of the VVL drive clockwise until it just contacts the “minimum lift end stop”. See Diagram #8 & #9

**Diagram #4**
Engine Overview

- Ignition Coils
- Breather and PCV Hoses
- Variable Valve Lift Motor Bracket
- See Diagram #6
- Intake Manifold

**Diagram #5**
Variable Valve Lift Motor

**Diagram #6**
Variable Valve Lift Motor Bracket Sequences

- MB992854: Mount a magnetic dial gauge
- MD998913: Dial Gauge Extension
NOTE: Ensure that the socket is 5mm away from the shaft holder as this may cause measurement errors. See Diagram #8

WARNING: Never apply more than 3 Nm to the coupling. If more torque is required, replace the rocker arm and camshaft assembly.

6. Mount a magnetic based dial gauge to the metal plate so that the extension from the dial gauge is in-line with the No. 1 intake valve. See Diagram #10

7. The probe of the dial gauge should contact the valve spring retainer in the middle but to the side of the rocker contact point. See Diagram #11

8. Set the dial gauge to zero.

9. Slowly rotate the worm shaft anti-clockwise until the worm wheel is approximately in the middle between the “Maximum Lift End Stop” and the “Minimum Lift End Stop”.

10. Insert a 0.15mm feeler gauge between the swing cam and the roller of the rocker arm.

11. Rotate the worm shaft clockwise until just contacting the “Minimum Lift End Stop”. The feeler gauge should be firmly clamped. See Diagram #9

12. The dial gauge should read -0.11 ± 0.03 mm

NOTE: With the 0.15mm feeler gauge in place, 0.26 mm of stroke occurs at the rocker arm adjusting screw side. The valve clearance can now be calculated using the following formula.

0.26 mm + (dial gauge reading) = Valve clearance
E.g. 0.26mm + (-0.11mm) = 0.15 mm Valve clearance

13. If the valve clearance is out of specification, adjust the clearance as follows.

Intake Valve Adjustment

1. Loosen the rocker adjusting lock nut on the valve rocker closest to the front of the engine. Pull up on the adjusting screw and apply engine oil between the adjusting screw and the end of the valve.

2. Then turn the adjusting screw until the dial gauge reads -0.11 mm.

3. Hold the adjusting screw in position while you temporarily tighten the lock nut.

4. Rotate the worm screw anti-clockwise until the segment gear is approximately in the middle of its travel.

5. Remove the feeler gauge.

6. Reposition the dial gauge to the rear side No. 1 intake valve. Repeat the “Intake Valve Clearance Measurement” and if necessary the “Intake Valve Clearance Adjustment” See Diagram #11

7. If an adjustment is required on the rear side intake valve, repeat the “Valve Clearance Measurement” and if necessary the “Valve Clearance Adjustment” on the front side intake valve of No. 1 cylinder.

8. Once correct, tension the lock nuts while holding the adjusting screws to 9.0 Nm.
Diagram #9
Range of Movement of the Gear Segment

WARNING: NEVER alter the lift stops.

Maximum Lift Stop

Minimum Lift Stop

Diagram #10
Measurement Set-up

Fit the feeler gauge in between the roller of the rocker and the swing cam.

NOTE: Only insert the feeler gauge no more than 5 mm.

See Diagram #1

NOTE: Set up the dial gauge so it is in-line with the angle of the valve stem.

Place dial gauge extensions on the front side of the valve spring retainer.

See Diagram #11
9. Rotate the worm screw anti-clockwise until the worm wheel is approximately in the middle of its travel.

10. Remove the feeler gauge.

**Exhaust Valve Adjustment**

1. With No.1 cylinder at TDC on the compression stroke.

2. Insert feeler gauges between the end of the valve and the rocker adjusting screw and measure the clearance. It should be **0.20 ± 0.03mm**.

3. If out of specification, loosen the lock nut and adjust the screw until the above value is achieved.

4. Hold the adjusting screw while you tighten the lock nut to **9.0 Nm**.

5. To complete the valve clearances for the other cylinders, rotate the engine until that cylinder is at TDC on the compression stroke and complete the above procedures for the Intake and Exhaust valves.

