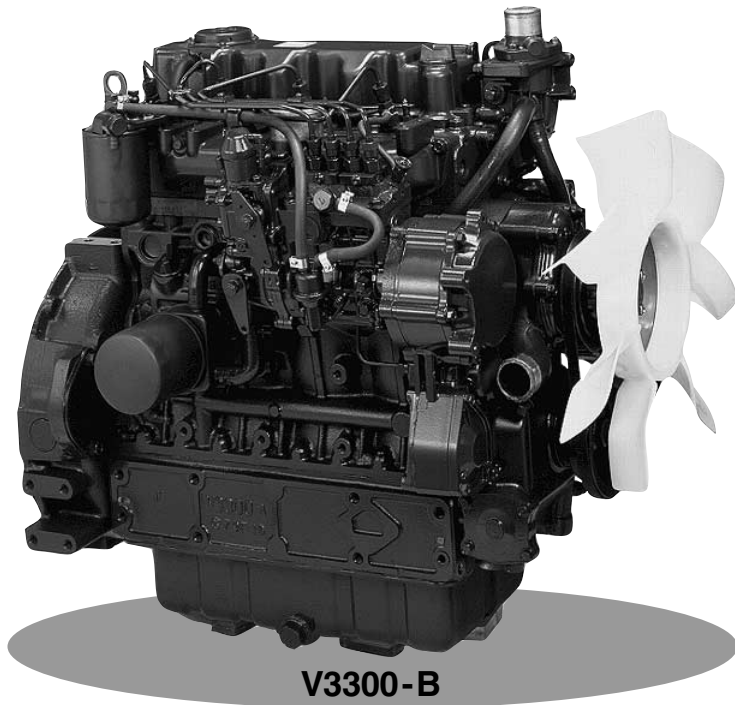


**FOCUS  
ON  
KUBOTA**

# ULTIMATE OEM-USE NEW CONCEPT THE V3300 SERIES



**V3300-B**



**V3300-TB**

**K**ubota diesel engines furnish all the power required by a variety of vehicles and equipment that perform a wide range of applications around the globe. In fact, Kubota has earned international renown as one of the leading industrial diesel engine manufacturers in the category of 100 PS or less. The widespread popularity of these quality engines can be attributed to their superb durability and reliability as well as to their outstanding performance while completing the job at hand.

The range of Kubota diesel engines was increased in 1998 with the addition of the V3300 Series with a rated output of 50.7 kW (69 PS) for the standard configuration and 61.9 kW (84 PS) for the Turbo configuration. Developed by incorporating a totally new concept, the V3300 Series is increasingly drawing attention for its high output, clean emissions, and compatibility with a broad range of vehicles and equipment.

Mr. Keiichi Taniguchi (KT), Mr. Yousuke Morimoto (YM), and Mr. Kiyoshi Hataura (KH), members of the team responsible for developing the V3300 Series, were interviewed by the Kubota Times (▶) to learn more of how these new concept engines were made possible.

## **Splitting the Crankcase into Upper and Lower Parts Makes Possible a Broader Range of Applications**

▶ Mr. Taniguchi, would you please begin by explaining the general background leading to the development of the V3300 Series of diesel engines?

**KT:** Our basic idea was, in the first place, to concentrate on in-house usage, specifically to develop a series of engines ideal for being mounted on tractors. It was realized that with in-house mounting being the primary application for such engines, it would become possible to make fairly precise

# CONCEPT ENGINES

estimates of production volume. Further, with such a guaranteed basic demand, the investment required for development and production would become feasible.

While OEM applications were also given consideration as a primary goal, on their own they would not have been sufficient unless a large-volume user could be guaranteed; a situation that would have been quite difficult to achieve. To achieve maximum cost effectiveness, therefore, meant combining OEM sales with in-house usage to achieve the mass-production that would result in lower costs. This in turn would strengthen competitiveness in the tractor market and thereby contribute to the establishment of an optimum cycle.

Let me point out that while Kubota diesel engines have earned a significant share of the market in the category of 100PS or less, the majority of them are currently rated at 50 PS or less. In fact, our market share for engines over 50PS remains relatively low. That being the case, there have long been plans to increase the outstanding line of quality Kubota diesel engines to include models rated at over 50PS such as those in the V3300 Series. The timing of this development

was a significant factor. Just when large-displacement, high-output engines were being increasingly sought for in-house mounting, the OEM market began seeking engines delivering higher-output. That being the case, designing the basic structure of these engines meant incorporating functions to match the needs of tractors with those for general-purpose applications to ensure maximum ease of usage.

► We have heard the development concept for the V3300 Series of diesel engines was totally unconventional.

