



Kiwi Cylinder Heads Ltd

Excessive Heat is the Killer!

When it comes to causes of Diesel Cylinder Head Failure, Excessive Heat is the Demon you are chasing.

Cylinder Heads only crack when they have become too hot. The “cracking” of the cylinder head is not the cause but only the end result. To successfully return a vehicle to reliable service the cause of this “excessive heat” must be located and remedied, or the replaced cylinder head will most likely re-fail within 3-12 months time. Causing you & your customer to question the result.

The poor old cylinder head wears the blame too often, when in fact the part that has actually “broken” is not to blame but the systems surrounding it are usually at fault instead. The cylinder head effectively becomes a “heat sink” and “sucks up” all this excessive heat to the point where it can no longer with stand it and it gives way, leading to an expensive repair job. All parts fail for a reason, and this reason or reasons need to be identified to be sure of a successful re-instatement of the vehicle into service.

There are three main systems, which can be a source of “excessive heat” for the Diesel Cylinder Head. (This is assuming the bottom end of the engine is in good operational condition, as we are discussing cylinder heads in this editorial)

*Those three systems are: **Cooling System, Fuel Delivery System and Exhaust System.** We need to investigate each of these systems in detail to ensure they are operating with in their original design parameters set by the vehicle manufacturer.*

Cooling System: *This is the first system that usually gets the attention. Areas to consider are.*

- *Radiator (some vehicles have more than one radiator, they all need to be cleaned or replaced. Just flushing is not that effective)*



- *All coolant hoses should be checked for deterioration, integrity, perishing and of coarse leaks.*
- *New and existing thermostats should be tested for correct operation.*

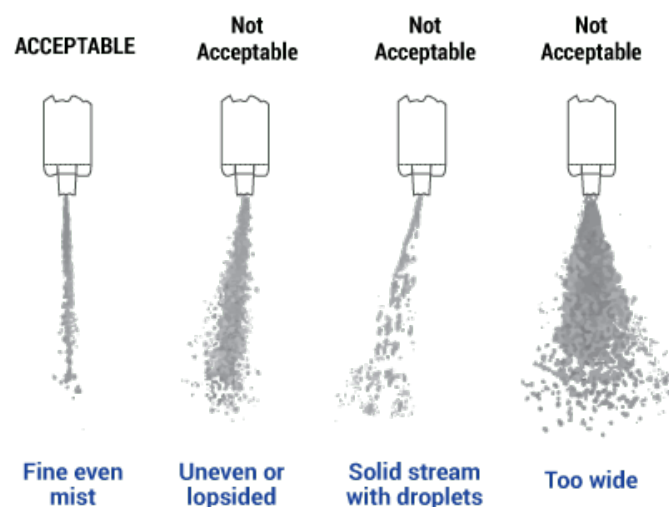
- Viscous fans and/or electric fans should also be checked for correct operation. Just because it's spinning doesn't mean it's drawing the correct airflow.
- Obstructions, debris blockage of radiator air flow.
- Heater cores, if the radiator was blocked good chance the heater core is compromised as well. Some vehicles such as people movers etc. have exceptionally detailed heater and cooling hose systems, which can present trouble with air locks. Be sure you have released any trapped air with in the system.
- Correct levels and types of "anti-freeze" and "inhibitor" and employed. Electrolysis (electric mice) and cavitation are extremely destructive also.



- Contaminated cooling systems (scale and rust build up) this will directly affect the ability of the cooling system to expel or radiate heat from the engine.

Fuel Delivery System: This is just as important as the cooling system.

