



Press Release

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Two-Stage 'Ecocharge' Turbocharging Pushes Gas Engine to World's Highest Class Efficiency

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PBST has announced that Kawasaki Heavy Industries' (KHI) new type KG-18-T gas engine, equipped with its two-stage-turbocharging 'Ecocharge' system, has recorded the world's highest class power generation efficiency of 51% with Japanese standard city gas.

Designed for power applications, the KG-18-T's Ecocharge solution consists of 1 x PBST TCX23 and 1 x PBST TCA66 turbochargers that have improved its power-generation efficiency by 1.5% compared to the previous generation of the engine, delivering a world-best class 51.0% in its output class.

KHI notes that engine and turbochargers have passed a durability test and are now ready for serial production. The turbochargers themselves were inspected after the durability test with KHI reporting their condition as very good.

KHI's Mr. Sakai – Senior Manager Four-stroke Engine Department and Head of Design Department – said: "Our new KG-18-T gas engine raises high expectations. This engine is the latest and most-efficient addition to our "Kawasaki Green Gas Engine" series. The design is based on its previous models KG-18-V and KG-18, which count more than 180 sold units since their introduction ten years ago. The newly developed two-stage turbocharging system improves power generation efficiency significantly resulting in the world's highest class efficiency in this output range. Consequently, we are keen awaiting to continue this engine's success story."

PBST's Ralph Klaunig – Vice President of Sales & License Turbochargers & Exhaust-Gas Treatment – said: "Naturally we are very happy with this announcement since KHI is the very first Original Equipment Manufacturer in the medium speed segment to launch an engine with our two-stage turbocharging solution. PBST is a market leader within two-stage turbocharging, with more than 35 million operating hours recorded from over 2,000 units, and it is very pleasing that we can now add the world's most efficient gas engine to our reference list."

The ECOCHARGE principle

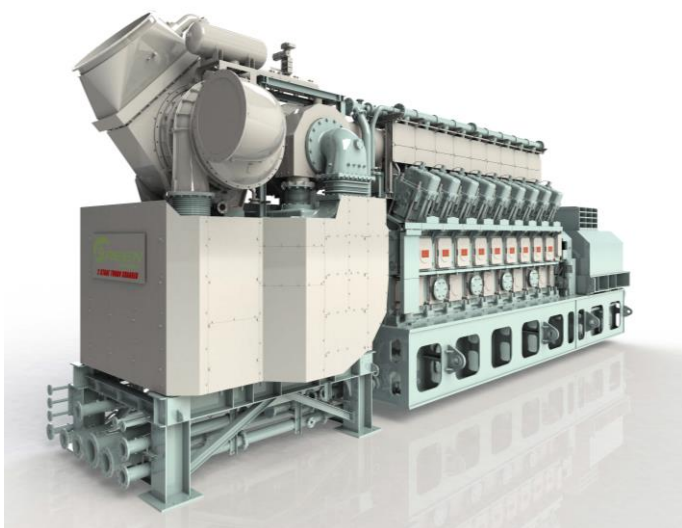
The ECOCHARGE principle optimally combines a low-pressure turbocharger – usually a TCT, TCA or TCR – with a high-pressure stage for which the newly developed TCX series was designed.

PBST ECOCHARGE offers major benefits for engine builders. The increase in turbocharging efficiencies, in comparison to single-stage turbochargers, is mainly related to the intercooler – positioned between the low-pressure-stage and high-pressure-stage turbochargers – that significantly reduces the energy required to compress the intake air to high pressure. The resulting, higher efficiencies have an instantaneous impact on the engine by advantageously increasing the air pressure over the cylinder during the scavenging process. Additionally, greater charged pressure by two-stage turbochargers foster the reduction of NO_x emissions



through the Miller cycle, while the improved scavenging efficiencies provided by the ECOCHARGE system make the engine more fuel efficient.

The higher power-density generated by the ECOCHARGE technology presents the opportunity to choose between significantly boosting an engine's power output or reducing engine size, all the while maintaining an excellent engine performance. The ECOCHARGE system's increased efficiencies and higher cylinder rating facilitate the use of a smaller engine with the same power output of a larger unit that employs traditional, single-stage turbocharging.



Ecocharging KHI's new KG-18-T engine



PBST TCX23 and TCA66 turbocharger



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PBST is your dependable partner for holistic air-management systems. We provide advanced and inspiring air-management systems for applications on water, rails, as well as on the ground. PBST has its roots in Germany and Czech Republic and has more than 80 years of experience in designing and manufacturing turbochargers and after treatment solutions. We push the limits to create high performance technologies, such as two-stage turbocharging, the EGR blower and SCR systems for all applications, in order to meet current and future challenges for our customers. Global after-sales services are provided by our authorized service partner MAN PrimeServ.

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