**KT:** In the sense that a completely new approach was taken, what you have heard is correct. As mentioned earlier, the fundamental reason for the development of Kubota engines has been to provide a quality source of dependable power for in-house applications. Only secondarily have they been available for OEM applications around the world.

In the under 100PS category, innovation and experience has provided us with a degree of technological know-how to deal with demand for engines of less than 50PS. However, we were on less firm footing when developing an engine of over 50PS. When mounting an engine to a tractor, the



*Mr. Keiichi Taniguchi (KT) is Manager of OEM Engine and Power Product R&D, in the Engine Engineering Department where he handles the technical applications of Kubota engines on OEM-equipment. In the development of the V3300 Series, he was specifically involved in aspects regarding applications.*



*Mr. Yousuke Morimoto (YM) is a Deputy Manager of Diesel Engine R&D in the Engine Engineering Department. As Chief of the development project responsible for the V3300 Series, Mr. Morimoto, together with Mr. Hataura, participated energetically at every stage in the development of these remarkable engines.*



*Mr. Kiyoshi Hataura (KH) is also a Deputy Manager of Diesel Engine R&D in the Engine Engineering Department. In addition to being in charge of design for the V3300 Series of diesel engines, he also participated positively in the development of the E-TVCS (Three Vortex Combustion System).*

Crankcase and Clutch Housing augment the tractor's frame to contribute strength and weight to the engine. In consideration of this, such an engine cannot be used for OEM-related applications without the appropriate modifications.

**YE:** As Kubota engines are used in a wide range of OEM applications, at times they need to fit specifications totally different from those required for use in tractors such as providing minimal weight and the elimination of unnecessary toughness. Bringing forth engines with the flexibility to meet the wide range of OEM requirements while being mounted in a variety of equipment was one of basic concepts in the development of the V3300 Series.

► How was it possible to accomplish this?

**YM:** We began by dividing the crankcase into upper and lower parts. Then, we replaced the structure of the lower crankcase. In consideration of tractor applications, we had a hard time figuring out a lower crankcase structure that would not generate strain. Research led us to using a unique rib structure that manages to completely clear any strength-related problems.

In this way we satisfied the requirement for light weight in general industrial use engines while providing a high-strength mono-block structure necessary for tractor applications.

► Does that mean that engines in the V3300 Series have an entirely new design not based on any conventional engine?

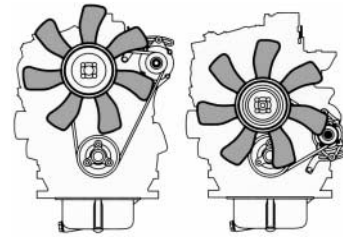
**YM:** Yes, it does! As these engines were designed from scratch, they are structurally quite different from other Kubota engines.

**KT:** As a result, these models can fit a large-capacity side PTO that easily fulfills the power needs of a variety of applications. Another advantage is that the mounting positions of the fan, the starter, and the oil filter can be freely selected to best match the bonnet size or engine mounting situation of each respective OEM-machine. Engines in this series also feature One-Side Maintenance so that the maintenance position can be selected from any of three different possible directions. To introduce these features in conventional engines would require the costly process of



making various alterations to the basic engine design.

► In other words, engines in this new series fit a variety of applications at a relatively low cost.



*Fan Attachment can be selected from 2 different locations.*

### Trade's First 3-Valve Mechanism Delivers High Output

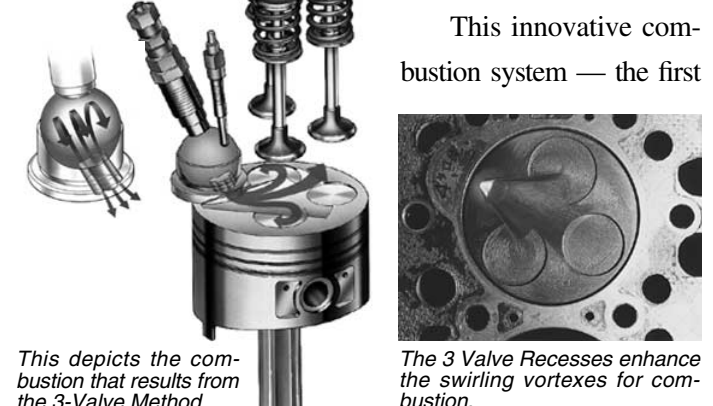
► What kind of output do engines in the V3300 Series deliver?

**KT:** The easiest way to increase output is to increase displacement. Doing it this way, however, results in a larger engine that is more difficult to fit into vehicles and equipment. Considering that OEM-use engines in particular must be compact and lightweight while providing high output, we incorporated these perimeters into the development concept for the V3300 Series.

