Service Engineering Bulletin

AUSTRALIA engine TECHNICAL

SB007

'Smoking' Diesel Engines

'Smoking' diesel engines are typified by three general smoke colour classifications - white, black and blue. Excessive engine smoke indicates a diesel engine is operating inefficiently and/or incorrectly and damage will result if the cause is not determined and rectified.

White Smoke

White smoke is a common characteristic of incompletely burned fuel in the cylinder. Unburned hydrocarbons exit through the exhaust system in a condensed, white smoke form that is characterised by an acrid odour that burns the nostrils and eyes. Generally, white smoke is more evident at start up in colder weather conditions, or at least until the engine approaches operating temperature. Extended idle periods can allow cylinders to cool and increase white smoke. Improper valve adjustment or incorrect fuel injection timing can also promote excessive white smoke. Lack of compression due to worn cylinder components, as well as low grades of fuel, can contribute to white smoke conditions. Air in the fuel lines, faulty fuel injectors, and coolant in the combustion chamber can all produce white exhaust smoke and typically result in a rough running engine.

Low engine temperature.	Check cooling system according to manufacturer's specifications. Check the correct temperature thermostat is fitted.
Incorrect valve adjustment.	Set valve clearances according to manufacturer's specifications.
Incorrect fuel injection timing.	Check for retarded pump timing. Adjust as necessary.
Incorrect injector adjustment.	Check injectors are operating correctly and the injector opening pressure is not too high.
Low compression.	Test compression on all cylinders to establish pattern. One low cylinder may indicate a specific mechanical failure. All cylinders low may suggest excess wear or wrong engine components.
Poor quality fuel.	Have fuel tested to ensure it is within industry specifications. Check there is no water in the fuel system - tank, lines and filters.

Black Smoke

Black smoke can generally be associated with excessive fuel in the cylinders. Either there is too much fuel in the cylinder for efficient combustion or there is a limited amount of air available for efficient combustion. In either situation, excess fuel is emitted from the exhaust as black smoke. Lugging of an engine - high load and low engine speed - can also produce excessive black exhaust smoke. Correct gear selection and operating techniques can combat this condition.

	LIMITED AIR SUPPLY
Dirty air cleaner.	Check and replace as necessary.
Restricted or damaged air inlet piping.	Check and replace as necessary.

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Restricted exhaust system.	Check and remedy restriction.
Intake leaks between turbo-charger and cylinder head.	Check for leaks according to engine manufacturer's procedures.
Turbocharger.	Check for condition and compliance to engine manufacturer's specifications.
Camshaft.	Check for worn camshaft lobes and replace camshaft if necessary.

EXCESS FUEL IN CYLINDERS

Faulty or worn injectors or nozzles.	Check according to manufacturer's specifications.
Incorrect injector adjustment.	Check injectors are operating correctly and the injector opening pressure is not too low.
Incorrect fuel injection timing.	Check for advanced pump timing. Adjust as necessary.
Fuel pump drain line restricted.	Check drain line for restrictions or crimps.
Incorrect fuel pump setting.	Have fuel pump tested for compliance to manufacturer's specifications. Check the delivery valve and the injection volume.
Incorrect valve adjustment.	Set valve clearances according to manufacturer's specifications.

Blue Smoke

Blue smoke indicates excess lubricating oil burned in the cylinder during combustion. Excess oil can escape up past the rings, down past the valve guides into the combustion chamber or enter in through the inlet manifold. Faulty PCV valves and tappet cover baffles can allow excess oil to enter the inlet manifold. Plugged return lines on turbochargers can introduce oil into the cylinders. High engine oil levels can also promote blue smoke. Attempts should be made to determine if oil is being burned in all cylinders or limited to one. Use of engine oils which do not comply to the engine manufacturer's specifications may promote accelerated carbon deposits and lead to blue smoke and oil control problems. Elevated oil temperatures reduce oil viscosity and may allow it to more readily escape past pistons, rings and valve guides into the combustion chamber.

Oil entering the inlet manifold through the breather tube.	Ensure the PCV valve is working correctly. Ensure the tappet cover baffles are in place. Baffles have been known to dissolve in caustic cleaning baths.
High engine oil level.	Check and calibrate dipstick if necessary. Fill to proper level.
Turbocharger - leaking seal or blocked return line.	Check turbocharger seals and oil return lines according to manufacturer's specifications.
Intake valve guides leaking.	Check guide wear is within manufacturer's specifications and replace if necessary.
Damaged or worn cylinders.	Perform compression or leak down tests on all cylinders. If below engine manufacturer's specifications, check for worn or damaged cylinder walls, pistons or rings.
Oil burning in one cylinder.	Check cylinder for worn guides or damaged valves. Check for broken or upside down rings. Check for missing oil return holes in piston oil ring grooves.