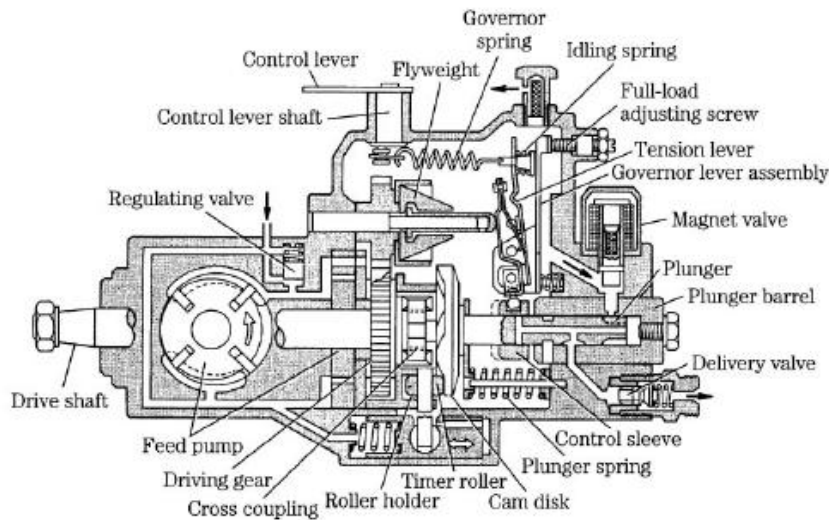
- **Fuel Injectors.** Start first by having all Diesel Fuel Injectors tested and/ or serviced / replaced. Diesels are all about the correct atomization of the fuel when it is delivered to the combustion chambers. Diesels will "run" on just about any form of oil. But it does not mean they are running correctly for long-term benefits. "Improper Fuel delivery" causes the EGT (Exhaust Gas Temps) to rise considerably. High EGTs are extremely detrimental to a Diesel Engines health and longevity. Always test/restore or replace the fuel Injectors.



Typical diesel spray patterns. Acceptable patterns produced are even, uniform mists of fuel. Unacceptable patterns are uneven and do not have proper mist density.

- **Diesel Fuel Pumps** (Indirect Diesel). Some models employ Electronically Controlled pumps. These can and are known to be problematic. All pumps should be considered at least for the correct delivery of fuel to the injectors. The injectors

may test fine but if the pump isn't supplying fuel at the right pressures and volume then the injector can't do its job as well. Most pumps have filter gauzes fitted to inlet/outlet pipes and can be obstructed with debris and particulates.



5-10 Bosch VE Series injection pump.

- **Fuel Filter Housings** can sometimes develop cracks which will let air into the fuel line causing cavitation with in the pump.
- **Fuel Quality.** Contaminated fuel, such as remote fuel storage tanks found commonly on construction, quarry sites as well as farms. These can be a great source of the dreaded "fuel bug" not to mention foreign particulates. Every time bulk fuel is handled it is at risk of contamination transfer. Most factory diesel fuel filters are "by-pass filters", this means should the filter become blocked the fuel will pass unfiltered to the rest of the fuel system components. This leads to damaged pump internals and fuel injector nozzles.



- **Common Rail & Direct Injection Diesels.** The latest technology engines (Common Rail) atomize the fuel finer than it has ever been atomized before. This is how they achieve so much power from small engine displacements. The finer the fuel atomization the more complete the combustion, more complete the combustion more efficiency and more power. However some of these Common Rail engines can generate up to 30,000psi at the injector nozzle at W.O.T (Wide Open Throttle). High pressure creates high temperature in the returning fuel to the fuel tank. This can lead to very hot fuel with in the fuel tanks. This once cooled can create condensation with in the fuel tank, contaminating the fuel with even more water. Water cannot be compressed, so if it were to reach the injectors at these pressures it can and does cause some real damage to the internals of the fuel injector. Cracked and melted

pistons, cracked cylinder heads, failed head gaskets; all can result from improper fuel delivery.

Exhaust System: The exhaust system includes any, Turbos, EGRs (Exhaust Gas Recirculation) EGR Coolers, Mufflers, D.P.F (Diesel Particulate Filter), Pre CATS and Exhaust Pipes themselves.

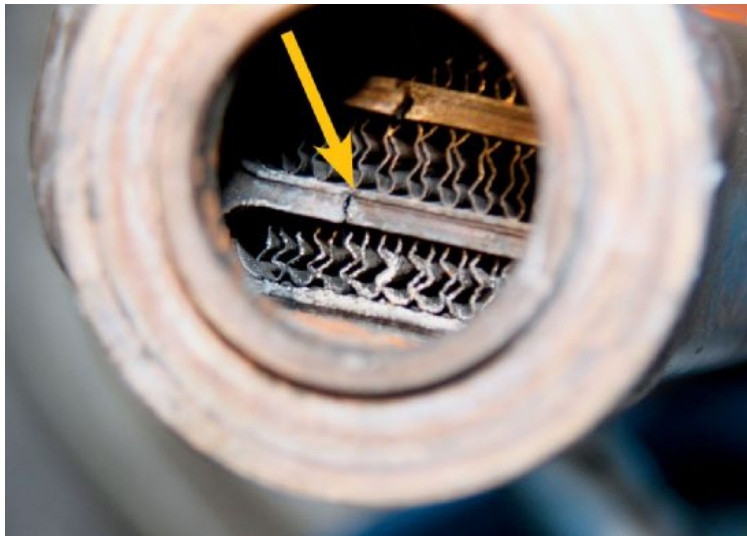
- **Turbos.** Make sure the turbo is not over boosting due to blocked MAP sensors or stuck Waste Gates. MAP sensors are commonly used to detect turbo boost and send a signal to the ECU, which then controls the amount of boost the turbo should be providing. If it is blocked with “EGR Gunk”, no or little manifold pressure is detected and the turbo is told to boost up. May sound like fun, but is not good for the long-term health of the engine. Couple with this a possible faulty injector or two, result very high EGT.