**Reassembly**

1. Ensure all sealing surfaces are clean and free of old sealant, oil, dirt and damage.

2. Fit a new gasket to the valve cover.

3. Apply sealant to the joints of the timing cover to the cylinder head and the corners of the “D” at the rear of the head.

4. Install the valve cover by angling the cover up on the exhaust side so you can slide the spark tubes into the seals in the cover without damaging them. Once the cover is all the way down the tubes, position it horizontally to the head, then press it down onto the sealing surface.

**Diagram #11**

**Measurement Locations**

**WARNING:** Never loosen the 5 Torx head bolts on the upper side of the rocker arms and camshaft assembly.

When setting up the dial gauge place the extended dial gauge probe on the front side of the front valve spring retainer, and on the rear side of the rear valve spring retainer. Repeat this for all of the other cylinders when set to TDC compression stroke.

**Valve Clearance:**
Intake: 0.15 ± 0.03 mm [cold] / (-0.11 ± 0.03 mm) [Dial gauge reading]
Exhaust: 0.20 ± 0.03 mm [cold]
5. Tighten the valve cover bolts in two stages and in the sequence. 1st: 3 Nm, 2nd: 5.5 Nm. 
   See Diagram #12

6. Install the Valve Lift Control Motor Bracket and tighten the three bolts in sequence to 21 Nm. 
   See Diagram #6

7. Rotate the worm shaft coupling anti-clockwise so it is in the position shown. 
   See Diagram #13

8. Move the Valve Lift Control Motor coupling so the narrower groove is vertical. 
   See Diagram #13

9. Apply clean engine oil to the seal of the valve cover and install the Valve Lift Control Motor. If all components are aligned correctly, the motor should slide in all the way with no effort. Do not force the components together.

10. Tighten the Valve Lift Control Motor bolts to 9.5 Nm.

11. Refit the ignition coils and tighten the bolts to 10 Nm.

12. Refit the engine cover and tighten bolts to 3 Nm.

13. Refit all other components in the reverse order.

14. Start engine and test drive.

15. Check for oil leaks and DTCs and repair or clear as required.

For more information on the 4J11 and 4J12 engines for the Mitsubishi Outlanders, login to Tech Online or call VACC’s Technical Advisory Service.
DPF Manual Regeneration

Diesel Particulate Filters (DPF) are one of the most common enquires we receive via VACC’s Technical Advisory Service. This article will answer some of the questions on manual or forced DPF regeneration.

As we know, in an ideal situation a vehicle fitted with a DPF should be driven at highway speeds at least weekly to allow the DPF to regenerate without any intervention from the driver or any automotive technician. However, the real world is full of car salesmen that do not assess the customers driving habits before they sell them an inappropriate vehicle, or fail to educate the new owner as to what the strange yellow light on the dashboard means. This is where the trouble starts and it is up to the technician to sort out the mess.

If a DPF warning light comes on the first step is to take the vehicle for a drive at highway speeds (above 60 km/h) for more than 30 minutes, this should allow regeneration to occur. If you are not in a position to take the car for a drive, a manual regeneration can be initiated. For most vehicles, this will require the use of a compatible scan tool.

In some cases there can be two options for manual regeneration; static (vehicle stationary) and dynamic (vehicle moving). These options are dependant on the soot load of the DPF. If the DPF is too full the system may only allow you to do a dynamic manual regeneration because the DPF’s temperature would be too high without some airflow from movement.

In most cases as long as the DPF soot load/accumulation is under 90% (you should be able to see this figure in the scan tools live data) a manual regeneration should be able to occur in the workshop, provided that the following things are in order:

- No Diagnostic Trouble Codes (DTCs) stored.
- The check engine light is OFF.
- There is more than half a tank of fuel.
- The engine oil is not diluted.
- Service light has been reset.
- The engine is at the correct operating temperature.
- The DPF pressure differential sensor is operating correctly and all of its hoses are free of holes and blockages.

