Factors contributing to diesel exhaust emissions

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If compliance with Original Equipment emissions standards is desired, **indirect** diesel injection engines are more vulnerable than any other.

Personnel servicing **direct** injection diesel engines are generally aware injection pump and injector operation must be maintained at manufacturers' specifications if engine performance, durability, and emissions are to meet original equipment manufacturer standards.

However, remarkably few understand the additional and highly critical role of components unique to the **indirect** injection engines fitted to the majority of passenger car and light commercial vehicles.

Successful engine designs possess a predictable, proportional relationship between the maximum quantity of **fuel** delivered, precombustion chamber **assembly volume**, and precombustion chamber cup exit port cross sectional **area**.

Exit port cross section **geometry**, exit port **angle**, and piston crown **shape** is likewise a complementary grouping, although seemingly subject to design team idiosyncrasies.

One precombustion chamber cup per cylinder is fitted to the cylinder head; the exit port cross sectional **area** unique to each engine specification and regulating the passage of combusting, rapidly expanding gasses as they burst from the precombustion chamber into the combustion chamber proper.

Also unique is the cavity **volume** formed in the precombustion chamber side of the cup, where it may customise total precombustion chamber volume to the specification demanded for that particular engine model.

Precombustion chamber cups must resist flame front temperatures approaching 1500 degrees C, most utilising special grades of stainless steel and a very few ceramics. Our elemental analysis of Original Equipment stainless cups suggests manufacturers choose cost effective rather than potentially more durable materials.

Engines subject to poor fuel quality, incorrect tune or specification, excessive loads, and overheating create abnormal conditions within the combustion chamber which readily distort and crack the precombustion chamber cup, so compromising its effectiveness.

Damaged or incorrect precombustion chamber cups contribute to or cause increased emissions, low power, poor economy, reluctant starting, and decreased service life.

Since few technicians understand their role, associated parts are often faulted and incorrectly replaced at considerable unnecessary expense and inconvenience.

With engine models proliferating, new parts unavailable or beyond budget, and Consumers demanding economical repair, used parts are often substituted.

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Exchanging components between different models of petrol engines is unusual, but not so with many diesels, whose manufacturers produce engine families with models which readily accept siblings' parts despite a now incorrect specification.

For instance, Toyota manufactures a family with models 2LII, 2LIIT, 2LTE, 3L, 3LT, 5L and 5LE engines fitting 1988 up Dyna, Hi-Lux, Hi-Ace, and Toyo-Ace models; their principle visible difference being the turbocharger. Whilst they offer markedly different performance and share virtually identical cylinder heads, subtle but crucial differences such as precom cup port dimensions and total precom chamber volumes differ by 25% and 4.2cc respectively.

Readily available cheap used imported engines and parts then provide an irresistible opportunity for the uneducated or unethical to substitute components and create mongrel engines certain to pollute, provide inferior performance, and resist all but expert diagnostic efforts.

Increasing sales of new non replica aftermarket cylinder heads add further confusion, for instance one well known manufacturer offering a Mitsubishi "4D55/56" cylinder head with assembled precombustion chamber volume 1.90cc less than the OEM. 4D56T, thereby increasing static compression from 20 to 21.2 : 1 and decreasing precombustion chamber volume by 9.6%, either condition gauranteed to cause problems ranging from increased emissions to premature engine failure.

Some blame Engine Reconditioners for this scandalous state of affairs, claiming since they regularly work to 0.01mm tolerances whilst machining, establishing precom cup port and cavity depth dimensions to +/- 0.20mm and thereby the cup identity, is well within their skill level. Overlooked however is the fact few reconditioners receive an entire engine for overhaul, permitting machining, purchase, and fitting of matching componetry ... instead many, if they ask at all, rely on oft questionable information provided by a cost fixated customer who may deliberately mislead the reconditioner to minimise his expenses.

Fiercely, perhaps fatally independent, victim to peer pressure and public censure, despite personal experiences and colleagues' anecdotes, many reconditioners then adopt a "head in sand" attitude, hoping with time the problem will simply disappear.

Neither are Original Equipment dealers assisting. Steinz recently provided a major importer with 24 O.E. cup part numbers for their engines, all manufactured within the last 15 years. Three cup types were stocked Nationally and seventeen Japan only, retail price $112.61 to $277.72. Four were available only when included in new cylinder heads.

Depending on model, our recommended Rebuilder price for superior Steinz replacements range from $28 to $50 each plus G.S.T. -- and our N.Z. Distributor normally stocks 70 different models from our expanding range.

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