- **EGR.** Exhaust Gas Recirculation Valve is another of these parts, which become blocked and jammed with “EGR Gunk” (Mixture of carbon and oil mist) The EGR system is there for a reason, not just annoyance. As the name suggests the recycle some of the exhaust gases back around into the inlet manifold to be scavenged. This helps reduce combustion temperature so the diesel engine does not produce so much or no NOx gases. When a diesel combustion temperature reaches approx. 2400 degrees Celsius, it starts to produce NOx gas; this is frowned upon these days for all our sakes. The EGR helps reduce this combustion temperature so as not to have this undesirable effect. The irony is that a faulty EGR valve or system can cause a diesel engine to run inefficiently and cause more pollution and have a detrimental effect on the engines performance and reliability. It is a common practice these days (out of economy and convenience) to “block” these EGR systems off with a simple “blanking plate” method. This will have an effect on the EGT of the engine as it loses the designed effect of lowering combustion temperatures.

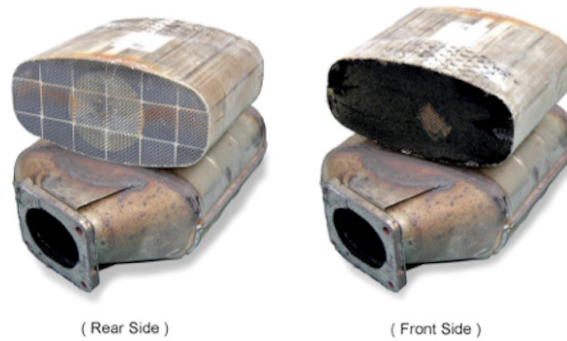


- **EGR Coolers.** EGR Coolers are as the name suggests related to and part of the EGR system. They are found on most Direct Injection and Common Rail Diesel engines today. They consist of a small radiator situated inside the EGR pipe running between the exhaust and the intake manifold. Their job is to cool the exhaust gases traveling to the intake. This is done with coolant from the cooling system. Problem with these is that sometimes the cooler cracks internally and allows coolant to be sucked from the cooling system and ultimately leading to an over heat situation. These should always be pressure tested regardless of the age of the EGR Cooler itself. One of the leading causes of EGR Cooler failure is again our old friend “High EGTs”. The high EGT can boil the coolant with in the cooler causing it to swell and crack.



- **Mufflers.** A blocked or collapsing muffler will cause excessive “back pressure”. Quite simply if the engine can not expel its hot exhaust gases they are going to back up and cause failure of turbos and cylinder heads. It is the same if the vehicle has a bent or damaged exhaust pipe, same result.
- **Diesel Particulate Filters, DPF.** Found in many late model diesel engine vehicles. Just as the name suggests they filter “Particulates” from the emitted exhaust gases before they enter the atmosphere. These heavy particulates are not good for us air breathing animals, nor are the NOx gases mentioned earlier. These DPF filters are cleaned by the engines ECU controlling either an increased fuel delivery or by directly injecting fuel into the catalyst at a set parameter so as to burn off build up with in the filter. This is only meant to happen with in certain requirements of vehicle operation, such as road speed. However vehicles which have lived a life of low speed travel can end up with blocked DPFs. This has an environmental as well as a mechanical disadvantage. Again affecting the EGTs.

Inside View of a Blocked DPF



Summary.

The poor cylinder head gets the blame far too often when in fact it is the surrounding systems the cause the true failure. If these systems are not thoroughly inspected and tested for correct operation, the most likely out come will be the continued premature failure of the replaced cylinder head and its associated components. Find the root of the “Excessive Heat” and you will solve your problems. There is no such thing as a “Cheap Diesel Repair” because they often will not fix the real problem.