If soot load/accumulation is above 90% in most cases it is recommended to replace the DPF.

NOTE: Some technicians are removing the DPFs and back-flushing them with a pressure washer to remove some of the soot to allow a manual regeneration. Also, there are some after-market services which can cut the DPF open and bake the core in an oven to burn off the soot then reassemble the filter and weld it back together.

Regeneration Buttons

Blocked DPFs are causing massive problems for vehicle manufacturers as there are many vehicles still under warranty that are having the DPFs replaced. To counter this problem some manufacturers are fitting DPF manual regeneration buttons so vehicle owners can initiate a manual regeneration when the DPF light comes on. Manual DPF regeneration buttons are relatively common in the heavy vehicle sector with Dyna, Mitsubishi Fuso, Isuzu, Kubota, Mercedes Benz and many others using them.

Toyota seems to be the first manufacturer to introduce DPF buttons into their passenger and light commercial vehicles, with the following models from 2016 onwards:

- LandCruiser 200 & 70 Series with the 1VD-FTV engine.
- Hiace with the 1KD-FTV engine.
- Coaster with the N04C engine.

As of late 2018 Toyota has started fitting DPF buttons to the LandCruiser Prado, Hilux and Fortuner models with the 2.8L 1GD-FTV, 2.4L 2GD-FTV engines. This will hopefully reduce the amount of time these vehicles spend in the workshop for DPF related issues.

This grand plan will only work if the owners of these vehicles are educated in the operation of their vehicle, and know to press the button when the yellow DPF light comes on. This is where you might have to assist your customer in understanding its correct operation.

There are many things which can stop a DPF system from operating correctly. The following Tech Talk articles can assist you with some common problems.

- Oil Dilution Ratio: June 2013 p. 3640
- DPF Facts: April 2015 p.3694
- Mazda DPF System Overview and Common Faults: June 2017 p.4348
- Diesel Fuel Vaporiser: Jan/Feb 2019 p. 4637

For more information on DPF systems login to Tech Online or call VACC’s Technical Advisory Service.
TechTalk Testing Times: O2 Sensors

Test yourself and your workmates on the common questions VACC’s Technical Advisory Service get asked on O2 Sensors.

Questions

1. I have a fault code for an O2 or A/F sensor. I replaced the sensor and I still have the code. What do you think is causing that problem?
2. Air Fuel Ratio (A/F) sensors and an

O2 sensors are the same. True or False?

3. Is there some simple rule that I can use to work out which sensor is which. True or False?
4. What does a Lazy or Slow O2 Sensor mean?

Answers

1. The ECU might be detecting a fault in the circuit, however there are many possible things to check. First check the wiring between the sensor and the ECU for open or short circuits. Then check the engine as it may be running rich or lean which is making the O2 sensor give readings which are out of range.

2. False. They both give a signal back to the ECU about the outcomes of the combustion but do so in different ways. A conventional O2 sensor will produce an oscillating voltage when the fuel mixture changes rich to lean. An A/F sensor produces a changing current signal that varies in direct proportion to the amount of unburned oxygen in the exhaust. Conventional O2 sensors are called Narrow Band sensors and A/F sensors are Wide Band sensors as they can measure a wider range of lean and rich air fuel ratios.

3. True. If you have a fault code which indicates Bank 1 Sensor 1 (B1S1) this means that the engine bank with No. 1 cylinder is bank 1. Sensor 1 is the first sensor the exhaust gases contact so it will be closest to the engine, upstream of the catalytic convertor. Bank 2 is the bank without No.1 cylinder. Sensor 2 will be the second sensor usually downstream of the catalytic convertor. There can sometimes be Sensor 3 which is further downstream. So, Bank 1 is on No.1’s side and Sensor 1 is the closest the engine and the other sensors follow in order.

4. As the sensors age or get contaminated, their ability to respond to the changes in the air fuel mixture slows down. This reduction in response time can increase fuel consumption and decrease performance. The output voltages may still look OK (oscillating between 0.1 – 0.9 V), however the frequency of this oscillating voltage is the problem. Compare one bank’s frequency to the other and they should be nearly the same. As a rule of thumb, at 2500 rpm a good sensor should oscillate 2 to 3 Hz in earlier models, and 5 to 7 Hz in later models.