**KH:** Towards realizing this, it was decided to incorporate the 3-Valve Type (2 intake valves and one exhaust valve per cylinder) Multi-Valve E-TVCS Combustion Method which is based on the conventional E-TVCS. This results in an enhanced air intake efficiency that translates into higher output. Then, combustion efficiency was further improved by conveniently locating the three valve recesses on top of the piston.

Please look at the diagram that illustrates combustion resulting from the 3-Valve Method. Combustion is promoted as a result of the process by which three vortexes form inside the combustion chamber. More specifically, the ejection ports emit active jets to the top of piston where the 3 valve recesses of the 3-Valve Mechanism turn them into powerfully swirling vortexes for enhanced combustion.

This innovative combustion system — the first



*This depicts the combustion that results from the 3-Valve Method.*

*The 3 Valve Recesses enhance the swirling vortexes for combustion.*

of this type available in the trade — increases output by as much as 7% and has greater torque than conventional models with the same-displacement.

### **Governor Mechanism and Combustion Ejection Pump Unitized**

► What is the emission efficiency of this new combustion system?

**KH:** The superior combustion performance results in significantly cleaner emissions.

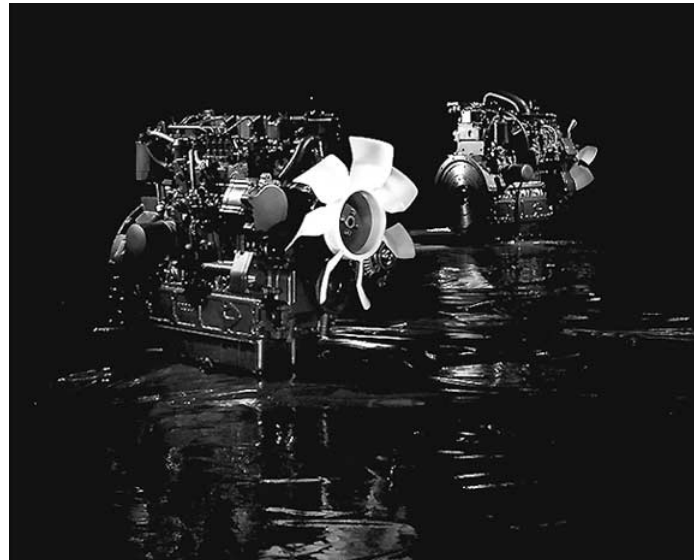
**YM:** The key to cleaner emissions while improving combustion efficiency was in determining the optimum balance in the rate and timing of fuel injection. This was achieved by pioneering an external governor mechanism unitized with the Fuel Injection Pump to regulate peak-torque in respect to the rate of fuel injected. As a result, both the Fuel Injection Rate Adjustment and the Injection Timing Adjustment are more precise and easier to control.

**KT:** This innovative development regulates rate and timing without the need to make these adjustments while the engine is in operation; it is enough to simply fit a preset unit to the engine. Settings for output and torque rise are made easily, precisely, and speedily with outstanding cost efficiency to best match the specific requirements of each OEM-customer.

### **Balancer Mounting Made Simpler**

**KH:** Providing maximum operator comfort was another step in the development concept for the V3300 Series. As a result of incorporating the 3-Stage Open-Valve Type Thermostat that features an exceptionally smooth water temperature rise, the clearance between the piston and the liner became smaller so that piston noise is significantly reduced. In addition, an internal Balancer that reduces the vertical vibration peculiar to a 4-cylinder engine is available as an option.

**KT:** The Balancer is extremely easy to install as space is set aside for it within the Crankcase. This is yet another feature particular to the V3300 Series that has never been available in conventional engines before. Previously, it was a difficult and chancy process to figure out how to lay out the gear or how to hold the shaft if a Balancer was to be retrofitted.



### **Expectations Placed on the V3300 Series**

► From what you have said, it seems that diesel engines in the V3300 Series feature the ideal OEM-use design as they positively respond to a broad scope of requirements.

**YM:** These engines were specifically developed to fit the parameters of a wide range of applications without increasing costs. While at present this innovative series is not yet as cost efficient as we would wish, it is expected that costs will drop further as production increases to provide an even greater cost-advantage in an increasingly wide range of applications.

**KH:** Models in the V3300 Series are the first Kubota engines developed specifically for OEM-use. As a result, it is expected they will play a pioneering role in expanding market share in the over 50PS category.

► Will the combustion system featuring the 3-Valve Mechanism that is incorporated into the V3300 Series be applied to other engines to be developed in the future?

**KT:** No such plans exist at the moment. While the overall concept for the development of the V3300 Series will probably be applied to other engines, the 3-Valve Mechanism may not be utilized as such due to the fact that beside the Vortex Chamber Type Combustion Method there are engines that feature the Direct Injection Method. Looking to the future, engines that make the best use of each particular method as they relate to specific applications are being considered.

► Thank you, gentlemen, for joining us today.