

Upgrading marine turbochargers

ABB Turbocharging explores ways to save fuel at sea

Since introducing the option of turbocharger upgrades in 2013, ABB Turbocharging has won contracts on a number of medium-speed engines in power generation plants.

With its benefits for fuel consumption at a time of rising fuel prices, upgrading turbochargers is, of course, equally possible for marine engines. Hence, in cooperation with engine builder Wärtsilä, ABB Turbocharging is anticipating strong demand by preparing upgrade packages for specific Wärtsilä marine engine models.



Cruise ships are among vessels benefiting from upgrades

Cruise ship study

“As a first step, together with Wärtsilä, at ABB Turbocharging we have started to look at upgrading turbochargers on the Wärtsilä W12V46 engine in cruise ships,” notes Reinier Bakker, Senior Manager, OEM Service Sales. “This is a logical step because cruise ships are powered

by what is essentially a floating electrical power plant, and they use the same Wärtsilä engine types as many land-based power stations. Hence, much of the work we have done on land can be readily translated to the cruise ship context.”

Depending on the size of the cruise ship, up to six diesel generator sets will be in use. “The floating power station concept is a great idea, since the same diesel engines, powering electrical generators in so-called ‘generator sets’, can provide power for the electric motors which drive the propellers as well as all the many other electrical powered devices, including many associated with passenger comfort on a sea-going hotel. For example: the air conditioning for the whole ship as well as the kitchens cooking three meals a day for over 4,000 passengers, the lighting in cabins, large dining rooms and sumptuous ballrooms.”

New compressor wheel

The basis of the upgrade would be fitting a new design of compressor wheel to the existing turbochargers on the generator sets’ engines. “As a first project, together with Wärtsilä, we are looking at the upgrade of TPL73-A30 turbochargers on their twelve cylinder, vee configuration type W12V46 diesel engines. The benefit we bring for the customer is to increase the efficiency of these turbo-chargers by incorporating the new compressor wheel, the so-called A32 model, which also has a wider compressor map, and can therefore offer its best efficiency over a wider spectrum of engine operation,” Bakker adds.

Significant saving

“In the preparatory project, testing has confirmed our experience that this upgrade will raise the engine’s fuel efficiency by 0.5% and upward. While this may not seem a great deal, over a typical annual running time for a marine engine, at current fuel prices, it could amount to a saving in fuel worth well over USD 40,000 per year for every 10 MW of engine power – and cruise ships can require up to 80 MW,” Bakker stresses.

Bakker points to further benefits of ABB Turbocharging upgrades. “Since only the compressor wheel and some other components, such as the compressor wall insert, need to be replaced, we retain the vast majority of the hardware of the original turbocharger. So such an upgrade can be implemented in a short time – typically two days maximum. “Moreover, we can maximize this benefit by incorporating the upgrade into a ‘SIKO’ overhaul.”

SIKO savings

SIKO is ABB Turbocharging’s advanced safety concept. Its designation derives from the German SIlcherkeitsKOnzept and denotes a sophisticated tool for calculating the effect of thermal and mechanical stresses on a given turbo-charger’s rotating components on an engine with a given load profile.

“The calculation takes into account a range of operating factors and values, resulting in a realistic recommendation regarding the optimum time to exchange the rotating parts in order to keep the turbocharger operating within acceptable safety standards”, Bakker explains. “And, since a SIKO overhaul always includes replacement of the turbocharger rotor by the ABB Turbocharging service team, a rotor with an upgraded compressor wheel can be fitted as part of the normal SIKO overhaul process.”

Financially, combining the turbocharger upgrade with a SIKO overhaul has two benefits. “First, the cost of the upgraded rotor can be absorbed into a scheduled, expected service operation. Second, after the SIKO overhaul, the engine operator can expect an immediate reduction in his fuel costs. Indeed, we calculate the saving will be enough to rapidly amortize any additional costs, within about half a year.”

Additional benefits

In the upgrade case described, the new compressor wheel brings additional benefits via an increase in turbocharger speed margin and reduced engine exhaust gas temperature. “The increased speed margin in combination with the wider compressor map can be used to improve engine response to load changes,” Bakker observes.

“The reduced engine exhaust gas temperature means that many parts of the engine, including the exhaust manifold – but also the turbochargers – will experience less thermal load and a reduction in maintenance costs, although hard to quantify at the moment, will be the positive consequence.

“So when ABB Turbocharging and Wärtsilä cooperate on turbocharger upgrades, the engine operator can look forward to a really attractive set of benefits,” Bakker concludes.

Upgrades: Benefits at a glance

- Significant fuel saving for rapid pay-back
- Improved engine load acceptance
- Extremely cost effective when included in a scheduled safety concept SIKO overhaul
- Reduced engine and turbocharger maintenance via lower thermal stress

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