For a video on A/F Sensor Operation, scan the QR code or use this link: tinyurl.com/WideBandO2

VACC Industry Awards Gala Dinner 2019 - tickets selling fast

VACC Industry Awards Gala Dinner
Saturday, 22 June 2019 • 6pm-midnight

We'd love you to make it
BOOK NOW: vacc.com.au/via
Diesel Exhaust Fluids: Questions & Answers

AdBlue can get you and your customers into trouble if you are not familiar with the SCR system.

Diesel Exhaust Fluids: Questions & Answers

VACC’s Technical Advisory Service has been receiving questions in relation to AdBlue, as there are a growing amount of vehicles on the road with Selective Catalytic Reduction (SCR) systems.

For a complete overview of how the SCR system works to remove NOx from the exhaust see the April 2015 issue of Tech Talk page 3961.

Is all AdBlue the same?

AdBlue is the trademarked name that belongs to German Association of the Automotive Industry. AdBlue is actually Diesel Exhaust Fluid (DEF) used in SCR systems. DEF is a very simple mixture of 67.5% de-ionised water and 32.5% urea. DEF is made by many companies which market it under their own product names, some of which are:

- Air Shield: Cummins/Valvoline
- BlueTec: Mercedes-Benz
- Penblue: Penrite

As long as any product you use complies with the aqueous urea solution rating of AUS32 and ISO 22241 you should be ok. Just about everyone calls DEF “AdBlue” in the same way many people call all vacuum cleaners a “Hoover”.

Does AdBlue have a shelf life?

Yes. There will be a used by date on the container that it comes in. If you are refilling a vehicle ensure that you only use fresh AdBlue.

How do I refill the system?

In many vehicles there is a filler point next to the fuel filler and the driver should fill this when the gauge indicates it is required. Other vehicles will have the filler point hidden and it should be refilled during normal servicing like the Mazda CX7 (see Tech Talk August 2017 page 4384).

Will the car run without AdBlue?

Unlikely. Most cars will enter limp home mode, then you will not be able to restart the engine until the system is refilled and reset.

I have refilled my Volkswagen and the system still thinks it is empty.

VW’s use an ultrasonic sensor in the bottom of the tank to measure the distance to the top of the fluid. If it is overfull, there will be no air gap between the fluid level and the top of the tank. The sensor will not see the top of the fluid level and will think the tanks is empty.

I have had to drain the SCR tank. How do I safely dispose of AdBlue?

You should use the method recommended by your licensed waste disposal facility, which should be the same as the procedure for glycol coolant and brake fluid (EPA waste code M130).

The vehicle owner has mixed AdBlue into the Diesel or Diesel into the AdBlue. What should I do?

First, tell them not to start the engine. Then drain, flush and bleed the contaminated system.

If the vehicle has been driven with either system contaminated, there will be damage done to the various components.

Is the Eolys fluid used by Peugeot and Citroën the same as AdBlue?

No. See the next issue of Tech Talk.

For more information, log on to Tech Online or call VACC’s Technical Advisory Service.

AdBlue is made out of urea... And there is urea in urine.... Soooo...If I am stuck in the middle of no where... Can I pee in the AdBlue tank and get going again?

AdBlue is a highly purified solution of 32.5% urea and de-ionised water (which means it has had all of its minerals removed. De-ionised water is different from distilled water).

Human urine has about 2 - 4% urea and includes a mixture of salts, toxins, bile pigments, hormones and mineralised water. As you can see, there are some differences. Some SCR systems have a sensor which will measure the concentration of urea, and system will not function if it is out of specifications. This is because even a small amount of impurities can damage the system beyond repair.

So NO, you can’t pee in the tank. If you are planning a trip into the outback and your rig has an SCR system, add a bottle of AdBlue to your kit, as well as extra oil and fuel to get yourself out of trouble.